



***Mechanical  
Clutches and  
Torque  
Overload  
Devices***



**EMERSON. CONSIDER IT SOLVED.™**

**LIFECORE Ex. 1018**

	Pages
I. General Clutch Information	
Clutch Product Offering .....	4 - 7
Modes of Operation .....	8
Principles of Operation .....	9 - 10
Design Features .....	11
Design Function .....	12 - 13
Part Number Explanation .....	12 - 13
II. Mechanical Cam Clutches	
M Series .....	14 - 27
MZEU Series .....	28 - 32
Conveyor Backstop Clutches .....	33 - 44
KK® Series .....	45 - 51
NSS Series .....	52 - 53
NFS Series .....	54 - 55
B Series .....	56 - 59
PB Series .....	60 - 61
HT Series .....	62 - 63
BR Series .....	64 - 71
III. Engineering Information	
Clutch Lubrication .....	72
Dimensions and Tolerances .....	73
Bore Sizes and Shaft Tolerances .....	74
Clutch Selection Procedures .....	75
Clutch Application Data Selection .....	76
IV. Torque Overload Device	
Torque Overload Device Product Offering .....	80 - 81
Torque Overload Device Design Function .....	82 - 83
Browning Shear Pin Hubs and Sprockets .....	84 - 87
Morse Torque Limiters .....	88 - 94
Morse Torque Limiter Couplings .....	93
Browning Torque Limiters .....	95 - 96
Browning Torq/Pro® .....	97 - 110
Browning Torq/Gard® .....	111 - 116
Browning Axial Gard .....	117 - 121
V. General Information .....	122
VI. Standard Terms and Conditions .....	128



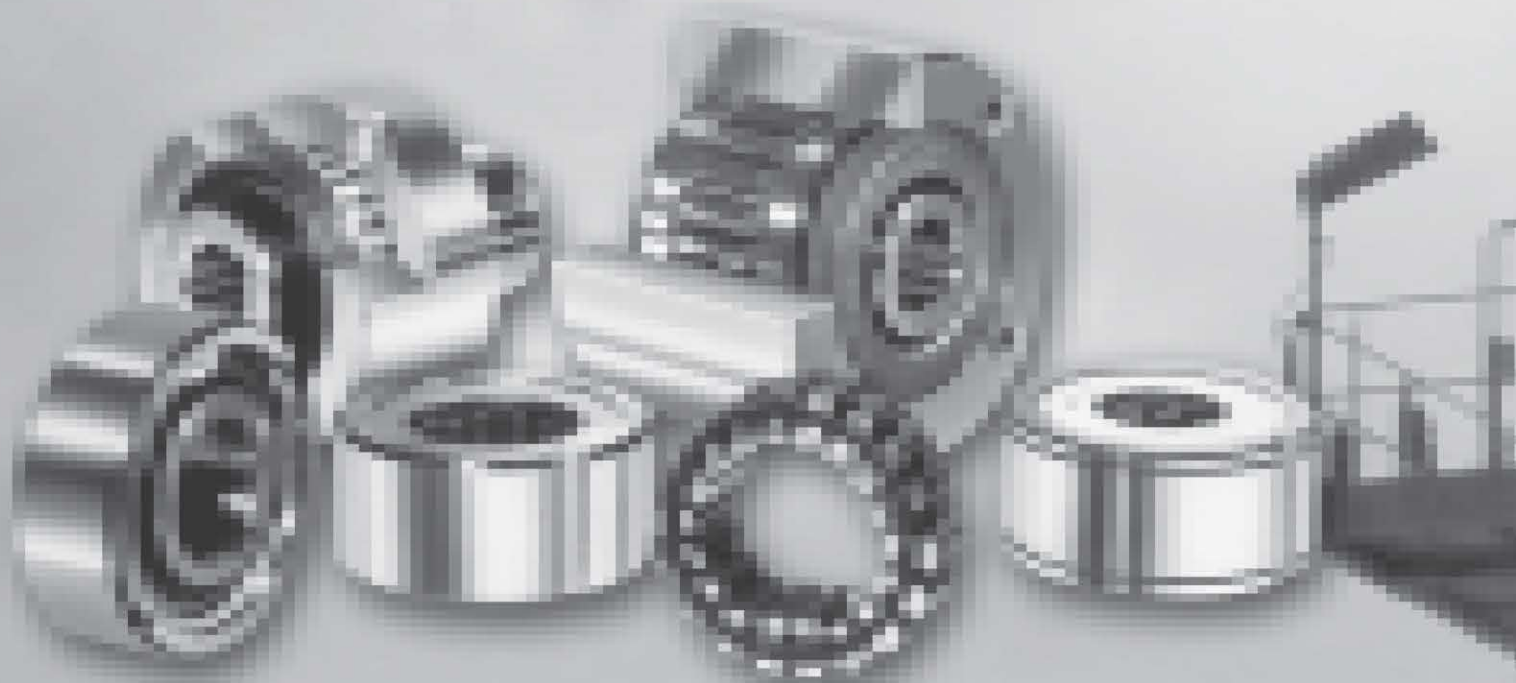
## Custom Design

The Morse line of clutches covers a wide range of sizes and capacities, which handle the majority of industrial applications. However, there are applications that require special designs to meet specific application needs.


Emerson Power Transmission offers engineering assistance in both design and application to help meet these specialized requirements.

For selection assistance, call Application Engineering at 1-800-626-2093 or fax the completed form on page 76 to:

Emerson Power Transmission Application Engineering  
Fax: (606) 564-2079







Morse mechanical cam clutches are precision devices that lock the inner and outer races through the wedging action of cams to transmit torque in one direction of rotation while overrunning in the opposite direction of rotation. These type units are often referred to as freewheels, sprag, overrunning, backstop or one-way clutches, depending upon their application.

Clutches are available with a bore range up through 17.7" and a torque range up through 500,000 lb. ft. and are the most complete and versatile cam clutches available for a variety of applications – from small business machines to giant steel slitters.

Eleven series of clutches perform three basic modes of operation:

- Overrunning
- Indexing
- Backstopping

These units have set standards of performance, offering:

- Higher overrunning speeds
- Greater torque capacities
- Longer service life



## M Series Clutch

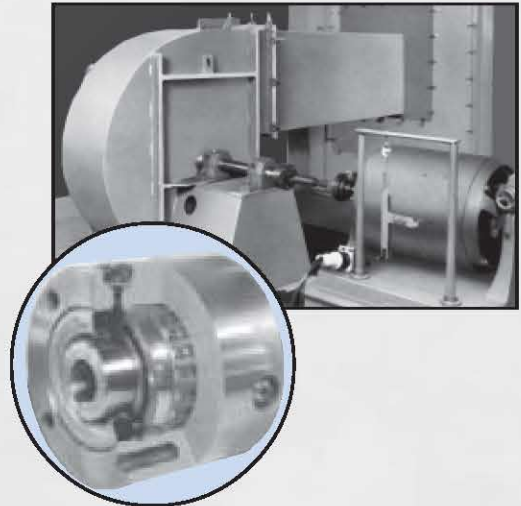
(Page 14)

### Features

- Self-contained clutch designed for a wide variety of applications
- Cam cage assembly engineered for optimum performance and increased capacity
- Two ball bearings included to support radial load and concentricity between races
- Close tolerance outer diameter to mount sheave, gears, sprockets and torque arms
- Positive contact lip or felt seals provided for grease or oil lubrication
- Tapped holes machined on ends of outer race for mounting auxiliary components
- Metric bore and keyway available
- Mounting accessories available

Bore range ..... 0.5" – 6.437"

Torque range ..... 275 – 25,000 lb-ft.



## MZEU Series

(Page 28)

### Features

- Full complement of cams
- Two bearings incorporated for concentricity control
- Symmetric, building block components
- Close tolerance outer diameter to mount sheave, gears, sprockets and torque arms
- Tapped holes at both ends of races to mount accessories
- Flange, torque arms and covers available

Bore range ..... 0.472" – 5.9"

Torque range ..... 44 – 25,000 lb-ft.



## Conveyor Backstop Clutches

(Page 33)

### Features

- Self-contained clutches created for high torque applications where reverse rotation of a head-shaft must be prevented
- Manufactured with large diameter rollers to provide bearing, clutch support, and maintain concentricity between inner and outer races
- Torque arm available to help prevent reverse rotations, plus an external felt seal and internal lip seal for low maintenance
- Available with an external felt seal and internal lip seal for low maintenance
- Retaining plate option available to secure backstop to shaft

Bore range ..... 2.25" – 17.7"

Torque range ..... 6,500 - 500,000 lb-ft.



## KK15 - KK40 Series

(Page 45)

### Features

- Self-contained ball bearing and cam clutch
- Designed with same dimensions as standard metric light series ball bearing
- Press fit option for shaft and housing
- Available with keyed inner and outer races
- Furnished filled with grease to increase wear life
- Seal options available for contaminated environments

Bore range ..... 0.59" – 1.57" (15mm - 40mm)

Torque range ..... 21.4 – 190 lb-ft.



## NSS Series

(Page 52)

### Features

- Designed with the same overall dimensions of a metric 200 light series ball bearing
- Created with an inner race containing a keyseat and an outer race that press fits in housing
- Excellent for applications where space is a consideration

Bore range ..... 0.32" – 2.36" (8mm - 50mm)

Torque range ..... 4.94 – 480 lb-ft.



## Value-Added Capabilities

- Special bores (splined, dual keyways, extended with setscrews)
- Special width
- Custom seal designs (viton, all rubber, etc)
- Special greases (low-temp, food grade, etc.)
- Dual cages for higher capacity in a wider but small OD package
- Gear or sprocket tooth cut into OD of clutch
- Special label needs such as inclusion of OEM part numbers
- Ability to kit products for final assembly
- Assembled to sprocket, coupling, etc.
- Custom engineering designs for OEMs

**NFS Series**

(Page 54)

**Features**

- Designed with the same overall dimensions as medium 300 series metric ball bearing
- Manufactured with an inner race containing a key-seat and an outer race containing key slots
- Furnished with protective oil

Bore range ..... 0.47" – 3.15" (12mm - 80mm)

Torque range ..... 13.27 – 2,900 lb-ft.

**B Series Clutches****Features**

- Rugged cam clutch designed for applications where space and weight are factors in clutch selection
  - Full complement of cams held in the outer races
  - Input shaft used as the inner race must be hardened and ground to size
  - Interchangeable with competitors' products
  - Bearing support and lubrication required
- 
- Primarily used for backstop applications

**B-200A Series**

(Page 56)

Bore range ..... 0.650" - 2.209"

Torque range ..... 39 - 575 lb-ft.

**B-500A Series**

(Page 58)

Bore range ..... 0.650" - 2.04"

Torque range ..... 60 - 1,250 lb-ft.



## PB3A - PB16A Series

(Page 60)

### Features

- Self-contained clutch designed with a bronze bushing for bearing support
- Hub diameter used for mounting auxiliary components such as gears, pulleys and sprockets

Bore range ..... 0.375" – 2.00"

Torque range ..... 40 – 1,800 lb-ft.



## HT Series

(Page 62)

### Features

- Designed for use on the end of a shaft
- Created for applications requiring space restrictions
- Integral bearing to help maintain concentricity
- Factory drilled and tapped holes for mounting accessories

Bore range ..... 0.425" – 2"

Torque range ..... 42 – 440 lb-ft.



## BR Series

(Page 64)

### Features

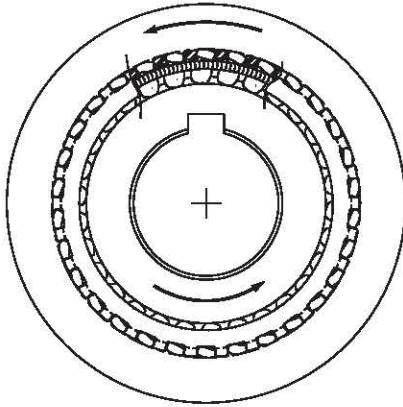
- Lift-off cam design provides contact free operation between the cams and races for increased wear life
- Symmetrical design allows operation in either direction
- External bearing support must be provided for concentricity between housing and shaft

Bore range ..... 0.8" – 9.4"

Torque range ..... 282 – 45,750 lb-ft.



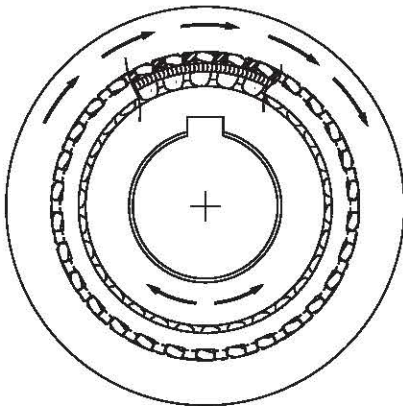
Morse cam clutches are precision devices that positively lock to transmit torque in one direction of rotation but overrun (freewheel) in the opposite direction of rotation. Eleven series of clutches are available, all using the same principles of operation. Since clutch applications encompass a variety of load and speed characteristics, Morse clutches are manufactured in a range of capacities and styles that are designed to provide the best functional characteristics in performing the three basic modes of operation.



## I. General Overrunning

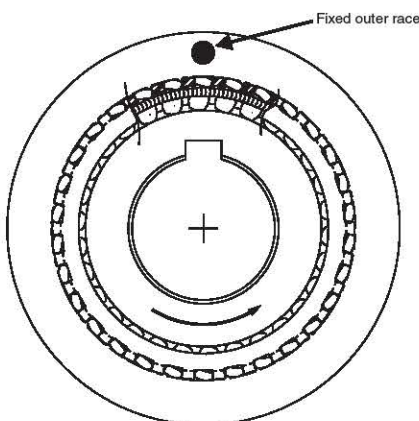
Clutches used in this type of application overrun at either the inner or outer race and are occasionally called upon to lock up and drive.

A typical application is a standby drive where an electric motor and a standby diesel engine are connected to a single driven fan shaft through one-way clutches. The fan can be driven by the motor or diesel engine. The diesel drive clutch overruns when the motor drives the fan. The motor clutch automatically overruns when the load is transferred to the diesel engine.



## II. Indexing

In this mode of operation, reciprocating motion applied to the driving race of the clutch is transformed into unidirectional, intermittent motion at the driven race. For example, on a printing press application, the clutch is mounted to an inking roll and a pinion is mounted to the driving race of the clutch. A rack meshing with the pinion provides reciprocating motion to the driving race. The clutch drives in the forward stroke (index) and overruns on the return stroke accomplishing intermittent unidirectional motion of the inking roll.



## III. Backstopping

In backstop (holdback) applications, the clutches are used to prevent reverse rotation of drive shafts, which could damage machinery and other expensive equipment. With the outer race of the clutch anchored to a stationary member, the inner race can overrun freely in one direction of rotation; reverse rotation is prevented by the automatic engagement of the clutch. Typical backstop applications occur in conveyor systems and gear reducers.





### *B-200A, B-500, PB-A, HT, CB, M, NSS, NFS, MZEU Series*

Morse clutches utilize a full complement of cams, which are placed between concentric inner and outer races. A light spring helps keep the cams in contact with the races. Torque is transmitted from one race to the other by wedging action of the cams between the races.

Morse mechanical clutches provide engagement or disengagement with minimal backlash.

Figure 1 shows the cams in a position to allow the inner race to overrun counter-clockwise or the outer race to overrun in a clockwise direction.

Figure 2 shows the cams are fully loaded and loads can be transmitted through the cams from a clockwise rotation of the inner race or a counter-clockwise rotation of the outer race.

### **KK Series**

The KK clutch consists of a standard metric ball bearing combined with cams. The clutch design is unique, incorporating an independent cam-cage assembly installed alongside the offset ball cage. The clutch has the same overall dimensions of the metric bearing. The clutches are entirely self-contained, and do not require additional bearing support.

The cam-cage assembly uses an energizing spring to help keep the entire complement of cams in light contact with the races to provide rapid engagement when torque transmission occurs. The wedging action of the full set of cams produces significant torque capability in a compact, economical package.

Figure 3 shows the cam-cage assembly in the KK clutch in a position to allow the inner race to overrun clockwise or the outer race to overrun in a counterclockwise direction.

Figure 4 shows the cam-cage assembly provides a full complement of cams to wedge against inner and outer races allowing torque transmission through the clutch.

Figure 1  
(Overrunning)

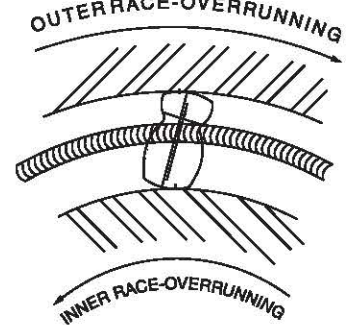


Figure 2  
(Driving)

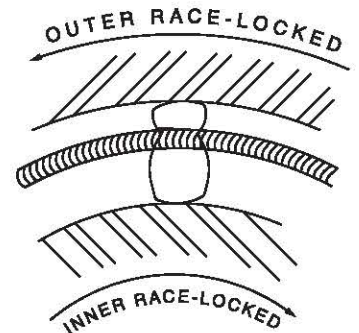


Figure 3

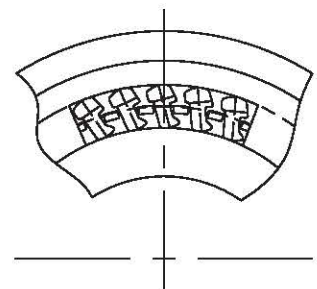
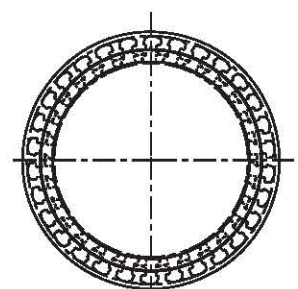


Figure 4







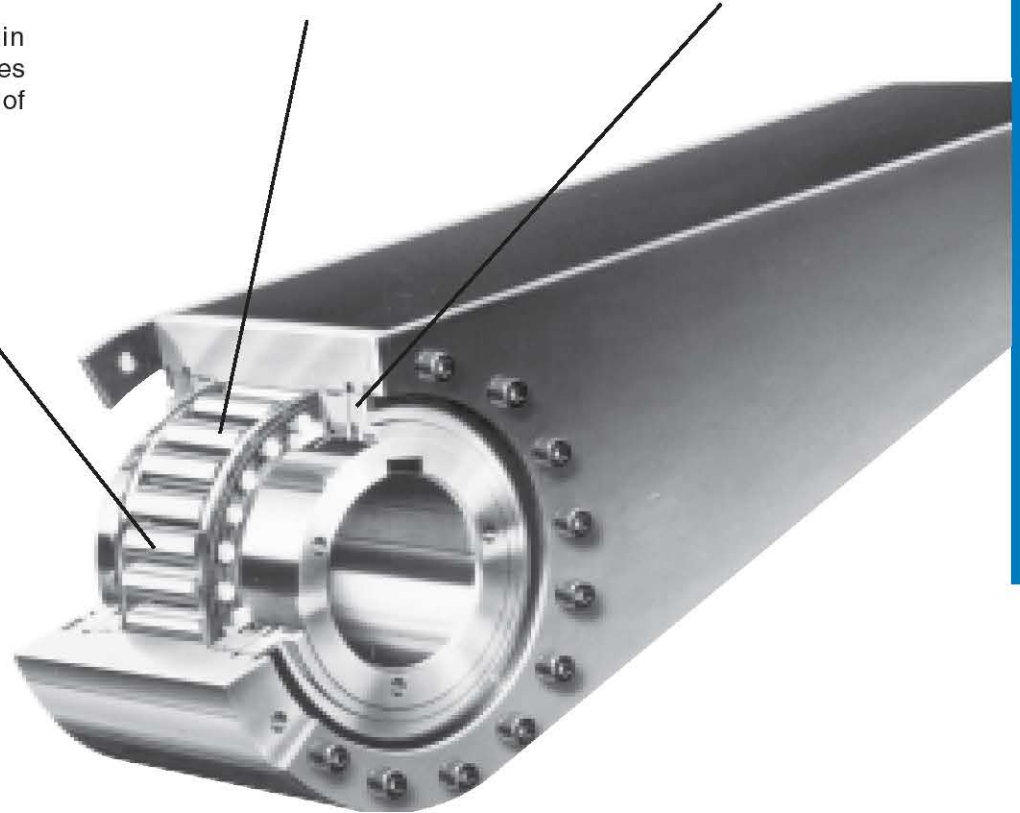
## Conveyor Backstop Clutches

**Synthetic high-performance grease**, continually circulated by rotating cam and roller cage.

**Spring-loaded cams** are in constant contact with both races for rapid engagement.

**Multiple seals.** Combination double lip and felt seals helps keep grease in and dirt out.

**Full-width rollers** maintain concentricity between the races and provide even distribution of bearing load.



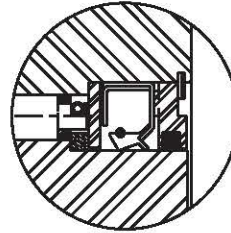
### Options available

- Taconite seals
- Made-to-order torque arms
- Retaining plates

For selection assistance, call Application Engineering at 1-800-626-2093 or visit [www.emerson-ept.com](http://www.emerson-ept.com)

### High Capacity, Longer Life, Lower Initial Cost Features

- Combination double lip and felt seals help keep grease in and dirt out for long life and less costly lube oil maintenance
- Synthetic grease lubricant allows operation in temperatures from - 40°F to 150°F
- Plate torque arm design lowers initial cost and provides easier installation
- Rotating cage evenly distributes grease for longer service life
- Larger bore range for a given torque than other units permits use of a smaller clutch for a given shaft size for further cost savings
- Full-width rollers and cams distribute bearing and torque loads evenly over a greater area, a significant improvement over competitive designs
- Rugged, anti-rollover cam design helps prevent sudden loss of load in demanding applications
- Available in torque capacities ranging from 6,500 to 500,000 lb.-ft. and bore sizes from 2 1/4 to 17 2/3 inches



Combination double lip and felt seals help keep grease in and dirt out.



Multiple seals standard on all sizes.

Model Number	Torque Capacity		Max. rpm *	Drag		Bore Range **		A (Overall Diameter)		B (Width)		C (Inner Race Length)	
	lb - ft	N-m		lb - ft	N-m	inches	mm	inches	mm	inches	mm	inches	mm
CB-7C	6,500	8,813	150	10	14	2.250 - 4.000	57.15 - 101.60	10.625	270.00	5.141	130.57	5.000	127.00
CB-12C	12,000	16,270	100	14	19	3.250 - 5.250	82.55 - 133.35	12.563	319.02	5.688	144.46	5.547	140.89
CB-19C	19,000	25,761	100	25	34	3.750 - 6.250	95.25 - 158.75	14.188	360.43	5.688	144.46	5.547	140.89
CB-30C	30,000	40,675	100	32	43	3.750 - 7.750	95.25 - 196.85	17.000	431.80	6.297	159.94	6.187	157.16
CB-45C	45,000	61,012	80	52	71	5.500 - 8.500	139.70 - 215.90	19.625	498.60	9.547	242.49	9.438	239.71
CB-65C	65,000	88,128	50	65	88	7.000 - 9.500	177.80 - 241.30	23.750	603.25	11.328	287.73	11.078	281.38
CB-90C	90,721	123,000	50	72	98	See page 36 for dimensions.							
CB-150C	150,000	203,373	50	80	108	8.000 - 11.500	203.20 - 292.10	30.750	781.05	11.328	287.73	11.078	281.38
CB-200C	195,456	265,000	50	101	137	See page 36 for dimensions.							
CB-250C	250,000	338,955	50	115	156	9.000 - 13.500	228.60 - 342.90	36.500	927.10	13.828	351.23	13.625	346.08
CB-375C	376,161	510,000	50	159	216	See page 36 for dimensions.							
CB-500C	505,974	686,000	50	180	245								

\* High speed options are also available. Contact Application Engineering at 1-800-626-2093.

\*\* Note: Any bore size within the range indicated will be provided without additional cost.

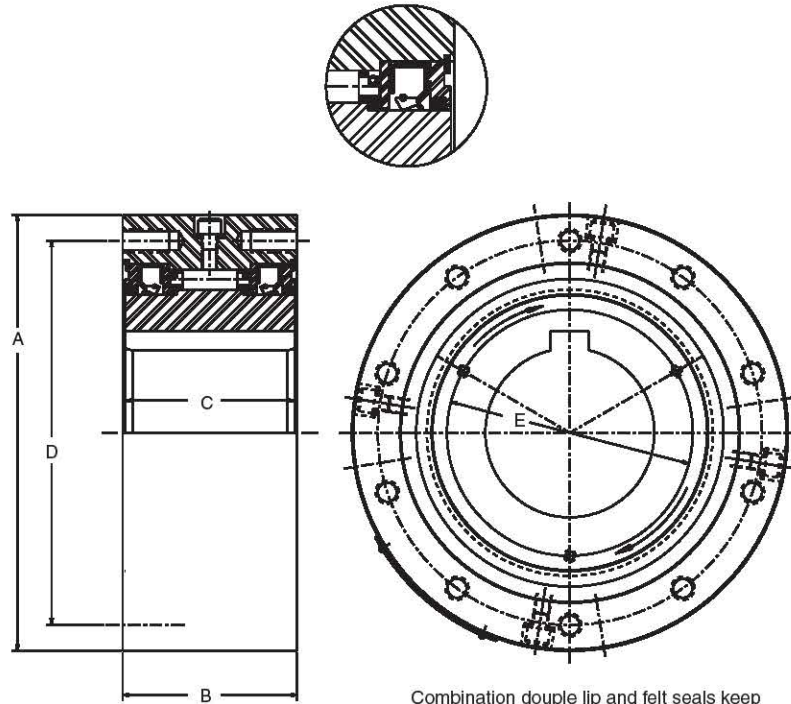
For torque arms see pages 38 - 40.

### Industries Served

- Aggregate processing
- Agriculture
- Conveyor manufacturing

### Field Applications

- Belt conveyor
- Bucket elevator
- Conveyors
- Low rpm head-shafts
- Inclined conveyor



Combination double lip and felt seals keep grease in and dirt out.

Model Number	D (Mounting Bolt Circle)		Mounting Holes				Inner Race Holes							
			Bolt	Thread Size	Depth		E Bolt Circle for Retaining Plate		No. of Bolts	Thread Size	Depth		Approximate Weight	
	Inches	mm			Inches	mm	Inches	mm			Inches	mm	lb	kg
CB-7C	9.0	229	6	.625 - 18 UNF	0.875	22.23	5.25	133.4	3	.375 - 24 UNF	0.500	12.70	80.0	36.3
CB-12C	11.0	279	8	.625 - 18 UNF	0.875	22.23	6.50	165.1	3	.375 - 24 UNF	0.500	12.70	160.1	72.6
CB-19C	12.5	318	10	.750 - 10 UNC	1.125	28.58	8.00	203.2	3	.375 - 24 UNF	0.500	12.70	195.1	88.5
CB-30C	15.0	381	10	.875 - 9 UNC	1.375	34.93	9.50	241.3	3	.500 - 20 UNF	0.625	15.88	330.0	149.7
CB-45C	17.5	445	16	.750 - 10 UNC	1.375	34.93	10.00	254.0	3	.500 - 20 UNF	0.625	15.88	625.0	283.5
CB-65C	21.0	533	16	1.000 - 8 UNC	1.625	41.28	12.00	304.8	3	.500 - 20 UNF	0.625	15.88	1300.1	589.6
CB-90C	See page 37 for dimensions.													
CB-150C	27.5	699	16	1.250 - 7 UNC	2.125	53.98	17.00	431.8	3	.625 - 11 UNC	0.875	22.23	1300.1	952.5
CB-200C	See page 37 for dimensions.													
CB-250C	32.0	813	16	1.250 - 7 UNC	1.875	47.63	20.00	508.0	3	.750 - 10 UNC	1.375	34.93	3500.1	1587.6
CB-375C	See page 37 for dimensions.													
CB-500C														



### High Capacity, Longer Life, Lower Initial Cost Features

- Combination double lip and felt seals help keep grease in and dirt out for long life and less costly lube oil maintenance
- Synthetic grease lubricant allows operation in temperatures from - 40°F to 150°F
- Plate torque arm design lowers initial cost and provides easier installation
- Rotating cage evenly distributes grease for longer service life
- Larger bore range for a given torque than other units permits use of a smaller clutch for a given shaft size for further cost savings
- Full-width rollers and cams distribute bearing and torque loads evenly over a greater area, a significant improvement over competitive designs
- Rugged, anti-rollover cam design helps prevent sudden loss of load in demanding applications
- Available in torque capacities ranging from 6,500 to 500,000 pound-feet and bore sizes from 2 1/4 to 17 2/3 inches



Multiple seals standard on all sizes.

Model Number	Max. Torque Capacity		Inner Race rpm * (Max.)	Overrunning Drag		Bore Range **		Dimensions					
								A		B		C	
	lb - ft	N-m		lb - ft	N-m	inch	mm	inch	mm	inch	mm	inch	mm
CB-45C	See page 34 for dimensions.												
CB-65C													
CB-90C	90,721	123,000	50	72	98	7.87-10.63	200 to 270	11.60	295	25.59	650	11.42	290
CB-150C	See page 34 for dimensions.												
CB-200C	195,456	265,000	50	101	137	9.84-13.19	250 to 335	12.01	305	33.47	850	12.60	320
CB-250C	See page 34 for dimensions.												
CB-375C	376,161	510,000	50	159	216	12.8-16.73	325 to 425	17.32	440	40.55	1030	17.72	450
CB-500C	505,974	686,000	50	180	245	13.78-17.72	350 to 450	17.72	450	42.91	1090	18.90	480

\* High speed backstop options are available. Contact Application Engineering at 1-800-626-2093 for further details.

\*\* Note: Any bore size within the range indicated will be provided without additional cost.

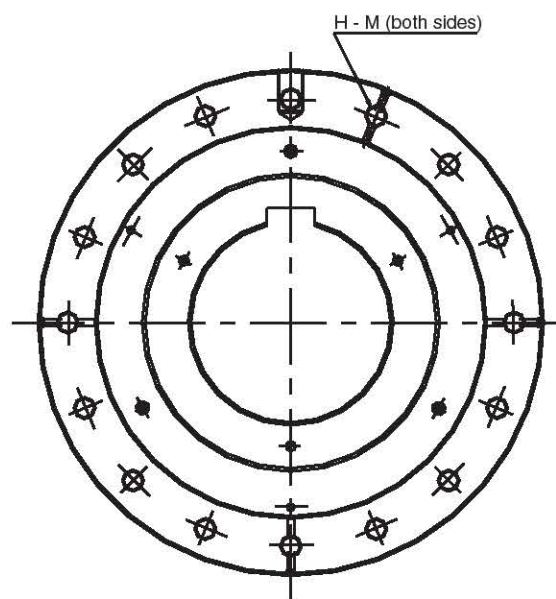
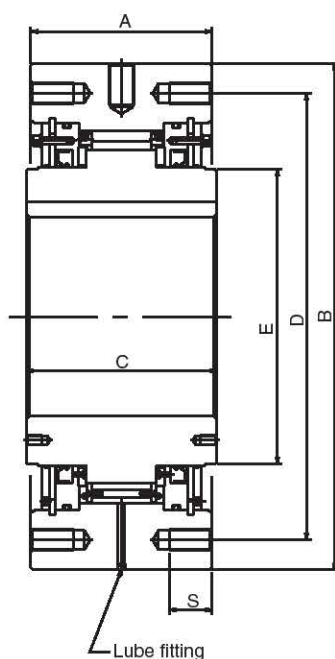
For torque arms see pages 38 - 40.

### Industries Served

- Aggregate processing
- Agriculture
- Conveyor manufacturing

### Field Applications

- Belt conveyor
- Bucket elevator
- Conveyors
- Low rpm head-shafts
- Inclined conveyor

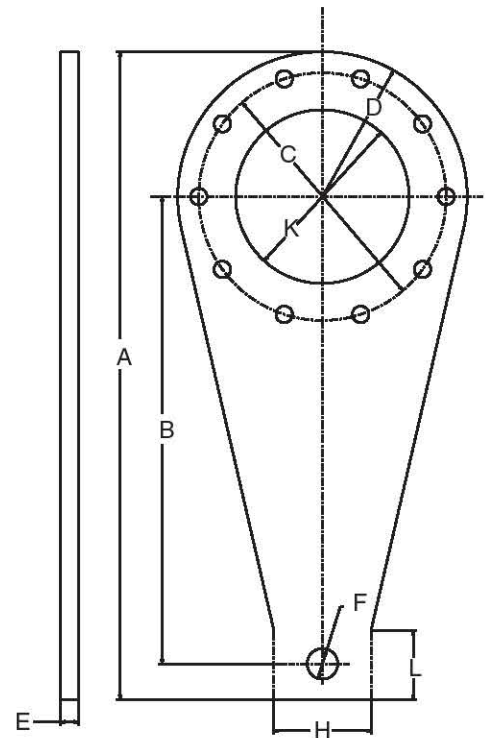


Combination single lip and felt seals keep grease in and dirt out.

Model Number	Dimensions											
	D		E		S		H-M No. of Tapped Holes x Size x Pitch (mm)	Lube Fitting Hole	Quantity of Grease		Weight w/o Torque Arm	
	Inch	mm	Inch	mm	Inch	mm			ounces	grams	lb	kg
CB-45C	See page 35 for dimensions.											
CB-65C												
CB-90C	22.64	575	14.57	370	1.97	50	16xM24xP3.0	PT 1/4	126.98	3,600	1367	620
CB-150C	See page 35 for dimensions.											
CB-200C	29.53	750	19.49	495	2.76	70	16xM36xP4.0	PT 1/4	158.73	4,800	2502	1135
CB-250C	See page 35 for dimensions.											
CB-375C	37.01	940	25.00	635	2.76	70	18xM36xP4.0	OIL	OIL	OIL	5401	2450
CB-500C	38.98	990	25.40	645	3.15	80	18xM42xP4.5	OIL	OIL	OIL	6217	2820

For assembly with CB-7C to CB-30C clutches

### Single Torque Arm



Model Number	Dimensions											
	A (Overall Length)		B (Shaft Center to End of Arm)		C		D (End Radius)		E (Thickness)		F (End Hole)	
	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
CB-7TA	22.3	567	15.3	387	9.0	229	5.3	135	0.5	13	1.25	31
CB-12TA	26.4	671	18.6	473	11.0	279	6.3	159	0.5	13	1.25	31
CB-19TA	31.7	806	22.9	581	12.5	318	7.1	180	0.9	22	1.50	38
CB-30TA	33.5	851	23.0	584	15.0	381	8.5	215	0.9	22	1.75	44

Model Number	Dimensions						Number of Bolts	Mounting Holes			Weight	
	H (Arm End Width)		K (Radius)		L (Straight Side Length)			Thread Size	Length			
	inch	mm	inch	mm	inch	mm			inch	mm	lb	kg
CB-7TA	4.375	111	5.625	143	2.906	74	6	5/8-18 UNF	1.50	38.1	20	9
CB-12TA	4.750	120	6.750	171	3.563	91	8	5/8-18 UNF	1.50	38.1	30	14
CB-19TA	4.750	120	8.500	216	3.375	86	10	3/4-10 UNC	1.75	44.5	60	27
CB-30TA	5.250	133	10.500	267	3.375	86	10	7/8-9 UNC	2.00	50.8	75	34

### Made-to-Order Torque Arms

Custom torque arms are available on a made-to-order basis for your unique requirements. For selection assistance, call Application Engineering at 1-800-626-2093 or fax the information to: Emerson Power Transmission Application Engineering Fax: (606) 564-2079

### Part Number Explanation

**CB - 45 C FB**

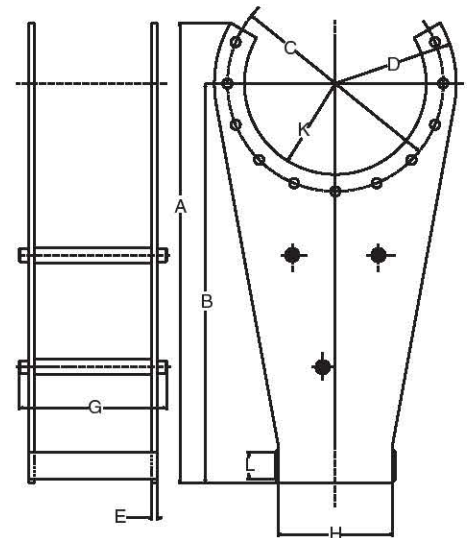
- Specify finished bore diameter
- Clutch only\*
- Torque capacity (ft-lbs. 1000's)
- Clutch series (conveyor backstop)

Conveyor backstop clutch built with standard keyway unless requested otherwise.

\* Torque arm, to be used with conveyor backstop clutch, should be ordered separately ex. CB-45TA.



### Double Torque Arm



Model Number	Dimensions											
	A (Overall Length)		B (Shaft Center to End of Arm)		C (Bolt Circle)		D (End Radius)		E (Thickness)		G (Overall Width)	
	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
CB-45TA	37.3	946	32.4	822	17.5	445	9.8	249	0.5	13	12.1	308
CB-65TA	45.3	1149	39.4	1000	21.0	533	11.9	302	0.5	13	14.4	366
CB-90TA	See page 40 for dimensions.											
CB-150TA	58.9	1495	51.3	1301	27.5	699	15.4	391	0.9	22	15.4	396
CB-200TA	See page 40 for dimensions.											
CB-250TA	72.0	1829	63.0	1600	32.0	813	18.3	464	0.9	22	18.3	459
CB-375 TA	See page 40 for dimensions.											
CB-500 TA												

Model Number	Dimensions						Number of Bolts	Mounting Holes			Weight	
	H (Arm End Width)		K (Radius)		L (Straight Side Length)			Thread Size	Length			
	inch	mm	inch	mm	inch	mm			inch	mm	lb	kg
CB-45TA	9.1	232	14.8	374.65	3.0	76	22	3/4-10 UNC	1.75	44.5	160	73
CB-65TA	11.2	281	18.0	457.20	3.0	76	22	1-8 UNC	2.00	50.8	235	107
CB-90TA	See page 40 for dimensions.											
CB-150TA	13.8	349	23.4	593.73	4.5	114	22	1 1/4-7 UNC	2.50	63.5	580	263
CB-200TA	See page 40 for dimensions.											
CB-250TA	15.8	400	27.0	685.80	6.0	152	22	1 1/4-7 UNC	2.50	63.5	835	379
CB-375 TA	See page 40 for dimensions.											
CB-500 TA												

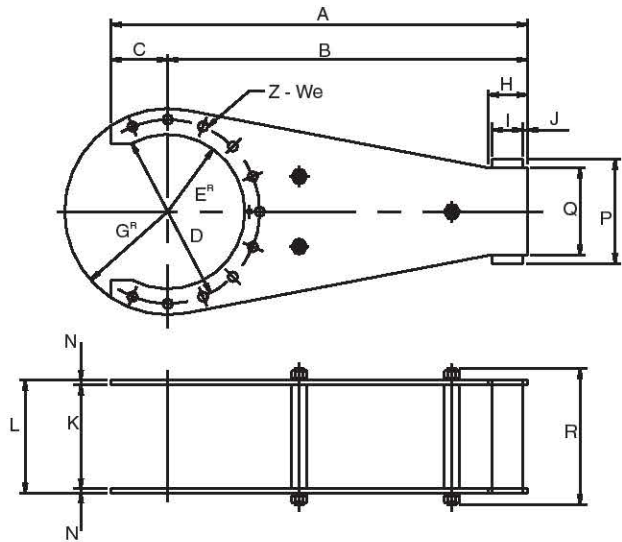
### Made-to-Order Torque Arms

Custom torque arms are available on a made-to-order basis for your unique requirements.

For selection assistance, call Application Engineering at 1-800-626-2093 or fax the information to:

Emerson Power Transmission Application Engineering  
Fax: (606) 564-2079

### Double Torque Arm



Model Number	Dimensions													
	A		B		C		D		E <sup>R</sup>		G <sup>R</sup>		H	
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
CB-45TA	See page 39 for dimensions.													
CB-65TA														
CB-90TA	50.0	1270	43.3	1100	6.7	170	22.6	575	9.3	235	12.8	325	4.3	110
CB-150TA	See page 39 for dimensions.													
CB-200TA	68.1	1730	59.1	1500	9.1	230	29.5	750	12.1	307	16.7	425	5.3	135
CB-250TA	See page 39 for dimensions.													
CB-375 TA	83.1	2110	70.9	1800	12.2	310	37.0	940	15.0	380	20.3	515	6.5	165
CB-500 TA	91.3	2320	78.7	2000	12.6	320	39.0	990	15.7	400	21.5	545	6.5	165

Model Number	Dimensions																	Weight	
	I		J		K		L		N		P		Q		R		Z-W		
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm		lb	kg
CB-45TA	See page 39 for dimensions.																		
CB-65TA																			
CB-90TA	4.0	100	0.394	10	11.6	295	12.6	319	0.472	12	11.7	298	10.2	260	14.8	375	11-26	243	110
CB-150TA	See page 39 for dimensions.																		
CB-200TA	4.7	120	0.591	15	12.0	305	13.5	343	0.748	19	15.2	386	13.0	330	15.9	405	11-39	595	270
CB-250TA	See page 39 for dimensions.																		
CB-375 TA	5.9	150	0.591	15	17.3	440	19.0	484	0.866	22	18.6	474	16.1	410	22.4	570	13-39	1058	480
CB-500 TA	5.9	150	0.591	15	17.7	450	19.4	494	0.866	22	17.7	450	17.7	450	22.8	580	13-45	1235	560

Backstop torque can be calculated using different methods based on conveyor configuration. The methods shown below are for basic selections and are based on CEMA (Conveyor Equipment Manufacturing Association) standards.

### Backstop Torque Calculation

$$HP = \frac{T \times N}{5250} \quad \begin{array}{l} N = \text{rpm of clutch at headpulley shaft} \\ T = (\text{lb-ft.}) \text{ torque} \end{array}$$

N = RPM @ headpulley shaft =

$$\text{Torque CB} = \frac{SF \times HP \text{ Total} \times 5250}{N}$$

### Bucket Elevator Backstop Selection

Friction resistance is ignored in the selection due to its small magnitude relative to the elevator capacity.

$$HP \text{ Total} = \frac{QH}{990} \quad \begin{array}{l} Q = \text{Maximum load, tons per hour} \\ H = \text{Vertical height of conveyor (feet)} \end{array}$$

Same nomenclature as conveyor method.

$$\text{Torque CB} = \frac{SF \times HP - \text{Motor Nameplate} \times 5250}{N}$$

### Motor Breakdown/Locked Rotor Torque Method

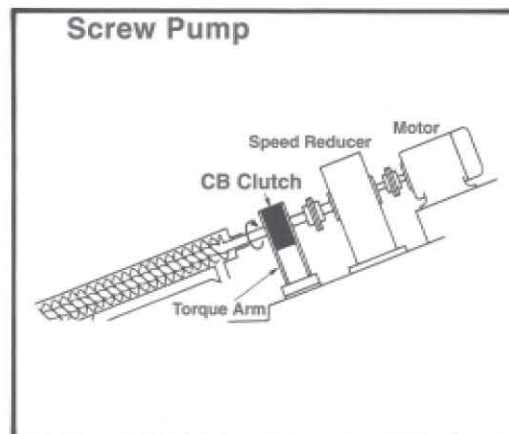
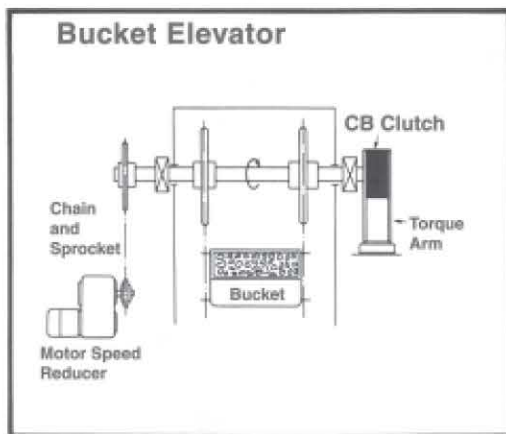
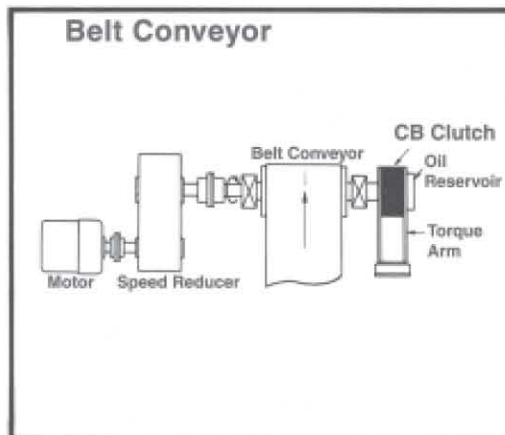
Selection is based on the following formula:

Depending on motor breakdown torque, apply the following service factors:

- 1.0 Breakdown torque less than or equal to 175%.
- 1.2 Breakdown torque greater than 175% to 250%.
- 1.5 Breakdown torque greater than 250% TO 400%.

### **CAUTION**

A backstop is a critical part of the conveyor design. Selection methods shown above should cover most basic conveyor applications. When designing a conveyor, it is necessary that the backstop is selected to handle the maximum load that the conveyor system is designed to handle. Consult Application Engineering at 1-800-626-2093 for backstop selection where conveyor design deviates from the methods shown.





## Pre-installation

1. Before installation, check the direction of shaft rotation during operation, often referred to as free shaft rotation. The backstop clutch overruns in this direction and is indicated by stamped rotational arrows on both ends of the clutch inner race.
2. It is important that the clutch fit the shaft properly. These clutches are intended to be installed with a slip fit-interference or shrink fits are not recommended. Bore tolerances and standard keyway dimensions are shown below.

## Dimensions - Inches

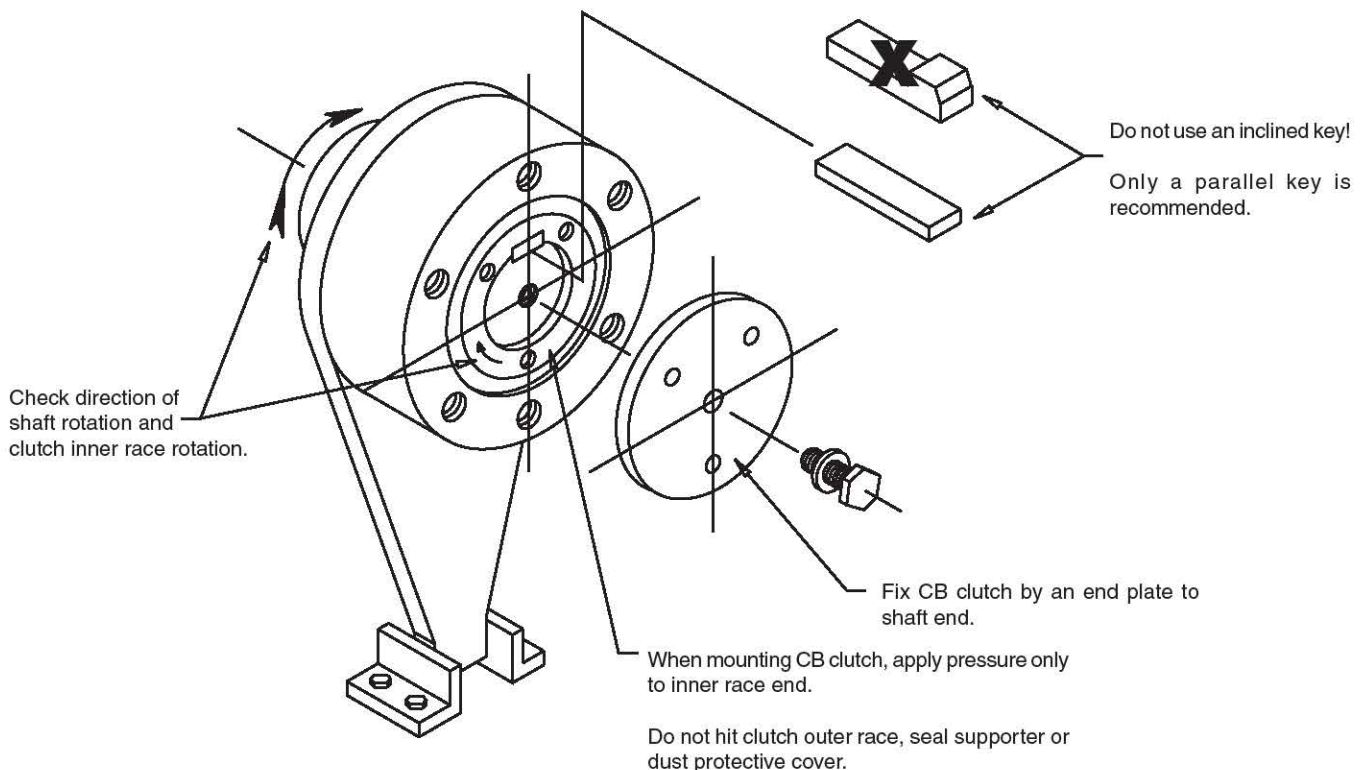
Nominal Shaft and Bore Dia.		Bore Tolerance	Standard Keyway Width* and Depth
Over	Thru	Nominal - .000	
2 1/4	2 3/4	+ .0020	5/8 x 5/16
2 3/4	3 1/4	+ .0020	3/4 x 3/8
3 1/4	3 3/4	+ .0020	7/8 x 7/16
3 3/4	4 1/2	+ .0020	1 x 1/2
4 1/2	5 1/2	+ .0025	1 1/4 x 5/8
5 1/2	6 1/2	+ .0025	1 1/2 x 3/4
6 1/2	7 1/2	+ .0030	1 3/4 x 3/4
7 1/2	9	+ .0030	2 x 3/4
9	11	+ .0035	2 1/2 x 7/8
11	13	+ .0040	3 x 1

\* Width tolerances are plus .002 minus .000; keyway depth is nominal plus .010 tolerance.

3. Use only parallel keys, do not use tapered keys. The key should be tight along both sides and in contact with the keyseat. Clearance has been allowed along the top. The key should not extend beyond the length of the clutch. Cover plate on shaft end is recommended for key keep.

## Installation

1. The shaft must be clean and free of burrs. Coat both shaft and key with oil, grease or a similar substance to ease installation.
2. Double check shaft rotation and arrow marks on the end of the clutch inner race to ensure correct rotational direction.
3. Push the backstop clutch on the shaft by applying pressure only to the end of the inner race. If hammering is required, use only a lead or rubber headed hammer to avoid damage to the inner race end. Do not hit the clutch outer race or seal support as internal damage may result. Exercise caution during installation to prevent seal damage.
4. Secure backstop clutch in position on the shaft. Use lock washers, snap rings, lock collars, end plates, adjacent components or similar items to hold clutch in position.



## Installation of Torque Arms

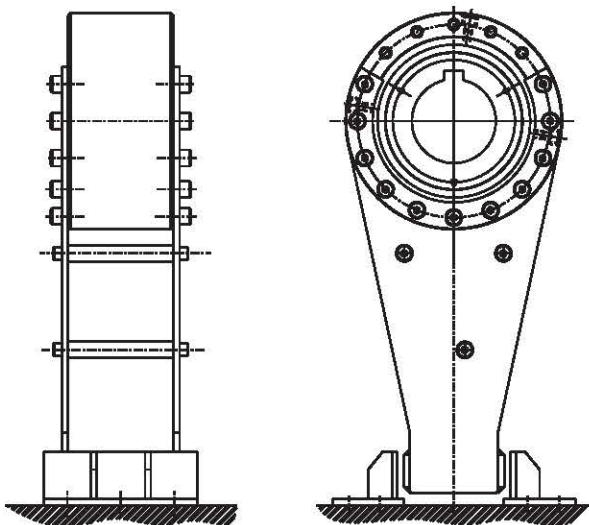
### Installation of Torque Arms

#### Torque Arm Mounting:

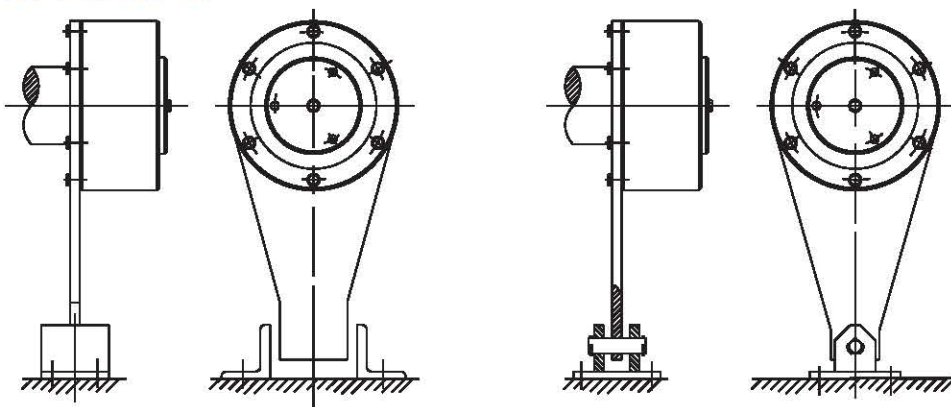
1. Restrain end of the torque arm to prevent rotation either by use of a pin or angle irons. Do not rigidly fasten the torque arm end.
2. Make sure the torque arm is free to move axially to prevent any preloading of the clutch bearings, due to shaft movement, misalignment or distortion of both conveyor frame and shafting.

3. Make sure that foreign material or ice cannot accumulate on the torque arm end to restrict its movement.
4. When using a pin, its diameter must be smaller by 1/16 inch than the hole in torque arm.
5. Torque arm may be mounted at any desired angle.
6. Make sure that the mounting surfaces of the clutch outer race and torque arms are clean and free of foreign particles, rust, or oil to ensure proper mounting.
7. Tighten torque arm mounting bolts to the following torque values. Use only ANSI grade 8 bolts minimum as supplied.

#### CB-45 to CB-500



#### CB-7 to CB-30



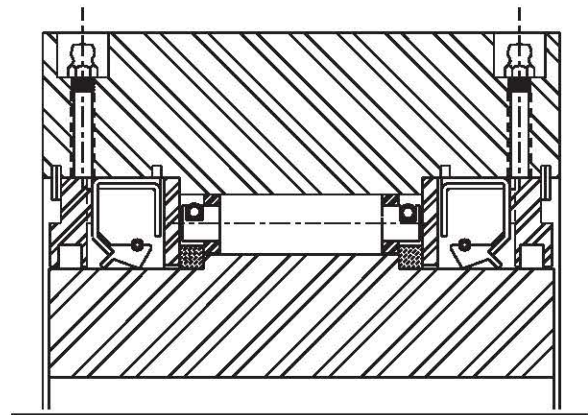
Bolt Size	Torque
1/2-20 UNF	110 lb. - ft.
5/8 -18 UNF	220 lb. - ft.
3/4 - 10 UNC	375 lb. - ft.
7/8- 9 UNC	580 lb. - ft.
M24xP3.0	822 lb. - ft.
1-8 UNC	865 lb. - ft.
M36xP4.0	1634 lb. - ft.
1 1/4 - 7 UNC	1750 lb. - ft.
M42xP4.5	2855 lb. - ft.

For plated bolt, reduce torque by 25%.



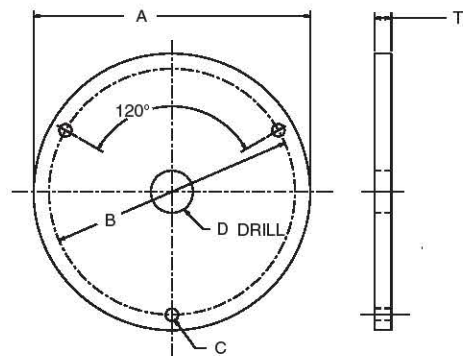
### Sealing Options

Purging seals are available for harsh, contaminated environments. With the torque arm protection, this sealing system provides 4-way protection by using double-lip seals, a grease chamber and an outer chamber through the torque arm. Custom sealing systems are available upon request. Consult Application Engineering for details.



### Retaining Plate

Retaining plates offer a means of positively securing the conveyor backstop clutch to a mating shaft and to prevent the key from walking. The retaining plate bolts to three drilled and tapped holes machined in the inner race. An additional hole provided in the plate is intended to align with a drilled and tapped hole machined in the end of the shaft.



Retaining Plate Number	Dimension in Inches										Weight	
	A (Overall Diameter)		B (Bolt Circle)		C (Bolt Hole)		D (Center Hole)		T (Thickness)			
	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	lb.	kg
CB-7RP	6.00	152.4	5.25	133.3	0.406	10.31	0.687	17.45	.575 .535	14.61 13.59	4.25	1.9
CB-12RP	7.25	184.2	6.50	165.1	0.406	10.31	0.687	17.45			6.50	2.9
CB-19RP	9.00	228.6	8.00	203.2	0.406	10.31	0.687	17.45			10.00	4.5
CB-30RP	11.00	279.4	9.50	241.3	0.531	13.49	0.781	19.84	.692 .646	17.58 16.41	18.00	8.2
CB-45RP	11.50	292.1	10.00	254.0	0.531	13.49	0.781	19.84			20.00	9.1
CB-65RP	13.50	342.9	12.00	304.8	0.531	13.49	0.781	19.84			27.50	12.5
CB-150RP	19.25	489.0	17.00	431.8	0.687	17.45	1.031	26.19	.924 .840	23.47 21.34	75.00	34.0
CB-250RP	22.75	577.9	20.00	508.0	0.781	19.84	1.031	26.19			100.00	45.4

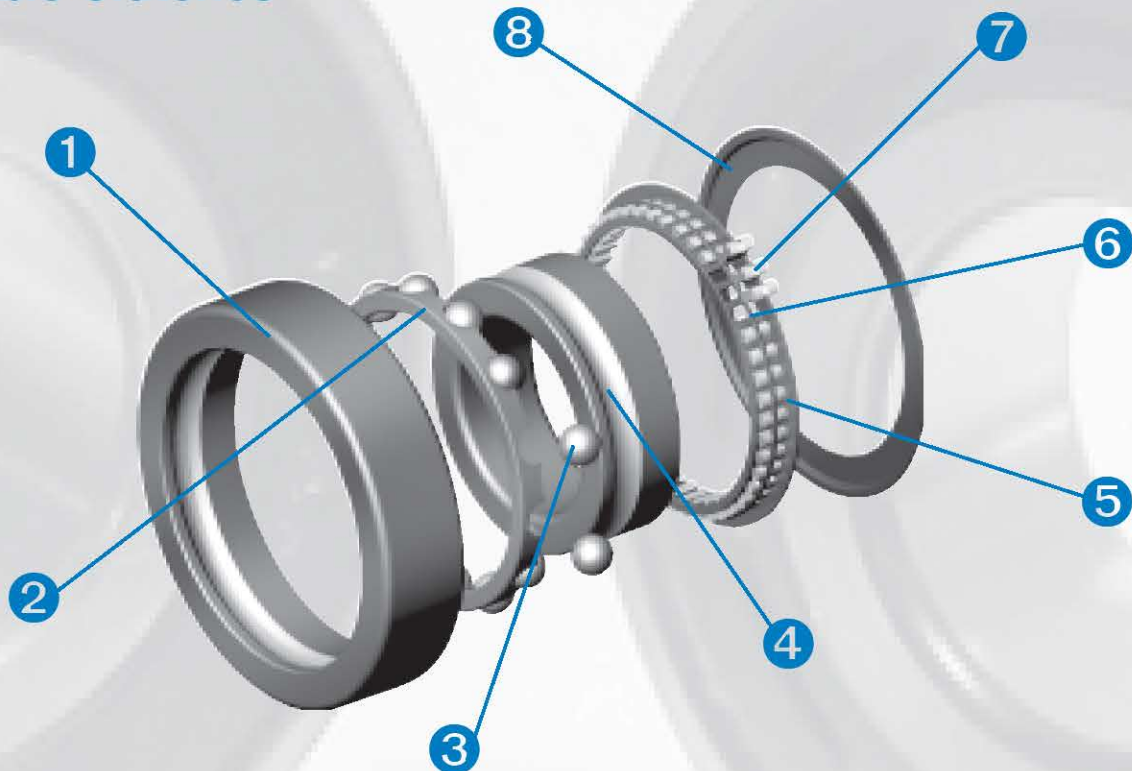
### Lubrication - Grease

- A. Morse CB clutches are prelubricated with Exxon Beacon® #325 grease. This grease is acceptable in environments with temperature ranges from -40°F to 150°F (-40°C to 65°C). Consult Application Engineering for lubricants beyond this temperature range.
- B. When relubrication is deemed necessary, remove one plug of the four found in the outer race of the clutch and replace with a zerk fitting. When relubricating, remove another plug opposite the grease fitting and pump grease into the clutch until grease flows freely from the plug opening. Replace the plug.
- C. Do not use lubricants that contain EP additives, as these are detrimental to the operation of the backstop.
- D. Use of non-compatible grease could cause clutch failure; contact Application Engineering when using grease other than specified.

ExxonBeacon is believed to be a trademark and/or a trade name of ExxonMobil Corporation and is not owned or controlled by Emerson Power Transmission Corporation. This trademark and/or registered trademark of others is used herein for product comparison purposes only, is the property of their respective owners and is not owned or controlled by Emerson Power Transmission Corporation. While reasonable efforts have been made to confirm ownership of the marks and names listed above, Emerson Power Transmission Corporation cannot and does not represent or warrant the accuracy of this information.



## Continuous Enhancements, Reliable Clutches



- 1 - High-Strength Outer Race** - Made from high carbon alloy steel, our precision-ground outer race provides fatigue life reliability.
- 2 - Rotating Bearing Retainer** - Located flush with the outer race, this retainer contains evenly spaced, hardened steel balls to provide equal distribution of load for optimized concentricity between the inner and outer races.
- 3 - Hardened Steel Ball Bearings** - Individually formed from hardened chrome alloy steel, the balls are secured within the retainer to provide concentricity and equal distribution of radial load within the clutch.
- 4 - Precision-Ground Inner Race** - Similar to a 6000 Series metric bearing, the ball pathway and cam wear surface are hardened and ground to enable rapid cam engagement and low drag operation.
- 5 - Durable Cam-Cage** - Made from molded nylon, the cam-cage provides equal spacing between each cam. When cams articulate within the cage, cam engagement is uniform providing equal distribution of load and more uniform stress on the cams and inner race.
- 6 - Heavy-Duty Garter Spring** - Located within the cam cage, the energizing garter spring creates the drag torque needed for accuracy of cam engagement.
- 7 - Profiled Cams** - Manufactured from high carbon steel, the cams carry high compressive loads when the clutch is locked and transmitting torque.
- 8 - Lightweight Retaining Endplate/Dust Shield** - Attached to the outer race, the end plate helps retain lubrication and protect components within the clutch assembly. Felt and contact lip seal designs are available.

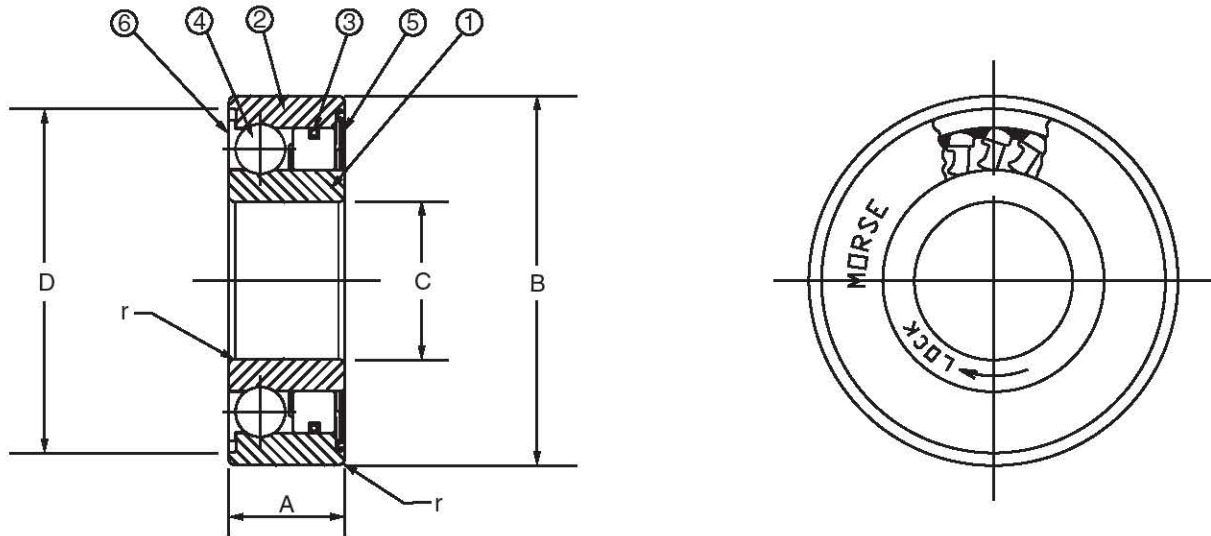
Morse brand KK clutches incorporate a compact cam clutch with built-in bearing support. This unique construction combines a cam clutch with a 6200 Series metric ball bearing for use in applications ranging from exercise equipment to industrial machinery. This general purpose clutch is intended for backstopping, indexing and overrunning applications and can be utilized with both oil and grease lubrication.



## Dimensions and Capacities

Size	A		B		C		D		r		Weight	
	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	g	lb
15	11	0.433	35	1.378	15	0.591	32.6	1.283	0.6	0.024	50	0.1
17	12	0.472	40	1.575	17	0.669	36.1	1.421	0.6	0.024	80	0.2
20	14	0.551	47	1.850	20	0.787	41.7	1.642	1.0	0.039	120	0.3
25	15	0.591	52	2.047	25	0.984	47.1	1.854	1.0	0.039	150	0.3
30	16	0.630	62	2.441	30	1.181	56.6	2.228	1.0	0.039	230	0.5
35	17	0.669	72	2.835	35	1.378	64.0	2.520	1.1	0.043	320	0.7
40	22	0.866	80	3.150	40	1.575	71.0	2.795	1.1	0.043	400	0.9

Size	Torque Capacity		Max. Overrunning Speed		Drag Torque		Radial Load Capacity			
	N-m	Ft-lb	Inner Race RPM	Outer Race RPM	N-m	Ft-lb	Dynamic		Static	
							N	lb	N	lb
15	29	21.4	3,600	2,000	0.010	0.0074	5,950	1337.6	3,230	726.1
17	43	31.7	3,500	1,900	0.010	0.0074	7,000	1573.7	3,700	831.8
20	61	45.0	3,000	1,600	0.014	0.0103	8,500	1910.9	4,900	1101.6
25	78	57.5	2,500	1,400	0.017	0.0125	10,700	2405.5	6,300	1416.3
30	140	103.3	2,000	1,100	0.030	0.0221	11,900	2675.2	7,900	1776.0
35	173	127.6	1,800	1,000	0.034	0.0251	13,500	3034.9	9,700	2180.6
40	260	191.8	1,800	900	0.040	0.0295	14,500	3259.7	11,700	2630.3



## Shaft Tolerance

Size	Shaft Diameter			
	Inches		mm	
15	0.5906	+0.0009 +0.0005	15	+0.023 +0.012
17	0.6693	+0.0009 +0.0005	17	+0.023 +0.012
20	0.7874	+0.0011 +0.0006	20	+0.028 +0.015
25	0.9843	+0.0011 +0.0006	25	+0.028 +0.015
30	1.1811	+0.0011 +0.0006	30	+0.033 +0.017
35	1.3780	+0.0013 +0.0007	35	+0.033 +0.017
40	1.5748	+0.0013 +0.0007	40	+0.033 +0.017

## Housing Tolerance

Size	Housing Diameter			
	Inches		mm	
15	1.3779	-0.0005 -0.0011	35	-0.012 -0.028
17	1.5748	-0.0005 -0.0011	40	-0.012 -0.028
20	1.8504	-0.0005 -0.0011	47	-0.012 -0.028
25	2.0472	-0.0006 -0.0013	52	-0.014 -0.033
30	2.4409	-0.0006 -0.0013	62	-0.014 -0.033
35	2.8346	-0.0006 -0.0013	72	-0.014 -0.033
40	3.1496	-0.0006 -0.0013	80	-0.014 -0.033

- ① Inner race
- ② Outer race
- ③ Cam cage
- ④ Ball
- ⑤ Shield
- ⑥ Retainer

## Part Number Explanation

**KK 25 1K 2GD**

- Series
- Bore size
- Keyed inner
- Incorporates 2 seals

**KK 25 2K 2GD**

- Series
- Bore size
- Keyed inner and outer
- Incorporates 2 seals



Morse KK clutches incorporate a compact cam clutch with built-in bearing support. This unique construction combines a cam clutch with a 6200 Series metric ball bearing for use in applications ranging from exercise equipment to industrial machinery. This general purpose clutch is intended for backstopping, indexing and overrunning applications and can be utilized with both oil and grease lubrication.

### Industries Served

- Fitness
- Manufacturing
- Printing
- Textile

### Field Applications

- Electric motor backstops
- Exercise equipment
- Household appliances
- Pump backstops

### Enhancements

- New sizes added
- New sealing and shielding options
- Both inner and outer race keyway options

**KK-1K**  
(keyed inner)



**KK-2K**  
(keyed inner and outer)

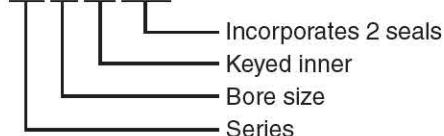
### Dimensions and Capacities

Size	Torque Capacity		Max. Overrunning Speed		Drag Torque		Radial Load Capacity			
	N-m	Ft-lb	Inner Race r/min	Outer Race r/min	N-m	Ft-lb	Dynamic		Static	
							N	lb	N	lb
15	29	21.4	3,600	2,000	0.010	0.0074	5,950	1337.6	3,230	726.1
17	43	31.7	3,500	1,900	0.010	0.0074	7,000	1573.7	3,700	831.8
20	61	45.0	3,000	1,600	0.014	0.0103	8,500	1910.9	4,900	1101.6
25	78	57.5	2,500	1,400	0.017	0.0125	10,700	2405.5	6,300	1416.3
30	140	103.3	2,000	1,100	0.030	0.0221	11,900	2675.2	7,900	1776.0
35	173	127.6	1,800	1,000	0.034	0.0251	13,500	3034.9	9,700	2180.6
40	260	191.8	1,800	900	0.040	0.0295	14,500	3259.7	11,700	2630.3

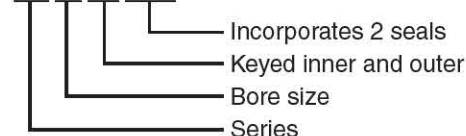
Note: Model No. marked on the inner race is only K for both 1K and 2K. (I. R. the marked KK17-K for both KK-17-1K and KK-17-2K).

### Part Number Explanation

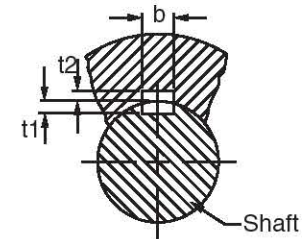
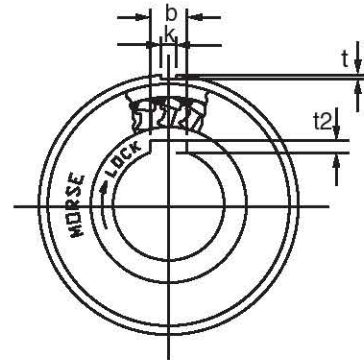
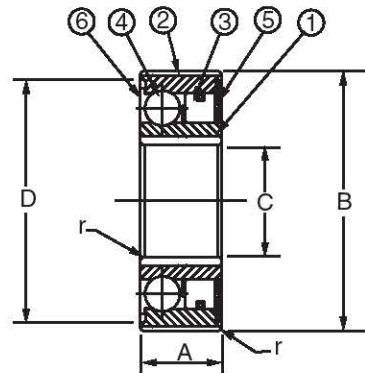
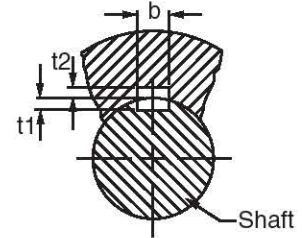
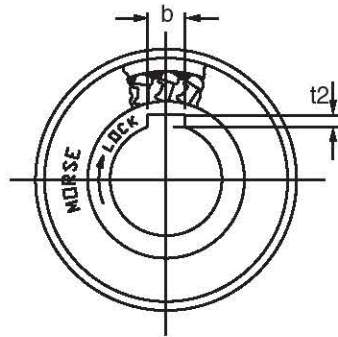
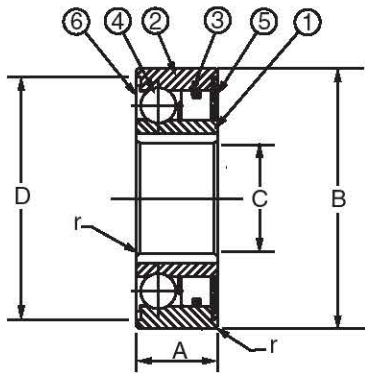
**KK 25 1K 2GD**



**KK 25 2K 2GD**



For selection assistance, call Application Engineering at 1-800-626-2093 or visit [www.emerson-ept.com](http://www.emerson-ept.com)



- ① Inner race
- ② Outer race
- ③ Cam cage
- ④ Ball
- ⑤ Shield
- ⑥ Retainer

### Dimensions and Capacities

Size	A		B		C		D		r		Weight	
	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	lb	g
15	0.433	11	1.378	35	0.591	15	1.283	32.6	0.024	0.6	0.1	50
17	0.472	12	1.575	40	0.669	17	1.421	36.1	0.024	0.6	0.2	80
20	0.551	14	1.850	47	0.787	20	1.642	41.7	0.039	1.0	0.3	120
25	0.591	15	2.047	52	0.984	25	1.854	47.1	0.039	1.0	0.3	150
30	0.630	16	2.441	62	1.181	30	2.228	56.6	0.039	1.0	0.5	230
35	0.669	17	2.835	72	1.378	35	2.520	64.0	0.043	1.1	0.7	320
40	0.866	22	3.150	80	1.575	40	2.795	71.0	0.043	1.1	0.9	400

Note: Model No. marked on the inner race is only K for both 1K and 2K. (I. R. the marked KK17-K for both KK-17-1K and KK-17-2K).

### Keyway Dimensions

Model	b js 10	t1	t2*	k js 9	t
KK15-1K	5.0	+0.024	1.9	1.2	-
KK15-2K	5.0	+0.024	1.9	1.2	-
KK17-1K	5.0	+0.024	1.9	1.2	-
KK17-2K	5.0	+0.024	1.9	1.2	-
KK20-1K	6.0	+0.024	2.5	1.6	-
KK20-2K	6.0	+0.024	2.5	1.6	-
KK25-1K	8.0	+0.029	3.6	1.5	-
KK25-2K	8.0	+0.029	3.6	1.5	-
KK30-1K	8.0	+0.029	3.1	2.0	-
KK30-2K	8.0	+0.029	3.1	2.0	-
KK35-1K	10.0	+0.029	3.7	2.4	-
KK35-2K	10.0	+0.029	3.7	2.4	-
KK40-1K	12.0	+0.035	3.3	5.0	-
KK40-2K	12.0	+0.035	3.3	5.0	-

Dimensions in mm

\* The dimension of t2 for KK25-1K and KK25-2K is 0.5 mm shallow compared to DIN 6885. 3. Process the keyway on the shaft 0.5 mm deeper to use DIN.

### Shaft Tolerance

Size	Shaft Diameter	
	mm	inches
15	15 -0.008 -0.028	0.5906 -0.0003 -0.0011
17	17 -0.008 -0.028	0.6693 -0.0003 -0.0011
20	20 -0.010 -0.031	0.7874 -0.0004 -0.0012
25	25 -0.010 -0.031	0.9843 -0.0004 -0.0012
30	30 -0.010 -0.031	1.1811 -0.0004 -0.0012
35	35 -0.012 -0.037	1.3780 -0.0005 -0.0015
40	40 -0.012 -0.037	1.5748 -0.0005 -0.0015

### Housing Tolerance

Model	Housing Diameter	
	mm	inches
KK15-1K	35 -0.012 -0.028	1.3779 -0.0005 -0.0011
KK15-2K	35 -0.002 -0.018	1.3779 -0.0001 -0.0007
KK17-1K	40 -0.012 -0.028	1.5748 -0.0005 -0.0011
KK17-2K	40 -0.002 -0.018	1.5748 -0.0001 -0.0007
KK20-1K	47 -0.012 -0.028	1.8504 -0.0005 -0.0011
KK20-2K	47 -0.003 -0.022	1.8504 -0.0001 -0.0009
KK25-1K	52 -0.014 -0.033	2.0472 -0.0006 -0.0013
KK25-2K	52 -0.003 -0.022	2.0472 -0.0001 -0.0009
KK30-1K	62 -0.014 -0.033	2.4409 -0.0006 -0.0013
KK30-2K	62 -0.003 -0.022	2.4409 -0.0001 -0.0009
KK35-1K	72 -0.014 -0.033	2.8346 -0.0006 -0.0013
KK35-2K	72 -0.006 -0.025	2.8346 -0.0002 -0.0010
KK40-1K	80 -0.014 -0.033	3.1496 -0.0006 -0.0013
KK40-2K	80 -0.006 -0.025	3.1496 -0.0002 -0.0010



## Model KK- 2GD and KK-2GD 1K

**KK-2GD**  
(sealed both sides)



**KK-2GD 1K**  
(sealed both sides,  
keyed inner)



### Dimensions and Capacities

Size	Torque Capacity		Max. Overrunning Speed		Drag Torque		Radial Load Capacity			
	N-m	Ft-lb	Inner Race r/min	Outer Race r/min	N-m	Ft-lb	Dynamic		Static	
							N	lb	N	lb
15	29	21.4	3,600	2,000	0.040	0.0295	5,950	1337.6	3,230	726.1
17	43	31.7	3,500	1,900	0.050	0.0369	7,000	1573.7	3,700	831.8
20	61	45.0	3,000	1,600	0.055	0.0406	8,500	1910.9	4,900	1101.6
25	78	57.5	2,500	1,400	0.055	0.0406	10,700	2405.5	6,300	1416.3
30	140	103.3	2,000	1,100	0.058	0.0428	11,900	2675.2	7,900	1776.0
35	173	127.6	1,800	1,000	0.060	0.0443	13,500	3034.9	9,700	2180.6
40	260	191.8	1,800	900	0.080	0.0590	14,500	3259.7	11,700	2630.3

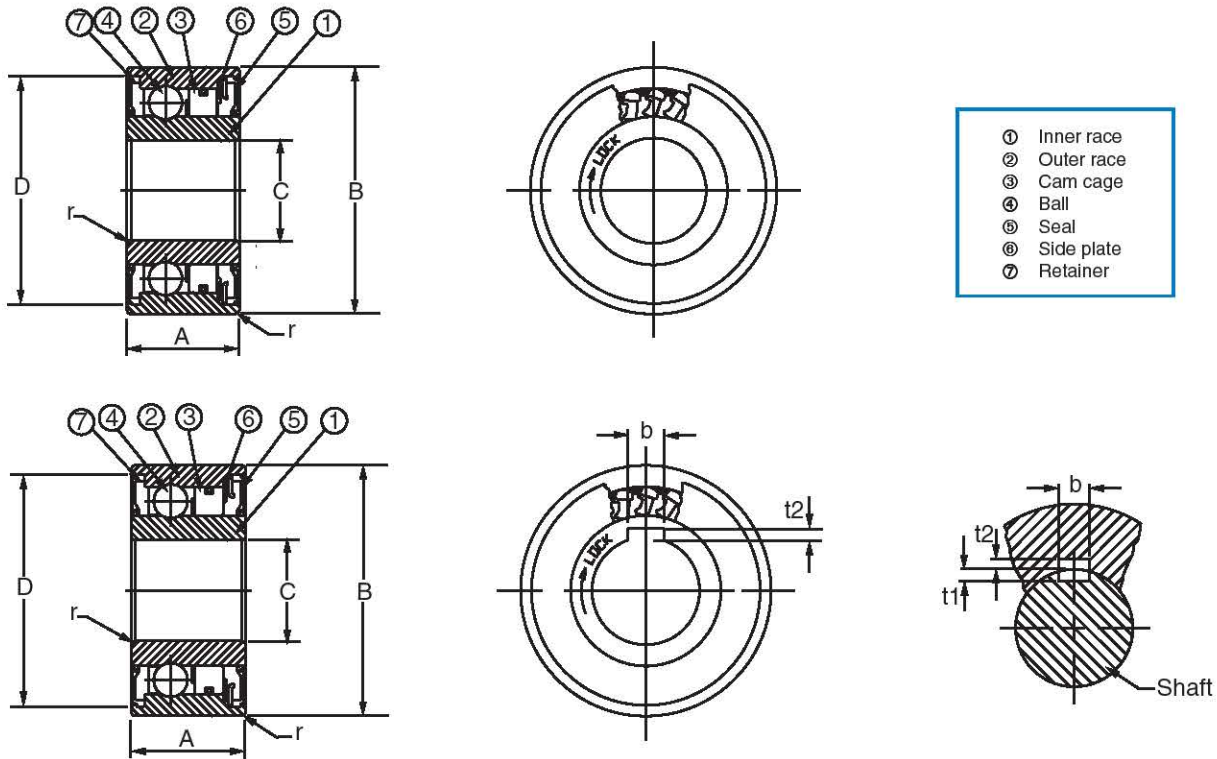
### Housing Tolerance

Size	Housing Diameter			
	inch		mm	
15	1.3779	-0.0005 -0.0011	35	-0.012 -0.028
17	1.5748	-0.0005 -0.0011	40	-0.012 -0.028
20	1.8504	-0.0005 -0.0011	47	-0.012 -0.028
25	2.0472	-0.0006 -0.0013	52	-0.014 -0.033
30	2.4409	-0.0006 -0.0013	62	-0.014 -0.033
35	2.8346	-0.0006 -0.0013	72	-0.014 -0.033
40	3.1496	-0.0006 -0.0013	80	-0.014 -0.033

### Shaft Tolerance

Model	Shaft Diameter			Model	Shaft Diameter		
	Inches		mm		Inches		mm
KK15-2GD	0.5906	+0.0009 +0.0005	15	KK15-2GD 1K	0.5906	-0.0003 -0.0011	15
KK17-2GD	0.6693	+0.0009 +0.0005	17	KK17-2GD 1K	0.6693	-0.0003 -0.0011	17
KK20-2GD	0.7874	+0.0011 +0.0006	20	KK20-2GD 1K	0.7874	-0.0004 -0.0012	20
KK25-2GD	0.9843	+0.0011 +0.0006	25	KK25-2GD 1K	0.9843	-0.0004 -0.0012	25
KK30-2GD	1.1811	+0.0011 +0.0006	30	KK30-2GD 1K	1.1811	-0.0004 -0.0012	30
KK35-2GD	1.3780	+0.0013 +0.0007	35	KK35-2GD 1K	1.3780	-0.0005 -0.0015	35
KK40-2GD	1.5748	+0.0013 +0.0007	40	KK40-2GD 1K	1.5748	-0.0005 -0.0015	40





### Dimensions and Capacities

Size	A		B		C		D		r		Weight	
	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	lb	g
15	0.630	16	1.378	35	0.591	15	1.278	32.45	0.024	0.6	0.2	70
17	0.669	17	1.575	40	0.669	17	1.435	36.45	0.024	0.6	0.2	100
20	0.748	19	1.850	47	0.787	20	1.667	42.35	0.039	1.0	0.3	150
25	0.787	20	2.047	52	0.984	25	1.852	47.05	0.039	1.0	0.4	200
30	0.827	21	2.441	62	1.181	30	2.189	55.60	0.039	1.0	0.6	280
35	0.866	22	2.835	72	1.378	35	2.543	64.60	0.043	1.1	0.9	410
40	1.063	27	3.150	80	1.575	40	2.819	71.60	0.043	1.1	1.3	600

### Keyway Dimensions

Model	b js 10	t1	t2
KK15-2GD 1K	5.0 +0.024	1.9	1.2
KK17-2GD 1K	5.0 +0.024	1.9	1.2
KK20-2GD 1K	6.0 +0.024	2.5	1.6
KK25-2GD 1K	8.0 +0.029	3.6	1.5
KK30-2GD 1K	8.0 +0.029	3.1	2.0
KK35-2GD 1K	10.0 +0.029	3.7	2.4
KK40-2GD 1K	12.0 +0.035	3.3	5.0

Dimensions in mm

\* The dimension of t2 for KK25-2GD 1K is 0.5 mm shallow compared to DIN 6885. 3. Process the keyway on the shaft 0.5 mm deeper to use DIN.

For selection assistance, call Application Engineering at 1-800-626-2093 or visit [www.emerson-ept.com](http://www.emerson-ept.com)

The NSS Series clutch is available in 12 sizes and is designed with the same overall dimensions as a light metric series ball bearing. The inner race offers a key seat and the outer race press fits into the housing. The clutch is furnished with protective oil and must be lubricated before operating. These clutches do not have bearings to support radial force, so additional bearing support is required. The NSS Series clutch is excellent for applications where space is restricted, and is suitable for overrunning.

### Lubrication

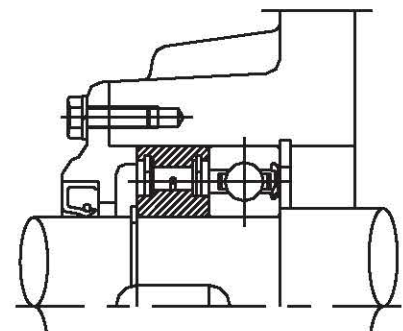
1. Oil lubrication is recommended.
2. Do not use greases or lubricants with EP additives.



Model Number	Torque Capacity		Maximum Overrunning Speed		Drag Torque		Bore Size H7				Keyway		Dimensions	
			Inner Race	Outer Race									A	
	lb - ft	N-m	rpm	rpm	lb - ft	N-m	Inches		mm		Inches	mm	Inches	mm
NSS-8	4.9	6.7	6,000	3,000	0.004	0.005	0.3150	+0.0006 -0.000	8	+0.015 -0.000	0.08 x 0.04	2 x 1.0	0.315	8
NSS-10	8.9	12.0	4,500	2,300	0.005	0.007	0.3937	+0.0006 -0.000	10	+0.015 -0.000	0.12 x 0.06	3 x 1.4	0.354	9
NSS-12	12.5	17.0	4,000	2,000	0.007	0.009	0.4724	+0.0007 -0.000	12	+0.018 -0.000	0.16 x 0.07	4 x 1.8	0.394	10
NSS-15	16.2	22.0	3,500	1,800	0.007	0.010	0.5906	+0.0007 -0.000	15	+0.018 -0.000	0.20 x 0.05	5 x 1.2	0.433	11
NSS-20	30.2	41.0	2,600	1,300	0.007	0.010	0.7874	+0.0008 -0.000	20	+0.021 -0.000	0.24 x 0.06	6 x 1.6	0.551	14
NSS-25	41.3	56.0	2,200	1,100	0.015	0.020	0.9843	+0.0008 -0.000	25	+0.021 -0.000	0.32 x 0.08	8 x 2.0	0.591	15
NSS-30	77.4	105.0	1,800	900	0.022	0.030	1.1811	+0.0008 -0.000	30	+0.021 -0.000	0.32 x 0.08	8 x 2.0	0.629	16
NSS-35	100.3	136.0	1,600	800	0.022	0.030	1.3780	+0.0010 -0.000	35	+0.025 -0.000	0.39 x 0.10	10 x 2.4	0.669	17
NSS-40	218.3	296.0	1,400	700	0.133	0.180	1.5748	+0.0010 -0.000	40	+0.025 -0.000	0.47 x 0.09	12 x 2.2	0.709	18
NSS-45	255.9	347.0	1,300	650	0.155	0.210	1.7717	+0.0010 -0.000	45	+0.025 -0.000	0.55 x 0.08	14 x 2.1	0.748	19
NSS-50	297.2	403.0	1,200	600	0.162	0.220	1.9685	+0.0010 -0.000	50	+0.025 -0.000	0.55 x 0.08	14 x 2.1	0.787	20
NSS-60	478.7	649.0	910	460	0.243	0.330	2.3622	+0.0012 -0.000	60	+0.030 -0.000	0.71 x 0.09	18 x 2.3	0.866	22

### Installation and Usage

1. The NSS series cam clutch is designed for press fit installation. Correct interference dimensions must be maintained to obtain maximum clutch performance.
2. Make sure the housing has enough strength to withstand the pressure required for the press fitting installation of the clutch. The internal diameter of the housing should meet the H7 tolerance.



### Features

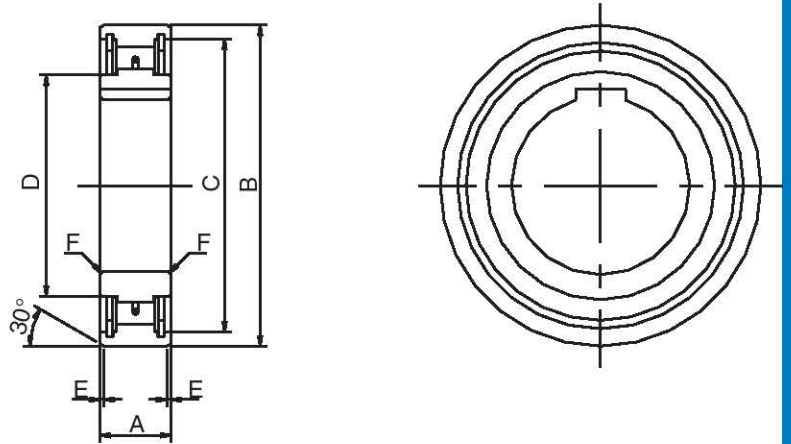
- Sprag type one way clutch
- High torque and longer life than roller ramp clutches
- Full metric design
- Overrunning speed is higher than roller ramp clutches

### Industries Served

- Food and beverage
- Gearing
- Printing
- Textile

### Field Applications

- Exercise equipment
- Food processing equipment
- Printing presses
- Roll conveyors



Model Number	Dimensions										Weight	
	B		C		D		E		F			
	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	lbs.	g
NSS-8	0.944	24	0.874	22.2	0.448	11.4	0.024	0.6	0.024	0.6	0.03	14
NSS-10	1.229	30	1.063	27.0	0.614	15.6	0.024	0.6	0.020	0.6	0.1	27
NSS-12	1.311	32	1.161	29.5	0.709	18.0	0.024	0.6	0.020	0.6	0.1	31
NSS-15	1.434	35	1.260	32.0	0.811	20.6	0.024	0.6	0.020	0.6	0.1	39
NSS-20	1.926	47	1.575	40.0	1.051	26.7	0.031	0.8	0.030	0.8	0.3	115
NSS-25	2.131	52	1.772	45.0	1.260	32.0	0.031	0.8	0.030	0.8	0.3	140
NSS-30	2.541	62	2.165	55.0	1.575	40.0	0.031	0.8	0.040	1.0	0.5	215
NSS-35	2.951	72	1.417	36.0	1.772	45.0	0.031	0.8	0.040	1.0	0.7	300
NSS-40	3.279	80	2.835	72.0	1.969	50.0	0.031	0.8	0.040	1.0	0.9	425
NSS-45	3.484	85	2.972	75.5	2.244	57.0	0.047	1.2	0.040	1.0	1.1	495
NSS-50	3.689	90	3.228	82.0	2.441	62.0	0.047	1.2	0.040	1.0	1.2	545
NSS-60	4.508	110	3.937	100.0	3.149	80.0	0.047	1.2	0.060	1.5	2.1	950

### Installation and Usage (continued)

- When installing the clutch, mount it with a type 62 bearing to avoid radial force, since this clutch does not have any bearings inside.
- Confirm the direction of rotation before installation.
- The recommended shaft tolerance is H7, and the key profile should be in accordance with the following standard.
- NSS-8 – 12.....DIN 6885. 1
- NSS-15 - 60 .....DIN 6885. 3
- Suitable surface pressure of the key should be selected according to your company design standards.

For selection assistance, call Application Engineering at 1-800-626-2093 or visit [www.emerson-ept.com](http://www.emerson-ept.com)



The NFS Series clutch is available in 13 sizes and is designed with the same overall dimensions as a medium metric series ball bearing. The NFS Series clutch offers approximately twice the torque capacity of the NSS Series clutch. The inner race contains a key seat and the outer race is designed with European key slots. The clutch is furnished with protective oil and must be lubricated before installation. In addition, bearing support is required.

### Lubrication

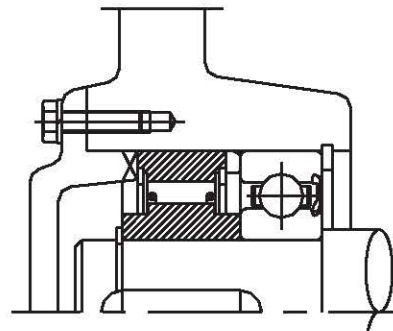
1. Oil lubrication is recommended.
2. Do not use greases or lubricants with EP additives.



Model Number	Torque Capacity		Maximum Overrunning Speed		Drag Torque		Bore Size H7				Keyway		Dimensions	
	Rated Torque Capacity		Inner Race	Outer Race									A	
	Ft.-Lbs.	N-m	r/min	r/min	Lb-Ft	N-m	mm		Inch		mm	in.	mm	in.
NFS-12	13.276	18	4,500	2,300	0.030	0.04	12	+0.018 -0.000	0.4724	+0.0007 -0.0000	4 x 1.8	0.16 x 0.07	13	0.512
NFS-15	20.652	28	3,500	1,800	0.044	0.06	15	+0.018 -0.000	0.5906	+0.0007 -0.0000	5 x 1.2	0.20 x 0.05	18	0.709
NFS-17	36.879	50	3,200	1,600	0.081	0.11	17	+0.018 -0.000	0.6693	+0.0007 -0.0000	5 x 1.2	0.20 x 0.05	19	0.748
NFS-20	61.956	84	2,500	1,300	0.133	0.18	20	+0.021 -0.000	0.7874	+0.0008 -0.0000	6 x 1.6	0.24 x 0.06	21	0.827
NFS-25	94.409	128	2,000	1,000	0.140	0.19	25	+0.021 -0.000	0.9843	+0.0008 -0.0000	8 x 2.0	0.32 x 0.08	24	0.945
NFS-30	147.514	200	1,600	800	0.155	0.21	30	+0.021 -0.000	1.1811	+0.0008 -0.0000	8 x 2.0	0.32 x 0.08	27	1.063
NFS-35	350.347	475	1,400	700	0.310	0.42	35	+0.025 -0.000	1.3780	+0.0010 -0.0000	10 x 2.4	0.39 x 0.10	31	1.220
NFS-40	447.706	607	1,300	650	0.339	0.46	40	+0.025 -0.000	1.5748	+0.0010 -0.0000	12 x 2.2	0.47 x 0.09	33	1.299
NFS-45	557.604	756	1,100	550	0.413	0.56	45	+0.025 -0.000	1.7717	+0.0010 -0.0000	14 x 2.1	0.55 x 0.08	36	1.417
NFS-50	829.031	1124	1,000	500	0.443	0.60	50	+0.025 -0.000	1.9685	+0.0010 -0.0000	14 x 2.1	0.55 x 0.08	40	1.575
NFS-60	1456.705	1975	840	420	0.642	0.87	60	+0.030 -0.000	2.3622	+0.0012 -0.0000	18 x 2.3	0.71 x 0.09	46	1.811
NFS-70	1854.256	2514	750	380	0.671	0.91	70	+0.030 -0.000	2.7559	+0.0012 -0.0000	20 x 2.7	0.79 x 0.11	51	2.008
NFS-80	2894.232	3924	670	340	0.900	1.22	80	+0.030 -0.000	3.1496	+0.0012 -0.0000	22 x 3.1	0.87 x 0.12	58	2.283

### Installation and Usage

1. The outer race of the NFS Series cam clutch is designed for press fit installation to the housing. Correct interference dimensions of the outer race must be maintained to obtain maximum clutch performance. The internal diameter of the housing should meet the H7 tolerance. Keyways should be made in the end faces of the clutch for proper installation.
2. Make sure the housing has enough strength to withstand the pressure required for the press fitting installation of the clutch.



### Features

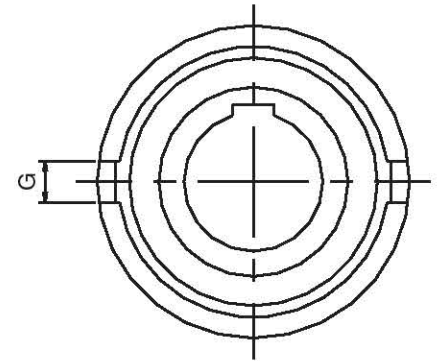
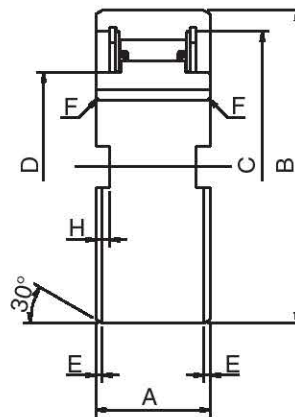
- Sprag type one way clutch
- High torque and longer life than roller ramp clutches
- Full metric design
- Overrunning speed is higher than roller ramp clutches

### Industries Served

- Food and beverage
- Printing
- European machinery
- Gearing
- Textile

### Field Applications

- Exercise equipment
- Roll conveyors
- Printing presses
- Food processing equipment



Model Number	Dimensions														Weight	
	B		C		D		E		F		G		H			
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	g.	lb.
NFS-12	35	1.378	30	1.181	18	0.709	0.6	0.024	0.3	0.012	4	0.157	1.4	0.055	68	0.1
NFS-15	42	1.654	36	1.417	22	0.866	0.8	0.031	0.3	0.012	5	0.197	1.8	0.071	120	0.
NFS-17	47	1.850	38	1.496	22	0.866	1.2	0.047	0.8	0.031	5	0.197	2.3	0.091	150	0.3
NFS-20	52	2.047	45	1.772	27	1.063	1.2	0.047	0.8	0.031	6	0.236	2.3	0.091	220	0.5
NFS-25	62	2.441	52	2.047	35	1.378	1.2	0.047	0.8	0.031	8	0.315	2.8	0.110	360	0.8
NFS-30	72	2.835	62	2.441	40	1.575	1.8	0.071	1.0	0.039	10	0.394	2.5	0.098	530	1.2
NFS-35	80	3.150	70	2.756	48	1.890	1.8	0.071	1.0	0.039	12	0.472	3.5	0.138	790	1.7
NFS-40	90	3.543	78	3.071	55	2.146	1.8	0.071	1.0	0.039	12	0.472	4.1	0.161	1050	2.3
NFS-45	100	3.937	85	3.358	59	2.323	1.8	0.071	1.0	0.039	14	0.551	4.6	0.181	1370	3.0
NFS-50	110	4.331	92	3.622	65	2.559	1.8	0.071	1.0	0.039	14	0.551	5.6	0.220	1900	4.2
NFS-60	130	5.118	110	4.331	84	3.307	2.6	0.102	1.5	0.059	18	0.709	5.5	0.217	3110	6.9
NFS-70	150	5.906	125	4.921	91	3.583	2.6	0.102	1.5	0.059	20	0.787	6.9	0.272	4390	9.7
NFS-80	170	6.693	140	5.512	100	3.937	2.6	0.102	1.5	0.059	20	0.787	7.5	0.295	6440.0	14.2

### Installation and Usage (continued)

- When installing the clutch, mount it with a type 63 bearing to avoid radial force, since this clutch does not have any bearings inside.
- Mount the clutch on the shaft by rotating it in the direction marked by the arrow shown on the clutch plate.
- The recommended shaft tolerance is H7, and the key profile should be in accordance with the following standard.  
NFS-12 DIN 6885. 1  
NFS-15 – 80 DIN6885. 3  
Suitable surface pressure of the key should be selected according to your company design standards.

### Part Number Explanation

**NFS - 35**

— Bore size in millimeters

— Clutch series



# **Morse®**

## **Mechanical Clutches**



### ***The industry's broadest line of conveyor backstop, overrunning and indexing clutches.***

Morse mechanical clutches offer the most complete and versatile selection in the industry. Eleven series of clutches perform three basic modes of operation:

- Overrunning
- Indexing
- Backstopping

These units have set standards of performance, offering:

- Higher overrunning speeds
- Greater torque capacities
- Longer service life

Cam clutches are precision devices that lock the inner and outer races through the wedging action of cams to transmit torque in one direction of rotation while overrunning in the opposite direction of rotation. These units are often referred to as freewheels, sprag, overrunning, backstop or one-way clutches, depending upon their application.

### ***Protect your equipment with Morse and Browning Torque Overload Devices.***

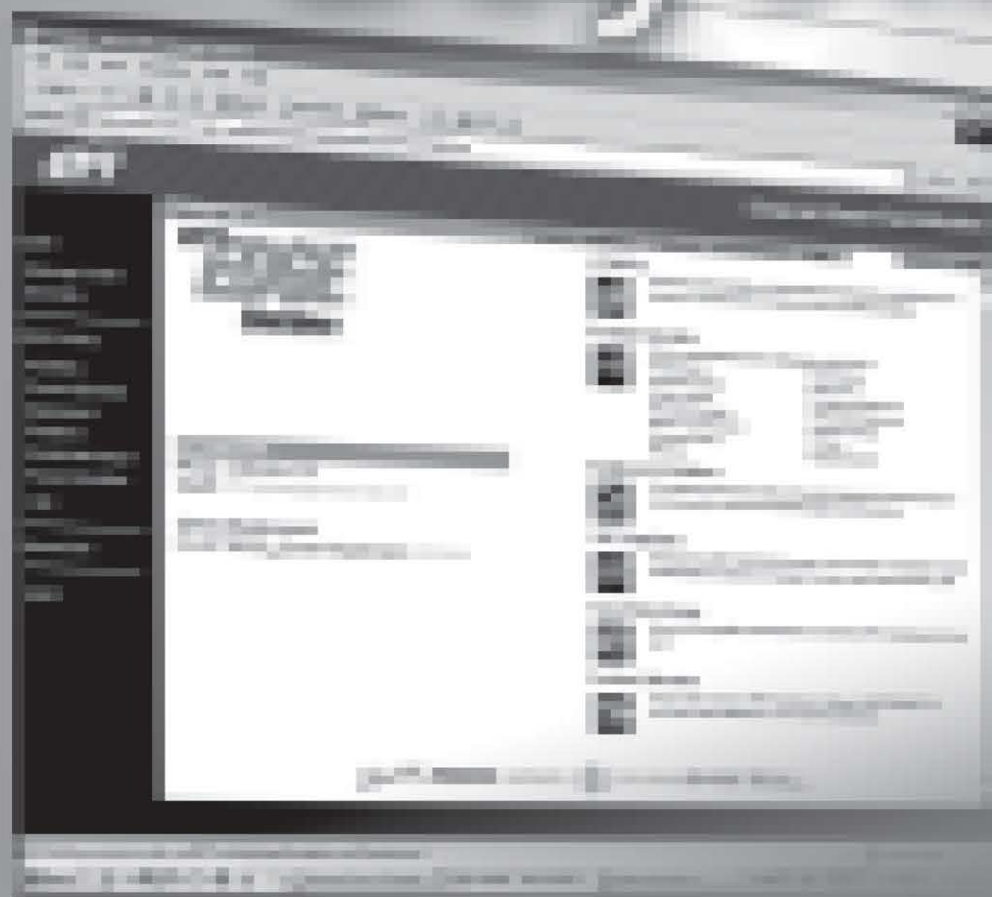
Browning and Morse torque overload devices are designed to protect machinery when an overload or jam occurs. Utilizing a torque overload device can help increase production, reduce downtime and prevent costly repairs. Emerson Power Transmission offers eight different types of torque overload devices available in shear pin, ball detent and friction facing designs. These units are available with up to 1800 rpm, 21,500 ft/lbs of torque and at best, can maintain trip torque within  $\pm 3\%$  accuracy to meet the needs of the most demanding applications.



For selection assistance, call Application Engineering at 1-800-626-2093 or visit [www.emerson-ept.com](http://www.emerson-ept.com)



# *Browning* Morse Beyond



**EPT**

**EDGE**

Online

# the Printed Page

[www.emerson-ept.com](http://www.emerson-ept.com)

Programs to reduce cost  
to you and your customers...

eCatalog

Product Selection

Engineered Solutions

CAD Templates

Smart Interchange

Product Literature



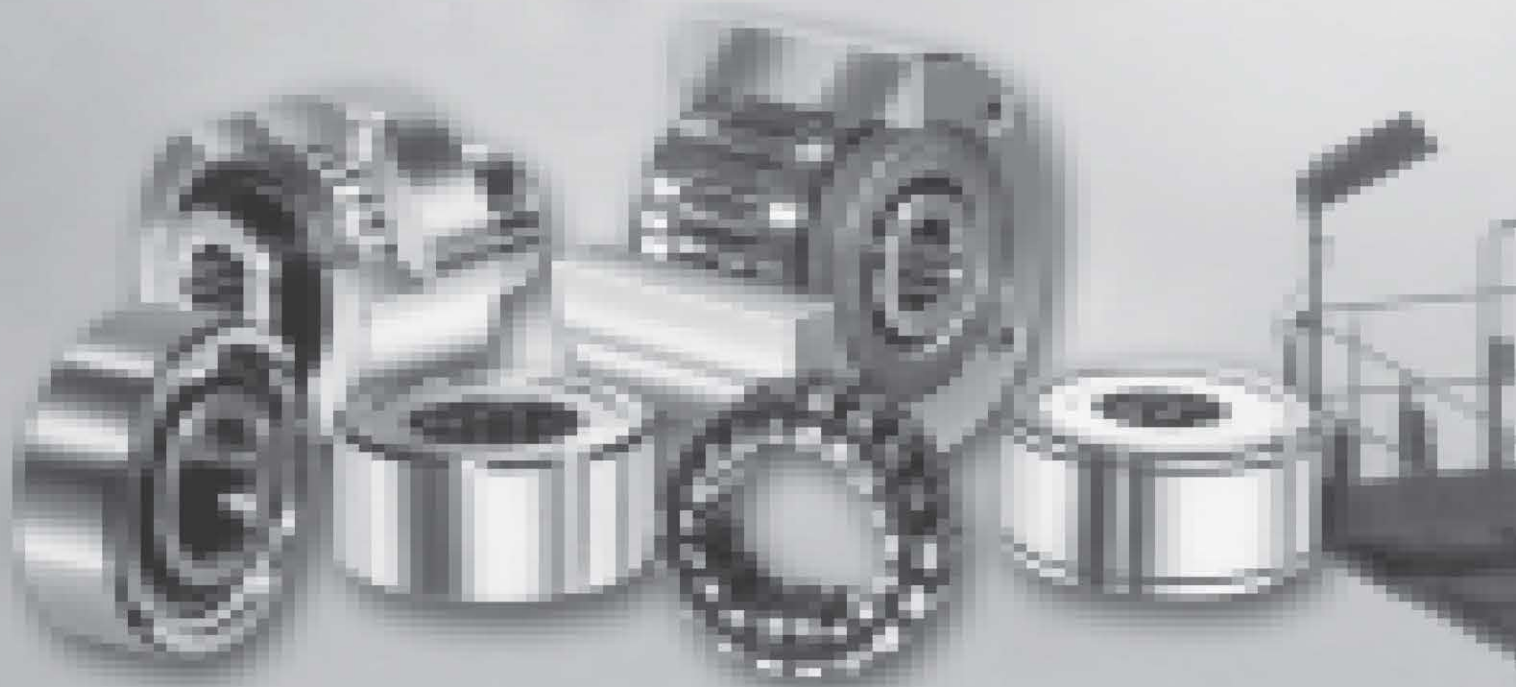
## Custom Design

The Morse line of clutches covers a wide range of sizes and capacities, which handle the majority of industrial applications. However, there are applications that require special designs to meet specific application needs.


Emerson Power Transmission offers engineering assistance in both design and application to help meet these specialized requirements.

For selection assistance, call Application Engineering at 1-800-626-2093 or fax the completed form on page 76 to:

Emerson Power Transmission Application Engineering  
Fax: (606) 564-2079







Morse mechanical cam clutches are precision devices that lock the inner and outer races through the wedging action of cams to transmit torque in one direction of rotation while overrunning in the opposite direction of rotation. These type units are often referred to as freewheels, sprag, overrunning, backstop or one-way clutches, depending upon their application.

Clutches are available with a bore range up through 17.7" and a torque range up through 500,000 lb. ft. and are the most complete and versatile cam clutches available for a variety of applications – from small business machines to giant steel slitters.

Eleven series of clutches perform three basic modes of operation:

- Overrunning
- Indexing
- Backstopping

These units have set standards of performance, offering:

- Higher overrunning speeds
- Greater torque capacities
- Longer service life

## STANDARD TERMS AND CONDITIONS OF SALE (August 15, 2001)

These Terms and Conditions, the attendant quotation or acknowledgment and all documents incorporated by specific reference therein, will be the complete and exclusive statement of the terms of the agreement governing the sale of goods ("Goods") by **Emerson Power Transmission Corporation** and its divisions and subsidiaries ("Seller") to Customer ("Buyer"). Buyer's acceptance of the Goods will manifest Buyer's assent to these Terms and Conditions. If these Terms and Conditions differ in any way from the terms and conditions of Buyer's order, or other documentation, this document will be construed as a counteroffer and will not be deemed an acceptance of Buyer's terms and conditions which conflict herewith.

1. **PRICES:** Unless otherwise specified in writing by Seller, Seller's price for the goods shall remain in effect for thirty (30) days after the date of Seller's quotation or acknowledgment of Buyer's order for the Goods, whichever occurs first, provided an unconditional, complete authorization for the immediate shipment of the Goods is received and accepted by Seller within such time period. If such authorization is not received by Seller within thirty (30) day period, Seller shall have the right to change the price for the Good to Seller's price for the Goods at the time of shipment.

2. **TAXES:** Any tax or governmental charge or increase in same hereafter becoming effective increasing the cost to Seller of producing, selling or delivering the Goods or of procuring material used therein, and any tax now in effect or increase in same payable by the Seller because of the manufacture, sale or delivery of the Goods, may at Seller's option, be added to the price.

3. **TERMS OF PAYMENT:** Subject to the approval of Seller's Credit Department, terms are net thirty (30) days from date of Seller's invoice in U.S. currency. If any payment owed to Seller is not paid when due, it shall bear interest, at a rate to be determined by Seller, which shall not exceed the maximum rate permitted by law, from the date on which it is due until it is paid. Seller shall have the right, among other remedies, either to terminate the Agreement or to suspend further performance under this and/or other agreements with Buyer in the event Buyer fails to make any payment when due. Buyer shall be liable for all expenses, including attorneys' fees, relating to the collection of past due amounts.

4. **SHIPMENT AND DELIVERY:** Shipments are made F.O.B. Seller's shipping point. Any claims for shortages or damages suffered in transit shall be submitted by the Buyer directly to the carrier. While Seller will use all reasonable commercial efforts to maintain the delivery date acknowledged or quoted by Seller, all shipping dates are approximate. Seller reserves the right to make partial shipments and to segregate "specials" and made-to-order Goods from normal stock Goods. Seller shall not be bound to tender delivery of any Goods for which Buyer has not provided shipping instructions.

5. **QUANTITY:** Buyer agrees to accept overruns of up to ten percent (10%) of the order on "made-to-order" Goods, including parts. Any such additional items shall be priced at the price per item charged for the specific quantity ordered.

6. **LIMITED WARRANTY:** Subject to the limitations of Section 7, Seller warrants that the Goods will be free from defects in material and workmanship under normal use, service and maintenance for a period of one year (unless otherwise specified by Seller in writing) from the date of shipment of the Goods by Seller. **THIS IS THE SOLE AND EXCLUSIVE WARRANTY GIVEN BY SELLER WITH RESPECT TO THE GOODS AND IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, ARISING BY OPERATION OF LAW OR OTHERWISE, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WHETHER OR NOT THE PURPOSE OR USE HAS BEEN DISCLOSED TO SELLER IN SPECIFICATIONS, DRAWINGS OR OTHERWISE, AND WHETHER OR NOT SELLER'S PRODUCTS ARE SPECIFICALLY DESIGNED AND/OR MANUFACTURED BY SELLER FOR BUYER'S USE OR PURPOSE.**

This warranty does not extend to any losses or damages due to misuse, accident, abuse, neglect, normal wear and tear, unauthorized modification or alteration, use beyond rated capacity, or improper installation, maintenance or application. To the extent that Buyer or its agents has supplied specifications, information, representation of operating conditions or other data to Seller in the selection or design of the Goods and the preparation of Seller's quotation, and in the event that actual operating conditions or other conditions differ from those represented by Buyer, any warranties or other provisions contained herein which are affected by such conditions shall be null and void. If within thirty (30) days after Buyer's discovery of any warranty defects within the warranty period, Buyer notifies Seller thereof in writing, Seller shall, at its option, repair or replace F.O.B. point of manufacture, or refund the purchase price for, that portion of the goods found by Seller to be defective. Failure by Buyer to give such written notice within the applicable time period shall be deemed an absolute and unconditional waiver of Buyer's claim for such defects. Goods repaired or replaced during the warranty period shall be covered by the foregoing warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. Buyer assumes all other responsibility for any loss, damage, or injury to persons or property arising out of, connected with, or resulting from the use of Goods, either alone or in combination with other products/components.

**SECTIONS 6 AND 7 APPLY TO ANY ENTITY OR PERSON WHO MAY BUY, ACQUIRE OR USE SELLER'S GOODS, INCLUDING ANY ENTITY OR PERSON WHO BUYS THE GOODS FROM SELLER'S DISTRIBUTOR AND SUCH ENTITY OR PERSON SHALL BE BOUND BY THE LIMITATIONS THEREIN.**

7. **LIMITATION OF REMEDY AND LIABILITY:** THE SOLE AND EXCLUSIVE REMEDY FOR BREACH OF ANY WARRANTY HEREUNDER (OTHER THAN THE WARRANTY PROVIDED UNDER SECTION 13) SHALL BE LIMITED TO REPAIR, REPLACEMENT OR REFUND OF THE PURCHASE PRICE UNDER SECTION 6. SELLER SHALL NOT BE LIABLE FOR DAMAGES CAUSED BY DELAY IN PERFORMANCE AND IN NO EVENT, REGARDLESS OF THE FORM OF THE CLAIM OR CAUSE OF ACTION (WHETHER BASED IN CONTRACT, INFRINGEMENT, NEGLIGENCE, STRICT LIABILITY, OTHER TORT OR OTHERWISE), SHALL SELLER'S LIABILITY TO BUYER AND/OR ITS CUSTOMERS EXCEED THE PRICE TO BUYER OF THE SPECIFIC GOODS PROVIDED BY SELLER GIVING RISE TO THE CLAIM OR CAUSE OF ACTION. BUYER AGREES THAT IN NO EVENT SHALL SELLER'S LIABILITY TO BUYER AND/OR ITS CUSTOMERS EXTEND TO INCLUDE INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES. THE TERM "CONSEQUENTIAL DAMAGES" SHALL INCLUDE, BUT NOT BE LIMITED TO, LOSS OF ANTICIPATED PROFITS, LOSS OF USE, LOSS OF REVENUE, COST OF CAPITAL AND DAMAGE OR LOSS OF OTHER PROPERTY OR EQUIPMENT.

It is expressly understood that any technical advice furnished by Seller with respect to the use of the Goods is given without charge, and Seller assumes no obligation or liability for the advice given, or results obtained, all such advice being given and accepted at Buyer's risk.

**GOODS AND/OR SERVICES SOLD HEREUNDER ARE NOT FOR USE IN ANY NUCLEAR AND RELATED APPLICATIONS.** Buyer accepts goods and/or services with the foregoing understanding, agrees to communicate the same in writing to any subsequent purchaser or users and to defend, indemnify and hold harmless Seller from any claims, losses, suits, judgments and damages, including incidental and consequential damages, arising from such use, whether the cause of action be based in tort, contract or otherwise, including allegations that the Seller's liability is based on negligence or strict liability.

8. **EXCUSE OF PERFORMANCE:** Seller shall not be liable for delays in performance or for non-performance due to acts of God, acts of Buyer, war, riot, fire, flood, other severe weather, sabotage, or epidemics; strikes or labor disturbances; governmental requests, restrictions, laws, regulations, orders or actions; unavailability of or delays in transportation; default of suppliers; or unforeseen circumstances or any events or causes beyond Seller's reasonable control. Deliveries may be suspended for an appropriate period of time as a result of the foregoing. If Seller determines that its ability to supply the total demand for the Goods, or to obtain material used directly or indirectly in the manufacture of the Goods, is hindered, limited or made impracticable due to causes addressed in this Section 8, Seller may allocate its available supply of the Goods or such material (without obligation to acquire other supplies of any such Goods or material) among itself and its purchasers on such basis as Seller determines to be equitable without liability for any failure of performance which may result therefrom. Deliveries suspended or not made by reason of this section may be canceled by Seller upon notice to Buyer without liability, but the balance of the agreement shall otherwise remain unaffected.

9. **CANCELLATION:** The Buyer may cancel orders only upon written notice and upon payment to Seller of cancellation charges which include, among other things, all costs and expenses incurred and commitments made by the Seller and a reasonable profit thereon.

10. **CHANGES:** Buyer may request changes or additions to the Goods consistent with Seller's specifications and criteria. In the event such changes or additions are accepted by Seller, Seller may revise the price and delivery schedule. Seller reserves the right to change designs and specifications for the Goods without prior notice to Buyer, except with respect to Goods being made-to-order for Buyer.

11. **TOOLING:** Tool, die, and pattern charges, if any, are in addition to the price of the Goods and are due and payable upon completion of the tooling. All such tools, dies and patterns shall be and remain the property of Seller. Charges for tools, dies, and patterns do not convey to Buyer, title, ownership interests in, or rights to possession or removal, nor prevent their use by Seller for other purchasers, except as otherwise expressly provided by Seller and Buyer in writing with reference to this provision.

12. **ASSIGNMENT:** Buyer shall not assign its rights or delegate its duties hereunder or any interest therein or any rights hereunder without the prior written consent of the Seller, and any such assignment, without such consent, shall be void.

13. **PATENTS AND COPYRIGHTS:** Subject to Section 7, Seller warrants that the Goods sold, except as are made specifically for Buyer according to Buyer's specifications, do not infringe any valid U.S. patent or copyright in existence as of the date of delivery. This warranty is given upon the condition that Buyer promptly notify Seller of any claim or suit involving Buyer in which such infringement is alleged, and that Buyer cooperate fully with Seller and permit Seller to control completely the defense or compromise of any such allegation of infringement. Seller's warranty as to use only applies to infringements arising solely out of the inherent operation (i) of such Goods, or (ii) of any combination of Goods in a system designed by Seller. In the event such Goods, singularly or in combination, are held to infringe a U.S. patent or copyright in such suit, and the use of such Goods is enjoined, or in the case of a compromise by Seller, Seller shall have the right, at its option and expense, to procure for Buyer the right to continue using such Goods, or replace them with non-infringing Goods; or modify same to become non-infringing; or grant Buyer a credit for the depreciated value of such Goods and accept return of them.

14. **MISCELLANEOUS:** These terms and conditions set forth the entire understanding and agreement between Seller and Buyer, and supersede all other communications, negotiations and prior oral or written statements regarding the subject matter of these terms and conditions. No change, modification, rescission, discharge, abandonment, or waiver of these terms and conditions of Sale shall be binding upon the Seller unless made in writing and signed on its behalf by an officer of the Seller. No conditions, usage or trade, course of dealing or performance, understanding or agreement purporting to modify, vary, explain, or supplement these Terms and Conditions shall be binding unless hereafter made in writing and signed by the party to be bound, and no modification shall be affected by the acceptance of purchase orders or shipping instruction forms containing terms at variance with or in addition to those set forth herein. Any such modifications or additional terms are specifically rejected by Seller. No waiver by Seller with respect to any breach or default or any right or remedy and no course of dealing, shall be deemed to constitute a continuing waiver of any other breach or default or of any other right or remedy, unless such waiver be expressed in writing and signed by the party to be bound. Seller is not responsible for typographical or clerical errors made in any quotation, orders or publications. All such errors are subject to correction. The validity, performance, and all other matters relating to the interpretation and effect of this contract shall be governed by the law of the state of New York. The United Nations Convention on the International Sale of Goods shall not apply to any transaction hereunder.