Americardan Universal Joints
5000 Series High Torque Density

Ameridrives Power Transmission

An Altra Industrial Motion Company

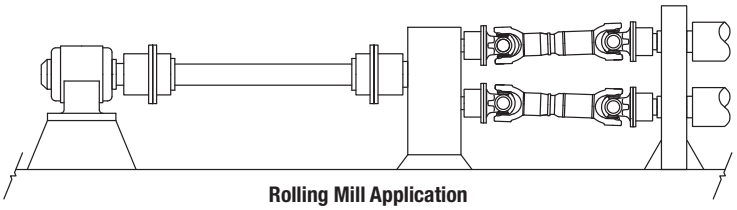
Building on over 30 years of experience in the design and manufacture of heavy-duty universal joints, Ameridrives Power Transmission (APT) introduces the 5000 series of universal joints. Currently available in five sizes with swing diameters ranging from 225mm to 390mm with larger sizes in preparation in excess of 1000mm. Static torque capabilities range from 54 kN-m to 5060 kN-m rated capacity.

Utilizing a proven one-piece yoke optimized with finite element analysis methods permit use of a larger diameter bearing cap, thus accommodating a larger bearing package and cross journal. Larger bearings assures higher capacity longer life universal joints for a given swing diameter. A round bearing cap also provides a more robust and efficient design. Yokes and crosses are balanced in terms of strength and deflection. The resulting joints are 130-200% greater endurance and peak capacity compared to former 3000 series for a given swing diameter.

APT universal joints offer greater dynamic ratings than other universal joints of equivalent size. The dynamic rating is a measure of the universal joint's life. It indicates the ability of the universal joint to transmit a given power through a specific joint operating angle at a certain speed for a specified number of hours. Since the life of the universal joint is really an expression of the life of the roller bearings, the dynamic rating of the universal joint can be calculated from a formula based on modifications of basic roller bearing formulas. APT design emphasis in this area has resulted in the adoption of larger diameter full compliment roller bearings as standard. Larger bearings mean greater life expectancy for a given swing diameter—an important consideration to designers and users who are now experiencing unsatisfactory universal joint performance yet do not have space for a larger size. In choosing universal joints for any industrial application, bear in mind this fact: APT universal joints offer greater dynamic ratings than other universal joints of equivalent size.

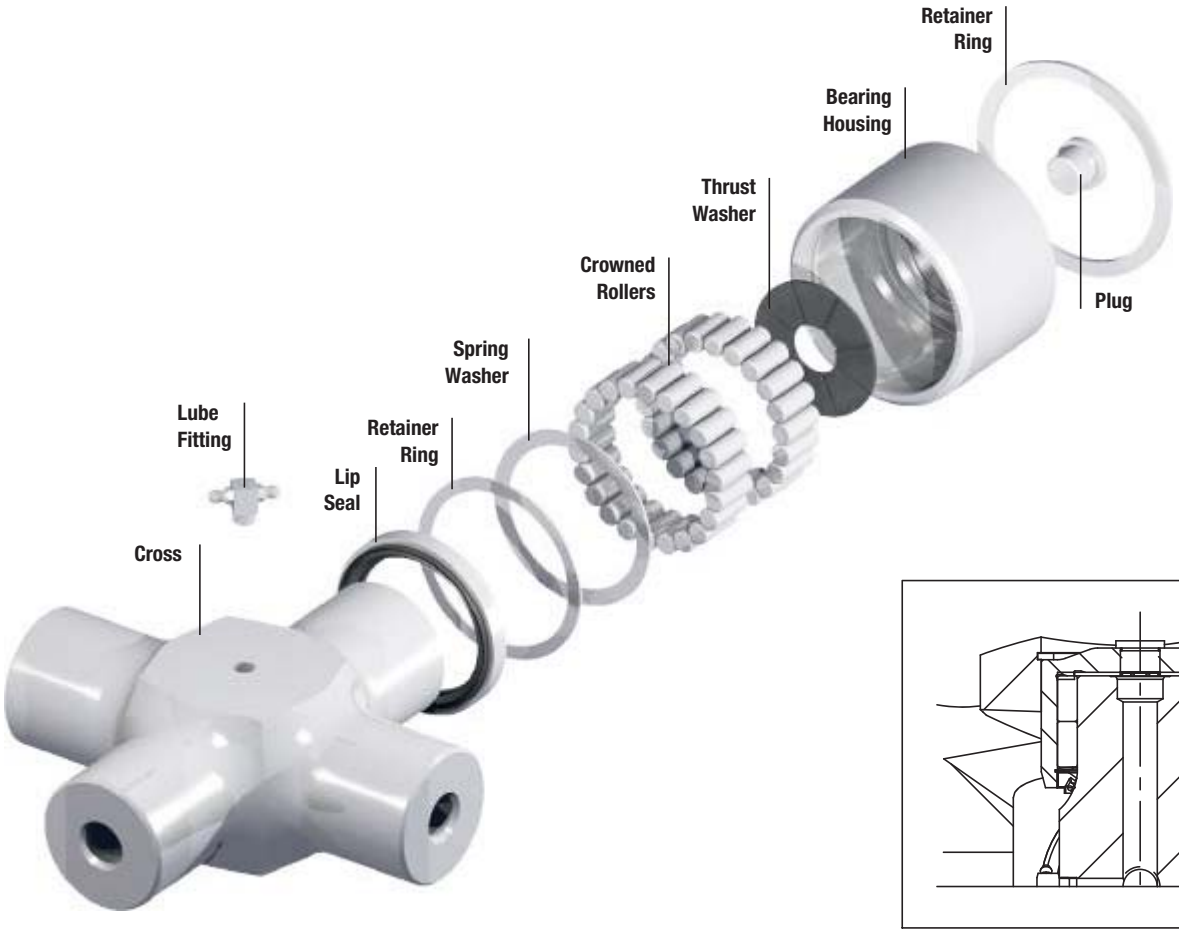
APT calculates a universal joint lifespan based on four variables—torque, speed, angularity and application factors. For this reason, you can choose a universal joint design to match the predicted lifespan of the other components in your drive system.

Two standard finishes are offered designated as the “Power Series” and the “Life Series”. The higher capacity “Power Series” utilizes larger diameter telescopic spline sections in order to take full advantage of the improved torque capacities of the joints. Where long bearing life is required the “Life Series” utilizes smaller more economical slip sections. This bulletin has been prepared to assist designers in making tentative size selections, trained factory Application Engineers are available in Green Bay, Wisconsin, to assist in solving universal joint application problems. Ameridrives Power Transmission factory authorized agents and distributors are available to make specific recommendations on universal joint applications. APT Engineers can offer special designs to meet specific application requirements.



Rolling Mill Application

Design Features



Radius Shoulder Trunions—Shoulder has generous radius at base of cross trunion to reduce stress.

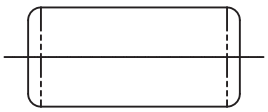
Double-Lip Seal—Abrasion resistant multi-lip extruder type seals to insure integrity of the bearing lube reservoir.

Thrust Bearings—Each cap has a filled nylon compound thrust washer to prevent steel-on-steel contact of the trunion to minimize friction and prevent galling under heavy loads. Filled nylon bearings automatically adjust themselves to compensate for minor deflections.

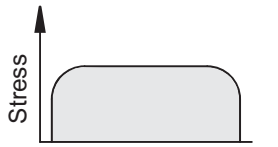
Crowned Rollers—Eliminate stress concentrations at the ends of the rollers. The reduction in stress contributes significantly to increased bearing (B10) life.

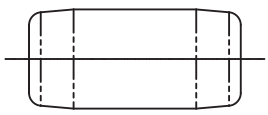
Zero Clearance Assembly—Cross and bearing assembled for zero radial clearance for optimum thrust and radial bearing performance and elimination of radial whirl and associated vibrations.

Contoured Bearing Caps—Allows longer cross journals for increased torque and bearing capacity.



Straight Roller





Crowned Roller

Selection Procedure

Four types of torque ratings are given for most joint sizes.

Life torque (Tl) is the bearing life rating of the universal joint. This torque is based on the B-10 life of the universal joint bearings. The life torque values listed are based on 5000 hours B-10 bearing life at 3° misalignment and 100 RPM. B-10 life is defined as the minimum life expectancy for a 90% probability of survival. Typically the average actual operating life of the bearings is 5X the calculated B-10 life.

Endurance Torque (Tdw) is the normal rating for fully reversed torque based on material strength.

Functional Limit Torque (Tcs) is the maximum permissible torque that can be transmitted without damage for a limited time.

Peak torque (Tk) is the maximum torque based on the capacity of the cross and bearing.

The torque ratings are based on material strength. When approaching these limits the capacity of the desired flange connection should be verified. When the service torque **(Tsv)** approaches the endurance torque **(Tdw)** or when the maximum torque approaches the peak torque capacity **(Tk)** of the universal joint, face keys or face pads are recommended. The number of pads and bolts are customized on a per application basis. Hirth radial teeth are also available on a per application basis.

Universal Joint Selection Calculate application torque **(Ta)** and service torque **(Tsv)**.

$$\mathbf{Ta} = \frac{\text{kW x 9.549}}{\mathbf{N}} \text{ (kN-M)}$$

N = Speed (RPM)

Tsv = Service Torque
= **Ta** x Service Factor (see page 5)

Tsv must be less than **Tdw** for reversing torque applications.

II. Check to see if life is sufficient.

$$\mathbf{Lh} = \frac{1.5 \times 10^6}{\mathbf{A} \times \mathbf{N}} \left[\frac{\mathbf{Tl}}{\mathbf{Ta}}\right]^{\frac{10}{3}}$$

Where:
Lh = B-10 life in hours

A = operating angle in degrees

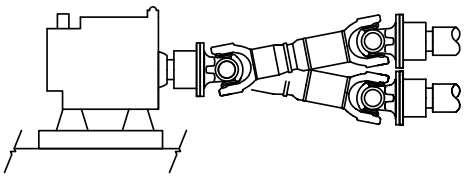
N = speed (RPM)

Tl = life torque

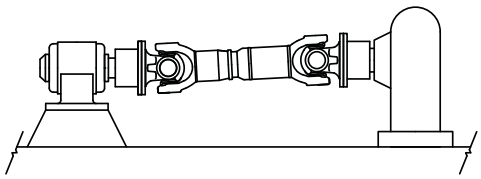
Ta = application torque

Determine Peak Torque conditions. **Tk** must exceed the maximum operating torque.

Other considerations:
There are many other items that can determine the size of a universal joint.



Universal joints permit motion of machinery



Universal joints allow offset of drive and driven equipment

These include:
1. Diameter and length limitations.
2. Bore size.
3. Equipment restrictions on forces and moments.
4. Speed limits (see charts on page 5)

a. due to mass acceleration as a function of misalignment

b. critical speed of center shaft

Telescopic splines are available on ST designs. Telescopic sections are required for length compensation between two end connections. They will compensate for length changes due to machine articulation, temperature changes, frame flexure . . . etc. For increased durability induction hardened, nitrided or coated splines are available on request.

Axial Forces

While universal joints do not produce axial forces they will transmit a portion of the axial forces applied to them. The amount of axial force that they can transmit via the spline section is a function of the spline coefficient of friction, operating torque and the spline pitch diameter per the following formula.

$$\mathbf{F} = \frac{2T\square}{\mathbf{PD}}$$

F = Axial Force

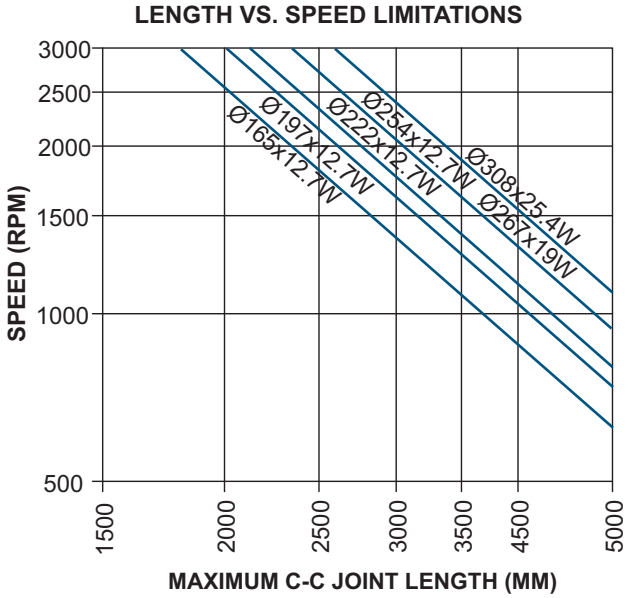
T = Operating Torque

□ = Coefficient of Friction (.11 to .15 for lubricated steel on steel, contact Ameridrives Power Transmission for other conditions)

PD= Spline Pitch Diameter

Application Service Factors

Load	Driven Equipment	Continuous Non-Reversing Prime Movers AC Motors Turbines	Reversing Prime Movers DC Motors Recipricating Engines
Constant Torque	Generators Centrifugal Pumps Conveyors	1.00	1.50
Light Torque	Continuous Casters Light fans Machine Tools Woodworking Equipment Paper Mill Equipment Bar & Rod Mills	1.25	2.00
Medium Torque	Compressors Pumps, Fans Cold Rolling Mills Presses Agricultural Equipment	1.50	2.25
Heavy Shock	Traction & Locomotive Drives Mixers, Crane Drives Mining Equipment Hot Rolling Mill Drives Runout tables	2.00	3.00
Very Heavy Shock	Ore Crushers Scale Breakers Feed Roll Drives	3.00	5.00



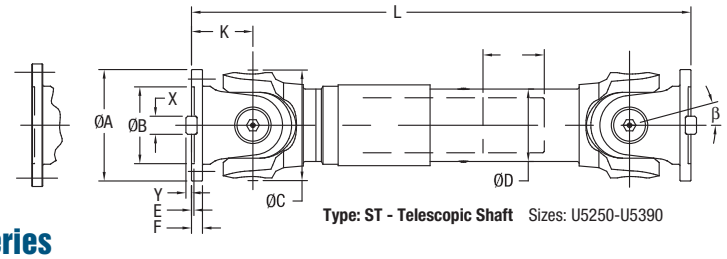
Maximum RPM

In applications where long shafts and/or high speed are combined, the speed is restricted by the lateral critical speed of the center section. This speed is a function of the center tube diameter, wall thickness and the effective length. The maximum operating speed must be less than the lateral critical speed. The maximum operating speed must not exceed 75% of critical speed. For most applications involving universal joints, operation at 1/2 critical speed will also create unacceptable vibration. For these applications the operating speed should be above or below 50% of the maximum indicated. For shafts greater than shown or where the the allowable speeds are exceeded special oversize tubing may be used. Please contact Ameridrives Power Transmission for details.

Balancing

Driveshafts are generally provided straightened and balanced. For some low speed applications they are provided straightened only. For high speed applications and some sensitive applications, special balance requirements may be required. Please contact Ameridrives Power Transmission.

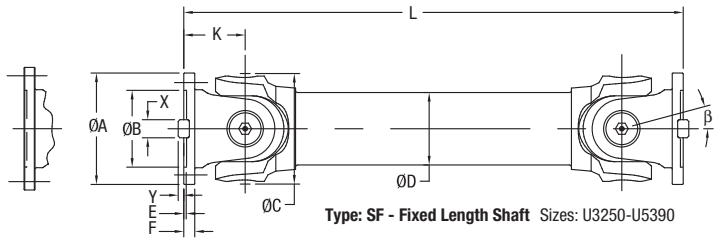
Engineering Data



Type: ST - Telescopic Shaft Sizes: U5250-U5390

Life Series

Series	U5225L	U5250L	U5285L	U5315L	U5350L	U5390L
Torque Ratings						
Tcs kN-m	54	78	115	150	199	327
Tk kN-m	42	60	88	115	153	252
Tdw kN-m	26	36	54	70	93	152
Tl kN-m	26	39	54	76	102	138
Dimensional Data						
	mm	**mm**	**mm**	**mm**	**mm**	**mm**
A	250	285	315	350	390	435
B	140	175	175	220	250	280
D	140	165	191	222	254	267
E	6	7	7	8	8	10
F	18	20	22	25	32	40
DBC	218	245	280	310	345	385
Bolt Qty.	8	8	8	10	10	10
H	18	20	22	22	24	27



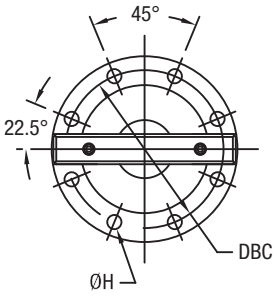
Type: SF - Fixed Length Shaft Sizes: U3250-U5390

Power Series

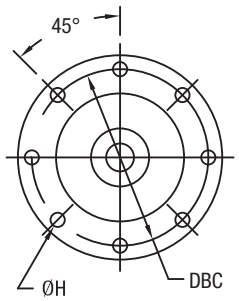
Series	U5225P	U5250P	U5285P	U5315P	U5350P	U5390P
Torque Ratings						
Tcs kN-m	78	115	150	199	327	483
Tk kN-m	60	88	115	153	252	372
Tdw kN-m	36	54	70	93	144	215
Tl kN-m	26	39	54	76	102	138
Dimensional Data						
	mm	**mm**	**mm**	**mm**	**mm**	**mm**
A	225	250	285	315	350	390
B	105	105	125	130	155	170
D	165	191	222	254	267	308
E	5	6	7	8	8	8
F	20	25	27	32	35	40
DBC	196	218	245	280	310	345
Bolt Qty.	8	8	8	10	10	10
H	17	19	21	23	23	25
X	32	40	40	40	40	70
Y	9.0	12.5	15	15	16	18

Minimum Length $L_{3)}$ / Length Compensation S							
		mm	**mm**	**mm**	**mm**	**mm**	**mm**
?		15°	15°	15°	15°	15°	15°
C		225	250	285	315	350	390
K		125	140	160	180	194	215
ST	**L**	875	935	1190	1315	1410	1530
	S	140	140	140	140	150	165
SF	**L**	570	625	720	805	855	955
FT	**L**	1110	1170	1210	1350	1465	1600
	S	140	140	140	140	150	165
FF	**L**	500	560	640	720	776	860

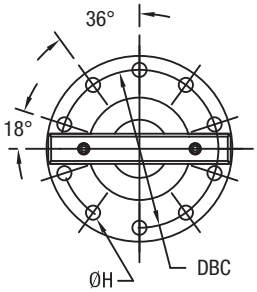
Flange Designs



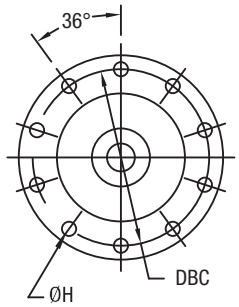
8 Bolt Flange Design
With Face Key



8 Bolt Flange Design

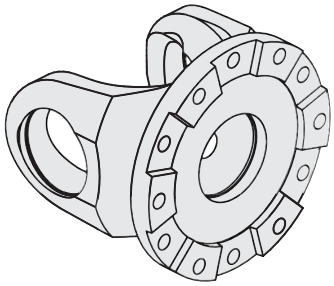


10 Bolt Flange Design
With Face Key

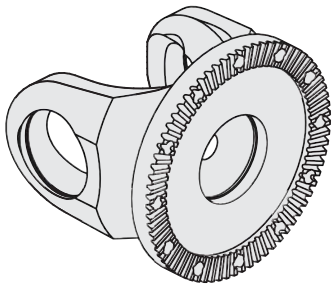


10 Bolt Flange Design

OPTIONAL FACE PAD DESIGNS

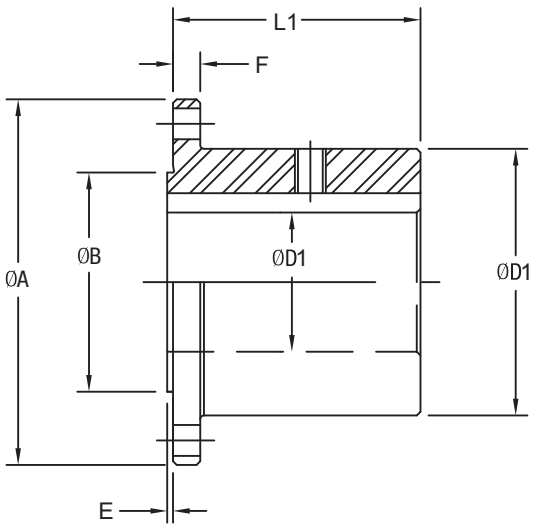


Optional Face Pad Design

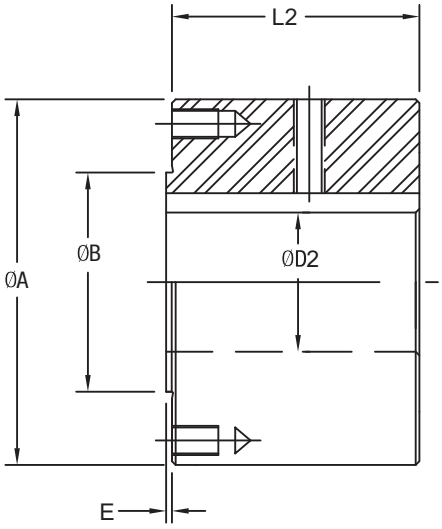


Optional Hirth Radial Tooth Design

COMPANION FLANGES



DESIGN I / SF



Design II / SLF

Size	U5225		U5250		U5285		U5315		U5350		U5390	
A	225	250	250	285	285	315	315	350	350	390	390	435
B	105	140	105	175	125	175	130	220	155	250	170	280
E	4	5	5	6	6	6	6	7	7	7	7	9
F	25	25	25	27	27	32	32	35	35	40	40	42
L1	125	150	150	175	175	205	205	230	230	255	255	285
D1	155	190	190	215	215	245	245	275	275	305	305	310
d1	105	125	125	140	140	164	164	184	184	205	205	210
L2	185	210	210	238	238	260	260	285	285	310	310	275
d2	150	165	165	190	190	210	210	228	228	255	255	295

In accordance with our established policy to constantly improve our products, the specifications contained herein are subject to change without notice. Ameridrives Power Transmission reminds users that safe operation depends on proper installation, operation and routine maintenance and inspection under prevailing conditions. It is the responsibility of the purchaser to provide and install guards or safety devices, which may be required by recognized safety standards or by local laws and ordinances. Further it is the responsibility of the purchaser to assure the interface connection between couplings and connected equipment (flanges, bolting, keys, hydraulic fits, etc.) are capable of handling anticipated loads.

Altra Industrial Motion

All Customer Service phone numbers shown in bold

Electromagnetic Clutches and Brakes

Warner Electric

Electromagnetic Clutches and Brakes

New Hartford, CT - USA
1-800-825-6544

For application assistance: 1-800-825-9050

St Barthelemy d'Anjou, France
+33 (0) 2 41 21 24 24

Precision Electric Coils and Electromagnetic Clutches and Brakes

Columbia City, IN - USA
1-260-244-6183

Matrix International

Electromagnetic Clutches and Brakes, Pressure Operated Clutches and Brakes

Brechin, Scotland
+44 (0) 1356 602000

New Hartford, CT - USA
1-800-825-6544

Inertia Dynamics

Spring Set Brakes; Power On and Wrap Spring Clutch/Brakes

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1-800-800-6445

Overrunning Clutches

Formsprag Clutch

Overrunning Clutches and Holdbacks

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1-800-348-0881– Press #1

For application assistance: 1-800-348-0881 – Press #2

Marland Clutch

Roller Ramp and Sprag Type Overrunning Clutches and Backstops

Burr Ridge, IL - USA
1-800-216-3515

Stieber Clutch

Overrunning Clutches and Holdbacks

Heidelberg, Germany
+49 (0) 6221 30 47 0

Engineered Couplings

Ameridrives Couplings

Mill Spindles, Ameriflex, Ameridisc

Erie, PA - USA
1-814-480-5000

Gear Couplings

San Marcos, TX - USA
1-800-458-0887

Bibby Transmissions

Disc, Gear, Grid Couplings, Overload Clutches

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+44 (0) 1924 460801

Boksburg, South Africa
+27 11 918 4270

TB Wood's

Elastomeric Couplings

Chambersburg, PA - USA
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For application assistance: 1-888-829-6637 – Press #7

General Purpose Disc Couplings

San Marcos, TX - USA
1-888-449-9439

Ameridrives Power Transmission

Universal Joints, Drive Shafts, Mill Gear Couplings

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1-920-593-2444

Huco Dynatork

Precision Couplings and Air Motors

Hertford, England
+44 (0) 1992 501900

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1-800-825-6544

Linear Products

Warner Linear

Linear Actuators

Belvidere, IL - USA
1-800-825-6544

For application assistance: 1-800-825-9050

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Heavy Duty Clutches and Brakes

Wichita Clutch

Pneumatic Clutches and Brakes

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1-800-964-3262

Bedford, England
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Twiflex Limited

Caliper Brakes and Thrusters

Twickenham, England
+44 (0) 20 8894 1161

Industrial Clutch

Pneumatic and Oil Immersed Clutches and Brakes

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Gearing

Boston Gear

Enclosed and Open Gearing, Electrical and Mechanical P.T. Components

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For application assistance: 1-800-816-5608

Nuttall Gear and Delroyd Worm Gear

Worm Gear and Helical Speed Reducers

Niagara Falls, NY - USA
1-716-298-4100

Belted Drives and Sheaves

TB Wood's

Belted Drives

Chambersburg, PA - USA
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For application assistance: 1-888-829-6637 – Press #7

Engineered Bearing Assemblies

Kilian Manufacturing

Engineered Bearing Assemblies

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1-315-432-0700

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P-1751-APT 12/10 Printed in U.S.A.