E2/20103

EUROGRIP™

Flexible couplings

New

A NEW PRODUCT RANGE TO DIN 740 PART 2

GATES EUROGRIP™ FLEXIBLE COUPLINGS
THE DESIGNER'S CHOICE

Electronic speed controls are increasingly being used in industry. In response to this requirement, Gates has developed a flexible coupling range covering standard motor sizes. Gates EuroGrip™ flexible couplings consist of a rubber sleeve and two metal end pieces. The design of Gates EuroGrip™ flexible couplings is unique, with its OGEE lines[1] allowing the coupling to act as a torque/life indicator for the drive.

Gates EuroGrip™ flexible couplings are available in sizes 19, 28, 42, 48 and 60 and are bored to a suit taper bush or a plain bore and keyway.

Gates EuroGrip™ flexible couplings have high vibration damping capacity, which makes them especially suitable for direct drive applications in pumps and compressors. Their high compliance is especially appreciated by designers of speed control systems, where resonance can be a problem. The zero backlash characteristics result in high positioning accuracy and repeatability, allowing a wide range of applications in the linear actuator market.

FEATURES

- Unique OGEE lines[1] on the sleeve are an indicator of torque and product life.
- Sleeves are made of a high-performance elastomeric compound. The sleeve design allows the coupling to act as a predictable fuse in the system.
- End pieces are made of a high-grade aluminum to reduce weight and inertia. The aluminum end pieces are anodised to increase wear resistance and strength. Available either with finished bore and keyway or to suit a taper bush.
- Temperatures range from -25°C to +100°C.

BENEFITS

- High vibration damping. Damping increases with load, which will prevent resonance.
- Low noise levels and quiet in operation.
- Zero backlash and, consequently, high positioning accuracy.
- Easy to install and to replace. Can be inspected without stopping the drive.
- Built-in safety measure: the driven machine will stop when the coupling fails.
- High tolerance of combinations of radial and angular misalignment.
- Durable.
- Low inertia.
- Compact design.
- Light weight.

[1] Patent applied for

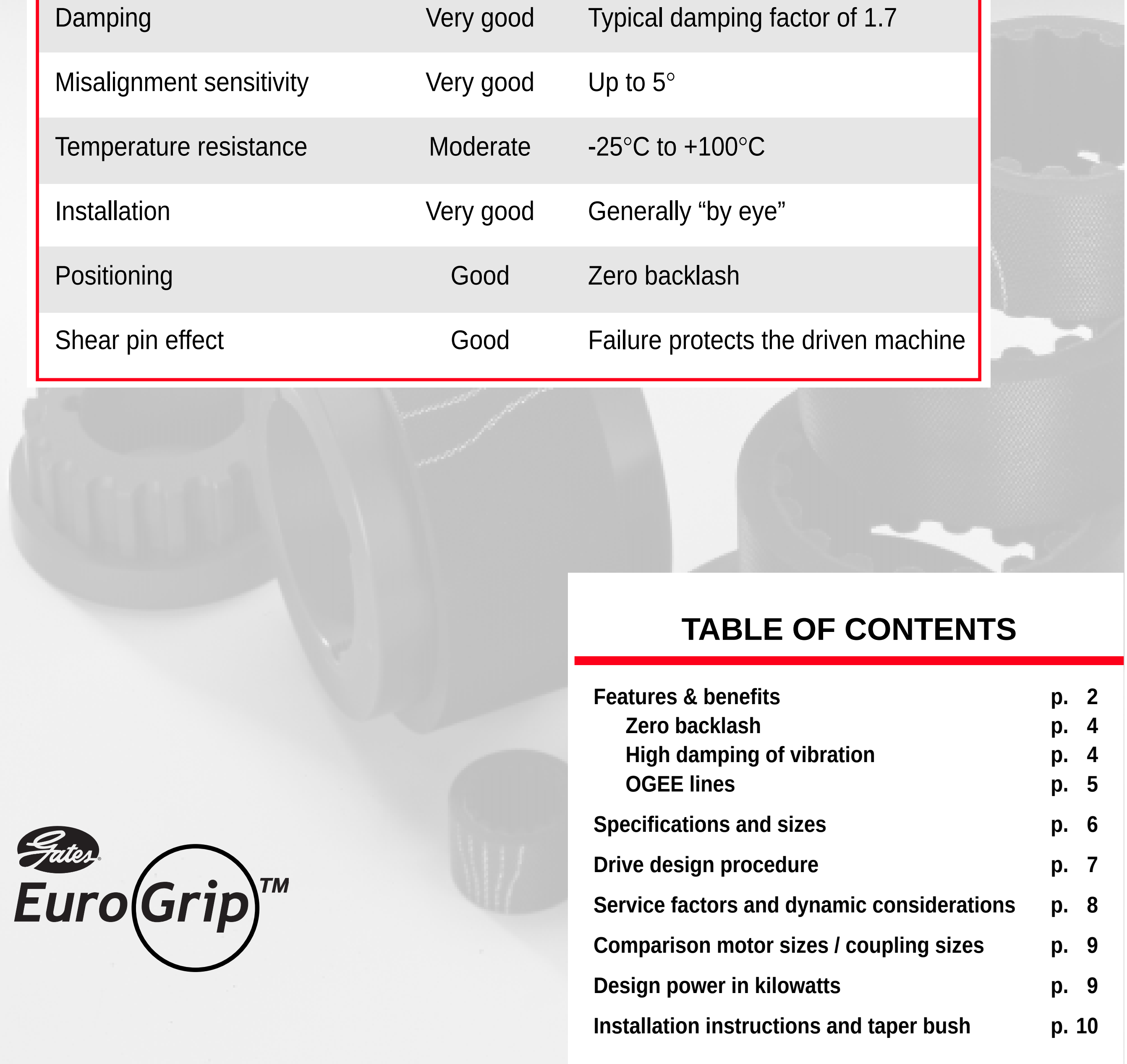
EUROGRIP™ COUPLINGS FEATURES & BENEFITS

AT A GLANCE

Gates EuroGrip™ flexible coupling was tested by the Institut für Maschinenelemente der RWTH-Aachen. The following table highlights the features and design opportunities of Gates EuroGrip™ flexible couplings. The technical evaluation is from the Institut für Maschinenelemente der RWTH-Aachen.

Table 1

	Gates EuroGrip™	
Torque	Good	Up to 850 Nm peak torque
Durability	Good	Conforms to DIN 740 Part 2
Torsional Flexibility	Very good	Approx. 7° twist at peak torque
Damping	Very good	Typical damping factor of 1.7
Misalignment sensitivity	Very good	Up to 5°
Temperature resistance	Moderate	-25°C to +100°C
Installation	Very good	Generally “by eye”
Positioning	Good	Zero backlash
Shear pin effect	Good	Failure protects the driven machine



Gates EuroGrip™

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EUROGRIP™ COUPLINGS FEATURES & BENEFITS

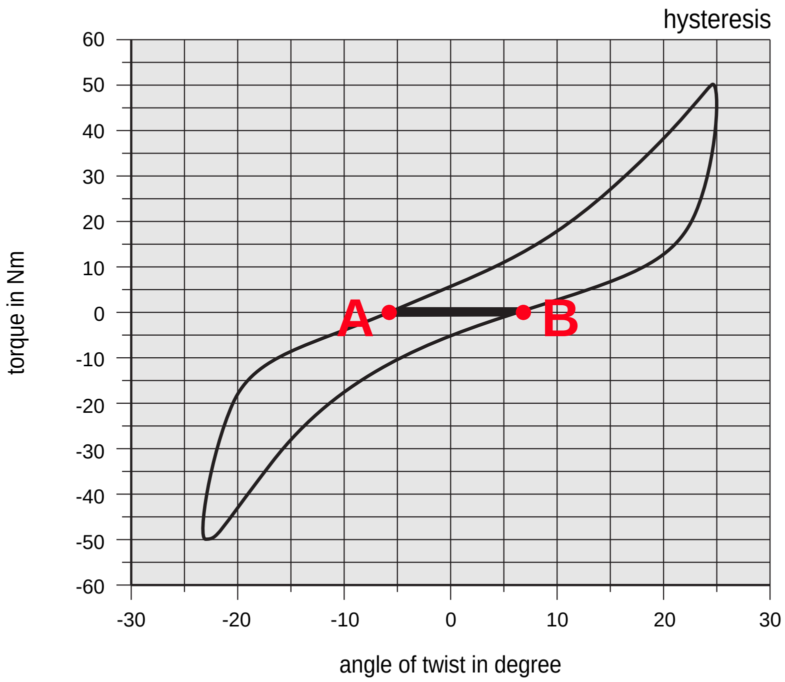
ZERO BACKLASH

Backlash is defined as the free movement or "play" occuring between two connected elements when subjected to a reversing movement. Backlash is different from the angular displacement that occurs with change of load i.e. elastic deformation.

Gates EuroGrip™ flexible coupling is classed as a zero backlash coupling, this is to say that though it will deform elastically whilst turning, on reversing it will return to the starting point. This feature is particularly required for positioning drives, actuators etc where the final position is critical.

The effect of zero backlash can be clearly seen in the hysteresis curve (see Fig. 1). As the displacement moves through the zero condition, there is a positive distance between the two boundary lines (points A & B). In a backlash situation, the two boundary lines would coincide becoming a single line along the displacement axis, the length of this line indicating the amount of backlash in the connection.

Figure 1



HIGH VIBRATION DAMPING

The damping coefficients are given in table 7 on page 8.

This value is the amount of vibrational energy the coupling will absorb and is calculated in accordance with DIN 740 part 2.

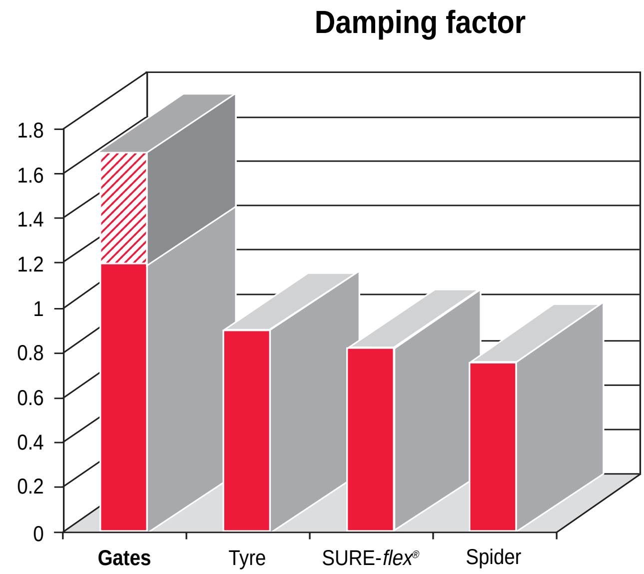
The value is calculated from the hysteresis curves and is the ratio between the absorbed energy over a complete load cycle and the elastic strain energy over a quarter period. Hence a factor of 2 would indicate that 50% of the vibrational energy is absorbed.

The chart at the right compares the damping coefficient of Gates new EuroGrip™ flexible couplings with typical flexible couplings.

Source: Tyre coupling (Fenner catalogue 300-89, page 4), SURE-*flex*® coupling (BROOK Hansen catalogue 9703, page S9) and Spider coupling (KTR Rotex® catalogue 11/96, page 4).

SURE-flex® is a registered trademark of T.B. Wood's Company Chambersburg, P.A. (USA).
Rotex® is a registered trademark of K.T.R. Kupplungstechnik GmbH, Rodder Damm, Germany.

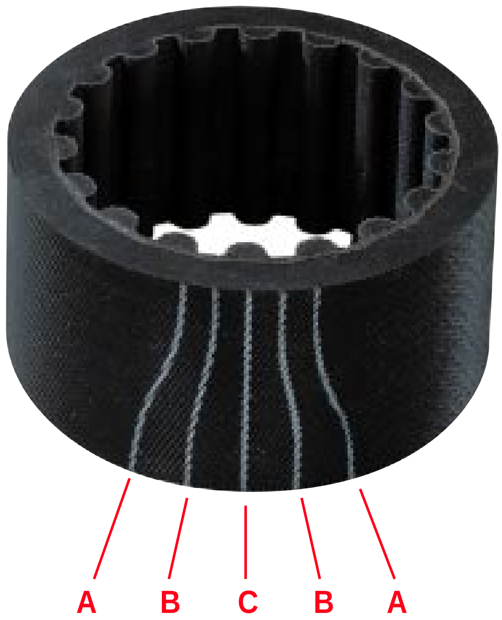
Figure 2



EUROGRIP™ COUPLINGS
FEATURES & BENEFITS

OGEE LINES [1]

Figure 3



The curved OGEE[1] lines printed on the outer surface of the coupling sleeve are intended to be used as a simple torque indicator.

The curves have been designed to become straight lines under given torque conditions. Hence, by viewing the coupling whilst running, with the aid of a stroboscope, a load estimate can be made.
The lines have been nominally set at zero (C), nominal (B) and overload torque (A) for both directions of twist:

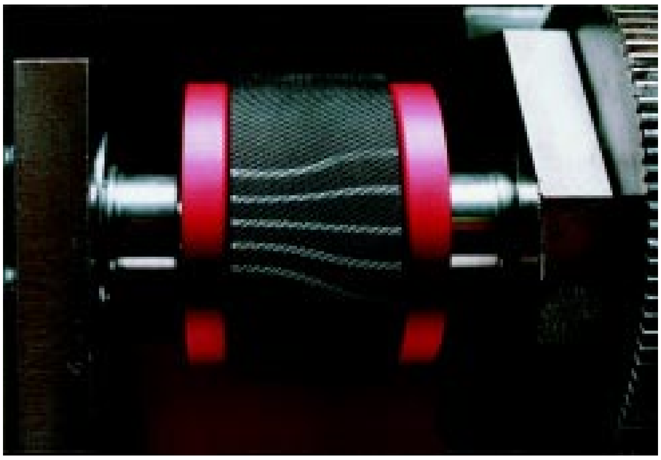
Table 2

Coupling	Design torques (Nm)		
Size code	C	B	A
19	0	18	30
28	0	70	110
42	0	150	250
48	0	300	500
60	0	500	850

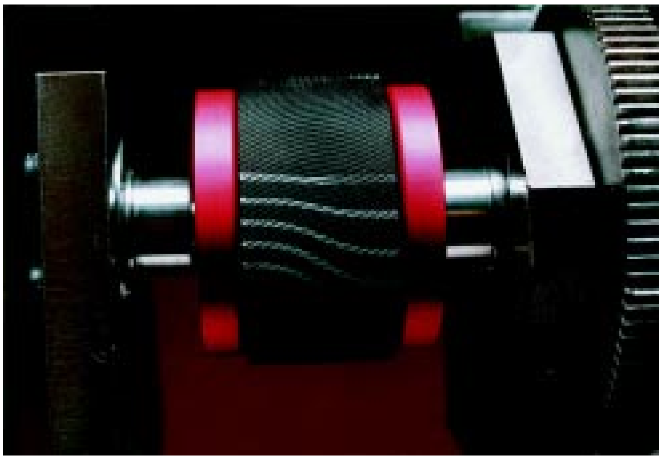
As the sleeve nears the end of its design life, under normal ambient conditions, the torsional characteristics will change. One will see line straightening at lower torque values than those previously observed. This change can be used as an indication that the sleeve should be replaced.
Note: When viewing the coupling, normal safety procedures must be followed and the use of a transparent guard is recommended.

The following pictures illustrate how the OGEE lines are seen under different torque conditions.

OGEE lines under no load.



OGEE lines at overload torque.



[1] Patent applied for

SPECIFICATIONS & SIZES

SLEEVE DIMENSIONS

The principal dimensions of a EuroGrip™ sleeve are
- sleeve outside diameter;
- sleeve length;
- total coupling length.

Gates EuroGrip™ couplings are made in sizes 19, 28, 42, 48 and 60.

Table 3

Coupling Size Code	Nominal shaft mm	Sleeve OD mm	Sleeve length mm	Sleeve weight g	Coupling total length mm
19	19	46	28	35	48
28	28	77	38	106	60
42	42	102	48	225	80
48	48	126	58	410	94
60	60	150	65	715	105

END PIECE DIMENSIONS

The principal dimensions of a EuroGrip™ end piece are
- taper bush size;
- bore;
- end piece length;
- shoulder diameter.

Table 4

Coupling size code	Taper Bush size PB(2)	Standard bore mm	End piece length mm	Shoulder diameter mm	Shoulder thickness mm	Over tooth diameter mm	Inertia J kgm^2	Weight nom. bore g
19 (1)	PB	14 / 19	22	42	9	36	0.000009	44
28	1108	24 / 28	28	72	11	62	0.000105	182
42	1615	38 / 42	38	96	16	84	0.000469	426
48	2017	48	45	118	18	104	0.001330	812
60	2517	55 / 60	50	136	20	120	0.002572	1145

(1) Size 19 available with bore and key only. All other EuroGrip™ couplings (sizes 28, 42, 48 and 60) available with bore and key or to suit taper bush. Size 28 with 1108 taper bush requires a shallow key.
(2) PB = Plain Bore.

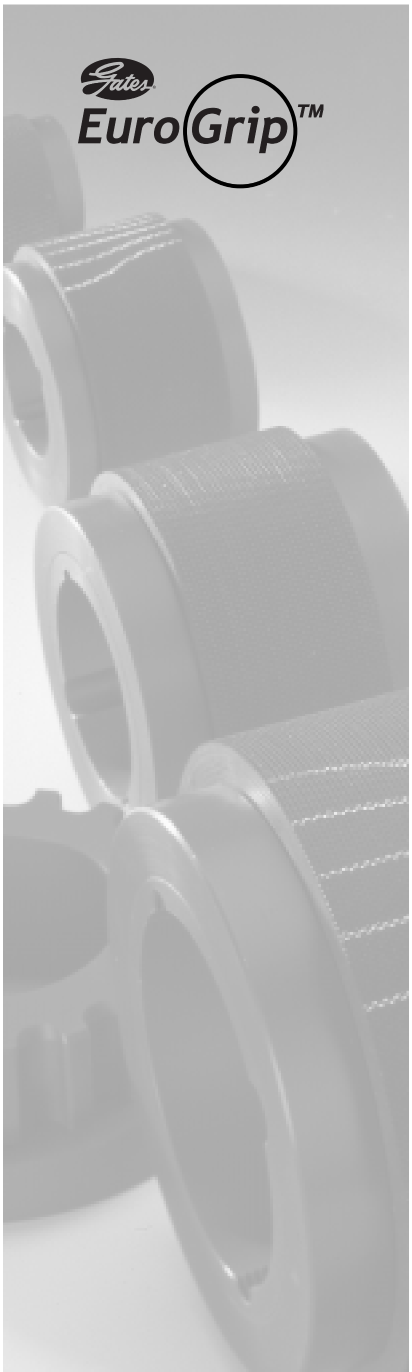
Note: End pieces are keyed according to ISO. Bore is to tolerance H7 fit (ISO). Endpieces are also available with unfinished bore.

PART NUMBERS

Table 5

Coupling	Part	Part number	Part	Part number
19	Sleeve	9901-51901	14 mm bore end piece 19 mm bore end piece	9902-51914 9902-51919
28	Sleeve End piece for taper bush	9901-52801 9902-52801	24 mm bore end piece 28 mm bore end piece	9902-52824 9902-52828
42	Sleeve End piece for taper bush	9901-54201 9902-54201	38 mm bore end piece 42 mm bore end piece	9902-54238 9902-54242
48	Sleeve End piece for taper bush	9901-54801 9902-54801	48 mm bore end piece	9902-54848
60	Sleeve End piece for taper bush	9901-56001 9902-56001	55 mm bore end piece 60 mm bore end piece	9902-56055 9902-56060

DRIVE DESIGN PROCEDURE



Before designing the coupling drive you need to determine the following drive requirements:

1. Power requirement or torque of the driven machine;

2. RPM of the driver;

3. Peak torque of the machine;

4. Shaft size of both driver and driven;

5. Driven machine type;

6. Driver type;

7. Taper bush or plain bore required.

STEP 1

Determine the service factor from Table 6 on page 8 based on machine type and driven type.

STEP 2

Calculate the design power or the design torque.

Design power = drive power x service factor

Design torque = drive torque x service factor

STEP 3

Determine the minimum coupling size to transmit the design torque/power. Check the design power of the coupling in Table 9 or check the design torque versus the nominal torque in Table 7.

STEP 4

For plain bore: Check required shaft size versus standard bores in table 4.

For taper bush: Check required shaft size versus bush size in table 10. Compare with taper bush size in table 4.

EXAMPLE OF CALCULATION

Details of driver side: 5.5kW 1460rpm
132S electric motor
Motor 38mm

Details of driven side: Screw compressor
Shaft 42mm

Taper bush for both shafts.

Service factor based on electric motor and approximation of machine type.
Service factor = 1.7
Design power = 1.7 x 5.5 = 9.35 kW
At 1460 rpm coupling size 28 and above meet the design power. (size 28 has design power of 10.7 kW)
Minimum coupling to transmit the torque is size 28.
Standard bore of 38 is a minimum taper bush of 1615 hence coupling size 42 is required.

Note : Dynamic behaviour such as heat generation due to damping, torsional elasticity, relative damping, resonance and natural frequency may be calculated in accordance with DIN 740 part 2 using the values in table 7.
For further assistance in these calculations please contact Gates Applications Engineering.

SERVICE FACTORS

Table 6

DRIVE N MACHINE	PRIME MOVER CLASSIFICATION: Electric motor Belt drives	Multicylinder Engine	2-3 Cylinder Engine	Single cylinder (consult Gates)
Light uniform duty; loads vary only slightly. Belt drives. Small generators. Small fans. Light conveyors. Liquid agitators. Centrifugal pumps.	**1.0**	**1.3**	**1.7**	**2.4**
Normal duty; some load variation without shock. Piston pumps 6 cyl. Rotary compressors. Screw compressors. Winding drums. Woodworking machines.	**1.7**	**2.0**	**2.2**	**2.7**
Heavy duty; shock loads, large masses accelerated. Piston pumps 4-6 cyl. Sand pumps. Presses. Large fans.	**2.3**	**2.5**	**2.7**	**3.2**
Very heavy duty; high shock loads, very large masses to be accelerated. Mills. Rubber processing. Piston pumps 1-2 cyl. Plunger pumps. Presses. Punches.	**2.8**	**3.0**	**3.5**	**4.0**

DYNAMIC CONSIDERATIONS

Table 7

Coupling Size code	Max. Shaft mm	Motor frame N°	Design torques (Nm)* Nominal T_{KN}	Peak T_K max	Alternating T_{KW}	Stiffness* Nm/rad $C_{T\ dyn}$	Damping Ψ	Damping Power* W
19	19	D80	18	30	4	700	1.4	12
28	28	D100-112	70	110	14	2000	1.7	28
42	42	D132-160	150	250	30	7000	1.2	48
48	48	D180	300	500	60	12000	1.6	70
60	60	D200-225	500	850	100	15000	1.4	110

* These values are derived from DIN 740 part 2 parameters and principles.

COMPARISON MOTOR SIZES / COUPLING SIZES

Table 8

Motor Size	Motor output 3000 rpm		Coupl. Size	Motor output 1500 rpm		Coupl. Size	Motor output 1000 rpm		Coupl. Size	Motor output 750 rpm		Coupl. Size	Shaft	
	kW	T (Nm)		kW	T (Nm)		kW	T (Nm)		kW	T (Nm)			
71	0.37	1.30	19	0.25	1.80	19	0.18	2.00	19	0.09	1.40	19	14 x 30	
	0.55	1.90		0.37	2.50		0.25	2.80		0.12	1.80			
80	0.75	2.50	19	0.55	3.70	19	0.37	3.90	19	0.18	2.50	19	19 x 40	
	1.10	3.70		0.75	5.10		0.55	5.80		0.25	3.50			
90S	1.50	5.00	28	1.10	7.50	28	0.75	8.00	28	0.37	5.30	28	24 x 50	
90L	2.20	7.40	28	1.50	10.00	28	1.10	12.00	28	0.55	7.90	28	24 x 50	
100L	3.00	9.80	28	2.20	15.00	28	1.50	15.00	28	0.75	11.00	28	28 x 60	
112M	4.00	13.00	28	4.00	27.00	28	2.20	22.00	28	1.50	21.00	28	28 x 60	
132S	5.50	18.00	42	5.50	36.00	42	3.00	30.00	42	2.20	30.00	42	38 x 80	
132M				7.50	49.00	42	4.00	40.00	42	3.00	40.00	42	38 x 80	
							5.50	55.00						
160M	11.00	36.00	42	11.00	72.00	42	7.50	75.00	42	4.00	54.00	42	42 x 110	
	15.00	49.00								5.50	74.00			
160L	18.50	60.00	42	15.00	98.00	42	11.00	109.00	42	7.50	100.00	42	42 x 110	
180M	22.00	71.00	48	18.50	121.00	48							48 x 110	
180L				22.00	144.00	48	15.00	148.00	48	11.00	145.00	48	48 x 110	
200L	30.00	97.00	60	30.00	196.00	60	18.50	181.00	60	15.00	198.00	60	55 x 110	
	37.00	120.00					22.00	215.00						
225S				37.00	240.00	60				18.50	244.00	60	55 x 110	60 x 140
225M	45.00	145.00	60	45.00	292.00	60	30.00	293.00	60	22.00	290.00	60	55 x 110	60 x 140
250M	55.00	177.00	60	55.00	356.00	60	37.00	361.00	60	30.00	392.00	60	60 x 140	

DESIGN POWER IN KILOWATTS

Table 9

Speed	Coupling size				
rpm	19	28	42	48	60
100	0.19	0.73	1.57	3.14	5.24
200	0.38	1.47	3.14	6.28	10.50
300	0.57	2.20	4.71	9.42	15.70
400	0.75	2.93	6.28	12.60	20.90
500	0.94	3.66	7.85	15.70	26.20
600	1.13	4.40	9.42	18.80	31.40
700	1.32	5.13	11.00	22.00	36.60
730	1.38	5.35	11.50	22.90	38.20
800	1.51	5.86	12.60	25.10	41.90
900	1.70	6.60	14.10	28.30	47.10
1000	1.88	7.33	15.70	31.40	52.40
1200	2.26	8.80	18.80	37.70	62.80
1400	2.64	10.26	22.00	44.00	73.30
1460	2.75	10.70	22.90	45.90	76.40
1800	3.39	13.20	28.30	56.50	94.00
2000	3.77	14.70	31.40	62.80	105.00
2400	4.52	17.60	37.70	75.40	126.00
2800	5.28	20.50	44.00	88.00	147.00
3200	6.03	23.50	50.30	101.00	168.00
3500	6.60	25.70	55.00	110.00	183.00
4000	7.54	29.30	62.80	126.00	209.00
4500	8.48	33.00	70.70	141.00	236.00
5000	9.42	36.60	78.50	157.00	262.00
5500	10.37	40.30	86.40	173.00	288.00
6000	11.31	44.00	94.20	188.00	314.00

INSTALLATION INSTRUCTIONS

Installation of Gates EuroGrip™ couplings is very simple and straightforward. As Gates EuroGrip™ couplings are designed to operate with some degree of misalignment, a set up “by eye” is normally sufficient. A maximum axial value of 5 degrees is recommended.

The sleeve is designed to operate with the end piece shoulders (flanges) lightly touching either end-face of the rubber sleeve. This ensures the correct gap between the end pieces is maintained.

Where taper bushes are to be used, the fitting instructions given on page 11 must be followed, paying particular attention to grub screw torque limits.

BORES AND KEYWAYS IN MILLIMETRES

Table 10

Bore Diam.	Keyway		Shallow Keyway Depth	Bush reference				
	Width	Depth		1108	1210	1615	2012	2517
9	3	1.4	-	X				
10	3	1.4	-	X				
11	4	1.8	-	X	X			
12	4	1.8	-	X	X			
14	5	2.3	-	X	X	X	X	
15	5	2.3	-	X	X	X	X	
16	5	2.3	-	X	X	X	X	X
18	6	2.8	-	X	X	X	X	X
19	6	2.8	-	X	X	X	X	X
20	6	2.8	-	X	X	X	X	X
22	6	2.8	-	X	X	X	X	X
24	8	3.3	-	X	X	X	X	X
25	8	3.3	-	X	X	X	X	X
28	8	3.3	1.3	S	X	X	X	X
30	8	3.3	-		X	X	X	X
32	10	3.3	-		X	X	X	X
35	10	3.3	-			X	X	X
38	10	3.3	-			X	X	X
40	12	3.3	1.3			S	X	X
42	12	3.3	1.3			S	X	X
45	14	3.8	-				X	X
48	14	3.8	-				X	X
50	14	3.8	-				X	X
55	16	4.3	-					X
60	18	4.4	-					X

S = shallow key required

TAPER BUSH TIGHTENING TORQUE

Table 11

Bush size	1108	1210	1615	2012	2517
Screw tightening torque (Nm)	5.6	20	20	30	50
Screw details **qty** **size (BSW)**	2 1/4”	2 3/8”	2 3/8”	2 7/16”	2 1/2”
Large end diameter (mm)	38.0	47.5	57.0	70.0	85.5
Approx mass (kg)	0.1	0.2	0.5	0.7	1.5

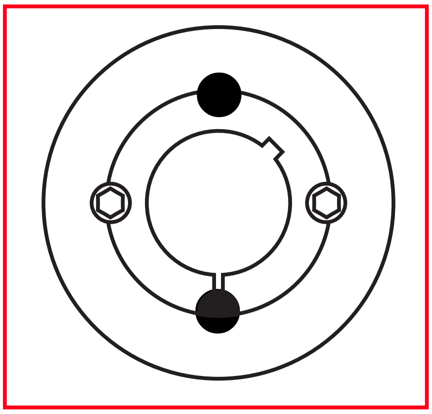
TAPER BUSHES

Insert bush into end piece.

Insert screws and locate on shaft.

Tighten screws finger tight.

Tighten screws alternately.



TO INSTALL

1. Remove any protective coating from the bore and outside of bush. After ensuring that the mating tapered surfaces are completely clean and free from oil or dirt, insert bush in end piece so that holes line up.
2. Sparingly oil thread and point of grub screws. Place screws loosely in holes and threaded in end piece, shown thus ⬡ in diagram.
3. Clean shaft and fit end piece to shaft as one unit and locate in position desired, remembering that bush will nip the shaft first and then end piece will be slightly drawn on to the bush.
4. Using a hexagon wrench tighten screws gradually and alternately until at required torque (see table 11 on page 10.)
5. Hammer against large-end of bush, using a block to prevent damage. (This will ensure that the bush is seated squarely in the bore.) Screws will now turn a little more. Repeat this alternate hammering and screw retorquing once or twice to achieve maximum grip on the shaft.
6. If a key is to be fitted, place it in the shaft keyway before fitting the bush. It is essential that it is a parallel key and side fitting only and has TOP CLEARANCE.
7. After drive has been running under load for a short time stop and check tightness of screws.
8. Fill emply holes with grease to exclude dirt.

TO REMOVE

1. Slacken all screws by several turns, remove one or two according to number of jacking out holes shown in ● diagram. Insert screws in jacking out holes after oiling thread and point of grub screws.
2. Tighten screws alternately until bush is loosened in end piece and assembly is free on the shaft.
3. Remove assembly from shaft.

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