RB and PM

Hi-Tec Industrial Couplings

RENOLD

Superior Coupling Technology

Introduction

Over 50 years of experience
Renold Hi-Tec Couplings has been a world leader in the design and manufacture of torsionally flexible couplings for over 50 years.

Commitment to Quality
As one of the first companies in the UK to gain approval to EN ISO 9001:2008, Renold Hi-Tec couplings can demonstrate their commitment to quality.

World Class Manufacturing
Continual investment is being made to apply the latest machining and tooling technology. The application of lean manufacturing techniques in an integrated cellular manufacturing environment establishes efficient working practices.

Engineering Support
The experienced engineers at Renold Hi-Tec Couplings are supported by substantial facilities to enable the ongoing test and development of product. This includes the capability for:

- Measurement of torsional stiffness up to 220 kNm
- Full scale axial and radial stiffness measurement
- Misalignment testing of couplings up to 2 metres diameter
- Static and dynamic balancing
- 3D solid model CAD
- Finite element analysis

TVA Service
Our resident torsional analysts are able to provide a full Torsional Vibration Analysis service to investigate a customer's driveline and report on the system performance. This service, together with the facility for transient analysis, is available to anyone and is not subject to purchase of a Renold Hi-Tec product.

Marine Survey Society Approvals
Renold Hi-Tec Couplings work with all major marine survey societies to ensure their products meet the strict performance requirements.

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RB Flexible Coupling

General purpose, cost effective range, which is manufactured in SG iron for torques up to 41kNm.

The Standard Range Comprises

- Shaft to shaft
- Shaft to shaft with increased shaft engagement
- Flywheel to shaft
- Flywheel to shaft with increased shaft engagement

Applications

- Generator sets
- Pump sets
- Compressors
- Wind turbines
- Metal manufacture
- Bulk handling
- Pulp and paper industry
- General purpose industrial applications

Features

- Intrinsically fail safe
- Control of resonant torsional vibration
- Maintenance free
- Severe shock load protection
- Misalignment capability
- Zero backlash
- Low cost

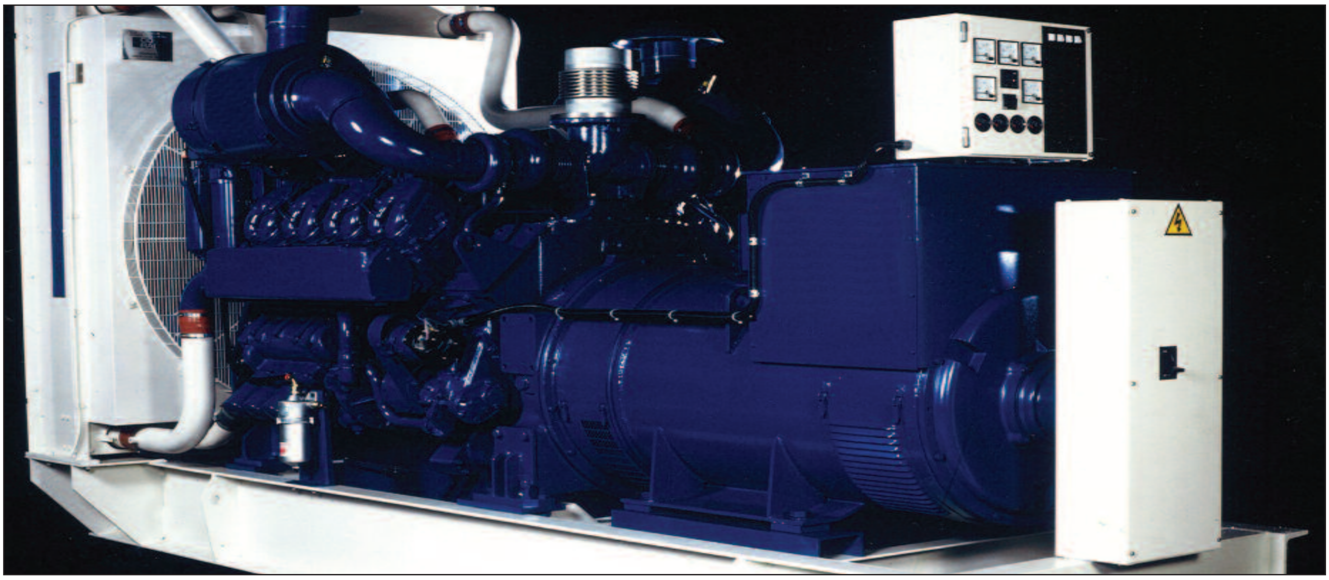
Benefits

- Ensuring continuous operation of the driveline in the unlikely event of rubber damage.
- Achieving low vibratory loads in the driveline components by selection of optimum stiffness characteristics.
- With no lubrication or adjustment required resulting in low running costs.
- Avoiding failure of the driveline under short circuit and other transient conditions.
- Allows axial and radial misalignment between the driving and driven machines.
- Eliminating torque amplifications through pre-compression of the rubber elements.
- The RB Coupling gives the lowest lifetime cost.

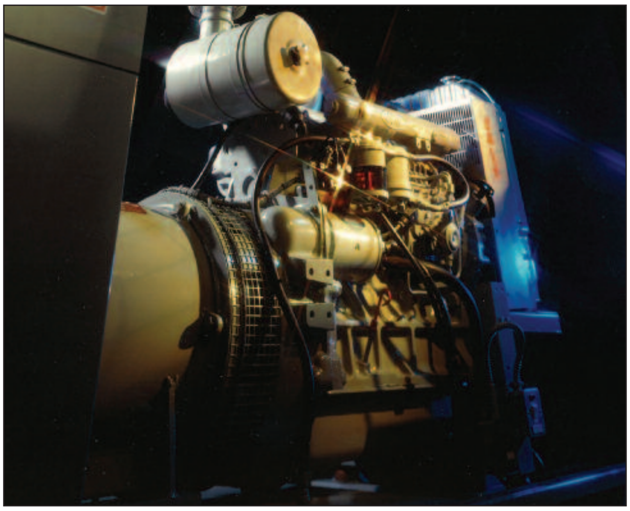
Construction Details

- Spheroidal graphite to BS 2789 Grade 420/12
- Separate rubber elements with a choice of grade and hardness with SM70 shore hardness being the standard
- Rubber elements which are totally enclosed and loaded in compression

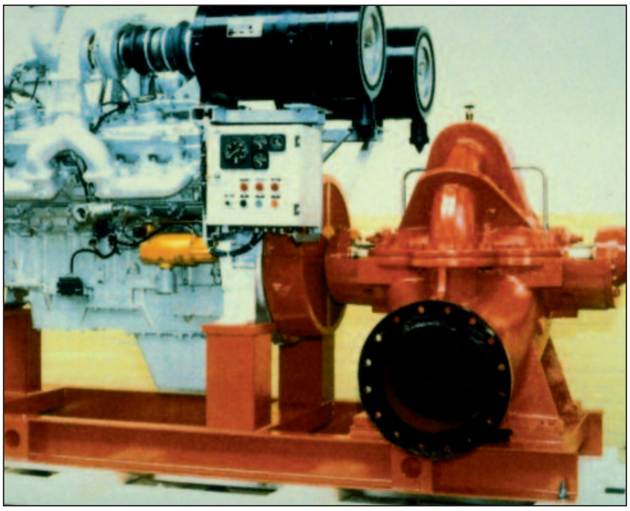
RB Typical Applications



Diesel generator set. Coupling fitted between the engine and alternator.

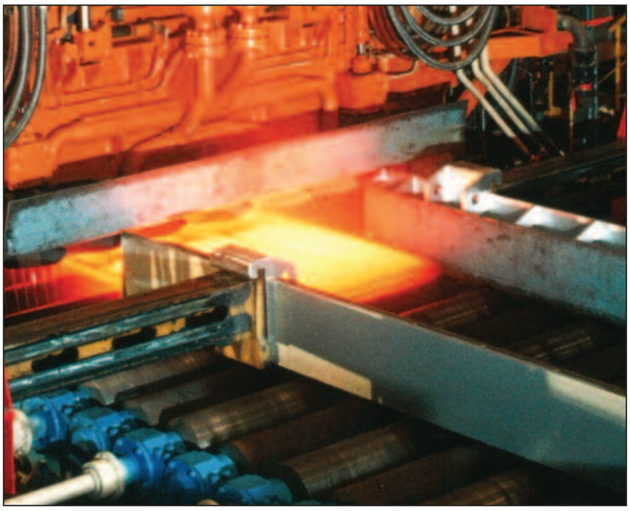


Diesel Generator Set. Coupling fitted between the engine and alternator.



Pump sets. Coupling fitted between diesel engine and centrifugal pump.

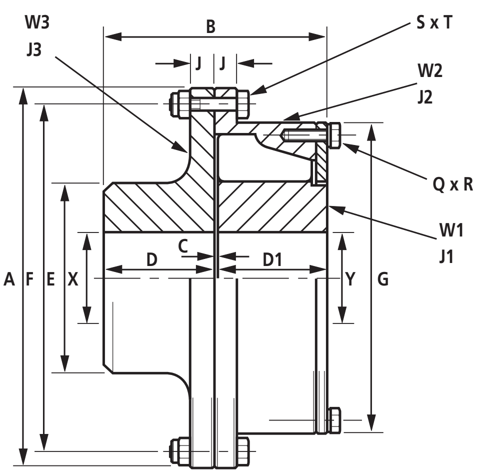
Steel mills. Couplings fitted on 35 tonne overhead crane, and on table roller drives.



Steel mills. Couplings fitted to table roller drives on rolling mills and furnace discharge tables.

RB Shaft to Shaft

Rigid half / Flex half



Features

- Can accommodate a wide range of shaft diameters
- Easy disconnection of the outer member and driving flange
- Coupling available with limited end float

Benefits

- Allows the optimum coupling to be selected
- Allows the driving and driven machines to be disconnected
- Provides axial location for armatures with axial float

Dimensions, Weight, Inertia and Alignment

COUPLING SIZE		0.12	0.2	0.24	0.37	0.73	1.15	2.15	3.86	5.5
DIMENSIONS (mm)	A	200.0	222.2	238.1	260.3	308.0	358.8	466.7	508.0	571.5
	B	104.8	111.2	123.8	136.5	174.6	193.7	233.4	260.4	285.8
	C	3.2	3.2	3.2	3.2	3.2	3.2	4.8	6.4	6.4
	D	50.8	54.0	60.3	66.7	85.7	95.2	114.3	127.0	139.7
	D1	50.8	54.0	60.3	66.7	85.7	95.2	114.3	127.0	139.7
	E	79.4	95.2	101.6	120.6	152.4	184.1	222.2	279.4	330.2
	F	177.8	200.0	212.7	235.0	279.4	323.8	438.15	469.9	542.92
	G	156.5	178	186.5	210	251	295	362	435	501.5
	J	12.7	14.3	15.9	17.5	19.0	19.0	19.0	22.2	25.4
	Q	5	6	6	6	6	6	6	7	8
	R	M8	M8	M8	M10	M10	M12	M12	M12	M12
	S	6	6	6	8	8	10	16	12	12
	T	M8	M8	M10	M10	M12	M12	M12	M16	M16
	MAX. X	50	60	65	80	95	115	140	170	210
	MAX. Y	55	70	75	85	95	115	140	170	210
	MIN. X & Y	30	35	40	40	55	55	70	80	90
RUBBER ELEMENTS	PER CAVITY	1	1	1	1	1	1	1	1	1
	PER COUPLING	10	12	12	12	12	12	12	14	16
MAXIMUM SPEED (rpm)	(1)	5250	4725	4410	4035	3410	2925	2250	2070	1820
WEIGHT (3) (kg)	W1	2.82	4.04	5.29	7.49	12.82	23.39	35.88	62.81	102.09
	W2	4.00	5.05	6.38	8.14	13.29	18.41	33.98	43.87	59.00
	W3	4.06	5.82	7.42	10.44	18.03	27.37	47.43	75.39	113.32
INERTIA (3) (kg m²)	J1	0.0044	0.0084	0.0131	0.0233	0.0563	0.1399	0.3227	0.8489	1.9633
	J2	0.0232	0.0375	0.0546	0.0887	0.20	0.3674	1.1035	1.9161	3.4391
	J3	0.0153	0.027	0.0396	0.0644	0.1475	0.2862	0.7998	1.512	2.9796
ALLOWABLE MISALIGNMENT (2)										
RADIAL (mm)		0.75	0.75	0.75	0.75	1.0	1.5	1.5	1.5	1.5
AXIAL (mm)		1.5	1.5	1.5	1.5	1.5	1.5	2.0	3.0	3.0
CONICAL (degree)		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

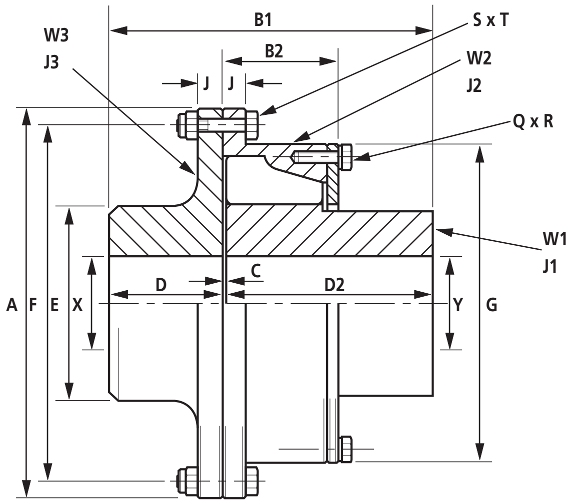
(1) For operation above 80% of the declared maximum coupling speed, it is recommended that the coupling is dynamically balanced.

(2) Installations should be initially aligned as accurately as possible. In order to allow for deterioration in alignment over time, it is recommended that initial alignment should not exceed 25% of the above noted data. The forces on the driving and driven machinery should be calculated to ensure that these do not exceed the manufacturers allowables.

(3) Weights and inertias are based on the minimum bore size.

RB Shaft to Shaft with Increase Shaft Engagement

Rigid half / Flex half



Features

- Long Boss Inner Member

Benefits

- Allows small diameter long length shafts to be used
- Reduces key stress
- Allows increased distances between shaft ends
- Full shaft engagement avoids the need for spacer collars

Dimensions, Weight, Inertia and Alignment

COUPLING SIZE		0.12	0.2	0.24	0.37	0.73	1.15	2.15	3.86	5.5
DIMENSIONS (mm)	A	200.0	222.2	238.1	260.3	308.0	358.8	466.7	508.0	571.5
	B1	139.0	152.2	173.5	189.9	233.9	268.4	309.1	343.4	386.1
	B2	54.0	57.2	63.5	69.8	88.9	98.4	119.0	133.4	146.0
	C	3.2	3.2	3.2	3.2	3.2	3.2	4.8	6.4	6.4
	D	50.8	54.0	60.3	66.7	85.7	95.2	114.3	127.0	139.7
	D2	85	95	110	120	145	170	190	210	240
	E	79.4	95.2	101.6	120.6	152.4	184.1	222.2	279.4	330.2
	F	177.8	200.0	212.7	235.0	279.4	323.8	438.15	469.9	542.92
	G	156.5	178	186.5	210	251	295	362	435	501.5
	J	12.7	14.3	15.9	17.5	19.0	19.0	19.0	22.2	25.4
	Q	5	6	6	6	6	6	6	7	8
	R	M8	M8	M8	M10	M10	M12	M12	M12	M12
	S	6	6	6	8	8	10	16	12	12
	T	M8	M8	M10	M10	M12	M12	M12	M16	M16
	MAX. X	50	60	65	80	95	115	140	170	210
	MAX. Y	55	70	75	85	95	115	140	170	210
	MIN. X & Y	30	35	40	40	55	55	70	80	90
RUBBER ELEMENTS	PER CAVITY	1	1	1	1	1	1	1	1	1
	PER COUPLING	10	12	12	12	12	12	12	14	16
MAXIMUM SPEED (rpm)	(1)	5250	4725	4410	4035	3410	2925	2250	2070	1820
WEIGHT (3) (kg)	W1	4.21	6.42	8.67	11.85	19.43	35.28	53.81	95.50	162.79
	W2	4.0	5.05	6.38	8.14	13.29	18.41	33.98	43.87	59.0
	W3	4.06	5.82	7.42	10.44	18.03	27.37	47.43	75.39	113.32
INERTIA (3) (kg m²)	J1	0.0059	0.0121	0.0193	0.0326	0.0770	0.1896	0.4347	1.1833	2.8953
	J2	0.0232	0.0375	0.0546	0.0887	0.2000	0.3674	1.1035	1.9161	3.4391
	J3	0.0153	0.0270	0.0396	0.0644	0.1475	0.2862	0.7998	1.5120	2.9796
ALLOWABLE MISALIGNMENT (2)										
RADIAL (mm)		0.75	0.75	0.75	0.75	1.0	1.5	1.5	1.5	1.5
AXIAL (mm)		1.5	1.5	1.5	1.5	1.5	1.5	2.0	3.0	3.0
CONICAL (degree)		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

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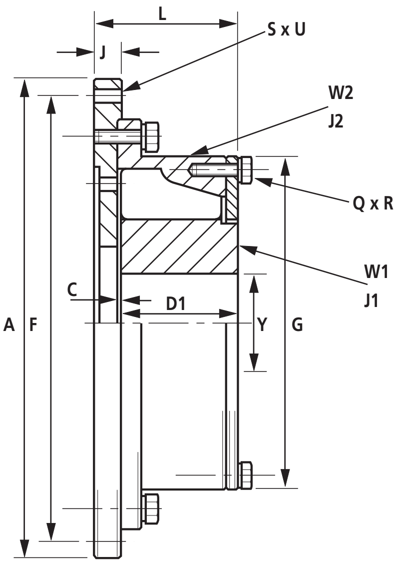
(3) Weights and inertias are based on the minimum bore size.

RB Standard SAE Flywheel to Shaft

0.24 to 1.15



Features

- Wide range of adaptor plates
- Choice of rubber compound and hardness
- Short axial length

Benefits

- Allows the coupling to be adapted to suit most engine flywheels
- Allows control of the torsional vibration system
- Allows the coupling to fit in bell housed applications

Dimensions, Weight, Inertia and Alignment

COUPLING SIZE		0.24		0.37		0.73		1.15	
		SAE 10	SAE 11.5	SAE 11.5	SAE 14	SAE 11.5	SAE 14	SAE 14	SAE 18
DIMENSIONS (mm)	A	314.3	352.4	352.4	466.7	352.4	466.7	466.7	571.5
	C	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
	D1	60.3	60.3	66.7	66.7	85.7	85.7	95.2	95.2
	F	295.27	333.38	333.38	438.15	333.38	438.15	438.15	542.92
	G	186.5	186.5	210	210	251	251	295	295
	J	20	20	20	20	20	20	20	28
	L	79.5	79.5	85.8	85.8	104.9	104.9	114.4	122.4
	Q	6	6	6	6	6	6	6	6
	R	M8	M8	M10	M10	M10	M10	M12	M12
	S	8	8	8	8	8	8	8	6
	U	10.5	10.5	10.5	13.5	10.5	13.5	13.5	16.7
	MAX. Y	75	75	85	85	95	95	115	115
	MIN. Y	40	40	40	40	55	55	55	55
RUBBER ELEMENTS	PER CAVITY	1	1	1	1	1	1	1	1
	PER COUPLING	12	12	12	12	12	12	12	12
MAXIMUM SPEED (rpm)	(1)	3710	3305	3305	2500	3310	2500	2500	2040
WEIGHT (3) (kg)	W1	5.29	5.29	7.49	7.49	12.82	12.82	23.39	23.39
	W2	15.71	17.1	19.96	28.76	24.01	35.31	39.03	61.0
INERTIA (3) (kg m^2)	J1	0.0131	0.0131	0.0233	0.0233	0.0563	0.0563	0.1399	0.1399
	J2	0.1922	0.2546	0.3087	0.7487	0.4000	0.8900	1.0274	2.3974
ALLOWABLE MISALIGNMENT (2)									
RADIAL (mm)		0.75	0.75	0.75	0.75	1.0	1.0	1.5	1.5
AXIAL (mm)		1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
CONICAL (degree)		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

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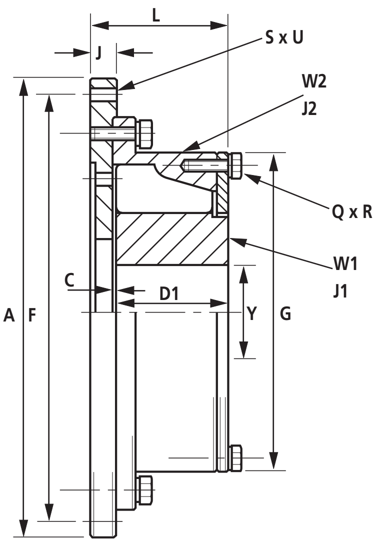
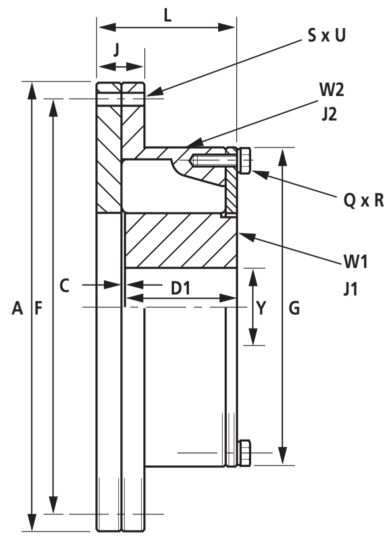
RB Standard SAE Flywheel to Shaft

2.15 - 5.5



Keep Plate (2.15 SAE 14 and 5.5 SAE 18)



Dimensions, Weight, Inertia and Alignment

COUPLING SIZE		2.15			3.86			5.5		
		SAE 14	SAE 18	SAE 21	SAE 18	SAE 21	SAE 24	SAE 18	SAE 21	SAE 24
DIMENSIONS (mm)	A	466.7	571.5	673.1	571.5	673.1	733.4	571.5	673.1	733.4
	C	4.8	4.8	4.8	6.4	6.4	6.4	6.4	6.4	6.4
	D1	114.3	114.3	114.3	127.0	127.0	127.0	139.7	139.7	139.7
	F	438.15	542.92	641.35	542.92	641.35	692.15	542.92	641.35	692.15
	G	362.0	362.0	362.0	435.0	435.0	435.0	501.5	501.5	501.5
	J	35.0	28.0	28.0	28.0	31.0	31.0	41.4	28.0	31.0
	L	135.05	143.0	143.0	157.35	160.35	160.35	162.05	170.0	173.05
	Q	6	6	6	7	7	7	8	8	8
	R	M12	M12	M12	M12	M12	M12	M12	M12	M12
	S	8	6	12	6	12	12	6	12	12
	U	13.2	16.7	16.7	16.7	16.7	22	16.7	16.7	22
	MAX. Y	140	140	140	170	170	170	210	210	210
	MIN. Y	70	70	70	80	80	80	90	90	90
RUBBER	PER CAVITY	1	1	1	1	1	1	1	1	1
ELEMENTS	PER COUPLING	12	12	12	14	14	14	16	16	16
MAXIMUM SPEED (rpm)	(1)	2500	2040	1800	2040	1800	1590	2040	1800	1590
WEIGHT (3)	W1	35.88	35.88	35.88	62.81	62.81	62.81	102.09	102.09	102.09
(kg)	W2	50.42	79.17	92.19	86.46	110.35	120.33	79.14	117.21	135.46
INERTIA (3)	J1	0.3227	0.3227	0.3227	0.8489	0.8489	0.8489	1.9633	1.9633	1.9633
(kg m²)	J2	1.6535	3.2935	4.9935	3.9461	6.4661	8.1461	4.5684	7.3291	9.6691
ALLOWABLE MISALIGNMENT (2)										
RADIAL (mm)		1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
AXIAL (mm)		2.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0
CONICAL (degree)		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

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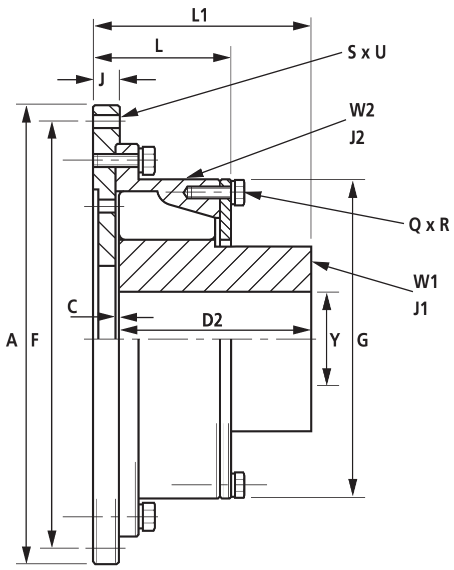
RB Standard SAE Flywheel to Shaft with Increased Shaft Engagement

0.24 - 1.15



Features

- Long Boss Inner Members

Benefits

- Allows small diameter long length shafts to be used
- Reduces key stress
- Allows increased distance between shaft end and flywheel
- Full shaft engagement avoids the need for spacer collars

Dimensions, Weight, Inertia and Alignment

COUPLING SIZE		0.24		0.37		0.73		1.15	
		SAE 10	SAE 11.5	SAE 11.5	SAE 14	SAE 11.5	SAE 14	SAE 14	SAE 18
DIMENSIONS (mm)	A	314.3	352.4	352.4	466.7	352.4	466.7	466.7	571.5
	C	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
	D2	110	110	120	120	145	145	170	170
	F	295.27	333.38	333.38	438.15	333.38	438.15	438.15	542.92
	G	186.5	186.5	210	210	251	251	295	295
	J	20	20	20	20	20	20	20	28
	L	79.5	79.5	85.8	85.8	104.9	104.9	114.4	122.4
	L1	129.2	129.2	139.1	139.1	164.2	164.2	189.2	197.2
	Q	6	6	6	6	6	6	6	6
	R	M8	M8	M10	M10	M10	M10	M12	M12
	S	8	8	8	8	8	8	8	6
	U	10.5	10.5	10.5	13.5	10.5	13.5	13.5	16.7
	MAX. Y	75	75	85	85	95	95	115	115
	MIN. Y	40	40	40	40	55	55	55	55
RUBBER ELEMENTS	PER CAVITY	1	1	1	1	1	1	1	1
	PER COUPLING	12	12	12	12	12	12	12	12
MAXIMUM SPEED (rpm)	(1)	3710	3305	3305	2500	3305	2500	2500	2040
WEIGHT (3) (kg)	W1	8.67	8.67	11.85	11.85	19.43	19.43	35.28	35.28
	W2	15.71	17.10	19.96	28.76	24.01	35.31	39.03	61.00
INERTIA (3) (kg m^2)	J1	0.0193	0.0193	0.0326	0.0326	0.0770	0.0770	0.1896	0.1896
	J2	0.1922	0.2546	0.3087	0.7487	0.4000	0.8900	1.0274	2.3974
ALLOWABLE MISALIGNMENT (2)									
RADIAL (mm)		0.75	0.75	0.75	0.75	1.0	1.0	1.5	1.5
AXIAL (mm)		1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
CONICAL (degree)		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

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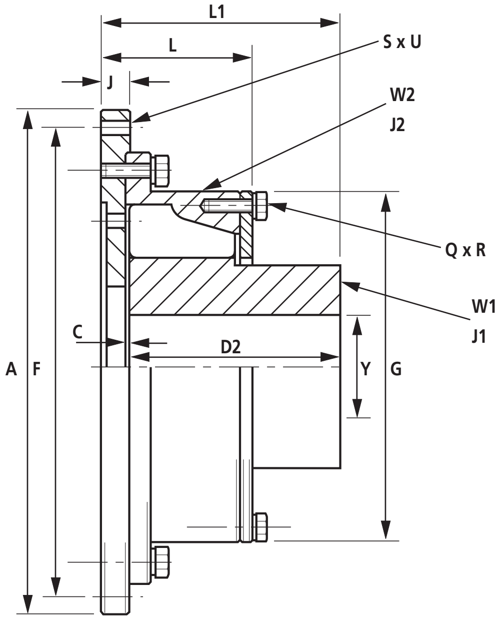
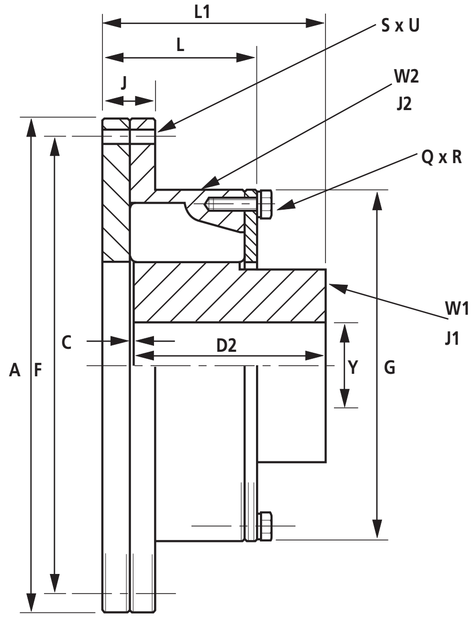
RB Standard SAE Flywheel to Shaft with Increased Shaft Engagement

2.15 - 5.5



Keep Plate (2.15 SAE 14 and 5.5 SAE 18)



Dimensions, Weight, Inertia and Alignment

COUPLING SIZE		2.15			3.86			5.5		
		SAE 14	SAE 18	SAE 21	SAE 18	SAE 21	SAE 24	SAE 18	SAE 21	SAE 24
DIMENSIONS (mm)	A	466.7	571.5	673.1	571.5	673.1	733.4	571.5	673.1	733.4
	C	4.8	4.8	4.8	6.4	6.4	6.4	6.4	6.4	6.4
	D2	190	190	190	210	210	210	240	240	240
	F	438.15	542.92	641.35	542.92	641.35	692.15	542.92	641.35	692.15
	G	362.0	362.0	362.0	435.0	435.0	435.0	501.5	501.5	501.5
	J	35.0	28.0	28.0	28.0	31.0	31.0	41.4	28.0	31.0
	L	135.0	143.0	143.0	157.4	160.4	160.4	162.05	170.0	173.0
	L1	210.7	219.7	219.7	240.4	243.4	243.4	262.4	271.3	273.3
	Q	6	6	6	7	7	7	8	8	8
	R	M12	M12	M12	M12	M12	M12	M12	M12	M12
	S	8	6	12	6	12	12	6	12	12
	U	13.5	16.7	16.7	16.7	16.7	22	16.7	16.7	22
	MAX. Y	140	140	140	170	170	170	210	210	210
	MIN. Y	70	70	70	80	80	80	90	90	90
RUBBER ELEMENTS	PER CAVITY	1	1	1	1	1	1	1	1	1
	PER COUPLING	12	12	12	14	14	14	16	16	16
MAXIMUM SPEED (rpm)	(1)	2500	2040	1800	2040	1800	1590	2040	1800	1590
WEIGHT (3) (kg)	W1	53.81	53.81	53.81	95.50	95.50	95.50	162.79	162.79	162.79
	W2	50.42	79.17	92.19	86.46	110.35	120.33	79.14	117.21	135.46
INERTIA (3) ($kg\ m^2$)	J1	0.4347	0.4347	0.4347	1.1833	1.1833	1.1833	2.8953	2.8953	2.8953
	J2	1.6535	3.2935	4.9935	3.9461	6.4661	8.1461	4.5684	7.3291	9.6691
ALLOWABLE MISALIGNMENT (2)										
RADIAL (mm)		1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
AXIAL (mm)		2.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0
CONICAL (degree)		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(1) For operation above 80% of the declared maximum coupling speed, it is recommended that the coupling is dynamically balanced.

(2) Installations should be initially aligned as accurately as possible. In order to allow for deterioration in alignment over time, it is recommended that initial alignment should not exceed 25% of the above noted data. The forces on the driving and driven machinery should be calculated to ensure that these do not exceed the manufacturers allowables.

(3) Weights and inertias are based on the minimum bore size.

RB Technical Data

1.1 Torque Capacity - Diesel Engine Drives

The RB Coupling is selected on the "Nominal Torque T_{KN}" without service factors for Diesel Drive applications.

The full torque capacity of the coupling for transient vibration whilst passing through major criticals on run up, is published as the maximum torque.
($T_{KMAX} = 3 \times T_{KN}$).

There is additional torque capacity built within the coupling for short circuit and shock torques, which is 3 x T_{KMAX}.

The published "Vibratory Torque T_{KW}", relates to the amplitude of the permissible torque fluctuation. The vibratory torque values shown in the technical data are at the frequency of 10Hz. The allowable vibratory torque at higher or lower frequencies $f_e = T_{KW} \sqrt{\frac{10Hz}{f_e}}$

The measure used for acceptability of the coupling under vibratory torque, is published as "Allowable dissipated heat at ambient temperature 30ºC".

1.2 Industrial Drives

For industrial Electrical Motor Applications refer to the "Selection Procedures", and base the selection on T_{KMAX} with the appropriate service factors.

The service factors used in the "Selection Procedures" are based upon 50 years' experience of drives and their shock frequency/amplitude. The stated T_{Kmax} quoted should not be exceeded by design, without reference to Renold Hi-Tec Couplings.

Care should be taken in the design of couplings with shaft brakes, to ensure that coupling torques are not increased by severe deceleration.

2.0 Stiffness Properties

The Renold Hi-Tec Coupling remains fully flexible under all torque conditions. The RB series is a non-bonded type operating with the Rubber-in-Compression principle.

2.1 Axial Stiffness

When subject to axial misalignment, the coupling will have an axial resistance which gradually reduces due to the effect of vibratory torque.

Given sufficient axial force, as shown in the technical data, the coupling will slip to its new position immediately.

2.2 Radial Stiffness

The radial stiffness of the coupling is torque dependent, and is as shown in the technical data.

2.3 Torsional Stiffness

The torsional stiffness of the coupling is dependent upon applied torque (see technical data) and temperature.

2.4 Prediction of the System Torsional Vibration Characteristics

An adequate prediction of the system's torsional vibration characteristics, can be made by the following method:

2.4.1 Use the torsional stiffness as shown in the technical data, which is based upon data measured at a 30˚C ambient temperature (C_{Tdyn}).

2.4.2 Repeat the calculation 2.4.1, but using the maximum temperature correction factor S_{t100}, and dynamic magnifier correction factor, M_{100}, for the selected rubber. Use tables on page 13 to adjust values for both torsional stiffness and dynamic magnifier.
ie. $C_{T100} = C_{Tdyn} \times S_{t100}$

2.4.3 Review calculations 2.4.1 and 2.4.2 and if the speed range is clear of criticals which do not exceed the allowable heat dissipation value as published in the catalogue, then the coupling is considered suitable for the application with respect to the torsional vibration characteristics. If there is a critical in the speed range, then actual temperature of the coupling will need to be calculated at this speed.

RB Technical Data

Rubber Grade	$Temp_{max}$ °C	S_t
Si70	200	St_{200} = 0.48
SM 60	100	St_{100} = 0.75
SM 70	100	St_{100} = 0.63
SM 80	100	St_{100} = 0.58
SM 70 is considered "standard"		

Rubber Grade	Dynamic Magnifier at 30°C (M_{30})	Dynamic Magnifier at 100°C (M_{100})
SM 60	8	10.7
SM 70	6	9.5
SM 80	4	6.9
Si70	7.5	M_{200}=15.63
SM 70 is considered "standard"		

2.5 Prediction of the actual coupling temperature and torsional stiffness

2.5.1 Use the torsional stiffness as published in the catalogue, this is based upon data measured at 30˚C and the dynamic magnifier at 30˚C. (M_{30})

2.5.2 Compare the synthesis value of the calculated heat load in the coupling (P_K) at the speed of interest, to the "Allowable Heat Dissipation" (P_{KW}).

The coupling temperature rise

$$°C = Temp_{coup} = \left(\frac{P_K}{P_{KW}}\right) \times 70$$

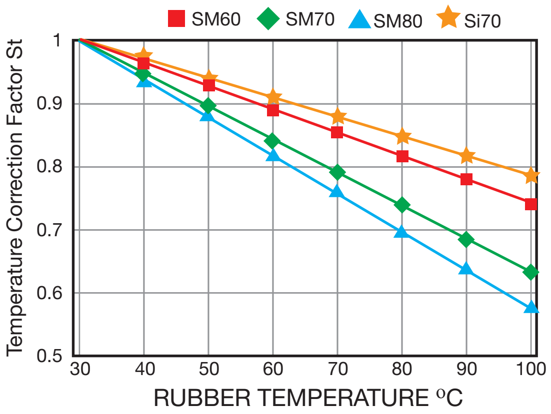
The coupling temperature = ϑ

$\vartheta = Temp_{coup} +$ Ambient Temp.

2.5.3 Calculate the temperature correction factor, S_t, from 2.6 (if the coupling temperature > 100˚C, then use S_{t100}). Calculate the dynamic Magnifier as per 2.7. Repeat the calculation with the new value of coupling stiffness and dynamic magnifier.

2.5.4 Calculate the coupling temperature as per 2.5. Repeat calculation until the coupling temperature agrees with the correction factors for torsional stiffness and dynamic magnifier used in the calculation.

2.6 Temperature Correction Factor



2.7 Dynamic Magnifier Correction Factor

The Dynamic Magnifier of the rubber is subject to temperature variation in the same way as the torsional stiffness.

$$M_T = \frac{M_{30}}{S_t} \qquad \psi_T = \psi_{30} \times S_t$$

Rubber Grade	Dynamic Magnifier (M_{30})	Relative Damping ψ_{30}
SM 60	8	0.78
SM 70	6	1.05
SM 80	4	1.57
Si70	7.5	0.83
SM 70 is considered "standard"		

RB Technical Data

COUPLING SIZE		0.12	0.2	0.24	0.37	0.73	1.15	2.15	3.86	5.5
NOMINAL TORQUE T_{KN} (kNm)		0.314	0.483	0.57	0.879	1.73	2.731	5.115	9.159	13.05
MAXIMUM TORQUE T_{Kmax}(kNm)		0.925	1.425	1.72	2.635	5.35	8.1	15.303	27.4	41.0
VIBRATORY TORQUE T_{KW} (kNm)		0.122	0.188	0.222	0.342	0.672	1.062	1.989	3.561	5.075
ALLOWABLE DISSIPATED HEAT AT AMBIENT TEMP 30ºC P_{KW} (W) P_{KW}	Si70	252	315	346	392	513	575	710	926	1144
	SM60	90	112	125	140	185	204	246	336	426
	SM70	98	123	138	155	204	224	270	369	465
	SM80	100	138	154	173	228	250	302	410	520
DYNAMIC TORSIONAL STIFFNESS C_{Tdyn} (MNm/rad)										
@0.25 T_{KN}	Si70	0.004	0.006	0.006	0.010	0.021	0.031	0.060	0.091	0.119
	SM60	0.007	0.009	0.010	0.016	0.032	0.049	0.093	0.142	0.186
	SM70	0.011	0.014	0.017	0.026	0.052	0.079	0.150	0.230	0.300
	SM80	0.016	0.021	0.025	0.039	0.079	0.119	0.225	0.346	0.453
@0.5 T_{KN}	Si70	0.013	0.017	0.020	0.030	0.062	0.093	0.176	0.271	0.355
	SM60	0.016	0.021	0.025	0.038	0.078	0.118	0.223	0.343	0.449
	SM70	0.022	0.028	0.034	0.052	0.105	0.159	0.300	0.460	0.602
	SM80	0.026	0.033	0.040	0.062	0.125	0.189	0.358	0.549	0.719
@0.75 T_{KN}	Si70	0.030	0.038	0.046	0.070	0.142	0.215	0.407	0.625	0.818
	SM60	0.035	0.045	0.054	0.082	0.167	0.253	0.479	0.735	0.962
	SM70	0.043	0.055	0.066	0.101	0.205	0.310	0.586	0.900	1.178
	SM80	0.049	0.063	0.076	0.117	0.238	0.360	0.680	1.043	1.366
@1.0T_{KN}	Si70	0.050	0.064	0.077	0.118	0.240	0.363	0.686	1.053	1.379
	SM60	0.057	0.073	0.088	0.134	0.273	0.413	0.780	1.197	1.567
	SM70	0.066	0.085	0.103	0.157	0.319	0.483	0.912	1.400	1.833
	SM80	0.078	0.100	0.121	0.185	0.377	0.570	1.077	1.653	2.164
RADIAL STIFFNESS NO LOAD (N/mm)	Si70	1153	1424	1622	1801	2391	2610	3243	4226	5343
	SM60	1020	1260	1435	1594	2116	2310	2870	3740	4728
	SM70	1255	1550	1765	1962	2586	2845	3530	4600	5810
	SM80	1728	2135	2430	2700	3654	3915	4860	6330	8008
RADIAL STIFFNESS @T_{KN} (N/mm)	Si70	2096	2594	2948	3335	4335	4754	5904	7690	9726
	SM60	2046	2536	2880	3207	4250	4650	5780	7520	9510
	SM70	2134	2638	3000	3435	4396	4835	6000	7820	9890
	SM80	2310	2855	3250	3610	4885	5235	6500	8465	10700
AXIAL STIFFNESS NO LOAD (N/mm)	Si70	788	962	1077	1225	1589	1780	2202	2886	3663
	SM60	1030	1250	1400	1600	2095	2310	2850	3700	4700
	SM70	1100	1350	1510	1710	2200	2500	3100	4100	5200
	SM80	2940	3690	4060	4620	6060	6700	8220	10760	13580
MAX AXIAL FORCE (1) @T_{KN} (N)	Si70	540	675	750	850	1100	1230	1500	1950	2500
	SM60	1080	1350	1500	1700	2200	2460	3000	3900	5000
	SM70	1150	1440	1600	1800	2360	2600	3200	4100	5300
	SM80	1300	1600	1760	2000	2600	2900	3500	4600	5800

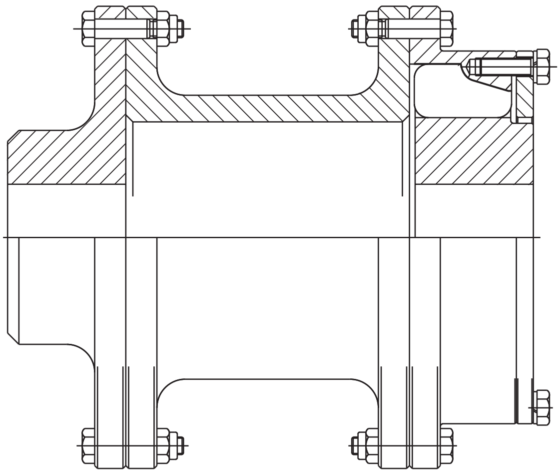
NB. SM70 is supplied as standard rubber grade with options of rubber grades SM60 or SM80, if these are considered a better solution to a dynamic application problem. It should be noted that for operation above 80% of the declared maximum coupling speed, the coupling should be dynamically balanced.

(1) The Renold Hi-Tec Coupling will "slip" axially when the maximum axial force is reached.

RB Design Variations

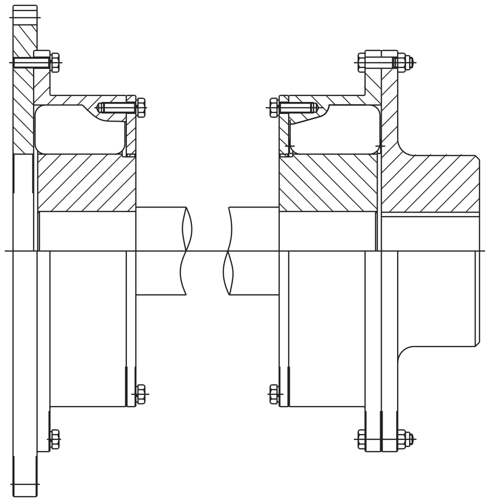
The RB Coupling can be adapted to meet customer requirements, as can be seen from some of the design variations shown below. For a more comprehensive list, contact Renold Hi-Tec.

Spacer Coupling



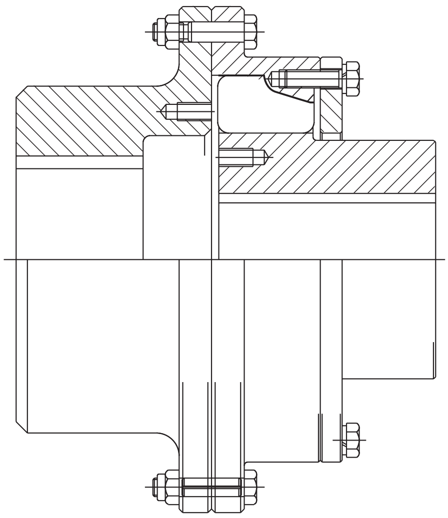
Spacer Coupling. Used to increase distance between shaft ends and allow easy access to driven and driving machines.

Cardan Shaft Coupling



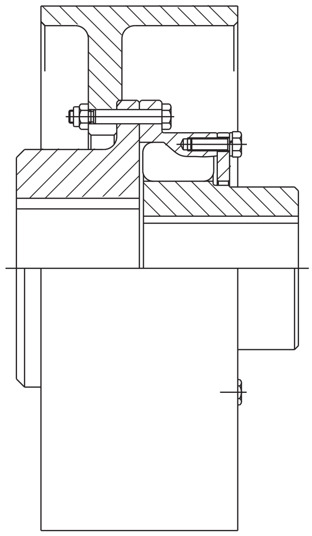
Cardan Shaft Coupling. Used to increase the distance between shaft ends and give a higher misalignment capability.

Coupling with Long Boss Inner Member



Coupling with long boss inner member and large boss driving flange for use on vertical applications.

Brake Drum Coupling



Coupling with brake drum for use on cranes, fans and conveyor drives, (brake disk couplings are available).

PM Features and Benefits

Heavy duty steel coupling for torques up to 6000KNm.

The Standard range comprises

- Shaft to shaft
- Flange to shaft
- Mill motor coupling
- Brake drum coupling

Applications

- Metal manufacture
- Mining and mineral processing
- Pumps
- Fans
- Compressors
- Cranes and hoists
- Pulp and paper industry
- General heavy duty industrial applications

Features

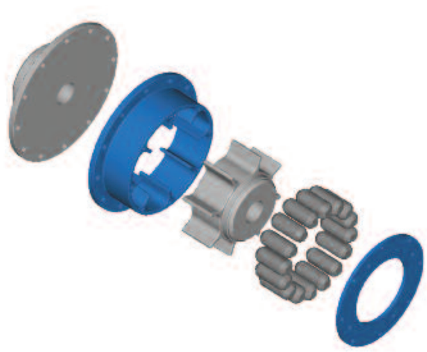
- Severe shock load protection
- Intrinsically fail safe
- Maintenance free
- Vibration control
- Zero backlash
- Misalignment capability
- Low cost

Benefits

- Giving protection and avoiding failure of the driveline under high transient torques.
- Ensuring continuous operation of the driveline in the unlikely event of rubber failure or damage.
- With no lubrication or adjustment required resulting in low running costs.
- Achieving low vibratory loads in the driveline components by selection of optimum stiffness characteristics.
- Eliminating torque amplifications through pre-compression of the rubber elements.
- Allows axial and radial misalignment between the driving and driven machines.
- The PM Coupling gives the lowest lifetime cost.

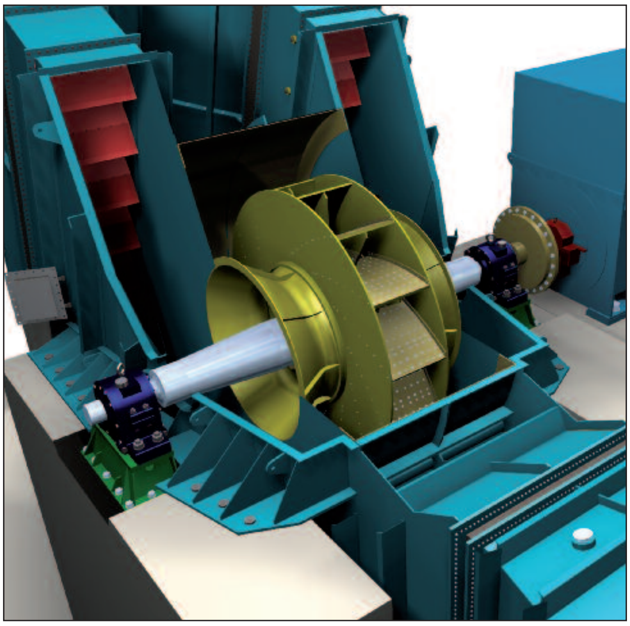
Construction details

- PM Couplings up to PM18 are manufactured in high strength ductile iron to BS EN 1563 and PM27 and above manufactured in cast steel to BS 3100 A4.
- Separate rubber elements with a choice of grade and hardness, styrene butadiene with 60 shore hardness (SM60) being the standard.
- Rubber elements loaded in compression.
- Rubber elements are totally enclosed.



PM Typical Applications

Ladle Crane. Couplings fitted on the input and output of the main hoist and long travel.



Fan Drive. Coupling fitted between the variable frequency electric motor and the fan.

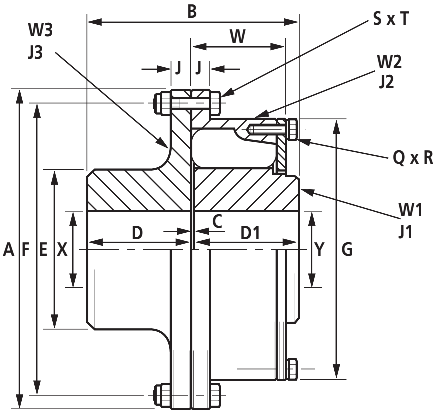
Conveyor. Couplings fitted on the input and output on conveyor drives.

Steam Turbine Gerator Set. Coupling fitted between the gearbox and alternator.

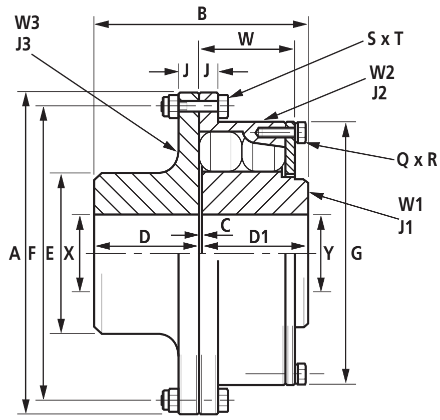
Eiffle Tower main lift. Coupling with brake disc fitted between the electric motor and the gearbox that raises, lowers and brakes lift.

PM Shaft to Shaft PM 0.4 to PM 130

0.4 - 60



90 - 130



Dimensions, Weight, Inertia and Alignment

COUPLING SIZE		0.4	0.7	1.3	3	6	8	12	18	27	40	60	90	130
DIMENSIONS (mm)	A	161.9	187.3	215.9	260.3	260	302	338	392	440	490	568	638	728
	B	103	110	130	143	175	193	221.5	254	290.5	329	377.5	432.5	487
	C	1	2	2	3	3	3	3.5	4	4.5	5	5.5	6.5	7
	D	51	54	64	70	86	95	109	125	143	162	186	213	240
	D1	51	54	64	70	86	95	109	125	143	162	186	213	240
	E	76	92	108	122	135	148	168	195	220	252	288	330	373
	F	146	171.4	196.8	235	240	276	312	360	407	458	528	598	680
	G	133	157	181	214.3	222	245	280	320	367	418	479	548	620
	J	9.5	11	12	14.5	11	13.5	14	16	18.5	21	24	26.5	31
	Q	5	5	6	6	8	8	8	8	8	8	8	8	8
	R	M8	M8	M8	M8	M8	M10	M12	M16	M16	M16	M20	M20	M24
	S	8	8	8	8	12	12	12	12	12	16	12	16	16
	T	M8	M8	M8	M8	M8	M12	M12	M16	M16	M16	M20	M20	M24
	W	36	39	46	60	81	89	102	118	134	152.7	175	200	226
	MAX. X & Y (4)	41	51	64	73	85	95	109	125	143	162	186	213	240
	MIN. X (5)	27	27	35	37	50	62	68	80	90	105	120	140	160
	MIN. Y	27	27	37	40	50	55	65	70	85	105	110	140	160
RUBBER ELEMENTS	Per Cavity	1	1	1	1	1	1	1	1	1	1	1	2	2
	Per Coupling	10	10	12	12	16	16	16	16	16	16	16	32	32
MAXIMUM SPEED (rpm) (1)		7200	6300	5400	4500	4480	3860	3450	2975	2650	2380	2050	1830	1600
WEIGHT (3) (kg)	W1	1.9	2.8	4.5	6.9	8.9	11.62	17.74	27.0	40.18	59.5	89.45	132.0	191.11
	W2	2.0	2.9	4.6	6.0	6.55	10.92	15.86	24.59	35.34	50.47	77.80	111.96	165.24
	W3	2.8	4.3	6.6	10.0	10.84	15.14	21.24	33.03	47.80	69.32	104.63	151.78	222.39
	TOTAL	6.7	10.0	15.7	22.9	26.3	37.7	54.8	84.6	123.3	179.3	271.9	395.7	578.7
INERTIA (3) (kg m^2)	J1	0.002	0.004	0.008	0.018	0.026	0.050	0.101	0.203	0.392	0.756	1.491	2.872	5.330
	J2	0.006	0.014	0.019	0.049	0.072	0.149	0.273	0.560	1.041	1.898	3.867	7.188	13.680
	J3	0.005	0.013	0.025	0.05	0.058	0.116	0.194	0.406	0.748	1.345	2.719	4.955	9.565
ALLOWABLE MISALIGNMENT (2)														
RADIAL (mm)		0.8	0.8	0.8	1.2	1.5	1.6	1.6	1.6	1.9	2.1	2.4	2.8	3.3
AXIAL (mm)		0.8	1.2	1.2	1.2	1.25	1.5	1.75	2.0	2.25	2.5	2.75	3.25	3.5
CONICAL (degree)		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(1) For operation above 80% of the declared maximum coupling speed, it is recommended that the coupling is dynamically balanced.

(2) Installations should be initially aligned as accurately as possible. In order to allow for deterioration in alignment over time, it is recommended that initial alignment should not exceed 25% of the above noted data. The forces on the driving and driven machinery should be calculated to ensure that these do not exceed the manufacturers allowables.

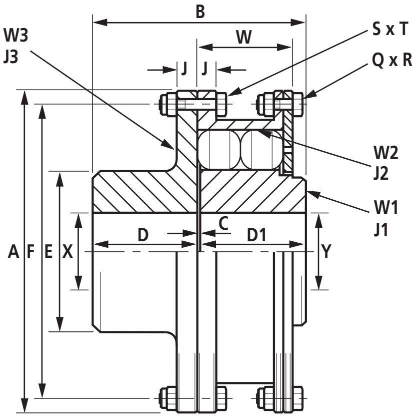
(3) Weights and inertias are calculated with mean bore for couplings up to and including PM600, and with maximum bore for PM900 and above.

(4) Oversize shafts can be accommodated in large boss driving flanges, manufactured to customer's requirements.

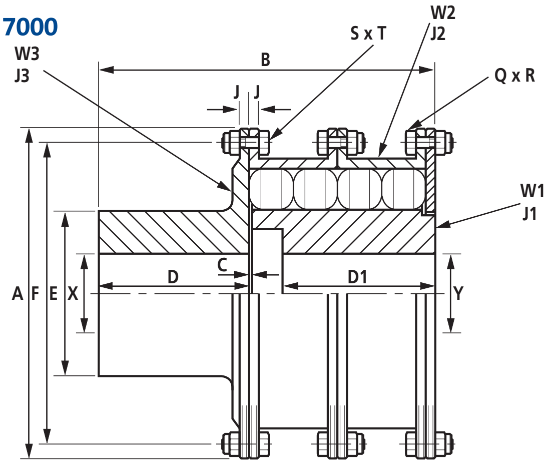
(5) PM0.4 - PM3 driving flanges are available with solid bores on request.

PM Shaft to Shaft PM 180 to PM 7000

180 - 600



850 - 7000



Dimensions, Weight, Inertia and Alignment

COUPLING SIZE		180	270	400	600	850	1200	2000	3500	4700	7000
	A	798	925	1065	1195	1143	1320.8	1574.8	2006.6	2006.6	2006.6
	B	544	623	710.5	812	831	869	1035	1245	1447	1877
	C	8	9	10.5	12	6.35	6.35	6.35	12.7	12.7	12.7
	D	268	307	350	400	406	425	508	507	711	875
	D1	268	307	350	400	406	425	508	507	711	875
	E	415	475	542	620	648	762	965	1016	1220	1370
	F	750	865	992	1122	1066.8	1239.9	1473.2	1892.3	1892.3	1892.3
DIMENSIONS	J	33.5	36	43	52	44.5	50.8	63.5	76	76	76
(mm)	Q	12	12	12	12	20	20	20	24	24	24
	R	M24	M30	M36	M36	M30	M30	M36	M36	M36	M36
	S	20	20	20	24	20	20	20	24	24	24
	T	M24	M30	M36	M36	M36	M36	M45	M48	M48	M48
	W	252	288.5	328	376	425.5	444.5	514.4	520.7	643.5	1003.3
	MAX. X & Y (4)	268	307	350	400	400	457	559	612	711	813
	MIN. X	167	192	232	285	343	381	457	533	609	686
	MIN. Y	170	195	235	285	343	381	457	533	609	686
RUBBER	Per Cavity	2	2	2	2	2	3	3	3	4	6
ELEMENTS	Per Coupling	32	32	32	32	48	78	84	96	128	192
MAXIMUM SPEED (rpm) (1)		1460	1260	1090	975	1000	870	725	580	580	580
	W1	262.3	389.0	562.4	813.3	1059.9	1633.3	2594.6	5263.3	6450.8	8644.4
WEIGHT (3)	W2	266.78	414.0	633.4	909.1	710.3	965.1	1670.9	2732.2	3921.2	4895.6
(kg)	W3	297.4	437.3	651.2	946.7	929.8	1388.8	2631.4	4185.5	7196.1	7742.9
TOTAL		826.5	1240.3	1847	2669.1	2700.0	3987.2	6896.9	12181.0	17568.1	21282.9
INERTIA (3)	J1	9.14	17.88	34.03	65.54	103.97	221.36	493.67	1653.41	2145.76	3063.85
(kg m^2)	J2	28.80	59.30	119.5	220.2	163.89	306.74	743.28	2075.48	3056.46	3755.94
	J3	15.35	29.89	60.66	115.7	105.01	212.24	587.70	1466.3	2637.60	2927.67
ALLOWABLE MISALIGNMENT (2)											
RADIAL (mm)		3.5	3.9	4.6	5.2	2.8	3.3	3.3	3.3	3.3	3.3
AXIAL (mm)		4.0	4.5	5.25	6.0	3.2	3.2	4.8	6.3	6.3	6.3
CONICAL (degree)		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(1) For operation above 80% of the declared maximum coupling speed, it is recommended that the coupling is dynamically balanced.

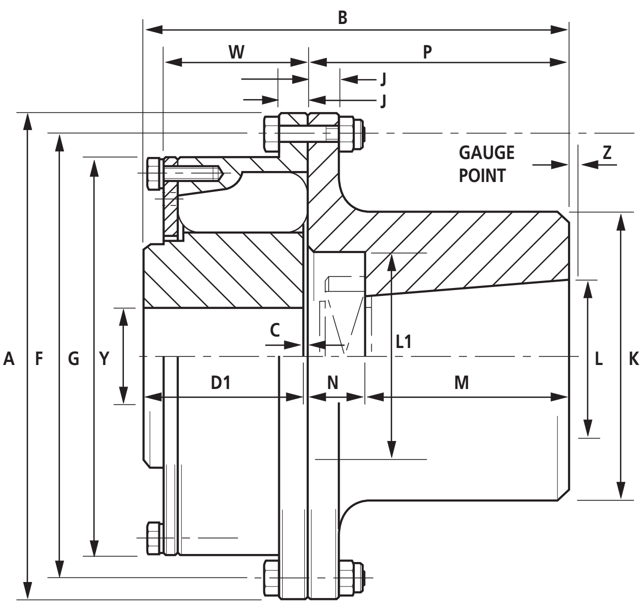
(2) Installations should be initially aligned as accurately as possible. In order to allow for deterioration in alignment over time, it is recommended that initial alignment should not exceed 25% of the above noted data. The forces on the driving and driven machinery should be calculated to ensure that these do not exceed the manufacturers allowables.

(3) Weights and inertias are calculated with mean bore for couplings up to and including PM600, and with maximum bore for PM900 and above.

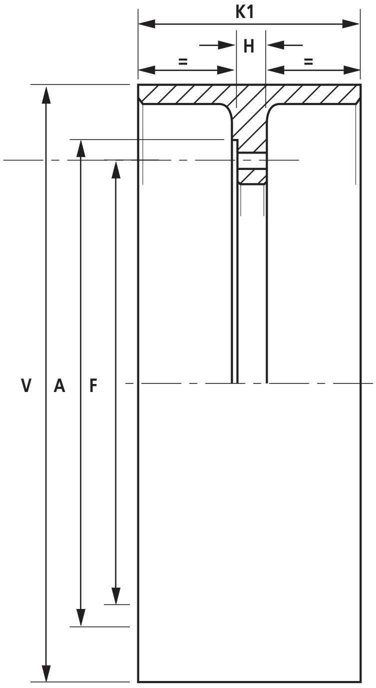
(4) Oversize shafts can be accommodated in large boss driving flanges, manufactured to customer's requirements.

PM Mill Motor Couplings

Mill motor coupling



Brakedrum



Brakedrums may be used in conjunction with the whole range of PM couplings and may be bolted on either the driving flange or flexible half side of the coupling, the recess - øA - locating on the outside diameter of the coupling.

Recommended brake drums for each size of coupling are shown in the table, but øV is adjustable to suit "Non-standard" applications.

Type PM-SDW dimensions table (Ingot motor)

COUPLING SIZE		0.7		1.3	3	6		12		18	
MOTOR FRAME SIZE		180M	180L	225L	250L	280M	280L	355L	400L	400LX	450L
hp		12.7	16	26	43	63	82	123	170	228	300
rpm		956	958	730	732	734	735	590	590	591	592
DIMENSIONS (mm)	A	187.3	187.3	215.9	260.3	260	260	338	338	392	392
	B	168	168	178	215	231	231	284.5	324.5	341	341
	C	2	2	2	3	3	3	3.5	3.5	4	4
	D1	54	54	64	70	86	86	109	109	125	125
	F	171.4	171.4	196.8	235	240	240	312	312	360	360
	G	157	157	181	214.3	222	222	280	280	320	320
	H	15.3	20.3	18.7	18.9	23.5	23.5	23.5	25.5	26	26
	J	11	11	12	14.5	11	11	14	14	16	16
	K	100	100	125	140	155	185	205	205	205	215
	K1	90	110	110	140	180	180	180	225	225	225
	L	42	42	55	60	75	75	95	100	100	110
	L1	70	70	90	105	120	120	135	155	155	170
	M	84	84	84	107	107	107	132	167	167	167
	N	28	28	28	35	35	35	40	45	45	45
	P	112	112	112	142	142	142	172	212	212	212
	V	250	315	315	400	500	500	500	630	630	630
	W	36	46	46	60	81	81	102	102	118	118
	MIN.Y	27	27	38	49	50	50	72	72	80	80
	MAX.Y	51	51	64	73	85	85	109	109	125	125
	Z	3	3	3	3	3	3	3	5	5	5

The motor ratings are taken for Periodic Duty Classes S4 and S5, 150 starts per hour with a cyclic duration factor at 40%. For motors operating outside these ratings, consult Renold Hi-Tec Couplings

PM Mill Motor Couplings

Type PM-MM dimensions table (AISE motor)

Series 6 mill motors

COUPLING SIZE		0.4	0.7		1.3	3	6	12		18	27			40
MOTOR FRAME SIZE		602	603	604	606	608	610	612	614	616	618	620	622	624
hp		7	10	15	25	35	50	75	100	150	200	275	375	500
rpm		800	725	650	575	525	500	475	460	450	410	390	360	340
	A	161.9	187.3	187.3	215.9	260.3	260	338	338	392	440	440	440	490
	B	153	172	172	196	219	237	281.5	281.5	318	336.5	336.5	392.5	466
	C	1	2	2	2	3	3	3.5	3.5	4	4.5	4.5	4.5	5
	D1	51	54	54	64	70	86	109	109	125	143	143	143	162
	F	146	171.4	171.4	196.8	235	240	312	312	360	407	407	407	458
	G	133	157	157	181	221	222	280	280	320	367	367	367	418
	H	13.5	15.3	15.3	18.7	18.9	18.5	18.5	18.5	21	21	21	21	21
	J	9.5	11	11	12	14.5	11	14	14	16	18.5	18.5	18.5	21
	K	102	121	121	133	171	178	190	216	241	254	305	305	305
DIMENSIONS	K1	83	95	95	146	146	171	222	222	286	286	286	286	286
(mm)	L	44.45	50.80	50.80	63.50	76.20	82.55	92.07	107.95	117.47	127.00	149.22	158.75	177.80
	L1	76.2	88.9	88.9	101.6	123.8	127	158.7	158.7	181	203.2	228.6	228.6	228.6
	M	70	83	83	95	111	111	124	124	137	149	168	178	232
	N	31	33	33	35	35	37	45	45	52	40	51	67	67
	P	101	116	116	130	146	148	169	169	189	189	219	245	299
	V	203	254	254	330	330	406	483	483	584	584	584	584	584
	W	36	39	39	46	60	81	102	102	118	134	134	152.7	152.7
	MIN.Y	22	27	27	38	49	50	72	72	80	92	92	92	105
	MAX.Y	41	51	51	64	73	85	109	109	125	143	143	143	162
	Z	3	3	3	3	3	3	3	3	5	5	5	5	5

Series 8 mill motors

COUPLING SIZE		0.4		0.7	1.3	3		6	12		18	27
MOTOR FRAME SIZE		802	802	803	804	806	808	810	812	814	816	818
hp		7.5	10	15	20	30	50	70	100	150	200	250
rpm		800	800	725	650	575	525	500	475	460	450	410
	A	161.9	161.9	187.3	215.9	260.3	260.3	260	338	338	392	440
	B	153	153	172	182	203	219	237	281.5	281.5	318	336.5
	C	1	1	2	2	3	3	3	3.5	3.5	4	4.5
	D1	51	51	54	64	70	70	86	109	109	125	143
	F	146	146	171.4	196.8	235	235	240	312	312	360	407
	G	133	133	157	181	221	221	222	280	280	320	367
	H	13.5	15.3	15.3	18.7	18.9	18.5	18.5	18.5	18.5	21	21
	J	9.5	9.5	11	12	14.5	14.5	11	14	14	16	18.5
	K	102	102	121	121	133	171	178	190	216	241	254
DIMENSIONS	K1	83	95	95	146	146	171	171	222	222	286	286
(mm)	L	44.45	44.45	50.80	50.80	63.50	76.20	82.55	92.07	107.95	117.47	127.00
	L1	76.2	76.2	88.9	88.9	101.6	123.8	127	158.7	158.7	181	203.2
	M	70	70	83	83	95	111	111	124	124	137	149
	N	31	31	33	33	35	35	37	45	45	52	40
	P	101	101	116	116	130	146	148	169	169	189	189
	V	203	254	254	330	330	406	406	483	483	584	584
	W	36	36	39	46	60	60	81	102	102	118	134
	MIN.Y	22	22	27	38	49	49	50	72	72	80	92
	MAX.Y	41	41	51	64	73	73	85	109	109	125	143
	Z	3	3	3	3	3	3	3	3	3	5	5

PM Technical Data

1.1 Prediction of the System Torsional Vibration Characteristics.

An adequate prediction of the system torsional vibration characteristics can be made by the following method.

1.1.1 Use the torsional stiffness as shown in the technical data, which is based upon data measured at a 30˚C ambient temperature (C_{Tdyn}).

1.1.2 Repeat the calculation made as 1.1.1 but using the maximum temperature correction factor St_{100}, and dynamic magnifier correction factor, M100, for the corrected rubber. Use tables below to adjust values for both torsional stiffness and dynamic magnifier. ie, $C_{Tdyn} = C_{Tdyn} \times S_{t100}$

Rubber Grade	Temp$_{max}$ °C	S_t
SM 60	100	$S_{t100} = 0.60$
SM 70	100	$S_{t100} = 0.44$
SM 80	100	$S_{t100} = 0.37$
SM 60 is considered "standard"		

Rubber Grade	Dynamic Magnifier at 30°C (M_{30})	Dynamic Magnifier at 100°C (M_{100})
SM 60	8	13.1
SM 70	6	13.6
SM 80	4	10.8
SM 60 is considered "standard"		

1.1.3 Review calculations 1.1.1 and 1.1.2 and if the speed range is clear of criticals which do not exceed the allowable heat dissipation value as published in the catalogue, then the coupling is considered suitable for the application with respect to the torsional vibration characteristics. If there is a critical in the speed range then actual temperature of the coupling will need to be calculated.

1.2 Prediction of the Actual Coupling Temperature and Torsional Stiffness

1.2.1 Use the torsional stiffness as published in the catalogue, this is based upon data measured at 30˚C and the dynamic magnifier at 30˚C (M_{30}).

2.2.2 Compare the synthesis value of the calculated heat load in the coupling (P_K) at the speed of interest to the "Allowable Heat Dissipation" (P_{KW}).

The coupling temperature rise

$$ºC = Temp_{coup} = \left(\frac{P_K}{P_{KW}}\right) \times 70$$

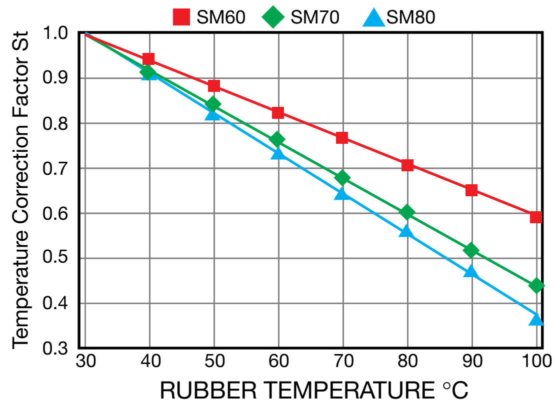
The coupling temperature = ϑ

$$\vartheta = Temp_{coup} + \text{Ambient Temp.}$$

1.2.3 Calculate the temperature correction factor St from 1.3 (if the coupling temperature > 100°C, then use S_{t100}). Calculate the dynamic Magnifier as per 1.4. Repeat the calculation with the new value of coupling stiffness and dynamic magnifier.

1.2.4 Calculate the coupling temperature as per 1.2. Repeat calculation until the coupling temperature agrees with the correction factors for torsional stiffness and dynamic magnifier used in the calculation.

1.3 Temperature Correction Factor



1.4 Dynamic Magnifier Correction Factor

The Dynamic Magnifier of the rubber is subject to temperature variation in the same way as the torsional stiffness.

$$M_T = \frac{M_{30}}{S_t} \qquad \psi_T = \psi_{30} \times S_t$$

Rubber Grade	Dynamic Magnifier (M_{30})	Relative Damping ψ_{30}
SM 60	8	0.78
SM 70	6	1.05
SM 80	4	1.57
SM 60 is considered "standard"		

PM Technical Data - Standard Blocks

PM 0.4 - PM 130

COUPLING SIZE		0.4	0.7	1.3	3	6	8	12	18	27	40	60	90	130
kW / rpm		0.045	0.07	0.14	0.32	0.63	0.84	1.25	1.89	2.83	4.19	6.28	9.43	13.62
MAXIMUM TORQUE T_{Kmax} (kNm)		0.43	0.67	1.3	3.0	6.0	8.0	12.0	18.0	27.0	40.0	60.0	90.0	130.0
VIBRATORY TORQUE T_{KW} (kNm) (2)		0.054	0.084	0.163	0.375	0.75	1.0	1.5	2.25	3.375	5.0	7.5	11.25	16.25
ALLOWABLE DISSIPATED HEAT AT AMB. TEMP. 30°C P_{KW} (W)		266	322	365	458	564	562	670	798	870	1018	1159	1209	1369
MAXIMUM SPEED (rpm)		7200	6300	5400	4500	4480	3860	3450	2975	2650	2380	2050	1830	1600
DYNAMIC TORSIONAL (3) STIFFNESS C_{Tdyn} (MNm/rad)														
@ 0.25 T_{KN}	SM 60	0.003	0.005	0.012	0.029	0.073	0.097	0.146	0.218	0.328	0.485	0.728	1.092	1.577
	SM 70	0.005	0.008	0.018	0.043	0.104	0.138	0.207	0.311	0.466	0.691	1.036	1.554	2.245
	SM 80	0.009	0.013	0.030	0.072	0.134	0.179	0.269	0.403	0.605	0.896	1.344	2.016	2.912
@ 0.50 T_{KN}	SM 60	0.005	0.008	0.019	0.046	0.104	0.138	0.207	0.311	0.466	0.691	1.036	1.554	2.245
	SM 70	0.007	0.010	0.025	0.058	0.139	0.185	0.277	0.416	0.624	0.924	1.386	2.079	3.003
	SM 80	0.010	0.015	0.036	0.086	0.181	0.241	0.361	0.542	0.813	1.204	1.806	2.709	3.913
@ 0.75 T_{KN}	SM 60	0.008	0.012	0.029	0.069	0.154	0.205	0.308	0.462	0.693	1.027	1.540	2.310	3.337
	SM 70	0.009	0.014	0.033	0.078	0.199	0.265	0.398	0.596	0.895	1.325	1.988	2.982	4.307
	SM 80	0.012	0.018	0.043	0.102	0.265	0.353	0.529	0.794	1.191	1.764	2.646	3.969	5.733
@ 1.0 T_{KN}	SM 60	0.011	0.018	0.043	0.102	0.224	0.299	0.448	0.672	1.008	1.493	2.240	3.360	4.853
	SM 70	0.012	0.018	0.044	0.105	0.277	0.370	0.554	0.832	1.247	1.848	2.772	4.158	6.006
	SM 80	0.014	0.021	0.051	0.122	0.382	0.510	0.764	1.147	1.720	2.548	3.822	5.733	8.281
RADIAL STIFFNESS (N/mm) @ NO LOAD	SM 60	685	723	1240	2050	6276	6966	7980	9140	10460	11069	12680	14500	16400
	SM 70	1070	1130	1950	3240	8400	9320	10680	12230	14000	15960	18280	20916	23646
	SM 80	1740	1820	3210	5190	11400	12650	14500	16600	19000	21660	24810	28200	32100
RADIAL STIFFNESS (N/mm) @ 50% T_{Kmax}	SM 60	1430	1510	2600	4300	13180	14630	16780	19200	21970	25050	28700	32820	37110
	SM 70	1760	1860	3200	5240	13800	15320	17550	20100	23000	26220	30040	34360	38850
	SM 80	2510	2650	4480	7450	16500	18320	20980	24000	27500	31350	35910	41100	46450
AXIAL STIFFNESS (N/mm) @ NO LOAD	SM 60	458	502	714	970	1060	1176	1347	1543	1766	2010	2306	2638	2980
	SM 70	753	828	1180	1610	2748	3050	3495	4000	4580	5220	5980	6840	7740
	SM 80	1040	1160	1670	2230	4120	4573	5240	6000	6867	7828	8968	10260	11600
AXIAL STIFFNESS (N/mm) @ 50% T_{Kmax}	SM 60	920	1050	1540	2020	2300	2500	2920	3310	3830	4360	4980	5720	6460
	SM 70	1100	1360	1920	2610	2750	3050	3500	4000	4580	5220	5980	6840	7740
	SM 80	1250	1450	2060	2750	4120	4570	5240	6000	6870	7830	8970	10260	11600
MAX. AXIAL FORCE (N) @ 50% T_{Kmax} (1)	SM 60	66	72	102	128	1501	1668	1913	2178	2502	2845	3267	3728	4218
	SM 70	78	80	112	140	1648	1825	2099	2374	2747	3139	3581	4101	4640
	SM 80	85	106	148	185	2237	2482	2845	3257	3728	4265	4866	5572	6298

(1 The couplings will ‘slip’ axially when the maximum axial force is reached.

(2) At 10Hz only, allowable vibratory torque at higher or lower frequencies fe = $T_{KW} \sqrt{\frac{10Hz}{fe}}$

(3) These values should be corrected for rubber temperature as shown in the design information section.

$$T_{KN} = \frac{T_{KMAX}}{3}$$

PM Technical Data - Standard Blocks

PM 180 - PM 7000

COUPLING SIZE		180	270	400	600	850	1200	2000	3500	4700	7000
kW / rpm		18.86	28.29	41.91	62.86	89.01	125.67	209.45	366.53	492.20	733.06
MAXIMUM TORQUE T_{Kmax} (kNm)		180.0	270.0	400.0	600.0	850.0	1200	2000	3500	4700	7000
VIBRATORY TORQUE T_{KW} (kNm) (2)		22.5	33.75	50.00	75.00	106.2	150.0	250.0	437.5	587.5	875.0
ALLOWABLE DISSIPATED HEAT AT AMB. TEMP. 30°C P_{KW} (W)		1526	1735	1985	2168						
MAXIMUM SPEED (rpm)		1460	1260	1090	975	1000	870	725	580	580	580
DYNAMIC TORSIONAL (3) STIFFNESS C_{Tdyn} (MNm/rad)											
@ 0.25 T_{KN}	SM 60	2.184	3.276	4.853	7.280	14.600	22.500	40.800	74.900	102.000	148.000
	SM 70	3.108	4.662	6.838	10.360	22.000	34.000	61.700	114.000	154.000	225.000
	SM 80	4.032	6.048	8.960	13.440	36.600	56.500	102.000	195.000	257.000	376.000
@ 0.50 T_{KN}	SM 60	3.108	4.661	6.838	10.360	23.100	35.500	64.000	117.000	161.000	232.000
	SM 70	4.158	6.237	9.240	13.860	29.900	46.100	83.300	153.000	209.000	304.000
	SM 80	5.418	8.127	12.040	18.060	43.800	67.600	123.000	226.000	307.000	443.000
@ 0.75 T_{KN}	SM 60	4.620	6.720	10.269	15.400	36.000	55.300	99.100	178.000	249.000	358.000
	SM 70	5.964	8.946	13.251	19.880	40.600	62.400	115.000	205.000	232.000	409.000
	SM 80	7.938	11.907	17.64	26.480	52.500	80.900	147.000	268.000	367.000	534.000
@ 1.0 T_{KN}	SM 60	6.720	10.080	14.931	22.400	54.000	82.900	149.000	265.000	372.000	533.000
	SM 70	8.316	12.474	18.480	27.720	54.700	84.100	151.000	272.000	379.000	546.000
	SM 80	11.466	17.199	25.480	38.220	63.000	97.100	175.000	320.000	439.000	638.000
RADIAL STIFFNESS (N/mm)	SM 60	18270	20920	23820	27300	37800	41900	54900	57500	76500	115000
@ NO LOAD	SM 70	26350	30170	34340	39370	60300	66200	87300	91100	122000	182000
	SM 80	35750	40945	46600	53400	95800	105000	140000	145800	195000	291000
RADIAL STIFFNESS (N/mm)	SM 60	41350	47350	53890	61780	85540	94820	124240	130120	173345	260245
@ 50% T_{Kmax}	SM 70	43290	49560	56420	64680	99073	108766	143434	149677	200446	299026
	SM 80	51760	59260	67460	77330	38714	152040	202720	211118	282360	421368
AXIAL STIFFNESS (N/mm)	SM 60	3324	3800	4332	4966	18200	20800	27700	28400	37800	56700
@ NO LOAD	SM 70	8620	9870	11230	12880	30300	34300	45600	47000	62700	94000
	SM 80	12924	14800	16844	19310	35000	39800	49300	75000	100000	150000
AXIAL STIFFNESS (N/mm)	SM 60	7200	8240	9380	10760	39440	45074	60026	61543	81913	122869
@ 50% T_{Kmax}	SM 70	8620	9870	11230	12880	30300	34300	45600	47000	62700	94000
	SM80	12920	14800	16840	19310	35000	39800	49300	75000	100000	150000
MAX. AXIAL FORCE (N)	SM 60	4709	5396	6131	7034	-	-	-	-	-	-
@ 50% T_{Kmax} (1)	SM 70	5160	5915	6730	7720	-	-	-	-	-	-
	SM 80	7014	8025	9143	10477	-	-	-	-	-	-

(1) The couplings will 'slip' axially when the maximum axial force is reached.

(2) At 10Hz only, allowable vibratory torque at higher or lower frequencies fe = $T_{KW} \sqrt{\frac{10Hz}{fe}}$

(3) These values should be corrected for rubber temperature as shown in the design information section.

$$T_{KN} = \frac{T_{KMAX}}{3}$$

PM Technical Data - Special Round Blocks

PM 12 - PM 600

COUPLING SIZE		12	18	27	40	60	90	130	180	270	400	600
kW / rpm		1.25	1.89	2.83	4.19	6.28	9.43	13.62	18.86	28.29	41.91	62.86
NOMINAL TORQUE T_{KN} (kNm)		3.2	4.8	7.2	10.67	15.99	24.0	34.67	48.0	72.0	106.67	159.99
MAXIMUM TORQUE T_{Kmax} (kNm)		12.0	18.0	27.0	40.0	60.0	90.0	130.0	180.0	270.0	400.0	600.0
VIBRATORY TORQUE T_{KW} (kNm) (2)		1.0	1.5	2.25	3.334	5.0	7.5	10.833	15.0	22.5	29.0	42.75
ALLOWABLE DISSIPATED HEAT AT AMB. TEMP. 30°C P_{KW} (W)		130	150	180	220	260	300	340	375	440	490	565
MAXIMUM SPEED (rpm)		3450	2975	2650	2380	2050	1830	1600	1460	1260	1090	975
DYNAMIC TORSIONAL (3) STIFFNESS C_{Tdyn} (MNm/rad)												
@ 0.25 T_{KN}	SM 60	0.053	0.08	0.12	0.18	0.27	0.613	0.885	1.226	1.839	2.724	4.087
	SM 70	0.072	0.109	0.163	0.241	0.362	0.895	1.293	1.79	2.685	3.978	5.967
	SM 80	0.1	0.149	0.224	0.322	0.498	0.747	1.079	1.493	2.24	3.319	4.98
@ 0.50 T_{KN}	SM 60	0.088	0.132	0.198	0.293	0.44	0.791	1.143	1.582	2.373	3.516	5.273
	SM 70	0.104	0.155	0.233	0.345	0.52	1.05	1.517	2.1	3.15	4.667	7
	SM 80	0.159	0.239	0.358	0.53	0.796	1.193	1.724	2.387	3.58	5.304	7.956
@ 0.75 T_{KN}	SM 60	0.168	0.251	0.377	0.559	0.84	1.154	1.667	2.308	3.462	5.129	7.693
	SM 70	0.162	0.243	0.364	0.539	0.809	1.317	1.902	2.634	3.951	5.853	8.78
	SM 80	0.214	0.321	0.481	0.713	1.069	1.603	2.316	3.207	4.81	7.126	10.689
@ 1.0 T_{KN}	SM 60	0.285	0.427	0.641	0.948	1.424	1.91	2.759	3.82	5.73	8.489	12.733
	SM 70	0.256	0.385	0.577	0.855	1.282	1.85	2.672	3.7	5.55	8.222	12.333
	SM 80	0.328	0.491	0.737	1.092	1.638	2.457	3.549	4.913	7.37	10.919	16.378
RADIAL STIFFNESS (N/mm) @ NO LOAD	SM 60	2619	3000	3433	3914	4497	5132	5798	6464	7398	8438	9657
	SM 70	3742	4286	4905	5592	6425	7333	8284	9236	10570	12050	13798
	SM 80	6138	7030	8044	9170	10538	12025	13586	15147	17335	19770	22628
RADIAL STIFFNESS (N/mm) @ T_{KN}	SM 60	9510	10900	12470	14215	16300	18640	21000	23480	26870	30650	35070
	SM 70	9056	10374	11870	13530	15550	17745	20048	22350	25580	29176	33390
	SM 80	9132	10460	11968	13644	15678	17892	20214	22535	25790	29410	33666
AXIAL STIFFNESS (N/mm) @ NO LOAD	SM 60	1122	1285	1470	1675	1925	2198	2482	2768	3168	3613	4135
	SM 70	1495	1710	1960	2234	2568	2930	3310	3690	4220	4818	5514
	SM 80	2545	2915	3335	3800	4368	4986	5632	6278	7187	8197	9380
AXIAL STIFFNESS (N/mm) @ T_{KN}	SM 60	2918	3340	3825	4360	5010	5718	6460	7200	8242	9400	10750
	SM 70	3067	3510	4020	4580	5266	6000	6790	7570	8660	9880	11300
	SM 80	3218	3686	4218	4808	5526	6306	7124	7942	9090	10368	11865
MAX. AXIAL FORCE (N) @ T_{KN} (1)		2943	3335	3728	4415	5003	5690	6475	7161	8240	9418	10791

(1) The couplings will 'slip' axially when the maximum axial force is reached.

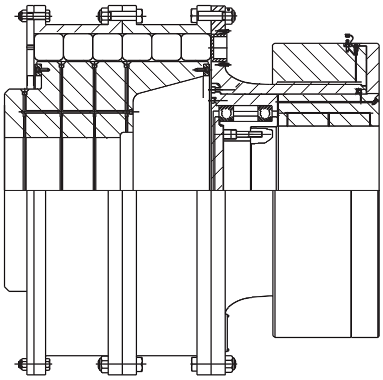
(2) At 10Hz only, allowable vibratory torque at higher or lower frequencies fe = $T_{KW} \sqrt{\frac{10Hz}{fe}}$

(3) These values should be corrected for rubber temperature as shown in the design information section.

PM Design Variations

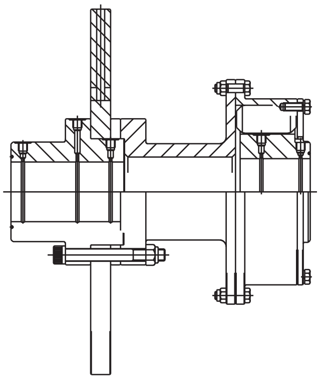
The PM Coupling can be adapted to meet customer needs as can be seen from some of the design variations shown below. For a more comprehensive list contact Renold Hi-Tec.

Torque Limiting Coupling



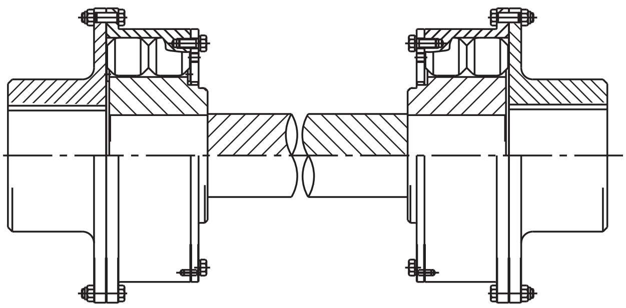
Combination with a torque limiting device to prevent damage to driving and driven machine under shock load.

Brake Disk Coupling



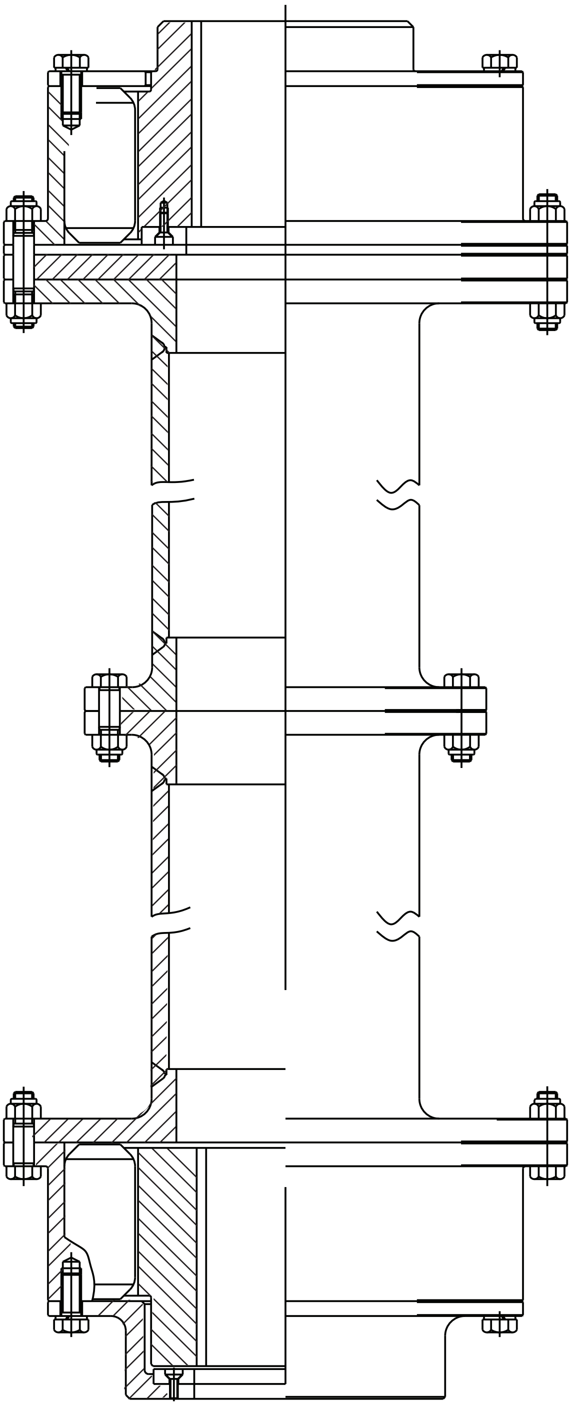
Combination with a brake disc, for use on cranes, fans and conveyor drives. (Brake drum couplings also available).

Cardan Shaft Coupling



Cardan Shaft Coupling. Used to increase the distance between shaft ends and give a higher misalignment capability.

Vertical Spacer Coupling



Spacer Couplings. Used to increase the distance between shaft ends and allow access to driven and driving machine.

Selection Procedure

- From the continuous Power (P) and operating Speed (n) calculate the Application Torque T_{NORM} from the formula:

$$T_{NORM} = 9549 \times (P/n)\ Nm$$

- Select Prime Mover Service Factor (Fp) from the table below.
- Select Driven Equipment Service Factor (Fm) from page 55.
- The minimum Service Factor has been set at 1.5.
- Calculate T_{MAX} from the formula:

$$T_{MAX} = T_{NORM} (Fp + Fm)$$

- Select Coupling such that $T_{MAX} < T_{Kmax}$
- Check **n** < Coupling Maximum Speed (from coupling technical data).
- Check Coupling Bore Capacity such that dmin < d < dmax.
- Consult the factory for alternatives, if catalogue limits are exceeded.

N.B. If you are within 80% of maximum speed, dynamic balancing is required.

T_{NORM} = Application Torque (Nm)
T_{MAX} = Peak Application Torque (Nm)
T_{KN} = Nominal Coupling Rating according to DIN 740 (kNm) (with service factor = 3 according to Renold Hi-Tec Couplings standard)
T_{Kmax} = Maximum Coupling Rating according to DIN 740 (kNm)
P = Continuous Power to be transmitted by coupling (kW)
n = Speed of coupling application (rpm)
Fp = Prime Mover Service Factor
Fm = Driven Equipment Service Factor
dmax = Coupling maximum bore (mm)
dmin = Coupling minimum bore (mm)

WARNING

It is the responsibility of the system designer to ensure that the application of the coupling does not endanger the other constituent components in the system. Service factors given are an initial selection guide.

Prime mover service factors

Prime Mover Factors		Fp
Diesel Engine	1 Cylinder	*
	2 Cylinder	*
	3 Cylinder	2.5
	4 Cylinder	2.0
	5 Cylinder	1.8
	6 Cylinder	1.7
More than	6 Cylinder	1.5
Vee Engine		1.5
Petrol Engine		1.5
Turbine		0
Electric Motor		0
Induction Motor		0
Synchronous Motor		1.5
Variable Speed*		
Synchronous Converter (LCI)	- 6 pulse	1.0
	- 12 pulse	0.5
PWM/Quasi Square		0.5
Cyclo Converter		0.5
Cascade Recovery (Kramer, Scherbius)		1.5

*The application of these drive types is highly specialised and it is recommended that Renold Hi-Tec Couplings is consulted for further advice.

The final selection should be made by Renold Hi-Tec Couplings.

Driven Equipment Service Factors

Application	Typical Driven Equipment Factor(Fm)
Agitators	
Pure liquids	1.5
Liquids and solids	2.0
Liquids-variable density	2.0
Blowers	
Centrifugal	1.5
Lobe (Rootes type)	2.5
Vane	2.0
Brewing and Distilling	
Bottling machinery	1.5
Lauter Tub	1.75
Briquetter Machines	3.0
Can filling machines	1.5
Cane knives	3.0
Car dumpers	3.0
Car pullers - Intermittent Duty	2.5
Clay working machinery	2.5
Compressors	
Axial Screw	1.5
Centrifugal	1.5
Lobe	2.5
Reciprocating - multi-cylinder	3.0
Rotary	2.0
Conveyors - uniformly loaded or fed	
Apron	2.0
Assembly	1.5
Belt	1.5
Bucket	2.0
Chain	2.0
Flight	2.0
Oven	2.5
Screw	2.0
Conveyors - heavy duty not uniformly fed	
Apron	2.0
Assembly	2.0
Belt	2.0
Bucket	2.5
Chain	2.5
Flight	2.5
Oven	2.5
Reciprocating	3.0
Screw	3.0
Shaker	4.0
Crane & hoists	
All motions	3.0
Crushers	
Ore	3.0
Stone	3.5
Sugar (1)	3.5
Dredgers	
Cable reels	2.5
Conveyors	2.0
Cutter head drives	3.5
Jig drives	3.5
Manoeuvering winches	3.0
Pumps	3.0
Screen drive	3.0
Stackers	3.0
Utility winches	2.0
Dynamometer	1.5
Elevators	
Bucket	3.0
Centrifugal discharge	2.0
Escalators	1.5
Freight	2.0
Gravity discharge	2.0
Fans	
Centrifugal	1.5
Cooling towers	2.0
Forced draft	2.0
Induced draft (without damper control)	2.0
Feeders	
Apron	2.0
Belt	2.0
Disc	2.0
Reciprocating	3.0
Screw	2.0

Application	Typical Driven Equipment Factor(Fm)
Generators	
Alternating	1.5
Not welding	1.5
Welding	2.2
Hammer mills	4.0
Lumber industry	
Barkers - drum type	3.0
Edger feed	2.5
Live rolls	2.5
Log haul-incline	2.5
Log haul-well type	2.5
Off bearing rolls	2.5
Planer feed chains	2.0
Planer floor chains	2.0
Planer tilting hoist	2.0
Sawing machine	2.0
Slab conveyor	2.0
Sorting table	2.0
Trimmer feed	2.0
Metal Manufacture	
Bar reeling machine	2.5
Crusher-ore	4.0
Feed rolls	*
Forging machine	2.0
Rolling machine	*
Roller table	*
Shears	3.0
Tube mill (pilger)	*
Wire Mill	2.0
Metal mills	
Drawn bench - carriage	2.5
Drawn bench - main drive	2.5
Forming machines	2.5
Slitters	2.0
Table conveyors - non-reversing	*
- reversing	*
Wire drawing and flattening machine	2.0
Wire winding machine	2.0
Metal rolling mills	
Blooming mills	*
Coilers - hot mill & cold mill	2.5
Cold mills	*
Cooling mills	*
Door openers	2.0
Draw benches	2.5
Edger drives	2.5
Feed rolls, reversing mills	*
Furnace pushers	2.5
Hot mills	*
Ingot cars	2.0
Manipulators	3.0
Merchant mills	*
Piercers	3.0
Pushers rams	2.5
Reel drives	2.0
Reel drums	2.0
Bar mills	*
Roughing mill delivery table	*
Runout table	*
Saws - hot, cold	2.0
Screwdown drives	2.5
Skelp mills	*
Slitters	2.0
Slabbing mills	*
Soaking pit cover drives	2.5
Straighteners	3.0
Table transfer & runabout	2.5
Thrust block	3.0
Traction drive	2.0
Tube conveyor rolls	2.0
Unscramblers	2.5
Wire drawing	2.0
Mills, rotary type	
Ball	2.5
Cement kilns	2.5
Dryers and coolers	2.5
Kilns	2.5
Hammer	3.5
Pebble	2.5
Pug	3.0
Rod	2.5
Tumbling barrels	2.5

Application	Typical Driven Equipment Factor(Fm)
Mining	
Conveyor - armoured face	3.0
- belt	1.5
- bucket	1.5
- chain	1.75
- screw	1.5
Dintheader	3.0
Fan - ventilation	2.0
Haulages	2.0
Lump breakers	1.5
Pulverisor	2.0
Pump - rotary	2.0
- ram	3.0
- reciprocating	3.0
- centrifugal	1.5
Roadheader	2.0
Shearer - Longwall	2.0
Winder Colliery	2.5
Mixers	
Concrete mixers	2.0
Drum type	2.0
Oil industry	
Chillers	2.0
Oil well pumping	3.0
Paraffin filter press	2.0
Rotary kilns	2.5
Paper mills	
Barker-auxiliaries hydraulic	3.0
Barker-mechanical	3.5
Barking drum (Spur Gear only)	3.5
Beater and pulper	3.5
Bleacher	2.0
Calenders	2.0
Chippers	2.5
Coaters	2.0
Converting machine (not cutters, platers)	2.0
Couch	2.0
Cutters, platers	3.0
Cylinders	2.0
Dryers	2.0
Felt stretcher	2.0
Felt whipper	2.0
Jordans	2.25
Line shaft	2.0
Log haul	2.5
Presses	2.5
Pulp grinder	3.5
Reel	2.0
Stock chests	2.0
Suction roll	2.0
Washers and thickeners	2.0
Winders	2.0
Printing presses	2.0
Propellors	
Marine - fixed pitch	2.0
- controllable pitch	2.0
Pullers	
Barge haul	2.5
Pumps	
Centrifugal	1.5
Reciprocating - double acting	3.0
single acting - 1 or 2 cylinders	3.0
3 or more cylinders	3.0
Rotary - gear, lobe, vane	2.0
Rubber industry	
Mixed - banbury	3.0
Rubber calender	2.0
Rubber mill (2 or more)	2.5
Sheeter	2.5
Tyre building machines	2.5
Tyre and tube press openers	2.0
Tubers and strainer	2.5
Screens	
Air washing	1.5
Grizzly	2.5
Rotary, stone or gravel	2.0
Travelling water intake	1.5
Vibrating	2.5
Sewage disposal equipment	2.0
Textile industry	2.0
Windless	2.5

* Use 1.75 with motor cut-out power rating

Selection Examples

Example 1

- Selection of 6 Cylinder Diesel Engine 750 kW at 900 rpm driving a Centrifugal Pump.

The coupling is flywheel mounted
Pump shaft diameter = dm

P	=	750 kW	n	=	900 rpm
dm	=	95 mm	temp	=	30^oC
Fp	=	1.7	Fm	=	1.5

T_{NORM} = (P/n) x 9549 Nm
= (750/900) x 9549 Nm
= 7.958 kNm

T_{MAX} = T_{NORM} (Fp + Fm)
= 7.958 (1.7 + 1.5)
= 25.466 kNm

- The application is considered light industrial and RB type coupling should be selected. Examination of RB catalogue shows RB 3.86 as:

T_{KMAX} = 27.4 kNm T_{KN} = 9.159 kNm

which satisfies the condition

- $T_{MAX} < T_{Kmax}$ (25.466 < 27.4) kNm
- $T_{NORM} < T_{KN}$ (7.859 < 9.159) kNm
- n < Coupling Maximum Speed (900 < 2500) rpm
- dmin < dm < dmax (80 < 95 < 170) mm

Example 2

- ▲ Selection of Induction Motor 800 kW at 1498 rpm driving a Rotary Pump.

Motor shaft = dp   Pump shaft = dm

P	=	800 kW	n	=	1498 rpm
dp	=	95 mm	dm	=	85 mm
temp	=	30^oC	Fp	=	0
Fm	=	2			

T_{NORM} = (P/n) x 9549 Nm
= (800/1498) x 9549 Nm
= 5.1 kNm

T_{MAX} = T_{NORM} (Fp + Fm)
= 5.1 (0 + 2) kNm
= 10.2 kNm

- ▲ The application requires a steel coupling (by customer specification) and PM type coupling should be selected. Examination of PM catalogue shows PM12 as:

T_{Kmax} = 12 kNm

which satisfies the condition

- ▲ $T_{MAX} < T_{Kmax}$ (10.2 < 12.0) kNm
- ▲ n < Coupling Maximum Speed (1498 < 3450) rpm
- ▲ dmin < dp < dmax (72 < 95 < 109) mm
- ▲ dmin < dm < dmax (72 < 85 < 109) mm

Calculation Service

- For over 50 years we have been the world leader in torsional vibration analysis for all types of machinery, we have developed sophisticated in-house computer programmes specifically for this purpose.
- A consultancy service is also available to customers in the selection of the correct product for their specific application.
- Renold Hi-Tec Couplings is well known in the diesel engine industry for its analysis techniques.
- In the heavy industrial sector, Renold Hi-Tec Engineers have made many torsional vibration analyses. For example, steady state transient and Torque Amplification Factors (TAF) on electric motor drivelines in cement mills, rolling mills, compressor drive trains, synchronous motor start ups and variable frequency (LCI, Kramer/Scherbius/PWM) applications.
- On page 30, two examples of torsional vibration analysis that are produced by Renold Hi-Tec Engineers are shown.

Transient Analysis

Calculated Examples

Illustrated below are two different types of transient torsional vibrations analysis that can be produced by Renold Hi-Tec Engineers. This ensures optimum solutions are reached by the correct selection, of torsional stiffness and damping characteristics of the coupling. Whilst the synchronous resonance and synchronous convertor (LCI) examples are shown, other applications which Renold Hi-Tec Couplings have experience of include, Torque Amplification, Electrical Speed Control Devices, PWM, Scherbius/Kramer, Short-Circuit and any re-connection of electrical circuits on the mechanical systems.

Example 1

Since June 1962 we have engineered flexible couplings for Synchronous Motor applications to reduce by damping, the damaging vibratory torques imposed into the system when accelerating through the first resonant frequency.

Table A

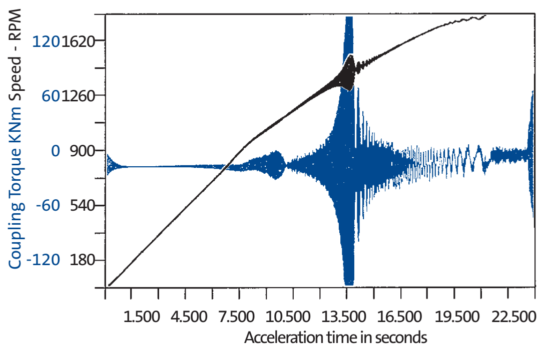


Table A shows vibrating torque experienced in the motor shaft when the system is connected rigidly (or by a gear or membrane coupling) to the driven system.

Table B

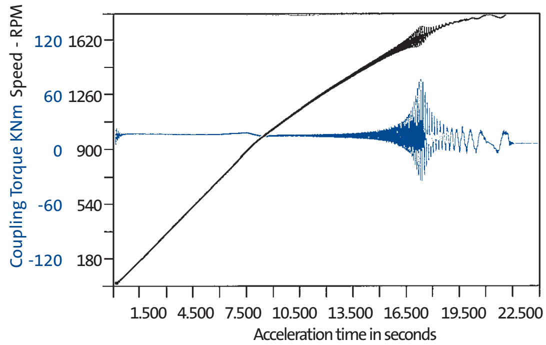


Table B shows the same system connected by a DCB coupling. A PM type coupling is also used in such applications.

Example 2

From 1981 we have been engineering flexible couplings for Synchronous Convertor (LCI) drives to control the forced mode conditions through the first natural frequency by judicial selection of torsional stiffness and damping.

Table C

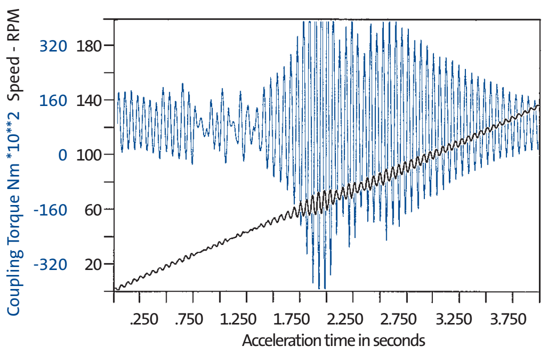


Table C shows a typical motor/fan system connected rigidly (or through a gear or membrane coupling) when damaging torques would have been experienced in the motor shaft.

Table D

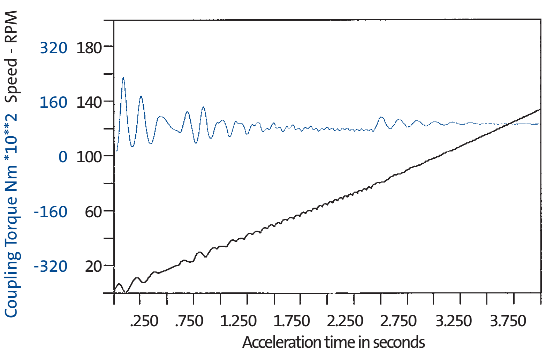


Table D shows the equivalent Renold Hi-Tec Couplings engineered solution using a PM coupling.

Rubber Information

The rubber blocks and elements used in Renold Hi-Tec Couplings are key elements in the coupling design. Strict quality control is applied in the manufacture, and frequent testing is part of the production process.

Rubber-in-Compression

These designs use non-bonded components, which allows for many synthetic elastomers to be employed.
These elastomers offer considerable advantages over others for specific applications, giving Renold Hi-Tec Couplings a distinctive lead in application engineering in specialised areas.

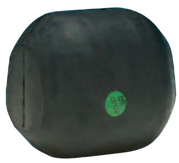
Rubber Compound

	Natural	Styrene-Butadiene	Neoprene	Nitrile	Stryene-Butadiene	Silicone
Identification label	Red (F, NM)	Green (SM)	Yellow (CM)	White (AM)	Blue (S)	Blue (Si)
Resistance to Compression Set	Good	Good	Fair	Good	Fair	Good
Resistance to Flexing	Excellent	Good	Good	Good	Good	Good
Resistance to Cutting	Excellent	Good	Good	Good	Fair	Fair
Resistance to Abrasion	Excellent	Good	Good	Good	Good	Fair
Resistance to Oxidation	Fair	Fair	Very Good	Good	Fair	Excellent
Resistance to Oil & Gasoline	Poor	Poor	Good	Good	Poor	Good
Resistance to Acids	Good	Good	Fair	Fair	Good	Good
Resistance to Water Swelling	Good	Good	Good	Good	Good	Good
Service Temp. Maximum; Continuous	80°C	100°C	100°C	100°C	100°C	200°C
Service Temperature Minimum	-50°C	-40°C	-30°C	-40°C	-40°C	-50°C
			Flame Proof		High Damping	

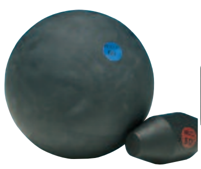
Rubber Block Types

DCB

PM



SPECIAL



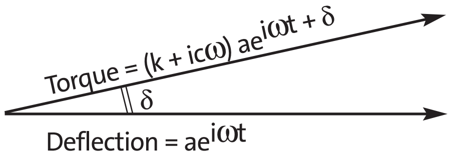
WB

NM	SM	CM	AM	S	Si
Renold 45					
	Renold 50	Renold 50		Renold 50	
Renold 60	Renold 60			Renold 60	
Renold 70	Renold 70	Renold 70	Renold 70	Renold 70	Renold 70
Renold 80	Renold 80				
			Renold 90		

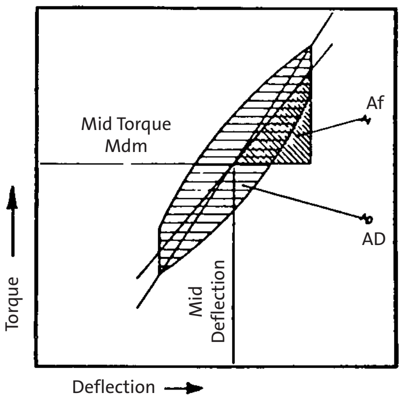
Damping Characteristics

Coupling damping varies directly with torsional stiffness and inversely with frequency for a given rubber grade. This relationship is conventionally described by the dynamic magnifier M, varying with hardness for the various rubber types.

$$M = \frac{K}{C\omega}$$



$$\tan\delta = \frac{C\omega}{K} = \frac{1}{M}$$



$$\psi = \frac{AD}{Af} = \frac{2\pi}{M}$$

This property may also be expressed as the Damping Energy Ratio or Relative Damping, ψ, which is the ratio of the damping energy, AD, produced mechanically by the coupling during a vibration cycle and converted into heat energy, to the flexible strain energy Af with respect to the mean position.

Where C = Specific Damping (Nms/rad)

K = Torsional Stiffness (Nm/rad)

ω = Frequency (Rad/s)

M = Dynamic Magnifier

δ = Phase Angle Rad

ψ = Damping Energy Ratio

The rubber compound dynamic magnifier values are shown in the table below.

Rubber grade	M
NM 45	15
SM 50	10
SM 60	8
SM 70	6
SM 80	4

Health and Safety at Work

Customers are reminded that when purchasing Renold products, for use at work or otherwise, additional and up-to-date information, which is not possible to include in Renold publications, must be obtained from your local sales office, in relation to:

(a) Guidance on individual product suitability, based on the various existing applications of the extensive range of Renold products.

(b) Guidance on safe and proper use, provided that full disclosure is made of the precise details of the intended, or existing, application.

All relevant information must be passed on to the persons engaged in, likely to be affected by and those responsible for the use of the product.

Nothing contained in this publication shall constitute a part of any contract, express or implied.

Product Performance

'The performance levels and tolerances of our product stated in this catalogue (including without limitation, serviceability, wearlife, resistance to fatigue, corrosion protection) have been verified in a programme of testing and quality control in accordance with Renold, Independent and or International standard recommendations.

No representation warranty or condition is given that our products shall meet the stated performance levels or tolerances for any given application outside the controlled environment required by such tests and customers must check the performance levels and tolerances for their own specific application and environment.

Guidance Notes

Whilst all reasonable care in compiling the information contained in this catalogue is taken, no responsibility is accepted for printing errors.
All information contained in this catalogue is subject to change after the date of publication.

Illustrations - The illustrations used in this catalogue represent the type of product described but the goods supplied may vary in some detail from those illustrated.

Specifications - The right is reserved to make modifications to design and dimensions as published in this catalogue to meet manufacturing conditions and developments in design and materials.

Renold - Products can be supplied by Renold companies or representatives around the world on the standard terms and conditions of sale of the company or representative from which the products are purchased.

Product Range

DCB-GS Range

The DCB-GS coupling is ideally suited for marine propulsion, power generation and reciprocating compressor applications where control of resonant torsional vibration and long life are essential.

Applications

- Marine Propulsion
- Compressors
- High Power Generator Sets

UJ Range

The UJ coupling is designed for use in conjunction with universal joint shafts.

Applications

- Construction Plant
- Railway Vehicles
- Pumps
- Steel Mills
- Paper Mills
- Power Take Offs

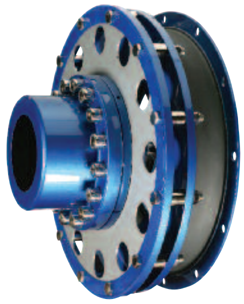
HTB Range

The HTB coupling is a high temperature blind assembly coupling for mounting inside bell housings.

Applications

- Marine Propulsion
- Compressors
- Generator and Pump Sets
- Rail Traction

VF Range

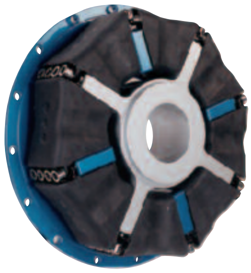


The highly flexible VF coupling has been designed for diesel engines that are mounted separately from marine gear and which can be placed on flexible mounts.

Applications

- Marine Propulsion
- Generator Sets
- Compressors Sets
- Power Take Offs

MSC Range



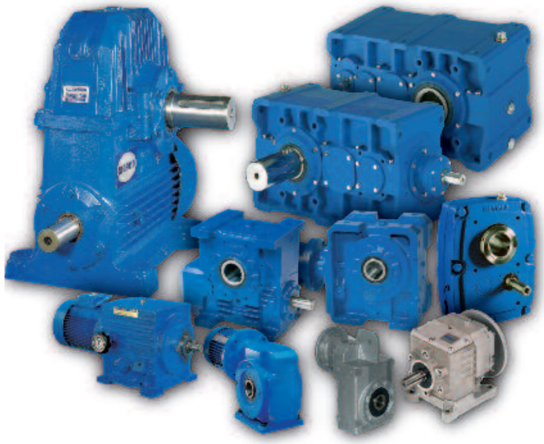
This innovative coupling has been designed to satisfy a vast spectrum of diesel drive and compressor applications providing low linear stiffness and a control of resonant torsional vibration with intrinsically failsafe operation.
Maximum torque of 375 kNm.

Applications

- Marine Propulsion
- Compressors
- High Power Generator Sets

Gears and Coupling Product Range

Gear Units



The Renold gearbox range is diverse, covering worm gears, helical and bevel helical drives and mechanical variable speed. Renold is expert in package drives and special bespoke engineered solutions, working closely with customers to fulfil their specific applicational requirements, including: mass transit, materials handling, power generation.

Tel: +44 (0) 1706 751000
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Email: gears.sales@renold.com.

Open Gears

Renold is expert in producing high quality, custom made worms and worm wheels to either commercial or precision grades for a wide variety of applications. Custom made commercial worm gears can be manufactured to customer's drawings or reverse engineered. High precision worm gears, which includes dual lead, are manufactured to the highest industry tolerance ensuring peak performance and smoothness of transmission.

Tel: +44 (0) 1706 751000
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Hi-Tec Couplings

Renold Hi-Tec Couplings product range is comprised of both rubber in compression and rubber in shear couplings for damping and tuning torsional vibrations in power drive lines, they have been developed over 50 years to satisfy industry needs for the complete range of diesel and electronic motor drives. Our design capability and innovation is recognised by customers around the world and is utilised in customising couplings to meet customer's specific requirements. Renold Hi-Tec Couplings deliver the durability, reliability and long life that customers demand.

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Gears and Coupling Product Range

Couplings

Renold Couplings manufactures specialist and industrial couplings. These include, Hydrastart fluid couplings, Gearflex gear couplings, Renoldflex torsionally rigid couplings and elastomeric couplings that include the Pinflex and Crownpin pin and bush couplings and the Discflex coupling range. Popular industrial products include the Spiderflex, Tyreflex and Chainflex couplings.
This wide and varied portfolio offers torque transmission capability from 107 Nm through to 4,747,000 Nm. Renold Couplings has the coupling solution for a wide range of demanding applications.

Tel: +44 (0) 2920 792737
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Freewheel Clutches

The Renold range of Freewheel Clutches feature both Sprag and Roller Ramp technology. Sprag Clutches are used in a wide range of safety critical applications. Typical examples of these are safety backstops on inclined bucket conveyor systems and holdbacks that can protect riders on some of the worlds most thrilling roller coasters.
The Trapped Roller range (roller ramp technology), are directly interchangeable with freewheels available in the market today. These high quality freewheel products deliver Backstopping, Overrunning and Indexing capabilities for a wide range of customer applications.

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Ajax Mill Products

Renold mill products consist of Gear spindles, Universal joint drive shafts and Gear Couplings. Renold Gear Spindles are designed to meet specific customer and application needs. Material, heat treatment, and gear geometry are selected for the specific requirements of each application. Three dimensional modeling and Finite Element Analysis (FEA) are used to further enhance the design process and to assure the best possible design solution.
Universal Joint drive shafts are available in both English and Metric sizes and offer a broad range of options and sizes up to and including 1.5 meter diameter.
Gear Couplings are offered in sizes ranging from AGMA size 1 through size 30 providing torque capabilities from 12,700 in-lb (1435 Nm) up to 51,000,000 in-lb (5,762,224 Nm).

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