

INSTALLATION & MAINTENANCE

# SERIES G

 **DAVID BROWN**  
R A D I C O N

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**IMPORTANT****Product Safety Information**

**General** - The following information is important in ensuring safety. It **must** be brought to the attention of personnel involved in the selection of David Brown Radicon Limited power transmission equipment, those responsible for the design of the machinery in which it is to be incorporated and those involved in its installation, use and maintenance.

David Brown power transmission equipment will operate safely provided it is selected, installed, used and maintained properly. As with any power transmission equipment **proper precautions must** be taken as indicated in the following paragraphs, to ensure safety.

**Potential Hazards** - these are **not** necessarily listed in any order of severity as the degree of danger varies in individual circumstances. It is important therefore that the list is studied in its entirety:-

- 1) Fire/Explosion
  - (a) Oil mists and vapour are generated within gear units. It is therefore dangerous to use naked lights in the proximity of gearbox openings, due to the risk of fire or explosion.
  - (b) In the event of fire or serious overheating (over 300°C), certain materials (rubber, plastics, etc.) may decompose and produce fumes. Care should be taken to avoid exposure to the fumes, and the remains of burned or overheated plastic/rubber materials should be handled with rubber gloves.
- 2) Guards - Rotating shafts and couplings must be guarded to eliminate the possibility of physical contact or entanglement of clothing. It should be of rigid construction and firmly secured.
- 3) Noise - High speed gearboxes and gearbox driven machinery may produce noise levels which are damaging to the hearing with prolonged exposure. Ear defenders should be provided for personnel in these circumstances. Reference should be made to the Department of Employment Code of Practice for reducing exposure of employed persons to noise.
- 4) Lifting - Where provided (on larger units) only the lifting points or eyebolts must be used for lifting operations (see maintenance manual or general arrangement drawing for lifting point positions). Failure to use the lifting points provided may result in personal injury and/or damage to the product or surrounding equipment. Keep clear of raised equipment.
- 5) Lubricants and Lubrication
  - (a) Prolonged contact with lubricants can be detrimental to the skin. The manufacturer's instruction must be followed when handling lubricants.
  - (b) The lubrication status of the equipment must be checked before commissioning. Read and carry out all instructions on the lubricant plate and in the installation and maintenance literature. Heed all warning tags. Failure to do so could result in mechanical damage and in extreme cases risk of injury to personnel.
- 6) Electrical Equipment - Observe hazard warnings on electrical equipment and isolate power before working on the gearbox or associated equipment, in order to prevent the machinery being started.
- 7) Installation, Maintenance and Storage
  - (a) In the event that equipment is to be held in storage, for a period exceeding 6 months, prior to installation or commissioning, David Brown Radicon Limited must be consulted regarding special preservation requirements. Unless otherwise agreed, equipment must be stored in a building protected from extremes of temperature and humidity to prevent deterioration.  
  
The rotating components (gears and shafts) must be turned a few revolutions once a month (to prevent bearings brinelling).
  - (b) External gearbox components may be supplied with preservative materials applied, in the form of a "waxed" tape overwrap or wax film preservative. Gloves should be worn when removing these materials. The former can be removed manually, the latter using white spirit as a solvent.  
  
Preservatives applied to the internal parts of the gear units do not require removal prior to operation.
  - (c) Installation must be performed in accordance with the manufacturer's instructions and be undertaken by suitably qualified personnel.
  - (d) Before working on a gearbox or associated equipment, ensure that the load has been removed from the system to eliminate the possibility of any movement of the machinery and isolate power supply. Where necessary, provide mechanical means to ensure the machinery cannot move or rotate. Ensure removal of such devices after work is complete.
  - (e) Ensure the proper maintenance of gearboxes in operation. Use only the correct tools and David Brown Radicon Limited approved spare parts for repair and maintenance. Consult the Maintenance Manual before dismantling or performing maintenance work.
- 8) Hot Surfaces and Lubricants
  - (a) During operation, gear units may become sufficiently hot to cause skin burns. Care must be taken to avoid accidental contact.
  - (b) After extended running the lubricant in gear units and lubrication systems may reach temperatures sufficient to cause burns. Allow equipment to cool before servicing or performing adjustments.
- 9) Selection and Design
  - (a) Where gear units provide a holdback facility, ensure that back-up systems are provided if failure of the holdback device would endanger personnel or result in damage.
  - (b) The driving and driven equipment must be correctly selected to ensure that the complete machinery installation will perform satisfactorily, avoiding system critical speeds, system torsional vibration, etc.
  - (c) The equipment must not be operated in an environment or at speeds, powers, torques or with external loads beyond those for which it was designed.
  - (d) As improvements in design are being made continually the contents of this catalogue are not to be regarded as binding in detail, and drawings and capacities are subject to alterations without notice.

The above guidance is based on the current state of knowledge and our best assessment of the potential hazards in the operation of the gear units.

Any further information or clarification required may be obtained by telephoning or writing to:

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## 1 UNIT IDENTIFICATION

When requesting further information, or service support quote the following information from the nameplate:

- Unit Type
- Order Number

DAVID BROWN RADICON

UNIT TYPE:

ORDER No:

INPUT KW:

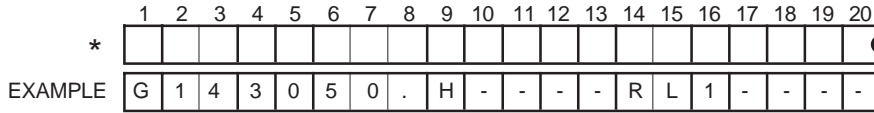
RATIO:

OUTPUT RPM:

ASSEMBLY POSITION:

OIL GRADE:

LUBRICATION:  Fill to correct Oil Level with oil of recommended grade. Drain and Flush at end of oil change period. See approved Lubricants leaflet for further details.



1 - SERIES G RANGE  G

2, 3 - SIZE OF UNIT  1  4 THROUGH  1  9

4 - NO OF REDUCTIONS  2 THROUGH  4

5 - REVISION VERSION  0 ETC

6, 7, 8 - NOMINAL OVERALL RATIO  
eg  8  .  0  
 5  0  .

9 - UNIT VERSION  
 H - HORIZONTAL PARALLEL SHAFT UNIT  
 V - VERTICAL PARALLEL SHAFT UNIT  
 B - HORIZONTAL RIGHT ANGLE UNIT  
 R - VERTICAL RIGHT ANGLE UNIT

10 - OUTPUTSHAFT  
 - STD SOLID SINGLE EXTENSION  
 D - STD SOLID DOUBLE EXTENSION  
 H - STD HOLLOW SHAFT WITH SHRINK DISC  
 A - STD AGITATOR WITH DROP BEARING HOUSING

20 - TORQUE ARM  
 - NO TORQUE ARM  
 T - TORQUE ARM

19 - CASE CONSTRUCTION  
 - CAST IRON  
 S - SG IRON  
 F - FABRICATION

18 - OIL LEVEL  
 - DIPSTICK  
 G - SIGHTGLASS

17 - COOLING  
 - NONE  
 F - MECHANICAL FAN  
 E - ELECTRIC FAN  
 C - COOLING COIL  
 A - MECHANICAL FAN & COOLING COIL  
 B - ELECTRIC FAN & COOLING COIL  
 S - SPRAY

16 - SHAFT ROTATION  
 1  2  3 OR  4

14, 15 - UNIT HANDING  
eg  R  L

13 - TYPE OF UNIT  
FOR REDUCER (STANDARD UNIT)  
ENTER  -  
TO ALLOW FITTING OF MOTOR  
SEE SERIES G CATALOGUE

12 - BACKSTOP  
 - NO BACKSTOP  
 X - BACKSTOP FITTED

11 - INPUTSHAFT  
 - STANDARD SINGLE EXTENSION  
 D - STANDARD DOUBLE EXTENSION (HORIZONTAL UNITS ONLY)

## **2 GENERAL INFORMATION**

The following instructions will help you achieve a satisfactory installation of your David Brown Radicon Series G unit, ensuring the best possible conditions for a long and trouble free operation.

All units are tested and checked prior to despatch, a great deal of care is taken in packing and shipping arrangements to ensure that the unit arrives at the customer in the approved condition.

**Warning:** Both Foot and shaft mounted units are designed to operate in the horizontal position. Reference must be made to David Brown, with full details, where units are required to operate in an inclined position.

## **3 FITTING OF COMPONENTS TO EITHER THE UNIT INPUT OR OUTPUT SHAFT**

The input or output shaft extension diameter tolerance is to ISO tolerance k6 (for shaft diameter  $\leq 50\text{mm}$ ) and m6 (for shaft diameter  $> 50\text{mm}$ ) and the fitted components should be to ISO tolerance M7 (for bore diameter  $\leq 50\text{mm}$ ) and K7 (for bore diameter  $> 50\text{mm}$ ).

- Items (such as gears, sprockets, couplings etc) should not be hammered onto these shafts since this would damage the shaft support bearings.
- The item should be pushed onto the shaft using a screw jack device fitted into the threaded hole provided in the end of the shaft.
- Items being fitted may be heated to 80/100°C to aid assembly further.

### THREADED HOLE DETAILS

UNIT SIZE	TYPE OF UNIT		INPUT SHAFT	OUTPUT SHAFT
14 & 15	Parallel	2 Stage	M16 x 36 mm deep	M30 x 63 mm deep
	Parallel	3 & 4 Stage	M12 x 25 mm deep	
	Right Angle	3 Stage	M12 x 32 mm deep	
16 & 17	Parallel	2 Stage	M20 x 43 mm deep	M42 x 81 mm deep
	Parallel	3 & 4 Stage	M16 x 36 mm deep	
	Right Angle	3 Stage	M16 x 36 mm deep	
	Right Angle	4 Stage	M12 x 32 mm deep	
18 & 19	Parallel	2 Stage	M24 x 52 mm deep	M42 x 81 mm deep
	Parallel	3 & 4 Stage	M20 x 43 mm deep	
	Right Angle	3 Stage	M20 x 43 mm deep	
	Right Angle	4 Stage	M16 x 36 mm deep	

## **4 WEATHER PROTECTION OF UNIT**

All units prior to despatch are test run with a rust preventative oil giving adequate protection to internal parts for a period of six months covering normal transport in the UK and overseas and covered storage. When the unit is installed the rust preventative dissolves in the first fill of lubricant without harmful effect.

Shaft extensions and hollow output shafts are protected with a rust inhibitor which is proof against sea water and suitable for under-cover storage up to 12 months.

- Notes:
- 1 Where gear units are to operate in abnormal conditions, or where they are to stand for long periods without running, eg in plant installation, David Brown must be notified so that suitable protective arrangements can be made. The rotating components (gears and shafts) must be turned a few revolutions once a month (to prevent bearings brinelling).
  - 2 Gear units which are commissioned and then left standing for an extended period should be operated loaded or unloaded for a short time every two weeks to circulate the lubricant to protect surfaces. If this is not possible the unit should be protected from corrosion.

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## 5 INSTALLATION

### 5.1 GENERAL



**WARNING:** The customer shall be responsible for the proper use of articles supplied by the company, particularly the rotating shafts between their driving and driven members, and their guarding for safety, and the company shall not be responsible for any injury or damage sustained as a result of the improper use of the articles supplied. Attention is hereby drawn to the danger of using naked lights in proximity to openings in gearboxes and gear units supplied by the company, and the company shall not be liable for any claim for injury or damage arising from any action in contravention of this warning.

**WARNING:** All units and couplings are despatched without oil or grease, on installing the unit fill with recommended lubricant to correct level.

**NOTE:** If lubricant is to be added later then it is important that the same oil is used as is already in the unit.

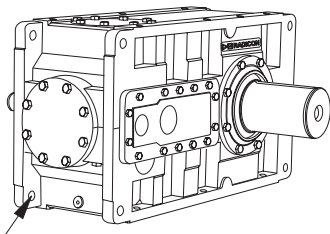
If an oil other than that in the unit is to be used the unit should be drained and flushed with the oil to be used and filled with the correct quantity.

### 5.2 LIFTING

Only the lifting points identified below must be used for lifting operations during installation.

#### Gearbox Only

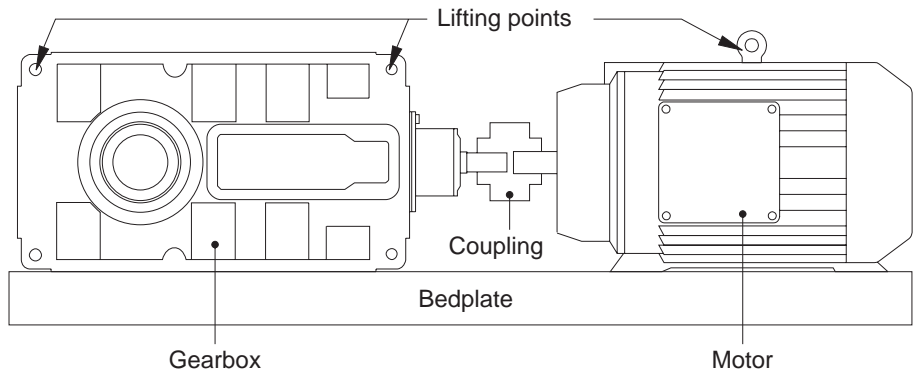
The gearbox can be lifted using any of the eight lifting points.



Lifting point at all corners

#### Gearbox on Bedplate

The lifting points on the bedplate must **NOT** be used to lift the whole drive assembly. Use the lifting points on the gearbox and motor to lift the bedplate assembly.



**Note:** Failure to use these lifting points could result in personal injury/or damage to the product and surrounding equipment.

### 5.3 FIXING TO CUSTOMER EQUIPMENT

Fixing the feet/pads to customer equipment use set screws to ISO grade 8.8 minimum.

Torque tighten to:-

Set Screw Size	Tightening Torque
M12	85 Nm
M16	200 Nm
M20	350 Nm
M24	610 Nm
M30	1220 Nm
M36	2150 Nm

### 5.4 MOTOR CONNECTIONS

#### TO MAINS

Connection of the electric motor to the mains supply should be made by a qualified person. The current rating of the motor will be identified on the motor plate, and correct sizing of the cables to electrical regulations is essential.

## 5.5 FOOT-MOUNTED UNITS

The following procedure is recommended for all foot mounted units.

Foot mounted units are supplied either as free standing units, or if required, mounted on a standard baseplate with a foot mounted motor correctly aligned and connected by a David Brown Radicon flexible coupling.

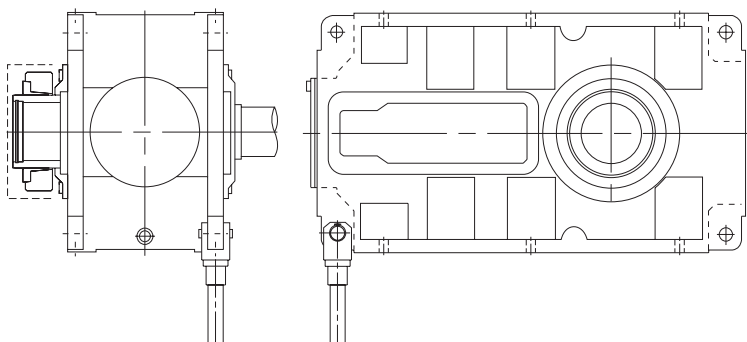
- a) Clean shaft extensions and ventilator when fitted.
- b) Secure unit, or baseplate if fitted to a rigid foundation using heavy duty bolts to ISO grade 8.8 minimum.
- c) Ensure baseplate is not distorted  
Note: Units not supplied on baseplates should if possible be mounted on the same bedplate as the prime mover.
- d) Align unit (see Appendix 4)  
Note: It is important to ensure when aligning unit on baseplate that all machined mounting points are supported over their full area.  
If steel packings are used these should be placed either side of the foundation bolt as close as possible. During the final bolting ensure the unit or baseplate is not distorted this will cause strains in the gear case resulting in errors of alignment of shafts and gearing.
- e) For units mounted on bedplates after alignment select any two diagonally opposite feet, drill ream and dowel in position.
- f) Fit guards in accordance with the factory acts.
- g) Check motor wiring for correct direction of rotation this is important when a backstop device is fitted.
- h) Fill gear unit with oil (if not factory filled) as detailed in Section 6.

## 5.6 SHAFT MOUNTED UNITS

The following procedure is recommended for all shaft and foot/shaft mounted units.

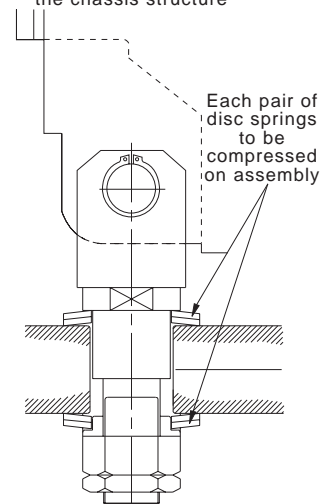
- a) Clean shaft extensions, driven machine shaft, gear unit bore and ventilator when fitted.
- b) Locate in position, ensuring it is as close as possible to the bearing on the driven machine.
- c) Secure unit onto the shaft. For units using a shrink disc device refer to section 5.6.1
- d) Fit torque arm to the side of the unit adjacent to the driven machine where possible, as detailed below.  
Note: Unless specified otherwise, the torque arm will be supplied loose.
- e) Anchor case to a secure point by means of the torque arm.
- f) Fit guards in accordance with the factory acts.
- g) Check motor wiring for correct direction of rotation, this is important when a backstop device is fitted.
- h) Fill gear unit with oil (if not factory filled) as detailed in Section 6.

**Figure 1**



**Figure 2**

The torque arm must be flexibly mounted to the chassis structure



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## 5.6.1 SHAFT MOUNTED UNITS USING A SHRINK DISC DEVICE

The gear unit is fitted with a 'shrink disc' device located on the hollow output shaft to provide a positive outer locking connection between gear unit and driven shaft. The 'shrink disc' is a friction device, without keys, which exerts an external clamping force on the hollow output shaft, thus establishing a mechanical shrink fit between the gear unit hollow shaft and driven shaft. 'Shrink disc' capacities have ample margins in dealing with transmitted torques and external loading imposed on gear units.

### WORKING PRINCIPLE

The 'shrink disc' consists of a locking collar, a tapered inner ring and locking screws. By tightening the locking screws, the locking collar and tapered inner ring are pulled together, exerting radial forces on the inner ring, thus creating a positive friction connection between hollow shaft and driven shaft (See Figure 2).

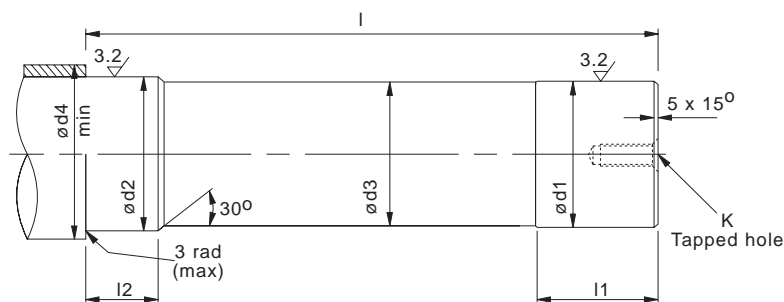
As the tapered surfaces of locking collar and inner ring are lubricated with Molykote 321R or similar and the taper angle is not self locking, locking collar will not seize on the inner ring and can be released easily when removal is necessary.

When the shrink disc is clamped in position the high contact pressures between tapered surfaces and screw heads and their seatings ensure hermetic sealing and eliminate the possibility of fretting corrosion.

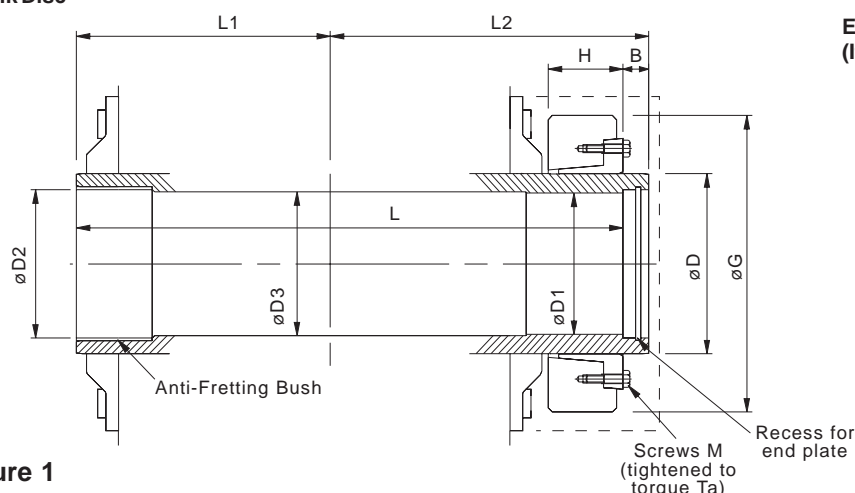
UNIT SIZE	CUSTOMERS SHAFT								SHRINK DISC						
	ød1	ød2	ød3	ød4	I	I1	I2	K	Type	B	øD	øG	H	M	Torque Ta (Nm)
14	95 h6	100 h6	94.5	115	413	55	50	M24 x50	HSD 120-81-95	22	120	197	53	M12	121
15	110 h6	115 h6	109.5	130	418	60	60	M24 x50	HSD 140-81-110	22	140	230	58	M14	193
16	125 h6	130 h6	124.5	147	530	70	70	M24 x50	HSD 160-81-125	28	160	290	68	M16	295
17	145 h6	150 h6	144.5	167	545	90	90	M30 x60	HSD 180-81-145	28	180	320	85	M16	295
18	160 h6	170 g6	159.5	185	685	90	90	M30 x60	HSD 200-81-160	30	200	340	85	M16	295
19	170 g6	180 g6	169.5	195	705	105	105	M30 x60	HSD 220-81-170	30	220	370	103	M20	570

UNIT SIZE	HOLLOW SHAFT							END PLATE						
	øD1	øD2	øD3	L	L1	L2	C	C1	ød5	ød6	øK1	M crs	P	Circlip
14	95	100	96	415	180	255	20	10.0	99.75 99.50	78	26	55	M12	D1300-1000
15	110	115	111	420	180	260	20	10.0 9.8	114.75 114.50	90	26	65	M12	D1300-1150
16	125	130	126	533	230	325	25	12.0 11.8	129.75 129.50	103	26	70	M16	D1300-1300
17	145	150	147	548	230	340	25	12.0 11.8	149.75 149.50	120	33	85	M16	D1300-1500
18	160	170	162	688	300	410	25	12.0 11.8	169.75 169.50	135	33	100	M16	D1300-1700
19	170	180	172	708	300	430	25	12.0 11.8	184.75 184.50	150	33	110	M16	D1300-1850

Customers Shaft



Hollow Shaft and Shrink Disc



End Plate (if required)

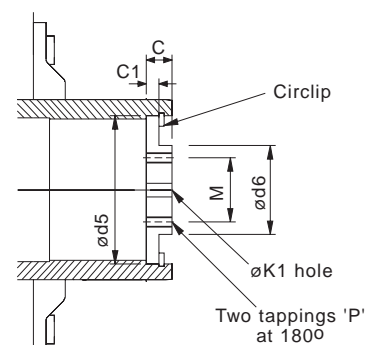


Figure 1

## 5.6.1 SHAFT MOUNTED UNITS USING A SHRINK DISC DEVICE

### INSTALLATION

'Shrink discs' are supplied with shaft mounted units. The following procedures should be followed when fitting or removing units from the driven shaft.

- 1 Release locking screws gradually and in succession. Initially a quarter of a turn on each screw will avoid tilting and jamming - do not remove locking bolts completely.
- 2 Remove 'shrink disc' - from gear unit hollow shaft.
- 3 Clean and degrease locating diameters of gear unit hollow shaft, driven shaft and 'shrink disc' locating diameter on hollow shaft extension.
- 4 Draw the gear unit onto the driven shaft (See Figure 3).
- 5 Grease tapered surfaces of outer ring and inner ring with Molykote 321R or similar.
- 6 Fit 'shrink disc' on gear unit hollow shaft to position shown in Figure 1.
- 7 Tighten all locking screws gradually and in succession. Do not tighten in a diametrically opposite sequence. Several passes are required until all screws are tightened until the inner and outer ring faces are in-line and the torque figures  $T_a$  shown in the table opposite are achieved.
- 8 Fit protective cover.

Note: When the hollow output shaft is to operate in a vertical position it is essential that the shaft of the driven machine is provided with a shoulder. When the thrust load is not taken by the shoulder on the driven shaft, a thrust plate, as shown in Figure 1, must be fitted.

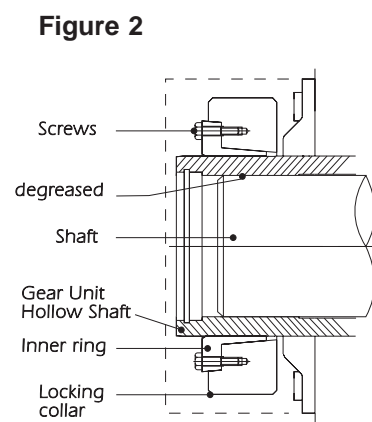
It is recommended that customers' shafts at the non-clamped end of the sleeve should be coated with Molykote 321R or equivalent.

### REMOVAL

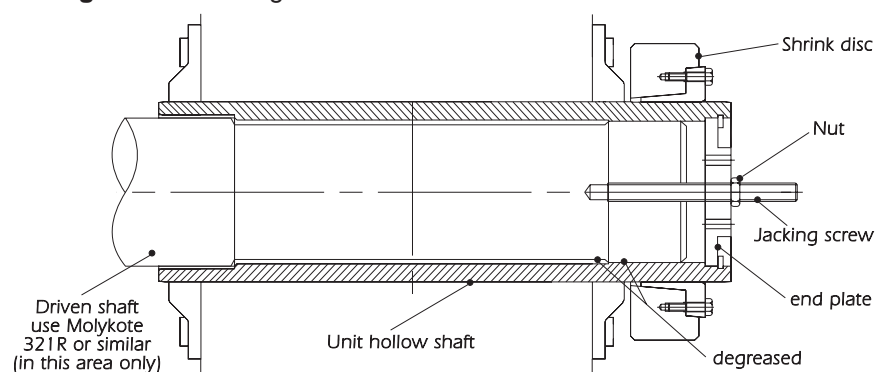
- 1 Removal procedure is similar to the reverse of installation.  
Note: Do not remove 'shrink disc' locking screws completely.
- 2 Remove any rust and dirt from gear unit hollow shaft.
- 3 Withdraw gear unit from driven shaft (See Figure 4).

Note: 'Shrink disc' should be removed and cleaned thoroughly, and Molykote 321R or similar applied to the tapered surfaces of inner ring and locking collar before re-use.

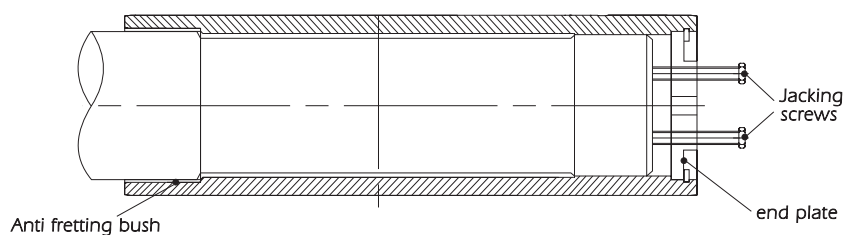
Note: Protective covers are supplied with all 'shrink discs'. Assembly or removal kits and thrust plates are not provided by David Brown.



**Figure 3** Mounting Gear Unit



**Figure 4** Removing Gear Unit



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## **6 LUBRICATION AND MAINTENANCE**

### **6.1 LUBRICATION**

All Series G units are despatched without oil (a warning label is attached), and therefore filled by the client. The David Brown Radicon grade and type of oil will be stamped on the nameplate in accordance with either of the types of oil from Tables 2 or 3 in Appendix 2.

The approximate quantity of oil required is given in Table 1, Appendix 2 and the unit should be filled to the level marked on the dipstick.

**Warning** Do not overfill the unit as this can cause leakage and overheating.

Where possible run the unit without load for a short time to circulate the lubricant thoroughly, then stop the unit and recheck the oil level after allowing the unit to stand for 10 minutes and if necessary top up to the correct mark on the dipstick.

### **6.2 PERIODIC INSPECTION**

Check oil level weekly and if necessary top up with the recommended grade of lubricant.

### **6.3 OIL / GREASE CHANGES**

On all sizes regular oil changes are essential and the following factors should be used to determine the frequency at which these are carried out.

- |   |  |
|---|--|
| a. Oil temperature - unit operating under load. | c. Environment - humidity, dust, etc.          |
| b. Type of oil.                                 | d. Operating conditions - shock, loading, etc. |

At elevated temperatures the effective life of the oil is very much reduced. This is most pronounced with oils containing fatty and E.P. additives. To prevent damage to the unit through lubricant breakdown the oil should be renewed as detailed in the following table:

UNIT OPERATING TEMPERATURE°C	RENEWAL PERIOD	
	MINERAL OIL	SYNTHETIC OIL
75 OR LESS	17000 HOURS or 3 YEARS	26000 HOURS or 3 YEARS
80	12000 HOURS or 3 YEARS	26000 HOURS or 3 YEARS
85	8500 HOURS or 3 YEARS	21000 HOURS or 3 YEARS
90	6000 HOURS or 2 YEARS	15000 HOURS or 3 YEARS
95	4200 HOURS or 17 MONTHS	10500 HOURS or 3 YEARS
100	3000 HOURS or 12 MONTHS	7500 HOURS or 2.5 YEARS
105	2100 HOURS or 8 MONTHS	6200 HOURS or 2 YEARS
110	1500 HOURS or 6 MONTHS	5200 HOURS or 18 MONTHS
<b>NB: INITIAL FILL OF OIL SHOULD BE CHANGED IN A NEW GEAR UNIT AFTER 1000 HOURS OPERATION OR ONE YEAR OR HALF THE ABOVE LIFE WHICHEVER IS THE SOONEST</b>		

**Note:**

Figures quoted are for oil temperatures when the unit has attained normal running temperature when operating under load. These figures are based on normal running but where conditions are particularly severe it may be necessary to change the oil more frequently. When changing lubricant, if same lubricant is not used then unit must be flushed out and filled only with one type of lubricant.

The procedure for changing an oil should be to drain the oil preferably when hot and after circulation. If the gear unit is to be flushed, the unit should be filled to the appropriate level with an oil of the same viscosity grade and type as the lubricating oil and run before the flushing oil is drained. This procedure should be followed especially if the type of oil is being changed. The unit should be filled with the approved oil to the level marked on the dipstick. Re-check the oil level after a short period of running and top up as necessary. On certain units the outputshaft bearings are grease lubricated, these should be regreased at 2000 to 3000 hour intervals unless otherwise instructed.

#### 6.4 LUBRICANT QUANTITY

The quantity of lubricant required by size and type is given in Table 1, Appendix 2.

#### 6.5 APPROVED LUBRICANTS

Tables 2 and 3 Appendix 2 give the lubricants approved for use in the gear unit.

#### 6.6 APPROVED GREASES

Appendix 3 gives the greases approved for use in the unit.

#### 6.7 CLEANING

With the drive stationary periodically clean any dirt or dust from the gear unit and the electric motor cooling fins and fan guard to aid cooling.

## **7 OPERATION**

#### 7.1 NOISE

The range of Series G products satisfies a noise (sound pressure level) of 85 dB(A) or less when measured at 1 metre from the unit surface.

Measurements taken in accordance with B.S.7676 Pt1 : 1993 (ISO 8579-1 : 1993).

#### 7.2 GENERAL SAFETY

Potential hazards which can be encountered during installation, maintenance and operation of drives is covered in greater detail in the product safety page at the front of this booklet.

Advice is also given on sensible precautions which need to be taken to avoid injury or damage.

**PLEASE READ !**

Any further information or clarification required may be obtained by contacting:-

David Brown Radicon  
Park Gear Works  
Huddersfield  
England HD4 5DD

Telephone: 01484 465610

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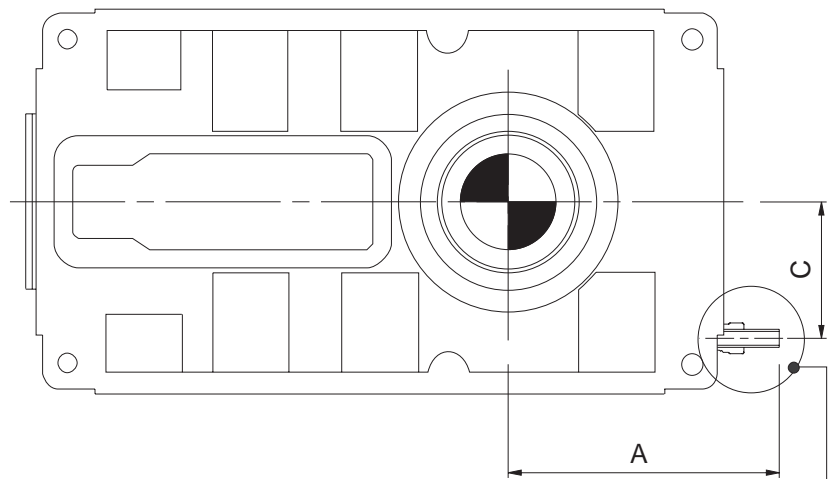
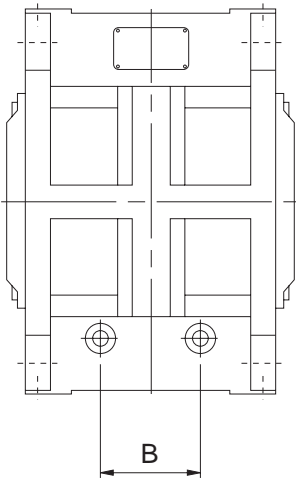
Cooling coils can be fitted to all unit types and handings.

Cooling coil connections for water inlet and outlet pipes are  $\varnothing 12\text{mm}$  on all sizes.

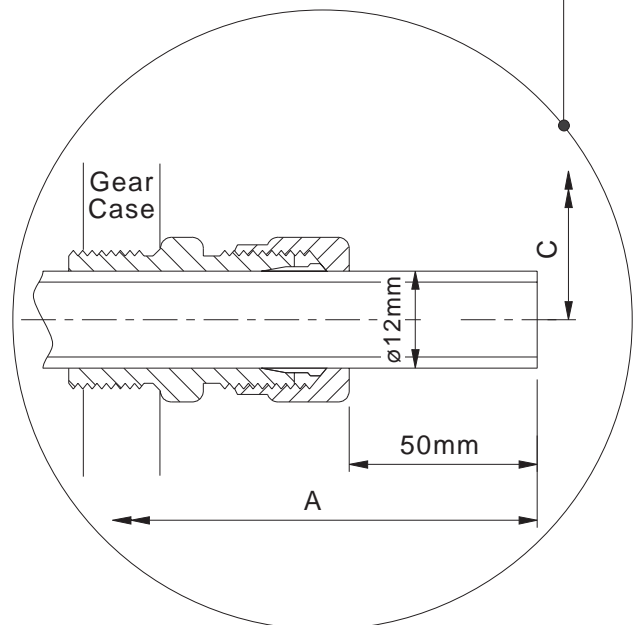
The protruding cooling coil pipe can be connected to customers pipe work via a suitable straight coupling.

**Water supply:** Cooling coils are suitable for fresh, brackish or sea water with flow in either direction. Connections are therefore interchangeable.

For best performance, the water supply should be at  $10^{\circ}\text{C}$  /  $12^{\circ}\text{C}$  temperature and at a flow rate of 5 litres / minute.



SIZE OF UNIT	A	B	C
14	310	120	163
15	270	120	163
16	370	150	220
17	315	150	220
18	315	200	285
19	385	200	285



All Series G units are despatched without oil (a warning label is attached), and therefore filled by the client. The David Brown Radicon grade and type of oil will be stamped on the nameplate in accordance with either of the types of oil from tables 2 or 3. The oil change period will be as stated in section 6 on page 7.

The approximate quantity of oil required is given in Table 1, but the unit should always be filled to the level marked on the dipstick.

Warning    Do not overfill the unit as this can cause leakage and overheating.

Where possible run the unit without load for a short time to circulate the lubricant thoroughly, then stop the unit and re-check the oil level after allowing the unit to stand for 10 minutes and if necessary top up to the correct mark on the dipstick.

In addition where bearings are grease packed, the greases approved are given in Appendix 3.

**TABLE 1 LUBRICANT QUANTITY (Litres)**

Oil quantities are approximate, fill unit to level marked on the dipstick.  
Do not overfill as this can cause leakage and overheating.

Unit Type		UNIT SIZE					
		14	15	16	17	18	19
Parallel Shaft 2 Stage	Horizontal	22	20	47	42	92	95
	Vertical	18	18	40	37	80	85
Parallel Shaft 3 Stage	Horizontal	21	19	46	41	91	94
	Vertical	18	18	40	37	80	85
Parallel Shaft 4 Stage	Horizontal	21	19	46	41	91	94
	Vertical	18	18	40	37	80	85
Right Angle 3 Stage	Horizontal	21	19	47	42	92	95
	Vertical	18	18	40	37	80	85
Right Angle 4 Stage	Horizontal	-	-	48	43	94	96
	Vertical	-	-	43	37	85	85

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**TABLE 2 APPROVED LUBRICANTS**
**Type E** Mineral oil containing industrial EP additives. These have a high load carrying capacity

SUPPLIER	LUBRICANT RANGE	See notes page 12	DAVID BROWN GRADE NUMBERS		
			5E	6E	7E
			AMBIENT TEMPERATURE RANGE °C		
			-5 to 25	0 to 40	10 to 50
Ampol Limited	Gearlube SP		SP220 (-1)	SP320 (-1)	SP460 (-1)
Batoyle Freedom Group	Remus		220 (-2)	320 (-2)	460 (-2)
Boxer Services Limited	Indus	e	220 (-10)	320 (-10)	460 (-10)
BP Oil International Limited	Energol GR-XF	c,e	220 (-16)	320 (-13)	460 (-1)
	Energol GR-XP	e	220 (-15)	320 (-10)	460 (-7)
Caltex	Meropa		220 (-4)	320 (-4)	460 (-4)
	RPM Borate EP Lubricant		220 (-7)	320 (-4)	460 (-7)
Carl Bechem GmbH	Berugear GS BM		220 (-20)	320 (-13)	460 (-10)
	Staroil G		220 (-13)	320 (-13)	460 (-10)
Castrol International	Alpha Max	c,e	220 (-19)	320 (-13)	460 (-10)
	Alpha SP	e	220 (-16)	320 (-16)	460 (-1)
Chevron International Oil Company Limited	Gear Comp EP (USA ver)		220 (-16)	320 (-13)	460 (-10)
	Gear CompEP (Eastern ver)		220 (-13)	320 (-13)	460 (-13)
	Ultra Gear		220 (-10)	320 (-7)	460 (-7)
Eko-Elda (Greece)	Gearlub		220 (-13)	320 (-10)	460 (-1)
Engen Petroleum Limited	Gengear		220 (-13)	320 (-10)	460 (-1)
Esso	Spartan EP	c	220 (-16)	320 (-13)	460 (-7)
Esso/Exxon	Spartan EP	h	220 (-12)	320 (-12)	460 (-4)
Fina	Giran		220 (-13)	320 (-10)	460 (-10)
Fuchs Lubricants (UK) Plc	Powergear			P/Gear (-16)	M460 (-4)
	Renogear V		220EP (-13)	320EP (-4)	460EP (-4)
	Renogear WE		220 (-7)	320 (-4)	400 (-4)
Fuchs Mineraloelwerke GmbH	Renolin CLPF Super	e	6 (-13)	8 (-10)	10 (-10)
Klüber Lubrication	Klüberoil GEM1		220 (-5)	320 (-5)	460 (-5)
Kuwait Petroleum International	Q8 Goya		220 (-16)	320 (-13)	460 (-10)
Lubrication Engineers Inc	Almasol Vari-Purpose Gear		607 (-18)	605 (-13)	608 (-10)
Mobil Oil Company Limited	Mobil gear 600 Series		630 (-13)	632 (-13)	634 (-1)
	Mobil gear XMP	c	220 (-19)	320 (-13)	460 (-7)
Omega Manufacturing Division	Omega 690	e		85w/140 (-15)	
Optimol Ölwerke GmbH	Optigear BM		220 (-11)	320 (-10)	460 (-7)
	Optigear		220 (-18)	320 (-9)	460 (-7)
Pertamina (Indonesia)	Masri	e	220 (-4)	320 (-4)	460 (-4)
Petro-Canada	Ultima EP	e	220 (-22)	320 (-16)	460 (-10)
Petromin Lubricating Oil Co.	Gear Lube EP	e	EP220 (-1)	EP320 (0)	EP460 (0)
Rocol	Sapphire Hi-Torque	e	220 (-13)	320 (-13)	460 (-13)
Sasol Oil (Pty) Limited	Cobalt	e	220 (-4)	320 (-1)	460 (-4)
	Hemat	e	220 (-10)	320 (-7)	460 (-4)
Shell Oils	Omala		220 (-4)	320 (-4)	460 (-4)
	Omala F	c	220 (-13)	320 (-10)	460 (-4)
Texaco Limited	Meropa	c	220 (-11)	320 (-11)	460 (-5)
	Meropa WM	c	220 (-19)	320 (-16)	460 (-10)
Total	Carter EP		220 (-7)	320 (-7)	460 (-4)
Tribol GmbH	Molub-Alloy Gear Oil		90 (-18)	690 (-16)	140 (-13)
	Tribol 1100		220 (-20)	320 (-18)	460 (-16)

**DANGER**

Numbers in brackets indicate recommended minimum operating temperature in °C.

**THE UNIT MUST NOT RUN BELOW THIS TEMPERATURE.**

**TABLE 3 APPROVED LUBRICANTS**

**Type H** Polyalphaolefin based synthetic lubricants with Anti-Wear or EP additives.  
These have a medium to high load carrying capacity.

SUPPLIER	LUBRICANT RANGE	See notes page 12	DAVID BROWN GRADE NUMBERS		
			5H	6H	7H
			AMBIENT TEMPERATURE RANGE °C		
			-10 to 30	0 to 45	10 to 50
Batoyle Freedom Group	Titan		220 (-31)	320 (-28)	
Boxer Services Limited	Silkgear		220 (-35)	320 (-35)	460 (-35)
BP Oil International Limited	Enersyn EPX	e		320 (-28)	
Caltex	Pinnacle EP		220 (-43)	320 (-43)	460 (-37)
Carl Bechem GmbH	Berusynth GP		220 (-38)	320 (-35)	460 (-32)
Castrol International	Alphasyn EP	c	220 (-37)	320 (-31)	460 (-31)
	Alphasyn T		220 (-31)	320 (-28)	460 (-28)
Chevron International Oil Co	Tegra		220 (-46)	320 (-33)	460 (-31)
Esso/Exxon	Spartan Synthetic EP	e	220 (-46)	320 (-43)	460 (-40)
Fina	Giran P		220 (-30)	320 (-25)	460 (-19)
Fuchs Lubricants (UK) Plc	Renogear SG		220 (-32)	320 (-30)	
Fuchs Mineraloelwerke GmbH	Renolin Unisyn CLP		220 (-37)	320 (-34)	460 (-28)
Klüber Lubrication	Klübersynth GEM 4		220 (-35)	320 (-35)	460 (-30)
Kuwait Petroleum International	Q8 EL Greco		220 (-22)	320 (-19)	460 (-16)
Lubrication Engineers Inc	Synolec Gear Lubricant		9920 (-40)		
Mobil Oil Company Limited	Mobilgear SHC		220 (-40)	320 (-37)	460 (-32)
	Mobilgear SHC XMP	c	220 (-40)	320 (-33)	460 (-31)
Optimol Ölwerke GmbH	Optigear Synthetic A		220 (-31)	320 (-31)	
Petro-Canada	Super Gear Fluid	e	220 (-43)	320 (-37)	460 (-37)
Shell Oils	Omala HD	c	220 (-43)	320 (-40)	460 (-37)
Texaco Limited	Pinnacle EP		220 (-43)	320 (-33)	460 (-33)
	Pinnacle WM	c	220 (-43)	320 (-43)	460 (-40)
Total	Carter EP/HT		220 (-34)	320 (-31)	460 (-28)
Tribol GmbH	Tribol 1510		220 (-36)	320 (-33)	460 (-28)

- NOTES:** c) These lubricants have been tested for micro-pitting (FZG Type C), test results are available.  
e) These lubricants contain additives which may adversely affect silvered or white metal components; consult oil supplier.  
h) Minimum operating temperatures of these lubricants are based on worst case values, lower operating temperatures may be available, please check with local stockist.

**DANGER**

Numbers in brackets indicate recommended minimum operating temperature in °C.  
**THE UNIT MUST NOT RUN BELOW THIS TEMPERATURE.**

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SUPPLIER	LUBRICANT RANGE	ALLOWABLE OPERATING TEMPERATURE RANGE °C	
		ABOVE	TO
BP Oil International Limited	Energrease LS-EP	-30	130
Caltex	Multifak EP	0	120
Castrol International	LMX Grease	-40	150
	Spheerol AP	-30	110
	Spheerol EPL	-10	120
Klüber Lubrication	Klüberlub BE 41-542	-20	140
Mobil Oil Company Limited	Mobilgrease XHP	-15	150
	Mobilith SHC	-20	180
Omega Manufacturing Division	Omega 85	-40	230
Optimol Ölwerke GmbH	Longtime PD	-45	140
Shell Oils	Albida RL	-20	150
	Alvania EP B	-20	120
	Nerita HV	-30	130
Texaco Limited	Multifak All Purpose EP	-30	140

**Notes:**

- 1) All the above greases are NLGI grade 2.
- 2) Refer to David Brown Radicon Application Engineers if the unit is operating in an ambient temperature outside the range of -30°C to 50°C.

### SHAFT ALIGNMENT

Errors of alignment fall into categories of angularity (see figure 1) and eccentricity (see figure 2), or a combination of both.

Errors of angularity should be checked for, and corrected, before errors of eccentricity.

Alignment in accordance with the following procedure will ensure vibration levels meeting those set out in ISO 10816 Part 1.

#### Errors of Angularity

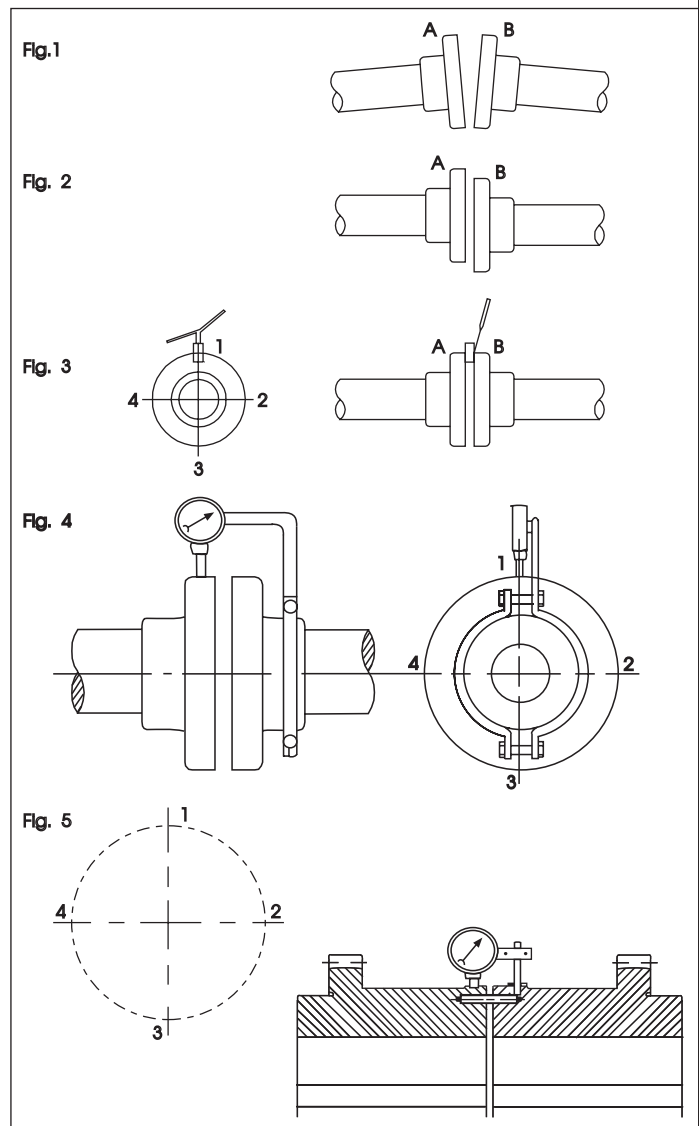
If the faces are perfectly true, the angularity can be checked by keeping both shafts stationary and taking measurements with a block gauge and feelers at the four points 1, 2, 3 and 4 as shown in figure 3. The difference between the readings 1 and 3 will give the error of alignment in the vertical plane, over the length of the shaft equal to the diameter of the coupling flanges, and from this the difference in the relative heights of the feet of the motor or other connected machine can be found by proportion. Similarly, the difference between the readings 2 and 4 gives the amount of sideways adjustment necessary to correct any errors of alignment in the horizontal plane.

Generally, however, the coupling faces will not be absolutely true and whilst any errors so found could be allowed for in checking angularity by the stationary method an easier method presents itself. This consists in marking the points 1 on both "A" and "B" and rotating both half couplings, keeping the marked points together. By taking measurements each quarter-revolution the errors in the vertical and horizontal planes are again found.

The permitted angularity error is as follows

TYPE OF COUPLING	ALLOWABLE GAP (G) (mm)
Flexible coupling with rubber elements or Double engagement gear type couplings	$G = 0.002 D$
Single engagement gear type coupling	$G = 0.001 D$
Rigid coupling	$G = 0.0005 D$

NOTE: D is the diameter (mm) at which the gap is measured.



NOTE: Check the alignment after running the unit until it has attained its normal working temperature. Any discrepancies can then be rectified.

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**Errors of Eccentricity**

The procedure for measuring eccentricity is precisely analogous to that used for angularity. In this case, however, the measurements are taken in a radial direction and the most convenient and accurate means of doing this utilises a dial indicator suitably clamped to one half coupling, and bearing on the hub or flange of the other, as shown in figures 4 and 5 on page 14.

Care however must be taken to ensure the support for the dial indicator is sufficiently rigid to prevent the weight of the indicator from causing deflection and, in consequence, inaccurate readings. Extra care should be taken where taper roller bearings are fitted to ensure that alignment is checked with shafts in mid-point position and a final check made with the unit at operating temperature.

The permitted eccentricity error which can be accommodated in addition to that of the angularity error is as follows :-

**i) Input Shaft**

As the input power to the unit varies with its overall ratio couplings of various sizes may be fitted to a particular unit.

The figures given below refer to shafts connected using a David Brown Radicon coupling and in addition to the errors of angularity, account for some 20% of the coupling mis-alignment capacity.

TYPE OF COUPLING	COUPLING SIZE	ALLOWABLE ECCENTRICITY (mm)	
Cone ring rubber element (X610)	01 to 02	0.025	
	03 to 05	0.035	
	06 to 08	0.065	
	09 to 12	0.095	
Gear type (X620)	X621	02	0.11
		03	0.145
	X622	02	0.070
		03	0.082
	X623	02	ZERO
		03	ZERO

**ii) Output Shaft**

TYPE OF COUPLING	UNIT SIZE	ALLOWABLE ECCENTRICITY (mm)
Flexible or rubber element	G14, G15, G16	0.100
	G17, G18, G19	0.120
Gear type	G14, G15, G16	0.150
	G17, G18, G19	0.175
Rigid	G14, G15, G16	0.075
	G17, G18, G19	0.085

**SPECIAL NOTE CONCERNING RIGID COUPLINGS**

In lining up elements involving rigid couplings it is important that no attempt is made to correct errors of alignment or eccentricity greater than those above by tightening of the coupling bolts (This applies when the system is cold or at operating temperature). The result is mis-alignment and the setting up of undue stresses in the shaft, coupling and bearings. This will be revealed by the springing apart of the coupling faces if the bolts are slackened off. A check on the angularity of a pre-assembled job, after bolting down, can be obtained in the case of rigid couplings by slackening off the coupling bolts, when any mis-alignment will cause the coupling faces to spring apart. This check may not, however, reveal any strains due to eccentricity owing to the constant restraint imposed by the spigot.

**SERIES X COUPLINGS**

David Brown Radicon Limited, produce standard flexible couplings to cover the complete range of Radicon units as follows:

- NYLICON** couplings, type 600 designed for fractional and small power drives up to a maximum torque of 465 Nm.
- CONE RING** couplings, type 611, 612, 613 and 614 designed for medium or heavy duty use. They are of the pin and bush type with bore sizes from 19 to 170 mm diameter.
- GEAR TYPE** couplings, types 621, 622 and 623 of single and double engagement types covering flange and sleeve designs. Hardened hubs are profile ground, fully crowned and chamfered. External dimensions are metric.
- RIGID TYPE** couplings, type 629 with bore sizes up to 280 mm diameter.