

**INSTALLATION & MAINTENANCE**

**SERIES A**

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

**SERIES A HEAVY DUTY**

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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:-

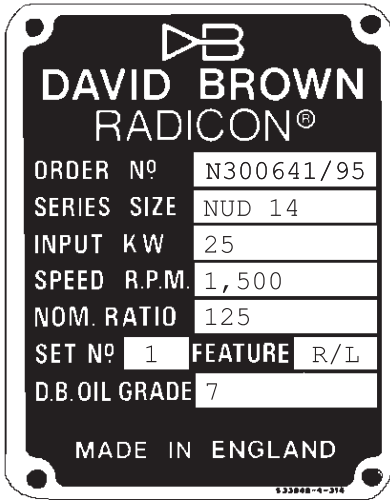
- 1) Fire/Explosion
  - (a) Oil mists and vapour are generated within gear units. It is therefore dangerous to use naked lights in the proximity of gearbox openings, due to the risk of fire or explosion.
  - (b) In the event of fire or serious overheating (over 300°C), certain materials (rubber, plastics, 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

Examples

10"	N	U		10	-	L
355.8 mm	CN	O		20	-	R
254 mm	CN	V	S	30	-	
508 mm	CN	U	DM	150	-	LR

UNIT SIZE (centres) \_\_\_\_\_

TYPE \_\_\_\_\_

- CN - METRIC SHAFT EXTENSIONS AND KEYWAYS
- N - IMPERIAL SHAFT EXTENSIONS AND KEYWAYS
- A - AMERICAN INCH SHAFT EXTENSIONS AND KEYWAYS

MOUNTING POSITION \_\_\_\_\_

- U - UNDERDRIVEN
- O - OVERDRIVEN
- V - VERTICAL OUTPUT SHAFT

VERSION \_\_\_\_\_

- S - SHAFT MOUNT ( STATE IF TORQUE ARM IS REQUIRED )
- D - DOUBLE REDUCTION ( WORM/WORM )
- M - MOTORISED FITTED WITH FLANGE ADAPTER FOR UNITS MOUNTING POSITION V
- HDST - HEAVY DUTY STIRRER UNIT
- CT - COOLING TOWER UNIT

RATIO \_\_\_\_\_

SINGLE REDUCTION UNITS 5/1 THROUGH 70/1  
DOUBLE REDUCTION WORM /WORM 75/1 THROUGH 4200/1

SHAFT HANDING \_\_\_\_\_

- R - RIGHT HAND
- L - LEFT HAND
- D - DOUBLE EXTENSION
- X - VERTICALLY UP
- Y - VERTICALLY DOWN

## **2 GENERAL INFORMATION**

The following instructions will help you achieve a satisfactory installation of your David Brown Radicon Series A 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.

Series A gear units will perform satisfactorily if subjected to full load immediately after installation. However, optimum performance is best achieved by a process of gradual load increments, up to the full value, over the first 50 hours or so of their working life. During these early stages of running, sensible precautions should be taken to avoid overloads.

The gear unit operating temperature may be higher during this period of run-in. A progressive reduction in temperature may occur over many hours until the unit has reached its highest efficiency.

## **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	INPUT SHAFT (SINGLE REDUCTION)	INPUT SHAFT (DOUBLE REDUCTION)	OUTPUT SHAFT
10	M20 x 43 mm deep	M12 x 25 mm deep	M24 x 50 mm deep
12	M20 x 43 mm deep	M12 x 25 mm deep	M24 x 50 mm deep
14	M20 x 43 mm deep	M12 x 25 mm deep	M30 x 63 mm deep
17	M24 x 52 mm deep	M12 x 25 mm deep	M30 x 63 mm deep
20	M24 x 52 mm deep	M12 x 25 mm deep	M36 x 74 mm deep
24	M30 x 63 mm deep	M20 x 43 mm deep	M36 x 74 mm deep

## **4 WEATHER PROTECTION OF UNIT**

All Series A units are provided with protection against normal weather conditions. Where units are to operate in extreme conditions, or where they are to stand for long periods without running, eg during plant construction, we should be notified when ordering so that arrangements for adequate protection can be made.

## **5 INSTALLATION**

### **5.1 MOTORISED AND REDUCERS**

All sizes will be oil filled by client.

If the unit is to be mounted in a different position to that originally intended then the amount of lubricant in the unit will require amending

- See Appendix 1 of this document for the revised quantities

NOTE: 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 FIXING TO CUSTOMER EQUIPMENT**

Fixing the Gear Head flange facing or feet to the customer equipment use set screws to ISO grade 8.8 minimum.

Torque tighten to:-

Set Screw Size	Tightening Torque
M24	610 Nm
M30	1220 Nm
M36	2150 Nm
M42	3460 Nm

### **5.3 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.

#### **MOTOR TERMINAL CONNECTION**

Circuit diagrams for the correct wiring of the motor terminal box are included as Appendix 2 of this document if the motor is of David Brown Radicon plating. Alternatively if the motor is supplied separately or if fitted with a motor from a different manufacturer, then this should have appropriate documentation provided with it.

#### **BRAKE MOTOR CONNECTION**

Installation of the David Brown Radicon Brake Motor is covered in Appendix 3.

## 5.4 FOOT-MOUNTED UNITS

The following procedure is recommended for all foot mounted units.

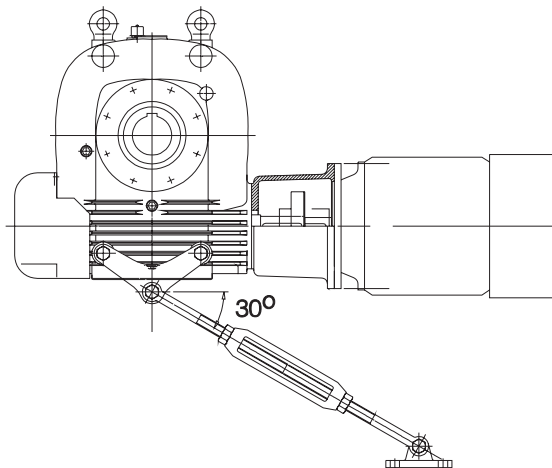
Foot mounted units are supplied either as free standing units, or if required, mounted on a standard baseplate with a foot mounted motor correctly aligned and connected by a David Brown Radicon flexible coupling.

- 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 5)  
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 finale 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 holdback device is fitted.
- h) Fill gear unit with oil (if not factory filled) as detailed in Section 6.

## 5.5 SHAFT MOUNTED UNITS

The following procedure is recommended for all shaft mounted units.

- a) Clean shaft extensions, bore and ventilator when fitted.
- b) Locate in position, using the most convenient method available see Appendix 6, ensuring it is as close as possible to the bearing on the driven machine.
- c) Secure unit onto the shaft using chosen method from Appendix 6.
- d) Fit torque arm to the side of the unit adjacent to the driven machine and lock in position axially, as detailed below.  
Note: Unless specified otherwise, the torque arm will be supplied loose.
- e) The torque arm should be loaded in tension and the angle between the input shaft centre line and the torque arm **MUST NOT EXCEED 30°** (See drawing).  
Note: There must be two torque arms fitted if a reversing drive is required.



Torque to:

Unit Size	Bolt Size	Torque
10, 12	M24	610 Nm
14	M30	1220 Nm

- f) Anchor case to a secure point by means of the torque arm.
- g) Fit guards in accordance with the factory acts.
- h) Check motor wiring for correct direction of rotation, this is important when a holdback device is fitted.
- i) Fill gear unit with oil (if not factory filled) as detailed in Section 6.

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### 5.6 REPLACEMENT OF OIL SEALS

1. Clean and drain the unit.
2. Remove the holding screws and withdraw oil catcher.  
NOTE: Take care not to damage the shims and do not alter the shaft position. Check for burrs or scratches on the shaft which could damage the new seal.
3. Tap the old seal out of the housing or cover using an appropriate sized drift.
4. Ensure that joint faces and shims are clean and position the shims in the oil catcher.
5. Coat joint faces of cover and case with a good jointing compound, replace oil catcher and tighten screws.
6. Smear oil seals with grease (See Appendix 4).
7. Fit replacement seal on a seal guide, slide it along the shaft and press the seal into the housing.
8. Fill with the correct amount of an approved lubricant, see Appendix 1.

### 5.7 HOLDBACKS

NOTE: Oils containing E.P. additives must not be used on Radicon units fitted with holdback devices without prior agreement with the oil manufacturer. These oils may severely affect the antifriction properties of the device and therefore reduce its efficiency.

When it becomes necessary to replace the Sprag Holdback where fitted, it is essential to check that the shaft meets with the following requirements.

1. The shaft diameter must be within the tolerances shown below.

UNIT SIZE	10	12	14	17	20	24
Shaft Diameter. mm (in.)	63.50 (2.500)	63.50 (2.500)	82.55 (3.250)	82.55 (3.250)	101.60 (4.000)	Details on application
	63.47 (2.499)	63.47 (2.499)	82.52 (3.249)	82.52 (3.249)	101.57 (3.999)	

2. Surface hardness must be HV30 650 - 750 (58 RC - 62 RC).
3. Surface finish must be .3 - .5  $\mu\text{m}$  CLA (13 - 20 micro inches CLA).
4. Taper must not exceed .003 mm. per cm. (0.0003 in. per inch)
5. If there is any doubt as to whether the shaft complies with these requirements it should be replaced or returned to David Brown Radicon for examination and/or reconditioning.

NOTE: Excessively worn shaft bearings can also have an adverse effect on the operation of direct mounted clutches and such bearings should be replaced.

Oil filled Radicon units have a lubrication system which is self-contained, positive and automatic at all normal speeds of operation and in either direction of rotation. For 'V' type units grease lubrication of wheel bearings is required, see Appendix 4.

## 6 LUBRICATION AND MAINTENANCE

### 6.1 LUBRICATION

All sizes will be oil filled by client. (See Appendix 1)

### 6.2 PERIODIC INSPECTION

- Check oil level every 1000 hours or 2 months whichever is sooner and if necessary top up with the recommended grade of lubricant.
- Add two shots of grease monthly to units having grease lubricated bearings.
- Refill lubricators when necessary with the recommended grease given in Appendix 4.

### 6.3 OIL CHANGES

Regular oil changes are essential except for those filled with synthetic long life lubricant. The following factors should be used to determine the frequency at which these are carried out.

- Oil temperature - unit operating under load.
- Type of oil.
- Environment - humidity, dust, etc.
- 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	
65 OR LESS	17000 HOURS	OR	3 YEARS	26000 HOURS OR 3 YEARS
70	12000 HOURS	OR	3 YEARS	26000 HOURS OR 3 YEARS
75	8500 HOURS	OR	3 YEARS	22000 HOURS OR 3 YEARS
80	6000 HOURS	OR	2 YEARS	15000 HOURS OR 3 YEARS
85	4200 HOURS	OR	17 MONTHS	10500 HOURS OR 3 YEARS
90	3000 HOURS	OR	12 MONTHS	7500 HOURS OR 2 1/2 YEARS
95	2100 HOURS	OR	8 MONTHS	6000 HOURS OR 2 YEARS
100	1500 HOURS	OR	6 MONTHS	4500 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.

### 6.4 LUBRICANT QUANTITY

The quantity of lubricant required by size and mounting position is given in Tables 2, 3 and 4, Appendix 1. A diagram showing unit type designations is also included in Appendix 1.

### 6.5 APPROVED LUBRICANTS

Appendix 1 gives the lubricants approved for use in the gear unit.

### 6.6 APPROVED GREASES

Appendix 4 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 NOISE

The range of Series A product 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).

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

David Brown Radicon Ltd  
Park Gear Works, Huddersfield  
England HD4 5DD Telephone: 01484 422180

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Radicon Heavy Duty Units are despatched without oil and must be filled with the correct grade of lubricant to the correct level before starting. The David Brown oil grade is stamped on the nameplate and the oil level should be taken to the middle of the sight glass. These are determined from the operating speed of the gearbox and the ambient temperature which if not given when ordering will be assumed to be 1450 rev/min input and 0 to 30°C ambient temperature using a polyglycol synthetic oil. Oil grades and oil levels should therefore always be checked before installation.

Details of David Brown approved lubricants, synthetic and mineral, are given in tables 5,6,7 and 8.

To determine the David Brown oil grade refer to Table 1

**TABLE 1 OIL GRADES**

Unit Size	Ambient Temperature °C	Input Speeds (Rev/min)							
		Below 200		201 to 500		501 to 1000		1001 to 1750	
		Ratio Range							
		5/1 to 15/1	20/1 to 70/1	5/1 to 15/1	20/1 to 70/1	5/1 to 15/1	20/1 to 70/1	5/1 to 15/1	20/1 to 70/1
SIZE 10 - 14	-30°C to 10°C	7 (9)	6 (9)	5 (7)	6 (8)	3 (5)	4 (6)	3 (5)	3 (5)
	-10°C to 30°C	8 (9)	8 (9)	6 (8)	7 (8)	5 (6)	5 (7)	4 (6)	4 (6)
	20°C to 50°C	9 (9)	9 (9)	7 (9)	8 (9)	5 (7)	6 (8)	5 (7)	5 (7)
SIZE 17 - 24	-30°C to 10°C	9 (9)	7 (9)	5 (7)	5 (7)	4 (6)	4 (6)	4 (6)	4 (6)
	-10°C to 30°C	8 (9)	8 (9)	5 (7)	6 (7)	4 (6)	4 (6)	4 (6)	4 (6)
	20°C to 50°C	9 (9)	9 (9)	6 (8)	7 (8)	5 (7)	5 (7)	5 (7)	5 (7)

Mineral oil grades are given in brackets.

**OIL CAPACITY (Litres)**

To determine the oil capacity refer to the appropriate table 2, 3 or 4. Oil capacities are only approximate and units should be filled to the middle of the sight glass. Please see dimension pages in the Series A Heavy Duty full technical catalogue for sight glass positions. Do not overfill as excess will cause overheating and leakage.

**TABLE 2 LUBRICANT QUANTITY Litres SINGLE REDUCTION**

Oil capacities given are for units running above 300 rev/min input, figures in brackets are for units running at 300 rev/min and below.

Unit Type	Size of Unit					
	10	12	14	17	20	24
CNU	18 (30)	30 (43)	41 (75)	56.8 (102)	68 (155)	105 (273)
CNO	10 (16)	15 (24)	24 (39)	-	-	-
CNV	18 (24)	30 (39)	50 (61)	109 (127)	146 (160)	-

**TABLE 3 LUBRICANT QUANTITY Litres DOUBLE REDUCTION**

The lubricant grade used in the primary unit should be that selected for the secondary unit. See exact ratios in the Series A Heavy Duty full technical catalogue for primary ratio, to calculate oil grade. Oil capacities are for overdriven primary units running above 100 rev/min, Figures in brackets are for units running at 100 rev/min and below.

Secondary unit oil capacities for CNU, CNO and CNV are for secondary units running at 300 rev/min input and below.

Unit Type	Unit stage	Size of Unit					
		10	12	14	17	20	24
CNUD	Primary	4 (6.6)	7 (13)	7 (13)	11 (22)	11 (22)	15 (24)
	Secondary	30	43	75	102	155	273
CNOD	Primary	4 (6.6)	7 (13)	7 (13)	-	-	-
	Secondary	16	24	39	-	-	-
CNVD	Primary	4 (6.6)	7 (13)	7 (13)	11 (22)	11 (22)	-
	Secondary	24	39	61	127	160	-

**TABLE 4 MOTORISED UNITS LUBRICANT QUANTITY Litres TRIPLE REDUCTION**

Motorised triple reduction worm units use a helical-worm primary unit. Oil capacities are given for underdriven primary units running at all input speeds. Secondary unit oil capacities can be taken from table 3.

Unit Type	Unit stage	Size of Unit					
		10	12	14	17	20	24
CNUD	Primary	4.6	6.0	6.0	12	-	-
CNOD	Primary	4.6	6.0	6.0	-	-	-
CNVD	Primary	4.6	6.0	6.0	12	-	-

**TABLE 5 APPROVED SYNTHETIC LUBRICANTS**
**Type G** Polyglycol based synthetic lubricants with Anti-Wear or EP additives.

SUPPLIER	LUBRICANT RANGE	Refer to notes page 8	DAVID BROWN GRADE NUMBERS						
			3G	4G	5G	6G	7G	8G	9G
			OIL SUPPLIERS' CORRESPONDING DESIGNATIONS						
Batoyle Freedom Group	Helicol W	b		* (-15)					
Boxer Services Limited	Boxergear W	b		150 (-15)	220 (-31)	320 (-31)	460 (-28)		
BP Oil International Limited	Energyn SG-XP	b			220 (-31)		460 (-34)	680 (-28)	
Caltex	Synlube CLP	b		150 (-37)	220 (-34)	320 (-31)	460 (-28)	680 (-31)	
	Synthetic Gear Lubricant	b		* (-25)					
Carl Bechem GmbH	Berusynth EP	b	100 (-31)	150 (-26)	220 (-25)	320 (-25)	460 (-25)	680 (-28)	1000 (-28)
Castrol International	Alphasyn PG	b		150 (-34)	220 (-34)	320 (-31)	460 (-28)		
Esso/Exxon	Glycolube	b		150 (-25)	220 (-25)	320 (-25)	460 (-23)		
Fina	Cirkan S	b		150 (-40)	220 (-43)	320 (-43)	460 (-37)		
	Giran S	b		150 (-49)	220 (-46)	320 (-43)	460 (-40)		
Fuchs Lubricants (UK) Plc	Renogear PGW	b		120 (-23)					
Fuchs Mineraloelwerke GmbH	Renolin PG	b	100 (-31)	150 (-34)	220 (-34)	320 (-34)	460 (-34)	680 (-28)	1000 (-28)
Inspec UK	Breox Ind Lubricant Sw	b		150 (-25)	220 (-25)	320 (-25)	460 (-23)		
	Breox Oil Soluble Ind Lub	b			220 (-23)				
	Breox Worm Gear Lube	b		65 (-25)					
Klüber Lubrication	Klübersynth GH6	b	100 (-30)	150 (-30)	220 (-25)	320 (-25)	460 (-20)	680 (-20)	1000 (-20)
Kuwait Petroleum International	Q8 Gade	b			220 (-22)	320 (-22)	460 (-22)		
Mobil Oil Company Limited	Glygoyle	b		22 (-25)	30 (-22)	HE320 (-37)	HE460 (-35)		
Optimol Ölwerke GmbH	Optiflex A	b		150 (-31)	220 (-28)	320 (-28)	460 (-28)	680 (-28)	1000 (-25)
Shell Oils	Tivela	b		SA (-25)	SB (-25)	SC (-25)	SD (-23)		
Texaco Limited	Synlube CLP	b		150 (-37)	220 (-34)	320 (-31)	460 (-28)	680 (-31)	
Tribol GmbH	Tribol 800	b	100 (-37)	150 (-37)	220 (-27)	320 (-25)	460 (-25)	680 (-25)	1000 (-23)

**TABLE 6 APPROVED SYNTHETIC LUBRICANTS**
**Type H** Polyalphaolefin based Synthetic, suitable for use in worm gear applications, do not contain EP additives.

**When using these lubricants mineral ratings should be used.** If in doubt consult David Brown Radicon Engineers.

SUPPLIER	LUBRICANT RANGE	Refer to notes page 8	DAVID BROWN GRADE NUMBERS						
			3H	4H	5H	6H	7H	8H	9H
			OIL SUPPLIERS' CORRESPONDING DESIGNATIONS						
BP Oil International Limited	Energyn HTX	b			220 (-31)	320 (-31)	460 (-25)		
Esso	Teresso SHP	b		150 (-37)	220 (-37)	320 (-31)	460 (-25)		
Exxon	Teresstic SHP	b	100 (-40)	150 (-34)	220 (-32)	320 (-30)	460 (-22)		
Fina	Cirkan P	b		150 (-49)	220 (-46)	320 (-46)	460 (-40)		
Mobil Oil Company Limited	SHC 600 Series			629 (-37)	630 (-37)	632 (-37)	634 (-34)	636 (-29)	639 (-31)
Shell Oils	Omala RL		100 (-52)	150 (-49)	220 (-43)	320 (-40)	460 (-37)	680 (-34)	1000 (-31)

**Notes:**

- These lubricants may have their working life reduced if used at elevated temperatures. Consult oil supplier when the normal operating temperature exceeds 80°C.
- These lubricants should **not** be used in units fitted with trailing sprag or holdback devices without prior agreement with the manufacturer; the additives, or the base fluids may modify the coefficient of friction which these devices depend on.

**DANGER**

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

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

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**TABLE 7 APPROVED MINERAL LUBRICANTS****Type M** Straight mineral oils (sometimes with mild additive treatments).

SUPPLIER	LUBRICANT RANGE	Refer to notes page 8	DAVID BROWN GRADE NUMBERS				
			5M	6M	7M	8M	9M
OIL SUPPLIERS' CORRESPONDING DESIGNATIONS							
Batoyle Freedom Group	Cronus	a	220 (-4)	320 (-4)			
Boxer Services Limited	Volga	a	220 (-4)	320 (-4)	460 (-4)	680 (-4)	1000 (+2)
BP Oil International Limited	Energol CS & DC	a	CS220 (-4)	CS320 (-4)	CS460 (-4)	CS680 (-4)	DCW1000 (-1)
Caltex	Rando		220 (-10)	320 (-4)			
Carl Bechem GmbH	Staroil CBT		220 (-13)	320 (-16)	460 (-10)	680 (-7)	
Castrol International	Cresta	a			V (-4)		SHS (-4)
	Magna	a	220 (-13)	320 (-4)			
Esso	Canthus TK	a					1000 (+2)
	Teresso		220 (-13)	320 (-7)	460 (-4)		
Exxon	Teresstic		220 (-12)	320 (-5)	460 (-4)		
Fina	Cirkan	a	220 (-9)	320 (-9)	460 (-12)	680 (-9)	
Fuchs Lubricants (UK) Plc	Renolin GP	b	220 (-7)	320 (-3)	460 (-2)		
Fuchs Mineraloelwerke GmbH	Renolin DTA		220 (-13)	320 (-7)			
Klüber Lubrication	Crucolan		220 (-5)	320 (-5)	460 (-5)		
Kuwait Petroleum International	Q8 Verdi		220 (-19)	320 (-7)	460 (-7)		
Lubrication Engineers Inc	Almasol Pure Mineral Oil		401 (-13)				
	Monolec Turbine Oil	b	6406 (-18)	6407 (-13)			
	Multilec Industrial Oil		6806 (-10)	6807 (-10)			
Petromin Lubricating Oil Co.	Turbine Oil		C220 (-1)	C320 (+2)	C460 (+2)		
Shell Oils	Vitrea / Vitrea M	a	220 (-1)	320 (-1)	460 (-1)	680 (-1)	
Texaco Limited	Regal EP		220 (-1)	320 (-1)	460 (-1)		

**TABLE 8 APPROVED MINERAL LUBRICANTS****Type A** Mineral oils containing mild EP or Anti-Wear additives.

SUPPLIER	LUBRICANT RANGE	Refer to notes page 8	DAVID BROWN GRADE NUMBERS				
			5A	6A	7A	8A	9A
OIL SUPPLIERS' CORRESPONDING DESIGNATIONS							
Ampol Limited	Tecoma	b	220 (-4)	320 (-4)			
Batoyle Freedom Group	Apollo	b	220 (-2)	320 (-2)	460 (-2)	680 (-1)	1000 (-1)
Caltex	Rando HD	b	220 (-7)				
Carl Bechem GmbH	Staroil Nr	b	220 (-7)				
Castrol International	Alpha ZN	b	220 (-4)	320 (-4)	460 (-4)		
Engen Petroleum Limited	Gencirc	b	220 (-1)	320 (-1)			
Fuchs Lubricants (UK) Plc	Centigear	b	F (-1)	G (-1)	H (+1)		
Fuchs Mineraloelwerke GmbH	Renolin CLP	b	106 (-16)	108 (-10)	110 (-10)	112 (-10)	
Mobil Oil Company Limited	DTE	b	BB (-7)	AA (+2)	HH (+2)		
Omega Manufacturing Division	Omega 670	b	SAE90 (-4)		SAE140 (-4)		
	Omega 680	b	SAE90 (-17)				
Sasol Oil (Pty) Limited	Rubis	b	220 (-1)				
Shell Oils	Tellus	b	220 (-1)	320 (-1)			
Total	Cortis ZS	b	220 (-4)	320 (-4)			
Tribol GmbH	Tribol 770	b	779 (-2)				

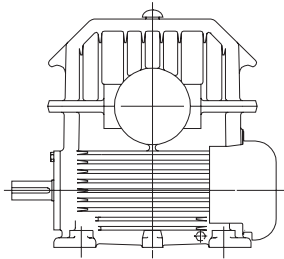
**DANGER**

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

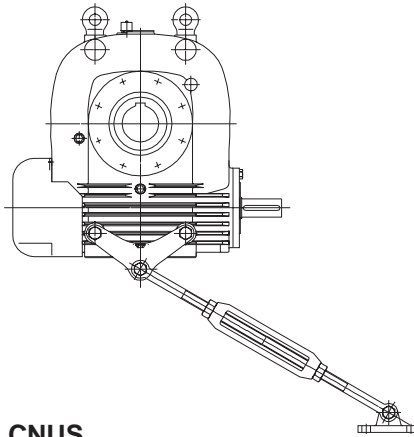
**THE UNIT MUST NOT RUN BELOW THIS TEMPERATURE.**

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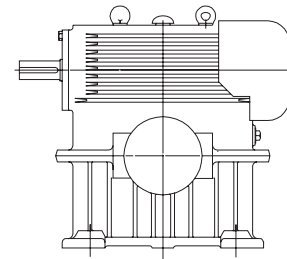
### SINGLE REDUCTION UNITS



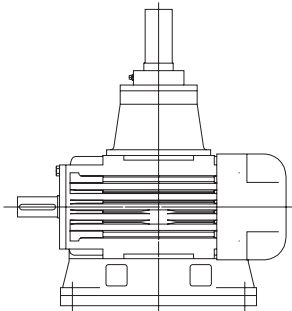
**CNU**  
UNDERDRIVEN



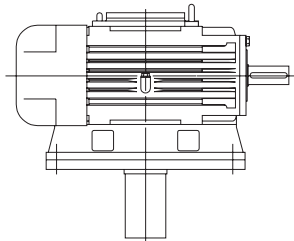
**CNUS**  
UNDERDRIVEN  
SHAFT MOUNT (WITH TORQUE  
ARM)



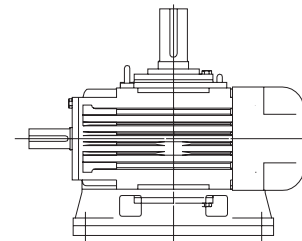
**CNO**  
OVERDRIVEN



**CNV-CT**  
VERTICAL OUTPUT SHAFT  
COOLING TOWER UNIT

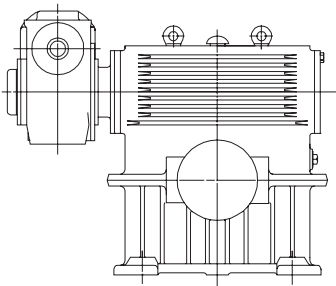


**V-HDST**  
VERTICAL OUTPUT SHAFT  
HEAVY DUTY STIRRER UNIT

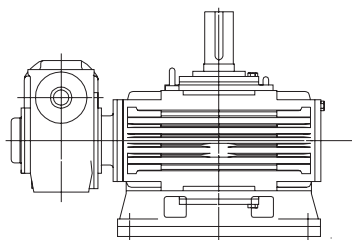


**CNV**  
VERTICAL OUTPUT SHAFT

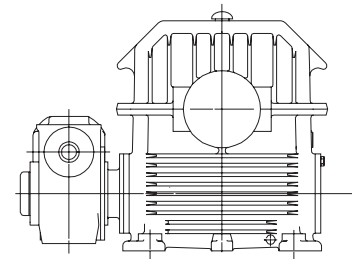
### DOUBLE REDUCTION UNITS



**CNOD**  
OVERDRIVEN  
DOUBLE REDUCTION (WORM/  
WORM)



**CNVD**  
VERTICAL OUTPUT SHAFT  
DOUBLE REDUCTION (WORM/  
WORM)



**CNUD**  
UNDERDRIVEN  
DOUBLE REDUCTION (WORM/  
WORM)

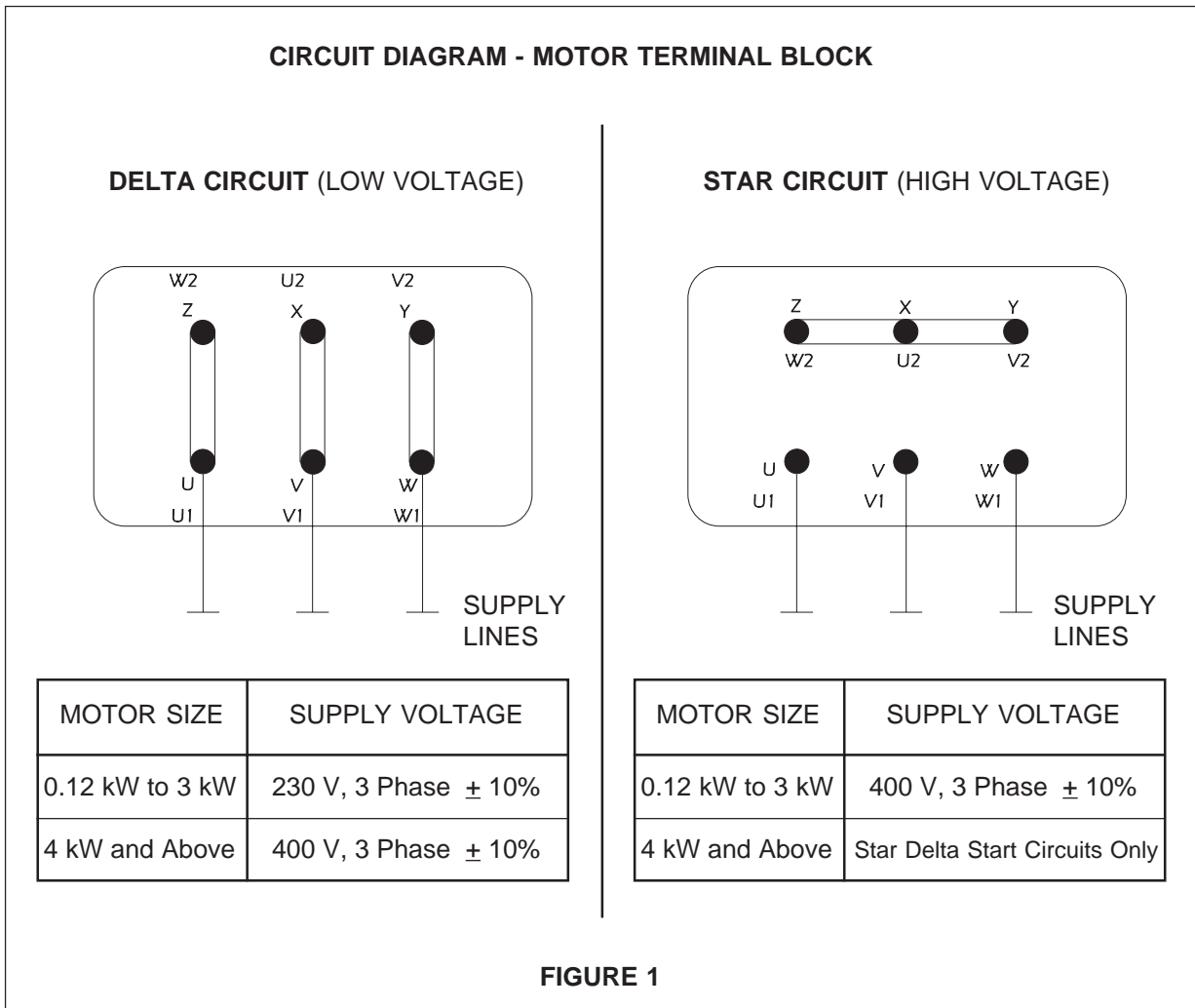
### THREE PHASE INDUCTION MOTOR INSTALLATION

#### CONNECTION TO MAINS POWER SUPPLY

- Connection of the electric motor to the mains supply should be done by a qualified person.
- Connect motor terminals in accordance with the diagram inside the terminal box cover. (Also identified in Fig. 1 on this sheet).

Note: It is important that the mains supply details are checked against the nameplate data and that they are connected as indicated on the nameplate. The correct sizing of the cables to electrical regulations is essential.

- To change the direction of rotation of the electric motor, one of the three main line terminals should be changed with the other.
- Connect the earth conductors to the marked earth terminals.



NOTE: This instruction only applies to David Brown Radicon plated motors. Motors fitted by the customer or requested by the customer of David Brown Radicon from a different manufacturer will have separate documentation provided with it.

## INSTALLATION (BRAKE)

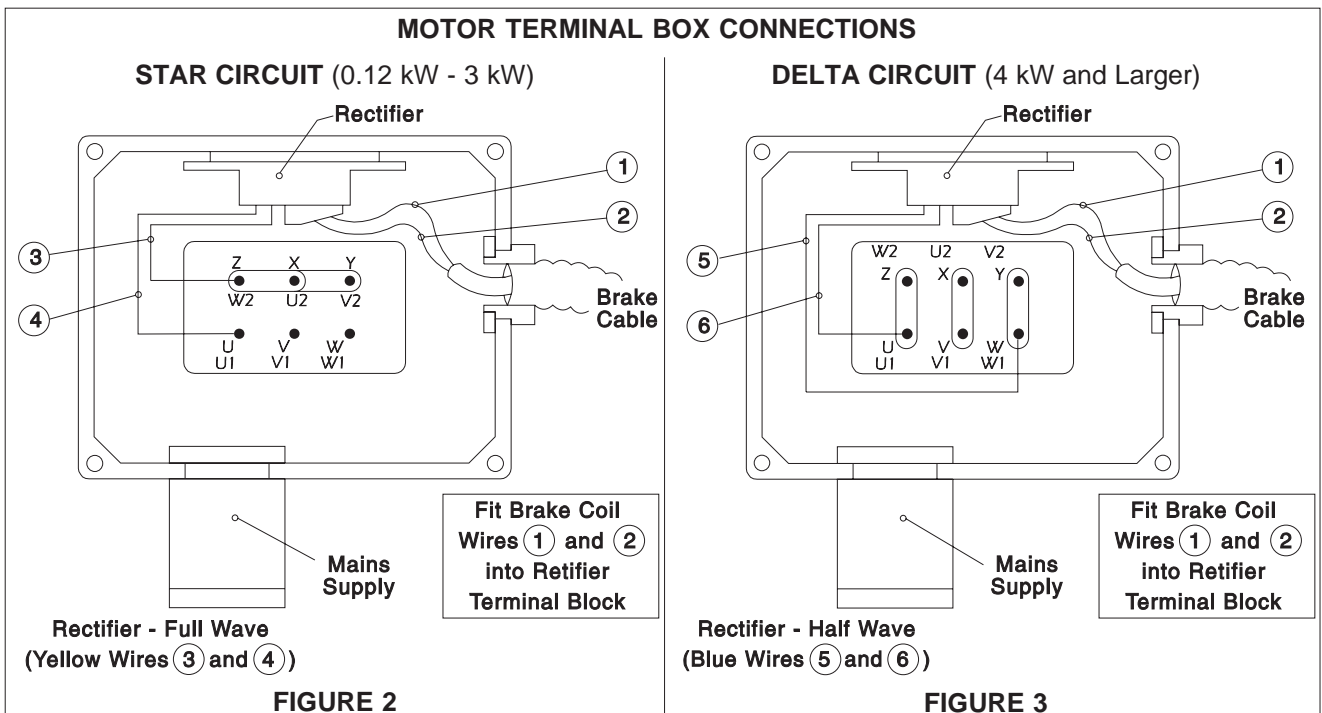
The fail safe brake (Fig 5) is factory fitted to the Radicon Electric Motor.

This includes the fitting of a rectifier and its wiring in the motor terminal box for standard AC switching with a mains supply voltage of 400 V + 10%, 3 phase, 50 HZ.

Installation of the geared motor by the customer requires the normal connection of the motor to the mains supply as indicated in the installation of electric motor section of this manual (Appendix 2).

## GENERAL BRAKE APPLICATION (AC SWITCHING)

Figures 2 & 3 are terminal box connection diagrams of the type of rectification used (depending on motor power) with switching on the AC line in parallel with the motor switch contactor, which will satisfy most braking applications.



## SPECIAL BRAKING APPLICATIONS (DC SWITCHING)

For fast braking (for safety critical applications, eg lifts, hoists and cranes) it is essential to switch the brake on the DC side of the rectifier, rather than the AC (input) side, as with the standard offering.

At customers request, a special rectifier is supplied with two additional contacts for the inbuilt suppressor, which are connected across the brake switch contacts (Figure 4).

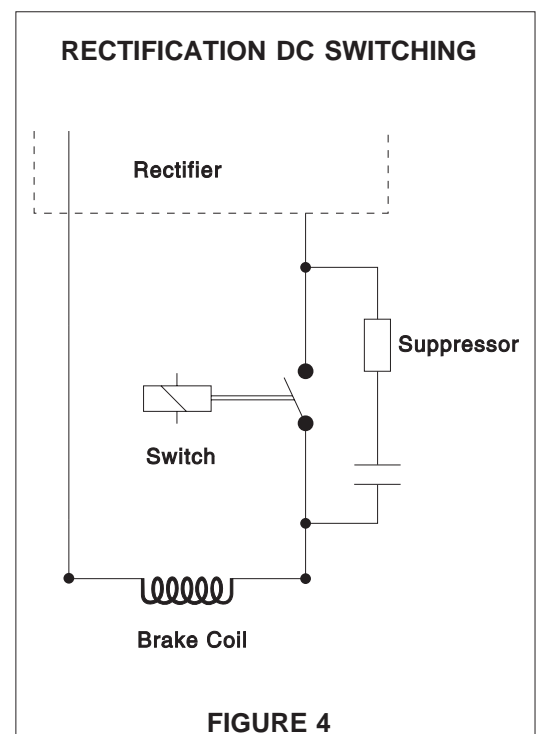
Note: When DC switching is specified, the rectifier is supplied loose in the terminal box. It is the installers responsibility to connect the rectifier which is conventionally located in such cases in the customers control panel.

## INVERTER SUPPLY

In all cases, the rectifier must be disconnected from the motor supply terminals, and a constant voltage (400 V ± 10%) supplied independently. It is normal in such cases to re-site the rectifier in the control panel with a separate switching arrangement.

## ALTERNATIVE MAINS VOLTAGE

Refer to David Brown Applications Department for guidance.

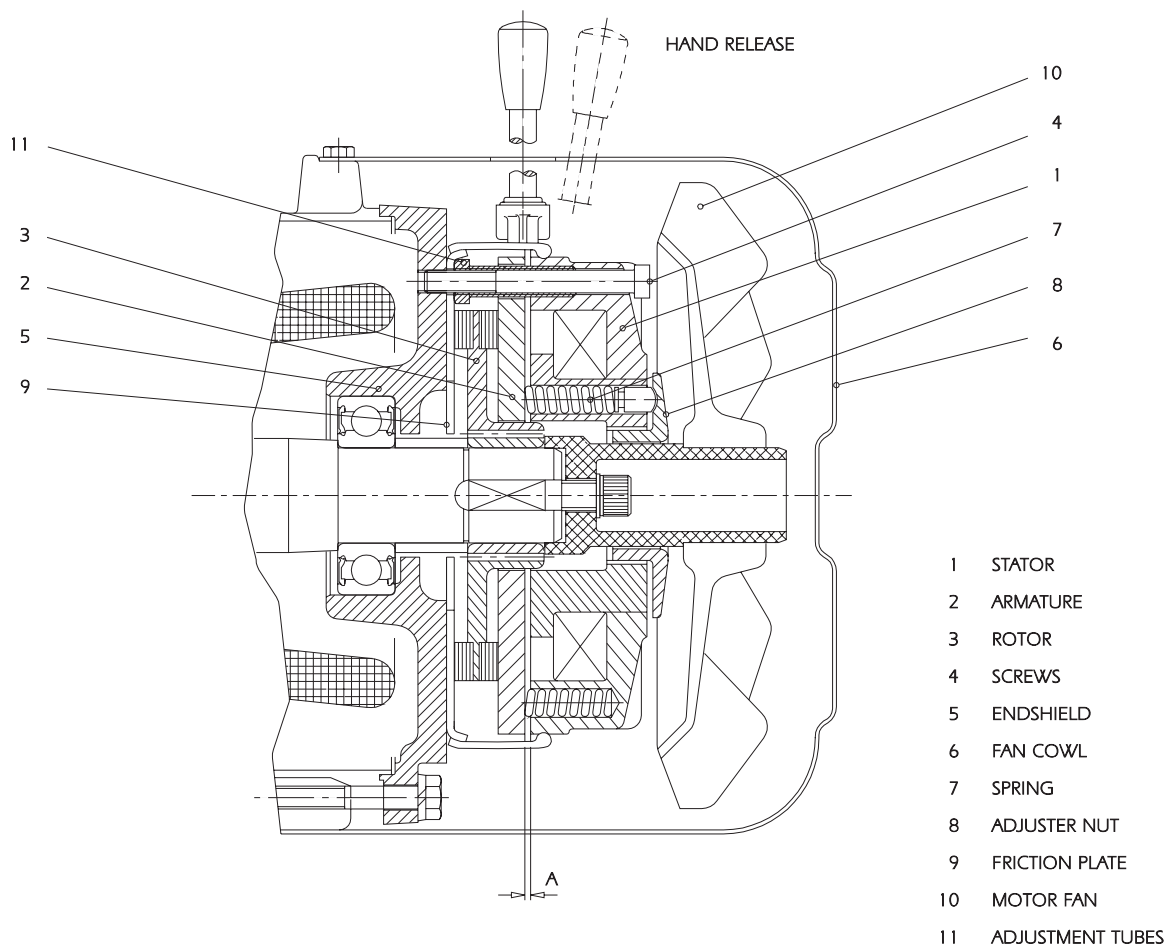


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### MAINTENANCE (BRAKE)

To maintain safety and efficient brake action, regular brake inspections are essential. Generally, a three monthly interval is adequate.

**NOTE:** More frequent inspections should be made for arduous applications (particularly cranes, hoists, lifts or high inertia drives).



**FIGURE 5**

### CHECKS AND ADJUSTMENTS (Fig 5)

**NOTE:** To access the brake for inspection remove fan cowl (6), any adjustment may require the removal of the motor fan (10) also.

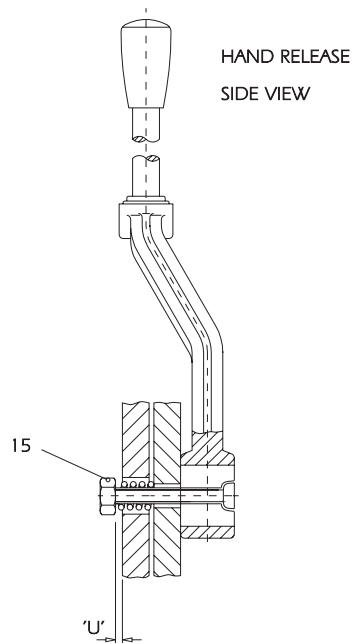
- 1 Check the brake is free of oil, grease and excess dust.
- 2 Check the maximum air gap 'A' (Fig 5), this must not be exceeded. Use a feeler gauge and check in three positions, ensuring the gap is even (see table 1).

Where adjustment is needed, slacken screws (4) and reset the gap by turning adjustment tubes (11). Re-tighten screws (4) to the correct torques in table 1.

- 3 At the same time as 2, check that the rotor (3) has not worn below the minimum thickness (see table 1)
- 4 If the brake is fitted with a hand release, check the hand release air gap 'U' (Fig 6, and table 1). This is a minimum figure, do not allow smaller settings. To reset this gap tighten the hexagonal hand release nuts (15).

### TORQUE ADJUSTMENT

The brake is supplied with nominal torque (table 1) set at the factory. This torque can be reduced by unscrewing the torque nut (8) (Fig 5) using a 'C' spanner to approximately 60% of nominal torque. Torque reduction steps identified in table 1.



**FIGURE 6**

**TABLE 1**

MOTOR FRAME SIZE		63	71	80	90	100/112	132
BRAKE SIZE		06	06	08	10	12	14
BRAKE TORQUE	Nm	2.85	4	8	16	32	60
A	mm	0.2	0.2	0.2	0.2	0.3	0.3
A max	mm	0.5	0.5	0.5	0.5	0.75	0.8
ROTOR BRAKE DISC MIN THICKNESS	mm	4.3	4.3	5.3	7.3	6	6.6
HAND RELEASE CLEARANCE 'U'	mm	1	1	1	1	1	1
BRAKE TORQUE REDUCTION/STEP	Nm	0.2	0.2	0.4	0.6	1.2	1.6
ASSEMBLY KIT BOLTS TIGHTENING TORQUE	Nm	3	3	6	10	10	25

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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

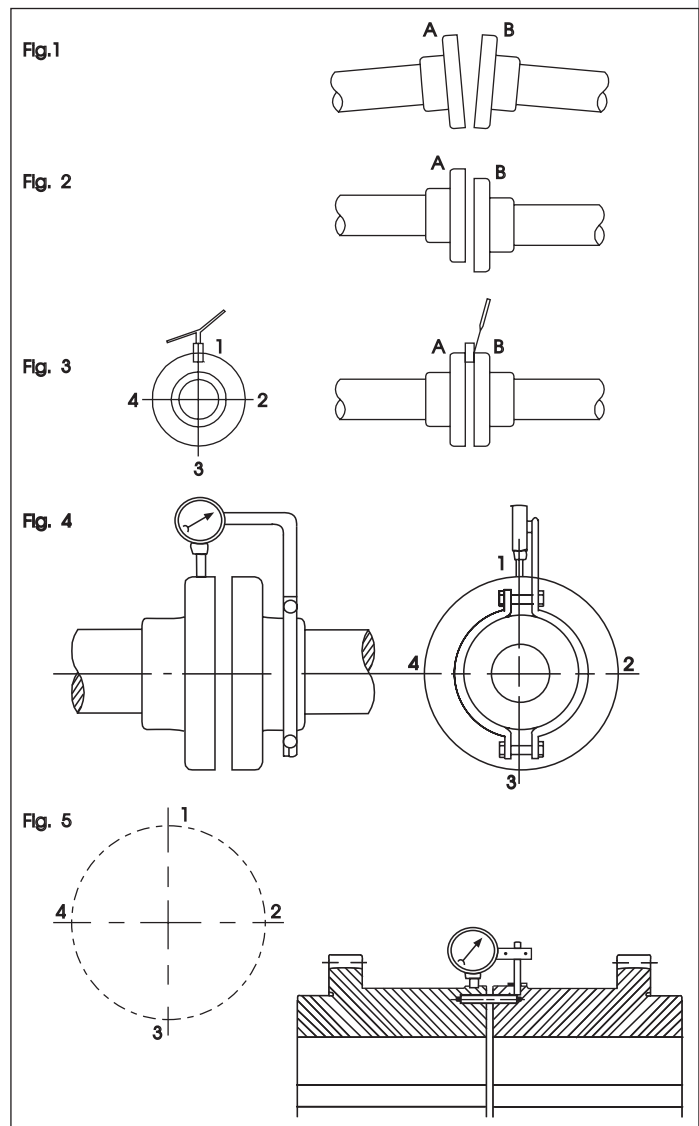
If the faces are perfectly true, the angularity can be checked by keeping both shafts stationary and taking measurements with a block gauge and feelers at the four points 1, 2, 3 and 4 as shown in figure 3. The difference between the readings 1 and 3 will give the error of alignment in the vertical plane 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.

### 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 16.

Care must, however, 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 :-

TYPE OF COUPLING	UNIT SIZE	ALLOWABLE ECCENTRICITY (mm)
Flexible or rubber element	10, 12 and 14	0.150
	17, 20 and 24	0.200
Gear type	10 and 12	0.075
	14 and 17	0.100
	20 and 24	0.125
Rigid	10 and 12	0.035
	14 and 17	0.050
	20 and 24	0.065

### **SPECIAL NOTE CONCERNING RIGID COUPLINGS**

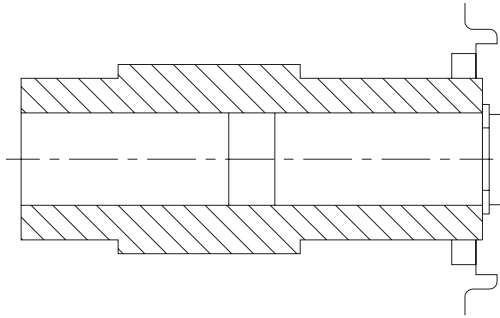
In lining up elements involving rigid couplings it is important that no attempt is made to correct errors of alignment or eccentricity greater than those above by tightening of the coupling bolts (This applies when the system is cold or at operating temperature). The result is mis-alignment and the setting 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**

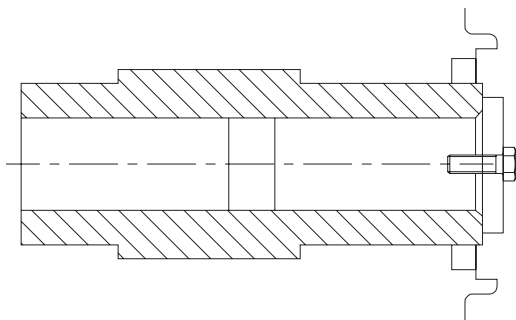
David Brown Radicon Limited, produce standard flexible couplings to cover the complete range of Radicon units as follows:

- 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.

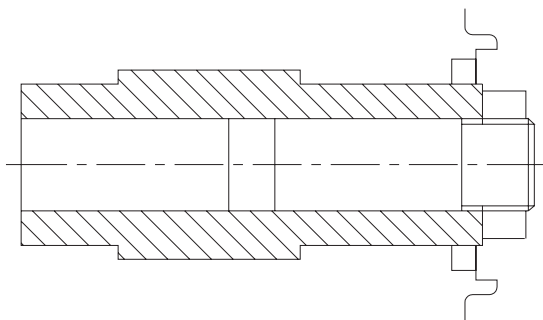
**SHAFT MOUNT UNITS  
ALTERNATIVE SHAFT FIXING METHODS**



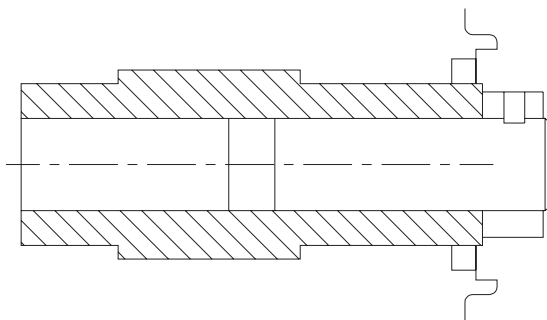
SHAFT MOUNT UNITS RETAINED WITH A CIRCLIP



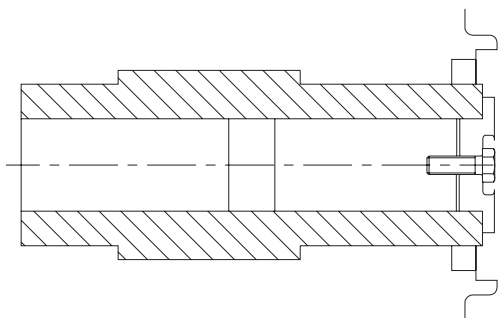
SHAFT MOUNT UNITS RETAINED WITH A BOLT AND PLATE



SHAFT MOUNT UNITS RETAINED WITH A LOCKNUT

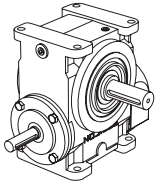


SHAFT MOUNT UNITS RETAINED WITH A COLLAR AND GRUBSCREW



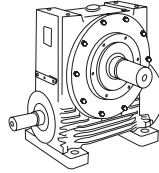
SHAFT MOUNT UNITS RETAINED WITH A RECESSED PLATE AND BOLT

### SERIES A - JUNIOR



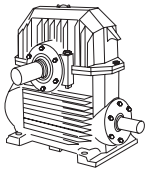
Power capacity to 11 kW  
Output torque capacity to 1,000 Nm  
Sizes 280, 410, 510, 610, 730 and 860  
Foot, flange and shaft mounting

### SERIES A - MID RANGE



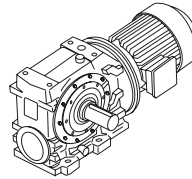
Power capacity to 140 kW  
Output torque capacity to 10,000 Nm  
Sizes 1002, 1252, 1602 and 2002  
Foot, flange and shaft mounting

### SERIES A - HEAVY DUTY



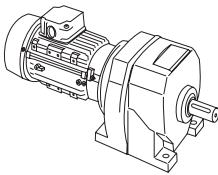
Power capacity to 835 kW  
Output torque capacity to 100,000 Nm  
Sizes 10, 12, 14, 17, 20 and 24  
Foot, flange and shaft mounting

### SERIES C



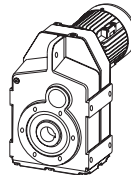
Power capacity to 45 kW  
Output torque capacity to 10,000 Nm  
Sizes 03, 04, 05, 06, 07, 08, 09 and 10  
Foot, flange and shaft mounting

### SERIES M



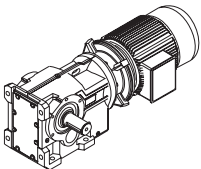
Power capacity to 90 kW  
Output torque capacity to 11,000 Nm  
Sizes 03, 04, 06, 07, 08, 09, 10, 13 and 14  
Foot and flange mounting

### SERIES F



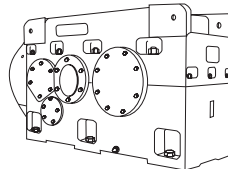
Power capacity to 45 kW  
Output torque capacity to 7,200 Nm  
Sizes 04, 06, 07, 08, 09 and 10  
Foot, flange and shaft mounting

### SERIES K



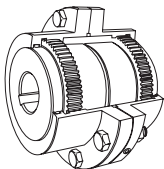
Power capacity to 90 kW  
Output torque capacity to 12,300 Nm  
Sizes 08, 09, 10 and 12  
Foot, flange and shaft mounting

### SERIES H



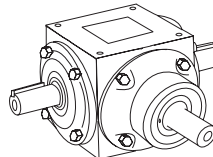
Power capacity to 8300 kW  
Output torque capacity to 128,000 Nm  
Sizes 140, 160, 180, 200, 225, 250, 280,  
315, 355, 400 and 450  
Single, double and triple parallel and  
right angle shaft  
Foot and shaft mounting

### SERIES X



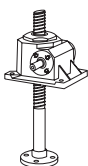
Nylicon low cost couplings to  
55 mm dia. bore  
610 Series Cone-Ring type to  
355 mm dia. bore  
620 Series Gear type to  
540 mm dia. bore  
Sadiguard Torque limiters for overload  
protection, to 115 mm dia. bore

### SERIES R



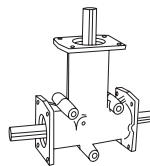
Power capacity to 265 kW  
Output torque capacity to 1,265 Nm  
Sizes 120, 160, 200, 260 and 350  
Output shaft and shaft mounting

### SERIES S



Load capacity to 100 tonnes  
Sizes 0.5, 1, 2.5, 5, 10, 25,  
50 and 100

### SERIES T



Power capacity to 15 kW  
Output torque capacity to 132 Nm  
Sizes 1, 2, 3, 4 and 5