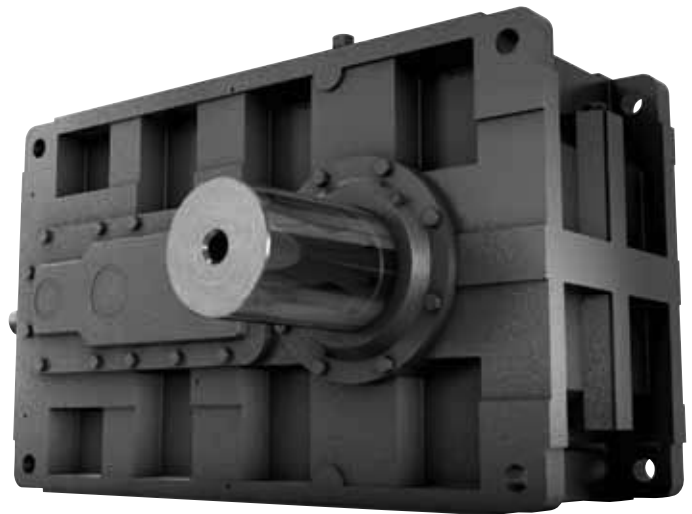


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Series G - Industrial Reducers
Installation & Maintenance



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Product Safety Information

IMPORTANT

General - The following information is important in ensuring safety. It **must** be brought to the attention of personnel involved in the selection of 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.


Our 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 oC), 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, we 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 our 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 backstop facility, ensure that back-up systems are provided if failure of the backstop 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 contacting our Application Engineers.

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Safety Warning Symbols



Electrical Hazard
Could result in death or serious injury



Danger
Could result in serious, slight or minor injuries



Danger (Touch Hazard)
Could result in death or serious injury



Damaging Situation
Could result in damage to gear unit or driven machinery



Important notes on Explosion Protection



Cleaning
Periodic cleaning necessary

Declaration of Conformity

Products:

Series G - Gear Units.

Radicon Transmission Uk Ltd hereby declares that products listed above have been designed in accordance with the following Directives and Standards.

- The Machinery Directive 2006/42/EC
- EN ISO 12100-1,2 The Safety of Machinery
- Conforms to all other harmonised standards, tests, and specifications, (In as much as they apply to our products)

Declaration of Incorporation

According to Machinery Directive 2006/42/EC Annex IIB

This product must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the provisions of the machinery directive 2006/42/EC.

The equipment shall only be loaded within the framework of our recommendations, and installed and operated in accordance with our installation and maintenance instructions.

The company hereby draws attention to the dangers of improper use of this equipment and particularly warns users against operating with inadequate guarding of rotating parts and the use of naked lights in close proximity to the equipment.

Radicon Transmission Uk Ltd will, upon a reasoned request from national authorities, provide any relevant information on its products

Signed by:



ENGINEERING MANAGER
Radicon Transmission UK Ltd

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with you at every turn

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1. General Information

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

Series G gear units are often supplied modified to suit customer requirements, or as part of a drive package.

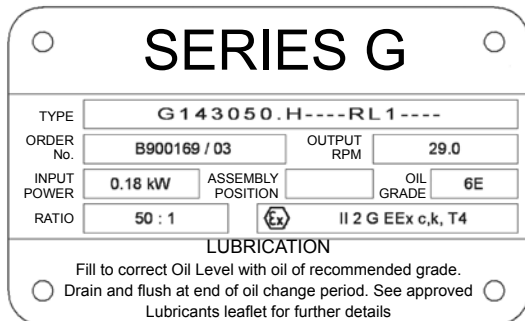
These instructions shall be supplementary to any information contained on the certified arrangement drawing and any separate instructions for equipment fitted to the gear unit. All units are tested and checked prior to despatch, a great deal of care is taken in packing and shipping arrangements to ensure that the unit arrives at the customer in the approved condition.

2. Weather Protection of Unit

All Series G 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, e.g. during plant construction, consult our application engineers so that arrangements for adequate protection can be made.

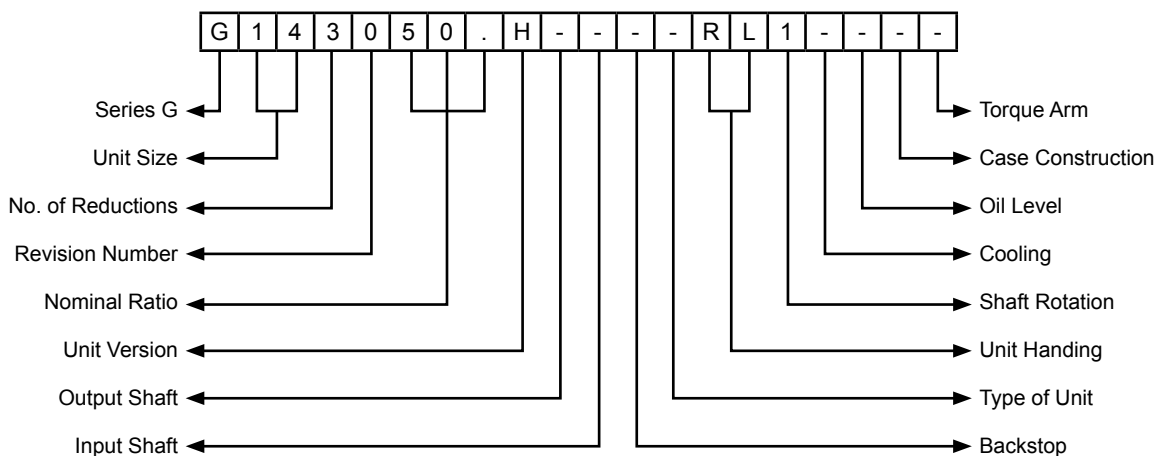
3. Reading the Nameplate

3.1 Unit Identification



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

- Unit type (Model No)
- Order Number / Year of Manufacture



Lubrication Grade

The lubrication grade is marked on the nameplate. See Appendix 2 for type and quantity of lubricant.

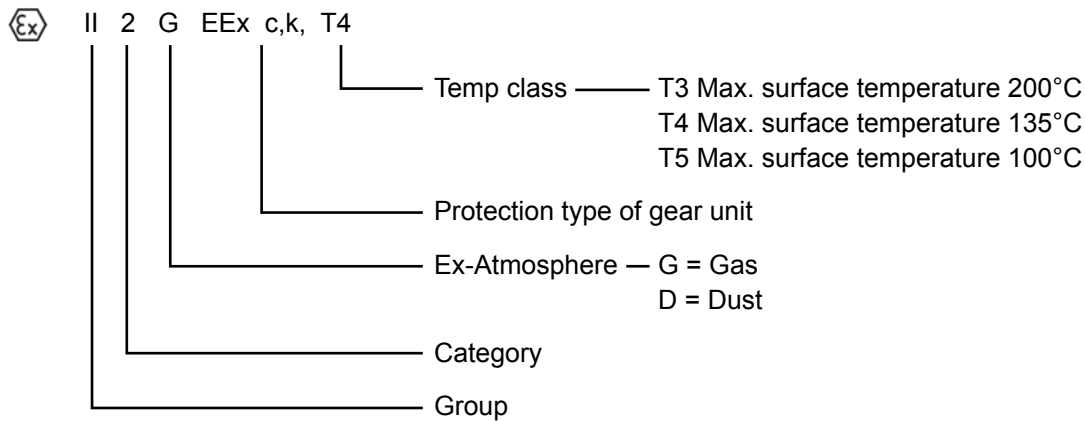
4. **Marking**







Units marked with this symbol are intended for use in industrial systems. Provided the units are correctly selected and are installed in accordance with these instructions (**gear units only**) they comply with the EU directive 94/9/EC ATEX 100a Group II Cat 2 zones 1 & 21 & Cat 3 zones 2 & 22.

Motors, couplings, or any other equipment fitted to the gear unit must also comply with this directive. If the gear unit is supplied as a geared motor package it is important to check the nameplates of the **gear unit and the motor** (or any other equipment fitted) corresponds with the classification of the potentially explosive atmosphere in which the unit is to be installed.

Understanding EU Directive 94/9/EC (ATEX 100a) Markings.



Examples:

-  II 2 G - (Zone 1) occasional hazardous explosive atmosphere
-  II 3 G - (Zone 2) rare short-term hazardous explosive atmosphere
-  II 2 D - (Zone 21) occasional hazardous explosive atmosphere during normal operation due to presence of combustible dust
-  II 3 D - (Zone 22) short-term hazardous explosive atmosphere due to presence of combustible dust; no hazard during normal operation

5. Installation

5.1 General

WARNING!



CAUTION

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 Series G units are despatched without oil, on installing the unit fill with recommended lubricant to correct level. In accordance with the details in section 6

5.2 Prior To Installation

- 5.2.1. Check gear unit has not ben damaged.
- 5.2.2. Check the gear unit / motor nameplate matches the requirements of the machine the unit is to be installed into.
- 5.2.3. Thoroughly clean the gearbox mounting surfaces that are to be used and the shafts of paint & anti-corrosion agents using a commercially available solvent. Ensure solvent does not make contact with the oil seals.

5.3. 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 50mm) and m6 (for shaft diameter $>$ 50mm) and the fitted components should be to ISO tolerance M7 (for bore diameter \leq 50mm) and K7 (for bore diameter $>$ 50mm).

- 5.3.1. Ensure shaft extensions, bores & keys etc are cleaned.
- 5.3.2. Items (such as gears, sprockets, couplings etc) should not be hammered onto these shafts since this would damage the shaft support bearings.
- 5.3.3. 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. See Table 1 below.
- 5.3.4. Items being fitted may be heated to 80/100°C to aid assembly further.



Unit Size	Type of Unit		Input Shaft	Output Shaft
14 & 16	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	
21 & 22	Parallel	2 Stage	M30 x 63 mm deep	M42 x 81 mm deep
	Parallel	3 & 4 Stage	M20 x 43 mm deep	
	Right Angle	3 Stage	M24 x 52 mm deep	
	Right Angle	4 Stage	M20 x 43 mm deep	

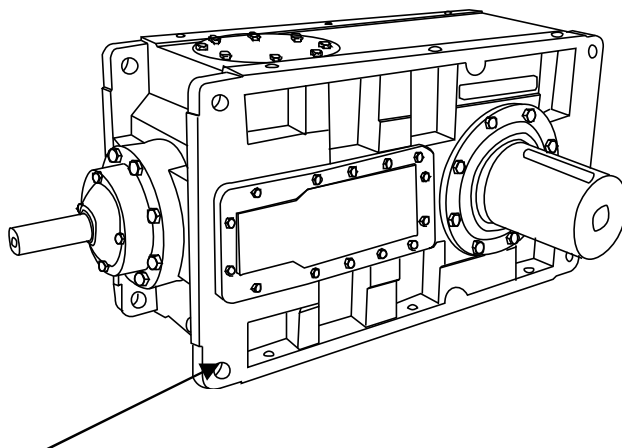
Table 1

5.4 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 gear unit and motor must **NOT** be used to lift the whole drive assembly. Use only the lifting points on the bedplate as identified on the assembly drawing 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.

5.5 Foot Mounted Units

5.5.1. Ensure the base foundation mounting surface is flat¹, vibration absorbing and torsionally rigid
Note: Units on baseplates should if possible be mounted on the same bedplate as the prime mover.

5.5.2. The gear unit must be installed in the specified mounting position. The maximum deviation from the designated mounting position is $\pm 5^\circ$ (unless gear unit is suitably modified and approved for non standard mounting positions).

5.5.3. 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 final bolting ensure the unit or baseplate is not distorted as this would cause strains in the gear case resulting in errors of alignment of shafts and gearing.

Check all mounting points are fully supported and adjust if necessary by using steel packings.

Torque tighten bolts to torque specified in Table 2 below.

5.5.4. Secure unit, or baseplate if fitted to a rigid foundation using heavy duty bolts to ISO grade 8.8 minimum.



Set Screw Size	Tightening Torque
M12	85 Nm
M16	200 Nm
M20	350 Nm
M24	610 Nm
M30	1220 Nm
M36	2150 Nm
M42	3460 Nm

Table 2

¹ Maximum permissible flatness error for mounting surface is 0.12mm.

5.6 Shaft Mounted Units

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

5.6.1.1. Clean shaft extensions, driven machine shaft, gear unit bore and ventilator when fitted.

5.6.1.2. Locate in position, ensuring it is as close as possible to the bearing on the driven machine.

5.6.1.3. Secure unit onto the shaft. For units using a shrink device refer to section 5.6.2.2.

5.6.1.4. Fit torque arm to the side of the unit adjacent to the driven machine where possible, as shown in figure 1 & 2 (page 7).

Note: Unless specified otherwise, the torque arm will be supplied loose.

5.6.1.5. Anchor case to a secure point by means of the torque arm.

5.6.1.6. Fit guards in accordance with the factory acts.

5.6.1.7. Check motor wiring for correct direction of rotation, this is important when a backstop device is fitted.

5.6.1.8. Fill gear unit with oil as detailed in section 6.



Torque arms are available for all shaft mounted units with parallel or right angle shafts. They are supplied as optional extras and are secured to gear cases as shown below.

Torque arms must be secured to the chassis structure in a flexible mounting as indicated.

Shaft mounted units are designed to operate in the horizontal position. Reference must be made to our Application Engineers, with details, where units are required to operate in an inclined position.

SHAFT MOUNTED UNITS FOR HIGH INERTIA DRIVE

When used on Traverse drives with high inertia driven loads, eg crane drives (slewing, long travel and cross travel) bogie drives and selected high inertia load roller table drives, it is recommended that shaft mounted units should be fitted with shock absorbing Torque Arms.

Consult our Application Engineers with specific application details.

It is recommended that the torque arm is fitted on the side of the unit adjacent to the driven machine.

The torque arm must be flexibly mounted to the chassis structure

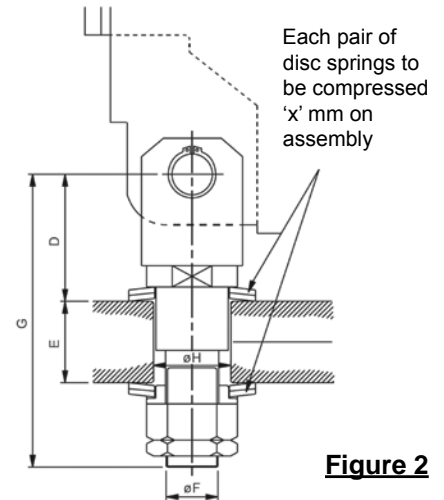


Figure 2

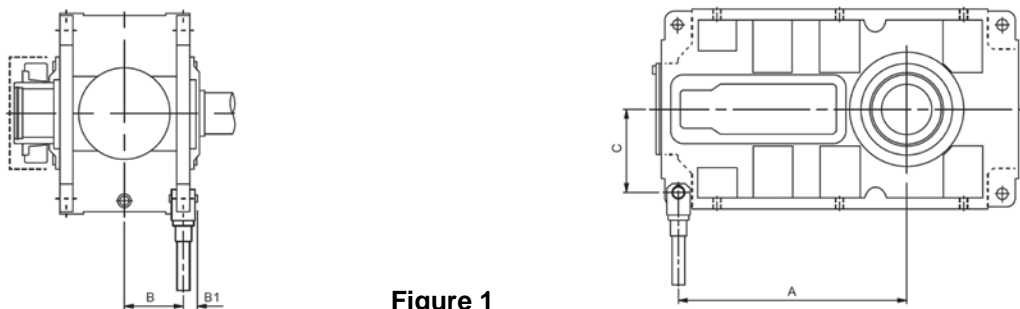


Figure 1

Size of Unit	A	B	B1	C	D	E		F	G	Disc Spring Ref	X	H
						Min	Max					
14	490	135	55	195	95	40	60	M30	207	80 x 41 x 4	1.1	41
15	530											
16	645	167	65	253	125	50	75	M36	262	100 x 51 x 6	1.1	52
17	700											
18	845	222	80	328	150	70	105	M48	336	125 x 71 x 6	1.7	72
19	910											
21 & 22	Contact our Application Engineers											

5.6.2. 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.

5.6.2.1 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 4).

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.

SERIES G

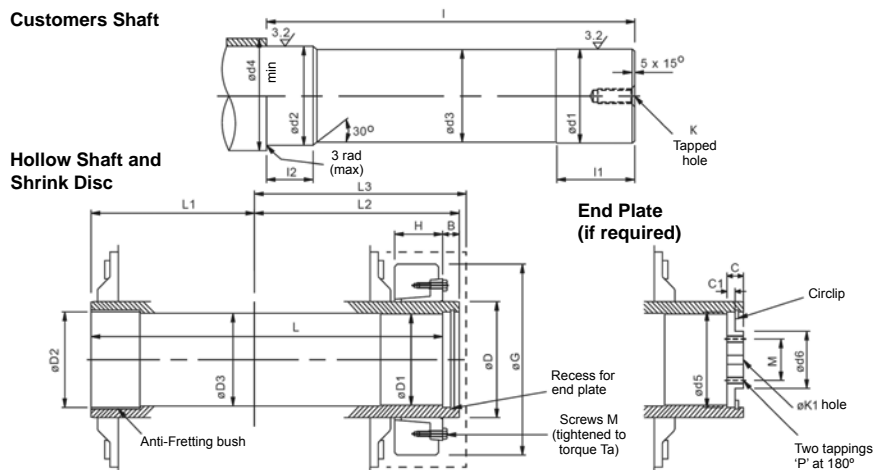
INSTALLATION

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 ×50	HSD 120-81-95	22	120	197	53	M12	121
15	110 h6	115 h6	109.5	130	418	60	60	M24 ×50	HSD 140-81-110	22	140	230	58	M14	193
16	125 h6	130 h6	124.5	147	530	70	70	M24 ×50	HSD 160-81-125	28	160	290	68	M16	295
17	145 h6	150 h6	144.5	167	545	90	90	M30 ×60	HSD 180-81-145	28	180	320	85	M16	295
18	160 h6	170 g6	159.5	185	685	90	90	M30 ×60	HSD 200-81-160	30	200	340	85	M16	295
19	170 g6	180 g6	169.5	195	705	105	105	M30 ×60	HSD 220-81-170	30	220	370	103	M20	570
21	210 g6	220 g6	209.5	225	820	130	105	M30 ×60	HSD 260-81-210	30	260	430	119	M20	570
22	230 g6	240 g6	229.5	235	835	145	105	M30 ×60	HSD 280-81-230	30 2	80	460	132	M20	570

Unit Size	Hollow Shaft								End Plate						
	ØD1	ØD2	ØD3	L	L1	L2	L3	C	C1	Ød5	Ød6	ØK1	M crs	P	Circlip
14	95	100	96	415	180	255	276	20	10.0 9.8	99.75 99.50	78	26	55	M12	D1300- 1000
15	110	115	111	420	180	260	276	20	10.0 9.8	114.75 114.50	90	26	65	M12	D1300- 1150
16	125	130	126	533	230	325	348	25	12.0 11.8	129.75 129.50	103	26	70	M16	D1300- 1300
17	145	150	147	548	230	340	348	25	12.0 11.8	149.75 149.50	120	33	85	M16	D1300- 1500
18	160	170	162	688	300	410	442	25	12.0 11.8	169.75 169.50	135	33	100	M16	D1300- 1700
19	170	180	172	708	300	430	442	25	12.0 11.8	184.75 184.50	150	33	110	M16	D1300- 1850
21	210	220	212	824	350	500	510	28	14.0 13.8	219.75 219.50	170	33	130	M20	D1300- 2200
22	230	240	232	839	350	515	535	28	14.0 13.8	239.75 239.50	190	33	150	M20	D1300- 2400

Table 3



5.6.2.2 Installation

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

- 5.6.2.2.1 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.
- 5.6.2.2.2 Remove 'shrink disc' – from gear unit hollow shaft.
- 5.6.2.2.3 Clean and degrease locating diameters of gear unit hollow shaft, driven shaft and 'shrink disc' locating diameter on hollow shaft extension.
- 5.6.2.2.4 Draw the gear unit onto the driven shaft (See Figure 5).
- 5.6.2.2.5 Grease tapered surfaces of outer ring and inner ring with Molykote 321R or similar.
- 5.6.2.2.6 Fit 'shrink disc' on gear unit hollow shaft to position shown in Figure 3.
- 5.6.2.2.7 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 3 are achieved.
- 5.6.2.2.8 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.

5.6.2.3 Removal

- 5.6.2.3.1 Removal procedure is similar to the reverse of installation.

Note: Do not remove 'shrink disc' locking screws completely.

- 5.6.2.3.2 Remove any rust and dirt from gear unit hollow shaft.
- 5.6.2.3.3 Withdraw gear unit from driven shaft (See Figure 6).

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..

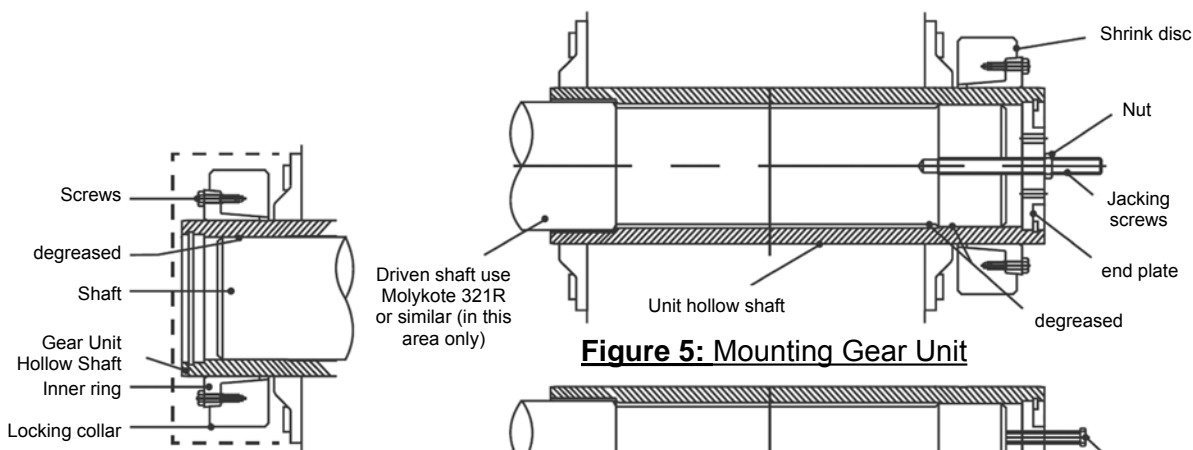


Figure 5: Mounting Gear Unit

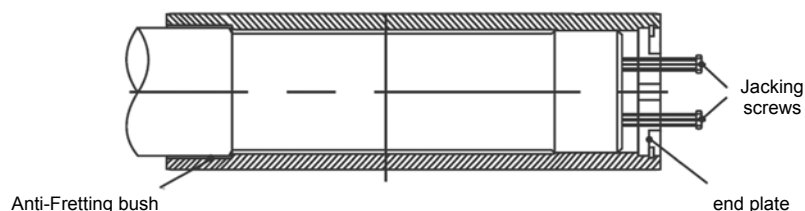


Figure 6: Removing Gear Unit



5.7. Units For Use In A Potentially Explosive Atmosphere

- 5.7.1. If the unit has been damaged in transit do not use. (Remove all transport fixtures and packings prior to start up)
- 5.7.2. Check nameplate of unit corresponds with the sites potentially explosive atmosphere classification.
- 5.7.3. Check ambient temperature falls within lubricant grade recommendations. (See Approved Lubricants p27)
- 5.7.4. Make sure no potentially explosive atmosphere exists during installation.
- 5.7.5. Make sure that gear unit is sufficiently ventilated with no external heat input – cooling air temperature should not exceed 40°C
- 5.7.6. Ensure mounting position corresponds to that marked on the nameplate. (Note! ATEX approval is only valid for mounting position specified on the nameplate.)
- 5.7.7. Check motors, couplings or any other equipment fitted to the gear unit has ATEX approval.
Check information listed on nameplates correspond to the environmental conditions of the site.
- 5.7.8. Ensure gearbox is not subjected to any loading greater than those marked on the nameplate.
- 5.7.9. **For units operated with inverter drives**, check motor suitability for use with the inverter.
Ensure that the inverter parameters do not exceed those of the motor.
- 5.7.10. **For belt driven units**, check all belts fitted are of sufficient electrical leakage resistance. ($< 10^9 \Omega$).
- 5.7.11. Ensure gear unit and other equipment is electrically grounded (Earthed).
- 5.7.12. Check and adjust guards and covers so that there is no ignition source from sparks that may be thrown by moving parts making contact with guards etc. Ensure coupling guards, covers etc are dust tight or are designed in such a way that a build up of dust deposits cannot form when the unit is used in Zone 21 & Zone 22 classification areas.

6. Lubrication

6.1. General

6.1.1. All Series G units are despatched without oil (a warning label is attached), and therefore filled by the client. The 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.

6.2. Temperature Limitations

6.2.1. Check lubricant grade (stamped on nameplate) is suitable for the operating ambient temperature range. Consult Table L1.

(ISO)	Lubricant	Ambient Temperature Range		
		-5°C to 20°C (type E) -30°C to 20°C (type H)	0°C to 35°C	20°C to 50°C
CLP (CC)	EP Mineral Oil (type E)	5E (VG 220)	6E (VG 320)	7E (VG 460)
CLP (HC)	Polyalphaolefin based Synthetic with EP additive (type H)	5H (VG 220)	5H (VG 220)	6H (VG 320)

Table L1



CAUTION

6.3. Ventilator

6.3.1. Clean & secure the ventilator in the correct location for the required mounting position.

6.4. Oil Level

6.4.1. 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 or any other level indicator fitted (sight glass etc.).

6.4.2. 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 or any other level indicator fitted (sight glass etc.).

WARNING Do not overfill as excess may cause overheating and leakage.



CAUTION

6.4.3. Check and re-fit all plugs & tighten to correct torque figure – see notes in maintenance section. Clean away any oil spillage from the surface of the gear unit and driven machinery.

6.5. Approved Lubricants

6.5.1. Oils

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

6.5.2. Greases

See Appendix 3 for greases approved for use in the gear unit.

7. Motor Connections

To mains:

- 7.1. 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.



RISK OF
ELECTRICAL
SHOCK

Motor terminal connection:

- 7.2. Motor terminal connection should be made in accordance with appropriate documentation supplied by the motor manufacturer.

8. Starting Up

8.1. Prior To Starting Up

- 8.1.1. Ensure ventilator is fitted see lubrication section 6.3
8.1.2. Check oil level, top up if necessary.



- 8.1.3. Ensure all safety devices are in place (i.e. guards fitted). Check and adjust guards and covers so that there is no ignition source from sparks that may be thrown by moving parts making contact with guards etc. Ensure coupling guards, covers etc are dust tight or are designed in such a way that a build up of dust deposits cannot form when the unit is used in Zone 21 & Zone 22 classification areas.

- 8.1.4. Remove any safety devices fitted to prevent machine rotation.
8.1.5. Starting up should only be performed or supervised by suitably qualified personnel.

Caution: Any deviation from normal operating conditions, (increased temperature, noise, vibrations, power consumption etc) suggests a malfunction, inform maintenance personnel immediately.

- 8.1.6. Units fitted with backstop, ensure motor is correctly wired for free direction of rotation.

9. Operation

9.1. Noise



The range of un cooled or water cooled Series G product satisfies a noise (sound pressure level) of 85 dB(A) or less when measured at 1 metre from the unit surface. Fan cooled units may exceed this level – Consult Application Engineering.

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

9.2. 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!

9.3. Initial Start Up For Gear Units Operating In A Potentially Explosive Atmosphere



During initial running it is important to measure the gear unit maximum surface temperature when run under maximum load after approximately 3 hours operation. The maximum surface temperature must **not** exceed 110°C for temperature class T3 & T4 and 80°C for T5. If this temperature is exceeded, shut down immediately and contact Application Engineering.

10. Maintenance

10.1. Prior To Any Maintenance Operations



10.1.1. De-energise the drive and secure against un-intentional switch on.

10.1.2. Wait until the unit has cooled down – Danger of skin burns & pressure build up.

10.2. Oil Plugs / Ventilator

10.2.1. Prior to removing plugs, ensure that the unit has cooled sufficiently so that oil will not burn.

10.2.2. Place a container under the oil drain plug to be removed. Note: it is recommended that the oil should be slightly warm, (40-50°C) when drained. (Cooler oil will be more difficult to drain correctly).

10.2.3. Top ups or refills should be done through the ventilator position.

10.2.4. Remember to refit all plugs and torque tighten to Table M1 below.

Gear Unit	Plug Size	Tightening Torque
G 14 & 15	M22	65 Nm
G 16 & LARGER	M33	130 Nm

Table M1

10.2.5. Clean away any oil spillage.

10.3. Lubrication

10.3.1. Periodic inspection.

For Units fitted with dipstick or other level indicating device, check the oil level every 3000 hours or 6 months whichever is sooner and if necessary top up with the recommended type of lubricant.

10.3.2. Oil changes.

10.3.2.1. 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
- b. Type of oil
- c. Environment – humidity, dust, etc.
- d. Operating conditions – shock, loading, etc.

10.3.2.2. At elevated temperatures the effective life of the oil is very much reduced. This is most pronounced with oils containing fatty and EP additives. To prevent damage to the unit through lubricant breakdown the oil should be renewed as detailed in Table M2.

Unit Operating Temperature °C	Mineral Oil CLP(CC) Type E	Synthetic Oil CLP(HC) Type H
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

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.

Table M2

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 with one type of lubricant.



CAUTION

Warning


Do not mix Synthetic and Mineral lubricants.

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



10.3.3. For units installed in potentially explosive atmosphere it is essential to ensure that the oil is changed on or before the renewal period specified in Table M2.

10.4. Bearings

10.4.1. Bearings should be replaced every 5 years for  marked units. Alternatively they should be replaced in accordance with the agreed specification.

10.5. Grease Lubrication

10.5.1. On certain units the output bearings are grease lubricated, these should be regreased at 2000 to 3000 hour intervals unless otherwise instructed.



10.6. Cleaning

10.6.1. 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.



10.6.2. Ensure build up of dirt or dust does not exceed 5mm.

11. Fault Diagnosis

11.1. Gear Unit Problems:

Symptom	Possible Causes	Remedy
Output shaft does not rotate, even though the motor is running or the input shaft is rotating.	Drive between shafts interrupted in the gear unit.	Return the gear unit / geared motor for repair.
Unusual, regular running noise	a) A meshing or grinding sound :damage to bearings b) A knocking sound : irregularity in gearing	a) Check oil (See Maintenance) b) Contact our Application Engineers or your local Sales Office
Unusual, irregular running noise	Foreign matter present in the oil	a) Check oil (See Maintenance) b) Stop the unit, contact our Application Engineers or your local Sales Office
Oil leaking ¹ • from gear unit cover • from motor flange • from gear unit flange • from output end oil seal	a) Defective gasket on gear unit cover b) Defective gasket c) Gear unit not ventilated	a) Retighten screws on gear unit cover and observe gear unit. If still oil leaks contact our Application Engineers or your local Sales Office. b) Contact our Application Engineers or your local Sales Office. c) Vent the gear unit.
Oil leaking from the ventilator	a) Gear unit over filled with oil b) Gear unit installed in an incorrect mounting position c) Frequent cold starts (oil foaming) and/or high oil level	a) Correct the oil level (See Lubrication) b) Correct the mounting position and check oil level (See Lubrication) c) Check the oil level (See Lubrication)

1) It is normal for small amounts of oil / grease to leak out of the oil seal during the running in period (24 hours running time)

<p>When contacting our sales office Please have the following information available:</p> <ul style="list-style-type: none"> • Nameplate data (complete) • Type and extent of the problem encountered • The time and the circumstances the problem occurred • A possible cause
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Any further information or clarification required may be obtained by contacting Our sales office, please see contact details at the back of this booklet.

Cooling Coil.

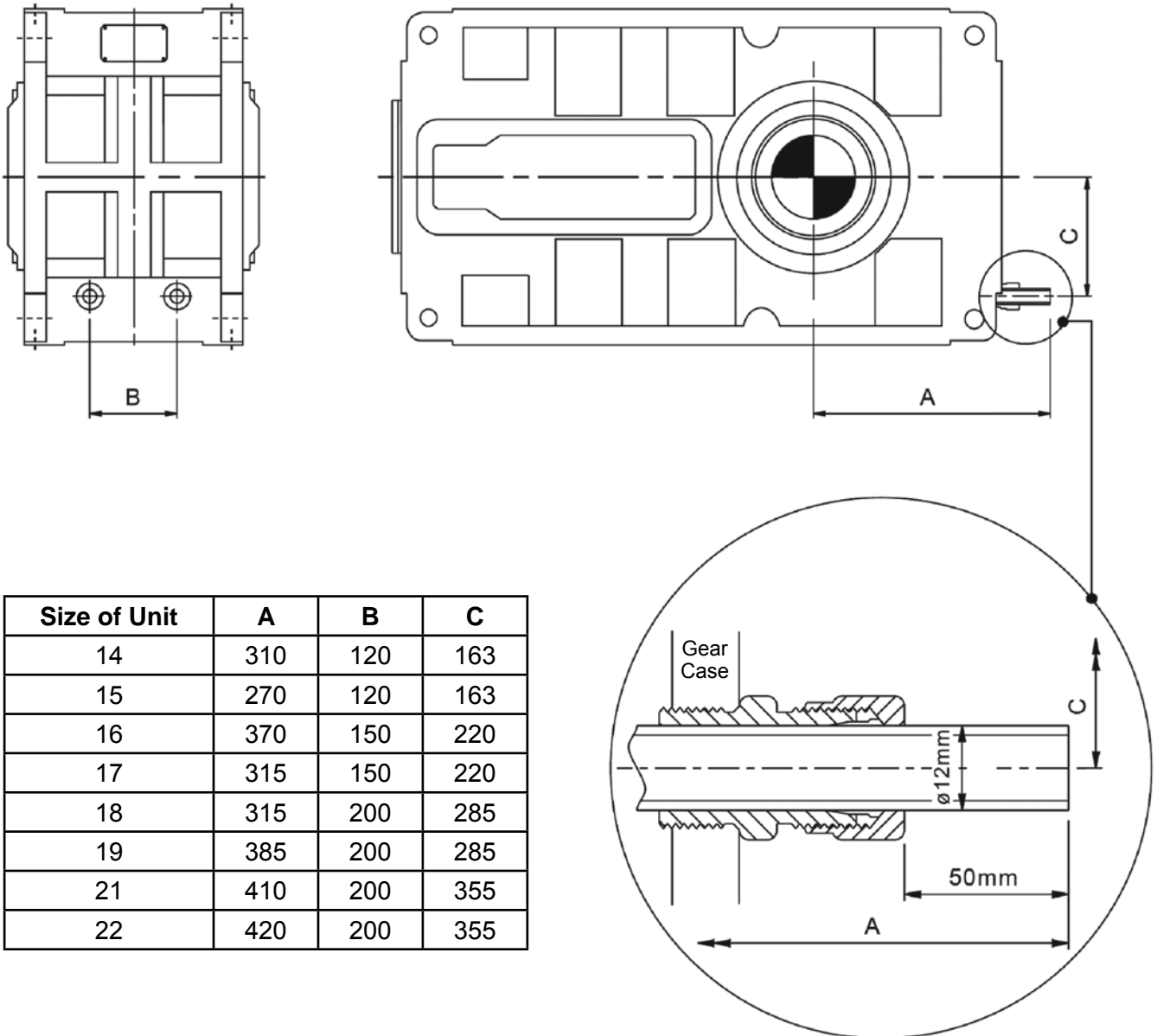
Cooling coils can be fitted to all unit types and handings.

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

Protruding cooling coil pipe can be connected to customer's 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°C / 12°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
21	410	200	355
22	420	200	355

Approved Lubrication.

All Series G units are despatched without oil (a warning label is attached), and therefore filled by the client. The 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 stated in Section 10.3 on Page 13.

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 or any other level indicator fitted (sight glass, etc.).

WARNING Do not overfill as excess may cause overheating and leakage.



CAUTION

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 or any other level indicator fitted (sight glass etc.).

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 to the level marked on the dipstick or any other level indicator fitted (sight glass, etc.).

Do not overfill as excess may cause overheating and leakage.

Unit Type		Unit Size							
		14	15	16	17	18	19	21	22
Parallel Shaft 2 Stage	Horizontal	22	20	47	42	92	95	180	161
	Vertical	18	18	40	37	80	85	140	150
Parallel Shaft 3 Stage	Horizontal	21	19	46	41	91	94	185	175
	Vertical	18	18	40	37	80	85	140	155
Parallel Shaft 4 Stage	Horizontal	21	19	46	41	91	94	185	175
	Vertical	18	18	40	37	80	85	140	155
Right Angle 3 Stage	Horizontal	21	19	47	42	92	95	185	175
	Vertical	20	20	43	39	87	92	140	170
Right Angle 4 Stage	Horizontal	-	-	48	43	94	96	190	175
	Vertical	-	-	45	39	89	89	140	185

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 19	Grade Numbers		
			5E	6E	7E
			Ambient Temperature Range °C		
			-5 to 20	0 to 35	20 to 50
Batoyle Freedom Group	Remus		220 (-2)	320 (-2)	460 (-2)
Boxer Services / Millers Oils	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		20 (-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 Comp EP (Eastern ver)		220 (-13)	320 (-13)	460 (-13)
	Ultra Gear		220 (-10)	320 (-7)	460 (-7)
Eko-Elda Abee	Eko Gearlub		220 (-13)	320 (-10)	460 (-1)
Engen Petroleum Limited	Gengear		220 (-15)	320 (-12)	460 (-3)
Esso/Exxon	Spartan EP	h	220 (-12)	320 (-12)	460 (-4)
Fuchs Lubricants	Powergear			P/Gear (-16)	M460 (-4)
	Renogear V		220EP (-13)	320EP (-4)	460EP (-4)
	Renogear WE		220 (-7)	320 (-4)	400 (-4)
	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)	
Optimal 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 (-7)
Petro-Canada	Ultima EP	e	220 (-22)	320 (-16)	460 (-10)
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) 4	60 (-4)
Saudi Arabian Lubr. Oil Co.	Gear Lube EP	e	EP220 (-1)	EP320 (0)	EP460 (0)
Shell Oils	Omala		220 (-4)	320 (-4)	460 (-4)
	Omala F	c	220 (-13)	320 (-10)	460 (-4)
Texaco Limited	Meropa		220 (-16)	320 (-16)	460 (-10)
	Meropa WM	c	220 (-19)	320 (-16) 4	60 (-11)
Total	Carter EP		220 (-7)	320 (-7)	460 (-4)
	CarterVP/CS		220 (-16)	320 (-13)	460 (-7)
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 the minimum pour point temperature of the specified oil in °C
 THE UNIT MUST NOT BE 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 19	Grade Numbers	
			5H	6H
			Ambient Temperature Range °C	
			-30 to 35	20 to 50
Batoyle Freedom	Group Titan		220 (-31)	320 (-28)
Boxer Services / Millers Oils	Silkgear		220 (-35)	320 (-35)
BP Oil International Limited	Energyn EPX	e		320 (-28)
Caltex	Pinnacle EP		220 (-43)	320 (-43)
Carl Bechem GmbH	Berusynth GP		220 (-38)	320 (-35)
Castrol International	Alphasyn EP	c	220 (-37)	320 (-31)
	Alphasyn T		220 (-31)	320 (-28)
Chevron International Oil Co	Tegra		220 (-46)	320 (-33)
Esso/Exxon	Spartan Synthetic EP	e	220 (-46)	320 (-43)
Fuchs Lubricants	Renogear SG		220 (-32)	320 (-30)
	Renolin Unisyn CLP		220 (-37)	320 (-34)
Klüber Lubrication	Klübersynth GEM4	e	220 (-30)	320 (-25)
Kuwait Petroleum International	Q8 El Greco		220 (-22)	320 (-19)
Lubrication Engineers Inc.	Synolec Gear Lubricant		9920 (-40)	
Mobil Oil Company Limited	Mobilgear SHC		220 (-40)	320 (-37)
	Mobil gear XMP	c	220 (-40)	320 (-33)
Optimal Ölwerke GmbH	Optigear Synthetic A		220 (-31)	320 (-31)
Petro-Canada	Super Gear Fluid	e	220 (-43)	320 (-37)
Shell Oils	Omala HD	c	220 (-43)	320 (-40)
Texaco Limited	Pinnacle EP		220 (-43)	320 (-43)
	Pinnacle WM	c	220 (-43)	320 (-40)
Total	Carter EP/HT		220 (-34)	320 (-31)
Tribol GmbH	Tribol 1510		220 (-36)	320 (-33)

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 the minimum pour point temperature of the specified oil in °C
THE UNIT MUST NOT BE RUN BELOW THIS TEMPERATURE.

Approved Bearing Greases.

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
Fuchs Lubricants	Renolit EP	-25	100
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 above greases are NLGI grade 2.
2. Refer to our Application Engineers if the unit is operating in an ambient temperature outside the range of -10°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 reading 1 and 3 will give the error of alignment in the vertical plane, over the length of 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 reading 2 and 4 gives the amount of sideways adjustment necessary to correct any errors of alignment in the horizontal plane.

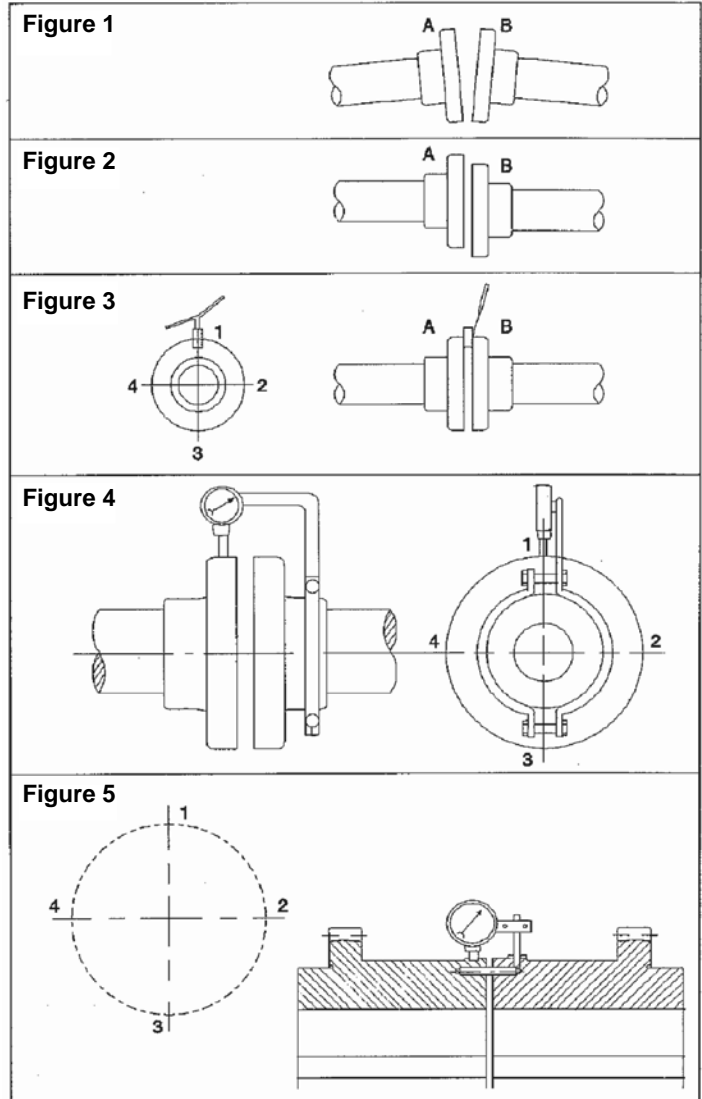
Generally, however, the coupling faces will not be absolutely true whilst any errors so found could be allowed for in checking angularity by the stationary method an easier presents itself. This consists in making the points 1 on both "A" and "B" and rotating both half couplings, keeping the mark points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

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

The permitted angularity error is as follows :

Type of Coupling	Allowable Gap (G) (mm)
Rigid Coupling	$G = 0.0005 D$
All other types	Please see Installation and Maintenance Manual for coupling type fitted

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



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 types and sizes may be fitted to a particular unit.

Please see appropriate installation and maintenance manual for coupling type and size fitted

ii) Output Shaft

Type of Coupling	Unit Size	Allowable Gap (G) (mm)
Rigid	G14 - G16	0.075
	G17 - G22	0.085
All other types	Please see appropriate installation and maintenance manual for coupling type and size fitted	

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 misalignment 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 misalignment 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

We produce standard flexible couplings to cover the complete range of units, please contact our sales office for details.

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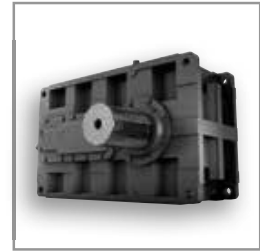
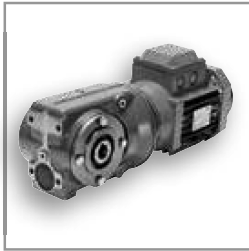
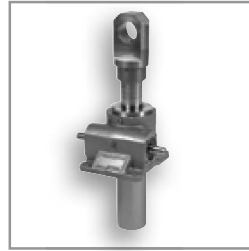
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