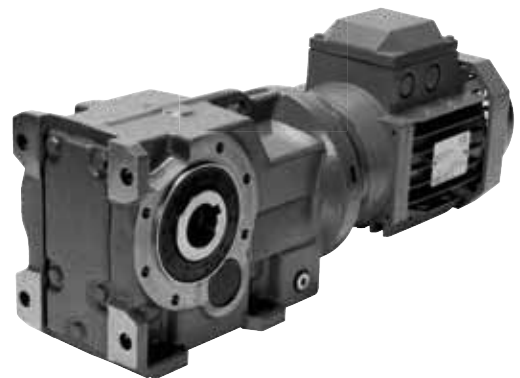
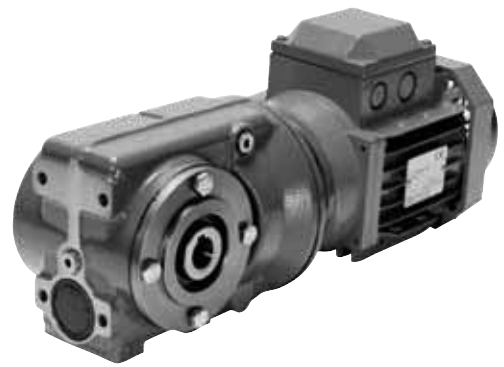
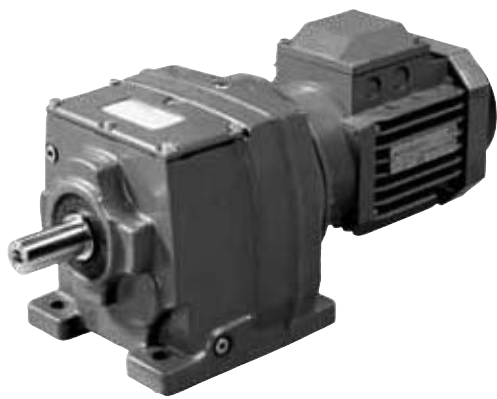


Series M. C. F. K - Geared Motors

Installation & Maintenance



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 C, F, K & M - 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

radicon 
with you at every turn

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1. General Information

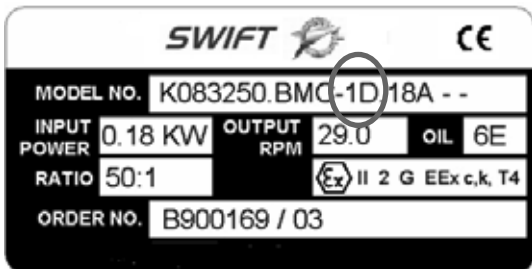
The following instructions will help you achieve a satisfactory installation of your gear unit, ensuring the best possible conditions for a long and trouble free operation.

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.

2. External Protection

All Series M C F & K 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

3.2 Gear Unit Rating

The power rating (kW) speed (rpm) and gear unit ratio are marked on the nameplate – Check that these details match the requirements of the machine prior to installation

3.3 Mounting Position

The mounting position can be determined from character 13 of the Model Number (Circled) See Appendix 4 for details. The gear unit must only be installed in the specified mounting position

3.4 Lubrication Grade


The lubrication grade is marked on the nameplate. See Appendix 4 for type and quantity of lubricant.

3.5 Group/Category/Temperature Class

Only units specifically selected for use in a potentially explosive atmosphere will be factory engraved with the Ex group, category and temperature class.

4. The Marking



Gear units with  marking are specifically selected for use as a component of an industrial system operating in a potentially explosive atmosphere

Provided the gear unit is correctly selected, Ex marked and installed in accordance with these instructions it will comply with the EU directive 94/9EC (ATEX 100a)

Units may be selected by our application engineers for use only in the following potentially explosive atmospheres:


Hazard Group II Cat 2 (zones 1 & 21) or Group II 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 both 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.

5. Installation

5.1 Safety Warning

<p>WARNING!</p> 	<p>The customer shall be responsible for the proper use of articles supplied by the company, particularly rotating shafts between the driving and driven members, and the provision of safety guarding.</p> <p>The company shall not be responsible for any injury or damage sustained as a result of the improper use of the articles supplied.</p> <p>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.</p>
---------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------



5.2. Prior to Installation

- 5.2.1. Check gear unit has not been damaged.
- 5.2.2. Check the gear unit / motor nameplate matches the requirements of the machine the unit is to be installed on.
- 5.2.3. Thoroughly clean the shaft and mounting surfaces that are to be used of 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

- 5.3.1. Ensure shaft extensions, bores & keys etc are cleaned.
- 5.3.2. The input or output shaft extension diameter tolerance is to ISO tolerance k6 (for shaft diameter ≤ 50mm) and m6 (for shaft diameter > 50mm) and the fitted components should be to ISO tolerance M7 (for bore diameter ≤ 50mm) and K7 (for bore diameter > 50mm).
- 5.3.3. Items (such as gears, sprockets, couplings etc) should not be hammered onto these shafts since this would damage the shaft support bearings.
- 5.3.4. 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.
- 5.3.5. Items being fitted may be heated to 80/100°C to aid assembly further.

Table 1

Shaft Diameter	Threaded Hole
13 - 16	M5 x 0.8p
17 - 21	M6 x 1.0p
22 - 24	M8 x 1.25p
25 - 30	M10 x 1.5p
31 - 38	M12 x 1.75p
39 - 50	M16 x 2.0p
51 - 85	M20 x 2.5p
86 - 130	M24 x 3.0p



5.4. Fitting the Motor

Follow these instructions only if the product is supplied without motor



- 5.4.1. Ensure motor bushing (if supplied) is correctly assembled into the gear unit plug-in shaft.
- 5.4.2. Fit the motor drive key or the special carbon fibre drive key (if supplied)
Note! The carbon fibre drive key may require shortening to suit certain motors.
- 5.4.3. Spray the plug-in bore with anti-fretting compound (Rocol DFMS or equivalent)
- 5.4.4. Slide the motor shaft fully into the plug-in bore (do not hammer)
- 5.4.5. Secure motor flange to the gear unit with the fastenings provided
- 5.4.6. Torque tighten the bolts to value specified in Section 5.5 -Table 2, (Note! Bolt torques for aluminium flanged motors should be 75% of the values listed in Table 2)



5.5. Foot Mounted or Flange Mounted Units

- 5.5.1. Ensure the base foundation / flange mounting surface is flat¹, vibration absorbing and torsionally rigid.
(¹ Maximum permissible flatness error for the mounting surface is 0.12mm)
- 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 1).

Note: It is important to ensure when aligning unit on a base plate that all machined mounting points are supported over their full area.

If steel packings are used, these should be placed either side of as close to the foundation bolt as possible.

During final bolting ensure the unit or base plate 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 the bolts to value specified in Table 2 except aluminium flange motors, Bolt torques for aluminium flanged motors should be 75% of the values listed below.

Note: Secure unit or base plate (if fitted) to a rigid foundation using heavy duty bolts to ISO grade 8.8 minimum.

Table 2

Bolt Size	Torque
M6	10 Nm
M8	25 Nm
M10	50 Nm
M12	85 Nm
M16	200 Nm
M20	350 Nm
M24	610 Nm
M30	1220 Nm
M36	2150 Nm

- 5.5.4. Recommended fasteners for securing base mounted units (ISO Grade 8.8).

Table 3

M01	M8 x 25L	K03	M10 x 25L	C03	M8 x 20L
M02	M8 x 30L	K04	M10 x 30L	C04	M10 x 30L
M03	M8 x 30L	K05	M12 x 35L	C05	M10 x 30L
M04	M12 x 40L	K06	M12 x 40L	C06	M12 x 40L
M05	M12 x 40L	K07	M16 x 50L	C07	M16 x 50L
M06	M12 x 40L	K08	M20 x 60L	C08	M20 x 65L
M07	M16 x 45L	K09	M24 x 70L	C09	M24 x 75L
M08	M16 x 60L	K10	M30 x 80L	C10	M24 x 80L
M09	M20 x 70L	K12	M36 x 100L		
M10	M24 x 80L				
M13	M30 x 90L				
M14	M36 x 100L				



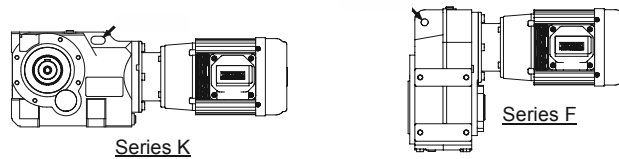
5.6. Installing Shaft mounted units

- 5.6.1. The gear unit must be installed in the specified mounting position.
- 5.6.2. Assembly of gear unit on to the machine shaft:
There three assembly methods dependant on the gear unit type:
 - Standard straight bore with keyway. See Appendix 2A.
 - Unit fitted with KIBO® bushes. See Appendix 2B.
 - Unit fitted with shrink disc. See Appendix 2C.
- 5.6.3. Anchor gear unit to a secure point on the structure by means of a torque arm. (See Appendix 2D).

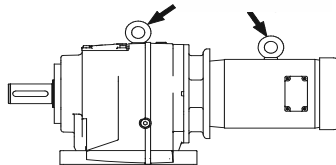


5.7. Lifting

- 5.7.1. Use only the lifting points provided.
- 5.7.2. Series F & K units have a lifting hole in the gear housing as indicated with the arrow.



- 5.7.3. Larger Series M & C units are supplied with a lifting eye.



- 5.7.4. If the motor is supplied with a lifting eye, the lifting point on the motor as well as the lifting point on the gear unit should be used.



5.8. Special Instructions for units to be used in a potentially explosive atmosphere

- 5.8.1. If the unit has been damaged in transit do not use. (Remove all transport fixtures and packings prior to start up)
- 5.8.2. Check nameplate of unit corresponds with the sites potentially explosive atmosphere classification.
- 5.8.3. Check ambient temperature falls within lubricant grade recommendations. (See Approved Lubricants in Appendix 4)
- 5.8.4. Make sure no potentially explosive atmosphere exists during installation.
- 5.8.5. Make sure that gear unit is sufficiently ventilated with no external heat input – cooling air temperature should not exceed 40°C
- 5.8.6. Ensure mounting position corresponds to that marked on the nameplate. (Note! ATEX approval is only valid for the mounting position specified on the nameplate)
- 5.8.7. Check motors, couplings or any other equipment to be fitted to the gear unit has ATEX approval. Check information listed on the nameplates correspond to the environmental conditions of the site.
- 5.8.8. Ensure gearbox is not subjected to any loading greater than those marked on the nameplate.
- 5.8.9. **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.
- 5.8.10. **For belt driven units**, check all belts fitted are of sufficient electrical leakage resistance. (< 109 Ω).
- 5.8.11. Ensure the gear unit and other equipment fitted is electrically grounded (Earthed).
- 5.8.12. Check and adjust safety guards and covers so that there is no ignition source from sparks that may be thrown by moving parts making contact with guards etc.
- 5.8.13. Ensure safety guards and covers etc... are designed dust tight or designed to prevent a build up of dust deposits from forming when the unit is used in Zone 21 or Zone 22 classification areas.



6. Lubrication

6.1. General

- 6.1.1. Series M F & K size 7 and below will be supplied factory filled with a quantity of EP mineral oil (Grade 6E) appropriate to the intended mounting position. However if, as requested, the gear unit is supplied without lubricant then the oil quantity required is obtained from Appendix 4.
- 6.1.2. Series M F & K size 8 and larger are supplied without lubricant (unless factory filled by request). Recommended lubricants are listed in our Approved Lubricants pages in Appendix 4.
- 6.1.3. Series C size 6 and below are supplied factory filled with synthetic lubricant (Grade 6G).
- 6.1.4. Series C Size 7 and larger are supplied without lubricant (unless factory filled by request). Recommended lubricants are listed in our Approved Lubricants pages in Appendix 4.

Temperature Limitations

The standard lubricant is suitable for operation in ambient temperatures of 0° to 35°C.
For use outside of these temperatures consult Table L1 (below) or consult our application engineers.

Table L1

-5°C to 20°C (5E) -30°C to 20°C (5G & 5H)	0°C to 35°C	20°C to 50°C
5E ISO CLP(CC) VG 220	6E ISO CLP(CC) VG 320	7E ISO CLP(CC) VG 460
5H ISO CLP(HC) VG 220	5H ISO CLP(HC) VG 220	6H ISO CLP(HC) VG 320
5G ISO CLP(PG) VG 220	6G ISO CLP(PG) VG 320	7G ISO CLP(PG) VG 460

Note! The recommended lubricant for Series **F K & M** is Grade **6E** [CLP(CC)VG320]
The recommended lubricant for Series **C** is Grade **6G** [CLP(PG)VG320]

6.2. Ventilator

- 6.2.1. Clean & secure the ventilator (if supplied) in the correct location for the required mounting position. (See Appendix 4)

6.3. Oil Level:



Units supplied without oil:

- 6.3.1. Fill gear unit with correct type of lubricant until oil escapes from level plug. See Appendix 4

Factory filled units:

- 6.3.2. If the unit is fitted with a level plug, (See Appendix 4) check oil level and top up with correct oil type as necessary.

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

- 6.3.3. Re-fit 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.

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.

Motor terminal connection:

- 7.2. The motor should be wired in accordance with the manufacturers instructions. (General circuit diagrams for 'Own Brand' motors are shown in Appendix 3)
- 7.3. If an alternative brand motor is supplied, it should always be wired in accordance with the manufacturers instructions.

8. Starting Up

8.1. Prior to starting up



- 8.1.1. Ensure the ventilator is fitted (if supplied) see lubrication section 6.2

- 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) suggest a malfunction, inform maintenance personnel immediately.

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

9. Operation

9.1. Noise



The range of product satisfies a noise (sound pressure level) of 85dB(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).

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. Gear units for use in a potentially explosive atmosphere



After 3 hours of operation check the gear unit surface temperature. This temperature should not exceed 110°C. If temperature exceeds this limit, shut down immediately and contact our application engineers.

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. Remove ventilator plug prior to removing level and/or drain plug. Warning do not stand over ventilator plug whilst removing as pressure build up behind the valved ventilator may cause it to eject when removed.
- 10.2.3. 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).
- 10.2.4. Top ups or refills should be done through the ventilator position.
- 10.2.5. Remember to refit all plugs and torque tighten to table M1 below.
- 10.2.6. Clean away any oil spillage.



Table M1

Plug	Torque
M10	12Nm
M12	20Nm
M14	26Nm
M16	34Nm
M22	65Nm



10.3. Lubrication

- 10.3.1. Periodic inspection.

For units fitted with level plug 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.

Smaller size units (without ventilator) are supplied factory filled and lubricated for life except for the following conditions:



- Mineral oil filled units operating at over 70°C surface temperature should be drained and refilled with the correct quantity of oil after 3 years operation.
- All units that are required to work in potentially explosive atmospheres (Group II category 2 zones 1 & 21 or category 3 zones 2 & 22) should be drained and refilled with correct quantity of lubricant in accordance with the schedule as listed in Table M2 - See Appendix 4 for correct oil quantity.

All larger size units (supplied with ventilator) should be drained and refilled with correct quantity of lubricant in accordance with the Tables M2 - See Appendix 4 for correct oil quantity.



Warning.

Do not mix Synthetic and Mineral lubricants.
Do not overfill the unit as this can cause leakage and overheating.



Oil Change Period: Series F K & M

UNIT OPERATING TEMPERATURE °C	RENEWAL PERIOD	
	MINERAL OIL	SYNTHETIC OIL
<75°C	17000 HOURS OR 3 YEARS	26000 HOURS OR 3 YEARS
80°C	12000 HOURS OR 3 YEARS	26000 HOURS OR 3 YEARS
85°C	8500 HOURS OR 3 YEARS	21000 HOURS OR 3 YEARS
90°C	6000 HOURS OR 2 YEARS	15000 HOURS OR 3 YEARS
95°C	4200 HOURS OR 17 MONTHS	10500 HOURS OR 3 YEARS
100°C	3000 HOURS OR 12 MONTHS	7500 HOURS OR 2 1/2 YEARS
105°C	2100 HOURS OR 8 MONTHS	6200 HOURS OR 2 YEARS
110°C	1500 HOURS OR 6 MONTHS	2100 HOURS OR 18 MONTHS

Oil Change Period: Series C

UNIT OPERATING TEMPERATURE °C	RENEWAL PERIOD	
	MINERAL OIL	SYNTHETIC OIL
<65°C	17000 HOURS OR 3 YEARS	26000 HOURS OR 3 YEARS
70°C	12000 HOURS OR 3 YEARS	26000 HOURS OR 3 YEARS
75°C	8500 HOURS OR 3 YEARS	22000 HOURS OR 3 YEARS
80°C	6000 HOURS OR 2 YEARS	15000 HOURS OR 3 YEARS
85°C	4200 HOURS OR 17 MONTHS	10500 HOURS OR 3 YEARS
90°C	3000 HOURS OR 12 MONTHS	7500 HOURS OR 2 1/2 YEARS
95°C	2100 HOURS OR 8 MONTHS	6000 HOURS OR 2 YEARS
100°C	1500 HOURS OR 6 MONTHS	4500 HOURS OR 18 MONTHS

NB: INITIAL FILL OF OIL SHOULD BE CHANGED IN A NEW GEAR UNIT AFTER 1000 HOURS OPERATION OR ONE YEAR WHICHEVER IS THE SOONEST



10.4. Bearings

- 10.4.1 For  marked units bearings should be checked after 5 years operation, and replaced (if necessary)

10.5. Grease Lubrication

- 10.5.1. Where re-greasing points are provided add 2 shots monthly of NLGI 2 grade grease. See appendix 4 for details of approved grease.



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 any dust build up does not exceed 5mm (maximum)

10.7. Motor Replacement



- 10.7.1. Isolate and secure the driven machine, and disconnect the motor power supply

- 10.7.2. Remove the motor flange fastenings

- 10.7.3. Carefully slide the motor away from the gear unit (do not hammer)

- 10.7.4. Clean the gear unit plug-in bore and the flange surface

- 10.7.5. Check the replacement motor is the of correct frame size and power rating for the gear unit, and re-fit the motor as described in Section 5.4



- 10.7.6. Re-connect motor power supply – See Section 7

Connection of the electric motor to the mains supply should be made by a qualified person.

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 the gearing	a) Check oil (See Inspection and Maintenance) b) Contact our Application Engineers
Unusual, irregular running noise	Foreign matter present in the oil	a) Check oil (See Inspection and Maintenance) b) Stop the unit, Contact our Application Engineers
Oil leaking ¹ • from the gear unit cover • from the motor flange • from the gear unit flange • from the output end oilseal	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 oil still leaks contact our Application Engineers b) Contact our Application Engineers c) Vent the gear unit (see Appendix 4 - Mounting positions)
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 section) b) Fit the ventilator in the correct position (see Appendix 4 - Mounting positions) 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)

When contacting our sales office

Please have the following information available:

- Nameplate data (complete)
- Type and extent of the problem encountered
- The time and the circumstances the problem occurred
- A possible cause

Any further information or clarification required may be obtained by contacting our sales office, please see contact details at the back of this booklet.

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.

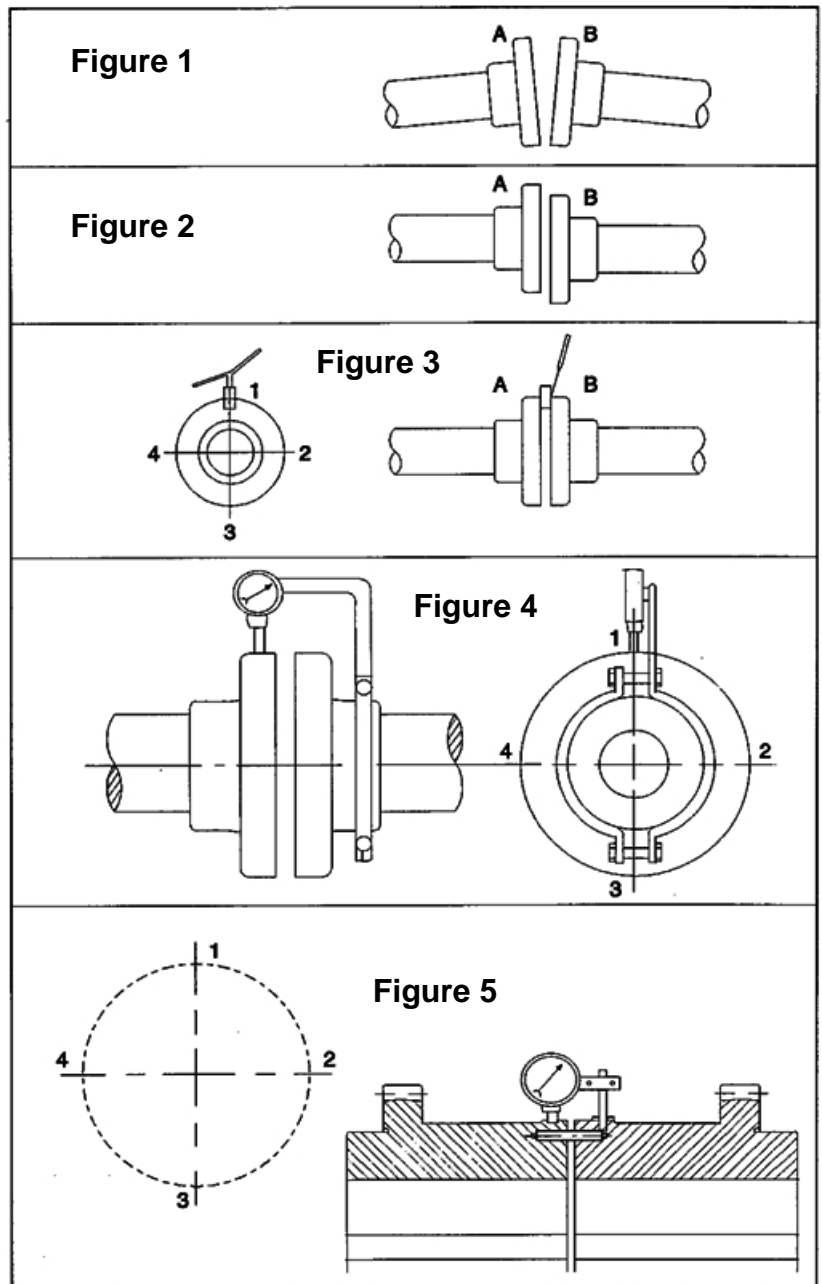
Errors of Angularity.

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 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 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.

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 appropriate 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 11.

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.

Type of Coupling	Unit Size	Allowable Eccentricity (mm)
Rigid	SIZE 08 & UNDER	0.025
	SIZE 09 & OVER	0.035
All other types	Please see appropriate installation and maintenance manual for coupling type fitted	

SPECIAL NOTE CONCERNING RIGID COUPLINGS

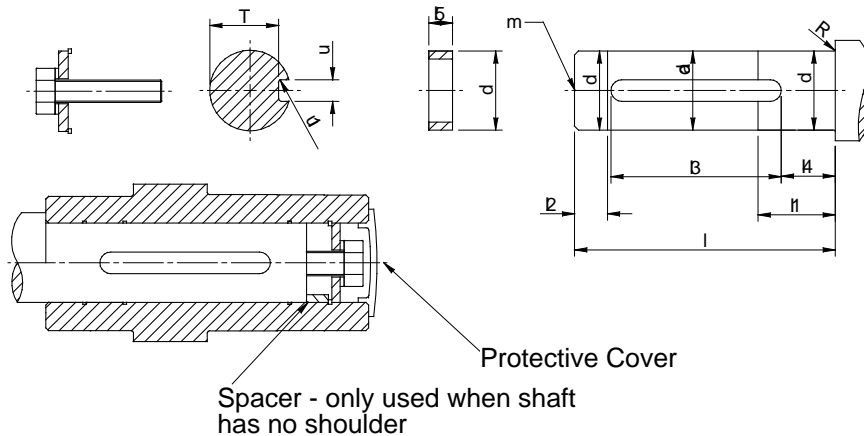
In lining up elements involving rigid couplings it is important that no attempt is made to correct errors of alignment or eccentricity greater than those above by tightening of the coupling bolts (This applies when the system is cold or at operating temperature). The result is miss-alignment and the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

We produce standard flexible couplings to cover the complete range of gear units, please contact Application Engineering for details.

Shaft Mounted Units - Standard Bore/Shaft Assembly

Customers Shaft Details



UNIT	Bore	d	da	l	l1	l2	l3	l4	l5	m	R	T	u	u1
C03	Std	19.993/ 19.980	19.6	82	30	10	613 61.0	3	22	M6 x 1.0 16 deep	0.8R	16.5 16.4	6.000/ 5.970	0.16 0.25R
C04	Reduced	29.993/ 29.980	24.6	99	38	13	79.3 79.0	3	23	M10 x 1.5 22 deep	0.8R	21.0 20.8	8.000/ 7.964	0.16 0.25R
	Std	29.993/ 29.980	29.6	99	45	15	79.3 79.0	3	26	M10 x 1.5 22 deep	0.8R	26.0 25.8	8.000/ 7.964	0.16 0.25R
C05	Reduced	29.993/ 29.980	29.6	104	45	15	79.3 79.0	3	23	M10 x 1.5 22 deep	0.8R	26.0 25.8	8.000/ 7.964	0.16 0.25R
	Std	34.991/ 34.975	34.6	104	53	18	77.3 77.0	3	23	M12 x 1.75 22 deep	0.8R	30.0 29.8	10.000/ 9.964	0.16 0.25R
C06	Reduced	39.991/ 39.975	39.6	125	60	20	100.5 100.0	3	31	M16 x 2 36 deep	0.8R	35.0 34.8	12.000/ 11.957	0.4 0.25R
	Std	44.991/ 44.975	44.6	125	68	23	101.5 101.0	3	31	M16 x 2 36 deep	0.8R	39.5 39.3	14.000/ 13.957	0.4 0.25R
C07	Reduced	49.991/ 49.975	49.6	153	75	25	130.5 130.0	3	35	M16 x 2 38 deep	1.2R	44.5 44.3	14.000/ 13.957	0.4 0.25R
	Std	59.990/ 59.971	59.6	153	90	30	148.5 148.0	3	38	M20 x 2.5 42 deep	1.2R	53.0 52.8	18.000/ 17.957	0.4 0.25R
C08	Reduced	59.990/ 59.971	59.6	183	91	31	148.5 148.0	3	37	M20 x 2.5 42 deep	1.2R	53.0 52.8	18.000/ 17.957	0.4 0.25R
	Std	69.990/ 69.971	69.6	183	105	35	177.5 177.0	3	37	M20 x 2.5 42 deep	1.2R	62.5 62.3	20.000/ 19.948	0.6 0.4R
C09	Reduced	69.990/ 69.971	69.6	227	105	35	177.5 177.0	3	58	M20 x 2.5 42 deep	1.2R	62.5 62.3	20.000/ 19.948	0.6 0.4R
	Std	89.988/ 89.966	76.6	227	135	45	221.5 221.0	3	58	M24 x 3.0 50 deep	1.2R	81.0 80.8	25.000/ 24.948	0.6 0.4R
C10	Reduced	79.990/ 79.971	79.6	260	120	40	225.5 225.0	3	53	M20 x 2.5 42 deep	1.2R	71.0 70.8	22.000/ 21.946	0.6 0.4R
	Std	99.988/ 99.966	99.6	327	150	45	238.5 238.0	10	46	M24 x 3.0 50 deep	0.8R	90.0 89.8	28.000/ 27.948	0.6 0.4R
F02	-	24.9931/ 24.980	24.6	82	40	13	70.3 70.0	3	23	M10 x 1.5 22 deep	0.8R	21.0 20.8	8.000/ 7.964	0.16 0.25R
F03 & K03	-	29.993/ 29.980	29.6	82	45	15	70.3 70.0	3	23	M10 x 1.5 22 deep	0.8R	26.0 25.8	8.000/ 7.964	0.16 0.25R
F04 & K04	-	34.991/ 34.975	34.6	109	60	20	90.5 90.0	3	23	M12 x 1.75 28 deep	0.8R	30.0 29.8	10.000/ 9.964	0.16 0.25R
F05 & K05	-	39.991/ 39.975	39.6	112	60	20	92.5 92.0	3	30	M16 x 2 36 deep	0.8R	35.0 34.8	12.000/ 11.957	0.4 0.25R
F06 & K06	-	39.991/ 39.975	39.6	126	75	25	100.5 100.0	3	30	M16 x 2 36 deep	0.8R	35.0 34.8	12.000/ 11.957	0.4 0.25R
F07 & K07	-	44.991/ 44.975	49.6	153	75	25	101.5 101.0	3	30	M16 x 2 36 deep	0.8R	44.5 44.3	14.000/ 13.957	0.4 0.25R
F08 & K08	-	59.990/ 59.971	59.6	173	90	30	148.5 148.0	3	37	M20 x 2.5 42 deep	0.8R	53.0 52.8	18.000/ 17.957	0.4 0.25R
F09 & K09	-	69.990/ 69.971	69.6	232	105	35	161.5 161.0	3	38	M20 x 2.5 42 deep	0.8R	62.5 62.3	20.000/ 19.948	0.6 0.4R
F10 & K10	-	79.990/ 79.971	79.6	275	120	40	188.5 188.0	5	37	M20 x 2.5 42 deep	0.8R	71.0 70.8	22.000/ 21.946	0.6 0.4R
F11	-	89.988/ 89.966	89.9	265	60	55	206.5 206.0	42	-	M24 x 3.0 50 deep	0.8R	81.0/ 80.8	25.000/ 24.948	0.6 0.4R
F12	-	99.988/ 99.966	99.6	329	59	60	228.5 228.0	50	-	M24 x 3.0 50 deep	0.8R	90.0 89.8	28.000/ 27.948	0.6 4R
K12	-	99.988/ 99.966	99.6	327	150	45	238.5 238.0	10	46	M24 x 3.0 50 deep	0.8R	90.0 89.8	28.000/ 27.948	0.6 0.4R

See next page for shaft assembly instructions.

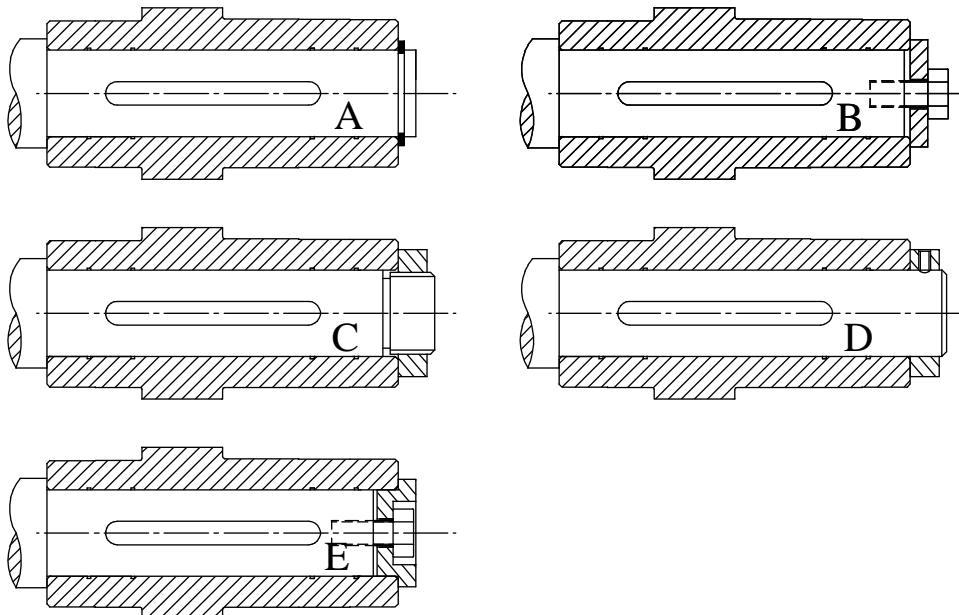
Standard Bore/Shaft Assembly Instructions



1. Spray the hollow shaft bore and mating diameter of output shaft with an anti-fret compound.
2. Fit the shaft to hollow bore location key in position in the output shaft.
3. Fit the circlip into the output sleeve. (Units F11 and F12 can not be secured in this way, it is recommended to use the alternative fixing method type B as shown below)
4. Fit the output shaft into the output sleeve. Remember to fit a spacer tube (not supplied) if the output shaft has no shoulder. (see dimension table for details)
5. Secure in place with the washer and bolt, Torque tighten the bolt to the values stated in the table below.
6. Fit the protective cover over the open end of the output sleeve.

Bolt	Torque
M10	15
M12	20
M16	45
M20	85
M24	200

Alternative shaft fixing methods shown below may be considered



A - Retained with a Circlip

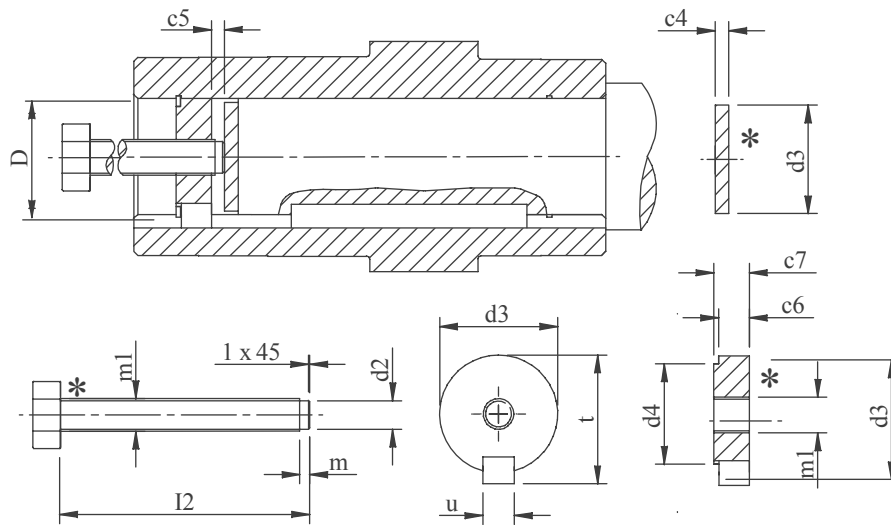
B – Retained with a Plate and Bolt

C – Retained with a Locknut

D – Retained with a Collar and Grub screw

E – Retained with a Plate and Bolt

Standard Bore/Shaft Disassembly.



*Parts supplied by customer

UNIT	Bore	c4	c6	c7	D (H7)	d2	d3	d4	l2	m	m1	t	u
C03	Std	5	10	12	20	7	19.9	11.2	120	3	M10 x 1.5	22	6
C04	Reduced	5	15	17	25	13	24.9	16.2	23	3	M16 x 2	28	8
	Std	5	15	17	30	13	29.9	20.8	160	3	M16 x 2	33	8
C05	Reduced	5	15	17	30	13	29.9	20.8	260	3	M16 x 2	33	8
	Std	5	15	17	35	13	34.9	25.2	160	3	M16 x 2	38	10
C06	Reduced	5	20	23	40	20	39.9	30.9	220	3	M24 x 3	43	12
	Std	5	20	23	45	20	44.9	34.1	220	3	M24 x 3	49	14
C07	Reduced	5	20	23	50	20	49.9	39	220	3	M24 x 3	54	14
	Std	8	24	27	60	26	59.9	47.4	250	5	M30 x 3.5	64	18
C08	Reduced	8	24	27	60	26	59.9	47.4	250	5	M30 x 3.5	64	18
	Std	8	24	27	70	26	69.9	58.4	310	5	M30 x 3.5	74.5	20
C09	Reduced	8	24	27	70	26	69.9	58.4	310	5	M30 x 3.5	74.5	20
	Std	8	24	27	90	26	89.9	75.3	360	5	M30 x 3.5	95	25
C10	Reduced	8	24	27	80	26	79.9	65.5	360	5	M30 x 3.5	85	22
	Std	8	30	34	100	32	99.9	84.1	420	5	M36 x 4	106	28
F02	-	5	15	17	25	10	24.9	16	120	3	M12 x 17.5	28	8
F03 & K03	-	5	15	17	30	13	29.9	20.8	130	3	M16 x 2	33	8
F04 & K04	-	5	15	17	35	13	34.9	25.2	160	3	M16 x 2	38	10
F05 & K05	-	5	20	23	40	20	39.9	29.9	190	3	M24 x 3	43	12
F06 & K06	-	5	20	23	40	20	39.9	29.9	190	3	M24 x 3	43	12
F07 & K07	-	5	20	23	50	20	49.9	39	220	3	M24 x 3	53.5	14
F08 & K08	-	8	24	27	60	26	59.9	47.4	250	5	M30 x 3.5	64	18
F09 & K09	-	8	24	27	70	26	69.9	56.4	310	5	M30 x 3.5	74.5	20
F10 & K10	-	8	24	27	80	26	79.9	65.5	360	5	M30 x 3.5	95	25
K12	-	8	30	34	100	32	99.9	84.1	420	5	M36 x 4	116	28

Disassembly Procedure

1. Remove locating bolt, retaining plate and circlip
2. Place plate on shaft end to protect the shaft screw thread
3. Assemble disassembly tooling as shown in diagram above
4. Turn screw to apply pressure to shaft end.

Series F - With Kibo Bushes.

The Series F Kibo Bush option requires a gear unit with a Kibo type tapered output bore, together with a Kibo bushing kit comprising of: bushes (2), locking nuts (2), end plate, fastening bolt, shaft key and protective cover.

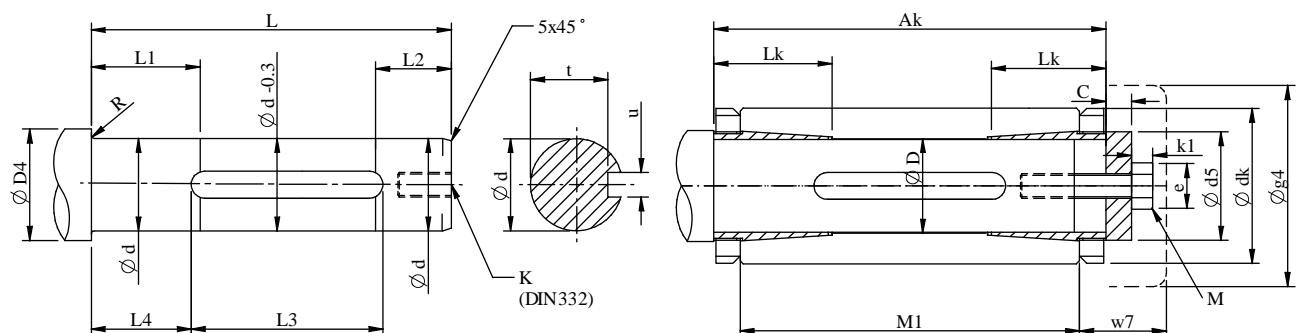
Assembly



1. Assemble the inner bushing and locknut onto the machine shaft. The inner bushing must be mounted against a shoulder or retaining circlip, the shoulder diameter should not exceed inside diameter of nut.
2. Fully back off the inner locknut.
3. Fit the key into the shaft keyway.
3. Assemble the gear unit onto the inner bushing and shaft.
4. Assemble the outer bushing into the gear unit bore, fit locknut and finger tighten until it makes contact with the gear unit shaft
5. Mount the end plate and fixing bolt, tighten the bolt to the correct torque, the inner bushing is now locked
6. Loosen off the fixing bolt, so the outer bushing is loose, back off the outer locknut.
7. Re-tighten the fixing bolt to the correct torque, the outer bushing is now locked.
8. Finger tighten both the locknuts against the gear unit shaft, the mounting is now complete.
9. Fit the protective cover.

Disassembly

- A. Remove the protective cover, fixing bolt and end plate
- B. Tighten the outer locknut with an adequate tool to withdraw the bushing from the gear unit shaft.
- C. Remove the gear unit from the shaft.



See table on next page for dimensions

NOTE: If reducer is to be used in a corrosive environment, machine shaft bushings and nuts should be oiled or greased. Do NOT use Molybdenum Disulfide based oil or grease.

Series F - Kibo Bushes

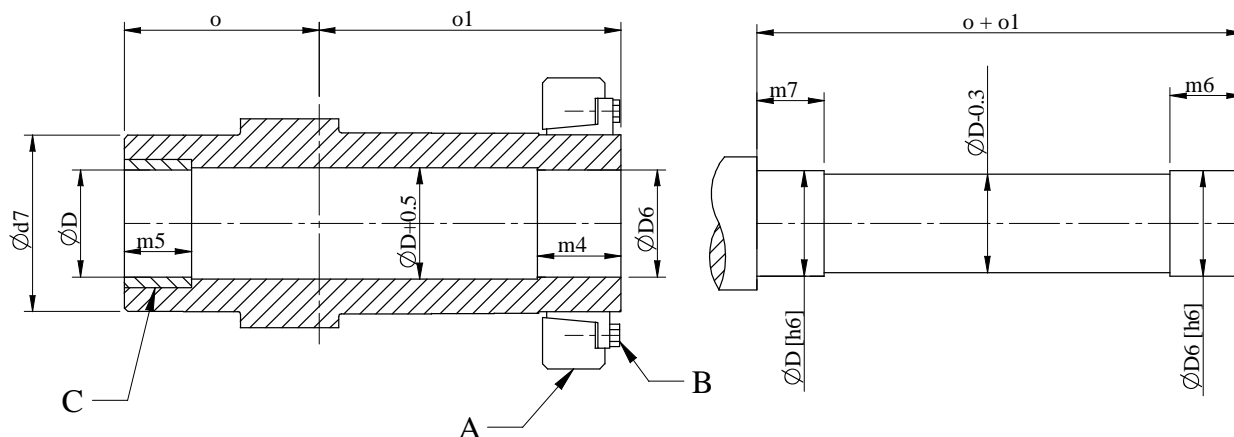
Dimensions (mm)

Unit Size	Customers Shaft												End Plate						Cover											
	d (h8)	d4		K Din(332)	L	L1	L2	L3	L4	r (max)	t	u (N9)	fk	m1	Ak	Lk	d5	C	d4			Tightening Torque Nm	g4	w7						
		min	max																M	e	k1									
F04	35	40		M12x28	175	40	36	60	60	1.2	30	10	65	180	40	45	10		M12	22	8	56	81	34						
	30	35	42	M10x22																					21	8	7	40	M10	20
	25	30																												
F05	40	45		M16x36	198	50	42	77	65	1.2	35	12	75	207	50	55	12		M16	28	10	124	85	43						
	35	40	51	M12x28																					26	8	8	70	M12	22
	30	35		M10x22																										
F06	40	45		M16x36	225	50	45	77	78	1.2	35	12	75	233	50	55	12		M16	28	10	124	85	43						
	35	40	51	M12x28																					26	8	8	70	M12	22
	30	35		M10x22																										
F07	50	55		M16x36	258	58	52	79	93	1.2	44.5	14	80	265	58	65	14		M16	28	10	154	122	43						
	45	50	61																						39.5	14	12	234	65	14
	40	45																												
F08	60	66		M20x42	293	61	52	108	97.5	1.6	53	18	98	303	61	75	16		M20	35	13	240	147	47						
	55	61	71																						44.5	14	16	270	61	16
	50	56		M16x36																										
F09	70	76		M20x42	340	70	50	131	75	1.6	62.5	20	110	369	67.5	85	20		M20	35	13	290	192	90						
	65	71	81																						58	18	18	330	67.5	20
	60	66																												
F10	80	89		M20x42	390	70	60	163	104	1.6	71	22	130	414	53	100	24		M20	35	13	274	242	90						
	75	84	96																						67.5	20	20	370	414	13
	70	79																												
F11	90	99		M24x50	368	70	73	181	110	2	81	25	140	390	57	105	26		M24	42	15	308								
	85	94	101																						76	22	22	140	390	15
	80	89																												
F12	100	109		M24x50	428	80	83	200	111	2.5	90	28	155	450	83	130	7		M24	42	15	451								
	95	104	116																						86	25	25	155	450	15
	90	99																												

Series K - With Shrink Disc

The Shrink Disc option requires a gear unit with a Shrink Disc type output bore, together with a Shrink Disc (A) locking device.

The Shrink Disc is a friction device (without keys) which exerts an external clamping force on the hollow gearbox shaft resulting in a mechanical shrink fit of the gear unit and driven shaft.



Dimensions(mm)

SIZE	D	D6	d7	m4	m5	m6	m7	o	o1	Torque Ta (Nm)
K03	30	30	50	31	20	36	25	60	86	29
K04	35	35	55	32	20	37	25	75	102	29
K05	40	40	60	36	20	41	25	83	112	29
K06	40	40	70	38	20	43	25	90	118	29
K07	50	50	80	36	30	41	35	105	136	35
K08	65	65	90	41	40	46	45	120	161	58
K09	75	75	100	55	40	60	55	150	195	58
K10	95	95	120	65	60	70	65	175	230	100
K12	105	105	140	85	60	90	75	205	280	160

Assembly



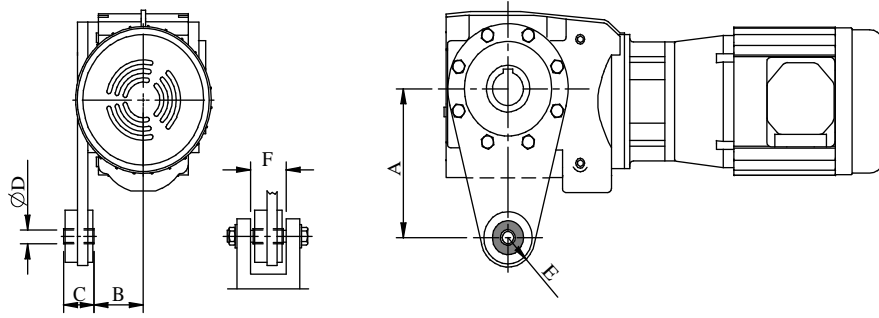
- Clean and degrease the locating diameters of the gear unit hollow shaft bore, the driven shaft and the shrink disk locating surfaces
- Ensure the Anti-fret yellow metal bush(C) is correctly inserted in the non driving end of the gear unit hollow shaft
- Draw the gear unit onto the driven shaft.
- Check and re-apply if necessary molykote 321R (or similar) to the tapered surfaces of the Shrink Disc inner ring and locking collar.
- Fit the Shrink Disc inner ring and collar into position on the shaft, fit and tighten all the locking screws gradually in succession, do **not** tighten in a diametrically opposite sequence. This tightening sequence will require several passes until all the screws are tightened to the torque specified in the table above.
- Fit the protective cover.

Disassembly similar to the reverse of the assembly procedure.

- Remove any rust and dirt from the assembly
- Loosen off the locking screws in succession but do not completely remove.
- Remove the shrink disk and withdraw the gear unit from the driven shaft.

NOTE: If the Shrink Disc is to be re-used it should be dismantled and cleaned thoroughly and Molykote 321R (or similar) applied to the tapered surfaces of the inner ring and collar

Series C Torque Bracket

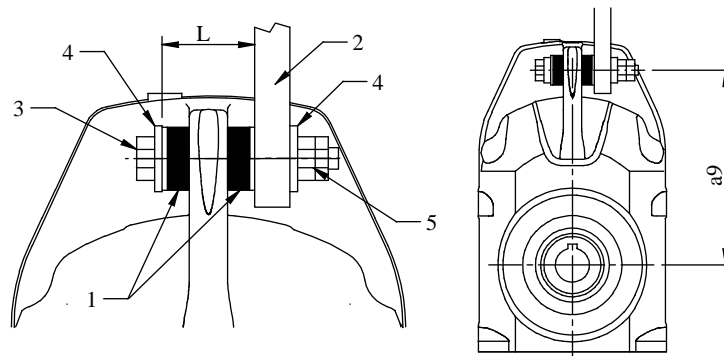


1. It is recommended that the torque bracket is positioned on the side of the gear unit adjacent to the driven machine.
2. The torque bracket requires a clevis type anchoring as shown above (not supplied)
3. The clevis position should be carefully adjusted at assembly so that it does not exert any external radial or axial pressure on the torque bracket

Torque Bracket Dimensions mm

Unit	A	B	C	D	E	F (min)
C03	110	47	36	10.4	23	41
C04	130	52	36	10.4	23	41
C05	160	52	36	10.4	23	41
C06	200	72	44	16.4	43	49
C07	250	78	60	16.4	43	65
C08	310	86	60	16.4	45	65
C09	380	98	80	25	50	85
C10	430	137	80	25	50	85

Series F Torque Buffers



1. Torque arm components consist of a pair of rubber buffers (1) the customer must supply other components.
2. The gear unit should be anchored to a plate (2) using a bolt (3), washers (4), nut and locknut (5) as shown above.
3. Tighten bolt (3) to compress rubber bushes (1) to achieve dimension 'L' (listed in table below) secure with locknut.

Unit	L	Bolt (3)	a9
F02	52	M12	140
F03			158
F04			170

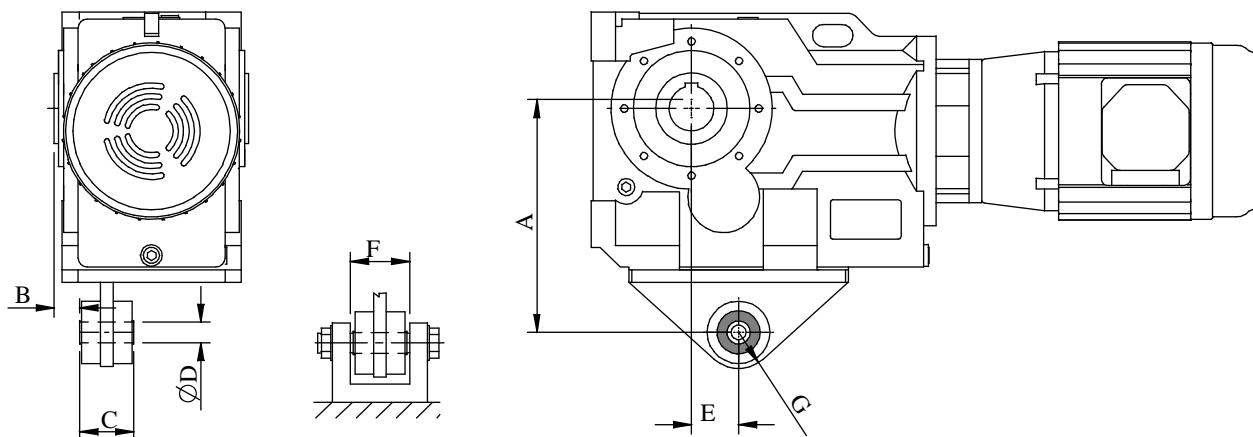
Unit	L	Bolt (3)	a9
F05	52	M12	198
F06			218
F07	80	M20	278

Unit	L	Bolt (3)	a9
F08	84	M20	346
F09	110	M24	395
F10	112		485

Unit	L	Bolt (3)	a9
F11	116	M24	485
F12	146	M30	550
-	-	-	-

Dimensions(mm)

Series K Torque Bracket



1. It is recommended that the torque bracket is positioned on the side of the gear unit adjacent to the driven machine.
2. The torque bracket requires a clevis type anchoring as shown above (not supplied)
3. The clevis position should be carefully adjusted at assembly so that it does not exert any external radial or axial pressure on the torque bracket

Torque Bracket Dimensions mm

Unit	A	B	C	D	E	F (min)	G
K03	140	20	36	10.4	23.5	41	23
K04	160	20	36	10.4	30	41	23
K05	192	18	60	16.4	40	65	38
K06	200	25	60	16.4	45	65	38
K07	250	25	60	16.4	52.5	65	38
K08	300	30	80	25	60	85	45
K09	350	40	100	25	70	105	45
K10	450	45	100	25	74	105	45
K12	550	10	126	38	60	131	63

Three Phase Induction Motor Installation.

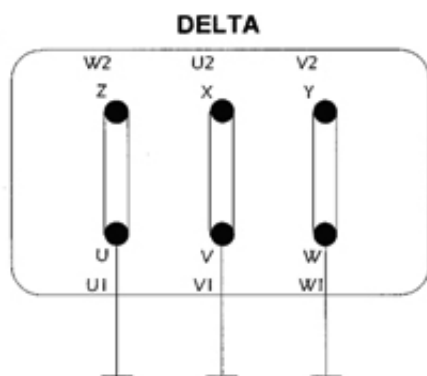
Connection to Mains Power Supply.



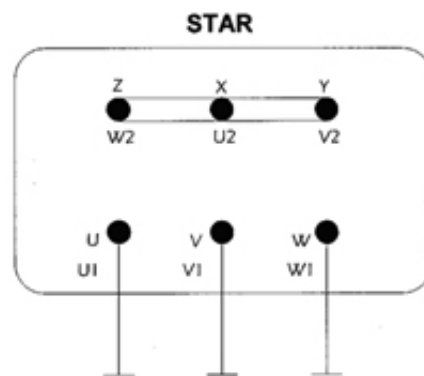
- Connection of the electric motor to the mains supply should be done by a qualified person.
- Connect motor terminals in accordance with the diagram inside the terminal box cover. (Also identified in the diagram below - this instruction only applies to our own brand plated motors)
- Motors fitted by the customer or requested by the customer from a different manufacturer will have separate documentation provided with it.

Note: It is important that the mains supply details are checked against the motor 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.



0.12 Kw - 2.2 Kw	220 / 240 v, 50Hz
	230 / 280 V, 60 Hz
≥3 Kw	380 / 420 V, 50 Hz
	440 / 480 V, 60 Hz



0.12 Kw - 2.2 Kw	380 / 420 v, 50Hz
	440 / 480 V, 60 Hz
≥3 Kw	380 / 420 V, 50 Hz

Approved Lubrication.

Type E Mineral oil containing industrial EP additives. These have a high load carrying capacity.

SUPPLIER	LUBRICANT RANGE	GRADE NUMBERS		
		5E	6E	7E
		AMBIENT TEMPERATURE RANGE °C		
		-5 to 20	0 to 35	20 to 50
Batoyle Freedom	Remus	220 (-2)	320 (-2)	460 (-2)
Boxer Services / Millers Oils	Indus	220 (-10)	320 (-10)	460 (-10)
BP Oil International Limited	Energol GR-XF	220 (-16)	320 (-13)	460 (-1)
	Energol GR-XP	220 (-15)	320 (-10)	460 (-7)
Caltex	Meropa	220 (-4)	320 (-4)	460 (-4)
	RPM Borate EP Lubricant	220 (-7)	320 (-4)	460 (-7)
Carl Bechem GmbH	Berugear GS BM	220 (-20)	320 (-13)	460 (-10)
	Staroil G	220 (-13)	320 (-13)	460 (-10)
Castrol International	Alpha Max	220 (-19)	320 (-13)	460 (-10)
	Alpha SP	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	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	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	220 (-19)	320 (-13)	460 (-7)
Omega Manufacturing Division	Omega 690		85w/140 (-15)	
Optimal Ölwerke GmbH	Optigear BM	220 (-11)	320 (-10)	460 (-7)
	Optigear	220 (-18)	320 (-9)	460 (-7)
Pertamina (Indonesia)	Masri	220 (-4)	320 (-4)	460 (-7)
Petro-Canada	Ultima EP	220 (-22)	320 (-16)	460 (-10)
Rocol	Sapphire Hi-Torque	220 (-13)	320 (-13)	460 (-13)
Sasol Oil (Pty) Limited	Cobalt	220 (-4)	320 (-1)	460 (-4)
	Hemat	220 (-10)	320 (-7)	460 (-4)
Saudi Arabian Lubr. Oil Co.	Gear Lube EP	EP220 (-1)	EP320 (0)	EP460 (0)
Shell Oils	Omala	220 (-4)	320 (-4)	460 (-4)
	Omala F	220 (-13)	320 (-10)	460 (-4)
Texaco Limited	Meropa	220 (-16)	320 (-16)	460 (-10)
	Meropa WM	220 (-19)	320 (-16)	460 (-11)
Total	Carter EP	220 (-21)	320 (-15)	460 (-12)
	Carter XEP	220 (-24)	320 (-18)	460 (-13)
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.

Approved Lubrication – Series C

Type G Polyglycol based synthetic lubricants with Anti-Wear or EP additives.

SUPPLIER	LUBRICANT TYPE	5G	6G	7G	8G	9G
Boxer Services / Millers Oils	Boxergear W	220 (-31)	320 (-31)	460 (-28)		
BP Oil International Limited	Enersyn SG-XP	220 (-31)		460 (-34)	680 (-28)	
Caltex	Synlube CLP	220 (-34)	320 (-31)	460 (-28)	680 (-31)	
Carl Bechem GmbH	Berusrsynth EP	220 (-25)	320 (-25)	460 (-25)	680 (-28)	1000 (-28)
Castrol International	Alphasyn PG	220 (-34)	320 (-31)	460 (-28)		
Esso/Exxon	Glycolube	220 (-25)	320 (-25)	460 (-23)		
Fuchs Lubricants	Renolin PG	220 (-34)	320 (-34)	460 (-34)	680 (-28)	1000 (-28)
Klüber Lubrication	Klübersynth GH6	220 (-25)	320 (-25)	460 (-20)	680 (-20)	1000 (-28)
	Klübersynth UH1 6	220 (-30)	320 (-25)	460 (-25)		
Kuwait Petroleum International	Q8 Gade	220 (-22)	320 (-22)	460 (-22)		
Laporte Performance Chemicals Limited	Berox Industrial Lubricant SW	220 (-25)	320 (-25)	460 (-23)	680 (-20)	1000 (-28)
	Berox SL Range	220 (-40)	320 (-37)	460 (-23)		
	Berox Oil Soluble Industrial Lube x	220 (-23)				
Mobil Oil Company Limited	Glygoyle	HE220 (-22)	HE320 (-37)	HE460 (-35)		
Optimal Ölwerke GmbH	Optiflex A +	220 (-28)	320 (-28)	460 (-28)	680 (-28)	1000 (-25)
Shell Oils	Tivela	SB (-25)	SC (-25)	SD (-23)		
	Tivela S	220 (-34)	320 (-34)	460 (-34)		
Texaco Limited	Synlube CLP	220 (-34)	320 (-31)	460 (-10)	680 (-31)	
Total	Carter SY	220 (-25)	320 (-28)	460 (-22)		
Tribol GmbH	Tribol 800	220 (-27)	320 (-25)	460 (-25)	680 (-25)	1000 (-23)

- + NOT SUITABLE FOR APPLICATIONS REQUIRING INDUSTRIAL EP ADDITIVES
- x THIS PARTICULAR LUBRICANT IS COMPATIBLE WITH TYPES E, AND H

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 Lubrication.

Type H Polyalphaolefin based synthetic lubricants with Anti-Wear or EP additives.

SUPPLIER	LUBRICANT TYPE	5H	6H
Batoyle Freedom Group	Titan	220 (-31)	320 (-28)
Boxer Services / Millers Oils	Silkgear	220 (-35)	320 (-35)
BP Oil International Limited	Enersyn EPX	-	320 (-28)
Caltex	Pinnacle EP	220 (-43)	320 (-43)
Carl Bechem GmbH	Berusynth GP	220 (-38)	320 (-35)
Castrol International	Alphasyn EP	220 (-37)	320 (-31)
	Alphasyn T	220 (-31)	320 (-28)
Chevron International Oil Co	Tegra	220 (-46)	320 (-33)
Esso/Exxon	Spartan Synthetic EP	220 (-46)	320 (-43)
Fuchs Lubricants	Renogear SG	220 (-32)	320 (-30)
	Renolin Unisyn CLP	220 (-37)	320 (-34)
Klüber Lubrication	Klübersynth GEM4	220 (-30)	320 (-25)
Kuwait Petroleum International	Q8 El Greco	220 (-22)	320 (-19)
Lubrication Engineers Inc.	Synolec Gear Lubricant	220 (-40)	-
Mobil Oil Company Limited	Mobilgear SHC	220 (-40)	320 (-37)
	Mobil gear XMP	220 (-40)	320 (-33)
Optimal Ölwerke GmbH	Optigear Synthetic A	220 (-31)	320 (-31)
Petro-Canada	Super Gear Fluid	220 (-43)	320 (-37)
Shell Oils	Omala HD	220 (-43)	320 (-40)
Texaco Limited	Pinnacle EP	220 (-43)	320 (-43)
	Pinnacle WM	220 (-43)	320 (-40)
Total	Carter SH	220 (-48)	320 (-42)
Tribol GmbH	Tribol 1510	220 (-36)	320 (-33)

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 Grease

NLGI grade 2 grease suitable for operation in ambient temperatures of -20°C to 50°C

- For use outside of this range contact our Application Engineers

SUPPLIER	GREASE TYPE
BP Oil International Limited	Energrease LS-EP
Caltex	Mulfak EP
Castrol International	LMX Grease
	Spheerol AP
	Spheerol EPL
Fuchs Lubricants	Renolit EP
Klüber Lubrication	Klüberlub BE41-542
Mobil Oil Company Limited	Mobilgrease XHP
	Mobilith SHC
Omega	Omega 85
Optimol	Longtime PD
Shell Oils	Albida RL
	Alvania EP B
	Nerita HV
Texaco Limited	Mulfak EP

Series C Lubrication

1. C03 to C06 are supplied factory filled with a quantity of polyglycol synthetic oil (Grade 6G) appropriate to the mounting position – If the gear unit is drained for any reason it must be re-filled with the correct grade and quantity of lubricant as shown in the table below.
2. C07 to C10 are supplied without lubricant and must be filled via the ventilator position with polyglycol synthetic oil (Grade 6G) until the oil escapes through the level plug hole – see table below for approximate lubricant quantity,
3. C07 to C10 Oil levels for some units are dependent on mounting position and speed of operation.
Level 1 (L-1) for output speeds below 100 rpm
Level 2 (L-2) for output speeds 100 rpm and above
4. **Maintenance:**
 - Oil levels for C07 to C10 can be checked and maintained by filling via the ventilator position until oil escapes through the level plug hole,
 - C03 to C06 these units must be fully drained and re-filled with the correct quantity of lubricant

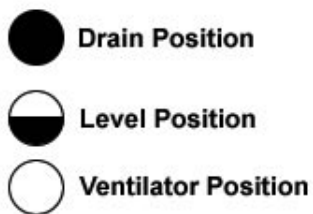
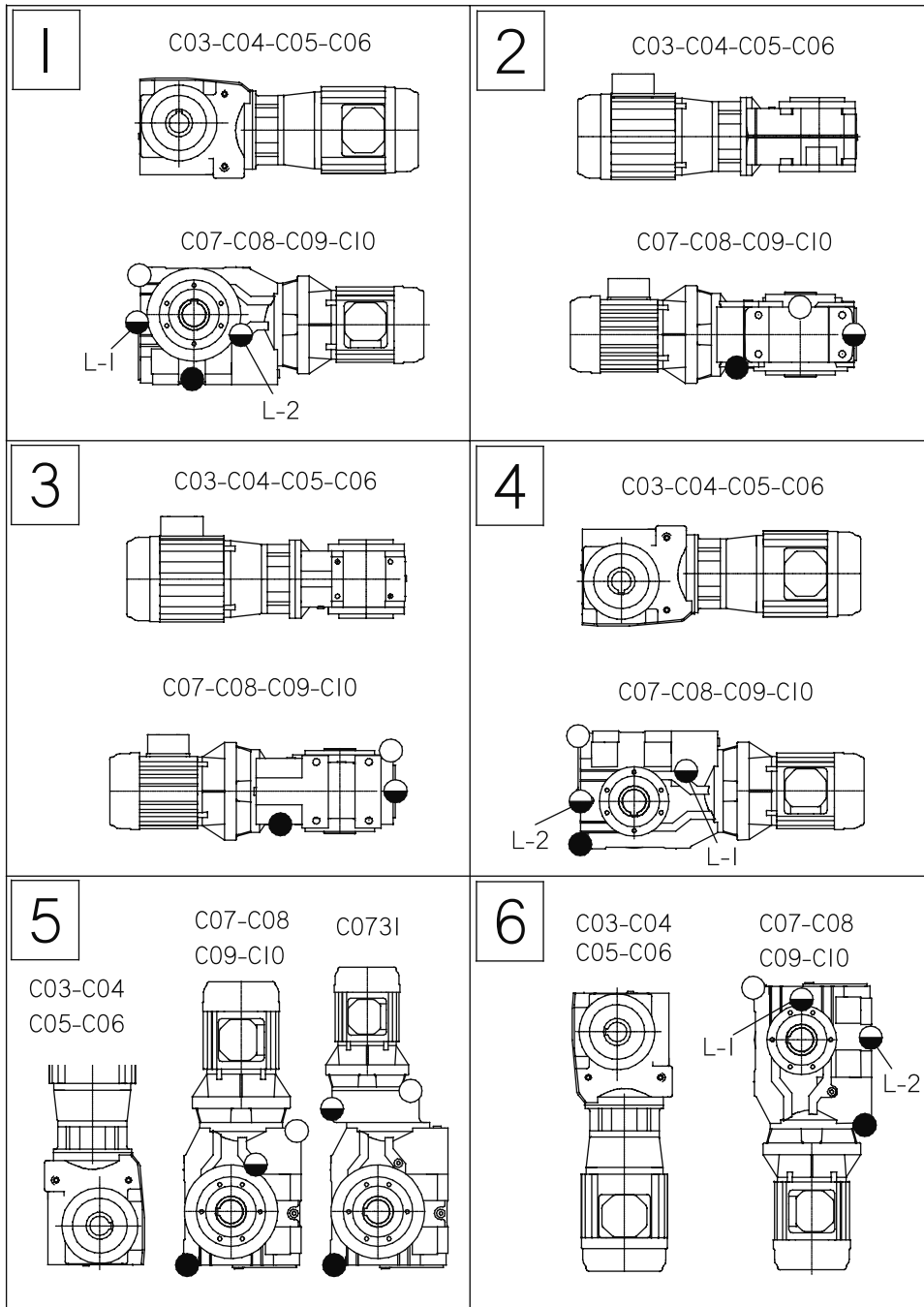
Lubricant Quantities (Litres)

Posn	Level	C0321	C0421	C0521	C0621	C0721	C0821	C0921	C1021
1	L-1	0.3	0.4	0.7	1.5	4.5	7.1	17	28
	L-2	-	-	-	-	3.0	5.9	11	17
2	-	0.5	0.7	1.0	2.3	3.5	6.2	12	21
3	-	0.5	0.7	1.0	2.3	3.5	6.2	12	21
4	L-1	0.7	1.0	1.4	3.1	5.1	9.5	17	26
	L-2	-	-	-	-	3.0	4.8	8.3	14
5	-	0.6	0.9	1.4	3.0	5.6	9.6	18	31
6	L-1	0.7	1.0	1.4	3.2	7.4	12	25	42
	L-2	-	-	-	-	5.1	9.5	17	28

Posn	Level	C0331	C0431	C0531	C0631	C0731
1	L-1	0.4	0.5	0.9	2.1	4.8
	L-2	-	-	-	-	3.8
2	-	0.8	0.9	1.4	2.5	3.7
3	-	0.8	0.9	1.4	2.5	3.7
4	L-1	1.2	1.5	2.1	4.0	5.9
	L-2	-	-	-	-	3.6
5	-	1.0	1.3	2.0	4.6	6.6
6	L-1	1.2	1.5	1.9	4.0	9.2
	L-2	-	-	-	-	6.9

5. C07 to C10 Fit the ventilator plug in the position appropriate to the mounting position. C03 to C06 do **not** require a ventilator
6. Quadruple Reduction Units consist of a Series M primary unit flange mounted onto the Series C unit, see Series M lubrication data for details appropriate to the primary unit, both units should be checked for oil type and quantity.

Series C Mounting Positions and Lubrication fill levels



Series F Lubrication

1. F02 to F07 are supplied factory filled with a quantity of EP mineral oil (Grade 6E) appropriate to the mounting position. If the gear unit is drained for any reason it must be re-filled with the correct grade and quantity of lubricant as shown in the table below.
2. F08 to F10 are supplied without lubricant and must be filled via the ventilator position with EP mineral oil (Grade 6E) until oil escapes through the level plug hole – see table below for approximate quantity of lubricant.
3. **Maintenance:**
 - Oil levels for F05 to F12 can be checked and maintained by filling via the ventilator position until oil escapes through the level plug hole,
 - F02, F03 and F04 These units must be fully drained and re-filled with the correct quantity of lubricant.

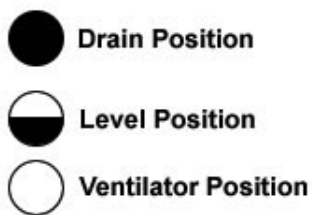
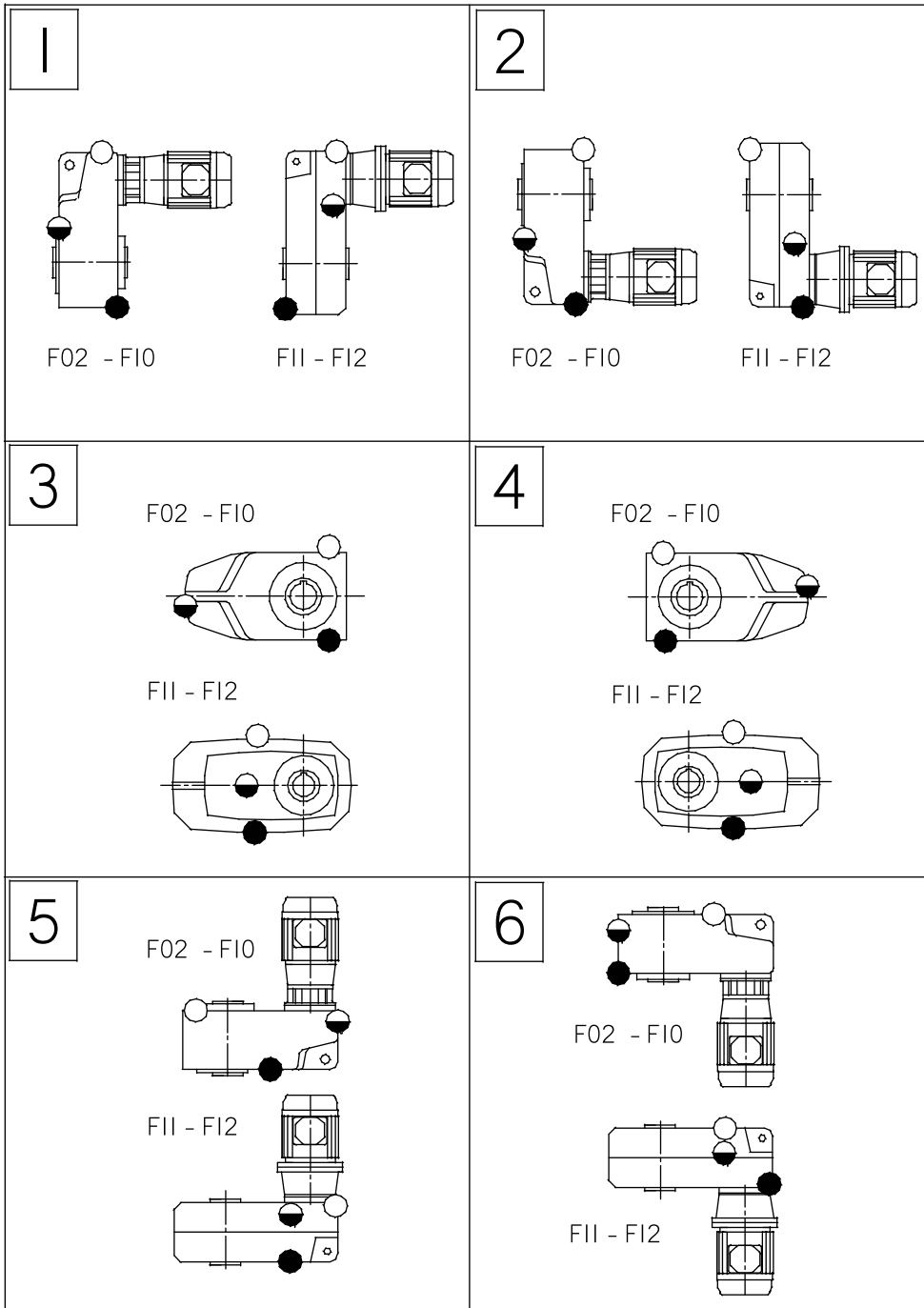
Lubricant Quantities (Litres)

Posn	F0222	F0322	F0422	F0522	F0622	F0722	F0822	F0921	F1021	F1121	F1221
1	0.8	1.3	1.3	2.1	3.5	6.3	10.7	19	34	28	47
2	0.4	0.8	0.8	1.4	2.3	3.5	7.1	13	22	17	27
3	0.4	1.1	1.1	1.4	2.3	3.4	8.8	17	28	22	36
4	0.5	0.8	0.8	1.8	3.0	5.0	4.7	15	27	24	40
5	1.1	1.2	1.2	2.8	4.5	8.0	9.7	24	43	34	56
6	1.3	2.0	2.0	3.2	5.2	9.0	17.2	25	43	30	50

Posn	F0232	F0332	F0432	F0532	F0632	F0732	F0832	F0931	F1031	F1131	F1231
1	0.8	1.2	1.2	2.1	3.5	6.3	10.4	19	34	27	45
2	0.4	0.8	0.8	1.4	2.3	3.5	7.3	15	24	16	25
3	0.4	1.1	1.1	1.4	2.3	3.4	9.2	17	28	21	34
4	0.5	0.8	0.8	1.8	3.0	5.0	5.3	16	27	23	38
5	1.1	1.2	1.2	2.8	4.5	8.0	9.7	24	43	33	53
6	1.3	2.0	2.0	3.2	5.2	9.0	17.4	25	43	29	48

1. F09 to F12 units only, fit the ventilator plug in the position appropriate to the mounting position. F02 to F08 units do **not** require a ventilator
2. Quadruple Reduction Units consist of a Series M primary unit flange mounted onto the Series F unit, see Series M lubrication data for details appropriate to the primary unit, both units should be checked for oil type and quantity.

Series F - Mounting Positions and Lubrication Fill Levels



Series K Lubrication

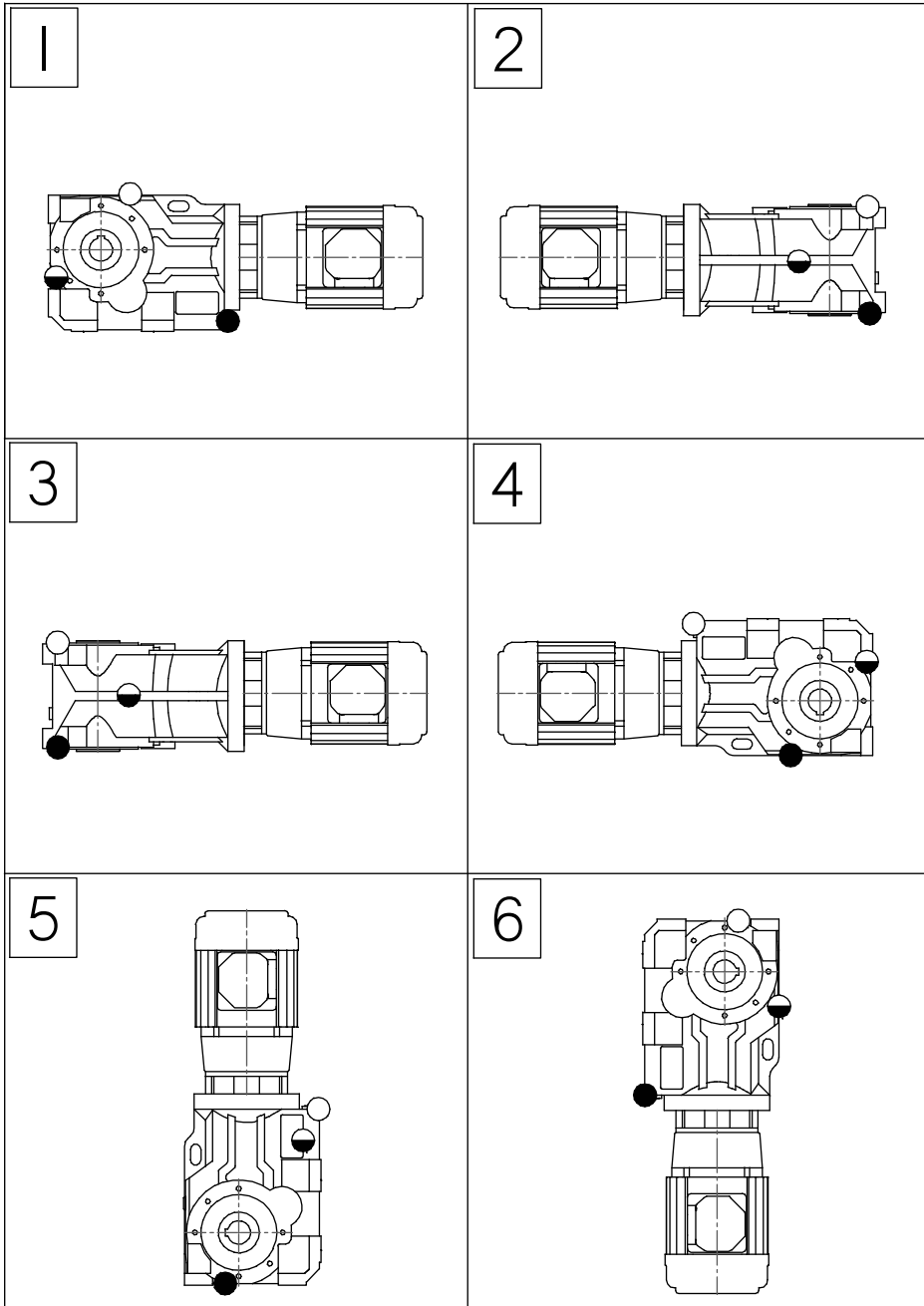
1. K03 to K07 are supplied factory filled with a quantity of EP mineral oil (Grade 6E) appropriate to the mounting position. If the gear unit is drained for any reason it must be re-filled with the correct grade and quantity of lubricant as shown in the table below.
2. K08 to K12 are supplied without lubricant and must be filled via the ventilator position with EP mineral oil (Grade 6E) until oil escapes through the level plug hole – see table below for approximate lubricant quantity,
3. **Maintenance:**
 - Oil levels for K06 to K12 can be checked and maintained by filling via the ventilator position until oil escapes through the level plug hole,
 - K03, K04 and K05 These units must be fully drained and re-filled with the correct quantity of lubricant.




Lubricant Quantities (Litres)

Posn	K0332	K0432	K0532	K0632	K0732	K0832	K0931	K1031	K1231
1	0.5	0.7	1.1	1.5	2.7	4.4	9.3	15	23
2	0.7	0.9	1.5	1.8	3.6	3.7	8.3	15	27
3	0.8	1.1	1.7	2.8	4.0	7.6	18	28	33
4	1.0	1.3	1.9	2.7	4.5	7.5	17	30	39
5	1.2	1.7	2.5	3.6	5.7	9.6	21	34	50
6	0.9	1.2	2.0	2.6	4.5	7.6	16	25	35

4. K06 to K12 units only, fit the ventilator plug in the position appropriate to the mounting position. K03 to K05 units do **not** require a ventilator.
5. Quintuple Reduction Units consist of a Series M primary unit flange mounted onto the Series K unit, see Series M lubrication data for details appropriate to the primary unit, both units should be checked for oil type and quantity.

Series K - Mounting Positions and Lubrication Fill Levels



-  **Drain Position**
-  **Level Position**
-  **Ventilator Position**

Series M Lubrication

1. M01 to M07 are supplied factory filled with a quantity of EP mineral oil (Grade 6E) appropriate to the mounting position. If the gear unit is drained for any reason it must be re-filled with the correct grade and quantity of lubricant as shown in the table below.
2. M08 to M14 are supplied without lubricant and must be filled via the ventilator position with EP mineral oil (Grade 6E) until oil escapes through the level plug hole – see table below for approximate lubricant quantity,
3. **Maintenance:**
 - a. Oil levels for M04 to M14 can be checked and maintained by filling via the ventilator position until oil escapes through the level plug hole,
 - b. These units M01, M02 and M03 must be fully drained and re-filled with the correct quantity of lubricant.

Lubricant Quantities (Litres)

Posn	M0122	M0222	M0322	M0422	M0522	M0622	M0722	M0822	M0921	M1021	M1321	M1421
1	0.5	0.8	0.8	1.5	1.5	2.0	2.6	4.2	10.5	14	17	24
2	0.8	1.2	1.2	1.8	1.8	2.0	2.9	6.3	12.0	22	31	49
3	0.6	0.7	0.7	1.6	1.6	1.9	2.7	5.4	12.0	22	31	49
4	0.8	1.2	1.2	1.8	1.8	1.7	3.0	7.3	12.0	19	28	41
5	0.7	1.1	1.1	2.0	2.0	2.2	3.2	6.8	16.8	32	47	72
6	1.0	1.4	1.4	2.6	2.6	2.8	4.7	9.3	16.4	26	38	65

Posn	M0132	M0232	M0332	M0432	M0532	M0632	M0732	M0832	M0931	M1031	M1331	M1431
1	0.6	0.8	0.8	1.6	1.6	2.1	2.7	4.4	11.5	14	18	25
2	0.9	1.3	1.3	1.9	1.9	2.1	3.0	6.5	12.0	24	33	50
3	0.7	0.7	0.7	1.7	1.7	2.0	2.8	5.6	12.0	24	33	50
4	0.9	1.2	1.2	1.9	1.9	1.8	3.1	7.5	12.0	21	30	43
5	0.7	1.1	1.1	2.1	2.1	2.3	3.3	6.8	16.8	32	47	72
6	1.1	1.6	1.6	2.7	2.7	2.9	4.8	9.7	16.5	28	40	67

6. M04 to M14 units only, fit the ventilator plug in the position appropriate to the mounting position. M01 to M03 units do **not** require a ventilator.
7. Quintuple Reduction Units consist of a smaller Series M primary unit flange mounted onto the main Series M gear unit, both units should be checked for oil type and quantity.

Series M - Mounting Positions and Lubrication Fill Levels

