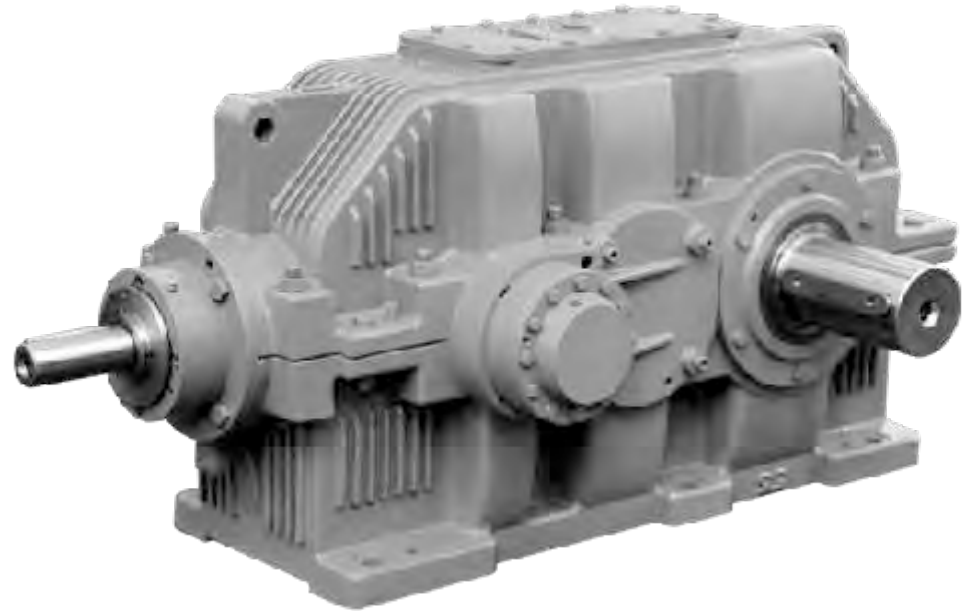


# EON SERIES

## INSTALLATION, OPERATION & MAINTENANCE MANUAL



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# INSTALLATION, OPERATION & MAINTENANCE MANUAL

## GENERAL

The proper working of a gear unit not only depends on the good design, the use of good material and good workmanship but also on careful installation, proper lubrication and proper working conditions.

Hence, it is of utmost importance to see that the installation of the gear unit is done according to the instructions given in this manual to ensure proper working of the gear and to ensure a long and trouble free service.

This manual should be kept with the person in-charge who handles the installation & operation. He should thoroughly study and understand the instructions given in this manual. Precisely following of this manual will give trouble free working of the Gear unit.

In the interest of future development, we reserve the right to introduce modifications to the individual subassemblies & accessories, which, while retaining the essential features, can be regarded as desirable to increase their efficiency, reliability and safety.

## SAFETY INSTRUCTIONS

The Gear unit is supplied after proper assembly & testing, duly painted and packed as per the contractual conditions. As such, in no case the Gear unit to be opened by the unauthorized person during its warranty period.

- ☞ The Gear unit may be opened with the agreed order condition.
- ☞ The unit may only be used & operated within the scope of the conditions specified in the order related documents.
- ☞ Rules & regulations to be followed for industrial safety during use of the Gear unit.
- ☞ Gear unit to be opened, serviced and repaired only by the trained personnel.
- ☞ Any work to be done on the Gear unit at stand-still condition, i.e. after switch off the motor or drive.
- ☞ All exposed rotating components such as shaft extensions, coupling, V-belt, sprockets etc are covered with guard to prevent an accident.
- ☞ Note affixed on Gear unit such as Name plate, arrows must be kept unpainted visible.
- ☞ Unauthorized modification, are NOT permitted.

## **DELIVERY**

Prior to dispatch all units are thoroughly inspected & test run on no load to ensure they comply with specifications. All the Gear units are dispatched with list of components packed in the box (if any). This should be checked on receipt as per Packing-list and missing of any part to be reported immediately.

Gear units are packed in wooden cases having suitable battens to facilitate handling. Casings are marked with the symbol showing the position of gear unit, inside the casing

Wherever grease lubrication points are provided, the grease filling is done from our works. The instruments like pressure gauges, temperature gauges etc are dispatched loose pack, shall be well protected in store. The inner parts of new units leaving our Works are sprayed with a rust protective oil which keeps them free from rust for 6 months, provided they are sheltered from atmospheric elements, preferably in a closed ventilated place.

The Gear units are supplied without oil filling. Recommended oil has to be filled up before commissioning the unit.

If used after protracted storage i.e. 6 months or more in covered areas ensure running for 2 hours prior to installation & ascertain leakage from seals. Rubber seals age hardens & cracks develop due to protracted storage.

The outside surface of the gear casing is painted by us to have resistance against weak acids, alkalizes, solvents and similar liquids and temperature upto + 140oc (approx).

All bright parts such as shaft ends are given a coat of anti-rust compound. Anti-rust compound is easily removable by applying nitro-thinners or suitable solvents. Please do not use files or sand papers for removal of anti-rust coating.

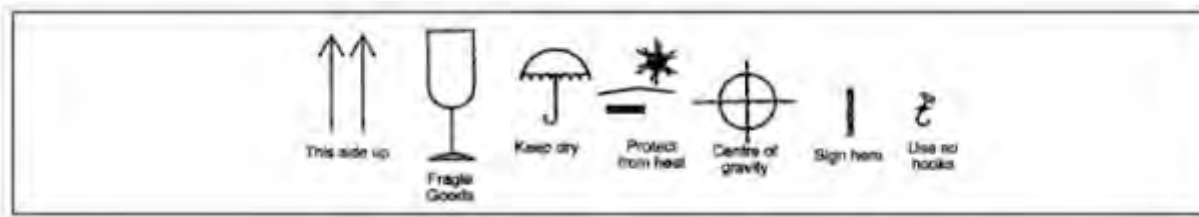
If the gear unit is required to be stored for a long time before putting into operation, then please follow the instructions given in this manual to prevent premature damage to the gear unit.

## **HANDLING**

Packing will defer dependent on the method of shipment & size. Packing, unless otherwise agreed contractually, will be as per our general practice.

During handling care to be taken that packing box & Gear unit to be lifted as per the symbols shown below. The packing of gear unit will differ, dependent on method of shipment and size. The packing, unless otherwise agreed contractually, complies with Packing guidelines.

The symbols shown on the packing should be noted. Their significance is as follows.



The Symbol draws attention to safety measure which MUST be observed to prevent damage and the personal injury.

**Note:** When handling the Gear unit special care has to be taken to avoid damage due to careless loading & unloading.

Transport of the complete gear unit should be undertaken by using wire ropes/cable strips of required strength. (Do not attach rope or cable strips around shafts)

While lifting the complete gear unit, please do not use the lifting lugs provided on the top cover.

Use the lifting lugs provided on bottom part of the gear cases (refer fig 1a, 1b, 1c, 1d& 1e). Figure 1a & 1d gives the correct way. Lift the gear unit which is fitted with lubrication piping carefully in such a way as to avoid any damage to the piping system.

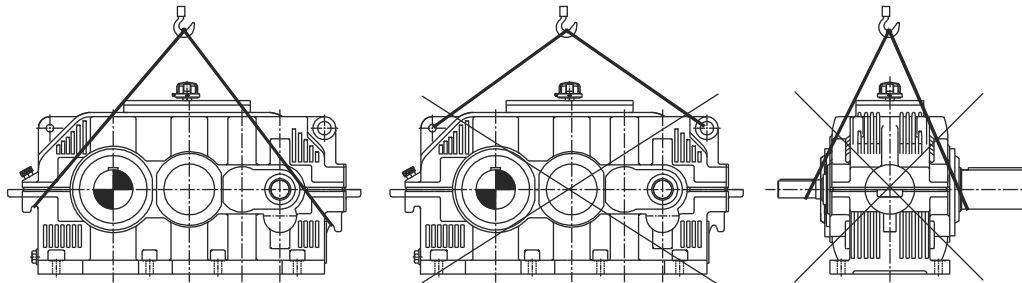


Fig:- 1a

Fig:- 1b

Fig:- 1c

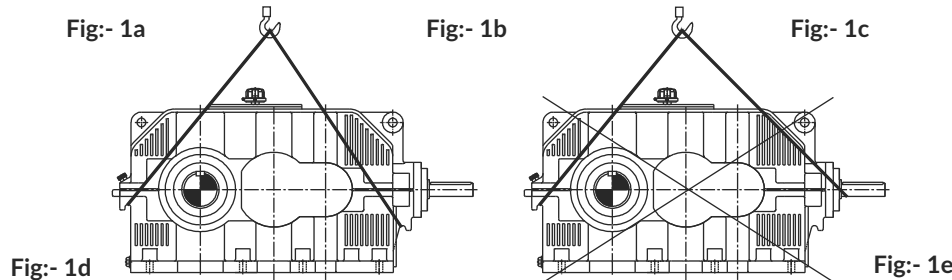


Fig:- 1d

Fig:- 1e

## STORAGE

Following instructions for the long time storage of the Gear units is of extreme importance on violation of which can lead to the premature failure :-

Long time storage of a Gear unit can be due to :

- ▶ Unit is not in action, however, installed in the place or
- ▶ Unit is kept in store and waiting for its use.

### 1. The Unit Is Installed; But Not In Action :

When the gear unit is installed in the system but is out of action, a quantity of oil must be added to exceed maximum level by 30 mm to 50 mm.

Special attention should be given to the condition of the oil. Old oil which may form a deposit or be acidic should be removed. The gears should be turned slowly by hand at intervals, in order to ensure the oil is distributed over all parts in contact. Wherever grease nipples are provided, add grease through grease nipples.

### 2. The Unit Is To Be Stored For a Long Time :

When the unit is to be stored for a long time, it should be run for 5 minutes after filling with a rust protective; say HP RUSTOP 388 or ensues oil. The level of the oil should be about 30 mm to 50 mm higher than the normal oil level.

All the parts having been thoroughly coated with oil, the protective fluid can be drained and kept for other similar operations. The inspection covers and the drain plugs should be completely sealed.

On starting up the speed reducer, no special preNote need be taken other than filling the oil bath according to the recommended quantity and quality of lubricant oil.

To prevent corrosion during storage, Silica Gel bags should be kept in the vicinity of gear unit, NOT INSIDE GEAR CASE. Silica Gel should be periodically checked for moisture absorption and be changed from time to time.

## IDENTIFICATION OF GEAR UNITS

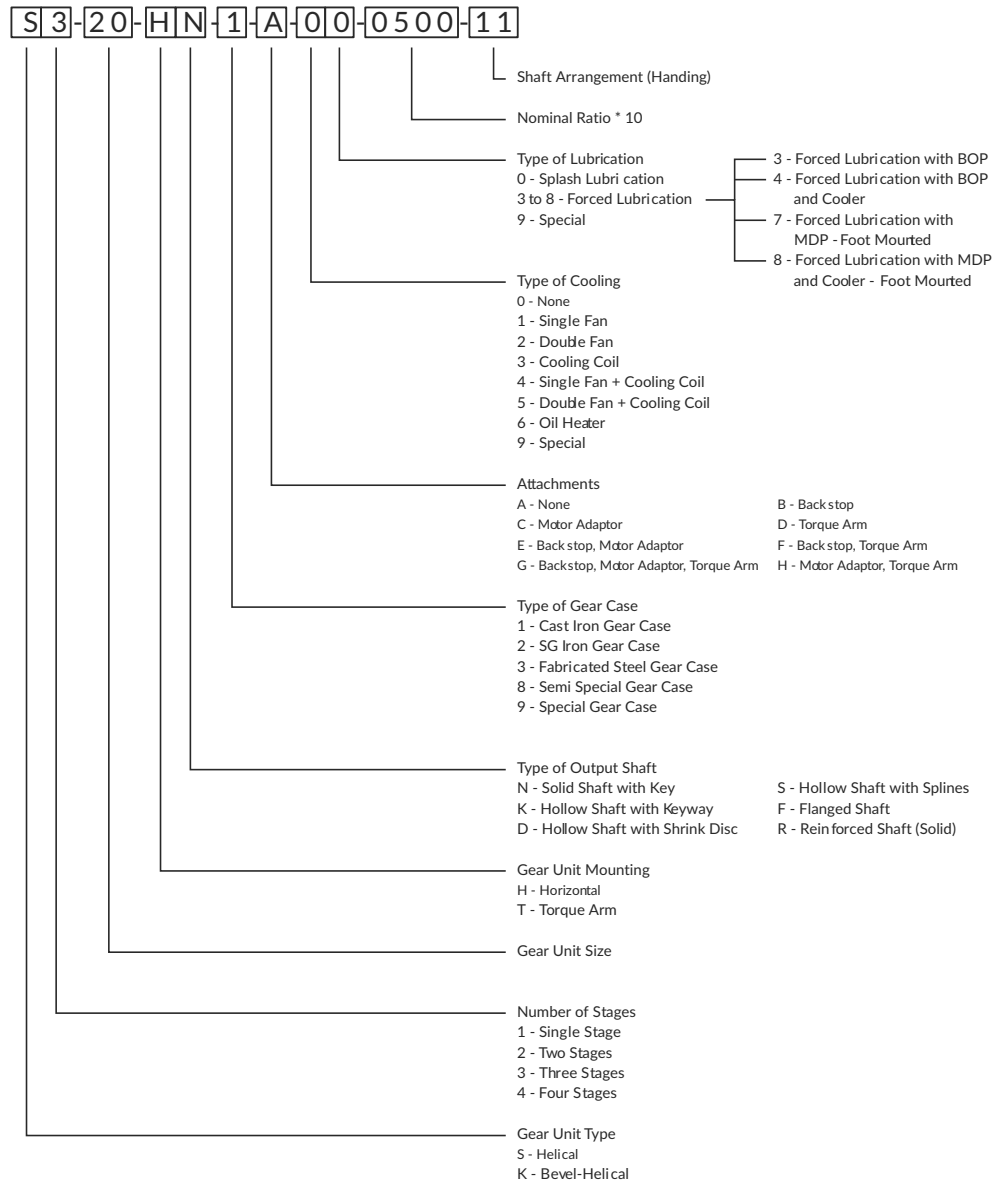
The diagram shows a rectangular nameplate for an ELECON EON series gear unit. The nameplate contains the following information and fields:

- 1**: ELECON logo
- 2**: EON series
- 3**: TÜV logo
- 4**: ELECON ENGG CO LTD (GEAR DIVISION), VALLABH VIDYANAGAR-388 120,GUJARAT-INDIA. Made in India
- 5**: Type :
- 6**: Motor Power  Serial No :
- 7**: Rated Power  Year of Mfg :
- 8**: Input Speed :  Weight (kgs):
- 9**: Exact Ratio :  Oil Grade:
- 10**: LUBRICATION
- 11**: Fill Oil up to dipstick marking. Change the oil every 6 months or 3000hrs whichever occurs first. See approved Lubricants leaflet for details
- 12**: (Points to the Rated Power field)
- 13**: (Points to the Motor Power field)

- |                                         |                                                                      |
|-----------------------------------------|----------------------------------------------------------------------|
| 1. Name & Address of the manufacturer   | 8. Oil Grade as per DIN                                              |
| 2. Name of the series                   | 9. Instruction for Lubricating oil change intervals                  |
| 3. Origin of Manufacture                | 10. Actual Speed Ratio of the gear unit (Input Speed / Output Speed) |
| 4. Type (Nomenclature) of gear unit     | 11. Input Speed in RPM                                               |
| 5. Serial Number                        | 12. Gear unit Rated Power in kW / H.P                                |
| 6. Year of Manufacturing                | 13. Motor Power in kW / H.P                                          |
| 7. Gear unit Average weight Without Oil |                                                                      |



# Nomenclature of gear unit



## **TECHNICAL DATA**

### **GEAR CASE**

Gear case made from Gray cast iron casting with Split Design to make ease of maintenance. Enhanced thermal capacity by increasing surface area. Gear cases Provided with oil dipstick.

### **GEAR INTERNALS**

The toothed gear components are case-hardened & ground and spiral bevel gears are hard cut. The noise level of the gear units, is minimized by virtue of the high quality system and ensure reliable running.

### **LUBRICATION**

The meshing to gear teeth are adequately supplied with oil for horizontal position of installation by splash lubrication. It ensures that the gear units are maintenance-free.

### **OIL PUMP**

Oil Pumps are used for force lubrication of gear units when ever required. Oil pumps are mainly fitted with two arrangements.

- Oil pump driven by the pinion shaft fitted by means of flange.
- Oil pumps driven by seperate motors and kept externally as Forced Lubrication System

### **BEARING**

All bearings are of anti-friction bearings. Lubrication of the anti friction bearings is effected for horizontal position of installation by splash lubrication.

### **OIL SEALING**

Positive Oil sealing with labyrinth sealing arrangement in high speed shaft

### **COOLING**

According to requirements , the gear unit is fitted with a fan, a cooling coil, or an oil cooler for cooling purposes.

### **FAN**

The fan is mounted on the high-speed shaft of the gear unit and protected by a fan cowl. The fan draws air through the protective grille of the fan cowl and causes it to flow through its lateral air ducts along the gear unit housing, thus dissipating a certain amount of the housing heat.

- Note : In the case of gear units which are fitted with a fan adequate clearance for the cooling are in the form of intake cross-section must be provided when fitting the guard for the coupling.

### **COOLING COIL**

The cooling coil is located in the oil sump of the gear unit and is provided with cooling water connection nipples outside the gear from which water supply pipe to be connected, water pressure should not exceed 8 bars. Water, seawater can be used as cooling water. When flowing through the cooling coil, a certain quantity of heat is extracted from the gear unit oil and transferred to the cooling water. Easy maintenance of cooling coil by its Plugged-in design which makes assembly / dismantling of cooling coil with out distuing the gear unit.

### **WATER-OIL COOLER**

The water-oil cooler is installed in the discharge line of the oil cooling system when provided. The water oil cooler dissipates a certain quantity of heat from the gear oil to the cooling water flowing through the cooler housing. A suitable cooling water supply should be provided by the users.

### **BACKSTOP**

When the Gear unit is fitted with a mechanical backstop. During operation this only permits rotation in the specified direction of rotation. This direction is marked on the gear unit input drive side by a corresponding direction of rotation arrow.

- Note : Before connecting the Gear unit Input to driven machine, the Gear unit should be checked for correct rotation.

### **FLUSHING PROCEDURE :**

It is always desirable to undertake a schedule of flushing the gear unit and the internal piping of the gear unit which is connected to the Force Lubrication System. The flushing is nothing but circulating in and out the flushing oil in the gear unit and piping under recommended pressure, which is normally 2 to 3 kg/cm<sup>2</sup>. For flushing the light low viscosity oil such as " LUBREX FLUSHING 22 " of Indian Oil or equivalent ( Dynamic viscosity = 19-22 Cst at 400 C ) should be used.

For flushing purpose the Force Lubrication System can be used for pumping the flushing oil through the pipes and the casing. While flushing, the terminal flanges of FLS should be fitted with wire mesh of sizes 250, 150, 60 Microns; one schedule after another. At the end of each schedule ( Normally of 8 Hours ) there should not be any accumulation dirt on the wire meshes employed in the terminal flanges which can be observed every 2/3 hours of flushing

WHEN FORCE LUBRICATION SYSTEM IS NOT SUPPLIED ALONGWITH GEAR UNIT, A SEPARATE PUMPING ARRANGEMENT NEEDS TO BE EMPLOYED FOR FLUSHING PURPOSE.

## INSTALLATION

Quiet running and long service life of the gear unit largely depend upon correct installation. Permissible deviation from the dimension "a" can be checked from the data provided by the coupling manufacturer (fig. 2a&2b).

Installation should be carried out in such a way that inspection cover, oil dipstick and drain plugs are readily accessible. Clients are requested to make provision for suitable draining pan below the oil outlet.

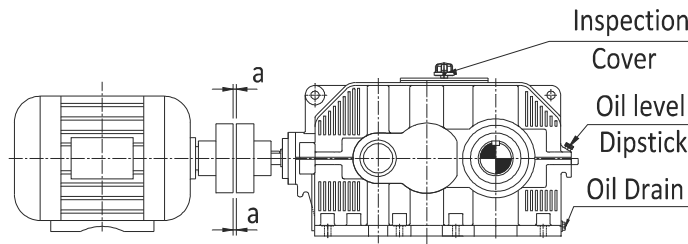


Fig:- 2a

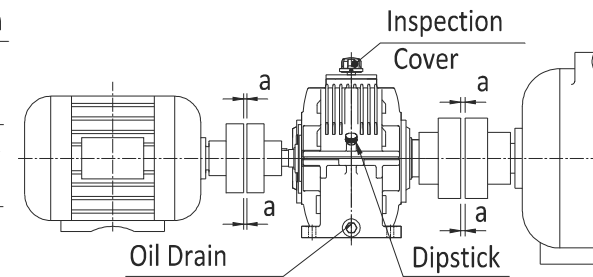


Fig:- 2b

## FOUNDATION

The gear unit must be mounted on leveled foundation using the correct size and type of foundation bolts. The foundation must have sufficient load carrying capacity. The foundation must be cast in the proportion like M 150/M 200, with suitable reinforcement. A civil engineer, expert in foundation technology should be consulted for checking suitability of foundation.

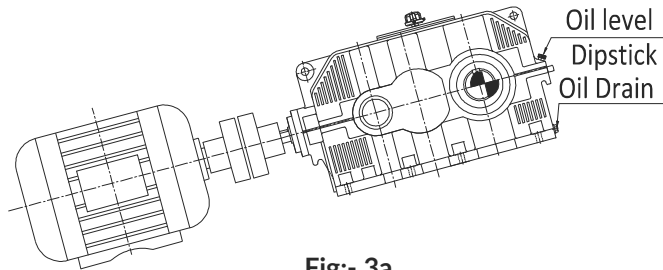


Fig:- 3a

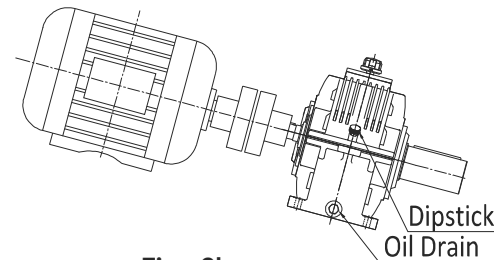
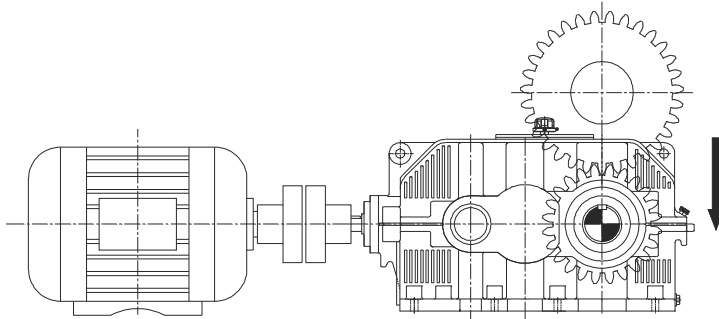


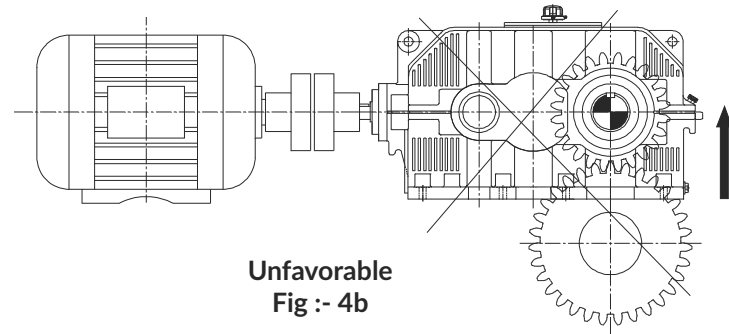
Fig:- 3b

The gear unit can be mounted in an inclined position, refer fig. 3a & 3b, only if this requirement is specified while ordering out the gear unit.

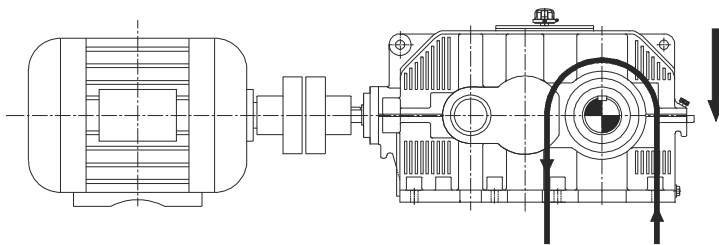
While mounting overhung pinions, gear or chain sprockets, care should be taken that as far as possible the reaction due to circumferential forces is directed downward i.e. towards foundation, figures 4a & 5a show the correct way of mounting overhung pinion and sprocket. Avoid installation as shown in figures 4b & 5b.



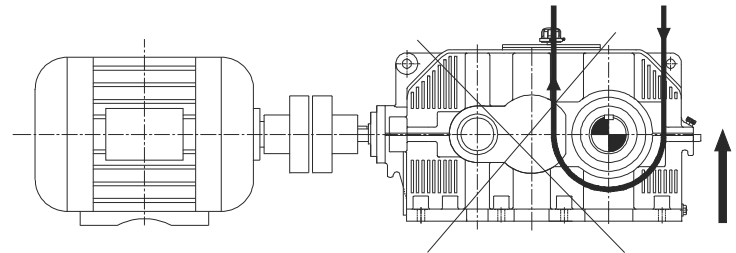
**Favorable**  
Fig :- 4a



**Unfavorable**  
Fig :- 4b



**Favorable**  
Fig :- 5a



**Unfavorable**  
Fig :- 5b

For shaft mounted gears, provision must be made for the torque arm of adequate strength and elasticity (Refer Fig. 6).

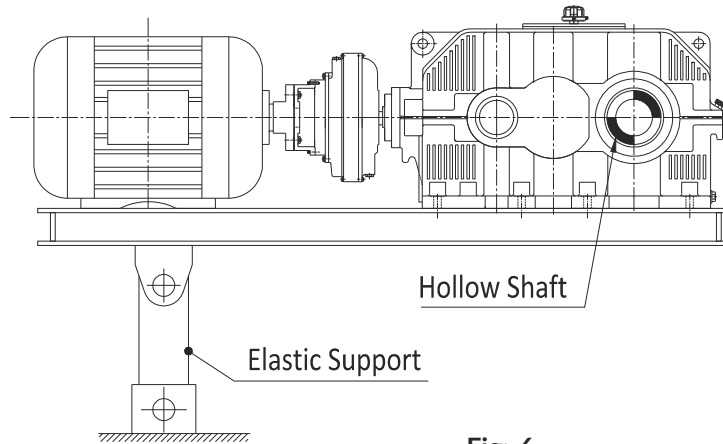


Fig:-6

Clamping Screw Thread	Tightening Torque Per Screw (Nm)
M8	35
M10	70
M12	121
M14	193
M16	295
M20	490
M24	840
M27	1450
M30	1650
M33	2220
M36	2850

Where the gear units are used in outdoor installations, they should be protected from direct sun, wind and rain. During operation, the free air flow along the surface of unit should not be obstructed. Wherever the lower parts of the gear casing are provided with an integrally cast and machined leveling seat, while aligning the gear unit with the prime mover and driven equipment, check the horizontal level by means of leveling seats. Correct leveling ensures proper lubrication of bearings (refer fig. 7).

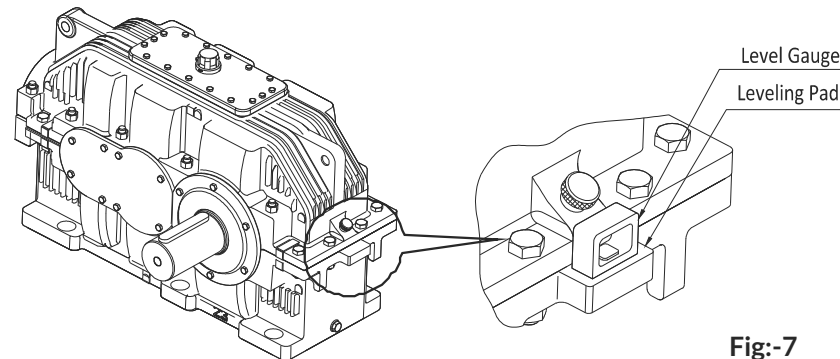


Fig:-7

After proper alignment tighten the foundation bolts, preferably with the torque wrench to prevent over tightening. Check the level after tightening of the bolts. If the gear unit is mounted on base frame or steel structure, provide the stops to prevent axial and lateral movement of gear due to external forces.

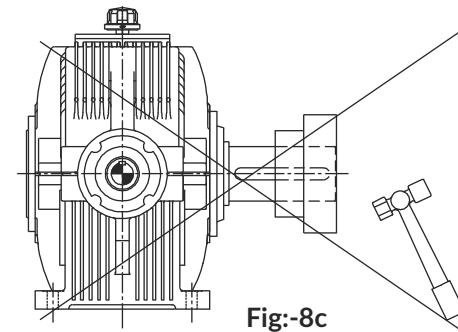
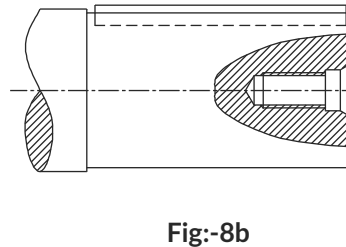
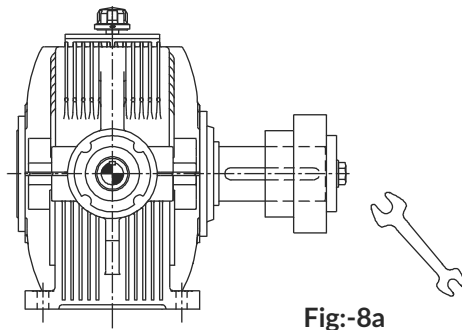
### **SPECIAL INSTRUCTIONS FOR THE INSTALLATION OF GEAR UNITS ON STRUCTURES**

The best practice is to install the gear units on rigid concrete foundations, however, in some applications the gear units are required to be mounted on machinery structures especially in Cement Plants, Chemical Plants etc. While the gear units are installed on structural foundation, care should be taken that gear unit is mounted on a combined base frame with driving motor and sufficient access should be there to properly align the input and output couplings. The most important point is that the supporting structure should be sufficiently strong so that no undue vibrations are generated.

Note that excess vibrations are dangerous to the gear unit and may cause premature failure of the gear unit.

### **COUPLING FITTING**

The input and output shafts of gear units are provided with a tapped hole at the end faces. This facilitates fitting various items like couplings, belt pulleys, sprockets, overhung pinions etc. (refer fig. 8a & 8b).



Wherever it is decided to fit the above items by shrinking or by heating, follow the specifications given by the manufacturer. The care should be taken to protect the oil seals for any damage. Under no circumstances, couplings or similar items should be mounted by giving heavy blows or impacts. This may cause damage to shafts, bearings, oil seals, etc. (refer fig. 8c)

## COUPLING ALIGNMENT

In order to minimize wear, vibration and coupling problem, it is a must that the accurate alignment between coupling hubs of connecting shafts is essentially achieved.

- ▶ Ensure correct gap between two coupling halves.
- ▶ Check angularity by checking clearance between coupling flanges at four outside positions. Difference between clearances measured at opposite positions should be less than 0.01 mm./100mm of dia.

Next, check eccentricity by means of a dial indicator as shown in fig. 9. The reading should be within 0.10 mm. It is important to keep the dial indicator support rigid, otherwise the weight of dial indicator will cause deflection and consequently inaccurate readings will be obtained.

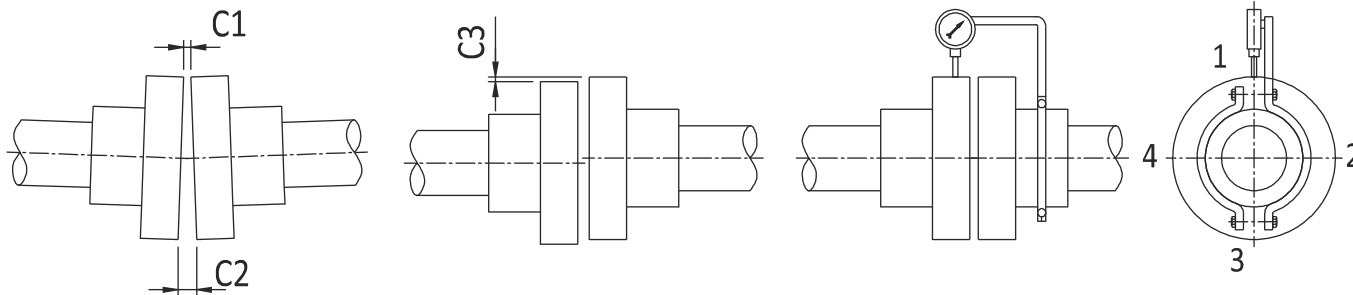


Fig:-9

$C1 \ \& \ C2 = 0.01\text{mm}/100\text{mm Dia.}$

$C3 = 0.05\text{mm}$

(Values shown here are only for guidance, for exact values refer to the corresponding coupling manufacturer's catalogue)

### Max. Residual Limit :

Up to 400 rpm	= 0.08mm (TIR)
400 to 1000 rpm	= 0.03 to 0.07mm (TIR)
1000 to 1500 rpm	= 0.03mm (TIR)
1500 to 3500 rpm	= 0.02mm (TIR)



## SAFETY PRECAUTION

The client should protect the coupling, rotating shaft extensions etc. with safety guards.

## LUBRICATION

Reliability, efficiency and wear free operation depend largely on correct lubrication.

Before commissioning, the gear unit must be filled with lubricating oil upto the oil level mark (refer fig. 10).

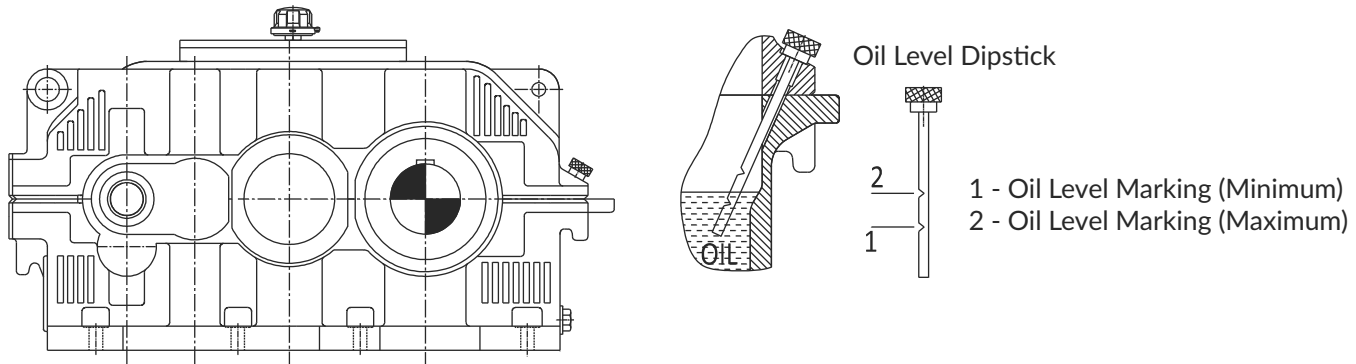


Fig:-10

Quantity of lubricating oil given in catalogue or in other specifications is only for guidance. The exact quantity should be decided by filling the oil upto the oil level mark (Maximum) in the dipstick. Too much oil causes heating of the gear unit and too little oil causes wear. In the case of gear units provided with a separate oil tank, specified quantity of oil should be maintained in the oil tank.

The lubrication oil should be poured into the gear unit through the inspection cover / breather plug (refer fig.11). Use only fresh and unadulterated oil filtered through mesh of 150 micron. Ensure sealing everytime the inspection cover is opened. Fig:-11 The oil level must be checked from time to time and maintained strictly as per the given oil level mark. The bearings are generally lubricated with the oil used for gears, unless they are provided with grease lubrication under specific operating conditions.

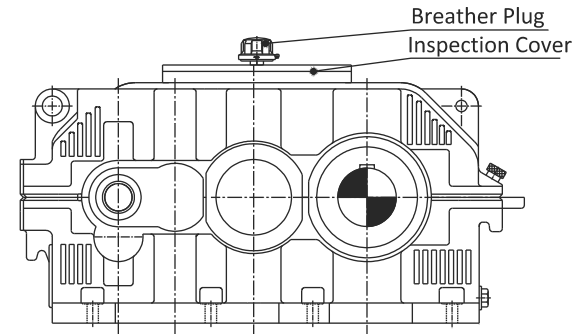


Fig:-11

## SELECTION OF LUBRICANTS

The class of lubricants is indicated on page-16. The class of lubricants states which oil or grease should be used under specific operating conditions.

In case of extreme temperature fluctuations from 0 to 30oc, special type of oil is necessary. Client should obtain the exact operating temperature to determine the correct lubricant.

In case of low ambient temperature, oil heating is necessary and where the ambient temperature is too high, oil cooling has to be provided. Hence, client should inform us the ambient temperature at the time of placing order.

## FORCED LUBRICATION SYSTEM

Forced Lubrication System is employed to enhance the thermal rating of the gear unit and when the gear unit is operating at very low speeds, the splashing in the gear unit is not sufficient to lubricate the gear internals and the bearings as well when peripheral velocity of gear internals is more than 15 m/sec. This chapter gives general information about components of F.L.S., however for specific details such as L.P.M. of pump, quantity of water circulation in oil cooler, refer separate manufacturing/schematic drawing for FLS h/w enclosed.

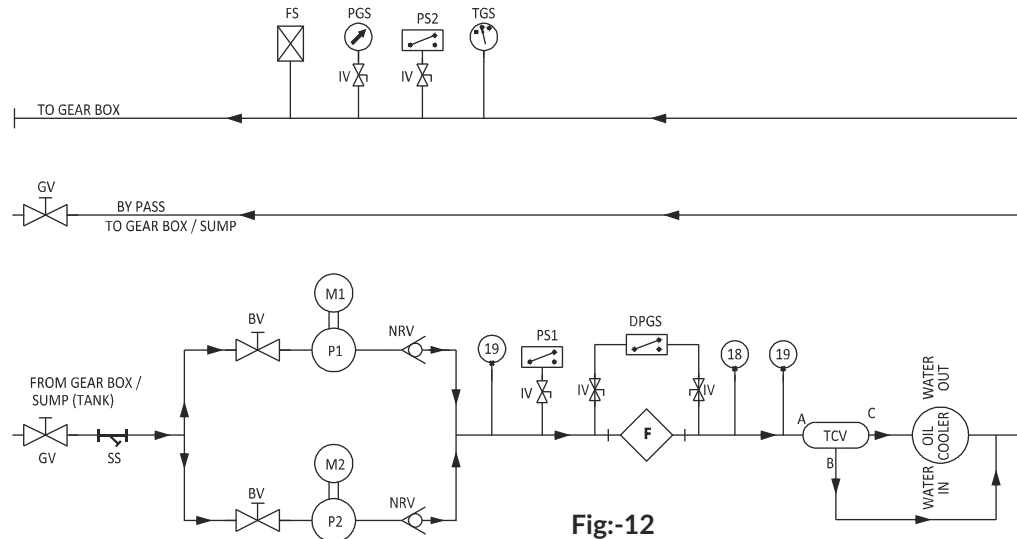


Fig:-12

**NOTES:**

LUBRICATION SYSTEM IS AS PER SCHEMATIC DRAWING WHICH SPECIFIES CIRCUIT AND NO. OF COMPONENTS. ONE OF THE PUMP IS ACTING AS MAIN PUMP AND OTHER AS AUXILIARY. IN CASE OF FAILURE OF MAIN PUMP AUXILIARY SHALL AUTOMATICALLY PUT ON; PUTTING OFF THE MOTOR OF MAIN PUMP. IN CASE OF CHOCKING OF FILTER OR FAILURE OF AUXILIARY PUMP AND IN TURN THE PRESSURE OF OIL SUPPLY TO THE GEAR UNIT IS LOWER THAN THE SET LIMIT; THERE SHALL BE AUDIO- VISUALALARM AND SIGNAL FOR PUTTING OFF THE MAIN MOTOR.

SYMBOL	DESCRIPTION
SS	Suction strainer
GV	Gate valve
BV	Ball valve
IV	Isolation valve
P	Pump
M	Motor
NRV	Non return valve
PS	Pressure switch
PGS	Pressure gauge with switch
DPGS	Diff. Pressure gauge with switch
F	Oil filter
TCV	Temperature control valve
TGS	Temperature gauge with switch
FS	Flow switch

**Setting of various switches**

- (1) PS1: Common pressure switch for PM-1 & PM-2 to change over 1.2 kg/cm2 ↓
- (2) PS2: Pressure switch after cooler just before gearbox oil inlet, to give signal to main motor pump 0.8 kg/cm2 ↓
- (3) FS: 80% of Full flow (Set a Factor) give an alarm for hooter to below ↓
- (4) DPGS: When pressure drop across the filter exceeds the hooter to give alarm for changing over filter 1 kg/cm2 ↑
- (5) PGS: Gear Inlet pressure increase .5kg/cm2, to give an alarm 2.5 kg/cm2 ↑
- (6) TGS: If oil inlet temperature increase, give alarm 80~ C ↑
- (7) TCV: Temperature control valve for bypassing oil cooler at low temperature 49~C

## **OIL PUMPS**

Oil pumps generally are of positive displacement type. They are either electric motor driven pumps or mounted directly to the gear unit. Oil pumps generally are geared type having sufficient capacity for flow rate and delivery pressure.

The recommended oil pressure during operation is 0.8 to 2 kg/cm<sup>2</sup> gauge. For shaft mounted pump the recommended pressure during operation is 0.5 to 2 kg/cm<sup>2</sup>

Oil pressure and flow rate of the gear type lubricating pumps are controlled by adjusting the relief valve and the gate valve provided in the delivery line.

In order to ensure that the gear unit does not start before the lubricating pump starts functioning, an interlocking should be done with the main motor and the motor driving the pump, the local control panel supplied alongwith FLS has this facility which should be used. As a rule, pressure regulation is not required for built-in oil pumps (i.e. directly mounted pumps).

*DO NOT DISMANTLE THEM AND THEIR FITTINGS.*

## **COOLING COILS**

Whenever cooling coils are provided inside the gear unit customer should make provision for water connection as per specification. Direction of water flow can be in either direction. Maximum water pressure allowed is 8 kg/cm<sup>2</sup>.

Water should be regulated through suitable valves.

Provision for water connection is to be made by the customer.

Where there is a likelihood of frost formation, when the unit is out of operation for a long period, cooling water must be drained off. To clear any residual water, use compressed air.

*FOR PROPER INSTALLATION / FITMENT OF COOLING COIL REFER PROCEDURE / SKETCH UNDER - APPENDIX.*

## **OIL FILTER**

The oil filter is provided in the lubricating system to trap foreign particles from the lubricating oil and this prevents damage to the gear unit.

Filter elements are having fine meshing and should be cleaned for the first time after 2 hours operation and then after 12 hours. After ensuring that filter elements do not carry any foreign particles, the further cleaning be done periodically once in a week or so.

Filter elements should be cleaned with petrol.

Pressure drops across the oil filter in case the filter elements are choked. This should be attended to as soon as it is noticed.

## OIL COOLERS

Oil cooler should be fitted and water connection should be provided as per the drawing supplied by us. Direction of water flow should be as per markings shown in the drawing. The maximum water pressure allowed is 8 kg/cm<sup>2</sup>. The oil cooler should be periodically cleaned.

The oil cooler should be provided with fresh water of lowest possible lime content.

Water content in the oil cooler must be drained out when there is likelihood of frost formation or when the gear unit is out of operation for a long time.

## OILTANK

Normally the gear unit bottom casing acts as a reservoir, from where oil pumps sucks the oil, however for smaller gear units separate oil tank is provided as part of FLS in which case oil level should be maintained in this tank and not in gear unit, before starting of FLS.

▪ **Note:** Alongwith FLS instruments like pressure switches, flow switches, RTDs are provided as agreed in Technical Specification of the order. Their position and set points are stipulated on the manufacturing drawing for the FLS schematic drawing for FLS dispatched separately. The details of Local Control Panels, when provided along with it's wiring diagram are given on LCP drawing dispatched separately.

For any clarification regarding oil pumps, coolers and filters, specific information sheet for the above must be referred to.

## COMMISSIONING

### CHECKING BEFORE STARTING

Please make following inspections before operating the unit.

- ▶ First check the atmospheric conditions at the installation site. Excessive dust or dirt, moisture, chemical contaminants, high or low ambient temperature, extreme weather conditions may affect the operation of the unit.
- ▶ Please see that no foreign matter or moisture has entered the reducer casing through inspection cover or other opening.
- ▶ Please see that rust-preventives are removed from all external parts. Keep the breather cleaned and free from obstruction.
- ▶ Check for free rotation of the shafts and Check for proper alignment and foundation bolt tightness.
- ▶ Check the oil pump or lubrication system for exact type and quantity of oil

- ▶ Check that piping and wiring of accessories are complete.
- ▶ Check that the lubrication system is pre-fitted to minimise time of build up of positive oil pressure. When oil pressure is available from an electric driven pump, operation of the spray jets should be checked, through inspection covers wherever applicable.
- ▶ The gear units provided with the Forced Lubrication System and installed in the dusty atmosphere, like cement plant, chemical plant etc., it is observed that foreign particles enter into the lubrication system and choke up the pipe-lines. Hence before commissioning it must be ensured that all the pipe-lines and nozzles, leading the oil spray to the pinion and gear mesh as well as to the bearing, are thoroughly cleaned. It is necessary that the spray condition and oil supply condition should be periodically checked. The spray of oil should fall exactly on the meshing point especially for outward running gears.
- ▶ Check for proper rotation of the oil pump and Check the setting of the pressure switch.

## TRIAL RUNNING

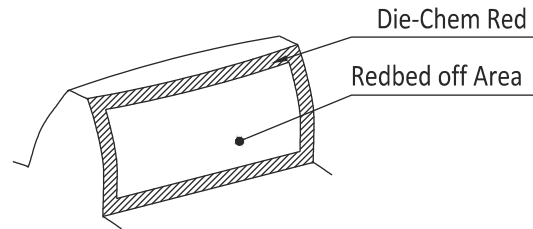
After installation and checking, please keep following points in mind :

During the trial run of the reducer, put unit into no-load operation by connecting the motor and the gear unit. To ensure smooth operation and long life, CONTINUE NO LOAD OPERATION FOR MORE THAN 3 HOURS. During this period, the gear unit and driven machine must be disconnected.

Run unit at no-load after connecting the gear unit and the driven machine. It is important to increase the load gradually without applying full load initially. Test run with no-load for 12 hours, 1/4 load for more than 48 hours and with 1/2 load for more than 48 hours. Then operate with 66% load for 48 hours minimum and then take full load.

Following procedure to be followed for checking the tooth rub-off :

- a) Apply Dye-chem Red or equivalent paint lacquer on complete length of gear tooth profile for two consecutive teeth at 3 or 4 places equidistant from each other. (This paint is quick - drying and once applied shall not get removed by oil or it's spray. However, after removal by pressure of pinion tooth, it is not harmful for lubrication when mixed in oil).
- b) After loading of gear unit, this paint shall get removed by tooth contact pressure under dynamic condition.
- c) Observe and record this dynamic tooth rub-off for each % loading. At 100% load there should be a rub-off of 80 to 90% of the total tooth profile are Typical case of recommended dynamic tooth rub-off is shown below.



**Fig:-13**

### **CHECKING AFTER STARTING**

Check vibration, unusual noise, oil leakage and record temperature every 15 minutes (wherever applicable), during commissioning. Check operation of oil pressure relief valve. Normal oil pressure is 0.8 to 2 kg/cm<sup>2</sup>.

Check tightness of all parts after load running.

Oil / bearing operating temperature : 90°C(max) and 85°C (preferably) when using specific lubricants. If the operating temperature is observed above 90°C, consult us.

### **OIL CHANGE**

The first oil change before 500 working hours. Subsequent oil changes must be made after every 10000 operating hours, depending on working conditions. If possible, the oil should be drained warm.

Where the gear unit has to be stored for a long time, consult us in advance for advice and to enable us to give a special treatment before dispatch, for storing the gear unit for a longer time.

### **PART IDENTIFICATION & SPARES**

Typical cross section general arrangement drawing is given in this manual to identify the parts. (page.no 26-31)

### **INTERPRETATION**

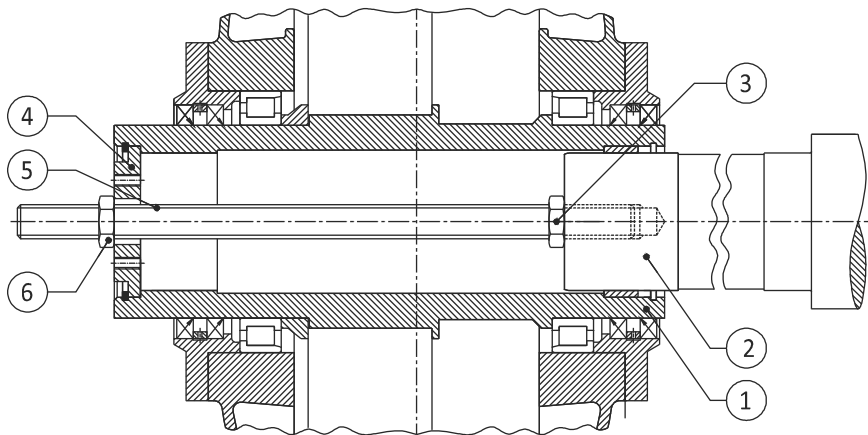
Wherever any difficulty arises in interpreting meaning of any of the terms, kindly consult us.

## LUBRICANTS CHART

DIN (ISO)	ISO VG class							
CLP	VG 150				Castrol Alpha SP 150	Bharath Amocam oil 150	Servo Mesh SP 150	Parthan EP 150
CLP-HP	VG 150	Mobilgear SHC XMP150		Carter SH 150	Optigear Synthetic X 150		Servosyn gear 150	
CLP	VG 220	Mobilgear XMP220	Shell omala F220	Carter EP 220	Castrol Alpha SP 150	Bharath Amocam oil 220	Servo Mesh SP 220	Parthan EP 220
CLP-HP	VG 220	Mobilgear SHC XMP220	Shell omala oil HD 220	Carter SH 220	Optigear Synthetic A 150		Servosyn gear 220	
CLP	VG 320	Mobilgear XMP320	Shell omala F320	Carter EP 320	Castrol Alpha SP 320	Bharath Amocam oil 220	Servo Mesh SP 320	Parthan EP 320
CLP-HP	VG 320	Mobilgear SHC XMP320 Mobil SHC 632	Shell omala oil HD 320	Carter SH 320	Optigear Synthetic A 320		Servosyn gear 320	
CLP	VG 460	Mobilgear XMP460	Shell omala F460	Carter EP 460	Castrol Alpha SP 460	Bharath Amocam oil 460	Servo Mesh SP 460	Parthan EP 460
CLP-HP	VG 460	Mobilgear SHC XMP460 Mobil SHC 634	Shell omala oil HD 460	Carter SH 460	Optigear Synthetic A 460		Servosyn gear 460	



## PROCEDURE OF MOUNTING THE GEAR UNIT WITH HOLLOW SHAFT



1. Hollow Output Shaft
2. Driven Machine Shaft
3. Nut
4. End Plate
5. Screw Spindle
6. Nut

Fit gear unit by means of nut and threaded spindle support is provided by the hollow shaft.

- Note: The hollow shaft should be in alignment with the machine shaft so that no canting will take place.

Clean the rust coating from Hollow Shaft

Clean the machine shaft.

Apply molykote/Graphite on machine shaft for easy fitting and avoid rusting after fitting.

Fit the machine shaft.

Instead of using the shown nut and threaded spindle, e.g. hydraulic lifting device may alternatively be used.

### AXIAL LOCKING

Depending on the design , secure hollow shaft axially on the machine shaft ( circlip , end plate, screw, and other.)

## DISMANTLING

Remove axial safety device of hollow shaft.

In case of formation of the rust at the seat surfaces press penetrating oil into the void of the bore and thus against the seats by means of a pump or similar so that the gear unit can be pulled off more easily. Feeding the penetrating oil is carried out via bores in the machine shaft refer Fig. 2 or in the end plate.

Pull off the gear unit by means of the device according to figure after sufficient reaction time of the penetrating oil.

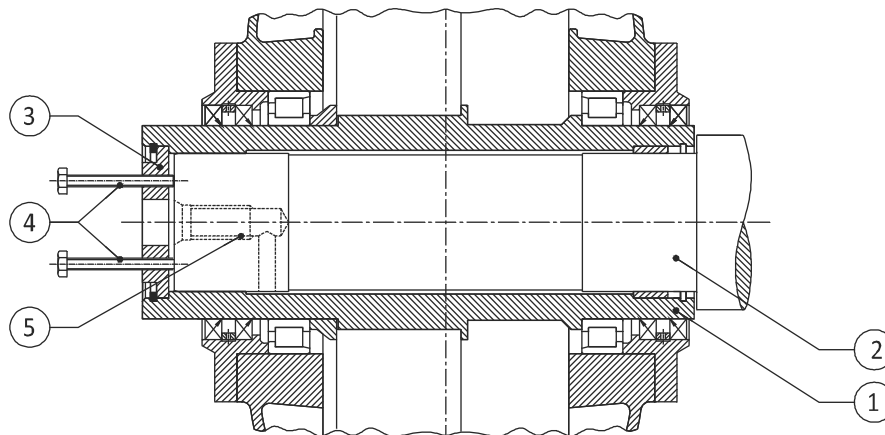
- Note : Make sure that there is no canting during pulling off.

The shrink disc is delivered ready for installation.

- Note : Do not disassemble shrink disc before first clamping.
- Note : In the area of the shrink disc seat, the bore of the hollow shaft as well as the machine shaft should be absolutely free of grease, As it will have negative effect on torque transmission.

The safety of the torque transmission depends on it to a great extent.

Dirty solvents and cleaning rags are unsuitable for degreasing.



1. Hollow Output Shaft
2. Driven Machine Shaft
3. End Plate
4. Screws
5. Bore for feeding pressurized oil

## PROCEDURE OF MOUNTING THE SHRINK DISC

The exact mounting distance (W) of the shrink disc can be taken from the dimension drawing.

- **Note:** In the area of the shrink disc seat, the outer surface of the hollow shaft may be greased.
- **Note:** Never tighten the clamping screws before the machine shaft is installed, too.

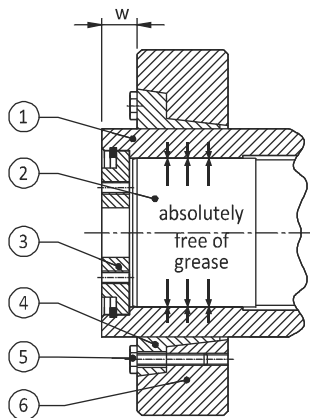
The clamping screws are to be tightened in several turns one after the other.

- **Note:** Never tighten screws crosswise!

Tighten all clamping screws until the front surfaces of the outer and inner race are flush.

- **Note:** The correct clamping state can thus be checked visually.

To avoid overloading the individual screws, the max. tightening torque (refer table) must not be exceeded, what is more important is that the faces are flush. If this flushness cannot be reached during clamping, consultation is necessary.



1. Hollow Output Shaft
2. Driven Machine Shaft
3. End Plate
4. Shrink Disc Inner Race
5. Clamping Screws
6. Shrink Disc Outer Race

## DISMANTLING OF THE SHRINK DISC

The loosening procedure is similar to that of clamping.

The clamping screws are to be loose in several turns one after the other.

If the outer race does not come off the inner race by itself, some clamping screws can be unscrewed and screwed in into the neighboring forcing threads.

Unclamping is then possible without any problem.

Pull of the shrink disc of the hollow shaft.

Clean and lubricate the shrink disc.

Loosened shrink discs do not have to be taken apart and lubricated again before being re-clamped. The shrink disc is only to be disassembled and cleaned when it is dirty.

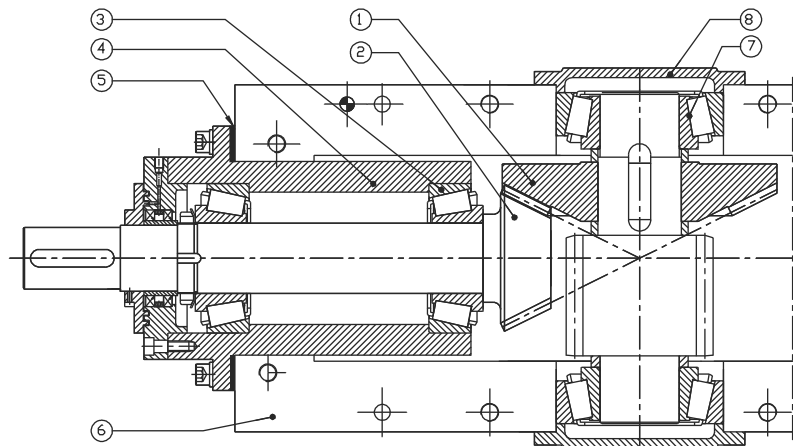
- **Note:** Only the inner sliding surfaces of the shrink disc are to be lubricated again in the connection.

## PROCEDURE FOR ADJUSTMENT OF SPIRAL BEVEL PAIRS IN ASSEMBLY

It is necessary to check the tooth contact of the bevel gears when ever it is disturbed.

Debur clean the gearcase (6), Sub-assemblies thoroughly (Input Bevel pinion sub assembly inside the flanged(4) bush as shown). Normally sub-assemblies are with taper roller bearings (7), instead of covers (8) side clamps are to be fitted on sides of input and spiral bevel wheel assembly bore during adjustment. Put the bevel pinion (2) and spiral bevel wheel (1) sub-assemblies as per the handling required and match the face width of both the pinion and wheel. Wheel sub assembly may be adjusted by moving the whole assembly inside the gear case(6). Pinion sub assembly may be moved by moving the flanged bush to and fro inside the gear case. Ensure that there will be sufficient backlash so that both the assemblies rotate smoothly. Now apply Mechanics blue on bevel pinion teeth on profile of 4 to 5 teeth and rotate to get the contact on mating spiral wheel. If the contact pattern is not as per the lapping contact ( i.e. about 45 to 50 % of tooth flank starting from the 'toe' side of spiral bevel pairs ), move the bevel pinion axially to and fro, by reducing or adding shims(5) inbetween the gear case (6) and flanged bush(4) till proper contact is achieved. Then adjust the backlash by moving spiral bevel wheel assembly in or out as per the standard (Use enclosed recommended values). Under this condition, take the spigot dimensions for spiral bevel wheel assembly with ' zero' clearance. After machining the cover spigots for the covers(8) and once again check contact, backlash and axial clearance.

## GUIDELINES FOR BACKLASH RELATIVE TO NORMAL MODULE FOR SPIRAL BEVEL



1. Bevel Gear
2. Bevel Pinion shaft
3. Input Line Bearing
4. Flanged Bush
5. Shim
6. Gear Case
7. Intermediate Bearing
8. Bearing Cover

MODULE Mn	BACKLASH (mm)
0.3-1.0	0.03 - 0.06
1	0.06 - 0.08
2	0.08 - 0.11
3	0.10 - 0.13
4	0.12 - 0.14
5	0.14 - 0.17
6	0.15 - 0.18
7	0.16 - 0.19
8	0.18 - 0.20
8 - 10	0.20 - 0.25
10 - 12	0.25 - 0.30
12 - 14	0.30 - 0.35
14 - 16	0.35 - 0.40
16 - 18	0.40 - 0.45
18 - 21	0.45 - 0.50

## PROCEDURE FOR FITTING & TESTING OF COOLING COILS

Cooling Coil assembly consists of cooling coil, cooling coil cover, Coil cup (welded with cooling coil inlet & outlet pipes), Washer, Hex nut, 'O' ring, Nipple etc.,..

Check the leakages by passing the water through the coil outside itself before fitment to ensure any welding leakages or any other defect.

Insert the cooling coil(2) in the cooling coil cover and ensure that the Coil cup resetting on the faces of the cooling coil cover.

Insert the 'O' ring in another side of the cooling coil plate on the coil cup. Insert the washer & ensure that, the 'O' ring properly rests inside the chamfer given in the washer.

Insert the 'O' ring on to the inlet, outlet pipe OD should rest the 'O' ring on to the chamfer provided on the washer and tighten the hex nut fully. Fix the nipples at the end of the coil cups in Inlet & outlets of cooling coil assembly.

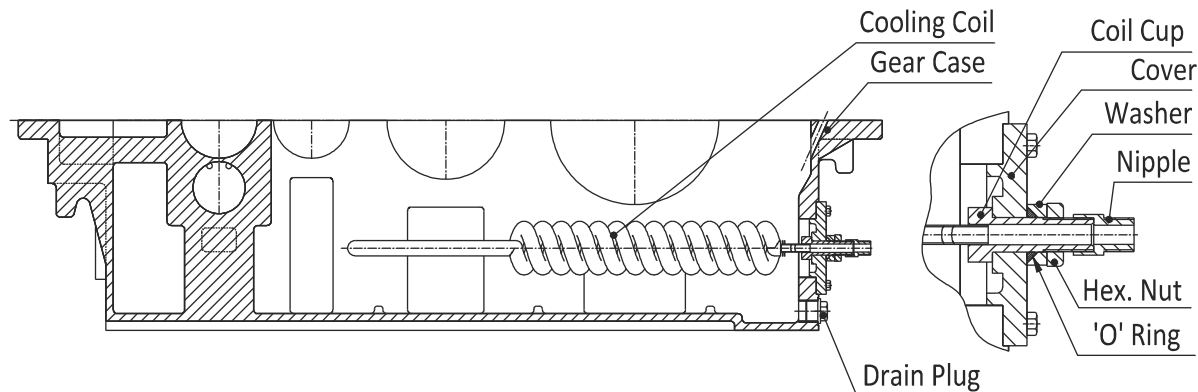
Finally mount the cooling coil cover with cooling coil assembly in the gear case. Pour the oil upto the recommended oil level (as per the oil level dipstick markings)

Ensure that, there is no leakage around the Cooling coil cover & Inlet / Outlet coil cup assembly.

Pass the water through the cooling coil at a pressure 5 kg/cm<sup>2</sup> for hydrostatic testing to ensure no leakages

Drain the oil, clamp the cooling coil inside the sump suitably

- **Note :** The lock nut (Hex. Nut) should not be loosened, once the cooling coil is fitted and tested as above.



## PROCEDURE FOR FITTING HOLDBACKS AT SITE

(Refer Arrgt. Sketch shown below the text)

Confirm the direction of rotation of the shaft on which holdback is to be fitted with mark (View in the direction of arrow to decide sense of rotation ) Check the length of the seating dia. of shaft (5) and width of the spider (7) which should be equal so that circlip should seat properly in the groove after fitting the spider in position. Check the concentricity of the adaptor plate (1) spigot, on which outer ring (3) of the holdback fits, with reference to pinion shaft extension, on which spider (7) of holdback fits, with help of a dial gauge which should be within 0.05 mm.

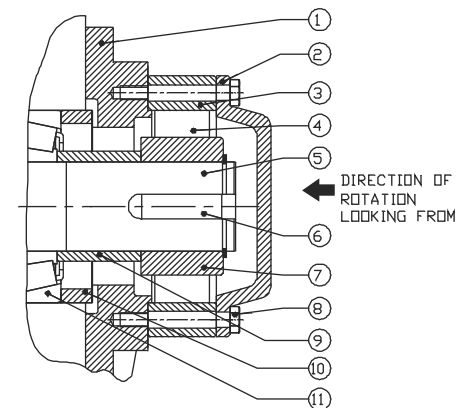
Fit the key (6) in position on shaft extension after removing the burrs. Fit the spider (7) on the shaft (5) with a slight hammer fit according to the direction of rotation required. See the spider (7) is not fouling with adaptor plate (1) when spider is fully resting on the shaft (5) step. If distance piece (10) is coming in between spider and bearing same is to be adjusted before fitting by checking the dimensions from bearing and circlip groove and total width of the spider.

Fill the grease EP2 in the spider sprags (4) Slide the outer ring (3) of the holdback on to the spider (7) in such a way that all the sprags (4) of spider (7) should be in its inner most position which can be achieved either by slightly rotating the outer ring on spider while pushing inside or by wrapping and tightening a thin wire on spider periphery. Slide outer ring (3) on to the spigot of adaptor plate (1), fill the grease once again and fit the end cover (2) and all the screws (8) by matching the holes of end cover (2), outer ring (3) and adaptor plate (1).

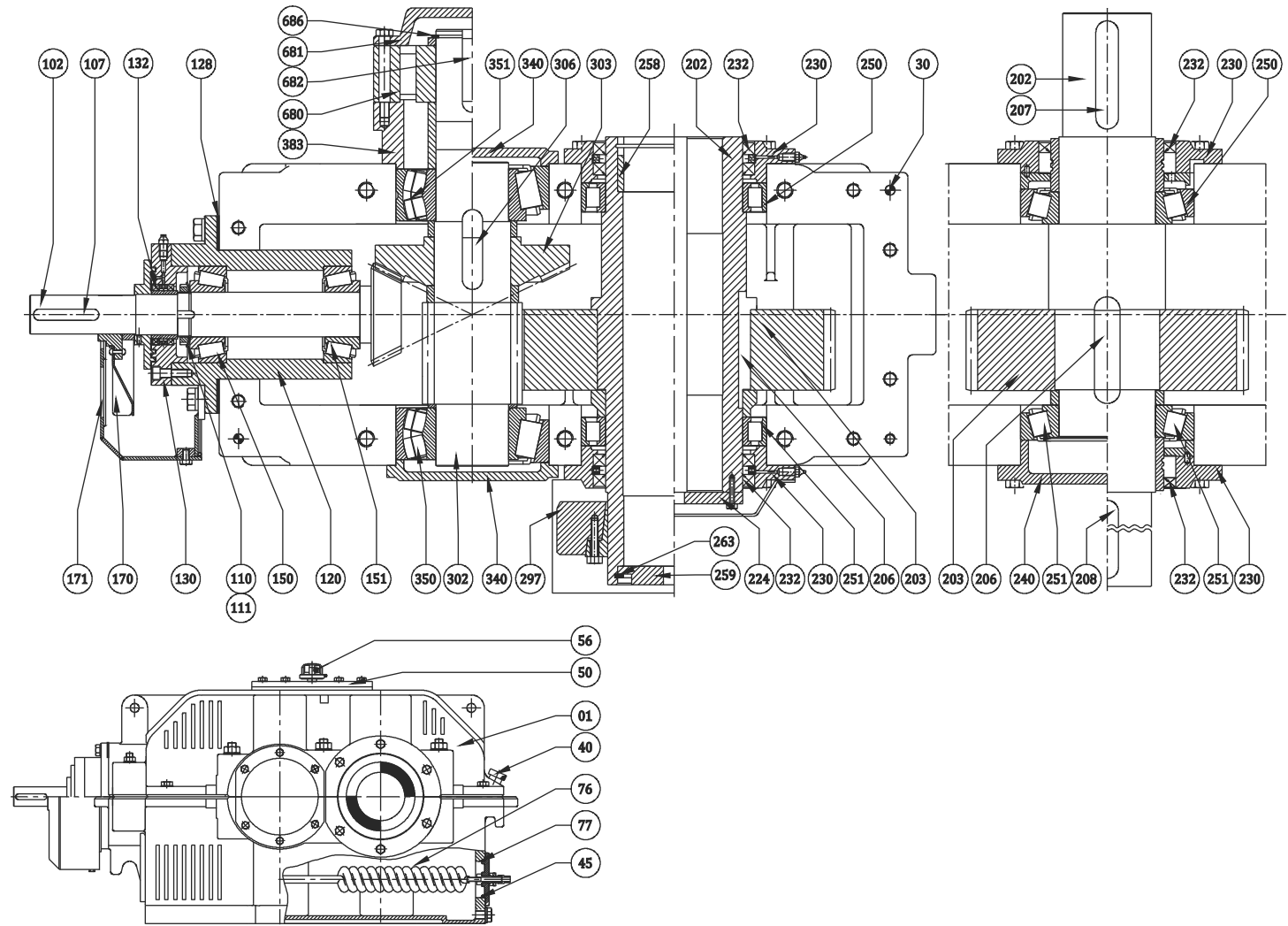
Confirm for the free rotation of holdback by rotating the input shaft according to the direction of rotation required.

Run the gear unit on no load for 4 hours during which check the noise and temperature or any abnormalities in holdback and gear unit.

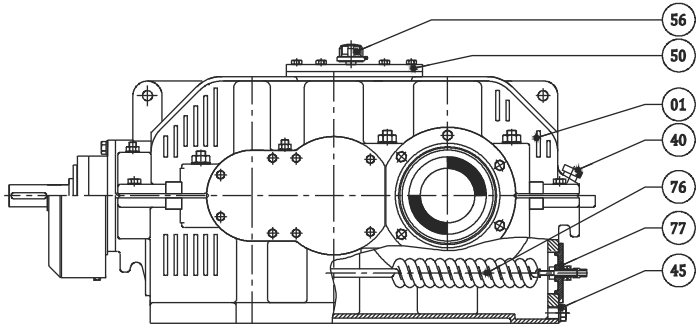
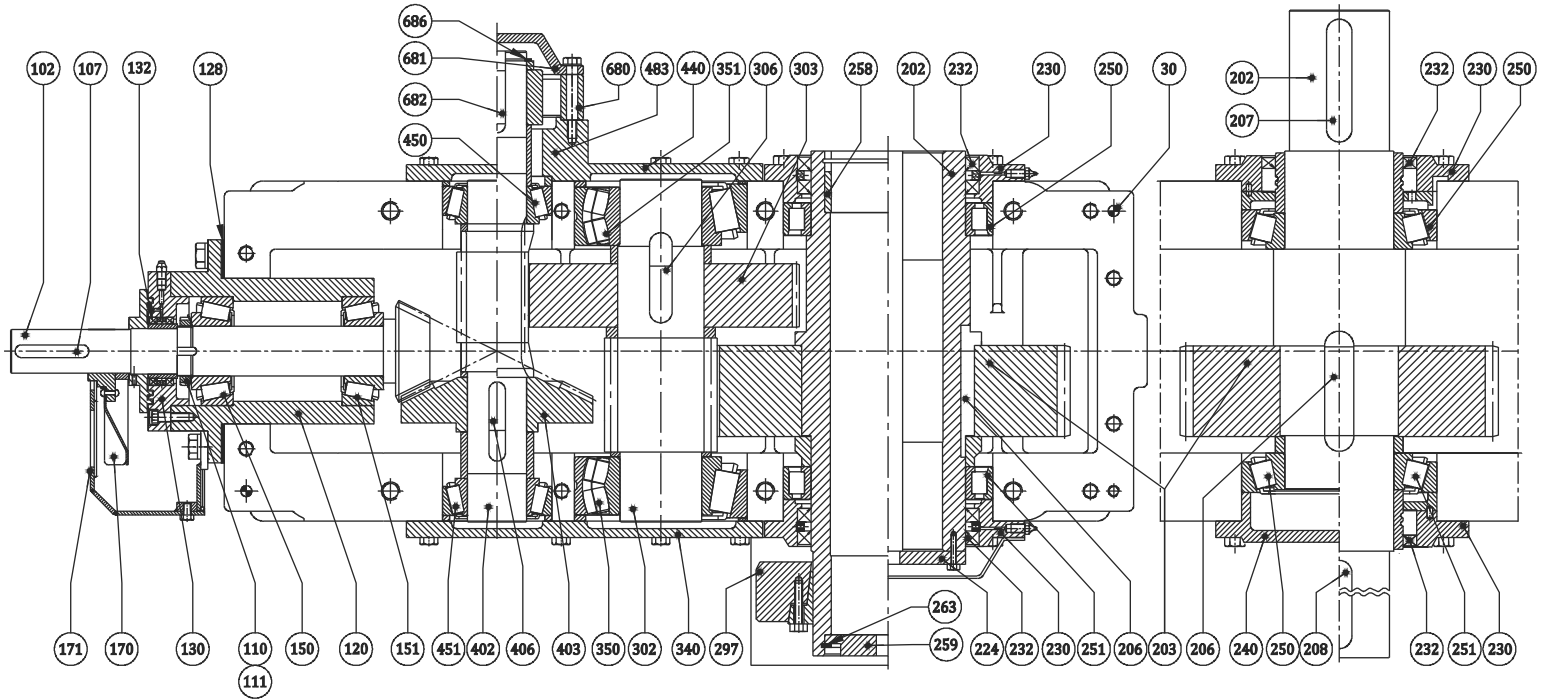
- |    |                |     |                |
|----|----------------|-----|----------------|
| 1. | Adapter Plate  | 7.  | Spider         |
| 2. | End Cover      | 8.  | Screws         |
| 3. | Outer Ring     | 9.  | Distance Piece |
| 4. | Sprag Elements | 10. | Distance Piece |
| 5. | Pinion Shaft   | 11. | Bearing        |
| 6. | Key            |     |                |



# K2 GEAR UNITS

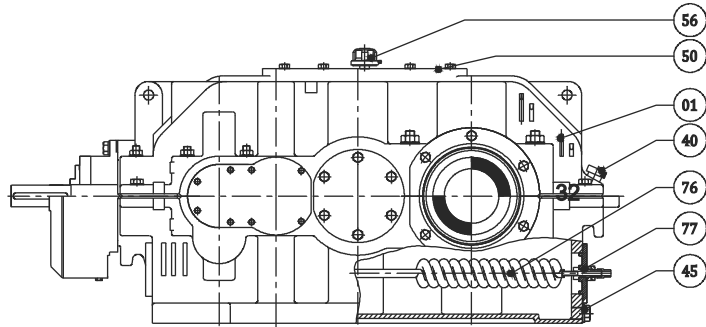
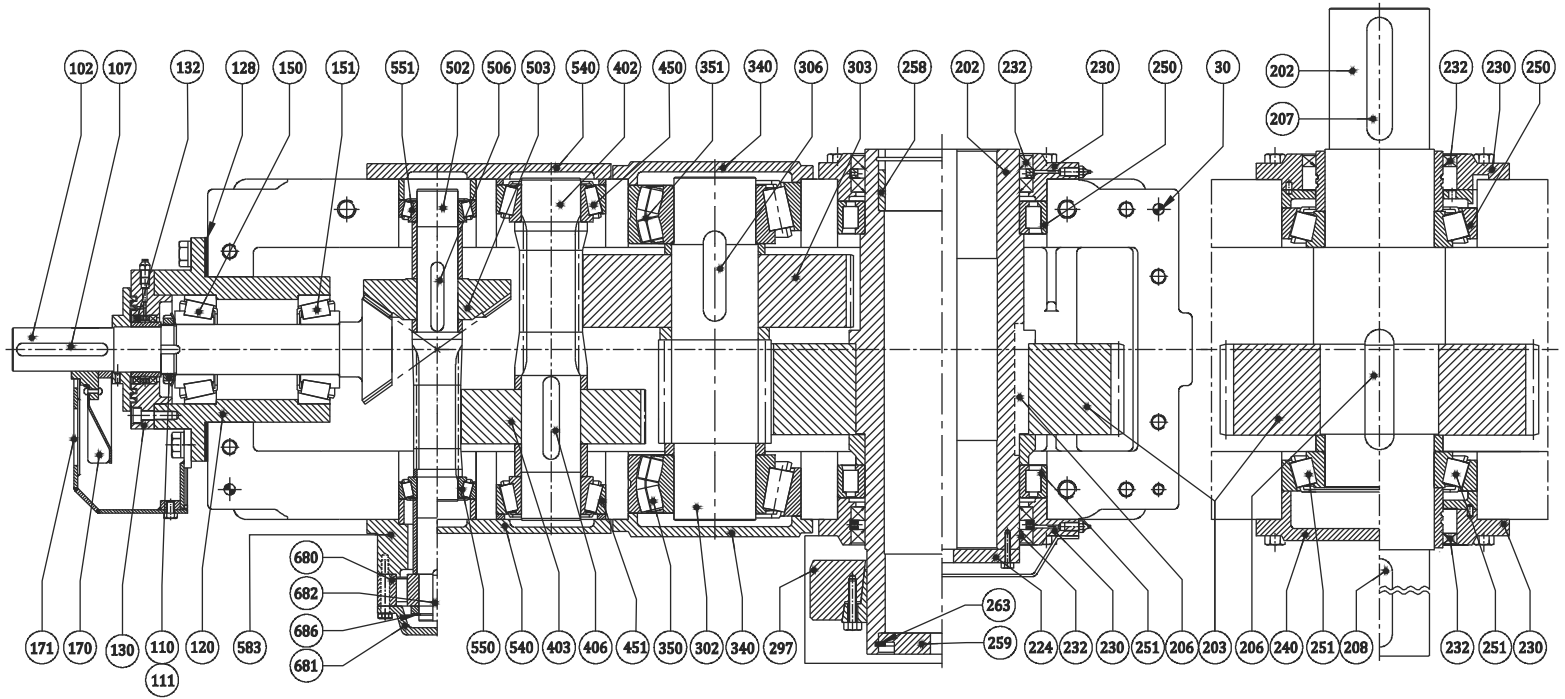


# K3 GEAR UNITS

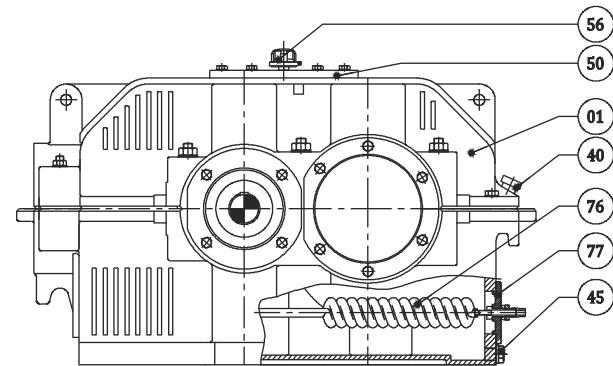
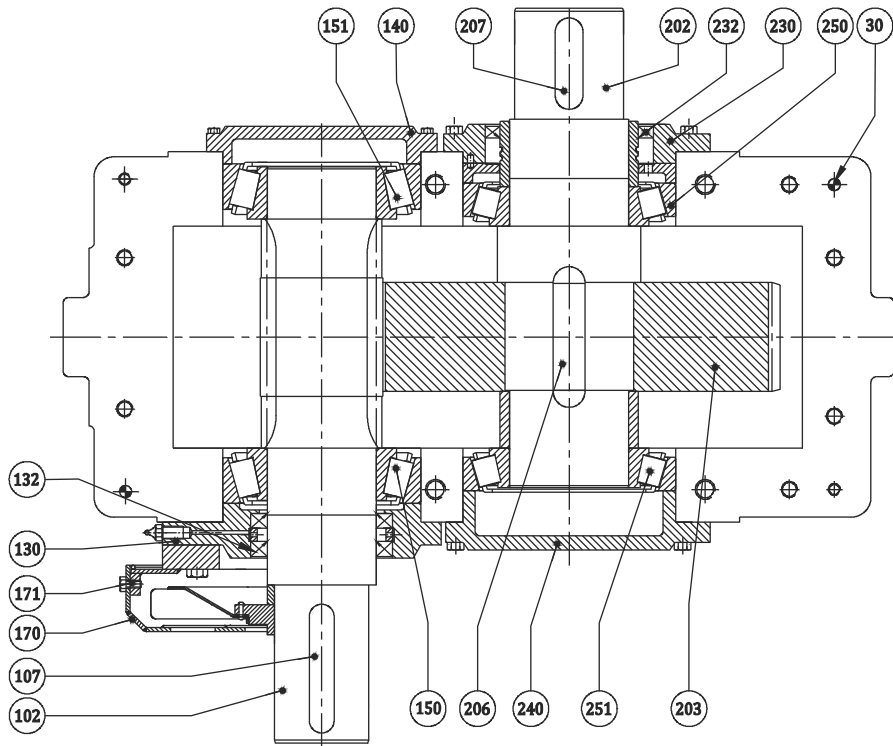




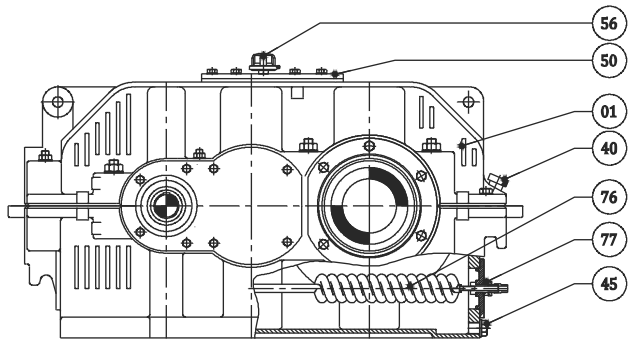
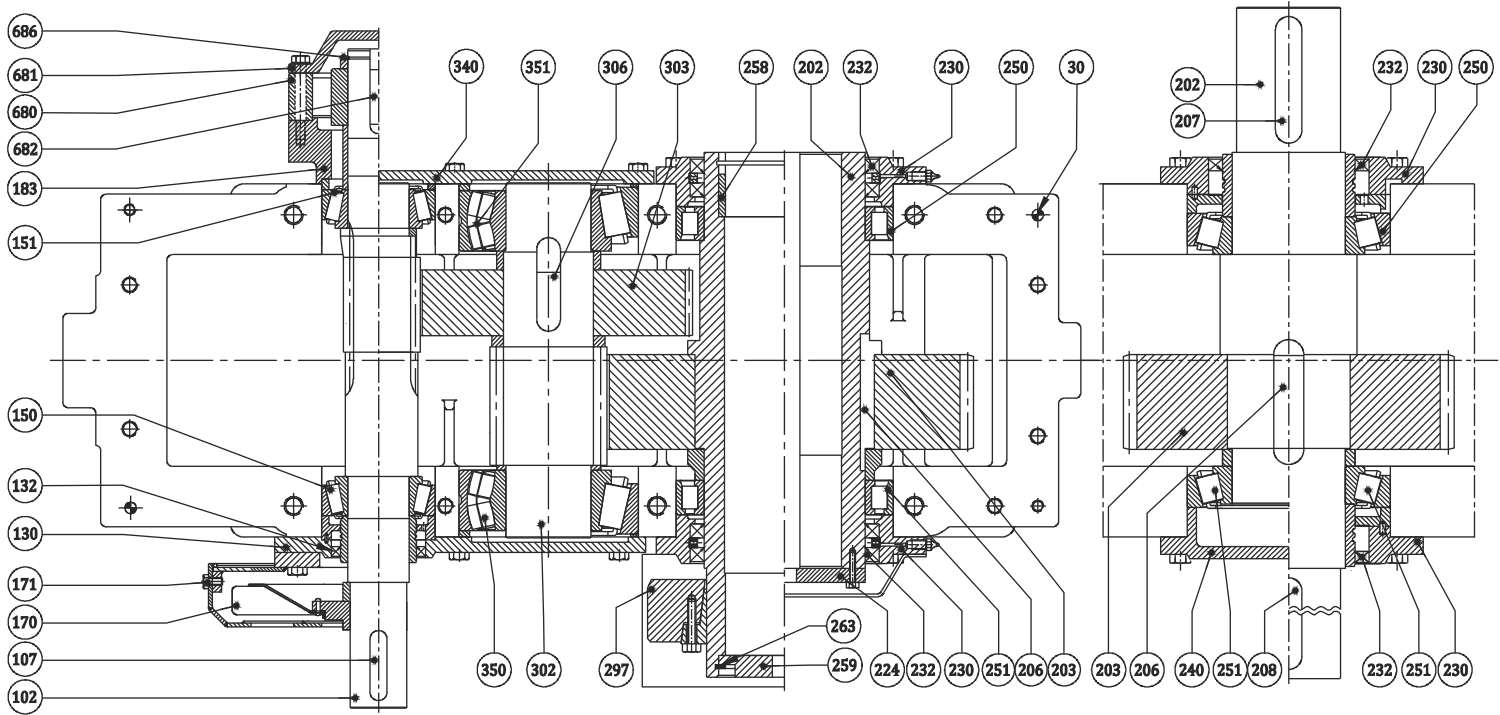
# K4 GEAR UNITS



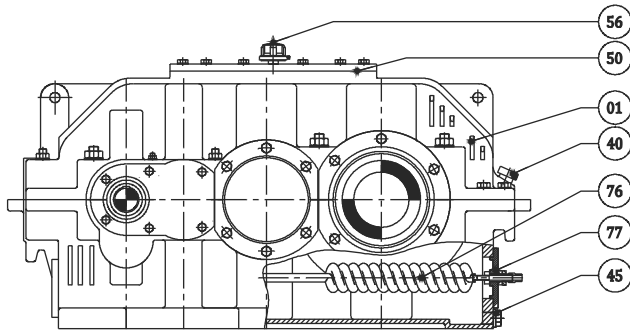
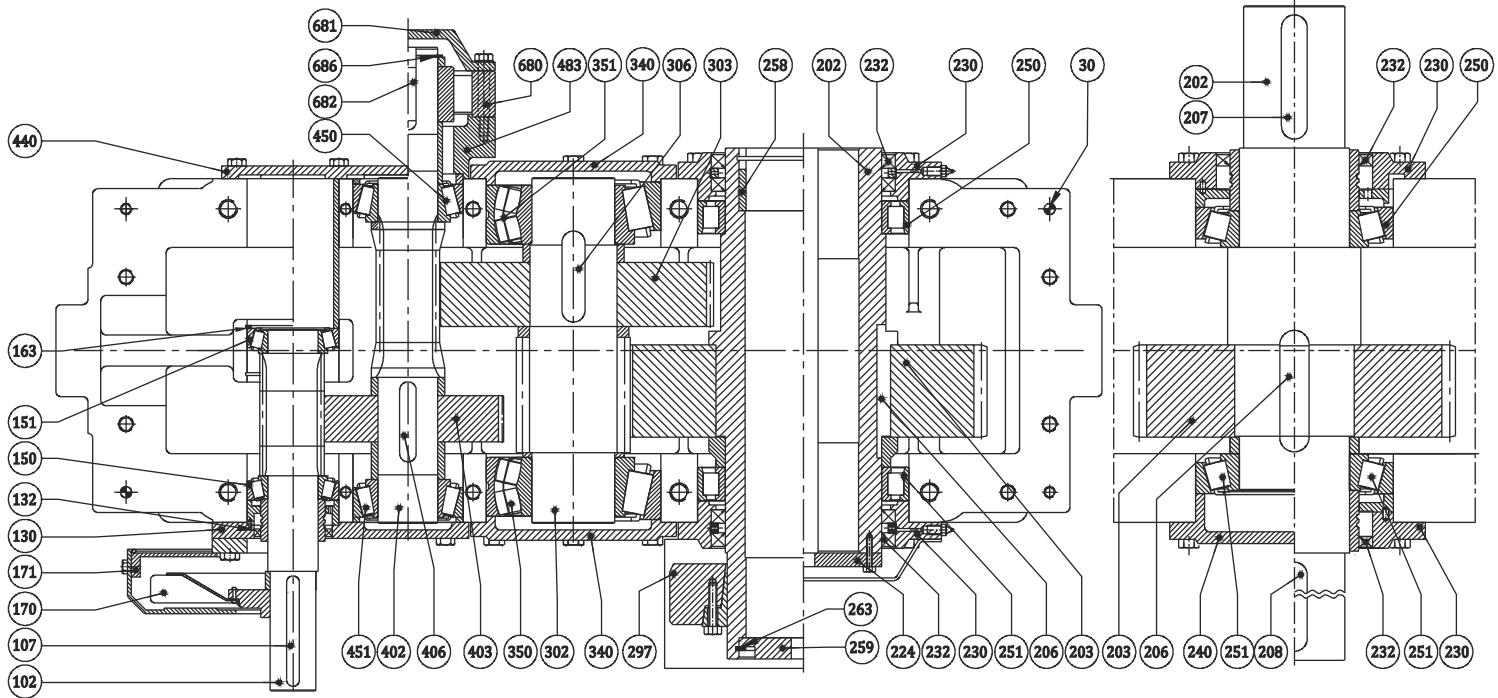
# S1 GEAR UNITS



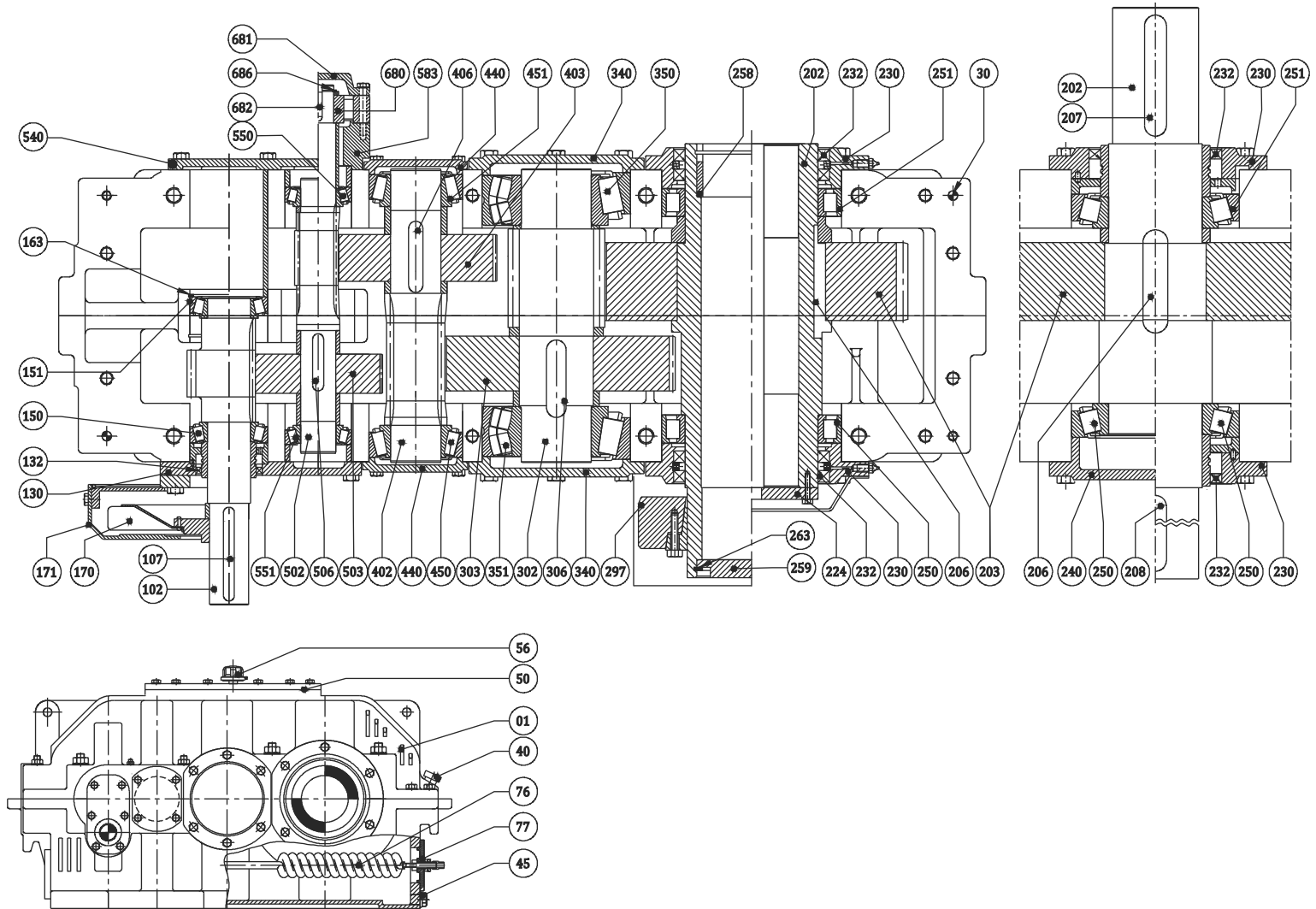
# S2 GEAR UNITS



# S3 GEAR UNITS



# S4 GEAR UNITS



For any service requirement, please contact our office with complete name plate details

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