405 EC e

Chemineer

Reliability & Technology in Mixing

Standardized gear units

Service manual

SHIPPED
WITHOUT OIL

n **New instructions** are indicated by a grey bar in the margin

SM2005

: DANGER

: WARNING

M : MAINTENANCE

n : NEW INSTRUCTION

SCOPE

This service manual contains the installation, operating, lubrication and maintenance instructions relative to the P4 standardized gear units.

All handling, storage, installation, start-up, inspection and maintenance of the equipment shall be done by personnel qualified in matters of industrial mechanical and - where applicable - electrical equipment.

1. GENERAL

1.1. GENERAL INSTRUCTIONS

Carefully read this manual before installing the gear unit.
Compliance with the instructions will assure long and troublefree operation of the gear unit.
The equipment should be checked against shipping papers and inspected for apparent damage sustained during transport. Any shortage, discrepancy or damage must immediately be reported to CHEMINEER.

1.1.1. Warranty

The warranty clause of the "General Conditions of Sale" applies to gear units installed and maintained as per instructions contained in this manual and in any additional instruction leaflets supplied with the gear unit insofar as the gear unit operates within the service and rating conditions put forward in the "Order Acknowledgement" and on the certified drawings.
Non compliance with these instructions, injudicious choice of lubricant or a lack of maintenance will render warranty agreement invalid.
This warranty clause applies to all parts of the gear unit with the exception of these parts which are subject to wear.

1.1.2. Safety

It is not allowed to use the gear unit for other applications or in other operating conditions than the one for which it is ordered.
The user shall be responsible for the proper installation of the complete equipment and the supply of protection guards and other safety equipment in accordance with local safety regulations.

Some seals in a gear unit can contain FKM1 material (trade names e.g. Viton® 2 and Fluorel® 3).
If seals, made out of FKM material, have been exposed to high temperatures (e.g. in case of a fire or when a bearing very close to the seal has experienced massive damage), highly corrosive organic fluorides may have been generated and contact with the skin must be avoided at all time. Since it is not always clear whether the used material is in fact FKM, it is strongly recommended to handle every seal that has been exposed to high temperatures with extreme care and to take the necessary precautions (*).

1: FKM is short for Fluoroelastomer
2: Viton® is a registered trademark of Dupont-Dow
3: Fluorel® is a registered trademark of Dyneon (3M)

Extraction from 'handling precautions for Viton® and related chemicals', technical information from Dupont-Dow.
Precaution in the event of fire.

Highly toxic products (**) of combustion can be generated in a fire involving Viton®. Personnel fighting such a fire must wear facemasks and a self-contained breathing apparatus. All unprotected personnel must leave the area immediately. Anyone exposed to fumes from the fire should be moved to fresh air at once and treated by a physician.
Anyone handling residues of Viton polymer or parts of Viton that have been involved in a fire must wear Neoprene gloves to avoid skin contact with these possibly highly corrosive residues, which likely include hydrogen fluoride. (Polyvinylchloride [PVC] gloves may be used if the temperature of the residue is below the melting point of the gloves.) Such residues should be decontaminated by washing in lime water (calcium hydroxide solution) and disposed of in the same manner as Viton® polymer. To dispose of Viton®, landfill is pre
tact with these possibly highly corrosive residues, which likely include hydrogen fluoride. (Polyvinylchloride [PVC] gloves may be used if the temperature of the residue is below the melting point of the gloves.) Such residues should be decontaminated by washing in lime water (calcium hydroxide solution) and disposed of in the same manner as Viton® polymer. To dispose of Viton®, landfill is preferred. The disposal method must be conform to national, state and local regulations.
Burning of Viton® is not recommended, unless conducted by an approved, licensed incineration process. In this case, the gaseous products should be treated by alkaline scrubbing. The gloves must be discarded after use.

(**) Combustion products of Vulcanizates of Viton®

Carbon Monoxide (CO)	Fluoroform (CHF3)
Carbon Dioxide (CO2)	Vinilidene Fluoride (H2CCF2)
Hydogen Fluoride (HF)	Hexafluoropropylene (C3F6)
Carbonyl Fluoride (COF3)	Low molecular weight fluocarbon fragments

Heaters, coolers, electrical alarms and other safety or monitoring devices supplied by CHEMINEER with the equipment must be installed and connected by the user as indicated on the relative document.

1.2. GENERAL SPECIFICATIONS

For general specifications such as dimensions, weight, connecting diagrams, refer to certified drawing of the gear unit and/or to the P4 standardized gear unit catalogues.

1.3. IDENTIFICATION

Inquiries concerning a gear unit should always specify the unit's complete type code and manufacturing number, which can be found on the nameplate. The nameplate, which is fitted on each gear unit, also contains ratings and/or torque, speed and lubrication instructions. This information is essential to identify positively the unit supplied by CHEMINEER.

2. SHIPPING

Prior to shipment each unit has been inspected and accepted by the QUALITY CONTROL DEPARTMENT according to order specifications, and after no load test of several hours in its normal operating position and at speed indicated on the nameplate.

2.1. SHIPPING CONDITIONS

Unless otherwise specified, gear units are shipped in unpacked condition and depending on necessity, fixed on wooden pallets with open crating protection. Sometimes parts, such as spare filter elements, are separately packed. In such events, the end-user must take care of the assembly (see chapter 5. INSTALLATION p. 5).

The P4 gear unit is shipped without oil.

All grease lubrication points are factory filled.

In case the gear unit, after arrival of the shipment from CHEMINEER, has to be transported further, then transport by train has to be avoided. If the units are to be transported by train anyhow, then the necessary precautions must be taken by the forwarder to avoid false Brinelling damage on gears and bearings.

2.2. PAINTING

The standard external paint for CHEMINEER gear units is an epoxy primer with high solids content, corresponding to the German Standard RAL 5021, water blue.
This paint system offers a 5 year protection for indoor installation provided the gear unit is not subjected to humid or chemical aggressive atmospheric conditions.
Overcoating is possible with most paints based on alkyd-, epoxy or polyurethane resins.

2.3. PRESERVATION

The inner parts of the gear units are sprayed with rust preventing mineral oil. The breather plug (standard, dust-proof, anti-humidity) is neither removed nor sealed.
The shaft extensions are protected with rust preventing grease and waxed paraffin paper. The hollow shafts and all unpainted machined surfaces are coated with an anti-oxidizing waxy varnish.
This standard system offers corrosion protection during transport and/or storage for up to one year indoors.

3. STORAGE

Always store gear units in their originally supplied shipping conditions.
Gear units should not be stored near vibrating machines in order to avoid damage to bearings.

3.1. SHORT TERM STORAGE

INDOORS
Up to two years indoors in a dry and ventilated area.

OUTDOORS
Up to six months outdoors.
The gear unit must be filled with a small amount of mineral oil containing an volatile corrosion protective additive. All gear unit openings (dipstick, breather, heater) are hermetically sealed and must remain sealed during handling and transport.

3.2. LONG TERM STORAGE

INDOORS
Up to five years indoors in a dry and ventilated area.

In case the units are stored for a period up to 5 years in a dry and ventilated area, the units have to be re-filled with a small amount of mineral oil containing a volatile corrosion protective additive after the second and the fourth year. The corrosion protection of the shaft extensions has to be checked - possibly corrected. At these occasions the high speed shaft must be turned until the low speed shaft has made 2 complete revolutions. After that the unit has to be hermetically sealed again.

OUTDOORS
Up to 2 years outdoors, in an hermetically sealed envelope and enclosed in a seaworthy packing case.

NOTE
All gear units treated and packed for long term storage have the following sticker with caution and instructions.

This gear unit contains … litres volatile corrosion inhibitor oil.

STORE ON SHIPPING POSITION AND KEEP HERMETICALLY CLOSE TO PREVENT VAPOURS OR OIL FROM ESCAPING TILL PUTTING INTO OPERATION

BEFORE PUTTING INTO OPERATION

- Replace the red plugs by the dipstick and breather (filter or plug).

- Drain the protective oil and fill the gear unit with the exact quantity of the prescribed gear oil (see also maintenance manual)

It may in some cases be necessary to rinse the gear unit with the selected oil before starting up. Check with the oil supplier.
See paragraph 6.6, page 10: The first oil filling.
See chapter 9, page 11: Starting Up.

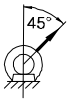
Handle any lubricant or oil with care and according to the handling and safety instructions to be supplied by the lubricant supplier on customer's request. These instructions have to be handed over to any personnel performing installation, maintenance or repair of the gear unit.

4. HANDLING

The P4 gear units are easy to handle and to install. Make use of integral oval lifting eyes (horizontal mount) and lifting eye nuts or integral rods (vertical mount).
For equal load sharing make use of all lifting eyes and use adequate tools.

Make use of attached lifting eye nuts or mount appropriate lifting eye nuts in housing feet. Attached lifting eye nuts must not be removed.
Eye nuts must be fully engaged before lifting.
Never lift units with slings wrapped around the shafts or motor lantern.

Lifting eye nuts attached to the gear unit:

Max. Force on eye nut (KN)	M16	M20	M24
	7	12	18
	4	7	10
	3,5	6	9

Horizontal mount

- Single stage gear units (type QHP.1)

Gear unit size	C	D	E	F	G
Low speed shaft side	Use the oval lifting eye and holes in the feets				
High speed shaft side					

- Multi stage gear units (type QH...)

Use only integral oval lifting eyes

Gear unit size	A	B	C	D	E	F	G	H	J	K
Low speed shaft side	Use only the integral oval lifting eyes									
High speed shaft side										

Gear unit size	L	M	N	P	Q	R	S	T
Low speed shaft side	Use only the integral oval lifting eyes							
High speed shaft side								

Vertical mount

- Gear units (type QV..2)

Gear unit size	C	D	E	F
Low speed shaft side	M16	M16	M20	M24
High speed shaft side	M20	M24	M24	M30

- Gear units (type QV..3)

Gear unit size	C	D	E	F	G	H
Low speed shaft side	M16	M16	M20	M24	M30	M30
High speed shaft side	M16	M20	M24	M24	M30	M30

- Gear units (type QVRG2 and QVRH2)

Gear unit size	J	K	L	M	N	P	Q	R	S	T
Low speed shaft side	Use only the integral rods									
High speed shaft side										

5. INSTALLATION

5.1. FITTING OF ACCESSORIES

The metric shaft extensions are equipped with keyways according to DIN 6885 "Blatt 1 - Form N1 or N3".
Threaded centre holes in these shafts according to DIN 332 Teil 2 Form D.
Couplings should be mounted on the shafts with interference fit according to specifications. In case of doubt please refer to CHEMINEER.
The inch shaft extensions are equipped with keyways according to USAS B17.1-1967.
Recommended bore tolerance :

- 0.0005" to - 0.001" for diameters ≤ 1 1/2"
- 0.001" to - 0.002" for diameters > 1 1/2"

Remove protection from shaft extensions and check keyfit and keyway height in component to be mounted onto shaft. Heating the component to 80-100°C (175-210°F) will be helpful.
Threaded centre hole in shaft to assist in mounting components onto shaft may be used.

Never mount components by impact as this may cause damage to the bearings.

Never use rigid couplings except on free end machine shafts (e.g. mixers, aerators) or in executions with a torque arm.

5.2. EXTERNAL LOADS

If external loads act on the gear unit, thrust blocks must be installed against the unit's feet, to prevent gear unit from shifting. Components transmitting radial load to the shaft should be mounted as close as possible to the housing.
Avoid exaggerated tension in transmission belts mounted on input or output shafts. On gear units with built-on motor and V-belt drive, tension has been factory set. Tension should be rechecked after 24 hours service. Chain transmissions must be mounted without preliminary tension.
In case a pinion is mounted on the shaft extension of the gear unit, care should be taken to have normal required backlash between pinion and gear and good contact pattern must be assured.

5.3. ERECTION

5.3.1. Levelling

Install gear unit level to better than 5 mm per 1 m (5/32 inch per 3 feet or 5mrad or 17 arc minutes) or within the limits indicated on the outline drawing for positions other than horizontal.

Always mount gear unit in position for which it was ordered.

Before altering this position or inverting the unit, please consult CHEMINEER.
It may be necessary to readapt the lubrication system.

5.3.2. Alignment

Align gear unit as accurately as possible with driving and driven machinery. Install gear unit level to better than 5 mm per 1 m (5/32 inch per 3 feet or 5mrad or 17 arc minutes) or within the limits indicated on the outline drawing for positions other than horizontal.
Maximum allowable misalignment depends on the couplings fitted on the shaft extension, please refer to data provided with coupling.
Use three fixation points of gear unit for alignment. Adjust other fixation points by shimming to 0,1 to 0,2 mm (0.004 to 0.008 inch), depending on the size of the gear unit.

5.4. SECURING OF SOLID SHAFT GEAR UNIT

Gear unit must be mounted onto a rigid and stable bedplate or foundation in order to avoid vibrations and possible overload of the housing fixation pads.
Use fixation holes indicated on dimensional drawing.
After correct alignment and shimming of all points, fix gear unit solidly onto its foundation with appropriate size bolts, grade 8.8 according to DIN 267 or SAE grade 5 for bolts 1 1/2" and smaller, ASTM.A-354 grade BC for bolts larger than 1 1/2", and grade 80 according to DIN 267 for stainless steel bolts. Dimensions and tightening torques: see table.
Note: for some horizontal executions with parallel shaft and fans, the protection hood of the fan must be removed (and remounted afterwards) to enable tightening of the bolts.

5.4.1. Tightening torques for steel bolts grade 8.8

n

Horizontal mount

- **Single stage gear units (type QHP.1)**

Gear unit size		C	D	E	F	G
Bolt size	ISO	M20	M24	M24	M30	M30
	UNC	3/4"	7/8"	1"	1 1/8"	1 1/4"
Tightening torque	Nm	285	450	660	830	1150
	lbf.in	2500	4000	5800	7300	10000

- **Multi stage gear units (type QH...)**

Gear unit size		A	B	C	D	E-F	G-H-J-K	L-M	N-P-Q	R-S-T
Bolt size	ISO	M16	M20	M24	M24	M30	M36	M42	M48	M56
	UNC	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	1 3/4"	2"	2 1/4"
Tightening torque	Nm	165	285	450	660	1150	2000	2500	3500	5300
	lbf.in	1450	2500	4000	5800	10000	18000	22000	31000	47000

Vertical mount

- **Gear units (type QV...)**

Gear unit size		Z (1)	Z (2)	A	B	C	D	E	F-G(3)	G(4)-H-J-K	L-M-N-P-Q	R-S-T
Bolt size	ISO	M20	M16	M16	M20	M24	M30	M30	M36	M42	M48	M56
	UNC	3/4"	5/8"	5/8"	3/4"	1"	1 1/8"	1 1/4"	1 1/2"	1 3/4"	2"	2 1/4"
Tightening torque	Nm	285	165	165	285	660	830	1150	2000	2500	3500	5300
	lbf.in	2500	1450	1450	2500	5800	7300	10000	18000	22000	31000	47000

(1) size Z : single stage unit (QVPZ1)
(2) size Z : 2-stage unit (QVRZ2 & QVRZ2L)
(3) size G : 2-stage unit
(4) size G : 3- and 4-stage unit

5.4.2. Tightening torques for stainless steel bolts grade 80

Horizontal mount

- **Single stage gear units (type QHP.1)**

Gear unit size		C	D	E	F	G
Bolt size	ISO	M20	M24	M24	M30	M30
	UNC	3/4"	7/8"	1"	1 1/8"	1 1/4"
Tightening torque	Nm					
	lbf.in					

- **Multi stage gear units (type QH...)**

Gear unit size		A	B	C	D	E-F	G-H-J-K	L-M	N-P-Q	R-S-T
Bolt size	ISO	M16	M20	M24	M24	M30	M36	M42	M48	M56
	UNC	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	1 3/4"	2"	2 1/4"
Tightening torque	Nm									
	lbf.in									

Vertical mount

- **Gear units (type QV...)**

Gear unit size		Z (1)	Z (2)	A	B	C	D	E	F-G(3)	G(4)-H-J-K	L-M-N-P-Q	R-S-T
Bolt size	ISO	M20	M16	M16	M20	M24	M30	M30	M36	M42	M48	M56
	UNC	3/4"	5/8"	5/8"	3/4"	1"	1 1/8"	1 1/4"	1 1/2"	1 3/4"	2"	2 1/4"
Tightening torque	Nm											
	lbf.in											

(1) size Z : single stage unit (QVPZ1)
(2) size Z : 2-stage unit (QVRZ2 & QVRZ2L)
(3) size G : 2-stage unit
(4) size G : 3- and 4-stage unit

The alignment of the complete drive packages mounted on a bedplate have been carefully checked before shipment. It is nevertheless required to check that the bedplate has not been deformed during transport or erection. Therefore check again alignment of couplings or other elements after final installation.

5.5 SECURING OF HOLLOW SHAFT GEAR UNITS

5.5.1 Hollow shaft gear unit with shrink disc connection

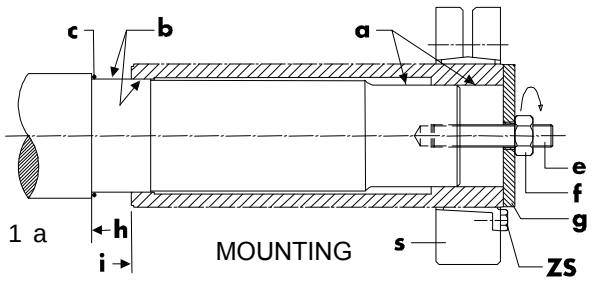
The CHEMINEER supplied shrink disc is ready to be installed.

Therefore do not dismantle shrink disc prior to first mounting.
The HSD-type is used as standard (fig.1c).
Upon request the SD-type is possible (fig 1d).

Mounting (see fig. 1a)

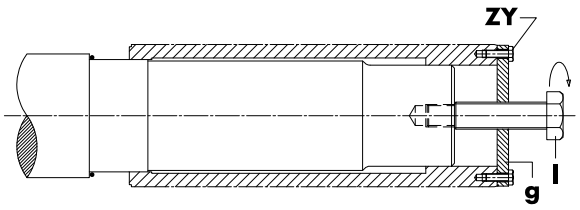
- Clean and degrease contact surfaces (a) and (b)
- Smear surface (b) - and not surface (a) - with "Molykote D321R" or similar.
- After the applied coating has hardened, slide the O-ring (c) onto the shaft.
- Draw the gear unit onto the shaft of the machine using threaded rod (e), nut (f) and distance ring (g) until faces (h) and (i) make contact.
- Fit shrink disc (s). A locating groove on the shaft indicates the position of the shrink disc. Tighten bolts (ZS) with a torque wrench. The required tightening torque for the HSD-type is shown in table 1.
  For the SD-type it can be found on the dimensional drawing.

NOTE: Never tighten bolts when shrink disc is unmounted.



1 a MOUNTING

FIG. 1



1 b DISMOUNTING

HSD type (see fig. 1c)
The tightening torques (TA) are indicated in table 1and on the name plate.
Tightening bolts are prestressed to the right level when outer ring (o) and inner ring (n) are flush (optical check).

SD type (see fig. 1d)
The tightening torques are indicated on the name plate (p) and on the dimensional drawing.
Remove spacers, attached for shipping, from between outer rings (o). When mounting and during tightening make sure that outer faces remain parallel.

HSD + SD type
Tighten bolts (ZS) in indicated sequence (q) one by one, progressively over several rounds, until required tightening torque (TA) is reached.
Do not tighten bolts crosswise.
Mount protection hood.

Securing in case of axial load
If the axial load is not absorbed by the shoulder of the machine shaft, a distance ring (g) must be included (see fig. 2b, page 13).

- Loosen all tightening bolts (ZS) uniformly, one by one in a continuous sequence, about a quarter of a turn per round.
- Should outer and inner ring of the HSD-type not release themselves, one can remove some tightening bolts and install them in tapped holes (r), in the inner ring, to trigger separation of both rings.
- Remove shrink disc from hollow shaft.
- Mount the distance ring (g) on the hollow shaft by means of bolts (ZY) (dimensions of ZY: see dimension drawing).
- Place the disassembly bolt (l) into the central hole in the distance ring (g).
- Remove the gear unit from the shaft by tightening the disassembly bolt (l).

Note

The parts e,f,g,l and ZY are not included as standard. They can be supplied upon special request.
For technical data, refer to catalogue or certified drawing.

Cleaning and greasing

Dismounted shrink discs do not have to be taken apart for cleaning and regreasing prior to reinstallation, unless they have been used in a very dirty environment.
After cleaning, recoat the tapered surfaces using a solid lubricant with a friction coefficient of 0,04 , e.g. Molykote D321R or similar.

Table 1: for HSD type only

Shrink discs	TA (Nm)	TA (lbf.in)
HSD 110-81x110	121	1070
HSD 125-81x125	121	1070
HSD 140-81x140	193	1700
HSD 165-81x165	295	2600
HSD 185-81x185	295	2600
HSD 220-81x220	570	5000
HSD 240-81x240	570	5000
HSD 260-81x260	570	5000
HSD 280-81x280	570	5000

Shrink discs	TA (Nm)	TA (lbf.in)
HSD 320-81x320	980	8600
HSD 340-81x340	980	8600
HSD 360-81x360	980	8600
HSD 390-81x390	1450	12800
HSD 420-81x420	1450	12800
HSD 440-81x440	1450	12800
HSD 480-81x480	1450	12800
HSD 500-81x500	1970	17400
HSD 530-81x530	1970	17400

Fig. 1c HSD TYPE

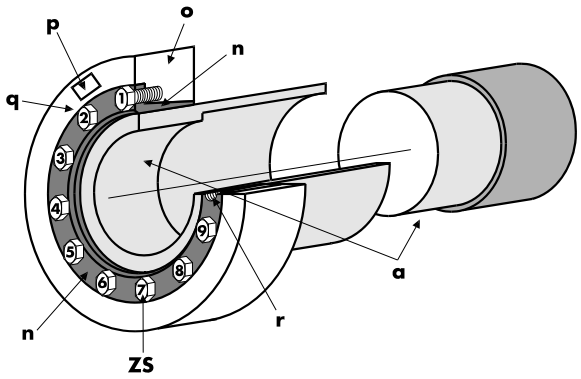
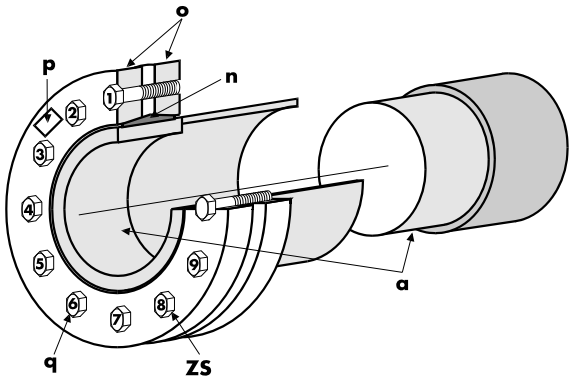


Fig. 1d SD TYPE



5.5.2 Hollow shaft gear unit with keyway connection

Mounting (fig. 2a)

- Coat mating faces (b) of the machine shaft with mounting compound.
- Slide the O-ring (c) onto the machine shaft.
- Place supplied mounting key (d) into keyway of machine shaft, with the boss against the shaft face.
- Place the gear unit into position on the machine shaft. Make sure that the keyways are correctly positioned.
- Press the gear unit on the shaft, using a threaded rod (e), a nut (f), and a distance ring (g) until the mounting key (d) and the distance ring (g) make contact.
- Remove the nut (f), the distance ring (g) and the mounting key (d).
- Ensure that key (m) has sufficient clearance on top.
- Fit the key (m) into the shaft (≠ mounting key).
- Remount the distance ring (g) and the nut (f).
- Draw the gear unit further onto the shaft until the faces (h) and (i) make contact.
- Remove the nut (f), the distance ring (g) and the threaded rod (e).

Securing (fig. 2b)

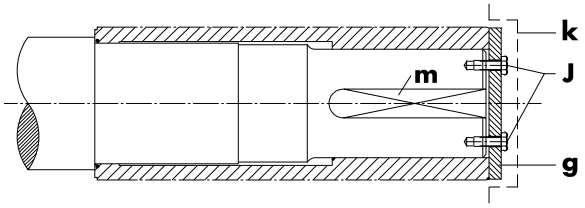
- Mount the distance ring (g) again on the machine shaft using correct fixation bolts (J).
- Install the protection cover (k).
  In case of external axial loads on the shaft, please refer to specific instructions on the outline drawing.

Dismounting (fig. 2c)

- Remove the protection cover (k) and the fixation bolts (J).
- Mount the distance ring (g) on the hollow shaft by means of bolts (ZY) (dimensions of ZY: see dimensional drawing).
- Place the disassembly bolt (l) into the central hole in the distance ring (g).
- Remove the gear unit from the shaft by tightening the disassembly bolt (l).

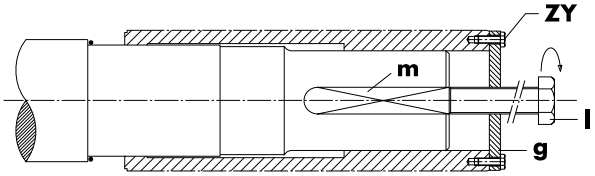
Note
The parts e,f,l and ZY are not included as standard, but can be supplied upon special request. For technical data, refer to catalogue or certified drawing.

Fig. 2a



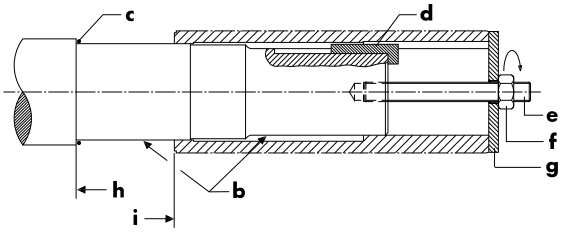
SECURING

Fig. 2b



DISMOUNTING

Fig. 2c



MOUNTING

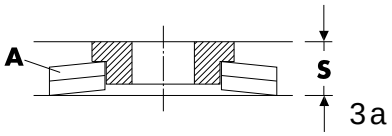
5.5.3. Mounting of the torque arm

After fitting and securing the gear unit to the driven shaft (see par.5.5.1 and 5.5.2), fix unit by means of the optionally supplied torque arm to a fixed torque reaction point. Refer to the certified drawing or catalogue for torque arm location on gear unit.

The connection between torque arm and reaction point must remain flexible and resilient. This is achieved by preloading the disc springs of the torque arm.

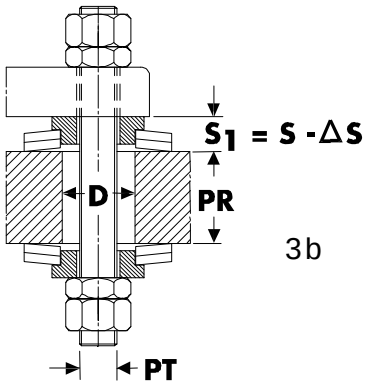
The preload of the disc springs (A) will be adjusted as follows:

- Determine the spacing S (fig. 3a), this is the spacing of the disk springs in unloaded and unmounted condition.
- Screw the nuts until spacing S1 (spacing between gear unit and fixed point) is reached, where S1 = S - ΔS (fig. 3b, 3c, 3d)
  ΔS =spacing obtained after compression of the disk springs (table 2, 3 and 4) due to the weight of the gear unit and tightening of the nuts.
- When the prescribed spacing S1 is obtained, lock the nuts by tightening outer nut against inner nut.



3a

Fig. 3

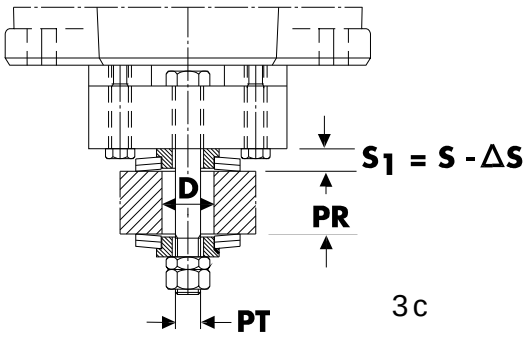


3b

Table 2

Gear unit size	D	PT	PR max		ΔS		A	
	±5		mm	inch	mm	inch	Q*	DIN 2093
QH.A2	35	M16	40	1.57	0,7	0.028	2 x 2	A 80
QH.B2	35	M20	50	1.97	0,7	0.028	2 x 2	A 80
QH.C2	45	M24	60	2.36	0,9	0.035	2 x 2	A 100
QH.D2	45	M24	60	2.36	0,9	0.035	2 x 3	A 100
QH.E2	60	M30	75	2.95	1,0	0.039	2 x 3	A 125
QH.F2	60	M30	75	2.95	1,0	0.039	2 x 3	A 125
QH.G2	60	M36	90	3.54	1,0	0.039	2 x 4	A 125
QH.H2	60	M36	90	3.54	1,0	0.039	2 x 4	A 125

Q*: number of disc springs

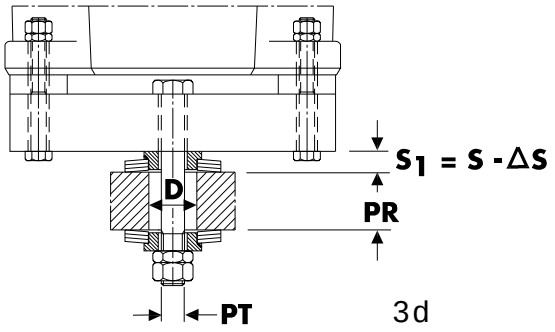


3c

Table 3

Gear unit size	D	PT	PR max		Δ S		A	
	±5		mm	inch	mm	Inch	Q*	DIN 2093
QH.C3	35	M20	50	1.97	0,7	0.028	2 x 3	A 80
QH.D3 – QH.D4	45	M24	60	2.36	0,9	0.035	2 x 2	A 100
QH.E3 – QH.E4	45	M24	60	2.36	0,9	0.035	2 x 3	A 100
QH.F3 – QH.F4	60	M30	75	2.95	1,0	0.039	2 x 2	A 125
QH.G3 – QH.G4	60	M36	90	3.54	1,0	0.039	2 x 3	A 125
QH.H3 – QH.H4	60	M36	90	3.54	1,0	0.039	2 x 3	A 125

Q*: number of disc springs



3d

Table 4

Gear unit size	D	PT	PR max		Δ S		A	
	±5		mm	inch	mm	inch	Q*	DIN 2093
QH.J3 – QH.J4	80	M42	105	4.1	1,4	0.055	2 x 3	A 160
QH.K3 – QH.K4	80	M42	105	4.1	1,4	0.055	2 x 3	A 160
QH.L3 – QH.L4	80	M48	120	4.7	1,4	0.055	2 x 4	A 160
QH.M3 – QH.M4	80	M48	120	4.7	1,4	0.055	2 x 4	A 160

Q*: number of disc springs

6. LUBRICATION

Lubrication serves four main functions:
- prevents metal to metal contact in gears and bearings
- reduces friction losses
- dissipates the generated heat from gears and bearings
- prevents corrosion

Different lubrication systems can be used, depending on
- gear velocity
- gear unit mounting position
- operating conditions

CHEMINEER gear units use one of following systems:
- splash lubrication
- forced feed lubrication: - circulation lubrication
  - pressure lubrication

These systems can be completed with auxiliary cooling in different forms (see COOLING).

6.1. SPLASH LUBRICATION

Splash lubrication is standard with horizontal shaft gear units and for speeds between 750 and 1800 min-1 at the high speed shaft. Gears and output shaft bearings are lubricated by immersion in the oil bath. Oil splash from gears fill oil pockets in the housing, assuring gravity circulation lubrication of the bearings via channels in housing and covers.
For other speeds at the high speed shaft, refer to CHEMINEER.

6.2. FORCED FEED LUBRICATION

All rotating elements above oil bath level are lubricated by a gear pump forcing the oil through pressure lines.
Pumps can be either of the integral type, driven by one of the gear unit shafts, or a motorpump.
The integral type pumps are always provided with a built-in reversing device for operation in both directions.
In case of motorpumps the direction of rotation is always indicated.
Built-on pumps reach their normal operating capacity already after a few seconds

Motorpumps should be switched on at least one minute before starting the gear unit.

6.2.1. Circulation lubrication

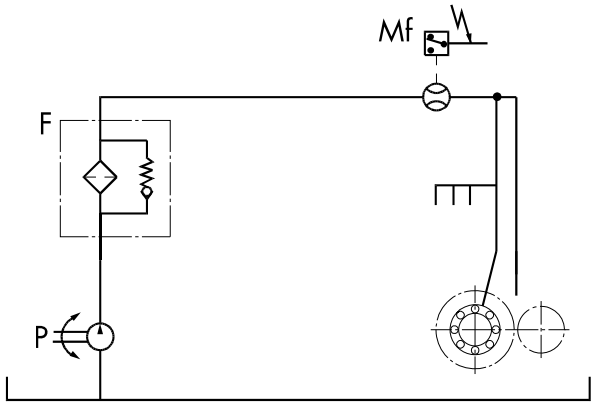
- With integral pump (fig. 4).
  The circulation lubrication system consists of
  - a pump P
  - a filter F with bypass (standard from gear unit size G onwards)
  - a flow switch Mf (standard from gear unit size G onwards)

Flow switch must be wired in a circuit to automatically stop the main drive motor when oil flow drops below alarm setting.

However, in order to avoid unwanted alarms during the start-up period or due to irregularities of the oil flow, we recommend retarding the alarm
signal; the alarm should be triggered only after the oil flow has been interrupted for a continuous period of 5 to 10 seconds.

- With motorpump
  The service manual of the lubrication and cooling system gives detailed information about the circulation lubrication system with motorpump.

Fig. 4



6.2.2. Pressure lubrication

The service manual of the lubrication and cooling system gives detailed information about the pressure lubrication system.

6.2.3. Instrumentation and settings

For detailed information on lubrication system, instrumentation and settings, refer to the certified drawing, the service manual of the lubrication and cooling system and/or separate leaflets on instrumentation, supplied with this manual.

Settings stated on the certified drawing have been set during test-run by CHEMINEER and should not be altered without written authorization.

Presettings, if stated, are recommended values set by CHEMINEER, but may be altered according to local conditions.

6.3. OIL SELECTION

Unless indicated otherwise on the gear unit's name plate (*) or in the special technical manual of the specific gear unit (if existing), the oil must be selected from the table at page 39 of this service manual, listing mineral oils and greases recommended by their respective brand name owners.
(*): e.g. mineral oil and synthetic oil are different oils.

Always use oil of the viscosity characteristics corresponding to those given on gear unit's nameplate.

The viscosity has been selected according to operating conditions specified in the order acknowledgement.
For conversion from ISO viscosity class VG to other viscosity units see table of corresponding lubricants p. 39

The oil suppliers are responsible for the selection and composition of their products.

Synthetic oils may be used only after written authorization from the CHEMINEER Engineering Department.
In that event, only synthetic oils specified by CHEMINEER with brand and product name may be used.

Handle any lubricant or oil with care and according to the handling and safety instructions to be supplied by the lubricant supplier on customer's request. These instructions have to be handed over to any personnel performing installation, maintenance or repair of the gear unit.

6.4. OIL QUANTITY (see fig. 5)

The oil level is determined by min. and max. markings on the dipstick.

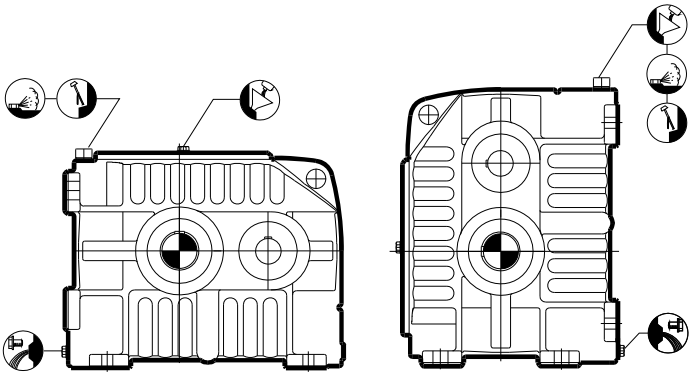
An oil level glass or an oil level switch is optionally available.

THREADED DIPSTICKS SHOULD BE CHECKED IN PLUGGED POSITION.
The oil level must be checked when the gear unit is out of operation.
On systems with filters and coolers, oil level must be checked with lubrication and cooling system filled with oil and after short test run.

The lubrication and cooling system, including the cooler, is automatically utilized when the oil bath temperature rises above 60°C (140°F).
If oil filling is required to take place earlier, the air must be released from the cooler whilst the pump is in operation.
The oil quantity mentioned on the nameplate of the gear unit is an approximate value given only for procurement purposes.

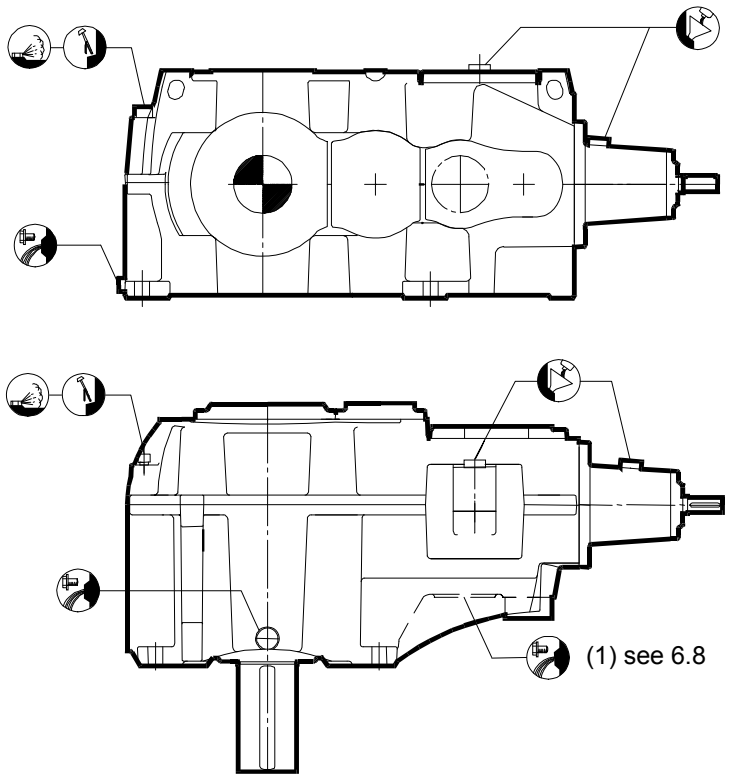
Fig. 5

- Single stage gear units



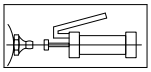
QHP.1 **QHP.1W**

- Multi stage gear units

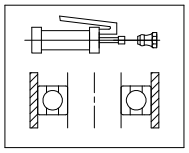


Type and position of the stickers: refer to certified drawing and gear unit

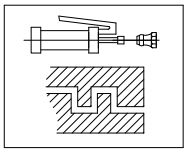
dipstick oil draining oil filling ventilation



grease lubrication points



grease lubrication points for bearings



grease lubrication points for labyrinth seal

M 6.5. THE FIRST OIL FILLING (see fig. 5)

Fill units only after final installation, especially gear units with vertical downwards shafts, to prevent oil splashing over drywell during handling.
Fill the gear unit exclusively through the oil filling opening which is provided in the inspection cover for that purpose. In that way, all bearings are lubricated with fresh oil.

Note :

- Additional oil filling of the bearing housing.
  4-stage horizontal gear units with right angle shafts (QHR.4) and 3- and 4-stage vertical gear units with right angle shafts (QVR.3 + QVR.4) require on initial oil filling also an additional oil filling of the bearing housing.
  See special sticker on gear unit.
  The additional oil quantity is mentioned on the certified drawing and on the sticker.

- Oil filling of a gear unit with M1 or M3 motor base.
  Units with horizontal shafts (QH ..) equipped with a motorbase M1 and M3 must be filled on initial filling with a small quantity of oil through the inspection cover located in the top face of the gear unit (see special sticker on gear unit).
  If easy access to the oil filler plug is prevented through lack of space between the motor base and the gear unit upper face, the motor base should be raised following removal of the belt.
  For gear units with M1 motor base the normal oil filling plug is located at the side of the output shaft, opposite the side where the dipstick is located.
  For gear units with M3 motor base the normal oil filling plug is located at the side of the dipstick.

If the gear unit is filled with storage oil, it has to be drained and it may in some instances be necessary to rinse the gear unit with the selected oil before starting up. Check with the oil supplier.

M 6.6. GREASE SELECTION (see table page 39)

Use only high quality greases, with EP-additives and consistency NLGI-Grade 3.
Greases with EP-additives and consistency NLGI-Grade 2 may be used for regreasable labyrinth type seals and grease lubricated lower bearing of the low speed shaft.

M 6.7. GREASE LUBRICATION POINTS (see fig. 5)

All greasing points for bearings which are not oil lubricated and for labyrinth seals are equipped with nipples according to DIN 71412 and have been filled before shipment.
The total number of nipples is indicated on the nameplate.
Some built-on backstops are grease lubricated.
For detailed information refer to appropriate leaflet supplied with this manual.

M 6.8. OIL DRAINING (see fig. 5)

Drain the oil while unit is still warm. Be careful while draining the hot oil, use an appropriate hot oil recipient.
To facilitate oil draining, remove dipstick. Drain units having a large oil volume through drain plug. Use portable pump. With some executions a small quantity of oil remains beneath the high speed bearings. This oil can be drained by means of a second drain plug (1).

6.9. VENTILATION (see fig. 5)

To prevent pressure build-up, the gear unit is provided with a breather which is generally integrated in the dipstick.
Take care and check regularly that this breather does not become clogged.
For some applications, the dipstick with breather hole is replaced by one without breather hole in combination with an anti-dust or anti-humidity breather.

7. COOLING

Heat generated in the gear unit due to friction and churning of the oil, must be dissipated through the housing into the environment.
It is important not to decrease the heath dissipation capacity of the housing.
Regularly clean the surface of the housing.

7.1. SEPARATE AIR COOLING

7.1.1. Fans

One or two fans may be mounted on gear unit shafts.
Check regularly that the air inlet and the air outlet are not obstructed.
Fans need no special maintenance, except occasional cleaning.

7.1.2. Air-oil coolers

The service manual of the lubrication and cooling system gives detailed information about the air-oil cooler.

7.2. SEPARATE WATER COOLING

All water cooling systems must be connected to a non-calcareous water supply. See also service manual on lubrication and cooling system and/or technical leaflets on specific instrumentation. The use of seawater must be specified with the order; coolers suited for use of seawater are available.
When unit is not operating and freezing temperatures may occur, water must be drained from cooling system. Drain facilities have to be provided by end user.
Unless otherwise stipulated, the water flow indicated on the dimensional drawing is the required rate for water at 20°C (70°F).
According to load, ambient temperature and the water temperature a lower rate will suffice.
Adjust waterflow to obtain an oil working temperature between 60 and 80°C (140 and 180°F).

7.2.1. Water-oil coolers

Refer to certified drawing for connection of the water-oil cooler to the coolant.
The service manual of the lubrication and cooling system gives detailed information about the water-oil coolers.

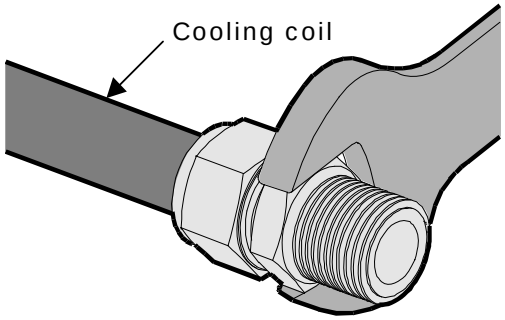
7.2.2. Cooling coils

Direction of waterflow is optional.
The cooling coils are suited for fresh as well as for seawater.
Maximum allowable water pressure: 0,8 MPa (8 bar, 116 psi).

Connection of cooling coil to water supply.

Warning: In order to avoid torsioning of cooling coil, hold premounted connection with suitable wrench as shown in fig. 6 below.

FIG. 6



8. BACKSTOPS

Backstops are wearing parts and must be inspected or replaced at intervals depending on operating conditions. The customer must take all necessary precautions to prevent that failure of the backstop could cause physical injury and/or severe damage to the drive and/or application.

The time span between two inspections depends on the operating conditions and the braking frequency, but should never exceed two years.
In case the backstop is part of a hoist drive which is subject to a periodical safety inspection, the control of the backstop must be included in the inspection procedure.

In case of transport of people: the user has to follow local legislation re. Inspection of safety devices.

An inspection or replacement of the backstop is also required in the following circumstances :

- In case of disassembly of the gear unit or one of its components
- In the event that abnormal wear or material break-out of gears, bearings or any other component or pollution of the oil has been detected in the gear unit, since this may have affected the condition of the sprags and raceways of the backstop.

The outcome of the periodical inspection is to be reported in a log book.

Never loosen any part of the backstop while the gear unit is loaded: loosening the backstop may cause reversal of the drive and running back of the load. Prior to loosening the backstop remove the load and secure the drive against unintentional movement.

8.1. STANDARD BACKSTOP INTEGRATED IN THE GEAR UNIT

These backstops are lubricated by the oil bath of the gear unit and require, apart from the regular inspections indicated above, no further maintenance.

8.2. EXTERNALLY FITTED BACKSTOP

In case the gear unit is equipped with an externally fitted backstop,
please refer to the corresponding additional Service Manual
for maintenance and inspection. The above instructions for inspection remain valid.

Alteration of the direction of rotation of a backstop may only be carried out by authorised personnel and according to the instructions shown in the relevant instruction leaflet.

9. STARTING-UP

9.1. ALL GEAR UNITS

Before starting-up, check oil level with dipstick and make sure that all points are lubricated.
Although all greasing points have been greased before delivery,
it is advisable to give a few shots with a grease gun before starting-up.

Check all fixation points between gear unit and foundation.
They may require retightening after some running time.

The alignment of the complete drive packages mounted on a bedplate has
been carefully checked before shipment. It is nevertheless required to check
that the bedplate has not been deformed during transport or erection.
Therefore check again alignment of couplings or other elements after final installation.

Make sure that protection hoods and air guiding plates, if any,
in case of fan cooling are properly fitted.

Gear units may rotate in both directions except when direction of rotation is indicated.

On gear units equipped with backstops, check whether direction of motor rotation corresponds to backstop freewheeling direction, before coupling motor to unit.
In case of complete drives, the direction of rotation of the motor has to be checked
by means of a phase meter.

Rotation of gear unit in reverse direction, even momentarily, may damage the backstop, and consequently is not allowed.

Units equipped with heaters must not be started before oil temperature is above 5°C (40°F).
Heaters are automatically disconnected when oil temperature is above 15°C (60°F).

Temperature of oilbath will rise with increased load. Continuous operating temperature of
80 to 85°C (175 to 185°F) is allowable for a standard gear unit filled with mineral oil.
Occasional operating temperatures of up to 95°C (200°F) are acceptable

9.2. GEAR UNITS WITH FORCED FEED LUBRICATION

For the different parts of the lubrication system, refer to service manual of the lubrication and cooling equipment and/or the technical leaflets concerning the specific components.

9.3. GEAR UNIT DRIVEN BY A TWO SPEED MOTOR

When switching from the higher to the lower speed, first decelerate so that the motor must accelerate when switched on at the lower speed. In this way high synchronisation peak torques can be avoided.

M 10. MAINTENANCE

Maintenance operations are limited to check oil level, to regular oil change, to regrease the lubrication points and filter cleaning.
OIL QUANTITY : see paragraph 6.4, page 9.
OIL DRAINING : see paragraph 6.8, page 10.

Read also M points in the other paragraphs.

10.1. INSPECTION AND MAINTENANCE

Rotating parts may cause harm and damage.
For inspection and maintenance always deenergize the drive and make sure that the drive is secured against unintentional switch-on or movement.

10.2. OIL CHANGE

Handle any lubricant or oil with care and according to the handling and safety instructions to be supplied by the lubricant supplier on customer's request. These instructions have to be handed over to any personnel performing installation, maintenance or repair of the gear unit.

The first oil change should be made preferably after 100 hours and no later than 800 hours of service. This oil may be used again after filtering. Filter the oil volume at least 10 times. Use a 10 µm filter or smaller. When the filtering system is used for different types of oil it should be rinsed with a suitable rinsing product. Drain well after rinsing.
The oil should then be renewed after 4000 to 8000 hours or a max. 18 months of service depending on the operating conditions. Use clean oil from clean drums. Avoid any penetration of abrasive particles and water.
The water content should be no higher than 0.05%.
It is recommended to exchange the oil before summertime, hence running with new fresh oil in the most critical period when thermal load is higher.
Drain the oil while unit is still warm. Be careful while draining the hot oil, use an appropriate hot oil recipient.
Every time the lubricant is renewed, it is recommended to flush the gear unit and the corresponding lubrication and cooling system with the fresh oil or a suitable flushing oil. Drain the used fresh oil or the flushing oil. Check to make sure that the lubrication and cooling system items are well drained.
If the lubrication system has an oil filter, change the filter cartridge after every 800 hours of service.
Operating procedure and specifications are mentioned in the service manual of the lubrication and cooling equipment and / or the technical leaflets for the specific instrumentation.
Steel mesh filter cartridge may be used again after thorough cleaning in a solvent.
Always refer to the oil supplier for the selection of rinsing and flushing products.

When the oil sump temperature is frequently 80° to 95°C (175° to 200°F), or in the event of a dusty or humid atmosphere, it is recommended to have an oil analysis performed by the oil supplier or a qualified laboratory after 4000 hours of service in order to determine the expected lifetime of the oil. Oil sump temperature must never be higher than 95°C (200°C), since oil then will degenerate very fast.

A representative oil sample should be taken either directly out of the oil sump - open the unit's inspection cover immediately after shutdown - or by means of flushing a certain amount of oil (capacity of the drain pipe + 2 litres) trough the drain cock or service piping before taking the oil sample. Make sure to use only appropriate and clean sample bottles.
Before starting-up, check the oil level with dipstick and make sure to add-up oil when required.

10.3. GREASE LUBRICATION POINTS

Regrease all lubrication points after every 800 hours of operation and while the gear unit is still warm.
Recommended greases are given in lubricant table. (page 39)
Grease quantity for bearings: see page 36-37.
Grease quantity for labyrinth seal: see page 38.
For longer lubrication intervals: consult CHEMINEER.

10.4. MAINTENANCE FREE OIL-LOCKTM SEAL

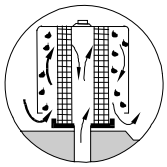
The high speed shaft is equipped as standard with an OIL-LOCKTM oil seal.
The high and low speed shaft of the P4 single stage gear units are equipped with an OIL-LOCKTM seal. This oil seal is wear resistant and maintenance free due to its centrifugal operating principle. The dual purpose labyrinth seal also prevents the entrance of dirt and moisture.
Disassembly of the OIL-LOCKTM seal should only be carried out by qualified personnel.

10.5. EXTENDED PERIODS OF STANDSTILL

When gear units are at standstill for an extended period, the protective oil film containing anti corrosion additives gradually disappears and the unprotected internal parts become subject to corrosion. Adverse ambient condi-tions such as humid, marine, tropical and chemically aggressive environ-ments will accelerate the process.
A periodic visual inspection through the inspection cover is required.

Corrosion of the internals can be avoided by letting run the gear unit for a few minutes every two weeks (depending on the ambient conditions) thus allowing the formation of a new oil film.

Install a special breather (ma shown below) to prevent moisture from entering the gear unit.



If it is not possible to run the unit regularly and the risk for corrosion is imminent, during extended periods of standstill the unit must be protected as follows :
- an oil soluble concentrate including corrosion inhibitors which are active both in the liquid and in the vapour phase has to be added. A 2% volume concentration is considered to be normal. Consult your oil supplier about lifetime, compatibility with the actual oil and about volume concentration.
- seal all gear unit openings (dipstick, breather etc.) hermetically .

10.6. SERVICE AFTER SALES

For technical assistance or additional information, the CHEMINEER sales centers are at your disposal. When you contact them, please specify the complete type code and the manufacturing number mentioned on the gear unit's nameplate.

10.7. REPAIRS

Any repair should only be carried out by qualified personnel.
Only original CHEMINEER spares should be used.

No products or substances may be used in the gear unit that should bring foreign ingredients (particularly solid or friction reducing additives amongst other things) in the oi

11. Grease quantity for bearings and grease quantity for labyrinth

11.1 Grease quantity (type Q.) in g for bearings

Type is indicated on the namaplate. Grease recommended by the oil suppliers: see page???

Sticker on gear unit:

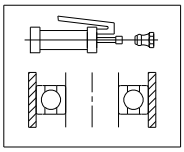


FIG.7

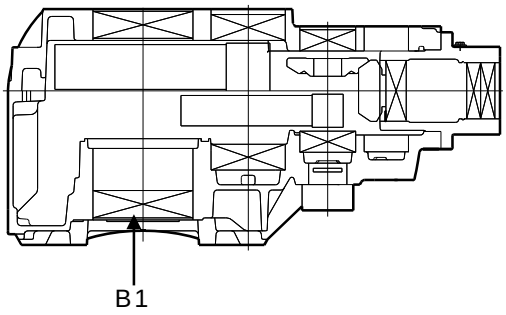


FIG.8

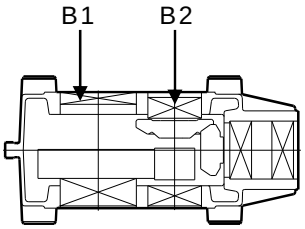


FIG.9

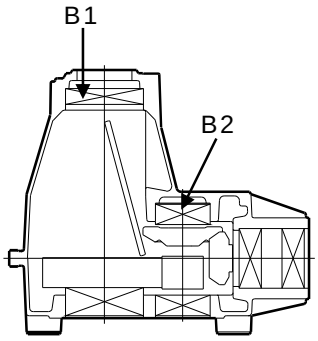
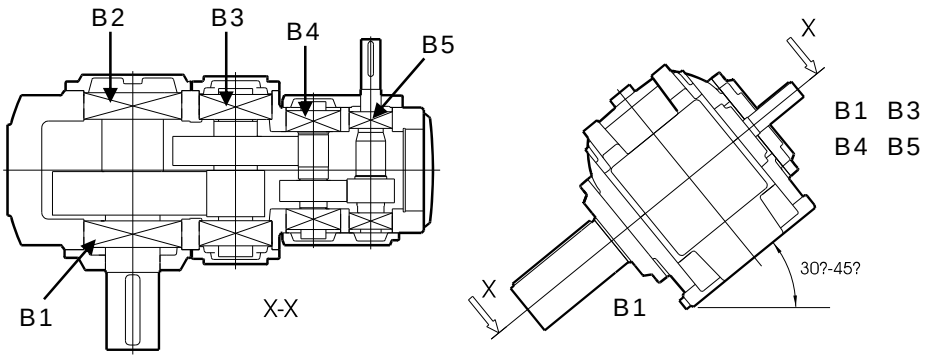


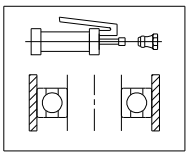
FIG.10



11.2 Grease quantity (type Q.) in g for bearings

Type is indicated on the namaplate. Grease recommended by the oil suppliers: see page???

Sticker on gear unit:



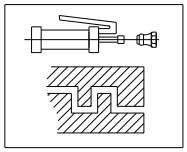
Size	Type Q1	Type Q2	Type Q3	Type Q4		Type Q5	
	Fig. 7	Fig. 7	Fig. 7	Fig. 8		Fig. 9	
	B1	B1	B1	B1	B2	B1	B2
Z				10	20	10	20
A				20	20	20	20
B				30	30	30	30
C	50	60	50				
D	60	80	60				
E	90	110	90				
F	120	150	120				
G	170	200	170				
H	180	230	180				
J	220	280	220				
K	260	320	260				
L	320	400	320				
M	340	410	340				
N	380	380	290				
P	470	470	350				
Q	490	490	360				
R	500	500	380				
S	600	600	440				
T	620	620	470				

Size	Type Q6	Type Q7	Type Q8	Type Q9				
	Fig. 7	Fig. 7	Fig. 7	Fig. 10				
	B1	B1	B1	B1	B2	B3	B4	B5
Z								
A								
B								
C	100				50	30	20	10
D	130	100	120		60	40	30	20
E	180	130	170		90	50	40	20
F	240	180	220		120	80	50	30
G		220	320					
H		280	400	180				
J		320	410	220				
K		320	500	260				
L		410	590	320				
M		370	700	340				
N				290				
P				350				
Q				360				
R								
S								
T								

Bearings without grease nipple are oil lubricated

11.2 Grease quantity (type Q.) in g for labyrinth seal

Greases recommended by the oil suppliers: see page???



On low speed shaft

Single stage gear units

Gear unit type	g
QHRC1Z..N	75
QHRD1Z..N	75
QHRF1Z..N	45

Gear unit type	g
QHPC1	10
QHPD1	10
QHPE1	15
QHPF1	25
QHPG1	35

Gear unit type	g
QVPZ1	10
QVPB1	10

Multi stage gear units

Gear unit Size	..N g	..D/..K g
C	25	25
D	35	25
E	55	30
F	60	65
G	75	65
H	60	120
J	60	130
K	130	145
L	135	155
M	145	160
N	215	
P	230	
Q	240	
R	255	
S		
T		

Gear unit Size	g
QVRZ2	50
QVRZ2L	30
QVRA2	70
QVRA2L	40
QVRB2	50
QVRB2L	55

On high speed shaft

Single stage gear units

Gear unit type	g
QHPC1	10
QHPD1	10
QHPE1	20
QHPF1	30
QHPG1	40

Multi stage gear units

Gear unit type	QHP…		QHR…			QVP…		QVR…		
	QHP.2	QHP.3	QHR.2	QHR.3	QHR.4	QVP.2	QVP.3	QVR.2	QVR.3	QVR.4
Z	-	-	-	-	-	-	-	10	-	-
A./.H	10	10	10	10	10	10	10	10	10	10
J./.T	20	20	20	20	20	20	20	20	20	20

The mineral oils and greases listed below, recommended by the respective brand name owners, have to be used, unless indicated otherwise on the gear unit's name plate (for instance mineral oil and synthetic oil are different oil). The required viscosity grade of the oil is mentioned on the name plate.

SUS/100°F	690	1100	1600	2300	(2)	(3)
BP	Energol GR-XP 150 Formulation L04021PBA	Energol GR-XP 220 Formulation L04022PBA	Energol GR-XP 320 Formulation L04023PBA	Energol GR-XP 460 Formulation L04024PBA	Energrease LS-EP 2 Energrease LS-EP 3	BP Motorenschutzöl MEK 20W-20
CASTROL	Alpha SP 150 Formulation L02045PBA	Alpha SP 220 Formulation L02046PBA	Alpha SP 320 Formulation L02047PBA	Alpha SP 460 Formulation L02048PBA	Spheerol EPL (2) / Olista Longtime 3EP	Alpha SP 220 S
FUCHS	Renolin CLP 150 Formulation 3110247	Renolin CLP 220 Formulation 3110248	Renolin CLP 320 Formulation 3110249	Renolin CLP 460 Formulation 3110250	Renolit FEP3 / Renolit FEP2 (2)	
(Exxon)MOBIL	Mobilgear XMP 150 Formulation 1998 (4)	Mobilgear XMP 220 Formulation 1998 (4)	Mobilgear XMP 320 Formulation 1998 (4)	Mobilgear XMP 460 Formulation 1998 (4)	Mobilux EP 3	Mobilarma 524
SHELL	Omala F 150 Formulation 1996 (4)	Omala F 220 Formulation 1996 (4)	Omala F 320 Formulation 1996 (4)	Omala F 460 Formulation 1996 (4)	Alvania EP 2	Ensis engine oil 30
STATOIL	LoadWay EP 150 Formulation SL970307-150	LoadWay EP 220 Formulation SL970307-220	LoadWay EP 320 Formulation SL970307-320	LoadWay EP 460 Formulation SL970307-460	Uniway Li 62	
TOTAL		Carter EP 220 Formulation I31238	Carter EP 320 Formulation I31238	Carter EP 460 Formulation I31238	Multis EP 3	Rubia R 30
TOTAL		Carter VP/CS 220 Formulation I30419	Carter VP/CS 320 Formulation I30419	Carter VP/CS 460 Formulation I30419	Multis EP 3	Rubia R 30

Oil and lubricant manufacturers can change product compositions.

The oil composition formulations mentioned in the above table, have to be used; a confirmation of the oil supplier that the oil has been manufactured according to the composition formulation mentioned in the above table, is essential. No other oil may be used.

The greases and storage oils mentioned in the above table have to be of a product composition formulation of before January 10th 2005; a confirmation from the grease or oil supplier is essential.

CHEMINEER, Inc. is not responsible or liable for composition changes. The oil and lubricant suppliers are responsible for the selection and composition of their products.

Should the customer not wish to follow CHEMINEER oil and grease prescriptions, the customer assumes responsibility for the technical suitability of the lubricant used.

Any oil and lubricant shall be handled with care and according to the handling and safety instructions to be supplied by the lubricant supplier on customer's request. These instructions have to be handed over to any personnel performing installation, maintenance or repair of the gear unit.

Footnotes referred to in the oil and lubricant table above:

(1) Only for low ambient temperatures, see nameplate of the gear unit

(2) Use only high quality greases, with EP-additives and consistency NLGI-Grade 3. Greases with EP-additives and consistency NLGI-Grade 2 may be used for greaseable labyrinth type seals and grease lubricated lower bearing of the low speed shaft.

(3) If the gear unit is filled with storage oil, it has to be drained and it may in some instances be necessary to rinse the gear unit with the selected oil before starting up. Check with the oil supplier.

(4) Composition formulation of the product designated by the year of its market introduction

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