

APPD.

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REVISIONS

SYM.

TOTAL 37 SHEETS

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 Project Name : Ca Mau Fertilizer
 Item : CO2 Compressor
 Item No. : K06101 / KT06101
 P.O. No. : 07087-K03/K04-PO
 EPC Contractor : Wu Huan Engineering Co.,Ltd
 End User : Petrovietnam-CPMB

DOCUMENT TITLE : OPERATION AND MAINTENANCE
 MANUAL OF GEAR

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HITACHI MFG No.: 37T7633

Gear Item No.: Z06101

INSTRUCTION MANUAL

MODEL: HCD025 GEAR UNIT

Ca Mau Fertilizer Plant Project

NOTICE:

DO NOT ATTEMPT TO INSTALL, OPERATE OR SERVICE
THE GEAR UNIT UNTIL YOU HAVE READ AND UNDERSTAND
THE INSTRUCTIONS WRITTEN IN THIS MANUAL.

READ AND KEEP THIS MANUAL

 **Hitachi Nico Transmission Co., Ltd.**

MANUAL No.

IM006343

SPEC. No.

0A006343

NOTE TO USERS

I. GENERAL

This manual contains general information regarding installation, operating, maintenance and trouble-shooting instructions of the Gear Units manufactured by the Hitachi Nico Transmission Co., Ltd. All Hitachi Gears are designed and constructed in accordance with Standards of the American Gear Manufacturers Association and the Hitachi Manufacturing Standards to give long period of trouble free service.

However, certain precautions and procedures must be observed in handling, installing, and servicing the unit in order to obtain optimum performance.

Furthermore, the instructions herein must be observed in order to avoid any accident or injuries of the personnel at the handling, installing, operation and servicing of the product.

All inquiries should be accompanied by the following information, which can be obtained from the unit name plate:

- (1) TYPE (Type and unit size)
- (2) RATING (Rating power, kW.)
- (3) INPUT SPEED (min^{-1} , rpm)
- (4) OUTPUT SPEED (min^{-1} , rpm)
- (5) MFG.NO.
- (6) DATE

(Orders for renewal parts should include description and part number shown on the attached drawing.)

II. SAFETY

The safety precautions given in this manual provide guides for the protection of personnel and the Gear Unit.

In addition to these precautions observe all appropriate general rules of safety and good judgement for your own protection.

MEANINGS OF NOTICES



DANGER

Indicates and imminently hazardous situation which, if not heeded, will result in death or serious injury.



WARNING

Indicates a potentially hazardous situation, which if not heeded, could result in death or serious injury.

(1) Exposed moving parts can cause injury.

Keep hand away from moving parts in operation,
For example, input and output shaft coupling.
Don't put hand into safety cover.

(2) Heating parts can cause burning.

Wear heat-protected glove when touching the
piping in operation.

(3) Never open the inspection port during operation
of the gear unit.

High temperature oil will gush out can cause
burns.



CAUTION

Indicates a hazardous situation which, if not heeded, may result in minor or moderate injury or damage to the Gear Unit.

NOTE

Indicates useful information for the equipment installation, operation, and maintenance.

CONTENTS

1. INTRODUCTION	6
2. TECHNICAL SPECIFICATIONS	7
3. CONSTRUCTION	8
3.1 GENERAL CHARACTERISTICS	8
3.2 EQUIPMENT LOCATION	8
4. HANDLING INSTRUCTION	9
5. INSTALLATION	10
5.1 INSTALLATION PROCEDURE	10
5.2 METHOD OF ASCERTAINING TOOTH CONTACT	10
5.3 METHOD OF ASCERTAINING BACKLASH	12
5.4 METHOD OF ALIGNMENT	12
5.5 WIRING OF INSTRUMENTS	15
6. OPERATION	16
7. MAINTENANCE AND INSPECTION	19
7.1 PROPER OPERATION REQUIRES PROPER MAINTENANCE	19
7.2 TROUBLE SHOOTING	21
8. DISASSEMBLY AND RE-ASSEMBLY	24
8.1 DISASSEMBLY	25
8.2 RE-ASSEMBLY	28
9. CARRYING EQUIPMENT	29
10. MAINTENANCE LIST	30
10.1 PERMISSIBLE BEARING WEAR (UNIT: MM)	30
10.2 BACK LASH (UNIT: MM)	30
11. LUBRICATION OIL LIST	31
12. STORAGE	32

Attached Drawing :

1. Construction spare parts list -----LS006343
2. Outline and assembly drawing of gear unit-----00D006373A

1. INTRODUCTION

This manual deals with the method of operation and maintenance of the motor drive gear unit. This gear unit is designed and manufactured to exhibit its superior performance. However, if it is operated improperly, it may result in unexpected troubles. Therefore, you are required to read this manual carefully and use the gearbox properly.

2. TECHNICAL SPECIFICATIONS

Item No.	Z06101
Type of Gear unit	HCD025
Driver	Turbine
Driven Machine	Compressor
Rated Power	4000 kW
Input speed	7800 min ⁻¹
Output speed	13277 min ⁻¹
Rotation :Input	CW (Viewed from shaft end)
:Output	CW (Viewed from shaft end)
Lubrication oil	Turbine oil ISO VG46
Oil quantity	170 l/min
Normal oil pressure	2.0 barG
Alarm	1.2 barG
Shut down	0.8 barG
Input oil temperature	45°C±5°C

3. CONSTRUCTION

3.1 General characteristics

Gear Casing

The gear casing(see attached drawing)consists of upper and lower casings split at the horizontal plane including shaft centers. The gear casing is rigid and well ribbed construction in order to prevent vibration, and misalignment to secure proper tooth contact under various operating conditions. The lower casing has one oil inlet flange to be connected with lubricating unit supplied by others.

Gear Rotors

The gear is single stage and double helical.The material of gears are high tensile strength special alloyed steel with high tensile strength and sufficiently heat treated before machining .The gears are manufactured for outstanding reliability, strength and durability by employing carburizing and high precision gear grinding in a temperature controlled room.

(1) High-speed Shaft(Pinion)

The pinion is a solid forging integral with a shaft.

(2) Low-speed Shaft(Gear)

The gear wheel is a solid forging integral with a shaft.

Bearing

All radial bearings are of steel backed babbitt type.

The journal bearings for both shafts are of symmetrical three lobe type or offsetted elliptical type and splitted into two halves for easy maintenance. All radial bearings are specially designed to suppress shaft vibration, which may be caused by hydrodynamic instabilities during the operation under various loading conditions.

Lubrication

Gear teeth are lubricated by a spray nozzle mounted on the lower casing.Lubricant is supplied to spray nozzle and to bearings through internal oil paths drilled through the casing.

3.2 Equipment location

The gear unit is installed between Compressor(LP) and compressor(HP).

4. HANDLING INSTRUCTION

During the maintenance and operation of gear drives, SAFTY COMES FIRST. By using the proper tools and proper way of handling, serious accidents can be prevented.

This manual lists a number of safety precautions. Follow them, and make sure that those working for you do the same.

- (1)When the unit is resting on the floor it always should be in a normal upright position with the weight resting on the mounting surface.
- (2)The unit should be lifted only with the heavy lifting lugs(hook) or eyebolts provided for this purpose. When more than one lifting lug or eyebolt is provided slings should be used to distribute the load evenly.
- (3)Never attempt to lift the unit by light eyebolt fixed into some covers, or thinner walled housing sections. Be sure to use lifting lugs on the lower casing when lifting the whole gear unit.
- (4)Never drag the gear unit. This will damage the machined mounting surfaces and may over-stress the housing.
- (5)When attaching sling to the unit, attention should be given to the behavior of the sling under load.

When handling gear units, attention should be paid not to damage instrumentation or wiring outside the casing.

5. INSTALLATION

5.1 Installation procedure

(1) Remove shipping cover:

All protective-shipping covers should be removed from the unit. The shaft extensions and outside-machined surfaces are protected during shipment by an anti-rust compound. This can be removed by using a solvent.

(2) Rust prevention:

When Hitachi Gear Drive leaves the factory, the internal parts are protected with a film of wax type rust preventative. Which protects the unit during shipment. This film is soluble in a lubricant, and does not have to be flushed out before filling with the recommended lubricant.

(3) When installing and centering the gear unit, the followings are MUST items to be checked.

- a) Proper tooth contact
- b) Proper backlash
- c) Proper alignment for the connection between the driver and the driven machine.

5.2 Method of ascertaining tooth contact

Proper tooth contact of gears has been ascertained during assembly at factory. However, deformed foundation and common base and improper tightening during installation work on site will sometime cause distortion of gear case, resulting in improper tooth contact. Therefore, after completing the installation of the machine, careful check for tooth contact is required. Tooth contact is checked in the following way.

- (1) Uniformly and thinly apply red solvent in oil (herein-after referred to as red paint). The red paint shall be applied to all tooth surfaces on entire periphery of pinions, and to four or five tooth surfaces, each one at four locations equally spaced around the periphery of the gears. At this time, take care so that the layer of paint will not be too thick.

- (2) Rotate the gear (when a turning device is provided on the prime mover side, the device shall be used) and transfer red paint to the mating tooth surface.

The transferred red paint shows tooth contact condition.

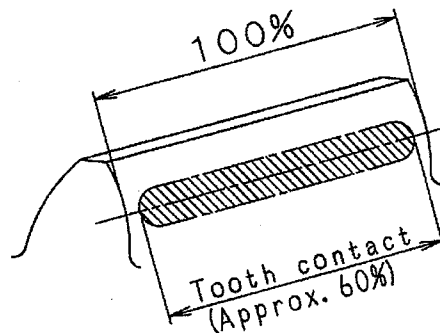
Further, tooth contact (transcription) condition of red paint may be required as a reference on later days, so keep a record of the tooth contact test.

For making the record, first, apply carbon to tooth corners and uniformly apply adhesive side of a wide adhesive transparent tape to tooth surface. Then, peel off the tape, and red paint is transferred on the tape.

The record can be preserved by applying the tape, on which red paint is transferred, on a paper (reproducible paper is preferable).

- (3) Judge and ascertain proper tooth contact from the condition of red paint comparing with the shop record in the inspection report.

Acceptable tooth contact is **approx. 60%** of face width.



Tooth Contact

- (4) Improper tooth contact is usually caused by the following items.
- a) Level of gear case foundation or common base foundation is not proper.
 - b) When adjusted with shims, the shims are not uniformly inserted.
 - c) Foreign matter entered between the gear case and the base.
 - d) Improper tightening of lock bolts of gear case.

It is presumed that the above faults cause deformation of gear

case or worsened parallelism of gear shafts.

Accordingly, carefully check the above items (a)-(d), and at the same time check for level of split face of the gear case and the gear shaft. In case that any discrepancies are detected, eliminate their causes and adjust the level so that proper tooth contact is obtained.

5.3 Method of ascertaining backlash

Backlash of the gear has been carefully checked during assembly at factory. Since there are very few reasons by which backlash is varied at the installation site, it is not particularly necessary to measure its value.

However, ascertain that at least there is a backlash by way of precaution.

When bearing metal is replaced, either one of the pinion or the gear is exchanged or abrasion is observed on tooth surface due to lapse of time, it should be ascertained that the tooth contact is proper and the backlash is within the proper range (refer to the inspection report).

Note that too little a backlash is generally more dangerous. (Considering the thermal expansion, and expansion of gear due to revolving centrifugal force)

5.4 Method of alignment

Precise alignment is indispensable considering the life of the machine and vibration. Accordingly, aligning job should be supervised by an experienced and skilled engineer.

(1) Connection of the gear unit with the driver machine.

The gear unit is connected to the driver machine with couplings, which are intended to absorb misalignment during operation.

However, when the machines are to be operated continuously at a high speed, misalignment should be made as small as possible to prevent excessive vibration. Alignment should be held within the allowance of eccentricity during continuous operation (hot condition).

Accordingly, during installation work (cold condition), it is necessary to set an alignment value including expected thermal deflection beforehand, considering the variation of center height due to thermal expansion on both driving side and driven side, or

the difference (Δhc) of deflection amount of the shaft centers.
(See Fig.1)

The difference (Δhc) of deflection amount of shaft centers is obtained by the following equations.

$$\Delta hc = |h_1 - h_2|$$
$$h_{1,2} = aH_{1,2}(Th_{1,2} - T_c)$$

Where,

a = Coefficient of linear expansion
($1.12 \times 10^{-5} / ^\circ\text{C}$ or $6.22 \times 10^{-6} / ^\circ\text{F}$)

H_1 = Center height of the driver or the driven machine

H_2 = Center height of the gear unit

Th_1 = Temperature ($^\circ\text{C}$ or $^\circ\text{F}$) of casing or bearing housing during continuous operation for the driver or the driven machine.

Th_2 = Ditto for the gear unit

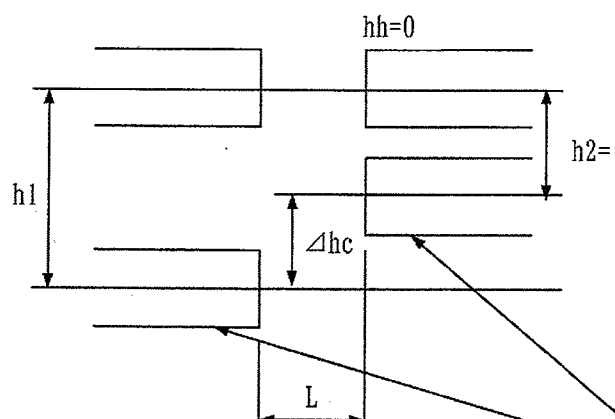
T_c = Temperature of atmosphere ($^\circ\text{C}$ or $^\circ\text{F}$) at the time of alignment work.

Normal temperature rise of the gear unit ($Th_2 - T_c$) is 35-50 deg. C (63-90 deg. F) on the condition of $T_c = 20^\circ\text{C}$ (68°F) and inlet oil temp. = 45-50 $^\circ\text{C}$ (113-122 $^\circ\text{F}$)

Driver machine

Gear Unit

Shaft position at hot condition



(h1: to be specified by the manufacturer of driver/driven machine.)

Shaft position at cold time

Fig.1. Method of Aligning
Table 1 Allowance of Alignment

	Cold	Hot
Run-out on periphery	See Fig.3	Within 0.05 mm (0.002 in.)
Run-out on face	Within 0.05 mm (0.002 in.)	Within 0.05 mm (0.002 in.)
L	*	*

*: Refer to turbine vender's data

Dial Gauge

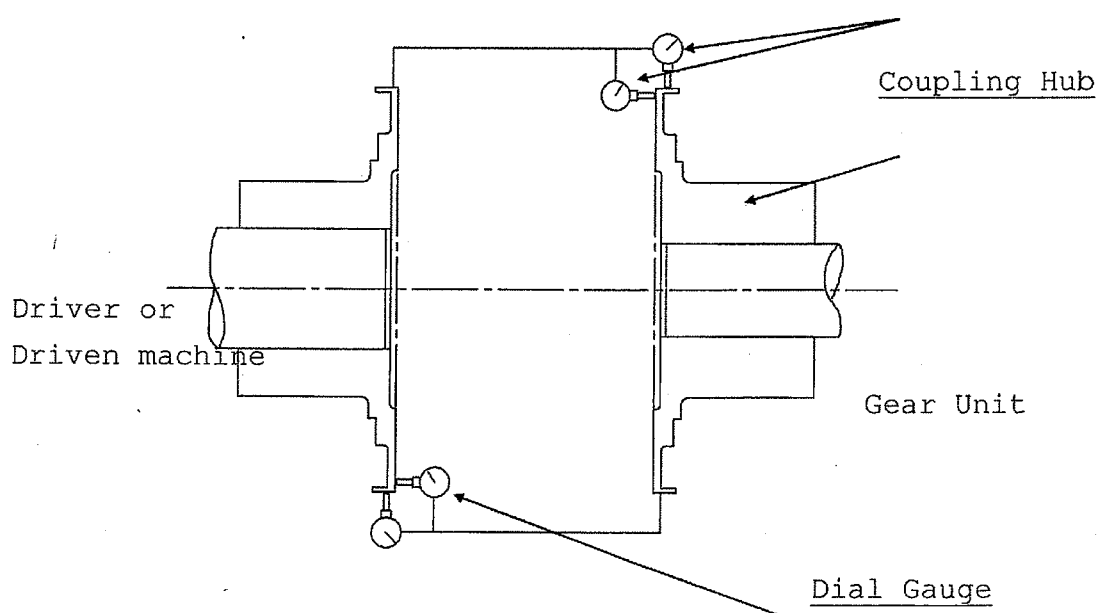
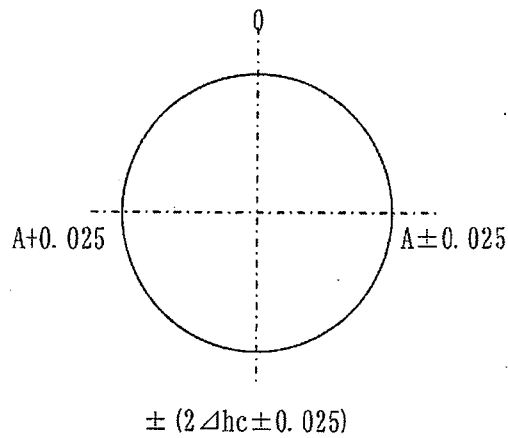


Fig.2. Alignment work at driver machine



Where,

A: optional value

- and + outside of parentheses corresponds + and - of value of Δhc respectively

unit: mm

Fig.3. Run-out on periphery

(2) A hot alignment check should be made at the test running. When all equipment have reached there normal operating temperature, stop operation and check alignment condition as quickly as possible. If mis-alignment is found, correct alignment before the equipment is cooled down.

5.5 Wiring of Instruments

Customer's connecting points for vibration detectors and/or temperature detectors are shown in the attached drawings.

After completion of installation of the gear unit and wiring of instrumentation, fill up all the sealing fittings with the sealing compound to seal up conduits for use in the hazardous locations.

6. OPERATION

Life of equipment can be extended with proper installation, operation and maintenance for the gear unit and related equipment. Attention should be paid particularly to the following points in operation and inspection.

(1) Prior to starting operation, supply lubricant of the main, 10°C (50°F) in temperature with required feeding pressure, for more than 30 minutes.

(2) Check points prior to starting operation

(a) For initial operation after installing the gear unit, check that the gear unit has been properly installed according to the section 5. Installation.

(b) Check that the related equipment, lubricating devices and safety devices are in proper condition. Checks should be made according to the instructions by respective manufacturers.

(c) Check that valves in lubricating piping system operates properly (normal open, normal close, or proper opening of adjusting valve).

Improper operation of valves may result in failure of supply of lubricant, which leads serious damage to the bearings and / or gears.

(d) Check the oil grade and supply amount.

(e) Check that flushing has been performed, that strainer has been sufficiently cleaned, and that pure oil will be supplied during operation.

(f) Check that water is supplied to the lube oil cooler.

(g) Operate the auxiliary oil pump and warm-up the oil sufficiently before starting operation.

(h) Before starting the initial operation after installation or a periodic inspection, open the inspection hole during warming-up, and check that the gears are being lubricated.



NEVER OPEN THE INSPECTION PORT DURING OPERATION OF THE GEAR UNIT.

HIGH TEMPERATURE OIL WILL GUSH OUT CAN CAUSE BURNS.

(i) During warming-up before starting normal operation, inspect each equipment and check that there is no oil leakage from shaft ends, mating faces of the case, flanges, mating faces

of the cover and joints of piping. In case that oil leakage is found, make necessary repairs by re-tightening, etc. When a repairing work is deemed necessary, contact the manufacturer of the equipment in trouble for further advice.

(3) Precautions during operation

After continuous operation was started, check the following items.

(a) Lubricating oil pressure

Check lubricating oil pressure with the pressure gauge on lubricating device. Normal pressure is **2.0 barG** at an inlet pip line of gear unit.

Normal operation	2.0 barG
Minor trouble (Alarm)	1.2 barG
Major trouble (Trip)	0.8 barG

Note:

In some plants, alarm minor trouble is omitted. In that case, include the checking of lubricating oil pressure as the item of daily inspection.

! CAUTION

1. In case that lubricating oil pressure is abnormally high, it is presumed that the piping system after pressure measuring point is closed, so carefully check the piping.
2. When the lubricating system is large and complicated, even if some minor pipes are closed (valve is not opened), abnormality of lubricating system may possibly be overlooked because variation of entire lubricating pressure is small.

Such overlooking may be effectively prevented by keeping the record of measured oil pressure periodically.

By doing so, small variations of oil pressure can be easily found. However, when variation of cooling water temperature is large, viscosity variation of lubricating oil appears as the variation of oil pressure. Therefore, it is necessary not to misjudge the phenomenon.

(b) Bearing temperature


Check the bearing temperature of the gear unit.

Following table shows an allowable temperature.

	Normal operating temp.	Minor trouble (Alarm)
Embedded temperature sensors	100°C	116°C

Note:

Check bearing temperature as a daily inspection.

 CAUTION

In case that bearing temperature varies and the variation does not coincide with lubricating oil temperature or when bearing temperature varies abruptly, it is suspected that the bearing is in some abnormal condition.

Therefore, immediately stop operation and investigate the cause of the trouble.

- (c) In case that abnormal sound or vibration is observed during operation, immediately stop operation and investigate the cause.
- (d) In case that an oil leakage is found, immediately stop operation and investigate the cause of the trouble.

7. MAINTENANCE AND INSPECTION

7.1 Proper Operation requires proper maintenance

Note that negligence of maintenance and inspection for a long period of time will sometimes results in unexpected troubles.

Inspection intervals and items to be inspected are as follows:

Maintenance and inspection interval	Contents
Daily	<ol style="list-style-type: none">1. Ascertain that lubricating oil pressure and bearing temperature are proper. (Refer to paragraph 6-(3) (a) and (b))2. Check the sound emitted from the main body of the gear unit with an acoustic bar and check the variation of the tone of the sound.3. Check the vibration of the shafts.4. Check for oil leakage.5. Keep gearbox and related parts neat and clean.
Weekly	<ol style="list-style-type: none">1. Sediments accumulated inside the strainer should be removed.
Monthly	<ol style="list-style-type: none">1. Check the turbidity of lubricant.2. During a halt of operation, check for looseness of the coupling bolts, and the hold-down bolts.
Annually	<ol style="list-style-type: none">1. Exchange lubricant. when operating hours are short and little deterioration of oil is expected, take sample oil and ask the oil company to ascertain that the oil has not been deteriorated before using it again.2. Since overhaul inspections for the following points from (a) to (c) require rather special techniques, request Hitachi to supervise the overhaul. (a) Check gears. (b) Check tooth contact of gears. (c) Check abrasion condition of bearing caused by a lapse of time and gap dimension.

	<p>3. Once a year, check that deflection of alignment of the couplings of the drive and driven machine is within the rated allowable range(see paragraph 5 INSTALLATION). When a deflection is found exceeding the rated value, and the vibration has increased compared with initial operating condition, re-alignment. Take and keep record of vibrations before and after re-alignment. This can be useful reference data for the next periodical inspection.</p>
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Note:

(1)Exchange lubricating oil about one month after the initial operation. Thereafter, exchange it once a year.

(2)In the case of keeping the gear unit at a standstill, operate the lubricating system for about 10 minutes once in two weeks in order to keep lubrication on bearings and gears and to prevent forming of rust. Take the same method when there is some period of time after trial operation or the machine is kept in the warehouse as a standby machine. When the machine cannot be operated, sufficiently apply lubricating oil or rust-preventive oil sufficiently) to the finished surface of gear teeth and shafts through the inspection hole on the top of the casing. At this time, take care so that no foreign matters enter the casing.

7.2 Trouble shooting

When an abnormal condition is observed during operation, presume the cause of the trouble and take appropriate counter measures. Refer to the following table for main causes.

(1) Trouble of the gear unit and its causes and counter-measures.

Phenomenon	Possible cause	Locating method and remedy
1.Abnormal noise	1.1 Wear of gear teeth	1.1 Carefully check the gear teeth to see if there is any abnormal abrasion. (When any abnormality is observed, contact Hitachi.)
	1.2 Abnormal bearing	1.2 Check if there is any abnormal abrasion or damage to bearing. If abnormality is found, replace the bearing with a spare bearing. In case that spare bearing is not available, place an order with the manufacturer.
	1.3 Faulty alignment of coupling	1.3 Perform re-alignment
	1.4 Loosened lock bolts of the main body of gear unit and lubricating system	1.4 Check for resonance due to looseness of lock bolts. Retighten.
	1.5 Influence from prime mover or driven machine	1.5 In case that there is abnormality in prime mover or driven machine, contact the respective manufacturer.
2.Abnormal vibration	2.1 gear teeth wear	2.1 Same as 1.1.
	2.2 Abnormal bearing	2.2 Same as 1.2.
	2.3 Faulty coupling alignment	2.3 Same as 1.3.
	2.4 Loosened lock bolts	2.4 Same as 1.4.

Phenomenon	Possible cause	Locating method and remedy
3.Oil leakage	3.1 Aged seat packing	3.1 Replace it
	3.2 Faulty application of liquid packing	3.2 Remove old liquid packing and apply new one.
	3.3 Faulty mounting or damage of labyrinth cover	3.3 When the cover is mounted upside down, re-mount it so that the small drain hole comes to lower side. Also, before re-mounting it, sufficiently clean labyrinth part sufficiently. When the labyrinth is damaged, replace it.
	3.4 Faulty tightening	3.4 Retighten. When oil leakage does not stop even after re-tightening, cause described in paragraphs 3.1 and 3.2 is presumed.

(2) Troubleshooting for lubrication system
(Lubrication device and piping)

Phenomenon	Possible cause	Locating method and remedy
1.Oil is not discharged	1.1 the lube oil valve is closed.	1.1 Open the valve.
	1.2 Air is sucked into suction piping.	1.2 Check that the oil level in the oil tank is within the standard range.
2.Lubricating oil pressure does not increase	2.1 Viscosity of oil is too high	2.1 Check if lubricating oil not specified is used.
	2.2 Leakage in piping	2.2 Check the piping.
	2.3 Air is sucked in.	2.3 Check the suction piping.

Phenomenon	Possible cause	Locating method and remedy
	2.4 Decreased oil viscosity because of temperature rise, made low piping resistance.	2.4 Check if temperature of cooling water in the oil cooler is too high and if flow rate is sufficient. Check cooling water control valve.
	2.5 Pressure setting of the safety valve is too low.	2.5 Adjust the safety valve to raise the pressure. Refer to its operating manual.
	2.6 The pressure gauge is out of order.	2.6 Replace or recalibrate the pressure gauge with proper one.
3.Feed oil pressure is too high.	3.1 The strainer is clogged.	3.1 Remove the deposit accumulated in the strainer.
	3.2 Foreign matter entered in piping.	3.2 Remove the foreign matter.
	3.3 Oil viscosity is too high.	3.3 same as item 2.1.
4.Feed oil temperature is unusually high.	4.1 Cooling water flow is interrupted, water flow rate is insufficient, or water temperature is high.	4.1 Adjust flow rate and temperature of water and clean the cooler.
	4.2 Bearing damage	4.2 Check if bearings are worn unusually or damaged.
5.Oil turbidity:	5.1 Water mixed with oil because of leaks in the cooler tubes.	5.1 Repair heat exchanger tubes.

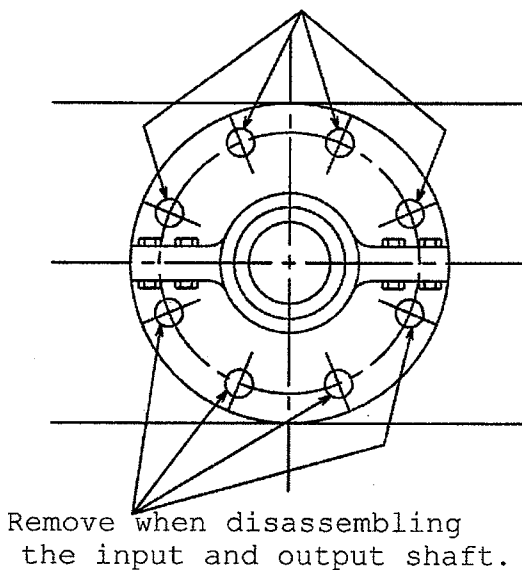
8.DISASSEMBLY AND RE-ASSEMBLY

For disassembly and re-assembly, it is essential to fully understand the structure and function of the gear unit beforehand, At the time of disassembly and re-assembly, cleanly wash each part so that dust or foreign matter do not stick to or enter, and pay full attention damage not to damage major parts.

Especially pay attention to keep tooth surfaces, journals and sliding surfaces of bearings free from any damage. For those portions where seat packing are used, from those be sure to insert the seat packing of the equivalent material (oil resistant), same dimensions and same shape as before at the time of re-assembly.

Upper casing

Remove when disassembling
the upper casing.

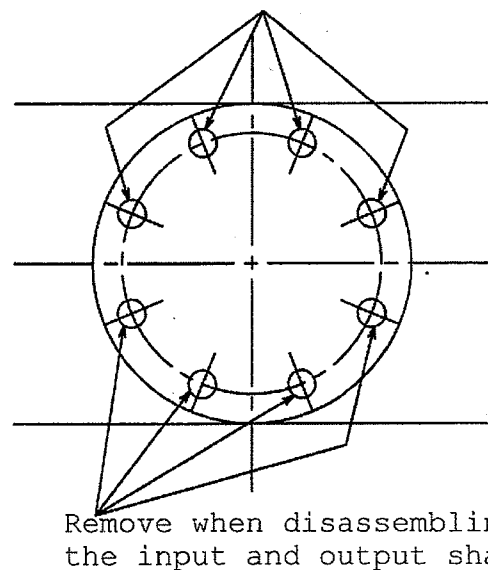


Lower casing

Fig.4

Upper casing

Remove when disassembling
the upper casing.



Lower casing

Fig.5

8.1 Disassembly

(1) Disassembly of instruments

No.	Disassembly	Cautions
1.	If an instrument panel for junction boxes or proximator housings are mounted on the gear casing, remove all wire and conduits at the entrance of junction boxes and proximator housings, and then remove the instrument panel with junction boxes.	Take care not to damage casings.
2.	Disconnect wire at the terminal head of vibration probes, and then remove vibration probes from the casing.	Ditto
3.	As for the embedded type temp. Detectors, disconnect lead wires at each terminal head and then remove terminal head from the casing. As for the probe type temp. Detectors, remove the detector from the casing.	Be sure to disconnect the lead wire of the sensors completely so the upper casing can be removed without cutting lead wires.
4.	Remove wires so the upper casing can be removed.	

(2) Disassembly of gearbox

To disassembly, observe the following procedure referring to the construction drawing.

No.	Disassembling	Cautions
1	Remove the bolts from the joining face of lower casing and upper casing.	Keep the bolts in a box etc. or keep them at one place not to be lost.
2	Remove the bolts from the input shaft coupling cover and output coupling cover, then remove the covers.	Ditto
3	Remove bolts from the labyrinth seal cover.	
4	<p>Using a wire rope, disassemble the upper casing utilizing crane or a chain block.</p> <p>As for the gear unit with upper casing integral with upper bearing housing, item (3) on the right need to be observed.</p>	<p>(1) Before lifting the upper casing, check that the fluid sealing compound applied to the joining face is completely detached.</p> <p>(2) Confirm that all bolts have been removed.</p> <p>(3) When lifting up, perform inching operation as vertically as possible, and check that the upper casing is held horizontally.</p> <p>(4) Stop the upper casing at a position where it is 5-10 mm apart and check that the upper half of each bearing is separated from the upper casing and is resting on the corresponding journal. If the upper bearing is sticking to the upper casing, separate it from the upper casing by gently tapping its side face by a plastic hammer or the like and put the upper bearing down on to the journal.</p> <p>(5) Pay full attention so that the upper casing will not collide against the other parts such as the gear.</p>

No.	Disassembling	Cautions
5	Remove the upper half of each bearing. If the parting line of the bearing is slanted, rotate them using threaded holes and then, remove locating pins.	(1) Since the babbit metal part of the upper metal is soft, use sufficient care not to damage it. (2) Removed bearings should be neatly arranged and placed at one place. Further, they should be protected with a vinyl sheet against dust.
6	Remove the pinion shaft and the gear shaft.	(1) Attached a piece of cloth at the portion of the shaft away from the journal, wind a rope on it and gently lift then up. (2) When lifting up, take sufficient care not to damage journal part, tooth face, and so on.

8.2 Re-assembly

(1) For re-assembly, follow the disassembly procedure backward.

(2) Cautions for re-assembly

- (a) before re-assembling, clean every part by removing rust preventing oil by using solvent (do not wipe with cloth or paper)
- (b) Do not apply wire ropes directly to machined surfaces (Especially to tooth surfaces, bearing surfaces, etc.) Be sure to insert a piece of cloth or vinyl sheet.
- (c) Assemble carefully. Do not collide a part against another part or drop it.
- (d) Check tooth contact of teeth, which mesh each other. The checking method for tooth bearing is as described in paragraph 5.2.
- (e) Confirm that any foreign matter or any assembly tools do not remain in the gear unit.
- (f) To mating surfaces of the upper and lower casing, apply fluid sealing compound so that oil leakage will not be caused.
- (g) Tighten all bolts and nuts firmly so that they will not get loose.
- (h) If used seat packing is used again, oil leakage may be caused because of a flow, which occurred at the time of disassembly. Therefore, replace the seat packing with a new one. At that time, use the seat packing "Valqua No.6500" or equivalent.

9. CARRYING EQUIPMENT

When you carry, move or relocate the gear unit for the purpose of installation, inspection and servicing, the following precautions should be observed.



- (a) Use the hooks or shackles on the lower casing when slinging the gear unit. The lifting lugs on the upper casing are not be used only for lifting the upper casing.
- (b) Prior to any hauling job, be sure to remove devices and piping harness, which may otherwise be damaged during hauling work.

10.MAINTENANCE LIST

10.1 Permissible Bearing Wear(Unite: mm)

		Bearing clearance		
		Bearing diameter	Designed value	Permissible wear limit
Radial bearing	High-speed shaft	85	0.150 ~ 0.214	0.235
	Low-speed shaft	100	0.150 ~ 0.214	0.235
Thrust bearing	High-speed shaft	—	—	—
	Low-speed shaft	—	0.247 ~ 0.398	0.600

10.2 Back lash (Unite: mm)

Designed value	Allowable value
0.346 ~ 0.556 mm	0.615 mm

11. LUBRICATION OIL LIST

Oil selection should be determined by the oil viscosity (VG class) specified on the nameplate of gear unit.

Manufacture	Product
JOMO	JOMO RIX Turbine 46
ENEOS	FBK Turbine 46
IDEMITSU	Turbine oil 46
	Super turbine oil 46
COSMO	Turbine super 46
Mobil	Moil DTE 846
ESSO	TERESSO Turbine 46
Shell	Turbo oil T 46

12.Storage

Preparation of Gear Unit

In the case where it is 6 months or longer till the initial operation of the gear unit after leaving the factory, or where the gear unit operation is suspended for long period of time (more than a month), a proper preparation for storage is necessary. Failure to take this preparation or insufficient preparation cause rust, and if the machine is operated under such undesirable condition, it may lead to an unexpected trouble. Take either of the following procedure:

1. Perform the rated-speed operation of the gear unit for 10 to 20 minutes once every 2 weeks to recent run-out of oil on the bearings, gears and internal face of gear casing.
2. Spray RUST VETO 377 (by E.F. Houghton & Co.) onto the tooth surface and bearings through the inspection window. (Rust prevention is effective for about 3 months)
3. Apply above RUST VETO 377 by brush. (Rust Prevention is effective for about 6 months). The gear unit will usually be delivered after giving the treatment in Hitachi shop; however, it is effective for max. 6 months.

NOTE: When your gear unit is stored in special ambient condition (At a place near the seaside or where high humidity or corrosive gas exists) or in rainy season, please contact Hitachi.

Record of Revisions

Change No.	Date	Description	Signature	Approved

INSTRUCTION MANUAL
MODEL: HCD025
No. IM006343

Approved C. Yoshida
 Checked T. Yokoyama
 Checked T. Sekurōi
 Designed _____
 Drawn A. Mitsuhashi
 Date 2010/2/15

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Design Department Omiya Plant

Overseas Sales and Service Network

1. For inquiries on this equipment , please contact our manufacturing plant through the nearest sales department.
2. Contents of this manual may be subject to change without notice due to remodeling of products.
3. Disclosure,presentation or reproduction of this manual to third parties shall be strictly prohibited.

Sales Department

Head Sales Office	405-3, Yoshinocho 1-chome, Kita-ku, Saitama 331-0811, Japan URL http://www.hitachi-nico.jp/ TEL +81-48-652-7979 (Industrial Transmissions Sales Dept.) TEL +81-48-652-6708 (Marine Transmissions Sales Dept.) FAX +81-48-652-8719
Osaka Branch	Kearny Place Honmachi 6F, 6-13, Awaza 1-chome, Nishi-ku, Osaka 550-0011, Japan TEL +81-6-6578-0615 FAX +81-6-6537-2190
Nagoya Sales Office	Kirix Marunouchi Bldg, 17-19,Marunouchi 1-chome, Naka-ku, Nagoya 460-0002, Japan TEL +81-52-211-4385 FAX +81-52-211-4396
Fukuoka Sales Office	Hakata Ekimae Daini Bldg. 2F, 6-23, Hakataeki Higashi 2-chome, Hakata-ku, Fukuoka 812-0013, Japan TEL +81-92-414-9220 FAX +81-92-414-9221
Sapporo Sales Office	Tsukamoto Bldg. 7-gokan 6F, 9-1, Kita Nanajyo Nishi 13-chome, Chuo-ku, Sapporo 060-0007, Japan TEL +81-11-221-6165 FAX +81-11-261-5670
Hiroshima Service Center	Kamiya Bldg, 2-2, Kamiyacho 2-chome, Naka-ku, Hiroshima 730-0036, Japan TEL +81-82-245-2378 FAX +81-82-241-4972

Plant to Manufacture the Products

Omiya Plant	405-3, Yoshinocho 1-chome, Kita-ku, Saitama 331-0811, Japan TEL +81-48-651-8411 (Service Dept.) FAX +81-48-664-2325
Kamo Plant	405, Oaza Gejyo Bo, Kamo, Niigata 959-1391, Japan TEL +81-256-52-2861 (Service Dept.) FAX +81-256-52-9068

TITLE		CONSTRUCTION SPARE PARTS LIST			PAGE	1/1
No.	NAME OF PARTS	DIMENSIONED SKETCH	Q'TY	MATERIAL	DRAWING No.	
1	GASKET		1	V#6500	22A025914A 00D006373A NO. 20	
2	GASKET		1	V#6500	318443903 00D006373A NO. 24 (ASME 150LB 1")	
3	GASKET		3	V#6500	318443906 00D006373A NO. 26 (ASME 150LB 2")	
4	GASKET		1	V#6500	318443912 00D006373A NO. 28 (ASME 150LB 6")	

Item No: Z06101

SYMBOL	DESCRIPTION	CHANGER NO.	DATE	SIGNATURE	APPROVED
△	REVISED	---	2010/2/1	A. Mizukoshi	C. Yoshida
△	REVISED	---	2009/10/11	A. Mizukoshi	C. Yoshida

APPROVED C. YOSHIDA		MATERIAL ---		MODEL HCD025	
CHECKED T. YOKOYAMA T. SAKURAI		HEAT TREATMENT ---		NAME CONSTRUCTION SPARE PARTS LIST	
DESIGNED A. MIZUKOSHI		SCALE NTS		DRAWING NO. LS006343	
DRAWN A. MIZUKOSHI		DATE 2009/5/15		3RD ANGLE PROJECTION	

REVISIONS

Hitachi Neco Transmission Co., Ltd.

A4V

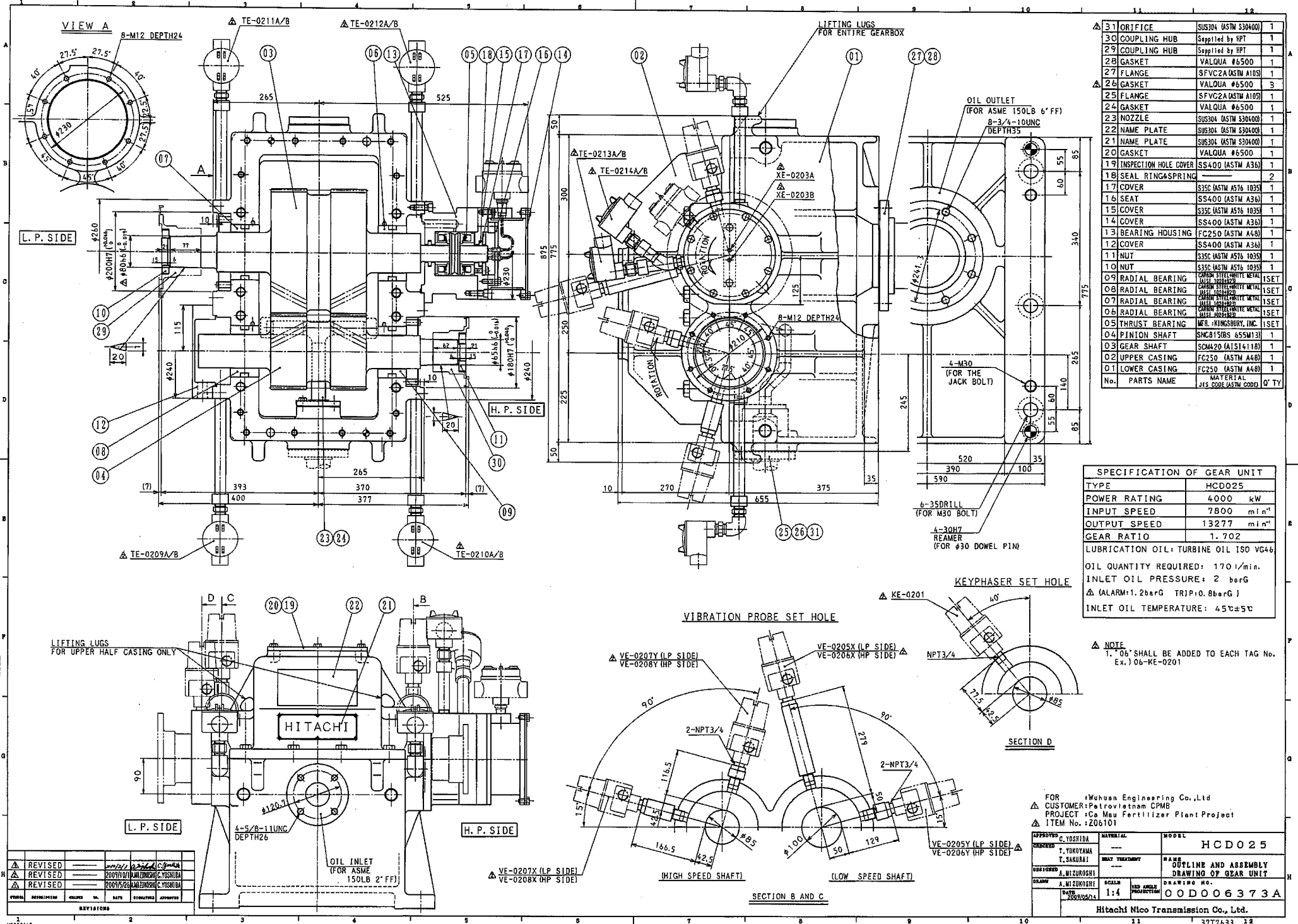
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37T7633

3N4-S4279947 26/

原図

3N4-SA279947 37/E 原図



31	ORIFICE	SUS304 (ASTM S30400)	1
30	COUPLING HUB	Supplied by RPT	1
29	COUPLING HUB	Supplied by RPT	1
28	GASKET	VALQUA #6500	1
27	FLANGE	SFVC2A (ASTM A109)	1
26	GASKET	VALQUA #6500	3
25	FLANGE	SFVC2A (ASTM A109)	1
24	GASKET	VALQUA #6500	1
23	NOZZLE	SUS304 (ASTM S30400)	1
22	NAME PLATE	SUS304 (ASTM S30400)	1
21	NAME PLATE	SUS304 (ASTM S30400)	1
20	GASKET	VALQUA #6500	1
19	INSPECTION HOLE COVER	SS400 (ASTM A36)	1
18	SEAL RING-SPRING		2
17	COVER	S35C (ASTM A576 1035)	1
16	SEAT	SS400 (ASTM A36)	1
15	COVER	S35C (ASTM A576 1035)	1
14	COVER	SS400 (ASTM A36)	1
13	BEARING HOUSING	FC250 (ASTM A48)	1
12	COVER	SS400 (ASTM A36)	1
11	NUT	S35C (ASTM A576 1035)	1
10	NUT	S35C (ASTM A576 1035)	1
09	RADIAL BEARING	DAIICHI STEEL CO. LTD. JAPAN	1 SET
08	RADIAL BEARING	DAIICHI STEEL CO. LTD. JAPAN	1 SET
07	RADIAL BEARING	DAIICHI STEEL CO. LTD. JAPAN	1 SET
06	RADIAL BEARING	DAIICHI STEEL CO. LTD. JAPAN	1 SET
05	THRUST BEARING	MFR. KINGSBURY, INC.	1
04	PINION SHAFT	SNCB15B5 65SM131	1
03	GEAR SHAFT	SCM420 (AISI4140)	1
02	UPPER CASING	FC250 (ASTM A48)	1
01	LOWER CASING	FC250 (ASTM A48)	1
No.	PARTS NAME	JIS CODE (ASTM CODE)	Q'TY

SPECIFICATION OF GEAR UNIT	
TYPE	HCD025
POWER RATING	4000 kW
INPUT SPEED	7800 min ⁻¹
OUTPUT SPEED	13277 min ⁻¹
GEAR RATIO	1.702
LUBRICATION OIL: TURBINE OIL ISO VG46	
OIL QUANTITY REQUIRED: 170 l/min.	
INLET OIL PRESSURE: 2 barg	
Δ (ALARM): 1.2barg TRIP: 0.8barg	
INLET OIL TEMPERATURE: 45℃±5℃	

NOTE
1. "06" SHALL BE ADDED TO EACH TAG No.
Ex.) 06-KE-0201

FOR		Wuhuan Engineering Co., Ltd
CUSTOMER:		Petrovietnam CPMB
PROJECT:		Co Mau Fertilizer Plant Project
ITEM No.:		Z06101
APPROVED	C. YOSHIDA	MODEL
CHECKED	T. YOKOYAMA	HCD025
DESIGNED	T. SAKURAI	NAME
DRAWN	A. WIZUKOSHI	OUTLINE AND ASSEMBLY
DATE	2009/06/04	DRAWING NO.
SCALE	1:4	00D006373A
Hitachi Neco Transmission Co., Ltd.		

REVISION	NO.	DATE	DESCRIPTION	APPROVED
REVISOR	1	2009/06/04	INITIAL DESIGN	C. YOSHIDA
REVISOR	2	2009/06/04	REVISION	T. YOKOYAMA
REVISOR	3	2009/06/04	REVISION	T. SAKURAI
REVISOR	4	2009/06/04	REVISION	A. WIZUKOSHI