

TEST REPORT OF ROOT'S VACUUM PUMP
真空ポンプ試験成績書

Messrs.
御注文主

Inspection Date
試験日 Jul.29.2005
Method of Measurement
試験方法 JIS B8341

VACUUM PUMP SPECIFICATION 真空ポンプ仕様		MOTOR SPECIFICATION 電動機仕様	
Type 型式	CT3-200U	Type 型式	T.E.F.C.
Suction Bore 吸込口径	50 A	Out put 出力	5.5 kW
Discharge Bore 吐出口径	40 A	Poles 極数	4 P
Speed 回転速度	2000 min ⁻¹	Frequency 周波数	50 Hz
Suction Pressure 吸込圧力	48 kPa	Voltage 電圧	400 V
Capacity 空気量	2.80 m ³ /min	Current 定格電流	A
		Maker 製造社	BALDOR

MEASUREMENT
測定値

Serial No.
製造番号 1496

Speed 回転速度 min ⁻¹	1972	1973	1977
Suction Pressure 吸込圧力 kPa	0.13	10.0	48.0
Discharge Pressure 吐出圧力 kPa	1 atm	1 atm	1 atm
Measurement 測定量 L/min	0	286	1240
Capacity 空気量 m ³ /min	0.00	3.11	2.81
Voltage 電圧 V	400	400	400
Current 定格電流 A	9.4	9.4	8.7

3V850

Check 検印	Test by 試験係
M. YAMAMOTO	K. KATO

ANLET CO., LTD



CAUTION

*For the safe use of the equipment,
always read this operation Manual
before operating the equipment.*

OPERATION MANUAL

INTERNAL PIPING LAND-MOUNTED
MULTI-STAGE ROOTS TYPE VACUUM PUMP
TORR DRY

CT3 TYPE (STANDARD)

ABOUT THE WARNINGS

In this operation Manual, the types of danger that could result in major accidents have been ranked according to the following three categories.

Understand the contents of these warnings and strive to prevent accidents from happening.

	DANGER	<i>Describes imminent danger which could result in death or serious injury.</i>
	WARNING	<i>Describes potential danger which could result in death or serious injury.</i>
	CAUTION	<i>Describes potential danger which could result in injury or damage to the equipment.</i>

Thank you for purchasing the Roots type vacuum pump (CT3).

Please read and fully understand this Operation Manual before using the CT3 and always use it in the proper manner.

Mis-operation of the CT3 could result in a major accident and/or injury.

Always pass this Operation Manual on to the final user.

Always store this Operation Manual in a safe place where it can be referred to easily.

Oct, 25, 2002
CT3-UM-001-R4
VP-UM1-2-E

ANLET CO. , LTD

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ANLET CORPORATION-OFFICES

1. MODEL AND SPECIFICATION CHART (STANDARD SPECIFICATIONS)

SPEC- IFICATIONS	MODEL CT3-60U	CT3-100U	CT3-200U	CT3-350U		CT3-700	CT3-1000
SUCTION PORT DIAMETER (A)	40	40	50	65		80	100
DISCHARGE PORT DIAMETER (A)	25	32	40	50		65	65
MEASURED PUMPING SPEED (m³/min)	1.26	2.08	3.82	5.13	6.41	11.3	16.1
POWER (kW)	2.2	3.7	5.5	7.5	11	15	22
SPEED (min ⁻¹)	1800	2300	2000	1600	2000	1700	1700
AMOUNT OF COOLANT WATER (l/min)	7	7	10	12		15	20
ABBREVIATED DIMENSIONS (mm)	690 x555 x1100	735 x605 x1100	800 x645 x1250	1060 x850 x1450		1150 x915 x1300	1150 x1025 x1255
ABBREVIATED WEIGHT (kg)	170	190	270	470		1120	1460

FLUIDS	Normal air and non-corrosive fluids; non-poisonous fluids; non-crystallizing fluids; non-solidifying fluids
POTENTIAL OPERATING PRESSURES	<Suction Port Side > Atmospheric pressure ~ Pumping pressure <Discharge Port Side > Atmospheric pressure
MOUNTING LOCATION	Indoors (If used outdoors, the pump must be positioned in a location where it will not be exposed to rain, water and other such conditions and requires some type of roof or similar covering.) → See section 5


DANGER

Never intake such gases as poisonous gases.

Always consider the dangers to the body when maintaining the equipment. Also, use extreme care when handling such gases as flammable gases as an error in the method of usage could result in unexpected explosions or other types of accidents.


CAUTION

The intake of corrosive fluids will result in corrosion-related trouble with the main components of the pump. The intake of crystallizing fluids and/or solidifying fluids penetrate into and adhere to the rotating parts of the pump and cause problems with rotation.

※Pumps that have been used to intake gases such as poisonous gases may not be received for repairs.

2. NAMES OF MAIN COMPONENTS OF VACUUM PUMP

See section 14-6
(Main Unit Development)

fig.1 CT3-60-U~350-U

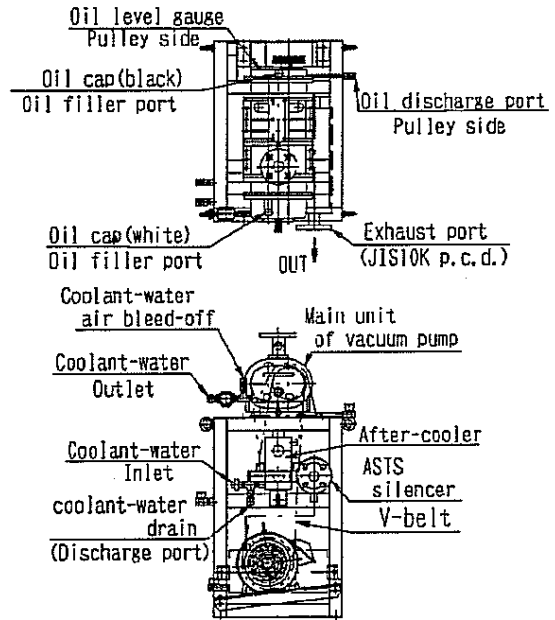
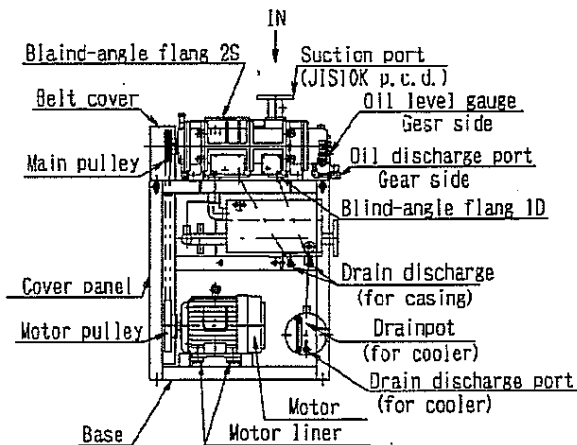


fig.2 CT3-700

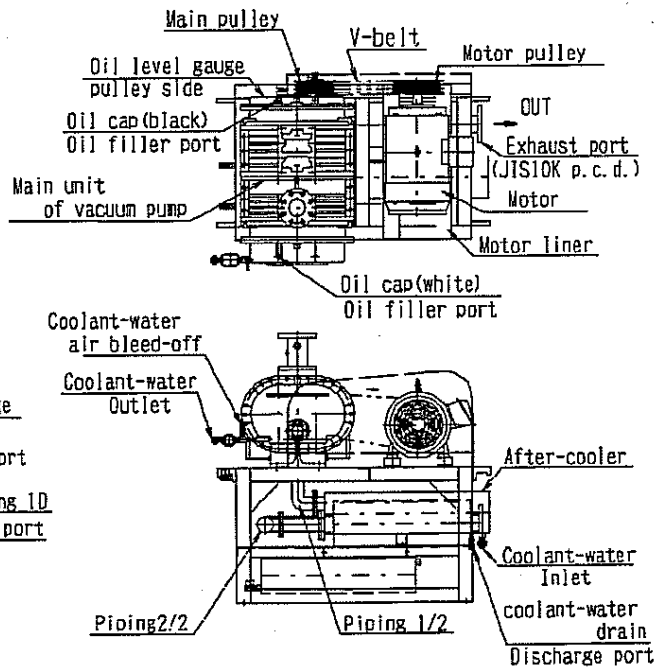
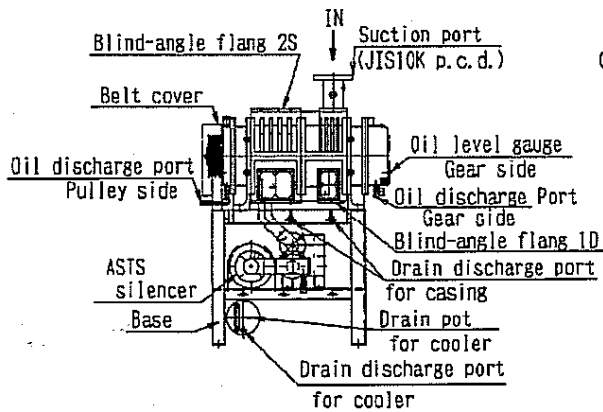
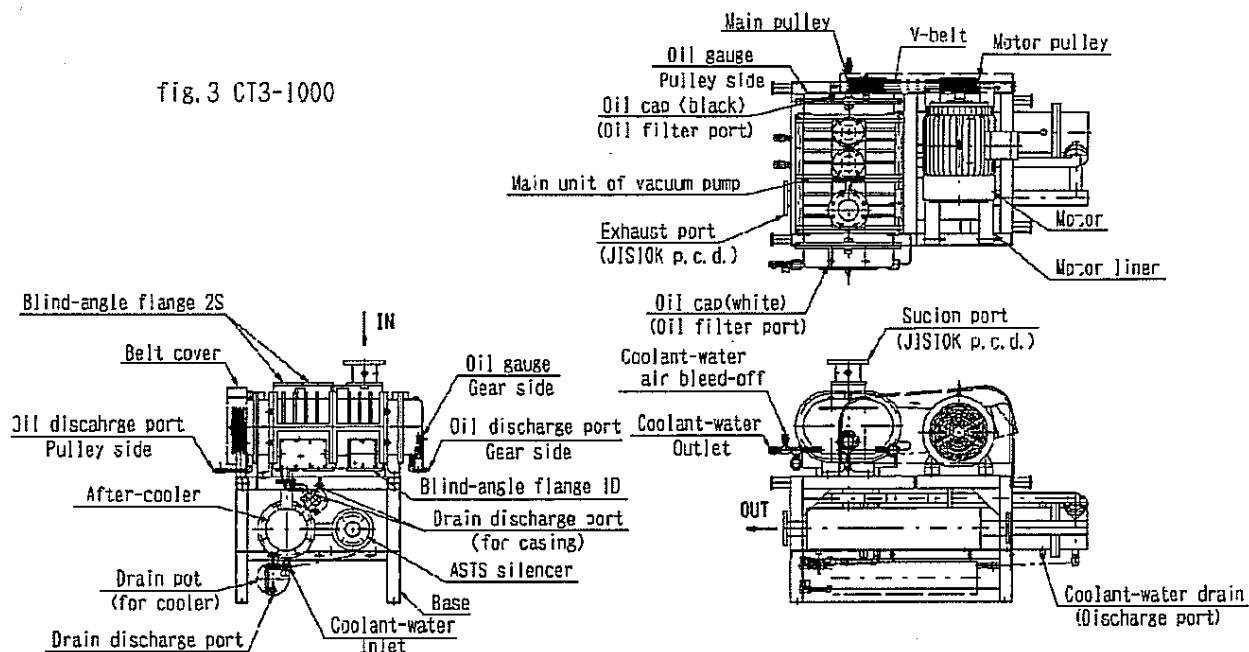


fig.3 CT3-1000



3. STANDARD ACCESSORIES

BASE, BELT COVER, COVER-PANEL (EXCLUDE CT3-700) ,V-BELT, V-PULLEY (FOR MAIN UNIT, FOR MOTOR)	1 SET
ASTS SILENCER	1
AFTER COOLER	1
DRAIN POT(FOR AFTER COOLER)	1
INTERNAL PIPING (WATER-COOLING PIPING, DRAIN PIPING)	1
ANCHOR BOLT	4

4. CONFIRMATION OF DELIVERED PARTS

Please confirm the following when the product is delivered.

- 1) Confirm that the pump model and specifications are as you ordered.
- 2) Check for external damage.
- 3) Check the tightness of the nuts, bolts and other fasteners.
- 4) Check if there are any auxiliary parts.



CAUTION Confirm that the product is for 50Hz or 60Hz applications. As this is a V-belt type model, the wrong cycles will result a change in pump speed.

5. MOUNTING

- 1) Install the pump indoors. If the pump must unavoidably be installed out of doors, provide a roof or the like so that the pump is protected from rain, water, and the like.

Also, carry out safety measures, sound-proofing measures, and the like by providing a fence or the like to prevent unauthorized personnel from approaching.

- 2) Allow enough space around the pump to permit easy preventative maintenance and disassembly. The required mounting space is shown in Chart 1.

CHART 1

PUMP MODEL	CT3-60U	CT3-100U	CT3-200U	CT3-350U	CT3-700	CT3-1000
LENGTH (m)	2.0 or more	2.0 or more	2.1 or more	2.2 or more	2.3 or more	2.6 or more
WIDTH (m)	1.8 or more	1.8 or more	1.9 or more	2.1 or more	2.2 or more	2.3 or more
HEIGHT (m)	2.5 or more	2.5 or more	2.7 or more	2.8 or more	2.8 or more	2.8 or more

Space is required on both sides of the pump during disassembly and assembly so the pump should be mounted in the center.

A winch, crane or other type of lifting device makes assembly and disassembly easier.

- 3) If the ambient temperature is 40°C or more, problems with the pump and motor will occur and there will be a decline in the service life of these components.

Always provide ventilation that will ensure an ambient temperature of 40°C or less.

- 4) Securely fix the pump in a level position to a concrete foundation using anchor bolts. (Tilt the pump as the gear oil will fluctuate.)
- 5) Apply sound absorbing material to the machine room where the pump is mounted and take steps such as using flexible piping at connections as countermeasures to noise and vibration.
- 6) Prepare a spare unit for use in the event of an emergency.

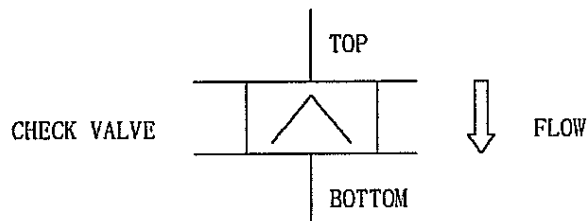


DANGER *Always use extreme care to prevent dropping accidents when lifting, transporting or moving the pump. Never place any part of your body under a pump that has been lifted.*
Never mount the pump near explosive material, flammable material or other dangerous material. This is extremely dangerous.
Never mount the pump in areas with heavy pedestrian traffic, in locations where children might enter, or other such areas.

6. PIPING

Components in the Roots type vacuum pump rotate with a clearance of only 0.1 to 0.3mm. Accordingly, as foreign material entering the pump will prevent rotation, the following cautions must be observed when routing the piping.

- 1) Mount a 40 to 200 mesh strainer to the suction side piping to prevent foreign material, such as welding particles, from entering into the pump. This strainer should be capable of being cleaned, as clogging will result in a decline in pump performance.
- 2) To avoid resistance in the suction and discharge piping, use piping with a diameter that is equal to or greater than that of the pump port diameter and keep piping distances short. (Reference: less than 10 meters.) If the piping is longer than this, increase the diameter of the piping.
- 3) Always provide a support for the piping so that its weight does not rest on the pump.
- 4) Always completely remove welding residue and rust from inside the piping.
- 5) If the inside of the vacuum container has been sand blasted, always completely remove all sand and other material.
- 6) Mount a vacuum valve (suction valve) and leak valve on the suction side.
- 7) If moisture is included in the air being handled, reduce the rise in the discharge piping. (Reference: less than 3 meters.) If the discharge piping is too high, the condensed liquid in the piping will flow back and cause resistance during pump exhaust. In such cases, a drain tank or similar device must be positioned directly after the exhaust side of the pump. This drain or similar device should be capable of being drained.
- 8) Install a check valve to the suction side to prevent reverse flow when the pump is stopped, or when several pumps are operated in series. When such a valve is used, it should be as shown in the illustration where the air of the vertical piping flows in a top to bottom direction.



- 9) If there is to be an intake of hot air, mount a cooling device on the suction side of the vacuum pump to cool the air to 40°C or less.
- 10) Use flexible piping as a countermeasure to vibration and to make maintenance easier.
- 11) When testing the air-tightness of the piping, including the vacuum pump, set the test pressure to 50 kPa or less.



CAUTION

Always use gaskets and sealant when connecting the piping to ensure leak-free operation. This is especially important on the suction side piping as a leak will result in reduced pump performance.

7. COOLING-WATER PIPES

- 1) Use the water indicated in Table 2 as the coolant water for the vacuum pump.
- 2) Set up the coolant-water piping and be sure to allow water to flow during operation (water pressure: 200 ~300 kPa)
- 3) When stopped for long periods, are during times of freezing temperature in winter, discharge the water from the drain.
- 4) Clean the interior periodically, because water scales or the like may build up in the coolant-water piping and the main-unit water-cooling portion (see section 15. maintenance and inspection.)

Clean with steam or high-pressure water at 300 to 400 kPa.

Effectiveness can be enhanced by also using a coolant-water system cleaning agent.

Clean the pump unit and cooler separately.

Table 2

HARDNESS	0. 5 or less
TEMPERATURE	3 0°C or less
PH [2 5°C]	6. 5 ~ 8. 0
CONDUCTIVITY [2 5°C]	2 0 0 μ s/cm or less
CHLORIDE ION (C l)	2 0 0 ppm or less
SULPHATE ION (S O ₄)	5 0 ppm or less
IRON (F e)	1. 0 ppm or less
HYDROSULFIDE ION (S)	None
AMMONIUM ION (N H ₄)	1. 0 ppm or less
FREE CARBON DIOXIDE	1. 0 ppm or less

- 5) The prescribed water quantity is indicated in Table 3.

Table 3

MODEL	CT3-60U	CT3-100U	CT3-200U	CT3-350U	CT3-700	CT3-1000
COOLING-WATER FLOW RATE (l/min)	7	7	10	12	15	20

NOTE: Cooling water must not be circulator through spmps to prevent them from rusting.

- 6) Install the optional flow switch.

8. ELECTRICAL WIRING

Electrical wiring, grounding and all other related operations must be implemented according to engineering standards for electrical equipment as well as standards for internal wiring and be performed properly by certified personnel.

- 1) Always use the wiring materials appropriate for the capacity of the electric motor.
- 2) Always provide a thermal fuse, breaker or similar protection device to prevent heat damage to the electric motor.
- 3) Always ground the electrical system to prevent electric shock related accidents.
- 4) Always make sure that electrical connections are secure.

It is recommended that connections be made after checking the phase rotation with phase rotation inspection equipment.

※Wiring diagrams are provided in such places as inside the regular motor terminal connection box for reference.

NOTE) If the star time is excessively long when the wiring is for star-delta operation (6-wire connection), it will result in insufficient torque and problems during starting. In such cases, use direct-input start or shorten the star time to approximately two to three seconds.



DANGER

Never permit sub-standard wiring or grounding operations to be performed by uncertified personnel. Not only is this illegal, it is extremely dangerous. There are legal obligations to provide breakers for electrical leakage and devices for overload protection to prevent electrical shock or fire (as well as accidents such as short-related accidents resulting from mis-wiring).

9. PREPARATIONS FOR OPERATION

Check the following items when operating the vacuum pump.

→ REFER TO SECTION 14

1) Piping

- Confirm that all connections are tight and that there is no clogging.
- Check that each valve is in the proper opened or closed position.

2) Manual Rotation

- Manually rotate the vacuum pump and check for abnormalities.
- If foreign material is present, it will be hard to rotate the pump and roughness in the rotation will be felt. If such conditions are experienced, the piping must be removed and cleaned.

3) Power Supply

- Check conditions such as the cycles of current, voltage and that all connections are secure.

4) Direction of Rotation

- Always confirm the direction of rotation prior to operation. Rotation should be to the left when viewed from the pulley and motor side. (Counter-clockwise direction)
- ※ Items of caution when confirming the direction of rotation.
When confirming the direction of rotation, open the main valve and start. If the main valve cannot be opened, use a by-pass piping or a similar configuration. Confirm the direction of operation for only an extremely brief period (approximately 1 second). In the event of reverse rotation, stop immediately.

5) Lubricating Oils

- With the pumped stopped, confirm that the level of the gear cover oil is in the middle of the oil level indicator. Replenish if required.



CAUTION

Always use care to keep fingers, etc., from being caught between the pulley and V-belt when performing manual rotation. Always mount all V-belt covers, and others, essential protective items prior to operating the machine.

10. STARTING EXHAUST OPERATIONS

Starting exhaust operations are performed according to the following procedure.

- 1) Allow coolant water to flow.
- 2) Close the main valve on the suction side of the pump.
- 3) Open all valves on the exhaust side.
- 4) Start the vacuum pump.
- 5) Slowly open the main valve on the suction side of the pump and expel the contents of the container.

<Starting when the vacuum tank is in a vacuum state>

If the main valve is opened prior to starting the vacuum pump, the pump will begin to reverse and increase the starting load. Therefore, start the operation with the main valve closed and then slowly open the main valve to expel the contents of the container.



CAUTION *Never touch the pump. If the vacuum tank is in a vacuum state, there is the danger that the pump will start reverse operation even if the pump switch is in the "off" position. There are fins on the pulley which will cause cuts or other injury if the hand, fingers, etc. are placed inside the cover.*

11. CONFIRMING OPERATION

- 1) Never directly touch the surface of the piping or pump with your hand, etc., as it is extremely hot.
Always use a thermometer to check the temperature.
- 2) Check for abnormal sounds or vibrations.
If an abnormal sound or vibration is heard or felt, stop the pump immediately and investigate the cause.
- 3) Check the amperage of the motor. (It should be below the amperage indicated on the stamped plate.) This could result in an overload if there is an abnormality in the discharge pressure.

12. STOPPING EXHAUST OPERATIONS

Stopping exhaust operations are performed according to the following procedure.

- 1) Close the main valve between the vacuum container and vacuum pump suction. (If the pump is stopped without this valve being closed, air will leak through the pump clearance area and cause the vacuum level in the vacuum container and line to drop. It could also cause the pump to suddenly start to reverse direction and cause problems.) Install a check valve on the suction side of the pump to prevent this when the pump is stopped.
- 2) Stop the vacuum pump.
- 3) Stop the cooling water.



CAUTION *Never touch the vacuum pump during operation or after it has been stopped. The surface temperature of the pump may exceed 100°C during operation and for 30 to 60 minutes after the pump has been stopped.*

13. CAUTIONS AND PREVENTING DANGER

13-1 PREVENTING DANGER

- ① The intake of toxic gases with this vacuum pump is dangerous.
" NEVER ATTEMPT THIS." Physical effects may occur when performing maintenance or the like.
In addition, caution is required with the intake of flammable gas or the like, because an error in the usage method could result in explosion or some other unforeseen accident. Use a fire net when taking in flammable solvent vapor.
- ② Never touch electrical connections and similar areas with your hands, etc. in order to prevent electrical shock accidents.
- ③ To ensure safety, be sure to operate with accessories such as the belt cover installed.
- ④ Never place hands or other objects near the V-belt guards during operation.
- ⑤ Never touch the pump with your hand during operation or for a period after it has been stopped as the pump and piping are at high temperatures.
- ⑥ Always turn off the electric power supply before manually rotating the pump or performing an inspection.
Always place a tag on the power source indicating "Under Inspection." or similar message to prevent the power from being accidentally turned on during an inspection.

13-2 CAUTIONS WHEN INSTALLING

- ① To prevent reverse flow of the pump, position a valve in front of the main body of the pump.
Close this valve before terminating pump operation and then terminate the operation.
It is also possible to use a check valve on the horizontal piping.
- ② Attach a strainer with a 40 to 200 mesh on the suction side of the piping to prevent weld residue or other foreign material from entering the pump.
- ③ If a valve is mounted on the discharge side of the pump, secure the handle of the pump so that it is not moved by vibration, etc. (Always completely open valves on the discharge side before operating the pump.)
- ④ If the piping on the discharge side is long, increase the diameter of the piping to prevent pressure loss. Keep overall pressure loss at 5 kPa or less.
- ⑤ Install the vacuum pump indoors. If the pump must unavoidably be installed out of doors, provide a roof or the so that the pump is protected from rain, water, and the like.
- ⑥ Never mount the pump in areas with heavy pedestrian traffic, in locations where children might enter, or other such areas.
- ⑦ Never mount the pump near explosive material, flammable material or other dangerous material.
- ⑧ Keep the ambient temperature (room temperature) around the pump at 40°C or below.
(Provide cooling fan or similar ventilation.)
- ⑨ Prepare an auxiliary unit. Arrange that the main unit will automatically stop in the event of trouble and quickly switch to the auxiliary unit and operate.
- ⑩ Always ground the equipment to prevent electric shock accidents. In addition, provide protection devices such as breakers or thermal fuses.
- ⑪ Always perform normal inspections.

13-3 CAUTIONS WHEN OPERATING

- ① During operation, allow coolant water to flow at the specified pressure, at the specified temperature or less, and at the specified amount or more. → See section 7
- ② If the discharge-side piping is closed, piping diameter is narrow, or pressure loss is applied, abnormal heating or rotor lock may occur, and so these actions should be avoided.
- ③ If the induction gas contains moisture, etc., always operate the pump empty (dry operation) for approximately fifteen minutes after the pump has been stopped to ensure that the inside of the pump is dry in order to prevent rust.
- ④ If vacuum pumps are going to be operated interchangeably, the interval of operation should be one to two weeks.
- ⑤ Fluids such as the drainage liquid should not be drawn into the pump.
- ⑥ If the gear oil changes color due to contact with impurities such as condensation, the oil should be completely changed.
- ⑦ If any abnormal sounds are experienced, immediately stop the pump and investigate the cause and rectify. Confirm that there are no abnormal sounds when restarting the pump.
- ⑧ Drain the drain and drain point of the middle section of the pump unit.

14. MAINTENANCE AND INSPECTION



CAUTION Always confirm that the pump has been stopped and the power supply is turned off before performing inspections or maintenance on the vacuum pump. There is the danger of the pump suddenly starting if it is in an automatic operation or similar mode.

14-1 INSPECTION CHART

There are many factors in determining the service life of the vacuum pump. Perform the following periodic inspections and maintenance to obtain a long service life from the pump.

INSPECTION ITEM	INSPECTION INTERVAL	TEST OPERATION	DAILY	MONTHLY	EVERY THREE MONTHS	EVERY YEAR	EVERY FOUR YEARS	NOTES
REMOVE FOREIGN MATERIAL FROM INSIDE PIPING		●						
TIGHTEN ALL CONNECTIONS		●			●			PUMP, PIPING, ETC.
OPEN VALVES		●	●					
COOLANT-WATER PIPING AND AMOUNT OF WATER		●	●					
AMOUNT OF GEAR AND SEAL CASE OIL		●	●					CENTER OF LEVEL GAUGE (WHEN PUMP IS STOPPED)
OIL LEAKS		●	●					
DIRECTION OF ROTATION		●						IN DIRECTION OF ARROW
AMOUNT OF VACUUM		●	●					
AMPERAGE AND VOLTAGE		●	●					RATED AMPERAGE AND VOLTAGE (ON STAMP PLATE)
EXHAUST VOLUME		●	●					
NOISE AND VIBRATION		●	●					
TEMPERATURE		●	●					INTAKE AIR, PUMP, MOTOR, ETC.
LUBRICATION OF GEARS AND BEARINGS		●	●					RATTLES
CHANGE GEAR AND SEAL CASE OIL				●				COMPLETE AMOUNT → SEE SECTION 14-2
CLEANING THE INSIDE OF THE COOLING WATER PIPE					●			
REPLENISH BEARING OIL SEALS						●		
INSPECT AND CLEAN INSIDE OF CASING						●		
CHANGE GEARS							●	
DISCHARGE DRAIN		●	●					
TENSION AND CONDITION OF V-BELTS		●	●					THERE IS A NEED FOR ADJUSTMENT AFTER INITIAL STRETCH → SEE SECTION 14-4
REPLACE V-BELTS						●		THERE IS A NEED FOR ADJUSTMENT AFTER INITIAL STRETCH → SEE SECTION 14-4

*Check the level of the gear oil before operation. also, check to see if there are any changes in the quality of the oil (color of the oil, etc.). Replenish oil if necessary. If there are changes in the quality of the oil, completely change the oil.

14-2 LUBRICATING OILS

Use lubricating oils according to chart 2.

CHART 2

GEAR OIL	HYDOL EP-83	TERESSO 68	(ESSO SEKIYU)
	(MATSUMURA OIL RESEARCH)	VP SUPER OIL 68	(JOMO)
	NEOVAC MR-200	COSMO VAC 68	(COSMO OIL)
	(MATSUMURA OIL RESEARCH)	HI-VAC OIL 68	(SHOWA SHELL)
	DAPHNE SUPER ACE-VAC	VITREA OIL 68	(SHOWA SHELL)
	(IDEMITSU KOSAN)	ZENERARUBAKYUMMORU 68	(GENERAL)
	FAIR VAC WHITE 68		
	(NIPPON OIL)		
			...or similar product

Oil Amounts

LUBRICATING OILS

LOCATION		CT3-60U	CT3-100U	CT3-200U	CT3-350U	CT3-700	CT3-1000
GEAR OIL	(1)	0.45	0.45	1.0	1.3	2.6	2.6
SEAL CASE	(1)	0.3	0.3	0.6	0.9	1.6	1.6

See "Oil Filler Port Is Vacuum Pump Component Nomenclature."

→ See section 2

※With the pump stopped, add oil to the center of the oil indicator.

Furthermore, change the oil completely approximately once a month.

※Use the same brand of oil.

※Use the oil cap with no hole for the gear side and the oil cap with a hole for the seal seal case side(pulley side).

※After use, treat all oils as industrial waste and dispose of properly.

14-3 LONG-TERM STORAGE, STOPPING AND RESTARTING THE PUMP.

When stopping or storing the pump for an extended period of time, use care in the following areas to prevent rust, etc., from forming inside the pump.

<STOPPING AND STORAGE>

- (1) If an operating pump is to be stopped for an extended period of time, intake fresh external air through the pump suction port to perform a drying operation of the inside of the pump, and then stop the pump.
- (2) Remove V-belts when storing.
- (3) Place a desiccant in the short piping of the suction side and put blind plugs on the pump suction and discharge ports to prevent moisture from entering.

< TEST OPERATING THE PUMP AFTER STORAGE>

- (1) Remove the desiccant and blind plugs.
- (2) Completely change the gear oil and replenish the grease.
- (3) Confirm the operation of the pump by manual rotation.
- (4) Measure the insulation of the motor and confirm the direction of rotation.
- (5) Mount the V-belts and adjust their tension.

14-4 ABOUT THE DRAIN

When taking in condensing gas, condensation may occur due to change in pressure or temperature.

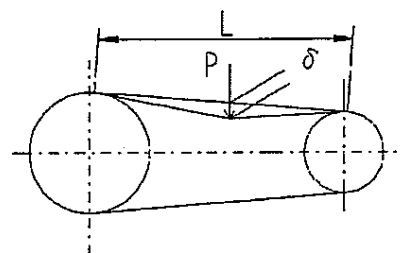
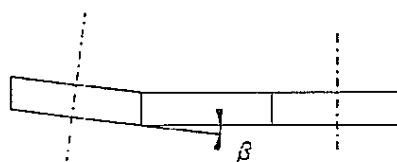
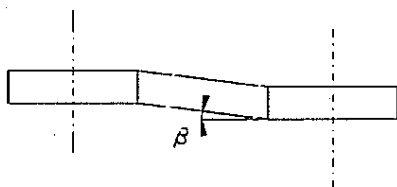
- (1) Design is such that condensant accumulates in the drain pot, and so it should be drained off when stopped or the like.
- (2) Because this pump is a multi-stage type and condensant may be generated in the middle stage, such condensant should also be drained off from the drain on the middle stage when the pump is stopped or the like.

Refer to "Vacuum Pump Component Nomenclature." in section 1 for the drain discharge port.
→ See section 2

14-5 TIGHTENING THE V-BELTS

- (1) Check the alignment of the pulleys.

Parallelism and eccentricity should be $\beta < 20'$.



- (2) Find the belt span (L). The belt span is the partial length where the belt and pulley are not in contact.
- (3) Apply the weight (P) shown below in a vertical direction to the center of the belt span.

BELT SHAPE	3 V	5 V
WEIGHT (P) (k g)	2.5 ~ 3.5	9 ~ 10

※When mounting a new belt, use a weight that is approximately 12% lighter when adjusting.

- (4) Adjust the deflection of the belt (δ) under the weight to the determined value. (Using a tension meter makes this task easier.)

$$\delta = 0.016 \times L \text{ (mm)}$$

- (5) When changing V-belts, change all V-belts.
- (6) Do not apply grease, wax or other similar substances to the V-belts or pulleys.

14-6 COOLING WATER

- (1) The method which removes a flexible joint

Fix a nut on the body side with a wrench, and loosen a joint on the flexible side.



CAUTION A screw on the body side sometimes becomes loose when a joint is loosened without fixing a nut on the body side.

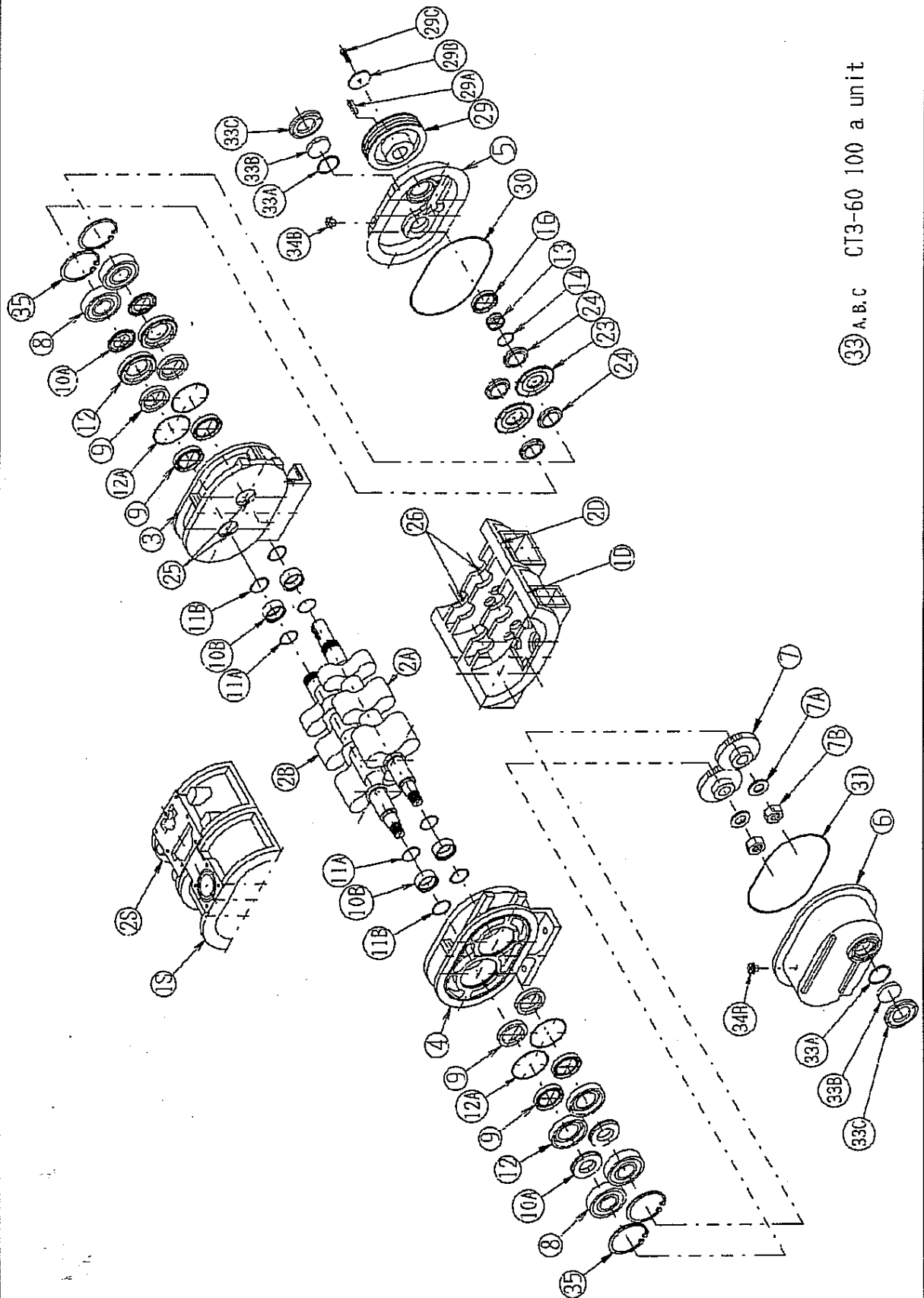
- (2) The way of tightening a flexible joint

Fix a nut on the body side with a wrench, and tighten a joint on the flexible side.



CAUTION The screw part of the body sometimes fractures when a joint is tightened without fixing a nut on the body side.

14-7 Main Unit Development for CT3 Pump



33 A,B,C CT3-60 100 a unit

14-7 DEVELOPMENT DRAWING PART LIST (CT3)

A NUMBER	NAME	MATERIAL	QUAN- TITY (1SET)	NOTES
1 S	CASING 1 S	FC200	1	
1 D	CASING 1 D	FC200	1	
2 S	CASING 2 S	FC200	1	
2 D	CASING 2 D	FC200	1	
2 A	ROTOR SHAFT A	FCD500-7	1	DRIVE SHAFT
2 B	ROTOR SHAFT B	FCD500-7	1	DRIVEN SHAFT
3	HOUSING L	FC200	1	
4	HOUSING R	FC200	1	
5	SEAL CASE	FC200	1	
6	GEAR COVER	FC200	1	
7	TIMING GEAR	SCM415	2	
7 A	CONED DISC SPRINGS		2	
7 B	GEAR STOP NUT	SS	2	
8	BEARING	SUJ2	4	OIL LUBRICANT
9	OIL SEAL FOR HOUSING	PTFE	8	JIS S-TYPE
10 A	W-SEAL FIRIKIRI	SS	4	
10 B	W-SEAL SLEEVE	SUS304	4	
11 A	O-RING FOR SLEEVE 1	PTFE	4	JIS S-TYPE
11 B	O-RING FOR SLEEVE 2	FKM	4	JIS G-TYPE
12	W-SEAL COLLAR	FC200	4	
12 A	O-RING FOR W-SEAL COLLAR	FKM	4	JIS G-TYPE
13	SLEEVE LA	S45C	1	
14	O-RING FOR SLEEVE LA	FKM	1	

A NUMBER	NAME	MATERIAL	QUAN- TITY (1SET)	NOTES
16	OIL SEAL FOR SEAL CASE	FKM	1	
21				
22				
23	FURIKAKE	ALUMINUM	2	
24	BEARING NUT	SS	4	
25	GLAND PACKING FOR HOUSING	PTFE	4 SET	
26	GLAND PACKING FOR CASING	PTFE	8 SET	
27				
29	MAIN PULLEY	FC200	1	
29 A	PULLEY STOP KEY	S45C	1	
29 B	PULLEY RETAINER PRATE	S45C	1	
29 C	PULLEY STOP BOLT	SS	1	
30	O-RING FOR SEAL CASE	NBR	1	
31	O-RING FOR GEAR COVER	NBR	1	
33 A	OIL GAUGE GASKET	PTFE	2	CT3-60, 100
33 B	OIL GAUGE GLASS	GLASS	2	BE UNITED
33 C	OIL GAUGE RETAINER PRATE	SS	2	RESIN
34 R	OIL CAP	RESIN	1	WHITE
34 B	OIL CAP	RESIN	1	BLACK
35	SNAP RING R	N63CA	4	

REPLACEMENT PARTS NUMBER LIST FOR CT3 VACUUM PUMP

Apr. 21, 2003 REVISION#4

PART NAMES	QUANTITY FOR ONE UNIT	MAIN MATERIAL	STRUCTURAL DRAWING AND OPERATION MANUAL	PUMP TYPES AND PART NUMBERS (BASIC DIMENSIONS)					NOTES
				CT3-600U	CT3-1000U	CT3-2000U	CT3-3500U	CT3-700U CT3-1000U	
TIMING GEAR	2 (1SET)	SCMH15	7	FT3-100 INTERCHANGE- ABILITY	FT3-100 INTERCHANGE- ABILITY	FT3-200 INTERCHANGE- ABILITY	FT3-350 INTERCHANGE- ABILITY	CT125 INTERCHANGE- ABILITY	FOR EACH TYPE
BEARING	4	SUJ2	8	6306Z	6306Z	6309Z	6311Z	6312Z	
OIL SEAL FOR HOUSING	8	PTFE	9	SM 38-68-11	SM 38-68-11	SM 55-78-12	SM 65-90-13	SM 70-95-13	
PURKERT FOR W-SEAL /SLEEVE FOR W-SEAL	4 SET	SS/SIS304	10A/10B	INNER ϕ 30	INNER ϕ 30	INNER ϕ 45	INNER ϕ 55	INNER ϕ 60	FOR EACH TYPE
O-RING 1.2 FOR SLEEVE	4/4	PTFE/FRM	11A/11B	S-30/ ϕ -30	S-30/ ϕ -30	S-45/ ϕ -45	S-55/ ϕ -55	S-60/ ϕ -60	
W-SEAL COLLAR	4	FC200	12	OUTER ϕ 72	OUTER ϕ 72	OUTER ϕ 100	OUTER ϕ 120	OUTER ϕ 130	FOR EACH TYPE
O-RING FOR W-SEAL SLEEVE	4	FKM	(12)	G-65	G-65	G-95	G-115	G-125	
SLEEVE 1A	1	S45C	13	INNER ϕ 24	INNER ϕ 24	INNER ϕ 38	INNER ϕ 45	INNER ϕ 48	FOR EACH TYPE
O-RING FOR SLEEVE 1A	1	FKM	14	S-24	S-24	S-38	G-45	P-48	
OIL SEAL FOR SEAL CASE	1	FKM	16	S32-52-11	S32-52-11	S45-68-9	S55-78-12	S80-82-12	
BEARING NUT	2 SET	SS	24	AN6 RIGHT/LEFT	AN6 RIGHT/LEFT	AN9 RIGHT/LEFT	AN11 RIGHT/LEFT	AN12 RIGHT/LEFT	
GLAND PACKING FOR HISING GLAND PACKING FOR CASING	1 SET	PTFE	25/26	9036 X \square 3.2					9036 X \square 3.2 /9036 X \square 4.8
V-BELTS	2~3	RUBBER	-	3V-2 710	3V-2 710, 750	3V-3 880 800	5V-2 1000 950	5V-3 630 570	INDICATES REPRESENTATIVE
OIL LEVEL GAUGE	1 SET or 2	RESIN SS-GLASS	-	MM 6 MM 4					PULLEY SIDE:MM6 GEAR SIDE:MM4
COOLING-WATER PIPES (FLEXIBLE JOINT)	1 SET	SUS304	-	T S 1510					EACH LONG PIPES
O-RING FOR INLET/OUTLET FLANGE	2	PTFE	-	-					1-SIZE INLET AND OUTLET FLANGE V-120 X 2 V-100 X 3 V-70 X 1
O-RING FOR SEAL CASE O-RING FOR GEAR COVER	1 SET	NBR	30/31	GS185X ϕ 3.1		GS250X ϕ 3.1	GS290X ϕ 3.1	GS400X ϕ 3.1	FOR EACH TYPE

15. QUICK DLAGNOSIS TABLE FOR VACUUM PUMP

COMPONENT	PROBLEM		PROBABLE CAUSE	SOLUTION
Motor	Dose not rotate		Loose or broken connection	Change connection or connect
			Burnt fuse	Replace fuse
			Electric leakage breaker has	Measure resistance of insulation and if no good, replace motor
			Abnormal voltage	Check power source voltage and motor stamp plate
			Motor defect	Overhaul or replace
	Rotates	Abnormal heat	Rise in ambient temperature	Inspect ventilation equipment
			Drop in voltage	Check wiring and voltage of power supply
			Overload	Check pump and check motor by Operating it only
		Insufficient rotation	Drop in voltage	Check the voltage among the three source
			2-Phase operation	Check the voltage among the three wires, perform continuity test of motor
			Wrong current cycle	Replace motor pulley
		Reverse rotation	Wrong connection	Change wiring (Change to 2-Phase)
Vacuum pump	Dose not rotate		Rotor lock	Clean interior section with cleaning solution or overhaul motor
			Foreign material in casing	Disassemble top part of casing and remove foreign material
			Broken belt	Replace belt
	Rotates	Abnormal noise or vibration	Insufficient or deteriorated gear oil	Replenish or change gear oil
			Mist or foreign material inside of casing	Clean interior with cleaning solution
			Rotor timing	Readjust timing gear
			Rise in discharge pressure	Check for pressure loss in the discharge piping; recheck valves, piping diameter and/or clean the interior of the piping (※ 1)
			Sound of V-belt slipping, mis-alignment of pulley, V-belt too tight	Readjust V-belt tension
			Air leakage	Increase tightness of pipe connection, replace gaskets
			Resonance in piping	Add a silencer to the resonating area
			Forgot to drain condensed liquid	Clean drain plug and drain piping, if electrical, check electrical components
			Large amount of condensed liquid drawn in	Install a trap or filter on the suction side
		Abnormal heat	Rise in discharge pressure	Same as ※ 1
			Rise in temperature due to insufficient ventilation	Inspect ventilation equipment
			Insufficient cooling water	Cooling water flow more rating
		Oil leak	Added too much oil	With the pump stopped, drain oil until the oil level is in the center of the oil indicator
			Deteriorated oil seals	Replace oil seals, overhaul
			Oil piping loose	Increase tightness; add stop plug to end of valve
		Insufficient exhaust volume	Air leaking from suction piping	Inspect suction piping
			Wear to rotor and casing	If the wear is due to operation, Coat the surface of the rotor and the interior surface of casing (Stainless coating); or replace rotor and casing
			Clogging of the suction piping	Clean interior of suction piping
			Rise in discharge pressure	Same as ※ 1
			V-belt slippage	Readjust the tension of the V-belt
			Insufficient speed	Increase the size of the V-pulley on the motor (increase rpm's)
			Clogging of filter if one is used	Clean the filter; replace the filter
			Failure of vacuum indicator or relative pressure vacuum indicator used at high elevations	Replace vacuum indicator and re-measure; use absolute vacuum indicator
		Oil contamination	Condensed liquid enters	Change oil seals; overhaul
			Insufficient oil	With the pump stopped, add oil until the oil level is in the center of the oil indicator
			Bearing wear	Overhaul
			Gear wear	Overhaul

16. STANDARD WARRANTY CONDITIONS

DESCRIPTION OF WARRANTY

This company warrants that the product will be free of defects in design, materials and workmanship for a period of 12 months. During this period, accidents that are recognized as being the caused by defects in design, material or workmanship will be repaired upon notification from your company. Note that, based upon the conditions of this guarantee, the range of responsibility for compensation by this company is limited only to repair or replacement of the defective part (compensatory treatment). There will be no compensation for secondary occurring loss(es).

Moreover, the total value of compensatory treatment shall be within the contract price of said product and any departure from the contracted specifications and conditions which have no effect upon performance shall not be deemed a defect based on the conditions of this warranty.

The conditions of this warranty shall not apply to rubber and/or similar components and/or to consumable parts that wear naturally. Moreover, the conditions of this warranty shall not apply to products specifically expressed and shall not apply to products used outside Japan.

ITEMS NOT COVERED BY WARRANTY

This company is not responsible for the following items.

1. Compensation for production losses related to a failure of the device.
2. Accident, damage or loss resulting from the misoperation or improper maintenance and control of the device.
3. Accident resulting from such activities as moving, disassembling or modifying by your company of the device.
4. Accident, damage or loss resulting from operation beyond specifications and for those resulting from such activities as modifying for other applications.
5. Damage to or influence upon other equipment resulting from the failure of the device.
6. Damage resulting from a catastrophe, disaster and/or Act of God.
7. Failure, damage or loss resulting from corrosion due to solvents, chemicals, etc., and/or from the entrance of dissolved adhering and/or solidified solid foreign materials.
8. Accidents or damage resulting from overloads, etc. when the valve is naturally closed.
9. Accidents resulting from corrosion or rust.
10. Failure or damage after the warranty period has expired.

The Warranty Service Network

Hokkaido, Tohoku region	Sendai Branch Office Shiwa-cho 15-25, Wakabayashi-ku, Sendai-shi, Japan 984-0041 Telephone (022)238-5491
Kanto region	Tokyo Sales Office Honcho 2-27-5, Nishi-Arai, Adachi-ku, Tokyo, Japan 123-0845 Telephone (03)3854-1311
	Yokohama Branch Office Fifth Floor, HI Building, Nishi-kanagawa, Kanagawa-ku, Yokohama-shi, Japan 221-0822 Telephone (045)412-3611
	Kitakanto Branch Office Third Floor, Iwasaki Building, Miyahara-cho 3-166, Kita-ku, Saitama-shi, Japan 331-0812 Telephone (048)660-3411
Shizuoka region	Shizuoka Branch Office Nakajima 1007-1, Suruga-ku, Shizuoka-shi, Japan 422-8046 Telephone (054)284-2511
Hokuriku region	Hokuriku Branch Office Ekinishi shinmachi 3-19-6, kanazawa-shi, Japan 920-0027 Telephone (076)265-3911
Chubu region	Nagoya Sales Office Meieki Minami 5-11-23, Nakamura-ku, Nagoya-shi, Japan 450-0003 Telephone (052)323-2311
Kansai region	Osaka Sales Office Nagata Nishi 4-1-34, Higashi Osaka-shi, Japan 577-0016 Telephone (06)6746-7111
Chugoku region	Hiroshima Branch Office Nishihara 8-33-20, Asaminami-ku, Hiroshima-shi, Japan 731-0113 Telephone (082)871-3941
Shikoku region	Takamatsu Branch Office Imasato-cho 2-12-7, Takamatsu-shi, Japan 760-0078 Telephone (087)835-1301
Kyushu, Okinawa region	Fukuoka Branch Office Y-S Fukuoka 3, Yutaka 2-2-57, Hakata-ku, Fukuoka-shi, Japan 812-0042 Telephone (092)437-2811

If any abnormality is experienced during the operation of this product, immediately stop operation and turn off the power supply. Check for the cause by referring to "Section 14-Quick Diagnosis Chart for the Vacuum Pump." If the cause of the abnormality cannot be identified, or if there are questions about the product, contact the dealer from which you purchased the product or contact any one of the offices listed above.

ROOTS TYPE VACUUM PUMP DATA SHEET

CT3

No. 5 6 2 9 2 6

Item No.			
Gas		Suction Temp	Normal temp. 40°C
Suc. Pressure	48 kPa	Setting Place	
Dis. Pressure	101.3 kPa	Collar	5Y7/1
Capacity	2.8 m ³ /min		Standard

Type	CT3-200-U	Q' ty	Material	
		1	Name of Parts	Remarks
Bore	Suc. 50A × Dic. 40A		Casing	FC 200
Speed	About 2000 min ⁻¹		Rotor Shaft	FCD 500-7
Coupling Type of 3-Stage	V-Belt		Housing R.L	FC 200
Seal Type	Oil Seal		Timing Gear	SCM 415
Weight	About 270 kg		Shaft Seal	Oil Seal PTFE
Cooling Way	After-cooler	Cooler	Body	SS
Cooling Water	About 10 ℓ/min		Heat Transfer Pipe	SS
			O-Ring	PTFE

Driving Motor		Frame Type	M3710T-50
Out Put	5.5 kW	Volts	400 V
Frequency	50 Hz	Poles	4 P
Maker	BALDOR		

Standard Accessories			Special Accessories		
Name	Q' ty	Remarks	Name	Q' ty	Remarks
Common Base	1				
V-Belt. V-Pulley	1 Set				
Anchor Bolt	1 Set				
Disc. Silencer	1				
Cooler Plumbing	1 Set				
V-Belt Cover	1				
Drain Pot(After-cooler)	1				

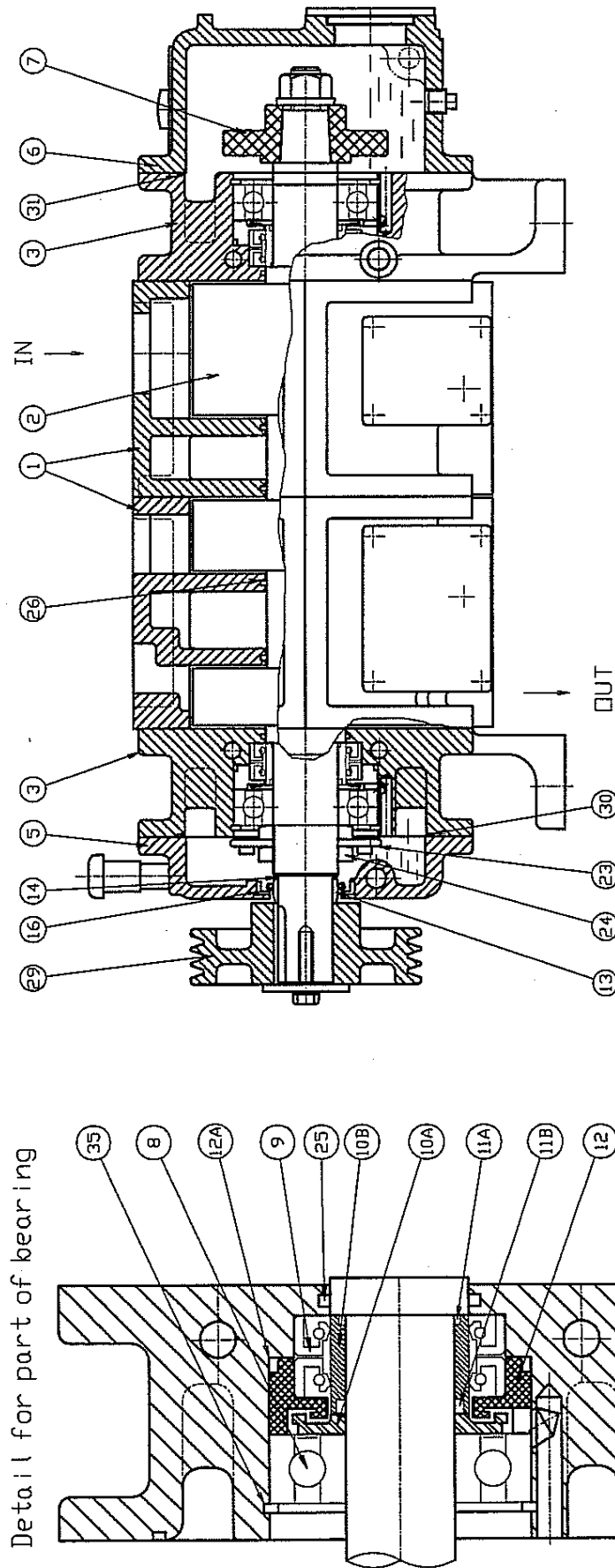
Note


ANLET CO.,LTD

Shaft Seal : Double Oil Seal

No.	Name of Parts	Material Q'ty	Notes	No.	Name of Parts	Material Q'ty	Notes
1	Casing	FC 200	1 IS, 1D, 2S, 2D each 1	18			
2	Rotor Shaft	FC 500-7	3 1 Shaft A, B	19			
3	Housing	FC 200	2	20			
4				21			
5	Seal Case	FC 200	1	22			
6	Gear Cover	FC 200	1	23	Sprinkle Plate	Aluminium	2
7	Timing gear	SCM 415	2 2 Parts and 1 set	24	Bearing Nut	SS	4
8	Bearing	SUJ 2	4 6309 Z (Oil Lubricant)	25	Gland Packing for Housing	PTFE	4set
9	Oil Seal for Housing	PTFE	8 SM 55-78-12	26	Gland Packing for Casing	PTFE	8set
10	Oil Seal for Oil Check	SS 400	4 Double Oil Seal	27			
11	Oil Seal for Oil Seal	SUS 304	4 Double Oil Seal	28			
12	Oil Ring 1 for Sleeve	PTFE	4 S 45	29	Pump Pulley	FC200	1 3V-3
13	Oil Ring 2 for Sleeve	FKM	4 G 45	30	Oil Ring for Seal Case	NBR	1 GS250*3.1
14	Oil Seal Collar	FC 200	4	31	Oil Ring for Gear Cover	NBR	1 GS250*3.1
15	Oil Ring for Oil Seal Collar	FKM	4 G 95	32			
16	Sleeve LA	S 450	1	33			
17	Oil Ring for Sleeve LA	FKM	1 S 38	34			
18	Oil Seal for Seal Case	FKM	1 S 45-68-9	35	Stop Ring R	N63CA	4
19				36			

Detail for part of bearing



	Drawing revision	Date	Prepared	Chief	Check	Drawing	Date	2004.11.9	Name	Structural Drawing
					K. Kump	M. M. No.	Material			
							Scale	NIS	Type	CT3-200U
							Srd.A. • Unit mm			
							 ANLET CO., LTD.			
Weight		kg							Dwg.No.	CT3-200U-N-WS-R6E

CHARACTERISTIC CURVE

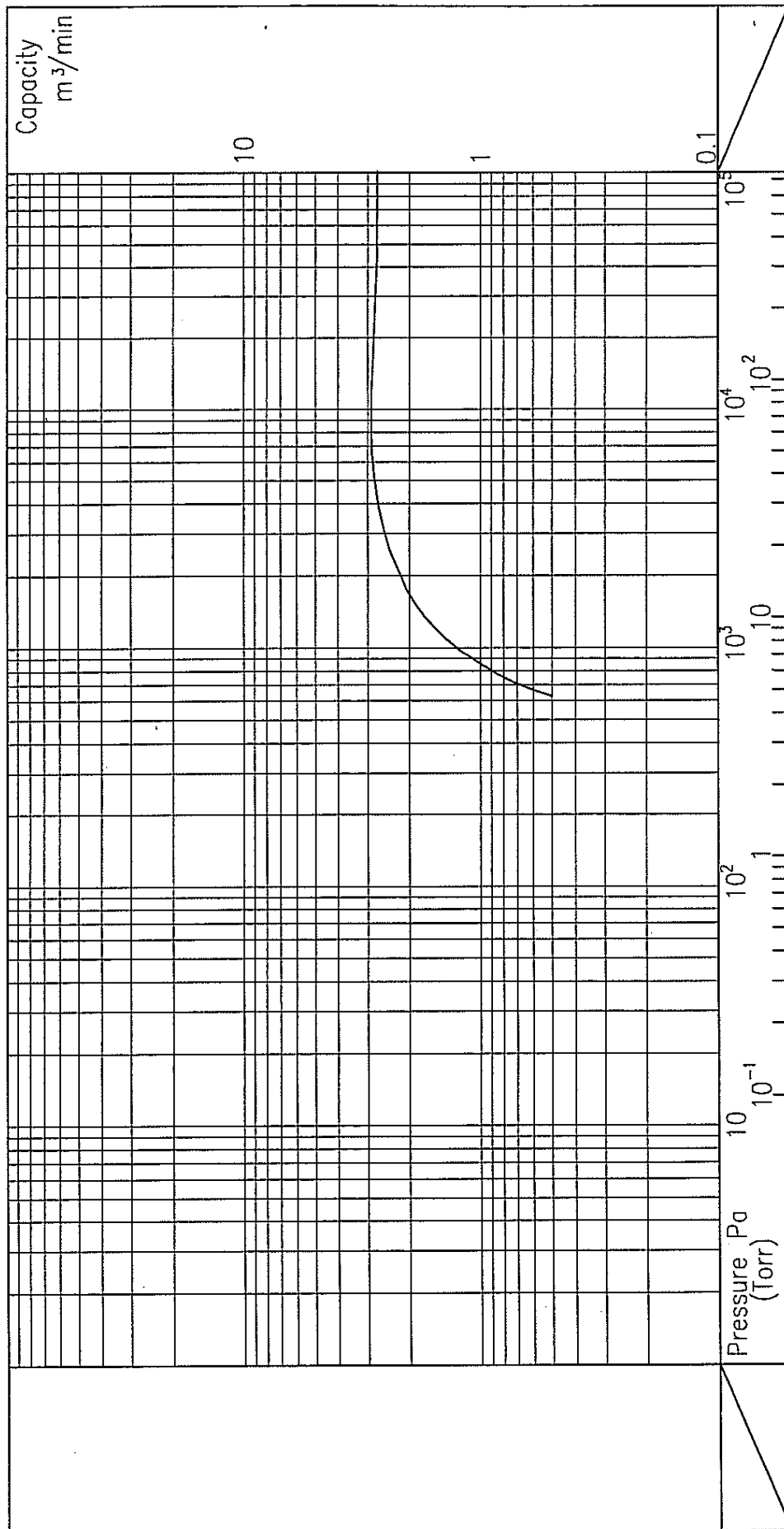
DATE. Sep. 5. 2003.

S.No. CT3-200U-CC-002E

D.No. CT3-TOKUSEI-01E

Sripulation	Capacity (m ³ /min)	Suction pressure (Pa)	Discharge pressure (Pa)	Speed (min ⁻¹)	Out put (kW)
standard			1atm	2000	5.5

Type CT3-200U



ANLET ANLET CO., LTD.

Check Drawing

