Inert Gas Systems

Our fire-fighting and fire prevention systems are essential for ensuring safety and protecting the life of the crew on board and property on your ships. These systems definitely require regular and proper maintenance to ensure their reliable operation in case of emergency. However, increasing troubles on the systems recently reported to us suggest that they are not always properly maintained. This document is to remind you of the typical consequences the lack of maintenance could have and of the importance of maintenance to keep the system sound and operable.

The negligence of the maintenance could lead to the failure of the system operation when needed and pose considerable risks to human life or property. Since these systems serve as the last resort for safety protection, you are kindly requested to review the maintenance arrangement to ensure their reliable operation.

Inspection/Maintenance Conducted by Uncertified Agencies

Uncertified agencies do not necessarily fully understand the fundamental structure and functions of the system, and sometimes omit electrical functional tests. Some reported malfunctions are caused by their unauthorized access to and improper modification of the program. In addition, replacing consumables is out of the scope of their service in most cases. Their failure to detect and identify signs and symptoms for a malfunction could lead to serious consequences, including activation failure of the system.

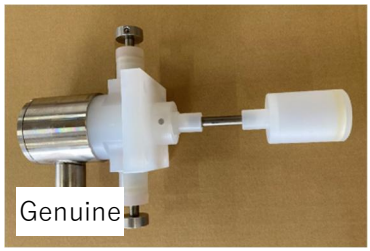
The system requires the use of genuine components and regular maintenance for its proper operation.

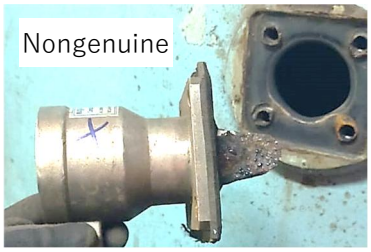
Use of Nongenuine Components

The use of nongenuine components not only fails to guarantee the intended performance, but can also cause system malfunctions or even lead to serious accidents. Some cases reported

to us show that corrosion and breakage of the rod and float in the scrubber and deck water seal are attributable to the use of nongenuine level switches.

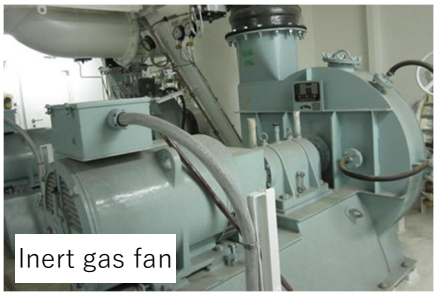
The genuine components are designed with specific working conditions taken into account. Do not use nongenuine components.



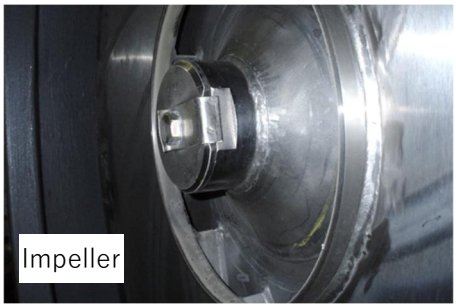


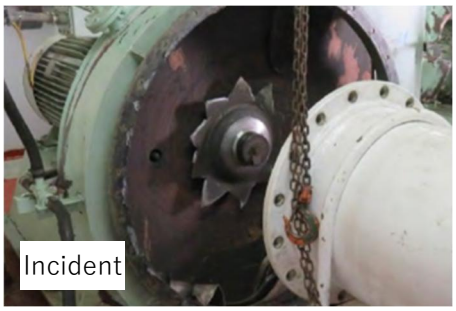
Regular Maintenance

The system requires regular maintenance. The negligence of the maintenance could lead to system malfunctions and damage to components, or even cause critical failures. For the details and intervals of the maintenance, please refer to the instruction manual of the system.

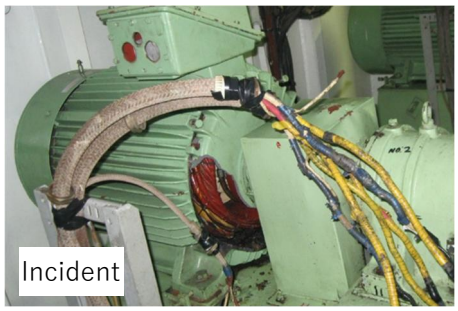


The impeller of the inert gas fan needs to be washed and cleaned according to the instruction manual every time the system is used. Flakes of residual solid substances attached to and deposited on the impeller could cause corrosion or break the rotational balance of the impeller if unevenly deposited, creating abnormal vibration. This can bring critical troubles or fatal accidents. To prevent this from happening, cleaning and washing in a designated manner and regular maintenance (including visual check, balancing examination, or nondestructive inspection) are essential. If anything wrong is found with the impeller, replacing it, not repairing it, is recommended. (NOTE: NEVER use a nongenuine impeller. Any impeller made of materials other than SUS316L is heavier and has more moment of inertia (GD2) than the genuine one, causing excessive stress that could lead to fan failure or breakage.)




Incident


Incident


Incident

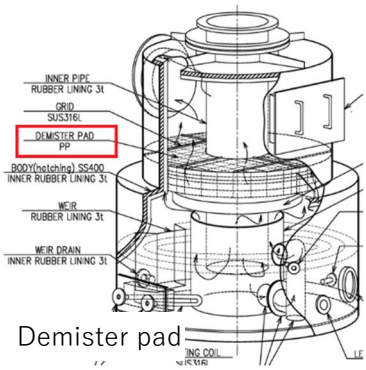
As stated above, the use of the genuine components, proper maintenance, as well as regular replacement of the consumables are essential for the system to work properly, and those can be attended to only by certified agencies.

For your information, the impeller takes about 5 and a half months from ordering to delivery. You are therefore kindly requested to contact us for its procurement well in advance if needed.

The demister pad in the deck water seal needs to be regularly washed and cleaned. It is unlikely to be clogged if other components are appropriately maintained. Conversely, insufficient maintenance could clog the demister pad even to the extent that the dirt on it cannot be washed off by cleaning. If that is the case, it needs to be replaced with the new one.

Depending on the marine environment and maintenance conditions, sediment may accumulate inside the seal pod, which can obstruct the proper flow of gas and compromise the backflow prevention function. Therefore, please be mindful of the intrusion of foreign substances, conduct regular internal inspections, and clean the interior as necessary.


Deck water seal



Demister pad


Cleaning

New demister pad

Mud deposition

Updating and Replacement of PLCs

The PLCs have 10 years of its design service life according to the manufacturer (OMRON). The systems exceeding 10 years from the ship's delivery are increasingly likely to have troubles with the PLCs. The earlier model (C200H) has already been discontinued and its backup stock and the after-sales service by the manufacturer are no longer available. If this applies to the system on your ship, it is strongly recommended to either update them to the current PLCs or replace them with the alternative as necessary. This process takes some time for the procurement as well as related tasks such as program transformation. You are therefore kindly requested to contact us for this well in advance if needed.

PLC (discontinued model)

PLC (compatible model)

Regular Replacement of Power Supply Unit

The AC/DC converter (power supply unit) in the main control panel has its design service life ranging from 5 to 10 years depending on its usage environment. Its regular replacement is recommended.

Power supply unit

Purification of Instrumentation Air

The instrumentation air supplied to the system should be dry and free from oil content. But cases reported to us from some vessels in service show that the instrumentation air entrains a considerable amount of compressor-derived oil mist. To prevent oil contamination, the compressed air must be of Purity Class 3 or cleaner according to the standards set in ISO 8573-1 for the system to properly function.

Pressure regulator

Contaminated air

The instrumentation air contaminated with the oil mist has a negative impact on the pneumatic actuator of the automatic valves, or instrumentation devices and oxygen analyzer, and worse than that, may require overhauling or replacing all the affected equipment. The purity of the instrumentation air therefore needs to be constantly attended to.

Valve positioner

Inspection and Maintenance

We have certified engineers who are fully qualified to inspect and service our inert gas systems to make sure of their reliable operation. Please feel free to contact us for the inspection and maintenance.

For request for quotation or order placement, please contact our service department at sales@kashiwa-tech.co.jp including necessary information such as the system name, your ship's name, and IMO No.

CHECK SHEET to consider replacing the equipment or parts

This is to recommend timing to consider replacing of the equipment or parts, not mandatory.
The item checked in the box is recommended to replace or keep spare, and the item shown as urgent or important is strongly recommend to replace.
If you have any clarification please feel free to contact us.

SYSTEM :
INERT GAS SYSTEM

No.	Check off if "Yes"	ITEM	LOCATION	CHECK POINT	ACTION	Remarks	Urgency or importance
1		PLC	CONTROL PANEL	MODEL : C200H (Discontinued Model)	Recommend to replace with compatible model since no support from OMRON and no new product is available.	Attachment 1	Very urgent
2		PLC	CONTROL PANEL	AGE : More than 10 years	Recommend to replace as design service life of the PLC is 10 years which is announced by OMRON.	Attachment 2	Very urgent
3		AC/DC CONVERTER (Power supply)	CONTROL PANEL	AGE : More than 7-10 years	Recommend to replace as design service life of the Power supply is 5 years which is announced by OMRON.	Attachment 3	Very urgent
4		Press. Controller	CONTROL PANEL	AGE : More than 10 years	Recommend to have a spare.	Maker recommendation	
5		I/P Converter	CONTROL PANEL	AGE : More than 5 years	Recommend to have a spare.	Maker recommendation	
6		Oxygen analyzer (Sensor)	ENGINE ROOM	Deterioration or AGE : More than 5 years	Recommend to have a spare unless redundancy analyzer is placed as the sensor deteriorates in approx. 3 to 5 years in avarage		Urgent
7		Oxygen analyzer (Receiver and cable)	ENGINE ROOM	AGE : More than 10 years	Recommend to have a spare.	Maker recommendation	
8		Oxygen analyzer (Sample filter)	ENGINE ROOM	Dirt check	Recommend to replace.		
9		Filter regulator for instrument air (Filter element)	ENGINE ROOM	Dirt check	Recommend to replace.		
10		UP-TAKE VALVE (Grand packing)	ENGINE ROOM	Consumables	Recommend to replace it at every inspection period.		
11		Control Valves (Positioner)	ENGINE ROOM (IG MAIN LINE)	Function	If mulfunction is obserbed, clean the positioner and check the instrument air condition or replace it.	There are several expected cause, so contact us for recovery if it has not recovered.	
12		IG FANS	ENGINE ROOM	Consumables		Attachment 4	Very important
13		Pressure switch	PUMP ROOM ENTRANCE	Deterioration or salt damage	Check the function and open the cover to check no salt damage. Recommend to have a spare.	Maker recommendation	

Kashiwa Tech Co., Ltd.

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Attachment 1

PRODUCT NEWS

Product Discontinuation Notices

Programmable Controllers, Networks

Issue Date
January 6 2016

No. 2016007CE

Discontinuation Notice of Programmable Controllers C200HX/HE/HE series and a part of C200H I/O and special I/O units.

Product Discontinuation	Recommended Replacement
Programmable Controllers	Programmable Controllers
Part of C200HX/C200HG/C200HE series	**Model CS1 or CJ2 series**
Model C200PC-ISA[]3(-[][][](-E))	**Model CS1 or CJ2 series**
Model C200PC-EXP01	**No recommended replacement**
Model 3G2NL-DRM21、-CPU02	**Model 3G2NJ-CPU11**
Model 3G2NL-CLK[][]	**Model 3G2NJ-CLK21**
Networks	Networks
Model C200H-B7A[][]	**Model CS1 or CJ2 series**
Model C200HW-DRT21, -DRM21-V1, -SRM21-V1, -CORT21	**Model CS1 or CJ2 series**

[Discontinuation date]

The end of March, 2017

[Caution on recommended replacement]

C200HX/HG/HE series CPU units and a part of I/O and special I/O units will be discontinued.
Replacement of PLCs will require design change works
(PLC Programming, unit setting, wiring and so on).

[Difference from discontinued product]

Recommended replacement Model	Body Color	Dimen-sions	Wire connection	Mounting Dimensions	Charac-teristics	Operation ratings	Operation methods
CS1 series	*	*	--	*	--	--	--
CJ2 series	--	--	--	--	--	--	--

** : Compatible
* : The change is a little/Almost compatible
– : Not compatible
- : No corresponding specification

Preventive Maintenance for Programmable Controllers

Date : 12 Jun. 2012

1. Introduction

The Programmable Controllers (PLC) that serve as the core of various control systems are composed of a large number of components. These components cannot be used indefinitely, and must be replaced when they have reached the end of their useful life. If a PLC should malfunction, considerable time is required to restore system operation and losses occur while the operation is stopped. To prevent PLC failures from occurring, we suggest that you consider a preventive maintenance program. Malfunctions can be prevented by replacing specific components shortly before wear-out failures (see section 2) begin to occur.

However, because there is also a possibility of early or random failures, we also recommend that you consider preparing spare parts to use as an emergency measure.

2. Useful Life (Years of Use vs. Malfunction Occurrence)

Component failures can ordinarily be classified into the three stages of early failures, random failures, and wear-out failures, as shown in the diagram below.

Early failure period:

This refers to defects, such as defective components or manufacturing problems that are discovered soon after the product is first used. We attempt to eliminate these failures by means of shipping inspections and other measures.

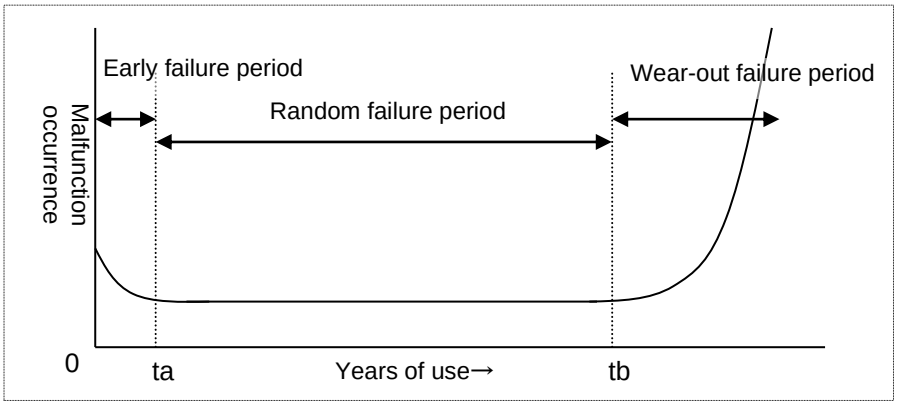
Random failure period:

This refers to failures that occur within the useful life of the equipment. They are called random failures because they occur suddenly and cannot be predicted.

Wear-out failure period:

Wear-out failures occur near the end of the useful life due to deterioration or wear. Because of this, their occurrence increases rapidly as time passes. The start of this period is indicated by ta in Fig. 1, while tb differs for each PLC and Unit. Our views on the useful life of PLC are given in section 3.

Fig. 1



3. PLC Lifetime

Some of the components used in the PLC have lifetimes of less than 10 years, depending on the environment in which the PLC is installed and the model of the PLC. These include batteries for memory back-up, output relays, fuses, photo couplers, and aluminum electrolytic capacitors. The lifetime of some Units is determined by these components. Lifetime calculations and design are employed based on the standard of a useful life of 10 years for PLC (compared with the former standard of 7 years).

4. Preventive Maintenance Time Guidelines (Recommended Replacement Times)

The following recommended replacement times (the equivalent of tb in Fig. 1) are guidelines for replacing the indicated items. For further details, please inquire and provide specific model numbers.

(Time relationship = Preventive maintenance time (recommended replacement time) < Design lifetime < Actual lifetime)

Unit Name		Recommended Replacement Time	Design Lifetime
Power Supply	C(C200H)/CV Series CS (C200Hα) (Manufactured in or before Oct. 2000)	5 years	7 years (operated at 30°C, 24 h/day) (Load rate 70%)
	CS (C200Hα), CJ Series (Manufactured in or after Nov. 2000) CP Series	8 years	10 years (operated at 40°C, 24 h/day) (Load rate 70%)
CPU	C/CV Series (See Note 1.)	7 years	7 years (operated at 30°C, 24 h/day)
	CS, CJ,CP Series	10 years	10 years (operated at 40°C, 24 h/day)
Backplane, I/O Unit (See Note 2.)		10 years	10 years (operated at 40°C, 24 h/day)
Special I/O Unit, CPU Bus Unit	C/CV Series, DRT1 Series DRT2 Series(Manufactured before Jun. 2004) SRT1, SRT2 Series	7 years	7 years (operated at 30°C, 24 h/day)
	CS, CJ,CP Series GX Series CRT1 Series DRT2 Series(Manufactured in or after Jun. 2004)	10 years	10 years (operated at 40°C, 24 h/day)

Note 1: Because the power supply is built-in to the C200H-CPU** and C200HS-CPU**, replacement/repair is recommended at 5 years.

Note 2: Except for relay contact output types. (See section 6, item 2 for information on relay contact output types.)

5. Spare Parts

1) Preparing spare parts

We recommend that you prepare spare parts in advance in order to shorten the amount of system downtime due to a PLC failure. Provide spare parts that match the PLC configuration that you are using.

2) Processing spare parts

(1) Storage conditions

The storage life of components is related to temperature and humidity (the lower these are the better). Store spare parts at a room temperature of 5 to 35°C (20 to 30°C recommended), with normal humidity of 30 to 80% (40 to 60% recommended), in a place that is not subject to direct sunlight. Do not store spare parts in places subject to the following conditions:

- Condensation
- Atmospheres with toxic gas (hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.), so as to prevent the components from oxidizing
- Ozone, radiation, ultraviolet radiation
- Vibrations or impacts

(2) Unit storage period

When storing spare parts (units) for extended periods, it is recommended that you apply current to them for approximately 30 minutes periodically (about once every three years), to maintain the function of the aluminum electrolytic capacitors (applying current to maintain the electrolyte) and check their operation. The storage limit must be periodically checked and controlled to ensure a storage limit of about 10 years (see note 1) because these units are equipped with aluminum electrolytic capacitors.

Note 1: The 10-year limit is a guideline that was determined by considering the static lifetime of aluminum electrolytic capacitors (approx. 15 years) and their operating period as spare parts.

(See the detailed explanation in item 6.)

(3) Storage period for memory back-up batteries

Store batteries separately, not mounted in the PLC. The storage period for batteries is two years, and this storage limit must be periodically checked and controlled.

(See the detailed explanation in item 6.)

6. Detailed Explanations

1) Memory back-up batteries

Back-up batteries are used for memory (RAM) back-up mainly in CPU Units. Refer to the operating instructions for each CPU to determine the capacity lifetime of the battery (the lifetime due to capacity reduction) because it varies depending on the CPU model, operating rate (the power ON rate), and the usage conditions (temperature).

In addition to the remaining capacity of the battery, there is also a danger of electrolyte leakage caused by deteriorated seals after many years of use. For this reason, all batteries should be replaced within five years. The static design lifetime of batteries is seven years.

When batteries are used past their lifetime, the possibility of electrolyte leakage becomes extremely high. Electrolyte is highly corrosive, and it is also electrically conductive, so there is a risk that it will corrode other parts around it and also generate smoke and odors. For these reasons, careful attention must be paid to the battery lifetime.

2) Output relays

The lifetime of I/O Units that use relay contact outputs is determined by the lifetime of the outputs. The relay lifetime depends greatly on the contact current, the ambient temperature, and the nature of the load (resistance load, inductance load, etc.). Decide on the timing for preventive maintenance from the relay life-test curve and number of operations listed in the I/O Unit operation manual.

3) Photo couplers

Photo couplers are used to isolate the I/O Units, Communications Units, and other PLC Units from the other equipment in the system. The LED that is built into the photo coupler has a lifetime, and the brightness of the LED lowers with usage until, at the end of its lifetime, the signal can no longer be transmitted.

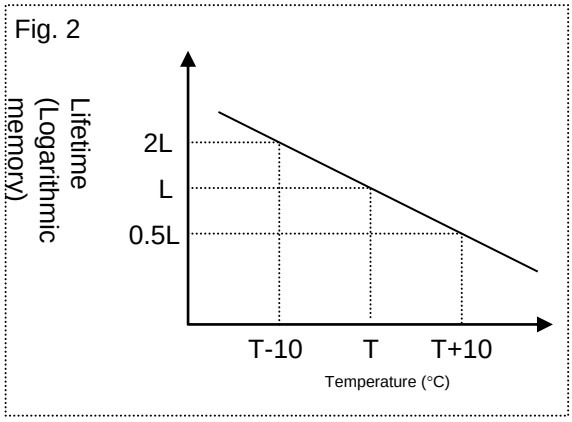
The lifetime varies depending on the ambient temperature and illumination time, but because the photo coupler lifetime is longer than that of the aluminum electrolytic capacitors, the Unit lifetime is determined by the aluminum electrolytic capacitors.

4) Aluminum electrolytic capacitors

(1) Aluminum electrolytic capacitor lifetime

Due to the component structure, the capacity reduction (performance drop) and lifetime of aluminum electrolytic capacitors is caused by its internal electrolyte gradually leaking out of the lower rubber seals. As shown in Fig. 2, the lifetime has a coefficient of correlation with the usage temperature.

Fig. 2



According to the Arrhenius equation (the doubling 10°C rule), the lifetime is reduced 1/2 with each 10°C rise in ambient temperature, and is doubled with each 10°C drop in ambient temperature.

The static lifetime of the aluminum electrolytic capacitor is about 15 years (due to deterioration of the electrolyte rubber seal). Therefore, the aluminum electrolytic capacitor lifetime is defined as the shorter of these two lifetimes, i.e., the lifetime calculated by the Arrhenius equation and the static design lifetime.

If the aluminum electrolytic capacitor is used past its lifetime, there is an extremely high possibility that electrolyte will leak out.

Electrolyte is highly corrosive, and it is also electrically conductive, so there is a risk that it will corrode other parts around it and also generate smoke and odors. For these reasons, careful attention must be paid to the lifetime of aluminum electrolytic capacitors.

(2) Power supply lifetime

1. The lifetime of the power supply is determined by calculating the lifetime of the aluminum electrolytic capacitor. Basically, the design lifetime is as follows.

   C/CV Series: 7 years (operated 24 h/day at 30°C, with a load rate of 70% (see note 1))

   CS1 Series: 10 years (operated 24 h/day at 40°C, with a load rate of 70% (see note 1))

   Note 1: Load rate = Sum of current consumed by system Units / Max. Power supply x 100

2. Relationship among ambient temperature, load rate, and lifetime

   Because a rise in the load rate also causes a rise in the heat generated by the power supply, the aluminum electrolytic capacitor temperature is affected by the sum of the ambient temperature and the heat generated by the power supply.

   Fig. 3 shows a typical sample of the change in lifetime according to changes in the ambient temperature and load rate. (Fig. 3 is a typical sample (C500-PA221) calculated from actual measurement values, and is not to be interpreted as assuring a certain lifetime.)

Fig. 3

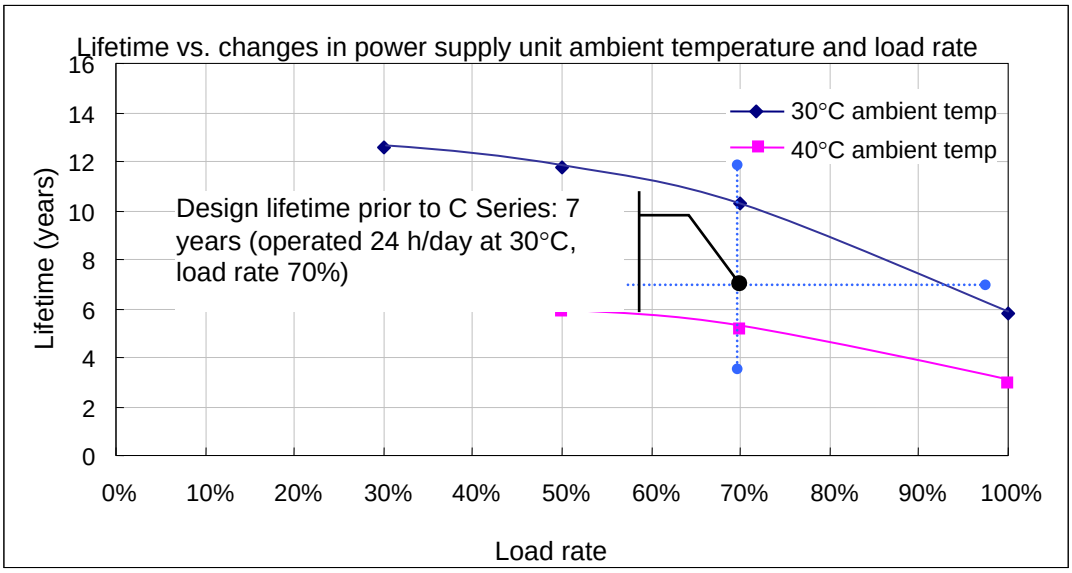
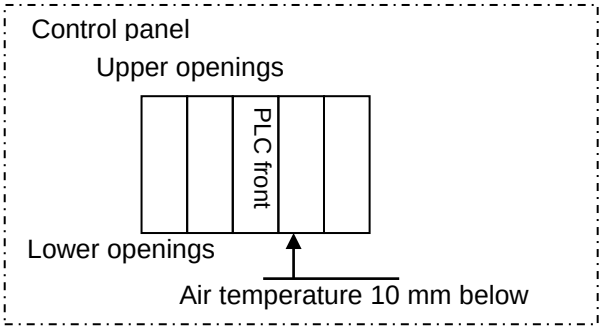


Fig. 4 Ambient temperature measurement reference point: temperature 10 mm below PLC



(3) CPU, Special I/O Unit (CPU Bus Unit)

The lifetime varies depending on the Unit.

When the Unit has an internal power supply module or uses aluminum electrolyte capacitors as an important functional component, the design lifetime is seven years for the C/CV Series (30°C), and 10 years for the CS/CJ Series or later (40°C).

When aluminum electrolyte capacitors are not used as an important functional component, the design lifetime is ten years.

(4) I/O Unit

Because aluminum electrolyte capacitors are not used as an important functional component, the design lifetime is ten years.

Period and Terms of Warranty

Warranty Period

The Power Supply warranty is valid for a period of three years from the date of shipment from the factory.

Terms of Warranty

The warranty is valid only for the following operating conditions.
1. Average ambient operating temperature of the Power Supply: 40°C max. (See note.)
2. Average load rate of 80% max. (See note.)
3. Mounting method: Standard mounting
4. Rated input voltage
Note: The maximum ratings must be within the derating curve.

If the Power Supply fails for reasons attributable to OMRON within the above warranty period, OMRON will repair or replace the faulty part of the Power Supply at the place of purchase or the place where the Power Supply delivered without charge.
This warranty does not cover the following types of failures.

(1) Failures that result from handling or operation of the Power Supply under conditions or in environments that are not given in this document and not given in any other specifications exchanged between OMRON and the customer
(2) Failures that originate in causes other than the delivered product itself
(3) Failures caused by disassembly, modification, or repair of the Power Supply by anyone other than OMRON
(4) Failures caused by applications or uses for which the Power Supply was not originally intended
(5) Failures caused by factors that could not be anticipated with the scientific or technical knowledge available when the Power Supply was shipped
(6) Failures caused by other causes for which OMRON is not responsible, such as natural disasters and other acts of God
This warranty is limited to the individual Power Supply that was delivered and does not cover any secondary, subsequent, or related damages.

Recommended Replacement Periods and Periodic Replacement for Preventive Maintenance

The recommended replacement period for preventive maintenance is greatly influenced by the application environment of the Power Supply. As a guideline, the recommended replacement period is 7 to 10 years.✻
To prevent failures or accidents that can be caused by using a Power Supply beyond its service live, we recommend that you replace the Power Supply as early as possible within the recommended replacement period.
However, bear in mind that the recommended replacement period is for reference only and does not guarantee the life of the Power Supply.

Many electronic components are used in the Power Supply and the Power Supply depends on the correct operation of these components to achieve the original Power Supply functions and performance.
However, the influence of the ambient temperature on aluminum electrolytic capacitors is large, and the service life is reduced by half for each 10°C rise in temperature (Arrhenius law).
When the capacity reduction life of the electrolytic capacitor is reached, the Power Supply failures or accidents may occur.
We therefore recommend that you replace the Power Supply periodically to minimize product failures or accidents in advance.
✻ The recommended replacement period applies under the following conditions: rated input voltage, load rate of 50% max., ambient temperature of 40°C max., and the standard mounting method.

This Power Supply model is designed with a service life of 10 years minimum under the above conditions.

Attachment 4

INERT GAS FAN

Maintenance Procedure

[Coupling Type]

● Contact information

KASHIWA TECH CO., LTD. (Tokyo Headquarters)
5-4 Takanawa, 4-Chome Minato-ku, Tokyo 108-0074, JAPAN

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E-mail: sales@kashiwa-tech.co.jp

1	30-Jan-23	Revised
0	22-Aug-22	Prepared
REV.	Date	Revision block
DWG.No.	I.G.F. Maintenance Procedure	

Inert Gas Fan

This system needs regular maintenance and replacement of the consumable parts.

For details, please see the separate maintenance procedure for the inert gas fan.

This document shows some of the consequences of the poor maintenance and negligence of part replacement.

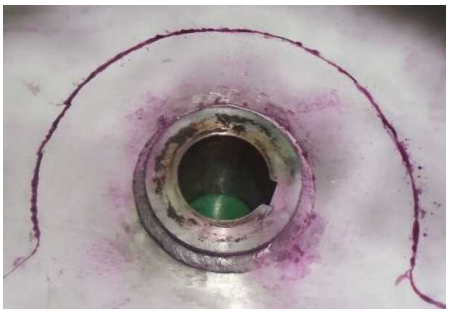
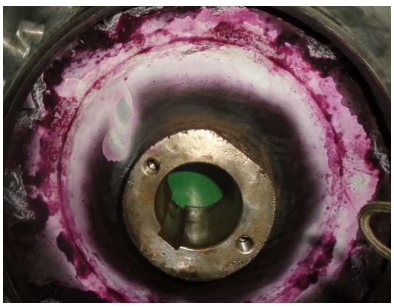
Poor cleaning unbalances the impeller and brings abnormal vibration, leading to breakage of the impeller.




Use of non-genuine parts or poor-maintained impeller causes excessive stress and abnormal vibration, leading to breakage of the fan. Do not use any non-genuine part.



PT inspection on the impeller is recommended at every docking for ships that have been in service for more than 10 years.

Replace the consumable parts regularly according to the maintenance procedure.

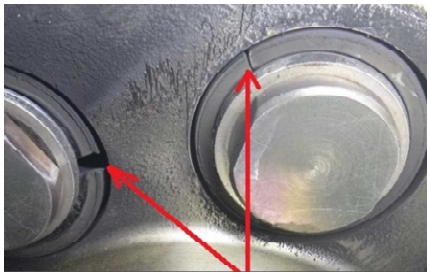


Table of Contents

Inert Gas Fan Maintenance Procedure

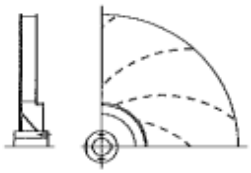
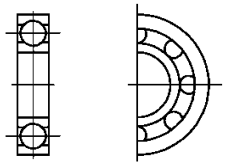
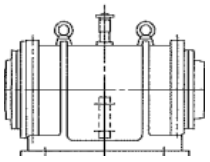
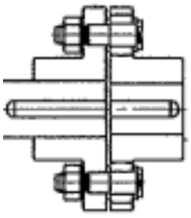
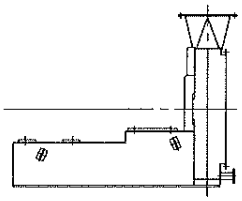
Maintenance Schedule Table

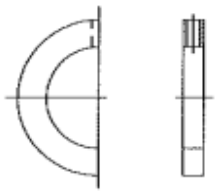
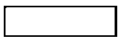
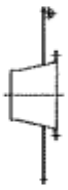
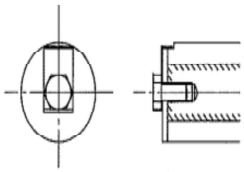
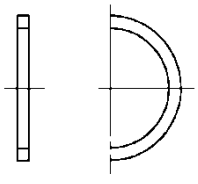
Inspection item		Method	Daily	Weekly	2.5th year. 1st docking	5th year. 2nd docking	7.5th year. 3rd docking	10th year. 4th docking	12.5th year. 5th docking	15th year. 6th docking	17.5th y 7th dock
Operation	Electric current	Ammeter	○								
Operation	Bearing temperature *3)	Thermometer or physical contact	○								
Operation	Bearing vibration	Physical contact	○								
Operation	Bearing vibration	Vibrometer		○							
Impeller	Dust and deformation	Visual observation			○	○	○	○	○	○	○
Impeller	Crack	P.T. *1)							○	○	○
Shaft	Bend and strain	Dial gauge			○	○	○	○	○	○	○
Bearing	Noise	Listening rod, vibromete		○		☆		☆		☆	
Bearing	Discoloration	Visual observation									
Shaft coupling	Center alignment *5)	Dial gauge			△	☆	△	☆	△	☆	△
Shaft coupling	Lubricating oil leakage	Visual observation	○ *2)								
Internal coating	Clack and flaking	Visual observation			○	○	○	○	○	○	○
Shaft sealing	Leakage *4)	Visual observation		○	△	△ *6)	△	△ *6)	△	△ *6)	△

The table above shows the rough intervals at which the customer is requested to conduct the inspection or replace the parts when docking.

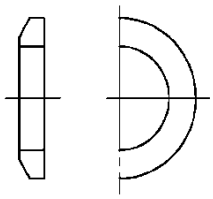
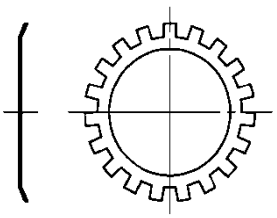
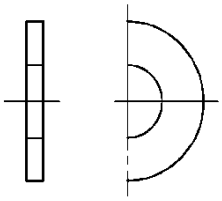
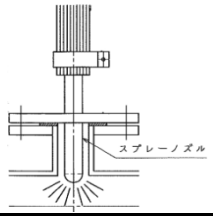
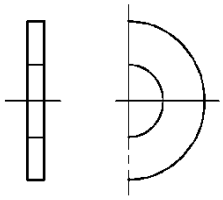
* Only personnel with expertise in the components (e.g. structure of the fan) are allowed to conduct the maintenance and inspection.
* If vibration exceeds the allowances shown below, check the centering and balancing of the rotators.

Replacement Parts and Intervals (See Sectional View of Inert Gas Fan)

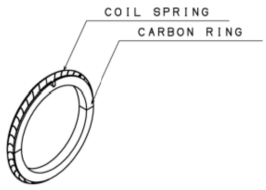
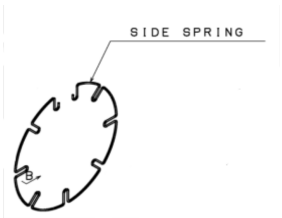
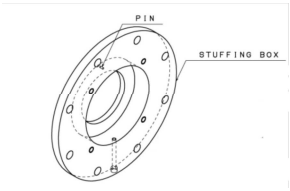
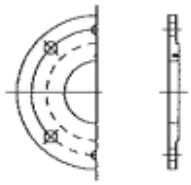
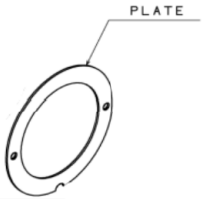
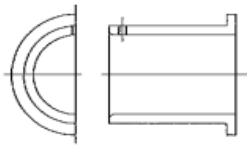
No.	Part name	Schematic diagram	Replacem't interval	Remarks
1.2	Impeller (including its hub)		10 years, or it depeds on condition	Corrosion found by the visual observation at docking is the sign for the replacement. It is recommended to keep the spare on board in advance, since its fabrication takes time. The use of a non-genuine part could break the impeller or damage the fan, leading to serious accidents.
3.16	Shaft (including oil splasher)		10 years, or it depeds on condition	Poor maintenance or wear-out of the coupling keyway due to the contact with the bearing for an extended period could lead to fretting.
4	Bearing		5 years	Its service life is 60,000 hours provided that its lubricating oil is replaced once a year. Keep a close eye on it since the nature of the system does now allow it. Excessive or insufficient lubricating oil leads to the temperature rise and seizure of the bearing, resulting in the failure of the fan. It is recommended to have the spare on board.
5.21	Bearing housing (including air vent pipe)		10 years	It is an oil-lubricating type. For its limited availability in a short time, it is advised to have the spare on board.
6	Coupling (JIS)		10 years	The contact section wears out due to the extended period of use. Replace the complete set with the new one every 10 years. * For FALK coupling, see the separate table.
7	Coupling cover	–	–	No service life is specified. Replace it whenever it is severely damaged beyond repair.
8	Casing (including its bed)		10 years	Promptly repair or replace it when cracking/flaking is observed on the coated surface.

Replacement Parts and Intervals (See Sectional View of Inert Gas Fan)				
No.	Part name	Schematic diagram	Replacem't interval	Remarks
9	Flinger		10 years	To avoid damage on the shaft, replace it whenever corrosion or excessive engagement is found on it.
10	Key (for the impeller)		10 years	It is replaced along with the shaft and impeller.
11	Suction cone		10 years	Promptly repair or replace it when cracking/flaking is observed on the coated surface.
12.13	Bolt and washer (for the impeller)		5 years	Replace them when the impeller is dismounted (to replace the shaft). The washer is bent for locking and non-reusable.
14	Plate	–	–	No service life is specified. Replace it whenever it is severely damaged.
15	Plug or thermometer	–	–	[Plug] Inform us when it is lost. [Thermometer] Replace it whenever it is unable to measure temperatures.
17	Shaft cover	–	–	It is non-reusable. Replace it along with the bearing.
18	Felt packing (for the bearing box)		5 years	It is non-reusable. Replace it along with the bearing.

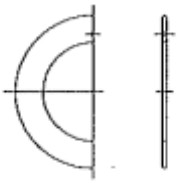
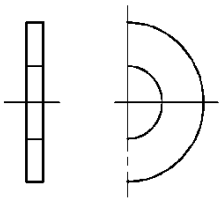
Replacement Parts and Intervals (See Sectional View of Inert Gas Fan)

No.	Part name	Schematic diagram	Replacem't interval	Remarks
19	Bearing nut		10 years	Its slots can be stripped as it is repeatedly tightened and loosened. Replace it whenever it cannot be tightly engaged with a hook spanner. It is advised to have the spare on board after the 3rd docking.
20	Bearing washer		5 years	It is non-reusable. Replace it along with the bearing.
22	Oil gauge	–	–	Replace it whenever it is unable to measure oil surface.
23	Gasket (for the suction cone)		5 years	Replace it whenever the suction cone is dismounted.
24	Spray nozzle		10 years	Replace it whenever it is deformed or damaged.
25	Parts for the coupling (bolts, nuts, and rubber bushings)	–	Every docking	They are all important parts for power transmission. Replace them at every docking. Check the bushings for cracks. * For FALK coupling, see the separate table.
	Packing for inspection port		Every time opening the port, or it depeds on	It is a rubber packing and reusable as long as it is free from brittleness or damage. Replace it at every docking.

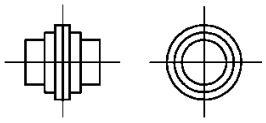
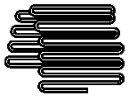
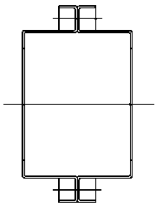
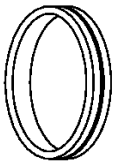
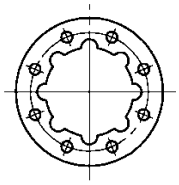
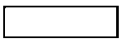
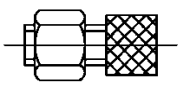
Replacement Parts and Intervals (See Sectional View of Stuffing Box)

No.	Part name	Schematic diagram	Replacem't interval	Remarks
1.2	Carbon ring Coil spring		Every docking	They could wear out or have cracking. Replace them at every docking.
3	Side spring		Every docking	It could wear out or have cracking. Replace it at every docking.
4	Stuffing box		10 years	Promptly replace it when cracking/flaking is observed on the coated surface.
5	Gland		10 years	Replace it whenever it is found deformed or damaged.
6	Plate		5 years	Replace it whenever it is found deformed or damaged.
7	Shaft sleeve		5 years	Replace it whenever it is found deformed or damaged.
8	Bolts (for fixing the gland)	—	5 years	Replace them every 5 years.
9	Bolts (for fixing the stuffing box)	—	10 years	Replace them along with the stuffing box.

Replacement Parts and Intervals (See Sectional View of Stuffing Box)

No.	Part name	Schematic diagram	Replacem't interval	Remarks
10	Liner		5 years	Replace it whenever it is found scratched, deformed or worn out.
11	Gasket		5 years	Replace it whenever the stuffing box is dismounted.

Replacement Parts and Intervals (for FALK Coupling)

No.	Part name	Schematic diagram	Replacem't interval	Remarks
	Hub (for the coupling)		5 years	Replace it when significant wear-out is found on the teeth of the gear or contact surface with the seal ring at the docking.
	Grid (for the coupling)		Every docking	Its elasticity absorbs impact load, vibration, and thrust loading as torque is transmitted. Since visual observation does not help determine its condition, replace it at every docking for preventive maintenance. It is recommended to keep the spare on board.
	Grid cover (for the coupling)		5 years	The grid oscillates in and contacts with the cover, resulting in the wear-out of the internal surface. Replace it along with the hub, and whenever it wears out. It is recommended to keep the spare on board.
	Seal ring (for the coupling)		Every docking	It seals the grease in the cover. It is of synthetic rubber which performance can be lowered by brittleness and wear-out due to temperature change or extended period of use. Poor sealing of grease promotes rapid wear-out of the parts including the hub. Replace it at every docking.
	Gasket (for the coupling)		Every docking	It is non-reusable. Replace it when the coupling gets opened.
	Key (for the coupling)		5 years	Replace it along with the shaft and hub.
	Bolt and nut (for the coupling cover)		Every docking	The locknut is non-reusable. Replace both the bolt and locknut when the coupling gets opened.

* The system uses either JIS or FALK coupling.
If the drawing specifies "JIS" coupling to be used, the information about FALK coupling is not applicable.

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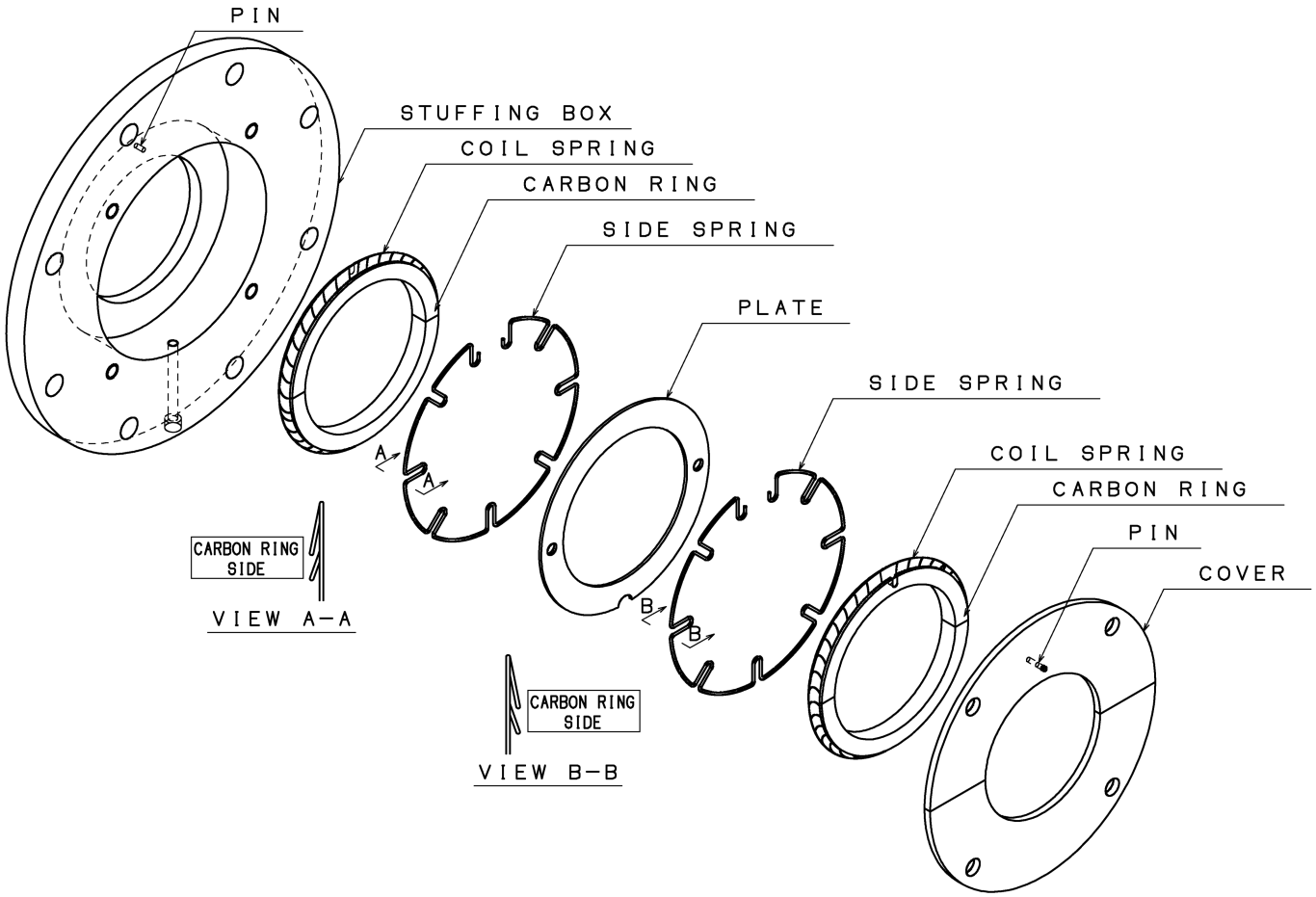
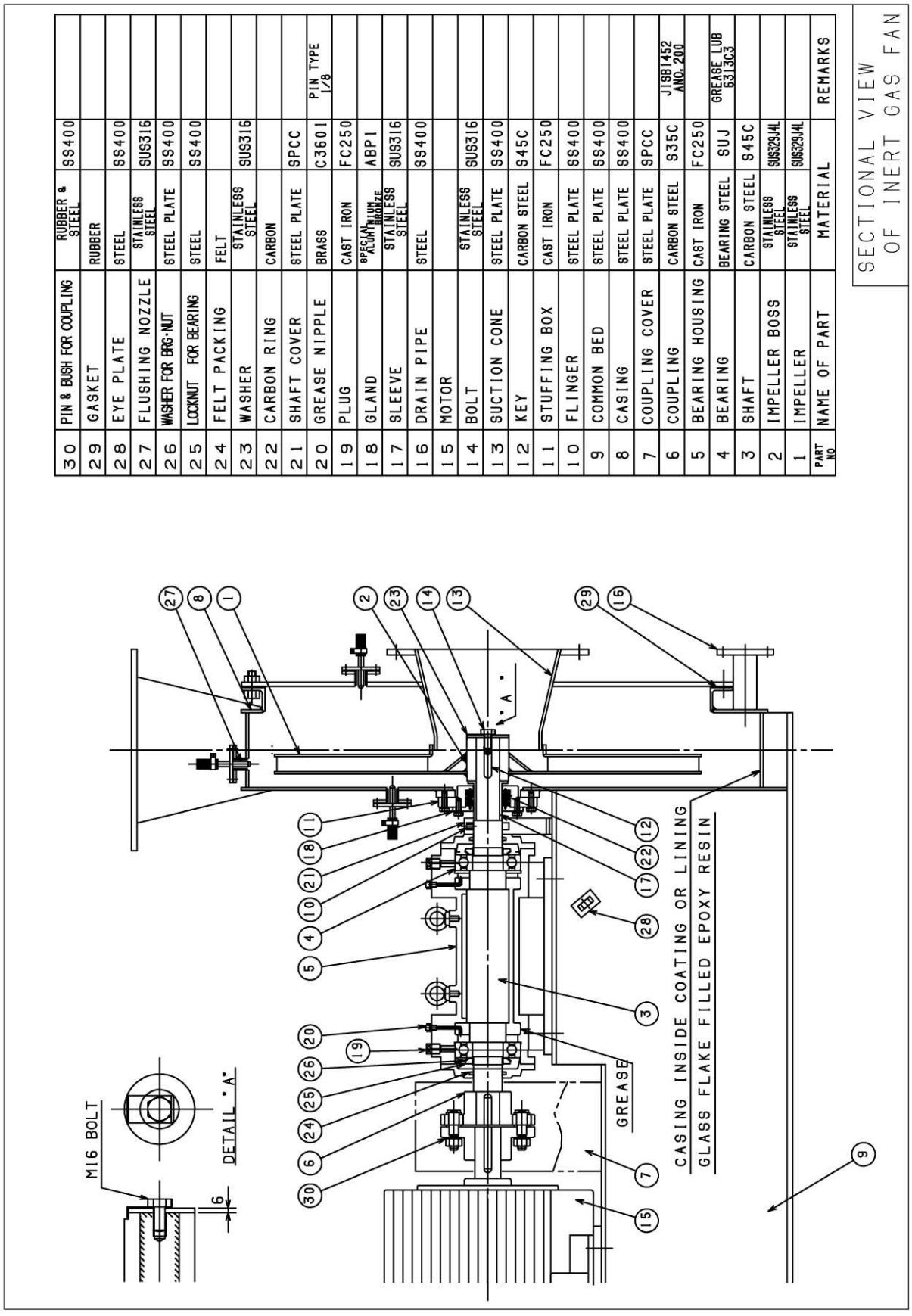


ASSEMBLY AND DISASSEMBLY
VIEW OF STUFFING BOX

GREASE TYPE

PART NO	NAME OF PART	MATERIAL	REMARKS
30	PIN & BUSH FOR COUPLING	RUBBER & STEEL	SS400	
29	GASKET	RUBBER		
28	EYE PLATE	STEEL	SS400	
27	FLUSHING NOZZLE	STAINLESS STEEL	SUS316	
26	WASHER FOR BRG·NUT	STEEL PLATE	SS400	
25	LOCKNUT FOR BEARING	STEEL	SS400	
24	FELT PACKING	FELT		
23	WASHER	STAINLESS STEEL	SUS316	
22	CARBON RING	CARBON		
21	SHAFT COVER	STEEL PLATE	SPCC	
20	GREASE NIPPLE	BRASS	C3601	PIN TYPE 1/8
19	PLUG	CAST IRON	FC250	
18	GLAND	SPECIAL ALUMINUM BRONZE	ABP1	
17	SLEEVE	STAINLESS STEEL	SUS316	
16	DRAIN PIPE	STEEL	SS400	
15	MOTOR			
14	BOLT	STAINLESS STEEL	SUS316	
13	SUCTION CONE	STEEL PLATE	SS400	
12	KEY	CARBON STEEL	S45C	
11	STUFFING BOX	CAST IRON	FC250	
10	FLINGER	STEEL PLATE	SS400	
9	COMMON BED	STEEL PLATE	SS400	
8	CASING	STEEL PLATE	SS400	
7	COUPLING COVER	STEEL PLATE	SPCC	
6	COUPLING	CARBON STEEL	S35C	JIS B1452 ANG. 200
5	BEARING HOUSING	CAST IRON	FC250	
4	BEARING	BEARING STEEL	SUJ	GREASE LUB 6313C3
3	SHAFT	CARBON STEEL	S45C	
2	IMPELLER BOSS	STAINLESS STEEL	SUS329J4L	
1	IMPELLER	STAINLESS STEEL	SUS329J4L	

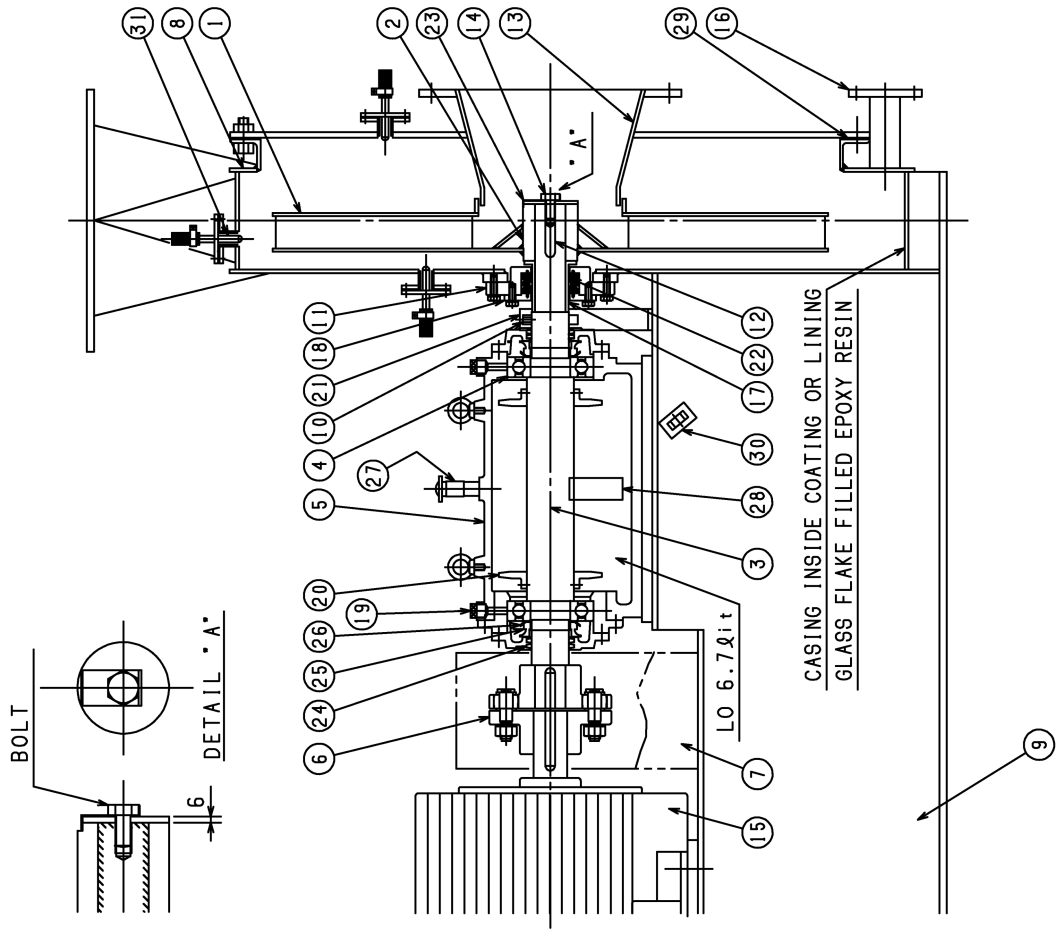
SECTIONAL VIEW
OF INERT GAS FAN



OIL TYPE

PART NO	NAME OF PART	MATERIAL	REMARKS
31	FLUSHING NOZZLE	STAINLESS STEEL SUS316	
30	EYE BOLT	STEEL SS400	
29	GASKET	RUBBER	
28	OIL GAUGE	ACRYLIC RESIN	
27	AIR ESCAPE PIPE	STEEL PIPE SGP	
26	LOCK WASHER FOR BEARING	STEEL PLATE SS400	
25	LOCKNUT FOR BEARING	STEEL SS400	
24	FELT PACKING	FELT	
23	WASHER	STAINLESS STEEL SUS316	
22	CARBON RING	CARBON	
21	SHAFT COVER	STEEL PLATE SPCC	
20	OIL SPLASHER	STEEL SS400	
19	PLUG	CAST IRON FC250	
18	GLAND	SPECIAL ALUMINUM BRONZE ABP1	
17	SLEEVE	STAINLESS STEEL SUS316	
16	DRAIN PIPE	STEEL SS400	
15	MOTOR		
14	BOLT	STAINLESS STEEL SUS316	
13	SUCTION CONE	STEEL PLATE SS400	
12	KEY	CARBON STEEL S45C	
11	STUFFING BOX	CAST IRON FC250	
10	FLINGER	STEEL PLATE SS400	
9	COMMON BED	STEEL PLATE SS400	
8	CASING	STEEL PLATE SS400	
7	COUPLING COVER	STEEL PLATE SPCC	
6	COUPLING	CARBON STEEL S35C	JIS A 250
5	BEARING HOUSING	CAST IRON FC250	
4	BEARING	BEARING STEEL SUJ	OIL BATH LUB 6316C3
3	SHAFT	CARBON STEEL S45C	
2	IMPELLER HUB	STAINLESS STEEL SUS329J4L	
1	IMPELLER	STAINLESS STEEL SUS329J4L	

SECTIONAL VIEW
OF INERT GAS FAN



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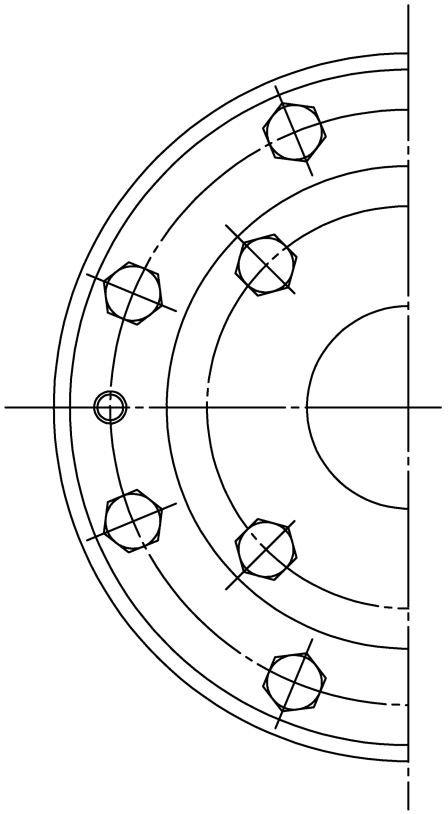

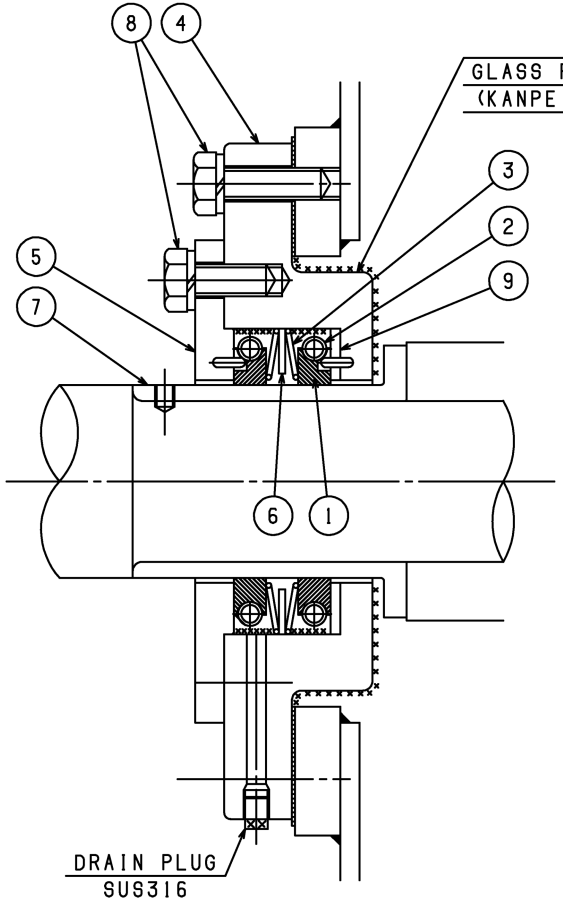

PART NO	NAME OF PART	MATERIAL		REMARKS
9	LINER	STAINLESS STEEL	SUS316	
8	BOLT	STEEL BAR	SS400	
7	SHAFT SLEEVE	STAINLESS STEEL	SUS316	
6	PLATE	STAINLESS STEEL	SUS316	
5	GLAND	SPECIAL ALUMINIUM BRONZE	ABP1	
4	STUFFING BOX	CAST IRON	FC250	
3	SIDE SPRING	STAINLESS STEEL	SUS316	
2	COIL SPRING	STAINLESS STEEL	SUS316	
1	CARBON RING	CARBON		

SECTIONAL VIEW
OF STUFFING BOX