

Inert Gas Generator 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.

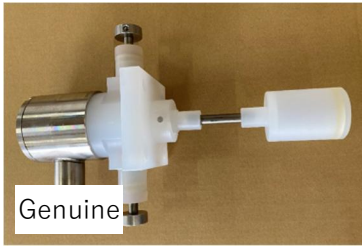
The system requires the use of genuine components and regular maintenance for its proper operation.

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 deck water seal are

attributable to the use of a nongenuine level switch.

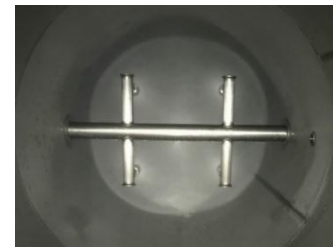
The genuine components are designed with specific working conditions taken into account. Do not use nongenuine components.



The jacket water and cooling water spray nozzles in the system on some vessels are also found to be nongenuine or clogged as a result of poor maintenance. For details, please refer to the attached document.



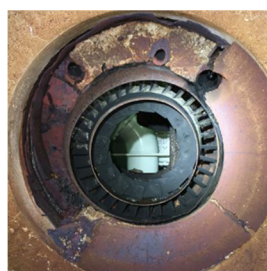
Our on-board inspection program performed by our certified agencies includes checking the clogging, spray pattern, and looseness or disengagement of the nozzles as a part of the operation check of the whole system. For details, please refer to the attached document.



Improper Repairing

Our service engineers visited a vessel in service on their request to work on reported soot generation in the system and found that the refractory around the burner had been improperly repaired in dock without notification to us, showing that they did not fully understand how the refractory worked.

The pictures below from left to right show "Brand-new refractory", "Refractory damaged by degradation", "Improperly repaired refractory" (with which a lot of soot was generated), and "Refractory of right amount" (with which the combustion was improved).



Please contact us whenever you plan repairing. No matter what needs to be repaired, we would be happy to support you with our expertise.

Improper Adjustment (Cooling Water)

Excessive supply pressure of the primary cooling water (for the jacket) could lead to implosion in the combustion chamber. A pressure switch is equipped to monitor the sea water pressure and stop the scrubber pump when it reaches the specified pressure. Please make sure that the switch is set to keep the pressure lower than the specified value shown on the final drawing and instruction manual. You are kindly requested to regularly check the pressure switch for its proper operation.



Please note that the sea water pressure varies depending on the ship's draft. For details, please refer to the attached document.

Please note that the sea water pressure varies depending on the ship's draft. For details, please refer to the attached document.

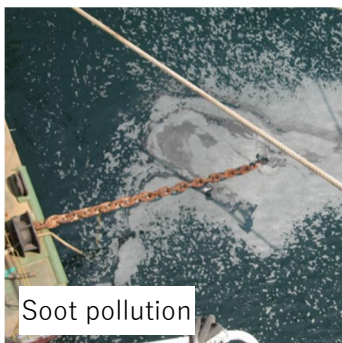
Improper Adjustment (Air-fuel Ratio)

Non-ideal balance between air and fuel for the burner causes unstable or incomplete combustion which brings such consequences as:

- A lot of soot in the inert gas



- Outflow of the sea water containing soot and oil overboard



Smoke tester

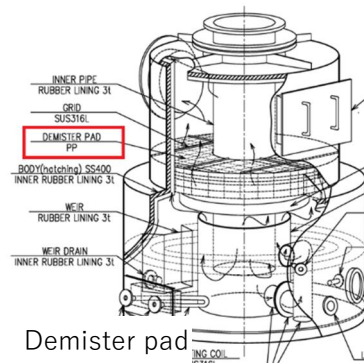


The use of a smoke tester is an effective way to check the combustion state and the quality of the generated gas and can be used as a reference to adjust the air-fuel ratio for the burner as appropriate to obtain favorable combustion. For details, please refer to the attached document.

Regular Maintenance

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.



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)



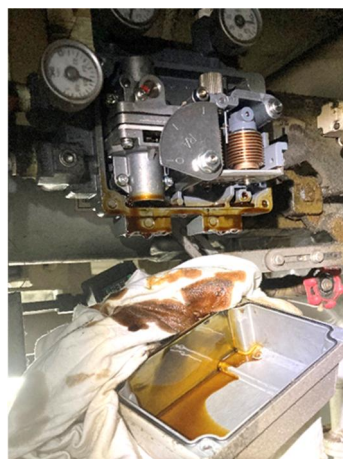
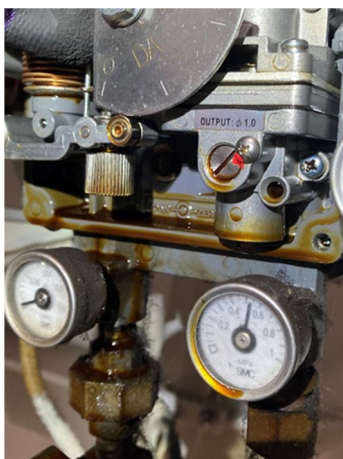
PLC (compatible model)

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 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.



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

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

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
GENERATOR 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 PLC is 10 years which is announced by OMRON.	Attachment 2	Very urgent
3		AC/DC CONVERTER	CONTROL PANEL	AGE : More than 7-10 years	Recommend to replace as design service life of PLC 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 average.		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		Control Valves (Positioner)	ENGINE ROOM (IG MAIN LINE)	Function	If malfunction is observed, 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.	
11		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	
12		Soot tester	N/A	Tool check	If soot tester is not used for soot monitoring, recommend to prepare to judge soot condition visibly.		Important
13		Burner	ENGINE ROOM	Deterioration or damage	Check the burner condition visually and contact us with photo if any damage is found. And also check if there is something strange of combustion.	Attachment 5	

Kashiwa Tech Co., Ltd.

● Contact information
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 FAX: +81-3-5449-2430
 E-mail: sales@kashiwa-tech.co.jp

KASHIWA INERT GAS GENERATOR SYSTEM

Information about consumables, tools and upgraded components

Burner Overhaul Kit

We recommend the installation of an overhaul kit to keep the burner in good condition. Please contact us for your inquiry for quotation so that we can offer you the most suitable one for your burner.



* The overhaul can be performed only by our authorized service agencies when they visit your ship for the inspection.

PLC Replacement Kit

Do you find in the control panel any PLCs that are already discontinued (e.g., Omron C200HE) or more than 10 years old?

Due to the limited availability, we recommend you replacing them with the latest models at the earliest possible opportunity to avoid an extended period of the system's inoperability.



We provide an easy-to-replace kit arranged by the PLC manufacturer with the corrected drawings of the system and detailed replacement procedure.

* We keep the full record of the system for its maintenance and modification and keep track of the replacement parts ordered after the ship went into service. Contact us for ordering the replacement parts.

Positioner for Control Valves

IGG pressure valve, main valve and exhaust valve are equipped with a positioner to control its opening. The glitchy positioner could destabilize the system's operation, resulting in failure of maintaining a proper pressure to deliver the inert gas to the cargo tanks.



* The positioners of 10 years old are recommended to be replaced.

I/P CONVERTOR

I/P converter is the component to send the opening/closing signal to the positioner on IGG pressure valve, main valve and exhaust valve. The malfunctioned converter would not send the proper signal to the positioner, leading to abnormal operation of the system.



* The newly-adopted converter since 2022 has compatibility and is interchangeable with the existing one.

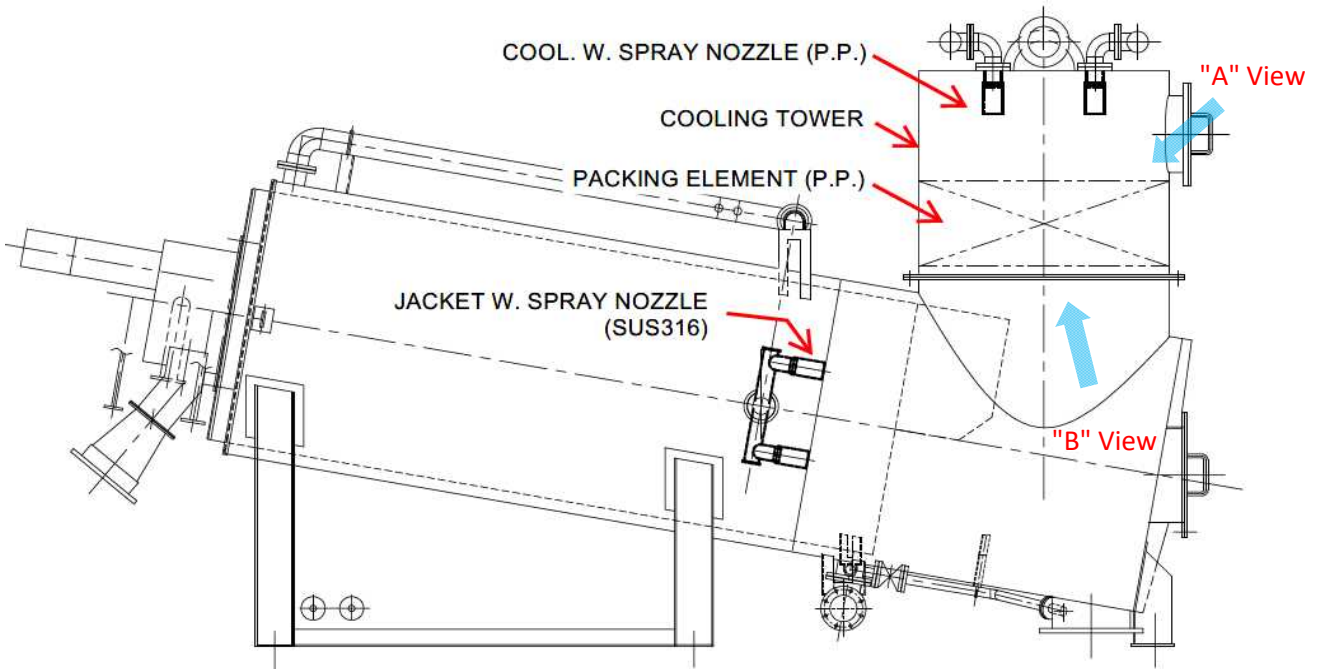
General Inspection

Our authorized service agencies are ready to serve you for the inspection of our systems. They are closely working with Kashiwa Tech for the reliable operation of the systems. Please feel free to contact us when you need the information about the nearest agency.

Please contact our service department at sales@kashiwa-tech.co.jp for request for quotation or order placement with such information as the system's name, ship's name and IMO number.





Kashiwa Tech Co., Ltd.

How to check the spray nozzles for protection of the packing elements in the cooling tower from melting



(1) Reported incident

1-1 Melted packing elements in the cooling tower

	"A" View	"B" View
Normal elements		
Melted elements		

(2) Suspected causes

The packing elements melt due to poor cooling performance caused by insufficient cooling water supply, which is attributable to such defects as shown in Paragraph (3). Besides, non-genuine nozzles are not able to produce proper spray pattern, which is crucial to achieve necessary cooling efficiency.

(3) Identified defects

(3) -1 JACKET W. SPRAY NOZZLE

- (a) Non-genuine nozzle used
- (b) Spray nozzle(s) missing
- (c) Clogged with foreign materials
- (d) Deformed by corrosion

(a) Genuine nozzle

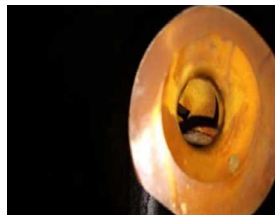
(a) Non-genuine nozzle



(b) Missing

(c) Clogged

(d) Deformed and damaged



(3) -2 COOL. W. SPRAY NOZZLE

- (a) Non-genuine nozzle used
- (b) Spray nozzle(s) missing
- (c) Clogged with foreign materials
- (d) Deformed by melting

(a) Genuine nozzle

(a) Non-genuine nozzle



Original condition

(b) Missing

(c) Clogged

(d) Deformed and damaged



- (4) Preventive measures (Check the following points.)
- (a) Do not use non-genuine nozzles. They are not designed to provide a sufficient amount of water at the rated pressure in an intended spray pattern.
 - (b) Check the outside and inside of the nozzles visually and ensure that its inside deflector is properly placed.

JACKET W. SPRAY NOZZLE

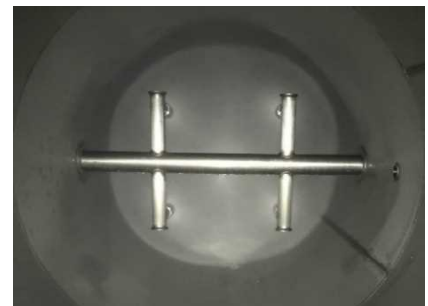
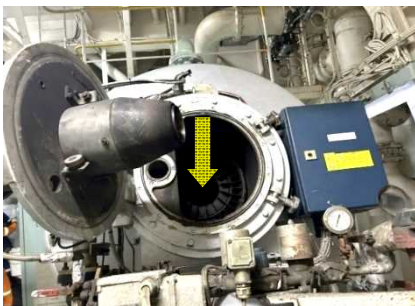


COOL W. SPRAY NOZZLE



- (c) Make sure that the nozzles are free from clogging with foreign materials.
- (d) Follow the steps below to check the spray pattern of the JACKET W. SPRAY NOZZLES.
 - (d)-a Make sure that the IGG system is stopped, and then open the burner door so that the combustion chamber holding the burner can be seen.
 - Note) Before opening the door especially right after the operation, ensure that the area is well ventilated.
 - (d)-b Run the cooling water pump to deliver sea water at the specified pressure. Check that the cooling water is sprayed in a proper pattern so that the water screen can cover the entire chamber without any gap to maximize its cooling efficiency.

Water screen covering the entire chamber



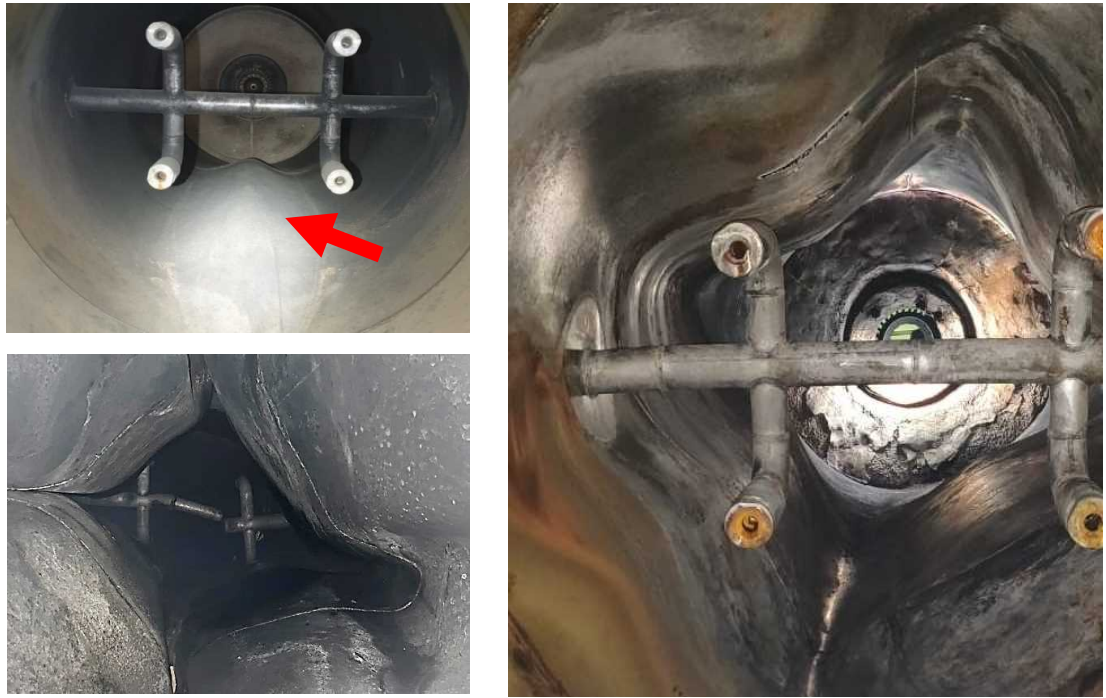
- (e) The spray pattern of COOL W. SPRAY NOZZLES must be full-cone having 120° of spray angle (because the sprayed water could gash out from the opened door, checking this may be impractical).

Full-cone spray pattern at 120°



How to prevent implosion of the combustion chamber

(1) Implosion incident in the combustion chamber

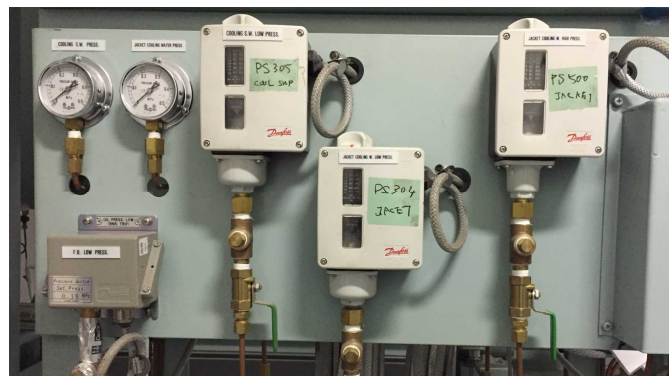


(2) Suspected causes

Abnormal high pressure water is supplied into the water jacket of the combustion chamber

(3) Preventive measure of the implosion

- (a) Excessive supply (pressure) of the jacket water could lead to implosion in the combustion chamber.
- (b) The pressure switch stops the scrubber pump when the pressure reaches the set high pressure. Do not adjust or raise the pressure above the specified value. The specified pressure is indicated in the final drawing and the operation manual. Note that the sea water pressure values depending on the ship's draft.

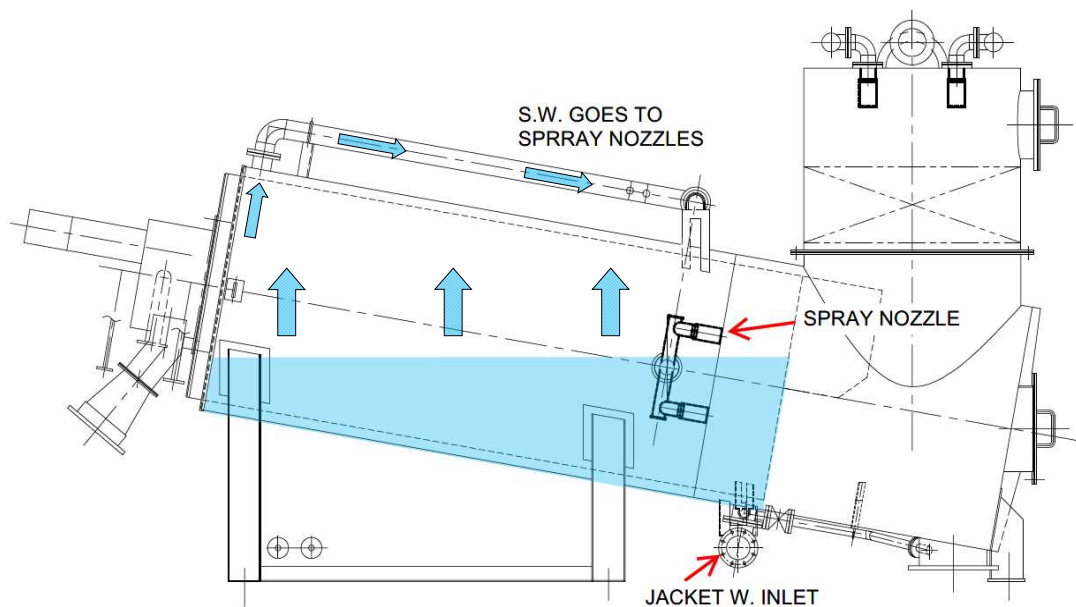




- (c) Check periodically if the pressure gauge indicates correctly and pressure switch functions properly for the jacket water line.
Mind that the scrubber pump does not stop as per the interlocking device mentioned in (b) above, if pressure switch is not in order, so make sure the performance of its pressure switch and pressure gauge periodically by calibration tool, etc.



- (d) Please note that the jacket water pressure gauge will not display the correct pressure unless the jacket water is fully charged in the water jacket of the combustion chamber. Therefore, do not operate the sea water inlet valve abruptly until the jacket water is fully charged, which takes approximately a few minutes.



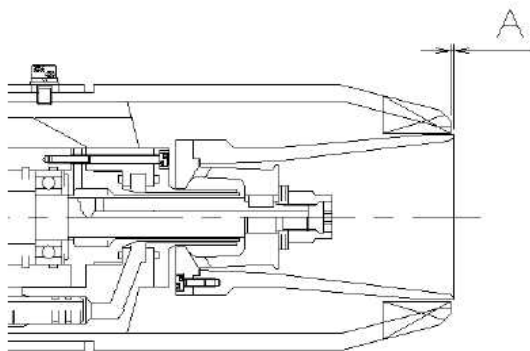
- (4) For inquiries

If you have any inquiries, please feel free to contact "sales@kashiwa-tech.co.jp" .

How to adjust and mainain the burner assembly condition

Adjustment of each assembly part

(a) Primary air nozzle and rotary-cup



Distance "A" is adjusted by movement of air nozzle.

$$\langle\langle 0.5 > A \geq 0 \rangle\rangle$$

In case distance become more than 0.5, atomized particles become more larger size and cause carbon stick. In case distance become less than 0, fuel oil collide into the air nozzle and cause oil leakage.



SUITABLE POSITION



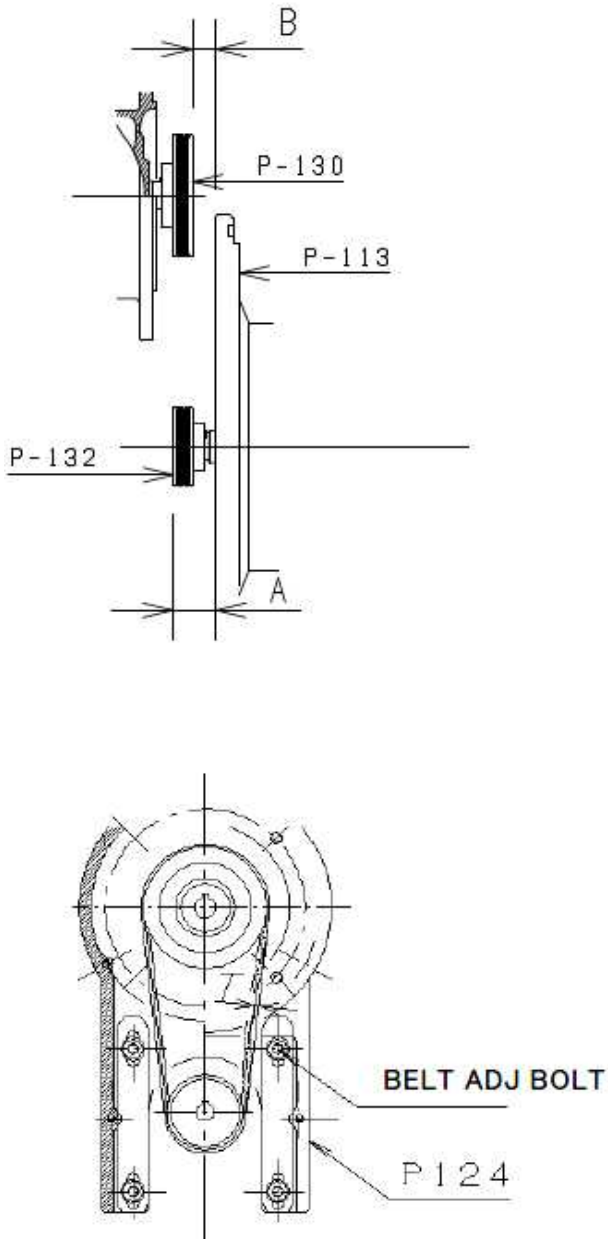
UNSUITABLE POSITION

Rotary cup is located inside of Primary air nozzle or located outside too much



If the rotary cup is positioned at unsuitable position, it may cause generating soot, or hydro carbon may be contained in the inert gas due to unburned oil.

(b) Burner belt



After pulley is disassembled, assembly procedures will be obtained in order to set pulley exact position.

In case surface of belt is not properly adjusted, it causes belt problem or cutting belt.

※Record the dimension A and B on the left drawing before disassembling it.

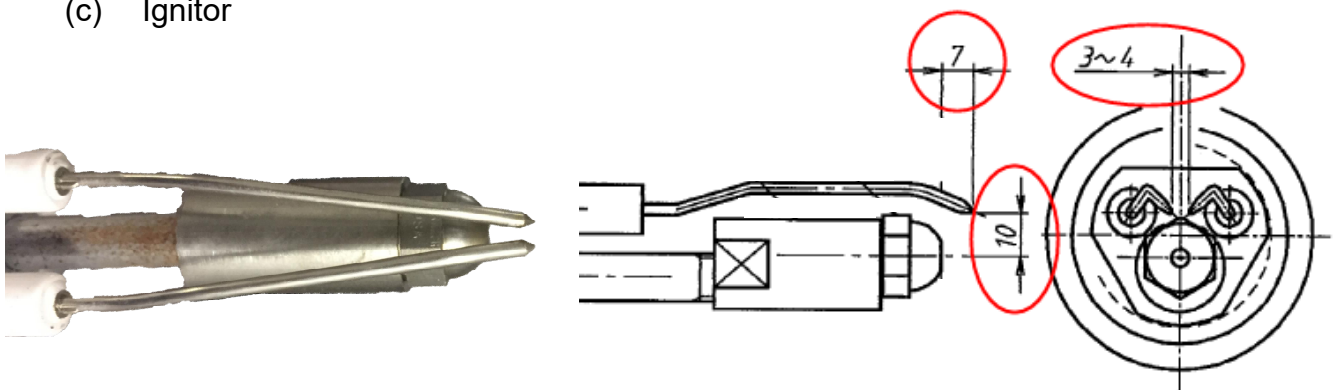
At first, main shaft pulley (P-132) is installed and "A" distance is set.

Then "B" distance from flange surface of burner body (P-113) is set accurately. Then belt is adjusted proper tension.

Belt tension is checked by your thumb.

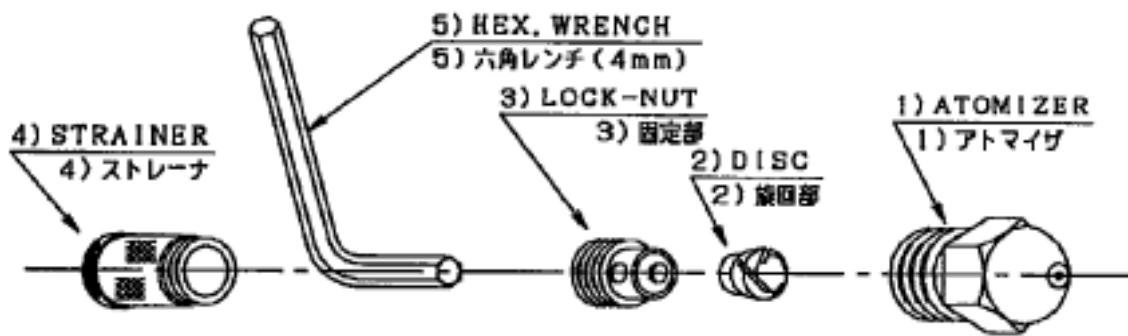
In case belt is not adjusted properly, it may cause abnormal wear out of belt thread and case abnormal noise.

(c) Ignitor





(d) Atomizer



Over-haule of Atomizer

When you clean the atomizer, please overhaul as shown in the above sketch for effective clean.

Please be aware of the direction of Disc. 2) when re-assembled.

Strainer 4) is not installed on the atomizer in case of C-oil impurities like tar will be adhered on the filter and this will cause bad oil flow.

**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**

Programmable Controllers

**Part of C200HX/C200HG/C200HE
series****Model C200PC-ISA[]3(-[] [] (-E))
Model C200PC-EXP01
Model 3G2NL-DRM21、-CPU02
Model 3G2NL-CLK[] []****Recommended Replacement**

Programmable Controllers

Model CS1 or CJ2 series**Model CS1 or CJ2 series
No recommended replacement
Model 3G2NJ-CPU11
Model 3G2NJ-CLK21**

Networks

**Model C200H-B7A[] []
Model C200HW-DRT21, -DRM21-V1,
-SRM21-V1, -CORT21**

Networks

**Model CS1 or CJ2 series
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	Dimensions	Wire connection	Mounting Dimensions	Characteristics	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.

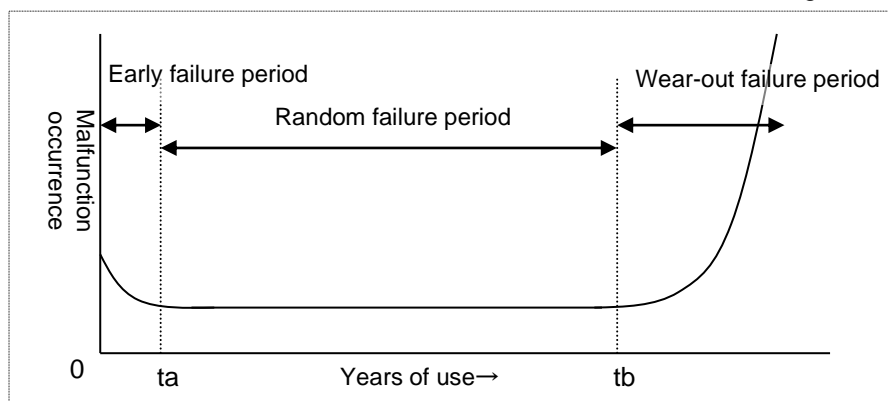
Random failure period:

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 t_a in Fig. 1, while t_b 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 t_b 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 (C200H α) (Manufactured in or before Oct. 2000)	5 years	7 years (operated at 30°C, 24 h/day) (Load rate 70%)
	CS (C200H α), CJ Series (Manufactured in or after Nov. 2000) CP Series	8 years	10 years (operated at 40°C, 24 h/day) (Load rate 70%)
	C/CV Series (See Note 1.)	7 years	7 years (operated at 30°C, 24 h/day)
CPU	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

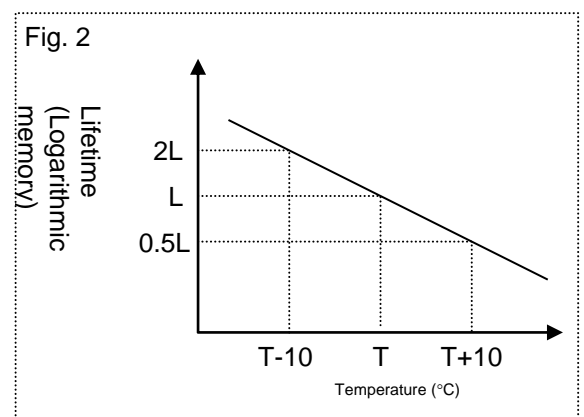
(1) Aluminum electrolytic capacitor lifetime

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.

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

- 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

- 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.)

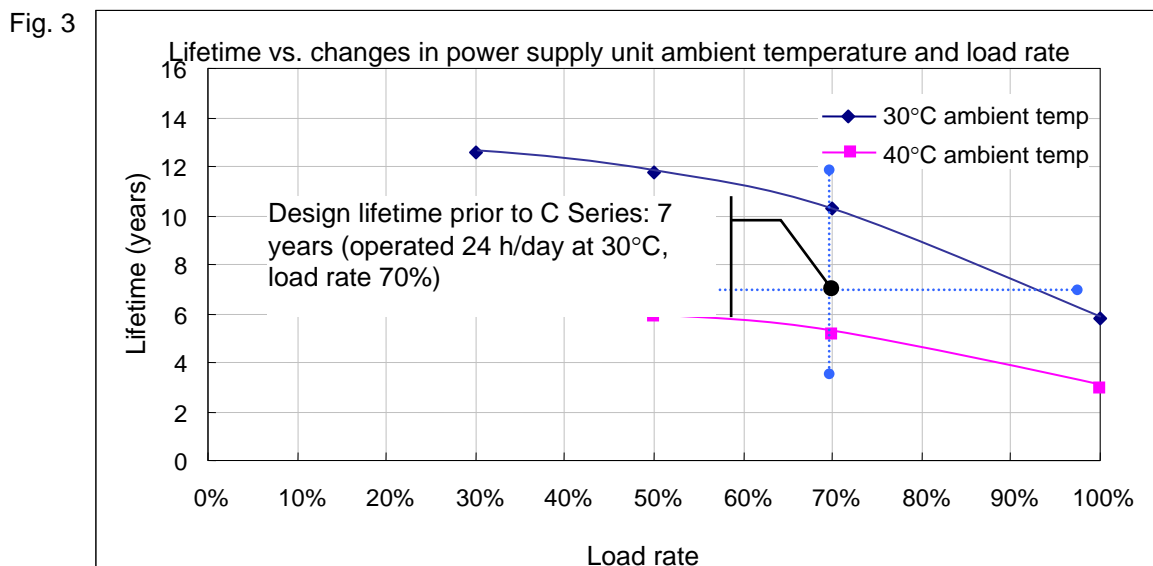
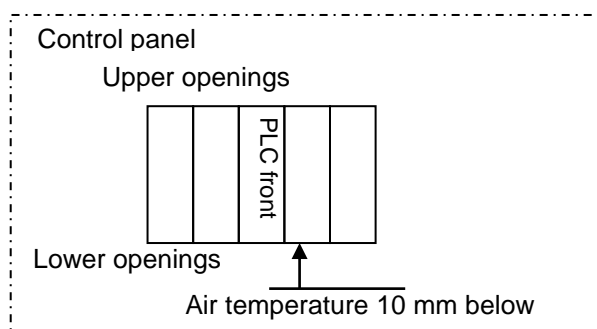


Fig. 4 Ambient temperature measurement reference point: temperature 10 mm below PLC



(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 life, 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.

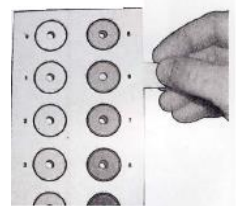
Smoke Tester

User Manual

How to Use

※Please operate the burner for at least 5min. before sampling the smoke.

- ① Detach the sampling tube from the clip of the cylinder.
- ② Loosen the clamp and put the cut-out filter paper between it, and fasten the clamp.
- ③ Insert the sampling tube into a gas duct in vertical direction to the gas flow.
- ④ Pull the handle 10 times to pump the smoke.
When pumping, pull the handle completely to the end, and after that, please do not move the handle for a few seconds. Please take 2~3 seconds for each pull to draw in the smoke better.
- ⑤ Pull out the sampling tube from the gas duct, and loosen the clamp to remove the filter paper.
- ⑥ Compare the smoke on the filter paper with 10 smoke samples of the smoke scale.
Please insert the filter paper in the smoke scale when comparing (It cannot be compared precisely without inserting in the scale because of transmission.)
Compare the smoke on the filter paper by prying it from each central hole of the smoke samples.
- ⑦ In case using the same filter paper continuously,
please avoid a part where the smoke is already attached on.



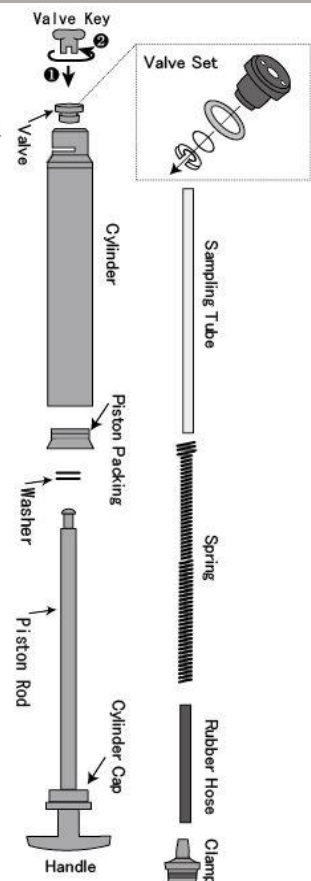
◎For Accurate Measurements

- Tap the sampling tube to clean off soots and rusts every 10 times of use.
Tighten the clamp without inserting the filter paper,
and pull the handle quickly for several times for cleaning.
- Please check occasionally if there is no air leakage from the smoke tester.
(see "Maintenance" for the details)
- Before sampling, warm the smoke tester above the room temperature to prevent dew condensation.
- It is written the criterion of judgement for the emergence of soot on the envelope of the filter paper.

Maintenance

1. Maintenance of the Smoke Tester

- ◆ Remove sticky soot particles
 - Stroke the pump quickly for several times pointing the top of the sampling tube downward without the filter paper. This cleans off sticky soots from the valve.
 - ◆ Disassembly of the smoke tester
 - ① Loosen the cylinder cap by turning round in anticlockwise direction.
 - ② Pull out the piston packing from the cylinder carefully.
Please take care to not damage the piston packing when pull it out.
 - ③ Loosen the clamp by turning round in anticlockwise direction.
 - ④ Using the accessory valve key, turning round the valve in anticlockwise direction to loosen.
 - ◆ Cleaning
 - ① Wipe up the silicon oil inside of the cylinder using a waste cloth put on a solvent.
 - ② Clean the hole of the valve and make sure it is actually cleaned.
 - ③ Condensated flue gas makes residual materials on the surface of the piston rod.
In this case, please polish the surface to clean off the residues with a sand cloth.
- ⚠ Please use a solvent which is for removing the silicon oil.
⚠ When removing the old silicon oil from the piston packing or the inside of the cylinder,
please treat them with care.



◆Application of Silicon Oil

It is usually necessary to add silicon oil when it is felt tight to pull the handle taking 2~3 sec. with the filter paper inserted.

- ① Clean the smoke tester thoroughly before applying the silicon oil as in "1. Maintenance of the Smoke Tester".
- ② Apply the moderate amount of the silicon oil to the piston packing, then mount it back to the smoke tester again.
- ③ Fit the silicon oil in the cylinder for the piston rod to move smoothly.
- ④ Assembly the rest of the parts.

❗ If more than a proper amount of silicon oil is applied, it will leak out from the smoke tester during storage.

2. Leak Test of the Pump

- ① Tighten the clamp without inserting the filter paper. Put the handle in to the very last.
- ② Close up the end of the sampling tube with a thumb.
- ③ Pull the handle as much as possible keeping the sampling tube closed up with a thumb. (refer to the picture on the right) Then get off the handle.



•If the handle moves back to the original position: The pump is sealed well.

•If the handle does not move back: There is a leakage from the pump.

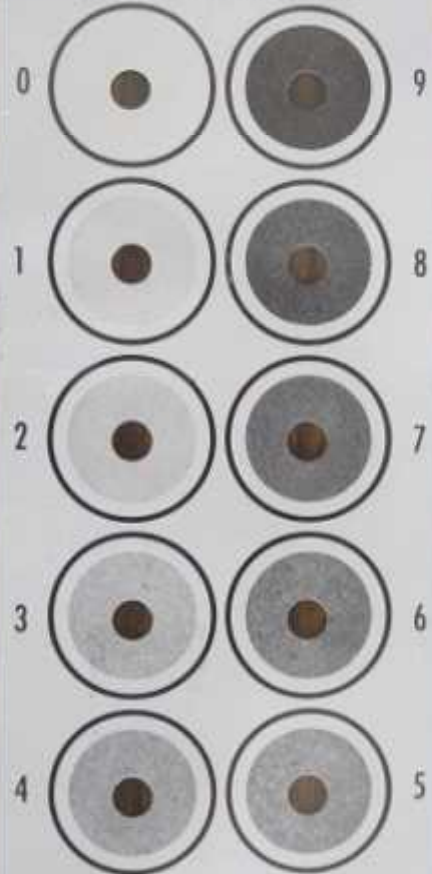


Predicted reasons:

- | | |
|----------------------------------|-------------------------|
| —Breakage on the rubber hose | ⇒Exchange it. |
| —Defect on the valve / valve set | ⇒Exchange it. |
| —Crack on the piston packing | ⇒Exchange it. |
| —Abration of the piston packing | ⇒Apply the silicon oil. |
| —Looseness of screws | ⇒Tighten the screws. |

BACHARACH OIL BURNER SMOKE SCALE

DEVELOPED IN COOPERATION WITH
SHELL DEVELOPMENT COMPANY



This scale is based on a test flue gas volume of 2250 cubic inches per square inch of filtering area, which is equivalent to 6 full strokes for models RZB and RAC Testers and 10 full strokes for models RCC and RCC-B Testers. For motor operated smoke-meter see instructions for sampling period.

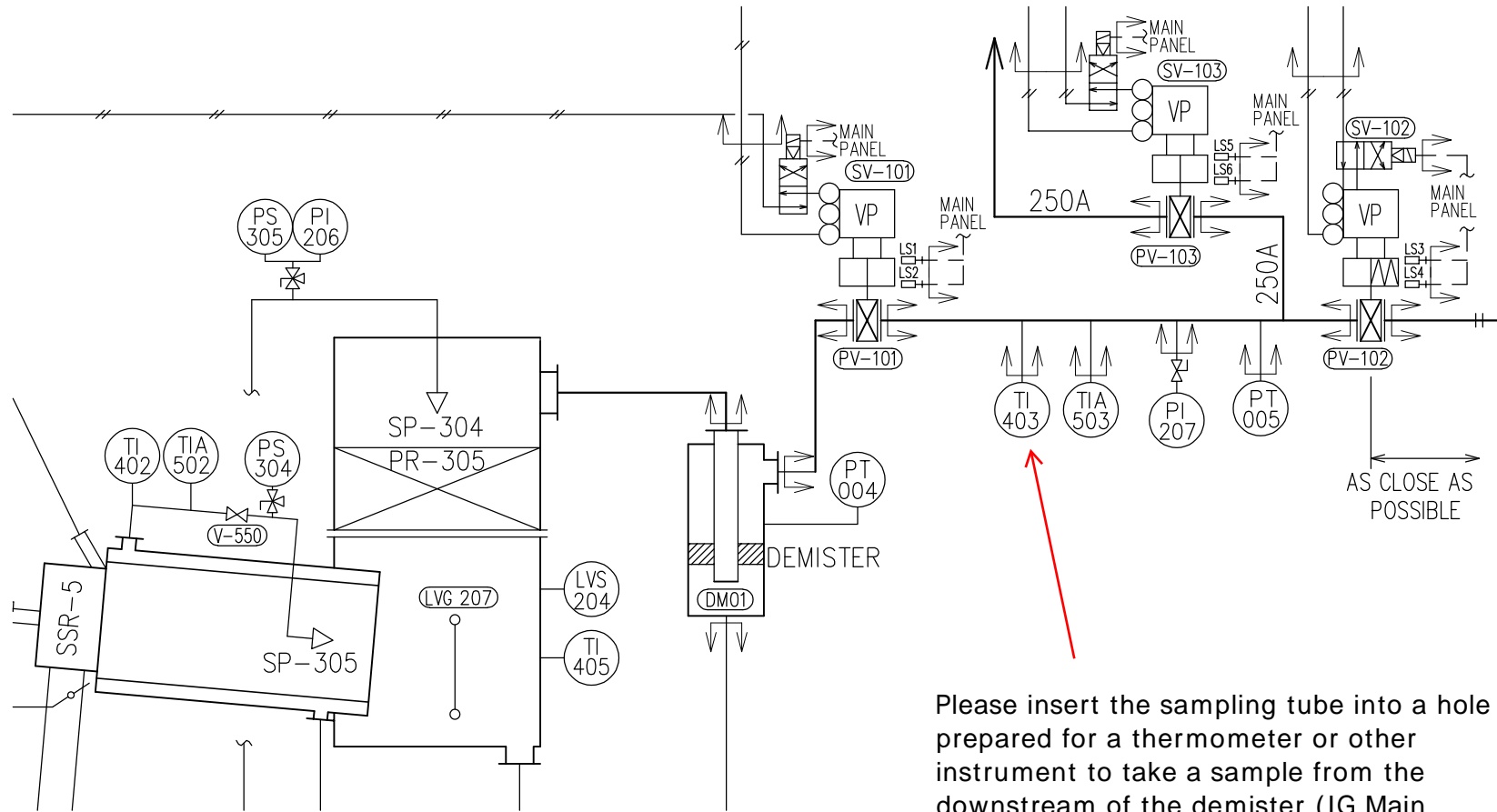
This Scale Conforms to ASTM D 2156-63T

Bacharach, Inc.
New Kensington, Pa. 15068

SCALE No.
R4776
Made in U.S.A.

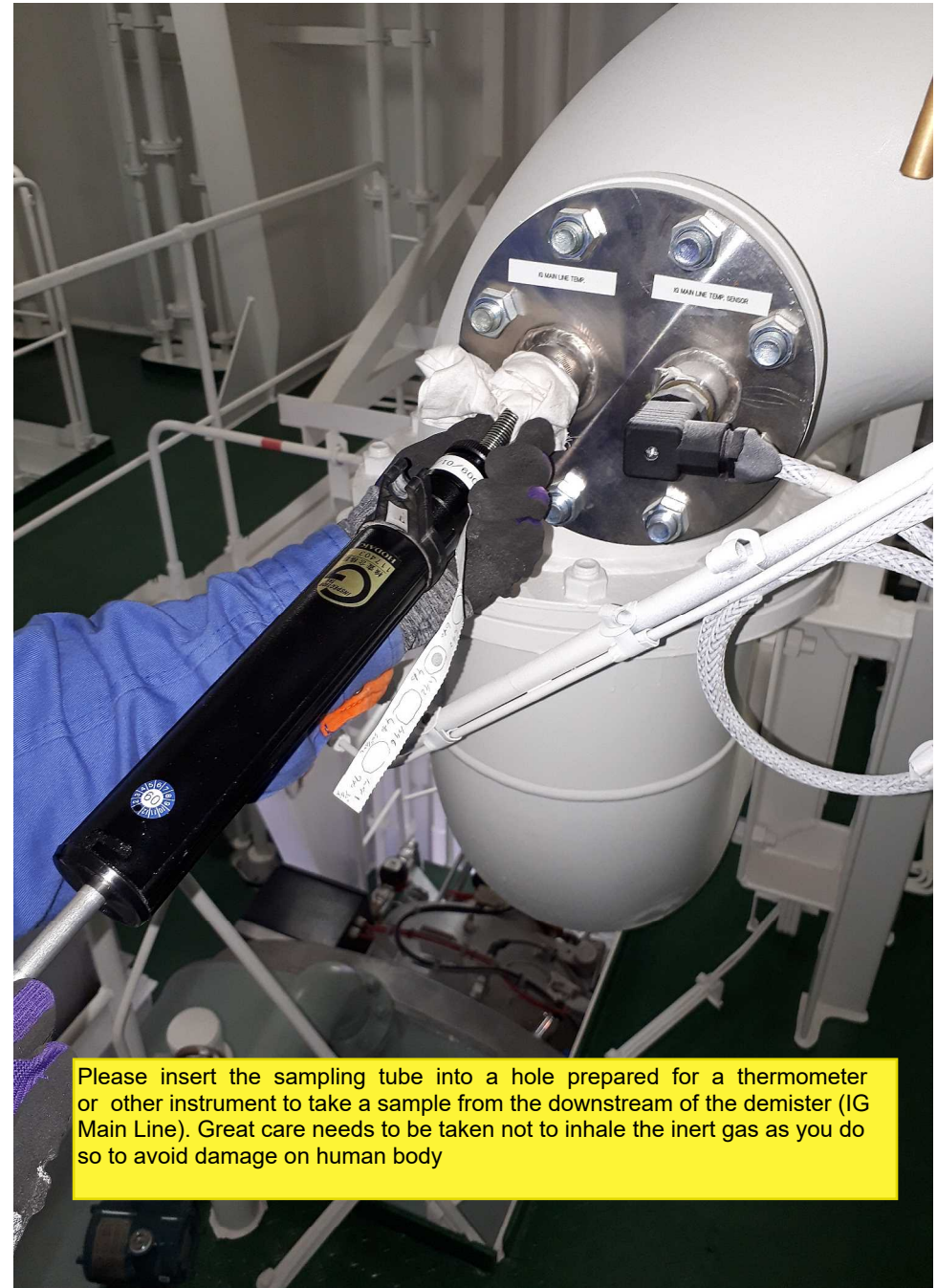


Note : This P&ID is conventional arrangement, not for particular project.



Please insert the sampling tube into a hole prepared for a thermometer or other instrument to take a sample from the downstream of the demister (IG Main Line).

Note : The installation for the instrument in the photo is just for reference, and it is different every project.



Please insert the sampling tube into a hole prepared for a thermometer or other instrument to take a sample from the downstream of the demister (IG Main Line). Great care needs to be taken not to inhale the inert gas as you do so to avoid damage on human body

