

# Maintenance Safety

## for

### YAMAMA GT6 - GT9

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# 1 Introduction

This document covers the safety precautions that the operator must consider while working at the GT10B2 gas turbine power plant. It includes the most important precautions which, if neglected, can cause personal injury or death. Besides this general safety information there are some additional precautions in the *Maintenance Instruction* to be considered, but are only concerned with specific actions or components.

## 1.1 Hazard seriousness levels

Common for all documents are the different levels of safety information. These are:

- Warning (symbol shown below)
- Caution The definition of the different levels and the way they are presented in the documentation is given below.



**Warning!** Indicates the presence of danger. Negligence of the sign may lead to personal injury or death and/or damage to the equipment.

**Caution!** CAUTION: Informs you of situations or conditions which, if not adhered to, may damage machinery or cause additional wear to the equipment.

## 1.2 Additional information

Other information that is important and should be followed by the maintenance personnel is labelled as a note. The definition of and the way notes are presented is given below.

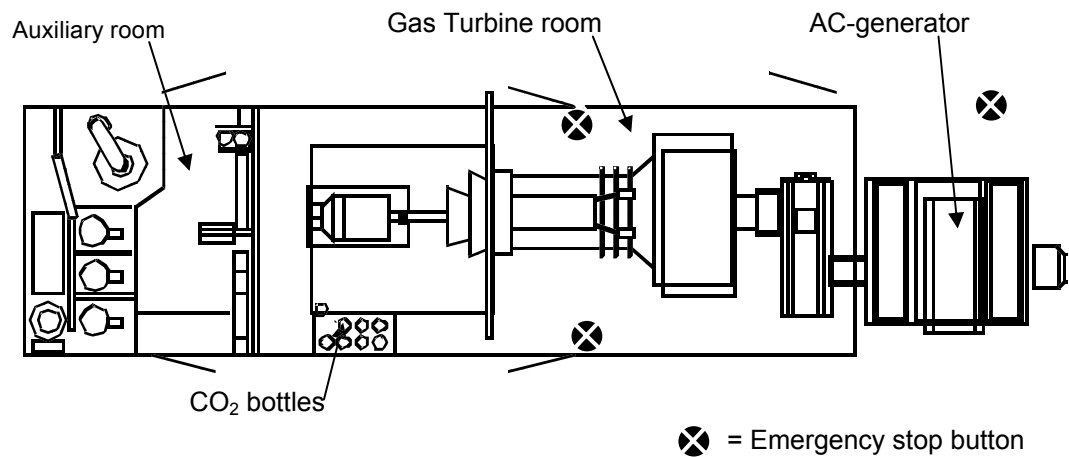
**Note!** NOTE: Note provides you with additional and useful information. Although less urgent than cautions and warnings, notes are important and shall not be ignored.

## 2 Emergency Stop Buttons

**Caution!**     **CAUTION: Never use the emergency stop buttons unless an emergency situation has occurred, since it will cause additional wear of the gas turbine**

The emergency stop buttons are used to stop the Gas Turbine (GT) when an emergency situation occurs. In such case, the GT stops immediately without any downloading period but with the lubricating oil pumps and barring of rotors running for cooling down.

Emergency stop buttons are placed as indicated in the figure below and one button is located in the control panel.



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### 3 Fire Extinguishing and Fire Warning Signals

#### RED WARNING LIGHTS



**Warning!** DO NOT ENTER the enclosure when the RED warning lights are activated (CO<sub>2</sub> is released). This means danger to life. Make sure that all CO<sub>2</sub> is vented out after a CO<sub>2</sub> release.

Before entering the enclosure, open the shut-off dampers, restart the ventilation, acknowledge the alarm and block the CO<sub>2</sub> equipment. Wait at least 3 minutes before entering the enclosure after starting the ventilation system.

**Note!** CO<sub>2</sub> is heavier than air and may remain in lower areas.

#### GREEN LIGHTS



**Warning!** Before entering the enclosure, inform operator personnel and block the CO<sub>2</sub>-equipment. When the fire extinguishing system is blocked, green lights will appear outside each entry door of the protected room(s).

#### RED FLASHING LIGHTS



**Warning!** When the fire detection system is indicating a possible fire, the flashing lights outside the gas turbine enclosure are activated. Investigate the reason for the alarm and take necessary measures.

**Note!** These lights are flashing when one detector only is indicating fire. This means that there may be a fire and/or of the detectors is giving a false fire indication.

#### SIRENS



**Warning!** When the siren is emitting a warning sound, immediately leave the enclosure and make sure that there are no people left in the enclosure. Close the enclosure doors and deblock the CO<sub>2</sub> equipment. Stay away from the enclosure and call the fire brigade.

## 4 Gas Leakage

### 4.1 General

If a gas leakage occurs, the gas will be ventilated out via the ventilation channel. Gas in the ventilation channel is automatically detected by the gas detection system. At low gas concentration, there will be an alarm. At high concentration, there will be a trip of the gas turbine with automatic closing of the gas fuel isolation valve.

### 4.2 Actions if gas fuel is detected

#### Actions at alarm level (10% of lower explosion limit, lel)

1. Acknowledge the alarm.



**Warning!** When entering the enclosure wear a flame-proof boiler-suit, eye protection, ear plugs and a hard hat.

2. Use a portable leakage detector and locate the leakage



**Warning!** One person must stay at the control station in case of a trip due to high gas concentration. In that case he/she has to make sure that no one is in the enclosure and that the doors are closed.

3. Decide if the gas turbine operation can continue without any risk or if the turbine has to be shut down to seal the leakage.
4. Contact Siemens Industrial Turbomachinery AB for further details.

**ACTIONS AT TRIP LEVEL (25% OF LOWER EXPLOSION LIMIT, LEL)**

**Warning!** Never enter the enclosure when high level of gas concentration is detected in the enclosure!

- 1 Make sure that no one is in the enclosure and that the doors are closed.
- 2 Acknowledge the trip.
- 3 Make sure that the ventilation system is in operation.
- 4 When no gas is detected in the enclosure, the doors can be opened and you may enter the enclosure.
- 5 Contact maintenance personnel and/or SIT for a leakage test of the gas fuel system.

## 5 Maintenance Warnings

### 5.1 General



#### Warning!

Follow the instructions given in the Maintenance instructions.

The recommended precautions and procedures of the subsuppliers must be followed.

Programming is only allowed to personnel authorized by SIT.

The Operator Station authority-key is to be kept in a safe place and may not be available to unauthorized personnel.

Ensure that operation of switches and valves can not endanger personnel and/or equipment.

Before working with electrical or pneumatic equipment, the electrical power or air supply must be shut off in order to prevent an unexpected start-up. The switch or the shut off valve must be tagged with “WORK IN PROGRESS – DO NOT START”.

When working on elevated levels, make sure that required protection and care are used to avoid falling accidents.

When handling heavy equipment be careful and always use adequate lifting equipment to lift during installation, maintenance and removal procedures.

Always follow the lifting instructions supplied with the equipment. Always check that the lifting equipment is in good condition and that it has sufficient capacity for the lift. Make sure that the lifting equipment is properly stored to prevent degradation.

Working with lifting equipment must only be carried out by qualified and trained personnel.

Do not stay under a suspended load



## 5.2 Working in the control module



### Warning!

Operation of the Gas Turbine is only permitted to be done by authorised personnel.

Never block automatic shutdown devices. Manual override of signals is only allowed to be done by authorised personnel who are fully aware of the functions and are taking responsibility for any possible dangerous conditions that may arise.

Be observant to control system fault alarms. Make sure that the reason of the alarm is investigated and that the fault is rectified without delay.

Use care when troubleshooting on electrical equipment. Voltage can be dangerously high.

## 5.3 Working in the enclosure

### ENTERING THE ENCLOSURE



#### Warning!

Before entering the enclosure, inform operator personnel and block the CO<sub>2</sub>-equipment. When the fire extinguishing system is blocked, green lights will appear outside each entry door of the protected room(s).

Always wear eye protection, gloves, safety boots, hard hat and when the gas turbine is in operation: ear plugs - be aware of the risk of misunderstanding due to high sound level.

Always bring a torch (explosion-proof as required by area classification), in case of loss of light.

Never work alone.

When inspecting combustion chamber flames, always wear welding goggles.

### GENERAL



#### Warning!

Do not smoke. Do not use open flames or spark producing devices unless the special precautions described in this document have been taken.

Do not work on the gas fuel system, or weld in the enclosure if the gas fuel system is filled with gas, or the gas turbine is running. Before welding is initiated, the gas turbine must be shut down and the gas fuel system depressurised, ventilated and flushed with nitrogen.

Ensure that operation of switches and valves can not endanger personnel and/or equipment.

Do not step on small piping, electrical conduit or junction boxes or use them as supports.

Before entering the turbine air intake/exhaust, or opening turbine inspection covers/plugs, the starter motor power supply must be switched off and tagged with "WORK IN PROGRESS – DO NOT START".

Liquid fuel skid and Gas Fuel Unit 1 are located outside Gas Turbine enclosure. The fuel skid areas are classified hazardous (for info see Gas Classification Drawing). Use explosion-proof equipment and tools when working on the fuel skids.

When using an air jet, do not direct it towards other people. The improper use of an air jet can cause bodily injury.

Provided it is possible, stay away from pressure lines and fittings during start-up of equipment.

Always keep in mind that wet surfaces may be slippery, especially when walking on the oil tank. Eliminate any fuel or oil leaks as soon as possible.

**Before working with electrical or pneumatic equipment, the electrical power or air supply must be shut off in order to prevent an unexpected start-up. The switch or the shut off valve must be tagged with “WORK IN PROGRESS – DO NOT START”.**

**Make sure that all turbine and exhaust duct inspection covers/plugs are closed before start-up. Avoid breathing possible leaking exhaust gas.**

**Check for zero system pressure before disconnecting pipes/opening system components.**

**Before manual barring of compressor rotor, the starter motor supply must be switched off and tagged with “WORK IN PROGRESS – DO NOT START”.**

**Make sure that the function of the system/components not have been changed after the maintenance has been carried out.**

## HANDLING OF LIQUIDS



### Warning!

**Use adequate personal protection when working with liquids such as liquid fuel, lubricating oil, fuel additives, cleaning agents etc. The manufacturers/suppliers should be contacted for safety data. In case of leakage, clean up in order to prevent slip and fall accidents. Avoid breathing possible oil/solvent vapours.**

**Contact and/or inhalation of cleaning agents, liquid fuel and fuel additives and oil products can cause health hazards, such as skin irritation, allergy and breathing difficulties.**

## GAS FUEL SYSTEM RISKS



**Warning!** Gas leakage can occur and cause breathing difficulties, explosions and fire.

Gas leakage can cause an explosion in combination with static electricity. Therefore, the gas pipes are earthed.

Gas leakage in combination with smoking or any flame/spark producing device, such as welding equipment can cause explosions. Therefore such devices should never be used when the gas fuel system is in operation.

## HOT SECTIONS



**Warning!** Contact with sections of the gas turbine without thermal insulation may cause burns.

Contact with exhaust channels without thermal insulation may cause burn injuries.

Possible leakage of hot gases may cause burn injuries.

## ROTATING PARTS



**Warning!** Stay clear of rotating shafts and couplings while they are running or not blocked for start-up. Negligence may lead to severe injury.

Before entering the air inlet plenum to inspect the compressor inlet or to clean up water that possibly is left after the washing, inform the GT control room personnel about the activity to be performed. Never put your hands in the compressor inlet unless the start motor's main breaker is switched off and locked in off-position. Not obeying this warning may lead to severe injuries.

Before leaving the plenum make sure that no tools, rags or dirt etc. is left as it can cause severe damages to the compressor.

## ELECTRICAL EQUIPMENT



**Warning!** Working with electrical equipment must only be performed by qualified personnel under the supervision of the authorised person responsible for electrical safety on the plant.

Before working on electrical equipment, always isolate the circuit by opening the appropriate breaker. Short circuit and ground where appropriate. Attach a temporary tag "WORK IN PROGRESS – DO NOT START" to the appropriate breaker, to warn against inadvertent energising of the circuit.

To prevent receiving an electrical shock when performing electrical tests, do not touch electrical components.

## 5.4 Leaving the enclosure



### **Warning!**

**When leaving the enclosure, inform the operating personnel and reactivate the CO<sub>2</sub>-equipment.**

## 6 Maintenance Cautions

### 6.1 General

**Caution!** Do not allow equipment to be rotated in reverse from normal rotation. Reverse rotation can cause serious damage.

**Caution!** Cap all open lines and fittings during maintenance, to prevent entry of contaminants into the system. Do not use tape

**Caution!** Make sure that no caps are left at reassembling

**Caution!** Do not flex cables and hoses unnecessarily. Repeated or excessive flexing will contribute to early failure. Flexible steel hoses are sensitive to excessive flexing and must be handled carefully.

### 6.2 Working in the control module

**Caution!** Switch off the mobile phone before entering the control module. Can cause disturbance on the control system and shutdowns.

### 6.3 Working in the enclosure

**Caution!** Switch off the mobile phone before entering the enclosure. Can cause disturbance on the control system and shutdowns.

## 6.4 Electrical and control equipment

**Caution!** Ensure that you always discharge yourself before touching electronics containing ESD-electrostatic discharge sensitive components.

**Caution!** When the AC400 has been restarted, the remaining controllers of the control network must be restarted to ensure proper function of alarm updating.

□ REVISION

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