

Operating 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 *Operation Instruction* to be considered, but are only concerned 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.

Note! 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 operation and maintenance personnel is labelled as a note. The definition of and the way notes are presented is given below.

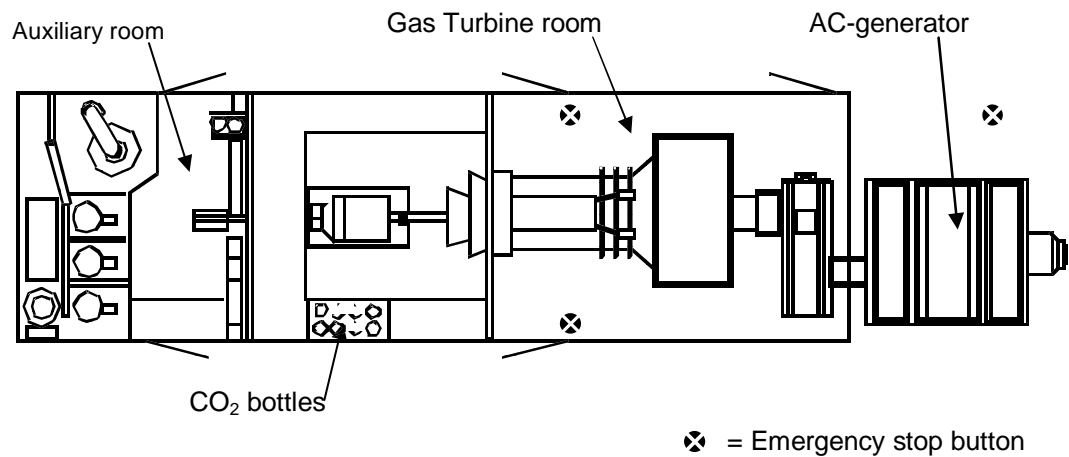
Note! Note provides you with additional and useful information. Although less urgent than cautions and warnings, notes are important and shall not be ignored.

2 Emergency Stop Buttons

Caution! 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. Emergency stop buttons are located at the turbine/generator control panels.



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3 Fire Extinguishing Equipment



Warning! Never press the CO₂ release buttons unless fire is detected and there are no people inside the enclosure.

3.1 General

Normally the CO₂-equipment should be active, which means that if a fire is detected by IR or Heat sensors, CO₂ is automatically released 30 seconds after fire alarm. It is also possible to release and block the CO₂-equipment manually as described below.

3.2 Release buttons

The CO₂ release buttons are used to manually activate the release of CO₂ into the gas turbine room. The CO₂ is released 30 seconds after a button is pressed. The buttons are located immediately outside each entry door of the protected room(s).

3.3 Mechanical release

CO₂ can also be manually released by pulling the handle at the pilot bottle (at the bottle set). It will initiate CO₂ release after 30 seconds delay.

3.4 Blocking equipment

When working in the enclosure the CO₂ equipment shall always be blocked to prevent CO₂ release. If CO₂ is inhaled, there is a very high risk of choking, which in worst cases can lead to death.

The blocking of the CO₂ equipment is done by closing the blocking device at the bottle set (initiates both pneumatic and electrical blocking of CO₂ release).

3.5 Fire warning signals

RED WARNING LIGHTS



Warning! DO NOT ENTER the enclosure when the RED warning lights are activated (CO₂ is released). This means danger to life. Make sure that all CO₂ is vented out after a CO₂ release.

Before entering the enclosure, open the shut-off dampers, restart the ventilation, acknowledge the alarm and block the CO₂ equipment. Wait at least 3 minutes before entering the enclosure after starting the ventilation system.

Note! CO₂ is heavier than air and may remain in lower areas.

GREEN LIGHTS



Warning! Before entering the enclosure, inform operator personnel and block the CO₂-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 CO₂ 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 when gas 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. If this happens, 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 (SIT) 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 Operational Warnings

5.1 General



Warning!

Follow the instructions given in the operation instruction while operating the Gas Turbine.

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

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”**.

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.

Programming is only allowed by personnel authorised by SIT. It is recommended that SIT should be consulted before any changes in the control program.

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

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.

Manual synchronising should only be carried out by authorised personnel. The utmost care must be taken to prevent out-of-phase synchronisation.

If there is a start failure when using liquid fuel, the combustion chamber casing and the exhaust gas casing must be drained before a new start attempt is made.

5.3 Working in the enclosure

ENTERING THE ENCLOSURE



Warning!

Always wear eye protection, hard hat and when the GT is in operation: ear plugs – be aware of the risk of misunderstanding due to high sounds 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 special precautions 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 has to 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 information 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 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 the air supply must be cut off in order to prevent 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.

HANDLING OF LIQUIDS



Warning!

Use adequate personal protection when working with liquids such as oil 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 can involve health hazards, such as irritated skin irritation and/or breathing difficulties.

Contact with oil products can cause allergy and/or skin irritation.

GAS FUEL SYSTEM RISKS



Warning!

Gas leakage can cause breathing difficulties, explosions and fire.

Gas leakage can cause an explosion in combination with static electricity. The gas pipes are therefore 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.

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.



Warning! It shall be clear that after a manual stop of any motor in the GT plant, the motor will restart automatically when the stop order is removed, following the automatic control and sequencing logic of the GT-control system. A manual stop can for example on the certain circumstances be initiated from the controller itself, on the Direct Online Starter (D.O.L.) starter or frequency converter of the Motor Control Center (MCC) system, or on the external safety breaker (option Note!) close to the motor.

Note! Safety breaker close to the motor is an option only available on a specific market. For safe work on a motor, use padlock device or remove the motor group in the Motor Control Center (MCC)"

5.4 Leaving the enclosure



Warning! When leaving the enclosure, inform the operating personnel and reactivate the CO₂-equipment.

6 Operational Cautions

6.1 Working in the control module

- Caution!** Watch the operator station start-up page for normal development of parameters and sequences and during start-up.
- Caution!** Prevent foreign matters and/or ice from entering the air inlet. Ingestion of solid matter will cause severe damage.
- Caution!** Before operating equipment, ensure that temporary covers are removed from air inlet, exhaust and vents. Ensure that these openings remain uncovered during operation.
- Caution!** Before start-up, make sure that all inspection openings are closed and that all equipment are in position for start up.
- Caution!** Switch off the mobile phone before entering the control module. Can cause disturbance on the control system and shutdowns.

6.2 Working in the enclosure

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

6.3 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.

6.4 Ventilation failure

When there is ventilation failure in the gas turbine enclosure, the unit will trip and the temperature will rise to above 60°C. Temporary ventilation is recommended by opening the enclosure doors. Block the CO₂-system and arrange for manual fire supervision.

REVISION

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