

SYSTEM DESCRIPTION FIRE DETECTION AND EXTINGUISHING SYSTEM, SGJ	Respons. dept GPMA	Date 2004-02-06	Reg. M DB 101
	Prepared Olaf Külbel		Yamama Cement

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Purpose of the system

The fire extinguishing system is designed for automatic detection and extinguishing of fire in the gas turbine enclosure and in the auxiliary room in order to limit damage.

That is:

- To automatically detect a fire in the gas turbine enclosure and auxiliary room.
- To automatically extinguish a fire when the detection system gives a signal.
- To automatically extinguish a fire when the system is manually released.

General description of the system

Refer to P&ID 2046 036

When the detection system detects a fire, a signal is sent from the central fire alarm unit to the extinguishing system. When the electrical actuator on the pilot bottle valve receives the signal, the valve will open and release the CO₂ pilot bottle. The pressure of the pilot bottle will activate a CO₂ pressure controlled time-delay unit. This unit will delay the discharge from the pilot bottle 30 seconds before it releases the main CO₂-bottles.

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Main components

An electric actuator opens the pilot bottle valve, SGJ10AA001-Y01. After activation, the pressure from the opened CO₂ bottle activates the timer delay unit, which after 30 seconds releases the remaining bottles. Each valve is equipped with a rupture disc for protection against too high bottle pressure.

It is possible to manually release CO₂ locally on the pilot cylinders.

- Cylinder valves

- SGJ10AA001
- SGJ10AA005
- SGJ10AA010
- SGJ10AA015
- SGJ10AA020
- SGJ10AA025
- SGJ10AA505
- SGJ10AA510

- Blocking device

- SGJ10AA004

The device makes it possible to manually block discharge of CO₂ into the protected room. The device has a limit switch for monitoring the block position, SGJ10AA004-S11. Blocking initiates an alarm, in the central fire alarm unit and on the status panels outside each normal entrance door, indicating that the system is blocked. This alarm is sent to the gas turbine control system. When the blocking device is closed the automatic release of the CO₂ is mechanically and electrically inhibited.

NOTE! For personnel safety reasons the blocking device must be closed before anyone enters the room, since the CO₂ is a suffocating gas.

- Retarding device

- SGJ10AA003
- SGJ10CG015

For personnel safety reasons the retarding device timer delays the release of CO₂ for 30 seconds after pilot bottle release.

The limit switch monitors the retarding device and gives a signal, if the retarding device has been released.

- Release cylinder

- SGJ10AA003-MS02

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The release cylinder is used for discharge of the CO₂ at the same time as the first row of CO₂ bottles.

- Check valves
SGJ10AA006
SGJ10AA011
SGJ10AA016
SGJ10AA021
SGJ10AA026
SGJ10AA506
SGJ10AA511

The check valves isolate the CO₂ bottles from each other preventing CO₂ to enter a possibly empty bottle.

- Test connections
SGJ10AA301

The test connection is used to test the pneumatic sirens and the mechanical release equipment.

- CO₂ Pilot bottle
SGJ10BB001

The pilot bottle is placed in the same rack as the CO₂ bottles.

- CO₂ bottles
SGJ10BB005
SGJ10BB010
SGJ10BB015
SGJ10BB020
SGJ10BB025
SGJ10BB505
SGJ10BB510

The CO₂ bottles are placed in a separate rack outside the gas turbine enclosure. Each bottle is of standard size (67 l) and filled with 45 kg CO₂.

- Monitoring CO₂ loss
SGJ10CG005
SGJ10CG010

Gives alarm if CO₂-level in any CO₂ bottle is under 90 %.

- Nozzles
SGJ10BP005
SGJ10BP010

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SGJ10BP015
SGJ10BP020
SGJ10BP505
SGJ10BP510

The nozzles are designed to effectively mix the CO₂ with the surrounding air in the protected room. The location and number of nozzles is selected in order to give an even CO₂ concentration in the room.

- Central fire alarm unit

There are one central fire alarm unit installed in the control room.

The central fire alarm unit controls the CO₂ release. It also provides information on the current status of the fire extinguishing system. The information is for example:

- Fire Warning
- Fire (alarm) Trip
- CO₂ released
- Fire system blocked
- Fire EQ fault
- Shut off damp OP GG or GEN

This information is also sent to the GT control system.

- Heat detectors

SGJ10CT005
SGJ10CT010
SGJ10CT015
SGJ10CT020

SGJ10CT515
SGJ10CT520

Four heat detectors are installed in the gas turbine enclosure and two heat detectors are installed in the auxiliary room and connected to the central fire alarm unit.

When a heat detector is activated, at a pre set temperature, a fire warning is issued.

Indication from two heat detectors or one in combination with a flame detector in either room gives release of CO₂ into the protected rooms. The heat detectors will only give fire warnings in the event of ventilation failure.

- Flame detectors

SGJ10CQ005
SGJ10CQ010
SGJ10CQ015
SGJ10CQ020

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<p>SGJ10CQ530</p> <p>Four flame detectors are installed in the gas turbine enclosure and one flame detector is installed in the auxiliary room and connected to the central fire alarm unit. The flame detectors sense the infra red radiation from flames. When one flame detector is activated fire warning is initiated. If at least two flame detectors or one flame detector and one heat detector are activated, fire alarm is issued and the CO₂ is released in the gas turbine enclosure and auxiliary room.</p> <ul style="list-style-type: none"> • Pressure switch SGJ10CP005 <p>The pressure switch senses the pressure in the manifold and gives a signal to the central fire alarm unit that the CO₂ has been released.</p> <ul style="list-style-type: none"> • Warning light flashing red (Fire warning) SGJ10EG010 SGJ10EG015 <p>Two flashing red warning lights, installed outdoors alongside the gas turbine enclosure, will flash when any detector is activated.</p> <ul style="list-style-type: none"> • Status lights steady green (CO₂ blocked) SGJ10EG001-H01 SGJ10EG002-H01 SGJ10EG003-H01 SGJ10EG504-H01 <p>Steady green status light, installed outside each normal entrance door to the protected room, will be activated when the system is blocked with the blocking device.</p> <ul style="list-style-type: none"> • Status lights steady red (Fire alarm) SGJ10EG001-H02 SGJ10EG002-H02 SGJ10EG003-H02 SGJ10EG504-H02 <p>Steady red status lights, installed outside each normal entrance door to the protected room, will be activated when the CO₂ is released.</p> <ul style="list-style-type: none"> • Sirens (electrical) SGJ10EJ005 SGJ10EJ505 <p>One siren is located inside each protected room. They will be activated at fire alarm.</p>				
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- Siren (mechanical)
SGJ10EJ010
SGJ10EJ510

One CO₂ driven siren, installed inside each protected room, will be activated when the CO₂ battery has been released and the delay unit is activated. The sound from this siren is different than the sound from the electrical sirens.

- Manual release push buttons
SGJ10EA001
SGJ10EA002
SGJ10EA003
SGJ10EA504

A push button, with a protective cover, for manual release of CO₂ is installed outside each entrance door to the protected rooms.

- Electrical heater
SGJ10AH005

An electrical heater installed in the accommodation for the CO₂ bottles.
The heater is dimensioned to heat the volume from min. surrounding temperature to at least +5 °C.

- Fan, CO₂ bottles
SGJ10AN005

A thermostat controlled fan installed in the accommodation for the CO₂ bottles.
The fan is dimensioned to cool down the volume from ambient temperature to less than +55 °C.

- Shut off dampers
SAG10AB005
SAG10AB010
SAG10AB020

- SAA10AB005
SAA10AB010

A shut off damper in each ventilation duct is closed, if the fire extinguishing system is activated, in order to maintain the CO₂ concentration in the protected room. The shut off damper closes using spring force by deactivation of a solenoid valve.
Shuts off dampers are part of the ventilation system description.

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Function

The system is fully automatic and always in operation, except when blocked for personal safety reasons.

In case that

- One heat detector
- or
- One flame detector

is activated the following shall happen:

- Indication (Fire warning) to the control and supervision system.
- Two red warning lights will flash outside the protected room.
- Fire warning will be indicated on the central fire alarm unit.

In case that

- One manual release push button
- or
- Two heat detectors (only fire warning in case of ventilation failure).
- or
- Two flame detectors
- or
- One flame detector and one heat detector (only fire warning in case of ventilation failure).

is activated the following shall happen, in addition to Fire warning:

- Fire (alarm) Trip will be indicated on the central fire alarm unit
- Fire alarm is issued from the central fire alarm unit to the GT control system
- Fire alarm is hardwired from the central fire alarm unit to the GT trip relays
- All shut off dampers are closed by the central fire alarm unit
- Activation of the CO₂ release, i.e.
- An electric actuator opens the pilot bottle valve
- A pneumatic (mechanical) siren will sound inside the protected rooms.
- An electrical siren will sound inside the protected rooms.
- The retarding device starts running
- The timer will after a 30 s time delay open the remaining bottle valves
- CO₂ is discharged via nozzles into the protected rooms

Start up

The system shall be in operation prior to gas turbine start up.

Continuous operation

The system shall be in operation during gas turbine operation.

In case of fire alarm the following happens simultaneously (in addition to actions described under Function).

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- The gas turbine is tripped, thereby closing the fuel shut off valves
- The fuel fire valve is closed isolating the internal fuel system
- The ventilation is stopped
- The shut off dampers are closed
- Gas fuel ventilation valves are opened

Shut down

The system shall be in operation during gas turbine stop.

Stand still

The system shall be in operation during gas turbine stand still.

Empty bottles should normally be replaced during stand still and always with the fire detection and extinguishing system blocked.

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Disturbances

Gas turbine trip

A gas turbine trip does not affect the system.

Generator breaker trip

A generator circuit breaker trip does not affect the system.

Loss of power supply

The complete system has a power backup, for at least 24 hours, in order to operate correctly during main power interruption.

System faults

Detector or bottle faults can result in inadequate CO₂ release. Detector fault results in an alarm on the central fire alarm unit. Fire extinguishing system door indication fault results in an interlock and alarm.

Other faults

Fault in connecting systems:

Shut off damper fault will limit the fire extinguishing system function. The consequence may be that a fire is not extinguished. See also ventilation system description.

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Technical specification

Dimensioning data

All electrical fire extinguishing equipment inside the Gas Generator room is explosion proof for use in hazardous area zone 1.

Piping system, nozzles, release velocity and volume concentrations are designed according to NFPA 12 with exceptions (SBF 110, Swedish code) and accepted practice.

The room sizes are according to drawing 2035 658 Rev.0.

Engineering data

Ambient data

Inside gas turbine room:	Max. temp.	150 °C
	Min. temp.	-5 °C
	At floor level	75 °C

At CO ₂ -cylinders:	Max. temp.	55 °C
	Min. temp.	5 °C

Inside aux. room:	Max. temp.	65 °C
	Min. temp.	-5 °C

Outside the protected room:	Max. temp.	55 °C
	Min. temp.	-5 °C

Emergency power supply

The complete system has a power backup, for at least 24 hours, in order to operate correctly during main power interruption.

The central fire alarm unit is equipped with a separate 24 VDC battery and a battery charger.

Installation

The detectors, CO₂-nozzles, one electrical siren, one mechanical siren are located inside the gas turbine enclosure. There are also detectors, CO₂-nozzles, one electrical siren and one mechanical siren located inside the auxiliary room. All other equipment is located outside the protected rooms.

The central fire alarm unit is installed in the control room.

Materials

Piping is made of galvanised steel.

Nozzles are made of brass.

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Component data

See the system lists.

Testing and service

Testing during normal operation

No function test, except for CO₂ bottle contents control, is possible during normal operation.

Accessibility during normal operation

All components in the fire detection and extinguishing system are accessible for visual inspection during normal operation.

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