

SYSTEM DESCRIPTION MBQ IGNITION GAS SYSTEM	Respons. dept GPMA	Date 031204	Reg. MDB 101
	Prepared Anders Samuelsson		Yamama Cement

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PURPOSE OF THE SYSTEM

The purpose of the system is to supply the ignition gas burner with the right amount of gas and air so the main flame can be ignited.

The purpose of the system is also to supply burner no. 6 with gas during ignition on liquid fuel of the gas turbine.

GENERAL DESCRIPTION OF THE SYSTEM

P&I diagram number 2046027.

Gas for the ignition gas unit is supplied from four gas bottles.

The gas then flows through a pressure reducing valve, two shut off valves, one flow control valve and an orifice into the ignition burner. Instrument air enters the system from an external supply system and flows through one manual shut off valve, a pressure reducing valve, a flow control valve and two shut off valves to supply the ignition burner with air.

Burner No. 6 is supplied with gas that flows from the ignition gas bottles, through one manual shut-off valve/control valve, two automatic shut-off valves and into burner no. 6.

MAIN COMPONENTS

Gas bottle

MBQ10BB005, MBQ10BB010, MBQ10BB015 & MBQ10BB020

The gas bottles are used to store the propane gas for the ignition gas system. Two of the four bottles are used to supply the ignition gas system with propane gas at the same time while the other two are stand-by. Two bottles are enough for around 30 starting attempts.

Pressure reducing valve (membrane valve)

MBQ10AA005, MBQ10AA010, MBQ10AA015 & MBQ10AA020

The pressure reducing valves is used to reduce the pressure of the propane gas to a pre-set value. The valves are also included to avoid condensation of the gas downstream the gas bottles since the ambient temperature controls the vaporisation pressure of the gas. The chance for condensation is then minimised if the actual pressure downstream the valves, is lower than the pressure in the bottles when the ambient temperature is falling.

Three way valve (ball valve)

MBQ10AA025

The three-way valve is used to set which gas bottles the propane gas comes from, either MBQ10BB005 and MBQ10BB010 or MBQ10BB015 and MBQ10BB020.

Heater

MBQ10AH010

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The heater in the gas bottle cabinet keeps the ambient temperature at a minimum temperature to maintain the vaporisation capacity of the propane gas.

Electrical heat-tracing and insulation
MBQ10AH005

The piping and components in contact with the natural gas are insulated and heat-traced to prevent temperature losses and condensation of natural gas in the gas fuel system.

Pressure reducing valve (membrane valve)
MBQ10AA035

The pressure-reducing valve is a membrane type and reduces the pressure of the gas to a pre-set value. The valve has a by-pass security connection that ventilates out gas from the system if one of the membranes inside the valve breaks.

Bypass valve (ball valve)
MBQ10AA210

The bypass valve is a ball type valve that is used for de-pressurising the system by removing trapped gas between the bottles and the ignition gas unit.

Pressure gauge
MBQ10CP005

The pressure gauge shows the pressure in the gas part of the ignition gas system downstream the pressure reducer MBQ10AA035. The indicator is used to set the pressure of MBQ10AA035 pressure reducing valve at the first start-up of the system. After tuning of the system for the first time this pressure is not needed other than trouble-shooting of the system.

Three-way valve (Spring closing type)
MBQ10AA040

The three-way valve is used as a shut-off valve to shutting of the fuel supply to the ignition burner. The shut off valve consists of a ball valve and a pneumatic actuator, which is connected to the solenoid valve MBQ10AA450. Closed position is when the upstream port is closed and no gas flows to the ignition burner. Gas between MBQ10AA040 and MBQ10AA045 is then ventilated out in the ventilation pipe. Open position is when the ventilation path is closed and the gas flows to the ignition burner. The valve is of a spring closing type and if the closing order or the operating air for any reason disappears, the valve returns to its position where the gas is ventilated out in the ventilation pipe. The valve is operated automatically.

Shut-off valve (Spring closing type)
MBQ10AA045

The shut off valve is used for shutting of the fuel supply to the ignition burner. The shut off valve consists of a ball valve and a pneumatic actuator, which is connected to the solenoid valve MBQ10AA450. The valve is of a spring closing type and if the closing order or the operating air for any reason disappears the valve returns to its closed position. The valve is operated automatically.

Solenoid valve
MBQ10AA450

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The solenoid valve is pneumatic and used for operating the shut off valves MBQ10AA040 and MBQ10AA045.

Check valve
MBQ10AA215

The safety valve is of a poppet design and secures that no ventilated gas from the gas fuel system enters the ventilation pipes in the ignition system.

Control valve
MBQ10AA050

The purpose of the valve is to control the flow of gas to the ignition gas burner. The control valve is a needle type valve that is operated manually.

Pressure gauge
MBQ10CP010

The pressure gauge shows the pressure in the gas part of the ignition gas system downstream the needle valve MBQ10AA050. It is used during initial start-up of the gas turbine and trouble shooting of the system.

Orifice
MBQ10BP005

The orifice is used to create a constant pressure to the ignition gas burner. The orifice is used to create turbulent flow of the ignition gas. The critical flow through the orifice results in a constant flow of ignition gas to the ignition gas burner independent of the pressure in the combustion chamber. The ignition gas flow is then constant as long as the pressure upstream of the orifice is constant.

Shut off valve (Ball valve)
MBQ10AA405

The shut off valve is used to isolating the system when repair should be done to the downstream components. The valve is a ball type valve and is operated manually.

Pressure regulating valve
MBQ10AA410

The pressure-regulating valve regulates the pressure of the instrument air to a pre-set value. The valve is a piston-type pressure -regulating valve.

Control valve
MBQ10AA415

The control valve is used to control the air-flow to the ignition gas burner. The control valve is a needle type valve that is operated manually.

Pressure gauge
MBQ10CP405

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The pressure gauge shows the pressure in the air part of the ignition gas system downstream the pressure reducer MBQ10AA410. The indicator is used to set the pressure of MBQ10AA410, pressure reducing valve at the first start-up of the system. After tuning of the system for the first time this pressure is not needed other than trouble-shooting of the system.

Three-way valve (Spring closing type)
MBQ10AA420

The three way valve is used as a shut-off valve to shutting of the air supply to the ignition burner. The shut off valve consists of a ball valve and a pneumatic actuator, which is connected to the solenoid valve MBQ10AA430. Closed position is when the upstream port is closed and no air flows to the ignition burner. Air between MBQ10AA420 and MBQ10AA425 is then ventilated out in the ventilation pipe. Open position is when the ventilation path is closed and the air flows to the ignition burner. The valve is of a spring closing type and if the closing order or the operating air for any reason disappears the valve returns to its position where the air is ventilated out in the ventilation pipe. The valve is operated automatically.

Shut-off valve (Spring closing type)
MBQ10AA425

The shut off valve is used for shutting of the air supply to the ignition burner. The shut off valve consists of a ball valve and a pneumatic actuator, which is connected to the solenoid valve MBQ10AA430. The valve is of a spring closing type and if the closing order or the operating air for any reason disappears the valve returns to its closed position. The valve is operated automatically.

Solenoid valve
MBQ10AA430

The solenoid valve is pneumatic and used for operating the shut off valves MBQ10AA420 and MBQ10AA425.

Ventilation valve
MBQ20AA205

The bypass valve is a ball type valve that is used for de-pressurising the system by removing trapped gas between the gas bottles and the ignition gas unit. The valve can only be operated manually.

Shut off valve
MBQ20AA005

The shut off valve is used to isolate the ignition gas supply to burner no. 6 and to restrict the ignition gas flow to burner no. 6.

Pressure gauge
MBQ20CP005

The pressure gauge shows the pressure in the gas pipe to burner no. 6. The indicator is used to check that the system is not pressurised before opening any part of the system for maintenance and to check the pressure during ignition of the gas turbine.

Shut off valve
MBQ20AA010

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The shut off valve is used for shutting of the propane fuel supply to the burner no. 6. The shut off valve consists of a ball valve using a pneumatic actuator and a solenoid valve. The valve is of a spring closing type and if the closing order or the operating air for any reason disappears the valve returns to its closed position. There is one limit switch indicating closed position. The valve is operated automatically.

Safety valve

MBQ20AA210

The safety valve is to protect the components of the burner no. 6 connection from high pressures.

Shut off valve

MBQ20AA015

The shut off valve is used for shutting of the propane fuel supply to the burner no. 6. The shut off valve consists of a ball valve using a pneumatic actuator, which is connected to the solenoid valve. The valve is of a spring closing type and if the closing order or the operating air for any reason disappears the valve returns to its closed position. There is one limit switch indicating closed position. The valve is operated automatically.

Shut off valve

MBQ20AA020

The shut off valve is used to make sure that only burner no. 6 in the manifold gets propane gas and the other burners do not get any propane gas during the start up of the gas turbine. The shut off valve consists of a ball valve using a pneumatic actuator, which is connected to the solenoid valve. The valve is of a spring opening type and if the closing order or the operating air for any reason disappears the valve returns to its open position. There is one limit switch indicating closed position. The valve is operated automatically.

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FUNCTION

The operation of the ignition gas system is fully automatic.

Start up

The ignition gas system is only in operation during start-up of the gas turbine. The ignition gas system is automatically started by the gas turbine start sequence. There must be pressurised gas and instrument air in the system until the two shut-off valves MBQ10AA040 and MBQ10AA420 respectively to be able to start the gas turbine.

MBQ10AA040, MBQ10AA045 and MBQ10AA420, MBQ10AA425 open giving air and gas flows to the ignition gas burner. The spark plug is activated and the gas/air mixture ignites.

When starting on liquid fuel the shut-off valves MBQ20AA010 and MBQ20AA015 opens after that the ignition burner flame has been indicated and MBQ20AA020 is closed at the same time. Gas flows to burner no. 6 in the primary gas manifold and the ignition burner ignites burner no. 6. The main flame is then ignited by burner no. 6 in the primary gas manifold.

If starting on process gas the ignition gas burner ignites burner no. 6 in the same way as when starting on liquid fuel. Burner No. 6 in the primary gas manifold then ignites the main flame.

When some seconds has passed after that the flame detector indicated that the ignition burner is burning, MBQ10AA040, MBQ10AA045 and MBQ10AA420, MBQ10AA425 closes and ignition gas and air are shut off.

Continuous operation

The ignition gas system is not in operation. There is pressurised gas and instrument air in the system upstream the two shut-off valves MBQ10AA420, MBQ10AA040 and MBQ20AA010, respectively.

Turbine stop

The ignition gas system is not in operation. There is pressurised gas and instrument air in the system upstream the two shut-off valves MBQ10AA420, MBQ10AA040, and MBQ20AA010, respectively.

Stand still

The ignition gas system is not in operation. There is pressurised gas and instrument air in the system upstream the two shut-off valves MBQ10AA420, MBQ10AA040, and MBQ20AA010, respectively.

It is recommended to close the valves on the ignition gas bottles so no gas leaks out when the gas turbine is standing still for longer periods of time, i.e. more than 30 days.

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DISTURBANCES

Gas turbine trip

The system is only in operation during the start-up phase of the gas turbine. Gas turbine trip during normal operation does not affect the system. Gas turbine trip during the start-up phase of the gas turbine will terminate the start-up procedure and the two shut-off valves to the ignition gas burner will close.

The two shut-off valves to burner No. 6 will also close.

Generator breaker trip

The system is only in operation during the start-up phase of the gas turbine so generator breaker trip during normal operation will not affect the system. Generator breaker trip during the start-up phase of the gas turbine will terminate the start-up procedure and the two shut-off valves to the ignition gas burner will close. The two shut-off valves to burner No. 6 will also close.

Loss of power supply

Loss of gas turbine power supply does not directly affect the system, since power supply to the solenoids is taken from UPS.

System faults

The faults that are supervised by alarms and/or shutdown procedures are listed in the alarm and trip document in the plant operation documentation.

Other faults

- Fault in connecting systems:

Too low gas pressure in the ignition gas bottles will result in failure to start the gas turbine.
Not enough gas in the ignition gas bottles will result in too little flow of gas to the ignition gas burner and failure to start the gas turbine.

- Instrument air system

Reduced instrument air pressure will result in malfunction of the following objects.

- | | |
|-------------------------|--|
| MBQ10AA040 & MBQ10AA045 | (Unpressurised position=closed position) |
| MBQ10AA420 & MBQ10AA425 | (Unpressurised position=closed position) |
| MBQ20AA010 & MBQ20AA015 | (Unpressurised position=closed position) |
| MBQ20AA020 | (Unpressurised position=open position) |

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TECHNICAL SPECIFICATION

Design criteria and standards

Propane is the gaseous fuel according to the fuel bought at the site and instrument air.

Dimensioning data

Fuel gas flow required 0,0012 kg/s (2,1 Nm³/h) for ignition gas burner and 0,005 kg/s (8,9 Nm³/h) for burner no. 6.

Air flow 30 Nm³/h.

Engineering data

Ignition gas line: Design pressure: 15 bar(g)
 Design temperature: -15°C to +70 °C

Instrument air line: Design pressure: 10/15 bar(g)
 Design temperature: -15°C to +70 °C

Emergency power supply

The solenoids operating the shut-off valves are powered from the 24 VDC system. The 24 VDC system is powered from the 230 VAC system.

Installation

The ignition gas unit is installed in the frame under the gas turbine. The ignition gas and the instrument air flows in two separate pipes to the ignition burner.

The ignition gas bottles are installed in a cabinet at the side of the gas turbines enclosure building.

Materials

All parts in contact with the ignition gas are made of stainless steel.

Component data

See the system lists.

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TESTING AND SERVICE

Testing during normal operation

No functional test is possible during start-up and normal operation of the gas turbine.

Accessibility during normal operation

Valves and instruments upstream of MBQ10AA040 and MBQ10AA420, MBQ20AA010 are available for maintenance during normal operation of the gas turbine.

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