

SYSTEM DESCRIPTION MBH20 PURGE AIR SYSTEM	Respons. dept GPMA	Date 04-02-05	Reg. MDB 101
	Prepared A.Samuelsson		Yamama Cement

Table of Contents

TABLE OF CONTENTS	1
PURPOSE OF THE SYSTEM	2
GENERAL DESCRIPTION OF THE SYSTEM	2
MAIN COMPONENTS	2
<i>Start up</i>	4
<i>Continuous operation</i>	4
<i>Turbine stop</i>	4
<i>Stand still</i>	5
DISTURBANCES	5
<i>Gas turbine trip</i>	5
<i>Generator breaker trip</i>	5
<i>Loss of power supply</i>	5
<i>System faults</i>	5
<i>Other faults</i>	6
TECHNICAL SPECIFICATION	6
<i>Design criteria and standards</i>	6
<i>Dimensioning data</i>	6
<i>Engineering data</i>	6
<i>Emergency power supply</i>	6
<i>Installation</i>	7
<i>Materials</i>	7
<i>Component data</i>	7
TESTING AND SERVICE	7
<i>Testing during normal operation</i>	7
<i>Accessibility during normal operation</i>	7

Approved 2004-02-05 Henrik Örn	Latest revision -	Archive	HG 9100
Checked 2004-02-05 Roger Jonsson		No. 1CS39429	

This document is issued in Pulse.

we reserve all rights in this document and in the information contained therein. Reproduction, use or disclosure to third Parties without express authority is strictly forbidden.
© Demag Delaval Industrial Turbomachinery AB

A 087 0474-B 00-03 MS Word 97

SYSTEM DESCRIPTION MBH20 PURGE AIR SYSTEM	Respons. dept	Date	Reg.
	GPMA	04-02-05	MDB 101
Prepared		Yamama Cement	
A.Samuelsson			

Purpose of the system

The purpose of the purge air system is to purge the gas fuel nozzles with air during turbine operation on liquid fuel in order to cool the nozzles, to prevent carbonisation in the nozzles and to prevent circulation of hot combustion gases.

General description of the system

Refer to P&ID 2046 021.

Air from the gas turbine compressor discharge flows through a cooler, a filter and shut-off valves before flowing to the gas fuel nozzles. The air flow depends on the compressor discharge pressure and the pressure drop between compressor and combustion chamber.

Main components

- Pressure tap
MBH20CP005
The pressure tap makes it possible to measure the purge air pressure from the compressor.
- Pressure tap
MBH20CP006
The pressure tap makes it possible to measure the purge air pressure upstream the cooler.
- Purge air cooler
MBH10AC005
The purge air cooler are combined with the seal air cooler (see System description MBH10 cooling and sealing air system).
- Orifice
MBH20BP205
The purpose of the orifice is to restrict the air flow in the drain from the purge air cooler.
- Pressure tap
MBH20CP007
The pressure tap makes it possible to measure the purge air pressure downstream the cooler.
- Pressure tap
MBH20CP010
The pressure tap makes it possible to measure the purge air pressure upstream the filter.

Approved 2004-02-05 Henrik Orn	Latest revision -	Archive	HG 9100
Checked 2004-02-05 Roger Jonsson		No. 1CS39429	

This document is issued in Pulse.

we reserve all rights in this document and in the information contained therein. Reproduction, use or disclosure to third Parties without express authority is strictly forbidden.
© Demag Delaval Industrial Turbomachinery AB

A 087 0474-B 00-03 MS Word 97

SYSTEM DESCRIPTION MBH20 PURGE AIR SYSTEM	Respons. dept GPMA	Date 04-02-05	Reg. MDB 101
	Prepared A.Samuelsson		Yamama Cement

This document is issued in Pulse.

- **Strainer**
MBH20AT005
This is a metal filter which protects the nozzles from particles. Cleaning of filter element can not be done during operation.
The filter is only used to protect the burners in case of particles coming from the cooler or the compressor.
- **Orifice**
MBH20BP230
The purpose of the orifice is to restrict the air flow in the drain from the purge air unit.
- **Temperature transmitter**
MBH20CT005
Purge air temperature downstream the cooler is continuously measured.
The temperature transmitter monitors the purge air temperature to the nozzles and versus the design temperature.

High air temperature (H1) gives an alarm.
High air temperature (H2) initiates unloading turbine trip.
- **Pressure tap**
MBH20CP015
The pressure tap makes it possible to measure the purge air pressure downstream the filter.
- **Shut-off valve (spring closing type)**
MBH20AA010
The valve is used to shut off the purge air flow to the gas pilot and main fuel nozzles. It also isolates the purge air system from the gas fuel system. The shut-off valve consists of a ball valve using a pneumatic, actuator. The valve is of spring closing type. If the open order or instrument air for any reason disappears it will return to its safe closed position. During turbine operation, limit switches are monitoring valve position and give alarm when not opened or closed acc. to ordered position. The valve position interlocks starting when not closed before start on gas fuel.
The valve can only be operated in automatic mode.
- **Pressure tap**
MBH20CP025
The pressure tap makes it possible to measure the purge air pressure to the gas nozzles.
- **Shut-off valve (spring closing type)**
MBH20AA020
The valve is used to shut off the purge air flow to the gas main fuel nozzles. It also isolates the purge air system from the gas fuel system. The shut-off valve consists of a ball valve using a pneumatic, actuator. The valve is of spring closing type. If the open order or instrument air for any reason disappears it will return to its safe closed position. During turbine operation, limit switches are monitoring valve position and give alarm when not opened or closed acc. to ordered position. The valve position interlocks starting when not closed before start on gas fuel.

Approved 2004-02-05 Henrik Orn	Latest revision -	Archive	HG 9100
Checked 2004-02-05 Roger Jonsson		No. 1CS39429	

we reserve all rights in this document and in the information contained therein. Reproduction, use or disclosure to third Parties without express authority is strictly forbidden.
© Demag Delaval Industrial Turbomachinery AB

SYSTEM DESCRIPTION MBH20 PURGE AIR SYSTEM	Respons. dept GPMA	Date 04-02-05	Reg. MDB 101
	Prepared A.Samuelsson		Yamama Cement

The valve can only be operated in automatic mode.

- Shut-off valve (spring closing type)
MBH20AA015

The valve is used to shut off the purge air flow to the gas primary fuel nozzles. It also isolates the purge air system from the gas fuel system. The shut-off valve consists of a ball valve using a pneumatic, actuator. The valve is of spring closing type. If the open order or instrument air for any reason disappears it will return to its safe closed position. During turbine operation, limit switches are monitoring valve position and give alarm when not opened or closed acc. to ordered position. The valve position interlocks starting when not closed before start on gas fuel.

The valve can only be operated in automatic mode.

- Ventilation valve (spring opening type)
MBH20AA215

The valve is used to depressurise the pipe between MBH20AA010, MBH20AA020 and MBH20AA015 during turbine stand still. The shut-off valve consists of a ball valve using a pneumatic, actuator. The valve is of spring opening type. If the close order or instrument air for any reason disappears it will return to its safe open position. There is a limit switch indicating "closed" incorporated with the valve. The reason for having the limit switch is that if the valve is not closed during operation, the operating personnel will notice and take necessary actions.

The valve position interlocks starting when not closed before turbine start on gas fuel.

The valve can only be operated in automatic mode.

Start up

The purge air system is automatically started by the gas turbine start sequence.

Start of the purge air system includes following steps:

Turbine running on liquid fuel:

- The ventilation valve MBH20AA215 closes.
- The shut-off valves MBH20AA010, MBH20AA015 and MBH20AA020 open when turbine is operating on liquid fuel.

Turbine running on gas fuel:

- The ventilation valve MBH20AA215 opens.
- The shut-off valves MBH20AA010, MBH20AA015 and MBH20AA020 close when turbine is operating on liquid fuel.

Continuous operation

During continuous operation on liquid fuel the purge air flows through the gas fuel nozzles.

Turbine stop

During turbine stop the shut off valves close. The ventilation valve opens and trapped air/gas between the shut-off valves is ventilated to the atmosphere.

Approved 2004-02-05 Henrik Orn	Latest revision -	Archive	HG 9100
Checked 2004-02-05 Roger Jonsson		No. 1CS39429	

This document is issued in Pulse.

we reserve all rights in this document and in the information contained therein. Reproduction, use or disclosure to third Parties without express authority is strictly forbidden.
© Demag Delaval Industrial Turbomachinery AB

A 087 0474-B 00-03 MS Word 97

SYSTEM DESCRIPTION MBH20 PURGE AIR SYSTEM	Respons. dept	Date	Reg.
	GPMA	04-02-05	MDB 101
	Prepared		
	A.Samuelsson	Yamama Cement	

This document is issued in Pulse.

Stand still

After shut down the system is not in operation. The shut-off valves are closed. The ventilation valve is opened.

Disturbances

Gas turbine trip

N/A.

Generator breaker trip

N/A.

Loss of power supply

Loss of gas turbine power supply will not directly affect the system, since AC power supply to the solenoids is taken from the 24VDC system. The 24VDC system is powered from the 230VAC UPS system.

System faults

- Shut-off valves MBH20AA010, MBH20AA015 and MBH20AA020

If any of these valves sticks in closed position the system can not supply purge air to the gas fuel nozzles.

If the shut-off valves stick in open or partly open position when ordered to close, gas fuel will enter the system during turbine operation on gas fuel.

Any of the valves in wrong position will give an alarm and if the turbine is starting on gas fuel the start will be aborted.

Fuel change to gas will also be aborted/blocked.

- Ventilation valve MBH20AA215

If the ventilation valve sticks in open position during liquid fuel operation, purge air will be ventilated to the atmosphere instead of flowing to gas fuel nozzles.

If the ventilation valve sticks in open position during gas fuel operation, any gas fuel leakage through shut off valves MBH20AA015 and MBH20AA020 will be ventilated to the atmosphere.

If it sticks in closed position, the purge air pipe between MBH20AA010, MBH20AA015 and MBH20AA020 can not be depressurised during turbine stand still.

Ventilation valve in wrong position will give an alarm and if the turbine is starting then the start will be aborted.

Fuel change to liquid fuel or gas fuel will also be aborted/blocked.

Approved 2004-02-05 Henrik Orn	Latest revision -	Archive	HG 9100
Checked 2004-02-05 Roger Jonsson		No. 1CS39429	

This document is issued in Pulse.

we reserve all rights in this document and in the information contained therein. Reproduction, use or disclosure to third Parties without express authority is strictly forbidden.
© Demag Delaval Industrial Turbomachinery AB

A 087 0474-B 00-03 MS Word 97

SYSTEM DESCRIPTION MBH20 PURGE AIR SYSTEM	Respons. dept	Date	Reg.
	GPMA	04-02-05	MDB 101
	Prepared		
	A.Samuelsson	Yamama Cement	

- Purge air cooler
Malfunction of cooler may result in high or low purge air temperature to the nozzles. High temperature (H2) gives a trip.

Malfunction of tubes will result in purge air pressure drop.

- Pipes

External pipe leakage may cause increased temperature level in the gas turbine room.

A detailed list of alarm&trip conditions is included in the plant operation documentation.

Other faults

Fault in connecting systems:

- Instrument air system

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

Shut-off valves (Unpressurised position = closed position)

Ventilation valve (Unpressurised position = opened position)

Technical specification

Design criteria and standards

Gas fuel specification according to 1CS26586.

Ambient air.

Dimensioning data

Purge air flow, liquid fuel operation 0,45 kg/s

Engineering data

Design pressure for components

connected to gas system: 30 Bar(g)

Design pressure for components

connected to purge air system only: 16 Bar(g)

Design temperature downstream cooler: -15 to +150 °C

Design temperature upstream cooler: -15 to +400 °C

Emergency power supply

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

Approved 2004-02-05 Henrik Örn	Latest revision -	Archive	HG 9100
Checked 2004-02-05 Roger Jonsson		No. 1CS39429	

SYSTEM DESCRIPTION MBH20 PURGE AIR SYSTEM	Respons. dept	Date	Reg.
	GPMA	04-02-05	MDB 101
	Prepared		
	A.Samuelsson		Yamama Cement

This document is issued in Pulse.

Installation

The purge air unit is installed near the gas turbine. The purge air cooler is installed outside the gas turbine package.

Materials

Valves and piping are made of stainless steel.

The purge air cooler is made of stainless steel except the supporting frame, which is made of galvanised steel.

Component data

See the aggregate and instrument lists

Testing and service

Testing during normal operation

System pressures can be checked during operation.

Accessibility during normal operation

No objects in the system are available for maintenance during normal operation, except the stand-by cooler.

we reserve all rights in this document and in the information contained therein. Reproduction, use or disclosure to third Parties without express authority is strictly forbidden.
© Demag Delaval Industrial Turbomachinery AB

A 087 0474-B 00-03 MS Word 97

Approved 2004-02-05 Henrik Örn	Latest revision -	Archive	HG 9100
Checked 2004-02-05 Roger Jonsson		No. 1CS39429	

SYSTEM DESCRIPTION MBH20 PURGE AIR SYSTEM	Respons. dept	Date	Reg.
	GPMA	04-02-05	MDB 101
Prepared		Yamama Cement	
A.Samuelsson			

Index of components

M

MBH20AA010
Shut-off valve, 3
MBH20AA015
Shut-off valve, 4
MBH20AA020
Shut-off valve, 3
MBH20AA215
Shut-off valve, 4
MBH20AT005
Strainer, 3
MBH20BP205
Orifice, 2
MBH20BP230

Orifice, 3
MBH20CP005
Pressure tap, 2
MBH20CP006
Pressure tap, 2
MBH20CP007
Pressure tap, 2
MBH20CP010
Pressure tap, 2
MBH20CP015
Pressure tap, 3
MBH20CP025
Pressure tap, 3
MBH20CT005
Pressure transmitter, 3

This document is issued in Pulse.

We reserve all rights in this document and in the information contained therein. Reproduction, use or disclosure to third Parties without express authority is strictly forbidden.
© Demag Delaval Industrial Turbomachinery AB

A 087 0474-B 00-03 MS Word 97

Approved 2004-02-05 Henrik Örn	Latest revision -	Archive	HG 9100
Checked 2004-02-05 Roger Jonsson		No. 1CS39429	