

SYSTEM DESCRIPTION AIR INTAKE FILTER SYSTEM, MBL	Respons. dept GPMI	Date 2004-02-04	Reg. M DB 101
	Prepared Kent Öhman		Yamama Cement

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A 087 0474-B 00-03 MS Word 97

Approved 2004-02-05 Karin Brüning	Latest revision -	Archive	HG 9100
Checked 2004-02-05 Roger Jonsson		No. ICS 39 421	

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Purpose of the system

The air intake filter system is designed to supply the gas turbine with filtered air and to conduct the inlet air from the filter to the low-pressure compressor inlet plenum. Filtering is necessary in order to minimise erosion, corrosion and compressor fouling and to prevent objects from entering the compressor.

A silencer reduces the compressor inlet noise breakout to the environment to a specified level.

General description of the system

Refer to P&ID 2046 023.

Air enters the system from two sides through respective weather louver and one stage filter bank into the central part of the intake housing. Each combined filter bank is equipped with a number of pulse-cleaning modules.

Air to the pulse clean ejectors is taken from an instrument air system, passing a filter, a pressure-reducing valve and enters an air accumulator. Each is accumulating the air needed for one cleaning sequence on respective cleaning module.

The pulse cleaning sequence is activated on high differential pressure across the filter. Shut-off valves perform the pulsing, one per two filter cartridges.

The dust collected during pulse cleaning is removed from the filter housing by dust removal fans.

The silencer, with noise absorbing baffles, is a part of the air inlet duct. The silencer casing is internally insulated to avoid sound transmission. The baffles consist of square-formed rods of perforated sheet metal filled with mineral wool.

The system is designed to match local air quality and weather conditions.

Main components

- Plenum door switch
MBL30CG005
The switch will indicate if the plenum door is opened.
Open door will initiate an alarm and a start interlock.
- Humidity transmitter
MBL30CM005
The transmitter is monitoring the ambient humidity and is installed in the same housing as MBL30CT005. The ambient humidity is one of the conditions controlling the anti-icing system.
- Temperature transmitter
MBL30CT005
The Pt100 sensor is monitoring the ambient temperature and is installed in the same housing as MBL30CM005. The ambient temperature is one of the conditions controlling the anti-icing system.
- Shut-off valve
MBL20AA005
The valve may be used to isolate the system during maintenance.

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- **Pressure regulator/filter**
MBL20AA010
 The pressure regulator maintains the pressure in the system at 7 bar and the filter prevents particles from entering the jet-pulse pressure pipes.

- **Safety valve**
MBL20AA015
 The safety valve protect the system to overpressure

- **Air accumulators**
MBL21BB005
MBL22BB005
MBL23BB005
MBL24BB005

- **Diaphragm valves**
MBL21AA010
MBL22AA010
MBL23AA010
MBL24AA010
 Each diaphragm valve supplies air to two filter cartridges.
 One pulse of air from the nozzle into the blowpipe above each element set provides both a shock wave inside the filter cartridge and a momentary reverse flow.

- **Weather louver**
MBL21AT005
MBL22AT005
MBL23AT005
MBL24AT005
 The weather louver prevents objects and precipitation from entering the air intake.

- **Filter section**
MBL21AT010
MBL22AT010
MBL23AT010
MBL24AT010
 Each filter section consists of standard sized filter cartridges and prevents particles from entering the gas turbine.

- **Dust removal fans**
MBL21AN005
MBL22AN005
MBL23AN005
MBL24AN005
 The dust removal fans are operated during the cleaning phase, each fan removes the dust collected in its filter section during pulse cleaning

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- **Differential pressure switch**
MBL20CP005
 The differential pressure switch is measuring across the filter sections.
 High differential pressure (H1) starts the jet-pulse cleaning sequence.
 Low differential pressure (L1) stops the jet-pulse cleaning sequence.

- **Differential pressure transmitter**
MBL20CP015
 The differential pressure transmitter signal is used for monitoring of the differential pressure over the filters.
 High differential pressure (H1) initiates an alarm.
 High differential pressure (H2) initiates an unloading turbine trip.

- **Pulse clean filter control box**
MBL20GH005
 The control box contains logic, contactors for the dust removal fans and cleaning logic for the filter elements. Fault in the equipment initiates an alarm.

- **Silencer**
MBL30BS005
 The silencer, with noise absorbing baffles, is a part of the air inlet duct. The silencer casing is internally insulated to avoid sound transmission. The baffles consist of square-formed rods of perforated sheet metal filled with mineral wool.
 The silencer prevents noise breakout to the environment.

- **Differential pressure transmitter**
MBL30CP015
 The transmitter is monitoring the differential pressure between the compressor inlet and outside the GT enclosure.
 High differential pressure (L1) initiates an alarm.
 High differential pressure (L2) initiates a turbine trip.

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Function

The system is fully automatic.

Start up

Air flow through the inlet increases as the GT speed rises.

Continuous operation

The air is sucked through the intake by the low-pressure compressor.
Air flows through the pulse clean filter and through the silencer before it enters the LPC inlet.
The system is in operation and if a high differential pressure across the filter is measured, the pulse cleanair equipment starts cleaning the filter. Dust is removed from the filter sections by the fans.

Turbine stop

Airflow through the inlet decreases as the GT coasts down.

Stand still

The system is not affected by the turbine stand still.

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Disturbances

Gas turbine trip

N/A.

Loss of power supply

Loss of AC power supply stops the pulse cleaning function.

System faults

Faults on the fans or the control valve and the pressure-reducing valve of the pulse cleanair supply line, may cause clogged filter and gas turbine trip.

Other faults

Losses of air to the pulse clean ejectors, taken from an instrument air system, results in absent filter cleaning ability.

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Technical specification

Design criteria and standards

The execution comply primarily with the legal and official stipulated federal, provincial and municipal laws and corresponding acceptance codes.
 The filter house and silencer follows the latest edition of the applicable Codes and standards for construction, welding, material, insulation and testing.
 Electrical installation is generally according to IEC. See SIEMENS instruction 2414 410.
 The air accumulators for the pulse clean filter are designed to be excluded from the ASME pressure vessel codes (diameter less than 6").

Dimensioning data

Air flow at 15°C, ISO conditions 79,5 kg/s

Engineering data

- Static negative pressure -1500 Pa
- Pressure pulsation max. ±3000 Pa
- Noise level outside filter house According to gas turbine unit specification
- Filter system efficiency F9 or higher

Emergency power supply

N/A

Installation

The air intake system is installed on the top of the gas turbine enclosure and connected by a duct to the low pressure compressor plenum chamber.

Materials

- Air intake housing Painted carbon steel
- Filter cartridge frame Stainless steel/plastic
- Inlet channel Painted carbon steel
- Baffle plates Marine aluminium plate
- Plenum chamber external Painted carbon steel plate
- Plenum chamber internal Perforated stainless steel plate

Component data

See the system lists.

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Testing and service

Testing during normal operation

Check of the differential pressure trends and visual inspections of the filters for planning of filter maintenance shall be done regularly.

Accessibility during normal operation

Access for filter maintenance is through service doors in the air intake. Permanent service platforms are installed inside and outside the air intake, where necessary, for convenient access and handling of replacement filter inserts.

Maintenance work on the pre-filter can be carried out during plant operation.

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MBL20AA010 Pressure Regulator/Filter	3	Diaphragm Valve MBL23AN005	3
MBL20AA015 Safety valve	3	Dust Removal Fan MBL23AT005	3
MBL20CP005 Differential Pressure Switch	4	Weather Louver MBL23AT010	3
MBL20CP015 Differential Pressure Transmitter	4	Filter MBL23BB005	3
MBL21AA010 Diaphragm Valve	3	Pressure Vessel MBL24AA010	3
MBL21AN005 Dust Removal Fan	3	Diaphragm Valve MBL24AN005	3
MBL21AT005 Weather Louver	3	Dust Removal Fan MBL24AT005	3
MBL21AT010 Filter	3	Weather Louver MBL24AT010	3
MBL21BB005 Pressure Vessel	3	Filter MBL24BB005	3
MBL22AA010 Diaphragm Valve	3	Pressure Vessel MBL30BS005	4
MBL22AN005 Dust Removal Fan	3	Silencer MBL30CG005	2
MBL22AT005 Weather Louver	3	Plenum door switch MBL30CM005	2
MBL22AT010 Filter	3	Humidity Transmitter MBL30CP015	4
MBL22BB005		Differential Pressure Transmitter, Inlet Air MBL30CT005	2
		Temperature Transmitter, Ambient	2

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