SYSTEM DESCRIPTION MBV LUBRICATION OIL SYSTEM	Respons. dept GPMA	Date 2003-11-27	Reg. M DB 101
	Prepared Karin Sjöqvist		YAMAMA CEMENT

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Purpose of the system

The purpose of the lubrication (lube) oil system is to supply oil of correct pressure and temperature to the gas turbine bearings and to the driven equipment for lubrication and cooling.
The pressure and temperature of the oil is continuously monitored to secure a safe operation of the turbine and the driven equipment.

That is:

- The system is in operation during start-up, turbine operation and the cooling down sequence after a turbine stop.
- The system will continuously deliver oil to the consumers in case of an AC power loss.

General description of the system

Refer to P&ID GT10B2 PG 2046 028

The lubrication media is mineral based turbine oil ISO VG46. This is valid both for temperate and tropical environment.

The system comprises a lube oil supply unit and a distributing pipe system.
The supply unit is installed in the turbine base frame and consists of an oil tank with top mounted components.

The system is built on 3 x AC-driven pump groups.
Each group consists of a low pressure main supply pump and a high pressure booster pump.
The high pressure booster pumps of screw type deliver oil to high pressure bearing no. 2.

Normally two pump groups are in operation and one is standby.
In case of failure on two pump groups and only one remaining in operation the system still can provide sufficient pressure and oilflow to the consumers during GT coast down.
Each pump group and the oil system ventilation fan has its own Static Frequency Converter (SFC).
In case of an AC-power failure the motors are fed from a battery via the SFC's.
By reducing pump/fan speed in certain steps, the SFCs are used in order to save battery capacity in case of AC-power loss.

The SFC's are supplied with direct AC feeding which is backed up by a battery system including the batteries and one charger (the charger is used for float charging of the batteries).
Each pump group is controlled by its own Programmable Logic Controller (PLC) system.
Communication between PLC, SFC and the Advant Turbine Controller is performed by digital hardwired signals.

There are two principal modes of operation.

- AC power mode

This is the normal mode of operation.
The pumps are supplied from the AC power supply system.

- DC power mode

This mode of operation occurs if the incoming AC power supply is lost.
In this mode, the pumps are supplied from the battery and the pump speed is reduced in order to save battery capacity.

Since the SFC's always are connected to the battery the switch over will cause no interruption of the lube oil supply.

The oil pressure to the bearings, at the turbine shaft level, is set during commissioning in the SFC and by a pressure adjusting valve.

The oil temperature is controlled by a temperature control valve, mixing cold lube oil from the cooler with warm oil bypassing the cooler, to a correct temperature.
Before entering the distribution piping the oil is filtered by a 2x100% duplex oil filter.

An AC-driven oil system ventilation fan maintains a sub-atmospheric pressure in the bearing casings, in order to prevent oil leakage through the shaft sealings.
Air from the bearing casings is evacuated through separate air suction pipes and the partly filled oil return piping to the tank, which is kept at sub-atmospheric pressure.
From the tank the oil mist passes through a filter extracting the oil from the air. The oil is returned to the tank and the air outlet is connected to atmosphere.

Main components

- Lube oil pump 1 (centrifugal type)

MBV21AP005

The low pressure main lube oil pump 1 is of vertical centrifugal type, submerged in the oil tank, and driven by an AC-motor, which is driven by an SFC.
This pump together with the Lube oil booster pump 1 MBV51AP005 are controlled as one object driven from one SFC. This object , named MBV11EA901 Lube oil group 1 can be operated in automatic or manual mode. The pump group is used as a redundant object together with lube oil group 2 and 3 , either of them can be selected for auto or standby operation. 2 of the 3 groups shall always be in operation and one group is kept as stand by.

- Pressure switch, lube oil pump 1 discharge
  MBV21CP005
  The switch is monitoring the discharge pressure after lube oil pump 1.

  Low discharge pressure (L1) will initiate a pump switch-over to stand-by lube oil pump group.
  If stand-by pump group fails to supply oil pressure, the turbine will trip

- Air release orifice, lube oil pump 1 discharge
  MBV21BP005
  The orifice will release trapped air.

- Non-return valve, lube oil pump 1 discharge
  MBV21AA010
  The valve prevents backflow from other operating pumps if lube oil pump 1 is inactive

- Shut off valve, lube oil pump 1 discharge (manually operated)
  MBV21AA015
  The manually operated valve is shut off if the lube oil pump will be removed.
  The valve is locked in open position during turbine operation

- Lube oil pump 2
  MBV22AP005
  The lube oil pump 2 is of vertical centrifugal type, submerged in the oil tank, and driven by an AC-motor, which is driven by an SFC.
  This pump together with the Lube oil booster pump 2 MBV52AP005 are controlled as one object driven from one SFC. This object , named MBV12EA901 Lube oil group 2 can be operated in automatic or manual mode. The pump group is used as a redundant object together with lube oil group 1 and 2 , either of them can be selected for auto or standby operation. 2 of the 3 groups shall always be in operation and one group is kept as stand by.

- Pressure switch, lube oil pump 2 discharge
  MBV22CP005
  The switch is monitoring the discharge pressure after lube oil pump 2.

  Low discharge pressure (L1) will initiate a pump switch-over to stand-by lube oil pump group.
  If stand-by pump group fails to supply oil pressure, the turbine will trip

- Air release orifice, lube oil pump 2 discharge
  MBV22BP005
  The orifice will release trapped air.

- Non-return valve, lube oil pump 2 discharge
  MBV22AA010
  The valve prevents backflow from other operating pumps if lube oil pump 2 inactive.

- Shut off valve, lube oil pump 2 discharge
  MBV22AA015
  The manually operated valve is shut off if the lube oil pump will be removed.
  The valve is locked in open position during turbine operation

- Lube oil pump 3
  MBV23AP005
  The lube oil pump 3 is of vertical centrifugal type, submerged in the oil tank, and driven by an AC-motor, which is driven by an SFC.
  This pump together with the Lube oil booster pump 3 MBV53AP005 are controlled as one object driven from one SFC. This object , named MBV13EA901 Lube oil group 3 can be operated in

automatic or manual mode. The pump group is used as a redundant object together with lube oil group 1 and 2 , either of them can be selected for auto or standby operation. 2 of the 3 groups shall always be in operation and one group is kept as stand by.

- Pressure switch, lube oil pump 3 discharge
  MBV23CP005
  The switch is monitoring the discharge pressure after lube oil pump 3.

  Low discharge pressure (L1) will initiate a pump switch-over to stand-by lube oil pump group.
  If stand-by pump group fails to supply oil pressure, the turbine will trip

- Air release orifice, lube oil pump 3 discharge
  MBV23BP005
  The orifice will release trapped air.

- Non-return valve, lube oil pump 3 discharge
  MBV23AA010
  The valve prevents backflow from other operating pumps if lube oil pump 3 inactive.

- Shut off valve, lube oil pump 3 discharge
  MBV23AA015
  The manually operated valve is shut off if the lube oil pump will be removed.
  The valve is locked in open position during turbine operation.

- Pressure point, downstream lube oil cooler
  MBV30CP010
  Pressure test point to verify oil pressure downstream the lube oil cooler.

- Thermowell, downstream lube oil cooler
  MBV30CT010
  Testpoint to verify temperature downstream the lube oil cooler.

- Lube oil temperature control valve
  MBV30AA020
  The three-way temperature control valve mixes cold lube oil from the cooler with warm oil from the tank in order to achieve correct oil temperature to the consumers.
  The valve is equipped with a manual override function in order to operate the valve in case of temperature closed loop control malfunction. The nominal mixing temperature is set depending on site conditions.

- Pressure adjusting valve, Lube Oil
  MBV30AA025
  The pressure adjusting valve is set during turbine commisioning and thereafter locked.
  The valve sets the inlet pressure to the consumers.

- Lube oil booster pump 1
  MBV51AP005
  The lube oil booster pump 1 is of screw displacement type, and driven by an AC-motor.
  The pump is controlled together with the low pressure lube oil pump 1 MBV21AP005 as one lube oil group. See description for MBV21AP005.
  Internal pressure relief valve protects from excessive overpressure.

- Non-return valve, lube oil booster pump 1 discharge
  MBV51AA010
  The valve prevents backflow from other operating pumps if lube oil booster pump 1 inactive.

- Shut off valve, lube oil booster pump 1 suction
  MBV51AA005
  The manually operated valve is shut off if the lube oil pump will be removed.
  The valve is locked in open position during turbine operation.

- Shut off valve, lube oil booster pump 1 discharge
  MBV51AA015
  The manually operated valve is shut off if the lube oil pump will be removed.
  The valve is locked in open position during turbine operation.

- Pressure switch, lube oil booster pump 1 discharge
  MBV51CP005
  The switch is monitoring the discharge pressure after lube oil booster pump 1.

  Low discharge pressure (L1) will initiate a pump switch-over to stand-by lube oil pump group.
  If stand-by pump group fails to supply oil pressure, the turbine will trip

- Lube oil booster pump 2
  MBV52AP005
  The lube oil booster pump 2 is of screw displacement type, and driven by an AC-motor.

  The pump is controlled together with the low pressure lube oil pump 2 MBV22AP005 as one lube oil group. See description for MBV22AP005.
  Internal pressure relief valve protects from excessive overpressure.

- Non-return valve, lube oil booster pump 2 discharge
  MBV52AA010
  The valve prevents backflow from other operating pumps if lube oil booster pump 2 inactive.

- Shut off valve, lube oil booster pump 2 suction
  MBV52AA005
  The manually operated valve is shut off if the lube oil pump will be removed.
  The valve is locked in open position during turbine operation.

- Shut off valve, lube oil booster pump 2 discharge
  MBV52AA015
  The manually operated valve is shut off if the lube oil pump will be removed.
  The valve is locked in open position during turbine operation.

- Pressure switch, lube oil booster pump 2 discharge
  MBV52CP005
  The switch is monitoring the discharge pressure after lube oil pump 2.

  Low discharge pressure (L1) will initiate a pump switch-over to stand-by lube oil pump group.
  If stand-by pump group fails to supply oil pressure, the turbine will trip

- Lube oil booster pump 3
  MBV53AP005
  The lube oil booster pump 3 is of screw displacement type, and driven by an AC-motor.
  The pump is controlled together with the low pressure lube oil pump 3 MBV23AP005 as one lube oil group. See desrciption for MBV23AP005.
  Internal pressure relief valve protects from excessive overpressure.

- Non-return valve, lube oil booster pump 3 discharge
  MBV53AA010
  The valve prevents backflow from other operating pumps if lube oil booster pump 3 inactive.

- Shut off valve, lube oil booster pump 3 suction
  MBV53AA005
  The manually operated valve is shut off if the lube oil pump will be removed.
  The valve is locked in open position during turbine operation.

- Shut off valve, lube oil booster pump 3 discharge
  MBV53AA015
  The manually operated valve is shut off if the lube oil pump will be removed.
  The valve is locked in open position during turbine operation.

- Pressure switch, lube oil booster pump 3 discharge
  MBV53CP005
  The switch is monitoring the discharge pressure after lube oil pump 3.

  Low discharge pressure (L1) will initiate a pump switch-over to stand-by lube oil pump group.
  If stand-by pump group fails to supply oil pressure, the turbine will trip

- Differential pressure indicator , bearing no. 2
  MBV54CP005
  Local indication of differential pressure across bearing no. 2.

- Pressure indicator , inlet pressure bearing no. 2
  MBV54CP010
  Local indication of inlet oil pressure to bearing no. 2.

- Differential pressure transmitter, Bearing no. 2
  MBV54CP015
  The transmitter is monitoring differential pressure, across Bearing no. 2, in order to prevent bearing damage.
  High pressure (H1) initiates an alarm.
  Low pressure (L1) initiates an alarm.
  Low pressure (L2) initiates a turbine trip.

- Differential pressure transmitter, Bearing no. 2
  MBV54CP020
  The transmitter is monitoring differential pressure, across Bearing no. 2, in order to prevent bearing damage.
  High pressure (H1) initiates an alarm.
  Low pressure (L1) initiates an alarm.
  Low pressure (L2) initiates a turbine trip.

- Differential pressure regulating valve , bearing no. 2
  MBV54AA005
  Regulates the oil flow from the lube oil booster pumps to the bearing no. 2 by overflowing oil from the pumps to the lube oil tank.
  The valve keeps a constant differential pressure across the bearing no.2.
  The valve is self operating.

- Shut off valve , upstream differential pressure regulating valve
  MBV54AA010
  The manually operated valve is shut off if the differential pressure valve will be removed.
  The valve is locked in open position during turbine operation.

- Bearing no. 2 Return Tank
  MBV60BB005
  High pressure tank for the returning oil from Bearing no. 2.

- Floating valves, Bearing no. 2 Return Tank
  MBV60AA005/010
  The floating valves drain the return oil from high pressure Bearing no. 2 return tank via the main return pipe to the lube oil tank MBV10BB005.
  The floating valves are self operating.

- Level switch, Bearing no. 2 Return Tank
  MBV60CL005

The level switch protects the return pipe from Bearing no. 2 from filling up with oil due to insufficient drainage through the floating valves in the tank to the main return pipe.
High level (H1) initiates a turbine trip.

- Orifice, Bearing no. 2 Return Tank
  MBV60BP005
  The orifice maintains the high pressure in return pipe from bearing no. 2 during turbine operation. Sealing air from the high pressure bearing is evacuated through the orifice from the bearing no. 2 return tank via the main return pipe to the lube oil tank.

- Ventilation valve, Bearing no. 2 Return Tank
  MBV60AA015
  The valve is open during turbine start-up until gas generator speed reaches 5500 rpm, thereafter the valve is closed.
  The valve is opened instantly at turbine trip and turbine stop in order to evacuate the high pressure air in the return pipe from bearing no. 2.
  Limit switches are monitoring the position of the valve.

- Lube oil cooler, air cooled
  MBV30AC015
  Air cooled heat exchanger module with associated AC-motor driven fan.
  The cooler is continuously vented to the tank by piping and an orifice in order to avoid air pockets.

- Air cooler fan 1
  MBV30AN015

  The fan can be operated in automatic or manual mode. The fan is used as a redundant object together with air cooler fan 2, 3 and 4, either of them can be selected for auto or standby operation.

- Lube oil cooler, air cooled
  MBV30AC020
  Air cooled heat exchanger module with associated AC-motor driven fan.
  The cooler is continuously vented to the tank by piping and an orifice in order to avoid air pockets.

- Air cooler fan 2
  MBV30AN020
  The fan can be operated in automatic or manual mode. The fan is used as a redundant object together with air cooler fan 1,3 and 4, either of them can be selected for auto or standby operation.

- Lube oil cooler, air cooled
  MBV30AC025
  Air cooled heat exchanger module with associated AC-motor driven fan.
  The cooler is continuously vented to the tank by piping and an orifice in order to avoid air pockets.

- Air cooler fan 3
  MBV30AN025

The fan can be operated in automatic or manual mode. The fan is used as a redundant object together with air cooler fan 1,2 and 4, either of them can be selected for auto or standby operation.

- Venting orifice, lube oil piping downstream cooler
  MBV30BP215
  The orifice is used to continuously vent the piping to the tank in order to avoid air pockets.

- Venting orifice, lube oil piping upstream cooler
  MBV30BP220
  The orifice is used to continuously vent the piping to the tank in order to avoid air pockets.

- Orifice, lube oil cooler by-pass
  MBV30BP005
  The orifice size is designed to give the same pressure drop in the by-pass line as through the lube oil cooler in order to minimise impact of variable oil flow through cooler vs. by-pass line.

- Shut off valve, drainage of system
  MBV40AA205
  The shut off valve drains oil in the pipe system back to the lube oil tank, e.g. during maintenance.
  The valve is locked in closed position during normal system operation.

- Shut off valves, air-cooled oil cooler vent
  MBV30AA220
  MBV30AA230
  MBV30AA250
  The valves are used for venting of the coolers to atmosphere during filling and emptying.
  The valves are locked in closed position during normal system operation.

- Shut off valves, air-cooled oil cooler drain
  MBV30AA225
  MBV30AA235
  MBV30AA255
  The valves drain oil from coolers.
  The valves are locked in closed position during normal system operation.

- Shut off valves, air-cooled oil cooler
  MBV30AA030
  MBV30AA035
  MBV30AA040
  MBV30AA045
  MBV30AA050
  MBV30AA055
  The valves are used to isolate the cooler during maintenance.
  The valve is locked in open position during normal system operation.

- Venting orifices, air-cooled oil cooler
  MBV30BP225
  MBV30BP230
  MBV30BP235
  The orifices are used to continuously vent the coolers to the tank in order to avoid air pockets and damage due to thermal expansion of oil.

- Lube oil filter (particle type)
  MBV40AT005
  MBV40AT010
  The 2x100% filter purifies the oil to the required level in order to avoid damage to the consumers. The filter cartridges are working according to particle principle and are made of micro glass fibre. Each filter casing is continuously vented to the tank via an orifice in order to avoid air pockets. The change-over between filters is made manually.

- Change-over valves, lube oil filter
  MBV40AA005
  MBV40AA010
  To make change-over between filters possible during turbine operation, the filters are provided with a manual change-over valve function. The valves are mechanically interconnected and designed to avoid significant system pressure drop during change-over.

- Equalisation valve, lube oil filter
  MBV40AA015
  The equalisation valve is used prior to change-over between filters, to enable filling of the standby filter in order to avoid a pressure drop in the system.

- Shut off valve , drainage of system
  MBV40AA210
  The shut off valve provides possibility for drainage of low point main oil pipe to bearings. The valve is locked in closed position during normal system operation.

- Venting orifices, lube oil filter
  MBV40BP205
  MBV40BP210
  The orifices are used to continuously vent the filter casings to the tank in order to avoid air pockets.

- Venting shut off valves, lube oil filter
  MBV40AA225
  MBV40AA230
  The shut off valves are used to isolate the filter casings in order to avoid loosing subatmospheric pressure during maintenance.
  The valves are locked in open position during normal system operation.

- Drainage shut off valves, lube oil filter
  MBV40AA215
  MBV40AA220
  The shut off valves are used to drain the filter casings clean side back to oil tank during maintenance.
  The valves are locked in closed position during normal system operation.

- Drainage shut off valves, lube oil filter
  MBV40AA235
  MBV40AA240
  The shut off valves are used to drain the filter casings dirty side to atmosphere during maintenance.
  The valves are locked in closed position during normal system operation.

- Differential pressure transmitter, lube oil filter
  MBV40CP010
  The transmitter is monitoring the differential pressure across the oil filter, indicating need for filter change-over and maintenance.
  At high (H1) differential pressure, an alarm is initiated

- Shut off valve, oil sampling
  MBV40AA020
  The valve permits oil sampling during turbine operation, in order to determine oil condition.

- Pressure transmitter, lube oil
  MBV40CP015
  The transmitter is monitoring oil supply pressure, downstream the filter, in order to prevent damage to the consumers.
  Low pressure (L1) initiates an alarm.
  Low pressure (L2) initiates a turbine trip.

- Pressure gauge, lube oil
  MBV40CP020
  Local indication of oil supply pressure to the consumers, downstream the filter.

- Pressure transmitter, lube oil
  MBV40CP025
  The transmitter is monitoring oil supply pressure, downstream the filter, in order to prevent damage to the consumers.
  Low pressure (L1) initiates an alarm.
  Low pressure (L2) initiates a turbine trip.

- Thermometer, lube oil
  MBV40CT010
  Local indication of oil temperature to consumers.

- Temperature transmitter, lube oil
  MBV40CT005
  The Pt100 sensor is monitoring the oil temperature, after cooling, in order to prevent damage to the consumers.
  Low temperature (L1) interlocks activation of the start motor.
  High temperature (H1) initiates an alarm.
  High temperature (H2) initiates a turbine trip.

- Temperature transmitter, lube oil
  MBV40CT015
  The Pt100 sensor is monitoring the oil temperature, after cooling, in order to prevent damage to the consumers.
  Low temperature (L1) interlocks activation of the start motor.
  High temperature (H1) initiates an alarm.
  High temperature (H2) initiates a turbine trip.

- Lube oil mist filter (coalescer type)
  MBV10AT005
  The filter extracts the oil mist from the air. The oil is returned to the tank and the air outlet is connected to atmosphere via a fan.
  The oil mist filter is working according to the coalescing principle.

- Differential Pressure Indicator, Lube Oil Mist Filter
  MBV10CP010
  Local indication of differential pressure across lube oil mist filter.

- Oil system ventilation fan
  MBV10AN005
  The AC-driven oil system ventilation fan maintains a sub-atmospheric pressure in the bearing casings, in order to prevent oil leakage through the shaft sealings.

  The fan can be operated in automatic or manual mode.

- Lube oil tank
  MBV10BB005
  The lube oil tank is a fully welded construction, designed to allow the oil to release air bubbles before it is redistributed to the consumers.
  A skiboard gives the returning oil a placid entrance and good possibility to release air bubbles to the surface.
  Manway opening is provided on top of the tank to allow unobstructed entry for inspection and cleaning of all interior parts.
  Weld-in thermowells for the oil heaters are integrated in the tank.

- Level gauge, lube oil tank

MBV10CL005
Local indication of the oil level by a level gauge top-mounted on the lube oil tank.

- Level transmitter, lube oil tank
  MBV10CL010
  The level transmitter is top-mounted on the lube oil tank.
  High level (H2) initiates an alarm.
  Alarm for max run down level. Only when pumps are not in operation.
  High level (H1) initiates an alarm.
  Increasing oil level can be caused by an internal leakage in the liquid-cooled heat exchanger.
  Low level (L1) initiates an alarm.
  This alarm indicates loss of oil in the system. Decreasing oil level can be caused by oil passing through the oil mist filter to the atmosphere, leakage in the piping or through the shaft sealings.
  Low level (L2) initiates an alarm.
  A possible reason for reaching the alarm level might be severe loss of oil in the system due to leakage.

- Pressure gauge, sub-atmospheric pressure in lube oil tank
  MBV10CP005
  Local indication of the sub-atmospheric pressure in the oil tank.

- Differential pressure transmitter, lube oil tank
  MBV10CP015
  The transmitter is monitoring sub-atmospheric pressure in the oil tank and in the return piping from the consumers during turbine operation. High level (H1) initiates an alarm.
  This might be caused by clogging of the oil mist filter or a malfunction of the oil system ventilation fan/driver.
  High level (H2) initiates a unloading turbine trip.
  The trip is required to avoid excessive oil leakage through the shaft sealings.

- Thermometer, lube oil tank
  MBV10CT005
  Local indication of oil temperature in the tank.
  The thermometer is installed in a thermowell in the oil tank.

- Oil filling point strainer, lube oil tank
  MBV10AT015
  The oil filling point is equipped with a strainer and is designed to allow filling during turbine operation.

- Siphon breaker, oil purification suction line
  MBV10BP010
  The siphon breaker is a drilled hole in the suction pipe to an oil purification connection.
  The siphon breaker prevents a complete emptying of the tank in case of a leakage on the discharge side of oil purification unit, if included.

- Shut off valve, lube oil tank drain (manually operated)
  MBV10AA210
  The valve is located in the lowest point of lube oil tank to permit complete emptying.
  The valve is locked in closed position during normal system operation.

- Lube oil heaters
  MBV10AH005
  MBV10AH010
  The heaters keep the oil in the tank at a minimum temperature required for start of the turbine.
  The heaters are installed direct into the oil at side of the lube oil tank.
  The heat power, which is transferred direct from the heating elements to the oil, is limited in order to increase the lifetime of the mineral oil.
  During longer stand still periods it is recommended that the heaters are turned off in order to extend the oil lifetime.

- Temperature transmitter, lube oil tank
  MBV10CT010
  The Pt100 is continuously monitoring the oil temperature in the oil tank.
  Low temperature (L2) interlocks start of the AC-pumps.
  Low temperature (L1) initiates start of the heaters, in order to heat the oil before start of the turbine or to maintain the oil temperature during standstill.
  High temperature (H1) initiates stop of the heaters.

- Overheating protection switch, lube oil heater 1
  MBV10CT025
  A 2xPT100 is integrated in the heater MBV10AH005.
  One of the PT100 is connected to a programmable temperature-limiting device, which is located into the control room.
  High temperature (H2) automatically disconnects the power in order to prevent overheating of the heater element.
  The temperature-limiting device has to be manually reset after an activation.

- Temperature switch, lube oil heater 1
  MBV10CT015
  A 2xPT100 is integrated in the heater MBV10AH005.
  One of the PT100 is connected to a programmable temperature control device, which is located into the control room. The temperatures, which have been set into the control device, will automatically controls the power to the heater.
  Low temperature (L1) initiates start of the heater.
  High temperature (H1) initiates stop of the heater.

- Overheating protection switch, lube oil heater 2
  MBV10CT030
  A 2xPT100 is integrated in the heater MBV10AH010.

One of the PT100 is connected to a programmable temperature-limiting device, which is located into the control room.
High temperature (H2) automatically disconnects the power in order to prevent overheating of the heater element.
The temperature-limiting device has to be manually reset after an activation.

- Temperature switch, lube oil heater 2
  MBV10CT020
  A 2xPT100 is integrated in the heater MBV10AH010.
  One of the PT100 is connected to a programmable temperature control device, which is located into the control room. The temperatures, which have been set into the control device, will automatically controls the power to the heater.
  Low temperature (L1) initiates start of the heater.
  High temperature (H1) initiates stop of the heater.

- Temperature transmitter, lube oil tank
  MBV10CT010
  The Pt100, installed in a thermowell , is continuously monitoring the oil temperature in the oil tank.
  High temperature (H1)initiates stop of the heaters.
  Low temperature (L1) initiates start of the heaters, in order to heat the oil before start of the turbine or to maintain the oil temperature during standstill.
  Low temperature (L2) gives an alarm and turbine start interlock

- Pressure point, return pipe bearing no. 3,4
  MBV10CP025
  Pressure test point to verify sub atmospheric pressure in return pipe bearing no. 3,4.

- Pressure point, return pipe generator bearings
  MBV10CP030
  Pressure test point to verify sub atmospheric pressure in return pipe from generator bearings.

- Pressure point, return pipe gearbox
  MBV10CP035
  Pressure test point to verify sub atmospheric pressure in return pipe from the gearbox.

- Pressure point, inlet pipe bearing no. 1
  MBV40CP030
  Pressure test point pressure gauge to verify inlet pressure to Bearing no. 1.

- Pressure point, inlet pipe bearing no. 3, 4
  MBV40CP035
  Pressure test point to verify inlet pressure to Bearing no. 3,4.

- Pressure point, Inlet pipe generator bearings
  MBV40CP040
  Pressure test point to verify inlet pressure to generator bearings.

- Pressure point, Inlet pipe to Gearbox
  MBV40CP045
  Pressure test point to verify inlet pressure to Gearbox.

- Pressure point, Inlet pipe to Bearing no. 2
  MBV54CP030
  Pressure test point to verify inlet pressure to Bearing no. 2.

- Pressure point, Return pipe Bearing no. 2
  MBV60CP005
  Pressure test point to verify return pressure from Bearing no. 2.

Function

A. Start up

When the gas turbine start sequence is activated the pre-selected lube oil pumps and the oil system ventilation fan will be ordered on. The electrical heaters in the oil tank keep the oil temperature above the minimum required for starting of the gas turbine.

B. Continuous operation

The system runs with two lube oil pump groups and the oil system ventilation fan in operation. If required a switch over to the standby pump group is automatically performed.

C. Turbine stop

The system is kept in operation. When the barring is finished after the gas turbine cooling down period the lube oil pumps and oil system ventialtion fan will stop automatically.

D. Stand still

The heaters in the lube oil tank keep the oil warm. During longer stand still periods it is recommended that the heaters are turned off in order to extend the oil lifetime.

Disturbances

A. Gas turbine trip

N/A.

B. Generator breaker trip

N/A.

C. Loss of power supply

At AC power supply loss the lube oil pump motors and the oil system ventilation fan motor is fed from a DC-battery backup system.
In order to save battery capacity the speed of the pumps and the fan is reduced in certain steps during coast down.

D. Other faults

Fault in connecting systems:

- External leakage
  Leakage in the consumers or external flange connections may cause decreased oil pressure or low lube oil tank level.

Technical specification

A. Design criteria and standards

Mineral oil specification according to MAT 81 21 09.

B. Dimensioning data

Design oil flow: 1200 l/min

Minimum 6 minutes retention time in the lube oil tank.

Battery capacity for a minimum of 10 hours cooling down period.

C. Engineering data

Refer to P&ID GT10B2 PG 2046 028

D. Emergency power supply

The lube oil pump groups and the oil system ventilation fan are powered by a DC battery back up system.

E. Installation

The lube oil supply tank unit is installed in the turbine baseframe.
Components in the system are mounted on the tank except for the cooler(s) and the bearing no. 2 return tank with associated components.
By a distributing pipe system, the lube oil supply unit is connected to the consumers.

F. Materials

The lube oil tank and the piping upstream the lube oil filter are made of carbon steel.
The piping downstream the lube oil filter are made of stainless steel.
Impulse tubing and orifices are made of stainless steel.
Pump casings and valves are made of cast iron or better.

G. Component data

Refer to the aggregate and instrument lists.

Testing and service

A. Testing during normal operation

- The function of the standby lube oil pumpgroup can be tested during normal operation.

B. Accessibility during normal operation

- The filter is of duplex type and can be switched over to clean side during operation. The contaminated filter element can then be changed during normal operation.
- Temperature instrumentation, except for the main supply supervision, can be replaced during turbine operation.
- The pressure gauges are replaceable during operation.
- Lube oil filling is possible.
- Lube oil samples can be taken.

Index of components

M

SYSTEM DESCRIPTION
MBV
LUBRICATION OIL SYSTEM

Respons. dept GPMA | Date 2003-11-27 | Reg. M DB 101

Prepared Karin Sjöqvist | YAMAMA CEMENT