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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.

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LUBRICATION OIL SYSTEM	Prepared Karin Sjöqvist	YAMAMA CEMENT

#### • 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.

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MBV LUBRICATION OIL SYS	STEM	Prepared					
		Karin Sjö	qv1st	YAMAM	IA CEMENT		
<ul> <li>Non-return valve, lube MBV21AA010</li> </ul>	oil pump 1 dischar	ge					
The valve prevents back	kflow from other o	perating pumps i	f lube oil pump	1 is inactiv	e		
• Shut off valve, lube oil	numn 1 discharge	(manually operat	ad)				
MBV21AA015	pump i discharge	(manually operat	eu)				
The manually operated				red.			
The valve is locked in c	pen position durin	ig turbine operation	on				
• Lube oil pump 2							
MBV22AP005 The lube oil pump 2 is o	of vertical centrifu	gal type submer	red in the oil ta	nk and driv	$x_{en}$ by an $AC_{e}$		
motor, which is driven		gai type, submerg		iik, and uiiv	ch by an AC-		
This pump together wit							
	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	f them can be selec	cted for auto or st					
always be in operation and one group is kept as stand by.							
Pressure switch, lube oil pump 2 discharge							
MBV22CP005	a the discharge na	acours ofter lube	ail anna 2				
The switch is monitoring	The switch is monitoring the discharge pressure after lube oil pump 2.						
Low discharge pressure				ube oil pun	np group.		
If stand-by pump group	fails to supply oil	pressure, the turk	oine will trip				
• Air release orifice, lube	oil pump 2 discha	rge					
MBV22BP005 The orifice will release	trapped air						
The office will feledse	trapped an:						
• Non-return valve, lube	oil pump 2 dischar	ge					
MBV22AA010 The valve prevents bacl	kflow from other o	perating pumps i	f lube oil pump	2 inactive.			
-							
• Shut off valve, lube oil MBV22AA015	Shut off valve, lube oil pump 2 discharge						
The manually operated				'ed.			
The valve is locked in c	pen position durin	g turbine operation	on				
• Lube oil pump 3							
MBV23AP005	of montional as a tail	aal tama ar-1	rad in the - 11	ما مصال	on hu on AC		
The lube oil pump 3 is on motor, which is driven		gai type, submerg	ged in the oil tai	nk, and driv	en by an AC-		
This pump together wit	h the Lube oil boos						
driven from one SFC. T	his object, named	MBV13EA901	Lube oil group	3 can be op	erated in		
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SIEMENS SYSTEM DESCRIPTION MBV LUBRICATION OIL SYSTEM automatic or manual mode. The pump group i group 1 and 2, either of them can be selected always be in operation and one group is kept i • Pressure switch, lube oil pump 3 discharge	for auto or standby operatio				
<ul> <li>MBV LUBRICATION OIL SYSTEM</li> <li>automatic or manual mode. The pump group i group 1 and 2, either of them can be selected always be in operation and one group is kept i</li> <li>Pressure switch, lube oil pump 3 discharge</li> </ul>	GPMA 2003-11-27 Prepared Karin Sjöqvist is used as a redundant object for auto or standby operatio	M DB 101 YAMAMA CEMENT			
<ul> <li>automatic or manual mode. The pump group i group 1 and 2, either of them can be selected always be in operation and one group is kept i</li> <li>Pressure switch, lube oil pump 3 discharge</li> </ul>	Karin Sjöqvist is used as a redundant object for auto or standby operatio	together with lube oil			
<ul><li>group 1 and 2, either of them can be selected always be in operation and one group is kept :</li><li>Pressure switch, lube oil pump 3 discharge</li></ul>	for auto or standby operatio				
		<i>0</i> <u>r</u> o <i>s</i>			
MBV23CP005 The switch is monitoring the discharge pressu	re after lube oil pump 3.				
Low discharge pressure (L1) will initiate a pu If stand-by pump group fails to supply oil pre	-	lube oil pump group.			
<ul> <li>Air release orifice, lube oil pump 3 discharge MBV23BP005 The orifice will release trapped air.</li> </ul>					
<ul> <li>Non-return valve, lube oil pump 3 discharge MBV23AA010 The valve prevents backflow from other operating pumps if lube oil pump 3 inactive.</li> </ul>					
<ul> <li>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.</li> </ul>					
<ul> <li>Pressure point, downstream lube oil cooler MBV30CP010 Pressure test point to verify oil pressure downstream the lube oil cooler.</li> </ul>					
<ul> <li>Thermowell, downstream lube oil cooler MBV30CT010 Testpoint to verify temperature downstream the lube oil cooler.</li> </ul>					
• Lube oil temperature control valve MBV30AA020 The three-way temperature control valve mixe tank in order to achieve correct oil temperatur The valve is equipped with a manual override temperature closed loop control malfunction. site conditions.	e to the consumers. function in order to operate	the valve in case of			
<ul> <li>Pressure adjusting valve, Lube Oil MBV30AA025 The pressure adjusting valve is set during turb The valve sets the inlet pressure to the consurt</li> </ul>	-	after locked.			
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© Demag Delaval Industrial Turbomachinery AB This document is issued in Pulse.	<ul> <li>Lube oil booster pump MBV51AP005 The lube oil booster p The pump is controlle oil group. See descrip Internal pressure relie</li> <li>Non-return valve, lub MBV51AA010 The valve prevents ba</li> <li>Shut off valve, lube o MBV51AA005 The manually operate The valve is locked in</li> <li>Shut off valve, lube o MBV51AA015 The manually operate The valve is locked in</li> <li>Shut off valve, lube o MBV51AA015 The manually operate The valve is locked in</li> <li>Pressure switch, lube MBV51CP005 The switch is monitor</li> <li>Low discharge pressu If stand-by pump grou</li> <li>Lube oil booster pump MBV52AP005 The lube oil booster pump MBV52AP005 The lube oil booster pump MBV52AP005</li> </ul>	pump 1 is of screw d d together with the tion for MBV21AP( f valve protects from e oil booster pump 1 ackflow from other of il booster pump 1 su d valve is shut off if a open position durin il booster pump 1 di d valve is shut off if a open position durin oil booster pump 1 di ing the discharge pr re (L1) will initiate up fails to supply oil p 2 pump 2 is of screw d ad together with the tion for MBV22AP(	low pressure lube 005. n excessive overp l discharge operating pumps if action f the lube oil pump g turbine operation scharge f the lube oil pump g turbine operation discharge essure after lube of a pump switch-ov pressure, the turb isplacement type, low pressure lube 005.	oil pump 1 MB ressure. I ube oil booste o will be remov on. o will be remov on. Dil booster pump er to stand-by 1 bine will trip and driven by a oil pump 2 MB	er pump 1 in ed. ed. p 1. ube oil pump	as one lube active. p group. r.
A 087 0474-B 00-03 MS Word 97	<ul> <li>Internal pressure relie</li> <li>Non-return valve, lub MBV52AA010 The valve prevents ba</li> <li>Shut off valve, lube o MBV52AA005 The manually operate The valve is locked in</li> </ul>	f lube oil booste o will be remov		active.		
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	LUBRICATION OIL SY	STEM	Prepared Karin Sjöd	Prepared Karin Sjöqvist		A CEMENT	
This document is issued in Pulse.	<ul> <li>Shut off valve, lube oi MBV52AA015 The manually operated The valve is locked in</li> <li>Pressure switch, lube of MBV52CP005</li> </ul>	l valve is shut off if open position durir	f the lube oil pump ng turbine operation		ed.		
This doc	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						
urbomachinery AB	<ul> <li>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.</li> </ul>						
© Demag Delaval Industrial Turbomachinery AB	<ul> <li>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.</li> </ul>						
© Demai	<ul> <li>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.</li> </ul>						
	<ul> <li>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.</li> </ul>						
	<ul> <li>Pressure switch, lube oil booster pump 3 discharge MBV53CP005 The switch is monitoring the discharge pressure after lube oil pump 3.</li> </ul>						
	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						
A 087 0474-B 00-03 MS Word 97	<ul> <li>Differential pressure indicator , bearing no. 2 MBV54CP005 Local indication of differential pressure across bearing no. 2.</li> </ul>						
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<ul> <li>SYSTEM DESCRIPTION MBV LUBRICATION OIL SYSTEM</li> <li>Pressure indicator , inlet pressure bearing no MBV54CP010 Local indication of inlet oil pressure to bear</li> </ul>		8 (22) Reg. M DB 101 YAMAMA CEMENT			
<ul> <li>Pressure indicator , inlet pressure bearing no MBV54CP010 Local indication of inlet oil pressure to bear</li> </ul>	Karin Sjöqvist	YAMAMA CEMENT			
MBV54CP010 Local indication of inlet oil pressure to bear					
-	ing no. 2.				
<ul> <li>Differential pressure transmitter, Bearing no MBV54CP015</li> </ul>	o. 2				
The transmitter is monitoring differential pr damage.	ressure, across Bearing no. 2, in	1 order to prevent bearing			
High pressure (H1) initiates an alarm. Low pressure (L1) initiates an alarm. Low pressure (L2) initiates a turbine trip.					
<ul> <li>Differential pressure transmitter, Bearing no MBV54CP020</li> </ul>	o. 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.					
<ul> <li>Differential pressure regulating valve , bearing no. 2 MBV54AA005</li> </ul>					
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.					
<ul> <li>Shut off valve, upstream differential pressu MBV54AA010 The manually operated valve is shut off if the The valve is locked in open position during</li> </ul>	he differential pressure valve w	vill be removed.			
<ul> <li>The valve is locked in open position during turbine operation.</li> <li>Bearing no. 2 Return Tank MBV60BB005</li> <li>Lick pressure tenk for the neturning oil from Decrine no. 2</li> </ul>					
<ul><li>High pressure tank for the returning oil from Bearing no. 2.</li><li>Floating valves, Bearing no. 2 Return Tank</li></ul>					
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.					
<ul> <li>Level switch, Bearing no. 2 Return Tank MBV60CL005</li> </ul>					
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[	SYSTEM DESCRIPTIO	DN	Respons. dept Date	9 (22) Reg.		
	MBV		GPMA 2003-11-27 Prepared	M DB 101		
	LUBRICATION OIL S	YSIEM	Karin Sjöqvist	YAMAMA CEMENT		
This document is issued in Pulse.	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.					
ıt is issu	Orifice, Bearing no. 2     MBV60BP005					
s documen	Sealing air from the h		a pipe from bearing no. 2 du acuated through the orifice a bil tank.			
Thi	• Ventilation valve, Be MBV60AA015	-				
	valve is closed.		as generator speed reaches	-		
inery AB	air in the return pipe		turbine stop in order to eva e valve.	cuate the high pressure		
al Turbomach	• Lube oil cooler, air co MBV30AC015	ooled				
Delaval Industrial Turbomachinery AB		anger module with associat ously vented to the tank by	ed AC-motor driven fan. piping and an orifice in or	der to avoid air pockets.		
© Demag Del	• Air cooler fan 1 MBV30AN015					
	-		mode. The fan is used as a them can be selected for au	•		
	• Lube oil cooler, air co MBV30AC020 Air cooled heat exch	ooled anger module with associat	ed AC-motor driven fan			
		0	piping and an orifice in or	der to avoid air pockets.		
	<ul> <li>Air cooler fan 2 MBV30AN020</li> </ul>					
	The fan can be opera	redundant object to or standby operation.				
	<ul> <li>Lube oil cooler, air cooled MBV30AC025</li> </ul>					
/ord 97	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.					
A 087 0474-B 00-03 MS Word 97	• Air cooler fan 3 MBV30AN025					
)474-B 0	Approved 2003-11-28 Henrik Orn	Latest revision a.) KS/GPMA/2004-05-26		Archive HG 9100		
A 087 (	Checked 2003-11-28 Roger Jonsson			No. 1CS38313		

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SYSTEM DESCRIP	TION	Respons. dept Date	10 (22) Reg.
MBV		GPMA 2003-11-27	M DB 101
LUBRICATION OI	L SYSTEM	Prepared Karin Sjöqvist	YAMAMA CEMENT
1		anual mode. The fan is used as a er of them can be selected for au	Ũ
• Venting orifice, h MBV30BP215	ube oil piping downstrea	m cooler	
The orifice is used	d to continuously vent th	e piping to the tank in order to a	void air pockets.
• Venting orifice, h MBV30BP220	ube oil piping upstream o	cooler	
The orifice is used	d to continuously vent th	e piping to the tank in order to a	woid air pockets.
• Orifice, lube oil c MBV30BP005	ooler by-pass		
The orifice size is		ne pressure drop in the by-pass l able oil flow through cooler vs.	-
• Shut off valve, dr	ainage of system		
MBV40AA205	1 • • 1 • .1 •		<b>1</b> • • .
		stem back to the lube oil tank, e ing normal system operation.	.g. during maintenance.
• Shut off valves, a MBV30AA220	ir-cooled oil cooler vent		
MBV30AA220 MBV30AA230			
MBV30AA250			
The valves are us	ed for venting of the coo	lers to atmosphere during filling	and emptying.
The valves are loo	cked in closed position d	uring normal system operation.	
	ir-cooled oil cooler drain	1	
MBV30AA225 MBV30AA235			
MBV30AA255			
The valves drain	oil from coolers.		
The valves are loo	cked in closed position d	uring normal system operation.	
	ir-cooled oil cooler		
MBV30AA030			
MBV30AA035 MBV30AA040			
MBV30AA040 MBV30AA045			
MBV30AA050			
MBV30AA055			
	ed to isolate the cooler d	-	
The valve is locke	ed in open position durin	g normal system operation.	
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		NT.	Respons. dept	Date	Reg.	11 (22)
	YSTEM DESCRIPTIC 1BV	<b>VIN</b>	GPMA	2003-11-27	M DB 10	1
L	UBRICATION OIL SY	<b>YSTEM</b>	Prepared Karin Sjög	lvist	YAMAM	A CEMENT
•	Venting orifices, air-o MBV30BP225 MBV30BP230 MBV30BP235 The orifices are used and damage due to th Lube oil filter (particl MBV40AT005 MBV40AT010 The 2x100% filter pu The filter cartridges a Each filter casing is c The change-over betw Change-over valves, T MBV40AA005 MBV40AA005 MBV40AA010 To make change-over a manual change-over avoid significant syste Equalisation valve, lu MBV40AA015 The equalisation valve filter in order to avoid Shut off valve, draina MBV40AA210 The shut off valve pro- valve is locked in close Venting orifices, lube MBV40BP205 MBV40BP210 The orifices are used Venting shut off valve MBV40AA230 The shut off valves and	to continuously vent t ermal expansion of oi e type) rifies the oil to the rec re working according ontinuously vented to veen filters is made m ube oil filter between filters possi valve function. The em pressure drop duri be oil filter e is used prior to chan l a pressure drop in th age of system ovides possibility for o sed position during no oil filter to continuously vent t es, lube oil filter	he coolers to the he coolers to the l. quired level in or to particle princ the tank via an of anually. ble during turbin valves are mecha ng change-over. hge-over betweer e system. drainage of low p ormal system ope he filter casings	e tank in order to der to avoid dan iple and are ma orifice in order anically intercon n filters, to enab point main oil p eration.	o avoid air p mage to the de of micro to avoid air e filters are nnected and ole filling of ole filling of	pockets consumers. glass fibre. pockets. provided with designed to f the standby f the standby ngs. The d air pockets.
	pressure during maint The valves are locked		ng normal system	n operation.		
	roved	Latest revision			Archive	HG
Hen	3-11-28 rik Orn <sup>cked</sup> 3-11-28	a.) KS/GPMA/2004-05	5-26		No.	9100

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SI	IEMENS					Sheet 12 (22)
	YSTEM DESCRIPTIO	N	Respons. dept	Date 2003-11-27	Reg. M DB 10	
	IBV UBRICATION OIL S	<b>TSTEM</b>	Prepared Karin Sjöc			IA CEMENT
•	Drainage shut off val MBV40AA215 MBV40AA220 The shut off valves ar maintenance. The valves are locked Drainage shut off val MBV40AA235 MBV40AA240 The shut off valves ar The valves are locked	re used to drain the l in closed position ves, lube oil filter re used to drain the	during normal syst filter casings dirty	em operation. side to atmospl		
•	Differential pressure MBV40CP010 The transmitter is mo change-over and main At high (H1) differen	transmitter, lube oil nitoring the different tenance.	filter ntial pressure acros	-	indicating r	need for filter
•	Shut off valve, oil sar MBV40AA020 The valve permits oil		rbine operation, in	order to detern	nine oil con	dition.
•	Pressure transmitter, MBV40CP015 The transmitter is mo to the consumers. Low pressure (L1) int Low pressure (L2) int	nitoring oil supply p	-	am the filter, in	order to pi	event damage
•	Pressure gauge, lube MBV40CP020 Local indication of oi		the consumers, do	ownstream the f	filter.	
•	Pressure transmitter, MBV40CP025 The transmitter is mo to the consumers. Low pressure (L1) in Low pressure (L2) in	nitoring oil supply j	-	am the filter, in	order to pi	event damage
•	Thermometer, lube of MBV40CT010 Local indication of oi		nsumers.			
2003	oved 3-11-28 rik Orn	Latest revision a.) KS/GPMA/2004	-05-26		Archive	нд 9100
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SIEMENS					Sheet 13 (22)
SYSTEM DESCRIPTION		Respons. dept	Date 2003-11-27	Reg. M DB 101	13 (22)
MBV LUBRICATION OIL SYS	TEM	Prepared Karin Sjöq		YAMAMA C	CEMENT
<ul> <li>Temperature transmitter MBV40CT005 The Pt100 sensor is mo consumers. Low temperature (L1) i High temperature (H1) High temperature (H2)</li> <li>Temperature transmitter MBV40CT015 The Pt100 sensor is mo consumers. Low temperature (L1) i High temperature (H1) High temperature (H2)</li> <li>Lube oil mist filter (coa MBV10AT005 The filter extracts the or connected to atmospher The oil mist filter is wo</li> <li>Differential Pressure In MBV10CP010 Local indication of differ</li> <li>Oil system ventilation f MBV10AN005 The AC-driven oil syster casings, in order to preventing the system</li> </ul>	hitoring the oil temp nterlocks activation initiates an alarm. initiates a turbine tr r, lube oil hitoring the oil temp nterlocks activation initiates an alarm. initiates a turbine tr lescer type) 1 mist from the air. e via a fan. king according to t dicator, Lube Oil M erential pressure act an m ventilation fan n ent oil leakage thro	of the start moto ip. perature, after coo of the start moto ip. The oil is returne the coalescing pri list Filter coss lube oil mist maintains a sub-at ough the shaft sea	r. oling, in order r. ed to the tank a nciple. filter.	to prevent dama	age to the t is
• Lube oil tank	in automatic of ma	indar mode.			
MBV10BB005 The lube oil tank is a fu before it is redistributed A skiboard gives the ret surface.	to the consumers.	-			
Manway opening is pro cleaning of all interior p Weld-in thermowells fo	arts.			y for inspection	and
• Level gauge, lube oil ta					
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SYSTEM DESCRIPTION		Date 2003-11-27	Reg. M DB 101	14 (22)
MBV LUBRICATION OIL SYSTEM	Prepared Karin Sjöqvi			A CEMENT
MBV10CL005 Local indication of the oil level by a	level gauge top-mounted	l on the lube o	oil tank.	
• Level transmitter, lube oil tank MBV10CL010 The level transmitter is top-mounted High level (H2) initiates an alarm.				
<ul> <li>Alarm for max run down level. Only High level (H1) initiates an alarm.</li> <li>Increasing oil level can be caused by Low level (L1) initiates an alarm.</li> <li>This alarm indicates loss of oil in the</li> </ul>	an internal leakage in the	e liquid-cool		-
This alarm indicates loss of oil in the through the oil mist filter to the atmo Low level (L2) initiates an alarm. A possible reason for reaching the ala leakage.	sphere, leakage in the pip	ping or throu	gh the shaft	sealings.
<ul> <li>Pressure gauge, sub-atmospheric press</li> <li>MBV10CP005</li> <li>Local indication of the sub-atmospheric</li> </ul>		ık.		
<ul> <li>Differential pressure transmitter, lube MBV10CP015 The transmitter is monitoring sub-atre the consumers during turbine operation This might be caused by clogging of fan/driver.</li> <li>High level (H2) initiates a unloading The trip is required to avoid excessive</li> </ul>	nospheric pressure in the on. High level (H1) initia the oil mist filter or a ma turbine trip.	ates an alarm. Alfunction of	the oil syster	110
• Thermometer, lube oil tank MBV10CT005 Local indication of oil temperature in The thermometer is installed in a ther				
• Oil filling point strainer, lube oil tank MBV10AT015 The oil filling point is equipped with operation.		d to allow fil	ling during t	urbine
• Siphon breaker, oil purification suction MBV10BP010 The siphon breaker is a drilled hole in The siphon breaker prevents a compl side of oil purification unit, if include	n the suction pipe to an o ete emptying of the tank	-		
pproved Latest revision 003-11-28 enrik Orn a.) KS/GPMA/2	2004-05-26		Archive	нд 9100
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SYSTEM DESCRI MBV	PTION	Respons. dept Date GPMA 2003-11-27	Reg. M DB 101
LUBRICATION O	IL SYSTEM	Prepared Karin Sjöqvist	YAMAMA CEMENT
MBV10AA210 The valve is loca	1	lly operated) lube oil tank to permit comple ing normal system operation.	ete emptying.
The heaters are in The heat power, to increase the li	nstalled direct into the oil which is transferred direc fetime of the mineral oil.	inimum temperature required f at side of the lube oil tank. t from the heating elements to nmended that the heaters are t	the oil, is limited in order
MBV10CT010 The Pt100 is con Low temperature Low temperature or to maintain th	e (L2) interlocks start of th	heaters, in order to heat the oi tandstill.	
MBV10CT025 A 2xPT100 is in One of the PT10 into the control of High temperatur heater element.	oom. e (H2) automatically disco		prevent overheating of the
<ul> <li>MBV10CT015 A 2xPT100 is in One of the PT10 the control room controls the pow Low temperature High temperature</li> <li>Overheating pro MBV10CT030</li> </ul>	. The temperatures, which	Immable temperature control d n have been set into the control heater. heater. ater 2	
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S	YSTEM DESCRIPTIC	N	Respons. dept Date GPMA 2003-1	11_27	Reg. M DB 10	16 (22)
	BV UBRICATION OIL SY	<b>YSTEM</b>	Prepared Karin Sjöqvist	11-27		A CEMENT
	into the control room. High temperature (H2 heater element.	2) automatically disc	ammable temperature-lim onnects the power in orde manually reset after an a	er to pre	event overh	
•		ted in the heater MB connected to a progra temperatures, which the heater. ) initiates start of the	nmable temperature con n have been set into the co heater.			
•	High temperature (HI Low temperature (L1 or to maintain the oil	n a thermowell, is co )initiates stop of the ) initiates start of the temperature during s	heaters, in order to heat		-	
•	Pressure point, return MBV10CP025 Pressure test point to		ric pressure in return pipe	bearin	g no. 3,4.	
•	Pressure point, return MBV10CP030 Pressure test point to		ngs ric pressure in return pipe	from g	generator be	earings.
•	Pressure point, return MBV10CP035 Pressure test point to		ric pressure in return pipe	from t	he gearbox.	
•	Pressure point, inlet p MBV40CP030 Pressure test point pre		y inlet pressure to Bearing	g no. 1.		
•	Pressure point, inlet p MBV40CP035 Pressure test point to		to Bearing no. 3,4.			
•	Pressure point, Inlet p MBV40CP040 Pressure test point to		gs to generator bearings.			
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LUBRICATION OIL SYSTEM	Prepared Karin Sjöc	qvist	YAMAMA	CEMENT

- 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.

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Che 200 Roc

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#### Generator breaker trip **B.**

N/A.

#### Loss of power supply C.

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.

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# **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.

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LUBRICATION OIL SYSTEM	Prepared Karin Sjöqvist	YAMAMA CEMENT

#### 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.

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ank Drain	15			
	15			
Lube Oil Heater 1 MBV10AH010				
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Oil Filling Point, Lube Oil Tank				
MBV10BB005				
Lube Oil Tank				
Lube Oil Tank 1 MBV10BP010				
Siphon Breaker, Oil Purification Suction Line				
e	14			
Lube Oil Tank Level Transmitter				
MBV10CP005				
Lube Oil Tank Sub-Atmospheric Pressure Gauge				
MBV10CP010				
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	ank Drain Tank ation Suction Line e mitter oheric Pressure Gauge			

Differential Pressure Indica MBV10CP015	tor, Lube Oil Mi	st Filter	13		
Lube Oil Tank Differential	Pressure Transm	itter	14		
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MBV10CT020					
Lube Oil Heater 2 Temperature switch					
MBV10CT025					
Lube Oil Heater 1 Overheating Protection					
MBV10CT030					
Lube Oil Heater 2 Overheating Protection					
MBV21AA010 Non-Return Valve			4		
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LUBRICATION OIL SYSTEM		Prepared Karin Sjöqvist YAMAMA Cl	EMEN
MBV21BP005		MBV30AN020	
Air release orifice, lube oil pump 1 discharge	3	Lube Oil Cooler Fan 2	
MBV21CP005 Lube Oil Pump 1 Discharge Pressure Switch	3	MBV30AN025 Lube Oil Cooler Fan 3	
MBV22AA010	5	MBV30BP005	
Non-Return Valve	4	Orifice, Lube Oil Cooler By-Pass	
MBV22AA015	4	MBV30BP215	c
Shut off Valve MBV22AP005	4	lube oil piping downstream cooler, Venting Ori MBV30BP220	nce
Lube Oil Pump 2	4	lube oil piping upstream cooler, Venting Orific	e
MBV22BP005		MBV30BP225	
Air release orifice, lube oil pump 2 discharge	4	Air-cooled oil cooler, Venting Orifice	
MBV22CP005 Lube Oil Pump 2 Discharge Pressure Switch	4	MBV30BP230 Air-cooled oil cooler, Venting Orifice	
MBV23AA010	+	MBV30BP235	
Lube Oil Pump 3, Non-Return Valve	5	Air-cooled oil cooler, Venting Orifice	
MBV23AA015	<i>_</i>	MBV30CP010	
Lube Oil Pump 3 discharge ABV23AP005	5	Pressure Point downstream lube oil cooler MBV30CT010	
Lube Oil Pump 3	4	Thermowell downstream lube oil cooler	
ABV23BP005		MBV40AA005	
Air release orifice, lube oil pump 3 discharge	5	Lube Oil Filter Change-Over Valve 1	
ABV23CP005 Lube Oil Pump 3 Discharge Pressure Switch	5	MBV40AA010 Lube Oil Filter Change-Over Valve 2	
/BV30AA020	5	MBV40AA015	
Lube Oil Cooler Temperature Control Valve	5	Lube Oil Filter Equalisation Valve	
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/BV30AA035		MBV40AA215	
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Shut Off Valve, Air-cooled oil cooler	10	Lube Oil Filter 1, Venting Shut off valve	
/IBV30AA050 Shut Off Value Air cooled oil cooler	10	MBV40AA230	
Shut Off Valve, Air-cooled oil cooler //BV30AA055	10	Lube Oil Filter 2, Venting Shut off valve MBV40AT005	
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MBV30AA220 Shut Off Valve, Air-Cooled Oil Cooler Vent	10	MBV40BP205 Lube Oil Filter 1, Venting Orifice	
MBV30AA225	10	MBV40BP210	
Shut Off Valve, Air Cooler Drain	10	Lube Oil Filter 2, Venting Orifice	
MBV30AA230 Shut Off Valve, Air Cooled Oil Cooler Vent	10	MBV40CP010 Lube Oil Filter Differential Pressure Transmitte	r
Shut Off Valve, Air-Cooled Oil Cooler Vent //BV30AA235	10	MBV40CP015	1
Shut Off Valve, Air Cooler Drain	10	Lube Oil Pressure Transmitter	
ABV30AA250	10	MBV40CP020	
Shut Off Valve, Air-Cooled Oil Cooler Vent //BV30AA255	10	Lube Oil Pressure Gauge MBV40CP025	
Shut Off Valve, Air Cooler Drain	10	Lube Oil Pressure Transmitter	
/IBV30AC015		MBV40CP030	
Lube Oil Cooler 1, Air Cooled	9	Pressure Point, Inlet Pipe Bearing no. 1	
/IBV30AC020 Lube Oil Cooler 2, Air Cooled	9	MBV40CP035 Pressure Point, Inlet Pipe Bearing no. 3,4	
ABV30AC025	/	MBV40CP040	
Lube Oil Cooler 3, Air Cooled	9	Pressure Point, Inlet Pipe Generator Bearings	
VBV30AN015 Lube Oil Cooler Fan 1	9	MBV40CP045 Pressure Point, Return Pipe Bearing no.2	
Luor On Cooler Fall I	У	riessue rom, keum ripe Bearing no.2	
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a.) KS/GPMA/20	104-05-26		100
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				Sheet	
	SIEMENS			22 (22)	
	SYSTEM DESCRIPTION MBV		Respons. dept Date GPMA 2003-11-27	Reg. M DB 101	
	LUBRICATION OIL SYSTEM		<sup>Prepared</sup> Karin Sjöqvist	YAMAMA CEMEN	Т
se.	MBV40CT005	10	Lube Oil Booster Pump 3,	Shut Off Valve	7
Pu	Lube Oil Temperature Pt100 MBV40CT010	13	MBV53AP005 Lube Oil Booster Pump 3		7
g	Lube Oil Thermometer MBV40CT015	12	MBV53CP005 Lube Oil Booster Pump 3,	Discharge Pressure Switch	7
ssue	Lube Oil Temperature Pt100	13	MBV54AA005	-	
S S	MBV51AA005 Lube Oil Booster Pump 1 , Shut Off Valve	6	MBV54AA010	lating Valve, Bearing no. 2	8
This document is issued in Pulse	MBV51AA010 Lube Oil Booster Pump 1, Non-Return Valve	6	Shut Off Valve upstream P MBV54CP005	CV	8
ocur	MBV51AA015 Lube Oil Booster Pump 1, Shut Off Valve	6	Differential Pressure Indica MBV54CP010	ator Bearing no. 2	7
is d	MBV51AP005		Pressure Indicator, Bearing	g no.2	8
₽	Lube Oil Booster Pump 1 MBV51CP005	6	MBV54CP015 Differential Pressure Trans	mitter, Bearing no. 2	8
	Lube Oil Booster Pump 1, Discharge Pressure Switch MBV52AA005	6	MBV54CP020 Differential Pressure Switc	h Bearing no 2	8
	Lube Oil Booster Pump 2, Shut Off Valve	6	MBV54CP030		-
	MBV52AA010 Lube Oil Booster Pump 2 ,Non-Return Valve	6	Pressure Point, Inlet Pipe E MBV60AA005/010	-	17
2	MBV52AA015 Lube Oil Booster Pump 2, Shut Off Valve	7	Floating Valves, Bearing n MBV60AA015	o. 2 Return Tank	8
	MBV52AP005 Lube Oil Booster Pump 2	6	Ventilation Valve, Bearing MBV60BB005	no. 2 Return Tank	9
	MBV52CP005		Bearing no. 2 Return Tank		8
a a	Lube Oil Booster Pump , Discharge Pressure Switch MBV53AA005	7	MBV60BP005 Orifice, Bearing no. 2 Retu	rn Tank	9
Inenni	Lube Oil Booster Pump 3, Shut Off Valve MBV53AA010	7	MBV60CL005 Level Switch, Bearing no.	2 Return Tank	8
טפומעמו וווטטאוומן דעוטטווומטוווופוץ אם	Lube Oil Booster Pump 3, Non-Return Valve	7	MBV60CP005		_
בי	MBV53AA015		Pressure Point, Return Pipe	e Bearing no.2	17

Approved	Latest revision	Archive	HG
2003-11-28 Henrik Örn	a.) KS/GPMA/2004-05-26		9100
Checked 2003-11-28 Roger Jonsson		No. 1CS38313	
Roger Jonsson		10838313	