GT24/GT26
Operation

Jacking Oil System

Training Module

ALSTOM (Switzerland) Ltd

This is a training module!

All plant-specific values and settings stated in this document are for information only; they are subject be change during commissioning of the plant.

For final values and settings please refer to the Customer Operation & Maintenance Manual.

Table of Contents

Module Objectives

Upon completion of this section, the trainee must be able to:

- Explain by heart the purpose.
- List the major components.
- Describe the purpose of the non-return valves.
- Describe how the jacking oil system is protected from overpressure.
- List the operating conditions requiring the jacking oil system to operate.
- List the conditions which must be fulfilled before the jacking oil system can start.
- List the probable causes of the "Motor Control Center - Not Ready" alarm.
- List the checks which must be made in the jacking oil system during rotor barring operation.

System Purpose and Scope

Figure 1 & Simplified Diagram

Two jacking oil systems are included in the auxiliary block of the gas turboset:

- MBV50 jacking oil system for the gas turbine and generator.
- MAV50 jacking oil system for the IP and LP steam turbine.

The jacking oil system supplies high-pressure oil to the bearings where it forms hydrostatically a lube oil film between journal and lower bearing shell at standstill or at low rotational speed of the rotor. This means lifting the shaft, ensuring the complete separation of the two metallic surfaces, thus enabling the rotor to “float”.

As soon as the rotor turns at higher speed, the oil film will be formed hydrodynamically enabled by the design of the bearing, the bearing’s clearance and the supplied lube oil. The jacking oil system is then switched off.

The jacking oil system must always operate when the rotor is at low speed, that is during:

- Startup of the gas turboset to reduce the starting torque,
- shutdown of the gas turboset,
- turning gear and hydraulic rotor barring operation,
- off-line compressor cleaning of the GT,
- fast cooling of the GT,
- rotor turning with SSD, e.g. motor roll during commissioning,
- rotate the shaft by hand from inside the exhaust gas plenum, e.g. during boroscope inspection.

Generally, the jacking oil system must be in operation as long as the rotor speed is below 90 % of the nominal speed.

The jacking oil system is normally not in service:

- During a complete standstill of the turboset.
- After the SSD is disconnected during startup.

The major components of the jacking oil systems of the gasturboset are:

- AC motor driven jacking oil pumps MBV50 AP001,
- lockable flow control valves MBV50 AA 010 / 020,
- non-return valves,
- pressure limiting valve MBV50 DP001,
- piping, safety and monitoring equipment.

System Description

Jacking Oil Pump

Figure 1 & Simplified Diagram

The AC motor driven jacking oil pump MBV50 AP001 is a pressure compensated axial-piston pump with variable displacement swashplate design and installed on the top plate of the lube oil tank.

This type of pump always:

- Maintains a constant pressure by the pump's internal pressure control valve MBV50 AA002, further it
- discharges the jacking oil exactly at the required flowrate, without excess oil flowing through the pressure limiting valve MBV50 DP001.

The discharge pressure of the jacking oil pump – i.e. the pressure of the jacking oil system – is adjusted by the internally installed pressure control valve MBV50 AA002.

The high-pressure jacking oil enters the bearings of the gasturboset and generator through a hole in the lowest part of the lower bearing shell and fills the pocket provided in this area. The resultant force in the pocket area lifts the rotor of the turboset, and generator respectively.

The correct lift of the shaft can be verified by measuring the lift by means of a dial distance gauge. Compare the measured value with the lift recorded during commissioning.

If the two AC motor driven lube oil pumps should fail, the AC motor driven jacking oil pump and the emergency lube oil pump are started automatically together, to supply oil as the turboset is shutting down.

Flow Control Valves

Figure 1 & Simplified Diagram

Flow control valves MBV50 AA010 / 020 / 030 / 040 are installed upstream of each bearing in the supply lines from the jacking oil pump. These valves are of the two-directional flow control type, returning surplus oil back into the oil tank. During commissioning the oil flow through each valve is adjusted until the correct rotor lift is achieved and then key-locked.

Non-return Valves

Non-return valves MBD11 AA001, MBD21 AA001, MKD11 AA001, MKD21 AA001, are installed upstream in each journal bearing supply line to prevent oil back flow. Additional non-return valves MBV50 AA011 / 021 / 031 / 041 are belonging to the gasturboset are installed downstream of the flow control valves also preventing back flow.

Pressure Limiting Valve

The pressure limiting valve MBV50 DP001 protects the system from overpressure.

Pressure Measuring

Pressure indicator MBV50 CP009 is installed permanently, pressure point MBV50CP011 allows measurement during commissioning and maintenance and is not equipped with an instrument. Pressure gauges for local indication are available in each of the lines down stream of the flow control valves.

Operation

In general the system shall be operated in accordance with the Plant Operation Concept.

Prior to startup, the preselection of component and all relevant valve positions have to be checked with the aid of the manual “Preparation Check List prior to Startup”:

Startup

Simplified Diagram

Before the jacking oil system can be started, the following conditions must be fulfilled:

- Any maintenance is completed and all work permits are withdrawn or cancelled.
- The operating mode of the gas turboset has been selected from: e.g. normal operation, rotor barring, compressor cleaning, fast cooling etc.
- Function Group (FG) lube oil on, oil pressure in the distribution system MBV40 is above the preset level.

When the above conditions are fulfilled, EGATROL's sequential start program automatically starts the jacking oil pump(s).

Shutdown

During a normal shutdown of the gas turboset, the jacking oil pump starts automatically by a signal from the sequential shutdown program after the turbine rotor speed has dropped below a preset percentage of the rated speed.

When the rotor has cooled down, the Function Group (FG) rotor barring can be shut down by the operator and then the jacking oil pump(s) are switched off.

Emergency Situations

In an emergency situation the same procedure applies as during normal gas turboset shutdown.

During shutdown of a tripped turboset, the pressure in the lube oil distribution system will perhaps drop. The emergency lube oil pump is started automatically by the EGATROL control system when the pressure in the lube oil distribution system drops below a preset limit.

If the EGATROL control system should fail, the rotor must be maintained turning during the cool down period. The jacking oil pump, is started by hand in the Human Machine Interface. However, this pump start is interlocked until the minimum lube oil pressure is supplied by the main or emergency lube oil pump. Thereafter the rotor barring can be started.

Protection and Fault Causes

General

The EGATROL controls and supervises the turboset.

An interlock prevents the jacking oil system from starting unless the lube oil pumps are supplying pressurized oil. This protection is part of EGATROL.

There are no alarms initiated from the jacking oil system to the EGATROL, but there are alarms in the Motor Control Center (MCC) from non-functioning AC motors.

Malfunctioning and possible causes

MCC not Ready

Possible causes:

- Breaker not switched on.
- Thermal protection has responded.
- One or more fuses are blown.

Required Action:

Investigate until the source of the problem is found. Take the action necessary to return the unit to normal operation.

Monitoring Equipment

Pressure Monitoring

Pressure gauge MBV50 CP011 monitors locally the pressure after the jacking oil pump.

Pressure gauge MBV50 CP010/020, MBV61 CP010 and MBV62 CP020 monitor locally the oil pressure after the flow control valves.

Periodic Checks

During operation of the jacking oil system, take a walk down - at least once per shift - to check for:

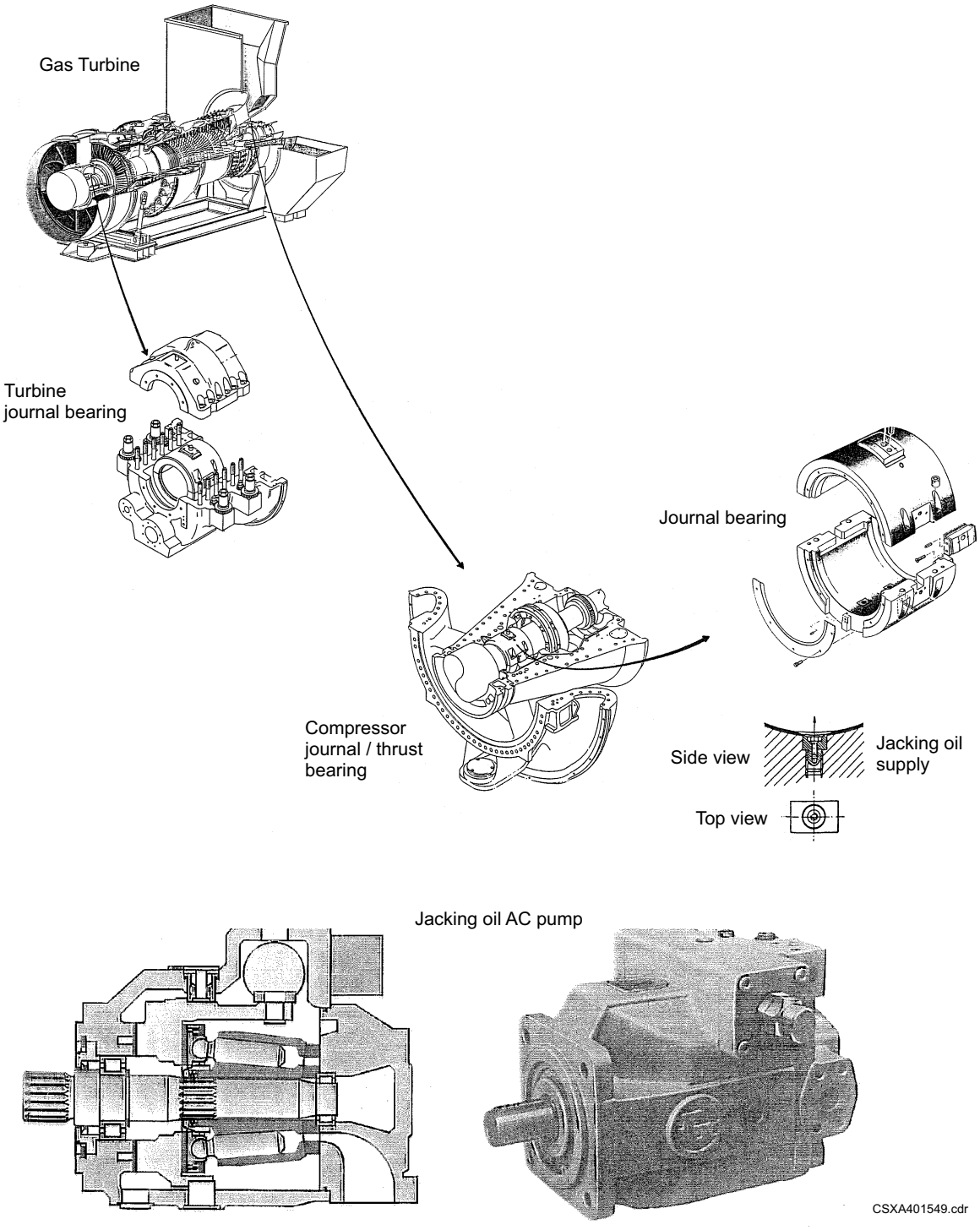
- The pressure indication on the pressure gauges.
- Leaks in the high-pressure piping.
- Noise, abnormal vibration and temperatures in pumps, motors and in piping.

Summary

This section discusses the jacking oil system and its operation, alarms with possible causes, which must be rectified. It lists checks which operating personnel must do when the system is in operation.

To ensure that you understand the material covered, review each of the Objectives (page 4).

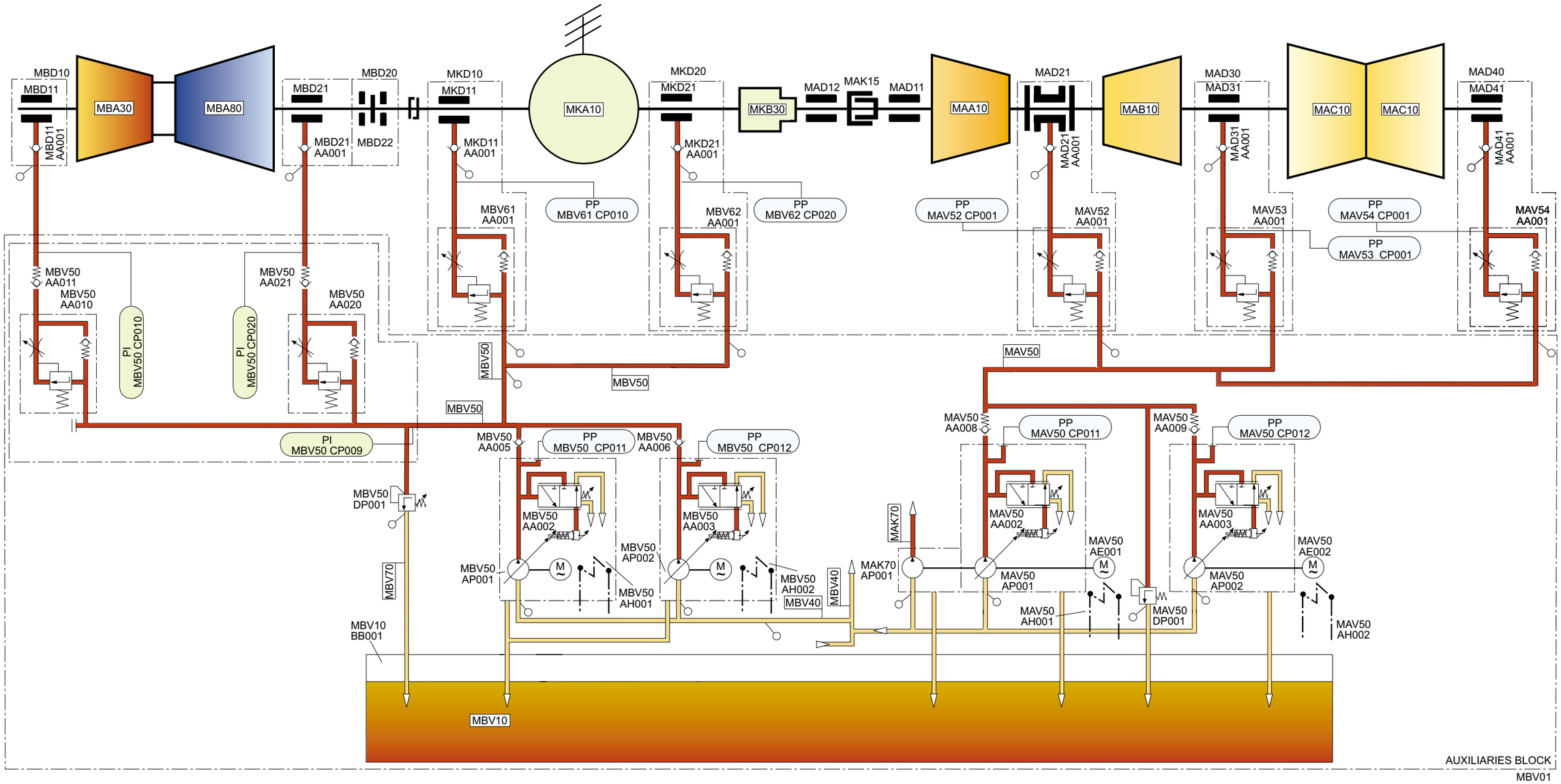
Figure 1: Typical Jacking Oil System



Jacking Oil System

Simplified Diagram

Derived from HTCT 319 678



Designation of Parts
Derived from HTCT 690 985 Var.12

KKS-No.	*Designation*
MAA10	HP steam turbine
MAB10	IP steam turbine
MAC10	LP steam turbine
MAD11	Journal bearing shell
MAD12	Journal bearing shell
MAD21	Journal bearing shell
MAD21 AA001	Non-return valve
MAD31	Journal bearing shell
MAD31 AA001	Non-return valve
MAD41	Journal bearing shell
MAD41 AA001	Non-return valve
MAK70	Turning gear supply
MAK70 AP001	Turning gear oil pump
MAK85 AP001	Hand pump (not in diagram HTCT 319 678)
MAV50	Jacking oil system, steam turbine
MAV50 AA002	Pressure control valve
MAV50 AA003	Pressure control valve
MAV50 AA008	Non-return valve
MAV50 AA009	Non-return valve
MAV50 AE001	Motor to jacking oil and turning gear oil pumps
MAV50 AE002	Motor to jacking oil pump
MAV50 AH001	Standstill heater, motor to pump MAV50 AP001
MAV50 AH002	Standstill heater, motor to pump MAV50 AP002
MAV50 AP001	Jacking oil pump, AC-motor driven
MAV50 AP002	Jacking oil pump, AC-motor driven
MAV50 CP011	Measuring point for pressure
MAV50 CP012	Measuring point for pressure
MAV50 DP001	Constant pressure valve
MAV52 AA001	Flow control valve
MAV52 CP001	Measuring point for pressure
MAV53 AA001	Flow control valve
MAV53 CP001	Measuring point for pressure
MAV54 AA001	Flow control valve
MAV54 CP001	Measuring point for pressure
MBA30	Gas turbine
MBA80	Compressor
MBD10	Turbine bearing perdestal

(Continued next page)

Designation of Parts *(continued)*

KKS-No.	*Designation*
MBD11	Journal bearing shell
MBD11 AA001	Non-return valve
MBD20	Compressor bearing pedestal
MBD21	Journal bearing shell
MBD21 AA001	Non-return valve
MBD22	Thrust bearing shell
MBV10	Lube oil storage system
MBV10 BB001	Tank
MBV21	Lube oil forwarding system (not in HTCT 319 678)
MBV21 AP001	Main lube oil pump 1 (not in HTCT 319 678)
MBV21 AP002	Main lube oil pump 2 (not in HTCT 319 678)
MBV22	Emergency lube oil system (not in HTCT 319 678)
MBV22 AP001	Emergency lube oil pump (not in HTCT 319 678)
MBV40	Lube oil distribution system
MBV50	Jacking oil system
MBV50 AA002	Pressure control valve
MBV50 AA010	Flow control valve
MBV50 AA011	Non-return valve
MBV50 AA020	Flow control valve
MBV50 AA021	Non-return valve
MBV50 AH001	Standstill heater, motor to pump MBV50 AP001
MBV50 AH002	Standstill heater, motor to pump MBV50 AP002
MBV50 AP001	Jacking oil pump, AC-motor driven
MBV50 AP002	Jacking oil pump, AC-motor driven
MBV50 CP009	Measurement of pressure
MBV50 CP010	Measurement of pressure
MBV50 CP011	Measuring point for pressure
MBV50 CP012	Measuring point for pressure
MBV50 CP020	Measurement of pressure
MBV50 DP001	Pressure limiting valve
MBV61 AA001	Flow control valve
MBV61 CP010	Measuring point for pressure
MBV62 AA001	Flow control valve
MBV62 CP020	Measuring point for pressure
MBV70	Lube oil return system
MKA10	Generator
MKB30	Exciter

(Continued next page)

Designation of Parts *(continued)*

KKS-No.	*Designation*
MKD10	Bearing pedestal, generator drive end
MKD11	Journal bearing shell, generator drive end
MKD11 AA001	Non-return valve
MKD20	Bearing pedestal, generator non-drive end
MKD21	Journal bearing shell, generator non-drive end
MKD21 AA001	Non-return valve