OKTO

2022

STAYING TRUE TO THE PRINCIPALS OF GOOD SOLID ENGINEERING

EXPERIENCE SHARE BULLETIN

FQC FIRST QUALITY CERTIFICATION ISO 9001 : 2015

OCCUPATIONAL HEALTH & SAFETY OHSAS 18001

OKTO Engineering

www.oktotr.com

E-mail : info@oktotr.com

OKTO

COMPANY OVERVIEW

OKTO Engineering is a dynamic company who specialized in the servicing and support of medium and low speed Diesel powered engines within the Marine and Power Generation Industries with OEM Service Engineering background certificated engineers.

OKTO Engineering offers comprehensive services in Operation & Maintenance, technical support and training, installation and commissioning, performance recovery and retrofit, in marine and power plant projects.

We strive to provide world's best services and solutions, timely delivery, highest safety standards while never having to compromise our quality of work. Our goal is to provide flexible and cost-effective solutions to deliver high levels of availability and profitability to our customers.

To back up our field service support, OKTO offer complete workshop facilities, capable of the full in-house overhaul of engines and in-situ/onboard. Our location makes us ideally suited to support Eurasia, although our team of engineers regularly travel the world including Asia, America, and Europe to support our customers.

We improve performance of deteriorated facilities status and provide services for life extension via scientific inspection.

All our business will leverage mutual synergy optimization, value of our clients and market, and fulfill our social responsibility that satisfies the diverse needs of customers around the world.

SERVICES

1. Diesel Engine Overhauls 2 Stroke & 4 Stroke.
2. Maintenance-Troubleshoot of Main Engine Pneumatic Manoeuvring System.
3. Maintenance and Repair of Propulsion Systems.
4. Overhaul and Adjustment of Cylinder Lubrication Systems.
5. Electric/Electronic troubleshoot and PCB repair.
6. Replica analyses of M/E cylinder liner.
7. Liner measurement through scavenge port by Chris Marine LDM.
8. Inspection and Condition Evaluation of Engine - Ship Condition Survey.
9. Dry Docking Support
10. Spare Part (Limited)
11. Aux Engine Crankshaft Replacement During Sailing.
12. Maintenance Service for Power Plants.

THE FORGOTTEN PARTS OF MAIN ENGINE

We would like to bring to your kind attention an issue which may cause undesired incidents on your main engine.

You may aware service letter SL2008-492 and relevant alerts from Swedish Club but after personally, witnessing same situation, we decided to share this experience with you and remind the importance of the issue.

While we were opening main engine bearings for class inspection during vessel in drydock, everything seems good such as appearance oil, cleanliness of crankcase etc. Upon completing of job, we left vessel and come back a few days after launching. Once we open crankcase door for deflection measurement, (which vessel already started lubrication oil pump before our arrival) we have observed that lubrication oil deteriorated from excessive water in the lubrication oil system, which result replacing whole lubrication oil in the system.

After further investigation, we found out reason as extreme water presence on tank top (between main engine and sump tank) and damaged diaphragm membrane. Since vessel at drydock and crew busy for hectic jobs, ignored bilge alarm raised from M/E sunken part and could not realise water accumulation below main engine.

Why this part became forgotten?

1. Because of design, even if membrane or bellow damaged, not possible to understand without dismantling. (Oil never leak to tank top)

2. In order to water leak to sump tank, water level to increase minimum 10-15 cm, but normally bilge alarm raising before that level and ship crew keeping tank top area at dry condition. **Only drydocking period, it is easy to disregard bilge alarm and water accumulation on the tank top area.**

How To Prevent Incident?

1. Best way to follow service letter and inspect/replace the defective parts.

2. Emphasize importance to keep tank top dry and pay special attention to alarm raised from M/E sunken area, especially during drydock period.Please see below pictures belongs to above experience.

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MAN Diesel

MAN Diesel A/S • Denmark

Service letter

SL08-492/JVG
March 2008

Rubber Diaphragm Sealings in Crankcase Oil Outlets
Action Code: WHEN CONVENIENT

The crankcase lubricating oil outlets guide the lubricating oil from the crankcase to the bottom tank. A diaphragm at the outlet pipes prevents water and other liquids in the area from contaminating the main engine lubricating oil system, which could lead to fatal damage of the main engine bearings.

According to our Checking and Maintenance Schedule in the instruction manual of MAN B&W engines, we recommend to check the condition of the diaphragm in the crankcase oil outlet every 32,000 hours of operation and to replace the diaphragm if necessary. The procedure concerns rubber diaphragms as well as metal bellow diaphragms. However, due to the risk of material problems in rubber diaphragms, we recommend to replace the rubber diaphragms at every scheduled inspection, which is noted in our checking procedure (no. 912-5.1) for Crankcase Oil Outlet, enclosed with this letter. It should be noted that the membranes are normally supplied by the shipyard and not by the engine manufacturer.

We draw your attention to the above-mentioned schedule and our procedure and inform you as follows:

How to avoid defect rubber diaphragm

To avoid water entering the main engine sump tank through a defect crankcase oil outlet, it is recommended to:

- Inspect the diaphragm sealing in the crankcase oil outlet every 32,000 hours of operation and replace the diaphragm if necessary. Always replace rubber diaphragms.

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- Inspect the diaphragm sealing at the earliest opportunity after delivery of a new-building. In case of a rubber diaphragm, make sure the material is oil resistant and replace if this is not the case.

- Inspect the diaphragm sealing at the earliest opportunity when taking delivery of an existing ship and replace the diaphragm if necessary. Always replace rubber diaphragms.

Questions or comments regarding this SL should be directed to our Dept. LEE4.

Yours faithfully
MAN Diesel A/S

Carl-Erik Egeberg Niels B. Clausen

Encl.: Checking procedure 912-5.1

The crankcase oil outlets guide the lubricating oil from the crankcase to the lubricating oil bottom tank. The sealings of the crankcase oil outlets must be checked at regular intervals, for example during dockings. The crankcase oil outlets may be equipped with either rubber diaphragm sealing or metal bellow sealing.

Note!
If the water content of the main engine lube oil is rising, this may indicate that the crankcase oil outlet sealings are fractured.

Rubber diaphragm sealing

1. To access the rubber diaphragm sealing remove:
   Screws A
   Grating B
   Screws C
   Cover plate D
   Screws E
   Steel ring F.

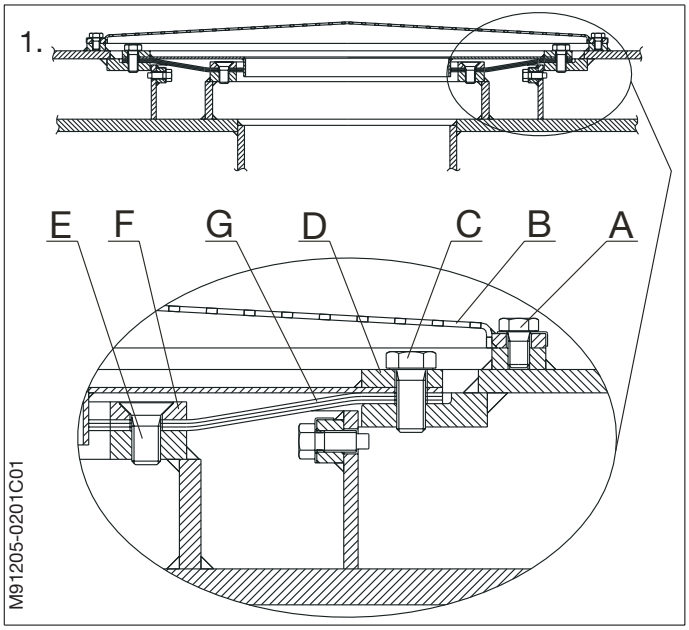
2. Lift away the rubber sealing diaphragms G and examine each diaphragm closely. In case of any rips or tears in the diaphragms, they must be replaced.

Note!
It is strongly recommended to always replace the diaphragms during inspection. If unavailable, new diaphragms may be made from three layers of 2 mm thick oil and temperature resistant rubber.

3. Mount:
   Rubber sealing diaphragms G
   Steel ring F
   Screws E
   Cover plate D
   Screws C
   Grating B
   Screws A.

Note!
Remember to fit new locking plates at screws A.

1.



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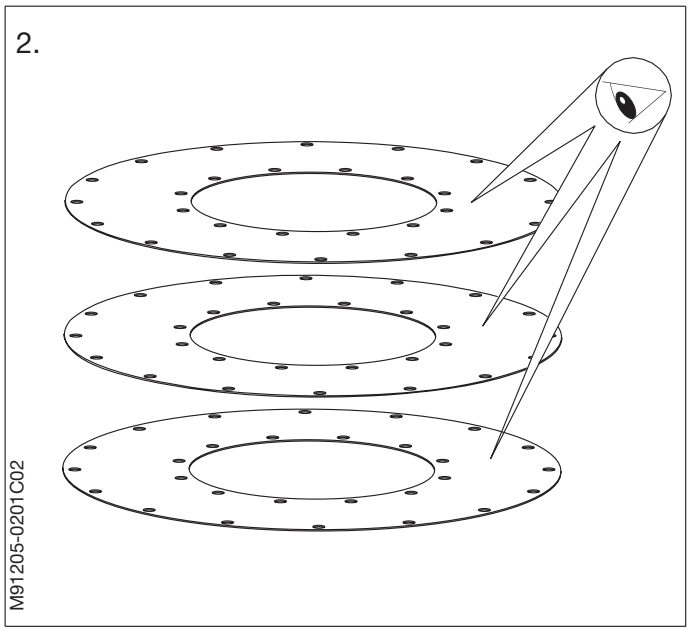

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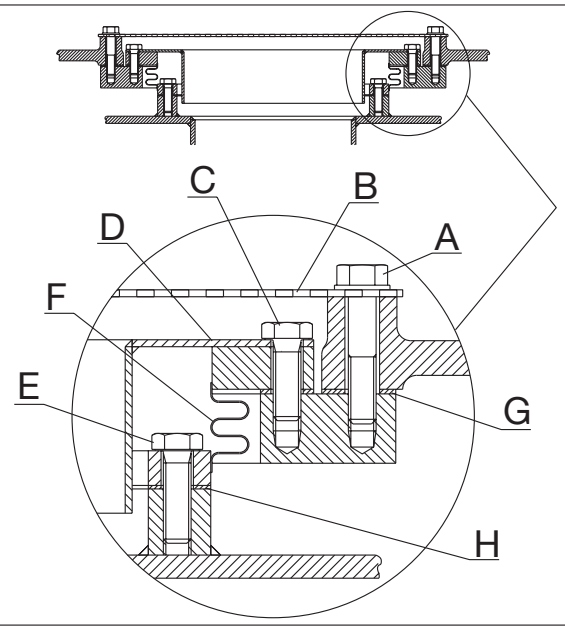

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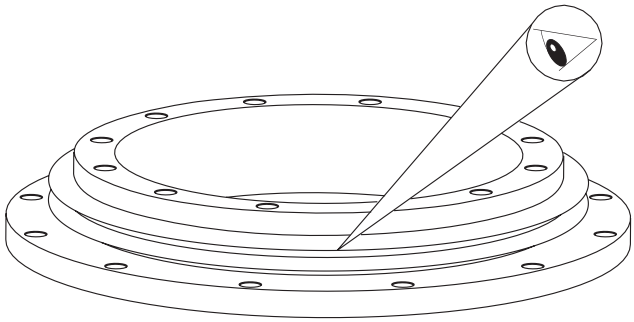


M91205-0201C07

Metal bellow sealing

4. Remove all screws A and grating B.

5. Remount four of the screws A at diametrically opposite positions.

6. Remove:
   Screws C
   Cover plate D
   Screws E.

7. Lift away metal bellow sealing F and examine it closely. If any cracks or punctures are found in the metal bellow sealing, it must be replaced.

Note!
It is recommended to always replace the metal bellow sealing during inspection.

8. Replace gaskets G and H.

9. Mount metal bellow sealing F.

10. Mount:
    Screws E
    Cover plate D
    Screws C.

11. Remove the four screws A.

12. Mount grating B.

13. Mount all screws A.

SVERIGES ÅNGFARTYGS ASSURANS FÖRENING
The Swedish Club
Est. 1872

MEMBER ALERT

October 20th 2007

The "forgotten" rubber membrane

Background

Following a number of recent incidents the Club launched an investigation regarding "forgotten" parts of the machinery. The parts in question are the rubber membranes connecting the main engine crankcase and sump tank.

Definitions: Wärtsilä/Sulzer & MAN Diesel A/S

The engine configurations concerned are all 2-stroke main engines from Wärtsilä/Sulzer, and MAN Diesel A/S.

It should clearly be mentioned that during commissioning of the ship the parts in question are supplied by the yard, and not by the engine manufacturers.

Sequence of Events

It has come to the Club's attention during the launched investigation in one of the cases, that the rubber membranes were not oil resistant, which eventually caused complete failure of the membranes. In other cases the rubber membranes failed due to natural aging process.

Defective rubber membranes may cause severe engine damage.

Consequence

In both cases described above excessive quantities of water on the tank top entered the main engine sump tank, and subsequently contaminated the main engine lubricating oil system, resulting in severe damage to the main engine bearings.

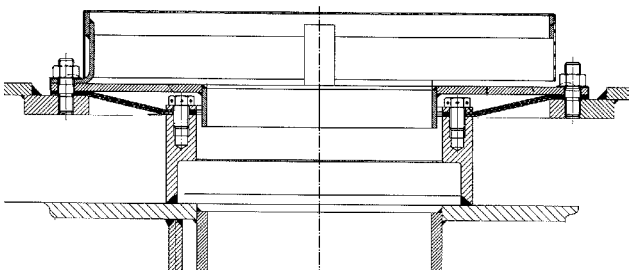
Weather it being the aging or the non-resistant to oil feature that triggers the failure of the membranes, is of less importance. The mere fact that these "forgotten" parts of the machinery can result in serious losses to owners and underwriters is a fact and therefore serious enough to promote steps being taken to prevent occurrence.

In a recent case the repair cost alone exceeded USD 3,000,000. This obviously does not take into account owners' deductible, loss of time and other commercial embarrassments connected with the casualty.

How to avoid a casualty

It is rather clear that the design of Wärtsilä/Sulzer and MAN Diesel A/S in this respect are similar, and as a consequence they are both potentially exposed.

We would like to emphasize that the actual parts in question, during commissioning of the ship, are supplied by the yard, and not by the engine manufacturers.



Design of the Wärtsilä/Sulzer sump tank connection.

Wärtsilä/Sulzer's recommendation is as follows: inspection of this part at 40,000 running hours, during a dry dock and replace it if it's damaged.

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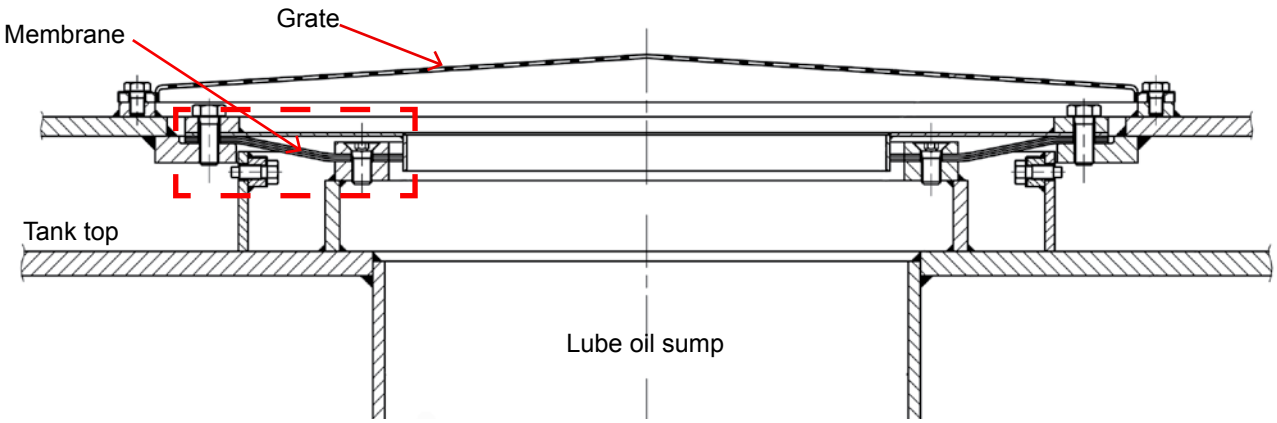
The forgotten Rubber membrane



The Swedish Club and MAN rekommend you to replace the membrane at each dry-docking and also keep extra membranes on board.

MAN Diesel A/S, Copenhagen, has recently issued a more comprehensive recommendation to replace all membranes in connection with each dry-docking of the vessel.

MAN Diesel A/S, Copenhagen, recommends: in order to avoid water entering the main engine sump tank through a defect in the crankcase oil outlet:

- Inspect the diaphragm sealing in crankcase oil outlet every 32,000 hours of operation and replace the diaphragm if it is indicated by the observation. Always replace in case of a rubber diaphragm.
- Inspect the diaphragm sealing at the earliest opportunity after delivery of a new-building. In case of a rubber diaphragm make sure the material is oil resistant and replace if this is not the case.
- Inspect the diaphragm sealing at the earliest opportunity when taking delivery of an existing ship and replace the diaphragm if it is indicated by the observation. Always replace in case of a rubber diaphragm.

In line with the recommendation issued by MAN Diesel A/S, Copenhagen, we recommend that all membranes are replaced in connection with every relevant scheduled inspection of the ship.

In addition, it is recommended to owners that they check the status of the membranes at earliest opportunity, unless they are certain that the membranes meet the required specifications.

Finally, it is recommended to owners currently in the process of commissioning a ship, or taking delivery of one, to check whether or not the relevant material composition of the rubber membranes is oil resistant and otherwise suitable for its intended purpose.

Given what was mentioned above, there is no guarantee that a fairly new ship does not have defective membranes. A new ship could very well have defective membranes if it turns out that the composition of the rubber in the membranes is not oil resistant.

Critical Situations

Obviously all situations encompassing free flowing water on the tank top in connection with defective membranes are critical. One of the situations identified by The Swedish Club which typically is more conspicuous in this respect is the dry-docking. During a dry-docking it is more common to have water on the tank top.

Cost of Replacement

The cost is approximately USD 1,000 – 3,000 depending on the number of outlets. Adding some extra in respect of labour cost, it is easily ascertained that this minor investment in planned maintenance is well spent money when comparing with what could otherwise happen.

For further information and details please contact:
The Swedish Club head office in Göteborg, Wärtsilä/ Sulzer or MAN Diesel A/S Copenhagen, Denmark, Marine Installation.

■

We would recommend to owners that spare membranes are kept onboard at all times.

Main Engine Lubricating Oil Outlet diaphragm

In 2007, the Swedish Club published a Member alert, The "Forgotten" Rubber membrane, where we reported about a number of main engine claims caused by water contaminated lubricants. The incidents caused by failure of the lubricating oil outlet diaphragm connecting the main engine crankcase and sump tank.

We have recently seen an increasing number of incidents regarding these "forgotten" parts of the machinery, hence the need to address this topic again.

The engine configurations concerned are all 2-stroke main engines from Wärtsilä and MAN Diesel A/S.

Consequences

In all cases excessive quantities of water on the tank top have entered the main engine sump tank via the defective diaphragm and subsequently contaminated the main engine lubricating oil system, resulting in severe damage to the main engine bearings and journals.

The repair cost for the engine damage can easily reach millions of dollars. This obviously does not take into account loss of time, towage, transshipment of cargo and other commercial embarrassment caused by the casualty.

Manufacturers' recommendations

The design of both Wärtsilä and MAN Diesel A/S lubricating oil outlet diaphragms are quite similar. Wärtsilä has recommended maintenance as follows:

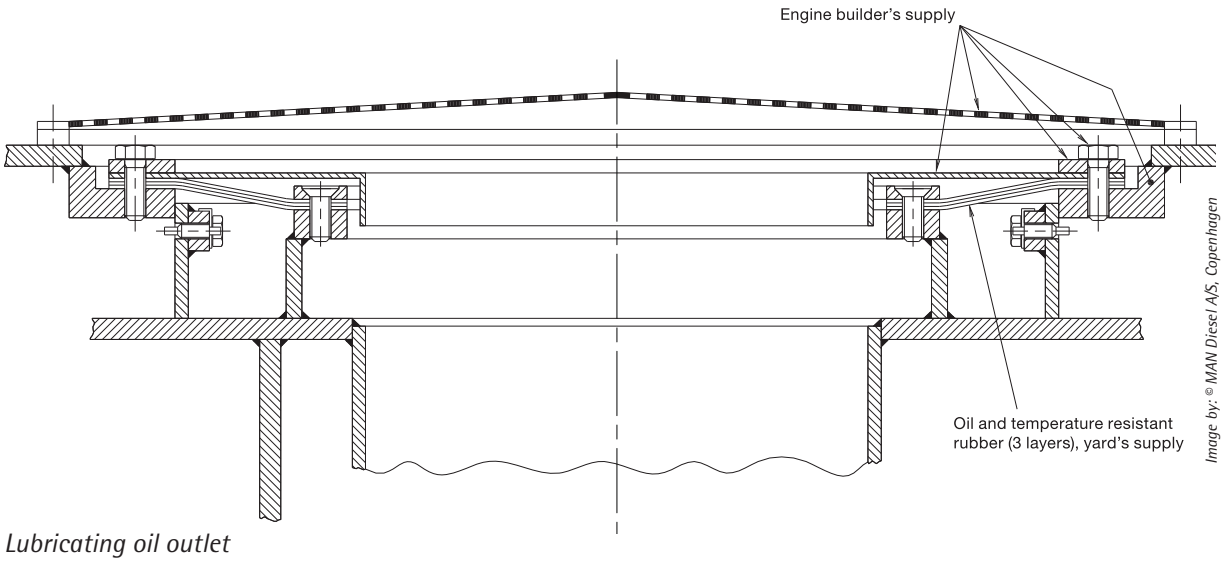
- Inspection/replace at 40,000 running hours or at dry dock.

MAN Diesel A/S, Denmark, has released a Service letter SL08-492/JVG, March 2008. In order to avoid water entering the main engine sump tank through a defect in the crankcase oil outlet, it is recommended to:

- Inspect the diaphragm sealing in the crankcase oil outlet every 32,000 hours of operation, and replace the diaphragm if indicated by the inspection.

Failed diaphragm

Deteriorated diaphragm



Lubricating oil outlet

It should be stated that during construction of the ship, the parts in question are supplied by the yard, and not by the engine manufacturers.

Loss Prevention

All situations with excessive water on the tank top in connection with defective diaphragms are critical. During a dry-docking it is, for various reasons, more common to have water on the tank top than during normal operations.

In line with the recommendation issued by MAN Diesel A/S, Copenhagen, we recommend that all diaphragms are replaced in connection with every relevant scheduled inspection of the ship.

If heavy contamination of water is present in the system: (1) the lube oil in the sump tank must be transferred to a settling tank, (2) the sump tank and crank case should be cleaned, and (3) fresh oil filled to the level recommended by the engine maker.

Observations

Obviously all situations with excessive water on the tank top in connection with defective diaphragms are critical. During a dry-docking it is, for various reasons, more common to have water on the tank top than during normal operations.

In the recent incidents we have noted that none of the vessels had enough lubrication oil onboard to completely replenish the system.

The cost of inspection/replacement is minimal compared to the consequences if it's left unattended.

We would recommend to owners that spare diaphragms are kept onboard at all times.

For further information and details please contact The Swedish Club's head office in Gothenburg.
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Mail: lossprevention@swedishclub.com

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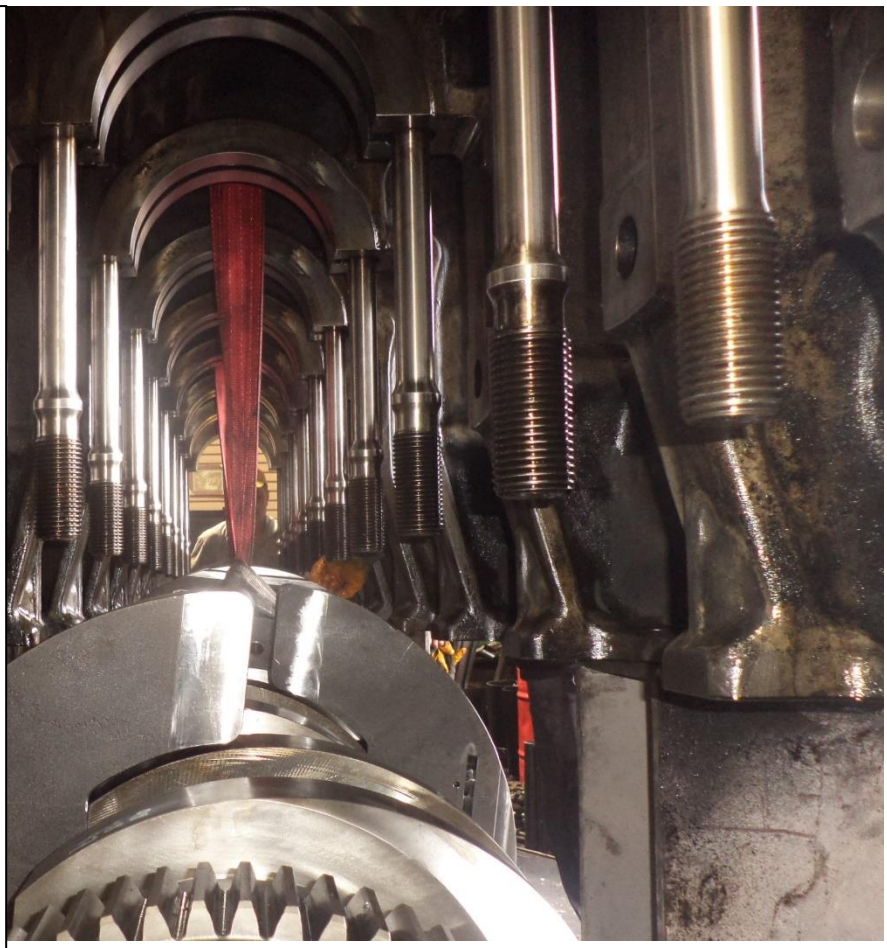
Maintenance Service

Diesel Engine Maintenance

With our global network, we ensure the stable supply of electricity for key industrial sectors by providing high-quality maintenance services for diesel power plants worldwide. Our preventative maintenance services cover the engines, generators and balance of power plant systems. Our thorough and timely service contributes to prevention of problems including low performance and unscheduled shutdowns and maximized performance.



Field Service

- Cylinder head Overhaul
- Planed Maintenance Overhaul
- Un-planned Maintenance Overhaul
- Component & Part Maintenance
- Auxiliaries Maintenance

Repair and Retrofit Service

- Engine Trouble Shooting
- Generator Trouble Shooting
- Auxiliaries Repair
- Component Retrofit & Repair
- Turbocharger Repair

Analysis & Diagnosis Service

- Performance Test & Evaluation
- Electrical & Control System Test
- System & Date Monitoring
- Alarm & Safety Test

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Service Report

MAIN ENGINE CYLINDER LUBRICATOR OVERHAUL

M/T SPRING

SPRING HOLDING

15 August 2020

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PLANT/VESSEL DETAILS

Vessel/plant	: SPRING	**Engine Builder**	: MITSUI MAN B&W
IMO	: 9378873	**Engine Type**	: 7S60MC
Customer	: SPRING HOLDING	**Engine no**	: 3209
Period	: 14-15.08.2022	**Running hours**	
Location	:SEFINE SHIPYARD-TURKEY		
Reason for visit	:Main Engine Cylinder Lubricator Overhaul		
Author	: Cengiz KUTUKCU		

1. SUMMARY

As requested, our service team consist of two service engineer and one technician has attended to vessel to carry out main engine cylinder lubricator overhaul while vessel docked at Sefine Shipyard / YALOVA.

- Both lubricators overhauled with owner supplied spare parts.
- General condition of O-rings, seals, gaskets, and check valve balls found in very poor condition, all replaced with new parts.
- Zero stroke adjustment of individual units done.
- Feed rates adjusted according to engine maker recommendation (1.1 g/kwh)
- Timing of the lubricators has checked and confirmed proper adjustment.
- Heating elements checked and confirmed proper functioning. Resistance of heating elements measured about 360 Ohm.
- Final timing measured 298° for NO:1 lubricator and 347° for NO:7 lubricator which comply with instruction manual.

Before dismantling the lubricator, initial feed rates measured as below, average consumption calculates as 1,144 g/kWh at 95 rpm while individual cylinders slightly different.

INITIAL PUMP STROKES_FEED RATES

1	2	3	4	5	6	7
2,13	2,14	1,54	1,69	2,12	2,20	2,07
2,02	1,83	1,71	1,89	2,52	2,71	2,18
1,66	1,79	2,01	1,90	2,73	2,37	1,69
2,15	2,06	1,92	2,02	3,24	2,68	2,56
2,00	1,83	1,80	2,02	2,79	2,47	1,98
2,12	3,06	2,83	2,01	2,55	2,56	2,28
CONSUMPTION FOR INDIVIDUAL CYLINDER BASED ON ABOVE ADJUSTMENT g/kWh						
1,053	1,108	1,030	1,006	1,391	1,307	1,113

After overhaul, feed rates adjusted as below which is according to engine maker's recommendation. (1,178 g/kWh @95 rpm)

7S60MC CYLINDER OIL FEED RATE (DOSAGE)

DATE	26.08.2022		MCR	14280	kWh @	105 RPM
Part Load %	70			9993	kWh @	93 RPM

Cylinder	7	pcs.	Volumetric efficiency:	0,9	
Diameter	6,0	mm	Density value:	0,92	
Oil inlets	6	pcs	**Max Recommended feed rate**	2,00	g/kWh
Engine	93	rpm	**Basic Setting**	1,10	g/kWh
Lubricator r	1,0	*Eng. rpm	**Min Recommended feed rate**	0,70	g/kWh

REMARKS:

INITIAL PUMP STROKES_FEED RATES

1	2	3	4	5	6	7
2,10	2,10	2,10	2,10	2,10	2,10	2,10
2,10	2,10	2,10	2,10	2,10	2,10	2,10
2,10	2,10	2,10	2,10	2,10	2,10	2,10
2,10	2,10	2,10	2,10	2,10	2,10	2,10
2,10	2,10	2,10	2,10	2,10	2,10	2,10
2,10	2,10	2,10	2,10	2,10	2,10	2,10
CONSUMPTION FOR INDIVIDUAL CYLINDERS BASED ON ABOVE ADJUSTMENT g/kWh						
1,153	1,153	1,153	1,153	1,153	1,153	1,153

2.PICTURES


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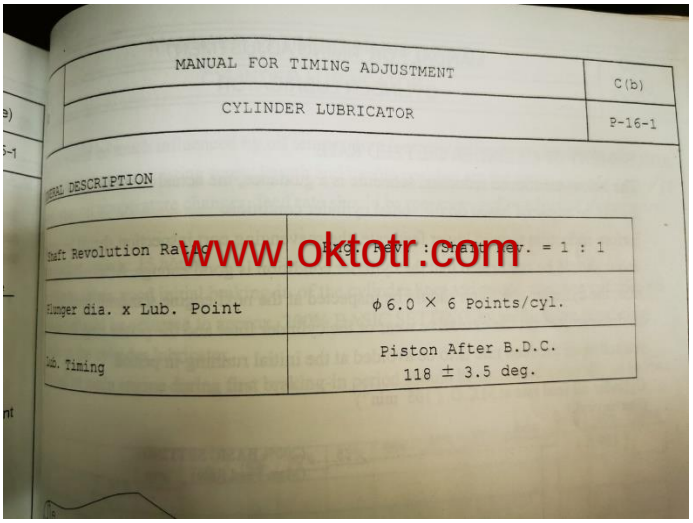

MANUAL FOR TIMING ADJUSTMENT | C(b)

CYLINDER LUBRICATOR | P-16-1

GENERAL DESCRIPTION

Shaft Revolution Ratio	Crankshaft : Camshaft Gear = 1 : 1
Plunger dia. x Lub. Point	ϕ6.0 × 6 Points/cyl.
Lub. Timing	Piston After B.D.C. 118 ± 3.5 deg.

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3.PROOF OF FEED RATE CALCULATION

Lubricator piston diameter	: 6.0 mm
Lubricator rpm/Engine rpm	: 1/1 (It can be 1/2 on some vessels, pay attention!!!)
Number of lubricators for 1 cylinder	: 6
Engine power at 93 rpm	: 9993 kw/h (Based on shop test)
Oil Density	: 0.92 g/cm3
Volumetric efficiency	: 0.9

Based on above:
Area of 1 piston= $(\pi x D^2)/4=(3.14x6^2)/4=$**28.26 mm²**
Stroke 2,1 mm ,Volume of 1 piston, at 1 stroke = Areax Stroke=28.26x=59,346 mm³

$$\text{Consumption for one cyl= FOR PER CYL} = \frac{\text{VOLUME x NUMBER OF LUBRICATOR x RPM x 60 x EFFICIENCY}}{1\,000\,000} = \text{LTR/HR}$$

Consumption for one cyl= (59,346x6x93x60x0.9)/1000000= **1.788 ltr/hr** for per cylinder
1.788xdensity=1.826x0.92=1.644 kg/hr=1644 g/hr (**Consumption for one cylinder per hour)**
Engine power for one cylinder= 9993/7= 1427 KW

Consumption for 1 kW=1644/1427=1.152 gr/kwh
Above calculation based on 93 rpm and adjustment arm at minimum position.

4.CONCLUSION and RECOMMENDATION

- Since lubricators has no auto LCD arrangement, lubricator adjustment arm to be positioned to manoeuvring position before manoeuvrings.
- Feed rate adjustment done about 1.1 g/kWh, same can be reduced more step by step based on scavenge inspection results.
- If any cylinder liner replaced or piston overhaul carried out, running in procedures to be followed as described by engine maker.
- Lubricator heaters to be switch on while stop and to be switched off while engine is running.

NO NEED TO REMOVE CYLINDER COVER

Monitoring

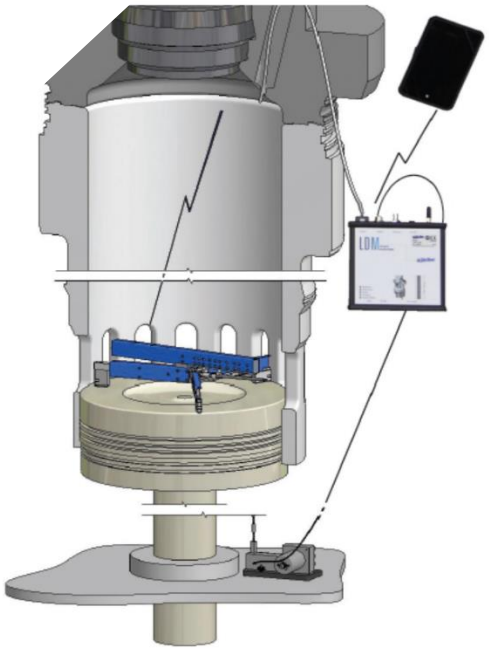
Liner Diameter Measurement

DURING PORT STAY OR ANCHORAGE, WITHOUT DISTURBING VESSEL'S OPERATION!!!

CHRIS-MARINE®

LDM

- **Avoid unplanned off-hire and reduce overhauling costs through continual monitoring of the cylinder condition.**
- **Pre-inspect cylinder condition before a piston overhaul to minimize downtime and cost.**
- **Safe, fast, and accurate measuring of cylinder liner wear and clover-leafing.**
- **No need to remove cylinder cover prior to measurement**

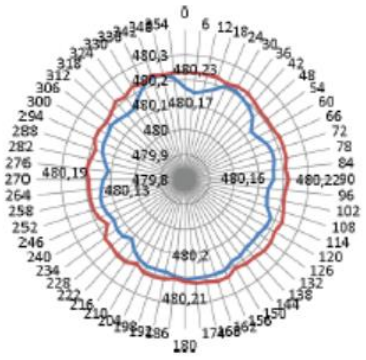


Detect abnormal cylinder deformation and wear before it leads to failure

The image shows two clover-leafing measurements at 79 mm and 298 mm below top rig TDC. Some clover shape can be seen at 79 mm with peaks about 0.10 mm higher than the valleys.

Such a wear pattern will generate blow-by and eventually collapsed or broken piston rings when the piston ring pack cannot seal tightly against the cylinder liner.

Cylinder honing can restore the cylinder condition.



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VARIABLE INJECTION TIMING EXPERIENCE SHARE

In connection with ***"EXPERIENCE SHARE FOR HEALT CHECK AND OVERHAUL OF REVERSING CYLINDERS"*** which has shared earlier and presently can be found in our web page, we would like to bring operator's kind attention to VIT system for MAN B&W 2-stroke diesel engines.

During our attendance for overhauling of pneumatic manoeuvring systems, we have observed that VIT system may neglected, **because in any case engine will continue to run with or without VIT.**

However, if we consider advantages of well-functioning VIT and harming effect of the defective VIT, it is very important to keep the system in good operational condition.

WHAT IS THE PURPOSE OF VIT SYSTEM?

1) Reduce fuel consumption.
2) Ensure safe start to ahead direction(Functioning only during starting)
3) Ensure safe start and give best possible astern performance.(Functioning during starting and astern running)
4) Ensure safe start during emergency control.

WHAT IS THE INCONVENIENCIES IF SYSTEM DID NOT PROPERLY ADJUSTED OR SOME OF THE COMPONENTS DEFECTİVE?

1) You cannot take advantages of above listed functions.
2) There is risk of EXCESSIVE PRESSURE JUMP (Pcomp-Pmax difference) which may result in piston ring collapse and broken piston rings…Please refer service letter SL1988-241 for more info about pressure jump.

So even you don't consider advantages of the VIT system, you should be sure present condition will not cause any damage on the engine. Therefore, it is very important to keep the system in well maintained condition.

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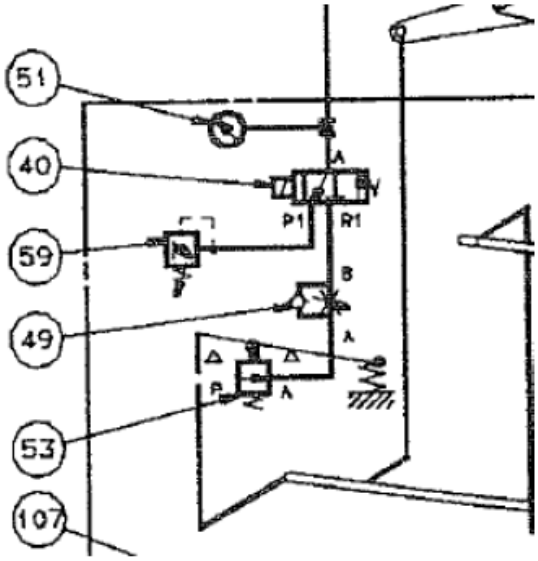

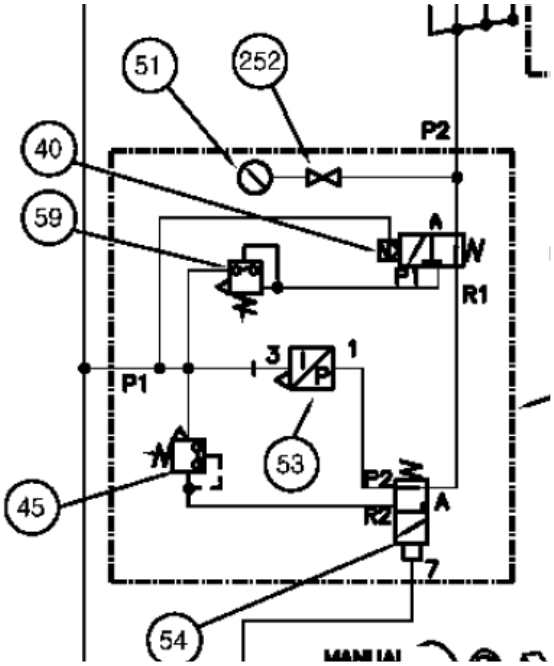

PILOT VALVE CONTROLLED SYSTEM

I/P CONTROLLED SYSTEM

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There are two different systems to control VIT(super) acturators for MC engines called **pilot valve controlled** and **I/P controlled**, and both serves for same purpose. Advantages of the I/P controlled systems are:

- Break point is not fixed and can change according to scavenge pressure, therefore no risk for the excessive pressure jump.
- Easy to control the VIT actuators just changing Poffset value on the governor control unit.

Below we will try refresh ship crew by giving some simple tips without boring with details... Your comments and contribution welcomed.

WHILE ENGINE IS IN ST-BY CONDITION:

1	Check the V/V Pos.40 energized and you can read pressure on gauge Pos. 51. This pressure value should be same as the break point pressure value.
2	Read the VIT indexes, and confirm values are same as break point VIT indexes (See shop test report).
3	Check all VIT actuators activated (Piston out). If some of them shows zero VIT index, suspect defected VIT actuator or obstructed pump barrel.
4	Confirm there is no air leak from any of the VIT actuator.
5	Increase and decrease the air pressure by reducing valve Pos.59 and confirm movement of the VIT actuators.(Such as zero VIT index at 0 bar and full VIT index at 5,0 bar)
6	After testing item-5, air pressure to be adjusted to break point pressure.

AFTER STARTING:

1	Just after starting to **AHEAD DIRECTION**, confirm V/V Pos.40 deactivated and pressure on the Pos.51 became zero. Confirm VIT indexes became zero as well. If V/V Pos.40 still active after **AHEAD RUNNING**, risk of the excessive pressure jump.(More than 35-40 bar between Pcomp and Pmax)
2	If engine start and run to **ASTERN DIRECTION**, Pos.40 should remain energized and break point VIT indexes are maintained.
3	If **EMERGENCY RUNNING**, you should read less pressure on Pos. 51, which should be equal to VIT index at %40-50 engine load. (See shop test report)

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AFTER %40-50 LOAD:

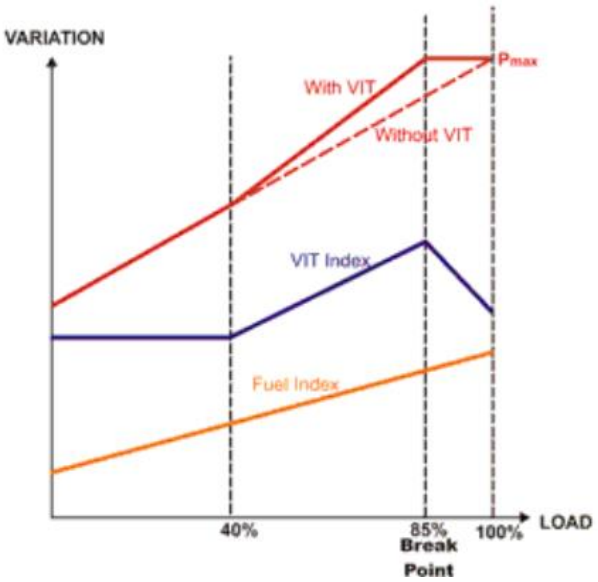
1	During ahead running, after %40-50 engine load, VIT indexes should gradually start to increase depend on the load.
2	VIT indexes should keep steady against 2-3 fuel index variation during rough sea condition etc. If not stable, than need re-adjustment of throttle valve(Pos.49) on pilot controlled system or change the t1-t2 parameters on I/P controlled systems.

If VIT indexes are increasing depend on the engine load, that means your pilot valve or I/P converter controlling the system.

It is necessary take engine performance and confirm MCR Pmax obtained at break point and stay same at MCR load… If any abnormalities found need adjust the system.

**Before adjusting individual cylinder Pmax by VIT actuators(+/- 3 bar), please make sure differences on MEP value for individual cylinders not more than 0.5 bar from mean value.

IF YOU HAVE ANY QUESTION, FEEL FREE TO CONTACT WITH US.



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SCRATCH ON VIT ACTUATOR SPINDLE

TEAR ON VIT ACTUATOR DIAPHRAGM

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TESTING THE VIT ACTUATOR

DEFECTIVE I/P CONVERTER

DEFECTIVE Pos.40 V/V

EXAMPLE FOR I/P TYPE VIT PARAMETERS AT KONGSBERG GOVERNOR

***Please note, in some cases such as excessively worn cylinder liners, fuel pumps or puzzle cracks on upper side of cylinder liners, VIT system should be put out of operation…

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Propulsion System Maintenance Concept

10 YEAR PROPELLER MAINTENANCE

- Remove blades, crack test
- Change zinc anode on hub cylinder
- Inner and outer shaft seal overhaul
- Propeller shaft flange crack test
- Measurement and check of stern tube bearings
- Change of high pressure seals in hub
- Measurement of blade flanges, cross head, slide shoes and bushes
- Geometrical check of blades
- Measurement and check of hub bearings
- Dismantling of shaft coupling and change of seals
- Change of seals on servo oil pipe flange
- Check / upgrade of feedback arrangement (ODS)
- Alignment check of feedback ring (ODS)

- Change of hydraulic hoses in power pack and OD ring
- Test and adjustment of max pressure, stand by function, safety valve and proportional valve
- Test of drain oil pumps
- Adjustment of: zero pitch, full ahead, full astern

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ALPHA LUBRICATION SYSTEM

Overhaul on Alpha Lubricators and other B&W Lubricators

Reference with MAN B&W service letter, SL2016-632/AAB in order to obtain optimum and trouble-free operation, Alpha Lubrication system must be overhauled every 5 years or 32.000RH.

It is also necessary to ensure dosing of the correct lubrication amount based on the provided set point.

Note that lack of maintenance may result in low or missing accumulator pressure, worn solenoid valves as well as defective non-return valves, which all may cause excessive lubrication above the setpoint. This can be avoided by using the recommended overhaul and maintenance strategy.

Since **OKTO®** has extensive experience and knowledge for alpha lubrication system, you can choose reliable service provider for Alpha lubrication system overhaul and trouble shooting.

Kindly note we can supply spare part for both MC and ME engine lubrication system as well.

Alpha Lubricator Unit Overhaul

- ✓ *Remove the lubricator*
- ✓ *Open-up lubricator for checking internal parts.*
- ✓ *Replacing non-return valves.*
- ✓ *Replacing feedback sensors.*
- ✓ *Replacing solenoid valves.*
- ✓ *Replacing and charging the accumulators.*
- ✓ *Replacing O-rings and seals.*
- ✓ *Assembling of lubricator on engine and test for leaks*
- ✓ *Test on the bench*

Alpha lubrication system health check

- ✓ *Checking angle encoder,back-up, pick-up control*
- ✓ *Adjusting index transmitter.*
- ✓ *Parameter check*
- ✓ *Lubrication adjustment check.*
- ✓ *Timing check*
- ✓ *Lubrication check through scavenge manifold*
- ✓ *Booster pump filter and spider coupling replacement*
- ✓ *Booster pump overhaul*

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- ✓ **Alpha lubrication system complete overhaul**
- ✓ **Alpha lubrication system health check**
- ✓ **Spare part supply**
- ✓ **System upgrade**
- ✓ **Alarm handling and troubleshooting**
- ✓ **Lub oil supply unit overhaul**

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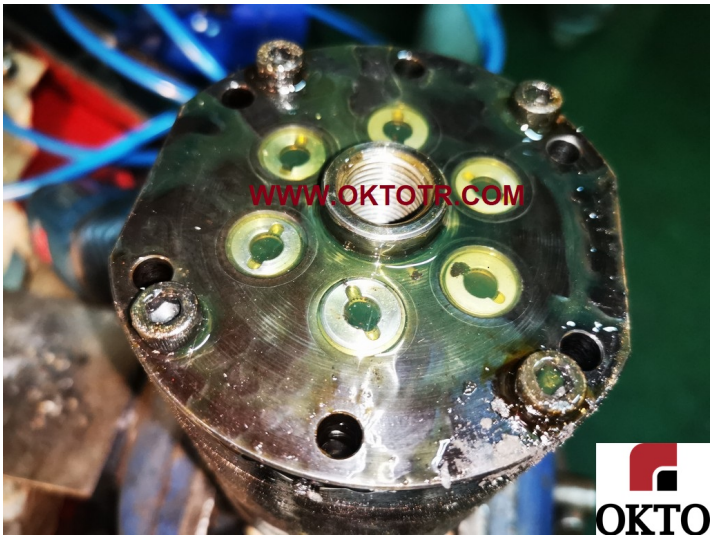
COMMON PROBLEMS OBSERVED IN ALPHA LUBRICATION SYSTEM
(Not limited with below list)

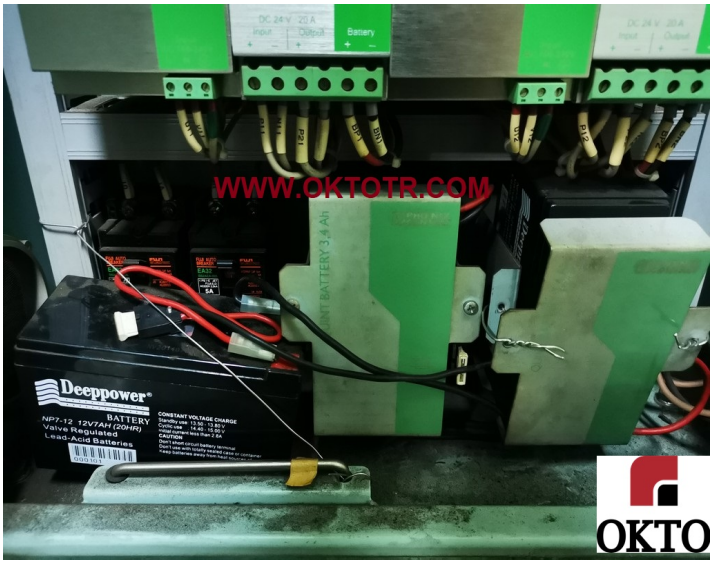
DEFECTIVE INDEX TRANSMITTER ARMS

DAMAGED SPIDER COUPLING ELEMENT

BURST INDUCTIVE SENSOR



DEFECTIVE OR LEAKY NON-RETURN VALVES

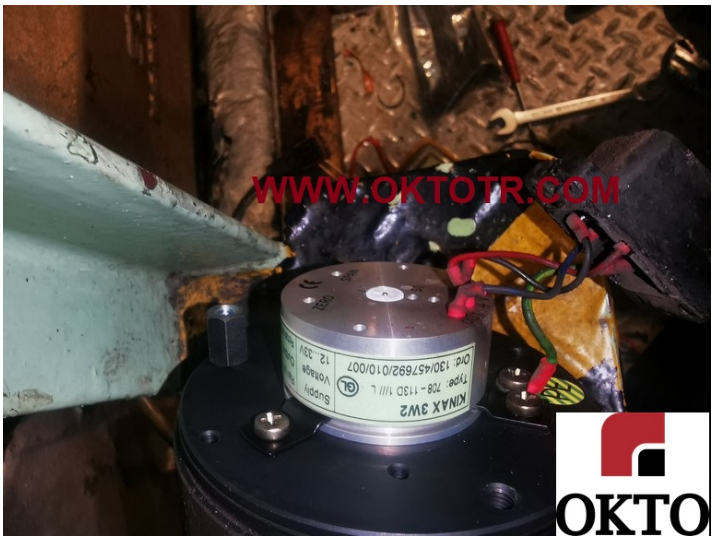


D. POWER SUPPLY UNIT AND EXPIRED BATTERY GROUP

BROKEN FILTER COVERS

ALUMINIUM FILTER COVERS SUPPLIED BY OKTO

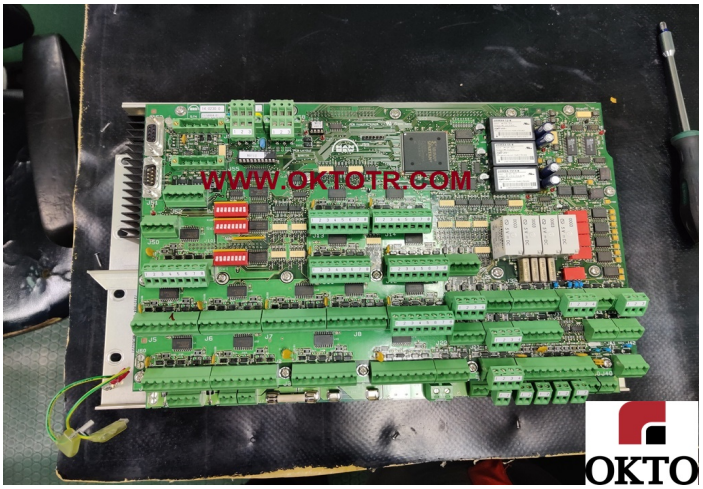
D. LUB OIL SUPPLY PUMPS



D. INDEX TRANSMITTER

WRONG ADJUSTED HEATER OR DEFECTIVE THERMO VALVE

MALADJUSTED INDEX TRANSMITTER OR PARAMETERS

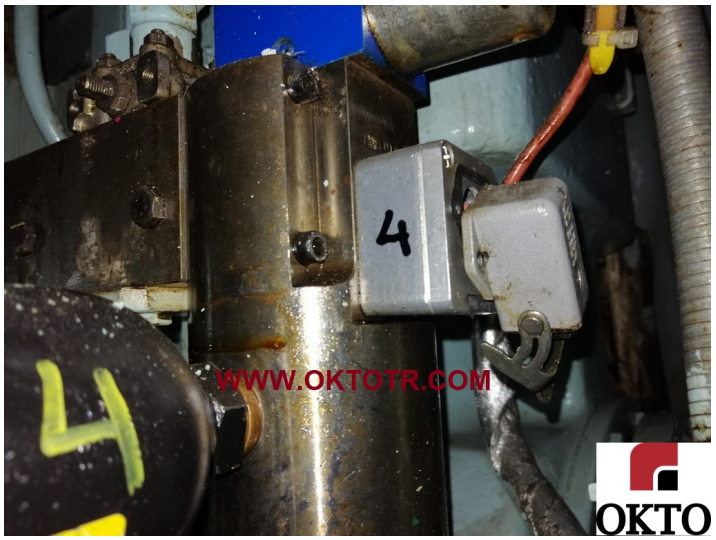


DEFECTIVE ELECTRONIC COMPONENTS

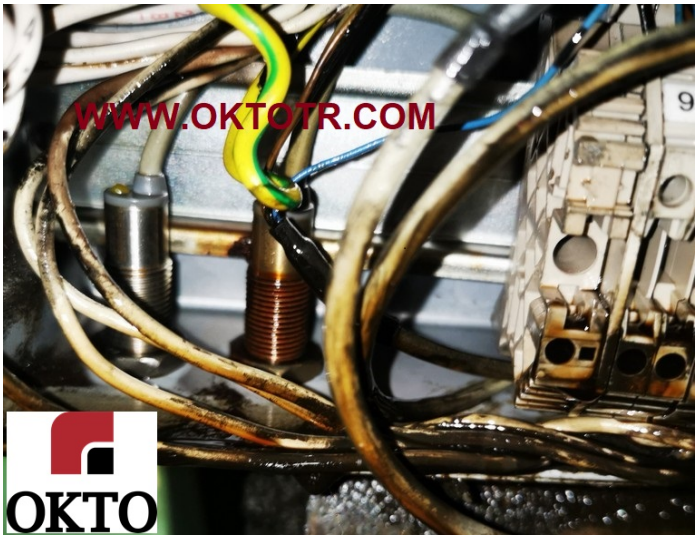
DAMAGED PISTON SURFACES

RECENT MAN SUPPLIED SOLENOID VALVES WHICH FABRICATED BY ATOS TEND TO FAILURE IN EARLY STAGE WHICH CAUSE THE FEEDBACK ALARM

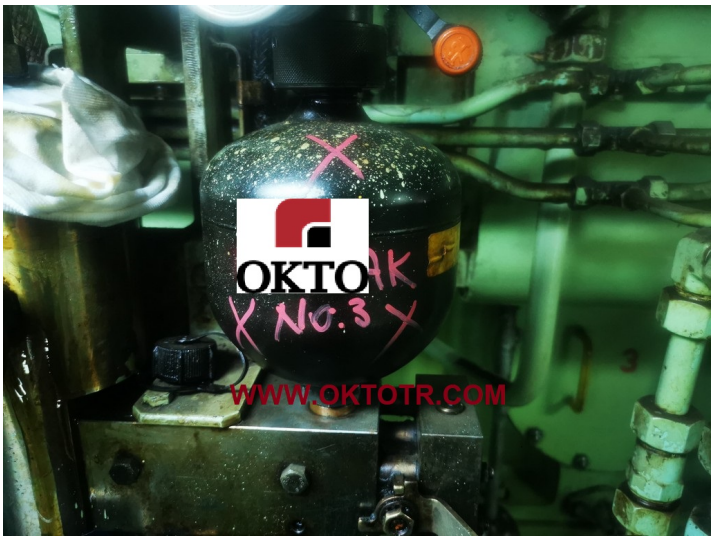
WE ARE ABLE TO SUPPLY TROUBLEFREE REXROTH SOLENOID VALVES



DEFECTIVE PLUG CONNECTIONS



D. PICK UP SENSORS



MALADJUSTED ENCODER

BURST OR DE-PRESSURIZED ACCUMULATORS

OKTO IS HERE WITH KNOWLEDGE&EXPERIENCE AND SPARE PARTS

Pneumatic Maneuvering System Overhaul

In the recent years, increased number of maneuvering troubles reported which may lead to costly accidents and time loss of operation.

Troubles are usually caused by sticking pneumatic valves, due to internal corrosion-dirt particles in the control air system-defective seals etc. In order to eliminate such cases planned regular maintenance is recommended by engine manufacturers.

To prevent such kind of incidents; we recommend maintain control air in good condition by regular drain, check the system within regular interval and complete overhaul of the system during dry docking periods.

OKTO offers you the troubleshooting, remote support, planned maintenance and spare part supply in the cost efficient manner.

Essential part is to carry out planned maintenance of the pneumatic components of the maneuvering system, which will prevent serious incidents/accidents

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Experience Share

MAIN ENGINE ROLLER CHAIN INSPECTION

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Staying True To The Principals Of Good Solid Engineering

PLANT/VESSEL DETAILS

Vessel/plant	:	**Engine Builder**	: MAN B&W DIESEL A/S
IMO	:	**Engine Type**	: 6S70MC-C
Customer	:	**Engine no**	:
Period	:	**Running hours**	:
Location	:		
Reason for visit	: Main Engine Roller Chain Inspection		
Author	:		

EXPERIENCE SHARE OF MAIN ENGINE ROLLER CHAIN INSPECTION

1-SUMMARY

OKTO Engineering service team has attended a vessel equipped with MAN B&W 6S70MC-C, which was suffering from abnormal sound in M/E roller chain casing.
Based on the inspection; it was found that guide bars were severely damaged which is common phenomenon. We do relate subject issue with improper adjustment of the roller chains tightening, however problem itself would not cause that much noise.

After further investigation, it was found out that aft chain has became slacked on some particular points, due to defect on one of the links which is about to detached.

In order to rectify such serious defects, damaged ones have been replaced with new link thus the proper tightening adjustment performed according to the manufacturer specifications.

2-PICTURES

DEFECTIVE LINK

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CHAIN LINK ABOUT TO DETACHED

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3-CONCLUSION and RECOMMENDATION

In general roller chains are trouble free systems and no need much attention, however in case of failure; consequences might be devastating.

Considering above, it is worth to spend time to carry out regular chain inspection according to MAN B&W Maintenance Manual Section-906.

If you have any question, please feel free to contact with us.

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Operation and Maintenance Powerplants

OKTO service experience which was accumulated domestic and all around the world enables us to provide the best quality Operation & Maintenance service for all types of power plants regardless of its manufacturers and plant types.

We make the highest availability and load factor with our customers' power plants.

Type of Power Plant

- Diesel Power Plant
- Gas turbine Power Plant
- Combined Cycle Power Plant
- Thermal Power Plant
- Industrial Power Plant

Operation & Maintenance Routine Activities

- Daily Operation and Routine Maintenance
- Performance Monitoring and Diagnostics
- Spare Parts and Inventory Management
- O&M Personnel Training
- Environmental Compliance Management

Operation & Maintenance Special Activities

- Major Overhaul
- Trouble Shooting
- Component Repair and Refurbishment
- Rehabilitation and Retrofits
- Technical Support

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PNEUMATIC MANOEUVRING SYSTEM

Overhaul of Main Engine Pneumatic Manoeuvring System

MAN B&W Diesel A/S

Service Letter

SL01-394/CBO
October 2001

Manoeuvring Systems
Action Code: WHEN CONVENIENT

Dear Sirs

An examination of various marine incidents, recorded and filed in our Service Department, has shown that one of the main causes of problems with starting and manoeuvring systems is insufficient maintenance of the pneumatic control system on the engine, including the air supply for this system.

Knowing that manoeuvring system problems can result in costly accidents and delays, we would like to give some recommendations:

Reference: MAN B&W Diesel A/S Service letter SL01-394/CBO

In recent years, an increased number of maneuvering troubles reported which may result in costly accidents and delays.

These troubles are usually caused by sticking pneumatic valves, due to internal corrosion-dirt particles in the control air system-defective seals, etc. can be prevented by planned maintenance as recommended by engine makers.

To prevent such kind of incidents; we recommend maintain control air in good condition by the regular drain, check the system within the regular interval and a complete overhaul of the system during dry-docking periods.

Pneumatic control systems is expertise demanding specific skill and knowledge to handle, OKTO offers you the troubleshooting, remote support, planned maintenance and spare part supply in cost-effective way.

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- ✓ **Overhaul of Main Engine Pneumatic Manoeuvring systems**
- ✓ **Pneumatic system health check**
- ✓ **Spare part supply**
- ✓ **Main starting valve and actuator overhaul**
- ✓ **Alarm handling and troubleshooting**
- ✓ **Starting air distributor overhaul**
- ✓ **Air reducing system overhaul**
- ✓ **VIT system adjustment**

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TYPICAL PROBLEMS FOUND IN PNEUMATIC MANOEUVRING SYSTEM

(Not Limited With Below)


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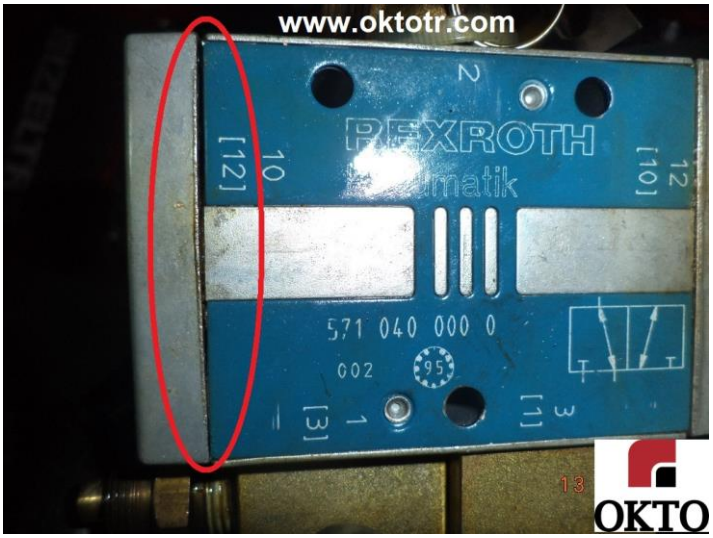
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OKTO IS HERE WITH KNOWLEDGE, EXPERIENCE AND SPARE PART

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Workshop & Warehouse

We offer in our base;

- Fuel injection equipment maintenance,
- Cylinder cover overhaul,
- Piston overhaul,
- Exhaust valve and driving gear maintenance, machining and grinding,
- Alpha lubricator maintenance, Ultrasonic cleaning of various components
- Cylinder liner honing, (on site honing is also possible)
- Wear ridge removal
- Non-destructive testing and evaluation
- Remote control system pneumatic valves overhaul

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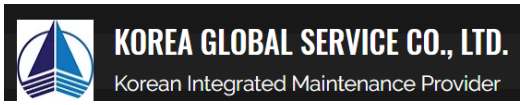
OUR REFERENCES



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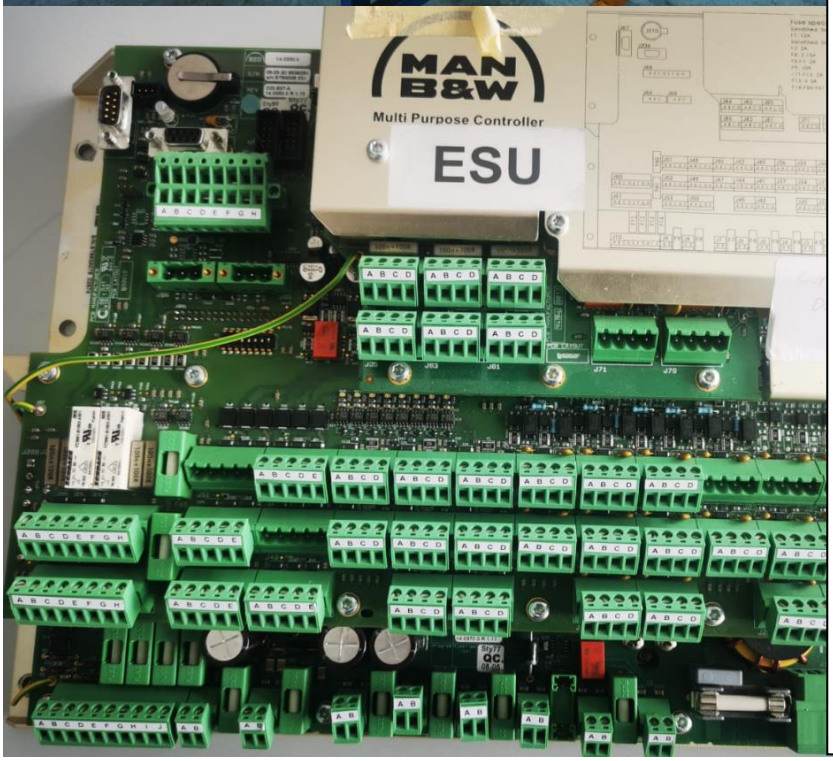

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ME-C , ME-B CONCEPT

We offer in our base;

- Fuel injection equipment maintenance,
- Cylinder cover overhaul,
- Piston overhaul,
- Exhaust valve and driving gear maintenance, machining and grinding,
- Alpha lubricator maintenance
- Cylinder liner honing, (on site honing is also possible)
- Wear ridge removal
- Non-destructive testing and evaluation
- Remote control system pneumatic valves overhaul
- Main starting valve overhaul
- Starting air distributor overhaul (ME-B)
- Troubleshoot
- Tacho system calibration
- MPC replacement
- HPS pump overhaul
- Hydraulic accumulator overhaul

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CHECKING AND ADJUSTMENT OF THE EXHAUST CAM FOR TWO STROKE MAN B&W MC ENGINES

For checking of the exhaust cam lead, we should know the **engine specific LIFTING HEIGHT** value which can be find in Maintenance manual Section 908-5.1 and/or in operation manual engine Shop test result which second one to be preferred.
This value somehow to be closed to 14,00 mm for 70MC, 12,00 mm for 60MC, 10,00 mm for 50MC and smaller bore.

Above given values are for reference only and engine specific values from shop test results to be taken into account.

For typical checking of the exhaust cam roller:

1. Stop the engine and close the starting air.
2. Stop the lubrication oil pump.
3. Remove the exhaust valve hydraulic pipe.
4. Bring the NO:1 cylinder to TDC. Measure the crankshaft position with pin gauge and confirm NO:1 cylinder exactly at TDC. (Recommended). Measure the camshaft position by pin gauge and confirm camshaft is in correct position. You should read 0 degrees on the turning wheel.

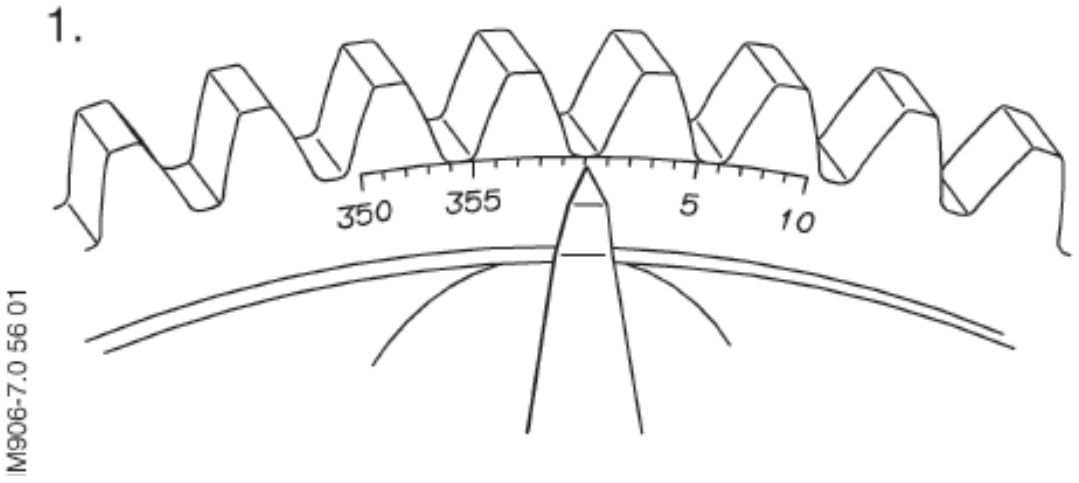
5. Measure the height of the exhaust roller.
6. Turn the engine **AHEAD** direction until the roller is lifted to indicated value in the shop test or maintenance manual. (For example, 12 mm).
7. Read and note the new angle indicated on the turning wheel. (For example, 113.70 deg). This is the value of the angle, which exhaust cam turned from TDC to reach to **lifting height** which called **A**
8. Turn the engine until lifting height value became to same lifting height, which is 12,00 mm in our example. (Due to shape of the cam, measured value will be increased for a while and will start to decrease to previous measurement).
9. When same value 12,00 mm obtained, read and note the angle indicated on the turning wheel. (For example, 258,30 deg) This is the value of angle, which exhaust cam turned from TDC to reach lifting height during **decreasing cycle** which called **B**
10. Theoretical middle point of the cam 180°
11. A+B=360°
12. (A+B)/2=180°
13. Difference of (A+B)/2 value from the 180° indicate us **exhaust cam Lead angle**…
14. This value to be compared with shop test value.

In our example:
A=113,70° B=258,30°
(A+B)/2= 186… 180-186= -6° exhaust cam lead angle…

Same procedures to be repeated for remained cylinder.

EXHAUST ROLLER OIL CYLINDER

EXHAUST ROLLER AT DISMANTLED CONDITION(FOR REFERENCE ONLY) MEASUREMENT CAN BE TAKEN ON THE TOP OF THE PISTON WITHOUT REMOVING OIL CYLINDER AND ROLLER



READ AND NOTE THE ANGLE ON THE TURNING WHEEL (NO:1 CYL AT TDC AT ILLUSTRATION)

OKTO ENGINEERING
Orta mah. Erk sok. Aslı Nemutlu San. Sit No7/6 Tuzla/İst
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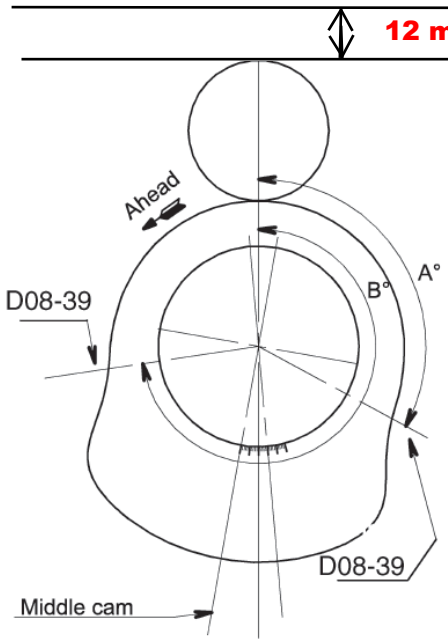


Fig.1 Subject cylinder at TDC

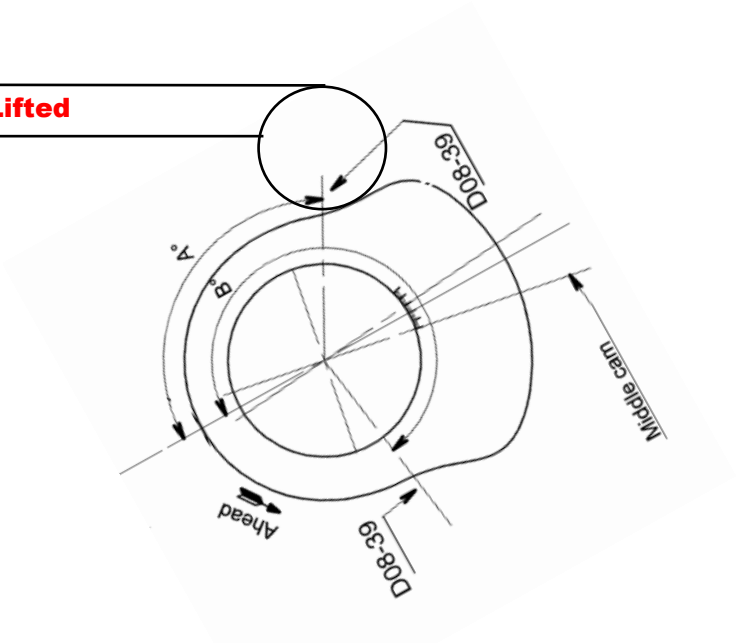


Fig.2 Exhaust cam has turned A degree until roller has lifted to determined value(113,70 deg and 12,00 mm in our example) .

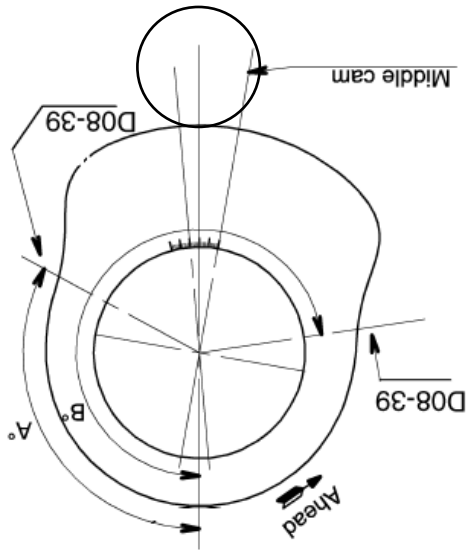


Fig.3 Exhaust cam further turned. Roller at highest point.

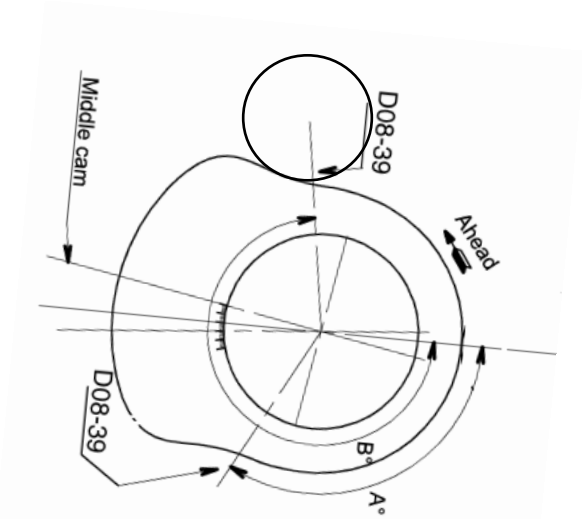


Fig.4 Exhaust cam turned total B degrees (258,30 deg.in our example) and same roller height (12 mm) with Fig.2 obtained.

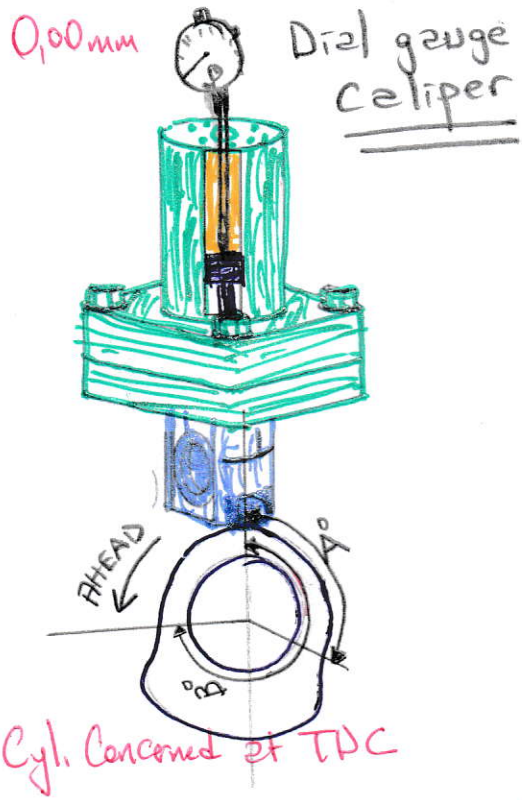


Fig.1 Cyl. Concerned at TDC

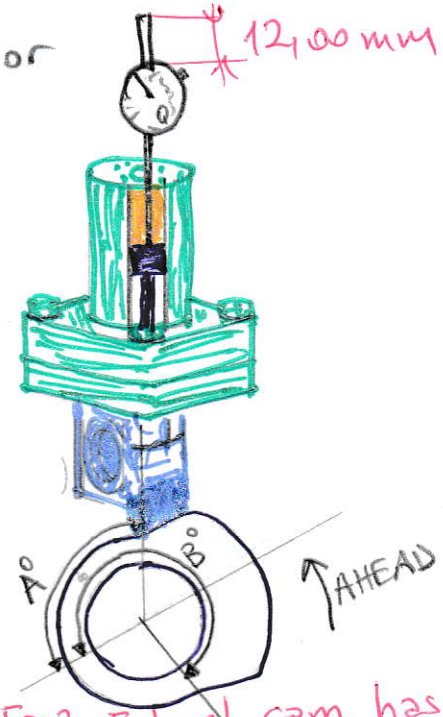


Fig.2 Exhaust cam has turned A° degree, until roller has lifted to determined value (113,70 deg and 12,00 mm in our example)

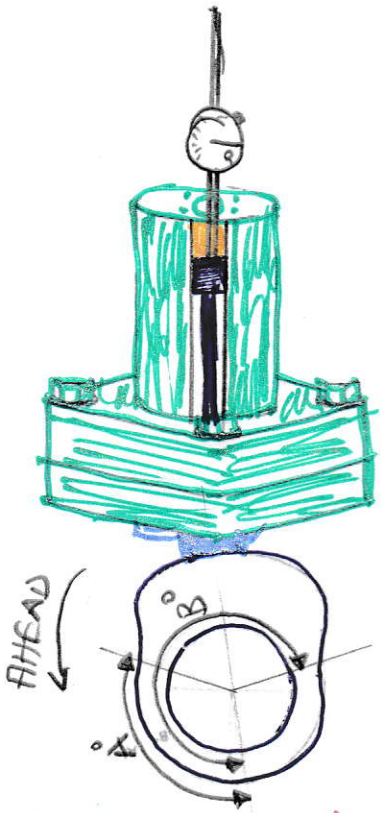


Fig.3 Exhaust cam further turned. Roller at highest point.

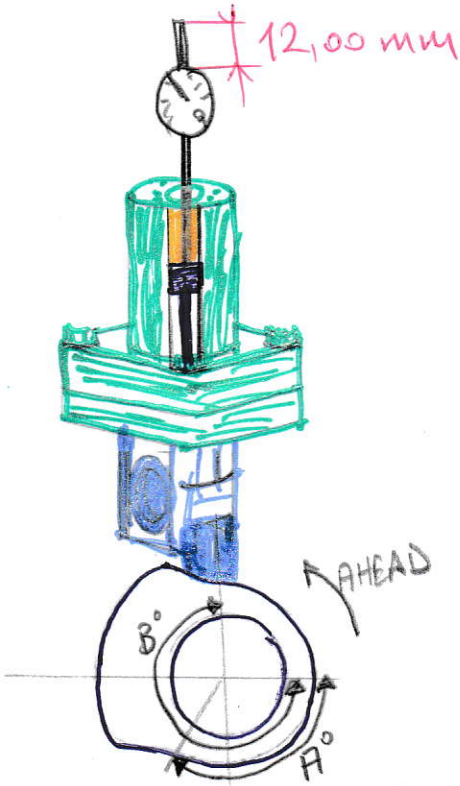


Fig.4. Exhaust cam has turned B° degrees (258,30° in our example) and same roller height (12,00mm) with Fig.2 obtained.

FIRING ORDER :	1-5-3-4-2-6	C/S Type	Casting	Forging
		C/S Angle	Regular	Irregular

(A : 113.7 ° => 12mm)

1. Exhaust Cam Lead (Advance Angle) (B : 258.3 ° => 12mm) (Design : -6 °)

CYLINDER No. / CHECK POINT	1	2	3	4	5	6						
Measured A Timing (Ahead)	113.70	353.70	233.70	293.70	173.70	53.70						
Measured B Timing (Astern)	258.30	138.30	18.30	78.30	318.30	198.30						
Lead Angle	-6	-6	-6	-6	-6	-6						

Above table shows shop test inspection report for same engine(60MC). As can be seen, difference between A and B is same for all cylinder, i.e. 258,3-113,7= 114,6 deg for NO:1 cyl and 126,3(360-233,70) +18,3= 114,6 deg for NO:3 cylinder.

1. Exhaust Cam Lead (Advance Angle)

Cylinder NO.	1	2	3	4	5	6	7	8	9	10	11	12	1
Measured Timing(Ahead)	-3.85	-3.80	-4.15	-3.85	-4.10	-4.00	BLANK						

* Angle A : 114.1 ° * Lift : 14.0 mm

* Angle B : 253.9 ° * Lift : 14.0 mm

Above inspection report shows another engine's(70MC) record. This table they do not indicated all A and B value for all cylinder, but they give only A and B value for NO:1 cylinder. Same values for other cylinders to be calculated based on firing order.

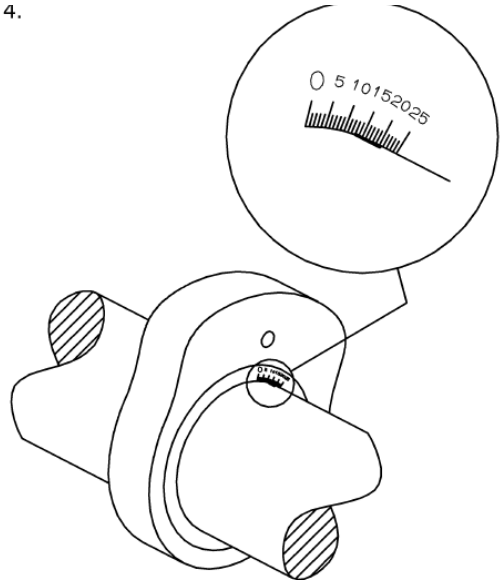
Description \ Cylinder No.			Design	1	2	3	4	5	6	7	8
Crank shaft T.D.C			— (Deg.)	0	102.9	257.1	205.7	154.3	308.6	51.4	
Exhaust valve (Roller guide lift 10mm)	Open (After T.)		115.6 (Deg.)	115.6	115.6	115.6	115.6	115.6	115.6	115.6	
	Shut (After T.)		246.4 (Deg.)	246.2	246.2	246.2	246.2	246.2	246.2	246.2	
Starting air distributor	Ahead	Open (After T.)	5 (Deg.)	4.0	3.4	3.9	3.8	3	3.4	4.6	
		Shut (After T.)	95 (Deg.)	92	92.1	93.9	94.3	93.7	93.0	91.6	
	Astern	Open (After T.)	5 (Deg.)	5	6.9	5.1	5.2	6.3	4.6	6.4	
		Shut (After T.)	95 (Deg.)	95	95.9	96.1	96.7	95.3	95.6	94.4	
F.O.Pump top lift			8.25 (mm)	8.26	8.2	8.26	8.29	8.25	8.24	8.2	
F.O.Pump shim height			— (mm)	2.5	2.5	2	2.5	2	1.5	2.5	

Firing Order :1-7-2-5-4-3-6

Another inspection report belongs to 35MC engine. Kindly note number of cylinders changed, which to be considered for firing order and TDC calculation for all cylinders

REMARK: The cam lead angle can be checked visually by reading directly the scale position of the exhaust cam over the marking scratch on the camshaft. For this check **position of the camshaft to be confirmed by pin gauge.**

4.



Several incidents reported that some or all the exhaust or fuel cams lost their correct position due to roller damages. In that case, cams in questions to be adjusted back to correct position.

Recommendation:

1. One of the common reason of the roller damages is malfunction of the reversing system. In case the reversing is not complete or doesn't take place, forces acting on the roller guide and reversing arm is so high that it can cause such damage to the components. Adjustment of the reversing arms to be checked during overhaul of the roller. Please see service letter SL1988-243 in line with maintenance manual related section in Plate no 909.
2. Another possible reason of the roller damages is water leakages to roller sections. In case no effective sealing between roller housing and engine frame, and excessive water leak from cooling jackets with blocked drains, it is possible to water enter to roller housing and brake the oil film which result stuck of the roller. Therefor it is very important to keep engine free from any leakages and make sure drain holes not blocked by foreign materials.
3. Roller overhaul and inspection should not be skipped and to be completed together with fuel pump overhauls. Crack tests will inform you in advance if any crack developed on the rollers which will cause damage in due course. Loose guide blocks also will cause misalignment and damage of the roller. Please see service letter SL1997-345 for more info.
4. Our experience shows that in some cases, it is overlooked to order seal & O-rings set for roller housings and umbrella seals, resulting cancelling roller overhaul and inspection, which should be done together with fuel pump overhaul during drydocks. Therefore, we recommend keep full set seal and O-ring for the roller and umbrella seal system on board.
5. We also recommend keeping below spares on board to prevent operational time losses.
    a. 1 pc two halves exhaust cam.
    b. 1 pc two halves roller cam
    c. 1 set fuel pump roller
    d. 1 set exhaust cam roller
    e. 1 pc fuel roller housing
    f. 1 pc exhaust roller housing
    g. 1 pc spring for fuel and exhaust roller

Remark: If you want to check fuel pump lead along with exhaust cam lead, make sure fuel pump roller is at ahead position. How to change roller position, please visit our web page www.oktotr.com

If you have any question or service request, please reach us through info@oktotr.com

Monitoring

Liner Condition Camera

CONTACT TO info@oktotr.com for LCC SERVICE

CHRIS-MARINE®

LCC

The Chris-Marine Liner Condition Camera (LCC) is used for in situ photography of the cylinder liner walls and piston ring pack in 2-stroke engines.

The photos are used when evaluating cylinder condition parameters such as cleanliness of ring land, size of cylinder wear edge, cylinder honing mark and wave-cut groove extension, black lacquering from corrosive wear and bore polish.

Product features

- The Chris-Marine Liner Condition Camera (LCC) has four cameras documenting the complete liner running surface, exhaust valve, start air valve, lube oil injector area and injector valves, without removing the cylinder cover:

  Cameras 1-3: facing the liner walls in slightly overlapping sectors

  Camera 4: facing upwards toward injectors and exhaust valve

  Cameras 1-4 and LED flashes mounted on the camera unit are triggered with a laser distance sensor to avoid unnecessary data collection and battery energy consumption

  Tablet camera: documents piston ring pack and topland condition

- The LCC unit includes all parts needed for in situ cylinder condition documentation of 2-stroke engines with a bore size from 480 to 980 mm.
- There is no need to remove cylinder cover or exhaust valve housing when using the LCC. Only venting of combustion chamber is necessary, e.g. by opening the indicator valve.
- High-temperature resistant electronic components and batteries allow operation without lowering engine coolant temperature for most engine types.
- Time required: ~15 min per cylinder unit
- With fully charged batteries it is possible to document up to 14 cylinders (subject to number of pictures taken per cylinder).

NO NEED TO REMOVE CYLINDER COVER

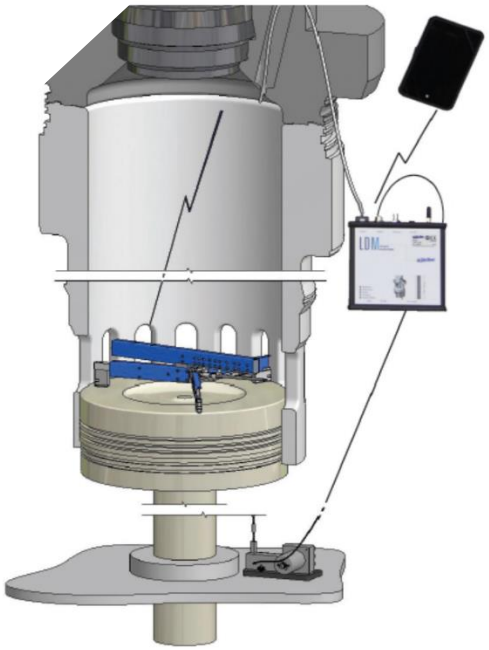
Monitoring

Liner Diameter Measurement

CHRIS-MARINE®
LDM

DURING PORT STAY OR ANCHORAGE, WITHOUT DISTURBING VESSEL'S OPERATION!!!

- Avoid unplanned off-hire and reduce overhauling costs through continual monitoring of the cylinder condition.
- Pre-inspect cylinder condition before a piston overhaul to minimize downtime and cost.
- Safe, fast, and accurate measuring of cylinder liner wear and clover-leafing.
- No need to remove cylinder cover prior to measurement



Contact to OKTO for complete package of cylinder condition monitoring

- *Measuring the liner diameter with LDM*
- *Checking the condition with LCC*
- *Measuring thickness of piston ring coating*
- *Takin replica sample and analysing*
- *Complete visual inspection by expert*