



Leading the Ocean & Beyond

ME, 2.5 years maintenance program

ME-C, ME-B

stx Heavy Industries



ME 2.5 years maintenance (Specialize for HCU, HPS)

- I. Overhaul interval of ME components**
- II. Benefit of 2.5 years maintenance**
- III. Service scheme**

I . Overhaul interval of ME components

[In accordance with the latest SL2017-650/SRJ]

-. ME-C engine ; extracted the category of service and focus on maintenance of HPS, HCU.

ME/ME-C Engines Guiding Overhaul Intervals and Expected Service Life			
Component	Overhaul interval (hours)	Expected service life (hours)	Remarks
Exhaust actuator	24,000	64,000	Lifetime can deviate due to cavitation.
Exhaust valve high-pressure pipe	24,000	64,000	Lifetime can deviate due to cavitation.
Proportional valve for main hydraulic pump		20,000	Replace valve after 20,000 hours.
Fuel oil pressure booster	32,000 based on engine observations	64,000 replace or recondition	Change sealing rings on hydraulic piston and suction valve at overhaul.
Suction valve	8,000	16,000	Check for wear at seat and conical ring.
Cylinder lubricator	24,000	96,000	Check timing and adjustment.
Accumulators on HPS and HCU	N ₂ pressure 2,000 Rubber diaphragms 32,000	Engine lifetime	Replace diaphragms after 5 years.

-. Others components are to be followed guidance described on overhaul guidance, SL2017-650.
; For planning of the 5 year dry docking, the overhaul strategy and overhaul interval to be checked.

-. The overhaul strategy made for reference based on approximately 10 years service experience of ME engine which accumulated expertise from in service. The detail service plan with relevant spare parts will be listed up according to the PJT information.

I . Overhaul interval of ME components

[In accordance with the latest SL2017-650/SRJ]

- ME-B engine ; extracted the category of service for HPS, HCU.

ME-B Engines Guiding Overhaul Intervals and Expected Service Life

Component	Overhaul interval (hours)	Expected service life (hours)	Remarks
Proportional valve for main hydraulic pump		20,000	Replace valve after 20,000 hours.
Fuel oil pressure booster	32,000 based on engine observations	64,000 replace or recondition	Change sealing rings on hydraulic piston and suction valve at overhaul.
Suction valve	8,000	16,000	Check for wear at seat and conical ring.
Cylinder lubricator	24,000	96,000	Check timing and adjustment
Accumulators on HPS and HCU	N ₂ pressure 2,000 Rubber diaphragms 32,000	Engine lifetime	Replace diaphragms after 5 years.

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II. Benefit of 2.5 years maintenance

[Purpose of inspection as pre-docking in advance]

1) Pre-docking inspection of the engine components especially on HCU, HPS system makes a profit ; result in proper set up plan of 5 year (32,000 hrs) dry docking.

1) Advantage

- a) Diagnose the engine condition which can be defined the work scope when 5 year, dry docking.
- b) Based on the report, the owner make a proper plan kinds of budget, procurement the relevant spare in advance (time-efficient and cost-efficient)

2) ME electric system inspection/verification

ME Engine which is controlled electronically, in case of electronic noise caused by improper cabling condition is fatal to ship as well as main engine operation. To prevent mentioned problem caused by improper cabling condition & maintenance and to emphasize the requirements about regular cabling inspection for ME engine, the inspection of ME system to be required on top priority during 2.5 years maintenance.

This inspection is prevention for saving the Operating Expenditure (OPEX) via appropriate treatment of cable and electrical system whole ME engine.

a) Electric part inspection

- Pressure transmitter, sensor and level sensor
- O.M.D / P.C.O / A.V.M / Cylinder L.O heating tank / Junction box / Auto filter

b) Network test (MPC, MPC10, MOP)

- Examination a cable connection / Check the insulation

c) Test and adjustment of maneuvering handle

d) Aux' blower, start up pump control panel

e) Function test for interlock system

f) Inductive sensor of HCU (Fuel, exh')

3) On board verification via overhaul the exh' actuator (ME-C engine).

- Exh' actuator : 24,000 hrs (Overhaul)

[In accordance with service experience and the latest overhaul guidance]

1) Engine control system – software version

- a) ME-C : 0905 or higher
- b) ME-B : 0906 or higher

2) Hydraulic Power Supply (HPS)

- a) ME-B, ME-C : Control valve : 20,000 hrs (replacement)
- b) Accumulator N2 recharge, measurement : 2,000 hrs

3) Hydraulic Cylinder Unit (HCU)

- a) Fuel oil pressure booster :
 - Suction valve : 16,000 hrs (replacement), 8,000 hrs (overhaul)
- b) Exh' actuator : 24,000 hrs / ME-C (Overhaul)
- c) Accumulator N2 recharge, measurement : 2,000 hrs

4) Hydraulic control valves

- Control valve : 20,000 hrs (replacement)

5) Hydraulic oil cleanliness

- After oil filter : ISO4406 XX/16/13 (Compulsory for optimum lifetime of ME components)
- Build up time / Decay time measurement

6) Electric system, equipment (See detail description following service scheme)

7) Confirmation trial

- Function test of HCU, HPS, Tacho system
- Re-tightening the main chain tightener / Inspection of gear wheel, guide bar
- Conduction confirmation trial in order to evaluate a overhaul and verification of ME electric components.

III. Service scheme

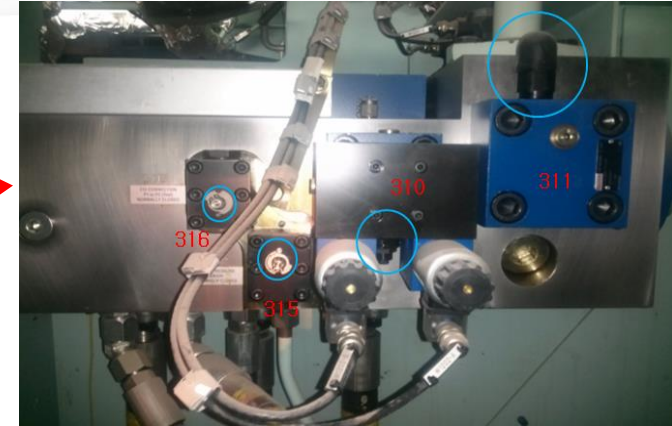
2) HPS (Hydraulic Power Supply)

- ME-C

a) The hyd' pressure re-setting.(#310, 311,312)

Final setting of pressure regulating valves.

Position No.	Valve	Setting
310	Safety Valve	310 bar
311	Safety Valve	315 bar
312	Start up pumps	225 bar



b) Then hydraulic pressure build up test will be carried out in order to verify the hydraulic system.

c) The accumulator on HPS to be checked of recharge pressure and condition.

■ Part List for preparation the 5 year (32,000 hrs) maintenance

a) Hyd' pump

- Repair kit replacement (Basic)
- Re-manufacturing (Option)
- Replacement (Option)
- Proportional valve (Basic)

b) Hyd' hose

- Hydraulic hoses on HPS
- Adaptor

c) Accumulator block

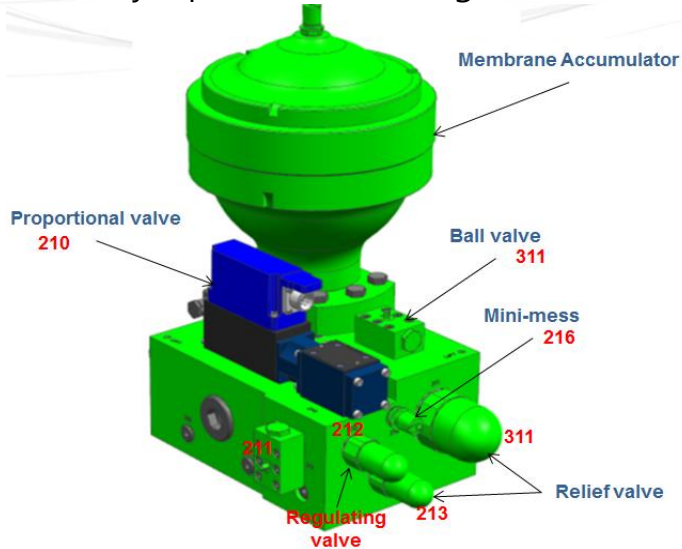
- Pos.310, 311 valve (cartridge valve)

III. Service scheme

2) HPS (Hydraulic Power Supply)

- ME-B

a) The hyd' pressure re-setting.(#212, 311, 213)



b) Then hydraulic pressure as decay time will be verified in order to verify the hydraulic system.

c) The accumulator on HPS to be checked of recharge pressure and condition.

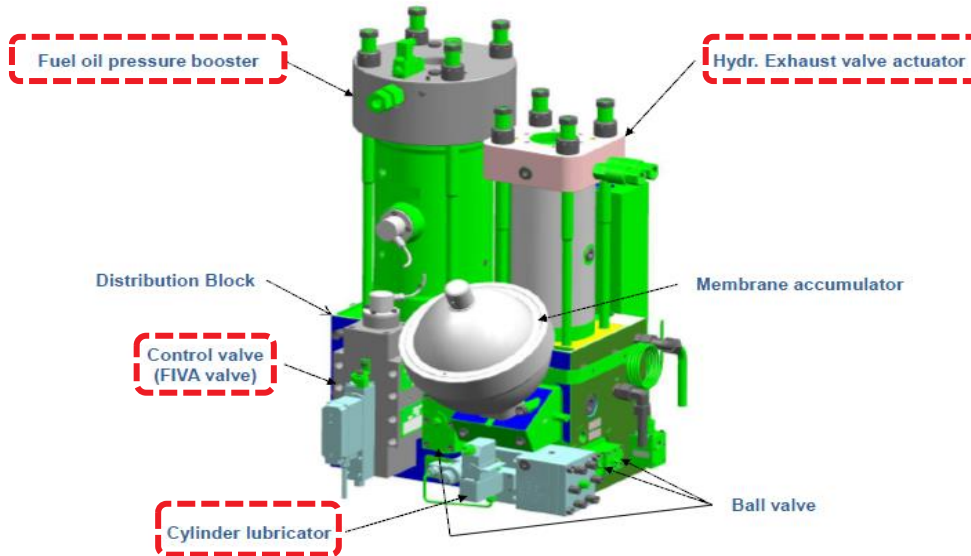
■ Part List for preparation the 5 year (32,000 hrs) maintenance

- a) Electrically controlled motor
 - Bearing
- b) Hyd' pump
 - Repair kit replacement (Basic)
 - Re-manufacturing (Option)
 - Replacement (Option)
- c) Claw coupling
- d) Accumulator block
 - Pos.213, 311, 212 valve
 - Proportional valve

III. Service scheme

3) 4) HCU (Hydraulic Cylinder Unit)

- a) After overhaul the components, evaluation of condition to be verified then relevant items to be replaced.
- b) The accumulator on HPS to be checked of recharge pressure and condition.



■ Part List for 2.5 year maintenance

- a) The suction valve on fuel oil booster to be overhaul for inspection at 8,000 hrs. Then replaced by 16,000 hrs.
- b) The exh' actuator to be overhaul for further inspection. ME-C (24,000 hrs), ME-B (32,000 hrs)
- c) The lubricator will be disassembled for replacement of the repair kit. (24,000 hrs)
- d) The 4/3way proportional valve of FIVA to be replaced at 20,000 hrs.

■ Part List for preparation the 5 year (32,000 hrs) maintenance

- a) Fuel oil pressure booster
 - Square sealing ring
- b) Exhaust valve actuator (ME-B)
 - Square sealing ring
- c) FIVA valve
 - Control valve
 - Including repair kit (sealing ring)
- e) Accumulator
 - Membrane

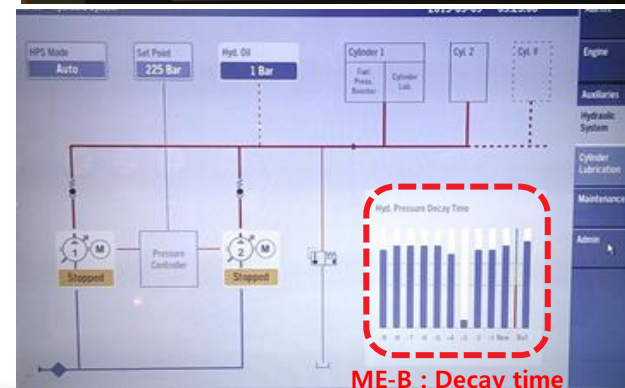
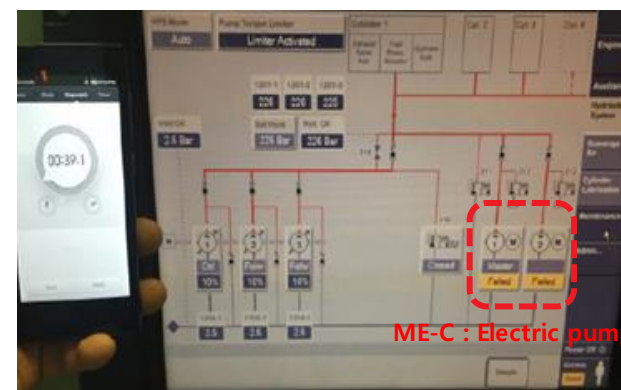
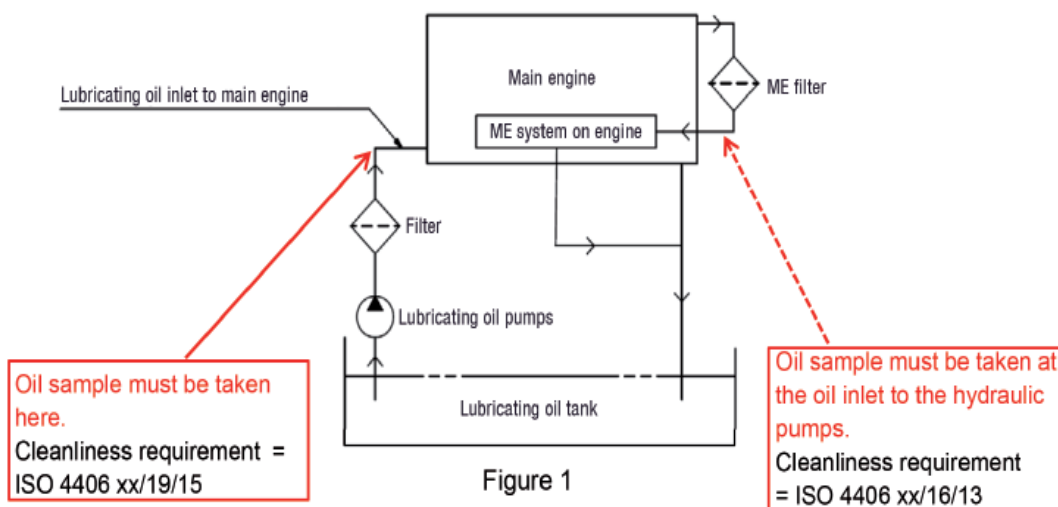
5) Hydraulic Oil Cleanliness

For optimum lifetime of ME components and liable operation, the hydraulic oil cleanliness should be met grade of ISO4406 XX/16/13.

The reference method for evaluation as condition-based monitoring system, the pump build up time until 225 bar pressure to be measured.

- ME-C : Only one electric pump to be required build up time within 3 min.
Both pumps to be required build up time within 1.5 min
- ME-B : Decay time (depressurize time from 220 bar to 160 bar) displayed by MOP when HPS system turn off

Lubricating oil system for an ME engine



6) Electric system, equipment

In order to eliminate electrical noise and low insulation, the cable connection/condition to be checked and rectified in case of found out abnormalities. Below items to be inspected while 2.5 year maintenance.

a) Electric part inspection

- MPC, MPC10, TSA, DAU ; connection condition, insulation check
- Power Supply Unit : ground failure test, insulation check
- PMI, CoCos EDS, Local Operation Panel (LOP)
- O.M.D / P.C.O / A.V.M / Cylinder L.O heating tank
- Auto filter
- Function test for interlock system
: Main starting air, distributor w / turning gear / control air system

b) Network test

- Ground failure test
- Resistance check and replace
- I/O connection test on network A,B

c) Test and adjustment of maneuvering handle

d) Aux' blower, start up pump control panel

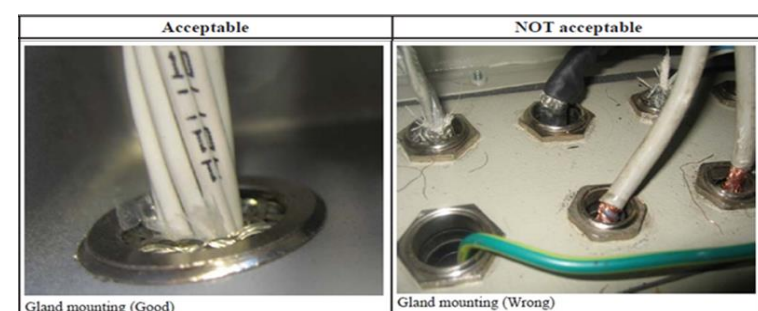
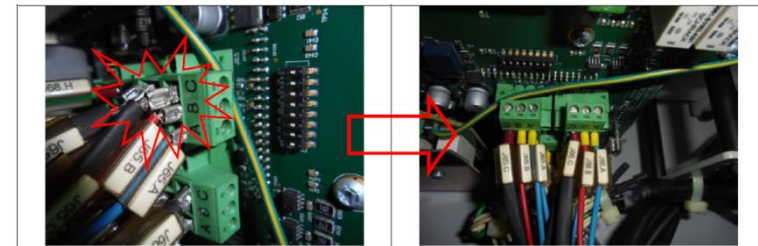
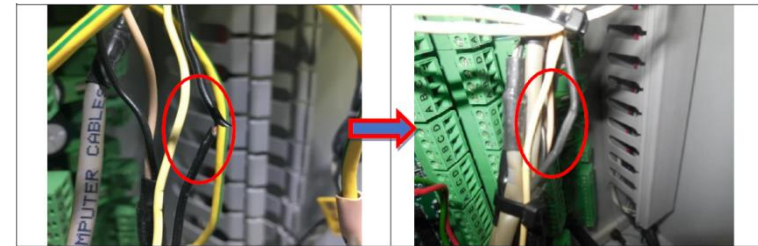
- Safety device test of control panel
- Local, remote / alarm function test

e) Check the pressure transmitter, sensor and level sensor

- Examination a cable connection
: Junction boxes / cylinder level oil / Hyd leakage
- Check the low insulation

f) Inductive sensor of HCU (Fuel, exh')

- Test and adjust



III. Service scheme

[Service scheme]

7) Confirmation trial

After completion all overhaul inspection and replacement of ME components on HCU and HPS, the confirmation trial to be required in order to evaluate for condition of restoration properly.

During confirmation trial monitoring and adjustment of ME performance will be conducted by qualified service engineer.

- Fuel Quality Adjustment (FQA)
- Cylinder oil feed rate
- Engine performance
- Tacho system : TDC calibration

Service scheme of 3 year maintenance	Day 1	Day 2	Day 3	Day 4	
Re-tightening of main chain tightener, Inspection of gear wheel tooth and chain guide bar	→				
Overhaul/replacement of HCU (exh' actuator) components # The extend of overhaul scope vary by selection service scope of owner.	→				
Inspection of electric system (MPC, MPC-10, PSU, Junction boxes, control panel, etc..)	→				
Function test and calibration of HCU, HPS, Tacho system. Function test of hydraulic leakage, starting air pilot valves Function test of interlock device and starting air pilot valve			→		
Sea trial (PMI measurement, safety device function test, Engine performance evaluation)				→	