Dear Sirs,

Further to our discussion, please find following the ME-C Engine's Control System and hydraulic pressure actuation and response PMS recommendations.

1. Save a Performance once per 30 days, when on high load. Always confirm after changing fuel that Fuel Quality Offset has been adjusted on the MOP and that Estimated Engine Load is within ±2% to the Actual Estimated Engine Load read from the PMI.
2. Save a set of HCU & HPS Events on the MOP for all cylinders at the same time you take your monthly performance. Record this and log together with your performance files.
3. Check that system can be pressurized (even with a small delay) only with one Start Up Pump working. For that, an action of changing the master function of the pumps is required. This refers to electrically driven pumps. Take the action when engine is in Standby and Stopped. Frequency: Once per 6 months.
4. Check HCUs safety by-pass. Engine must be stopped. MOP on Chief access. HPS in manual. Main State to be at Stand-by. Startup pumps must run. Open manual connection valve 316 (P1-P2). Valve 316 must be closed after the test is completed. At the MOP screens go to Auxiliaries, HPS, open Pump by-pass through ACU-1. Click on the oblique area of the 310. Verify that 310 opens. Then Close the 310 through the ACU-1. Follow the same procedure through ACU-3. Remember to close 316 after testing. Frequency: Every 6 months. Expected result per step: pressure will be drained and pressure level will be close to zero bar and then will be increased again to normal level.
5. Check that your aux blowers can be individually started and stopped from the MOP, remotely. This requires blowers to be switched to manual mode. Check this when the engine is stopped and not overload the blowers. It is the function that we need to check, NOT the blowers. Confirm functionality through the ACUs corresponding feedback signals (Ch40, 41, 82). Test the blowers one by one: Access the Scavenge Air screen to perform this testing. Frequency: Whenever you check your blowers locally.
6. Check Encoders Adjustment. Turn Engine to TDC of Cyl. No1, confirm by the pin gauge. Check that the indicator light for the TSA-A amplifier turns on when Cyl. No1 at TDC. Turn the engine a few degrees back and forth and confirm that the LED turns on/off accordingly. Do the same for checking the TSA-B when Cyl. No1 is at 45 degrees. Frequency: (6 months)
7. Check of Encoder at Flywheel (Reference Sensor). Turn Engine 90 degrees ATDC of Cyl. No1 and check that the LED on the sensor is on. Sensor distance to flywheel teeth = 2mm. . Frequency: (6 months)
8. Check LOP lamps. Every 3 months.
9. Test of the pilot valves to the main starting valve and test of the pilot valve of the slow turning valve by MOP status screen. Click on the oblique area of the screen. This test is to be

made after arrival in Port together with the test of the cylinders starting air valves. Frequency: Regular testing (Operation manual pg 64-65). State of engine FWE. Ask permission from bridge.

10. Test of the starting air valves of the cylinders. Make a slow turn and an Air Run through the MOP. Both more than one revolution. Confirm by visual inspection that rotation has the same regularity during the full revolution. Frequency: Regular Testing. State of engine FWE. Ask permission from bridge.
11. Check cylinder lubrication Slowdown function. Engine must be stopped. Main State to Stand-By mode. Close the manual valve for lube oil supply to all cylinders (valve 560 on the HCU blocks). Now activate from the MOP-Auxiliaries-Cylinder Lubrication screen the Lubricator Testing Sequence for all cylinders. If everything is in proper condition an alarm of lube oil must be triggered for all the cylinders. Slow Down requisition must rise. After test Lubricato Test Sequence must revert to "All Off". Frequency: every 6 months.
12. Test the Shutdown signals to all MPC units. Engine must be stopped. Activate Emergency Stop and check that both ECU-A, ECU-B plus all the CCUs give alarms for shutdown. Frequency: Every 6 months. (Check General Operation Manual, pg 65 for ME engines)
13. Leakage test of the Hydraulic System. Engine Stopped. See procedure M90622-XXXX and Datasheet D10622-XXXX for detailed test. Version number relates to procedure/datasheet in Vol 2, Maintenance Manual and is Engine SPECIFIC. Frequency: Every 6 months. (Check General Operation Manual, pg 65 for ME engines)
14. Check the HCU accumulators. Engine Stopped. Main State at Stand-by. HPS mode at manual. Stand-by pumps stopped. Close valve 420. Open valve 421 to drain any oil present in the HCU. After oil is drained connect pressure setting tool or digital instrument given by the maker to check pressure. Pressure is according to pressure adjustment diagram. Allowable tolerance is ±5bar. Our recommendation is checking once per 30-45 days in order to be always on the safe side.
15. Check the HPS accumulators. Engine Stopped. Main State at Stand-by. HPS mode at manual. Stand-by pumps stopped. Open valve 315 to drain any oil that may be present in the HPS and the accumulators. After oil is drained connect pressure setting tool or digital instrument given by the maker to check pressure. Pressure is according to pressure adjustment diagram. Allowable tolerance is ±5bar. Our recommendation is checking once per 30-45 days in order to be always on the safe side.
16. HPS engine driven pumps test. Perform the troubleshooting test on the MOP for every pump. Engine must be stopped. Start up pumps must be running. Observe the feedback signals after ordering swash plate to move to ±15 degrees. If swash plate needs to be changed then take HPS function test to calibrate. Once per 2 or 3 months.
17. HCU test. Perform the troubleshooting test on the MOP for every cylinder. Engine must be stopped. Start up pumps must be running. Observe the feedback signals after ordering a real injection and a real exhaust valve opening to run. Reference values of the feedback signals can be found on the HCU Function test screen. If a plunger needs to be changed then calibrate the new plunger through the HCU function test. Once per 2 or 3 months.
18. Check the pressure built up time with one startup pump running. Engine must be stopped. HPS in manual mode. Start up pumps must be both stopped. Pressure must be roughly 0bar. Procedure goes as follows: Start the Start Up Pump No1. Measure the pressure built up time. This must lay within 1.5-3.0min. Stop this pump. Do the same with the second pump. Once per 6 months.
19. Check the pressure built up time with both startup pumps running. Turn from FWE to STANDBY. Time must be less than 1.5min. Do the same with the second pump. Once per 6 months.

20. Test of FIVA: Engine must be stopped. Standby mode is required. Fuel Supply is required. Take the first part of the function test of each HCU and if new plunger is not installed then do not save any new calibration results for the fuel plunger. Observe the feedback signals of the key values and compare with the reference values. Approximate time 15min per HCU Function Test. Once per 2 or 3 months.
21. Tachos Function Test: Required to be taken as a step by step mentioned procedure on the MOPs, each time we change an angle encoder.

Disclaimer

All above stated procedures are originating both from the officially MDT published instruction manuals as well as service experience gained by the MAN PrimeServ Academy in Piraeus stemming from customers' cases. The function and understanding of the above stated procedures require primarily properly trained personnel in the ME-C engine's control system in any of our Academies and the application of these maintenance procedures do not in any way present or entail any possible damage to the main engine , if strictly followed by trained personnel onboard . Hence MAN Diesel & Turbo will not accept any liability in future which may be associated in any way direct or indirect from the application of the above mentioned procedures.