



Service Letter

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Low Load Operation for MC and ME engines Long Term Operation Mode

Action Code: WHEN CONVENIENT

In connection with requests from shipowners asking for guidelines for operating engines with reduced load in order to save fuel, we have prepared this new Service Letter on this issue.

The recommendations are to be considered as overall guidelines based on engine performance including the exhaust gas boiler in general. In case permanent low-load operation of the engine is required, the exhaust gas boiler manufacturer should be consulted for advice, as well.

Low-load operation with MC/MC-C engines

With the introduction of slide fuel valves, engine conditions for service at low loads for long term operation have been significantly improved.

With slide valves, satisfactory continuous running conditions can be obtained down to 50-60% of MCR rpm (10-20% engine load) without making any changes on the engine itself, but obeying certain procedures in this range below 40%.

The engine load can be reduced to 40% without taking any particular precautions in the systems and procedures. At any load above 40%, the auxiliary blower has generally switched off, and the exhaust gas has a velocity which is sufficient for transporting soot away during normal operation and soot blasting.

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However, with a few engine lay-outs, the auxiliary blowers switch off at a load slightly above 40%. If so, the actual cut-out level determines the load level.

At a permanent load below 40% for long term operation, preparations should be evaluated in accordance with the conditions described below.

It is our experience that long-term low-load operation increases the risk of exhaust gas boiler fouling caused by a build-up of carbon and hydrocarbons in the exhaust gas boiler at low temperatures. Furthermore, the exhaust gas velocity is so low at low load that deposits from soot blasting cannot be removed.

The increased fouling can generally be related to the more difficult operation conditions for the fuel system at low load, with relatively small injection amounts at lower injection pressure (due to the low RPM).

Depending on boiler configuration, it may be recommendable to install a by pass of the exhaust gas boiler, so that the exhaust gas, at proper velocities, can be sent through this by pass connection at low loads.

Uncontrolled building up of soot in the exhaust gas boiler can lead to fires and, in the worst case, melting of the boiler tubes!

Even with a by pass of the exhaust gas boiler at low loads, the depositing of soot which settles in the gas ways should always be reduced to ensure a safe operation of the engine and turbocharger.

Measures to improve the fuel valve performance at low load:

- 1) Introduction of slide valves (i.e. fuel valve atomizers with no sac volume). Slide valves are our standard today and can be installed as retrofit on MC/MC-C engines in service. In the slide valve, the sac volume is omitted and the combustion is improved during all load steps.
- 2) Cylinder cut-out system. The cylinder cut-out system, to be used at rpm's below 40% of MCR rpm, allows the engine to operate with only half of the cylinders, resulting in increased load on the operating cylinders with improved operating conditions for the fuel system as a result and, thereby, ensuring stable running conditions down to 20-25% of nominal rpm. The speed limits for the actual plant should be evaluated by MAN Diesel on a case-to-case basis

Furthermore, in some special cases, it can be relevant to introduce auxiliary blowers with increased capacity in order to reach a higher load before they switch off. In such case, the auxiliary blowers are running permanently at relatively high part loads in accordance with the increased setting point for "cut out".



To avoid continuous start/stop of the auxiliary blowers, the permanent low-load operation should be set to a level outside cut in/cut out of the auxiliary blowers.

The MC/MC-C engines can be operated below 20% load without special measures for improvement of slow steaming conditions for short periods (12-24 hours). However, it is recommended to increase the engine load above 75% load for approx. one hour every 12 hours in order to increase the velocity of the gas and thereby clean the gas ways.

In relation to the expected increased depositing of soot in the internal parts of the engine and turbocharger, special attention should be given to turbocharger cleaning, which should be carried out more frequent than stated in the instruction for normal operation.

Optimisation of the part load service conditions by turbocharger re-matching and change of fuel nozzles will change the IMO NO_x certification and require a new IMO certification of the engine.

If the desired ship speed is at very low loads (i.e. below 20% load), turbocharger matching has only marginal influence on the engine performance, and only marginal improvements can be obtained by re-matching.

In previous Service Letters on low-load operation, it has been recommended to change fuel valve nozzles to new nozzles with smaller nozzle holes, this recommendation is not valid for slide fuel valves. If previous standard fuel valve types are used, MAN Diesel recommends to change to slide fuel valves. A change of nozzle hole size and a change to slide fuel valves have the same impact on the IMO NO_x certification of the engine, which is merely that the new configuration has to be amended to the technical file of the engine.

MAN Diesel is able to assist with IMO certification when new modes on board the vessels are defined.

Operation modes for MC/MC-C engines

Engine Load	Exh. boiler by-pass	Slide valves	Cylinder cut out
> 40%	No	Recommended Not necessary	No
20 – 40%	Yes	Yes	No
< 20%	Yes	Yes	Yes*

*Only at extreme low load (less than 40% MCR-rpm). This is mainly relevant for tankers during so-called lightering service, or low load leaving/entering harbour of container ships.



Low-load operation with ME/ME-C engines

With the introduction of ME and ME-C engines as well as the slide fuel valves, the engine conditions for service on low loads for long term operation have improved considerably.

However, the general description of low-load operation given in the section "Low-load operation with MC/MC-C engines" of this Service Letter remains valid for ME/ME-C engines. However, the need for an intermittent load increase is reduced to twice a week.

ME/ME-C engines are equipped with slide fuel valves as standard. The injection pressure is independent of the engine load and creates an optimised injection on all load levels and, accordingly, makes cylinder cut out less relevant for securing stable running conditions at very low loads.

Further optimisation possibilities exist for the ME/ME-C engines. These will be described in the following.

The ME/ME-C engines are delivered in economy mode as standard, ensuring optimal SFOC in the high load area. The economy mode is of course fulfilling the requirements with regard to the IMO NO_x emission limits.

In the economy mode, the engine is fully capable of operating continuously for long periods at part load and low load without making any special adjustments of the engine.

However, the ME/ME-C engine also offers opportunities for implementing other operating modes than the economy mode described briefly above. The most common alternative operating mode installed on the ME/ME-C engines is the so-called emission mode, where the NO_x emission cycle value is lowered by 10% to 25% by special adjustment of engine parameters mainly in the high load area (75% and 100%).

Also in the emission mode, the engine is fully capable of operating continuously for long periods also at part load and low load without making any special adjustments of the engine.

The ME/ME-C engine does, however, offer four different operating modes, and lately there have been increasing requirements for investigating the possibilities of applying a low-load or part-load operating mode.

How the low-load or part-load operating mode is applied will very much depend on the specific requirements to the operation profile of the engine and vessel.



Application of a special low or part load operation mode can include different options.

The most low and part-load oriented optimisation of the ME/ME-C engine can include special matching of turbochargers, installation of variable by pass, turbocharger cut-out systems, optimisation of compression volume and special fuel valve nozzles. This option should only be used if most of the operating time for the entire lifetime of the ship is expected to be in the low and part-load area.

The SFOC gain in the low and part-load area will be 3-4 g/kWh compared to the obtainable reference economy mode SFOC, and the SFOC increase in the high and full-load area will also be 3-4 g/kWh when compared to the obtainable reference economy mode SFOC. It should be mentioned that the obtainable reference economy mode can only be obtained if the engine is rebuilt to standard with regard to matching of turbochargers, permanent closing of variable by pass, resetting of compression volume and special fuel valve nozzles. The engine settings will, however, secure that full load (MCR) operation can be obtained.

The simplest possible low and part-load optimisation of the ME/ME-C engine is limited to such action as special parameter settings of the exhaust valve actuation and fuel injection timing and profile in the low and part-load area. This option can be applied if the vessel has schedules planned where low and part-load operation is foreseen. An example could be a container vessel requiring low load on certain "legs" of its route.

The SFOC gain in the low and part-load area will be 1-2 g/kWh compared to the obtainable reference economy mode, and the SFOC increase in the high and full-load area will also be 1-2 g/kWh when compared to the obtainable reference economy mode. The engine will, however, be able to operate in the reference economy mode by pushing a button on the ME engine control panel.

Operation modes for ME/ME-C engines

Engine Load	Exh. boiler by-pass	Slide valves	Cylinder cut out	Slow steaming mode relevant
> 40%	No	Standard	No	Yes
20 – 40%	Yes	Standard	No	Yes
< 20%	Yes	Standard	No	Yes

Questions regarding this Service Letter should be directed to our Operation Dept. LEO.

Yours faithfully
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