Market Update Note

18 December 2023

MAN Energy Solutions introduces engine control system support for ’PTO option 2 for EEDI’

’PTO option 2 for EEDI’ accounts for the PTO power used in the EEDI calculation

In recent years, the implementation of shaft generator/power take-off (PTO) has increased dramatically. This has resulted in an increasing interest in the possibilities of accounting for the PTO when calculating the Energy Efficiency Design Index (EEDI).

The EEDI guideline MEPC 364(79) and the IACS procedure PR38 outline two options accounting for the PTO in the EEDI, options 1 and 2. Until now, MAN Energy Solutions has supported option 1. With ’PTO option 2 for EEDI’, MAN Energy Solutions introduces support for option 2, where the support is provided by the engine control system (ECS) based on inputs from the power management system (PMS).

For vessels where the nameplate/rated electric power of the PTO is larger than $P_{AE}/0.75$, option 2 will result in an attained EEDI which is lower than for option 1, with the same installed engine power. This will often be the case for vessels with a large onboard power consumption, for example for cooling of the cargo on gas and chemical tankers and vessels with a high reefer capacity.

Alternatively, the functionality can be applied to increase the main engine power and torque for driving the PTO in service, while maintaining an EEDI value as for an engine with lower installed engine power and no PTO.

As the engine can deliver its full power at the specified maximum continuous rating (P_{SMCR}) when full PTO power is exploited, the engine is NO_X certified as usual, in accordance with P_{SMCR}. Furthermore, the application of PTO option 2 for EEDI does not affect the specific fuel oil consumption (SFOC) of the engine, nor auxiliary capacities as the engine remains able to deliver 100% power.

Options for accounting for a PTO in the EEDI
With option 1, the power of the main engine (P_{ME}) used for calculating the EEDI is determined as:

$P_{ME,\ opt\ 1}=0.75\times(P_{SMCR}-P_{PTO})$, with the limitation that $0.75\times P_{PTO}\leq P_{AE}$.

- P_{PTO} is the nameplate/rated PTO power
- P_{AE} is the auxiliary power in percentage of P_{SMCR}

With option 2, the power of the main engine used for calculating the EEDI is determined as:

$P_{ME,\ opt\ 2}=0.75\times P_{LIM,\ propulsion}$, with $P_{LIM,\ propulsion}=P_{SMCR}-P_{PTO}$, see Fig. 1.

Utilising option 2 will accordingly provide a better EEDI result, compared to an identical engine configuration utilising option 1 calculations.

Engine control system support for ’PTO option 2 for EEDI’
MAN Energy Solutions offers different interfaces for the communication between the ECS and the PMS. For PTO option 2 for EEDI, it is necessary that the ECS continuously receives input from the PMS about the actual PTO power in service, and therefore PTO interface option C is a requirement.

For a plant with PTO interface option C, no further cabling or PMS functionalities are necessary, since the support of PTO option 2 for EEDI is solely performed by the ECS.

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Example of utilisation of 'PTO option 2 for EEDI' on a Kamsarmax (82k dwt) bulk carrier
Consider a Kamsarmax bulk carrier with a 6S60ME-C10.5 engine, an SMCR in L4 of 9,000 kW at 84 rpm, and 7% propeller light running margin.

In this example, a PTO with 900 kWe power is replacing one of the typical three auxiliary engines onboard of such capacity. Considering 90% efficiency, a rated PTO power of P_{PTO}=1,000 kW mechanic load on the shaft is included.

The SMCR of 9,000 kW and P_{PTO}=1,000 kW implies that:

$P_{LIM,\ propulsion}=P_{SMCR}-P_{PTO}=9{,}000-1{,}000=8{,}000$ kW

$P_{ME,\ opt.\ 2}=0.75\times P_{LIM,\ propulsion}=6{,}000$ kW

This can be compared to the value attained by applying option 1:

$P_{ME,\ opt.\ 1}=0.75\times(P_{SMCR}-P_{PTO})\leftrightarrow$

$P_{ME,\ opt.\ 1}=0.75\times(P_{SMCR}-P_{AE}/0.75)$
$=0.75\times(9{,}000-450/0.75)=6{,}300$ kW

To attain the same P_{ME} as for option 2 but without the PTO, the SMCR should be reduced to 8,000 kW.

$P_{ME,\ no\ PTO}=0.75\times P_{SMCR}=0.75\times 8{,}000=6{,}000$ kW

This implies changing the engine to a 5S60ME-C10.5 with an SMCR of 8,000 kW at 84 rpm.

Fig. 1 shows the difference between the limitations for continuous loading for these two ratings, applying the same propeller with a light running margin of 7% to the original SMCR.

Fig. 1 illustrates that by applying PTO option 2 for EEDI, it is possible to apply an engine with a higher rating and wider load diagram than otherwise applicable. This allows for high utilisation rates of the PTO in service for the benefit of the overall plant efficiency. In this specific example, the extent of derating for the 6S60ME-C10.5 engine is furthermore greater than for the 5S60ME-C10.5, resulting in a lower SFOC.

For support regarding layout of PTO/PTI, classification and application of PTO option 2 for EEDI, contact MAN Energy Solutions, Copenhagen at MarineProjectEngineering2s@man-es.com

For support regarding the final specification, quotations and ordering of PTO option 2 for EEDI, contact our licensees.

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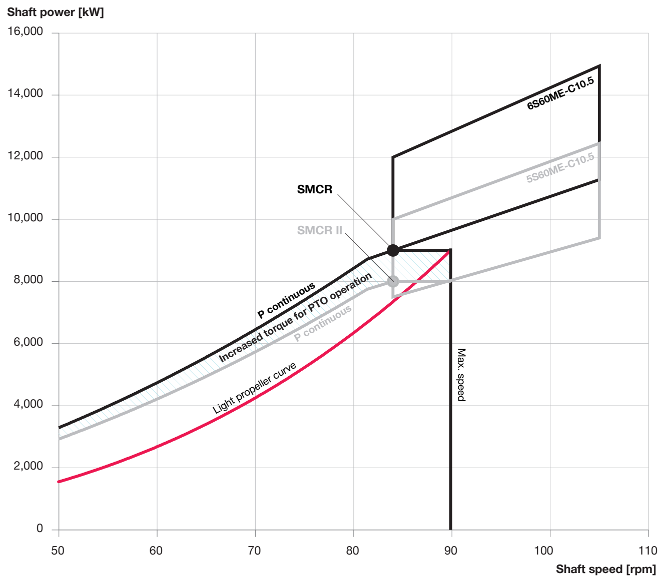

Fig. 1: Difference in limits for continuous loading of two engines with: SMCR of 9,000 kW at 84 rpm and SMCR of 8,000 kW at 84 rpm. Applying PTO and utilising PTO option 2 for EEDI for the engine with the high SMCR will provide the same EEDI value as for the engine with the low SMCR, but without PTO.