GUIDANCE NOTES

CHINA CLASSIFICATION SOCIETY

GUIDELINES ON CALCULATION AND VERIFICATION OF THE ATTAINED ENERGY EFFICIENCY EXISTING SHIP INDEX (EEXI)

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2.2.3 Power of main engines ($P_{ME(i)}$)

(3) In cases of LNG carriers with power limitation/power reduction modification, for LNG carriers having steam turbine propulsion, $P_{ME(i)}$ is 83% of the limited installed power (MCR_{lim}) for each main engine (i). For LNG carriers having diesel electric propulsion, $P_{ME(i)}$ is 83% of the limited installed power (MPP_{lim}), divided by the electrical efficiency, for each main engine (i). For LNG carriers having dual fuel conventional propulsion LNG Carriers, $P_{ME(i)}$ is 83% of the limited installed power (MCR_{lim}) or 75% of the original installed power (MCR), whichever is lower. ~~For LNG carriers,~~ The power from combustion of the excessive natural boil-off gas in the engines or boilers to avoid releasing to the atmosphere or unnecessary thermal oxidation should be deducted from $P_{ME(i)}$ with the approval of the verifier. The recommended method of deduction is given in Appendix 2.

2.2.5 Ship speed (V_{ref})

~~(8) For energy efficiency improvement achieved by the application of resistance reduction coating on the ship, the energy-saving effect can be obtained by sea trial.~~

(8) In case of lower friction hull coatings, which are considered an EET (Energy Efficiency Technology) in Category A as per IMO MEPC.1/Circ 896, the V_{ref} may be determined as follows:

—— for both pre-EEDI and EEDI ships by new sea trials which, if carried out at a draft other than EEXI draft, may be calibrated by the original model test or CFD without the effect of low friction coating;

—— for pre-EEDI ships by:

• re-evaluation of model test or

• model scale CFD calculation or

• model test supplemented with CFD calculation following the requirements in the Annex 1 of CCS《Guidelines for Verification and Survey of Low Friction Performance of Hull Coatings》 without any calibration by sea trials provided that the CFD are based on APPENDIX 4 of this guidelines. In case of CFD, the new average hull roughness is not to be taken into account directly in the numerical simulations.

APPENDIX 2 CALCULATION OF THE ATTAINED EEXI OF LNG CARRIERS

1 Calculation of steam turbine LNG carriers
2 Calculation of diesel electric LNG carriers
3 Calculation of dual fuel conventional propulsion LNG Carriers

The below methodology considers LNG as the primary fuel. The formula for the Attained EEXI is the below:

$$Attained\ EEXI = \frac{P_{ME}.\left(C_{FME_{Gas}}.SFC_{ME_{Gas}} + C_{FME_{Pilotfuel}}.SFC_{ME_{Pilotfuel}}\right) + P_{AE}.\left(C_{FAE_{Gas}}.SFC_{AE_{Gas}} + C_{FAE_{Pilotfuel}}.SFC_{AE_{Pilotfuel}}\right)}{Capacity\ .V_{ref}}$$

In cases where overridable shaft or engine power limitation is installed and after deduction of the power from combustion of excessive natural boil-off gas, the formula changes as follows:

$$Attained\ EEXI = \frac{P_{ME\_revised}.\left(C_{FME_{Gas}}.SFC_{ME_{Gaslim}} + C_{FME_{Pilotfuel}}.SFC_{ME_{Pilotfuel}\ lim}\right) + P_{AE}.\left(C_{FAE_{Gas}}.SFC_{AE_{Gas}} + C_{FAE_{Pilotfuel}}.SFC_{AE_{Pilotfuel}}\right)}{Capacity\ .V_{ref}}$$

Nomenclature：

MCR — Maximum Continuous Rating；

P_{ME} — 0.75 MCR；

V_{ref} — Reference Speed, in kn；

$SFC_{ME_{Gas}}$ — Certified specific fuel consumption, given in g/kWh, of the main engine on gas mode at 75% of MCR；

$SFC_{ME_{Gas}lim}$ — Specific fuel consumption, given in g/kWh, of the main engine on gas mode at $PME_{\_lim}$；

$SFC_{ME_{Pilotfuel}}$ — Specific fuel consumption of pilot fuel for dual fuel ME at 75% MCR according to testbed result；

$SFC_{ME_{Pilotfuel}\ lim}$ — Specific fuel consumption of pilot fuel for dual fuel ME at $PME_{\_lim}$；

C_F — Conversion factor between fuel consumption and CO2 emission, for LNG, CF=2.750 t-CO2/t-Fuel；

MCR_{lim} — The new value of MCR to which the engine or shaft must be limited to comply with the Required EEXI；

$PME_{\_lim}$ — minimum of 0.83 MCRlim and 0.75 MCR；

P_{BOG} — is the nominal power generated by consuming all boil-off gas from the cargo tanks

$P_{Excessive}$ — The excessive power from combustion of excessive natural boil-off gas is defined as the difference between nominal power generated by consuming all boil-off gas from the cargo tanks and $(MCR_{lim} + P_{AE})$：

$$P_{Excessive} = P_{BOG} - (MCR_{lim} + P_{AE})$$

$P_{ME\ revised}$ — The relevant power value after deduction of $P_{Excessive}$, this value will be used in the calculation of the Attained EEXI：

$$P_{ME\ revised} = P_{ME\_lim} - P_{Excessive}$$

BOR_{LNG}——Daily boil-off rate, in t/day,：

$$BOR_{LNG} = 0.000864 \cdot V_{Cargo}$$

V_{Cargo}——Cargo Tank Volume as per capacity plan, in m3

Based on the daily boil-off rate BOR_{LNG} and inputs from the main engine NOx Technical File (Parent Engine), P_{BOG} can be determined. The SFC_{MEgas} to be used is the weighted average corresponding to the 75% of the engines' MCR values.

$$P_{BOG} = \frac{BOR_{LNG} \cdot 1000000}{SFC_{MEgas} \cdot 24}\ [kW]$$

If $P_{BOG} > (MCR + P_{AE})$ *then* $P_{BOG} = MCR + P_{AE}$