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Recommendation concerning manual / local control capabilities for software dependent machinery systems

1. Application

IMO requires through SOLAS that local control of essential machinery shall be available in case of failure in the remote (and for unattended machinery spaces, also automatic) control systems. For traditional mechanical propulsion machinery, this design principle is well established.

The same design requirement applies to computerized propulsion machinery, i.e. complex computer based systems with unclear boundaries and with functions maintained in the different components.

Today's complex machinery installations normally depend on programmable control systems, often integrated in common control system networks. Such control systems may consist of a combination of embedded units physically integrated in the machinery components and/or control units located near the machinery or in another location on board.

The above mentioned SOLAS requirements are:

SOLAS II-1/Reg. 31.2 (Machinery controls)

2   Where remote control of propulsion machinery from the navigating bridge is provided, and the machinery spaces are intended to be manned, the following shall apply:

…

> *.6   it shall be possible to control the propulsion machinery locally, even in the case of failure in any part of the remote control system. It shall also be possible to control the auxiliary machinery, essential for the propulsion and safety of the ship, at or near the machinery concerned.*
>
> *SOLAS II-1/Reg. 49 (Unattended machinery spaces)*
>
> *4   It shall be possible for all machinery essential for the safe operation of the ship to be controlled from a local position, even in the case of failure in any part of the automatic or remote control systems.*

The two requirements appear similar but not identical.

The term "*remote control system"* in the first concerns remote control of propulsion machinery; a failure in this shall not prevent independent local control of the propulsion machinery.

The term "*remote control systems*" in the second concerns any remote control system used to maintain the vessels propulsion.

"Automatic control systems" concerns automatic functions required to operate the propulsion machinery with unattended engine room. Typical examples of such are automatic start of standby pumps, automatic boiler control system, PID controllers for oil- and FW coolers etc.

The main purpose of this Recommendation is to consider the abovementioned SOLAS requirements on complex programmable control systems for propulsion machinery.

1.1 Other applications – CAT II / CAT III

The design recommendations in 2 and 3 should also be considered for other CAT II and CAT III systems, not being a part of the propulsion system(s).

2. Design recommendations for propulsion control and related auxiliary systems

a) Local control should be provided for.

b) The individual local control systems should include necessary Human Machine Interface (HMI) for effective local operation.

c) Local control systems should be of a robust design suitable for the environmental exposure and the intended operation.

d) Local control systems should be self-contained and not depend on other systems or external communication links for its intended operation.

e) A single failure in a local control system should not cause loss of the propulsion function. For single-engine plants, this normally implies that component redundancy shall be arranged. For multiple engine plants with independent local control systems, the objective could be satisfied provided minimum manoeuvrability for the safe operation of the vessel is maintained after a single failure.

f) Failure in remote control systems should not prevent local operation.

g) Unused communication ports should be disabled.

h) Facilities for selecting "local" at or near the machinery shall be provided for. When local control is selected, any control signal(s) from the remote control system shall be ignored.

3. Auxiliary services

a) For electrically driven units in auxiliary services, the local control should normally be arranged at the motor starter in MCC's and, if applicable, also near the EUC.

b) For machinery systems which due to their complexity requires continuous automatic control, manual control of the individual EUC's may not be feasible. In such cases, local means shall be provided to both monitor the concerned process- and to enable/disable any automatic functions / modes (a typical example is the gas supply system to a gas fuelled engine).

4. Test and Surveys

a) Tests to demonstrate the necessary independence, functionality and operability should be carried out prior to delivery and also periodically.

Appendix 1

Examples of local control in different applications

a) Diesel-electric propulsion thrusters:

Local control of propulsion thrusters is normally directly at the VFD, or through a dedicated HMI / control panel in the engine room or in the thruster room."

b) Gas operated propulsion machinery

Local control of single fuel / dual fuel engine engines is normally provided for through a dedicated HMI / local control panel located in the immediate vicinity of the engine.

Local control of the gas supply/gas preparation is normally depending on automatic functionality with a dedicated HMI. Local manual control of the individual EUC's is normally not required.

c) Gas turbine

Local control and monitoring of the gas turbine is normally provided for through local control panel in the immediate vicinity outside of the turbine enclosure.

Local control of the gas turbine is normally depending on automatic functionality with a dedicated HMI. Local manual control of the individual EUC's is normally not required.

d) Steam propulsion / boiler

Local boiler control is normally provided for through a dedicated Boiler Gauge Board / BGB, located in the immediate vicinity of the boiler.

Local control of the boiler is normally depending on automatic functionality with a dedicated HMI. Local manual control of the individual EUC's is normally not required.

Appendix 2

Definitions

a) Automatic control: control of machinery without human intervention as per predefined logic.

b) EUC: Equipment Under Control (pumps, valves, motors etc.)

c) Local control system: any component needed to perform local control of the concerned machinery.

d) Local control: is normally control from a location at or near the concerned machinery, but for specific arrangements local control can also be from a separate compartment.

e) Local indicators: Indicators located at the position where local control is performed, and / or at the controlled machinery.

f) MCC: Motor Control Centre.

g) Manual Control: Command given manually by the operator. Manual control may be through operation of mechanical, hydraulic, electrical, computer based systems or a combination of some/all.

h) Remote control system: any component in addition to the local control system which is required for control from a remote location relative to the concerned machinery.

i) Remote control: is control from a distant location relative to the concerned machinery, normally outside the machinery space.

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