MSC Guidelines for Steering-Gear Electrical Systems

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Purpose: This document outlines basic guidance for submitting steering-gear control and alarm system drawings for vessels meeting the requirements of 46 CFR Subchapter J.

References:

a) 46 CFR 58.25 – Steering Gear
b) 46 CFR 113.40 – Rudder Angle Indicator Systems
c) 46 CFR 113.43 – Steering Failure Alarm Systems

Contact Information: If you have any questions or comments concerning this document, please contact the Marine Safety Center (MSC) by email or phone. Please refer to the Procedure Number E2-20.

Email: MSC@uscg.mil
Phone: 202-795-6729
Website: http://homeport.uscg.mil/msc

Responsibilities: The submitter shall provide sufficient documentation and plans to indicate compliance with the applicable requirements outlined in references (a) through (c). The submission shall be made electronically to the above email address or, if paper, in triplicate to the MSC's address found on the above website. To facilitate plan review, all plans and information specified in these guidelines should be submitted as one complete package through a single point of contact for the project.

Applicability: Refer to PRG E2-23 Electrical Plans – Small Passenger Vessels for vessels inspected under Subchapter T. This document applies to all other inspected vessels.

General Guidance:

General Requirements:

- Each self-propelled vessel must have both main and auxiliary steering gear, unless it otherwise complies with the requirements of 46 CFR 58.25.

- As per 46 CFR 58.25-10(e), an auxiliary steering gear is not required on a vessel with two or more identical power units if the main steering gear can manipulate the rudder as described by 46 CFR 58.25-10(b)(2) while:
  a) any one of the power units is not operating on a passenger vessel, or
  b) all power units are operating on a cargo vessel.

- Non-electrical auxiliary steering arrangements may be acceptable as per 46 CFR 58.25-10(b)(3) & (c)(3).

- Self-propelled tank vessels must meet the requirements of 46 CFR 58.25-85.

Steering Motors:

- As per 46 CFR 58.25-5(f), steering gear must be separate and independent of all shipboard systems except their switchboards, autopilot and similar navigational equipment, and propulsion machinery for integrated steering/propulsion systems.

- Each electric-driven steering-gear power unit must have at least two feeder circuits meeting the requirements of 46 CFR 58.25-65(a). If there are multiple electric-driven power units, each must be supplied by a separate feeder, as per 58.25-65(b). Connecting multiple feeder circuits via an ABT or MBT is not allowed, as it constitutes a single point of failure.

- As per 46 CFR 58.25-30 and 111.70-3(b), each steering-gear motor controller must have low-voltage release (LVR).

- As per 46 CFR 58.25-55(a)-(c), the following regulations apply to steering-gear feeder circuits:
  a) Circuit breakers must provide instantaneous trip protection set at:
     1. Between 300% and 375% of the rated full-load current (DC).
     2. Between 175% and 200% of the locked-rotor current (AC).
  b) Additional steering-gear feeder overcurrent protection is not allowed.
  c) Overload protective devices are not allowed. Motors must have a device that activates audible and visual alarms in the machinery control location if a motor overload condition exists that could cause motor overheating.

- As per 46 CFR 58.25-65(c)&(d), feeder circuits must have disconnect switches in the steering-gear compartment and must have a current-carrying capacity of:

a) 125% of the rated steering motor or power unit full-load current, and
b) 100% of the normal current of one steering-gear control system including all associated motors.

Alarms:

- The following audible and visual alarms must be present:
  a) In the pilothouse, as per 46 CFR 58.25-25(d):
     1. Power failure to any control system.
     2. Power failure to any power unit.
     3. Low-level in a powered steering-gear hydraulic fluid reservoir.
  b) In the machinery space, as per 46 CFR 58.25-25(e):
     1. Power failure of any phase in a three-phase power supply.
     2. Overload of a main or auxiliary steering-gear motor or a motor for a steering-gear control system.
     3. Low-level in a powered steering-gear hydraulic fluid reservoir.

- As per 46 CFR 58.25-25(f), a "motor running" indicator light must activate in the pilothouse and machinery space when a main or auxiliary steering-gear power motor is energized.

- As per 46 CFR 113.43, a steering failure alarm must be installed in the pilothouse of vessels over 1600GT.
  a) The alarm system must be separate from, and independent of, each steering-gear control system, except for input received from the steering wheel shaft.
  b) The power supply must be independent and fed from the final emergency power source through the wheelhouse emergency distribution panel, if installed.
  c) Only instantaneous overcurrent protection is permitted and must be set between 400% and 500% of:
     1. the current-carrying capacity of the smallest conductor, or
     2. the normal system load.
  d) The requirements for when this alarm actuates are located in 46 CFR 113.43-3(a).

Control System:

- Each power-driven steering-gear system must be provided with at least one control system, as per 46 CFR 58.25-70(a).

- As per 46 CFR 58.25-70, two separate and independent control systems must be provided in the pilothouse, but the steering wheel/lever does not need to be duplicated.
  a) Supplementary steering-gear control not giving full followup may also be provided from the pilothouse.
  b) When the auxiliary steering gear is not power-driven, both control systems for the main steering gear must be full followup.
  c) When the auxiliary steering gear is power-driven, each steering gear must have a control system.

- As per 46 CFR 58.25-70(d), the control system must receive power either
  a) from the steering gear power unit feeder circuit in the steering gear compartment, or
  b) directly from the switchboard busbars adjacent to the power units.

- As per 46 CFR 58.25-70(e), each steering-gear control system must have a switch in the steering-gear compartment that disconnects the system from its power source and from the steering system that it serves. This can be the same switch that disconnects the feeder circuit required by 58.25-65(c).

- Vessels of 500GT or above must have steering gear controls in the steering gear compartment which must not be rendered inoperable by failure of the controls in the pilothouse.

- As per 46 CFR 58.25-80, steering-gear control systems must be arranged to allow immediate resumption of manual operation in the pilothouse when the vessel is fitted with automatic pilots and ancillary steering gear. A switch must be provided, at the primary steering position, to completely disconnect the automatic equipment from the control system.

- As per 46 CFR 58.25-70(c), each steering-gear control system must be provided with a switch in the pilothouse that:
  a) provides power to the complete system and its associated power units through a single operation,
  b) is operated by one lever,
  c) is arranged such that only one control system and power unit can be energized from the pilothouse at one time,
  d) is arranged such that the lever passes through “OFF” during transfer of control from one system to another, and
  e) is in a separate enclosure or is separated by a fire-resistant barrier from the other switches.

- Steering control systems may only have instantaneous short-circuit protection rated between 400% and 500% of the conductor current-carrying capacity or normal system load, as per 46 CFR 58.25-55(d).

- The short-circuit protective device for each steering-gear control system must be located in the steering-gear compartment and in the control circuit immediately following the system disconnect switch, as per 46 CFR 58.25-55(e).

- Each rudder-angle indicator (RAI) must be independent (in terms of power and signal) of all other systems, and be powered from an emergency power source. Refer to 46 CFR 58.25-25(b).

- 46 CFR 113.40-5 requires that, if power-operated, the rudder position must be displayed at the principal steering station. If there is non-followup steering control at the alternative steering station, a separate RAI system must show the rudder position.

- As per 46 CFR 58.25-50(a), electrically-powered steering gear must be provided with limit switches to interrupt control system output to the steering gear before the rudder reaches its mechanical stops.
