U.S. Department of Homeland Security

United States Coast Guard

Marine Safety Center Technical Note

MTN 01-09
16703/Hydraulic Helm
February 17, 2009

Subj: HYDRAULIC HELM STEERING SYSTEMS FOR SUBCHAPTER K VESSELS

Ref: (a) Title 46 CFR Subpart 58.25 – Steering Gear
(b) Title 46 CFR Subpart 114.540 – Equivalents

1. Purpose: This Marine Technical Note (MTN) provides guidance for industry design and Marine Safety Center (MSC) review of hydraulic helm steering systems submitted for Coast Guard approval. Steering systems designed in compliance with reference (a), as modified by the design alternatives outlined in this MTN, will be considered as providing a level of safety equivalent to that intended by regulation. Other alternatives may be proposed, and will be considered on a case by case basis per reference (b).

2. Background:

a. Prior to 1996, all passenger vessels of less than 100 gross tons were regulated under 46 CFR Subchapter T. In 1996, 46 CFR Subchapter K was published to establish standards for certain vessels which, because of their greater size, passenger capacity and resulting complexity, were beyond the traditional description of a small passenger vessel. Subchapter K provides a middle ground between traditional small passenger vessels regulated under Subchapter T and large passenger vessels regulated under Subchapter H.

b. Subchapter T allows for the installation of a common steering system utilizing a hydraulic helm as defined in paragraph (3)(a) of this MTN. Under Subchapter K, steering systems are required to comply with the main and auxiliary steering requirements of Subchapter F detailed in reference (a). Although hydraulic helm system designs do not fully comply with the requirements of Subchapter F, designers have proposed continued use of hydraulic helm systems aboard Subchapter K vessels.

c. The intent of this MTN is to offer a means for designers to demonstrate an equivalency to reference (a) by identifying specific criteria for the installation of hydraulic helm systems which will ensure a degree of reliability, independence, and redundancy appropriate for passenger vessels certificated under Subchapter K.

3. Discussion:

a. The steering gear regulations in reference (a) rely on a design approach of redundancy and separation which is provided through the installation of separate main and auxiliary steering systems (or duplicate power unit steering gear). This helps ensure that steering

can be "speedily regained" in the event of a main steering gear casualty. A typical hydraulic helm system using one or more steering stations often cannot meet all the requirements of reference (a) since the inherent nature of its design prevents it from providing features such as:

(1) full follow-up control prescribed by 46 CFR 58.25-70(b);
(2) two independent pilothouse control systems;
(3) adequate isolation features to allow restoration of steering after a single point failure; and/or
(4) means to stop the steering gear prior to reaching the rudder stops.

b. Hydraulic helm systems are recognized as being well-suited for use on small vessels due to such features as the ability to operate the helm manually when power to steering pumps is lost; superior reliability of low-pressure hydraulic systems; their excellent service record; and proven simplicity, maintainability and ease of repair. For small passenger vessels, an appropriate level of safety can be achieved by incorporating additional safety measures in system design; however, the shortcomings mentioned above present a greater risk on vessels of larger capacity, which are not offset by the advantages hydraulic helms afford. Therefore, on Subchapter K vessels within certain thresholds, systems which incorporate the design criteria of enclosure (1), along with applicable provisions of reference (a), will be considered to provide a level of safety equivalent to that intended by the regulations.

4. Applicability: This MTN applies to the MSC review of hydraulic helm steering systems for all U.S. flagged vessels subject to the requirements of Subchapter K carrying not more than 600 passengers or having overnight accommodations for not more that 49 passengers. This MTN does not apply to high speed craft. Designers requesting an equivalence under reference (b) to comply with the International Code of Safety for High Speed Craft (HSC Code) are referred to Navigation and Vessel Inspection Circulars (NVIC) 6-99, *Plan Review, Inspection, And Certification Guidance For Vessels Built To The International Code Of Safety For High-Speed Craft And Additional Information Regarding Non-Code High-Speed Vessels*. This NVIC is available on the National Maritime Center website at: http://www.uscg.mil/hq/g-m/nvic/.

5. Definitions:

a. **Follow Up (FU)**: A closed-loop feedback control that relates the position of the helm to a specific rudder angle by transmitting the helm angle order to the power actuating system and, by means of feedback, automatically stopping the rudder when the angle selected by the helm is reached.

b. **Non Follow Up (NFU)**: Steering system control that provides only directional control of the rudder. With this control, the operator must stop the rudder by cancelling the signal

when the desired rudder position is indicated by the rudder angle indicator at the steering station.

c. **Hydraulic Helm Steering Systems**: A hydraulic helm steering system is a purely hydraulically actuated and controlled steering system. In its simplest form, the system consists of a manually powered helm pump connected to hydraulic cylinders. Rotation of the helm pump delivers oil flow directly to the steering cylinders; fluid displaced from the opposite side of the cylinder is directed back to the hydraulic helm pump. System designs vary widely and may include multiple helm stations, multiple cylinders, and power pump units.

6. Action: Hydraulic helm steering system plans and calculations submitted to the MSC for approval for use aboard Subchapter K vessels meeting the applicability of paragraph (4) will be reviewed for compliance with the applicable regulations in reference (a), this MTN, and any specific requirements established by the OCMI or MSC. The plans must provide sufficient detail to permit a thorough review of the steering system. All requirements of reference (a) apply if not specifically addressed by this MTN.

P. E. LITTLE

Encl: (1) Hydraulic Helm Steering System Acceptance Criteria for Small Passenger Vessels Certificated under Subchapter K, Carrying Not More Than 600 Passengers or Having Overnight Accommodations for Not More Than 49 Overnight Passengers

Copy: Commandant (CG-521), Office of Design and Engineering Standards
Commandant (CG-543), Office of Vessel Activities
Commandant (CG-546), Office of Quality Assurance and Traveling Inspections

Enclosure (1) to MTN 01-09: Hydraulic Helm Steering System Acceptance Criteria for Small Passenger Vessels Certificated Under Subchapter K, Carrying Not More Than 600 Passengers or Having Overnight Accommodations for Not More Than 49 Overnight Passengers

Design Issue	Design Criteria
Power Units	Power driven steering pumps must be provided if necessary to meet the provisions of 46 CFR 58.25-10. Pumps, whether powered or hydraulic helm, must be of sufficient capacity to meet the performance requirements appropriate to the system design, either main steering with duplicate pumps or main steering plus auxiliary steering, and must be arranged so that each pump may be isolated from the system.
Two Sources of Hydraulic Fluid	Each steering system must have a dedicated source of hydraulic fluid. In systems employing common power piping only one sump or reservoir need be provided. A replacement supply of hydraulic fluid sufficient to recharge the system must be carried on the vessel. Split sumps, each side having the capacity to charge the system and provided with independent suction and return valves and piping, are acceptable as primary and replacement fluid supply. Cascading sumps are not acceptable. In vessels on Oceans, Great Lakes and Coastwise routes, the second supply of fluid must comply with 46 CFR 58.25-20.
Follow Up Control	Follow-up control of steering need not be provided for small passenger vessels certificated under Subchapter K employing hydraulic helm steering control and carrying not more than 600 passengers.
Dual Hydraulic Cylinders	Dual hydraulic cylinders must be provided and arranged so that a failed cylinder may be isolated and disconnected to allow steering to be restored with the remaining cylinder. Alternatively, a single rotary actuator complying with 58.25-60 may be provided.
Routing of Piping	All piping must be routed as far inboard as practicable such that the piping would not be adversely affected by the side damage described in 46 CFR Table 171.080(a). Piping must be routed as high as practicable, but in no case, must the piping be routed less than 0.5 meters (or beam/50, whichever is less) from all bottom plating and structural plating members. Where a steering control system is electrical, these criteria apply to the routing of cable runs. Where a steering station is located outside the given parameters, such as on a bridge wing, the control piping must be routed inboard until within the parameters and then down and aft to the steering gear. In a given vessel design, other issues must be considered such as routing away from hot surfaces, engine exhaust manifolds, and major pieces of electrical equipment or routing to prevent piping being used as a step.
Single Piping	Single runs of piping/tubing are acceptable; a design/safety factor of 6 to 1 is required. The steering hydraulic system must be dedicated to steering service.
Maximum Force at Wheel	In order to permit manual steering by an individual, the maximum force required to operate the steering system must not exceed 160N (36 lbf). This capability must be demonstrated to the satisfaction of the OCMI.

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Design Issue	Design Criteria
Steering System Independence	The steering system must be separate and independent of all other shipboard systems as required by 46 CFR 58.25-5(f) except that steering pumps may be driven by propulsion engines or generator prime movers. Where steering pumps are driven by a generator prime mover, the steering pump must be considered a generator load with a demand factor of 1.0 for purposes of load analysis.
Dedicated Hydraulic System	The steering hydraulic system must be dedicated to steering service.
Dedicated Electrical System	From the point of connection to the circuit breaker on the main (or emergency) switchboard, supporting electrical systems must be dedicated to steering service.
Manual Steering Capability (loss of power pumps)	A power steering system must include a manual steering capability which is immediately available in the event the vessel loses all power driven steering pumps. Where a main steering gear with duplicate power units is not provided (i.e., where an auxiliary steering gear is required), this manual steering capability is acceptable as auxiliary steering only if two helm units at separate locations are provided.
Two Control Units	Two separate and independent steering control systems must be provided. For a manual system (i.e., no power pumps), two helm pumps are required. Examples of acceptable control arrangements are (1) two helm pumps, or (2) one helm pump and one jog lever operating a solenoid directional control valve. Where the second control station is not in the pilothouse, the communications requirements of 46 CFR 121.602(b) must be complied with.
Limit Switches	For manually controlled systems, the operator may be considered a means of stopping the steering gear prior to reaching the rudder stops. For electrically controlled systems, including those controlled by a jog-lever, autopilot, dynamic positioning, or other electrical input, limit switches are required.
Rudder Angle Indicators	Rudder angle indication must be provided in the pilot house, at the steering gear, and at each alternative steering station. Each rudder angle indicator need not have its own transmitter.