Hydraulic Locking Means for Steering Control Systems

Amended Rules and Guidance

Rules for the Survey and Construction of Steel Ships Part D
Rules for the Survey and Construction of Inland Waterway Ships
Guidance for the Survey and Construction of Inland Waterway Ships

Reason for Amendment

IACS Unified Requirement (UR) E25(Rev.1) specifies requirements related to failure detection and response for steering control systems and such requirements have already been incorporated into the NK Rules.

UR E25 stipulates that steering gear shall be capable of stopping rudders in their “current position without manual intervention” in the event of a failure that causes the steering gear to become uncontrollable. In the case of electrical failure (e.g. a data communication error), it is possible to maintain rudder angle without manual intervention using electrical signals since the problem is not a mechanical failure. Hydraulic locking, on the other hand, is a mechanical failure caused by sticking of the solenoid valve, and it was pointed out by IACS members that it is quite difficult to maintain rudder angle without manual operation in such cases. IACS decided to discuss the treatment of hydraulic locking in UR E25 and also review UR M42 since it outlines design requirements for steering gear. As a result, IACS adopted UR E25(Rev.2) and UR M42(Rev.6) in March 2022 to delete requirements related to the treatment of hydraulic locking from UR E25 and revise the provision for manual operation in accordance with the instructions for the stopping of hydraulic system pumps specified in UR M42.

Accordingly, relevant requirements are amended based upon UR E25(Rev.2) and UR M42(Rev. 6).

Outline of Amendment

The main contents of this amendment are as follows:

(1) Specifies the definition for “hydraulic locking”.
(2) Adds measures related to the hydraulic locking of steering gear.

"Rules for the survey and construction of steel ships" has been partly amended as follows:

Part D MACHINERY INSTALLATIONS

Chapter 15 STEERING GEARS

15.1 General

Paragraph 15.1.2 has been amended as follows.

15.1.2 Terminology

The terms used in this chapter are defined as follows:

((1) to (5) are omitted.)

(6) A "control system" is defined as the equipment by which orders are transmitted from the navigating bridge to the power units. Steering gear control systems comprise transmitters, receivers, hydraulic control pumps and their associated motors, motor controllers, piping and cables. Steering gear control systems are also understood to cover "equipment required to control steering gear power actuating systems".

(7) "Maximum working pressure" means the maximum expected pressure in the system when the steering gear is operated under the conditions specified in **15.2.2(1)**.

(8) "Hydraulic locking" means all situations where two hydraulic systems (usually identical) oppose each other in such a way that may lead to loss of steering. Such a loss of steering can either be caused by pressure in the two hydraulic systems working against each other or by hydraulic "by-pass" (i.e. the systems puncture each other and cause pressure drop on both sides or make it impossible to build up pressure).

15.3 Controls

Paragraph 15.3.1 has been amended as follows.

15.3.1 General*

(-1 and -2 are omitted.)

3 For the control systems specified in the requirements of **1(2)** above, at least the following most probable failures that may cause reduced or erroneous system performance are to be automatically detected and individual visible and audible alarms are to be given on the navigation bridge:

(1) Power supply failure

(2) Earth fault on AC and DC circuits

(3) Loop failure in closed loop systems, both command and feedback loops (normally short circuit, broken connections and earth faults)

(4) Data communication errors

(5) Programmable system failures (Hardware and software failures)

~~(6) Hydraulic locking~~

(~~7~~6) In the case of closed loop systems, deviation between rudder order and feedback

Individual visible and audible deviation alarms are to be initiated on the navigation bridge when the rudder's actual position does not reach its set point within acceptable time limits (e.g. follow-up control and autopilot). The deviation alarm may be caused by mechanical,

hydraulic or electrical failures.

4 For the control systems specified in the requirements of **1(2)** above, the failures (as defined but not limited to those in **-3** above) likely to cause uncontrolled movement of the rudder are to be clearly identified. In the event of such a failure, the following response is to be implemented:

(1) the rudder is to stop in the angle when failure occurs without manual intervention, or

(2) the rudder is to return to the midship/neutral position.

For mechanical failures such as sticking valves and failure of static components (pipes, cylinders), system response without manual intervention is not mandatory, and operators may instead follow instructions permanently displayed in accordance with **15.1.4-2** in the case of such failures.

(-5 and -6 are omitted.)

“Rules for the survey and construction of inland waterway ships” has been partly amended as follows:

Part 7 MACHINERY INSTALLATIONS

Chapter 12 STEERING GEARS

12.1 Controls

Paragraph 12.1.2 has been amended as follows.

12.1.2 Terminology

The terms used in this chapter are defined as follows:

((1) to (5) are omitted.)

(6) A “control system” is defined as the equipment by which orders are transmitted from the navigating bridge to the power units. Steering gear control systems comprise transmitters, receivers, hydraulic control pumps and their associated motors, motor controllers, piping and cables. Steering gear control systems are also understood to cover “equipment required to control steering gear power actuating systems”.

(7) “Maximum working pressure” means the maximum expected pressure in the system when the steering gear is operated under the conditions specified in **12.2.2(1)**.

(8) “Hydraulic locking” means all situations where two hydraulic systems (usually identical) oppose each other in such a way that may lead to loss of steering. Such a loss of steering can either be caused by pressure in the two hydraulic systems working against each other or by hydraulic “by-pass” (i.e. the systems puncture each other and cause pressure drop on both sides or make it impossible to build up pressure).

Title of Paragraph 12.1.4 has been amended as follows.

12.1.4 Display of Operating Instructions, etc.**

12.3 Controls

Paragraph 12.3.1 has been amended as follows.

12.3.1 General*

(-1 and -2 are omitted.)

3 For the control systems specified in the requirements of **1(2)** above, at least the following most probable failures that may cause reduced or erroneous system performance are to be automatically detected and individual visible and audible alarms are to be given on the navigation bridge:

(1) Power supply failure
(2) Earth fault on AC and DC circuits
(3) Loop failure in closed loop systems, both command and feedback loops (normally short circuit, broken connections and earth faults)
(4) Data communication errors
(5) Programmable system failures (Hardware and software failures)

~~(6) Hydraulic locking~~

(~~7~~6) In the case of closed loop systems, deviation between rudder order and feedback

Individual visible and audible deviation alarms are to be initiated on the navigation bridge when the rudder's actual position does not reach its set point within acceptable time limits (e.g. follow-up control and autopilot). The deviation alarm may be caused by mechanical, hydraulic or electrical failures.

4 For the control systems specified in the requirements of **1(2)** above, the failures (as defined but not limited to those in **-3** above) likely to cause uncontrolled movement of the rudder are to be clearly identified. In the event of that failure, following response is to be implemented:

(1) the rudder is to stop in the angle when failure occurs without manual intervention, or

(2) the rudder is to return to the midship/neutral position.

For mechanical failures such as sticking valves and failure of static components (pipes, cylinders), system response without manual intervention is not mandatory, and operators may instead follow instructions permanently displayed in accordance with **12.1.4-2** in the case of such failures.

(-5 is omitted.)

“Guidance for the survey and construction of inland waterway ships” has been partly amended as follows:

Part 7 MACHINERY INSTALLATIONS

Chapter 12 STEERING GEARS

12.1 General

Paragraph 12.1.4 has been added as follows.

12.1.4 Display of Operating Instructions, etc.

The “appropriate instructions for emergency procedures” specified in **12.1.4-2, Part 7 of the Rules** are to simply indicate those emergency procedures corresponding to the design of steering gear (for example, procedures for shutting down failed systems indicated by alarm systems) and are to be provided at suitable places at steering control posts on navigation bridges.