SC 246 Steering gear test with the vessel not at the deepest seagoing draught

(June 2011) (Corr.1 Dec 2011) (Rev.1 Sept 2015)

Regulations

1. SOLAS II-1/29.3:

The main steering gear and rudder stock shall be:

.1 of adequate strength and capable of steering the ship at maximum ahead service speed which shall be demonstrated;

.2 capable of putting the rudder over from 35° on one side to 35° on the other side with the ship at its deepest seagoing draught and running ahead at maximum ahead service speed and, under the same conditions, from 35° on either side to 30° on the other side in not more than 28 s;

where it is impractical to demonstrate compliance with this requirement during sea trials with the ship at its deepest seagoing draught and running ahead at the speed corresponding to the number of maximum continuous revolutions of the main engine and maximum design pitch, ships regardless of date of construction may demonstrate compliance with this requirement by one of the following methods:

.1 during sea trials the ship is at even keel and the rudder fully submerged whilst running ahead at the speed corresponding to the number of maximum continuous revolutions of the main engine and maximum design pitch; or

.2 where full rudder immersion during sea trials cannot be achieved, an appropriate ahead speed shall be calculated using the submerged rudder blade area in the proposed sea trial loading condition. The calculated ahead speed shall result in a force and torque applied to the main steering gear which is at least as great as if it was being tested with the ship at its deepest seagoing draught and running ahead at the speed corresponding to the number of maximum continuous revolutions of the main engine and maximum design pitch; or

.3 the rudder force and torque at the sea trial loading condition have been reliably predicted and extrapolated to the full load condition. The speed of the ship shall correspond to the number of maximum continuous revolutions of the main engine and maximum design pitch of the propeller;

Note:

1. This UI is to be uniformly implemented by IACS Societies on ships contracted for construction ~~(as defined in IACS PR29)~~ on or after 1 July 2012.

2. Rev.1 of UI SC246 is to be uniformly implemented by IACS Societies on ships contracted for construction on or after 1 January 2017.

~~2~~3. The “contracted for construction” date means the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. For further details regarding the date of “contract for construction”, refer to IACS Procedural Requirement (PR) No. 29.

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.3 operated by power where necessary to meet the requirements of paragraph 3.2 and in any case when the Administration requires a rudder stock of over 120 mm diameter in way of the tiller, excluding strengthening for navigation in ice; and

.4 so designed that they will not be damaged at maximum astern speed; however, this design requirement need not be proved by trials at maximum astern speed and maximum rudder angle.

2. SOLAS II-1/29.4:

The auxiliary steering gear shall be:

.1 of adequate strength and capable of steering the ship at navigable speed and of being brought speedily into action in an emergency;

.2 capable of putting the rudder over from 15° on one side to 15° on the other side in not more than 60 s with the ship at its deepest seagoing draught and running ahead at one half of the maximum ahead service speed or 7 knots, whichever is the greater; ~~and~~

where it is impractical to demonstrate compliance with this requirement during sea trials with the ship at its deepest seagoing draught and running ahead at one half of the speed corresponding to the number of maximum continuous revolutions of the main engine and maximum design pitch or 7 knots, whichever is greater, ships regardless of date of construction, including those constructed before 1 January 2009, may demonstrate compliance with this requirement by one of the following methods:

.1 during sea trials the ship is at even keel and the rudder fully submerged whilst running ahead at one half of the speed corresponding to the number of maximum continuous revolutions of the main engine and maximum design pitch or 7 knots, whichever is greater; or

.2 where full rudder immersion during sea trials cannot be achieved, an appropriate ahead speed shall be calculated using the submerged rudder blade area in the proposed sea trial loading condition. The calculated ahead speed shall result in a force and torque applied to the auxiliary steering gear which is at least as great as if it was being tested with the ship at its deepest seagoing draught and running ahead at one half of the speed corresponding to the number of maximum continuous revolutions of the main engine and maximum design pitch or 7 knots, whichever is greater; or

.3 the rudder force and torque at the sea trial loading condition have been reliably predicted and extrapolated to the full load condition; and

.3 operated by power where necessary to meet the requirements of paragraph 4.2 and in any case when the Administration requires a rudder stock of over 230 mm diameter in way of the tiller, excluding strengthening for navigation in ice.

Interpretation

In order for ships to comply with the performance requirements stated in regulations 29.3.2 and 29.4.2 they are to have steering gear capable of meeting these performance requirements when at their deepest seagoing draught.

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In order to demonstrate this ability, the trials may be conducted in accordance with Section 6.1.5.1 of ISO 19019:2005 Sea-going vessels and marine technology – Instructions for planning, carrying out and reporting sea trials.

On all occasions when trials are conducted with the vessel not at the deepest seagoing draught the loading condition can be accepted on the conditions that either:

1. the rudder is fully submerged (at zero speed waterline) and the vessel is in an acceptable trim condition~~,~~.

2. ~~or~~ the rudder ~~load and~~ torque at the trial loading condition have been reliably predicted (based on the system pressure measurement) and extrapolated to the maximum seagoing draught condition using the following method to predict the equivalent torque and actuator pressure at the deepest seagoing draught: ~~full load condition, to the satisfaction of the Administration or Recognized Organization. In any case for the main steering gear trial, the speed of the ship corresponding to the number of maximum continuous revolution of main engine and maximum design pitch applies.~~

$$Q_F = Q_T \alpha$$

$$\alpha = 1.25\left(\frac{A_F}{A_T}\right)\left(\frac{V_F}{V_T}\right)^2$$

Where:

α is the Extrapolation factor.

Q_F is the rudder stock moment for the deepest service draught and maximum service speed condition.

Q_T is the rudder stock moment for the trial condition.

A_F is the total immersed projected area of the movable part of the rudder in the deepest seagoing condition.

A_T is the total immersed projected area of the movable part of the rudder in the trial condition.

V_F is the contractual design speed of the vessel corresponding to the maximum continuous revolutions of the main engine at the deepest seagoing draught.

V_T is the measured speed of the vessel (considering current) in the trial condition.

Where the rudder actuator system pressure is shown to have a linear relationship to the rudder stock torque the above equation can be taken as:

$$P_F = P_T \alpha$$

Where:

P_F is the estimated steering actuator hydraulic pressure in the deepest seagoing draught condition.

P_T is the maximum measured actuator hydraulic pressure in the trial condition.

Where constant volume fixed displacement pumps are utilised then the regulations can be deemed satisfied if the estimated steering actuator hydraulic pressure at the deepest draught is less than the specified maximum working pressure of the rudder actuator. Where a variable delivery pump is utilised pump data should be supplied and interpreted to estimate the delivered flow rate

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corresponds to the deepest seagoing draught in order to calculate the steering time and allow it to be compared to the required time.

Where A_T is greater than $0.95A_F$ there is no need for extrapolation methods to be applied.

3. Alternatively the designer or builder may use computational fluid dynamic (CFD) studies or experimental investigations to predict the rudder stock moment at the full sea going draught condition and service speed. These calculations or experimental investigations are to be to the satisfaction of the Society.

In any case for the main steering gear trial, the speed of the ship corresponding to the number of maximum continuous revolution of main engine and maximum design pitch applies.

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