

**RESOLUTION A.467(XII)**

*Adopted on 19 November 1981  
Agenda item 10(b)*

**GUIDELINES FOR ACCEPTANCE OF NON-DUPLICATED RUDDER  
ACTUATORS FOR TANKERS, CHEMICAL TANKERS AND GAS  
CARRIERS OF 10,000 TONS GROSS TONNAGE AND ABOVE  
BUT LESS THAN 100,000 TONNES DEADWEIGHT**

THE ASSEMBLY,

RECALLING Article 16(i) of the Convention on the Inter-Governmental Maritime Consultative Organization,

NOTING that the expanded Maritime Safety Committee at its forty-fifth session adopted the 1981 amendments to the International Convention for the Safety of Life at Sea, 1974, which include improved steering gear standards for passenger and cargo ships, incorporating the relevant requirements of resolution A.325(IX) and the 1978 Protocol relating to the above Convention,

NOTING ALSO that these amendments to steering gear requirements contain, specifically in relation to tankers, chemical tankers and gas carriers of certain sizes, a reference to guidelines for acceptance of non-duplicated rudder actuators,

HAVING CONSIDERED the recommendation made by the Maritime Safety Committee at its forty-fourth session,

1. ADOPTS the Guidelines for Acceptance of Non-Duplicated Rudder Actuators for Tankers, Chemical Tankers and Gas Carriers of 10,000 Tons Gross Tonnage and Above but Less Than 100,000 Tonnes Deadweight, which are annexed to this resolution;
2. INVITES all Governments concerned to apply these Guidelines when considering equivalent safety standards to Regulation II-1/29.16 as required by Regulation II-1/29.17.2 of the 1981 amendments to the 1974 SOLAS Convention.

ANNEX

**GUIDELINES FOR ACCEPTANCE OF NON-DUPLICATED RUDDER ACTUATORS FOR  
TANKERS, CHEMICAL TANKERS AND GAS CARRIERS OF 10,000 TONS GROSS  
TONNAGE AND ABOVE BUT LESS THAN 100,000 TONNES DEADWEIGHT**

(References are related to Regulations II-1/29.2.3 and 29.3.2 of  
the 1981 amendments to the 1974 SOLAS Convention)

**1 MATERIALS**

Parts subject to internal hydraulic pressure or transmitting mechanical forces to the rudder stock should be made of duly tested ductile materials complying with recognized standards. Materials for pressure retaining components should be in accordance with recognized pressure vessel standards. These materials should not have an elongation of less than 12 per cent nor a tensile strength in excess of 650 N/mm<sup>2</sup>.

## 2 DESIGN

### Design pressure

2.1 The design pressure should be assumed to be at least equal to the greater of the following:

- .1 1.25 times the maximum working pressure to be expected under the operating conditions required in Regulation 29.3.2;
- .2 the relief valves setting.

### Analysis

2.2.1 The manufacturers of rudder actuators should submit detailed calculations showing the suitability of the design for the intended service.

2.2.2 A detailed stress analysis of the pressure retaining parts of the actuator should be carried out to determine the stresses at the design pressure.

2.2.3 Where considered necessary because of the design complexity or manufacturing procedures, a fatigue analysis and fracture mechanics analysis may be required. In connexion with these analyses, all foreseen dynamic loads should be taken into account. Experimental stress analysis may be required in addition to, or in lieu of, theoretical calculations depending on the complexity of the design.

### Allowable stresses

2.3 For the purpose of determining the general scantlings of parts of rudder actuators subject to internal hydraulic pressure the allowable stresses should not exceed:

$$\begin{aligned}\sigma_m &\leq f \\ \sigma_\rho &\leq 1.5f \\ \sigma_b &\leq 1.5f \\ \sigma_\rho + \sigma_b &\leq 1.5f \\ \sigma_m + \sigma_b &\leq 1.5f\end{aligned}$$

where

$\sigma_m$  = equivalent primary general membrane stress

$\sigma_\rho$  = equivalent primary local membrane stress

$\sigma_b$  = equivalent primary bending stress

f = the lesser of  $\frac{\sigma_B}{A}$  or  $\frac{\sigma_y}{B}$

$\sigma_B$  = specified minimum tensile strength of material at ambient temperature

$\sigma_y$  = specified minimum yield stress or 0.2 per cent proof stress of material at ambient temperature

A and B are as follows

|   | Steel | Cast steel | Nodular cast iron |
|---|-------|------------|-------------------|
| A | 4     | 4.6        | 5.8               |
| B | 2     | 2.3        | 3.5               |

**Burst test**

2.4.1 Pressure retaining parts not requiring fatigue analysis and fracture mechanics analysis may be accepted on the basis of a certified burst test at the discretion of the Administration and the detailed stress analysis required by 2.2.2 need not be provided.

2.4.2 The minimum bursting pressure should be calculated as follows:

$$P_b = P \cdot A \frac{\sigma_{Ba}}{\sigma_B}$$

where

$P_b$  = minimum bursting pressure

$P$  = design pressure as defined in 2.1

$A$  = as from table in 2.3

$\sigma_{Ba}$  = actual tensile strength

$\sigma_B$  = tensile strength as defined in 2.3

**3 CONSTRUCTION DETAILS****General**

3.1 The construction should be such as to minimize local concentrations of stress.

**Welds**

3.2.1 The welding details and welding procedures should be approved.

3.2.2 All welded joints within the pressure boundary of a rudder actuator or connecting parts transmitting mechanical loads should be full penetration type or of equivalent strength.

**Oil seals**

3.3.1 Oil seals between non-moving parts, forming part of the external pressure boundary, should be of the metal upon metal type or of an equivalent type.

3.3.2 Oil seals between moving parts, forming part of the external pressure boundary, should be duplicated, so that the failure of one seal does not render the actuator inoperative. Alternative arrangements providing equivalent protection against leakage may be accepted at the discretion of the Administration.

**Isolating valves**

3.4 Isolating valves should be fitted at the connexion of pipes to the actuator, and should be directly mounted on the actuator.

**Relief valves**

3.5 Relief valves for protecting the rudder actuator against over-pressure as required in Regulation 29.2.3 should comply with the following:

- .1 The setting pressure should not be less than 1.25 times the maximum working pressure expected under operating conditions required in Regulation 29.3.2.

- .2 The minimum discharge capacity of the relief valves should not be less than the total capacity of all pumps which provide power for the actuator, increased by 10 per cent. Under such conditions the rise in pressure should not exceed 10 per cent of the setting pressure. In this regard, due consideration should be given to extreme foreseen ambient conditions in respect of oil viscosity.

#### 4 NON-DESTRUCTIVE TESTING

The rudder actuator should be subjected to suitable and complete non-destructive testing to detect both surface flaws and volumetric flaws. The procedure and acceptance criteria for non-destructive testing should be in accordance with requirements of recognized standards. If found necessary, fracture mechanics analysis may be used for determining maximum allowable flaw size.

#### 5 TESTING

5.1 Tests, including hydrostatic tests, of all pressure parts at 1.5 times the design pressure should be carried out.

5.2 When installed on board the ship, the rudder actuator should be subjected to a hydrostatic test and a running test.