SECTION 6 STANDING RIGGING CHAINPLATES

1 General

1.1 Application

1.1.1 The present Section defines structural requirements for the scantling of chainplates or all other element connecting standing rigging, their structural connection to the hull's substructure and local hull reinforcement.

2 Chainplates and local hull structure

2.1 Design Loads

2.1.1 General

Loads induced by the standing rigging (stays, backstays and vertical/lower shrouds) are to be submitted by the designer or the Yard.

These loads can be:

a) The design loads defined for the various sailing conditions taking into account the different sail configuration for all wind heading from head wind to down wind and sail reductions

a) When the design load defined in a) are not submitted, the load taken into consideration are the breaking load of stays and shrouds.

2.1.2 Loads on chainplates

As a general rule, the loads F_S to take into account for the chain plate scantling, in N, is:

$$F_S = F_D \cdot C_i$$

where:

F_D : Design load, in N, defined in [2.1.1] a)

C_i : Safety coefficient taken equal to 3

When the design load defined in [2.1.1]a) is not submitted, the value of F_S, in N, is to be taken equal to:

$$F_S = F_D \cdot C_I$$

where:

F_D : Breaking load, in N, defined in [2.1.1] b)

C_I : Safety coefficient taken equal to 1,2

In case of several shrouds or stays connected to the same chainplate, the applied load will be equal to the sum of F_S of the stronger shroud and of 0,8 times the F_S of the others.

2.1.3 Loads to apply on local hull structure

The design load to apply to the local hull structure supporting chainplates is to be taken equal to 1,6 times the load F_S defined in [2.1.2].

2.2 Allowable stresses

2.2.1 The scantling of chainplates or all other element connecting standing rigging, their structural connection to the hull's substructure and local hull reinforcement defined in this section are based on forces defined in [2.1] associated to:

- admissible stresses taken equal to the minimum guaranteed tensile strength of the materials for steel or aluminium structure

Note 1: For aluminium, the effect of welding in the heat affect zone is to be taken into account for the determination of the minimum guaranteed strength.

- for composite materials, safety coefficient applied on the theoretical breaking strength and equal to:

  $$SF = C_V \cdot C_F$$

  where C_V and C_F are defined in Ch 4, Sec 3, [5.4.1].

Note 2: Breaking criteria for layers of composite structures are defined in Ch 12, Sec 3, [5].

2.3 Scantling of chainplates

2.3.1 General

This sub article gives the requirements for scantling of chainplates.

2.3.2 Metallic chainplates

The actual tensile stress $\sigma_{tensile}$, in MPa, in the chainplate is to be less than the allowable stress defined in [2.2.1] and is obtain from the following formula:

$$\sigma_{tensile} = F_S / A_t$$

where:

F_S : Load, in N, defined in [2.1.2]

A_t : Total cross section, in mm^2, solicited in tensile

The actual shear stress τ_{shear}, in MPa, in the chainplate is to be less than the allowable stress defined in [2.2.1] and is obtain from the following formula:

$$\tau_{shear} = F_S / A_S$$

where:

F_S : Load, in N, defined in [2.1.2]

A_S : Total shear section, in mm^2, solicited in shear

The actual diametral pressure $\sigma_{bearing}$, in MPa, in way of the chainplate eye is to be less than the allowable stress defined in [2.2.1] and is obtain from the following formula:

$$\sigma_{bearing} = F_S / (D \cdot th_C)$$

F_S : Load, in N, defined in [2.1.2]

D : Diameter, in mm, of the chainplate eye

th_C : Thickness, in mm, of the chain plate in way of the eye.

2.3.3 Composite chainplates

The review of chainplates made of composite materials is to be performed on a case by case basis.

2.4 Scantling of local hull structures in way of chainplates

2.4.1 Application

The main types of connection between chainplates and their supporting structures considered in this rules are bolted connection, welded connection and bonded connection.

In case of other type of connection, the Society may accept the connection on a case by case basis.

2.4.2 General

Supporting structures are to be designed in such a way that they sustain load defined in [2.1.3] within allowable stresses' level defined in [2.2].

2.4.3 Bolted connection

Material and grade of bolts are to be submitted for information.

Bolts are to be designed to sustain shear forces, induced by load defined in [2.1.3]. The scantling of the bolts is to be carried out taking into account the allowable stresses defined in [2.2].

Where applicable, bolts may be pre-stressed in compliance with appropriate standards. In such a case, the grade of bolts is to be selected accordingly and details of pre-stressing process are to be submitted.

The tightening of bolts is to be suitably checked.

Bolting system is to be so design as to allow taking off for inspection.

Where a backplate is provided, its thickness is to be at least equal to 0,25 times the bolt's diameter

Where there is no backplate, nut is to be fitted with a washer for each bolt.

Dimensions of washers cannot be taken smaller than the following:

- Diameter to be, at least, equal to 4 times the bolt's diameter
- Thickness to be, at least, equal to 0,25 times the bolt's diameter.

For metallic hulls, bolting system is to be protected from galvanic corrosion where materials of nuts and washers are made of different metallic materials.

2.4.4 Welded connections

Where welded connections of metallic chainplates to metallic hulls are used, they are to comply with all requirements relating to weldings, as defined in Part B, Chapter 11.

2.4.5 Bonded connection

The bonded connections are mainly defined by the shear surface of bonding, capable of sustaining the applied loads defined in [2.1.3].

The type of adhesive used depends on the type of materials of the supporting structures and of chainplates. All requirements for surface's preparation and adhesives' use are defined in Ch 12, Sec 2, [5].

The minimum bonding surface S_{min}, in mm^2, is to be not less than:

$$S_{min} = \frac{F}{\tau_{am}}$$

where:

F : Load, in N, defined in [2.1.3]

τ_{am} : Allowable shear stress, in MPa, of the adhesive used

Mechanical properties of adhesive have to be provided by manufacturers.

Where not given, the allowable stress of adhesives, whatever their type, is usually taken equal to 5 MPa.

Mechanical test may be requested by the Society in order to check that the bounded connection as produced by the Yard is, at least, equivalent to the theoretical properties. In this case, the sample tests are to be performed according to Ch 12, Sec 5, [4].