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RULES FOR THE CONSTRUCTION AND CLASSIFICATION OF STEEL SHIPS 2013

Errata No.2

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[Part I] 1.6.2(f)(ii)

(ii) Survey of the hull structure
IACS URZ23 Table 1~~II 2.17 1~~ provides a list of surveyable items for the hull structure and coating and is applicable to this Society including:

[Part II] Table II 1-1

Table II 1-1 Test Requirements for Tanks and Boundaries

Item number	Tank or boundary to be tested	Test type	Test head or pressure	Remarks
1	Double bottom tanks [4]	Leak & Structural [1]	The greater of - top of the overflow, - to 2.4m above top of tank [2], or - to bulkhead deck	
…	…	…	…	…
20	Ballast ducts	Leak & Structural [1]	The greater of - ballast pump maximum pressure, or - setting of any pressure relief valve	

Note :
[1] Structural test is to be carried out for at least one tank of the same construction (i.e., same design and same workmanship) on each vessel provided all subsequent tanks are tested for leaks by an air test. However, where structural adequacy of a tank was verified by structural testing, the subsequent vessels in the series (i.e., sister ships built in the same shipyard) may be exempted from such testing for other tanks which have the structural similarity to the tested tank, provided that the water-tightness in all boundaries of exempted tanks are verified by leak tests and thorough inspection is carried out. In any case, structural testing is to be carried out for at least one tank for each vessel in order to verify structural fabrication adequacy. (See ~~1.4.3~~1.4.4 (b)(ii)(1))
[2] Top of tank is deck forming the top of the tank excluding any hatchways.
[3] Hose Test may also be considered as a medium of the test. See ~~1.4.2~~1.4.3 (b).
[4] Including tanks arranged in accordance with the provisions of SOLAS regulation II-1/9.4.
[5] Including duct keels and dry compartments arranged in accordance with the provisions of SOLAS regulation II-1/9.4.
[6] Where water tightness of watertight door has not been confirmed by prototype test, testing by filling watertight spaces with water is to be carried out. See SOLAS regulation II-1/16.2 and MSC/Circ.1176.
[7] Where a hose test is not practicable, other testing methods listed in ~~1.4.3~~1.4.4 (d)(vii) through ~~1.4.3~~1.4.4 (d)(ix) may be applicable subject to adequacy of such testing methods being verified. See SOLAS regulation II-1/11.1.
[8] As an alternative to the hose testing, other testing methods listed in ~~1.4.3~~1.4.4 (d)(vii) through ~~1.4.3~~1.4.4 (d)(ix) may be applicable subject to the adequacy of such testing methods being verified. See SOLAS regulation II-1/11.1.

[Part II] Table II 1-2

Table II 1-2 Additional Test Requirements for Special Service Ships/Tanks

Item number	Type of Ship/Tank	Structures to be tested	Type of Test	Test Head or Pressure	Remarks
1	Liquefied gas carriers	Cargo containment systems (See remarks)	See ~~1.4.3~~1.4.4 (d)(i)	See ~~1.4.3~~1.4.4 (d)(i)	See also Table II 1-1 for other tanks and boundaries
2	Edible liquid carriers	Independent tanks	Leak & Structural	The greater of - top of the overflow, or	

				- to 0.9m above top of tank [1]	
3	Chemical carriers	Integral or independent cargo tanks	Leak & Structural	The greater of - to 2.4m above top of tank [1], or - to top of tank [1] plus setting of any pressure relief valve	
Note : [1] Top of tank is deck forming the top of the tank excluding any hatchways.					

[Part II] Table II 24-2

Table II 24-2 Allowable Surface Pressure, q_a

Bearing material	q_a (N/mm^2)
Lignum-vitae	2.5
White metal, oil lubricated	4.5
Synthetic material with hardness between 60 and 70 Shore D (Note 1)	5.5
Steel (Note 2) and bronze and hot-pressed bronze-graphite materials	7.0

Notes:

1. Indentation hardness test at 23°C and 50% moisture, ~~acc.~~ according to a recognized standard. Synthetic bearing materials are to be of approved type.
2. Stainless and wear-resistant steel in an approved combination with stock liner. Higher values than given in the Table may be taken if they are verified by tests.

[Part II] II 33.2.1

33.2.1 The sloshing pressures given in 33.2.2, 33.2.3 and 33.2.6 are to be considered together with the general structural strength formulae given in 33.3, 33.4 and 33.5. The impact pressures p_i given in 33.2.4 to 33.2.7 are to be used together with impact structural strength formulae given in ~~33.5.5~~ 33.5.6.

[Part II] 33.3.7

33.3.7 Strengthening against liquid impact pressure in larger tanks

If the ship side forms boundary of larger ballast or cargo tanks with free sloshing length l_s > 0.13 L and or breadth b_s > 0.56 B, the side structure is to have scantlings according to ~~33.5.5~~ 33.5.6 for impact loads referred to in 33.2.1.

[Part III] 1.1.3

1.1.3 Except otherwise provided by this Chapter, the requirements for the construction of general ships given in ~~the preceding Chapters of this Part~~ Part II of the rules are to apply.

[Part III] 2A.2.1(f)(iv)

~~(4)~~(iv) In the case of bottom damage, a portion from the outflow from a cargo tank may be captured by nonoil compartments. This effect is approximated by application of the factor $C_{DB(i)}$ for each tank, which shall be taken as follows:

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[Part III] 11.9.5

~~11.9.5 The depth of water under the keel in the testing area should be at least two times the vessel draft at amidships.~~

~~11.9.6~~ 11.9.5 The steady bollard pull test requirements are as follows.

[Part III] 12.1.4(f)

(f) ~~9~~Specification and location of the fireman's outfits provided.

[Part III] 12.4.11

12.4.11 Foam concentrate is to be sufficient for at least 30 minutes of simultaneous operation of both monitors at maximum capacity with assumed concentrated rate of 5%. The foam expansion ratio is not to exceed 12.

[Part III] 12.6.2

(a) Protective clothing of material to protect the skin from heat radiating~~,~~ from the fire and from burns and scalding by steam. The outer surface is to be water-resistant.

~~(b) from the fire and from burns and scalding by steam. The outer surface is to be water-resistant.~~

~~(c)~~ (b) Boots and gloves of rubber or other electrically non-conducting material.

~~(d)~~ (c) A rigid helmet providing effective protection against impact.

~~(e)~~ (d) An electric safety lamp (hand lantern) of an approved type with a minimum operating period of three hours.

~~(f)~~ (e) An axe having an insulated handle.

~~(g)~~ (f) A self-contained breathing apparatus, which is to be capable of functioning for a period of at least 30 minutes and having a capacity of at least 1200 liters of free air. Spare, fully charged air bottles are to be provided at the rate of at least one set per required apparatus.

~~(h)~~ (g) For each breathing apparatus, a fireproof lifeline of sufficient length and strength is to be provided capable of being attached by means of a snap-hook to the harness of the apparatus or to a separate belt, in order to prevent the breathing apparatus becoming detached when the life-line is operated.

[Part IV] 3.5.2(a)(iii)(1)

(1) For the crankpin fillet

$$\sigma_{BH} = \pm(\alpha_B \cdot \sigma_{BN})$$

where:

σ_{BH} = alternating bending stress in crankpin fillet (N/mm^2);

α_B = stress concentration factor for bending in crankpin fillet (determination see 3.5.3).

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[Part IV] Table IV 4-1

Table IV 4-1 Hydraulic Test Pressure on Deck Machinery and Pump Parts

Parts to be Tested	Test Pressure, MPa
Steering gear:	
Steam reciprocating steering engine.	See 2.9.1 of this Part.
Hydraulic steering gear, pump case, cylinder etc.	1.5 W or W + 7, whichever is smaller.
Windlass:	
Steam reciprocating windlass engine.	See 2.9.1 of this Part.
Diesel windlass engine.	See 3.10.1 of this Part.
Hydraulic pump and motor.	1.5 W or W + 7, whichever is smaller.
Reciprocating compressors:	
Air Compressor:	
Cylinder, liner, cover, inter- and fter-coolers.	
Compressed air side.	1.5 W
Cooling water space.	0.4 but not less than 1.5 W
Refriagerant compressor.	See Part X
Pump:	
Pump prime mover, steam or diesel engine.	See 2.9.1 and 3.10.1 of this Part.
Pump casing.	0.4 but not less than 1.5 W.
Piping:	
Group-I and -II pipes and fittings.	See Part VI.
Where: W = Design pressure and/or maximum working pressure for therespective parts, in MPa.	

[Part IV] 7.2.1(a)

(a) For propeller blade of conventional design, the required blade thickness is to comply with the following formula:

$$t=\text{~~1.17~~}C_1K_m\sqrt{k_1k_2\frac{H\times10^6}{NBZS}}$$

[Part V] 3.2.1

3.2.1 Flat ~~and~~ end plates

[Part V] 3.8.9

3.8.9 The notation used in 3.8 of this Part are defined as follows:

T = Minimum thickness of tube or pipe, in mm.
W = Design pressure, in MPa.
d_0 = Outside diameter of tube, in mm.
D_t = Internal diameter of cross tube, in mm, but not to exceed 300mm.
S = Minimum tensile strength of the material of which the tube is designed to be made, in N/mm^2.
E = 1.0 for seamless tubes, and
0.85 for electric resistance welded tubes.
F = Constant as shown in Table V 3-1 for 3.8.1 above, and in ~~Table V 3-9 and V 3-10~~ Table V 3-10 and V 3-11 for 3.8.6 above.
C_1 = 1.0mm for tubes expanded into tube seats.
0 for tubes strength-welded to headers and drums.
C = 1.0mm for carbon and low alloy steels
0.3mm for copper and copper alloys.
0 for stainless austenitic steels.

[Part V] Table V 3-8

Table V ~~3-8~~3-9 Minimum Thickness of Tubes

Nominal Outside Diameter of Tube d_0 (mm)	Minimum Thickness (mm)
$d_0 \le 38$	1.75
$38 < d_0 \le 50$	2.16
$50 < d_0 \le 70$	2.40
$70 < d_0 \le 75$	2.67
$75 < d_0 \le 95$	3.05
$95 < d_0 \le 100$	3.28
$100 < d_0 \le 125$	3.50

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[Part V] Table V 3-9

Table V ~~3-9~~3-10 Constant F for Tubes within Heat Exchanger

Kind of Material		Design Temperature (℃)										
Grade	Min T. S. (N/mm^2)	Up to 50	75	100	125	150	175	200	225	250	275	300
Seamless copper tubes (phosphorous-oxidized)	205	4.77	5.86	6.21	6.21	6.41	7.59	10.25	—	—	—	—
Seamless brass tubes	315	4.63	4.63	4.63	4.63	4.63	4.70	13.13	—	—	—	—
	355	4.33	4.38	4.38	4.44	4.44	7.89	16.15	—	—	—	—
Seamless copper-nickel tubes	275	4.04	4.04	4.04	4.37	4.51	4.66	4.77	5.00	5.09	5.73	6.71
	315	4.32	4.38	4.38	4.44	4.50	4.50	4.70	~~485~~ 4.85	5.00	5.25	5.53
	365	4.51	4.63	4.74	4.87	4.93	5.07	5.21	5.29	5.45	5.53	5.62
Steel pipes	See Part XI	See Table V ~~3-10~~3-11										

Notes: 1. Value F may be determined by interpolation at intermediate temperature.
2. Constant F for other materials may be acceptable upon special consideration.

[Part V] Table V 3-10

Table V ~~3-10~~3-11 Constant F for Steel Pipes

Material			Design Temperature (℃)													
Kind	Grade	Min T.S. (N/mm^2)	Up to 100	150	200	250	300	350	375	400	425	450	475	500	525	550
Carbon steel pipes	P11	370	3.01	3.25	3.52	3.85	4.25	4.74	—	—	—	—	—	—	—	—
	P12	410	2.97	3.20	3.47	3.83	4.27	4.56								
	P13	480	3.08	3.31	3.61	3.93	4.10	4.25								
Low alloy steel pipes	P21	380	3.19	3.39	3.62	3.92	4.27	4.47	4.58	4.75	4.94	5.21	5.43	5.85	—	—
	P22	410	3.39	3.53	3.69	3.90	4.14	4.41	4.51	4.61	4.82	5.13	5.39	5.77	7.45	10.79
	P23	410	3.39	3.53	3.69	3.90	4.14	4.41	4.51	4.61	4.82	5.13	5.39	5.77	7.32	10.25
	P24	410	3.39	3.53	3.69	3.90	4.14	4.41	4.51	4.61	4.82	5.13	5.39	5.77	7.32	10.00

Notes: 1. Value F may be determined by interpolation at intermediate temperature.
2. Constant F for other materials may be acceptable upon special consideration.

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[Part V] 5.1.6

5.1.6 Where boilers are located on tween decks in machinery spaces and boiler rooms are not separated from a machinery space by watertight bulkheads, the tween decks are to be provided with coamings at least ~~76~~75mm in height. This area may be drained to the bilges.

[Part VI] 3.5.11

3.5.11 In ships of 4,000 ~~tons gross~~ gross tonnage and above other than oil tankers and in oil tankers of 150 ~~tons gross~~ gross tonnage and above, no ballast water is to be carried in any fuel oil tank.

[Part VII] 2.5.11(a)

(a) The system is to be a loud speaker installation enabling the broadcast of messages to all spaces where crew members or passengers, or both, are normally present and to muster stations. The system is to provide for the broadcast of messages from the navigation bridge and other places on board as may be required by the Society, with an override function so that all emergency messages may be broadcast if any loudspeaker in the spaces concerned has been turned off, its volume has been turned down or the public address system is in used for other purpose ~~emergency messages may be broadcast if any loudspeaker in the spaces concerned has been turned off, its volume has been turned down or the public address system is in used for other purpose.~~
The system is to be installed with regard to acoustically marginal conditions and is not to require any action from the addressee. The system is to be protected against unauthorized use.

[Part VII] 7.3.1

7.3.1 The secondary terminal voltage difference between no load and the rated current with a unity power factor, expressed as a percentage of the no load secondary voltage, is not to exceed the following values:

For ~~up to~~ less than 5 kVA per phase 5%
For 5 kVA and over per phase 2.5%

[Part VII] 12.1.1(a)

12.1.1 In addition to the requirements of other relevant Chapters the special requirements of this Chapter apply to:

(a) Oil tankers for the carriage in bulk of oil cargoes having a flash point ~~below~~ not exceeding 60°C (closed cup test).

[Part VII] 12.8.8

12.8.8 Zones within 5 m of any pressure/vacuum valve required by 5.9.1(b)(i) of Part VI, or at any height above and within a 10 m radius (measured horizontally) of any vent required by 5.9.1(b)(ii) of Part VI, and below and within a 3 m radius of any such vent not of the high velocity type.

(a) Intrinsically safe equipment

[Part XI] Fig XI 3-1

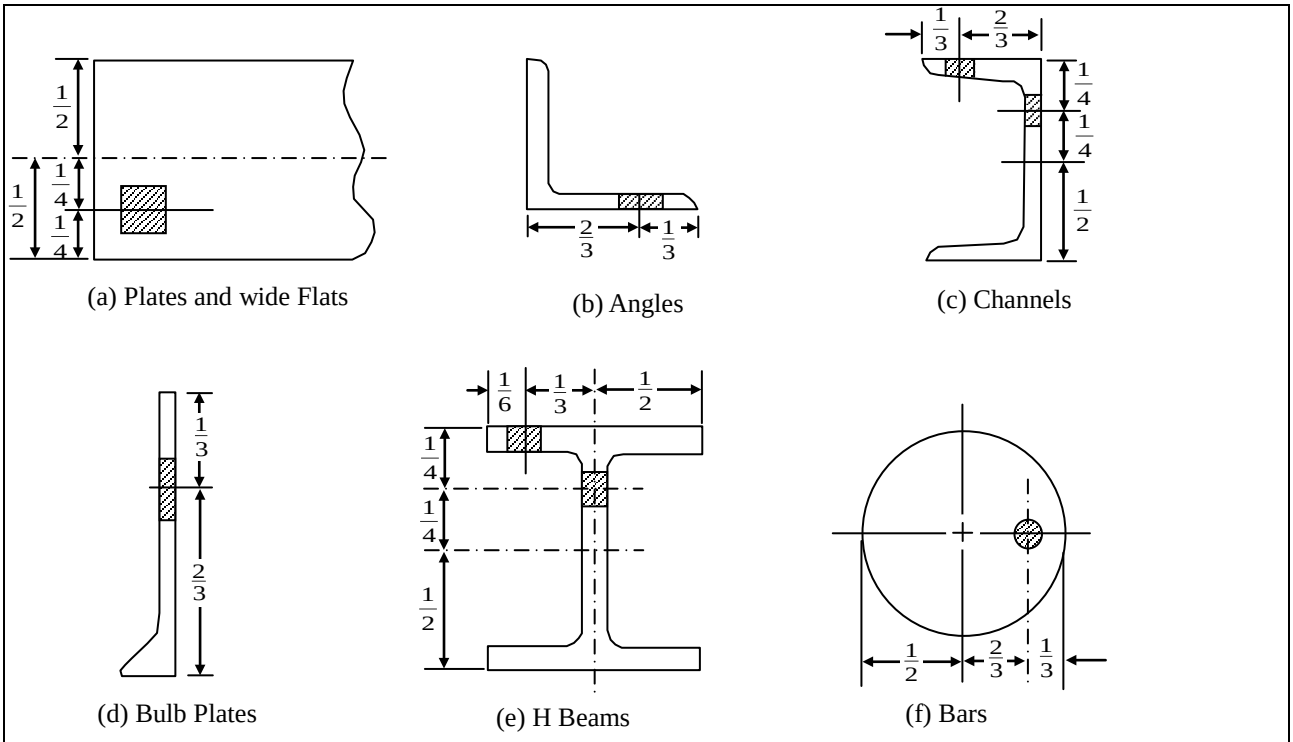

Fig. XI 3-1 Test Samples

[Part XI] Table XI 8-2

Table XI 8-2 Mechanical Properties for Acceptance Purposes and Test Requirements of Steel Forgings and Hot Rolled Machine Steel Bars for Ship and Machinery Constructions

Material Grade		Tensile Test (See Note 1)				Hardness Test	No. of Test Specimens
		Specified Minimum Tensile Strength (See Note 3) (N/mm^2)	Yield Stress min. (N/mm^2)	Elongation on $L=5.65\sqrt{A}$ min. (See Note 4) (%)	Reduction of Area min. (See Note 4) (%)	Hardness Brinell Numbers min. (See Note 5) (HBN)	
Carbon Steels (See Note 6)	F1-	400	200	26 (19)	50 (35)	110~150	See Table XI 8-5
		440	220	24 (18)	50 (35)	125~160	
		480	240	22 (16)	45 (30)	135~175	
		520	260	21 (15)	45 (30)	150~185	
		560	280	20(14)	40 (27)	160~200	
		600	300	18 (13)	40 (27)	175~215	
		640	320	17 (12)	40 (27)	185~230	
		680	340	16 (12)	35 (24)	200~240	
		720	360	15 (11)	35 (24)	210~250	
		760	380	14 (10)	35 (24)	225~265	
Low Alloy Steels (See Note 7)	F2-	550	350	20(14)	50 (35)	160~200	
		600	360	18 (14)	50 (35)	175-215	
		650	~~450~~ 390	17(12)	50(35)	190~230	
		700	420	16 (12)	45 (30)	205-245	
		800	480	14 (10)	40 (27)	235-275	
		900	630	13 (9)	40 (27)	260-320	
		1000	700	12 (8)	35 (24)	290-365	
		1100	770	11 (7)	35 (24)	320-385	

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[Part XII] 1.3.2 (a)

(a) Deposited metal ~~tensile and~~ longitudinal tensile test specimens are to be of type T1 as given in Table XI 2-1 of Part XI, where, the diameter, d, is generally to be 10 mm. Except otherwise required, longitudinal axis of the specimens is to coincide with the center of the weld approximately in way of the half thickness of the plate.

[Part XII] 1.3.3 (d)

(d) Weld reinforcements and back straps are to be removed, filed, ground or machined flush with the surfaces of the plate. Edges of test specimens are to be rounded to a radius of ~~1.5~~ 1 to 2 mm.

[Part XII] 1.3.5 (a)

(a) A fillet welde~~d~~ test assembly or specimen in form of T joint is to have the fillet weld on one side gouged or machined to facilitate breaking the another side fillet weld by closing the two abutting plates together, subjecting the root of weld to tension (see Fig. XII 1-4).

[Part XII] 1.3.7 (a)

(a) Where the result of a tensile or bending test does not comply with the requirements, 2 additional test specimens of the same type are to be prepared from either the same test assembly of the first test or the assembly newly welded with ~~same~~ welding condition same as the first test assembly ~~and~~ are to be satisfactorily tested.

[Part XII] 2.2.2

2.2.2 Range of approval welding procedures
The scope of approval of the welding procedures ~~are~~ is in accordance with the followings. However, the range of approval differing from the requirements specified in this Chapter may be accepted that it is deemed appropriate by the Society.

[Part XII] 2.3.1 (a)

(a) Test assemblies are to be prepared with the same or equivalent material and welded by ~~same~~ procedure same as indicated in the welding procedure specification. In case the welding procedure is applicable for welding various grades of materials, test assemblies prepared by representative grades of materials among them may be accepted.

XII 2.3.3 (a) (i)

(i) 2 transverse tensile tests,

[Part XII] 2.3.3 (a) (ii)

(ii) 2 face~~s~~ and 2 root~~s~~ bending tests when thickness is not more than 20 mm, or 4 side bending tests when thickness is more than 20 mm,

[Part XII] 3.2.7

3.2.7 The qualification test requirements for welders intended to engage in the welding works of the special materials and the welding work not specified in this Chapter are to be in accordance with the specific approval given by the Society.

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[Part XII] Table XII 4-8

Table XII 4-8 Approval Tests for Semi-Automatic Welding Materials

Tests	Test Assemblies					No. of Test Specimens to be taken from each Test Assembly for Tests
	Welding Positions	Dia. of Wire to be used (mm)	No. of set	Plate Thickness (mm)	Dimensions	
Deposited Metal (See Notes 1 and 2)	Downhand	Largest dia.	1	20	See Fig. XII 4-1	1 – Deposited tensile and 1 – 3 Impact
		Smallest dia.	1			
Butt Weld (See Notes 3 and 7)	Downhand (See Note 4)	1st run: smallest dia. Remaining runs: largest dia.	1	15 ~ 20	See Fig. XII 4-2	1 – Transverse tensile, 1 – Face bending, 1 – Root bending and 1 – 3 Impact (See Note 6)
	Horizontal (see Note 5)	1st run: smallest dia. Remaining runs: Largest dia. available for the position concerned.	1			
	Vertical		1			
	Overhead		1			
Fillet Weld (See Note 8)	Downhand	1.2	1	20	See Fig. XII 4-3	3 – Macro-etching/ Hardness and 2 – Fracture
		1.6	1			

[Part XII] 5.6.4

5.6.4 Preparations and executions of weldings, and preheating, stress relieving and inspections of welded construction part of machinery are to be done in accordance with the requirements stated in 5.1 to 5.5 of this Chapter, if applicable.

[Part XII] 5.7.4 (d)

(d) Where pressure vessels are made of materials having a superior notch toughness, stress relieving may be omitted when specially approved by the Society in a particular case.

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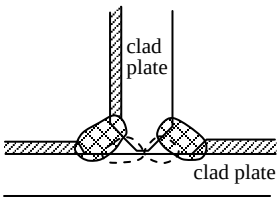
[Part XII] Fig. XII 5-5



Assembly subjected to high stresses: Root beads can be welded with over-alloyed welding materials and the top layer with ordinary stainless steel welding material, or root bead is welded with ~~a~~ normal strength steel welding material and the top layer with over-alloyed welding material.

Fig. XII 5-5 Examples on welding sequence

[Cargo Gear] 2.4

2.4 The following certificates are required to be attached to the Register:

(a) Certificate of Test and Thorough Examination of Derricks, Winches, and their Accessory Gear (ILO Form 2)(~~CG~~GC 17).

(b) Certificate of Test and Thorough Examination of Derricks, Winches, and their Accessory Gear, for operation in Union Purchase (ILO Form 2(U))(~~CG~~GC 17U).

(c) Certificate of Test and Thorough Examination of Cranes or Hoists and their Accessory Gear (ILO Form 3)(~~CG~~GC 18).

(d) Certificate of Test and Thorough Examination of Cargo Lifts/Cargo Ramps and their Accessory Gear (ILO Form 3LR)(~~CG~~GC 18LR).

(e) Certificate of Test and Thorough Examination of Loose Gear (ILO Form 4)(~~CG~~GC 19).

(f) Certificate of Test and Thorough Examination of Rope(~~CG~~GC 20).

[Cargo Gear] Table 4.2

Table 4.2 Proof Load for cargo gear assembly

Safe working load SWL (t)	Proof load (t)
SWL<20	1.25 × SWL
20 ≤ SWL<50	SWL + 5
50 ≤ SWL<100	1.1 × SWL
100 ~~<~~≤ SWL	Load as considered appropriate by the Society

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[Cargo Gear] 8.3(c)

(c) Buckling strength

For member subjected to compression, the value obtained from the following formula is not to exceed the allowable stress σ_a given in Table 8.2.

$1.15\ \omega\sigma_c$ N/mm^2

where:

σ_c = Axial compressive stress, N/mm^2.

ω = Coefficient calculated by the formula in Table 8.3 and Table 8.4 for the slenderness ratio and type of the member concerned.

[Cargo Gear] 8.3(d)

(d) Combined compressive stress

The compressive stress due to combination of the compressive stress due to axial compression and that due to bending moment is to meet the following formula:

$$[(\sigma_c/\sigma_{ca})+(\sigma_b/\sigma_a)\ ] \leq 1.0$$

where:

σ_a = Allowable bending stress given in Table 8.2, N/mm^2.

σ_{ca} = Allowable compressive stress to be taken as a quotient of σ_a divided 1.15, N/mm^2.

σ_b = Compressive stress due to bending moment, N/mm^2.

σ_c = Compressive stress due to axial compression, N/mm^2.

[Cargo Gear] 8.4(b)(ii)

(ii) The section modulus of stayed posts at the base may be the value specified in reduced by the value obtained from the following formula:

$10(h^3/d_m)\sum R$ cm^3

where:

h = As specified in 8.4(a).

d_m = Outside diameter of the post at the base in the direction in which R assumes minimum in the slewing range for the formula in 8.4(b)(i)(1) or in the axis parallel to the athwartship direction of the ship for the formula in 8.4(b)(i)(2), cm.

$\sum R$ = Sum of the values obtained from the following formula for each effective stay:

$(d_s^2 a^2)/(l_0^2 ls^2)$

d_s = Diameter of the wire rope for stays, mm.

l_s = Length of stays between the upper and lower ends, m.

l_o = Length equal to l_s reduced by the value obtained from the following formula:

$0.045\ d_s+0.26$ m

a = Length of horizontal projection of the stays measured in the same direction as the measurement of d_m.

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[Cargo Gear] 8.4(e)(i)(3)

(3) The section modulus about the horizontal axis is to be the value obtained from the formula in 8.4(b)(i)(2) multiplied by the coefficient obtained from the following formula. Where this coefficient exceeds 0.2, it may be taken as 0.2.

$0.25(\gamma'/c')$

where:

γ' = specified in 8.4(b)(iii)(2).

c' = Ration of the actual section modulus ,cm3,of the post at the base about the axis parallel to the longitudinal direction of the ship to that obtained from the formula in 8.4(b)(i)(2).

[Cargo Gear] 8.5(b)(i)

(i) The moment of inertia of section at an arbitrary position at a distance of *x* (m), from the center of eye fitting at derrick heel is not to be less than obtained from the following formula. Where a doubling plate is fitted for a sufficient length, 70% of the doubling plate may be added to D(x) and A(x) in the formula.

$$I(x)=C_B P l^2\{1-3.136[(x/l)-0.5]^2\}+1000D(x)l_1 x\mathrm{Wg}\cos\theta/[2l\mathrm{n}(\sigma_0-10P/A(x)]$$

where:

$I(x)$ = Required moment of inertia of section at a distance of *x*, m, from the derrick heel, cm^4.

C_B = As specified in 8.5(a).

P = Axial compression of boom specified in 8.5(a)(i)(1), kN.

l = Effective length of boom, m.

n = Sum of sheaves of cargo block for cargo fall (except cargo block for cargo relief).

W = Safe working load as specified in 8.4(b)(i)(1), t.

θ = Allowable minimum angle of boom, degree.

l_1 = Distance between the eye fittings for whipped rigging, m. See Fig. 8.1.

D(x) = Outside diameter of derrick boom at a distance of *x* (m) from the boom heel minus plate thickness , cm.

A(x) = Sectional area of derrick boom at a distance of *x* (m) from the boom heel, cm^2.

σ_0 = Value given in Table 8.11, N/mm^2.

[Cargo Gear] 9.1(d)(ii)

(ii) The inertial force is to be obtained by multiplying the sum of the mass of the moving parts and the hoisting load (in slewing motion, the load is assumed to be at the top of jib) by the following coefficient depending on the condition of motion. In the case of traveling by driven wheels, however, this inertial force need not exceed 15% of the driving wheel load.

Level luffing motions : $0.01V^{1/2}$

Traversing or traveling motions: $0.008V^{1/2}$

Slewing motions : $0.006\,V^{1/2}$

Where V = Velocity of motion concerned to be determined by the designer, m/min

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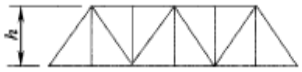
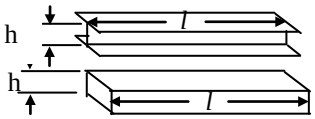
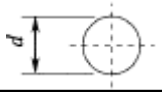
[Cargo Gear] Table 9.3

Table 9.3 Shape Factor C_s

Type of area under wind pressure		C_s
Truss of angle 	ϕ<0.1	2.0
	0.1≤ϕ<0.3	1.8
	0.3≤ϕ<0.9	1.6
	0.9≤ϕ	2.0
Plate girder or box girder 	(l/h)<5	1.2
	5≤ (l/h)<10	1.3
	10≤ (l/h)<15	1.4
	15≤ (l/h)<25	1.6
Cylindrical member or truss of cylindrical member 	d $q^{1/2}$<1.0	1.2
	1.0≤d $q^{1/2}$	0.7

Note:

ϕ = Repleteness ratio equal to the ratio of projected area under wind pressure to the projected area surrounded by the outer contour of the area under wind pressure.

l = Length of plate girder or box girder, m.

h = Height of plate girder or box girder looked at from windward, m.

d = Outer diameter of cylindrical member, m.

q = Value calculated by the following formula :

$(gC_hV^2/16)\times10^{-3}$ kPa