ISO9001 · ISO14001

SSQS

Samsung Shipbuilding Quality Standard

Samsung Shipbuilding Quality Standard 2005

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HISTORY

Sep.	**1979.**	**The First Edition**
Jan.	**1984.**	**The First Revision**
Mar.	**1986.**	**The Second Revision**
Jun.	**1988.**	**The Third Revision**
Jun.	**1990.**	**The Fourth Revision**
Oct.	**1992.**	**The Fifth Revision**
May.	**1994.**	**The Sixth Revision**
Sep.	**1996.**	**The Seventh Revision**
Apr.	**2000.**	**The Eighth Revision**
Jan.	**2005.**	**The Ninth Revision**

P R E F A C E

This Samsung Shipbuilding Quality Standard(SSQS) is compiled in an effort to standardize the production and quality control practices for the building of new vessels in Samsung Heavy Industries Co., Ltd.

Considering the importance of the quality control in the shipbuilding industry, the process control policy has been emphasized as the basic quality control policy to minimize potential defects at each production stage and to assure the quality of the final products.

This booklet consists of two sections ;

- Quality Standard
- Scope of Inspection

The Standard mentioned in the booklet will be generally applied to the quality control of the shipbuilding at the Geoje Shipyard.

PART A. QUALITY STANDARD

I. HULL PART

1. MATERIAL

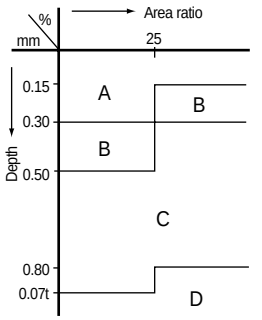
1-1. Rolled plate

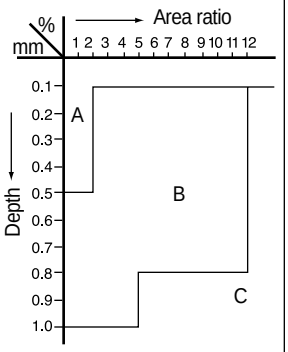
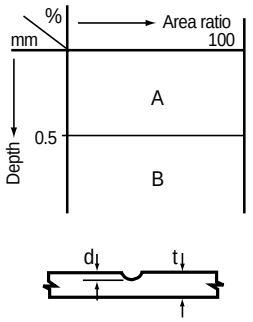
1-1-1. Definition of imperfection and defect

- An imperfection is some feature which introduces an irregularity in an otherwise uniform structure.
- A defect is a specific imperfection which impairs the suitability of that structure for its intended purpose.

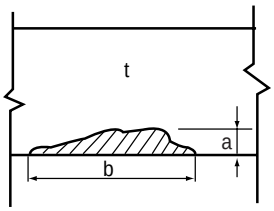
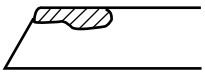
In order to determine if a particular imperfection is actually a defect, there must be some standard which defines the acceptable limits of that imperfection. When its size or concentration exceeds these limits, it is deemed a defect. We can therefore think of a defect as simply a rejectable imperfection.

Imperfections related to the following discontinuities.
: Pitting, rolled in scale, indentations, roll marks, scratches and grooves
Defects related to the following discontinuities.
: Cracks, shells, seams, spills, blisters, hot tears and sand patches

Object		Detail	Correction / Remarks
1-1-2. Surface Imper-fections	Pit	Grade of pitting  Area ratio (%)= $\frac{\text{Area of pitting}}{\text{Total area of steel surface}} \times 100$	1. Grade A : Repair is unnecessary. 2. Grade B : 1) Outer surface of shell plates: To be repaired by grinding (if necessary) (When painting with epoxy can not be done, grinding is to be carried out.) 2) Others : Repair is unnecessary. 3. Grade C : 1) Outer surface of shell plates : To be repaired by grinding 2) Others : Painting with epoxy to be carried out 4. Grade D: Repair method is to be determined after discussion with owner and class. ∗ Recommended repair method : Grinding followed by welding 5. The ground area shall not exceed the tolerances as follows. 1) Single ground area : 0.25㎡ 2) Total ground area : 2% of the total surface area 6. Repaired area by welding shall not exceed : 1) Single ground area : 0.125㎡ 2) Total ground area : 2% of the total surface area of the side involved

Object		Detail	Correction / Remarks
1-1-2. Surface Imper-fections	Flaking	Grade of surface flaking  	1. Grade A : Repair is unnecessary. Grade B : To be repaired if necessary Grade C : To be repaired 2. Repair method Depth of defects : d Plate thickness : t 1) $d < 0.07t$ (max. 3mm) ⋯ Removed by grinding 2) $0.07t \leq d \leq 0.2t$ ⋯ Grinding followed by welding (The welded area should be less than 2% of the total surface area.)
	Inden-tation (other defects)	Grade of indentation  	1. Grade A : Repair is unnecessary. Grade B : Repair is necessary. 2. Repair method Depth of defects : d Plate thickness : t 1) $d < 0.07t$ (max. 3mm) : Grinding 2) $0.07t \leq d \leq 0.2t$: Welding and grinding 3. The welded area should be less than 2% of the total area of a plate.

Unit : mm

Object		Detail	Correction / Remarks
1-1-3. Lamination	Local lamination	$a \leq 1t$  *"b" is the length of the defect on the flame-cut edge.* *"a" is the other dimension.* *"t" is the plate thickness.*	In case where the range of lamination is limited, it can be chipped out and built-up by welding as shown in (a). (a)  In case where the range of lamination is limited, but is also near the plate surface, it is preferable to make the built-up welding as shown in (b). (b)  It must be carefully examined whether the procedure is acceptable or not, in case where the degree of the lamination is more severe and defective.
	Severe lamination requiring a local exchange of plate	$a > 1t$	It is recommended to exchange locally the plate, in case where the range of lamination is fairly extensive. The standard minimum breadth of plate to be exchanged : Shell and strength deck plating in way of cruciform or T-joints ····· 1,600mm Shell, strength deck plating and other primary members ····· 800mm Other structural members ····· 300mm

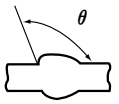
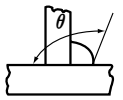
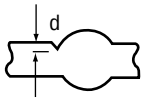
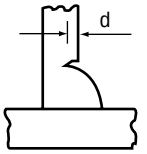
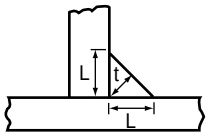
1-2. Cast steel

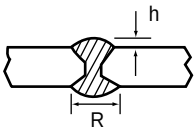
Object	Detail	Correction / Remarks
Defects of cast steel	In case where examined defect is over 20% of thickness, or over 25mm deep and 150mm long	In case where cavity, crack and other injurious defects are found, 1) Remove the defects by gouging. 2) Gouged areas shall be welded in accordance with maker's recommendation and/or an approved WPS. 3) Repaired areas shall be checked by magnetic particle testing or ultrasonic testing.

2. WELDING

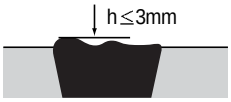
2-1. Shape of bead

Unit : mm

Item	Details		Tolerance limits	Remarks
2-1-1. Over-lap	Butt		$\theta \leq 90°$	In case $\theta > 90°$, grinding or welding is necessary to make $\theta \leq 90°$.
	Fillet			
2-1-2. Under cut	Butt		d ≤ 0.5 (Length of less than 90mm continuous)	Where 0.5 < d ≤ 1 undercut to be ground smooth (Localised only) Where d > 1 undercut to be filled by welding (Carefully avoid short bead for high tensile steels)
	Fillet			
2-1-3. Leg length and throat			$L \geq L_0$ $t \geq t_0$ If $0.9L_0 \leq L < L_0$ or $0.9t_0 \leq t < t_0$, the extent is to be less than 10%	L_0 : Designed leg length t_0 : Designed throat

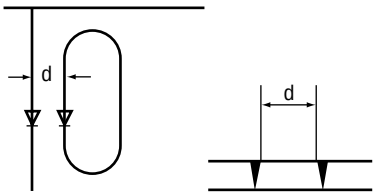
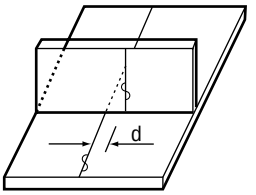
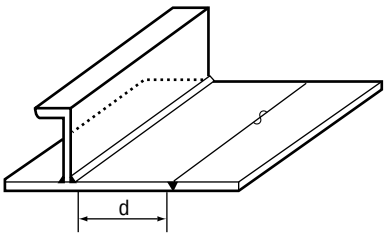
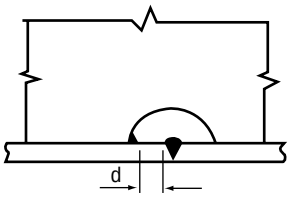
Item	Details	Standard range	Tolerance limits
2-1-4. Height of reinforcement		h ≤ 0.2R	max. h = 6

Unit : mm

Item	Details	Tolerance limits	Corrections / remarks
2-1-5. Irregularity of multi weld		$h \leq 3$	When the surface irregularity exceeds 3mm, apply grinding until the irregularity becomes less than 3mm. (This repair standard is applicable to fillet welds also)

2-2. Preparation of welding

Unit : mm

Item	Details		Tolerance limits	Remarks
2-2-1. Distance between two butt welds			$d \geq 30$	
			$d \geq 0$	
2-2-2. Distance between butt weld and fillet weld		Main structure	$d \geq 10$	
		Other structure	$d \geq 0$	
		Main structure	$d \geq 5$	
		Other structure	$d \geq 0$	

2-3. Short bead

Unit : mm

Item	Details	Tolerance limits	Corrections / remarks
2-3-1. Damage part of base metal	• Normalized 50HT • Cast steel	≥50	∗ In case where short bead is used unavoidably, preheating is necessary at 100±25℃. ∗ Where short bead is made erroneously, remove the bead by grinding, and weld over tolerable bead length after confirming crack.
	• Mild steel	≥30	
	• TMCP 50HT (Ceq. ≤0.36%)	≥10	
2-3-2. Repair part of welding bead and tack welding	• Normalized 50HT • Cast steel	≥50	
	• Mild steel • TMCP 50HT (Ceq.≤0.36%)	≥30	

2-4. Repair of arc strike

Details	Tolerance limits	Corrections
• Normalized 50HT • Cast steel • TMCP 50 HT • Grade E of mild steel	Prohibited	In case where arc strike is made erroneously, remove the hardened zone by grinding

2-5. Pre-heating

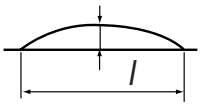
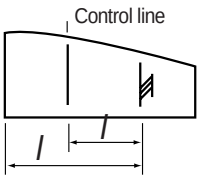
Details	Limits of atmospheric temperature	min. preheating temperature
• Mild steel • TMCP 50HT (Ceq.≤0.36%)	T≤-5℃	min. 50℃
• Normalized 50HT	T≤ 5℃	min. 50℃

∗ Remark : 1. When Ceq. of touched metals is different, the higher Ceq. has to be taken.
2. Cast steel & all other steel grades, specific temperature of Cast steel shall be followed by approved WPS independently atmospheric temperature, if required in approved WPS.

3. MARKING

3-1. Cutting line and fitting line

Unit : mm

Section	Item	Standard range	Tolerance limits	Remarks
3-1. Cutting line and fitting line	Size and shape	±1.0	±2.5	
	Straightness 	±1.0	±1.5	min. l = 5m
	Location of member and mark for fitting 	l ±2.0	l ±3.0	

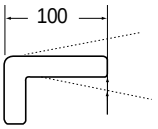
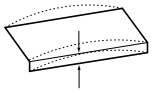
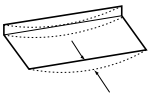
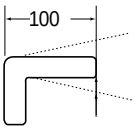
4. CUTTING

Unit : mm

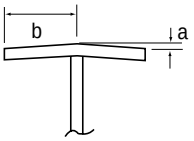
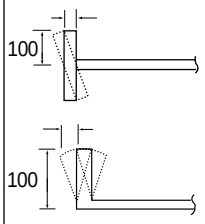
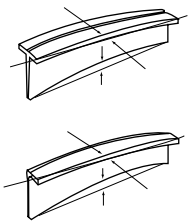
Section	Item			Standard range	Tolerance limits
4-1. Notch	Free edge	1) Upper edge of sheer strake 2) Free edge of strength deck within 0.6 L ⌀ and opening of shell plate 3) Main longitudinal strength members		–	Not allowed
		Longitudinal and transverse strength members		–	Ind. ≤ 1
		Other		–	Ind. ≤ 3
	Weld groove	Butt Weld	w ≤ 3	–	Ind. ≤ 1.5
			w > 3		Ind. ≤ 2.5
		Fillet weld		–	Ind. ≤ 3
4-2. Dimension	Straight-ness of plate edge	Both side submerged arc welding		±0.4	±0.5
		Manual welding, semi automatic welding		±1.0	±2.5
	Depth of groove	Deviation of l_1 and l_2 between designed depth and actual depth		±1.5	±2.0
	Length of taper	Deviation of l between designed length and actual length		3d±0.5d	3d±1.0d
	Size of member	General members compared with correct size		±3.5	±5.0
		Especially for the depth of floor and girder of double bottom compared with correct size		±2.5	±4.0
		Breadth of face bar compared with correct size		±2.0	-3.0~+4.0

5. FABRICATION

Unit : mm

Section	Subsection	Item	Standard range	Tolerance limits	Remarks
5-1. Flanged longitudinal	Breadth of flange and web	 Compared with correct size	±3.0	±5.0	
	Angle between flange and web	 Compared with template	±2.5 per 100	±4.5 per 100	
	Curvature or straightness in the plane of flange	 per 10m in length	±10	±25	
	Curvature or straightness in the plane of web	 per 10m in length	±10	±25	
5-2. Flanged bracket	Breadth of flange	 Compared with correct size	±3.0	±5.0	
	Angle between flange and web	 Compared with template	±3.0 per 100	±5.0 per 100	

Unit : mm

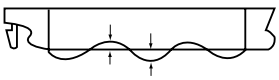
Section	Subsection	Item	Standard range	Tolerance limits	Remarks
5-3. Built-up sections	Distortion of face plate		$a = 2 + \frac{b}{100}$	$a = 5 + \frac{b}{100}$	
	Deviation of squareness between face plate and web		± 1.5 per 100	± 3.0 per 100	
	Longitudinal and transverse distortion at face plate and web		± 5	± 8	per span between primary members

5-4. Line heating

<table>
<tr><th>Section</th><th colspan="2">Item</th><th>Standard range</th><th>Remarks</th></tr>
<tr><td rowspan="6">Max. heating temperature on surface</td><td rowspan="3">• Normalized 50HT</td><td>Water cooling just after heating</td><td>under 650℃</td><td rowspan="3"></td></tr>
<tr><td>Air cooling after heating</td><td>under 900℃</td></tr>
<tr><td>Air cooling and subsequent water cooling after heating</td><td>under 900℃ (Starting temperature of water cooling to be under 500℃)</td></tr>
<tr><td>TMCP 50HT (Ceq.≤0.36%) AH, DH</td><td>Water cooling just after heating or air cooling</td><td>under 1000℃</td><td>Within 3 cycles as far as practicable</td></tr>
<tr><td>TMCP 50HT (Ceq.≤0.36%) EH</td><td>Water cooling just after heating or air cooling</td><td>under 900℃</td><td rowspan="2">Within 2 cycles as far as practicable</td></tr>
<tr><td colspan="3">* Note : Air cooling means by compressed air.
Heating means by flame torch.</td></tr>
</table>

6. ACCURACY OF HULL FORM

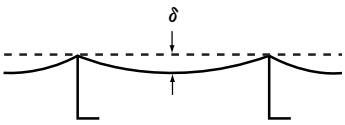
Unit : mm

Item	Details	Standard range	Remarks
Length	Length between perpendiculars	±50 per 100m	Applied to ships of 100m length and above. For the convenience of the measurement, the point where the keel is connected to the curve of the stem may be substituted for the fore perpendicular in the measurement of the length.
Breadth	Moulded breadth amidship	±15	Applied to ships of 15 meter breadth and above. To be measured on the upper deck.
Depth	Moulded depth amidship	±10	Applied to ships of 10 meter depth and above.
Flatness of keel	Deformation for the whole length 	±25	Up (-) and Down (+) against the check line of keel sighting.

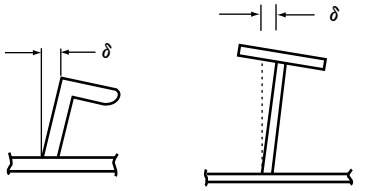
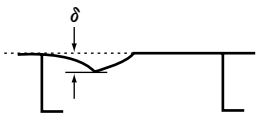
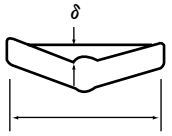
7. DEFORMATION

7-1. Deformation

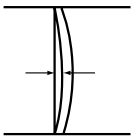
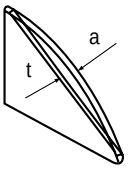
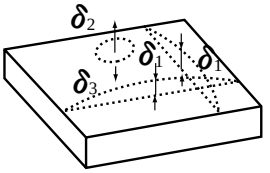
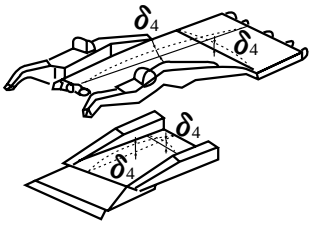
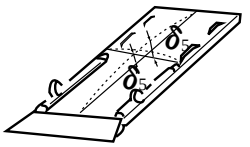
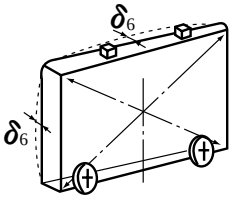
Unit : mm

Area	Item	Standard range	Tolerance limits	Remarks
Shell plate	Parallel part (side shell)	±4	±7	For length of frame space, longi. space, stiffener space, any of the above is not applicable for over 1.8m length. 
	Parallel part (bottom shell)	±4	±7	
	Fore and aft part	±5	±7	
Double bottom tank top plate		±4	±7	
Bulkhead	Longi. bulkhead, trans-bulkhead & swash bulkhead	±6	±8	

Unit : mm

Area	Item	Standard range	Tolerance limits	Remarks
Strength deck	Parallel part (Between 0.6L amidship)	±4	±7	
	Fore and aft part	±6	±9	
	Covered part	±7	±9	
Second deck	Bare part	±6	±8	
	Covered part	±7	±9	
Forecastle deck, poop deck	Bare part	±4	±7	
	Covered part	±6	±9	
Superstructure deck	Bare part	±4	±6	
	Covered part	±7	±9	
House wall	Outside wall	±4	±7	
	Inside wall	±6	±8	
	Covered part	±7	±9	
Interior member	Web of girder, trans.	±5	±7	
Floor and grider of double bottom		±5	±7	
Unfairness of interior members after welding (beam, frame, stiffener, floor girder, etc.)		-	≤8	
Angular distortion of welding joint after welding 	Skin plate between 0.6L amidship	-	≤6	
	Fore and aft shell plating and transverse strength member	-	≤7	
Span of frame or beam	Others	-	≤8	

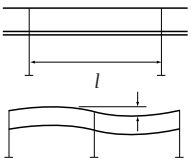
Unit : mm

Item	Details			Standard range	Tolerance limits	Remarks
H-type Pillar	Distortion between decks 			±4	±6	
Tripping bracket and small stiffener	Distortion at the part of free edge 			a≤t/2	max. 8	
Vehicles loading apparatus	Hoistable deck (Liftable deck) 	Deflection of deck δ_1		+5 0	+10 -5	
		Deformation of deck	δ_2	+5	+10	
			δ_3	-2	-5	
	Stern ramp 	Transverse and longitudinal deflection δ_4		-	±5	δ_4, δ_5 to be measured on the top plate of girder
	Midship ramp 	Transverse and longitudinal deflection δ_5		-	±5	
	Bulkhead door 	Transverse and longitudinal deflection δ_6		-	±3	δ_6 = actual measurement value
	Fixed ramp			±6	±8	

Remarks : Maker's instruction shall prevail regarding the above deformation of ramps.

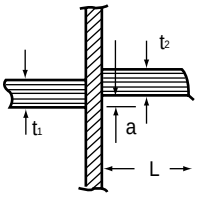
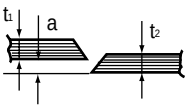
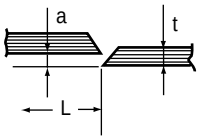
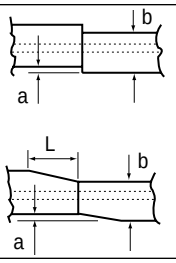
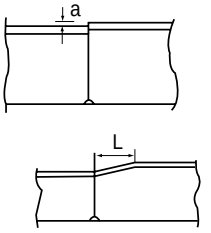
7-2. Deformation per basic length

Unit : mm

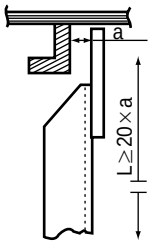
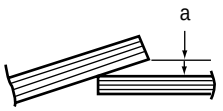
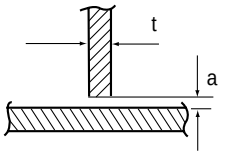
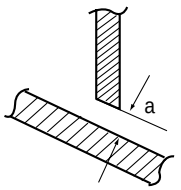
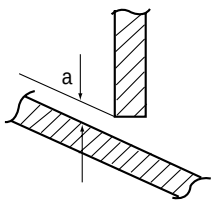
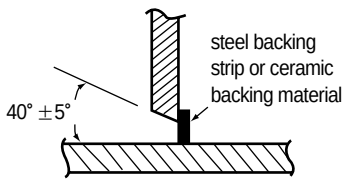
Area	Item	Standard range	Tolerance limits	Remarks
Shell plate	Parallel part	±2*l* / 1000	±3*l* / 1000	 • To be measured between one trans. space (min. *l* = 3m) • Measured length is about 5m for bulk-head, outside wall etc.
	Fore and aft part	±3*l* / 1000	±4*l* / 1000	
Deck and top plate of double bottom	-	±3*l* / 1000	±4*l* / 1000	
Bulkhead	-	±4*l* / 1000	±5*l* / 1000	
Accommodation	Deck	±3*l* / 1000	±4*l* / 1000	
	Outside wall	±2*l* / 1000	±3*l* / 1000	
Others	-	±5*l* / 1000	±6*l* / 1000	

8. DETAILS

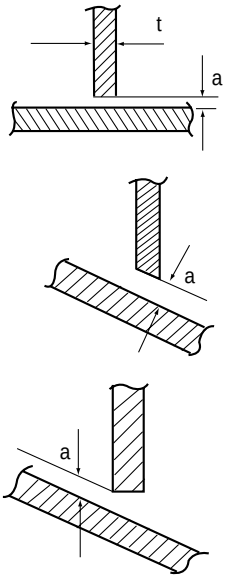
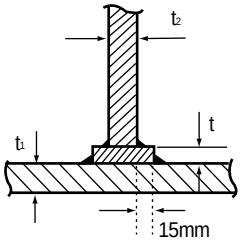
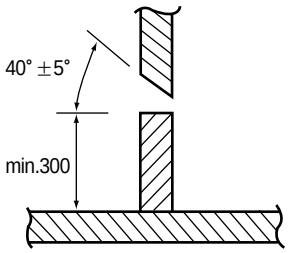
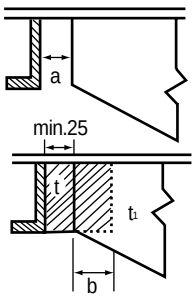
Unit : mm

Object		Detail	Tolerance limits	Corrections / Remarks
8-1. Misalignment between components on each side of through going component		 $t_1 \leq t_2$	Strength members $a \leq \frac{t_1}{3}$ Others $a \leq \frac{t_1}{2}$	1. $\frac{t_1}{3} < a \leq \frac{t_1}{2}$ (in case of strength member) the weld throat to be increased by 10% 2. $a > \frac{t_1}{2}$ Position to be adjusted. adjustment length $L \geq 50 \times a$
8-2. Misalignment in block/section joint (Shell plate, deck, bottom, inner bottom, bulkhead, etc.)		 $t_1 \leq t_2$	Strength members $a \leq 0.15t_1$ (max. 3) Others $a \leq 0.2t_1$ (max. 3)	The plates are to be adjusted.
8-3. Misalignment in joints between longitudinal profiles.	web		Primary members $a \leq 0.15t$ (max. 3) Secondary members $a \leq 0.2t$ (max. 3)	Adjustment length $L \geq 30 \times a$ or adjustment by welding
	Flange		$a \leq 0.04b$ (max.8)	When $0.04b < a \leq 8$, grind corners to smooth taper over distance min.L = 3a When $a > 8$, release and adjust the plate min.L = 50a
	Height of web		$a \leq 3$	1. $3 < a \leq 6$ Make a smooth shape by build-up. 2. $a > 6$ Release and adjust over min. L=50a for primary structure and L=30a elsewhere and weld after knuckling the flange.

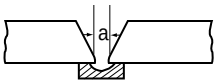
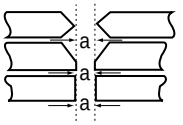
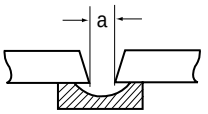
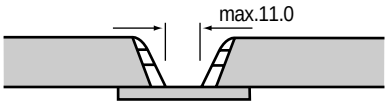
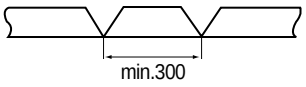
Unit : mm

Object	Detail	Tolerance limits	Corrections / Remarks
8-4. Overlap brackets		a≤3	1. 3<a≤5 Adjust before welding 2. a>5 Release and adjust in length L≥20×a
8-5. Gap for overlap joint		a≤3	1. 3<a≤5, increase leg length (Planned leg length+a) 2. a>5, Refitting
8-6. Gap before welding of fillet joint	Fillet weld   	a≤3	1. When 3<a≤5 The weld leg length to be increased as much as the gap opening exceeding 3mm $L=L_0+(a-3)$ (L : Increased leg length L_0 : Designed leg length) 2. When 5<a≤16 1) Weld with bevel preparation to make bevel edge of web to 40° ±5°. attach steel backing strip or ceramic backing material, and remove it after welding. Then, weld the opposite side after gouging. 

Unit : mm

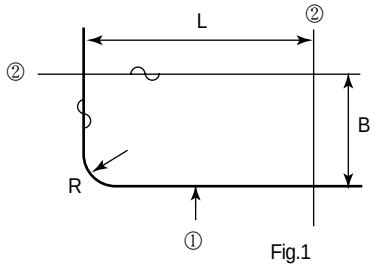
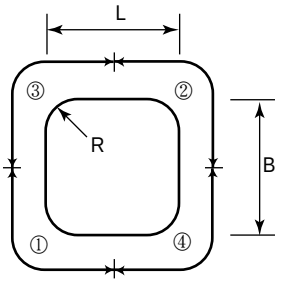
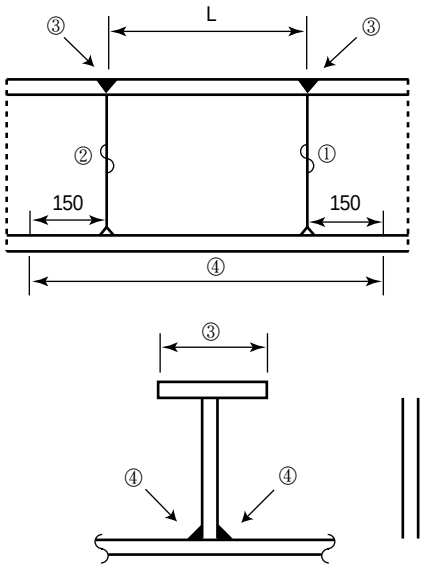
Object	Detail	Tolerance limits	Corrections / Remarks
8-6. Gap before welding of fillet joint	Fillet weld 	$a \leq 3$	2) Liner treatment Subject to CLASS acceptance and not to be used in areas of tensile stress perpendicular to liner  $t_2 \leq t \leq t_1$ 3. When a > 16 Partial renewal 
8-7. Gap before welding of joint between bracket/intercoastal and frame, beam, stiffener, etc. and in way of slot		$a \leq 3$	1. When $3 < a \leq 5$, the weld leg length to be increased as much as the gap opening exceeding 3. 2. When $5 < a \leq 10$, bevel 40° ±5° and build up by welding. 3. When a>10, fit the collar plate as shown in detail. $t \geq t_1$ b : 2t+25(min.50).

Unit : mm

Object	Detail	Tolerance limits	Corrections / Remarks
8-8. Butt joint	1. One side SAW 	$a \leq 3$	1. $3 < a \leq 8$ First or second pass by FCAW with ceramic backing 2. $a > 8$ Refitting or re-preparation after build-up
	2. Both side SAW 	$a \leq 1.5$	1. $1.5 < a \leq 5$: Sealing bead is to be done. 2. $a > 5$: Refitting
	3. FCAW 	$3.4 \leq a \leq 11.4$	1. $11.4 < a \leq 25$  Build-up the gap with welding on one or both sides of the preparation, with backing material to maximum gap of 11.0. 2. $a > 25$ Partial renewal 

8-9. Repair by insert plate

Unit : mm

Detail	Repair standard	Remarks
8-9-1. Repair by insert plate  Fig.1  Fig.2	L = min. 300 B = min. 300 R = 5 × Plate thickness and min.100 1) Seam with insert piece is to be welded first. 2) Original seam is to be released and welded over for a min. 100. 3) Welding sequence ① → ② → ③ → ④	
8-9-2. Repair by built up section by insert plate  	L = min. 300 1) Welding sequence ① → ② → ③ → ④ 2) Web butt weld scallop to be filled during final pass ④	

Unit : mm

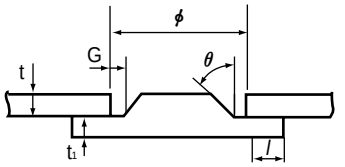
8-9-3. Treatment of hole made erroneously

(D : Diameter, B : Width of holes)

Sub-section	Item	Method	Remarks
D < 200 B < 300	Strength member in skin plate	ⓐ	Open the hole to over 75 ϕ
		or ⓑ	Open the hole to over 300 ϕ
	Others	ⓑⓒ or ⓓ	
D ≥ 200 B ≥ 300	Strength member in skin plate	ⓑ	
	Others	ⓑ or ⓒ	
Serration, scallop, slot	-	ⓑ or ⓒ	

Method of treatment

ⓐ : Spigot patch



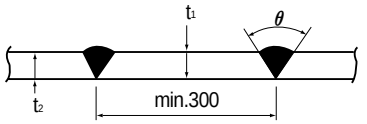
$\theta = 40° \pm 5°$

G = 4~6

t_1 = 1/2t~t

l = 50

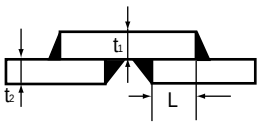
ⓑ : Closing by butt weld



$\theta = 40° \pm 5°$

$t_1 \geq t_2$

ⓒ : Closing by lapping piece

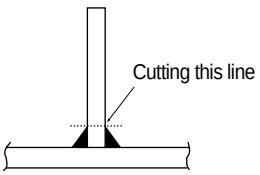


$t_1 \geq t_2$

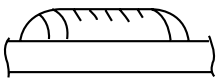
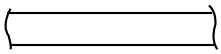
L = 50

ⓓ : In case where it is difficult from structural point of view to open a hole over 300, it is to be welded carefully by low hydrogen electrode after preheating and to be confirmed by non-destructive testing.

9. SURFACE FINISH CONDITION

Section	Area	Scope of staging sockets and lifting eye piece to be removed	Remarks
9-1. Staging sockets	In tank	Not to be removed	•Lifting eye pieces concerned with fatigue strength to be removed. •Method of removing ① Parts of ruining appearance and passages to be flush to base plate. ② Others to be done by gas cutting at the bond zone.  but, the parts being especially important for strength to be soft toe.
	In engine room	Not to be removed, except disturbance to passages or cargo handling	
	In hold	Ditto	
	Exposed parts of shell, upper deck etc.	To be removed	
9-2. Lifting eye piece	In tank	Not to be removed, except disturbance to passages or cargo handling	
	In engine room	Ditto	
	In hold	Ditto	
	Exposed parts of shell, upper deck etc.	To be removed	

Note : The details will be prepared for each project, respectively.

Item	Details	Standard treatment	
		Area	Remarks
9-3. Welding bead for repair of notches		Non-exposed areas (Cargo hold, H.F.O & W.B.tanks, Void, etc.)	Remain welding beads
		Exposed areas	Weld and flush grind off

10. MARKING ON SHIP SIDE

Unit : mm

Item	Details	Standard range	Tolerance limits	Remarks
marking on ship side	Draft marks	±1.0	±2.0	To be checked at marking condition
	Freeboard marks	±0.5	±0.5	

Ⅱ. PAINTING PART

1. PRIMARY SURFACE PREPARATION AND PRE-PRIMING

Item	Details	Standard treatment	
		Grade	Thickness of priming
1-1. Steel plates and sections	Hull structural members of steel thickness 6mm and above	Shot and grit blasting ISO 8501-1-Sa $2\frac{1}{2}$	An average $15 \pm 5\mu m$ dry film thickness of inorganic zinc shop primer.
1-2. Outfitting	Pipes, Supports, Seats, etc	Pickling or Power tooling ISO 8501-1-St 2	No pre-priming shall be applied basically

2. SECONDARY SURFACE PREPARATION

2-1. Surface preparation grade

Grade	Standard
Sa $2\frac{1}{2}$	It shall comply with ISO standard and then correspond in appearance to the photographs designated Sa $2\frac{1}{2}$.
T/UP Sa $2\frac{1}{2}$	Damaged shop primed area and welding line to be treated to Sa $2\frac{1}{2}$. Intact shop primed area shall remain as it is. Any remaining traces of contamination shall show only as slight stains in the form of spots or stripes.
Sa 1	It shall comply with ISO standard and then correspond in appearance to the photographs designated Sa 1.
Pt3	It shall comply with JSRA standard and then correspond in appearance to the photographs designated Pt3.
Pt2	It shall comply with JSRA standard and then correspond in appearance to the photographs designated Pt2.

Abbr.) T/UP : Partial treatment for damaged and rusted spot

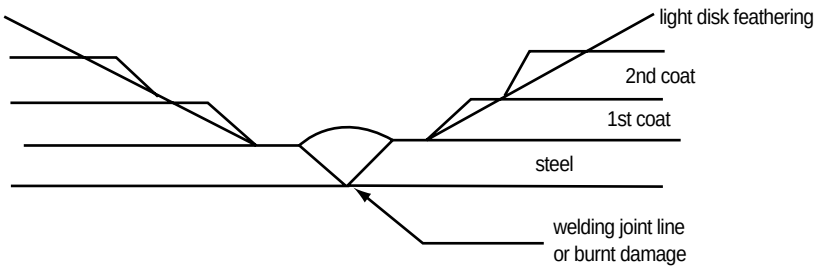
2-2. Standard grade of surface cleaning

Items	Standard
Oil and fat	The remaining traces may be visible
Zinc salt	Irremovable by soft hand touch
Fume by welding or gas cutting	Irremovable by soft hand touch
Chalk marks	To be removed, but the traces removed may be visible
Talc chalk marks	Not to be removed
Marking paints	Marking paints compatible with subsequent coats should not be removed
Other foreign matters	The remaining traces may be visible

2-3. Damaged parts after pre-erection and erection

Details	Standard	
	Grade	Remarks
Rusted, burnt and joint area	Power tooling - Pt2 or Pt3 (JSRA)	In general, surrounding areas to be feathered to ensure adhesion between coats as shown in Fig.
Mechanically damaged area	Light disc-feathering or hand sand-papering	
Intact coating immediately adjacent areas for repair	Feathered with disc or sand -papering.	

Fig.



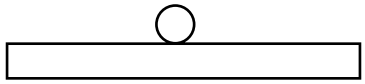
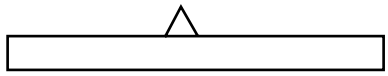
2-4. Preparation of edges and treatment of welding spatter

1) Sharp edge

One pass grinding (1C) shall be applied at hull fabrication shop for Water Ballast Tank, Fresh Water Tank and exposed area.

For other dry space sharp edge shall not be treated to 1C.

2) welding spatters

Unstable spatter		Spatters shall be removed by hand & power tools.
Stable but sharp angle		Sharp angle spatter shall be ground off until the angle becomes obtuse.
Stable and obtuse		Spatter shall be left.

3) Rolled edges

Rolled edges of section shall not be smoothed by mechanical tools.

3. PAINTING

<table>
<tr><th>Items</th><th>Standard</th><th>Remarks</th></tr>
<tr><td>Painting appliance</td><td>Airless spray,
roller and brush</td><td>Airless spray to be adopted mainly, but roller and brush also can be used where they are more suitable</td></tr>
<tr><td rowspan="3">Stripe coat</td><td>All kind of hole and free edge
- to be coated with roller or brush after main coat</td><td>The stripe coating for various tank such as Water Ballast Tank etc shall be applied in accordance with the paint specification.</td></tr>
<tr><td colspan="2">For manual welding or irregular welding line of wet space one time stripe coat shall be applied with roller or brush after or before 2nd coat as below
- Water tight boundary and around frame - all manual welds to be striped
- Other weld bead - rough bead(which cannot be painted properly with airless spray) only to be striped.</td></tr>
<tr><td>Behind angle
- stripe coat shall be applied with roller after or before 2nd coat</td><td>In case of low D.F.T touch up shall be applied.</td></tr>
</table>

4. AMBIENT CONDITION

Items	Standard	Remarks
Ambient condition	Surface temperature - No limitation	In all cases, Limitation on max. or min. surface temperature in the manufacturer's instructions shall be followed (Depend on products)
	Relative humidity - Below 85%	
	Dew point - steel temperature should be 3℃ above dew point	Surface must be free from condensation

5. D.F.T MEASUREMENT

Details	Standard
Dry film thickness	Total Dry Film Thickness specified in the painting specification shall be attained at least 90% of measuring point, and the film thickness on the remaining 10% measuring point shall not be less than 90% of this specified film thickness.
Measuring point	In general, the five (5) separate spot measurements shall be made over every 10㎡ in tanks and for each 20㎡ in other spaces. The average of five (5) separate spot measurements must be within the specified thickness, while single spot measurements are permitted to be 90% of the specified thickness.
Non-measuring areas	No measurement of Dry Film Thickness shall be made on; 1. Machinery and the like and on non-corrosive materials. 2. Outfittings and pipes with nominal diameter of 250mm and below 3. Pipe supports, machinery seats and small fittings 4. Areas within 50mm from edges of painted steel members, welding beads.

6. TIME FOR D.F.T MEASUREMENT

The measurement of Dry Film Thickness shall be carried out in accordance with the following table.

〈Standard for measuring of Dry Film Thickness〉

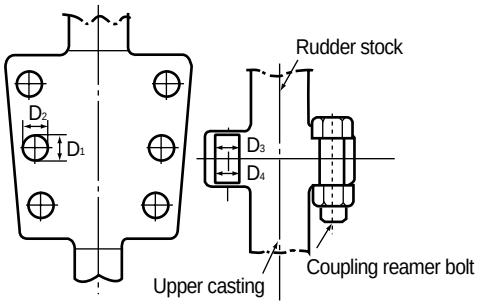
Kind of Paint / Time / Area		Epoxy		Alkyd or other conventional paint
		After A/C paint	After final coating	After A/C paint
Bottom shell		0	0	-
Side shell		0	0	-
Exposed part		0	-	-
Various tank		-	0	-
Accommodation	out	0	-	-
E/ casing	in	-	-	*0
E/ Room, Void, Cofferdam and Dry space		-	-	*0

* In E/R, void, cofferdam and dry space, D.F.T will not be checked always. Only painting condition will be inspected to ensure no bare steel or holiday.

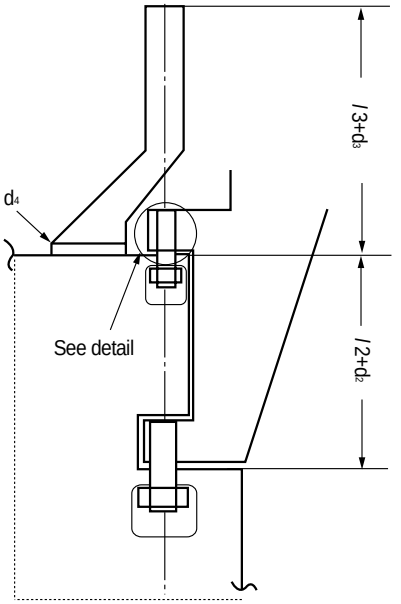
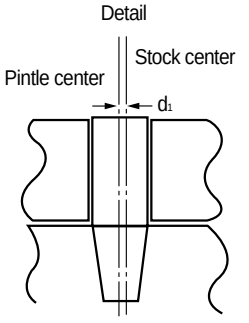
Ⅲ. OUTFITTING PART

1. MAIN MACHINERY

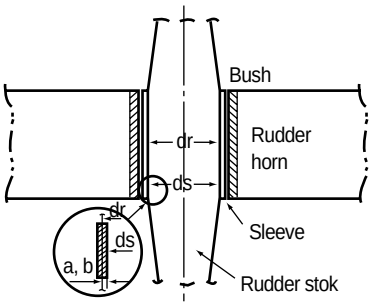
Unit : mm

Section	Item	Standard range	Tolerance limits
1-1. Rudder	1-1-1. Centering		
	a. Diameter of piano wire	0.4~0.7	
	b. Tension of piano wire	50kg	±5kg
	c. Tolerance between shaft & rudder centers	≤8	
	1-1-2. Boring		
	a. Eccentricity of rudder horn (upper, lower gudgeon) after boring	≤0.05	
1-2. Steering system	1-2-1. Rudder upper casting & rudder stock		
	a. Reamer bolt size & hole size		
	a-1 : Roundness $\lvert D_1-D_2 \rvert$	≤0.01	
	a-2 : Difference $\lvert D_3-D_4 \rvert$ (Top diameter to bottom diameter)	≤0.02	
	a-3 : Interference $D=D_b-D_h$	$0.005 \le D \le 0.015$	
	D_b : Bolt diameter		
	D_h : Hole diameter		
			

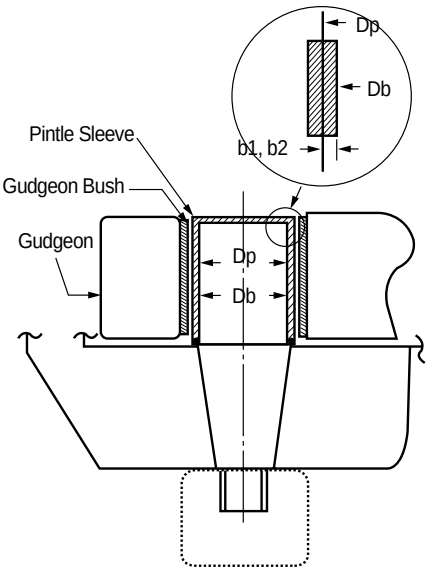
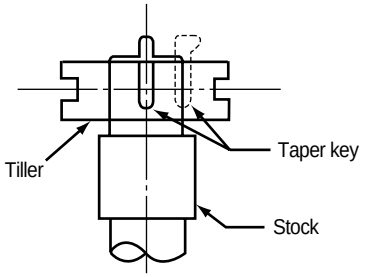
Unit : mm

Section	Item	Standard range	Tolerance limits
1-2. Steering system	1-2-2. Jointing		
	a. Contact area ratio(between rudder and stock)	$\geq 70\%$	
	b. Over set(pintle center to stock center)	$d_1 \leq 0.3$	≤ 0.5
	c. Length of rudder stock	$d_3 = \pm 3$	
	d. Length of rudder	$d_2 = \pm 5$	
	e. Total length of rudder with stock	± 5	
	f. Gap(stock palm and rudder after tightening of reamer bolt)	$d_4 \leq 0.04$	Clearance within 10mm depth can be allowed.
			
			

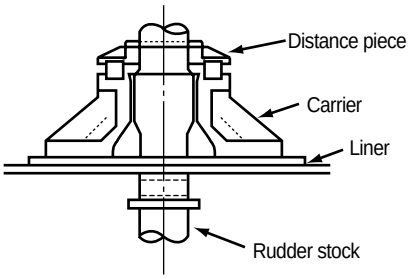
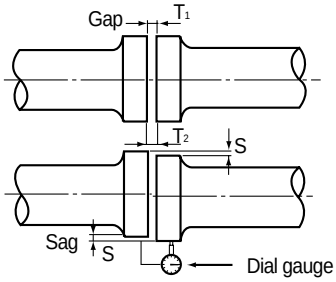
Unit : mm

Section	Item	Standard range	Tolerance limits
1-2. Steering system	1-2-3. Sleeve on rudder stock a. "SUS" sleeve(interference) dr-ds=a b. "BC" sleeve(interference) dr-ds=b Where, dr : stock outer diameter ds : sleeve inner diameter  	$a=\frac{(5\sim10)dr}{10,000}$ $b=\frac{(10\sim20)dr}{10,000}$	
	1-2-4. Pintle a. Contact area ratio on taper cone part b. Interference between pintle and sleeve b_1 : "SUS" sleeve Dp-Db b_2 : "BC" sleeve Dp-Db Where, Db : Sleeve inner diameter Dp : Pintle outer diameter	$\geq 70\%$ $b_1=\frac{(5\sim10)Dp}{10,000}$ $b_2=\frac{(10\sim20)Dp}{10,000}$	

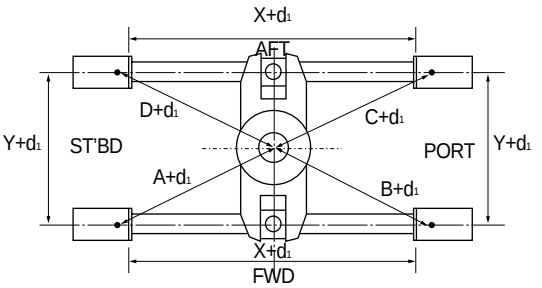
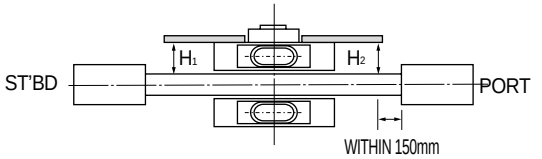
Unit : mm

Section	Item	Standard range	Tolerance limits
1-2. Steering system	1-2-4. Pintle DWG. 		
	1-2-5. Gudgeon bush(interference) a. "BC", "SUS" sleeve Dh-Dg b. Lignumvitae or phenol resin Dh-Dg Dh : Bush outer diameter Dg : Gudgeon inner diameter	 0.05* 0.05*	 * To be in accordance with maker's instruction.
	1-2-6. Rudder stock and rudder tiller a. Clearance of taper key 	 0.005~0.015	

Unit : mm

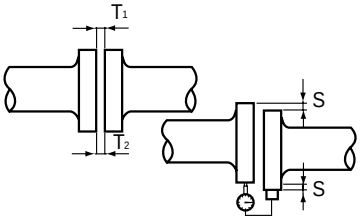
Section	Item	Standard range	Tolerance limits
1-2. Steering system	1-2-7. Installation of rudder carrier and stuffing box		
	a. Liner contact area(ratio)	$\geq 60\%$	
	b. Clearance between carrier and liner after bolt tightening	≤ 0.05	
			
	1-2-8. Ram cylinder type(steering gear)		
	a. Reamer bolt fitting Db-Dh Db : Bolt outer diameter Dh : Hole inner diameter	$0.005 \leq D \leq 0.015$	
	b. Liner(top liner & chock liner) Clearance after bolt tightening	< 0.06	
	c. Ram cylinder installation horizontal level and distortion d_1 : Clearance of ram cylinder	$\leq 0.07 d_1$	
	d. Coupling's alignment of hyd. oil pump		
	• Gap(face) $\lvert T_1 - T_2 \rvert$	≤ 0.05	Maker's standard
	• Sag(circum.) S	≤ 0.05	
			

Unit : mm

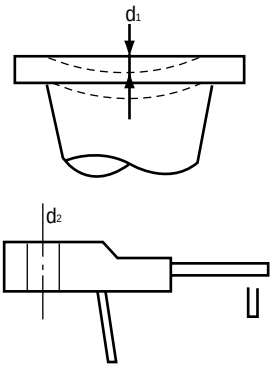
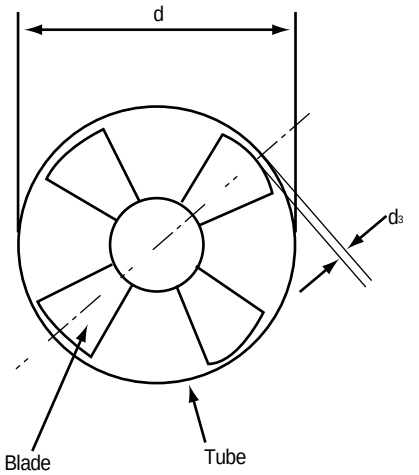
Section	Item	Standard range	Tolerance limits
1-2. Steering system	1-2-9. Rotary vane type(steering gear)		
	a. Taper part of rudder stock and steering gear boss		
	• Ratio of contact area	≥ 70%	
	b. Travel length of force fitting	*	* According to maker's recommen-dation
	c. Coupling's alignment(solid type) of hyd. oil pump		
	• Gap(face) | T1-T2 |	≤ 0.05	Maker's standard
	• Sag(circum) S	≤ 0.05	
	1-2-10. Alignment of steering gear		
		d1 ≤ 1	d1 ≤ 2
		| H1-H2 | ≤ 0.08	| H1-H2 | ≤ 0.15
	1-2-11. Main engine installation		
	1. Contact ratio ─ Main engine chock liner	≥ 70%	≥ 60%
	1. Contact ratio ─ Bearing chock liner	≥ 60%	≥ 50%
	2. Clearance between liner and base (After holding down bolt tightening)	≤ 0.04	

2. AUXILIARY MACHINERY

Unit : mm

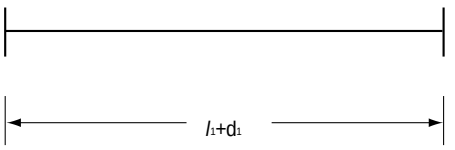
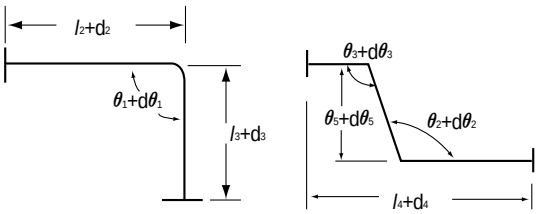
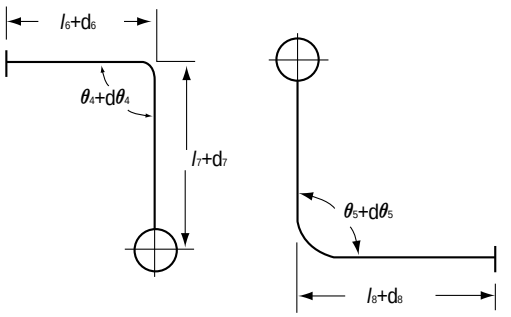
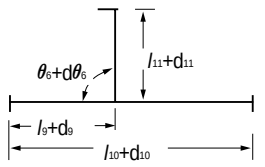
Section	Item	Standard range	Tolerance limits
2-1. Aux. machinery	2-1-1. Auxiliary machinery(E/R.DK) Installation of aux. machinery shall be carried out in accordance with the following three grades. Feeler guage measurement between seat & machine shall be carried out after tightening of holding down bolts. (1) Grade "A" : Diesel generator, Turbo generator, Shaft generator, Inter shaft bearing, Windlass. (2) Grade "B" : Fresh water pump, Cooling water pump, Fire pump, Fuel oil pump, Ballast pump, Lub oil pump, Bilge & General service pump, Emergency diesel & fire pump, Emergency diesel generator, Air compressor, Cargo pump & motor & turbine. (3) Grade "C" : Other machinery which are not listed "Grade A" and "Grade B". - Tightness of holding down bolts shall be checked by hammering after installation completed.	≤0.04 ≤0.05 -	The feeler gauge of standard thickness should not be inserted more than 10mm -
2-2. General aux. pumps	2-2-1. Coupling alignment of aux. pumps (solid type) 		

Unit : mm

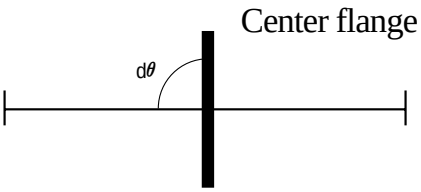
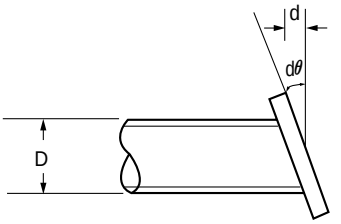
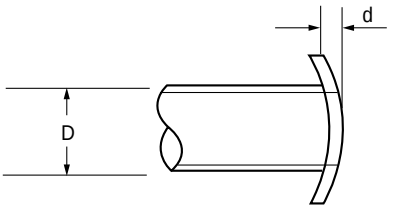
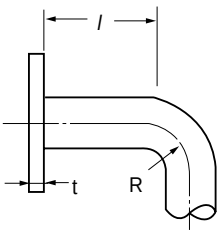
Section	Item	Standard range	Tolerance limits
	a. Gap(face) $\lvert T_1-T_2 \rvert$	± 0.05	Maker's standard
	b. Sag(circum) S	± 0.05	
2-3. Bow thruster (If any discrepancy is found between the SSQS and maker's standard, the maker's standard shall prevail.)	2-3-1. Installation of shaft		
	a. Plane of flange d_1	$d_1 \leq 0.4$	-
	b. Difference of bolt hole on flange d_2	$d_2 \leq 0.6$	-
			
	2-3-2. Clearance between tube and blade		
		$d_3 \geq \frac{d}{600}$	-

3. PIPING

Unit : mm

Section	Item	Standard range	Remarks
3-1. Pipe fabrication	3-1-1. Cutting, bending & etc. a. Straight pipe	$d_1 = \pm 2$	1. l_1, l_2… Indicated length on the drawing
			
	b. Bending pipe		2. θ_1, θ_2… Indicated angle on the drawing
		$d_2 = \pm 2$ $d_3 = \pm 2$ $d_4 = \pm 2$ $d_5 = \pm 2$	
			
		$d\theta_1 = \pm 1°$ $d\theta_2 = \pm 1°$ $d\theta_3 = \pm 1°$	3. d_1, d_2… Tolerance between Indicated length on the drawing and actually made one
	(Two directional bending)	$\lvert \theta_2 - \theta_3 \rvert \leq 2°$	
			
		$d_6 = \pm 2$ $d_7 = \pm 2$ $d_8 = \pm 2$ $d\theta_4 = \pm 1°$ $d\theta_5 = \pm 1°$	4. $d\theta_1$, $d\theta_2$… Tolerance between angle on the drawing and actually made one
	(Three directional bending)		
	c. Branch pipe		
		$d_9 = \pm 2$ $d_{10} = \pm 2$ $d_{11} = \pm 2$ $d\theta_6 = \pm 1°$	

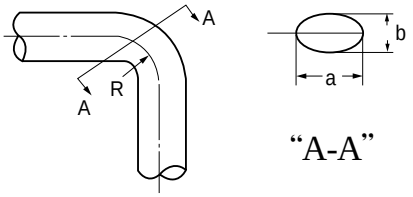
Unit : mm

Section	Item	Standard range	Remarks
3-1. Pipe fabrication	d. Penetration piece 	dθ ≤ ±0.5°	
	3-1-2. Fitting of flange a. Angle of flange to pipe 	-d ≤ max.2 dθ ≤ ±0.5°	D : Pipe normal diameter
	b. Bending of flange 	a) d ≤ 1.5 when D ≥ 500 b) d ≤ 1.0 when 200 ≤ D<500 c) d ≤ 0.5 when D<200	d:Bend dimension
	c. Distance between flange and bending area 	l ≥ t R ≥ 2D	
	Note : Elbow piece can be connected to the flange directly		

Unit : mm

<table>
<tr><th>Section</th><th>Item</th><th>Standard range</th></tr>
<tr><td>3-1.
Pipe
fabrication</td><td>3-1-3. Transformation by bending

a. Ellipticity (E)

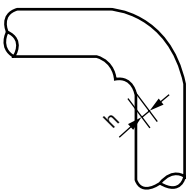
“A-A”

∗ $E = \frac{|a - b|}{D} \times 100\%$

∗ $B = \frac{t - t_1}{t} \times 100\%$

where D : Outer diameter of pipe
B : Thickness reduction ratio
t : Original pipe thickness
t_1 : Thickness after bending
R : Bending radius
a : Large diameter
b : Small diameter

b. Wrinkle

where,
h : Wrinkle height
D : Outer diameter of pipe</td><td>$E \leq 10\%$

∗ In accordance with class rule requirement

B : As below

Steel pipe bending

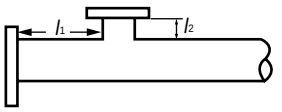
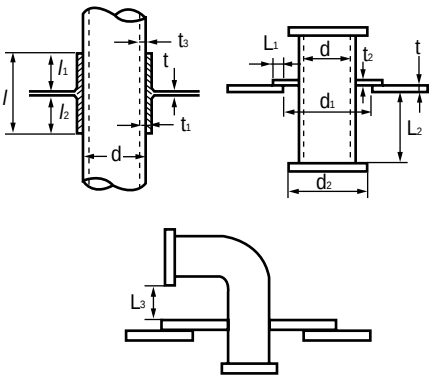
<table>
<tr><th>Radius</th><th>Hot bend</th><th>Cold bend</th></tr>
<tr><td>$R \leq 2D$</td><td>$B \leq 15\%$</td><td>$B \leq 25\%$</td></tr>
<tr><td>$2D < R \leq 3D$</td><td>$B \leq 10\%$</td><td>$B \leq 20\%$</td></tr>
<tr><td>$R > 3D$</td><td>$B \leq 5\%$</td><td>$B \leq 15\%$</td></tr>
</table>

Copper pipe bending

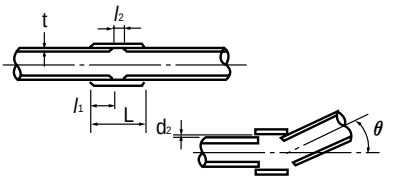
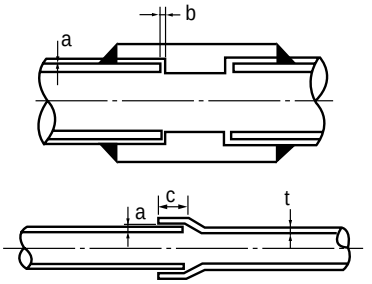
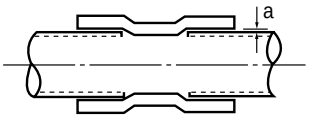
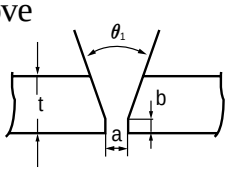
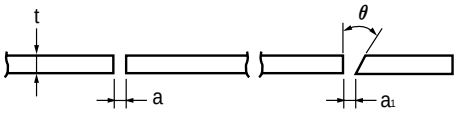
<table>
<tr><th>Radius</th><th>Hot bend</th><th>Cold bend</th></tr>
<tr><td>$R \leq 2D$</td><td>$B \leq 20\%$</td><td>$B \leq 30\%$</td></tr>
<tr><td>$2D < R \leq 3D$</td><td>$B \leq 15\%$</td><td>$B \leq 20\%$</td></tr>
<tr><td>$R > 3D$</td><td>$B \leq 10\%$</td><td>$B \leq 15\%$</td></tr>
</table>

$h < 2$</td></tr>
</table>

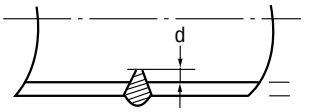
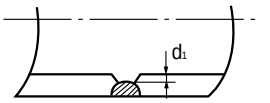
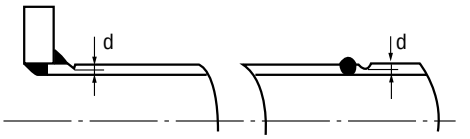
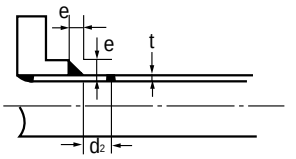
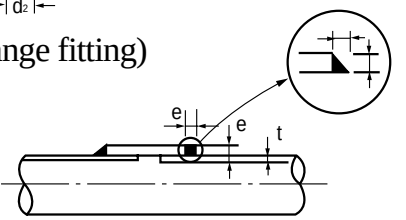
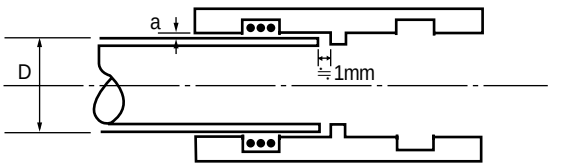
Unit : mm

Section	Item	Standard range	Remarks
3-1. Pipe fabrication	3-1-4. Distance beween the flange and the branch pipes 	$l_1 \geq 30$ $l_2 \geq 30$	l_2 : Distance between flange face and the pipe surface can be reduced in unavoidable situation.
	3-1-5. Fitting of penetration piece 	l =100 when d≤65 l =150 when d≥80 l =200 when d≥550 l_1, $l_2 \geq 15$ t_2=12when t≤12 t_2=15when 12<t<15 t_2=20when t≥15 $t_1 \geq t_3$ $L_1=30\pm5$ when d≤100 $L_1=40\pm5$ when 125≤d≤500 $L_1=50\pm5$ when d≥550 $d_1=d_2+10$ $L_2 \geq 50$ $L_3 \geq 25$	d:Pipe nominal diameter

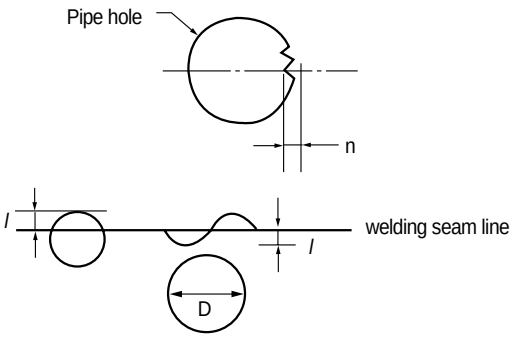
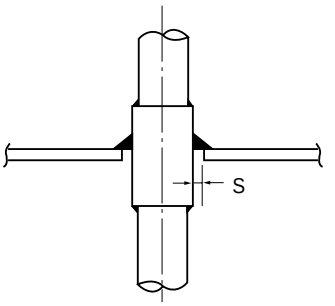
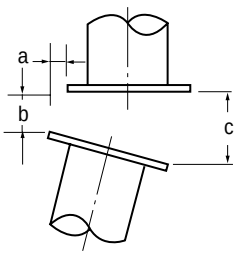
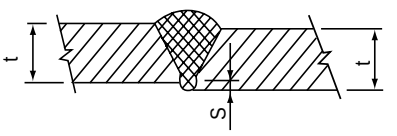
Unit : mm

Section	Item	Standard range	Remarks
3-1. Pipe fabrication	3-1-6. Sleeve welding Joint  	L ≥ 50 $l_1 \geq 9.5$ when D ≤ 65 $l_1 \geq 25$ when D ≥ 80 $l_2 \geq 2$ $d_2 \leq 2.0$ $\theta < 3°$	
	3-1-7. Socket welding Joint  	a ≤ 0.8 b ≤ 1.5	
	3-1-8. Solder brazing Joint (Silver brazing)  	0.05 ≤ a ≤ 0.15	
	3-1-9. Welding a. Weld groove  (Grade Ⅰ pipe)  (Grade Ⅱ, Ⅲ & others)	a=3±0.5 b=1.6±0.8 θ_1=60°±5° t<4.8:a<2.0 t≥4.8:a=1~4 a_1=0~2 $\theta \geq 30°$	Grade of pipes will be decided according to the concerned class rules.

Unit : mm

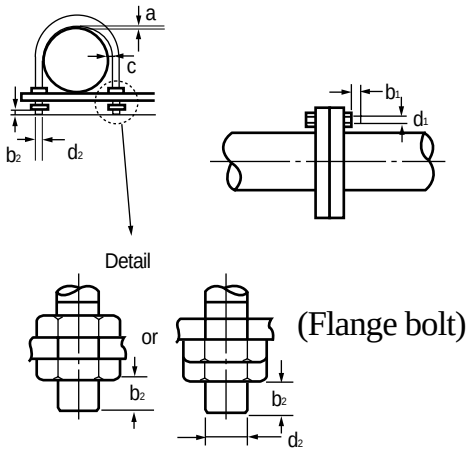
Section	Item	Standard range	Remarks
3-1. Pipe fabrication	b. Back bead of weld	Class Ⅰ, Ⅱ pipe	
	 (Class Ⅰ, Ⅱ)	pipe thickness (t, mm) / back height (d, mm) $t \leq 6$ / $d \leq 1.5$ $6 > t$ / $d \leq 3.0$	
	 (Class Ⅲ, other pipe)	Class Ⅲ pipe & others $d_1 \leq 0.5$	
	c. Undercut of weld		
		$d \leq 0.5$	
	d. Leg length of weld		In accordance with design practice
	 (Flange fitting)	$e \geq t$ $d_2 \geq 5$	
	 (Sleeve jointing)	$e \geq t$	In accordance with design practice
	3-1-10. Al-brass brazing joint		
		when D=10~40 $0.05 \leq a \leq 0.08$ max. a=0.15 when D=50~100 $0.05 \leq a \leq 0.1$	

Unit : mm

Section	Item	Standard range	Remarks
3-2. Pipe fitting	3-2-1. Pipe hole cutting & penetration a. Hole cutting finishing  b. Pipe penetration  3-2-2. Alignment a. flange  b. pipe and Fittings 	Holes on the main structure $n \leq 0.8$ Holes not on the main structure $n \leq 1.5$ l=0.1D (min. 50) $s \leq 5$ $a \leq 2$ $c-b \leq 2$	Only one side welding to be applied except upp. Deck, Tank BHD & Fore/ Aft BHD.

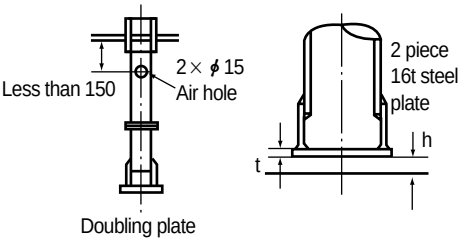
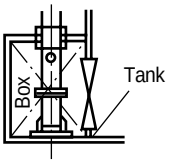
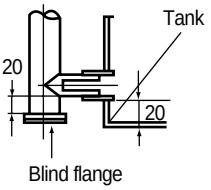
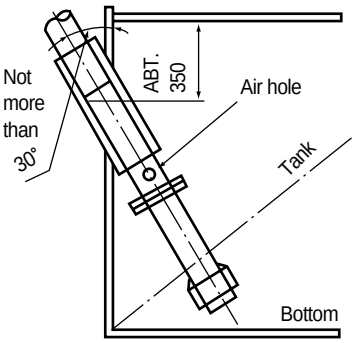
pipe indiameter (D, mm)	pipe thickness (t, mm)	internal misalignment (S, mm)
D<150	t ≤ 6	Smaller value of S ≤ 1 or t/4
150 ≤ D<300	t ≤ 9.5	Smaller value of S ≤ 1.5 or t/4
300 ≤ D or 9.5 < t		Smaller value of S ≤ 2.0 or t/4

Unit : mm

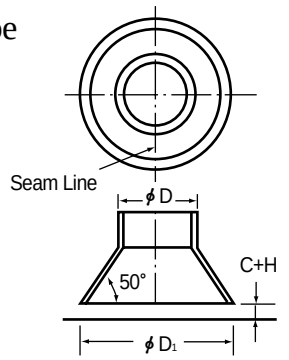
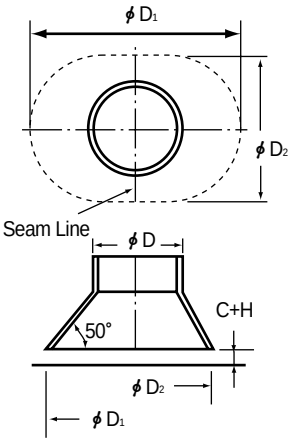
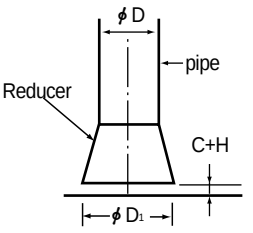
<table>
<tr><th>Section</th><th>Item</th><th>Standard range</th><th>Remarks</th></tr>
<tr>
<td>3-2.
Pipe
fitting</td>
<td>3-2-3. Bolting
 

(Flange bolt)
(“U” bolt)
3-2-4. Distance between bands of supports
<table>
<tr><th>Pipe nominal dia:A</th><th>Max. distance</th><th>Pipe nominal dia:A</th><th>Max. distance</th></tr>
<tr><td>10</td><td>1.4m</td><td>125</td><td>4.5m</td></tr>
<tr><td>15</td><td>1.6m</td><td>150</td><td>5.0m</td></tr>
<tr><td>20</td><td>1.8m</td><td>200</td><td>5.0m</td></tr>
<tr><td>25</td><td>2.1m</td><td>250</td><td>5.5m</td></tr>
<tr><td>32</td><td>2.4m</td><td>300</td><td>6.0m</td></tr>
<tr><td>40</td><td>2.6m</td><td>350</td><td>6.0m</td></tr>
<tr><td>50</td><td>2.8m</td><td>400</td><td>6.0m</td></tr>
<tr><td>65</td><td>3.2m</td><td>500</td><td>7.0m</td></tr>
<tr><td>80</td><td>3.5m</td><td>600</td><td>7.0m</td></tr>
<tr><td>100</td><td>4.0m</td><td>700</td><td>7.0m</td></tr>
</table>
Above standard distance will be adopted as working guideline that is, the distance can be increased depending on the actual installation condition.</td>
<td>* $b_1 \leq \frac{d_1}{2}$
* $b_2 \leq \frac{d_2}{2}$
$a \leq 2$
$0 \leq c \leq 2$</td>
<td>* Marked standard will be adopted as working guideline</td>
</tr>
</table>

Unit : mm

Section	Item	Standard range	Remarks
3-2. Pipe fitting	3-2-5. Sounding pipe a. Straight type  b. Special type b-1. Box type  b-2. Elbow sounding  b-3. Bow sounding type 	t=15 h=20±5	

Unit : mm

Section	Item	Standard range	Remarks
3-2. Pipe fitting	3-2-6. Suction bellmouth A-type  	H = ±10 H = ±5	Main line Stripping line
	B-type  	H = ±10 H = ±5	Main line Stripping line
	C-type  	H = ±5	

Unit : mm

<table>
<tr><th>Section</th><th>Item</th><th>Standard range</th><th>Remarks</th></tr>
<tr><td>3-2.
Pipe
fitting</td><td>a. A-type
<table>
<tr><th rowspan="2">Nominal dia</th><th colspan="2">Bellmouth Dimension</th><th rowspan="2">C</th></tr>
<tr><th>D</th><th>D1</th></tr>
<tr><td>80</td><td>89.1</td><td>200</td><td>15</td></tr>
<tr><td>100</td><td>114.3</td><td>275</td><td>20</td></tr>
<tr><td>125</td><td>139.8</td><td>400</td><td>20</td></tr>
<tr><td>150</td><td>165.2</td><td>450</td><td>25</td></tr>
<tr><td>200</td><td>216.3</td><td>550</td><td>35</td></tr>
</table>
b. B-type
<table>
<tr><th rowspan="2">Nominal dia</th><th colspan="3">Bellmouth Dimension</th><th rowspan="2">C</th></tr>
<tr><th>D</th><th>D1</th><th>D2</th></tr>
<tr><td>250</td><td>276.4</td><td>675</td><td>400</td><td>50</td></tr>
<tr><td>300</td><td>318.5</td><td>860</td><td>550</td><td>50</td></tr>
<tr><td>350</td><td>355.6</td><td>865</td><td>550</td><td>80</td></tr>
<tr><td>400</td><td>406.4</td><td>1000</td><td>600</td><td>80</td></tr>
<tr><td>450</td><td>457.2</td><td>1170</td><td>600</td><td>100</td></tr>
<tr><td>500</td><td>508.6</td><td>1240</td><td>750</td><td>100</td></tr>
<tr><td>550</td><td>558.3</td><td>1410</td><td>750</td><td>120</td></tr>
</table>
c. C-type
<table>
<tr><th rowspan="2">Nominal dia</th><th>Bellmouth Dimension</th><th rowspan="2">C</th></tr>
<tr><th>D × D1</th></tr>
<tr><td>40</td><td>40 × 65</td><td>15</td></tr>
<tr><td>50</td><td>50 × 80</td><td>15</td></tr>
<tr><td>65</td><td>65 × 100</td><td>20</td></tr>
<tr><td>80</td><td>80 × 125</td><td>25</td></tr>
<tr><td>100</td><td>100 × 150</td><td>35</td></tr>
<tr><td>125</td><td>125 × 200</td><td>40</td></tr>
<tr><td>150</td><td>150 × 250</td><td>45</td></tr>
<tr><td>200</td><td>200 × 300</td><td>65</td></tr>
</table></td><td>H = ± 10
H = ± 5

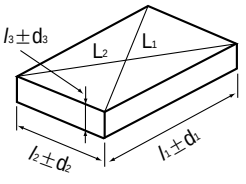
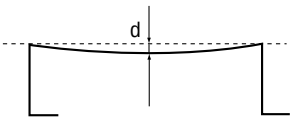
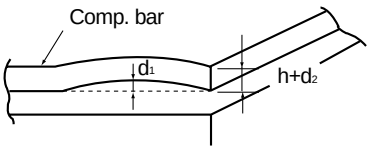
H = ± 10
H = ± 5

H = ± 5</td><td>Main line
Stripping line

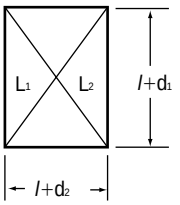
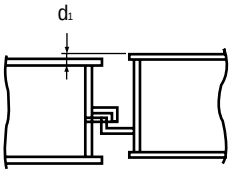
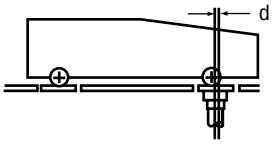
Main line
Stripping line</td></tr>
</table>

4. SHEET METAL OUTFITTING

Unit : mm

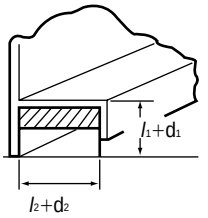
Section	Item	Standard range	Remarks
4-1. Hatch cover	4-1-1. Hatch cover		
	 a. Length deviation d_1	$d_1, d_2 \pm (3+\frac{4}{10,000}L)$	
	b. Width deviation d_2		
	c. Height deviation d_3	± 3	
	d. Diagonal deviation $\lvert L_1-L_2 \rvert$	≤ 10	
	4-1-2. Deflection		
		± 4	
	4-1-3. Fitting dimension of compression bar		
			
	a. Distance from center line d_1	± 5	
	b. Compression bar level d_2	± 4	

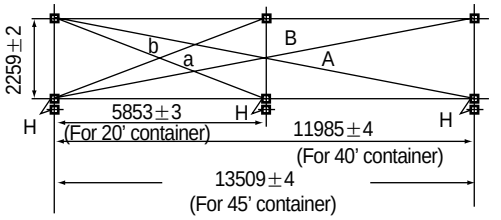
Unit : mm

Section	Item	Standard range	Remarks
4-1. Hatch cover	4-1-4. Hatch coaming		
	 1) Dimension		
	a. Length deviation d_1	±10	
	b. Width deviation d_2	±10	
	c. Diagonal deviation $\lvert L_1-L_2 \rvert$	≤15	
	2) Level of top plate deviation	±3	
	4-1-5. Inter-connection		
			
	a. Alignment of top plates deviation d_1	≤5	
	4-1-6. Position of jack head		
			
	a. Off-set(wheel & jack center line) : d	±5	

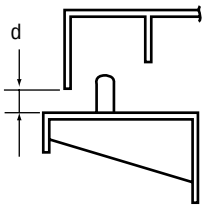
Unit : mm

<table>
<tr><th>Section</th><th>Item</th><th>Standard range</th><th>Remarks</th></tr>
<tr><td>4-1.
Hatch
cover</td><td>4-1-7. Water tight structure

a. Packing gutter(height) deviation d_1
b. Packing gutter(width) deviation d_2
 

4-1-8. Dimension for container loading
(typical for on deck)
 

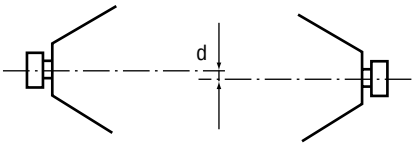
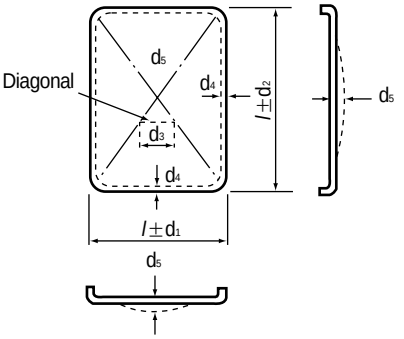
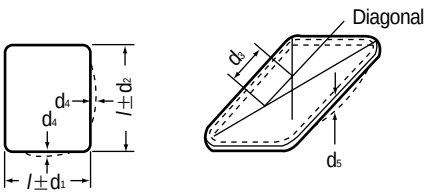
<table>
<tr><th>No</th><th>Measuring point</th><th>Allowable tolerance</th></tr>
<tr><td>1</td><td>｜a-b｜</td><td>≤6</td></tr>
<tr><td>2</td><td>｜A-B｜</td><td>≤8</td></tr>
<tr><td>3</td><td>The level differential of sockets for a container</td><td>±3</td></tr>
</table>

4-1-9. Gap between H/Coaming and
H/Cover skirt plate(Non packing type)
 
</td><td>±2
±1

4≤d≤20</td><td>

Maker's recommend-ation</td></tr>
</table>

Unit : mm

Section	Item	Standard range	Remarks
4-1. Hatch cover	4-1-10. Level difference of two balanced roller 	d≤5	
4-2. Steel door	4-2-1. Water tight door body		
	a. Tolerance of width or height d_1, d_2	≤5	
	b. Difference between diagonals d_3	≤5	
	c. Straightness of side and deviation d_4	≤5	
	d. Deflection d_5	≤5	
			
	4-2-2. Small type steel hatch cover		
	a. Height deviation d_1	0~+10	
	b. Width or length deviation d_2	≤5	
	c. Difference between diagonals d_3	≤5	
	d. Straightness deviation d_4	≤5	
	e. Deflection d_5	≤5	
			

PART B. SCOPE OF INSPECTION

ABBREVIATION

Witnessed by

C : Class surveyor
O : Owner supervisor
Q : Q.A inspector
M : Maker supervisor

Ⅰ. HULL

No	Inspection Items		In Shop				On Board				Remarks
			C	O	Q	R	C	O	Q	R	
1	Sub-assembly block inspection including leak test				○	○					In accordance with approved inspection & Test Plan
2	Block & P.E block Inspection including leak test for hull structure below super-structure deck		○	○	○						
3	Block & P.E block Inspection for Deck house & Funnel			○	○						
4	Erection joints inspection for hull structure below super-structure deck						○	○	○		
5	Erection Joints Inspection for Deck house & Funnel						○	○	○		
6	Rudder	Construction	○	○	○						
		Air Test									
7	Air and/or tank strength test for hull tanks		○	○	○		○	○	○		In accordance with approved Tank Test Plan
8	Non-Destructive Test (NDT)					○				○	In accordance with approved NDT Plan
9	Keel Sighting before Launching								○	○	
10	Measurement of Hull Dimension						○	○	○	○	
11	Confirmation of Hull Marking	Freeboard					○		○		Marking condition
		Draft					○	○	○		
		Ship name & Funnel mark		○	○			○	○		
		BHD. Mark		○	○			○	○		
12	Bottom Survey before launching						○	○	○		
13	Inclining Experiment/Dead weight measurement						○	○	○	○	According to I/E scheme

Ⅱ. HULL OUTFITTING

Inspection Items	Maker's Shop		On Board		Remarks
	C	O	C	O	
1. Anchor & chains					
Verification			○	○	
2. Cargo gear & rigging arrangement					
1) Crane & davit					* If cargo gear book requested
Operation & load test	○	○	○*	○	1.0 ton S.W.L, and over
2) Small davits				○	
Operation					
3. Hatch, door, window, etc.	○*				* Class A or B side scuttle
Hose test/Chalk test			○*	○	According to load line regulation
4. Ladder					
1) Accommodation ladder					
Proof load test	○		○*		* If authority
Operation				○	requested
2) Pilot ladder					
Construction	○				
Operation			○	○	Authority for safety equipment certificate.
5. Life saving & fire fighting equipment					SOLAS item
1) Lifeboat & davit					
Load test	○	○	○	○	
Equipment check	○		○	○	
2) Other life saving equipment					
Confirmation	○		○	○	
3) Rescue boat launching test with ship speed at least 5knot			○		
4) Fire fighting system					
Confirmation & testing			○	○	
5) Fire damper & Fire stop					
install. with operation.			○	○	
6) E/R local fire fighting sys. testing			○	○	

Inspection Items	Maker's Shop		On Board		Remarks
	C	O	C	O	
6. Ventilation			○*	○	* If crew accommodation cert. Required from CLASS.
1) Air conditioning system Volume check in cabin					
2) Mechnical ventilation volume check			○	○	
7. Accommodation facilities					
1) A-60 Insulation and draft stop.			○	○	Cable and duct penetration shall be confirmed.
2) Galley & laundry equipment operation				○	
8. Deck machinery					
1) No load test	○	○		○	
2) Windlass load test			○	○	At sea trial.
3) Auto tension system operation				○	If applied.
9. Others					
1) Tank level gauge function				○	
2) Draft reading gauge function				○	
3) Loading instrument function			○	○	
4) Anti heeling system function				○	
10. Cargo hatch cover					
1) Hose test			○	○	
2) Operation test				○	
11. Side thruster					
1) Blade gap check				○	
2) Seal leak test				○	

Ⅲ. MACHINERY

Inspection Items	Maker's Shop		On Board		Remarks
	C	O	C	O	
1. Shafting					
1) Light beam alignment for shafting			○	○	Case by case
2) Force fitting of stern bush			○	○	
3) Force fitting of propeller			○	○	
4) Check of stern clearance			○	○	By weardown gauge
5) Leak test of stern sealing			○	○	
6) Stern tube L.O system flushing condition				○	
7) Coupling bolt fitting				○	
8) Shaft jack-up test			○	○	
9) Inter/Propeller shaft final inspection	○				
10) Propeller shaft with Propeller contact	○				
11) Propeller final machining	○				
12) Stern boss/Rudder horn casting final	○				
2. Main engine					
1) Condition check of chock liners or fast			○	○	
2) Holding down bolt tightness check (Before & After sea trial)			*	*	* Record to be submitted.
3) Crank shaft deflection (Cold & Hot)			○	○	
4) Flushing condition of L.O system				○	
5) Safety device function test	○	○	○	○	According to the approved drawing
6) Piston alignment	○	○			
7) Mooring trial			○	○	
8) Shop test	○	○			One set only
9) Overhaul inspection	○	○	○	○	
10) Starting test			○	○	

Inspection Items	Maker's Shop		On Board		Remarks
	C	O	C	O	
3. Auxiliary boiler					
1) Hydro test	○	○			
2) Safety device test			○	○	
3) Accumulation test			○	○	
4. Economizer					
1) Hydro test	○				
2) Safety valve setting			○	○	
5. Generator engine					
1) Crank shaft deflection(Hot condition)			○*	○*	* Record to be submitted.
2) Safety device test	○	○	○	○	
3) Shop test	○	○			
4) Overhaul inspection after shop trial	○	○			
6. Air compressor & air tanks					
1) Tank hydro test	○				
2) Safety device test	○		○	○	
3) Automatic control test				○	
5) Air charging test			○	○	
7. Cargo turbine/pump & water ballast pump					
1) Safety device test	○		○	○	* Record to be submitted.
2) Capacity check			○*	○	
8. Stripping pump					
1) Operating test			○	○	
9. Tank cleaning system (machine, heater, pump) Operating test				○	
10. ODME Function test			○	○	
11. Steering gear					
1) Pipe piece/Actuator hydro test	○	○			

Inspection Items	Maker's Shop		On Board		Remarks
	C	O	C	O	
2) Safety valve setting			○	○	At sea trial
3) Operation test			○	○	
4) Installation			○	○	
12. Air-con & refrigerator, provision plant					
1) System vacuum test				○	
2) Safety device test				○	At sea trial
3) Running test				○	
13. Oily water seperator					
Safety device function			○	○	
14. Incinerator					
Safety device function	○		○	○	
15. Emergency fire pump					
1) Shooting test			○	○	* If engine driven
2) Running test(4hrs)			○*	○*	
16. Sewage treatment unit					
Operating & safety device test			○	○	
17. Bilge suction test					
(E/R, Hold, Pump Room)			○	○	
18. F.O/L.O/D.O Purifier					
1) Running test		○			
2) Automatic control test				○	
3) Safety device test				○	
19. Engine room crane					
1) Operation test			○	○	
2) Load test	○	○	○*	○	* 1.0 ton S.W.L, and over
20. Quick closing valve for oil tank					
Operation test			○	○	

Inspection Items	Maker's Shop		On Board		Remarks
	C	O	C	O	
21. Inert gas generating system					
1) Safety device function			○	○	
2) Blower capacity test			○	○	By pitot tube
22. Power pack for hydro oil system					
Safety device function	○		○	○	
23. C.P.P system					
1) Pipe flushing & hydro test			○*	○	* Hydro test for class Ⅰ & Ⅱ grade pipes
2) Safety device function			○	○	
3) Operating					
-Pitch control(remote & manual)			○	○	
-Pump operating				○	
24. Personnel lift(elevator)					
Safety & operating test			○*	○	* If certificate requested at contract stage
25. Rudder					
1) Stock final, machining/NDT	○				Case by case
2) Pintle/neck bush fitting	○	○	○	○	Case by case
3) Force fitting of pintle/stock	○	○	○	○	
4) Stock/bearing clearance check			○	○	
6) Tiller fitting			○	○	
7) Jumping stopper clearance check			*	*	* Record to be submitted
8) Contact area between rudder stock & tiller	○				
26. Workshop machinery					
Operation test				○	
27. Ship side V/V operation			○	○	
28. Hydraulic power pack for remote control valves					

Inspection Items	Maker's Shop		On Board		Remarks
	C	O	C	O	
1) Safety device test	○		○	○	
2) V/V operation test			○	○	

Ⅳ. PIPING

Inspection Items	In Shop		On Board		Remarks
	C	O	C	O	
1. Steam line					
1) Installation inspection			○	○	Class Ⅰ & Ⅱ grade
2) Hydrostatic test	○	○	○	○	pipes shall be hydro test/ NDT in shop
2. Air line					or onboard to meet
1) Installation inspection			○	○	the class rule
2) Hydrostatic test	○	○	○	○	requirements.
3. Feed water line for boiler					
1) Installation inspection			○	○	
2) Hydrostatic test	○	○	○	○	
4. Heating coil in tanks					Application for the
Hydrostatic test or air test			○	○	installation inspection will not
5. F.O supply lines					be prepared.
1) Installation inspection			○	○	
2) Hydrostatic test	○	○	○	○	
6. F.O transfer line air test or hydro test			○	○	
7. Cargo line, Stripping line, Tank cleaning line, Crude oil washing line					
1) Installation inspection			○	○	
2) hydrostatic test			○	○	
8. Main engine L.O line, stern tube L.O line, Camshaft L.O line flushing				○	
9. Pipe line in living quarter Flooding or leak test				○	
10. OX/AC line Leak test with installation inspection			○	○	

Ⅴ. ELECTRIC

Inspection Items	Maker's Shop		On Board		Remarks
	C	O	C	O	
1. Main generator					
1) Shop test	○	○			
2) Insulation resistance test (Cold & Hot condition)			○*	○*	* Record to be submitted
3) Parallel operation test			○	○	
4) Governor test			○	○	
5) Auto control test			○	○	
6) Safety device test for generator engine			○	○	
7) Load characteristic test			○	○	
2. Emergency generator					
1) Shop test	○	○			
2) Insulation resistance test (Cold & Hot condition)			○*	○*	* Record to be submitted
3) Governor test			○	○	
4) Safety device test for generator engine			○	○	
5) Load characteristic test			○	○	
3. Shaft generator					
1) Shop test	○				
2) Insulation resistance test			○*	○*	* Record to be submitted
3) Safety device test			○	○	
4) M/E holding R.P.M			○	○	
5) Parallel operation test			○	○	
6) Load characteristic test			○	○	
4. Main switch board					
1) Fabrication & shop test	○	○			
2) Generator protection test			○	○	
a. Over current trip					
b. Reverse power trip					
c. Preferential trip					
d. Under voltage trip					

Inspection Items	Maker's Shop		On Board		Remarks
	C	O	C	O	
3) Safety alarm test			○	○	
a. Low/high voltage alarm					
b. Low/high frequency					
4) Black out test with sequential start test			○	○	
5) Interlock test			○	○	
5. Emergency switchboard					
1) Fabrication & shop test	○	○			
2) Generator protection device test			○	○	
a. Over current trip					
b. Under voltage trip					
6. Bow thruster			○	○	
1) Safety device			○	○	
2) Pitch control test				○	At sea trial
3) Operation					
7. Stand by auto starting of auxiliary machine			○	○	
8. Sensor test					
1) Pressure sensor test			○	○	
2) Temperature sensor test			○	○	
3) Level sensor test			○	○	
9. Lighting equipment function					
1) Navigation & signal light			○	○	
2) Emergency light			○	○	
3) Day time signal light			○	○	
10. Communication equipment and alarm system					
1) Auto telephone				○	
2) Sound power telephone			○	○	
3) Public addressor & talk back system			○	○	
4) Fire detection system			○	○	
5) General alarm			○	○	
6) CO_2 alarm/Foam alarm			○	○	
7) Extension alarm			○	○	
8) Engine order telegraphy			○	○	

Inspection Items	Maker's Shop		On Board		Remarks
	C	O	C	O	
9) Rudder angle indicator			○	○	
10) Em' cy engineer call			○	○	
11) Hospital call/Ref. chamber call			○	○	
11. Navigation equipment					
1) Whistle			○	○	
2) Magnetic compass				○	
3) Gyro compass, autopilot				○	
4) Searching Equipment				○	
5) Electric clock					
6) Navigator					
7) Automatic identification systam			○	○	
8) Voyage data recorder			○	○	
12. Radio equipment					
1) Radio telegraph plant			○*	○	* On behalf of government
2) V.H.F telephone			○*	○	
3) Satellite communicator			○*	○	
4) Communal aerial system				○	
5) Ship security alert system				○	
13. Insulation resistance test for main circuits			*	*	* Record to be submitted
14. Emergency stop for F.O pumps & ventilation fan			○	○	
15. E/R, Accommodation, on deck cable installation inspection			○*	○*	* Application for the inspection will not be prepared except behind of wall pannel or ceiling
16. Battery charger function			○*	○*	* If over 5kw
17. Dead ship start			○	○	
18. Reef. Com. Monitoring system check				○	
19. MGPS/ICCP				○	

Ⅵ. PAINTING

Stage / Item / Location	Inspection Witnessed by			
	Block		Hull	
	Surface preparation	Finish After final coating	Surface preparation	Finish After final coating
Flat & Side bottom	O.Q.M	O.Q.M	O.Q.M	O.Q.M
Topside	O.Q.M	Q.M	O.Q.M	O.Q.M
Main deck	O.Q.M	Q.M	O.Q.M	O.Q.M
Accommodation outside	O.Q.M	O.Q.M	O.Q.M	O.Q.M
W.B. tanks	O.Q.M	O.Q.M	O.Q.M	O.Q.M
F.W. tanks	-	-	O.Q.M	O.Q.M
Cargo holds	O.Q.M	O.Q.M	O.Q.M	O.Q.M
Cargo tanks (where to be coated)	O.Q.M	O.Q.M	O.Q.M	O.Q.M

O : Owner supervisor
Q : Q.A Inspector
M : Paint maker supervisor

Note : 1. In general, the Owner supervisor shall have free access to monitor the progress of workmanship provided that it does not disturb the work to SHI.
2. The others except above mentioned shall be inspected by the Builder's QA inspectors and/or paint manufacture's supervisors.

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