



Comparison of  
No.47 Shipbuilding and Repair Quality Standard  
(1996)  
(Rev. 1, 1999)  
(Rev.2, Dec. 2004)  
with  
Japan Shipbuilding Quality Standard  
(JSQS, 1004, Appendix 0144)  
and  
Production Standard of the German Shipbuilding Industry  
(FS, 2003)

**PART A - SHIPBUILDING AND REPAIR QUALITY STANDARDS FOR NEW CONSTRUCTION**

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## **REFERENCES**

1. IACS "Bulk Carriers - Guidelines for Surveys, Assessment and Repair of Hull Structure"
2. TSCF "Guidelines for the inspection and maintenance of double hull tanker structures"
3. TSCF "Guidance manual for the inspection and condition assessment of tanker structures"
4. IACS UR W7 "Hull and machinery steel forgings"
5. IACS UR W8 "Hull and machinery steel castings"
6. IACS UR W11 "Normal and higher strength hull structural steel"
7. IACS UR W13 "Allowable under thickness tolerances of steel plates and wide flats"
8. IACS UR W14 "Steel plates and wide flats with improved through thickness properties"
9. IACS UR W17 "Approval of consumables for welding normal and higher strength hull structural steels"
10. IACS UR Z10.1 "Hull surveys of oil tankers" and Z10.2 "Hull surveys of bulk carriers" Annex I
11. IACS Recommendation No. 12 "Guidelines for surface finish of hot rolled plates and wide flats"
13. IACS Recommendation No. 20 "Guide for inspection of ship hull welds"



## 1. Scope

- 1.1 This standard provides guidance on shipbuilding quality standards for the hull structure during new construction and the repair standard where the quality standard is not met.

Whereas the standard generally applies to

- conventional ship types,
- parts of hull covered by the rules of the Classification Society,
- hull structures constructed from normal and higher strength hull structural steel, the applicability of the standard is in each case to be agreed upon by the Classification Society.

The standard does generally not apply to the new construction of

- special types of ships as e.g. gas tankers -structures fabricated from stainless steel or other, special types or grades of steel

- 1.2 The standard covers typical construction methods and gives guidance on quality standards for the most important aspects of such construction. Unless explicitly stated elsewhere in the standard, the level of workmanship reflected herein will in principle be acceptable for primary and secondary structure of conventional designs. A more stringent standard may however be required for critical and highly stressed areas of the hull, and this is to be agreed with the Classification Society in each case. In assessing the criticality of hull structure and structural components, reference is made to ref. 1, 2 and 3
- 1.3 Details relevant to structures or fabrication procedures not covered by this standard are to be approved by the Classification Society on the basis of procedure qualifications and/or recognized national standards.
- 1.4 It is intended that these standards provide guidance where established shipbuilding or national standards approved by the Classification Society do not exist.
- 1.5 For use of this standard, fabrication fit-ups, deflections and similar quality attributes are intended to be uniformly distributed about the nominal values. The shipyard is to take corrective action to improve work processes that produce measurements where a skewed distribution is evident. Relying upon remedial steps that truncate a skewed distribution of the quality attribute is unacceptable.

## 2. General requirements for new construction

- 2.1 In general, the work is to be carried out in accordance with the Classification Society rules and under the supervision of the Surveyor to the Classification Society
- 2.2 Provisions are to be made for proper accessibility, staging, lighting and ventilation. Welding operations are to be carried out under shelter from rain, snow and wind.
- 2.3 Welding of hull structures is to be carried out by qualified welders, according to approved and qualified welding procedures and with welding consumables approved by the Classification Society, see Section 3. Welding operations are to be carried out under proper supervision by the shipbuilder.

[no equivalent in FS or JSQS]



### **3. Qualification of personnel and procedures**

#### **3.1 Qualification of welders**

- 3.1.1 Welders are to be qualified in accordance with the procedures of the Classification Society or to a recognized national or international standard, e.g. EN 287, ISO 9606, ASME Section IX, ANSI/AWS D1.1. Recognition of other standards is subject to submission to the Classification Society for evaluation. Subcontractors are to keep records of welders qualification and, when required, furnish valid approval test certificates.
- 3.1.2 Welding operators using fully mechanized or fully automatic processes need generally not pass approval testing provided that the production welds made by the operators are of the required quality. However, operators are to receive adequate training in setting or programming and operating the equipment. Records of training and production test results shall be maintained on individual operator's files and records, and be made available to the Classification Society for inspection when requested.

[no equivalent in FS or JSQS]

#### **3.2 Qualification of welding procedures**

Welding procedures are to be qualified in accordance with the procedures of the Classification Society or a recognized national or international standard, e.g. EN288, ISO 9956, ASME Section IX, ANSI/AWS D1.1. Recognition of other standards is subject to submission to the Classification Society for evaluation. The welding procedure should be supported by a welding procedure qualification record. The specification is to include the welding process, types of electrodes, weld shape, edge preparation, welding techniques and positions.

[no equivalent in FS or JSQS]

#### **3.3 Qualification of NDE operators**

- 3.3.1 Personnel performing non-destructive examination for the purpose of assessing quality of welds in connection with new construction covered by this standard, are to be qualified in accordance with Classification Society rules or to a recognized international or national qualification scheme. Records of operators and their current certificates are to be kept and made available to the Surveyor for inspection.

[no equivalent in FS or JSQS]

### **4. Materials**



#### **4.1 Materials for Structural Members**

All materials, including weld consumables, to be used for the structural members are to be approved by the Classification Society as per the approved construction drawings and meet the respective IACS Unified Requirements. Additional recommendations are contained in the following paragraphs. All materials used should be manufactured at a works approved by the Classification Society for the type and grade supplied.

[no equivalent in FS or JSQS]



## 4.2 Surface Conditions

Detail	JSQS (Tolerance limits)	Rec. 47 (Limit)	VSM (Limit)																
4.2.2 Unrepaired Conditions	<p>Repair unnecessary:  <math>&lt; 20\%</math> area ratio            and <math>&lt; 0.3</math> mm depth            (Ref. I.A.1/2, pg. 2)</p>	<p>Minor imperfections, in accordance with the limits described in Table 1, are permissible and may be left unrepaired.</p> <table border="1"> <thead> <tr> <th>Area ratio (%)</th> <th>15~ 20%</th> <th>5~ 15%</th> <th>0~5%</th> </tr> </thead> <tbody> <tr> <td><math>t &lt; 20\text{mm}</math></td> <td>0.2mm</td> <td>0.4m m</td> <td>0.5mm</td> </tr> <tr> <td><math>20\text{mm} \leq t &lt; 50\text{mm}</math></td> <td>0.2mm</td> <td>0.6m m</td> <td>0.7mm</td> </tr> <tr> <td><math>50\text{mm} \leq t</math></td> <td>0.2mm</td> <td>0.7m m</td> <td>0.9mm</td> </tr> </tbody> </table>	Area ratio (%)	15~ 20%	5~ 15%	0~5%	$t < 20\text{mm}$	0.2mm	0.4m m	0.5mm	$20\text{mm} \leq t < 50\text{mm}$	0.2mm	0.6m m	0.7mm	$50\text{mm} \leq t$	0.2mm	0.7m m	0.9mm	<p>Limit acc. to DIN EN 10 163-1 und DIN EN 10 029, class B            (Ref. 1.1., pg. 5)</p>
Area ratio (%)	15~ 20%	5~ 15%	0~5%																
$t < 20\text{mm}$	0.2mm	0.4m m	0.5mm																
$20\text{mm} \leq t < 50\text{mm}$	0.2mm	0.6m m	0.7mm																
$50\text{mm} \leq t$	0.2mm	0.7m m	0.9mm																
4.2.3 Repairs of Defects		<p>Defects are to be repaired by grinding or welding irrespective of their size and number. Repair by grinding may be carried out over the entire surface up to a depth equal to <math>-0.3\text{mm}</math>.</p>	<p>acc. to DIN EN 10 163-1</p>																
4.2.4 Repairs by Grinding	<p><math>d &gt; 0.07 t</math>, max 3 mm            (Ref. I.A.1/2, pg. 2)</p>	<p>The nominal thickness is not to be reduced by more than 7% or 3mm, whichever is the lesser. Each single ground area is not to exceed <math>0.25\text{m}^2</math>. The defects are to be completely removed by grinding. Complete elimination of the defects is to be verified by a magnetic particle or dye penetrant test procedure. The ground areas must have smooth transitions to the surrounding surface.</p>	<p>max. <math>0,25 \text{ m}^2</math> per local area (max area defined)            max. 2 % of the total surface            (Ref. 1.2, pg. 6)</p>																
4.2.5 Repairs by welding	<p><math>0.07 t &lt; d &lt; 0.2 t</math>,            max 3 mm            (Ref. I.A.1/2, pg. 2)</p>	<p>Local defects, which cannot be repaired by grinding, may be repaired by chipping and/or grinding followed by welding in accordance with the qualified procedures approved by the Classification Society concerned.</p> <p>Any single welded area is not to exceed <math>0.125\text{m}^2</math>. The weld preparation should not reduce the thickness of the product below 80% of the nominal thickness. Welding is to be completed with one layer of weld bead in excess, which is subsequently to be ground smooth, level with the plate surface. The soundness of the repair is to be verified by ultrasonic, magnetic particle or dye penetrant methods.</p>	<p>max. 20 % of nominal thickness            max. <math>0,125 \text{ m}^2</math> per local area            max. 2 % of the total surface            (Ref. 1.2, pg. 6)</p>																
<p>4.2.6.1 Lamination</p>  	<p>In case where the range of lamination is limited, it can be chipped out and build-up by welding (a). In case where the range of lamination is limited also, but is near the plate surface, it is preferable to make the build-up welding as shown in (b).</p> <p>It is recommended to exchange locally the plate in case where the range of lamination is fairly extensive. The standard minimum breadth of the plate to be exchanged:</p> <ul style="list-style-type: none"> <li>• 1600mm for shell and strength deck under large constraint,</li> <li>• 800mm not under large constraint,</li> <li>• 300mm for other structural members.</li> </ul> <p>(Ref. I.C.1/2, pg. 2)</p>	<p>Severe lamination is to be repaired by local insert plates. The minimum breadth or length of the plate to be replaced is to be:</p> <ul style="list-style-type: none"> <li>• 1600mm for shell and strength deck plating in way of cruciform or T-joints,</li> <li>• 800mm for shell, strength deck plating and other primary members,</li> <li>• 300mm for other structural members.</li> </ul> <p>Local limited lamination may be repaired by chipping and/or grinding followed by welding in accordance with sketch (a). In case where the local limited lamination is near the plate surface, the repair may be carried out as shown in sketch (b).</p>	<p>Length and width of insert plate:            L and B <math>&gt; 300</math> mm            or  <math>10 t</math>            (Ref. 1.1.5, pg. 7)</p>																



Detail	JSQS (Tolerance limits)	Rec. 47 (Limit)	VSM (Limit)
4.2.6.2 Weld Spatters	?	<p>Loose weld spatters are to be removed completely by grinding to clean metal (see Table 9.13) on:</p> <ul style="list-style-type: none"> <li>• shell plating</li> <li>• deck plating on exposed decks</li> <li>• in tanks for chemical cargoes</li> <li>• in tanks for fresh water and for drinking water</li> <li>• in tanks for lubricating oil, hydraulic oil, including service tanks</li> </ul>	<p>Loose weld splatter will be removed on:</p> <ul style="list-style-type: none"> <li>• Areas insulated from outside</li> <li>• decks underneath deck covering</li> <li>• Cargo holds</li> <li>• Exposed decks incl. deck outfits, shell topside and superstructures</li> <li>• Underwater areas of shell, pools</li> <li>• Visible areas within engine rooms, store rooms, service and technical rooms, shops, kitchens, living rooms and service routes (above 2m height)</li> <li>• behind ceilings, underneath insulation and cladding</li> <li>• within service routes</li> <li>• cargo holds</li> <li>• voids, cofferdams</li> <li>• BW tanks</li> <li>• Crude oil tanks</li> <li>• Slop tanks, grey water and dirt water tanks, boiler water tanks and distillate tanks</li> <li>• Tanks for fresh water and drinking water</li> </ul> <p>(Ref. 3.3.1, Table 2, pg. 11)</p>

## 5. Cutting

Detail	JSQS (Tolerance limits)	Rec. 47 (Limit)	VSM (Limit)
5.1 Gas Cutting  Roughness	<p>Mechanised gas cutting: R=200/200 µm</p> <p>Manual gas cutting / free edges: R=300/1000 µm</p> <p>Manual gas cutting / welding edges: R=800/1500 µm</p> <p>(Ref. III.A.1/2, pg. 4)</p>	<p>Mechanised gas cutting: R=150 µm</p> <p>Manual gas cutting / free edges: R=300/500 µm</p> <p>Manual gas cutting / welding edges: R=800/1500 µm</p>	<p>u=0.5mm for strength members u=1mm for other members No diff. between methods!</p>
Individual non-sharp notches caused by torch failure  <u>Free edges of members:</u>  Sheer strake etc  Longitudinal and transverses  Others	<p>No notch</p> <p>&lt; 1.0mm</p> <p>&lt; 3.0mm</p> <p>(Ref. III.B.1/2, pg. 4)</p>	<p>No notch</p> <p>&lt; 1.0mm</p> <p>&lt; 3.0mm</p>	<p>No notch</p> <p>&lt; 3.0mm</p>



<u>Weld edges:</u>			
Butt weld, Shell plate and strength deck in 0.6L amidship	< 2.0mm	< 2.0mm	< 3.0mm
	< 3.0mm	< 3.0mm	
Butt weld, Others	< 3.0mm	< 3.0mm	
Fillet weld	(Ref. III.B.1/2, pg. 4)		

## 6. Fabrication and fairness

- 6.1 Flanged longitudinals and flanged brackets (see Table 6.1)
- 6.2 Built-up sections (see Table 6.2)
- 6.3 Corrugated bulkheads (see Table 6.3)
- 6.4 Pillars, brackets and stiffeners (see Table 6.4)
- 6.5 Maximum heating temperature on surface for line heating (see Table 6.5)
- 6.6 Block assembly (see Table 6.6)
- 6.7 Special sub-assembly (see Table 6.7)
- 6.8 Shape (see Table 6.8 and 6.9)
- 6.9 Fairness of plating between frames (see Table 6.10)
- 6.10 Fairness of plating with frames (see Table 6.11)
- 6.11 Preheating for welding hull steels at low temperature (See Table 6.12)

## 7. Alignment

The quality standards for alignment of hull structural components during new construction are shown in Tables 7.1, 7.2 and 7.3. The Classification Society may require a closer construction tolerance in areas requiring special attention, as follows:

- Regions exposed to high stress concentrations
- Fatigue prone areas
- Detail design block erection joints
- Higher tensile steel regions

## 8. Welding Details

- 8.1 Typical butt weld plate edge preparation (manual welding) - see Table 8.1 and 8.2
- 8.2 Typical fillet weld plate edge preparation (manual welding) - see Table 8.3 and 8.4
- 8.3 Typical butt and fillet weld profile (manual welding) - see Table 8.5
- 8.4 Lap, plug and slot welding - see Table 8.6
- 8.5 Distance between welds - see Table 8.7
- 8.6 Automatic welding - see Table 8.8

## 9. Repair

- 9.1 Typical misalignment repair - see Tables 9.1 to 9.3
- 9.2 Typical butt weld plate edge preparation repair (manual welding) - see Table 9.4 and 9.5
- 9.3 Typical fillet weld plate edge preparation repair (manual welding) - see Tables 9.6 to 9.8
- 9.4 Typical fillet and butt weld profile repair (manual welding) - see Table 9.9
- 9.5 Distance between welds repair - see Table 9.10
- 9.6 Erroneous hole repair - see Table 9.11
- 9.7 Repair by insert plate - see Table 9.12
- 9.8 Weld surface repair - see Table 9.13

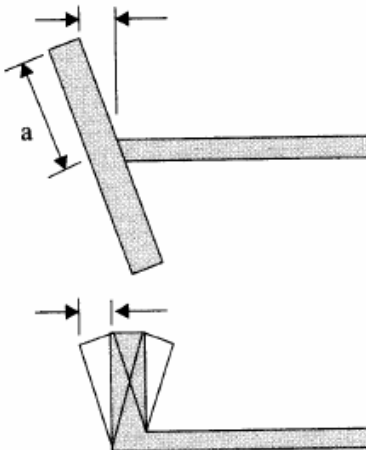
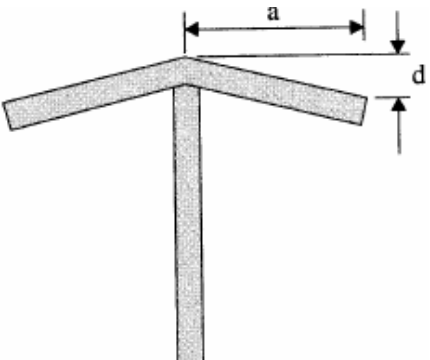
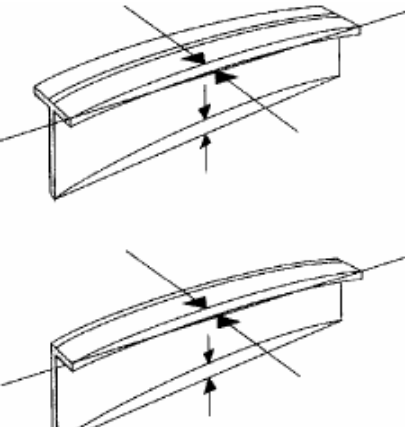


**TABLE 6.1 – Flanged Longitudinals and Flanged Brackets**

Detail	JSQS (Tolerance limits)	Rec. 47 (Limit)	VSM (Limit)
Breadth of flange compared to correct size 	$\pm 5 \text{ mm}$ (Ref. IV.A.1, pg. 6)	$\pm 5 \text{ mm}$	$- 5 \text{ mm per } 100 \text{ mm,}$ $\text{max. } 15 \text{ mm}$ (Ref. 4.1.1, pg. 12)
Angle between flange and web compared to template 	$\pm 4,5 \text{ mm per}$ $100 \text{ mm of } a$ (Ref. IV.A.1, pg. 6)	$\pm 5 \text{ mm}$ $\text{per } 100 \text{ mm of } a$	$\pm 5 \text{ mm}$ $\text{per } 100 \text{ mm of } a$ (Ref. 4.1.1, pg. 12)
Straightness in plane of flange and web 	$\pm 25 \text{ mm per } 10 \text{ m}$ (Ref. IV.A.4 + 5, pg. 6)	$\pm 25 \text{ mm per } 10 \text{ m}$	No requirement

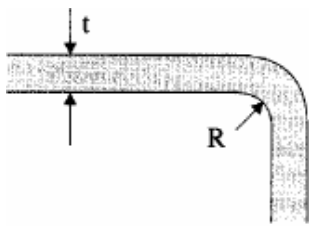
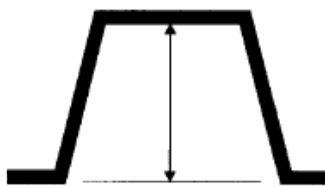
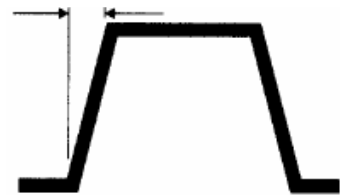
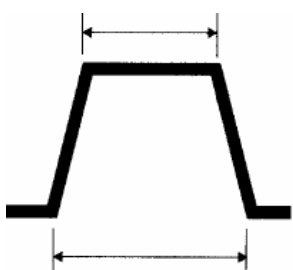
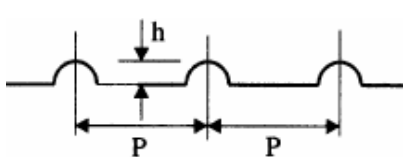


**TABLE 6.2 – Built Up Sections**

Detail	JSQS (Tolerance limits)	Rec. 47 (Limit)	VSM (Limit)
<p>Frames and longitudinal</p> 	<p><math>\pm 3</math> mm (absolute?)  (Ref. IV.D.2, pg. 7)</p>	<p><math>\pm 3</math> mm per 100 mm of a</p>	<p><math>\pm 5</math> mm per 100 mm of a  (Ref. 4.1.1, pg. 12)</p>
<p>Distortion of face plate</p> 	<p><math>d \leq 5 + a/100</math> mm  (Ref. IX.C.6, pg. 23)</p>	<p><math>d \leq 5 + a/100</math> mm</p>	<p><math>\pm 5</math> mm per 100 mm of a  (Ref. 4.1.2, pg. 12)</p>
<p>Distortion of girder and transverse at upper edge and flange</p> 	<p><math>\pm 8</math> mm per length of span  (Ref. IX.C.1, pg. 23)</p>	<p><math>\pm 8</math> mm per span between primary members</p>	<p>No requirement</p>

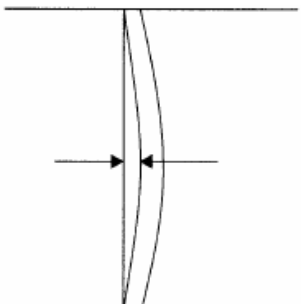
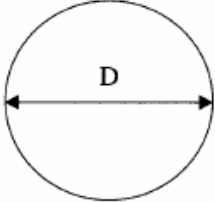
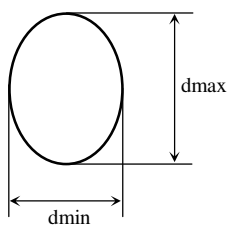
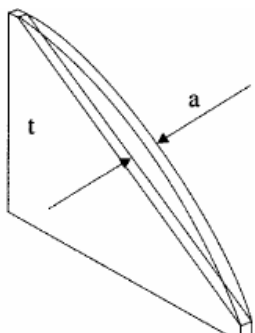


**TABLE 6.3 – Corrugated Bulkheads**

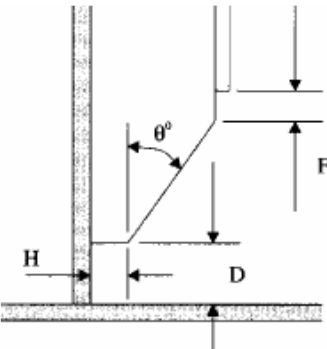
Detail	JSQS (Tolerance limits)	Rec. 47 (Limit)	VSM (Limit)												
<p>Mechanical bending</p> 	?	$R \geq 3 t$ mm Material to be suitable for cold flanging (forming) and welding in way of radius	<p>No requirement. GL-Requirement:</p> <table border="1"> <thead> <tr> <th>Plate thickness t</th> <th>Minimum inner bending radius r</th> </tr> </thead> <tbody> <tr> <td>to 4 mm</td> <td><math>1,0 \times t</math></td> </tr> <tr> <td>to 8 mm</td> <td><math>1,5 \times t</math></td> </tr> <tr> <td>to 12 mm</td> <td><math>2,0 \times t</math></td> </tr> <tr> <td>to 24 mm</td> <td><math>3,0 \times t</math></td> </tr> <tr> <td>over 24 mm</td> <td><math>5,0 \times t</math></td> </tr> </tbody> </table>	Plate thickness t	Minimum inner bending radius r	to 4 mm	$1,0 \times t$	to 8 mm	$1,5 \times t$	to 12 mm	$2,0 \times t$	to 24 mm	$3,0 \times t$	over 24 mm	$5,0 \times t$
Plate thickness t	Minimum inner bending radius r														
to 4 mm	$1,0 \times t$														
to 8 mm	$1,5 \times t$														
to 12 mm	$2,0 \times t$														
to 24 mm	$3,0 \times t$														
over 24 mm	$5,0 \times t$														
<p>Depth of corrugation</p> 	$\pm 6$ mm (Ref. IV.E.1, pg. 8)	$\pm 6$ mm	$\pm 0,5 t$ (Ref. 4.1.3, pg. 12)												
<p>Breadth of corrugation web</p> 		$\pm 6$ mm	No requirement												
<p>Breadth of corrugation</p> 	$\pm 6$ mm (Ref. IV.E.1, pg. 8)	$\pm 6$ mm	not limited (Ref. 4.1.3, pg. 12)												
<p>Pitch and depth of swedged corrugated bulkhead compared with correct value</p> 	$h : \pm 5$ mm In case where it does not connect with others $P : \pm 9$ mm In case where it connects with others $P : \pm 3$ mm (Ref. IV.E.2, pg. 8)	$h : \pm 5$ mm Where it is not aligned with other bulkheads $P : \pm 9$ mm Where it is aligned with other bulkheads $P : \pm 3$ mm	No requirement												



**TABLE 6.4 – Pillars, Brackets and Stiffeners**

Detail	JSQS (Tolerance limits)	Rec. 47 (Limit)	VSM (Limit)
Pillar (between decks) 	6 mm (Ref. IX.C.3, pg. 23)	6 mm	No requirement
Cylindrical structure diameter (pillars, masts, posts, etc.) 	$\pm D/150$ mm max. $\pm 7,5$ mm (Ref. IV.E.3, pg. 8)	$\pm D/150$ mm max. $\pm 7,5$ mm	Circumference tolerance $0.6xs \leq 18$ mm $\Leftrightarrow$ Diameter tolerance $0.2xs \leq 5.7$ mm (Ref. 4.3.1, pg. 13)
Ovality of cylindrical structure 	No requirement	No requirement	$d_{max} - d_{min} \leq 0.02 \times d_{max}$ (Ref. 4.3.1, pg. 13)
Tripping bracket and small stiffener, distortion at the part of free edge 	$\approx t$ (Ref. IX.C.3, pg. 23)	max. 8 mm	No requirement



<p>Snipe end of secondary face plates and stiffeners</p> 	?	<p><math>\theta = 30^\circ</math></p> <p>H = 15 mm: + 5 mm - 5 mm</p> <p>D = 25 mm: + 10 mm - 5 mm</p> <p>F = 15 mm: <math>\pm 5</math> mm</p>	No requirement
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**TABLE 6.5 Maximum Heating Temperature on Surface for Line Heating**

Item		JSQS (Tolerance limits)	Rec. 47 (Standard)	VSM (Limit)
Conventional Process AH32-EH32 & AH36-EH36	Water cooling just after heating	Under 650 °C	Under 650 °C	No requirement
TCMP type AH32-EH32 & AH36-EH36 (Ceq.>0.38%)	Air cooling after heating	Under 900 °C	Under 900 °C	No requirement
	Water cooling subsequent water cooling after heating	Under 900 °C (starting temperature of water cooling to be under 500 °C)	Under 900 °C (starting temperature of water cooling to be under 500 °C)	
TMCP type AH32-DH32 & AH36-DH36 (Ceq. ≤ 0.38%)	Water cooling just after heating or air cooling	Under 1000 °C	Under 1000 °C	No requirement
TMCP type EH32 & EH36 (Ceq. ≤ 0.38%)	Water cooling just after heating or air cooling	Under 900 °C (starting temperature of water cooling to be under 550 °C)  (Ref. IV.F.1, pg. 9)	Under 900 °C (starting temperature of water cooling to be under 550 °C)	No requirement

NOTE:

$$Ceq = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15} (\%)$$



**TABLE 6.6 – Block Assembly**

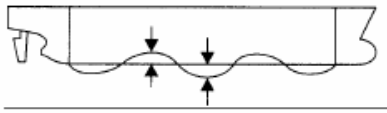
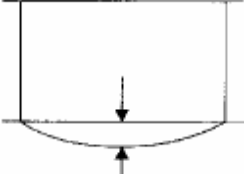
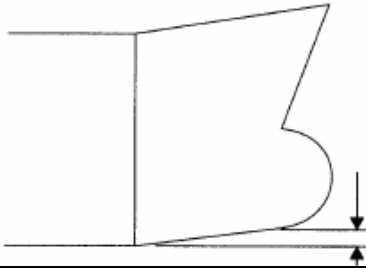
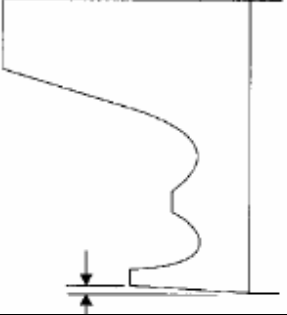

Item	JSQS (Tolerance limits)	Rec. 47 (Limit)	VSM (Limit)
<b>Flat Plate Assembly</b>	(Ref. V.A.1, pg. 10)		
Length and Breadth	± 6 mm	± 6 mm	No requirement
Distortion	20mm	± 20 mm	
Squareness	8 mm	± 10 mm	
Deviation of interior members from plate	± 10 mm	10 mm	
<b>Curved plate assembly</b>	(Ref. V.A.2, pg. 10)		
Length and Breadth	± 8 mm	± 8 mm measured along the girth	No requirement
Distortion	20 mm	± 20 mm	
Squareness	15 mm	± 15 mm	
Deviation of interior members from plate	± 10 mm	10 mm	
<b>Flat cubic assembly</b>	(Ref. V.A.3, pg. 10/11)		
Length and Breadth	± 6 mm	± 6 mm	No requirement
Distortion	20mm	± 20 mm	
Squareness	8 mm	± 10 mm	
Deviation of interior members from plate	± 10 mm	10 mm	
Twist	20 mm	± 20 mm	
Deviation between upper and lower plate	10 mm	± 10 mm	
<b>Curved cubic assembly</b>	(Ref. V.A.4, pg. 11)		
Length and Breadth	± 6 mm	± 8 mm measured along with girth	No requirement
Distortion	20mm	±20mm	
Squareness	8 mm	±15mm	
Deviation of interior members from plate	± 10 mm	±10mm	
Twist	25 mm	±25mm	
Deviation between upper and lower plate	15 mm	±15mm	

**TABLE 6.7 – Special Sub-Assembly**

Item	JSQS (Tolerance limits)	Rec. 47 (Limit)	VSM (Limit)
Distance between upper/lower gudgeon	$\pm 10$ mm (Ref. V.A.5(a), pg. 11)	$\pm 10$ mm	No requirement
Distance between aft edge of boss and aft peak bulkhead	$\pm 10$ mm (Ref. V.A.5(b), pg. 12)	$\pm 10$ mm	No requirement
Twist of sub-assembly of stern frame	10 mm (Ref. V.A.5(c), pg. 12)	10 mm	No requirement
Deviation of rudder from shaft center line	15 mm (Ref. V.A.5, pg. 12)	8 mm	No requirement
Twist of rudder plate	10 mm (Ref. V.A.5, pg. 12)	10 mm	No requirement
Flatness of top plate of main engine bed	10 mm (Ref. V.A.5, pg. 12)	10 mm	No requirement
Breadth and length of top plate of main engine bed	$\pm 6$ mm (Ref. V.A.5, pg. 12)	6 mm	No requirement



**TABLE 6.8 – Shape**

Detail	JSQS (Standard range)	Rec. 47 (Standard)	VSM (Limit?)
Deformation for the whole length 	$\pm 25$ mm (Ref. VI.B.1, pg. 13)	$\pm 50$ mm per 100 m against the line of keel sighting	$\pm 25$ mm per 100 m length (Ref. 9.2.1, pg. 27)
Deformation for the distance between two adjacent bulkheads 	$\pm 15$ mm (Ref. VI.B.1, pg. 13)	$\pm 15$ mm	$\pm 25$ mm per 100 m length (Ref. 9.2.1, pg. 27)
Cocking-up of fore body 	$\pm 30$ mm (Ref. VI.B.2, pg. 13)	$\pm 30$ mm	$+ 50$ mm $- 25$ mm (Ref. 9.2.2, pg. 27)
Cocking-up of aft-body 	$\pm 20$ mm (Ref. VI.B.2, pg. 13)	$\pm 20$ mm	$+ 50$ mm $- 25$ mm (Ref. 9.2.2, pg. 27)
Rise of floor amidships 	$\pm 15$ mm (Ref. VI.B.3, pg. 13)	$\pm 15$ mm	$\pm 25$ mm for 10 m of the half breadth (Ref. 9.2.3, pg. 28)

**TABLE 6.9 – Shape**

Item	JSQS (Standard range)	Rec. 47 (Standard)	VSM (Limit)
Length between perpendiculars	<p><math>\pm 50</math> mm per 100m</p> <p>Applied to ships of 100 metre length and above. For the convenience of the measurement the point where the keel is connected to the curve of the stern may be substituted for the fore perpendicular in the measurement of the length.</p> <p>(Ref. VI.A.1, pg. 12)</p>	<p><math>\pm 50</math> (?) per 100 m</p> <p>Applied to ships of 100 metre length and above. For the convenience of the measurement the point where the keel is connected to the curve of the stern may be substituted for the fore perpendicular in the measurement of the length.</p>	<p><math>\pm 100</math> mm per 100 m length</p> <p>(Ref. 9.1.1, pg. 27)</p>
Length between aft edge of boss and main engine	<p><math>\pm 25</math> mm</p> <p>(Ref. VI.A.1, pg. 12)</p>	<p><math>\pm 25</math> mm</p>	<p>No requirement</p>
Moulded breadth at midship	<p><math>\pm 15</math> mm</p> <p>Applied to ships of 15 metre breadth and above. Measured on the upper deck.</p> <p>(Ref. VI.A.2, pg. 12)</p>	<p><math>\pm 15</math> mm</p> <p>Applied to ships of 15 metre breadth and above. Measured on the upper deck.</p>	<p><math>\pm 15</math> mm per 10 m breadth, max. 40 mm</p> <p>(Ref. 9.1.2, pg. 27)</p>
Moulded depth at midship	<p><math>\pm 10</math> mm</p> <p>Applied to ships of 10 metre depth and above.</p> <p>(Ref. VI.A.3, pg. 12)</p>	<p><math>\pm 10</math> mm</p> <p>Applied to ships of 10 metre depth and above.</p>	<p>- 10 mm per 10 m depth, + not fixed</p> <p>(Ref. 9.1.3, pg. 27)</p>

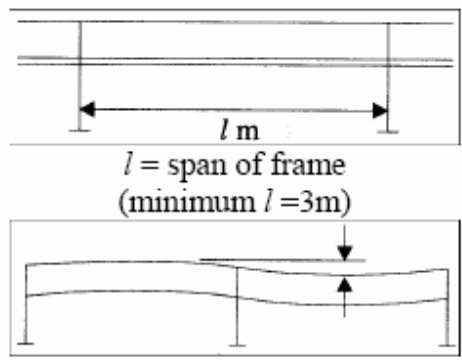


**TABLE 6.10 – Fairness of Plating Between Frames**

Item		JSQS (Tolerance limits)	Rec. 47 (Limit)	VSM (Limit 95 / 5 %)
Shell plate	Parallel part (side & bottom shell)	6 mm (Ref. IX.A.1, pg. 22)	8 mm	4 / 7 mm (Ref. 6.1.1, pg. 20)
	Fore and aft part			
Tank top plate		7 mm (Ref. IX.A.2, pg. 22)		6 / 8 mm (Ref. 6.1.1, pg. 20)
Bulkhead	Bulkhead Trans. Bulkhead Swash Bulkhead 4mm	8 mm (Ref. IX.A.3, pg. 22)		6 / 8 mm (Ref. 6.1.1, pg. 20)
Strength deck	Parallel part	6 mm	8 mm	4 / 6 mm (Ref. 6.1.1, pg. 20)
	Fore and aft part	9 mm	9 mm	4 / 6 mm
	Covered part	9 mm (Ref. IX.A.4, pg. 22)	9 mm	7 / 9 mm (Ref. 6.1.1, pg. 20)
Second deck	Bare part	8 mm	8 mm	6 / 9 mm (Ref. 6.1.1, pg. 20)
	Covered part	9 mm (Ref. IX.A.5, pg. 22)	9 mm	
Forecastle deck	Bare part	6 mm	8 mm	4 / 6 mm (Ref. 6.1.1, pg. 20)
Poop deck	Covered part	9 mm (Ref. IX.A.6, pg. 22)	9 mm	7 / 9 mm (Ref. 6.1.1, pg. 20)
Super structure Deck	Bare part	6 mm	6 mm	4 / 6 mm (Ref. 6.1.1, pg. 20)
	Covered part	9 mm (Ref. IX.A.7, pg. 22)	9 mm	7 / 9 mm (Ref. 6.1.1, pg. 20)
House wall	Outside wall	6 mm	6 mm	4 / 6 mm (Ref. 6.1.1, pg. 20)
	Inside wall	6 mm	8 mm	4 / 6 mm (Ref. 6.1.1, pg. 20)
	Covered part	9 mm (Ref. IX.A.9, pg. 22)	9 mm	6 / 8 mm (Ref. 6.1.1, pg. 20)
Interior member (web of girder, etc)		7 mm (Ref. IX.A.10, pg. 22)	7 mm	No requirement
Floor and girder in double bottom		8 mm (Ref. IX.A.11, pg. 22)	7 mm	No requirement



**TABLE 6.11 – Fairness of Plating with Frames**

Item		JSQS (Tolerance limits)	Rec. 47 (Limit)	VSM (Limit)
Shell plate	Parallel part	$\pm 3 \times l / 1000$ mm	$\pm 3 \times l / 1000$ mm	$0.2 \times \sqrt{l}$ (Ref. 6.2.2, pg. 22)
	Fore and aft part	$\pm 2 \times l / 1000$ mm (Ref. IX.B.1, pg. 23)	$\pm 4 \times l / 1000$ mm	$0.2 \times \sqrt{l}$ (Ref. 6.2.2, pg. 22)
Strength deck (excluding cross deck) and top plate of double bottom	-	$\pm 4 \times l / 1000$ mm (Ref. IX.B.2, pg. 23)	$\pm 4 \times l / 1000$ mm	$0.2 \times \sqrt{l}$ (Ref. 6.2.2, pg. 22)
Bulkhead	-	$\pm 5 \times l / 1000$ mm (Ref. IX.B.3, pg. 23)	$\pm 5 \times l / 1000$ mm	$0.2 \times \sqrt{l} + 0.3$ (Ref. 6.2.2, pg. 22)
Others	-	$\pm 6 \times l / 1000$ mm (Ref. IX.B.5, pg. 23)	$\pm 6 \times l / 1000$ mm	$0.2 \times \sqrt{l} + 0.3$ (Ref. 6.2.2, pg. 22)
 <p><math>l = \text{span of frame}</math> (minimum <math>l = 3\text{m}</math>)</p>				

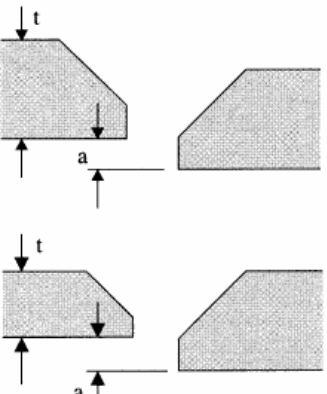
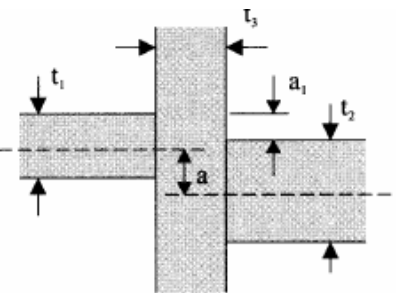


**TABLE 6.12 – Preheating for welding hull steels at low temperature**

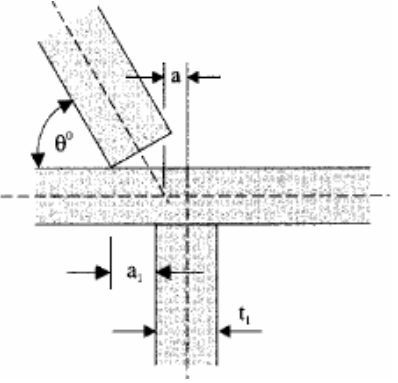
Item		JSQS (Tolerance limits)	Rec. 47 (Standard)		VSM (Limit)
			Base metal temperature needed preheating	Minimum preheating temperature	
Normal strength steels	A, B, D, E	Below -5°C	Below 0°C	20°C <sup>1)</sup>	Below -10°C, if t<15mm and not strength member
TMCP H.T. steel, low temp steel (Ceq<0.36%)	AH32 – EH 32 AH36 – EH 36	Below 0°C			When taking suitable measures welding of shipbuilding steel is generally permissible at ambient temp. below 0°C.
H.T.steel, Cast steel TMCP HT.steel, low temp stell (Ceq>0.36%)		Below 5°C			- " -
(Note) <sup>1)</sup> This level of preheat is to be applied unless the approved welding procedure specifies a higher level.					



**TABLE 7.1 – Alignment**

Detail	JSQS (Tolerance limits)	Rec. 47 (Limit)	VSM (Limit)
<p>Alignment of butt welds</p> 	<p>Strength member:  <math>a \leq 0.15 t</math>  max. 3 mm</p> <p>Other:  <math>a \leq 0.2 t</math>  max. 3 mm</p> <p>(Ref. VIII.C.4, pg. 19)</p>	<p><math>a \leq 3.0 \text{ mm}</math></p>	<p>Low (classification level):  <math>a \leq 0.25 t</math>  max. 5 mm</p> <p>Medium (class. level):  <math>a \leq 0.15 t</math>  max. 4 mm</p> <p>High (class. level):  <math>a \leq 0.1 t</math>  max. 3 mm</p> <p>(Table 1, No. 18)</p>
<p>Alignment of fillet welds <math>t_1 &lt; t_2</math></p> 	<p>Strength member:  <math>a \leq 0.333 t</math></p> <p>Other:  <math>a \leq 0.5 t</math></p> <p>(Ref. VIII.C.3, pg. 17)</p>	<p>(STANDARD)</p> <p>a) Strength and higher tensile:  <math>a \leq t_1/4</math>  measured on the median.</p> <p><math>a_1 \leq (5t_1 - 3t_2)/6</math>  measured on the heel line.</p> <p>b) Other:  <math>a \leq t_1/2</math> measured on the median.</p> <p><math>a_1 \leq (2t_1 - t_2)/2</math>  measured on the heel line.</p>	<p><math>a_1 \leq 0.5 t</math>, t of thicker plate, measured on the heel line</p> <p>(Ref. 5.4.1, pg. 17)</p> <p><math>a \leq 0,1xt \leq 3\text{mm}</math>, t of thicker plate</p> <p>(Ref. 4.3.3)</p>



Alignment of fillet welds		(STANDARD)	
 <p data-bbox="762 562 778 595">?</p>		<p data-bbox="927 371 1126 517">a) Strength and higher tensile: <math>a \leq t_1/3</math> measured on the median</p> <p data-bbox="927 551 1126 640"><math>a_1 \leq (5t_1 - 3t_2)/6</math> measured on the heel line.</p> <p data-bbox="927 674 1142 752">b) Other: <math>a_1 \leq t_1/2</math> measured on the median</p> <p data-bbox="927 786 1126 875"><math>a_1 \leq (2t_1 - t_2)/2</math> measured on the heel line.</p>	<p data-bbox="1190 517 1398 573"><math>a \leq 0.5 t</math>, different reference lines</p> <p data-bbox="1190 607 1406 640">(Ref. 5.4.2, pg. 18)</p>



**TABLE 7.2 – Alignment**

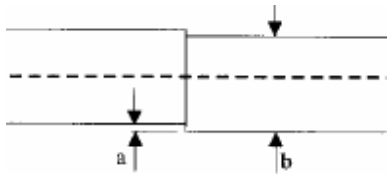
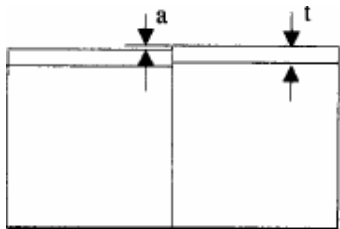
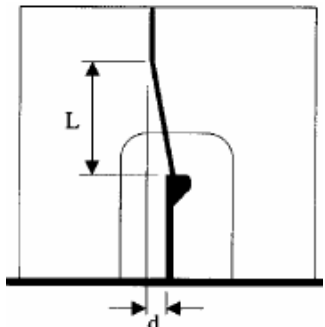
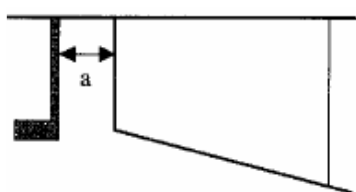
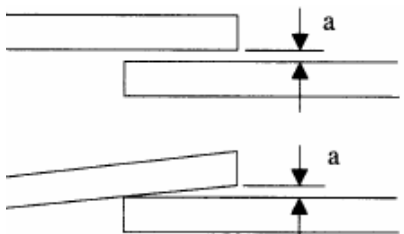
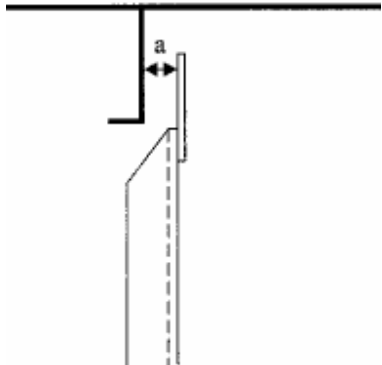
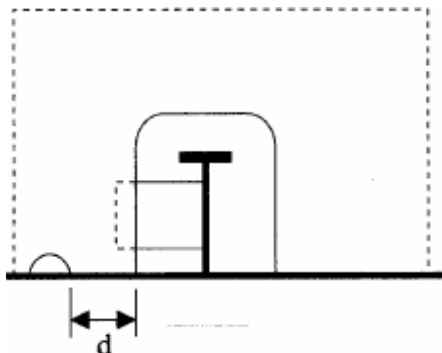
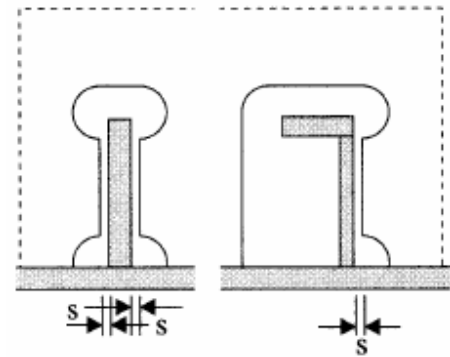
Detail	JSQS (Tolerance limits)	Rec. 47 (Limit)	VSM (Limit)
Alignment of flange of T-longitudinal 	?	a = 8.0 mm	No requirement
Alignment of height of T-bar, L-angle bar or bulb 	?	3.0 mm	No requirement
Alignment of panel stiffener 	?	Only standard	No requirement
Gap between bracket/intercostal and Stiffener 	?	3 mm	No requirement
Alignment of lap welds 	$a \leq 3 \text{ mm}$ (Ref. VIII.C.3, pg. 19)	Only standard	No requirement

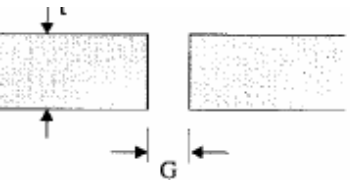
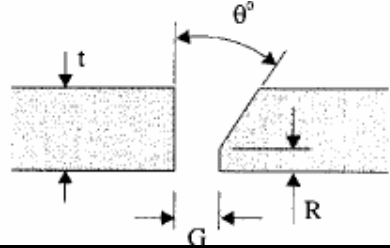
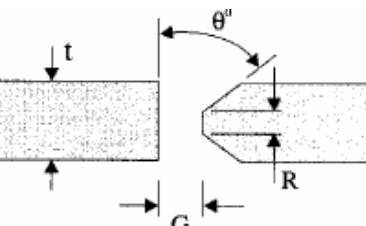
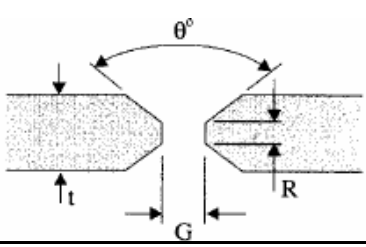
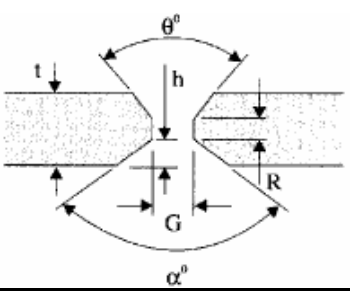


TABLE 7.3 – Alignment

Detail	JSQS (Tolerance limits)	Rec. 47 (Standard)	VSM (Limit)
<p>Gap between beam and frame</p> 	<p><math>a \leq 5.0 \text{ mm}</math> (Ref. VIII.C.3, pg. 17)</p>	<p>( Standard ) <math>a \leq 2.0 \text{ mm}</math></p>	<p>No requirement</p>
<p>Position of scallop</p> 	<p>?</p>	<p>( Standard ) <math>d \geq 75 \text{ mm}</math></p>	<p>No requirement</p>
<p>Gap around stiffener in cut-out</p> 	<p><math>s \leq 3.0 \text{ mm}</math> (Ref. VIII.B.2, pg. 16)</p>	<p>( Standard ) <math>s \leq 2.0 \text{ mm}</math></p>	<p>No requirement</p>



**TABLE 8.1 – Typical Butt Weld Plate Edge Preparation (Manual Welding)**

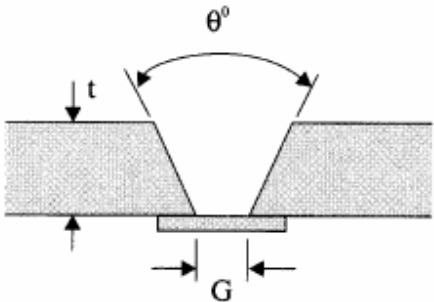
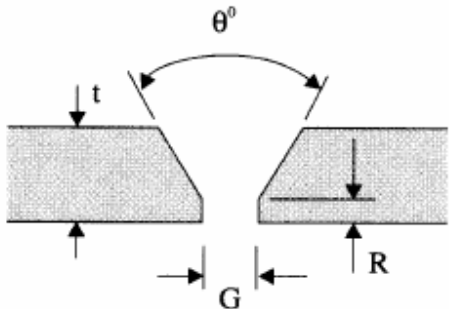
Detail	JSQS (Tolerance limits)	Rec. 47 (Standards)	VSM (Limit)
<p>Square butt</p> 		$t \leq 5 \text{ mm}$ $G = 3 \text{ mm}$	No requirement
<p>Single level butt</p> 		$t > 5 \text{ mm}$ $G \leq 3 \text{ mm}$ $R \leq 3 \text{ mm}$ $\theta = 50^\circ - 70^\circ$	No requirement
<p>Double bevel butt</p> 		$t > 19 \text{ mm}$ $G \leq 3 \text{ mm}$ $R \leq 3 \text{ mm}$ $\theta = 50^\circ - 70^\circ$	No requirement
<p>Double vee butt, uniform bevels</p> 		$G \leq 3 \text{ mm}$ $R \leq 3 \text{ mm}$ $\theta = 50^\circ - 70^\circ$	No requirement
<p>Double vee butt, non-uniform bevel</p> 		$G \leq 3 \text{ mm}$ $R \leq 3 \text{ mm}$ $6 \leq h \leq t/3 \text{ mm}$ $\theta = 50^\circ \alpha = 90^\circ$	No requirement

**NOTE 1**

Different plate edge preparation may be accepted or approved by the Classification Society on the basis of an appropriate welding procedure specification. For welding procedures other than manual welding, see paragraph 3.2 Qualification of weld procedures.



**TABLE 8.2 – Typical Butt Weld Plate Edge Preparation (Manual Welding)**

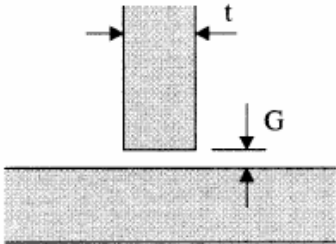
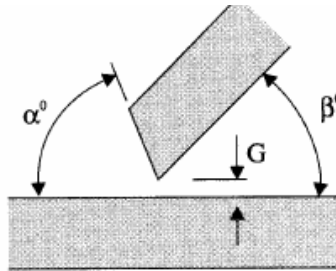
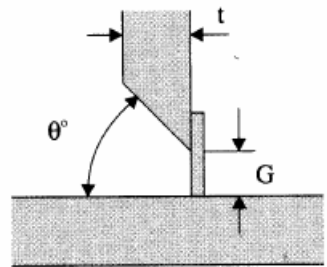
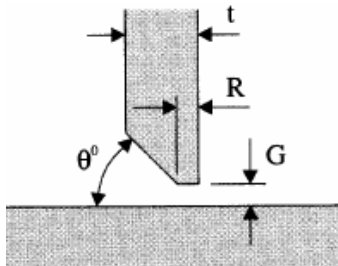
Detail	JSQS (Tolerance limits)	Rec. 47 (Limit)	VSM (Limit)
Single vee butt, one side welding with backing strip (temporary or permanent) 		$G = 3 - 9 \text{ mm}$ $\theta = 30^\circ - 45^\circ$	No requirement
Single vee butt 		$G \leq 3 \text{ mm}$ $\theta = 30^\circ - 70^\circ$ $R \leq 3 \text{ mm}$	No requirement

**NOTE 1**

Different plate edge preparation may be accepted or approved by the Classification Society on the basis of an appropriate welding procedure specification. For welding procedures other than manual welding, see paragraph 3.2 Qualification of welding procedures.

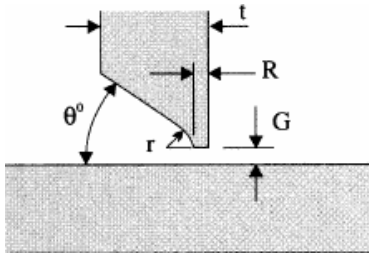
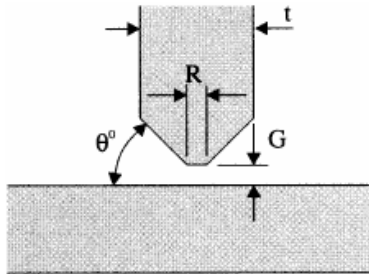
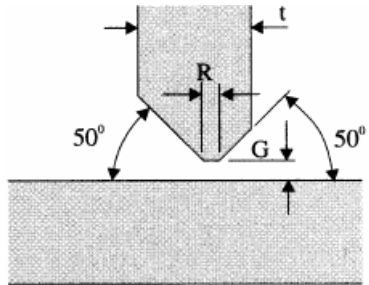
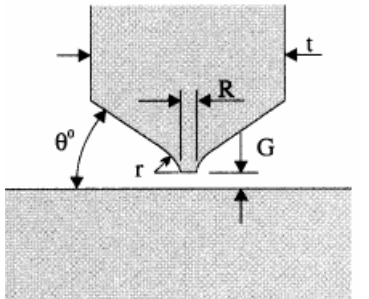


**Table 8.3 - Typical Fillet Weld Plate Edge Preparation (Manual Welding)**

Detail	JSQS (Tolerance limits)	Rec. 47 (Standard)	VSM (Limit)
<p>Tee Fillet</p> 		$G \leq 2 \text{ mm}$	<p>Low:  <math>G \leq 1 + 0.3x_a \text{ mm}</math>; max. 4 mm            Medium:  <math>G \leq 0.5 + 0.2x_a \text{ mm}</math>; max. 3mm            High:  <math>G \leq 0.5 + 0.1x_a \text{ mm}</math>; max. 2mm            (Ref. Table 1, No. 10)</p>
<p>Small angle fillet</p> 		$\alpha = 50^\circ - 70^\circ$ $\beta = 70^\circ - 90^\circ$ $G \leq 2 \text{ mm}$	No requirement
<p>Single bevel tee with permanent backing</p> 		$G \leq 4 - 6 \text{ mm}$ $\theta^\circ = 30^\circ - 45^\circ$	No requirement
<p>Single bevel tee</p> 		$G \leq 3 \text{ mm}$ $R \leq 3 \text{ mm}$ $\theta^\circ = 50^\circ$	No requirement
<p><b>NOTE 1</b>            Different plate edge preparation may be accepted or approved by the Classification Society on the basis of an appropriate welding procedure specification. For welding procedures other than manual welding, see paragraph 3.2 Qualification of welding procedures.</p>			

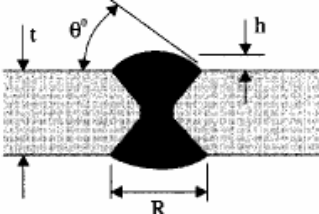

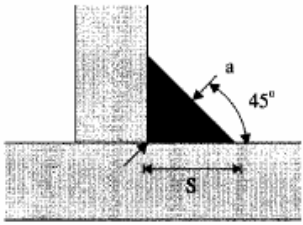
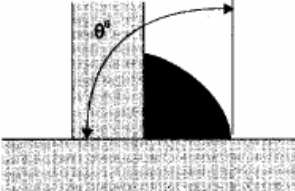


**Table 8.4 Typical Fillet Weld Plate Edge Preparation (Manual Welding)**

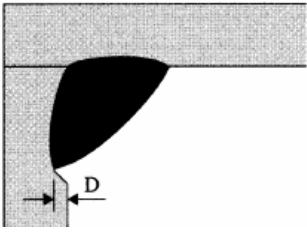
Detail	JSQS (Tolerance limits)	Rec. 47 (Standard)	VSM (Limit)
Single 'J' tee 		$G = 2.5 - 4 \text{ mm}$ $r = 12 - 15 \text{ mm}$ $R = 3 \text{ mm}$ $\theta \geq 35^\circ$	No requirement
Double bevel tee symmetrical 		$t > 19 \text{ mm}$ $G \leq 3 \text{ mm}$ $R \leq 3 \text{ mm}$ $\theta = 50^\circ$	No requirement
Double bevel tee asymmetrical 		$t > 19 \text{ mm}$ $G \leq 3 \text{ mm}$ $R \leq 3 \text{ mm}$	No requirement
Double J bevel symmetrical 		$G = 2.5 - 4 \text{ mm}$ $r = 12 - 15 \text{ mm}$ $R \leq 3 \text{ mm}$ $\theta \geq 35^\circ$	No requirement
<p><b>NOTE 1</b>            Different plate edge preparation may be accepted or approved by the Classification Society on the basis of an appropriate welding procedure specification. For welding procedures other than manual welding, see paragraph 3.2 Qualification of welding procedures.</p>			



**Table 8.5 Typical Butt And Fillet Weld Profile (Manual Welding)**

Detail	JSQS (Tolerance limits)	Rec. 47 (Limit)	VSM (Limit)
<p>Butt weld toe angle (and weld overfill ??)</p> 	<p><math>\theta \leq 90^\circ</math> h not defined (Ref. VII.A.1, pg. 14)</p>	<p><math>\theta \leq 60^\circ</math> max. h = 6 mm</p>	<p>Low: <math>h \leq 1\text{mm} + 0.3 R</math>; max. 10 mm  Medium: <math>h \leq 0.5\text{mm} + 0.2 R</math>; max. 7mm  High: <math>h \leq 0.5\text{mm} + 0.1 R</math>; max. 5mm  (Ref. Table 1, No. 12)</p>
<p>Butt weld undercut</p> 	<p>Skin plate and face plate midship, over 90 mm continuous: D = 0.5 mm  Other: D = 0.8 mm (Ref. VII.A.2, pg. 14)</p>	<p>0.5 mm</p>	<p>Low: max. 1,5 mm  Medium: max. 1,0mm  High: max. 0,5mm  (Ref. Table 1, No. 11)</p>
<p>Fillet weld leg length</p>  <p>s = leg length a = throat depth</p>	<p><math>s \geq 0.9s_d</math> <math>a \geq 0.9a_d</math>  <math>s_d = \text{design } s</math> <math>a_d = \text{design } a</math> (Ref. VII.A.3, pg. 14)</p>	<p><math>s \geq 0.9s_d</math> <math>a \geq 0.9a_d</math>  over short weld lengths  <math>s_d = \text{design } s</math> <math>a_d = \text{design } a</math></p>	<p><math>a \geq (a_d - 0,3 \text{ mm})/1.1</math>  Low: a - <math>a_d</math> max. 2 mm  Medium: a - <math>a_d</math> max. 1mm  High: Not permitted  (Ref. Table 1, No. 15)</p>
<p>Fillet weld toe angle</p> 	<p><math>\theta \leq 90^\circ</math> (Ref. VII.A.3, pg. 14)</p>	<p><math>\theta \leq 90^\circ</math>  In areas of stress concentration and fatigue, the Class Society may require a lesser angle.</p>	<p>No requirement</p>



<p>Fillet weld undercut</p> 	<p><math>D = 0.8 \text{ mm}</math> (Ref. VII.A.2, pg. 14)</p>	<p><math>D = 0.5 \text{ mm}</math></p>	<p>Low: <math>D = 1,5 \text{ mm}</math> Medium: <math>D = 1,0 \text{ mm}</math> High: <math>D = 0,5 \text{ mm}</math> (Ref. Table 1, No. 11)</p>
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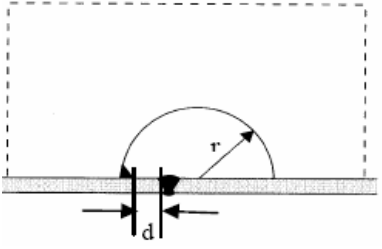
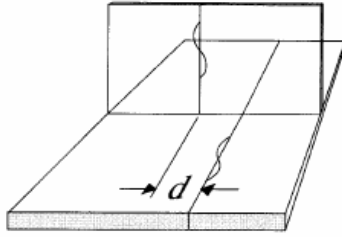
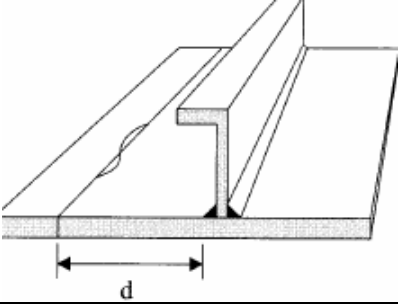
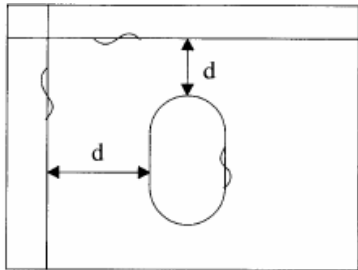


**Table 8.6 Typical Lap, Plug and Slot Welding (Manual Welding)**

Detail	JSQS (Tolerance limits)	Rec. 47 (Limits)	VSM (Limit)
Fillet weld in lap joint <p><math>t_1 &gt; t_2</math></p>	?	( Standard )  $b = 2t_2 + 25\text{mm}$  location of lap joint to be approved by the Classification Society	No requirement
Fillet weld in joggled lap joint <p><math>t_1 &gt; t_2</math></p>	?	( Standard )  $b \geq 2 t_2 + 25 \text{ mm}$	No requirement
Plug welding 	?	<b>when <math>t \leq 12 \text{ mm}</math></b> $l = 60 \text{ mm}$ $R = 6 \text{ mm}, 40^\circ\text{-}50^\circ$ $G = 12 \text{ mm}$ $L > 2l$  <b>when <math>12 &lt; t \leq 25 \text{ mm}</math></b> $l = 80 \text{ mm}$ $R = 0.5t \text{ mm}, 30^\circ$ $G = t \text{ mm}$ $L > 2l$	No requirement, Req. by Class
Slot welding 	?	<b>when <math>t \leq 12 \text{ mm}</math></b> $l = 80 \text{ mm}$ $G = 20 \text{ mm}$ $L = 2l\text{-}3l \text{ max. } 250\text{mm}$  <b>when <math>t &gt; 12 \text{ mm}</math></b> $l = 100 \text{ mm}$ $G = 2t$ $L = 2l\text{-}3l \text{ max. } 250 \text{ mm}$	No requirement, Req. by Class

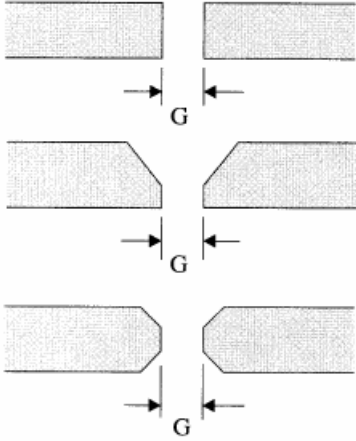


**Table 8.7 Distance Between Welds Table**

Detail	JSQS (Tolerance limits)	Rec. 47 (Standard)	VSM (Limit)
Scallops over weld seams 	for main structure $d \geq 5 \text{ mm}$  for other structure $d \geq 0 \text{ mm}$  (Ref. VIII.A.2, pg. 16)	for $r \geq 30 \text{ mm}$ $d \geq 5 \text{ mm}$  The "d" is to be measured from the toe of the fillet weld to the toe of the butt weld.	$d \geq 10 \text{ mm}$  If $d < 10 \text{ mm}$ the welding hole is not to be enlarged by cutting. The fillet weld has to overlap the transition zone to the butt weld.  (Ref. 5.5.2, pg. 19)
Distance between two butt welds 	$d \geq 0 \text{ mm}$  (Ref. VIII.A.1, pg. 16)	$d \geq 0 \text{ mm}$	$d$ optional,  if measures have been taken for a satisfactory welding of butt welds  (Ref. 5.2.1, pg. 19)
Distance between butt weld and fillet weld 	for main structure $d \geq 10 \text{ mm}$  for other structure $d \geq 0 \text{ mm}$  (Ref. VIII.A.2, pg. 16)	$d \geq 10 \text{ mm}$	Fillet weld first: $d \geq 30 \text{ mm} + 2 t$  Butt weld first: $d \geq 10 \text{ mm}$  Local exceptions are permissible, e.g. in case of acute angular crossing stiffeners  (Ref. 5.5.1, pg. 19)
Distance between butt welds 	for cut-outs $d \geq 30 \text{ mm}$  (Ref. VIII.A.1, pg. 16)	for cut-outs $d \geq 30 \text{ mm}$	for cut-outs $d \geq 50 \text{ mm} + 4 t$  (Ref. 5.5.1, pg. 19)
		for margin plates $d \geq 300 \text{ mm}$  limit: 150 mm (??)	



### 8.8 - Automatic Welding Table

Detail	JSQS (Tolerance limits)	Rec. 47 (Limit)	VSM (Limit)
<p>Submerged Arc Welding (SAW)</p> 	<p>One side SAW: <math>G \leq 5 \text{ mm}</math> (Ref. VIII.C.2, pg. 18)</p> <p>Both side SAW: <math>G \leq 2 \text{ mm}</math> (Ref. VIII.B.1, pg. 18)</p>	<p><math>G \leq 5 \text{ mm}</math></p> <p>Edge preparation as per Tables 8.1 and 8.2 SAW may follow WPS approved by the Classification Society. See Note 1.</p>	<p>According to welding procedure; if <math>G</math> is larger than specified, then gaps up to <math>G = t</math>, max. 30 mm may be closed build-up welding trimmed to the required gap width</p> <p>(Ref. 5.2.3, pg. 17)</p>
<p><b>NOTE 1</b> Different plate edge preparation may be accepted or approved by the Classification Society on the basis of an appropriate welding procedure specification. For welding procedures other than manual welding, see paragraph 3.2 Qualification of welding procedures.</p>			