

Welding Procedure Qualification Tests and Related Requirements

Object of Amendment

Rules for the Survey and Construction of Steel Ships Parts K and M
Guidance for the Survey and Construction of Steel Ships Parts K and M
Guidance for the Approval of Materials and Equipment for Marine Use

Reason for Amendment

In Chapters 2 and 4 of Part M of the Rules for the Survey and Construction of Steel Ships, the requirements concerning welding procedures and related specifications are specified based on IACS Unified Requirement (UR) W28.

The UR contains many provisions unique to classification societies that differ from international standards, and reviews had not been conducted since 2013. Accordingly, IACS carried out reviews to ensure consistency with the latest international standards such as ISO and AWS. In addition, discussions regarding the application of welding procedure specifications approved on the basis of other standards, the approval procedures for steel confirmed to have weldability for high heat input welding and the requirements concerning approval tests for welding procedures were held.

As a result, IACS UR W28 (Rev.3) as well as UR W11 (Rev.10), UR W16 (Rev.4) and W16 (Rev.4 Corr.1), which specify requirements for the rolled steels used for hull structures and offshore structures, and UR W23 (Rev.3), which specifies requirements for welding consumables for rolled steels for offshore structures, were adopted.

Accordingly, relevant requirements are amended based on IACS UR W28 (Rev.3), UR W11 (Rev.10), UR W16 (Rev.4), UR W16 (Rev.4 Corr.1) and UR W23 (Rev.3).

Outline of the Amendment

The main contents of this amendment are as follows.

- (1) Clarifies the reference standards concerning the surface quality of steel in Chapter 3, Part K.
- (2) Specify approval test procedures to confirm weldability for high heat input welding, as well as the identification symbols to be assigned when such weldability has been confirmed in the Guidance for the Approval of Materials and Equipment for Marine Use.
- (3) Amends requirements concerning approval tests for welding procedures specified in Chapters 2 and 4 of Part M.
- (4) Clarifies the reference standards for hydrogen tests of welding consumables for high-strength steels used in offshore structures in Chapter 6, Part M.
- (5) Specifies the requirements in cases where welding procedure specifications approved in accordance with national or international standards as Appendix 2.2.2-7, Part M.
- (6) Specifies the scope of approval for welding procedure specifications when using steels whose weldability for high heat input welding as Appendix 4.1.3-12, Part M.

Effective Date and application

- (1) Rules and Guidance for the Survey and Construction of Steel Ships Part K and Guidance for the Approval of Materials and Equipment for Marine Use
This amendment applies to ships, offshore structures and steels that fall under the

following:

- (a) This amendment applies to ships or offshore structures for which the building contract is placed on or after 1 January 2027.
 - (b) This amendment applies to steels for which the application is submitted to the Society on or after 1 January 2027.
 - (c) This amendment applies to steels for which the application for approval of the manufacturing process is submitted to the Society on or after 1 January 2027.
 - (d) This amendment applies to ships the keels of which are laid or which are at a similar stage of construction on or after 1 January 2027.
- (2) Rules and Guidance for the Survey and Construction of Steel Ships Part M, excluding Chapter 6, Part M of the Rules
This amendment applies to ships the keels of which are laid or which are at a similar stage of construction on or after 1 January 2027.
- (3) Chapter 6, Rules for the Survey and Construction of Steel Ships Parts M
This amendment applies to welding consumables for which the application for approval is submitted to the Society on or after 1 January 2027.

An asterisk (*) after the title of a requirement indicates that there is also relevant information in the corresponding Guidance.

ID:DH25-15

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS Part K MATERIALS Chapter 1 GENERAL 1.5 Marking and Test Certificate 1.5.1 Marking 1 Every materials complying with the requirements is to be clearly stamped with the Society's brand <i>MR</i> including the marks deemed appropriate by the Society and marked with the following particulars in at least one position by the maker. (1) Material grade (2) Name or mark to identify the maker. (3) Number or mark to identify the piece. (4) Condition of heat treatment (if Chapter 3 of this Part applies, except for “as rolled” steel) (5) Name, order number or other identification marks (if required by the purchaser) (6) <u>For steels which have been approved for welding with high heat input, a notation indicating the value of heat input applied in the confirmation test added to the grade designation, e.g. “KE36-W300” (in the case of heat input 300 kJ/cm).</u> 2 Materials which are unsuitable for stamping may be marked with brands, seals or by other suitable means.	RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS Part K MATERIALS Chapter 1 GENERAL 1.5 Marking and Test Certificate 1.5.1 Marking 1 Every materials complying with the requirements is to be clearly stamped with the Society's brand <i>MR</i> including the marks deemed appropriate by the Society and marked with the following particulars in at least one position by the maker. (1) Material grade (2) Name or mark to identify the maker. (3) Number or mark to identify the piece. (4) Condition of heat treatment (if Chapter 3 of this Part applies, except for “as rolled” steel) (5) Name, order number or other identification marks (if required by the purchaser) 2 Materials which are unsuitable for stamping may be marked with brands, seals or by other suitable means.	W11/16.1 W16/13.1 As identification symbols for steels approved for high heat input welding have been introduced, the corresponding notation is also required to be indicated on the test certificate.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
3 Materials which can not be stamped and marked in accordance with the requirements in -1 and -2 due to small size may be properly marked in the lump. 1.5.2 Test Certificate* 1 The manufacturer is to submit test certificate on the rolled steel materials which have passed the specified test and inspection requirements for each material mark for the Surveyor's signature. However, another method may be used instead of Surveyor's signature, provided that it is deemed appropriate by the Society. 2 The test certificate specified in -1 are to contain, in addition to the dimensions, mass, etc., of the steel material, at least items (1) through (11) of the following particulars: (1) Purchaser's order number and if known the ship number which the material is intended; (2) Identification number or symbol; (3) Identification of manufacturer; (4) Identification of grade of material including <u>any additional notations (for example Z25, W300 or RCB). In the case of the corrosion resistant steel for cargo oil tanks specified in 3.13 including the brand name;</u> (5) Chemical Composition (ladle analysis on elements specified in the requirement and added when necessary) (including additive elements for improving corrosion resistance in the case of the corrosion resistant steel for cargo oil tanks specified in 3.13); (6) Carbon equivalent (C_{eq}) or cold cracking susceptibility (P_{cm}) calculated from the following formula using ladle analysis except where otherwise specified (only in such a case as specified in this	3 Materials which can not be stamped and marked in accordance with the requirements in -1 and -2 due to small size may be properly marked in the lump. 1.5.2 Test Certificate* 1 The manufacturer is to submit test certificate on the rolled steel materials which have passed the specified test and inspection requirements for each material mark for the Surveyor's signature. However, another method may be used instead of Surveyor's signature, provided that it is deemed appropriate by the Society. 2 The test certificate specified in -1 are to contain, in addition to the dimensions, mass, etc., of the steel material, at least items (1) through (11) of the following particulars: (1) Purchaser's order number and if known the ship number which the material is intended; (2) Identification number or symbol; (3) Identification of manufacturer; (4) Identification of grade of material (<u>including the brand name in the case of the corrosion resistant steel for cargo oil tanks specified in 3.13</u>); (5) Chemical Composition (ladle analysis on elements specified in the requirement and added when necessary) (including additive elements for improving corrosion resistance in the case of the corrosion resistant steel for cargo oil tanks specified in 3.13); (6) Carbon equivalent (C_{eq}) or cold cracking susceptibility (P_{cm}) calculated from the following formula using ladle analysis except where otherwise specified (only in such a case as specified in this	W11/17.1 W16/14.1 The test certificate is required to indicate the full material designation, including any suffix notation.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
Part.); $C_{eq} = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15} \quad (\%)$ $P_{cm} = C + \frac{Si}{30} + \frac{Mn}{20} + \frac{Cu}{20} + \frac{Ni}{60} + \frac{Cr}{20} + \frac{Mo}{15} + \frac{V}{10} + 5B \quad (\%)$ (7) Mechanical test results (including any standards, in cases where standards differing from those specified in this Part are used); (8) Condition of heat treatment (if Chapter 3 of this Part applies, except for “as rolled” steel); and (9) Deoxidation practice is to be stated (rimed steel only). (10) Results of surface inspections (if Chapters 3, 5, and 6 of this Part apply, specify results only) (11) Results of ultrasonic tests (if Chapters 3, 5, and 6 of this Part apply, specify results only) 3 The manufacturer is to enter the following statement on the certificate to show that the steel material has been made by an approved process, and the declaration is to be signed by the personnel of the manufacturing shop in charge of product quality control or inspection. However, another method may be used instead of the signature of the person in charge, provided that it is deemed appropriate by the Society. (Example) <i>We hereby certify that the material has been made by an approved process and has been satisfactorily tested in accordance with the Rules of Nippon Kaiji Kyokai.</i>	Part.); $C_{eq} = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15} \quad (\%)$ $P_{cm} = C + \frac{Si}{30} + \frac{Mn}{20} + \frac{Cu}{20} + \frac{Ni}{60} + \frac{Cr}{20} + \frac{Mo}{15} + \frac{V}{10} + 5B \quad (\%)$ (7) Mechanical test results (including any standards, in cases where standards differing from those specified in this Part are used); (8) Condition of heat treatment (if Chapter 3 of this Part applies, except for “as rolled” steel); and (9) Deoxidation practice is to be stated (rimed steel only). (10) Results of surface inspections (if Chapters 3, 5, and 6 of this Part apply, specify results only) (11) Results of ultrasonic tests (if Chapters 3, 5, and 6 of this Part apply, specify results only) 3 The manufacturer is to enter the following statement on the certificate to show that the steel material has been made by an approved process, and the declaration is to be signed by the personnel of the manufacturing shop in charge of product quality control or inspection. However, another method may be used instead of the signature of the person in charge, provided that it is deemed appropriate by the Society. (Example) <i>We hereby certify that the material has been made by an approved process and has been satisfactorily tested in accordance with the Rules of Nippon Kaiji Kyokai.</i>	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
4 The requirements in -1 to -3 are to be applied to the materials which are specified in this Part but which are other than rolled steel materials. Chapter 3 ROLLED STEELS 3.1 Rolled Steels for Hull 3.1.9 Quality and Repair of Defects* 1 The finished material is to have a surface quality in accordance with the following (1) to (6): (1) The steel is to be free from surface defects prejudicial to the use of the material for the intended application. (2) The responsibility for meeting the surface finish requirements rests with the manufacturer of the material, who is to take the necessary manufacturing precautions and is to inspect the products prior to delivery. At that stage, however, rolling or heat treatment scale may conceal surface discontinuities and defects. If, during the subsequent descaling or working operations, the material is found to be defective, the Society may require materials to be repaired or rejected. (3) The finished material is to have a surface quality in accordance with standards deemed appropriate by the Society for cases other than those specified in this 3.1.9. Rolled steel bars may comply with manufacturer standards. (4) The surface quality inspection method is to be in accordance with recognized national or international	4 The requirements in -1 to -3 are to be applied to the materials which are specified in this Part but which are other than rolled steel materials. Chapter 3 ROLLED STEELS 3.1 Rolled Steels for Hull 3.1.9 Quality and Repair of Defects* 1 The finished material is to have a surface quality in accordance with the following (1) to (6): (1) The steel is to be free from surface defects prejudicial to the use of the material for the intended application. (2) The responsibility for meeting the surface finish requirements rests with the manufacturer of the material, who is to take the necessary manufacturing precautions and is to inspect the products prior to delivery. At that stage, however, rolling or heat treatment scale may conceal surface discontinuities and defects. If, during the subsequent descaling or working operations, the material is found to be defective, the Society may require materials to be repaired or rejected. (3) The finished material is to have a surface quality in accordance with standards deemed appropriate by the Society for cases other than those specified in this 3.1.9. Rolled steel bars may comply with manufacturer standards. (4) The surface quality inspection method is to be in accordance with recognized national or international	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
standards agreed between purchaser and manufacturer, accepted by the Society. (5) Imperfections of a harmless nature, regarded as being inherent of the manufacturing process, are permissible irrespective of their number, provided the maximum permissible limits of Class A of <i>EN 10163:2004</i> Part 2 <u>for plates and wide flats, the maximum permissible limits of Class C of <i>EN 10163:2004</i> Part 3 for sections</u> or limits specified in a recognized equivalent standard accepted by the Society, are not exceeded and the remaining steel thickness remains in accordance with the requirements in 3.1.8. Total affected area with imperfection not exceeding the specified limits are not to exceed 15% of the total surface in question. (6) Defects given in the following (a) or (b) are to be rejected or repaired irrespective of their size and number. (a) Affected areas with imperfections with a depth exceeding the limits of Class A of <i>EN 10163:2004</i> Part 2 <u>for plates and wide flats, the maximum permissible limits of Class C of <i>EN 10163:2004</i> Part 3 for sections</u> or the maximum permissible limits specified in a recognized equivalent standard accepted by the Society (b) Cracks, injurious surface flaws, shells (overlapping material with non-metallic inclusions), sand patches, laminations and sharp edged seams (elongated defects) visually evident on surface and/or edge of plate 2 The repair of defects is in accordance with the following (1) and (2):	standards agreed between purchaser and manufacturer, accepted by the Society. (5) Imperfections of a harmless nature, regarded as being inherent of the manufacturing process, are permissible irrespective of their number, provided the maximum permissible limits of Class A of <i>EN 10163</i> Part 2 or limits specified in a recognized equivalent standard accepted by the Society, are not exceeded and the remaining steel thickness remains in accordance with the requirements in 3.1.8. Total affected area with imperfection not exceeding the specified limits are not to exceed 15% of the total surface in question. (6) Defects given in the following (a) or (b) are to be rejected or repaired irrespective of their size and number. (a) Affected areas with imperfections with a depth exceeding the limits of Class A of <i>EN 10163</i> Part 2 or the maximum permissible limits specified in a recognized equivalent standard accepted by the Society (b) Cracks, injurious surface flaws, shells (overlapping material with non-metallic inclusions), sand patches, laminations and sharp edged seams (elongated defects) visually evident on surface and/or edge of plate 2 The repair of defects is in accordance with the following (1) and (2):	W11/7.3.1 The reference standard for sections has been specified. W11/7.3.2 The reference standard for sections has been specified.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
(1) The defects specified in -1(6) may be removed by local grinding provided that the following (a) to (e) are satisfied. The grounded areas are to have a smooth transition to the surrounding surface of the product. Complete elimination of the defect is to be verified by magnetic particle or liquid penetrant testing. The remaining steel thickness is to remain in accordance with the requirements in 3.1.8. Such local grindings are to be carried out in the presence of a surveyor unless otherwise approved by the Society. (a) The nominal product thickness does not be reduced by more than 7% or 3 mm, whichever is the less. (b) Each single grounded area does not exceed 0.25 m². (c) All grounded areas do not exceed 2% of the total surface in question. (d) Grounded areas lying in a distance less than their average breadth to each other are to be regarded as one single area. (e) Grounded areas lying opposite each other on both surfaces do not decrease the product thickness by values exceeding the limits as stated under (a). (2) Defects which cannot be dealt with as (1) above may be repaired by chipping or grinding followed by welding, subject to the approval by the Society, provided that the following (a) to (e) are satisfied. Repair of defects is to be followed by magnetic particle or liquid penetrant testing. Such welding repair is to be carried out in the presence of a surveyor unless otherwise approved by the Society.	(1) The defects specified in -1(6) may be removed by local grinding provided that the following (a) to (e) are satisfied. The grounded areas are to have a smooth transition to the surrounding surface of the product. Complete elimination of the defect is to be verified by magnetic particle or liquid penetrant testing. The remaining steel thickness is to remain in accordance with the requirements in 3.1.8. Such local grindings are to be carried out in the presence of a surveyor unless otherwise approved by the Society. (a) The nominal product thickness does not be reduced by more than 7% or 3 mm, whichever is the less. (b) Each single grounded area does not exceed 0.25 m². (c) All grounded areas do not exceed 2% of the total surface in question. (d) Grounded areas lying in a distance less than their average breadth to each other are to be regarded as one single area. (e) Grounded areas lying opposite each other on both surfaces do not decrease the product thickness by values exceeding the limits as stated under (a). (2) Defects which cannot be dealt with as (1) above may be repaired by chipping or grinding followed by welding, subject to the approval by the Society, provided that the following (a) to (e) are satisfied. Repair of defects is to be followed by magnetic particle or liquid penetrant testing. Such welding repair is to be carried out in the presence of a surveyor unless otherwise approved by the Society.	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
Subsequent to the finish grinding, the piece may be required to be normalized or otherwise heat treated at the surveyor's discretion. (a) The weld preparation is not to reduce the thickness of the product below 80% of nominal thickness. For occasional defects with depths exceeding the 80% limit, special consideration may be given at the surveyor's discretion. (b) Any single welded area is not to exceed 0.125 m^2 and the sum of all areas is not to exceed 2% of the surface side in question. (c) If weld repair depth exceeds 3 mm, ultrasonic testing may be requested by the Society. (d) The distance between two welded areas is not to be less than their average width. (e) The repair is to be carried out by qualified welders using a procedure for the appropriate steel grade approved by the Society. The electrodes are to be of low hydrogen type and are to be dried in accordance with the manufacturer's requirements and protected against rehumidification before and during welding. 3 Internal soundness is to be in accordance with the following (1) and (2): (1) Verification of internal soundness is the responsibility of the manufacturer. (2) If steels are ordered with ultrasonic tests, this is to be made in accordance with an accepted standard at the discretion of the Society.	Subsequent to the finish grinding, the piece may be required to be normalized or otherwise heat treated at the surveyor's discretion. (a) The weld preparation is not to reduce the thickness of the product below 80% of nominal thickness. For occasional defects with depths exceeding the 80% limit, special consideration may be given at the surveyor's discretion. (b) Any single welded area is not to exceed 0.125 m^2 and the sum of all areas is not to exceed 2% of the surface side in question. (c) If weld repair depth exceeds 3 mm, ultrasonic testing may be requested by the Society. (d) The distance between two welded areas is not to be less than their average width. (e) The repair is to be carried out by qualified welders using a procedure for the appropriate steel grade approved by the Society. The electrodes are to be of low hydrogen type and are to be dried in accordance with the manufacturer's requirements and protected against rehumidification before and during welding. 3 Internal soundness is to be in accordance with the following (1) and (2): (1) Verification of internal soundness is the responsibility of the manufacturer. (2) If steels are ordered with ultrasonic tests, this is to be made in accordance with an accepted standard at the discretion of the Society.	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended						Original				Remarks		
3.8 High Strength Rolled Steels for Offshore Structures						3.8 High Strength Rolled Steels for Offshore Structures						W16 Corr.1 Table 2 A note has been added to clarify the application of the upper thickness limits, in order to align with Table K3.28, which specifies the maximum thicknesses for each type of product and heat treatment.
3.8.11 Marking						3.8.11 Marking						
Table K3.29 Maximum Carbon Equivalent and Cold Cracking Susceptibility Values												
Grade of steel and heat treatment		Carbon equivalent (%) ⁽¹⁾							Cold-cracking-Susceptibility (%)			
		C _{eq}										
		Thickness (mm) ⁽²⁾										
		Plate/Flat bar 平鋼				Section	Bar	Tubular				
		t ≤ 50	50< t ≤ 100	100< t ≤ 150	150 ≤ t ≤ 250 (3)	t ≤ 50	t ≤ 250 or d ≤ 250	t ≤ 65 (4)				
KA420	N/NR	0.46	0.48	0.52	0.52	0.47	0.53	0.47	—	—		
KD420	TMCP	0.43	0.45	0.47	—	0.44	—	—	—	—		
KE420		0.45	0.47	0.49	—	—	—	0.46	—	—		
KF420	QT	0.45	0.47	0.49	—	—	—	0.46	—	—		
KA460	N/NR	0.50	0.52	0.54	0.54	0.51	0.55	0.51	0.25	—		
KD460	TMCP	0.45	0.47	0.48	—	0.46	—	—	0.30	0.23		
KE460		0.47	0.48	0.50	—	—	—	0.48	0.32	0.24		
KF460	QT	0.47	0.48	0.50	—	—	—	0.48	0.32	0.24		
KA500	TMCP	0.46	0.48	0.50	—	—	—	—	0.32	0.24		
KD500		0.48	0.50	0.54	—	—	—	0.50	0.34	0.25		
KE500	QT	0.48	0.50	0.54	—	—	—	0.50	0.34	0.25		
KF500		0.56	0.60	0.64	—	—	—	0.56	0.36	0.28		
KA550	TMCP	0.48	0.50	0.54	—	—	—	—	0.34	0.25		
KD550		0.56	0.60	0.64	—	—	—	0.56	0.36	0.28		
KE550	QT	0.56	0.60	0.64	—	—	—	0.56	0.36	0.28		
KF550		0.56	0.60	0.64	—	—	—	0.58	0.38	0.30		
KA620	TMCP	0.50	0.52	—	—	—	—	—	0.34	0.26		
KD620		0.56	0.60	0.64	—	—	—	0.58	0.38	0.30		
KE620	QT	0.56	0.60	0.64	—	—	—	0.58	0.38	0.30		
KF620		0.56	0.60	0.64	—	—	—	0.58	0.38	0.30		

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended						Original					Remarks	
<i>KA690</i> <i>KD690</i> <i>KE690</i> <i>KF690</i>	<i>TMCP</i>	0.56	—	—	—	—	—	—	—	0.36	0.30	
<i>KA890</i> <i>KD890</i> <i>KE890</i>	<i>QT</i>	0.64	0.66	0.70	—	—	—	—	0.68	0.40	0.33	
<i>KA890</i> <i>KD890</i> <i>KE890</i>	<i>TMCP</i>	0.60	—	—	—	—	—	—	—	0.38	0.28	
<i>KA890</i> <i>KD890</i> <i>KE890</i>	<i>QT</i>	0.68	0.75	—	—	—	—	—	—	0.40	—	
<i>KA960</i> <i>KD960</i> <i>KE960</i>	<i>QT</i>	0.75	—	—	—	—	—	—	—	0.40	—	
Notes: (1) For steel grades <i>K460</i> and higher, <i>CET</i> may be used instead of <i>C_{eq}</i> . In such cases, <i>CET</i> is to be calculated according to the following formula. $CET = C + \frac{(Mn + Mo)}{10} + \frac{(Cr + Cu)}{20} + \frac{Ni}{40}$ (2) For bars, “thickness” is to be read as either “radius” or “length of one side” (3) <u>The thickness range exceeding 150 mm but not exceeding 250 mm applies only to steels in the normalised (<i>N</i>) condition.</u> (4) <u>The thickness range exceeding 50 mm but not exceeding 65 mm applies only to steels in the normalised (<i>N</i>) condition.</u>												

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended						Original						Remarks		
Table K3.30 Mechanical Properties														Same as above.
Grade of steel and heat treatment		Yield point or Proof stress (N/mm ²)			Tensile strength (N/mm ²) ⁽³⁾		Elongation $L_0=5.65\sqrt{S_0}$ (%) ⁽¹⁾⁽²⁾		Impact test ⁽⁷⁾⁽⁸⁾					
		Thickness (mm) ⁽⁴⁾			Thickness (mm) ⁽⁴⁾				Testing temperature (°C)	Minimum mean absorbed energy (J) ⁽²⁾				
		3 < t ≤ 50	50 < t ≤ 100 ⁽⁵⁾	100 < t ≤ 250 ⁽⁵⁾⁽⁹⁾	3 < t ≤ 100	100 < t ≤ 250 ⁽⁶⁾⁽⁹⁾	T	L		T	L			
KA420	N/NR TMCP QT	420 min.	390 min.	365 min.	520~680	470~650	19	21	0	28	42			
KD420									-20					
KE420									-40					
KF420									-60					
KA460	N/NR TMCP QT	460 min.	430 min.	390 min.	540~720	500~710	17	19	0	31	46			
KD460									-20					
KE460									-40					
KF460									-60					
KA500	TMCP QT	500 min.	480 min.	440 min.	590~770	540~720	17	19	0	33	50			
KD500									-20					
KE500									-40					
KF500									-60					
KA550	TMCP QT	550 min.	530 min.	490 min.	640~820	590~770	16	18	0	37	55			
KD550									-20					
KE550									-40					
KF550									-60					
KA620	TMCP QT	620 min.	580 min.	560 min.	700~890	650~830	15	17	0	41	62			
KD620									-20					
KE620									-40					
KF620									-60					
KA690	TMCP QT	690 min.	650 min.	630 min.	770~940	710~900	14	16	0	46	69			
KD690									-20					
KE690									-40					
KF690									-60					
KA890	TMCP QT	890 min.	830 min.	—	940~1100	—	11	13	0	46	69			
KD890									-20					
KE890									-40					
KA960	QT	960 min.	—	—	980~1150	—	10	12	0	46	69			
KD960									-20					
KE960									-40					

Notes:
(1) For steels whose strength levels are K420 to K960, U1 test specimens may be used. In such cases, the minimum elongation for the

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<i>U1</i> test specimen is to comply with the requirements given in Table K3.31. (2) The direction of the longitudinal axis of the test specimen to the direction of final rolling is denoted by <i>L</i> for parallel or <i>T</i> for transverse. (3) For steels complying with the requirements specified in 3.11, the results of tensile tests in the through thickness direction are not to be less than 80% of specified minimum tensile strength. (4) For bars, “thickness” is to be read as “radius” or “length of one side” (5) For plates, flat bars and sections, the values in the thickness range of $3 < t \leq 50$ are to applied regardless of thickness in cases where the design requires that tensile properties are maintained throughout the thickness. (6) For plates, flat bars and sections for applications, values in the thickness range of $3 < t \leq 100$ are to applied regardless of thickness in cases where the design requires that tensile properties are maintained throughout the thickness. (7) When the absorbed energy of two or more test specimens among a set of test specimens is less in value than the specified minimum mean absorbed energy or when the absorbed energy of a single test specimen is less in value than 70% of the specified minimum mean absorbed energy, the test is considered to be failed. (8) Impact tests for nominal thicknesses of less than 6 mm may be omitted. (9) <u>The thickness range exceeding 150 mm but not exceeding 250 mm applies only to steels in the normalised (N) condition.</u>		
The effective date of the amendment is according to EFFECTIVE DATE AND APPLICATION (A)		

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS Part M WELDING Chapter 2 WELDING WORKS 2.2 Work Scheme 2.2.1 Welding Application Plan* <u>1</u> The manufacturer is to submit the welding application plan, including the following items, to the Society every ship for approval prior to welding works. Midship section plan (showing grades of materials, thickness, dimension, etc.) may be used as the plan. (1) Kinds of main structural members for hull within 0.6L amidship, which are intended for on-site welding (2) Kinds of welding procedure which is applied to the welding in preceding (1) and its welding position, including the number and the date of approval of the welding procedure (3) Others items considered necessary by the Society <u>2</u> The weld metal strength and/or toughness may be lower than that specified for the base metal provided that the application has design approval for the undermatching weld metal, and the consumables are a lower grade approved in accordance with Chapter 6 of this Part. In such cases, the weld metal strength and/or toughness which has been	RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS Part M WELDING Chapter 2 WELDING WORKS 2.2 Work Scheme 2.2.1 Welding Application Plan* The manufacturer is to submit the welding application plan, including the following items, to the Society every ship for approval prior to welding works. Midship section plan (showing grades of materials, thickness, dimension, etc.) may be used as the plan. (1) Kinds of main structural members for hull within 0.6L amidship, which are intended for on-site welding (2) Kinds of welding procedure which is applied to the welding in preceding (1) and its welding position, including the number and the date of approval of the welding procedure (3) Others items considered necessary by the Society (Newly added)	W28/4.1.6 It has been clarified that, where an undermatching weld is adopted, the WPS is required to ensure the strength specified in the approved design.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>confirmed at approval of welding procedure specification is to be not less than that specified in the approved design.</u> 2.2.2 Welding Procedure and Related Specification* 1 Welding procedure and related specification are to be approved by the Society in accordance with the requirements specified in Chapter 4 of this Part. 2 At least the following welding conditions are to be included in the welding procedure specification specified in preceding -1. (1) Welding procedure (2) Base metal (grade of steel and maximum thickness) (3) Welding consumables (brand, grade, shielded gas, backing, etc.) (4) Kind of welding (butt or fillet) (5) Welding position (6) Details of edge preparations according to the thickness of base metal (including standard tolerances for edge preparation condition, i.e. groove angle, root gap, and misalignment), number of electrodes and arrangement, leg length or throat thickness, layer or pass sequence and welding parameter (amperage, voltage, welding speed, heat input, current). (7) Preheating and interpass temperature (8) Post weld heat treatment (9) Applicable member (only in cases where brittle fracture tests and technical documents related to such brittle fracture tests are omitted in 4.2.7-7) (10) Other conditions necessary for the welding procedure 3 The welding procedure and related specification, in addition to the requirements in preceding -2, are to be	2.2.2 Welding Procedure and Related Specification* 1 Welding procedure and related specification are to be approved by the Society in accordance with the requirements specified in Chapter 4 of this Part. 2 At least the following welding conditions are to be included in the welding procedure specification specified in preceding -1. (1) Welding procedure (2) Base metal (grade of steel and maximum thickness) (3) Welding consumables (brand, grade, shielded gas, backing, etc.) (4) Kind of welding (butt or fillet) (5) Welding position (6) Details of edge preparations according to the thickness of base metal (including standard tolerances for edge preparation condition, i.e. groove angle, root gap, and misalignment), number of electrodes and arrangement, leg length or throat thickness, layer or pass sequence and welding parameter (amperage, voltage, welding speed, heat input, current). (7) Preheating and interpass temperature (8) Post weld heat treatment (9) Applicable member (only in cases where brittle fracture tests and technical documents related to such brittle fracture tests are omitted in 4.2.7-7) (10) Other conditions necessary for the welding procedure 3 The welding procedure and related specification, in addition to the requirements in preceding -2, are to be	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
including repair procedure of the welding defects which comprise the following provisions. (1) Kind of the welding defects (2) The way of chipping, grinding, etc. for the welding defects (3) Edge preparations after the removal of the welding defects (4) Quality verification scheme for the portion of the welding defects removed, including non-destructive inspection (5) Procedures of the welding, including the welding procedure, the welding consumables, the welder's qualifications, preheating, post weld heat treatment, etc. (6) Quality verification scheme of the repair part, including non-destructive inspection <u>4 A preliminary welding procedure specification (pWPS) is to be prepared by the manufacturer which intends to perform the welding procedure qualification test. The pWPS can be modified and amended during procedure tests as deemed necessary however it is to define all relevant variables required by this Part.</u> <u>5 The manufacturer is to submit to the Society a pWPS for review prior to the tests. In case that the test pieces welded according to the pWPS show unacceptable results the pWPS is to be revised by the manufacturer. The new revised pWPS is to be qualified in accordance with this Part.</u> <u>6 On satisfactory qualification of the pWPS, the Society may approve it as a welding procedure qualification for production welding based on contents of the pWPS. The welding procedure qualification approval range is to be based on the welding procedure qualification record and is to comply with Chapter 4.</u>	including repair procedure of the welding defects which comprise the following provisions. (1) Kind of the welding defects (2) The way of chipping, grinding, etc. for the welding defects (3) Edge preparations after the removal of the welding defects (4) Quality verification scheme for the portion of the welding defects removed, including non-destructive inspection (5) Procedures of the welding, including the welding procedure, the welding consumables, the welder's qualifications, preheating, post weld heat treatment, etc. (6) Quality verification scheme of the repair part, including non-destructive inspection (Newly added) (Newly added) (Newly added)	W28/3.1.1 The procedure for WPS approval has been specified. W28/3.1.2 Same as above. W28/3.1.3 Same as above.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>7 Welding procedures qualified in accordance with national or international welding procedure qualification standards may result in a difference in the examination, testing, and range of approval. For the acceptance of such qualifications, then Annex 2.2.2-7 “Requirements for the Acceptance of Welding Qualifications to National or International Standards“ is to be followed.</u> Chapter 4 WELDING PROCEDURE AND RELATED SPECIFICATIONS 4.1 General 4.1.3 Execution of Tests* <u>1 Tests are intended to verify that a manufacturer is adequately qualified to perform welding operations using a particular procedure. For the approval of welding procedure and related specifications, the tests specified in 4.2 to 4.6 are to be carried out based on the representing conditions, such as the edge preparation, welding parameter, etc., described in the welding procedure specification, with satisfactory results. However, for high strength rolled steels for offshore structures, the tests are to be carried out for every kind of heat treatment.</u> 2 Part of or all requirements for the tests provided in preceding -1 may be dispensed in the case which deemed appropriate by the Society, subject to the approval of the welding procedure specifications. 3 The addition of tests or test conditions other than those specified in this Chapter for the welding procedure qualification (e.g. design of strength, thickness and	(Newly added) Chapter 4 WELDING PROCEDURE AND RELATED SPECIFICATIONS 4.1 General 4.1.3 Execution of Tests* 1 For the approval of welding procedure and related specifications, the tests specified in 4.2 to 4.6 are to be carried out based on the representing conditions, such as the edge preparation, welding parameter, etc., described in the welding procedure specification, with satisfactory results. However, for high strength rolled steels for offshore structures, the tests are to be carried out for every kind of heat treatment. 2 Part of or all requirements for the tests provided in preceding -1 may be dispensed in the case which deemed appropriate by the Society, subject to the approval of the welding procedure specifications. 3 The addition of tests or test conditions other than those specified in this Chapter for the welding procedure qualification (e.g. design of strength, thickness and	W28/1.6 The provisions for the acceptance of WPSs qualified in accordance with other standards have been specified. W28/2.1 The purpose of the welding procedure qualification test has been specified.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
temperature, and welding heat input) may be required, where deemed necessary by the Society. 4 The changes of backing material for one-side welding are to be deemed appropriate by the Society. 5 For qualification tests for stainless clad steels, the requirements specified in 4.2 to 4.6 are to be complied with. However the impact test may be dispensed with where other welding procedure qualification on the stainless clad steel base metal has been approved under the same welding condition. 6 Welding procedure used by dissimilar process (combination welding) may be carried out with separate welding procedure tests for each weld process. 7 Welding procedures approved using test assemblies prepared for multi-run techniques are not to be applied to single-run techniques. 8 <u>Separate approval is required for each degree of mechanisation of the welding process, e.g. manual, partly mechanised, fully mechanised or automatic welding.</u> 9 <u>For gas shielded welding processes, the qualification is restricted to the nominal composition of the shielding gas used in the qualification test.</u> 10 <u>If tack welds and/or start and stop points are a condition of the welding process they are to be fused into the joint and are to be included in the test assemblies.</u>	temperature, and welding heat input) may be required, where deemed necessary by the Society. 4 The changes of backing material for one-side welding are to be deemed appropriate by the Society. 5 For qualification tests for stainless clad steels, the requirements specified in 4.2 to 4.6 are to be complied with. However the impact test may be dispensed with where other welding procedure qualification on the stainless clad steel base metal has been approved under the same welding condition. 6 Welding procedure used by dissimilar process (combination welding) may be carried out with separate welding procedure tests for each weld process. 7 Welding procedures approved using test assemblies prepared for multi-run techniques are not to be applied to single-run techniques. (Newly added) (Newly added) (Newly added)	W28/5.5.3 It has been clarified that approval is required for each welding process, in accordance with the current practice. W28/5.5.4 It has been specified that the qualification test is to be carried out using a shielding gas of the same composition as that specified in the WPS, in accordance with the current practice. W28/4.1.3 It has been specified that the test assembly is to include tack welds and weld stop/start locations.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>11 Where most of the welding connections are a fillet weld type, a fillet weld qualification in addition to the butt weld qualification test is to be performed to confirm that acceptable weld quality is achieved.</u>	(Newly added)	W28/4.1.4 The relevant UR requirements have been incorporated. However, where the joint is within the approved range of the qualification, no additional qualification test is required, thereby maintaining the current practice.
<u>12 For welding procedure qualification tests using steels with approved high heat input grade notation, refer also to Annex 4.1.3-12 “Requirements for Welding Qualification Using Approved High Heat Input Steel”. In this Part, “high heat input welding” means the following:</u> (1) <u>For steels of all strength levels, welding with a heat input greater than 50 kJ/cm;</u> (2) <u>Notwithstanding (1), for high strength rolled steels for offshore structures manufactured by quenching and tempering and having a specified minimum yield strength of 420 N/mm² or above, welding with a heat input greater than 35 kJ/cm for strength levels 420 N/mm² and above.</u> <u>13 Steel mill recommendations are to be considered by the manufacturer when applying high heat input welding to steels without an approved high heat input grade notation.</u> <u>Note:</u> <u>The manufacturer is to be aware that the use of steels which do not have an approved high heat input grade notation have not undergone a weldability test for a specified high heat input.</u>	(Newly added)	W28/2.2 W28/4.1.5 The term "high heat input welding" has been defined, and the requirements for WPSs using steels approved for high heat input welding have been specified in an Annex.
4.1.4 Range of Approval* 1 The scope of approval of the welding procedure and	(Newly added)	W28/2.2 Requirements regarding the use of steels not approved for high heat input welding have been specified.
4.1.4 Range of Approval* 1 The scope of approval of the welding procedure and	4.1.4 Range of Approval* 1 The scope of approval of the welding procedure and	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
related specifications of rolled steels for hull and high strength rolled steels for offshore structures are in accordance with the following (1) through (6), on the condition that other welding conditions are same. However, the range of approval differing from the requirements specified in this Chapter may be accepted that it is deemed appropriate by the Society. (1) Kind of weld joints Kind of weld joints is in accordance with in Table M4.1. (2) Thickness The range of the thickness is in accordance with in Table M4.2. (3) Leg length of fillet welding The range of the leg length of fillet welding is in accordance with in Table M4.3. (4) Kinds of base metal (a) Rolled steels for hull i) Within the same strength level, the welding procedures are considered applicable to lower toughness grade (material with higher specified impact test temperature). ii) In addition to the requirement in i), within the same and below toughness grades, the welding procedures are considered applicable to the one and two lower strength levels (material with the one and two lower specified yield strength). iii) <u>Where high heat input welding is being applied to steels without an approved high heat input grade notation, the welding procedures are only applicable for that toughness grade tested, and one strength level below.</u>	related specifications of rolled steels for hull and high strength rolled steels for offshore structures are in accordance with the following (1) through (6), on the condition that other welding conditions are same. However, the range of approval differing from the requirements specified in this Chapter may be accepted that it is deemed appropriate by the Society. (1) Kind of weld joints Kind of weld joints is in accordance with in Table M4.1. (2) Thickness The range of the thickness is in accordance with in Table M4.2. (3) Leg length of fillet welding The range of the leg length of fillet welding is in accordance with in Table M4.3. (4) Kinds of base metal (a) Rolled steels for hull i) Within the same strength level, the welding procedures are considered applicable to lower toughness grade (material with higher specified impact test temperature). ii) In addition to the requirement in i), within the same and below toughness grades, the welding procedures are considered applicable to the one and two lower strength levels (material with the one and two lower specified yield strength). (Newly added)	W28/5.2.1 It has been specified that the existing requirements continue to apply to steels not approved for high heat input welding, while the requirements for steels approved for high heat input welding are given in the Annex.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
iv) <u>For applicability of strength and toughness grade range for steels with approved high heat input grade notation, see Annex 4.1.3-12 "Requirements for Welding Qualification Using Approved High Heat Input Steel".</u> (b) High strength rolled steels for offshore structures i) Within the same strength level, the welding procedures are considered applicable to lower toughness grade. ii) In addition to the requirement in i), within the same and below toughness grades, the welding procedures are considered applicable to the one lower strength levels. <u>For steel strength levels 890 and 960 N/mm², a test made in strength level 960 N/mm² qualifies both 960 and 890 N/mm², however, a test made in 890 N/mm² qualifies only 890 N/mm².</u> iii) <u>The approval of quenched and tempered steels does not qualify thermo-mechanically rolled steels (TMCP steels) and vice versa.</u> iv) <u>Where high heat input welding is being applied to plates without an approved high heat input grade notation, the welding procedures are only applicable for that toughness grade and strength level tested.</u> v) <u>For applicability of strength and toughness grade range for plates with approved high heat input grade notation, see Annex 4.1.3-12 "Requirements for Welding Qualification Using Approved High Heat Input Steel".</u>	(b) High strength rolled steels for offshore structures i) Within the same strength level, the welding procedures are considered applicable to lower toughness grade. ii) In addition to the requirement in i), within the same and below toughness grades, the welding procedures are considered applicable to the one lower strength levels. (c) <u>Notwithstanding the requirement given in (a) and (b), for the large heat input welding specified in Note (6) of Table M4.2, the welding procedures are considered applicable to that toughness grade tested and one strength level below.</u>	W28/5.2.3 It has been specified that steels of higher strength levels are subject to separate provisions, and that the requirements for steels approved for high heat input welding are provided in the Annex. W28/5.2.2 It has been specified that the approval is valid only for the base metal used in

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>(c) KE47</u> The welding procedures are <u>only</u> applicable for that toughness grade <u>and</u> strength level tested. (5) Kinds of welding consumables <u>(a) The welding consumables are to be not brand but grade (including all suffixes), except the large heat input specified Note (6) of Table M4.2.</u> <u>(b) High strength rolled steels for offshore structures having a strength levels 890 N/mm² and 960 N/mm², no change in the trade name of the consumable is permitted.</u> <u>(c) No change in welding consumable trade name is permitted for high heat input welding procedure qualifications.</u> <u>(d) For applications with a design temperature below -20 °C, the following requirements are to apply.</u> <u>i) For SMAW and FCAW, where a change of welding consumable brand is made for consumables approved with an impact test temperature of -20 °C or below, the manufacture is to weld an additional test assembly using a heat input equal to or greater than that used in the original qualification test. The impact test specimens taken from the weld metal are to be tested</u>	<u>(d) Notwithstanding the requirements given in (a) to (c), welding procedures for KE47 within the same and below toughness grades are considered applicable to one lower strength level. However, for the large heat input welding specified in Note (6) of Table M4.2, the welding procedures are considered applicable to that toughness grade tested and the same strength level.</u> (5) Kinds of welding consumables The welding consumables are to be not brand but grade (including all suffixes), except the large heat input specified Note (6) of Table M4.2. (Newly added)	the qualification test. W28/5.6 It has been specified that steels of higher strength levels are covered separately. It has been specified that the existing requirements continue to apply to high heat input welding. Requirements for changes to welding consumables and shielding gases for service at low temperatures have been specified.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>and are to meet the requirements for butt joint impact tests ($t \leq 50 \text{ mm}$) specified in Tables M4.9 to M4.11.</u> ii) <u>For SAW, a change in combinations (wire and flux) approved with an impact test temperature of 0 °C or above is permitted, provided that the proposed combination is approved, the welding flux is of the same type (e.g. agglomerated, fused, neutral, active or alloyed) and the nominal composition of the main flux constituents is the same. For welding consumables approved with an impact test temperature of -20 °C or below, changes in wire and flux are not permitted.</u> (6) Welding position (a) Welding position is in accordance with in Table M5.10. The welding position of T-joints with partial penetration and T-joints with full penetration are to be the same welding position as fillet weld joints. (b) Approval tests are to be performed each welding position. However, to qualify a range of positions, test assemblies are to be welded for highest heat input position and lowest heat input position and all applicable tests are to be made on those assemblies. The above excludes welding in the vertical position with travel in the downward direction which will always require separate tests and only are acceptable for that position. (c) <u>It is permissible that a test assembly welded in the horizontal position will qualify both flat and</u>	(6) Welding position (a) Welding position is in accordance with in Table M5.10. The welding position of T-joints with partial penetration and T-joints with full penetration are to be the same welding position as fillet weld joints. (b) Approval tests are to be performed each welding position. However, to qualify a range of positions, test assemblies are to be welded for highest heat input position and lowest heat input position and all applicable tests are to be made on those assemblies. The above excludes welding in the vertical position with travel in the downward direction which will always require separate tests and only are acceptable for that position. (Newly added)	W28/5.4.2 It has been specified that qualification in the horizontal position also qualifies the flat position, irrespective of the heat input. The relevant UR requirements have been incorporated from the

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>horizontal positions provided that the heat input is in accordance with (7).</u> (7) <u>Heat input</u> <u>Heat input of welding for actual works is to be complied with the requirements specified in the following.</u> (a) <u>Rolled steels for hull</u> i) <u>The upper limit of heat input approved is 1.25 times the heat input used in welding the test assembly, but not over 55 kJ/cm.</u> ii) <u>Where a steel without approved high heat input grade notation is used the upper limit is 1.1 times greater than that used in welding the test assembly.</u> iii) <u>For steels with approved high heat input grade notation, see Annex 4.1.3-12 "Requirements for Welding Qualification Using Approved High Heat Input Steel".</u> iv) <u>The lower limit of heat input approved is 0.75 times the heat input used in welding the test assembly.</u> (b) <u>High strength rolled steels for offshore structures</u> i) <u>The upper limit of heat input approved is 1.25 times greater than that used in welding the test assembly or 55 kJ/cm (38.5 kJ/cm for QT condition) whichever is smaller.</u> ii) <u>Where a steel without approved high heat input grade notation is used the upper limit is 1.1 times greater than that used in welding the test assembly.</u> iii) <u>For steels with approved high heat input</u>	(Newly added) (Newly added) (Newly added)	Guidance. There is no change to the existing requirements applicable to steels not approved for high heat input welding. W28/5.7.1 It has been specified that the requirements for steels approved for high heat input welding are provided in the Annex. The relevant provisions have been transferred from the Guidance. There is no change to the existing requirements applicable to steels not approved for high heat input welding. W28/5.7.4 It has been specified that, for steels of higher strength levels, the upper and lower approval limits are restricted. The relevant provisions have been transferred from the Guidance. There

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
grade notation, see Annex 4.1.3-12 "Requirements for Welding Qualification Using Approved High Heat Input Steel". iv) <u>The lower limit of heat input approved is 0.75 times lower than that used in welding the test assembly.</u> v) <u>For strength levels 890 N/mm^2 and 960 N/mm^2 the upper and lower limit is 1.1 times and 0.9 times to that used in the test.</u> (8) <u>Preheating and interpass temperature</u> <u>Preheating and interpass temperature for actual work are to be complied with the requirements specified in the following.</u> <u>(a) The minimum preheating temperature is that used in the qualification test.</u> <u>(b) The maximum interpass temperature is that used in the qualification test.</u> (9) <u>Post-heating</u> <u>The temperature and duration of post-heating used in the test for hydrogen release are not to be reduced. Post-heating is not to be omitted but may be added.</u> (10) <u>Post-weld heat treatment</u> <u>(a) The heat treatment used in the qualification test is to be maintained during manufacture. Holding time may be adjusted as a function of thickness.</u> <u>(b) For welding of <i>TMCP</i> steel the <i>PWHT</i> is not to be carried out above the lower transformation temperature.</u> <u>(c) The temperature used in production is not to deviate by more than 20 °C from that used for the qualification.</u> (9) <u>Shop primers</u>	(Newly added) (Newly added) (Newly added) (Newly added)	is no change to the existing practice. W28/5.9 Requirements for the use of post-heating for hydrogen diffusion as a qualification test condition have been specified. W28/5.10 The relevant provisions have been transferred from the Guidance and revised, taking into account the relevant UR requirements. W28/5.12 Requirements for the application of shop primer have been specified.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>Welding procedure qualification with shop primer will qualify those without but not vice versa.</u> (Deleted) 3 Where deemed necessary by the Society for welding procedure, restrictions on the heat treatment of base metals, carbon equivalent or cold cracking susceptibility and the locations of application of the welding procedure may be imposed. 4 The range of approval of materials other than rolled steels for hull, high strength rolled steels for offshore structures and steel pipes is to be as deemed appropriate by the Society.	3 <u>The restriction of welding procedure condition (e.g. heat input welding and preheating) in actual work is to be deemed appropriate by the Society.</u> 4 Where deemed necessary by the Society for welding procedure, restrictions on the heat treatment of base metals, carbon equivalent or cold cracking susceptibility and the locations of application of the welding procedure may be imposed. 5 The range of approval of materials other than rolled steels for hull, high strength rolled steels for offshore structures and steel pipes is to be as deemed appropriate by the Society.	The provisions for welding heat input and preheating have been transferred to the Rules, taking into account the relevant UR requirements. The paragraph numbering has been revised. The paragraph numbering has been revised.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended

Table M4.2 Approved Range of Thickness ^{(1), (9)}

Thickness of test assemblies <i>t</i> (mm) (2), (3), (4), (5)	Approved range of thickness (mm) ⁽¹⁰⁾		
	Multi-run technique ^{(7), (8)}	Single-run technique or Two-run technique ^{(7), (8), (11)}	<u>High</u> heat input welding process ⁽⁶⁾
Butt welding ⁽⁴⁾			
<u>$3 < t \leq 12$</u>	<u>$3 \text{ to } 2t$</u>	<u>$0.5t \text{ to } 1.3t$ (the minimum value is not less than 3.)</u>	<u>$0.7t \text{ to } t$</u>
<u>$12 < t \leq 40$</u>	<u>$0.5t \text{ to } 2t$</u>	<u>$0.5t \text{ to } 1.1t$</u>	<u>$0.7t \text{ to } t$</u>
<u>$40 < t \leq 100$</u>	<u>$0.5t \text{ to } 2t$</u>	<u>$0.7t \text{ to } 1.1t$</u>	<u>$0.7t \text{ to } t$</u>
<u>$100 < t$</u>	<u>$50 \text{ to } 2t$</u>	<u>$-$</u>	<u>$0.7t \text{ to } t$</u>
Fillet welding			
<u>$3 \leq t < 30$</u>	<u>$3 \text{ to } 2t$</u>	<u>$3 \text{ to } 2t$</u>	<u>$0.7t \text{ to } t$</u>
<u>$30 \leq t$</u>	<u>$5 \leq$</u>	<u>$5 \leq$</u>	<u>$0.7t \text{ to } t$</u>

Notes:

(1) Welding procedure used by dissimilar process (combination welding) is to be correspondingly applied to **Table M4.2**. In this case, thickness or throat thickness of each welding method is to be *t*.

(2) For unequal plate thickness or pipe wall thickness of butt welds the lesser thickness is ruling dimension.

(3) For fillet welds, the range of approval shall be applied to the web thickness and flange thickness of test piece.

(4) For T-joints with full penetration and T-joints with partial penetration, *t* is the thickness of the web thickness and flange thickness of test assembly and the requirements to be correspondingly applied are the requirements for butt welding.

(5) For branch connections, *t* is the thickness of main pipes and branch pipes respectively, and the requirements to be correspondingly applied are the requirements for butt welding.

(6) Applies where high heat input welding applied to plates without an approved high heat input notation. Where high heat input welding is applied to steels bearing a high heat input designation, the requirements of Annex 4.1.3-12 "Requirements for Welding Qualification Using Approved High Heat Input Steel" are to be complied with. The suitability of the applied high heat input to thinner plates is to be determined by the manufacturer or the shipyard based upon practical considerations.

Original

Table M4.2 Approved Range of Thickness ^{(1), (9)}

Thickness of test assemblies <i>t</i> (mm) ^{(2), (3), (4), (5)}	Approved range of thickness (mm) ⁽¹⁰⁾			<u>Fillet welding</u>
	Multi-run technique	Single-run technique or Two-run technique ⁽¹¹⁾	<u>Large</u> heat input welding process ⁽⁶⁾	
<u>$t \leq 100$</u>	<u>$0.5t \text{ to } 2t$ ^{(7), (8)} (100 max)</u>	<u>$0.7t \text{ to } 1.1t$ ^{(7), (8)} (100 max)</u>	<u>$0.7t \text{ to } t$</u>	<u>$0.5t \text{ to } 2t$ ^{(7), (8)} (100 max)</u>

Notes:

(1) Welding procedure used by dissimilar process (combination welding) is to be correspondingly applied to **Table M4.2**. In this case, thickness or throat thickness of each welding method is to be *t*.

(2) For unequal plate thickness or pipe wall thickness of butt welds the lesser thickness is ruling dimension.

(3) For fillet welds, the range of approval shall be applied to the web thickness and flange thickness of test piece.

(4) For T-joints with full penetration and T-joints with partial penetration, *t* is the thickness of test assembly on the open edge side and the requirements to be correspondingly applied are the requirements for butt welding.

(5) For branch connections, *t* is the thickness of main pipes and branch pipes respectively, and the requirements to be correspondingly applied are the requirements for butt welding.

(6) Large heat input welding means the welding with a welding heat input of not less than 50 kJ/cm.

W28/Table 2

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>including plate manufacturer's recommendations, during welding qualification, together with previous experience.</u> (7) For the vertical-down welding and tube positions for welding downwards, the test piece thickness t is always taken as the upper limit of the range of application. (8) For <u>pipe</u> test assembly thickness not more than 12 mm, the specified minimum content is not applicable. (9) For the kinds of test assemblies specified in Table M4.12, even though the test specimen has passed the hardness test specified in 4.2.9, 4.3.6 and 4.4.6, the upper limit of the thickness range of approval is to be restricted to the thickness of the test assembly when three or more of the hardness values in the heat affected zone are less than 25HV lower than the values specified in Table M4.12. (10) For steel pipes for low temperature service, the upper limit is to be a maximum of 25 mm unless another value is considered appropriate by the Society. (11) Two-run technique refers to a welding process involving a single pass on both sides.	(7) For the vertical-down welding and tube positions for welding downwards, the test piece thickness t is always taken as the upper limit of the range of application. (8) For test assembly thickness not more than 12 mm, the specified minimum content is not applicable. (9) For the kinds of test assemblies specified in Table M4.12, even though the test specimen has passed the hardness test specified in 4.2.9, 4.3.6 and 4.4.6, the upper limit of the thickness range of approval is to be restricted to the thickness of the test assembly when three or more of the hardness values in the heat affected zone are less than 25HV lower than the values specified in Table M4.12. (10) For steel pipes for low temperature service, the upper limit is to be a maximum of 25 mm unless another value is considered appropriate by the Society. (11) Two-run technique refers to a welding process involving a single pass on both sides.	

Table M4.3 Applicable Leg Length Throat Thickness of Fillet Welding

Approved range of leg length throat thickness (mm) ⁽³⁾		
Single-run technique	Multi-run technique	High heat input welding process ⁽⁴⁾
0.75 $f a$ to 1.5 $f a$ ⁽¹⁾⁽²⁾	0.5 f to 2 f ⁽⁴⁾⁽²⁾ no restriction	0.75 a to 1.0 a
Notes: (1) a: throat thickness of test piece (2) Where welding in vertical downward position or tube position for welding downwards is applied, the approved range of thickness is to be a. (3) Where a fillet weld is qualified by means of a butt weld test, the throat thickness a range is to be based on the <u>thickness of the deposited metal</u>. (4) Applies where high heat input welding applied to plates without an approved high heat input notation. Where <u>high heat input welding is applied to steels bearing a high heat input designation, the requirements of Annex 4.1.3-12 "Requirements for Welding Qualification Using Approved High Heat Input Steel" are to be complied with. The suitability of the applied high heat input to thinner plates is to be determined by the manufacturer based upon practical considerations, including plate manufacturer's recommendations, during welding qualification, together with previous experience.</u>		

W28/Tab 3

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>4.1.5 Welding Procedure Qualification Record</u> <u>1</u> <u>Welding conditions for test assemblies and test results are to be recorded in a welding procedure qualification record. Forms of welding procedure qualification records can be taken from relevant standards.</u> <u>2</u> <u>A statement of the results of assessing each test piece, including retests, is to be made for each welding procedure test. The relevant items listed for the welding procedure specification are to be included.</u> <u>3</u> <u>A statement that the test piece was made according to the particular welding procedure specification is to be signed by the Surveyor witnessing the test and is to include the Society's identification.</u> 4.2 Tests for Butt Welded Joints 4.2.4 Finished Inspection <u>1</u> <u>Welded surface is to be regular and uniform and is to be free from injurious defects, such as cracks, undercuts, overlaps, etc.</u> <u>2</u> <u>Imperfections detected are to be assessed in accordance with ISO 5817:2023, Level B, except for undercut, excess weld metal, incorrect weld toe and excess of penetration for which Level C applies.</u> 4.2.5 Tensile Tests* 1 Tensile tests are to be carried out with the <i>U2A</i>, <i>U2B</i>, <i>2C</i>, <i>2D</i> or <i>2E</i> test specimens shown in Table M3.1. However, where other test specimens are used, they are to be approved by the Society. The ultimate tensile strength is not	(Newly added) (Newly added) (Newly added) (Newly added) 4.2 Tests for Butt Welded Joints 4.2.4 Finished Inspection Welded surface is to be regular and uniform and is to be free from injurious defects, such as cracks, undercuts, overlaps, etc. (Newly added) 4.2.5 Tensile Tests* 1 Tensile tests are to be carried out with the <i>U2A</i>, <i>U2B</i>, <i>2C</i>, <i>2D</i> or <i>2E</i> test specimens shown in Table M3.1. However, where other test specimens are used, they are to be approved by the Society. The ultimate tensile strength is not	W28/4.5.1 The existing practice has been specified in accordance with the relevant UR requirements. W28/4.5.2 Same as above. W28/4.5.3 Same as above. W28/4.2.2.1 The acceptance criteria have been specified.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
to be less than the minimum ultimate tensile strength specified for the base metal except for those specified in Table M4.7 2 The number of tensile test specimens taken from each test assembly is to be as shown in Table M4.6. 3 As for the requirements for tensile tests of welded joints of steels of different specified strength, those for joints of steels of lower specified strength are to be applied. 4 Notwithstanding -1 above, the ultimate tensile strength of the welded joints of steels where welding consumables different from those given in Table M2.1 are selected in accordance with 2.4.1-1(3) is not to be less than the minimum ultimate tensile strength of the selected welding consumable. <u>However, where approved by the design applicable to the welding work concerned, the tensile strength is to be not less than the minimum weld metal tensile strength required by the design (e.g. in the case of high strength rolled steels for offshore structures having strength levels of 890 N/mm² and 960 N/mm²).</u> 4.2.6 Bend Tests 1 Bend tests are to be carried out with the face bend and root bend or side bend test specimen shown in <i>UB-1</i>, <i>UB-2</i>, <i>B-3</i>, <i>B-4</i>, or <i>B-5</i> of Table M3.2, and the test specimens are to be bent by the jig shown in Table M4.8. There is to be no crack nor any other defect greater than 3 mm in length in any direction on the surface of bent specimen. 2 The number of bend test specimens taken from each test assembly is to be as shown in Table M4.6. 3 <u>For butt joints in heterogeneous steel plates or with undermatching weld metal (e.g. high strength rolled steels for offshore structures having strength levels of 890 N/mm² and</u>	to be less than the minimum ultimate tensile strength specified for the base metal except for those specified in Table M4.7 2 The number of tensile test specimens taken from each test assembly is to be as shown in Table M4.6. 3 As for the requirements for tensile tests of welded joints of steels of different specified strength, those for joints of steels of lower specified strength are to be applied. 4 Notwithstanding -1 above, the ultimate tensile strength of the welded joints of steels where welding consumables different from those given in Table M2.1 are selected in accordance with 2.4.1-1(3) is not to be less than the minimum ultimate tensile strength of the selected welding consumable. 4.2.6 Bend Tests 1 Bend tests are to be carried out with the face bend and root bend or side bend test specimen shown in <i>UB-1</i>, <i>UB-2</i>, <i>B-3</i>, <i>B-4</i>, or <i>B-5</i> of Table M3.2, and the test specimens are to be bent by the jig shown in Table M4.8. There is to be no crack nor any other defect greater than 3 mm in length in any direction on the surface of bent specimen. 2 The number of bend test specimens taken from each test assembly is to be as shown in Table M4.6. (Newly added)	W28/4.2.2.2/4.2.2.3 It has been specified that, where the approved design specifies strength values higher than the specified minimum values of the welding consumables, the design values are to be taken into account. W28/4.2.2.4 It has been specified that, where a soft zone is present, a longitudinal

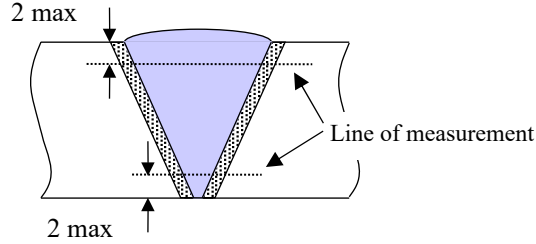
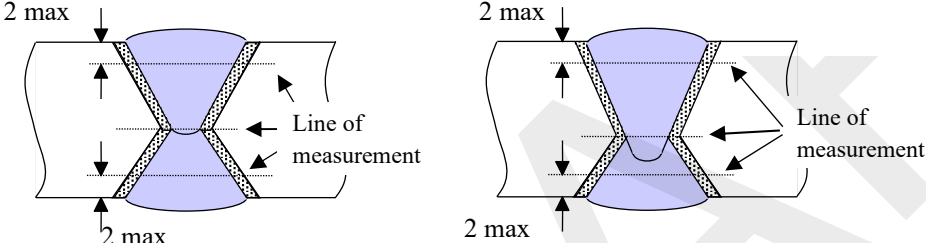
Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>960 N/mm²), face and root longitudinal bend test specimens may be used instead of transverse bend test specimens.</u> 4.2.7 Impact Tests* 1 Impact test specimens are to be <i>U4</i> specimens shown in Table K2.5 and to be taken from the position shown in Fig. M4.2 to Fig. M4.4. Where <i>U4</i> impact test specimens cannot be taken because of the convenience of material, the requirements in sub-paragraphs 2.2.4-4 and 2.3.2-2 in Part K of the Rules is to be applied. 2 The number of specimens taken from each test assembly and the position of notch for the specimen are to be as shown in Table M4.6 and Fig. M4.2 to Fig. M4.4. The longitudinal direction of the notch of the test specimen is to be in the direction of the thickness of test material. 3 The testing temperature and the minimum mean absorbed energy of three specimens are to be as specified in Table M4.9 to Table M4.11 and the percent brittle fracture of the specimens is to be measured. <u>However, where permitted by the approved design applicable to the welding work concerned, the test temperature and absorbed energy are to be not less than those required by the approved design (e.g. for high strength rolled steels for offshore structures having strength levels of 890 N/mm² and 960 N/mm²).</u> 4 The test specimens are to be taken from the automatically welded part, for the combined joint welded by automatic welding and manual or semi-automatic welding. It may be required to take another set of test specimens from the manually or semi-automatically welded part, where deemed necessary by the Society. 5 For the butt joints where higher grade of steel is welded to lower grade of steel, the impact test is to be carried out in accordance with the requirements for the impact tests	4.2.7 Impact Tests* 1 Impact test specimens are to be <i>U4</i> specimens shown in Table K2.5 and to be taken from the position shown in Fig. M4.2 to Fig. M4.4. Where <i>U4</i> impact test specimens cannot be taken because of the convenience of material, the requirements in sub-paragraphs 2.2.4-4 and 2.3.2-2 in Part K of the Rules is to be applied. 2 The number of specimens taken from each test assembly and the position of notch for the specimen are to be as shown in Table M4.6 and Fig. M4.2 to Fig. M4.4. The longitudinal direction of the notch of the test specimen is to be in the direction of the thickness of test material. 3 The testing temperature and the minimum mean absorbed energy of three specimens are to be as specified in Table M4.9 to Table M4.11 and the percent brittle fracture of the specimens is to be measured. 4 The test specimens are to be taken from the automatically welded part, for the combined joint welded by automatic welding and manual or semi-automatic welding. It may be required to take another set of test specimens from the manually or semi-automatically welded part, where deemed necessary by the Society. 5 For the butt joints where higher grade of steel is welded to lower grade of steel, the impact test is to be carried out in accordance with the requirements for the impact tests	tensile test specimen may be used. W28/4.2.2.5 It has been specified that, where the approved design specifies strength values higher than the specified minimum values of the welding consumables, the design values are to be taken into account.

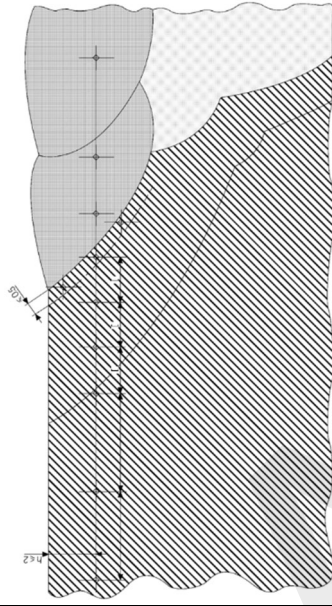
Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
of butt joints of the lower grade of steel. 6 As for the requirements for impact tests of welded joints of steels of different specified strength, those for joints of steels of lower specified strength are to be applied. 7 In cases where maximum thickness to be approved is more than 50 <i>mm</i> but not exceeding 70 <i>mm</i>, <i>CTOD</i> tests or deep notch tests (hereinafter referred to as “brittle fracture tests”), or technical documents related to such brittle fracture tests may be required in addition to impact tests; in cases where such maximum thickness to be approved exceeds 70 <i>mm</i>, brittle fracture tests are to be carried out in addition to impact tests or technical documents related to such brittle fracture tests are to be submitted to the Society. Also, brittle fracture tests described above are to be carried out at the maximum thickness to be approved. However, both brittle fracture tests and the technical documents related to such brittle fracture tests may be omitted where deemed appropriate by the Society. 4.2.9 Hardness Test 1 Vickers hardness is to be measured at the position shown in Fig. M4.5. The kinds of specimens for Vickers hardness are to be in accordance with the requirements specified given in Table M4.12. 2 The number of specimens for hardness test is to be in accordance with the requirements specified given in Table M4.6.	of butt joints of the lower grade of steel. 6 As for the requirements for impact tests of welded joints of steels of different specified strength, those for joints of steels of lower specified strength are to be applied. 7 In cases where maximum thickness to be approved is more than 50 <i>mm</i> but not exceeding 70 <i>mm</i>, <i>CTOD</i> tests or deep notch tests (hereinafter referred to as “brittle fracture tests”), or technical documents related to such brittle fracture tests may be required in addition to impact tests; in cases where such maximum thickness to be approved exceeds 70 <i>mm</i>, brittle fracture tests are to be carried out in addition to impact tests or technical documents related to such brittle fracture tests are to be submitted to the Society. Also, brittle fracture tests described above are to be carried out at the maximum thickness to be approved. However, both brittle fracture tests and the technical documents related to such brittle fracture tests may be omitted where deemed appropriate by the Society. 4.2.9 Hardness Test 1 Vickers hardness is to be measured at the position shown in Fig. M4.5. The kinds of specimens for Vickers hardness are to be in accordance with the requirements specified given in Table M4.12. 2 The number of specimens for hardness test is to be in accordance with the requirements specified given in Table M4.6.	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
Fig. M4.5 Hardness Test (Unit: <i>mm</i>)  (a) For One side  (b) For Both side		

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
 (c) Example of Measurement Locations in the Grain Coarsened Heat Affected Zone Notes: (1) For each row of indentations there shall be a minimum of 3 individual indentations in the weld metal, the heat affected zones (both side) and the base metal (both sides). (2) Measuring intervals are to be 1 mm on the basis of the bond. (3) Test force is to be 98.07 N. (4) For KE47, measurement at mid thickness line of is to be added. (5) <u>In addition, two indentations are required in the grain coarsened heat affected zone, one above and one below the hardness test row.</u>		App. Fig. C.2 The location for measurement of the coarse-grained region has been illustrated. The same applies hereinafter. W28/4.2.2.7 It has been specified that additional measurements are to be carried out in the coarse-grained region. The same applies hereinafter.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original		Remarks																																
Table M4.12 Requirements of Hardness Test <table><tr><th>Kinds of test assembly</th><th colspan="2">Vickers hardness (<i>HV</i>10)</th></tr><tr><td rowspan="3">Rolled steels for hull</td><td><i>KA36, KD36, KE36, KF36</i> <i>KA40, KD40, KE40, KF40</i></td><td>350 max</td></tr><tr><td><i>KE47</i></td><td>350 max⁽⁺⁾</td></tr><tr><td></td><td></td></tr><tr><td rowspan="6">High strength rolled steels for offshore structures</td><td><i>KA420, KD420, KE420, KF420</i> <i>KA460, KD460, KE460, KF460</i></td><td>350 max</td></tr><tr><td><i>KA500, KD500, KE500, KF500</i> <i>KA550, KD550, KE550, KF550</i> <i>KA620, KD620, KE620, KF620</i> <i>KA690, KD690, KE690, KF690</i></td><td>420 max</td></tr><tr><td><i>KA890, KD890, KE890,</i> <i>KA960, KD960, KE960</i></td><td>450 max</td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td rowspan="2">Rolled steels for low temperature service</td><td><i>KL37</i></td><td>350 max</td></tr><tr><td><i>KL5N43, KL9N53, KL9N60</i></td><td>420 max</td></tr><tr><td>Steel pipes for low temperature service</td><td><i>KLP9</i></td><td>420 max</td></tr></table> Notes: (1) Steels considered to have brittle crack arrest properties specified in 3.12, Part K are to be 380 max. (2) A higher value up to 380 <i>HV</i>10 may be accepted for single pass fillet welds subject to special consideration by the Society.			Kinds of test assembly	Vickers hardness (<i>HV</i> 10)		Rolled steels for hull	<i>KA36, KD36, KE36, KF36</i> <i>KA40, KD40, KE40, KF40</i>	350 max	<i>KE47</i>	350 max ⁽⁺⁾			High strength rolled steels for offshore structures	<i>KA420, KD420, KE420, KF420</i> <i>KA460, KD460, KE460, KF460</i>	350 max	<i>KA500, KD500, KE500, KF500</i> <i>KA550, KD550, KE550, KF550</i> <i>KA620, KD620, KE620, KF620</i> <i>KA690, KD690, KE690, KF690</i>	420 max	<i>KA890, KD890, KE890,</i> <i>KA960, KD960, KE960</i>	450 max							Rolled steels for low temperature service	<i>KL37</i>	350 max	<i>KL5N43, KL9N53, KL9N60</i>	420 max	Steel pipes for low temperature service	<i>KLP9</i>	420 max	W28/4.3.3.3 Requirements applicable to fillet welds under conditions resulting in particularly rapid cooling have been specified.	
Kinds of test assembly	Vickers hardness (<i>HV</i> 10)																																		
Rolled steels for hull	<i>KA36, KD36, KE36, KF36</i> <i>KA40, KD40, KE40, KF40</i>	350 max																																	
	<i>KE47</i>	350 max ⁽⁺⁾																																	
High strength rolled steels for offshore structures	<i>KA420, KD420, KE420, KF420</i> <i>KA460, KD460, KE460, KF460</i>	350 max																																	
	<i>KA500, KD500, KE500, KF500</i> <i>KA550, KD550, KE550, KF550</i> <i>KA620, KD620, KE620, KF620</i> <i>KA690, KD690, KE690, KF690</i>	420 max																																	
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Rolled steels for low temperature service	<i>KL37</i>	350 max																																	
	<i>KL5N43, KL9N53, KL9N60</i>	420 max																																	
Steel pipes for low temperature service	<i>KLP9</i>	420 max																																	
4.2.10 Non-destructive Inspection 1 Internal inspections by radiographic examination or ultrasonic examination, and surface inspections by magnetic particle examination or liquid penetrant examination are to be carried for whole length of the welding. <u>Non-destructive inspection procedures are to be agreed with the Society.</u> The result of non-destructive inspection is to show that there are no crack, poor penetration, lack of fusion and other injurious defects. 2 In case any post-weld heat treatment is required or specified, non-destructive inspection test is to be performed after heat treatment. 3 For high strength rolled steels for offshore structures	4.2.10 Non-destructive Inspection 1 Internal inspections by radiographic examination or ultrasonic examination, and surface inspections by magnetic particle examination or liquid penetrant examination are to be carried for whole length of the welding. The result of non-destructive inspection is to show that there are no crack, poor penetration, lack of fusion and other injurious defects. 2 In case any post-weld heat treatment is required or specified, non-destructive inspection test is to be performed after heat treatment. 3 High strength rolled steels for offshore structures are		W28/4.2.2.1 It has been specified that this is to be verified during the review of the qualification test plan. This is a clarification of the existing practice. The same applies hereinafter. W28/4.2.2.1																																

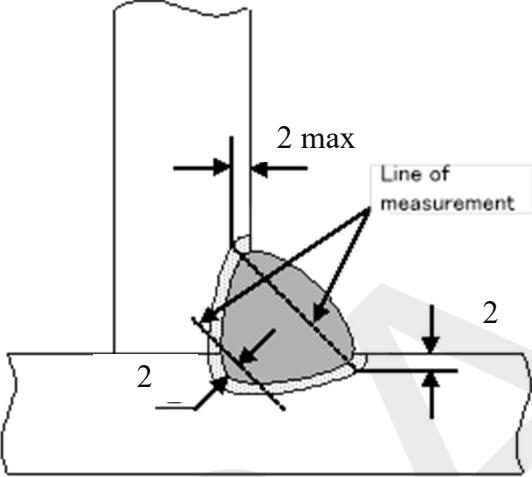
Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>not subject to post-weld heat treatment, the non-destructive testing is to be delayed for a minimum of 48 hours after welding for steels having strength levels of 420 N/mm² to 690 N/mm², and for a minimum of 72 hours after welding for steels having strength levels of 890 N/mm² and 960 N/mm².</u> <u>4 Imperfections detected are to be assessed in accordance with ISO 5817:2023, Level B, except for undercut, excess weld metal, incorrect weld toe and excess of penetration for which Level C applies.</u> 4.3 Tests for Fillet Weld Joints 4.3.4 Finished Inspection <u>1 Welded surface is to be regular and uniform and is to be free from injurious defects, such as cracks, undercuts, overlaps, etc.</u> <u>2 Imperfections detected are to be assessed in accordance with ISO 5817:2023, Level B, except for undercut, excess weld metal, incorrect weld toe and excess of penetration for which Level C applies.</u> 4.3.7 Fracture Tests 1 In cases where the test assembly is a plate, a test specimen is to be taken from the remainder of the test assembly after the macro-structure specimen has been removed. 2 In cases where the test assembly is a pipe (or tube), an appropriate number of test specimens is to be taken from the remainder of the test assembly after the macro-structure specimen has been removed. 3 The test assemblies are to be broken by pressing as shown in Fig. M4.6, without cracks, poor penetrations, blow	<u>to be delayed for minimum of 48 hours, unless heat treatment has been carried out.</u> (Newly added) 4.3 Tests for Fillet Weld Joints 4.3.4 Finished Inspection Welded surface is to be regular and uniform and is to be free from injurious defects, such as cracks, undercuts, overlaps, etc. (Newly added) 4.3.7 Fracture Tests 1 In cases where the test assembly is a plate, a test specimen is to be taken from the remainder of the test assembly after the macro-structure specimen has been removed. 2 In cases where the test assembly is a pipe (or tube), an appropriate number of test specimens is to be taken from the remainder of the test assembly after the macro-structure specimen has been removed. 3 The test assemblies are to be broken by pressing as shown in Fig. M4.6, without cracks, poor penetrations, blow	Requirements according to the strength level have been specified. The same applies hereinafter. W28/4.2.2.1 The acceptance criteria have been specified. The same applies hereinafter. W28/4.2.2.1 W28/4.3.3.4

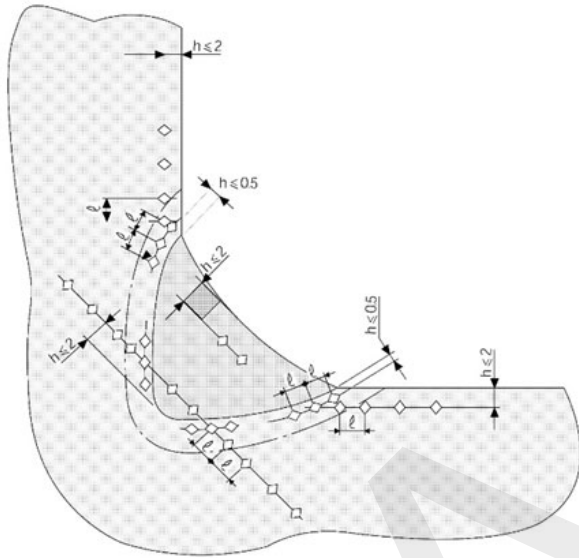
Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
holes and injurious defects in the fractured surface. Where, however, the sum of lengths having blow holes (include poor penetrations), except at both ends of the specimen (only for plate test assemblies), is not greater than 10% of the total welded length, the test may be regarded as satisfactory. <u>Any imperfection that is detected is to be assessed in accordance with ISO 5817:2023, Level B.</u> 4.3.8 Non-destructive Inspection 1 Surface inspections by magnetic particle examination or liquid penetrant examination are to be carried for whole length of the welding. <u>Non-destructive inspection procedures are to be agreed with the Society.</u> The result of non-destructive inspection is to show that there are no crack and other injurious defects. 2 In case any post-weld heat treatment is required or specified, non-destructive inspection test is to be performed after heat treatment. 3 <u>For high strength rolled steels for offshore structures not subject to post-weld heat treatment, the non-destructive testing is to be delayed for a minimum of 48 hours after welding for steels having strength levels of 420 N/mm² to 690 N/mm², and for a minimum of 72 hours after welding for steels having strength levels of 890 N/mm² and 960 N/mm².</u> 4 <u>Imperfections detected are to be assessed in accordance with ISO 5817:2023, Level B except for undercut, incorrect weld toe, excessive convexity and excessive throat thickness for which Level C applies.</u>	holes and injurious defects in the fractured surface. Where, however, the sum of lengths having blow holes (include poor penetrations), except at both ends of the specimen (only for plate test assemblies), is not greater than 10% of the total welded length, the test may be regarded as satisfactory. 4.3.8 Non-destructive Inspection 1 Surface inspections by magnetic particle examination or liquid penetrant examination are to be carried for whole length of the welding. The result of non-destructive inspection is to show that there are no crack and other injurious defects. 2 In case any post-weld heat treatment is required or specified, non-destructive inspection test is to be performed after heat treatment. 3 <u>High strength rolled steels for offshore structures are to be delayed for minimum of 48 hours, unless heat treatment has been carried out.</u> (Newly added)	W28/4.2.2.1 W28/4.3.3.1 W28/4.3.3.1

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
4.3.10 Retests Fig. M4.7 Hardness Test (Unit: <i>mm</i>)  (a) <u>Position of the indentations for hardness test</u>	4.3.10 Retests	

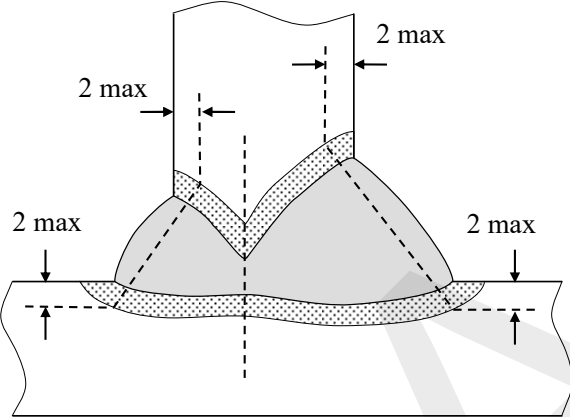
Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
 (b) Example of Measurement Locations in the Grain Coarsened Heat Affected Zone Notes: (1) For each row of indentations there shall be a minimum of 3 individual indentations in the weld metal, the heat affected zones (both side) and the base metal (both sides). (2) Measuring intervals are to be 1 mm on the basis of the bond. (3) Test force is to be 98.07 N. (4) <u>In addition, two indentations are required in the grain coarsened heat affected zone, one above and one below the hardness test row.</u>		App. Fig.C.4a
4.4 Tests for T-joints with Full Penetration 4.4.4 Finished Inspection 1 Welded surface is to be regular and uniform and is to be free from injurious defects, such as cracks, undercuts, overlaps, etc. 2 Imperfections detected are to be assessed in	4.4 Tests for T-joints with Full Penetration 4.4.4 Finished Inspection Welded surface is to be regular and uniform and is to be free from injurious defects, such as cracks, undercuts, overlaps, etc. (Newly added)	W28/4.3.3.3
		W28/4.2.2.1

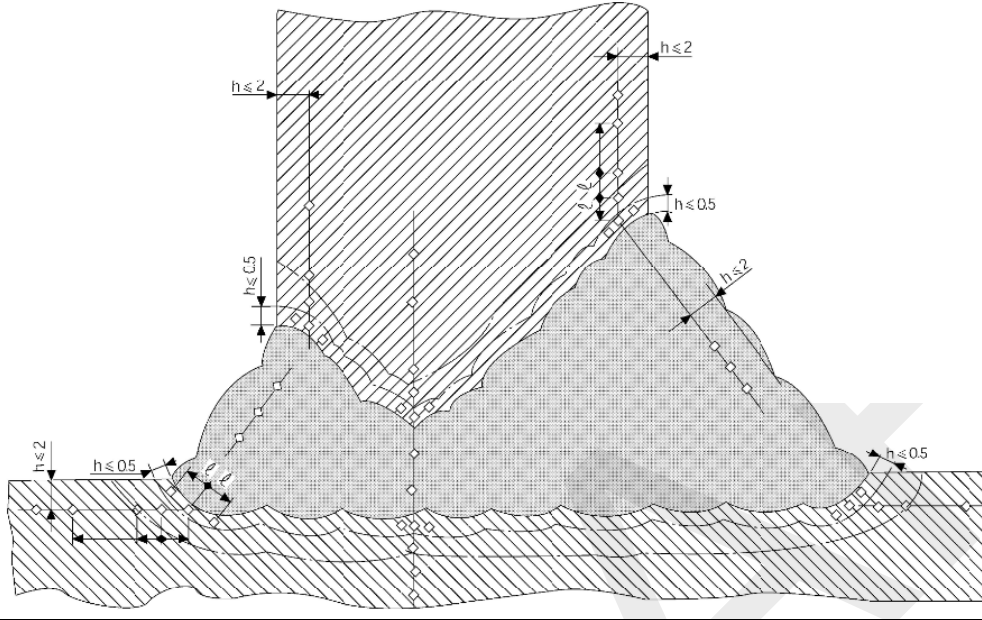
Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>accordance with ISO 5817:2023, Level B, except for undercut, excess weld metal, incorrect weld toe and excess of penetration for which Level C applies.</u> 4.4.7 Non-destructive Inspection 1 Internal inspections by radiographic examination or ultrasonic examination, and surface inspections by magnetic particle examination or liquid penetrant examination are to be carried for whole length of the welding. <u>Non-destructive inspection procedures are to be agreed with the Society.</u> The result of non-destructive inspection is to show that there are no crack, poor penetration, lack of fusion and other injurious defects. 2 In case any post-weld heat treatment is required or specified, non-destructive inspection test is to be performed after heat treatment. 3 <u>For high strength rolled steels for offshore structures not subject to post-weld heat treatment, the non-destructive testing is to be delayed for a minimum of 48 hours after welding for steels having strength levels of 420 N/mm² to 690 N/mm², and for a minimum of 72 hours after welding for steels having strength levels of 890 N/mm² and 960 N/mm².</u> 4 <u>Imperfections detected are to be assessed in accordance with ISO 5817:2023, Level B, except for undercut, excess weld metal, incorrect weld toe and excess of penetration for which Level C applies.</u>	4.4.7 Non-destructive Inspection 1 Internal inspections by radiographic examination or ultrasonic examination, and surface inspections by magnetic particle examination or liquid penetrant examination are to be carried for whole length of the welding. The result of non-destructive inspection is to show that there are no crack, poor penetration, lack of fusion and other injurious defects. 2 In case any post-weld heat treatment is required or specified, non-destructive inspection test is to be performed after heat treatment. 3 <u>High strength rolled steels for offshore structures are to be delayed for minimum of 48 hours, unless heat treatment has been carried out.</u> (Newly added)	W28/4.2.2.1 W28/4.2.2.1 W28/4.2.2.1

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
4.4.9 Retests Fig. M4.9 Hardness Test (Unit: <i>mm</i>)  (a) <u>Position of the indentations for hardness test</u>	4.4.9 Retests	

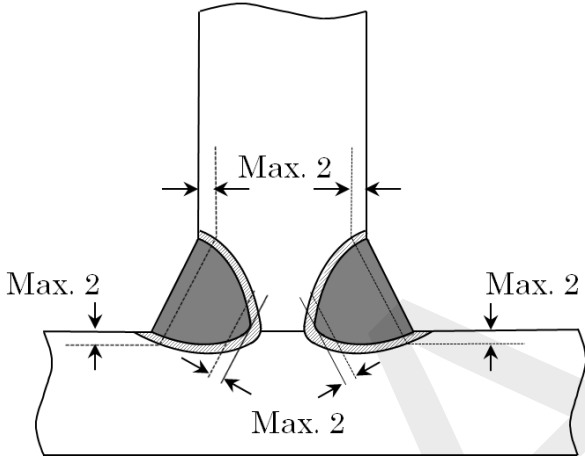
Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
 (b) Example of Measurement Locations in the Grain Coarsened Heat Affected Zone Notes: (1) For each row of indentations there is to be a minimum of 3 individual indentations in the weld metal, the heat affected zones (both side) and the base metal (both sides). (2) Measuring intervals are to be 1 mm on the basis of the bond. (3) Test force is to be 98.07 N. (4) <u>In addition, two indentations are required in the grain coarsened heat affected zone, one above and one below the hardness test row.</u>		App. Fig.C.4b
4.5 Tests for T-joints with Partial Penetration 4.5.4 Finished Inspection <u>1</u> Welded surface is to be regular and uniform and is to be free from injurious defects, such as cracks, undercuts, overlaps, etc. <u>2</u> Imperfections detected are to be assessed in	4.5 Tests for T-joints with Partial Penetration 4.5.4 Finished Inspection Welded surface is to be regular and uniform and is to be free from injurious defects, such as cracks, undercuts, overlaps, etc. (Newly added)	W28/4.3.3.3
		W28/4.2.2.1

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>accordance with ISO 5817:2023, Level B, except for undercut, excess weld metal, incorrect weld toe and excess of penetration for which Level C applies.</u> 4.5.8 Non-destructive Inspection 1 Surface inspections by magnetic particle examination or liquid penetrant examination are to be carried for whole length of the welding. <u>Non-destructive inspection procedures are to be agreed with the Society.</u> The result of non-destructive inspection is to show that there are no crack and other injurious defects. 2 In case any post-weld heat treatment is required or specified, non-destructive inspection is to be performed after heat treatment. 3 <u>For high strength rolled steels for offshore structures not subject to post-weld heat treatment, the non-destructive testing is to be delayed for a minimum of 48 hours after welding for steels having strength levels of 420 N/mm² to 690 N/mm², and for a minimum of 72 hours after welding for steels having strength levels of 890 N/mm² and 960 N/mm².</u> 4 <u>Imperfections detected by visual or non-destructive testing are to be assessed in accordance with ISO 5817:2023, Level B, except for undercut, excess weld metal, incorrect weld toe and excess of penetration for which Level C applies.</u>	4.5.8 Non-destructive Inspection 1 Surface inspections by magnetic particle examination or liquid penetrant examination are to be carried for whole length of the welding. The result of non-destructive inspection is to show that there are no crack and other injurious defects. 2 In case any post-weld heat treatment is required or specified, non-destructive inspection is to be performed after heat treatment. 3 <u>High strength rolled steels for offshore structures is to be delayed for minimum of 48 hours, unless heat treatment has been carried out.</u> (Newly added)	W28/4.2.2.1 W28/4.2.2.1 W28/4.2.2.1

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
4.5.10 Retests Fig. M4.11 Hardness Test (Unit: <i>mm</i>)  ----- Line of measurement Notes: (1) For each row of indentations there is to be a minimum of 3 individual indentations in the weld metal, the heat affected zones (both side) and the base metal (both sides). (2) Measuring intervals are to be 1 <i>mm</i> on the basis of the bond. (3) Test force is to be 98.07 <i>N</i>. (4) <u>In addition, two indentations are required in the grain coarsened heat affected zone, one above and one below the hardness test row. The measurement locations are to be in accordance with Fig. M4.7.</u>	4.5.10 Retests	
The effective date of the amendment is according to EFFECTIVE DATE AND APPLICATION (B)		

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
Chapter 6 WELDING CONSUMABLES 6.9 Welding Consumables for High Strength Rolled Steels for Offshore Structures 6.9.11 Hydrogen Test 1 Hydrogen Test is to be carried out for welding consumables except gas shielded arc solid wire by the <u>mercury method to ISO 3690:2018</u>, glycerine method, mercury method, gaschromatographic method or other methods deemed appropriate by the Society. 2 The average volume of hydrogen is to comply with the requirements specified given in Table M6.63 according to the test procedures specified in preceding -1 or the type of suffixes to be added to the grade marks.	Chapter 6 WELDING CONSUMABLES 6.9 Welding Consumables for High Strength Rolled Steels for Offshore Structures 6.9.11 Hydrogen Test 1 Hydrogen Test is to be carried out for welding consumables except gas shielded arc solid wire by the glycerine method, mercury method, gaschromatographic method or other methods deemed appropriate by the Society. 2 The average volume of hydrogen is to comply with the requirements specified given in Table M6.63 according to the test procedures specified in preceding -1 or the type of suffixes to be added to the grade marks.	W23/4.1 The requirements have been clarified.
The effective date of the amendment is according to EFFECTIVE DATE AND APPLICATION (C)		

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>Annex 2.2.2-7 REQUIREMENTS FOR THE ACCEPTANCE OF WELDING QUALIFICATIONS TO NATIONAL OR INTERNATIONAL STANDARDS</u> <u>1.1 General</u> <u>1.1.1 Application</u> <u>1 Welding procedures qualified in accordance with other national or international welding procedure qualification standards may result in a difference in the examination, testing, and range of approval. For the acceptance of such qualifications, then this Annex is to be followed.</u> <u>2 Where welding procedures are qualified to the requirements of national and international standards, those standards or codes are to be applied in full, cross-mixing requirements of Standards and Codes is not permitted. In order to accept proposals for those welding qualifications, 1.1.2 and 1.1.3 below are considered as typical scenarios and solutions, which are not exhaustive.</u> <u>1.1.2 Examination</u> <u>1 In the case that the manufacturer proposes a welding procedure specification which has had no the Society involvement, then it is to only be accepted if qualified under a recognised third party organisation for welding qualifications, acceptable to the Society.</u> <u>2 For assurance purposes, at the discretion of the Society, it may be necessary to carry out additional</u>	(Newly added) (Newly added) (Newly added) (Newly added) (Newly added) (Newly added) (Newly added)	W28 Annex A Requirements have been specified for the acceptance of WPSs qualified in accordance with other standards, where approval is requested by the manufacturer.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>qualification tests to confirm the validity of the welding procedure specification.</u> 3 <u>Welding qualifications are to be supported by a <i>WPQR</i>, with the conditions and test results documented as 4.1.5, Part M of the Rules.</u> 4 <u>Where weld procedures have been qualified without non-destructive testing (<i>NDT</i>) being performed on the qualification test pieces, then <i>NDT</i> is to be carried on a supplementary test piece, or on the first production welds.</u> 1.1.3 Testing 1 <u>Where tests and their extent do not meet the requirements of Chapter 4, Part M of the Rules, then measures are to be taken to address the missing tests.</u> 2 <u>Where a welding procedure is qualified without impact tests, a supplementary test piece is to be welded and tested in accordance with 4.2.7, Part M of the Rules.</u> 3 <u>In the case that national or international standard steel grades have been used in the procedure qualification test, the acceptance criteria for impact tests are to be in accordance with the requirements of Chapter 4, Part M of the Rules.</u> 4 <u>Where a welding procedure is qualified without hardness tests, a supplementary test piece is to be welded and tested in accordance with 4.2.9, 4.3.6, 4.4.6, 4.5.6, and 4.6.6, Part M of the Rule, as applicable.</u> 5 <u>For fillet weld procedures qualified without fracture tests, a supplementary test piece is to be welded and tested in accordance with 4.3.7, Part M of the Rule.</u> 1.1.4 Range of Approval 1 <u>Where the range of approval does not align with the requirements of Chapter 4, Part M of the Rule, then measures are to be taken to revise the qualified range of the welding procedure specification.</u>	(Newly added) (Newly added) (Newly added) (Newly added) (Newly added) (Newly added) (Newly added) (Newly added) (Newly added) (Newly added)	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>2 Where non approved welding consumables have been used in the <i>WPQR</i>, then for production welding, equivalent welding consumables which are approved by the Society is to be used.</u>	(Newly added)	
<u>3 In addition to -2 above, equivalent welding consumables that are approved by the Society are to be specified in the welding procedure specification. To qualify the new welding procedure specification a supplementary test piece is to be welded using the approved welding consumable under the welding procedure specification conditions and is to be tested as a minimum for impact toughness, however other tests may be required by the Society in accordance with this Chapter 4, Part M of the Rule.</u>	(Newly added)	
<u>4 Where a welding procedure specification has a range of approval for preheating and interpass temperature which differs from that stated in 4.1.4-1 (8), Part M of the Rule, then the approved limits are to be revised accordingly.</u>	(Newly added)	
<u>5 Where the <i>WPQR</i> does not support the welding procedure specification range of approval for welding position in accordance with Chapter 4, Part M of the Rule, then supplementary test piece(s) is required to approve all positions in accordance with 4.1.4-1 (6), Part M of the Rule.</u> <u>Note:</u> <u>The highest heat input position is normally vertical up (PF). The lowest heat input position is normally horizontal-vertical (PC).</u>	(Newly added)	
<u>6 Where the range of heat input is outside the range, as per the limits as stated in 4.1.4-1 (7), Part M of the Rule, then the welding procedure specification range is to be adjusted to meet the requirements of Chapter 4, Part M of the Rule.</u>	(Newly added)	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>7 Where a welding procedure specification has a range of approval for base metal which differs from that stated in 4.1.4-1 (4), Part M of the Rule, then the approval range of the welding procedure specification is to be revised in terms of the strength and toughness levels and delivery conditions.</u> <u>Annex 4.1.3-12 REQUIREMENTS FOR WELDING QUALIFICATION USING APPROVED HIGH HEAT INPUT STEEL.</u> <u>1.1 General</u> <u>1.1.1 Application</u> <u>1 The information in this Annex relates to welding with high heat input, which is defined in 4.1, Part M of the Rules. This annex is applicable to welding qualifications using steels with approved high heat input grade notations, as described in 1.1.1-3 and -4, Part 2 of the Guidance for the Approval of Materials and Equipment for Marine Use, whereby a steel mill has optionally requested approval for their products for high heat input weldability.</u> <u>Note:</u> <u>For approved steels as described in -1 above, the approval and grade notation relate to the maximum tested heat input level on the steels thickness that has undergone the weldability test. The high heat input used for the approval of thick steels may not be suitable for applications on thinner steels. The suitability of the applied heat input to thinner steels is to be determined by the manufacturer or the shipyard based upon practical considerations during welding qualification, and previous experience.</u>	(Newly added) (Newly added) (Newly added) (Newly added) (Newly added)	W28 Annex E Requirements for the approval of WPSs using steels approved for high heat input welding have been specified.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
2 The steels material certificate will indicate a ‘W’ notation confirming the maximum heat input qualified. For welding qualification, the manufacturer or the shipyard is to choose the steels heat input notation appropriate for the production welding, noting that the production welding heat input is not to exceed the welding qualification steels notation. Therefore, the selected steels heat input notation for welding qualification is to be equal to, or higher than the production welding heat input, noting the heat input range given in 1.1.3(6)(a) and (b). Note: Where a qualification test for KE36 material using 300 <i>kJ/cm</i> heat input may be performed on <i>KE36-W300</i> (or higher) steels, noting the heat input range for production welding given in 1.1.3(6)(a).	(Newly added)	
3 The manufacturer or the shipyard is to consider the steel mill’s recommendations for the welding of steels which are approved for high heat input welding.	(Newly added)	
<u>1.1.2 Range of Approval of Base Material</u>	(Newly added)	
1 A qualification performed with high heat input welding is applicable to steels with high heat input notation with the same or higher heat input notation to that used for qualification.	(Newly added)	
2 Other steels with a lower heat input notation may be used provided that the production heat input does not exceed the base material high heat input notation. Note: Where a qualification test for <i>KE500</i> material using 100 <i>kJ/cm</i> heat input may be performed on <i>KE500-W100</i> steels (or higher), noting the heat input range for production welding given in 1.1.3(6)(b). The range of approval of base	(Newly added)	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>material includes notations of high heat input <i>W100</i> and above.</u> <u>1.1.3 Range of Approval</u> <u>Where approved high heat input steels are used in the welding procedure qualification, the following conditions and ranges apply in lieu of 4.1.4, Part M of the Rules, Range of Approval.</u> <u>(1) Base material</u> <u>(a) Rolled steels for hull:</u> <u>Where high heat processes are being applied to steels with an approved high heat input notation, for each strength level, welding procedures are considered applicable to the same and lower toughness grades as that tested, and one strength level below.</u> <u>Note:</u> <u>i) <i>KD36-W300</i> tested qualifies base material toughness grades with Charpy-V notch impact tested at 0 °C, and -20 °C</u> <u>ii) <i>KD36-W300</i> tested qualifies base material with strength levels <i>K36</i> and <i>K32</i>.</u> <u>iii) Applying i) and ii) means <i>KD36-W300</i> tested qualifies <i>KA32</i>, <i>KD32</i>, <i>KA36</i>, <i>KD36</i> steel grades with a high heat input notation.</u> <u>(b) High strength rolled steels for offshore structures, for strength levels <i>K420-K500</i>:</u> <u>Where high heat processes are being applied to steels with an approved high heat input notation, for each strength level, welding procedures are considered applicable to the same and lower toughness grades as that tested, and one strength level below.</u> <u>Note:</u>	(Newly added) (Newly added)	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
i) <u>KE500-W300 tested qualifies base material toughness grades with Charpy-V notch impact tested at +20 °C, 0 °C, and -20 °C.</u> ii) <u>KE500-W300 tested qualifies base material with strength levels K500 and K460.</u> iii) <u>Applying i) and ii). means KE500-W300 tested qualifies KA460, KD460, KE460, KA500, KD500 and KE500 steel grades with a high heat input notation.</u> (2) <u>Thickness</u> (a) <u>For high heat input welding applied to steels with an approved high heat input notation, the upper limit of the range of approval is to be 1.2 times the thickness of the test assembly. The lower limits are to be 0.7 times the thickness of the test assembly.</u> (b) <u>Where the fillet weld test was a single run, in addition to the material thickness range, the upper limit of the range of approval for throat thickness is to be 1.2 times the throat thickness of the test assembly.</u> <u>Note:</u> <u>Related to 1.1.3(2), the manufacturer or the shipyard is to note that the suitability of the applied high heat input to thinner steels is also to be determined based upon practical considerations, including steels manufacturer's recommendations, during welding qualification, together with previous experience.</u> (3) <u>Welding position</u> <u>In accordance with requirements specified in 4.1.4 (6), Part M of the Rules.</u> (4) <u>Welding process</u> <u>In accordance with requirements specified in 4.1.3,</u>		

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>Part M of the Rules.</u> <u>(5) Welding consumables</u> <u>In accordance with requirements specified in 4.1.4 (5), Part M of the Rules.</u> <u>(6) Heat input</u> (a) <u>For rolled steels for hull the upper limit of heat input approved is 1.1 times greater than that used in welding the test piece, provided that the heat input level does not exceed the heat input notation of the steels used in production.</u> (b) <u>For high strength rolled steels for offshore structures (K420-K500) the upper limit of heat input approved is 1.1 times greater than that used in welding the test piece, provided that the heat input level does not exceed the heat input notation of the steels used in production. High heat input welding processes are not applicable to steels with strength levels K550-K960.</u> <u>Note:</u> <u>Where test steels selected: KE36-W300, the maximum selected heat input used in the welding procedure is 200 kJ/cm, the maximum qualified heat input from WPQT is 220 kJ/cm (i.e. corresponds to 1.1 times of the maximum heat input used). Range of approval of production welding includes base material notations of high heat input W220 and above.</u>		
The effective date of the amendment is according to EFFECTIVE DATE AND APPLICATION (B)		

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS Part K MATERIALS K3 ROLLED STEELS K3.1 Rolled Steels for Hull K3.1.9 Quality and Repair of Defects 1 The wording “standards deemed appropriate by the Society” specified in 3.1.9-1(3), Part K of the Rules means the standards specified in <i>EN 10163:2004</i> Part 1 (<u>general requirements</u>), Part 2 (<u>plates and wide flats</u>), Part 3 (<u>sections</u>) or the equivalent thereto. 2 Surface inspection standards for pitting and scab in imperfections are, in principle, to be in accordance with Japan Shipbuilding Quality Standards (<i>JSQS</i>). 3 Affected areas specified in 3.1.9-1(5), Part K of the Rules are to conform to standards applied by the manufacturer. 4 In the case specified in 3.1.9-2(2), Part K of the Rules, the manufacturer is to present records of repairs and subsequent inspections which are traceable to each repair to the surveyor upon request. 5 Before repair works prescribed in 3.1.9-2(2), Part K of the Rules, the following documents are to be submitted to the Society for approval. (1) Specifications of repairing procedure which state	GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS Part K MATERIALS K3 ROLLED STEELS K3.1 Rolled Steels for Hull K3.1.9 Quality and Repair of Defects 1 The wording “standards deemed appropriate by the Society” specified in 3.1.9-1(3), Part K of the Rules means the standards specified in <i>EN 10163</i> Part 1, Part 2, Part 3 or the equivalent thereto. 2 Surface inspection standards for pitting and scab in imperfections are, in principle, to be in accordance with Japan Shipbuilding Quality Standards (<i>JSQS</i>). 3 Affected areas specified in 3.1.9-1(5), Part K of the Rules are to conform to standards applied by the manufacturer. 4 In the case specified in 3.1.9-2(2), Part K of the Rules, the manufacturer is to present records of repairs and subsequent inspections which are traceable to each repair to the surveyor upon request. 5 Before repair works prescribed in 3.1.9-2(2), Part K of the Rules, the following documents are to be submitted to the Society for approval. (1) Specifications of repairing procedure which state	W11/7.1 The edition year of the referenced standard has been specified.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
about kind of surface defects, the way of chipping, grinding and welding, etc. (2) Reports on results of tensile test, bend test, impact test, macro-structure inspection and hardness test on test samples repaired according to the procedure specified in above (1) K3.8 High Strength Rolled Steels for Offshore Structures K3.8.3 Steel Making Processes, Deoxidation Practice and Chemical Composition A fine grain structure is to have an index of 6 or finer as standard which is to be determined by micrographic examination in accordance with <i>ISO 643:2024</i> or an equivalent test standard deemed appropriate by the Society.	about kind of surface defects, the way of chipping, grinding and welding, etc. (2) Reports on results of tensile test, bend test, impact test, macro-structure inspection and hardness test on test samples repaired according to the procedure specified in above (1) K3.8 High Strength Rolled Steels for Offshore Structures K3.8.3 Steel Making Processes, Deoxidation Practice and Chemical Composition A fine grain structure is to have an index of 6 or finer as standard which is to be determined by micrographic examination in accordance with <i>ISO 643</i> or an equivalent test standard deemed appropriate by the Society.	W16/3.3.1 The edition year of the referenced standard has been specified.
The effective date of the amendment is according to EFFECTIVE DATE AND APPLICATION (A)		

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS Part M WELDING M2 WELDING WORKS M2.2 Work Scheme M2.2.1 Welding Application Plan <u>3 In 2.2.1-2, Part M of the Rules, the selection of welding consumables for undermatching joints is, in principle, to be in accordance with the combinations of base metals and welding consumables specified in Table M2.1, Part M of the Rules.</u> M4 WELDING PROCEDURE AND RELATED SPECIFICATIONS M4.1 General M4.1.4 Range of Approval 1 Application of provisory requirement specified in 4.1.4-1, Part M of the Rules is to be applied to 4.1.4-1(4)(c), Part M of the Rules and to be in accordance with Table M4.1.4-1.	GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS Part M WELDING M2 WELDING WORKS M2.2 Work Scheme M2.2.1 Welding Application Plan (Newly added) M4 WELDING PROCEDURE AND RELATED SPECIFICATIONS M4.1 General M4.1.4 Range of Approval 1 Application of provisory requirement specified in 4.1.4-1, Part M of the Rules is to be applied to 4.1.4-1(4)(c), Part M of the Rules and to be in accordance with Table M4.1.4-1. <u>In this case, test records which the Surveyor</u>	It has been clarified that the application of Part M, 2.2.1-2. of the Rules is based on the matching of base metals and welding consumables specified in Table M2.1. Table M4.1.4-1 has been revised for consistency with the requirements of W28.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks																																								
2 In addition to -2 above, where test records which the Surveyor deems appropriate are to be submitted to the Surveyor, within the same and below toughness grades, the welding procedures are considered applicable to the one and two lower strength levels (material with the one and two lower specified yield strength). Table M4.1.4-1 Range of Approval for Rolled Steel for the Large Heat Input Welding <table><tr><th>Grade of test assembly⁽¹⁾</th><th>Approval range of grade</th></tr><tr><td>KA</td><td>KA</td></tr><tr><td>KB</td><td>KB</td></tr><tr><td>KD</td><td>KD</td></tr><tr><td>KA32</td><td>KA, KA32</td></tr><tr><td>KD32</td><td>KD, KD32</td></tr><tr><td>KA36</td><td>KA32, KA36</td></tr><tr><td>KD36</td><td>KD32, KD36</td></tr><tr><td>KA40</td><td>KA,36, KA40</td></tr><tr><td>KD40</td><td>KD36, KD40</td></tr></table> Note: (1) For thickness above 50 mm, this Table is not applicable. 3 With respect to the provisions of 4.1.4-1(1) and -2(1), Part M of the Rules, fillet weld joints, T-joints with full penetration and T-joints with partial penetration welding positions included in the approval of butt welding are to be in accordance with the following. (1) For plates, Table M4.1.4-2 of this guidance and Table M5.10, Part M of the Rules (2) For pipes, Table M4.1.4-3 of this guidance and Table M5.11, Part M of the Rules 4 The wording “Set-on, Set-in and Set-through” specified in 4.1.4-2(1), Part M of the Rules means the	Grade of test assembly ⁽¹⁾	Approval range of grade	KA	KA	KB	KB	KD	KD	KA32	KA, KA32	KD32	KD, KD32	KA36	KA32, KA36	KD36	KD32, KD36	KA40	KA,36, KA40	KD40	KD36, KD40	<u>deems appropriate are to be submitted to the Surveyor.</u> (Newly added) Table M4.1.4-1 Range of Approval for Rolled Steel for the Large Heat Input Welding <table><tr><th>Grade of test assembly⁽¹⁾</th><th>Approval range of grade</th></tr><tr><td>KA</td><td>KA</td></tr><tr><td>KB</td><td>KA, KB</td></tr><tr><td>KD</td><td>KA, KB, KD</td></tr><tr><td>KA32</td><td>KA, KA32</td></tr><tr><td>KD32</td><td>KA, KB, KD, KA32, KD32</td></tr><tr><td>KA36</td><td>KA, KA32, KA36</td></tr><tr><td>KD36</td><td>KA, KB, KD, KA32, KD32, KA36, KD36</td></tr><tr><td>KA40</td><td>KA32, KA,36, KA40</td></tr><tr><td>KD40</td><td>KA32, KD32, KA36, KD36, KA40, KD40</td></tr></table> Note: (1) For thickness above 50 mm, this Table is not applicable. 2 With respect to the provisions of 4.1.4-1(1) and -2(1), Part M of the Rules, fillet weld joints, T-joints with full penetration and T-joints with partial penetration welding positions included in the approval of butt welding are to be in accordance with the following. (1) For plates, Table M4.1.4-2 of this guidance and Table M5.10, Part M of the Rules (2) For pipes, Table M4.1.4-3 of this guidance and Table M5.11, Part M of the Rules 3 The wording “Set-on, Set-in and Set-through” specified in 4.1.4-2(1), Part M of the Rules means the	Grade of test assembly ⁽¹⁾	Approval range of grade	KA	KA	KB	KA, KB	KD	KA, KB, KD	KA32	KA, KA32	KD32	KA, KB, KD, KA32, KD32	KA36	KA, KA32, KA36	KD36	KA, KB, KD, KA32, KD32, KA36, KD36	KA40	KA32, KA,36, KA40	KD40	KA32, KD32, KA36, KD36, KA40, KD40	The requirements have been revised to ensure that the newly introduced M4.1.4-2 provides an equivalent scope of application to the existing requirements. Table M4.1.4-1 has been revised for consistency with the requirements of W28. The paragraph numbering has been revised. The paragraph numbering has been revised.
Grade of test assembly ⁽¹⁾	Approval range of grade																																									
KA	KA																																									
KB	KB																																									
KD	KD																																									
KA32	KA, KA32																																									
KD32	KD, KD32																																									
KA36	KA32, KA36																																									
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KA40	KA,36, KA40																																									
KD40	KD36, KD40																																									
Grade of test assembly ⁽¹⁾	Approval range of grade																																									
KA	KA																																									
KB	KA, KB																																									
KD	KA, KB, KD																																									
KA32	KA, KA32																																									
KD32	KA, KB, KD, KA32, KD32																																									
KA36	KA, KA32, KA36																																									
KD36	KA, KB, KD, KA32, KD32, KA36, KD36																																									
KA40	KA32, KA,36, KA40																																									
KD40	KA32, KD32, KA36, KD36, KA40, KD40																																									

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
following (1) to (3). (1) Set-on means a shape in which the end of the pipe is abutted against the surface of the flange (or main pipe)(Fig. M4.1.4-1 a)). (2) Set-in means a shape in which a pipe is inserted into a socket within the flange (or main pipe) (Fig. M4.1.4-1 b)). (3) Set-through means a shape in which a pipe penetrates a hole in the flange (or main pipe) (Fig. M4.1.4-1 c)). (Deleted)	following (1) to (3). (1) Set-on means a shape in which the end of the pipe is abutted against the surface of the flange (or main pipe)(Fig. M4.1.4-1 a)). (2) Set-in means a shape in which a pipe is inserted into a socket within the flange (or main pipe) (Fig. M4.1.4-1 b)). (3) Set-through means a shape in which a pipe penetrates a hole in the flange (or main pipe) (Fig. M4.1.4-1 c)). 4 <u>The wording “deemed appropriate by the Society” specified in 4.1.4-3, Part M of the Rules means the following (1) to (3).</u> (1) <u>Heat input</u> <u>Heat input of welding for actual works is to be complied with the requirements specified in the following (a) and (b).</u> <u>(a) The upper limit of heat input approved is 1.25 times the heat input used in welding the test piece, but not over 55 kJ/cm. However, for high heat input processes specified in Note (6) of Table M4.2, Part M of the Rules, the upper limit is 1.1 time the heat input used in welding the test piece.</u> <u>(b) The lower limit of heat input approved is 0.75 times the heat input used in welding the test piece.</u> (2) <u>Preheating and interpass temperature</u> <u>Preheating and interpass temperature for actual work are to be complied with the requirements specified in the following (a) and (b).</u> <u>(a) The minimum preheating temperature is that used in the qualification test.</u>	The relevant provisions have been transferred to the Rules.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
5 For the wording “deemed appropriate by the Society” specified in 4.1.4-4, Part M of the Rules, the approval of welding procedure and related specifications of rolled stainless steel, aluminium alloys and rolled steels for low temperature service are to comply with the requirements specified in the following (1) to (3), provided that the applied welding condition is the same. (1) Rolled Stainless Steel For rolled stainless steel, <u>the requirements for the rolled steels for hall specified in 4.1.4-1, Part M of the Rules</u> (excluding the requirements of large heat input welding) <u>are</u> to be applied. However, the kind of base metal is to be the same as test assembly. Where the provisory requirement specified in 3.5.5-1, Part K of the Rules is applied, the steel with the specified minimum proof stress less than that of the tested steels may be included. In addition, the heat input, interpass temperature and post-weld heat treatment for <i>KSUS329J1</i>, <i>KSUS329J3L</i>, <i>KSUS329J4L</i>, <i>KSUS323L</i>, <i>KSUS821L1</i>, <i>K329J1TP</i>, <i>K329J3LTP</i> and <i>K329J4LTP</i> are to be in accordance with the following (a) to (c). (a) Heat input Heat input of welding for actual work is to comply with the following requirements: i) The upper limit of heat input approved is to be 1.25 times the heat input when welding	<u>(b) The maximum interpass temperature is that used in the qualification test.</u> (3) <u>Post-weld heat treatment</u> <u>The heat treatment used in the qualification test is to be maintained during actual work. Holding time may be adjusted as a function of thickness.</u> 5 For the wording “deemed appropriate by the Society” specified in 4.1.4-5, Part M of the Rules, the approval of welding procedure and related specifications of rolled stainless steel, aluminium alloys and rolled steels for low temperature service are to comply with the requirements specified in the following (1) to (3), provided that the applied welding condition is the same. (1) Rolled Stainless Steel For rolled stainless steel, 4.1.4-1 and -3, Part M of the Rules (excluding the requirements of large heat input welding) is to be applied. However, the kind of base metal <u>is</u> to be the same as test assembly. Where the provisory requirement specified in 3.5.5-1, Part K of the Rules is applied, the steel with the specified minimum proof stress less than that of the tested steels may be included. In addition, the heat input, interpass temperature and post-weld heat treatment for <i>KSUS329J1</i>, <i>KSUS329J3L</i>, <i>KSUS329J4L</i>, <i>KSUS323L</i>, <i>KSUS821L1</i>, <i>K329J1TP</i>, <i>K329J3LTP</i> and <i>K329J4LTP</i> are to be in accordance with the following (a) to (c). (a) Heat input Heat input of welding for actual work is to comply with the following requirements: i) The upper limit of heat input approved is to be 1.25 times the heat input when welding the test assembly, but is not to exceed 35	The reference numbering has been revised.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
the test assembly, but is not to exceed 35 <i>kJ/cm</i>. ii) The lower limit of heat input approved is to be 0.75 times the heat input when welding the test assembly, but is not to exceed 5 <i>kJ/cm</i>. (b) Interpass temperature The maximum interpass temperature is to be the one used when welding the test assembly, but is not to exceed 150°C. (c) Post-weld heat treatment Post-weld heat treatment is to be avoided. (2) Aluminium Alloys The requirements specified in the following (a) thorough (h) are to be applied. (a) Type of welded joints Type of welded joints is to be as specified in Table M4.1.4-4. Where the welding procedures of butt welded joints are approved, the fillet welded joints corresponding to the welding position are to be included. (b) Thickness Range of thickness is to be as specified in Table M4.1.4-5. (c) Throat thickness of fillet welds Throat thickness of fillet welds is to be as specified in Table M4.1.4-6. (d) Kind of aluminium alloys Kind of aluminium alloys is to be as specified in Table M4.1.4-7. (e) Kind of welding consumables Range of approval for welding consumables is to be	<i>kJ/cm</i>. ii) The lower limit of heat input approved is to be 0.75 times the heat input when welding the test assembly, but is not to exceed 5 <i>kJ/cm</i>. (b) Interpass temperature The maximum interpass temperature is to be the one used when welding the test assembly, but is not to exceed 150°C. (c) Post-weld heat treatment Post-weld heat treatment is to be avoided. (2) Aluminium Alloys The requirements specified in the following (a) thorough (h) are to be applied. (a) Type of welded joints Type of welded joints is to be as specified in Table M4.1.4-4. Where the welding procedures of butt welded joints are approved, the fillet welded joints corresponding to the welding position are to be included. (b) Thickness Range of thickness is to be as specified in Table M4.1.4-5. (c) Throat thickness of fillet welds Throat thickness of fillet welds is to be as specified in Table M4.1.4-6. (d) Kind of aluminium alloys Kind of aluminium alloys is to be as specified in Table M4.1.4-7. (e) Kind of welding consumables Range of approval for welding consumables is to be	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
as specified in the followings. i) Welding consumables having the same grade as used for the procedure qualification tests. ii) Welding consumables having the higher specified strength than the welding consumable used for the procedure qualification tests. (f) Preheat and interpass temperature Preceding -4(2) is to be applied. (g) Post-weld heat treatment or ageing The heat treatment or ageing used in the qualification test is to be maintained during actual work. However, prolonged natural ageing may be used as the artificial ageing for 6000 series alloys. (h) Joints for combination welding procedure In the joint welded by dissimilar processes (combination welding), the subsequent process may be excluded, provided the weldings are applied within the approved thickness range and no alteration of the welding sequence from approved condition is made. (3) Rolled Steels for Low Temperature Service <u>The requirements for the rolled steels for hull specified in 4.1.4-1, Part M of the Rules</u> are to be applied. However, thickness and the kind of base metal are to be in accordance with the following (a) and (b): (a) Thickness The range of thickness is to be as specified in Table M4.2, Part M of the Rules. Moreover, the upper limit of the range of thickness is, in principle, to be a	as specified in the followings. i) Welding consumables having the same grade as used for the procedure qualification tests. ii) Welding consumables having the higher specified strength than the welding consumable used for the procedure qualification tests. (f) Preheat and interpass temperature Preceding -4(2) is to be applied. (g) Post-weld heat treatment or ageing The heat treatment or ageing used in the qualification test is to be maintained during actual work. However, prolonged natural ageing may be used as the artificial ageing for 6000 series alloys. (h) Joints for combination welding procedure In the joint welded by dissimilar processes (combination welding), the subsequent process may be excluded, provided the weldings are applied within the approved thickness range and no alteration of the welding sequence from approved condition is made. (3) Rolled Steels for Low Temperature Service 4.1.4-1 and -3, Part M of the Rules are to be applied. However, thickness and the kind of base metal are to be in accordance with the following (a) and (b): (a) Thickness The range of thickness is to be as specified in Table M4.2, Part M of the Rules. Moreover, the upper limit of the range of thickness is, in principle, to be a	The reference numbering has been revised.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
maximum of 40 <i>mm</i>. An upper limit of more than 40 <i>mm</i>, however, may be used when deemed appropriate by the Society. (b) Kind of base metal The kind of base metal is, in principle, to be as specified in Table M4.1.4-8.	maximum of 40 <i>mm</i>. An upper limit of more than 40 <i>mm</i>, however, may be used when deemed appropriate by the Society. (b) Kind of base metal The kind of base metal is, in principle, to be as specified in Table M4.1.4-8.	
The effective date of the amendment is according to EFFECTIVE DATE AND APPLICATION (B)		

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
GUIDANCE FOR THE APPROVAL OF MATERIALS AND EQUIPMENT FOR MARINE USE Part 2 METALLIC MATERIALS Chapter 1 APPROVAL OF MANUFACTURING PROCESS OF ROLLED STEELS 1.1 General 1.1.1 Scope 1 In accordance with the requirements in 1.2, Part K of the Rules for the Survey and Construction of Steel Ships (hereinafter referred to as “the Rules”), the requirements in this chapter apply to tests and inspection for the approval of manufacturing process of rolled steels as specified in Chapter 3, Part K of the Rules. 2 For those materials required to be approved by the Society under the requirements in 1.1.1-3, Part K of the Rules, the requirements of this chapter correspondingly apply to the tests and inspection for the approval of the manufacturing process of rolled steels. 3 For the approval of manufacturing process of rolled steels for hull specified in 3.1, Part K of the Rules, when a confirmation of the weldability of a steel for which special consideration is given in a range of welding heat input, is made as a request by manufacturer’s option, the requirements in Chapter 1A apply to such confirmation.	GUIDANCE FOR THE APPROVAL OF MATERIALS AND EQUIPMENT FOR MARINE USE Part 2 METALLIC MATERIALS Chapter 1 APPROVAL OF MANUFACTURING PROCESS OF ROLLED STEELS 1.1 General 1.1.1 Scope 1 In accordance with the requirements in 1.2, Part K of the Rules for the Survey and Construction of Steel Ships (hereinafter referred to as “the Rules”), the requirements in this chapter apply to tests and inspection for the approval of manufacturing process of rolled steels as specified in Chapter 3, Part K of the Rules. 2 For those materials required to be approved by the Society under the requirements in 1.1.1-3, Part K of the Rules, the requirements of this chapter correspondingly apply to the tests and inspection for the approval of the manufacturing process of rolled steels. 3 For the approval of manufacturing process of rolled steels for hull specified in 3.1, Part K of the Rules, when a confirmation of the weldability of a steel for which special consideration is given in a range of welding heat input, is made as a request by manufacturer’s option, the requirements in Chapter 1A apply to such confirmation.	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
4 For the approval of manufacturing process of high strength rolled steel for offshore structures specified in 3.8, Part K of the Rules, when a confirmation of the weldability of a steel for which special consideration is given in a range of welding heat input, is made as a request by manufacturer's option, the requirements in 1.4.3 apply to such confirmation. For the purpose of this requirement, high heat input welding means welding with a heat input greater than 50 kJ/cm for steels with heat treatment of <i>N/NR</i> and <i>TMCP</i>, and greater than 35 kJ/cm for <i>QT</i> steels. The following items are to be taken into account for approval. (1) The approval procedure for high heat input steel qualification requires that the maximum thickness or dimensions of steel is subject to weldability testing using the highest heat input covered by the approval. (2) The approval for the thickness or dimensions of steel tested at the specified heat input level does not imply suitability for thinner plates at the same heat input level, where lower heat inputs may be required. 5 In cases where semi-finished products manufactured by other manufacturers are used, such semi-finished products are to be manufactured by those approved processes specified in Chapter 1B. 1.2 Approval Application 1.2.2 Documents to be Submitted 1 Each of the documents given in (1) and (2) are to be submitted together with the appropriate application form specified in 1.2.1. (1) Approval test plan (2) Technical data given in the following (a) through (k)	(Newly added) 4 In cases where semi-finished products manufactured by other manufacturers are used, such semi-finished products are to be manufactured by those approved processes specified in Chapter 1B. 1.2 Approval Application 1.2.2 Documents to be Submitted 1 Each of the documents given in (1) and (2) are to be submitted together with the appropriate application form specified in 1.2.1. (1) Approval test plan (2) Technical data given in the following (a) through (k)	W16/1.7 The procedure for confirming weldability for high heat input welding upon request has been specified. For rolled steels for hull, the provisions of 3 apply. Transferred due to the addition of 4.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
(a) Data on works i) Name and location of the works ii) General indications relevant to the background iii) Dimension and size of the works iv) Organizational chart and number of staff employed v) Estimated total annual production of finished and semi-finished products (for shipbuilding and for other applications) (b) Data on quality control system i) Organization and number of staff employed of the quality control department ii) Qualification of the personnel involved in activities related to the quality of the products iii) Items and methods for quality control system iv) Outline of system used for identification of materials v) Outline of testing machines and relevant calibration procedures and records vi) Outline of equipment for chemical analyses and metallography and relevant calibration procedures vii) Outline of equipment for non-destructive tests and relevant calibration procedures viii) Certification of compliance of the quality system with <i>ISO 9001:2015</i>, if any ix) Where approval has already been granted for viii) by other classification societies, certification (a copy) of such approval (c) Data on steel products	(a) Data on works i) Name and location of the works ii) General indications relevant to the background iii) Dimension and size of the works iv) Organizational chart and number of staff employed v) Estimated total annual production of finished and semi-finished products (for shipbuilding and for other applications) (b) Data on quality control system i) Organization and number of staff employed of the quality control department ii) Qualification of the personnel involved in activities related to the quality of the products iii) Items and methods for quality control system iv) Outline of system used for identification of materials v) Outline of testing machines and relevant calibration procedures and records vi) Outline of equipment for chemical analyses and metallography and relevant calibration procedures vii) Outline of equipment for non-destructive tests and relevant calibration procedures viii) Certification of compliance of the quality system with <i>ISO 9001</i>, if any ix) Where approval has already been granted for viii) by other classification societies, certification (a copy) of such approval (c) Data on steel products	W11 A2 2.1 / W16 App. 2.1 Edition year of the referenced standard specified.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
i) Type of product, grade of steel (<u>including any additional notations</u>) and condition of heat treatment ii) Maximum manufacturing thickness or dimensions iii) Deoxidation practice and grain refining elements iv) Manufacturing control standard for each chemical composition (if the system of constituent depends on grade, thickness, heat treatment etc., the different ranges are to be specified, as appropriate. In cases where grain refining, micro alloying and residual elements, including <i>Zr</i>, <i>Ca</i> or rare earth metals, are added, the manufacturing control standard for each element is to be specified along with the aim of addition. For high strength rolled steels for offshore structures, details regarding nitrogen binding elements are to also be included.) v) Maximum carbon equivalent (in cases where specified otherwise, this value is to be calculated by the formula specified in 1.5.2-2(6), Part K of the Rules) vi) Maximum cold cracking susceptibility (P_{cm}) for higher strength grades with low carbon content $C \leq 0.13\%$ (this value is to be calculated by the formula specified in 1.5.2-2(6), Part K of the Rules) vii) Actual manufacturing records within the specific period (chemical composition, mechanical properties and thickness or dimension are expressed in the form of	i) Type of product, grade of steel and condition of heat treatment ii) Maximum manufacturing thickness or dimensions iii) Deoxidation practice and grain refining elements iv) Manufacturing control standard for each chemical composition (if the system of constituent depends on grade, thickness, heat treatment etc., the different ranges are to be specified, as appropriate. In cases where grain refining, micro alloying and residual elements, including <i>Zr</i>, <i>Ca</i> or rare earth metals, are added, the manufacturing control standard for each element is to be specified along with the aim of addition. For high strength rolled steels for offshore structures, details regarding nitrogen binding elements are to also be included.) v) Maximum carbon equivalent (in cases where specified otherwise, this value is to be calculated by the formula specified in 1.5.2-2(6), Part K of the Rules) vi) Maximum cold cracking susceptibility (P_{cm}) for higher strength grades with low carbon content $C \leq 0.13\%$ (this value is to be calculated by the formula specified in 1.5.2-2(6), Part K of the Rules) vii) Actual manufacturing records within the specific period (chemical composition, mechanical properties and thickness or dimension are expressed in the form of	W16 App. 2.2 It has been specified that the grade designation is to include all suffixes.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
histogram or statistics for each heat treatment) (d) Data on manufacturing process i) Origin and storage of raw materials ii) Flow chart of the manufacturing process iii) Outline of major manufacturing facilities (including control methods) iv) Storage of finished and semi-finished products (e) Data on steel making process i) Outline of steel making process ii) Type and capacity of steel making furnace and the number of daily charge iii) Raw materials and sub materials iv) Deoxidation, grain refining, refining and secondary refining practice v) Nitrogen binding practice (for high strength rolled steels for offshore structures only, if any) vi) Type of desulphurisation, dehydrogenation, sulphide treatment, ladle refining or vacuum degassing installations vii) Casting methods (ingot casting or continuous casting) viii) Casting/Solidification cooling rate control ix) Scarfing and discarding procedures of ingot or semi-finished products x) Size and weight of ingot or semi-finished products (f) Additional data in the case of applying continuous casting i) Outline of continuous casting machine (including type of casting machine, number	histogram or statistics for each heat treatment) (d) Data on manufacturing process i) Origin and storage of raw materials ii) Flow chart of the manufacturing process iii) Outline of major manufacturing facilities (including control methods) iv) Storage of finished and semi-finished products (e) Data on steel making process i) Outline of steel making process ii) Type and capacity of steel making furnace and the number of daily charge iii) Raw materials and sub materials iv) Deoxidation, grain refining, refining and secondary refining practice v) Nitrogen binding practice (for high strength rolled steels for offshore structures only, if any) vi) Type of desulphurisation, dehydrogenation, sulphide treatment, ladle refining or vacuum degassing installations vii) Casting methods (ingot casting or continuous casting) viii) Casting/Solidification cooling rate control ix) Scarfing and discarding procedures of ingot or semi-finished products x) Size and weight of ingot or semi-finished products (f) Additional data in the case of applying continuous casting i) Outline of continuous casting machine (including type of casting machine, number	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
of strand, casting practice, casting temperature, casting speed etc.) ii) Preventive methods for re-oxidation of charge iii) Reduction methods for non-metallic inclusions iv) Preventive methods for segregation v) Presence of electromagnetic stirring vi) Presence of soft reduction system (g) Data on ingot or semi-finished product reheating process i) Outline of heating furnace (including type and capacity) ii) Heating temperature and holding time (h) Data on rolling process i) Outline of rolling machine (including type and capacity of rolling machine and control methods of thickness and temperature) ii) Starting and finishing temperature of rough and finish rolling (if the temperature depends upon grade of steel and thickness, the differences are to be clearly indicated) iii) Reduction ratio (if the ratio depends upon grade of steel and thickness, the differences are to be clearly indicated) iv) Outline of descaling device (i) Additional data in case of applying <i>CR/NR</i> or <i>TMCP</i>. i) Outline of <i>CR/NR</i> or <i>TMCP</i> process (including control method of thickness and temperature and calibration method of the control equipment) ii) Re-crystallization temperature, <i>Ar3</i>	of strand, casting practice, casting temperature, casting speed etc.) ii) Preventive methods for re-oxidation of charge iii) Reduction methods for non-metallic inclusions iv) Preventive methods for segregation v) Presence of electromagnetic stirring vi) Presence of soft reduction system (g) Data on ingot or semi-finished product reheating process i) Outline of heating furnace (including type and capacity) ii) Heating temperature and holding time (h) Data on rolling process i) Outline of rolling machine (including type and capacity of rolling machine and control methods of thickness and temperature) ii) Starting and finishing temperature of rough and finish rolling (if the temperature depends upon grade of steel and thickness, the differences are to be clearly indicated) iii) Reduction ratio (if the ratio depends upon grade of steel and thickness, the differences are to be clearly indicated) iv) Outline of descaling device (i) Additional data in case of applying <i>CR/NR</i> or <i>TMCP</i>. i) Outline of <i>CR/NR</i> or <i>TMCP</i> process (including control method of thickness and temperature and calibration method of the control equipment) ii) Re-crystallization temperature, <i>Ar3</i>	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
temperature and its determination methods iii) Control standards for controlled rolling (including control ranges for thickness and temperature at the beginning and the end of rough and finish rolling) iv) Outline of Accelerated Cooling (<i>AcC</i>) (including outline of cooling system, cooling method, temperature range, cooling speed and a cooling measure in a uniform way) v) Actual manufacturing records within the specific period (in addition to (c)vii) above, description of relation between tensile strength and carbon equivalent, and variation of mechanical properties in direction of rolling, direction of the steel width and direction of thickness) vi) Recommendation relevant to cold and hot working after shipment (where only the case of the special attention is needed) vii) Range of available welding heat input (where the upper limit of welding heat input exceeds 50 <i>kJ/cm</i>) viii) Minimum and maximum heat input and recommended pre-heat/interpass temperatures for welding work (for high strength rolled steels for offshore structures only) (j) Data on heat treatment process i) Outline of heat treatment furnace (including type and capacity) ii) The methods used to determine austenitizing temperature, re-crystallization	temperature and its determination methods iii) Control standards for controlled rolling (including control ranges for thickness and temperature at the beginning and the end of rough and finish rolling) iv) Outline of Accelerated Cooling (<i>AcC</i>) (including outline of cooling system, cooling method, temperature range, cooling speed and a cooling measure in a uniform way) v) Actual manufacturing records within the specific period (in addition to (c)vii) above, description of relation between tensile strength and carbon equivalent, and variation of mechanical properties in direction of rolling, direction of the steel width and direction of thickness) vi) Recommendation relevant to cold and hot working after shipment (where only the case of the special attention is needed) vii) Range of available welding heat input (where the upper limit of welding heat input exceeds 50 <i>kJ/cm</i>) viii) Minimum and maximum heat input and recommended pre-heat/interpass temperatures for welding work (for high strength rolled steels for offshore structures only) (j) Data on heat treatment process i) Outline of heat treatment furnace (including type and capacity) ii) The methods used to determine austenitizing temperature, re-crystallization	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
temperature and <i>Ar3</i> temperature iii) Rate of temperature increase, heating temperature and unit holding time per <i>mm</i> (if these depend upon grade of steel and thickness, the differences are to be clearly indicated) iv) Cooling method and cooling rate (if these depend upon grade of steel and thickness, the differences are to be clearly indicated) v) Accuracy and calibration of temperature control device vi) Measurement methods of temperature for each process (k) Data on product surface inspection i) Acceptance criteria and applicable standards for surface inspections ii) Number of operators, personnel arrangement, distances between operators and products during inspection (including diagram) iii) Luminance of inspection site (l) Data on product internal soundness i) Test procedures and applicable standards for verification of internal soundness ii) Acceptance criteria and applicable standards for internal imperfections iii) Verification method of internal soundness (including frequency of internal inspections, and steel grade, thickness, etc., of applicable steel.) (m) Additional documents related to the approval of the manufacturing process of corrosion resistant steel for cargo oil tanks specified in 3.13, Part	temperature and <i>Ar3</i> temperature iii) Rate of temperature increase, heating temperature and unit holding time per <i>mm</i> (if these depend upon grade of steel and thickness, the differences are to be clearly indicated) iv) Cooling method and cooling rate (if these depend upon grade of steel and thickness, the differences are to be clearly indicated) v) Accuracy and calibration of temperature control device vi) Measurement methods of temperature for each process (k) Data on product surface inspection i) Acceptance criteria and applicable standards for surface inspections ii) Number of operators, personnel arrangement, distances between operators and products during inspection (including diagram) iii) Luminance of inspection site (l) Data on product internal soundness i) Test procedures and applicable standards for verification of internal soundness ii) Acceptance criteria and applicable standards for internal imperfections iii) Verification method of internal soundness (including frequency of internal inspections, and steel grade, thickness, etc., of applicable steel.) (m) Additional documents related to the approval of the manufacturing process of corrosion resistant steel for cargo oil tanks specified in 3.13, Part	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
K of the Rules for the Survey and Construction of Steel Ships i) Test plan for the corrosion resistance test for cargo oil tanks (including the timing of the Surveyor's presence) ii) Details of test equipment and test environment iii) Technical data for assessment criteria of the chemical composition range of elements to be added for improving the corrosion resistance for pre-shipment inspection iv) Technical background of the chemical composition range described in iii) above v) The grades, brand names and maximum thickness of the corrosion resistant steel for cargo oil tanks vi) The welding consumables (the brand names and the approval certificate numbers) and the welding methods to be applied (n) Additional documents related to the manufacturing process approval of steels considered to have brittle crack arrest properties specified in 3.12, Part K of the Rules i) In-house test reports of the brittle crack arrest properties ii) Approval test program of the manufacturing process for brittle crack arrest properties iii) Production test procedure for brittle crack arrest properties (o) Where approval has already been granted by other Classification Societies, documentation of such approval tests performed (p) Other data deemed necessary by the Society	K of the Rules for the Survey and Construction of Steel Ships i) Test plan for the corrosion resistance test for cargo oil tanks (including the timing of the Surveyor's presence) ii) Details of test equipment and test environment iii) Technical data for assessment criteria of the chemical composition range of elements to be added for improving the corrosion resistance for pre-shipment inspection iv) Technical background of the chemical composition range described in iii) above v) The grades, brand names and maximum thickness of the corrosion resistant steel for cargo oil tanks vi) The welding consumables (the brand names and the approval certificate numbers) and the welding methods to be applied (n) Additional documents related to the manufacturing process approval of steels considered to have brittle crack arrest properties specified in 3.12, Part K of the Rules i) In-house test reports of the brittle crack arrest properties ii) Approval test program of the manufacturing process for brittle crack arrest properties iii) Production test procedure for brittle crack arrest properties (o) Where approval has already been granted by other Classification Societies, documentation of such approval tests performed (p) Other data deemed necessary by the Society	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
2 Where any part of manufacturing process is assigned to other works, additional information relevant to the name and address of the works in question together with the organization and method of inspection for the materials of which the manufacturing process is assigned are to be included. 3 Notwithstanding the requirements in preceding -1, where the documents are duplicated by the ones at the previous approval for the same type of products, grades, deoxidation practice, etc., part or all of the documents may be omitted. However, approval test specified in 1.4 is required, approval test plan specified in -1(1) is not be exempted from submission.	2 Where any part of manufacturing process is assigned to other works, additional information relevant to the name and address of the works in question together with the organization and method of inspection for the materials of which the manufacturing process is assigned are to be included. 3 Notwithstanding the requirements in preceding -1, where the documents are duplicated by the ones at the previous approval for the same type of products, grades, deoxidation practice, etc., part or all of the documents may be omitted. However, approval test specified in 1.4 is required, approval test plan specified in -1(1) is not be exempted from submission.	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended				Original		Remarks
1.4 Approval Test				1.4 Approval Test		
1.4.3 Details of Test				1.4.3 Details of Test		
Approval test item		Selected location of test samples (1) (2)	Length direction of test specimen (3) (4)	Testing method	Acceptance criteria	Notes
Base metal test	Chemical analysis	Top	—	JIS G 0320, JIS G 0321 or equivalent method. Ladle analysis and product analysis are to be performed for elements specified in Part K of the Rules, and other elements as deemed necessary. In cases where a carbon equivalent or cold cracking susceptibility value is to be satisfied, the value is to be specified.	Chemical composition by ladle analysis is to comply with the requirements in Chapter 3, Part K of the Rules.	• The sample is to be selected from tensile test specimens. • Excessive differences in the chemical compositions between ladle analysis and product analysis are not to be accepted. • Analysis is to be carried out for grain refining and micro-alloying elements (including Zr, Cr, or rare earth metals) • In the case of rolled steels for hulls, analysis is to be carried out for As, Sn, B and Sb. (for B and Sb in the case of steel making by electric furnace or open hearth furnace) • In the case of high strength rolled steels for offshore structures, if applicable, analysis is to be carried out for As, Sn, B, Sb, Bi, Pb and H, and nitrogen binding elements are also to be included.
	Sulphur print	Top	Transverse	JIS G 0560, ISO 4968 or equivalent method. Sulphur prints are to be taken from plate edges which are perpendicular to the axis of the ingot or slab. These sulphur prints are to be approximately 600 mm long taken from the centre of the edge selected, i.e. on the ingot centreline, and are to include the full plate thickness.	Bias etc. deemed to have negative effects are not to be present.	-
	Microscopic	Top	Parallel	JIS G 0555, ISO 4967:2013 or equivalent	To be as deemed	-
						W16 App. Table A1 Edition year of the referenced standard specified.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended				Original		Remarks
	examination for non-metallic inclusions	Bottom	Parallel	method.	appropriate by the Society.	
	Macro-structure	Top	Transverse	JIS G 0553, ISO 4969 or equivalent method.		• For continuous casting billets before rolling, macrostructure tests may be omitted for bottom portions.
		Bottom	Transverse			
	Micro-structure	Top	—	Microscopic photographs (approx. 100x) of base metal, joining part and cladding metal are to be taken.		-
		Bottom	—			
	Base metal test	Austenite grain size Ferrite grain size	Top	—		JIS G 0551, ISO 643, ASTM E 112:2021 or equivalent method. Magnification of microscopic photographs are to be, as a rule, 100x. The grain size is required for each microscopic photograph. In the case of austenite grain sizes which cannot be measured, pre-austenite grain size is to be determined.
• In the case of ferrite grain size numbers over ASTM E 112:2021 grain size 10, microscopic photographs (500x 500) are to be taken.						
Hardness test		Top	—	In accordance with the requirements in Part K of the Rules. Hardness distribution in the thickness direction is to be measured in the case of stainless clad steel.	For decisions other than those specified according to Chapter 3, Part K of the Rules, to be as appropriate by the Society.	• In the case of high strength rolled steels for offshore structures, microscopic photographs (100x 100 and 500x 500) are to be taken.

W11 3.6.2
Edition year of the
referenced standard
specified.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended				Original		Remarks
Base metal test	Tensile test	Top	Transverse	In accordance with the requirements in Part K of the Rules.	To meet the requirements in Chapter 3, Part K of the Rules. • In the case of hot coils, test samples are also to be selected from the middle of the length direction specified in 1.4.2-1. • In the case of high strength rolled steels for offshore structures, test specimens are to be taken with their longitudinal axis parallel and transverse to the final direction of rolling from top and bottom • In cases where deemed necessary by Society, additional test specimens are taken with their longitudinal axis parallel to the final direction of rolling • In the case of round tensile test specimens of bars taken from steels over 40 mm in thickness, test specimens are to be taken from 1/4 and 1/2 of thickness. • In the case of high strength rolled steels for offshore structures, reduction of area and yield to tensile ratio are to be reported for reference. • When the capacity of the available testing machine is insufficient, tests may be carried out using specimens of reduced thickness in the thickness direction of the product in cases where such specimens are deemed appropriate by the Society in consideration of the type of heat treatment to be applied. In such cases, additional tests (tensile tests using the specimen of reduced thickness, hardness tests, micro- structures, etc.) may be required, and the thickness of the specimen to be used is to be stated in the approval test plan.	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended				Original			Remarks
Base metal test	Bend test	Bottom	Transverse	In accordance with the requirements in Part K of the Rules.	To meet the requirements in Chapter 3, Part K of the Rules.	- When approved by the Society, test samples taken from the top may be used. - Shapes and sizes of test specimens, testing methods and acceptance criteria for materials for which bend tests are not prescribed in the Part K of the Rules are to be as deemed appropriate by the Society.	
	SR tensile test	Top	Parallel	To be as deemed appropriate by the Society.	To be as deemed appropriate by the Society.	-	
		Bottom	Parallel	However, the test specimens which have been maintained for 2 <i>minutes</i> per 1 <i>mm</i> of thickness at 600 °C (minimum 60 <i>minutes</i>), as a rule, to be used			
Base metal test	Thickness directional tensile test	Top	Thickness direction	In accordance with the requirements in Part K of the Rules.	To meet the requirements in Chapter 3, Part K of the Rules.	-	
		Bottom					
	Shearing strength test	Top	—	In accordance with the requirements in Part K of the Rules.	To meet the requirements in Chapter 3, Part K of the Rules.	-	
		Bottom	—				
	V-notch Charpy impact test	Top	Parallel	Using <i>U</i> /4 test specimen, the transition temperature curve of the absorbed energy and fracture surface ratio is to be determined by testing three pieces at each temperature in addition to the lateral expansion of test specimen. Furthermore, the test temperature is to	For decisions other than those specified according to Chapter 3, Part K of the Rules to be as appropriate by the Society.	- In the case of hot coils, test samples are also to be selected from the middle of length direction specified in 1.4.2-1. - In the case of high strength rolled steels for offshore structures, additional test specimens are to be taken with their longitudinal axis parallel to the final direction	
			Transverse				

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended					Original		Remarks
		Bottom	Parallel	include the temperature as specified in Part K of the Rules , and its interval is to be 10 ~ 20°C. ⁽⁷⁾		of rolling from samples selected at bottoms. • V-notch charpy impact test specimens for stainless clad steels are to be taken from the base material. • In the case of steels over 40 <i>mm</i> in thickness, test specimens are to be taken from 1/4 and 1/2 of thickness. • In the case of rolled steels for hull, the test temperatures are to include at least the temperatures in Table 2.1-4. • In the case of high strength rolled steels for offshore structures, the test temperatures are to include at least the temperatures in Table 2.1-5.	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended				Original		Remarks
Base metal test	Strain aging charpy impact test	Top	Parallel	Using <i>U4</i> test specimen, the transition temperature curve of the absorbed energy and fracture surface ratio is to be determined by testing three pieces at each temperature in addition to the lateral expansion of test specimen. Furthermore, the test temperature is to include the temperature as specified in Part K of the Rules , and the test specimens which have been maintained for one hour at 250°C after strain of 5% or 10% have been applied is, as a rule, to be used.	To be as deemed appropriate by the Society.	- In the case of hot coils, test samples are also to be selected from the middle of length direction specified in 1.4.2-1. - In the case of steel other than steel plates (including flat bars not less than 600 mm in width), the test may be omitted. - In the case of high strength rolled steels for offshore structures, additional test specimens are to be taken with their longitudinal axis parallel to the final direction of rolling - In the case of steels over 40 mm in thickness, test specimens are to be taken from 1/4 and 1/2 of thickness. - In the case of rolled steels for hulls, the test temperatures are to include at least the temperatures in Table 2.1-4. - In the case of high strength rolled steels for offshore structures, the test temperatures are to include at least the temperatures in Table 2.1-5. - In the case of high strength rolled steels for offshore structures, this test may be carried out on the thickest plate.
	Hydrogen embrittlement test	Top	Parallel	In accordance with the requirements in Part K of the Rules .	In accordance with the requirements in Part K of the Rules	-
		Bottom	Parallel			
Brittle fracture test	<i>CTOD</i> test or deep notch test	Top	Parallel	To be consulted with the Society the dimension of test specimen, test condition etc. When newly performing tests at the time of approval.	To be as deemed appropriate by the Society.	-

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended					Original		Remarks
	Temperature gradient <i>ESSO</i> test, double tension test or <i>CAT</i> evaluation test	Top	Parallel	In accordance with Annex K3.12.3-1 or Annex K3.12.3-2, Part K of the Guidance for the Survey and Construction of Steel Ships.		- Where the brittle crack arrest properties are evaluated by K_{ca} and the brittle crack arrest test results fail to meet the requirement, further brittle crack arrest tests may be carried out. In such cases, the judgment of acceptance is to be made on the arrest toughness value K_{ca} for all test specimens. - Results of initial tests, failed tests and additional tests are to be included in test reports.	W11 3.6.2 W16 App. 3.7.6 Edition year of the referenced standard specified.
	<i>NRL</i> drop weight test	Top	Parallel	<i>ASTM E 208:2019</i> or equivalent method.		Nil-ductility transition temperatures (<i>NDTT</i>) and photographs of test specimens after testing are to be included in test reports.	
Weldability (5) (6) (7)	Butt welding tensile test	Top	Transverse for welding direction	Tensile test is to be carried out for one test specimen of <i>U2A</i> or <i>U2B</i>	In accordance with the requirements in Chapter 4, Part M of the Rules.	- In the case of steels other than steel plates (including flat bars not less than 600 mm in width), the test may be omitted. - Test specimens are, in principle, to be selected from each test sample specified in Table 2.1-6. - When the capacity of a test machine is exceeded by the use of a full-thickness specimen, the test specimen may be divided in the thickness direction to be tested.	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended				Original			Remarks
	Butt welding impact test	Top		One set of three <i>U4</i> test specimens is to be selected from at weld junction, 2 mm from weld junction, 5 mm from weld junction and 20 mm from weld junction of position of notch respectively (Refer to Fig. 2.1-2), and tested at temperature in accordance with Part K of the Rules. For cases of heat input > 200 kJ/cm, then an additional test is to be taken at 10 mm from fusion line.	To be as deemed appropriate by the Society.	- In the case of steels other than steel plates (including flat bars not less than 600 mm in width), the test may be omitted. - Test specimens are, in principle, to be selected from each test sample specified in Table 2.1-6. - Test specimens are to be taken at 1-2 mm below the face sides of test samples. - For high strength rolled steels for offshore structures, specimens whose notches are located at the weld metal are to be tested in addition to the specimens specified in the left column. In addition, in cases where plate thickness is not less than 50 mm, test specimens at root sides are required for each aforementioned position.	W11 A2 3.7.3 W16 App. 3.7.6 Additional testing required for approval for high heat input welding upon request.
Weldability (5) (6) (7)	Welding hardness test	Top	—	Rolled steels for hull Rolled steels for low temperature service High strength rolled steel for offshore structures (Each plate is to include steel flats not less than 600 mm in width) At sections of butt welding joints, welding hardness tests are measured 0.7 mm pitch from weld junction to base metal along with the two parallel lines which are 1 mm inside from the both surface of base metal.	Values of maximum hardness are not to exceed the values specified in Table 2.1-8 . Other steel plates are to be as deemed appropriate by the Society.	- Test specimens are, in principle, to be selected from each test sample specified in Table 2.1-6. - Sketches of weld joints depicting groove dimensions, number of passes, and hardness indentations are to be attached to test reports together with photomacrographs of weld cross sections. - Hardness tests are carried out at HV5 for rolled steels for hulls, and at HV10 for high strength rolled steels for offshore structures.	
				Rolled steels other than those mentioned above	<i>JIS Z 3101</i> or equivalent method.	To be as deemed appropriate by the Society.	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended				Original			Remarks
	Y-shape weld crack test (Hydrogen crack test)	Top	—	To be in accordance with internationally recognized standards such as <i>ISO 17642-2:2005</i> , etc.	To be as deemed appropriate by the Society.	- In the case of steels other than steel plates (including flat bars not less than 600 <i>mm</i> in width), the test may be omitted. - For high strength rolled steels for offshore structures, the relationship between minimum preheat temperature and thickness is to be described.	W16 App. 3.7.6 Edition year of the referenced standard specified.
	CTOD test or deep notch test	Top	Transverse for welding direction	CTOD tests are to be carried out in accordance with <i>ISO 15653:2018</i> or the equivalent. Three test specimens notched in the through thickness direction in grain coarsened HAZ (CGHAZ) are to be selected for each butt weld test assembly and tested at -10°C. When performing deep notch tests at the time of approval, the Society is to be consulted about the dimensions of test specimens, test conditions, etc.	To be as deemed appropriate by the Society.	- In the case steels of other than steel plates (including flat bars not less than 600 <i>mm</i> in width), the test may be omitted. - CTOD specimens for the high strength rolled steels for offshore structures are to be taken from test samples (b) and (c) specified in Table 2.1-6. Specimen dimension are to comply with Table 2.1-9.	
Corrosion resistance test	Corrosion test	Top	—	To be in accordance with internationally recognized standards such as <i>JIS G 0575</i> , <i>G 0576</i> and <i>G 0591</i> , etc.	To be as deemed appropriate by the Society.	-	
Non-destructive test	Ultrasonic test or Eddy current test	Entire surface	—	Stainless clad steels	<i>JIS G 0601</i> or equivalent method.	To meet class F of <i>JIS G 0601</i>	-
				Steel with consideration for thickness directional characteristics	In accordance with Chapter 3, Part K of the Rules for the Survey and Construction of Steel Ships.	In accordance with the requirements in Chapter 3, Part K of the Rules for the Survey and Construction of Steel Ships.	-
				Round bars for chains	<i>JIS G 0801</i> and <i>JIS G 0202</i> or equivalent method.	To be free from any defects deemed to have negative effect.	-

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended				Original		Remarks
Corrosion resistance test for cargo oil tanks	Top	—	In accordance with Annex 1.2.	In accordance with Annex 1.2.	- The chemical composition of test specimens for corrosion resistance tests of cargo oil tanks is to be set in accordance with the documents specified in 1.2.2 to make it possible to confirm the validity of the chemical composition range (upper and lower limits) of elements to be added for improving corrosion resistance. - With respect to corrosion resistance tests for cargo oil tanks, IACS Unified Interpretation SC258 as amended is to be applied in addition to Annex 1.2.	

Notes:

- (1) In the case of ingot casting, “top” means edge of top side of ingot for length direction specified in 1.4.2-1(2), “bottom” means edge of another side. In case of continuous casting, any edge is available of both edge for length direction specified in 1.4.2-1(2). However, in the case of ingot casting for high strength rolled steels for offshore structures, “top” and “bottom” mean the edge corresponding to the top and bottom of the ingot specified in 1.4.2-1(3).
- (2) Selected position at width direction or section for each kind is to meet the requirements in 3.1.6-4, **Part K of the Rules.**
- (3) “Length direction of test specimen” denotes the direction of the test sample to the direction of final rolling.
- (4) For steel products other than steel plate (i.e. steel sections, steel bars), when it is difficult to be taken test specimens with their longitudinal axis transverse to the rolling direction, test specimens may be taken parallel to the rolling direction subject to the approval with the Society.
- (5) The bevel preparation is to be 1/2V or K related to thickness, and the test sample is to be welded by procedures commonly used for the relevant steels in consideration of the welding heat inputs specified in Table 2.1-6.
- (6) In test records, the figure indicated the details of edge preparations, layer or pass sequence and measuring position of hardness are to be included, in addition to macroscopic photograph of welded section, welding procedure, welding consumables (brand, mark, shielded gas, backing etc.), welding parameter (amperage, voltage, welding speed, heat input, current etc.), preheating temperature and interpass temperature. However, where only requested maximum hardness test, these requirement may not be applied.
- (7) Weldability tests are, in principle, to be carried out on the thickest plate.
- (8) Regardless of (2) above, selected locations of test samples in the width direction are to meet the requirements in 3.12.4-2, **Part K of the Rules.**

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended			Original		Remarks
Table 2.1-6 Test Samples for Weldability Tests					
Kind of rolled steels			Welding direction of test samples to the direction of final rolling direction of base metal	Test samples ^{(1) (2)}	W16 App. 3.7.1 Additional testing required for approval for high heat input welding upon request.
Rolled steel for hulls			Transverse	(a) Butt weld test assembly welded with 15kJ/cm heat input (b) Butt weld test assembly welded with 50kJ/cm heat input	
Rolled steel for low temperature service			Parallel	Same as above	
High strength rolled steel for offshore structures	KA420, KD420, KE420, KF420, KA460, KD460, KE460, KF460, KA500, KD500, KE500, KF500 ⁽³⁾	N, NR	Transverse	(a) Butt weld test assembly welded with 15±2kJ/cm heat input (b) Butt weld test assembly welded with 50±5kJ/cm heat input (c) Butt weld test assembly welded with same heat input given in (b), but with post-weld heat treatment (PWHT) (d) Butt weld test assembly welded with the maximum heat input requested for approval ^{(3) (4)}	
		TMCP	Parallel		

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
Notes: (1) Unless otherwise specified in this table, test samples are not subjected to any heat treatment. (2) PWHT is to be carried out in accordance with the condition specified in Table 2.1-7. (3) In cases where the high heat input welding over the value specified in the table is to be included in the approval requested by the manufacture, the test sample is to be assembly (a) specified in this table: a butt weld test assembly in the as welded condition and a test assembly in the PWHT condition, both welded with the maximum heat input being approved. Where manufacturers optionally request approval for steels intended for high heat input welding, assemblies are also to be welded using the maximum heat input requested for approval. <u>(a) One test plate is required, to represent the maximum heat input level at the thickness or dimensions of steel requested for approval.</u> <u>(b) The heat input is not to be less than 60 kJ/cm for N/NR and TM, and 40 kJ/cm for QT steels, and expressed in an increment of 10 kJ/cm for N/NR and TM and 5 kJ/cm for QT steels, at the stated plate thickness, e.g. requested maximum heat input of 100 kJ/cm at 60mm plate thickness.</u> <u>(c) Testing is to include assemblies in the as-welded condition and the Post Weld Heat Treated (PWHT) condition.</u> <u>(d) The approval for the thickness or dimensions of steel tested at the specified heat input level does not imply suitability for thinner plates at the same heat input level, where lower heat inputs may be required.</u> Notes: i) <u>High heat input used for the approval of thick plate may not be suitable for applications on thinner plates.</u> ii) <u>A grade notation of W300, for example, demonstrates the suitability of the material at the maximum approved thickness to be welded with heat inputs up to 300 kJ/cm.</u> iii) <u>The suitability of high heat inputs for lower thickness plates is to be determined by the fabricator, together with any manufacturers recommendations.</u> (4) The applicable maximum heat input is to be indicated in the approval application. (5) If the manufacturer also requests approval for PWHT condition, this test assembly may be included as a test sample.		
1.5 Approval 1.5.1 Notification of Approval 1 The Society grants approval of the manufacturing process of rolled steels or semi-finished products which have been deemed appropriate on the basis of the reports of the Surveyor and documents submitted in accordance with requirements in 1.2 through 1.4. In this case, a “Certificate of Approval” is published including the <u>following information and term of validity of approval etc.</u> and the approved	1.5 Approval 1.5.1 Notification of Approval 1 The Society grants approval of the manufacturing process of rolled steels or semi-finished products which have been deemed appropriate on the basis of the reports of the Surveyor and documents submitted in accordance with requirements in 1.2 through 1.4. In this case, a “Certificate of Approval” is published including the <u>name of works, kind of rolled steels,</u> term of validity of approval etc. and the	W11 A2 5.1 Contents of the approval notification revised.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
content etc. is described in “Particulars of Approval Conditions”. (1) <u>Manufacturer</u> (2) <u>Strength and toughness grade</u> (3) <u>Fine grain practice</u> (4) <u>Condition of supply</u> (5) <u>Maximum approved thickness or dimensions of steel</u> (6) <u>Any other suffix or notation (e.g. ‘Z’)</u> 2 <u>For the high strength rolled steels for offshore structures specified in 3.8, Part K of the Rules for the Survey and Construction of Steel Ships, the Society grants approval of the manufacturing process of rolled steels or semi-finished products which have been deemed appropriate on the basis of the reports of the Surveyor and documents submitted in accordance with requirements in 1.2 through 1.4. In this case, a “Certificate of Approval” is published including the following information and term of validity of approval etc. and the approved content etc. is described in “Particulars of Approval Conditions”. In addition, the maximum heat input applied to test assemblies for weldability tests in of the manufacturing process approval is to be described in the “Particulars of Approval Conditions”. In addition, where weldability tests are carried out for test assemblies to which post-weld heat treatments are applied, the weldability of the test assembly to which post-weld heat treatment is applied it to be confirmed and the maximum heat input applied to test assembly is to be described in the “Particulars of Approval Conditions”.</u> (1) <u>Manufacturer</u> (2) <u>Grade designation with notation of heat input, where applicable</u> (3) <u>Deoxidation practice</u> (4) <u>Fine grain practice</u>	approved content etc. is described in “Particulars of Approval Conditions”. 2 <u>In addition to -1, for the high strength rolled steels for offshore structures specified in 3.8, Part K of the Rules for the Survey and Construction of Steel Ships, the maximum heat input applied to test assemblies for weldability tests in of the manufacturing process approval is to be described in the “Particulars of Approval Conditions”. In addition, where weldability tests are carried out for test assemblies to which post-weld heat treatments are applied, the weldability of the test assembly to which post-weld heat treatment is applied it to be confirmed and the maximum heat input applied to test assembly is to be described in the “Particulars of Approval Conditions”.</u>	W16 App. 5.1 Contents of the approval notification revised.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
(5) Condition of supply (6) Maximum approved thickness or dimensions of steel (7) For steels approved for high heat input welding, the tested thickness will also be stated. 3 In relation to -2 above, the notation indicating the value of heat input applied in the confirmation test is to be added to the grade designation of the test plate, e.g., “K4420-W300” (in the case of heat input 300 kJ/cm applied). The heat input selected is not to be less than 60 kJ/cm for N/NR and TM, and 40 kJ/cm for QT steels and expressed in an increment of 10 kJ/cm for N/NR and TM, and an increment of 5 kJ/cm for QT. 4 Notwithstanding -1 above, for the corrosion resistant steel for cargo oil tanks specified in 3.13, Part K of the Rules for the Survey and Construction of Steel Ships, the Society grants approval of the manufacturing process for corrosion resistant steel for cargo oil tanks which have been deemed appropriate on the basis of the reports of the Surveyor and documents submitted in accordance with requirements in 1.2 through 1.4. In this case, a “Certificate of Approval” is published including the name of works, kind of corrosion resistant steel for cargo oil tanks, term of validity of approval etc. and at least the following items are described in “Particulars of Approval Conditions”. (1) Brands name and approval number (2) Chemical composition range (additive elements for ensuring corrosion resistance) and corrosion resistance process of the steel (3) Maximum thickness (4) Applicable welding consumables (the brand names and the approval certificate numbers) and welding methods (5) Applicable area	(Newly added) 3 Notwithstanding -1 above, for the corrosion resistant steel for cargo oil tanks specified in 3.13, Part K of the Rules for the Survey and Construction of Steel Ships, the Society grants approval of the manufacturing process for corrosion resistant steel for cargo oil tanks which have been deemed appropriate on the basis of the reports of the Surveyor and documents submitted in accordance with requirements in 1.2 through 1.4. In this case, a “Certificate of Approval” is published including the name of works, kind of corrosion resistant steel for cargo oil tanks, term of validity of approval etc. and at least the following items are described in “Particulars of Approval Conditions”. (1) Brands name and approval number (2) Chemical composition range (additive elements for ensuring corrosion resistance) and corrosion resistance process of the steel (3) Maximum thickness (4) Applicable welding consumables (the brand names and the approval certificate numbers) and welding methods (5) Applicable area	W16 App. 5.2 Suffix notation for the grade designation specified. Transferred due to the addition of 3.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
5 Among those data submitted in accordance with the requirements in 1.2.2 and 1.4.5 which the Society deems necessary, a seal of approval is stamped and returned to the applicant. 1.5.4 Changes in the Approved Content 1 In case of changes in the approved content such as those given in the following (1) through (9) are occurred, in response to the content of changes, documents corresponding to the requirements in 1.2.2 are to be submitted to the Society, in addition to the appropriate application form (Form 1-1) and a "Certificate of Approval" (copy). (1) Addition to material grades (2) Changes in the steel making process (3) Changes in the casting making process (4) Changes in the rolling process (5) Changes in the limits of thickness (6) Changes in the heat treatment process (7) Changes in the chemical composition, added element etc. (8) In case of a part of manufacturing process (rolling, heat treatment etc.) is assigned to other works (9) Changes in the kind of semi-finished product being used (10) <u>For steels intended for high-heat input welding notation, change of maximum heat input and/or applicable thickness or dimensions of steel.</u> 2 For the corrosion resistant steel for cargo oil tanks specified in 3.13, Part K of the Rules for the Survey and Construction of Steel Ships, in case of changes in the approved content such as those given in the above -1(1) through (9) and following (1) and (2) are occurred, in response to the content of changes, each of documents	4 Among those data submitted in accordance with the requirements in 1.2.2 and 1.4.5 which the Society deems necessary, a seal of approval is stamped and returned to the applicant. 1.5.4 Changes in the Approved Content 1 In case of changes in the approved content such as those given in the following (1) through (9) are occurred, in response to the content of changes, documents corresponding to the requirements in 1.2.2 are to be submitted to the Society, in addition to the appropriate application form (Form 1-1) and a "Certificate of Approval" (copy). (1) Addition to material grades (2) Changes in the steel making process (3) Changes in the casting making process (4) Changes in the rolling process (5) Changes in the limits of thickness (6) Changes in the heat treatment process (7) Changes in the chemical composition, added element etc. (8) In case of a part of manufacturing process (rolling, heat treatment etc.) is assigned to other works (9) Changes in the kind of semi-finished product being used (Newly added) 2 For the corrosion resistant steel for cargo oil tanks specified in 3.13, Part K of the Rules for the Survey and Construction of Steel Ships, in case of changes in the approved content such as those given in the above -1(1) through (9) and following (1) and (2) are occurred, in response to the content of changes, each of documents	Transferred due to the addition of 3. W16 App. 2.3 Changes requiring approval specified.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
corresponding to the requirements in 1.2.2 are to be submitted to the Society, in addition to the appropriate application form (Form 1-2) for Changes in the Approved Content of Manufacturing Process of Corrosion Resistant Steel for Cargo Oil Tanks” and the “Certificate of Approval” (copy). (1) Changes in the chemical composition range of elements to be added for improving the corrosion resistance (2) Changes in the applicable welding consumables 3 Upon studying the items of changes in approved content specified in -1 or -2, the Society requests factory inspection and approval tests in accordance with 1.4 as necessary. In cases where the applicable welding consumables specified in -2(2) are changed, the corrosion resistance test for corrosion resistant steel specified in Annex 1.2 may be limited to only tests for welded joints. 4 The Society is to examine the submitted data specified in -1 or -2 and reports of factory inspection and approval test specified in -3, and if the Society considers them appropriate, is to approve the changes in the approved content. In this case, as a rule, the validity of the “Certificate of Approval” specified in -1 or -2 are not changed. 5 Manufacturers whose request for changes in approved content is accepted are to return the old “Certificate of Approval” and the relevant “Particulars of Approval Conditions” to the Society as soon as possible after receiving the new certificate.	corresponding to the requirements in 1.2.2 are to be submitted to the Society, in addition to the appropriate application form (Form 1-2) for Changes in the Approved Content of Manufacturing Process of Corrosion Resistant Steel for Cargo Oil Tanks” and the “Certificate of Approval” (copy). (1) Changes in the chemical composition range of elements to be added for improving the corrosion resistance (2) Changes in the applicable welding consumables 3 Upon studying the items of changes in approved content specified in -1 or -2, the Society requests factory inspection and approval tests in accordance with 1.4 as necessary. In cases where the applicable welding consumables specified in -2(2) are changed, the corrosion resistance test for corrosion resistant steel specified in Annex 1.2 may be limited to only tests for welded joints. 4 The Society is to examine the submitted data specified in -1 or -2 and reports of factory inspection and approval test specified in -3, and if the Society considers them appropriate, is to approve the changes in the approved content. In this case, as a rule, the validity of the “Certificate of Approval” specified in -1 or -2 are not changed. 5 Manufacturers whose request for changes in approved content is accepted are to return the old “Certificate of Approval” and the relevant “Particulars of Approval Conditions” to the Society as soon as possible after receiving the new certificate.	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
Chapter 1A WELDABILITY CONFIRMATION OF ROLLED STEELS FOR HULL 1A.1 General 1A.1.1 Scope 1 In accordance with the provisions in 1.1.1-3, the requirements in this chapter apply to the weldability confirmation of rolled steels intended for welding with high heat input over 50 <i>kJ/cm</i> as a request by manufacturer's option, for the approval of manufacturing process of rolled steels for hull specified in 3.1, Part K of the Rules for the Survey and Construction of Steel Ships (hereinafter referred to as "the Rules"). 2 For the weldability confirmation, the requirements in this chapter are applied provided that: (1) the Society confirms that the rolled steels have a prescribed weldability by tests under the manufacturer's specific welding conditions; and (2) conditions and applicable range for the approval of welding procedures and related specifications by the provisions of Part M of the Rules are not restricted by "Weldability Confirmation Records" by the provisions in this chapter. (3) <u>For steels approved for high heat input welding, the approval test is to be carried out using the designated maximum tested heat input level on the maximum thickness or dimensions of steel.</u> (4) <u>High heat input used for the approval of the maximum thickness or dimensions of steel may not be suitable for applications on thinner plates. The suitability of high heat inputs for lower thickness</u>	Chapter 1A WELDABILITY CONFIRMATION OF ROLLED STEELS FOR HULL 1A.1 General 1A.1.1 Scope 1 In accordance with the provisions in 1.1.1-3, the requirements in this chapter apply to the weldability confirmation of rolled steels intended for welding with high heat input over 50 <i>kJ/cm</i> as a request by manufacturer's option, for the approval of manufacturing process of rolled steels for hull specified in 3.1, Part K of the Rules for the Survey and Construction of Steel Ships (hereinafter referred to as "the Rules"). 2 For the weldability confirmation, the requirements in this chapter are applied provided that: (1) the Society confirms that the rolled steels have a prescribed weldability by tests under the manufacturer's specific welding conditions; and (2) conditions and applicable range for the approval of welding procedures and related specifications by the provisions of Part M of the Rules are not restricted by "Weldability Confirmation Records" by the provisions in this chapter. (Newly added)	W11 App.B 3.1 Overview of this Chapter specified.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>plates is to be determined by the fabricator, together with any manufacturer's recommendations.</u> 3 The time of the weldability confirmation may be different from that of approval of manufacturing process specified in Chapter 2 in this part. 4 The requirements provided in Chapter 2 in this part are applicable unless otherwise specified in this chapter. 1A.2 Application of the Weldability Confirmation 1A.2.2 Documents to be Submitted 1 Each of the documents given in (1) and (2) are to be submitted together with the application form specified in 1A.2.1. (1) Confirmation test plan (2) Technical data (a) Data on steel products i) Type of products and grades of steel ii) Range of manufacturing thickness or dimensions iii) Deoxidation practice and fine grain practice iv) Standard for chemical composition (if the system of constituent depends on grade, thickness, heat treatment, etc., the different ranges are to be specified, as appropriate.) v) Maximum carbon equivalent (C_{eq}) and maximum cold cracking susceptibility (P_{cm}) (this value is to be calculated by the formula specified in 1.5.2-2(6), Part K of the Rules) vi) Actual manufacturing records within the specific period (tensile and Charpy impact	3 The time of the weldability confirmation may be different from that of approval of manufacturing process specified in Chapter 2 in this part. 4 The requirements provided in Chapter 2 in this part are applicable unless otherwise specified in this chapter. 1A.2 Application of the Weldability Confirmation 1A.2.2 Documents to be Submitted 1 Each of the documents given in (1) and (2) are to be submitted together with the application form specified in 1A.2.1. (1) Confirmation test plan (2) Technical data <u>given in the following (a) through (d)</u> (a) Data on steel products i) Type of products and grades of steel ii) Range of manufacturing thickness or dimensions iii) Deoxidation practice and fine grain practice iv) Standard for chemical composition (if the system of constituent depends on grade, thickness, heat treatment, etc., the different ranges are to be specified, as appropriate.) v) Maximum carbon equivalent (C_{eq}) and maximum cold cracking susceptibility (P_{cm}) (this value is to be calculated by the formula specified in 1.5.2-2(6), Part K of the Rules) vi) Actual manufacturing records within the specific period (tensile and Charpy impact	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
tests are expressed in the form of histogram or statistics for each heat treatment) (b) Items for control system in accordance with manufacturing process to prevent deterioration of toughness of heat affected zone (chemical composition, steel making process, steel casting process, steel rolled process, heat treatment, etc. are to be specified) (c) Items for control system in accordance with welding procedure to improve strength and toughness of welded joints (where the case is needed) (d) <u>Maximum heat input requested for the thickness or dimensions of steel tested. The requested heat input is to be stated in an increment of 10 kJ/cm, but not less than 60 kJ/cm, e.g. requested maximum heat input of 100 kJ/cm at 60 mm plate thickness.</u> (e) Other data deemed necessary by the Society 2 Notwithstanding the requirements in preceding -1, where the following documents are duplicated, part or all of the documents to be submitted may be omitted. However, confirmation test specified in 1A.4 is required, confirmation test plan specified in -1(1) is not to be exempted from submission. (1) Documents submitted for approval of manufacturing procedure of the rolled steels (2) Documents submitted of other steels, different from type of products, grades of steels, heat treatment, etc., that are already confirmed with weldability by the Society	tests are expressed in the form of histogram or statistics for each heat treatment) (b) Items for control system in accordance with manufacturing process to prevent deterioration of toughness of heat affected zone (chemical composition, steel making process, steel casting process, steel rolled process, heat treatment, etc. are to be specified) (c) Items for control system in accordance with welding procedure to improve strength and toughness of welded joints (where the case is needed) (d) Other data deemed necessary by the Society 2 Notwithstanding the requirements in preceding -1, where the following documents are duplicated, part or all of the documents to be submitted may be omitted. However, confirmation test specified in 1A.4 is required, confirmation test plan specified in -1(1) is not to be exempted from submission. (1) Documents submitted for approval of manufacturing procedure of the rolled steels (2) Documents submitted of other steels, different from type of products, grades of steels, heat treatment, etc., that are already confirmed with weldability by the Society	W11 App.B 2 Designation of heat input that may be requested for approval specified.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
1A.4 Confirmation Test 1A.4.1 Extent of the Confirmation Tests Confirmation tests of rolled steels in the same manufacturing process may be the following (1) and (2) if deemed appropriate by the Society. (1) <u>Approval tests on the highest toughness grades covers the lower toughness grades.</u> (2) <u>For higher strength tensile steels, in addition to (1), approval tests on one strength level cover the same grade and below in the strength level immediately below.</u> (3) <u>For steels approved for high heat input welding, the approval will be based on the maximum tested heat input level and the maximum thickness or dimensions of steel tested.</u> (a) <u>High heat input used for the approval of the maximum thickness or dimensions of steel may not be suitable for applications on thinner plates.</u> (b) <u>A grade notation of W300, for example, demonstrates the suitability of the material at the maximum approved thickness to be welded with heat inputs up to 300 kJ/cm.</u> (c) <u>The suitability of high heat inputs for lower thickness plates is to be determined by the</u>	1A.4 Confirmation Test 1A.4.1 Extent of the Confirmation Tests Confirmation tests of rolled steels in the same manufacturing process may be the following (1) and (2) if deemed appropriate by the Society. (1) <u>Results of confirmation tests carried out for two steels of different grade in the same strength level (two steels different in the requirements of impact test temperature) can cover that for steels of intermediate grade in the same strength level.</u> (2) <u>In addition to the provisions in preceding (1), for high tensile steels, such results can cover following steels:</u> (a) <u>steels of same grades in the strength level immediately below the level of the tested steels; and</u> (b) <u>steels of intermediate grade of the tested grades in the strength level immediately below the level of the tested steels.</u> (Newly added)	W11 App. B 3.1 Lower-grade steels included in the approval range. Approved heat input limited to the upper limit.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
<u>fabricator, together with any manufacturers recommendations.</u> 1A.4.2 Test Assemblies 1 Test assemblies <u>for</u> confirmation tests are to <u>consist of one test assembly, to represent the maximum heat input level at the thickness or dimensions of steel requested for approval.</u> 2 Dimensions of test assemblies are to be sufficient to take required test specimens. 3 <u>One butt weld assembly welded at the requested heat input level is to be generally prepared with the weld axis transverse to the plate rolling direction.</u> 4 The welding of test assemblies should be as far as possible in accordance with the normal practices applied at shipyards. 1A.4.3 Details of Test	1A.4.2 Test Assemblies 1 Test assemblies <u>of</u> confirmation tests are <u>generally to be two test assemblies of the different thickness. In this case, thinner thickness of test assemblies is not to be more than one-half of thicker plates.</u> 2 Dimensions of test assemblies are to be sufficient to take required test specimens. 3 <u>Welding direction is generally to be transverse to the plate rolling direction of test assemblies.</u> 4 The welding of test assemblies should be as far as possible in accordance with the normal practices applied at shipyards. 1A.4.3 Details of Test	W11 App.B 3.3 Requirements for the test assembly revised. W11 App.B 3.4 Preparation of the test assembly specified.

Table 1A.1 Confirmation Test Item, Testing Method and Acceptance Criteria

Confirmation test item	Length direction of test specimen ⁽²⁾	Testing method	Acceptance criteria
Macroscopic test ⁽¹⁾	Transverse	JIS G 0553 or equivalent method.	Absence of cracks, lack of penetration, lack of fusion and other injurious defects.
Microscopic test	Transverse	Along mid-thickness line across transverse section of the weld, one micrograph with x100 magnification is to be taken at each position of the weld metal centreline, fusion line and at a distance 2, 5, 10 and 20 mm from the fusion line to base metal.	To be as deemed appropriate by the Society.
Hardness test ⁽¹⁾	Transverse	Along two lines across transverse weld section 1 mm beneath plate surface on both face and root side of the weld, indentations by HV5 are to be made at weld metal	The maximum hardness value is not to be over 350.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended			Original		Remarks
		centreline, fusion line and each 0.7 mm position from fusion line to unaffected base metal (minimum 6 to 7 measurements for each heat affected zone).			W11 App. 3.5 Additional testing required for approval for high heat input welding upon request.
Butt welding tensile test	Transverse	Tensile test is to be carried out for two test specimens of <i>U2A</i> and <i>U2B</i> .	In accordance with the requirements in Chapter 4, Part M of the Rules.		
Butt welding bend test	Transverse	Two transverse test specimens of <i>UB-2</i> are to be bent through an angle of 120° over a former having a radius of 2 times the thickness of test specimens. ⁽³⁾	In accordance with the requirements in Chapter 4, Part M of the Rules.		
V-notch Charpy impact test	Transverse	Charpy impact specimens of <i>U4</i> (three specimens for one set) are to be taken within 2 mm below plate surface on face side (in case of both sides are to be welded, final welded side) of the weld with the notch perpendicular to the plate surface. These specimens transverse to the weld is to be taken with the notch located at the weld junction and 2 mm, 5 mm and, <u>at a minimum 20 mm</u> from weld junction of position of notch respectively. These specimens are to be tested at temperature in accordance with Part K of the Rules. ^{(4) (5) (6)} <u>For cases of heat input > 200 kJ/cm, then an additional test is to be taken at 10 mm from fusion line.</u>	In accordance with the requirements in Chapter 4, Part M of the Rules.		
Visual inspection	-	Visual inspection of welded parts is to be carried out.	Over all welded surfaces are to be uniform and free from injurious defects such as cracks, undercuts, overlaps etc.		
Notes :					
(1) The figures of macroscopic photograph and the position of hardness test are to be included in a report of the confirmation test.					
(2) Length direction of test specimen is the direction against welding line.					
(3) For plate thickness up to 20 mm, two butt welding bend specimens may be replaced to one face bend and one root bend specimens of <i>UB-1</i> .					
(4) When deemed necessary by the Society, the Society may request submission of transported temperature curve of energy and crystal defect par.					
(5) For steel plate with thickness greater than 50 mm or one side welding for plate thickness greater than 20 mm, one additional set of the specimens is to be taken from the root side of the weld.					
(6) Test temperature may be different degrees subject to the approval with the Society.					

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
1A.5 Weldability Confirmation 1A.5.1 Publication of the Confirmation Records 1 The Society publishes “Weldability Confirmation Records” including the following <u>information</u> for rolled steels for hull having a prescribed weldability confirmed in accordance with requirements in 1A.2 through 1A.4. (1) Name of works (2) Material grade (<u>including any additional notations</u>) (3) Deoxidation practice (4) Fine grain practice (5) Heat treatment (6) Thickness of test assemblies (7) The identification number of “Particulars of Approval Conditions” for the manufacturing process of the steels 2 Among those data submitted in accordance with the requirements in 1A.2.2 and 1A.4.5 which the Society deems necessary, a seal of approval is stamped and returned to the applicant. 3 <u>Upon issuance of the certificate, a notation indicating the heat input applied in the confirmation test is to be added to the grade designation of the test material, e.g. “KE36-W300” (in the case of a heat input of 300 kJ/cm). The value of this notation is to be not less than 60 kJ/cm and is to be expressed in increments of 10 kJ/cm.</u>	1A.5 Weldability Confirmation 1A.5.1 Publication of the Confirmation Records 1 The Society publishes “Weldability Confirmation Records” including the following <u>(1) through (10)</u> for rolled steels for hull having a prescribed weldability confirmed in accordance with requirements in 1A.2 through 1A.4. (1) Name of works (2) Material grade (3) Deoxidation practice (4) Fine grain practice (5) Heat treatment (6) Thickness of test assemblies (7) <u>Welding method</u> (8) <u>Manufacturer and brand of welding consumables (if necessary)</u> (9) <u>Welding heat input applied in the confirmation test</u> (10) The identification number of “Particulars of Approval Conditions” for the manufacturing process of the steels 2 Among those data submitted in accordance with the requirements in 1A.2.2 and 1A.4.5 which the Society deems necessary, a seal of approval is stamped and returned to the applicant. (Newly added)	W11 App.B 5 Items to be included in the approval notification revised. W11 App.B 6 Suffix notation in the grade designation specified.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
Chapter 1B APPROVAL OF MANUFACTURING PROCESS OF SEMI-FINISHED PRODUCTS 1B.2 Approval Application 1B.2.2 Documents to be Submitted 1 Each of the documents given in (1) and (2) are to be submitted together with the appropriate application form specified in 1B.2.1. (1) Approval test plan (2) Technical data given in the following (a) through (h) (a) Data on works i) Name and location of the works ii) General indications relevant to the background iii) Dimension and size of the works iv) Organizational chart and number of staff employed v) Estimated total annual production of semi-finished products (for shipbuilding and for other applications) (b) Data on quality control system i) Organization and number of staff employed of the quality control department ii) Qualification of the personnel involved in activities related to the quality of the products iii) Items and methods for quality control system iv) Outline of system used for identification of materials v) Outline of testing machines and relevant	Chapter 1B APPROVAL OF MANUFACTURING PROCESS OF SEMI-FINISHED PRODUCTS 1B.2 Approval Application 1B.2.2 Documents to be Submitted 1 Each of the documents given in (1) and (2) are to be submitted together with the appropriate application form specified in 1B.2.1. (1) Approval test plan (2) Technical data given in the following (a) through (h) (a) Data on works i) Name and location of the works ii) General indications relevant to the background iii) Dimension and size of the works iv) Organizational chart and number of staff employed v) Estimated total annual production of semi-finished products (for shipbuilding and for other applications) (b) Data on quality control system i) Organization and number of staff employed of the quality control department ii) Qualification of the personnel involved in activities related to the quality of the products iii) Items and methods for quality control system iv) Outline of system used for identification of materials v) Outline of testing machines and relevant	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
calibration procedures and records vi) Outline of equipment for chemical analyses and metallography and relevant calibration procedures vii) Outline of equipment for non-destructive tests and relevant calibration procedures viii) Certification of compliance of the quality system with <i>ISO 9001:2015</i>, if any (c) Data on semi-finished products i) Type of semi-finished products (rolled steels for hulls) ii) Kind of semi-finished products (ingots, slabs, blooms, billets, etc.) iii) Type of steel (normal or higher strength) iv) Maximum and minimum manufacturing dimensions v) Deoxidation practice and grain refining elements vi) Manufacturing standard for each chemical composition vii) Maximum carbon equivalent (C_{eq}) (this value is to be calculated by the formula specified in 1.5.2-2(6), Part K of the Rules) viii) Maximum cold cracking susceptibility (P_{cm}) for higher strength grades with low carbon content $C \leq 0.13\%$ (this value is to be calculated by the formula specified in 1.5.2-2(6), Part K of the Rules) ix) Actual manufacturing records within the specific period (chemical composition and dimension are expressed in the form of histogram or statistics for each kind of	calibration procedures and records vi) Outline of equipment for chemical analyses and metallography and relevant calibration procedures vii) Outline of equipment for non-destructive tests and relevant calibration procedures viii) Certification of compliance of the quality system with <i>ISO 9001</i>, if any (c) Data on semi-finished products i) Type of semi-finished products (rolled steels for hulls) ii) Kind of semi-finished products (ingots, slabs, blooms, billets, etc.) iii) Type of steel (normal or higher strength) iv) Maximum and minimum manufacturing dimensions v) Deoxidation practice and grain refining elements vi) Manufacturing standard for each chemical composition vii) Maximum carbon equivalent (C_{eq}) (this value is to be calculated by the formula specified in 1.5.2-2(6), Part K of the Rules) viii) Maximum cold cracking susceptibility (P_{cm}) for higher strength grades with low carbon content $C \leq 0.13\%$ (this value is to be calculated by the formula specified in 1.5.2-2(6), Part K of the Rules) ix) Actual manufacturing records within the specific period (chemical composition and dimension are expressed in the form of histogram or statistics for each kind of	W11 App.A 2.1 Edition year of the referenced standard specified.

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
semi-finished products and type of steel) (d) Data on manufacturing process i) Origin and storage of raw materials ii) Flow chart of the manufacturing process iii) Outline of major manufacturing facilities (including control methods) iv) Storage of semi-finished products (e) Data on steel making process i) Outline of steel making process ii) Type and capacity of steel making furnace and the number of daily charge iii) Raw materials and sub materials iv) Deoxidation and refining practice v) Secondary refining practice vi) Casting methods (ingot casting or continuous casting) vii) Scarfing and discarding procedures of ingot or semi-finished products viii) Size and weight of ingot or semi-finished products (f) Additional data in the case of applying continuous casting i) Outline of continuous casting machine (including type of casting machine, number of strand, casting practice, casting temperature, casting speed etc.) ii) Preventive methods for re-oxidation of charge iii) Reduction methods for non-metallic inclusions iv) Preventive methods for segregation v) Presence of electromagnetic stirring vi) Presence of soft reduction system	semi-finished products and type of steel) (d) Data on manufacturing process i) Origin and storage of raw materials ii) Flow chart of the manufacturing process iii) Outline of major manufacturing facilities (including control methods) iv) Storage of semi-finished products (e) Data on steel making process i) Outline of steel making process ii) Type and capacity of steel making furnace and the number of daily charge iii) Raw materials and sub materials iv) Deoxidation and refining practice v) Secondary refining practice vi) Casting methods (ingot casting or continuous casting) vii) Scarfing and discarding procedures of ingot or semi-finished products viii) Size and weight of ingot or semi-finished products (f) Additional data in the case of applying continuous casting i) Outline of continuous casting machine (including type of casting machine, number of strand, casting practice, casting temperature, casting speed etc.) ii) Preventive methods for re-oxidation of charge iii) Reduction methods for non-metallic inclusions iv) Preventive methods for segregation v) Presence of electromagnetic stirring vi) Presence of soft reduction system	

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
(g) Where approval has already been granted by other Classification Societies, documentation of such approval tests performed (h) Other data deemed necessary by the Society 2 Notwithstanding the requirements in preceding -1, where the documents are duplicated by the ones at the previous approval for the same type of products, part or all of the documents may be omitted. However, approval test specified in 1B.4 is required, approval test plan specified in -1(1) is not be exempted from submission.	(g) Where approval has already been granted by other Classification Societies, documentation of such approval tests performed (h) Other data deemed necessary by the Society 2 Notwithstanding the requirements in preceding -1, where the documents are duplicated by the ones at the previous approval for the same type of products, part or all of the documents may be omitted. However, approval test specified in 1B.4 is required, approval test plan specified in -1(1) is not be exempted from submission.	
The effective date of the amendment is according to EFFECTIVE DATE AND APPLICATION (A)		
EFFECTIVE DATE AND APPLICATION (A) 1. The effective date of the amendments is 1 January 2027. 2. Notwithstanding the amendments, the current requirements apply to ships, marine and offshore structures or steels other than those which fall under the following: (1) Ships, marine and offshore structures for which the date of contract for construction* is on or after the effective date. (2) Steels for which the application for survey is submitted to the Society on or after the effective date. (3) Steels for which the application for manufacturer approval is submitted to the Society on or after the effective date. (4) Ships the keels of which were laid or which were at a similar stage of construction on or after the effective date. (Note) The term “a similar stage of construction” means the stage at which the construction identifiable with a specific ship begins and the assembly of that ship has commenced comprising at least 50 tonnes or 1%* of the estimated mass of all structural material, whichever is the less. * For high speed craft, “1%” is to be read as “3%”. * “contract for construction” is defined in the latest version of IACS Procedural Requirement (PR) No.29.		

Amended-Original Requirements Comparison Table (Welding Procedure Qualification Tests and Related Requirements)

Amended	Original	Remarks
IACS PR No.29 (Rev.0, July 2009)		
1. The date of “contract for construction” of a vessel is the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. This date and the construction numbers (i.e. hull numbers) of all the vessels included in the contract are to be declared to the classification society by the party applying for the assignment of class to a newbuilding. 2. The date of “contract for construction” of a series of vessels, including specified optional vessels for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective owner and the shipbuilder. For the purpose of this Procedural Requirement, vessels built under a single contract for construction are considered a “series of vessels” if they are built to the same approved plans for classification purposes. However, vessels within a series may have design alterations from the original design provided: (1) such alterations do not affect matters related to classification, or (2) If the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the shipbuilder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval. The optional vessels will be considered part of the same series of vessels if the option is exercised not later than 1 year after the contract to build the series was signed. 3. If a contract for construction is later amended to include additional vessels or additional options, the date of “contract for construction” for such vessels is the date on which the amendment to the contract, is signed between the prospective owner and the shipbuilder. The amendment to the contract is to be considered as a “new contract” to which 1. and 2. above apply. 4. If a contract for construction is amended to change the ship type, the date of “contract for construction” of this modified vessel, or vessels, is the date on which revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder. Note: This Procedural Requirement applies from 1 July 2009. EFFECTIVE DATE AND APPLICATION (B) 1. The effective date of the amendments is 1 January 2027. 2. Notwithstanding the amendments, the current requirements apply to ships the keels of which were laid or which were at <i>a similar stage of construction</i> before the effective date. (Note) The term “<i>a similar stage of construction</i>” means the stage at which the construction identifiable with a specific ship begins and the assembly of that ship has commenced comprising at least 50 <i>tonnes</i> or 1%* of the estimated mass of all structural material, whichever is the less. * For high speed craft, “1%” is to be read as “3%”. EFFECTIVE DATE AND APPLICATION (C) 1. The effective date of the amendments is 1 January 2027. 2. Notwithstanding the amendments, the current requirements apply to welding consumables other than those for which the application for approval is submitted to the Society on or after the effective date.		