

INDIAN REGISTER OF SHIPPING

CLASSIFICATION NOTES

Qualification Scheme for Welders of Hull Structural Steels

December 2021



IRCLASS
Indian Register of Shipping

General Information

Applications for Welder or Welding Operator initial qualification received by IRS on or after 01 January 2022 will be subjected to the requirements of this Classification Note.

Existing qualifications will be renewed in accordance with the requirements of this Classification Note, when they become due.

CLASSIFICATION NOTES

Qualification Scheme for Welders of Hull Structural Steels

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Section 1

Scope

1.1 This document provides requirements for a qualification scheme for welders intended to be engaged in the fusion welding of steels for hull structures as specified in the following Part/ Chapters/ Sections (as relevant and applicable) of the *IRS Rules and Regulations for the Construction and Classification of Steel Ships* ::

- a) Part 2, Chapter 5, Section 2
- b) Part 2, Chapter 3, Section 2, 3 and 10
- c) Part 2, Chapter 4, Section 2

1.2 This qualification scheme does not cover welders engaged in oxy-acetylene welding.

1.3 This qualification scheme does not cover welding of pipes and pressure vessels.

1.4 Alternative welding Standards or Codes are to be applied in full, however, cross-mixing requirements of Standards and Codes is not permitted.

Section 2

General

2.1 Those welders intended to be engaged in welding of hull structures in shipyards and manufacturers are to be tested and qualified in accordance with this Classification Note and issued with a qualification certificate endorsed by IRS.

2.2 The welding operator responsible for setting up and/or adjustment of fully mechanized and automatic equipment, such as submerged arc welding, gravity welding, electro-gas welding and MAG welding with auto-carriage, etc., is to be qualified whether he operates the equipment or not. However a welding operator, who solely operates the equipment without responsibility for setting up and/or adjustment, does not need qualification provided that he has experience of the specific welding work concerned and the production welds made by the operators are of the required quality.

The qualification test and approval range of the welding operator are to be in accordance with ISO 14732:2013.

2.3 This Classification Note is applicable to welding of hull structures both during new construction and repair of ships.

2.4 The training of welders, control of their qualification and maintenance of their skills are the responsibility of shipyards and manufacturers. Surveyor is to verify and be satisfied that the welders are appropriately qualified.

2.5 Equivalence of national or international standards to this Classification Notes.

2.5.1 Welders or welding operators qualified in accordance with national or international welder qualification standards may also be engaged in welding of hull structures at the discretion of IRS provided that standard is considered equivalent to this Classification Notes from technical perspective covering examination, testing and range approval.

2.5.2. Even if requirements stipulated in the standards are applied, the requirement for revalidation of welders' qualification are to be in accordance with Cl. 6.2.1.

Section 3

Range of qualification of welders

3.1 A welder is to be qualified in relation to the following variables of welding:

- a) base metal
- b) welding consumables type
- c) welding process
- d) type of welded joint
- e) plate thickness
- f) welding position

3.2 Base metals for qualification of welders or welding operators are combined into one group with a specified minimum yield strength $R_{eH} \leq 460 \text{ N/mm}^2$. The welding of any one metal in this group covers qualification of the welder or welding operator for the welding of all other metals within this group.

3.3 For manual metal arc welding, qualification tests are required using basic, acid or rutile covered electrodes. The type of covered electrodes (basic, acid or rutile) included in the range of approval would be at the discretion of IRS.

Welding with filler material qualifies for welding without filler material, but not vice versa.

3.4 The welding processes for welder's qualification are to be classified in Table 1 as,

M - Manual welding

S - Semi-automatic welding/Partly mechanized welding

T - TIG welding

Each testing normally qualifies only for one welding process. A change of welding process would require a new qualification test.

Table 1 - Welding processes for welder's qualification			
Symbol	Welding process in actual welding works		ISO 4063:2009
M	Manual welding	Manual metal arc welding (metal arc welding with covered electrode)	111
S	Partly mechanized welding	Metal inert gas (MIG) welding	131
		Metal active gas (MAG) welding Flux cored arc (FCA) welding	135, 138 ¹ 136 ²
T	TIG welding	Tungsten inert gas (TIG) welding	141
<p>Note:</p> <p>IRS may require separate qualification for solid wires, metal-cored wires and flux-cored wires as follows:</p> <p>¹ A change from MAG welding with solid wires (135) to that with metal cored wires (138), or vice versa is permitted.</p> <p>² A change from a solid or metal cored wire (135/138) to a flux cored wire (136) or vice versa requires a new welder qualification test.</p>			

3.5 The types of welded joint for welder's qualification are to be classified as shown in Table 2 in accordance with the qualification test.

Table 2 - Types of welded joint for welder's qualification					
Type of welded joint used in the test assembly for the qualification test				Type of welded joint qualified	
Butt weld	Single sided weld	With backing	A	A, C, F	
		Without backing	B	A, B, C, D, F	
	Double sided weld	With gouging	C	A, C, F	
		Without gouging	D	A, C, D, F	
Fillet weld	----	----	F	F	

Welders engaged in full/ partial penetration T welds are to be qualified for butt welds for the welding process and the position corresponding to the joints to be welded.

3.6 For fillet welding, welders who passed the qualification tests for multi-layer technique welding can be deemed as qualified for single layer technique, but not vice versa.

3.7 The qualified plate thickness range arising from the welder qualification test plate thickness is shown in Table 3.

Table 3 - Plate thicknesses for welder's qualification	
Thickness of test assembly T (mm)	Qualified plate thickness range t (mm)
$T < 3$	$T \leq t \leq 2T$
$3 \leq T < 12$	$3 \leq t \leq 2T$
$12 \leq T$	$3 \leq t$

3.8 The welding positions qualified as a result of the actual welding position used in a satisfactory welder's qualification test, are shown in Table 4 and Table 5. Diagrams showing the definitions of weld position used in Table 4 and Table 5 are shown in Figure 1.

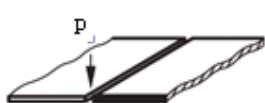
Table 4 - Qualified welding positions when testing with butt welding		
Qualification Test Position with butt weld	Qualified welding positions in actual welding works	
	Butt welds	Fillet welds
PA	PA	PA, PB
PC	PA, PC	PA, PB, PC
PE	PA, PC, PE	PA, PB, PC, PD, PE
PF	PA, PF	PA, PB, PF
PG	PG	PG

Table 5 - Qualified welding positions when testing with fillet welding	
Qualification Test Position with fillet weld	Qualified welding positions in actual welding works
	Fillet welds
PA	PA
PB	PA, PB
PC	PA, PB, PC
PD	PA, PB, PC, PD, PE
PE	PA, PB, PC, PD, PE
PF	PA, PB, PF
PG	PG

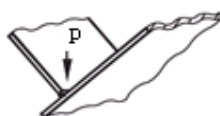
IRS may require a qualification test with fillet welding for welders who are employed to perform fillet welding only. Welders engaged in welding of T joints with partial or full penetration are to be qualified for butt welding.

3.9 A welder qualified for butt or fillet welding can be engaged in tack welding for the welding process and position corresponding to those permitted in his certificate.

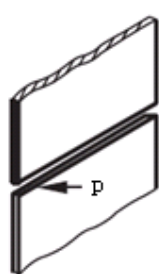
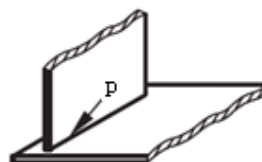
Alternatively, welders engaged in tack welding only can be qualified on the test assemblies shown in Figure 5 or Figure 6.



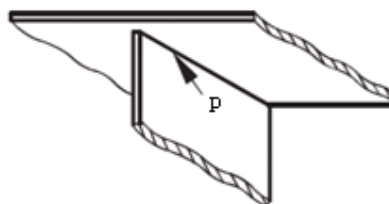
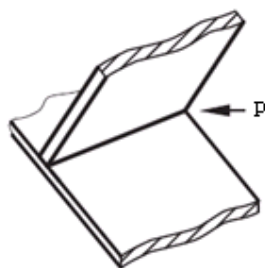
a) PA: flat position



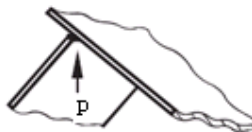
b) PB: horizontal vertical position



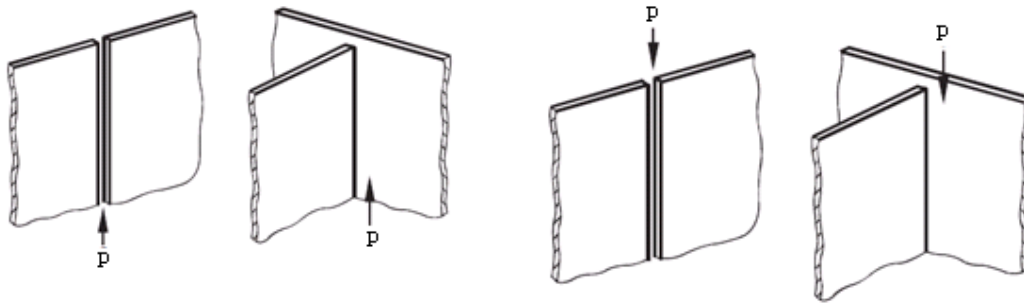
c) PC: horizontal position



d) PD: horizontal overhead position



e) PE: overhead position



f) PF: vertical up position

g) PG: vertical down position

Note: p is the welding position.

Figure 1 Welding positions

Section 4

Qualification test

4.1 General

4.1.1 Welding of the test assemblies and testing of test specimens is to be witnessed by the Surveyor.

4.2 Test assemblies

4.2.1 Test assemblies for butt welds and for fillet welds are to be prepared as shown in Figure 2, Figure 3 and Figure 4 in each qualification test.

4.2.2 Test assemblies for butt tack welds and for fillet tack welds are to be prepared as shown in Figure 5 and Figure 6.

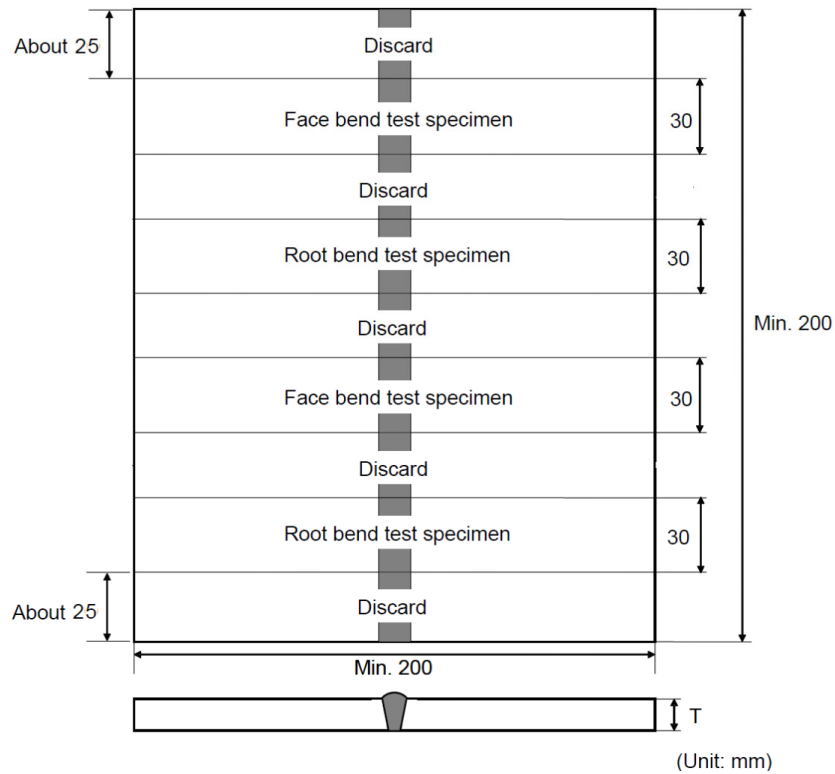


Figure 2 : Dimensions and types of test assembly for butt welds (T < 12mm)

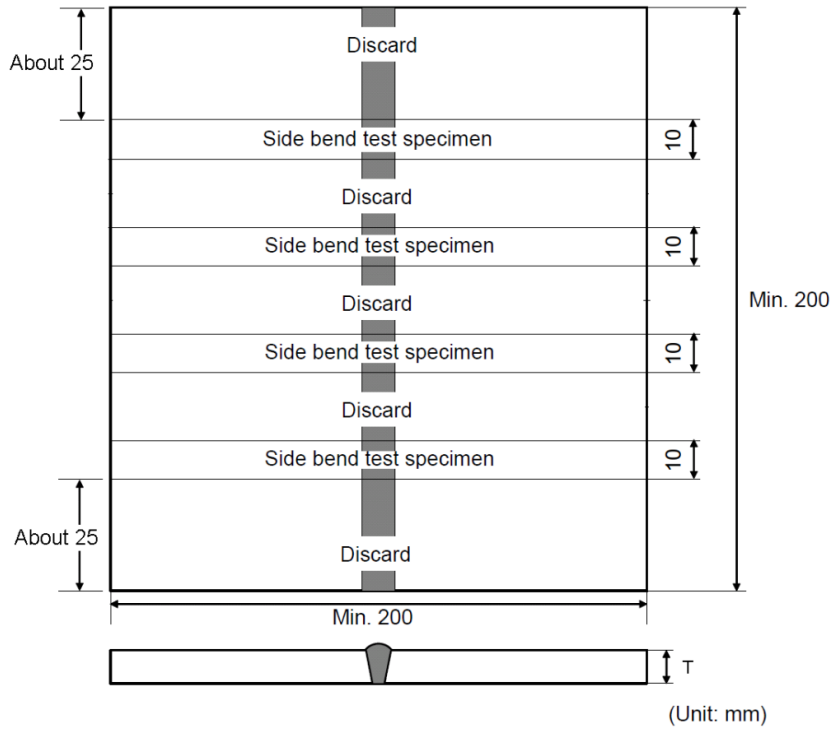


Figure 3 : Dimensions and types of test assembly for butt welds ($T \geq 12\text{mm}$)

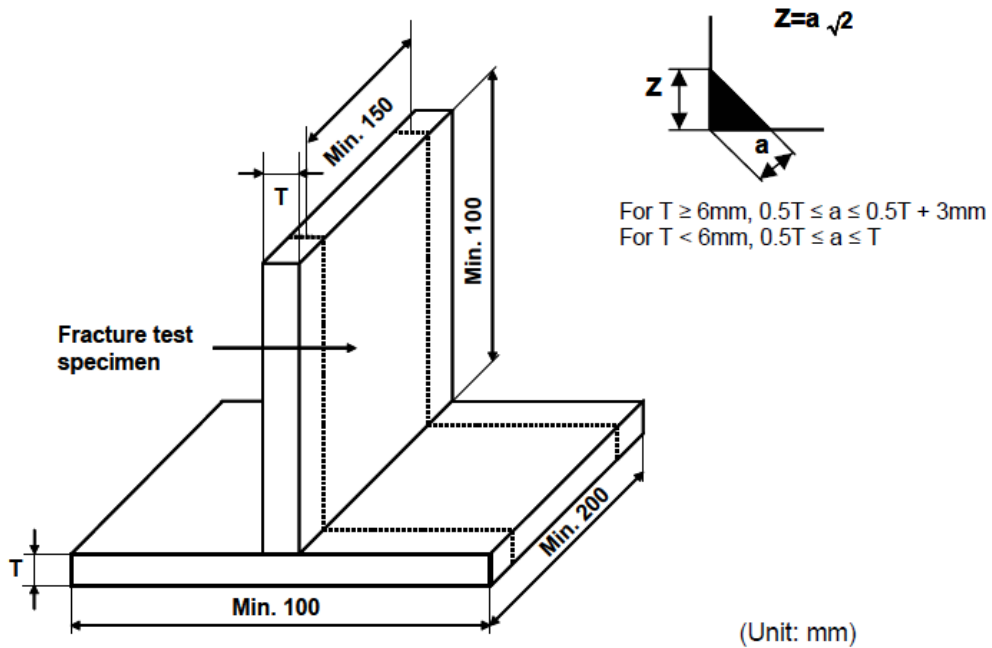


Figure 4 : Dimensions and types of test assembly for fillet welds

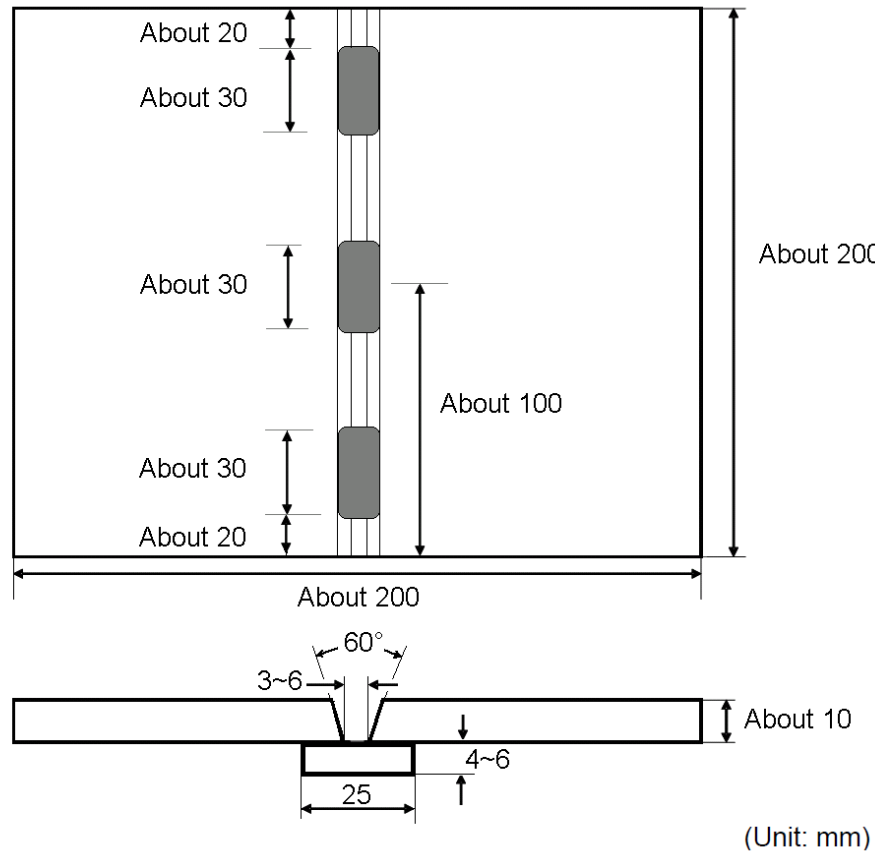


Figure 5 : Dimensions and types of test assembly for tack butt welds

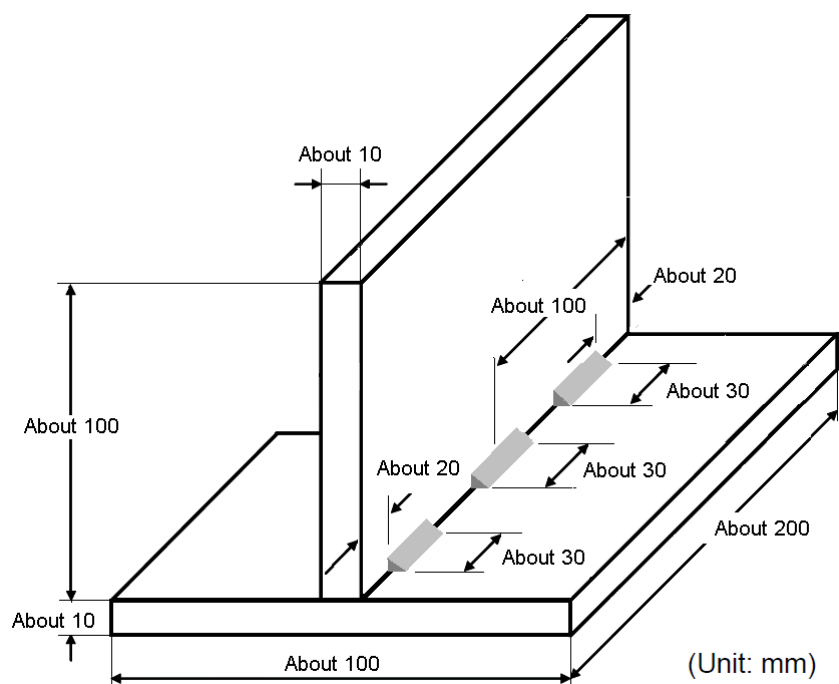


Figure 6 : Dimensions and types of test assembly for tack fillet welds

4.2.3 Testing materials and welding consumables are to conform to one of the following requirements or to be of equivalent grade approved by IRS.

a) Testing materials

- Hull structural steels specified in Part 2, Chapter 3, Section 2&3 of *IRS Rules and Regulations for the Construction and Classification of Steel Ships*.
- Hull structural forged steels specified in Part 2, Chapter 5, Section 2 of *IRS Rules and Regulations for the Construction and Classification of Steel Ships*.
- Hull structural cast steels specified in Part 2, Chapter 4, Section 2 of *IRS Rules and Regulations for the Construction and Classification of Steel Ships*.
- Hull structural steels with specified minimum yield point 460 N/mm² specified in Part 2, Chapter 3, Section 10 of *IRS Rules and Regulations for the Construction and Classification of Steel Ships*.

b) Welding consumables

- Consumables for hull structural steels specified in Part 2, Chapter 11, Section 2 of *IRS Rules and Regulations for the Construction and Classification of Steel Ships*.
- Consumables for YP47 steels specified in Part 2, Chapter 11, Section 7 of *IRS Rules and Regulations for the Construction and Classification of Steel Ships*.

4.2.4 The welder qualification test assembly is to be welded according to a welding procedure specification (WPS or pWPS) simulating the conditions in production, as far as practicable.

4.2.5 Root run and capping run need each to have a minimum of one stop and restart. The welders are allowed to remove minor imperfections only in the stop by grinding before restart welding.

4.3 Examination and test

4.3.1 The test assemblies specified in 4.2 are to be examined and tested as follows:

a) For butt welds

- Visual examination
- Bend test

Note: Radiographic test or fracture test may be carried out in lieu of bend test except the gas-shielded welding processes with solid wire or metal cored wire.

b) For fillet welds

- Visual examination
- Fracture test

Note: Two macro sections may be taken in lieu of the fracture test.

c) For tack welds

- Visual examination

- Fracture test

Additional tests may be required, at the discretion of IRS.

4.3.2 Visual examination

The welds are to be visually examined prior to the cutting of the test specimen for the bend test and fracture test. The result of the examination is to show the absence of cracks or other serious imperfections.

Imperfections detected are to be assessed in accordance with quality level B in ISO 5817:2014, except for the following imperfection types for which level C applies;

- Excess weld metal
- Excess penetration
- Excessive convexity
- Excessive throat thickness

4.3.3 Bend test

Transverse bend test specimens are to be in accordance with Pt.2, Ch.2 of IRS Rules and Regulations for the Construction and Classification of Steel Ships

The mandrel diameter to thickness ratio (i.e. D/T) is to be that specified for welding consumable (Pt.2, Ch.11 of IRS Rules and Regulations for the Construction and Classification of Steel Ships) approvals +1.

Two face bend test and two root bend test specimens are to be tested for initial qualification test, and one face and one root bend test specimens for extension of approval. For thickness 12mm and over, four side specimens (two side specimens for extension of approval) with 10 mm in thickness may be tested as an alternative.

At least one bend test specimen is to include one stop and restart in the bending part, for root run or for cap run.

The test specimens are to be bent through 180 degrees. After the test, the test specimens are not to reveal any open defects in any direction greater than 3mm. Defects appearing at the corners of a test specimen during testing should be investigated case by case.

4.3.4 Radiographic test

When radiographic testing is used for butt welds, imperfections detected are to be assessed in accordance with ISO 5817:2014, level B.

4.3.5 Fracture test (Butt welds)

When fracture test is used for butt welds, full test specimen in length is to be tested in accordance with ISO 9017:2017. Imperfections detected are to be assessed in accordance with ISO 5817:2014, level B.

4.3.6 Fracture test (Fillet welds)

The fracture test is to be performed by folding the upright plate onto the through plate. Evaluation is to concentrate on cracks, porosity and pores, inclusions, lack of fusion and incomplete penetration. Imperfections that are detected are to be assessed in accordance with ISO 5817:2014, level B.

4.3.7 Macro examination

When macro examination is used for fillet welds, two test specimens are to be prepared from different cutting positions; at least one macro examination specimen is to be cut at the position of one stop and restart in either root run or cap run. These specimens are to be etched on one side to clearly reveal the weld metal, fusion line, root penetration and the heat affected zone.

Macro sections are to include at least 10mm of unaffected base metal.

The examination is to reveal a regular weld profile, through fusion between adjacent layers of weld and base metal, sufficient root penetration and the absence of defects such as cracks, lack of fusion etc.

4.4 Retest

4.4.1 When a welder fails a qualification test, the following will apply:

- a) In cases where the welder fails to meet the requirements in part of the tests, a retest may be welded immediately, consisting of another test assembly of each type of welded joint and position that the welder failed. In this case, the test is to be done for duplicate test specimens of each failed test.

All retest specimens are to meet all of the specified requirements.

- b) In cases where the welder fails to meet the requirements in all parts of the required tests or in the retest prescribed in 4.4.1 a), the welder is to undertake further training and practice.
- c) When there is specific reason to question the welder's ability or the period of effectiveness has lapsed, the welder is to be re-qualified in accordance with the tests specified in 4.2 and 4.3.

4.4.2 Where any test specimen does not comply with dimensional specifications due to poor machining, a replacement test assembly is to be welded and tested.

Section 5

Certification

5.1 Qualification certificates are normally issued when the welder has passed the qualification test in accordance with the IRS' Rules. Each Shipyard and Manufacturer are responsible for the control of the validity of the certificate and the range of the approval.

5.2 The following items are to be specified in the certificate:

- a) Range of qualification for base metal, welding processes, filler metal type, types of welded joint, plate thicknesses and welding positions.
- b) Expiry date of the validity of the qualification.
- c) Name, date of birth, identification and the photograph of the welder.
- d) Name of shipbuilder / manufacturer.

5.3 When a certificate is issued, the relative documents such as test reports and/or re-validation records will be archived as annexes to the copy of certificate.

5.4 The status of approvals of each individual qualification is to be demonstrated to IRS when requested.

Section 6

Period of Validity

6.1 Initial approval

6.1.1 Normally the validity of the welder's approval begins from the issue date of qualification certificate when all the required tests are satisfactorily completed.

6.1.2 The certificate is to be signed at six-month intervals by the shipyards'/manufacturers' personnel who is responsible for production weld quality provided that all the following conditions are fulfilled:

- a) The welder is engaged with reasonable continuity on welding work within the current range of approval. An interruption for a period no longer than six months is permitted.
- b) The welder's work in general is in accordance with the technical conditions under which the approval test is carried out.
- c) There is no specific reason to question the welder's skill and knowledge.

6.1.3 If any of these conditions are not fulfilled, IRS is to be informed and the certificate is to be cancelled.

6.1.4 The validity of the certificate may be maintained in agreement with IRS as specified in 6.2. The chosen maintenance option of qualification in accordance with 6.2.1 a) or b) or c) is to be stated on the certificate at the time of issue.

6.2 Maintenance of the approval

6.2.1 Revalidation is to be carried out by IRS. The skill of the welder is to be periodically verified by one of the following options:

- a) The welder is to be re-tested every 3 years.
- b) Every 2 years, two welds made during the last 6 months of the 2 years validity period is to be tested by radiographic or ultrasonic testing or destructive testing and are to be recorded. The weld tested is to reproduce the initial test conditions

except for the thickness. These tests revalidate the welder's qualifications for an additional 2 years.

- c) A welder's qualification for any certificate shall be valid as long as it is signed according to 6.1.2 subject that all the following conditions are fulfilled. In this option, the fulfilment of all the conditions shall be verified by IRS. The frequency of verification by IRS shall be no longer than 3 years and is to be agreed between IRS and the shipyards/manufacturers.

I. The welder is working for the same shipyard/manufacturer which is responsible for production weld quality as indicated on his or her qualification certificate.

II. IRS shall verify that the welder quality management system of the shipyard/manufacturer includes as minimum:

- A designated person responsible for the coordination of the welder quality management system.
- List of welders and welding supervisors in shipyard/manufacturer
- If applicable, list of subcontracted welders
- Qualification certificate of welders and description of the associated management system
- Training requirements for welder qualification programme
- Identification system for welders and WPS used on welds
- Procedure describing the system in place to monitor each welder performance based on results of welds examination records (e.g. repair rate, etc.) including the criteria permitting the maintenance of the welder qualification without retesting.

III. The shipyards/ manufacturers have to document at least once a year that the welder has produced acceptable welds in accordance with construction quality standards and IRS' requirements in the welding positions, type of welds and backing conditions covered by its certificate. Which documents are required and how to document the evidences should be in agreement between the IRS and the shipyards/manufacturers.

6.2.2 Compliance with the above conditions shall be verified by IRS and maintenance of the welder's qualification be endorsed on the Certificate accordingly.

Annex

EXAMPLE OF WELDER'S QUALIFICATION CERTIFICATE

Welder's name:		Date of birth:		Photograph
Cert. No:		Sex:		
Identification No.				
Employer's name and address				
WPS/pWPS No.				
Date of initial approval				
This is to certify that the welder has passed the qualification test [/and re-validation record audit] according to the rules of IRS, and is qualified to undertake welding operation specified in range of qualification of this certificate.				
Items	Test piece	Range of qualification		
Welding process				
Base metal				
Filler metal type				
Plate thickness				
Type of welded joint				
Welding position				
Revalidation method	In accordance with 6.2.1 a) <input type="checkbox"/> b) <input type="checkbox"/> c) <input type="checkbox"/>			
Other details				

This certificate is issued at _____ [place], and valid until _____ [DD/MM/YYYY].

Signature/seal of examiner: _____ Issued on _____ [DD/MM/YYYY].

	Report No. to be reviewed	Date of report	Signature of Employee	Date of signature
1				
2				
3				

TEST RECORD

Type of test	Performed and accepted	Not required
Visual examination		
Radiographic examination		
Surface examination		
Macro examination		
Fracture test		
Bend test		
Additional tests		

Note: This page (test record) is to be as the back page of a certificate.

End of Classification Note