Contents

1. Scope

This document specifies the requirement pertaining acceptance of the filler materials, during welding activities for the DNB Vessel and HNB3 Vessel.

2. Reference documents

RCC-MR 2007; Section-4; RS 2000: Acceptance of Filler material

RCC-MR 2007; Section-4; RS 5000: Qualification of Filler materials

3. Acceptance of Filler materials

3.1 Purpose of the acceptance test

3.1.1 The main purpose of the acceptance tests is to establish that the lots of filler materials used in manufacture are of a constant quality similar to that of the lots which have undergone qualification tests. The acceptance tests shall, therefore, be carried out under reproducible conditions and shall be related to the qualification tests carried out on filler materials outside the dilution zone.

3.1.2 They shall be carried out in the presence of the Quality Control Department of the Supplier of the filler materials and/or of the Manufacturer and ITER-India.

3.1.3 Materials to be used for repair welds shall be subjected to at least the same series of tests as the materials used to make the weld which is to be repaired.

3.2 Acceptance specification

3.2.1 The Manufacturer shall draw up acceptance specifications for the supply of filler materials. This document shall be drafted in accordance with the provisions of this ~~section (~~Section 1 ~~of~~ Annexure___~~)~~ and shall refer to and comply with the provisions of the technical qualification data sheet for filler materials.

3.2.2 In the case of acceptance performed on the weld deposit, following shall be included in addition to the provision of this section:

- The welding parameters,
- The interpass temperature and any prescribed post-weld heat treatment,
- The basic drawing for taking test specimens,
- A specification data sheet mentioning the results to be obtained

3.3 Designation

- Wires: EN 12072, supplemented by AWS A 5.9
- Covered electrodes: EN 1600 supplemented by AWS A 5.4.
- Shielding gases: A gas or mixture of gases is defined by its nominal composition and by one or more indices of purity. EN 439 shall be used.

3.4 Dimensional characteristics

- TIG wires: EN ISO 544
- MIG or MAG wires: EN ISO 544
- Covered electrodes: The dimensions of electrodes are in accordance with standard NF EN ISO 544, except for the length of alloy core electrodes which may be shorter. Compliance with equivalent standards other than French is acceptable.
- Other products: The dimensional characteristics of other products (flux-cored, wires, submerged-arc welding wires) shall be specified by the product Supplier in agreement with the Manufacturer

3.5 Definition of a lot

3.5.1 Solid wires: A wire or strip lot is consistent with class S3 of NF EN ISO 14344 at least.

3.5.2 Flux cored wires: A flux cored wire lot is consistent with class T4 of NF EN ISO 14344 at least.

3.5.3 Covered Electrodes: A coverered electrode lot will be consistent with class C3 of NF EN ISO standard 14344.

3.5.4 Solid flux: A flux lot is designated and consistent with class F2 of NF EN ISO standard 14344 at least. A lot of flux shall be associated with a lot of wire or strip to form an indivisible pair for acceptance and manufacture.

3.6 Lot test

3.6.1 Product analysis of the filler material

3.6.1.2 Chemical composition

3.6.1.3 Ferrite contents shall be 3-10 %. This may be determined by the Schaeffler's diagrams or the Schaeffler's diagrams modified by Delong (Clause 5).

3.6.1.4 The level of cobalt shall be maximum 0.2% for filler material. Adjustment of the filler material chemical composition on maximum Cobalt content may be needed if it cannot be compliant to this requirement. This possible adjustment shall be agreed with IO.

3.6.2 Tests on weld metal for strength:

3.6.2.1 All lots or combinations of lots of filler materials shall be subjected to chemical analysis and mechanical tests.

3.6.2.2 The chemical analysis shall be performed either on material from the test plate for mechanical tests or on the weld metal as specified in standard NF EN ISO 6847.

3.6.2.3 Dimension of the test piece: The test plate shall in all cases be long enough for test samples to be taken both for the series of required tests and any retests. The dimension of acceptance filler metal test plates shall be in conformance with type 1.3 or 1.4 or 1.5 of standard NF EN 1597-1 with the following stipulations:

- The width (a) of filler metal acceptance test plates shall be increased to at least 150 mm
- The length of solid wire- flux combination test plates shall be at least 500 mm. In solid wire-flux combination, the test plate dimensions shall be in compliance with following figure.

3.6.3 Preparation of test plates: The base metal used to make the test plate (including the backing strip) shall be the grade corresponding to the grade of the filler material under test

3.6.4 Operating conditions

3.6.4.1 Drying

Before use, electrodes and fluxes shall be dried under the conditions recommended by the Suppliers of filler materials in the qualification data sheets of the qualification record.

3.6.4.2 Parameters

The test plate shall be made in the flat position. The welding parameters, the conditions for preheating and interpass temperature and any conditions for post-weld heat treatment shall be prescribed in the acceptance specifications. It is recommended that the temperature should be close to the maximum permitted interpass temperature.

3.6.4.3 Examination of the test plate

- Each bead shall be visually inspected and brushed, if necessary.
- Any slag shall be removed completely, by grinding if necessary.
- Volumetric examination of test plates is not required. It may however be carried out to ensure that test specimens are taken from sound metal.

3.6.4.4 Welding sequences

- The direction of welding shall be changed after each bead.
- In the case of automatic welding processes, however, all beads may be made in the same direction.
- Furthermore, In the case of automatic welding with solid flux, the following requirements shall be applied: (1) for weld beads at the edge of the groove, the wire shall be held vertical at a distance from the groove within: diameter + 1.5 mm / - 0.5 mm (2) three passes shall be made per layer if a test plate with broad groove is used

3.6.5 Sampling and test methods

3.6.5.1 An outline sketch indicating the position of test specimens shall be included in the acceptance specifications.

3.6.5.2 Chemical analysis: Chemical analysis and determination of the ferrite content shall be carried out in the center of the test plate, in the extension of the cylindrical tensile test specimen or on a fragment of the same specimen.

3.6.6 Number and type of tests

As a rule, the tests to be carried out on the weld metal are of the same type as the tests performed on the base metal to be welded. The list which follows shows the series of tests to be carried out:

3.6.6.1 Chemical analysis

3.6.6.2 Tensile tests

- 1 tensile test at room temperature,
- 1 tensile test at 200 C

3.6.6.3 Impact tests

- 1 set of three Charpy V-notch test specimens for impact tests at room temperature

3.6.6.4 Determination of ferrite content

3.6.6.5 Crack susceptibility test

- Groove cracking test: The electrodes and wires with a minimum specified ferrite content lower than 5% shall be tested for groove cracking as defined in Appendix RS1.910.
- Cracking test on rising vertical assembly: A rising vertical position welding test shall be performed for any set of electrodes with a minimum specified ferrite content lower than 5%, likely to be used in any welding position other than flat (1G). This test is defined in Appendix RS1.0940.

3.6.7 Results

3.6.7.1 Test results shall in general comply with the requirements of Welding Procedure Qualification (Annexure 6, Section 2) and requirements of (EN 12072 + AWS A 5.9) and (EN 1600 + AWS A 5.4) taking the following into account:

- elongation after fracture shall be at least equal to 30%
- Chemical analysis: S <=0.015 %, P <=0.025 %, Co<=0.05, Nb<=0.01, Ta<=0.01

3.6.7.3 Retests

- Any test improperly executed shall be invalidated and the same shall be subjected to the retest.
- If one or more tests produce results not in conformity with the specification, confirmatory tests may be performed; retests shall comprise two tests for each unsatisfactory test.
- For the lot to be accepted the results of all such retests shall be satisfactory.
- In the case of impact tests, a single unsatisfactory result shall require the repetition of twice the entire series of tests at the given temperature.
- The test specimens for the retests shall be taken from the same test plate as the test specimens giving unsatisfactory results. If this is not possible, another test plate shall be prepared for the whole series of tests and all the results obtained shall be satisfactory.

3.6.8 Acceptance report

3.6.8.1 The full designation of the material used for the acceptance tests, the specified values and the result of each test shall be recorded in a report. This document shall identify the specification which stipulates acceptance conditions. This document shall notify the compliance with the specification.

3.6.8.2 The period of validity of the acceptance is limited to the period indicated by the Supplier in the qualification data sheet, starting from the date of signature of the report. It should not exceed five years.

3.7 Labelling

3.7.1 Each package of any material shall be labelled with at least the following details:

- Supplier's name
- standard designation (if any)
- trade name
- grade
- heat or lot number
- dimensions
- quantity

3.7.2 The term "package" shall mean any of the following:

- case
- box
- coil
- drum
- sack

3.7.3 In addition, covered electrodes shall be marked individually near the bared end with some conventional or trade designation enabling them to be identified properly after drying.

4. Master list of accepted filler

Contractor shall prepare the master list of all the accepted filler material to be used for manufacturing of DNB Vessel and HNB3 Vessel.

The list shall include the complete tractability with the packaging and the identification on the filler material.

The list shall be a living document and shall be updated as the new filler (batch / heat) is procured / accepted. The same shall be provided to ITER-India for approval each time it is updated.

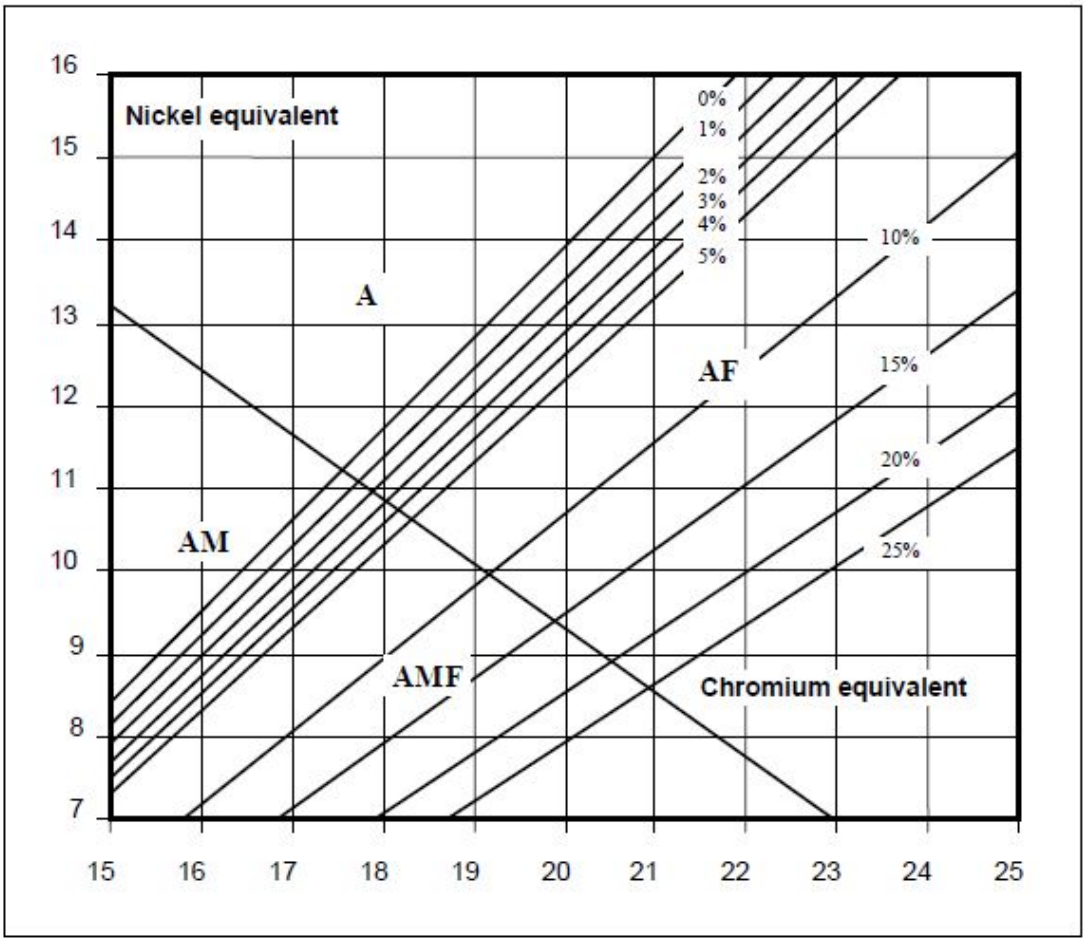
The approved master list shall be available at the stores and contractor shall ensure that the filler material provided to the welder / welding operator is from the approved list only.

5. Reference diagrams

Ref: RCC-MR 2007, Section 3

Figure RMC 1341.1: Schaeffler diagram – determination of the δ ferrite content

Nickel equivalent: Ni eq. = Ni + 30 C + 0.5 Mn
Chromium equivalent: Cr eq. = Cr + Mo + 1.5 Si + 0.5 Nb



Ref: RCC-MR 2007, Section 3

Figure RMC 1341.3: Delong diagram – determination of the δ ferrite content

Nickel equivalent: Ni éq. = Ni + 30 C + 30 N + 0.5 Mn
Chromium equivalent: Cr éq. = Cr + Mo + 1.5 Si + 0.5 Nb