Guideline No.: W-03 (202204)

W-03

ALUMINUM ALLOY PLATES

Issued date: April 24, 2022

Foreword

China Classification Society (hereinafter referred to as CCS) Product Inspection and Testing Guideline (hereinafter referred to as this Guideline) contains the technical requirements, inspection and testing criteria related to classification and statutory survey of marine products to be applied for CCS approval/inspection.

This Guideline frees the users to adopt other test methods and requirements which are equivalent to or are stricter than this Guideline.

This Guideline is published and updated by CCS, and is released at http://www.ccs.org.cn. Your comments or suggestions are welcomed and may be sent to our email addressed mp@ccs.org.cn .

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Main changes :

1. Modified the structure of the guide according to the requirements of procedure documents, add “Definitions” and “Main components and parts” XX and revise relevant contents.

2. Revised "7.2 Selection of typical samples " to add that the selection of typical products shall be under the same rolling process.

3. Revised "7.3 Type test Items" to add requirements on sampling location of Mechanical properties test, Corrosion test and Macrostructure examination, the Metallographic test cannot replace Corrosion test in initial approval, and the sampling requirement of external dimension inspection.

4. Modified the “Foreword” of the Guideline.

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ALUMINUM ALLOY PLATES

1 Application

1.1 This Guideline applies to the works approval and inspection of the rolled aluminum alloy plates manufactured according to CCS Rules for Classification of Sea-going Steel Ships and CCS Rules for Materials and Welding.

1.2 This Guideline is applicable to aluminum alloy plates manufactured by mould casting or continuous or semi-continuous casting process, and formed by hot rolling or cold rolling. The delivery condition is to be of O,HXX/HXXX.

2 Normative references

2.1 The basis for approval and inspection of aluminum alloy plates are as follows:

(1) CCS Rules for Classification of Sea-going Steel Ships;

(2) CCS Rules for Materials and Welding.

3 Terms and definitions

Nil.

4 Drawings and documents

4.1 A manufacturer intending for approval by CCS is to submit an application to CCS for works approval.

4.2 The applicant is to submit the following documents in triplicate to CCS for information.

(1) Particulars of the manufacturer: the name, address and history of the manufacturer; the type and specification of the manufactured products; the type, specification, production equipment, inspection/test equipment and delivery condition of the products for approval; the quality statistics of the products in recent years; other recognized qualification certificates.

(2) Management documents, including quality system documents: organizational structure, quality control points, responsibilities of the management departments / managers, quality management system documents, identification and the documentary trail,regulations on management of purchasing and acceptability Criteria of raw materials, qualified vendor list

and quality certificate ,etc

(3) Main production equipment, a list of inspection/test equipment and technological parameters: smelting equipment, casting/continuous casting equipment, heating furnace, heat treatment furnace for rolling mill, shearing equipment, straightening equipment.

(4) Process documents: flow chart of manufacturing process, control criteria of the manufacturer, technological specifications (operation guidance) or a list, in which the following are to be included:

① Smelting, refining, casting (including technological specifications and ingots quality control);

② Rolling:

- milling and pickling of ingots;
- heating system;
- parameters for hot rolling (such as initial and finishing rolling temperatures, speed, total reduction);
- temperature and thickness measurements, etc.;,
- cold rolling reduction system, finishing;

③ Heat treatment process documents;

④ Control of inspection in other stages (such as flattening, straightening, shearing, external dimension, sampling and marking);

⑤ Qualification certificate of the test and inspection personnel.

4.3 The type test program is to be submitted to CCS for approval.

4.4 Other documents where deemed necessary by CCS.

5 Technical requirements

The design is to comply with the requirements of PART ONE of CCS Rules for Materials and Welding.

6 Materials and components

The billet used to aluminum alloy rolling sheet is to be made at works approved by CCS.

7 Type test

7.1 Determination of the type test program

The type test program may be proposed by the applicant and examined and approved by CCS, or proposed by CCS and confirmed by the applicant. The program is to include:

(1) The aluminum alloy grade, specification, and delivery state of the products for approval;

(2) The aluminum alloy grade, specification and delivery state of the typical samples for test approval;

(3) The test items and the standard or rules adopted;

(4) Sampling scheme and descriptions;

(5) Place of test and qualification of the laboratory (if applicable, the qualification of the subcontractor and the agreement);

(6) Name of the testing organization.

7.2 Selection of typical samples

(1) The aluminum sheets that applied for approval should select the representative products according to the different grades ,delivery states , the rolling process and should meet the maximum thickness of cases, choose the maximum width as much as possible. CCS may require additional approval test for the smallest or medium products as the case may be.

(2) Sampling: the sample for type test is to be taken from the top and bottom of the aluminum alloy plate rolled by the same ingot or billet.

7.3 Type test items

(1) Chemical composition analysis: Si, Fe, Cu, Mn, Mg, Cr, Zn, Ti, Ni, Ca, V, Zr, Al and other added elements.

(2) Tensile samples are to be taken at 1/3 width from a longitudinal head and tail of the edge of

rolled plates. Tests in the transverse direction are required. If the width is insufficient for obtaining transverse test specimens, or in the case of strain hardening alloys, tests in the longitudinal direction will be permitted. The size of the prepared specimens and the test results are to comply with the requirements of CCS Rules for Materials and Welding.

(3) Corrosion test is to comply with the following requirements:

① The Corrosion test samples are to be taken at 1/2 width from a longitudinal head and tail of the edge of rolled plates The Test process for corrosion test are to comply with the requirements of ASTM G66, ASTM G67 and CCS Rules for Materials and Welding;

② The requirements of ASTM G66 are recommended for the size and cutting method of the specimen for exfoliation resistance test. The test result is not to be lower than the requirements for PB;

③ The requirements of ASTM G67 are recommended for the size and cutting method of the specimen for intercrystalline corrosion. The mass loss of test result is not to exceed 15 mg/cm^2;

④ The CCS will not accept metallographic examination in place of Intergranular and Exfoliation corrosion tests at the initial approved type test.

(4) Macrostructure examination: plates of more than or equal to 6.5 mm in thickness are to be conducted macrostructure examination and the samples are to be taken from a longitudinal head and tail of the edge of rolled plates. Macrostructure is to be free from laminations.

(5) The manufacture is to control the external dimension and its tolerance. The percentage of occasional check or review of inspection record is to depend on the quality control of the manufacturer. The under-thickness tolerance of the plates is to comply with the requirements of CCS Rules for Materials and Welding.

(6) Surface quality inspection is to comply with the following requirements:

① The surface of the plates is to be well ground, smooth and even, and free from harmful defects that will impair further manufacture processes and proposed application, such as cracks, laps, laminations, corrosion, oxide inclusions, oxide skins, blisters, significant metallic and non-metallic intrusions;

② Minor pressing, colliding, rolling, pasting, printing marks may be accepted in the surface, provided that the depth is not over 1/2 of the under-thickness tolerance;

③ Slight surface imperfections may be removed by mechanical means or grinding, provided that the prior agreement of CCS Surveyor is obtained. The depth of any rectification is not to exceed the allowable minus deviation, and no unfavorable effects to the material are allowed. Unless otherwise agreed, all such rectifications are to be carried out under the witness of the Surveyor. Defects unable to be repaired are generally not allowed to be weld repaired;

④ The edges of the plates are to be straight and plane, and free from burrs.

(7) The requirements for welding property test of aluminum alloy plates are as follows:

① Welding property test is to be carried out for the plates selected according to the chemical composition of the approved designation, i.e. aluminum-magnesium alloy with magnesium content not more than 4%, aluminum-magnesium alloy with magnesium content not less than 4% but less than 6%, aluminum-silicon-magnesium alloys. The thickness of the test plate is to be in accordance with Table3.1.4.5b, Chapter 3, PART THREE of CCS Rules for Materials and Welding. The welding procedure is to be prepared according to the relevant requirements in Chapter 3, PART THREE of CCS Rules for Materials and Welding, and submitted to CCS for approval;

② Aluminum alloy plates are generally to be subject to butt welding property test. The test plates are to be cut with the weld parallel to the rolling direction of the plates. It is recommended that tungsten inert gas arc welding (TIG) or metal inert gas arc welding (MIG) be adopted for the welding. The selected wires are to be corresponding to the chemical composition and grade of the parent material, and to be furnished with CCS approval;

③ The welders engaged in welding of aluminum alloys are to be subject to an operational technique training and a qualification test, and they are strictly required to hold a Qualification Certificate of Welder;

④ The test items are to include:

(a) Four bend test specimens (two face bend and two root bend);

(b) Two transverse tensile test specimens and one macro-specimen (which may be prepared from the discard);

⑤ The result of the test is to comply with the following:

(a) The tensile strength of butt weld is to comply with Table 3.2.6.1, Chapter 3, PART THREE of CCS Rules for Materials and Welding;

(b) After test, the test specimens are not to reveal any crack or any open defect in any direction greater than 3 mm;

(c) The macro section examination is to reveal the absence of cracks, lack of fusion or other open defects.

8 Unit/batch inspection

8.1 The unit/batch inspection of aluminum alloy plates should be carried out after the works approval, otherwise the unit/batch inspection should be carried out according to requirements of type test.

8.2 The unit/batch inspection after the works approval should be carried out according to the approved test program. The test program is to contain the test items for witness, review and on-site examination. The items are to include:

(1) Surface quality and thickness inspection;

(2) Chemical composition analysis;

(3) Mechanical property test;

(4) Macrostructure examination (if required);

(5) Exfoliation corrosion and intercrystalline corrosion test (if required);

(6) Other items where deemed necessary by CCS.

8.3 When the aluminum alloy plates accepted by CCS Surveyor, the ends of the each plates are to bear identifications conforming to CCS Rules for Materials and Welding, i.e. CCS stamp,code or trade mark of the manufacturer, designation and condition number of aluminum alloy, “M” showing that products are corrosion tested (if applicable), identification mark which will enable the full history of the item to be traced.

8.4 After the inspection of aluminum alloy plates is completed, the manufacturer is to submit its quality certificate to CCS Surveyor for review. The quality certificate is to contain at least following items:

(1) Name of the purchaser and order number;

(2) Quantity, size and weight of the product

(3) Delivery condition and grade of material;

(4) Chemical composition of aluminum alloy;

(5) Batch number or identification mark which will enable the full history of the item to be traced;

(6) Test results;

(7) Clarifying manufacturer's statement "According to CCS Rules or approval by CCS, accepted acceptance criteria or relevant standards, tests are satisfactory".

8.5 After satisfactory inspection of the products and review of the documents submitted by the manufacturer, CCS Surveyor is to issue a Certificate of Marine Products.