Production Weld Tests

Amended Guidance

Guidance for the Survey and Construction of Steel Ships Parts GF, and N

Reason for Amendment

The International Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels (the IGF Code) and the International Code of the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (the IGC Code), both specify that, production weld tests are required to be carried out during the tank construction process, and these requirements have already been respectively incorporated into Chapter 16, Part GF of the Rules and Chapter 6, Part N of the NK Rules. In addition to the aforementioned code requirements, the Society has independently developed its own requirements related to such test and these are respectively specified in Part GF and N of the Guidance.

However, it was found that some parts of the Society's independently developed were unclear. Accordingly, relevant requirements are amended for clarification.

In addition to the above, relevant requirements related to the test procedures are amended in reference to current Society practice.

Outline of Amendment

(1) Delete requirements related to the frequency of production weld tests.
(2) Specify test criteria and additional tests for each test item in cases where the item fails to comply with relevant requirements.

"Guidance for the survey and construction of steel ships" has been partly amended as follows:

Part GF SHIPS USING LOW-FLASHPOINT FUELS

GF16 MANUFACTURE, WORKMANSHIP AND TESTING

GF16.3 Welding of Metallic Materials and Non-destructive Testing for the Fuel Containment System

Paragraph GF16.3.5 has been amended as follows.

GF16.3.5 Production Weld Tests

1 Production weld tests are to ~~be in accordance with the requirements specified in 16.3.5, Part GF and Chapter 11, Part D of the Rules and are also to~~ comply with the following ~~requirements~~:

~~(1) Application~~

~~When welding is made for independent tanks of ships carrying liquefied gases in bulk, the production weld tests are to be carried out for each position of welding in accordance with the following requirements, in addition to the welding procedure qualification tests specified in Part M of the Rules.~~

~~(a) Type *A* independent tanks~~

~~The production weld test is to be carried out on at least one test sample for every 50 *m* of welding length of butt joints of principal structural members. However, consideration may be given for reduction of the number of test sample or omission of the production weld test taking into account the past records and the actual state of quality control system of the manufacturer.~~

~~(b) Type *B* independent tanks~~

~~The production weld tests are to be carried out on at least one test sample for every 50 *m* of welding length of butt joints of principal structural members. However, the number of test sample may be reduced to one test sample for every 100 *m* of welding length taking into account the past records and the actual state of quality control system of the manufacturer. In this case, however, at least one or more test specimens are to be selected for one tank.~~

~~(c) Type *C* independent tanks~~

~~The production weld tests are to be carried out on at least one test sample for every 30 *m* of welding length of butt joints of principal structural members. However, the number of test sample may be reduced to one test sample for every 50 *m* of welding length taking into account the past records and the actual state of quality control system of the manufacturer.~~

(~~2~~1) Test procedures

(a) The production weld tests are to be carried out ~~for every welding length specified in the above (1)~~ for welded joints made under the same welding procedure, welding position and welding conditions.

(b) Test ~~sample~~ assemblies are, in principle, to be located on the same line as the welded joints of the body and to be welded at the same time of welding of the body.

(~~3~~2) Kind of test

The ~~K~~kind~~s~~ of the test is ~~are~~ to be as given in **Table GF16.3.5-1**. In the case of Type *A* and Type *B* independent tanks, tensile tests need not be carried out.

(~~4~~3) Test assemblies

The shape and size of test assemblies are to be as shown in **Fig. GF16.3.5-1**. ~~In cases of Type *A* and Type *B* independent tanks, tensile test may not be required.~~

(~~5~~4) Test specimens

(a) The shape and size of tensile test specimens are to be of the *U*2*A* or *U*2*B* test specimen specified in **Table M3.1**, **Part M of the Rules**.

(b) The shape and size of bend test specimens are to be of the *UB*-1, *UB*-2 and ~~*UB*-3~~10 test specimens specified in **Table M3.2**, **Part M of the Rules**. For test specimens with a thickness ~~exceeding 20~~ not less than 12 *mm*, side bend test specimens ~~are to~~ may be substituted for face bend and root bend test specimens.

(c) Impact test specimens are to be the *U*4 test specimen specified in **Table K2.5**, **Part K of the Rules**. In the impact test, one set of test specimens comprising three pieces are to be taken from every test assembly.

The test specimens are to be taken alternately from the position *A* and from a position among *B* through *E* where the lowest value is recorded in the welding procedure qualification test, shows in **Fig. M4.4**, **Part M of the Rules**. This means that one set of three test specimens are taken from a test assembly at the position *A*, thence other set of three test specimens are taken in the subsequent test assembly from the position among *B* through *E* where the lowest value is recorded, and this procedure is repeated.

(~~6~~5) Tensile tests

The tensile strength of weld metal is to be more than the specified value of the base metal. However, the tensile strength of weld metal which has lower tensile strength than that of the parent metal is to be complied with ~~the requirements in~~ **4.2.5**, **Part M of the Rules**.

(~~7~~6) Bend tests

(a) The bend test specimen is to be bent up to an angle of 180 degrees by a test jig with an inner radius of double the thickness of the test specimen.

(b) The results of the bend test are to be as free from cracks exceeding 3 *mm* in length in any direction on the outer bent surface and from other significant defects.

(~~8~~7) Impact tests

(a) ~~The specified value for the impact test~~ Minimum average energy values are to be the value prescribed for the base material being joined. However, test temperature may be determined in accordance with ~~the requirements in~~ **GF6.4.13-2**.

(b) Minimum single energy values are to be in accordance with **16.3.3-5(3), Part GF of the Rules**.

(c) For type *C* independent tanks and process pressure vessels, notwithstanding the preceding **(b)**, minimum single energy values are to be in accordance with **11.5.4-1 (3)(b), Part D of the Rules**.

2 For the purpose of ~~the requirements in~~ **16.3.5-1**, **Part GF of the Rules**, the number of test specimens for production weld tests of secondary barriers may be reduced to the extent as deemed appropriate by the Society considering the experience of same welding procedures in past, workmanship and quality control. In general, intervals of production tests for secondary barriers may be approximately 200 *m* of butt weld joints and the tests are to be representative of each welding position.

3 For the purpose of ~~the requirements in~~ **16.3.5-5**, **Part GF of the Rules**, production weld tests for membrane tanks are left to the discretion of the Society depending on the construction system of the tank.

4 Procedures for additional tests before rejection are to comply with the following:

(1) Tensile tests

The requirements in **11.5.4-3, Part D of the Rules** are to be complied with.

(2) Bend test

(a) The requirements in **4.2.12-2, Part M of the Rules** are to be complied with.

(b) For type *C* independent tanks and process pressure vessels, notwithstanding the preceding **(a)**, bend tests are to be in accordance with **11.5.4-3, Part D of the Rules**.

(3) Impact tests

(a) The requirements in **16.2.2-4, Part GF of the Rules** are to be complied with.

(b) For type *C* independent tanks and process pressure vessels, notwithstanding the preceding **(a)**, impact tests are to be in accordance with **11.5.4-3, Part D of the Rules**.

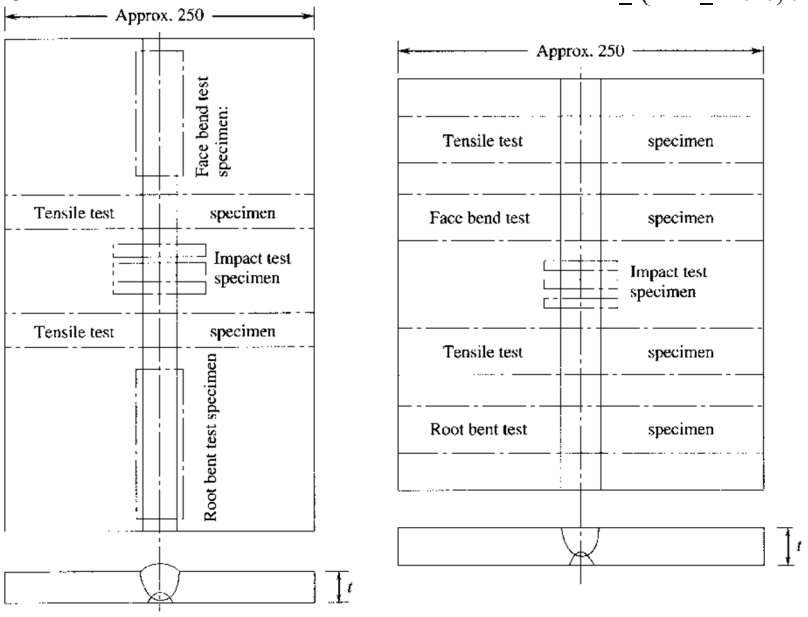
Table GF16.3.5-1 Kinds of Tests

Material	Kind of test
9 *% Ni* steel	Tensile test, bend test and impact test
Austenitic stainless steel	Tensile test, and bend test
Aluminium alloy(1)	Tensile test, and bend test
~~Steel for low temperature service (excluding 9% *Ni* steel)~~ Others	Tensile test, bend test and impact test

Note:

(1) For aluminium alloys other than type 5083, additional tests may be required to verify the toughness of the material.

Fig. GF16.3.5-1 Test Assemblies for Production Weld Tests (units: *mm*, *t*: thickness)



(a) For 9% *Ni* steel (b) For materials other than (a)

Note:

(1) In the case of Type *A* and Type *B* independent tanks, tensile tests need not be carried out.

Part N SHIPS CARRYING LIQUEFIED GASES IN BULK

N6 MATERIALS OF CONSTRUCTION AND QUALITY CONTROL

N6.5 Welding of Metallic Materials and Non-destructive Testing

Paragraph N6.5.5 has been amended as follows.

N6.5.5 Production Weld Tests

1 Production weld tests are to ~~be in accordance with the requirements specified in 6.5.5, Part N and Chapter 11, Part D of the Rules and are also to~~ comply with the following ~~requirements~~:

~~(1) Application~~

~~When welding is made for independent tanks of ships carrying liquefied gases in bulk, the production weld tests are to be carried out for each position of welding in accordance with the following requirements, in addition to the welding procedure qualification tests specified in Part M of the Rules.~~

~~(a) Type *A* independent tanks~~

~~The production weld test is to be carried out on at least one test sample for every 50 *m* of welding length of butt joints of principal structural members. However, consideration may be given for reduction of the number of test sample or omission of the production weld test taking into account the past records and the actual state of quality control system of the manufacturer.~~

~~(b) Type *B* independent tanks~~

~~The production weld tests are to be carried out on at least one test sample for every 50 *m* of welding length of butt joints of principal structural members. However, the number of test sample may be reduced to one test sample for every 100 *m* of welding length taking into account the past records and the actual state of quality control system of the manufacturer. In this case, however, at least one or more test specimens are to be selected for one tank.~~

~~(c) Type *C* independent tanks~~

~~The production weld tests are to be carried out on at least one test sample for every 30 *m* of welding length of butt joints of principal structural members. However, the number of test sample may be reduced to one test sample for every 50 *m* of welding length taking into account the past records and the actual state of quality control system of the manufacturer.~~

(~~2~~1) Test procedures

(a) The production weld tests are to be carried out ~~for every welding length specified in the above (1)~~ for welded joints made under the same welding procedure, welding position and welding conditions.

(b) Test ~~sample~~ assemblies are, in principle, to be located on the same line as the welded joints of the body and to be welded at the same time of welding of the body.

(~~3~~2) Kind of test

The ~~K~~kind~~s~~ of the test ~~are~~ is to be as given in **Table N6.5.5-1**. In the case of Type *A* and Type *B* independent tanks, tensile tests need not be carried out.

(~~4~~3) Test assemblies

The shape and size of test assemblies are to be as shown in **Fig. N6.5.5-1**. ~~In cases of Type *A* and Type *B* independent tanks, tensile test may not be required.~~

(~~5~~4) Test specimens

(a) The shape and size of tensile test specimens are to be of the *U*2*A* or *U*2*B* test specimen specified in **Table M3.1**, **Part M of the Rules**.

(b) The shape and size of bend test specimens are to be of the *UB*-1, *UB*-2 and *B*-~~3~~ 10 test specimens specified in **Table M3.2**, **Part M of the Rules**. For test specimens with a thickness not less than 12 *mm*, side bend test specimens may be substituted for face bend and root bend test specimens.

(c) Impact test specimens are to be the *U*4 test specimen specified in **Table K2.5**, **Part K of the Rules**. In the impact test, one set of test specimens comprising three pieces are to be taken from every test assembly.

The test specimens are to be taken alternately from the position *A* and from a position among *B* through *E* where the lowest value is recorded in the welding procedure qualification test, shows in **Fig. M4.4**, **Part M of the Rules**. This means that one set of three test specimens are taken from a test assembly at the position *A*, thence other set of three test specimens are taken in the subsequent test assembly from the position among *B* through *E* where the lowest value is recorded, and this procedure is repeated.

(~~6~~5) Tensile tests

The tensile strength of weld metal is to be more than the specified value of the base metal. However, the tensile strength of weld metal which has lower tensile strength than that of the parent metal is to be complied with ~~the requirements in~~ **4.2.5**, **Part M of the Rules**.

(~~7~~6) Bend tests

(a) The bend test specimen is to be bent up to an angle of 180 degrees by a test jig with an inner radius of double the thickness of the test specimen.

(b) The results of the bend test are to be as free from cracks exceeding 3 *mm* in length in any direction on the outer bent surface and from other significant defects.

(~~8~~7) Impact tests

(a) ~~The specified value for the impact test~~ Minimum average energy values are to be the value prescribed for the base material being joined. However, test temperature may be determined in accordance with the requirements in **N4.19.2**.

(b) Minimum single energy values are to be in accordance with **6.5.3-5(3), Part N of the Rules**.

(c) For type *C* independent tanks and process pressure vessels, notwithstanding the preceding **(b)**, minimum single energy values are to be in accordance with **11.5.4-1(3)(b), Part D of the Rules**.

2 For the purpose of ~~the requirements in~~ **6.5.5-1**, **Part N of the Rules**, the number of test specimens for production weld tests of secondary barriers may be reduced to the extent as deemed appropriate by the Society considering the experience of same welding procedures in past, workmanship and quality control. In general, intervals of production tests for secondary barriers may be approximately 200 *m* of butt weld joints and the tests are to be representative of each welding position.

3 For the purpose of ~~the requirements in~~ **6.5.5-5**, **Part N of the Rules**, number of test specimens for the production weld tests for integral tanks may be reduced to the same level as in the case of secondary barrier given in the preceding **-2**. Production weld tests for membrane tanks are left to the discretion of the Society depending on the construction system of the tank.

4 Procedures for additional tests before rejection are to comply with the following:

(1) Tensile tests

The requirements in **11.5.4-3, Part D of the Rules** are to be complied with.

(2) Bend tests

(a) The requirements in **4.2.12-2, Part M of the Rules** are to be complied with.

(b) For type *C* independent tanks and process pressure vessels, notwithstanding the preceding **(a)**, bend tests are to be in accordance with **11.5.4-3, Part D of the Rules**.

(3) Impact tests

(a) The requirements in **6.3.2-4, Part N of the Rules** are to be complied with.

(b) For type *C* independent tanks and process pressure vessels, notwithstanding the preceding **(a)**, impact tests are to be in accordance with **11.5.4-3, Part D of the Rules**.

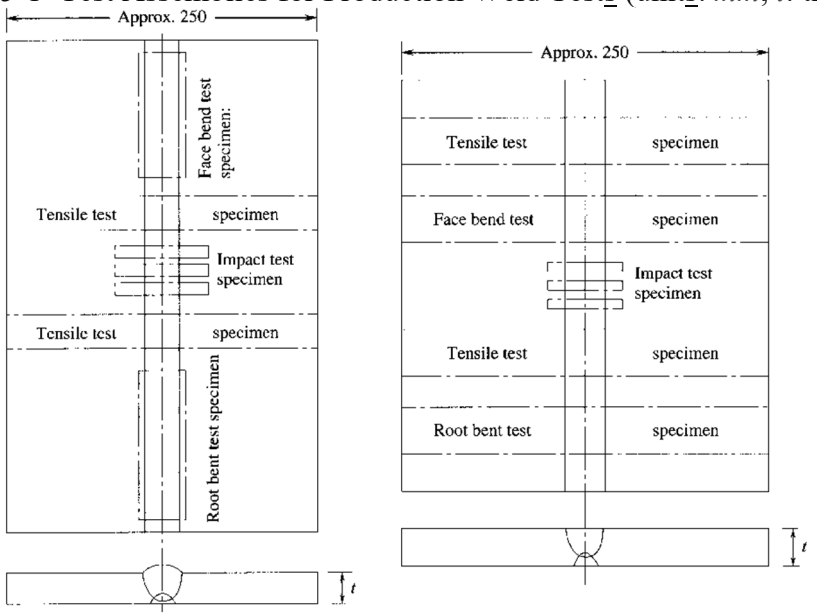
Table N6.5.5-1 Kinds of Tests

Material	Kind of test
9% *Ni* steel	Tensile test, bend test and impact test
Austenitic stainless steel	Tensile test, and bend test
Aluminium alloy (1)	Tensile test, and bend test
~~Steel for low temperature service (excluding 9% *Ni* steel)~~ Others	Tensile test, bend test and impact test

Note:

(1) For aluminium alloys other than type 5083, additional tests may be required to verify the toughness of the material.

Fig. N6.5.5-1 Test Assemblies for Production Weld Tests (units: *mm*, *t*: thickness)



(a) For 9% *Ni* steel (b) For materials other than (a)

Note:

(1) In the case of Type *A* and Type *B* independent tanks, tensile tests need not be carried out.