

Tests for Semiconductor Converters for Power, etc.

Amended Rules and Guidance

Rules for the Survey and Construction of Steel Ships Part H

Rules for High Speed Craft

Rules for the Survey and Construction of Inland Waterway Ships

Guidance for the Survey and Construction of Steel Ships Parts H

Guidance for the Survey and Construction of Inland Waterway Ships

Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use

Reason for Amendment

- (1) In 1.2.1, Part H of the Rules for the Survey and Construction of Steel Ships, etc., it is specified that type tests shall, in principle, be carried out for semiconductor power converters to be installed on ships.

Semiconductor power converters used for propulsion or main power generation, however, tend to have large capacities and specifications that may differ greatly on a per ship basis, and thus are mainly produced as single products rather than mass produced in large quantities. For this reason, common practice has been to carry out individual inspections (shop tests) of such semiconductors as an alternative to type tests as specified in H1.2.1, Part H of the Guidance for the Survey and Construction of Steel Ships.

Accordingly, relevant requirements are amended to specify that individual inspections are to be carried out for semiconductor power converters for propulsion or main power generation applications.

- (2) The Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use specifies that the term of validity of certificates for approval of materials and equipment is five years from the date of approval. (In case of renewal of approval, five years from the next day after the expiration date of the previous certificate.)

On the other hand, it is specified that the term of validity of the certificates for type tested products is five years from the date of passing said type tests.

Accordingly, relevant requirements are amended to specify that the term of validity of certificates for type-tested products is to be five years from the date of approval so that it is the same as the term of validity for certificates of approval for machinery and equipment. (In case of renewal of approval, five years from the next day after the expiration date of the previous certificate.)

Outline of Amendment

The main contents of this amendment are as follows:

- (1) Specifies that semiconductor power conversion devices used in the following electrical equipment shall be subject to individual inspection.
 - (a) Rotating machines for propulsion and their respective control equipment
 - (b) Ship service generators (main, auxiliary and emergency)
 - (c) Main and emergency switchboards
- (2) Amends requirements so that the term of validity of certificates for type-tested products

is five years from the date of approval. (In case of renewal of approval, five years from the next day after the expiration date of the previous certificate.)

“Rules for the survey and construction of steel ships” has been partly amended as follows:

Part H ELECTRICAL INSTALLATIONS

Chapter 1 GENERAL

1.2 Testing

Paragraph 1.2.1 has been amended as follows.

1.2.1 Shop Tests*

1 The electrical equipment specified below is to be tested in accordance with the respective requirements in this Part at the place of manufacture or at other locations having adequate apparatus for testing and inspections. However, tests for any equipment with small capacities as specified in (4) and (5) are to be conducted as deemed appropriate by the Society.

- (1) Rotating machines for propulsion and their respective control equipment
- (2) Ship service generators (main, auxiliary and emergency)
- (3) Main and emergency switchboards
- (4) Motors for auxiliary machinery specified in **1.1.6-1(1)** to **1.1.6-1(3)**, **Part D** (hereinafter referred to as “motors for essential services” in this Part)
- (5) Controlgears for those motors specified in (4) above
- (6) Transformers for power and lighting of single phase 1 *kVA* or more and three phase 5 *kVA* or more. However, those transformers used only for special services such as those ones for Suez Canal Search Lights, etc. are to be excluded
- (7) Semiconductor converters for power of not less than 5 *kW* and their respective accessories that are used for supplying power to the electrical equipment specified in (1) to (3) above
- ~~(78)~~ Other electrical equipment as deemed necessary by the Society

2 Any electrical equipment used for auxiliary machinery for specific use for those ships specified in **1.1.6-1(4)** and **1.1.6-1(5)**, **Part D** as well as those deemed necessary by the Society are to be tested in accordance with the respective requirements in this Part.

3 For those electrical equipment manufactured by mass production, test procedures suited to their production methods, notwithstanding the requirements given in **-1**, may be applied subject to Society approval.

4 Electrical equipment and cables shown in the following items (1) to (6) are to be subjected to type tests for each type of products.

- (1) Fuses
- (2) Circuit breakers
- (3) Electromagnetic contactors
- (4) Explosion-protected electrical equipment
- (5) Cables for power, lighting and internal communications
- (6) Semiconductor converters for power of not less than 5 *kW* that are used for ~~supplying power to the electrical equipment specified in -1(14) to and (5) above~~

5 Electrical equipment and cables having a certificate considered acceptable to the Society may be exempted partially or wholly from the tests and inspections.

Chapter 2 ELECTRICAL INSTALLATIONS AND SYSTEM DESIGN

2.12 Semiconductor Converters for Power

Paragraph 2.12.4 has been added as follows.

2.12.4 Shop Tests*

1 The converters and accessories specified in **1.2.1-1(7)** are to be tested in accordance with the following **(1)** to **(5)**. However, those tests required by **(1)** below may be omitted, subject to Society approval, for products which are produced in a series of identical types from the second unit onward.

- (1)** Temperature rise tests for converters and their accessories are to be carried out under normal working conditions. In addition, the temperature rise for the interiors of converters is not to exceed manufacturer specified values while the temperature rise for the exteriors of converters (*e.g.* the connecting parts of busbars and cables for switchboards as well as coils, contactors and resistors) is not to exceed the values specified in the requirements given in **2.8.3**. Furthermore, temperature test methods for semiconductor element connections are to be as deemed appropriate by the Society.
- (2)** Instruments, switching devices and protective devices fitted in converters are to be checked for normal operation under operating conditions.
- (3)** High voltage tests specified in *IEC* 60146-1-1 or *IEC* 61800-5-1
- (4)** High voltage tests between live parts and earths for accessories charged with auxiliary circuit potential are to be in accordance with the requirements given in **2.8.4-4**.
- (5)** Immediately after such high voltage tests have been carried out, insulation resistance between live parts of converters and their accessories and earths is not to be less than 1 *MΩ* when tested with *d.c.* voltages of at least 500 *V*.

“Rules for high speed craft” has been partly amended as follows:

Part 10 ELECTRICAL INSTALLATIONS

Chapter 1 GENERAL

1.2 Testing

Paragraph 1.2.1 has been amended as follows.

1.2.1 Shop Tests*

1 Electrical equipment specified below is to be tested in accordance with the respective requirements in **Chapter 2, Part H of the Rules for the Survey and Construction of Steel Ships** at the manufacturer’s works or at other works which provide with the adequate apparatus for testing and inspections.

- (1) Rotating machines for propulsion and their control equipment
- (2) Craft service generators of not less than 50 *kVA*
- (3) Switchboards with input power of not less than 50 *kVA*
- (4) Motors of not less than 50 *kW* for auxiliary machinery specified in **1.1.6-1(1) to (3), Part D of the Rules for the Survey and Construction of Steel Ships**, and their control gears
- (5) Transformers of single phase not less than 30 *kVA* and three phase not less than 50 *kVA* excluding those for special services such as one for a Suez Canal Search Light
- (6) Semiconductor converters for power of not less than 50 *kW* and their respective accessories that are used for supplying power to the electrical equipment specified in (1) to (3) above
- ~~(6)~~ Other electrical equipment as deemed necessary by the Society

2 (Omitted)

3 Cables for power, lighting and internal communications and semiconductor converters for power of not less than 50 *kW* used for supplying power to the electrical equipment specified in -1(4) are to be subjected to type test for each type of products.

4 (Omitted)

“Rules for the survey and construction of inland waterway ships” has been partly amended as follows:

Part 8 ELECTRICAL INSTALLATIONS

Chapter 1 GENERAL

1.2 Testing

Paragraph 1.2.1 has been amended as follows.

1.2.1 Shop Tests*

1 The electrical equipment specified below is to be tested in accordance with the respective requirements in this Part at the place of manufacture or at other locations having adequate apparatus for testing and inspections. However, tests for any equipment with small capacities as specified in (4) and (5) are to be conducted as deemed appropriate by the Society.

- (1) Rotating machines for propulsion and their respective control equipment
- (2) Main generators
- (3) Main switchboards
- (4) Motors for auxiliary machinery specified in 1.1.5-1(1) to 1.1.5-1(3), Part 7 (hereinafter referred to as “motors for essential services” in this Part)
- (5) Controlgears for those motors specified in (4) above
- (6) Transformers for power and lighting of single phase 1 *kVA* or more and three phase 5 *kVA* or more. However, those transformers used only for special services such as those ones for Suez Canal Search Lights, etc. are to be excluded
- (7) Semiconductor converters for power of not less than 5 *kW* and their respective accessories that are used for supplying power to the electrical equipment specified in (1) to (3) above
- ~~(78)~~ Other electrical equipment as deemed necessary by the Society

2 Any electrical equipment used for auxiliary machinery for specific use for those ships specified in 1.1.5-1(4) and 1.1.5-1(5), Part 7 as well as those deemed necessary by the Society are to be tested in accordance with the respective requirements in this Part.

3 For those electrical equipment manufactured by mass production, test procedures suited to their production methods, notwithstanding the requirements given in -1, may be applied subject to Society approval.

4 Electrical equipment and cables shown in the following items (1) to (5) are to be subjected to type tests for each type of products.

- (1) Circuit breakers
- (2) Electromagnetic contactors
- (3) Explosion-protected electrical equipment
- (4) Cables for power, lighting and internal communications
- (5) Semiconductor converters for power of not less than 5 *kW* that are used for ~~supplying power to the electrical equipment specified in -1(14) to and~~ (5) above

5 Electrical equipment and cables having a certificate considered acceptable to the Society may be exempted partially or wholly from the tests and inspections.

Chapter 2 ELECTRICAL INSTALLATIONS AND SYSTEM DESIGN

2.3 System Design (Protection)

Paragraph 2.12.4 has been added as follows.

2.12.4 Shop Tests*

1 The converters and accessories specified in 1.2.1-1(7) are to be tested in accordance with the following (1) to (5). However, those tests required by (1) below may be omitted, subject to Society approval, for products which are produced in a series of identical types from the second unit onward.

- (1) Temperature rise tests for converters and their accessories are to be carried out under normal working conditions. In addition, the temperature rise for the interiors of converters is not to exceed manufacturer specified values while the temperature rise for the exteriors of converters (e.g. the connecting parts of busbars and cables for switchboards as well as coils, contactors and resistors) is not to exceed the values specified in the requirements given in 2.8.3. Furthermore, temperature test methods for semiconductor element connections are to be as deemed appropriate by the Society.
- (2) Instruments, switching devices and protective devices fitted in converters are to be checked for normal operation under operating conditions.
- (3) High voltage tests specified in IEC 60146-1-1 or IEC 61800-5-1
- (4) High voltage tests between live parts and earths for accessories charged with auxiliary circuit potential are to be in accordance with the requirements given in 2.8.4-4.
- (5) Immediately after such high voltage tests have been carried out, insulation resistance between live parts of converters and their accessories and earths is not to be less than 1 MΩ when tested with d.c. voltages of at least 500 V.

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

Part H ELECTRICAL INSTALLATIONS

H2 ELECTRICAL INSTALLATIONS AND SYSTEM DESIGN

H2.12 Semiconductor Converters for Power

Paragraph H2.12.4 has been added.

H2.12.4 Shop Tests

1 Regarding the temperature rise tests for semiconductor element connections mentioned in **2.12.4-1(1), Part H of the Rules**, temperature rise measurements for individual element parts such as cooling fins, cases and coolant parts, etc. may be accepted. However, such temperature rise tests may be carried out on the aforementioned element parts only in cases where manufacturers specify in advance that the temperature rise of semiconductor element connections will not exceed their maximum allowable temperature if the temperature rise of their parts is within allowable limits.

2 With respect to **2.12.4-1(2), Part H of the Rules**, tests which may inadvertently inflict serious damage on the protective devices of semiconductor elements may be omitted in cases where the proper operation of semiconductor element protective fuses, etc. can be confirmed.

3 With respect to **2.12.4-1(3), Part H of the Rules**, test voltages for high voltage tests may be in accordance with **Table H2.12.4-1**. The test voltage is to be applied for one minute; however, one second may be allowed for products produced in a series of identical types from the second unit onward.

Table H2.12.4-1 Test voltages for high voltage tests

<u>Rated a.c. voltage (V)</u>	<u>Test voltage</u>	
	<u>a.c. r.m.s (V)</u>	<u>d.c (V)</u>
<u>≤ 50</u>	<u>1,250</u>	<u>1,770</u>
<u>100</u>	<u>1,300</u>	<u>1,840</u>
<u>150</u>	<u>1,350</u>	<u>1,910</u>
<u>300</u>	<u>1,500</u>	<u>2,120</u>
<u>600</u>	<u>1,800</u>	<u>2,550</u>
<u>1,000</u>	<u>2,200</u>	<u>3,110</u>
<u>> 1,000</u>	<u>3,000</u>	<u>4,250</u>
<u>3,600</u>	<u>10,000</u>	<u>14,150</u>
<u>7,200</u>	<u>20,000</u>	<u>28,300</u>
<u>12,000</u>	<u>28,000</u>	<u>39,600</u>
<u>17,500</u>	<u>38,000</u>	<u>53,700</u>

Note:

1. Interpolation is permitted.

“Guidance for the survey and construction of inland waterway ships” has been partly amended as follows:

Part 8 ELECTRICAL INSTALLATIONS

Chapter 2 ELECTRICAL INSTALLATIONS AND SYSTEM DESIGN

2.12 Semiconductor Converters for Power

Paragraph 2.12.4 has been added.

2.12.4 Shop Tests

1 Regarding the temperature rise tests for semiconductor element connections mentioned in **2.12.4-1(1), Part 8 of the Rules**, temperature rise measurements for individual element parts such as cooling fins, cases and coolant parts, etc. may be accepted. However, such temperature rise tests may be carried out on the aforementioned element parts only in cases where manufacturers specify in advance that the temperature rise of semiconductor element connections will not exceed their maximum allowable temperature if the temperature rise of their parts is within allowable limits.

2 With respect to **2.12.4-1(2), Part 8 of the Rules**, tests which may inadvertently inflict serious damage on the protective devices of semiconductor elements may be omitted in cases where the proper operation of semiconductor element protective fuses, etc. can be confirmed.

3 With respect to **2.12.4-1(3), Part 8 of the Rules**, test voltages for high voltage tests may be in accordance with **Table 8.2.12.4-1**. The test voltage is to be applied for one minute; however, one second may be allowed for products produced in a series of identical types from the second unit onward.

Table 8.2.12.4-1 Test voltages for high voltage tests

Rated <i>a.c.</i> voltage (V)	Test voltages	
	<i>a.c. r.m.s</i> (V)	<i>d.c</i> (V)
<u>< 50</u>	<u>1,250</u>	<u>1,770</u>
<u>100</u>	<u>1,300</u>	<u>1,840</u>
<u>150</u>	<u>1,350</u>	<u>1,910</u>
<u>300</u>	<u>1,500</u>	<u>2,120</u>
<u>600</u>	<u>1,800</u>	<u>2,550</u>
<u>1,000</u>	<u>2,200</u>	<u>3,110</u>
<u>> 1,000</u>	<u>3,000</u>	<u>4,250</u>
<u>3,600</u>	<u>10,000</u>	<u>14,150</u>
<u>7,200</u>	<u>20,000</u>	<u>28,300</u>
<u>12,000</u>	<u>28,000</u>	<u>39,600</u>
<u>17,500</u>	<u>38,000</u>	<u>53,700</u>

Note:

1. Interpolation is permitted.

“Guidance for the approval and type approval of materials and equipment for marine use” has been partly amended as follows:

Part 8 TYPE TESTS OF ELECTRICAL EQUIPMENT AND CABLES

Chapter 1 GENERAL

1.1 General

Paragraph 1.1.3 has been amended as follows.

1.1.3 Articles

Electrical equipment cables subject to the type test are to be as follows.

- (1) (Omitted)
- (2) (Omitted)
- (3) (Omitted)
- (4) (Omitted)
- (5) (Omitted)
- (6) Semiconductor converters for power
Semiconductor converters for power ~~of not less than 5 kW that are used for supplying power to the following electrical equipment:~~ for which type tests are required by relevant requirements
 - ~~(a) Rotating machines for propulsion and their respective control equipment;~~
 - ~~(b) Ship service generators (main, auxiliary and emergency);~~
 - ~~(c) Main and emergency switchboards;~~
 - ~~(d) Motors for auxiliary machinery specified in 1.1.6 1(1) to 1.1.6 1(3), Part D of the Rules for the Survey and Construction of Steel Ships; and~~
 - ~~(e) Control gears for those motors specified in (d) above.~~

1.4 Certificate

Paragraph 1.4.3 has been amended as follows.

1.4.3 Term of Validity

The term of validity is ~~five years~~ from the date of ~~passing the type tests~~ approval.

1.4.4 Renewal of Validity

Sub-paragraph -3 has been amended as follows.

3 Where the periodical investigation has been passed, the Society will re-issue the new certificate, the term of validity of which is ~~five years~~ from the date of ~~passing the periodical investigation~~ expiration for the existing certificate. Manufacturers are to return the old “Certificate of Approval” to the Society as soon as possible after receiving the new certificate and the term of validity of the old one expires.