



Guideline No.: E-03(201510)

## E-03 MOTORS

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Foreword:

This Guideline is a part of CCS Rules, which contains technical requirements, inspection and testing criteria related to classification and statutory survey of marine products.

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## MOTORS

### 1 Application

1.1 This Chapter applies to motors for ships and offshore installations, but not to micro control motors.

1.2 This Chapter is applicable to motors for general purposes. Where motors, which are intended for special purposes or for which special tests are required, are not specifically covered by this Chapter, the standards for such motors are to apply.

### 2 Normative references

2.1 The approval and inspection of motors are to be based on the following documents:

CCS Rules for Classification of Sea-going Steel Ships, 2012 and its amendments;

CCS Rules for Materials and Welding, 2012 and its amendments;

CCS Guidelines for Type Approval Test of Electric and Electronic Products, 2006, GD01-2006;

IACS UR E13 (May 2004) Test requirements for Rotating Machines;

IEC 60092-301:1980{Ed.3.0} Electrical installations in ships - Part 301: Equipment – Generators and motors;

IEC 60092-301-am1:1994 {Ed.3.0};

IEC 60092-301-am2:1995 {Ed.3.0};

IEC 60034-1:2010 {Ed.12.0} Rotating machines - Part 1: Rating and performance;

IEC 60085:2007{Ed.4.0} Electrical insulation – Thermal classification;

IEC60034-5:2006 {Ed.4.1} Rotating machines - Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) – Classification;

IEC 60034-6:1991 {Ed.2.0} Rotating machines - Part 6: Methods of cooling(IC code);

IEC 60034-7:2001 {Ed.2.1} Rotating machines - Part 7: Classification of types of construction, mounting arrangement and terminal box position (IM Code);

IEC60034-8:2014 {Ed.3.1} Rotating machines - Part 8: Terminal markings and direction of rotation;

IEC60034-15:2009 {Ed.3.0} Rotating machines - Part 15: Impulse voltage withstand levels of rotating AC machines with form-wound stator coils;

IEC60068-2-30:2005 {Ed.3.0} Environmental testing - Part 2 – 30: Tests-test Db: Damp heat, cyclic (12h + 12h cycle);

IEC60068-2-11:1981 {Ed.3.0} Environmental testing - Part 2: Tests – test Ka: Salt mist;

IEC60079-0:2011 {Ed.6.0} Electrical apparatus for explosive gas atmosphere - Part 0: General requirements;

IEC60079-1:2014 {Ed.7.0} Electrical apparatus for explosive gas atmosphere - Part 1: Flameproof enclosures “d”;

IEC 60079-2:2014{Ed.6.0} Electrical apparatus for explosive gas atmosphere - Part 2: Pressurized enclosures “p”;

IEC60079-7:2006 {Ed.4.0} Electrical apparatus for explosive gas atmosphere - Part 7: Increased safety “e”.

2.2 In lieu of the standards referred to in this Chapter, other equivalent standards or standards acceptable to CCS may be applied as appropriate.

### **3 Definitions**

3.1 For the purpose of this Chapter:

3.1.1 AC high-voltage motor is a 3-phase AC motor rated over 1 kV.

### **4 Plans and documents**

4.1 The following plans and documents are to be submitted to CCS for approval:

General plans;

Detailed drawings of main parts, including assembly of stators, assembly of rotors, turning axle, assembly of collector rings or commutators, bedplates, and structure of terminal boxes;

Technical specifications of the products;

Type test programme.

4.2 The following plans and documents are to be submitted to CCS for information:

Drawing of nameplate;

Specimen of test quality certificate;

Operation instructions for the products.

### **5 Materials and components**

5.1 The shaft material of propulsion motors is to be certified by CCS; for motors operated at 100 kW and above, the material selected for design is to comply with the requirements of CCS Rules for Materials and Welding.

### **6 Design and technical requirements**

6.1 The design and manufacture of products is to comply with the requirements of CCS Rules for Classification of Sea-going Steel Ships, CCS Rules for Materials and Welding and IEC 60092-301; thermal classification of electrical insulation is to comply with IEC 60085; classification of degrees of protective enclosures is to comply with IEC 60034-5; methods of cooling are to comply with IEC 60034-6; construction and mounting arrangement is to comply with IEC 60034-7; terminal markings and direction of rotation are to comply with IEC 60034-8; explosion-proof motors are to comply with IEC 60079.

### **7 Type test**

7.1 Selection of typical samples

7.1.1 Types and specifications of test samples are to cover the products for which approval is sought and be technically representative for determining, through type test, whether the manufacturer has the capability to manufacture the approval products as required by CCS.

(2) Samples selected from the same series of motors are to be representative in terms of power, speed, construction type, installation type (vertical or horizontal), degree of protection, duty,

method of cooling, insulation level, purpose and manufacturing process. Two motors are to be taken for each specification where approval is requested for the first time.

7.1.3 At least one of the test samples is to be rated not less than 80% to 100% of the maximum power for which approval is requested.

7.2 Items and requirements for type test

7.2.1 The type test of motors is to be in accordance with Table 7.2.1(1) and Table 7.2.1(2).

**Type Test Items for Motors**

**Table 7.2.1(1)**

| No. | Test item                                                                    | Technical requirements                                                       | Test method                                                                  |
|-----|------------------------------------------------------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| 1   | Visual examination                                                           | Approved plans and technical documents                                       | Visual examination of Compliance                                             |
| 2   | Measurement of insulation resistance                                         | 3.2.9.6, PART FOUR of CCS Rules for Classification of Sea-going Steel Ships  | 3.2.9.6, PART FOUR of CCS Rules for Classification of Sea-going Steel Ships  |
| 3   | Measurement of winding resistance                                            | Technical specifications                                                     | Bridge method or voltage-current method                                      |
| 4   | Overload/overcurrent test                                                    | 3.2.5.1, PART FOUR of CCS Rules for Classification of Sea-going Steel Ships  | 3.2.5.1, PART FOUR of CCS Rules for Classification of Sea-going Steel Ships  |
| 5   | Overspeed test <sup>①</sup>                                                  | IEC 60034-1 para. 8.5                                                        | IEC 60034-1 para. 8.5                                                        |
| 6   | Withstand voltage test                                                       | IEC 60034-1 para. 8.1                                                        | IEC 60034-1 para. 8.1                                                        |
|     |                                                                              | IEC 60034-15                                                                 | IEC 60034-15 (for high-voltage motors)                                       |
| 7   | No-load test                                                                 | 3.2.9.14, PART FOUR of CCS Rules for Classification of Sea-going Steel Ships | 3.2.9.14, PART FOUR of CCS Rules for Classification of Sea-going Steel Ships |
| 8   | Examination of bearings                                                      | 3.2.9.16, PART FOUR of CCS Rules for Classification of Sea-going Steel Ships | 3.2.9.16, PART FOUR of CCS Rules for Classification of Sea-going Steel Ships |
| 9   | Rated load test and measurement of temperature rise                          | 3.2.3.1, PART FOUR of CCS Rules for Classification of Sea-going Steel Ships  | IEC 60034-1 para. 7                                                          |
| 10  | Test of degree of protective enclosure                                       | IEC 60034-5                                                                  | IEC 60034-5                                                                  |
| 11  | Power supply variation test                                                  | CCS GD01 – 2006, 2.4                                                         | CCS GD01 – 2006, 2.4                                                         |
| 12  | Inclination test                                                             | CCS GD01 – 2006, 2.6                                                         | CCS GD01 – 2006, 2.6                                                         |
| 13  | Damp heat test                                                               | CCS GD01 – 2006, 2.10                                                        | CCS GD01 – 2006, 2.10                                                        |
| 14  | Salt mist test Ka                                                            | CCS GD01 – 2006, 2.13                                                        | CCS GD01 – 2006, 2.13                                                        |
| 15  | Electromagnetic compatibility-measurement of conducted emission <sup>②</sup> | CCS GD01 – 2006, 3.2                                                         | CCS GD01 – 2006, 3.2                                                         |

① Not applicable for squirrel cage motors.

② Only applicable for synchronous motors and DC motors.

**Type Test Items for Motors – Test of Explosion-Proof Motors<sup>①</sup>**      **Table 7.2.1(2)**

| No | Test item                        | Technical requirement                                    | Test method                                              |
|----|----------------------------------|----------------------------------------------------------|----------------------------------------------------------|
| 1  | Explosion-proof performance test | IEC 60079-0<br>IEC 60079-1<br>IEC 60079-2<br>IEC 60079-7 | IEC 60079-0<br>IEC 60079-1<br>IEC 60079-2<br>IEC 60079-7 |

① The explosion-proof motors are to be certified as required by the Administration.

## 8 Unit/batch inspection

8.1 The manufacturer is to carry out routine tests for each motor according to Table 8.1. The routine test report is to contain test results and serial numbers of the test samples which have been type tested.

8.2 For manufacturers with CCS Type Approval B, the Surveyor is to witness the testing of 5% of motors or at least 2 motors on site.

8.3 All motors rated at 50 kW or above and intended for essential services are to be inspected by CCS Surveyor during the test and if necessary, in the manufacturing process.

8.4 Additional test items may be required where deemed necessary by the Surveyor.

8.5 Material certificates are to be checked according to requirements of 5.1.

**Routine Test Items for Motors**

**Table 8.1**

| No | Test item                              | Technical requirement                                                        | Test method                                                                  |
|----|----------------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| 1  | Visual examination                     | Approved plans and technical documents                                       | Visual examination of Compliance                                             |
| 2  | Measurement of insulation resistance   | 3.2.9.6, PART FOUR of CCS Rules for Classification of Sea-going Steel Ships  | 3.2.9.6, PART FOUR of CCS Rules for Classification of Sea-going Steel Ships  |
| 3  | Measurement of winding resistance      | Technical conditions                                                         | Bridge method or voltage-current method                                      |
| 4  | Overload/overcurrent test <sup>①</sup> | 3.2.5.1, PART FOUR of CCS Rules for Classification of Sea-going Steel Ships  | 3.2.5.1, PART FOUR of CCS Rules for Classification of Sea-going Steel Ships  |
| 5  | Overspeed test <sup>②</sup>            | IEC 60034-1 para. 8.5                                                        | IEC 60034-1 para. 8.5                                                        |
| 6  | Withstand voltage test                 | IEC 60034-1 para. 8.1                                                        | IEC 60034-1 para. 8.1                                                        |
|    |                                        | IEC 60034-15                                                                 | IEC 60034-15 (for high-voltage motors)                                       |
| 7  | No load test                           | 3.2.9.14, PART FOUR of CCS Rules for Classification of Sea-going Steel Ships | 3.2.9.14, PART FOUR of CCS Rules for Classification of Sea-going Steel Ships |
| 8  | Examination of bearings                | 3.2.9.16, PART FOUR of CCS Rules for Classification of Sea-going Steel Ships | 3.2.9.16, PART FOUR of CCS Rules for Classification of Sea-going Steel Ships |

① Applicable for motors rated over 100 kW intended for essential services.

② Not applicable for squirrel cage motors.