

Amendments of the Guidance for Manufacturing Process and Type Approval, Etc.

(Development Review : For external opinion inquiry)



2024. 1.

Machinery Rule Development Team

Effective Date : 1 July 2024

(The contract date for ship construction)

Present	Amendment	Note												
<div>CHAPTER 3 TYPE APPROVAL</div> <div>Section 1 – 21 <same as the present Rules></div> <div>Section 22 Cable Laying</div> <div>2201. – 2202. <same as the present Rules></div> <div>2203. Type test</div> <div>1. – 3. <same as the present Rules></div> <div>Table 3.22.2 type tests for cable trays/protective casings made of plastics materials</div> <table><tr><th>Test item</th><th>Approval test method and acceptance criteria</th></tr><tr><td rowspan="2">Resistivity Test</td><td>(a) Cable trays/protective casings passing through a hazardous area should be electrically conductive. The cable tray/protective casings should be tested in accordance with IEC 62631-3-1:2016 and IEC 62631-3-2:2015.</td></tr><tr><td>(b) The volume resistivity level of the cable trays/protective casings and fittings should be below $10^5\Omega$ and the surface resistivity should be below $10^6\Omega$m. The resistance to earth from any point in these appliances should not exceed $10^6\Omega$.</td></tr></table>	Test item	Approval test method and acceptance criteria	Resistivity Test	(a) Cable trays/protective casings passing through a hazardous area should be electrically conductive. The cable tray/protective casings should be tested in accordance with IEC 62631-3-1:2016 and IEC 62631-3-2:2015.	(b) The volume resistivity level of the cable trays/protective casings and fittings should be below $10^5\Omega$ and the surface resistivity should be below $10^6\Omega$ m. The resistance to earth from any point in these appliances should not exceed $10^6\Omega$.	<div>CHAPTER 3 TYPE APPROVAL</div> <div>Section 1 – 21 <same as the present Rules></div> <div>Section 22 Cable Laying</div> <div>2201. – 2202. <same as the present Rules></div> <div>2203. Type test</div> <div>1. – 3. <same as the present Rules></div> <div>Table 3.22.2 type tests for cable trays/protective casings made of plastics materials</div> <table><tr><th>Test item</th><th>Approval test method and acceptance criteria</th></tr><tr><td rowspan="4">Resistivity Test</td><td>Cable trays/protective casings of plastic materials passing through a hazardous area are to be complied with the following.</td></tr><tr><td>(a) They should <u>not</u> be electrically <u>non-conductive</u> and <u>should ensure satisfactory earthing between any point in these appliances and the ship's hull.</u> The cable tray/protective casings should be tested in accordance with IEC 62631-3-1:2016 and IEC 62631-3-2:2015.</td></tr><tr><td>(b) The volume resistivity level of the cable trays/protective casings and fittings should be below $10^5\Omega$m and the surface resistivity should be below $10^610^8\Omega$. The resistance to earth from any point in these appliances should not exceed $10^6\Omega$.</td></tr><tr><td>(c) <u>The cable tray/protective casings should be tested in accordance with IEC 62631-3-1:2016 and IEC 62631-3-2:2015.</u></td></tr></table>	Test item	Approval test method and acceptance criteria	Resistivity Test	Cable trays/protective casings of plastic materials passing through a hazardous area are to be complied with the following.	(a) They should <u>not</u> be electrically <u>non-conductive</u> and <u>should ensure satisfactory earthing between any point in these appliances and the ship's hull.</u> The cable tray/protective casings should be tested in accordance with IEC 62631-3-1:2016 and IEC 62631-3-2:2015.	(b) The volume resistivity level of the cable trays/protective casings and fittings should be below $10^5\Omega$ m and the surface resistivity should be below $10^610^8\Omega$. The resistance to earth from any point in these appliances should not exceed $10^6\Omega$.	(c) <u>The cable tray/protective casings should be tested in accordance with IEC 62631-3-1:2016 and IEC 62631-3-2:2015.</u>	<div>(Amended)</div> <div>- It has been amended surface resistivity for non-metal materials to apply to IACS Rec.73(Rev.2 Jan 2023).</div> <div>- The requirements have been amended for clarity.</div>
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Present	Amendment	Note
<p style="text-align: center;">Section 23 Automatic and Remote Control Systems</p> <p>2301. – 2303. <same as the present Rules></p> <p>2304. Type test</p> <p>1. Hardware</p> <p>(1) <same as the present Rules></p> <p>(2) Test methods and criteria</p> <p>(A) After the drawings and documents submitted in accordance with the requirements in 2302. have been examined, tests are to be carried out in accordance with the testing condition and method of Table 3.23.1 in the presence of the Society's surveyor, and they are to be proven to satisfy the criteria of Table 3.23.1.</p> <p>(B) – (D) <same as the present Rules></p> <p>2. – 3. <same as the present Rules></p> <p style="text-align: center;">Section 24 – 38 <same as the present Rules></p>	<p style="text-align: center;">Section 23 Automatic and Remote Control Systems</p> <p>2301. – 2303. <same as the present Rules></p> <p>2304. Type test</p> <p>1. Hardware</p> <p>(1) <same as the present Rules></p> <p>(2) Test methods and criteria</p> <p>(A) After the drawings and documents submitted in accordance with the requirements in 2302. have been examined, tests are to be carried out in accordance with the testing condition and method of Table 3.23.1 in the presence of the Society's surveyor, and they are to be proven to satisfy the criteria of Table 3.23.1.</p> <p>Table 3.23.1 <see the next page></p> <p>(B) – (D) <same as the present Rules></p> <p>2. – 3. <same as the present Rules></p> <p style="text-align: center;">Section 24 – 38 <same as the present Rules></p>	<p>(Amended)</p> <p>– It has been amended to apply to UR E10(Rev,9 Aug 2023).</p> <p>– Requirements for functional and performance tests have been aligned with both the Korean and English versions of the rules, as well as the unified requirements.</p>

⟨Amendments⟩

Table 3.23.1 Environmental Test Items, Testing Conditions and Methods, and Criteria (continued)

No.	Test item	testing condition and method	Criteria
1-5	⟨same as the present Rules⟩		
6	Dry heat test	⟨same as the present Rules⟩	<ul style="list-style-type: none"> · No abnormality is observed. · The equipment is comply with the requirements of performance test and functional test.
7	Damp heat test	⟨same as the present Rules⟩	<ul style="list-style-type: none"> · No abnormality is observed. · The equipment is comply with the requirements of performance test and functional test.
8	Vibration test	<p>⟨same as the present Rules⟩</p> <p>More severe conditions may exist for example <u>automatic and remote control systems installed</u> on exhaust manifolds or fuel oil injection systems of diesel engines. For equipment specified for increased vibration levels the vibration test is to be conducted at the agreed vibration level, frequency range and duration. Values may be required to be in these cases 40 Hz to 2000 Hz- acceleration $\pm 10.0 g$ at 600 °C duration 90 minutes.</p> <ul style="list-style-type: none"> · ⟨same as the present Rules⟩ 	<ul style="list-style-type: none"> · No abnormality is observed. · The equipment is comply with the requirements of performance test and functional test.
9-11	·⟨same as the present Rules⟩		

Table 3.23.1 Environmental Test Items, Testing Conditions and Methods, and Criteria (continued)

No.	Test item	Testing condition and method	Criteria
12	Cold test	<ul style="list-style-type: none"> The test shall be carried out at $25 \pm 10^\circ\text{C}$ in atmospheric temperature. The equipment is switched off except for the operation<u>functional</u> test and apply the environmental condition of $+5 \pm 3^\circ\text{C}$ for 2 hours. And functional test is to be carried out during the last hour at the test temperature and after recovery. For the equipment installed in open decks, etc., the environmental condition of $-25 \pm 3^\circ\text{C}$ is applied for 2 hours. Insulation resistance measurements are carried out before and after cold test. Detailed test methods are referred to Test Ab or Test Ad of IEC 60068-2-1:2007. <p>Fig 3.23.3 (same as the present Rules)</p>	<ul style="list-style-type: none"> No abnormality is observed. The equipment is comply with the requirements of <u>performance test</u> and functional test.
13	Salt mist ⁽²⁾ test	<ul style="list-style-type: none"> Salt mist test is to be carried out for equipment installed in weather exposed areas. The equipment is switched off except when its operation is checked. Apply four cycles of the environmental condition of spraying NaCl liquid (saline solution, 5 % NaCl, pH 6.5 ~ 7.2, $20 \pm 2^\circ\text{C}$) for 2 hours and leaving for 7 days. Check the operation of the equipment during the 7th day of each cycle and after recovery. Damp chamber conditions for storage are to be maintained as follows; <ul style="list-style-type: none"> Temp. : $40^\circ\text{C} \pm 2^\circ\text{C}$ Relative humidity : 93% +2% -3% The test is carried out according to the following procedure <ul style="list-style-type: none"> Insulation resistance and functional test before test Functional test on the 7th day of each cycle period Insulation resistance and functional<u>performance</u> test : 4 to 6 hours after recovery On completion of exposure, the equipment is to be examined to verify that deterioration or corrosion (if any) is superficial in nature. Detailed test methods are referred to Test Kb of IEC 60068-2-52:2017. 	<ul style="list-style-type: none"> No abnormality is observed. The equipment is comply with the requirements of performance test and functional test.
14	<p>〈same as the present Rules〉</p>		

Table 3.23.1 Environmental Test Items, Testing Conditions and Methods, and Criteria (continued)

No.	Test item	Testing condition and method	Criteria								
15	Electromagnetic field immunity test	<ul style="list-style-type: none">Check the operation of the equipment when the radiated radio frequency immunity test is carried out according to the following condition.	<ul style="list-style-type: none">Performance Criterion A(2)								
		<table><tr><td>Frequency range</td><td>80 MHz ~ 6 GHz</td></tr><tr><td>Modulation</td><td>80 % AM at 1,000 Hz</td></tr><tr><td>Field strength</td><td>10 V/m</td></tr><tr><td>Frequency sweep rate</td><td>$\leq 1.5 \times 10$ decades/sec. (or 1 %/3 sec.)</td></tr></table>		Frequency range	80 MHz ~ 6 GHz	Modulation	80 % AM at 1,000 Hz	Field strength	10 V/m	Frequency sweep rate	$\leq 1.5 \times 10$ decades/sec. (or 1 %/3 sec.)
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Frequency sweep rate	$\leq 1.5 \times 10$ decades/sec. (or 1 %/3 sec.)										
<ul style="list-style-type: none">If for tests of equipment an input signal with a modulation frequency of 1,000 Hz is necessary, a modulation frequency(80 % AM) of 400 Hz may be chosen.											
<ul style="list-style-type: none">The test is to be confined to the appliances exposed to direct radiation by transmitters at their place of installation.											
<ul style="list-style-type: none">If an equipment is intended to receive radio signals for the purpose of radio communication (e.g. wifi router, remote radio controller), then the immunity limits at its communication frequency do not apply, subject to the requirements in Pt 6, Ch 2, 406. 2-407. 2 (2) of Rules for the Classification of Steel Ships.											
		<ul style="list-style-type: none">Detailed test methods are referred to Test level 3 of IEC 61000-4-3:2020 or IEC 61000-4-3:2006+AMD1:2007+AMD2:2010.									
16-19	(same as the present Rules)										

Table 3.23.1 Environmental Test Items, Testing Conditions and Methods, and Criteria (continued)

No.	Test item	Testing condition and method	Criteria
20	Radiated emission test	<div><div><div><div><div><div></div><div></div></div><div><div></div><div></div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><di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Present	Amendment	Note
<p style="text-align: center;">Section 39 Electric Power Converters (2022)</p> <p>3901. <same as the present Rules></p> <p>3902. Type tests</p> <p>Type tests are to be carried out in accordance with <u>Table 3.39.1</u> or <u>Table 3.39.2</u> and supplementary tests may be required where deemed necessary by the Society. Type tests may be partly or wholly exempted, subject to the approval by the Society, in cases where the manufacturer submits the test reports issued by an authorized test laboratory in accordance with the standard approved by the Society.</p> <p style="text-align: center;">Section 40 <same as the present Rules></p>	<p style="text-align: center;">Section 39 Electric Power Converters (2022)</p> <p>3901. <same as the present Rules></p> <p>3902. Type tests</p> <p>Type tests are to be carried out in accordance with <u>Table 3.39.1</u>, or <u>Table 3.39.2</u> or <u>Table 3.39.3</u> and supplementary tests may be required where deemed necessary by the Society. Type tests may be partly or wholly exempted, subject to the approval by the Society, in cases where the manufacturer submits the test reports issued by an authorized test laboratory in accordance with the standard approved by the Society.</p> <p style="text-align: center;">Section 40 <same as the present Rules></p>	<p>(Amended)</p> <ul style="list-style-type: none"> - One of insulation resistance tests in Table 3.39.1 and 3.39.2 has been deleted to be complied with IEC 60146-1-1. - One of test method for the high voltage test in Table 3.39.1 and 3.39.2 has been deleted because the method is the same as IEC 61800-5-1. <p>(Newly added)</p> <ul style="list-style-type: none"> - Table 3.39.1 has been updated specifically for UPS and Table 3.39.3 for power supply converters has been newly added.

<Present>

Table 3.39.1 UPS/Electric power converters for power supply (2023)

No.	Test item	Test method	
1	Visual inspection	No.1	Table 3.23.1
2	Electrical power supply failure test	No.3	
3	Electrical power supply variation test	No.4	
4	Dry heat test	No.6	
5	Damp heat test	No.7	
6	Variation test	No.8	
7	Inclination test	No.9	
8	<u>Insulation resistance test²⁾</u>	<u>No.10</u>	
9	Cold test	No.12	
10	Electromagnetic compatibility(EMC) test	No.14~21	
11	High voltage test	IEC 61800-5-1, 5.2.3.2 ³⁾	
12	Insulation resistance test	IEC 60146-1-1, 7.2.3.1	
13	Temperature rise test	IEC 60146-1-1, 7.4.2	
14	Light load test / Functional test	IEC 62040-3, 6.2.2.3 & 60146-1-1	
15	<u>Input voltage and frequency tolerance test</u>	<u>IEC 62040-3, 6.4.1</u>	
16	<u>Short circuit test</u>	IEC 62040-3, 6.4.2.10	
17	<u>Full load test¹⁾</u>	IEC 62040-3, <u>6.4.3.1</u> & <u>6.4.3.2</u>	
18	<u>Dynamic performance test</u>	<u>IEC 62040-3, 6.4.3.3</u>	
19	<u>Stored and restored energy test¹⁾</u>	IEC 62040-3, <u>6.4.4</u>	
20	Capacitor discharge test	IEC 61800-5-1, <u>5.2.3.7</u>	
21	Cooling failure test	IEC 61800-5-1, <u>5.2.4.5</u>	
(Note)			
1) Only applicable for UPS.			
2) The test shall be carried out before and after both No.8 Damp heat test and No.9 Cold Test.			
3) Alternatively tests of IEC 60416-1-1, 7.2 or equivalent method may be accepted.			

〈Amendments〉

Table 3.39.1 UPS/Electric power converters for power supply (2024)

No.	Test item	Test method	
1	Visual inspection	No.1	Table 3.23.1
2	Electrical power supply failure test	No.3	
3	Electrical power supply variation test	No.4	
4	Dry heat test	No.6	
5	Damp heat test	No.7	
6	Variation test	No.8	
7	Inclination test	No.9	
8	Insulation resistance test ²⁾	No.10	
9 8	Cold test	No.12	
10 9	Electromagnetic compatibility(EMC) test	No.14~21	
11 10	High voltage test	IEC 61800-5-1, 5.2.3.2 ³⁾⁽¹⁾	
12 11	Insulation resistance test	IEC 60146-1-1, 7.2.3.1	
13 12	Temperature rise test	IEC 60146-1-1, 7.4.2	
14 13	Light load test / Functional test	IEC 62040-3, 6.2.2.3 & 60146-1-1	
15	Input voltage and frequency tolerance test	IEC 62040-3, 6.4.1	
16 14	Short-circuit Fault clearing capacity test	IEC 62040-3, 6.4.2.10 9.2	
17 15	Full-Load test ¹⁾	IEC 62040-3, 6.4.3.1 & 6.4.3.2 6.2.2.5, 6.4.2.2, 6.4.2.3 & 6.4.2.9.1	
18	Dynamic performance test	IEC 62040-3, 6.4.3.3	
19 16	Stored and restored energy test ¹⁾	IEC 62040-3, 6.4.4 3	
20 17	Capacitor discharge test	IEC 61800-5-1, 5.2.3.7 8	
21 18	Cooling failure test	IEC 61800-5-1, 5.2.4.5 13	
(Note)			
1) Only applicable for UPS.			
2) The test shall be carried out before and after both No.8 Damp heat test and No.9 Cold Test.			
3) (1) Alternatively tests of IEC 60416-1-1, 7.2 or equivalent method may be accepted.			

〈Present〉

Table 3.39.2 Electric power converters for essential motors (2023)

No.	Test item	Test method	
1	Visual inspection	No.1	Table 3.23.1
2	Electrical power supply failure test	No.3	
3	Electrical power supply variation test	No.4	
4	Dry heat test	No.6	
5	Damp heat test	No.7	
6	Variation test	No.8	
7	Inclination test	No.9	
<u>8</u>	<u>Insulation resistance test²⁾</u>	<u>No.10</u>	
<u>9</u>	Cold test	No.12	
<u>10</u>	Electromagnetic compatibility(EMC) test	No.14~21	
<u>11</u>	Impulse voltage test ¹⁾	IEC 61800-5-1, <u>5.2.3.1</u>	
<u>12</u>	High voltage test	IEC 61800-5-1, <u>5.2.3.2³⁾</u>	
<u>13</u>	Insulation resistance test	<u>IEC 60146-1-1, 7.2.3.1</u>	
<u>14</u>	Light load test / Functional test	<u>IEC 60146-1-1, 7.3.1 & 7.5</u>	
<u>15</u>	Rated current test	<u>IEC 60146-1-1, 7.3.2</u>	
<u>16</u>	Temperature rise test	IEC 60146-1-1, 7.4.2, IEC 61800-5-1, <u>5.2.3.8</u>	
<u>17</u>	<u>Safety requirements : Electric, Thermal and Energy</u>	<u>IEC 61800-5-1, 5</u>	
(Note)			
1) The tests shall be carried out if not meet the criteria given in Pt 6, from Table 6.1.20 to Table 6.1.22			
2) The test shall be carried out before and after both No.8 Damp heat test and No.9 Cold Test.			
3) Alternatively tests of IEC 60416-1-1, 7.2 or equivalent method may be accepted.			
3) <newly added>			

〈Amendments〉

Table 3.39.2 Electric power converters for essential motors (2024)

No.	Test item	Test method	
1	Visual inspection	No.1	Table 3.23.1
2	Electrical power supply failure test	No.3	
3	Electrical power supply variation test	No.4	
4	Dry heat test	No.6	
5	Damp heat test	No.7	
6	Variation test	No.8	
7	Inclination test	No.9	
8	Insulation resistance test²⁾	No.10	
9 8	Cold test	No.12	
10 9	Electromagnetic compatibility(EMC) test	No.14~21	
11 10	Impulse voltage test ¹⁾	IEC 61800-5-1, 5.2.3.4 <u>2⁽³⁾</u>	
12 11	High voltage test	IEC 61800-5-1, 5.2.3.2 ³⁾⁽²⁾ <u> </u>	
13 12	Insulation resistance test	IEC 60146-1-1, 7.2.3.1 ⁽³⁾ <u> </u>	
14 13	Light load test / Functional test	IEC 60146-1-1, 7.3.1 & 7.5 ⁽³⁾ <u> </u>	
15 14	Rated current test	IEC 60146-1-1, 7.3.2 ⁽³⁾ <u> </u>	
16 15	Temperature rise test	IEC 60146-1-1, 7.4.2, IEC 61800-5-1, 5.2.3.8 <u>10⁽³⁾</u>	
17	Safety requirements : Electric, Thermal and Energy	IEC 61800-5-1, 5	
(Note)			
(1) The tests shall be carried out if not meet the criteria given in Pt 6, from Table 6.1.20 to Table 6.1.22			
2) The test shall be carried out before and after both No.8 Damp heat test and No.9 Cold Test.			
3) (2) Alternatively tests of IEC 60416-1-1, 7.2 or equivalent method may be accepted.			
(3) Alternatively tests of IEC 62447 or equivalent method may be accepted.			

〈Newly added〉

Table 3.39.3 Electric power converters for power supply (2024)

No.	Test item	Test method	
1	Visual inspection ⁽⁶⁾	No.1	Table 3.23.1
2	Electrical power supply failure test	No.3	
3	Electrical power supply variation test ⁽¹⁾⁽³⁾	No.4	
4	Dry heat test	No.6	
5	Damp heat test	No.7	
6	Variation test	No.8	
7	Inclination test	No.9	
8	Cold test	No.12	
9	Electromagnetic compatibility(EMC) test	No.14~21	
10	High voltage test ⁽³⁾	IEC 60146-1-1, 7.2	
11	Insulation resistance test ⁽²⁾⁽³⁾	IEC 60146-1-1, 7.2.3.1	
12	Temperature rise test ⁽⁶⁾	IEC 60146-1-1, 7.4.2	
13	Light load test / Functional test	a) IEC 60146-1-1, 7.3.1 and 7.5 b) specification c) Emergency shutdown and restart	
14	Short circuit test ⁽³⁾⁽⁴⁾	The test is to be carried out at light load (e.g., 10%). The short circuit is through suitable fuses or breakers that meet the manufacturer's or supplier's specification for fault clearing in the event of short circuit.	
15	Full load test ⁽³⁾⁽⁵⁾	Measure output of voltage and frequency at rated output	
16	Capacitor discharge test ⁽⁶⁾	IEC 61800-5-1, 5.2.3.8	
17	Cooling failure test ⁽⁶⁾	IEC 61800-5-1, 5.2.4.13	
(Note)			
1) Only applicable for UPS.			
2) The test shall be carried out before and after both No.8 Damp heat test and No.9 Cold Test.			
3) Alternatively tests of IEC 60416-1-1, 7.2 or equivalent method may be accepted.			