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## HMN-005 Insert Series

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## 1. SCOPE

### 1.1. Content

This specification covers the performance, tests and quality standards for the contact inserts of heavy duty connector series **HMN-005-MS/FS**. The contact inserts are available for positions number 5. The termination conductor-contact insert is affected via a spring clamp contact which is integrate into the contact insert.

The contact insert is designed for conductors of 0.5 mm<sup>2</sup> up to 2.5 mm<sup>2</sup>.

### 1.2. Qualification

When tests are performed, the following specified specifications and standards shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

## 2. APPLICABLE DOCUMENTS

The following documents form part of this specification to the extent specified herein. In the case of a conflict between the requirements of this specification and the product drawing or of conflicts between the requirements of this specification and the referenced documents, this specification shall take precedence.

### 2.1. TE Connectivity Documents

- A. Customer drawing and name  
HMN-005 insert series

### 2.2. Other Documents

- EN 61984: Connectors - Safety requirements and tests
- IEC 60068: Environmental testing
- IEC 60512: Connectors for electronic equipment -Test and measurements
- IEC 60529: Degrees of Protection Provided by Enclosures (IP Code)
- IEC 60664-1: Insulation coordination for equipment within low-voltage systems (Part 1)
- EN 61373: Railway application - Rolling stock equipment - Shock and vibration test
- ISO 6988: Metallic and other non-organic coatings - Sulfur dioxide test with general condensation of moisture



### 3. REQUIREMENTS

#### 3.1. Design and Construction

Product shall be of the design, construction and physical dimensions specified on the applicable product drawing.

#### 3.2. Materials

Materials used in the construction of this product shall be as specified on the applicable product drawing.

#### 3.3. Rated

- Rated Current / Voltage / Impulse Voltage / Pollution Degree  
**16A 400V 6KV 3**
- Operation Temperature -40°C ~+125°C
- Degree of Protection IP20
- Protection Class II
- Overvoltage Category III

#### 3.4. Performance and Test Description

Product shall be designed to meet the electrical, mechanical and environmental performance requirements specified in Paragraph 3.5. Unless otherwise specified, all tests shall be performed at ambient environmental conditions per IEC 60512 / EN 61984.

#### 3.5. Test Requirements and Procedures Summary

| General |                                    |                                       |   |
|---------|------------------------------------|---------------------------------------|---|
| No.     | Test Items                         | Requirements                          | Condition according to  |
| 3.5.1   | Visual and dimensional examination | Meets requirements of product drawing | Visual and dimensional examination<br>IEC 60512-1-1/-2, Test 1a and 1b<br>6.2 of EN 61984 |

| Mechanical |                       |  |   |
|------------|-----------------------|--|---|
| 3.5.2      | Durability of marking | Marking shall be still readable according to 6.2 of EN61984 (If marking made by impression, molding, pressing or engraving or the like are not subjected to this test) | Test piston: Size 1<br>Wet test with liquid: water<br>Duration: 10 cycles<br>Force:5N<br>IEC 60068-2-70 Test Xb<br>7.3.2 of EN61984 |



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|       |   |   |  |
|-------|---|---|--|
| 3.5.3 | Polarisation and coding                   | For multi-pole connector, require provision against incorrect mating according to 6.3 & 6.9.1 of EN 61984<br>No damage likely to impair function                              | For unenclosed connector (internal connections) 20N<br>For enclosed connector (external connections) 1.5 x Mating force, but not higher than 80N<br>Test 13e of IEC 60512-13-5   |
| 3.5.4 | Pull out force of terminations            | See 6.6 of EN 61984   | See 6.6 of EN 61984  |
|       | <sup>a</sup> for spring clamp connections | The conductor of the smallest and largest cross-sectional area shall not slip out of the clamping unit, and pull out force as specified in Table 3 IEC 60999-1 or IEC 60999-2 | Mechanical tests on the conductor connection as specified in 9.3-9.5 of IEC 60999-1 or IEC 60999-2 or IEC 60352-7  |
| 3.5.5 | Contact retention force in insert         | No axial displacement likely to impair normal operation, min 50N force for each pin or socket<br>6.18.2 of EN 61984   | Test load applied in axial direction, test speed:20mm/min, permissible shift contacts of 1.0mm,<br>Test 15a of IEC 60512-15-1  |
| 3.5.6 | Mechanical strength impact                | Connector and internal insulation shall no damage to impair normal use. A reduction of clearance and creepage distance is not allowed.<br>6.18.1 & 6.18.3 of EN 61984         | Dropping height:<br>- 750mm for specimens of mass ≤ 250g<br>- 500mm for specimens of mass >250g<br>Dropping cycles:8<br>positions in 45° step, one cycles per position<br>IEC 60512-7-2 Test 7b  |
| 3.5.7 | Mechanical Operation (Durability)         | 500 operation cycles without load<br>No damage likely to impair normal use<br>6.14.1 of EN 61984  | Shall be engaged and disengaged by means of<br>A) a device simulating normal operating conditions at the speed of approximately 50mm/min<br>B) manual mating/un-mating 300 Max. cycle per hour<br>IEC 60512-9-1 Test 9a<br>7.3.9 of EN 61984 |
| 3.5.8 | Vibration, Random                         | No damage likely to impair function<br>No discontinuities greater than $t > 1\mu s$   | Frequency:5~150Hz<br>Per EN 61373, Category 1, Class B (IEC60068-2-6 Test Fc)  |
| 3.5.9 | Shock                                     | No damage likely to impair function<br>No discontinuities greater than $t > 1\mu s$   | Acceleration:50m/s <sup>2</sup><br>Duration:30ms<br>Total 18 shocks(three positive and three negative in each of the three orthogonal axes)<br>Per EN 61373  |



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| <b>Electrical</b> |                                   |   |   |  |
|-------------------|-----------------------------------|---|---|--|
| 3.5.10            | Contact Resistance                | Initial   | Max.5 mΩ  | Test current: 1A<br>Measure points <sup>b</sup> at the end of the termination<br>Max three contacts per specimen plus protective earthing, if any<br>IEC 60512-2-2 Test 2b |
|                   |                                   | Final   | The change of contact resistance shall be no more than 50 % of the reference value or ≤5 mΩ.<br>The higher value is permissible |  |
| 3.5.11            | Temperature Rise Test             | The sum of the ambient temperature and the temperature rise ( $\Delta T$ ) of a connector shall not exceed the upper limiting temperature<br>6.16 of EN 61984 |   | Length of test cable see table 7 of 7.3.8 of EN 61984<br>Carry its rated current<br>Upper limiting temperature:125°C<br>(Table 5b) IEC 60512-5-1 Test 5a                   |
| 3.5.12            | Dielectric Voltage Withstand Test | No flashover or breakdown of voltage<br>6.13 of EN 61984  |   | Impulse test voltage according to Table 8, applied three impulses of each polarity and interval of at least 1s between impulses.<br>7.3.12 of EN 61984                     |
| 3.5.13            | Insulation Resistance             | Not less than 400MΩ   |   | Test voltage 1000V DC<br>Time:60s<br>IEC 60512-3-1 Test 3a Method B  |

| <b>Environmental</b> |   |                                     |  |  |
|----------------------|---|-------------------------------------|--|--|
| 3.5.14               | Cold  | No damage likely to impair function |  | Subject mated specimen to -40°C<br>Duration time:16h, Test Ab<br>Per IEC 60512-11-10 Test 11j<br>(IEC 60068-2-1)   |
| 3.5.15               | Dry Heat  | No damage likely to impair function |  | Subject mated specimen to +125°C<br>Duration time:168h Test Bb<br>Per IEC 60512-11-9 Test 11i<br>(IEC 60068-2-2)   |
| 3.5.16               | Damp Heat, cyclic                               | No damage likely to impair function |  | Subject mated specimen to<br>Min ambient temperature: 25°C<br>Max ambient temperature: 45°C<br>Number of cycles:21<br>Duration time:12h+12h<br>Variant 1<br>IEC 60512-11-12 Test 11m |
| 3.5.17               | Rapid Change of temperature (Temperature Cycle) | No damage likely to impair function |  | Subject mated specimen to<br>Ta=-40±2°C to Tb=+125±2°C,<br>duration t1: 1h each extreme,<br>100 cycles<br>IEC 60512-11-4 Test 11d<br>(IEC 60068-2-14 Test Na)                        |



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|   |                                   |  |  |
|---|-----------------------------------|--|--|
| 3.5.18  | Corrosion (Alternative)           | No damage likely to impair function<br>Per 6.21 of EN 61984                      | Test 1: Flowing mixed gas corrosion according to test 11g, method 1 or method 4 (Table 1)<br>Duration time: 4day (96h)<br>IEC 60512-11-7 Test 11g<br>7.3.14 of EN 61984                              |
|   |                                   |  | Test 2: Sulphur dioxide test with general condensation of moisture according to EN ISO 6988<br>Duration time:24h (1 test cycle)<br>7.3.14 of EN 61984  |
| 3.5.19  | Protection against electric shock | no live parts shall be accessible by test finger, 6.4.2.2 or 6.4.2.3 of EN 61984 | Unenclosed connector. Test finger or 50mm sphere pressed with 20N against the surface as specified by the manufacture<br>Mated specimen and socket connector (if application)<br>7.3.6.1 of EN 61984 |
| <p><sup>a</sup> test items are for themselves separate tests and are performed on new specimens.<br/> <sup>b</sup> measuring point: at the conductors as close as possible to the termination, if this is not possible, the conductor resistance shall be recalculated.</p> |                                   |  |  |

Number of Specimen as below table 1:

| Table 1 - Number of Specimen  |                              |   |
|---|------------------------------|---|
| Test  | Description                  | Numbers & consist of                              |
| Group A   | Mechanical Test              | 3 pairs connectors                                |
| Group B   | Service life Test            | 3 pairs connectors                                |
| Group C   | Temperature rise Test, Mated | 3 pairs connectors                                |
| Group D   | Climatic Test, Mated         | 3 pairs connectors                                |
| Group E   | Degree of protection Test    | 3 pairs connectors                                |
| Group F   | Temperature Cycle Test       | 3 pairs connectors                                |
| Group G   | Vibration and Shock Test     | 3 pairs connectors (assemble with Hood & Housing) |
| <p>Note: For connector family of the same design and comparable size, test may be made only on that member of the family which represents the worse case for that test.</p> |                              |   |



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## 3.6. Test Sequences

| Test or Examination   | Test Group     |     |     |      |     |     |     |
|---|----------------|-----|-----|------|-----|-----|-----|
|   | A              | B   | C   | D    | E   | F   | G   |
|   | Test Sequence  |     |     |      |     |     |     |
| Visual and dimensional examination                                  | 1,6            | 1,5 | 1,3 | 1,11 | 1,3 | 1,8 | 1,6 |
| Durability of marking   | 2              |     |     |      |     |     |     |
| Polarisation and coding<br>(If application)                         | 3              |     |     |      |     |     |     |
| Pull out force of terminations<br>Only for spring clamp connections | 7 <sup>a</sup> |     |     |      |     |     |     |
| Contact retention force in insert                                   | 4              |     |     |      |     |     |     |
| Mechanical strength impact  | 5              |     |     |      |     |     |     |
| Mechanical Operation (Durability)                                   |                | 3   |     |      |     |     |     |
| Vibration, Random   |                |     |     |      |     |     | 3   |
| Shock   |                |     |     |      |     |     | 4   |
| Contact Resistance  |                | 2,4 |     | 2,8  |     | 2,5 | 2,5 |
| Temperature Rise Test   |                |     | 2   |      |     |     |     |
| Dielectric Voltage Withstand Test                                   |                |     |     | 3,9  |     | 6   |     |
| Insulation Resistance   |                |     |     | 4,10 |     | 7   |     |
| Cold  |                |     |     | 5    |     |     |     |
| Dry Heat  |                |     |     | 6    |     |     |     |
| Damp Heat, cyclic   |                |     |     |      |     | 4   |     |
| Rapid Change of temperature (Temperature Cycle)                     |                |     |     |      |     | 3   |     |
| Corrosion   |                |     |     | 7    |     |     |     |
| Protection against electric shock                                   |                |     |     |      | 2   |     |     |

**Notes:**

- 1) Numbers indicate the sequence in which the tests are performed.
- 2) <sup>a</sup> test items are for themselves separate tests and are performed on new specimens.



## 4. QUALITY ASSURANCE PROVISIONS

### 4.1. Qualification Testing

#### A. Specimen Selection

Specimens shall be prepared in accordance with applicable Instruction Sheets and shall be selected at random from current production.

#### B. Test Sequence

Specimens shall be tested in accordance with the paragraph 3.6 test sequence.

### 4.2. Requalification Testing

If changes significantly affecting form, fit or functions are made to the product or manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by development/product, quality and reliability engineering.

### 4.3. Acceptance

Acceptance is based on verification that the product meets the requirements of paragraph 3.5. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken and specimens resubmitted for qualification. Testing to confirm corrective action is required before re-submittal.

### 4.4. Quality Conformance Inspection

The applicable quality inspection plan shall specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification. Bulk wire resistance shall be subtracted from resistance readings.