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International Standard



5065/2

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**Aircraft — Magnetic indicators —  
Part 2 : Tests**

*Aéronefs — Indicateurs magnétiques — Partie 2: Essais*

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## Foreword

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# Aircraft — Magnetic indicators — Part 2 : Tests

## 1 Scope and field of application

This part of ISO 5065 specifies the test procedures and performance requirements for the characteristics of aircraft magnetic indicators specified in ISO 5065/1 and shall be read in conjunction with it.

## 2 References

ISO 2669, *Environmental tests for aircraft equipment — Steady state acceleration.*

ISO 2678, *Environmental tests for aircraft equipment — Insulation resistance and high voltage tests for electrical equipment.*

ISO 5065/1, *Aircraft — Magnetic indicators — Part 1: Characteristics.*

ISO 7137, *Aircraft — Environmental conditions and test procedures for airborne equipment.*<sup>1)</sup>

## 3 Test details

The tests and performance requirements shall comply with the details given in the table on the following pages.

1) Endorsement, in part, of the publication EUROCAE ED-14A/RTCA DO-160A (a document published jointly by the European Organisation for Civil Aviation Electronics and the Radio Technical Commission for Aeronautics).

Test No.	Title of test	Test procedure	Test results required								
1	<b>Contact insertion force</b>	<p>Carry out the test individually on each contact.</p> <p>Insert the contact using the appropriate insertion tool until the locking system operates.</p> <p>Check that the contact is effectively locked by applying to the cable a slight tensile force which is less than that specified for the contact retention test.</p>	<p>The insertion force shall not be greater than the following values:</p> <table border="1"> <thead> <tr> <th rowspan="2">Contact size</th> <th colspan="2">Insertion force</th> </tr> <tr> <th>N</th> <th>lbf</th> </tr> </thead> <tbody> <tr> <td>20</td> <td>45</td> <td>10</td> </tr> </tbody> </table>	Contact size	Insertion force		N	lbf	20	45	10
Contact size	Insertion force										
	N	lbf									
20	45	10									
2	<b>Contact extraction force and mechanical endurance</b>	<p>Carry out the test individually on each contact.</p> <p>Extract the contact using the appropriate extractor tool. For this, introduce the tool until the system of unlocking operates, then, while keeping the axial alignment, apply a sufficient force to the cable to extract the contact. Using the appropriate insertion tool, insert the contact until the locking system operates. These two operations make up one cycle.</p> <p>Carry out ten cycles on two contacts chosen from those which are the closest to each other on each specimen.</p> <p>Measure the extraction force during the first and final cycles.</p>	<p>The extraction force shall not be greater than the following values:</p> <table border="1"> <thead> <tr> <th rowspan="2">Contact size</th> <th colspan="2">Extraction force</th> </tr> <tr> <th>N</th> <th>lbf</th> </tr> </thead> <tbody> <tr> <td>20</td> <td>45</td> <td>10</td> </tr> </tbody> </table>	Contact size	Extraction force		N	lbf	20	45	10
Contact size	Extraction force										
	N	lbf									
20	45	10									
3	<b>Contact retention in the insert</b>	<p>Carry out the test individually on each contact.</p> <p>Introduce the contact using the appropriate insertion tool until the locking system operates. Having withdrawn the tool, check by exerting a slight tensile force that the contact is really locked.</p> <p>Apply to the contact, using approved devices, an axial force of increasing intensity, the rate of variation of which shall be less than 5 N/s. Apply the final load, which is given below, for 5 s.</p> <table border="1"> <thead> <tr> <th rowspan="2">Contact size</th> <th colspan="2">Final load</th> </tr> <tr> <th>N</th> <th>lbf</th> </tr> </thead> <tbody> <tr> <td>20</td> <td>90</td> <td>20</td> </tr> </tbody> </table>	Contact size	Final load		N	lbf	20	90	20	<p>There shall be no deterioration of either the insert or the contact. The movement of the contact shall be less than 0,3 mm.</p>
Contact size	Final load										
	N	lbf									
20	90	20									
4	<b>Supply voltage and current consumption</b>	<p>Carry out the test at ambient temperature.</p>									
4a	<b>Coils (Category 1)</b>	<p>Measure the current consumption of the coils at <math>\leq 0,045</math> A. Measurement shall be made after 1 min under a continuous voltage of 28 V.</p>	<p>The magnetic indicator shall operate fully.</p>								
4b	<b>Coils (Category 2)</b>	<p>Measure the current consumption of the coils at <math>\leq 0,030</math> A. Measurement shall be made after 1 min under a continuous voltage of 28 V.</p>	<p>The magnetic indicator shall operate fully.</p>								
4c	<b>Drop-out voltage</b>	<p>The mobile sector shall return to its datum position before a decreasing supply voltage falls below 3 V.</p>									

Test No.	Title of test	Test procedure	Test results required
4d	<b>Lamps</b>	Measure lamp currents, as follows: <ul style="list-style-type: none"> <li>— at <math>0,120 \pm 0,018</math> A for two lamps using a voltage of 5 V;</li> <li>— at <math>0,020 \pm 0,003</math> A for one lamp using a voltage of 28 V.</li> </ul>	The lamps operate satisfactorily if they are as specified by the manufacturer.
5	<b>Insulation resistance</b>	Submit the magnetic indicators to an insulation resistance test as specified in ISO 2678.	Minimum values shall be in accordance with table 2 of ISO 2678.
6	<b>Thermal shock</b>	<p>Submit the magnetic indicator to the following thermal shock treatment.</p> <p>Two chambers are required for this test, one at low temperature, the other at high temperature. Transfer the magnetic indicator from one chamber to the other as quickly as possible within a time not exceeding 1 min. During the transfer operation the temperatures of the chambers shall be held to within 5 °C of the values specified.</p> <p>Submit the indicators to the three cycles shown in the following diagram. At the end of each cycle, operate the magnetic indicator using the specified minimum operating voltage. If lamps are fitted, energize at the rated voltage.</p>	<p>There shall be no visible sign of mechanical deterioration. The magnetic indicators shall operate normally and there shall be no appreciable change in the minimum supply voltages.</p>
7	<b>Low and high temperature operation</b>	<p>Submit the magnetic indicators to the following tests to examine their operation at extreme temperatures of <math>-40</math> °C and <math>+90</math> °C.</p> <p>Place the specimens in a chamber in which the low temperature is maintained at <math>-40 \pm 2</math> °C. Keep the specimens at this temperature for 2 h with the coils and lamps un-energized.</p>	

Test No.	Title of test	Test procedure	Test results required
7	<b>Low and high temperature operation</b> <i>(concluded)</i>	<p>Then place the specimens in a chamber and repeat the test at the high temperature maintained at <math>+ 90 \pm 2</math> °C. Keep the specimens at this temperature for 2 h with the lamps on throughout. Then check operation.</p> <p>Examine every display position.</p> <p>Repeat a low voltage drop-out test at extreme temperature ensuring that the mobile sector returns to its datum position before a decreasing supply voltage falls below 1 V.</p>	<p>Mobile sectors shall move positively, accurately and without excessive overshoot upon application of the specified minimum supply voltage.</p>
8	<b>Extreme storage temperature</b>	<p>Store the magnetic indicators in the unenergized condition at the following temperatures:</p> <ul style="list-style-type: none"> <li>— cold: <math>- 50</math> °C for 2 h;</li> <li>— hot: <math>- 110</math> °C for 2 h.</li> </ul> <p>After the magnetic indicators have been exposed to these conditions and allowed to revert to ambient temperature, carry out a visual examination and a functional test of the magnetic indicators.</p> <p>Carry out an insulation resistance test (see test No. 5).</p>	<p>The indicators shall operate satisfactorily and suffer no visible deterioration.</p>
9	<b>Damp heat (humidity)</b>	<p>Submit the specimens to a damp heat (humidity) test as specified in 6.3.2 of ISO 7137, category B.</p> <p>Test duration: 240 h, comprising 10 cycles each lasting 24 h</p> <p>Check the performance of the magnetic indicators at the end of each 24 h period in accordance with step 5 specified in 6.3.2 of ISO 7137.</p> <p>Carry out an insulation resistance test (see test No. 5).</p>	<p>Examine for any trace of corrosion and any deterioration resulting from the test.</p>
10	<b>Salt spray</b>	<p>Submit the specimens to a salt spray test in accordance with clause 14 of ISO 7137.</p> <p>Test duration: 48 h</p> <p>After the magnetic indicators have been exposed to these conditions, carry out a visual examination and a functional test of the magnetic indicators.</p>	<p>The magnetic indicators shall work normally and there shall be no visible corrosion or damage sufficient to impair their use.</p>
11	<b>Life</b>	<p>Unless otherwise stated, carry out the test at an ambient temperature of between <math>+ 15</math> °C and <math>+ 35</math> °C.</p> <p>During the test, mount the magnetic indicators as follows:</p> <ul style="list-style-type: none"> <li>— horizontally for 40 % of operations;</li> <li>— on one side for 20 % of operations;</li> <li>— face down for 20 % of operations;</li> </ul>	

Test No.	Title of test	Test procedure	Test results required
11	<b>Life</b> ( <i>concluded</i> )	<ul style="list-style-type: none"> <li>— horizontally and at + 90 °C for 10 % of operations;</li> <li>— horizontally and at – 40 °C for 10 % of operations.</li> </ul> <p>Subject each control input of each magnetic indicator in the sample to <math>1 \times 10^6</math> operations. An operation is defined as "OFF"- "ON"- "OFF" with a duration of between 0,5 and 1 s.</p> <p>The supply voltage shall be 28 V d.c. Throughout the test, lamps (if fitted) shall be on.</p> <p>On completion of life testing, test for insulation resistance (see test No. 5).</p>	At the end of the test, the magnetic indicators shall work normally.
12	<b>Acceleration</b>	<p>Submit the magnetic indicators to steady-state acceleration tests as specified in ISO 2669 in the following test conditions:</p> <ul style="list-style-type: none"> <li>— for functioning test: severity grade 3;</li> <li>— for structural integrity test: severity grade 3 with operational requirements as specified for equipment category A.</li> </ul> <p>Values apply to the three axes (six attitudes).</p> <p>Visually inspect the specimens at the end of the tests.</p> <p>Operate the magnetic indicators and carry out a functional control.</p>	<p>No deterioration shall be observed. The magnetic indicators shall work normally.</p> <p>The magnetic indicators shall show no malfunction while the acceleration forces are being applied.</p>
13	<b>Vibration</b>	<p>Submit the magnetic indicators to vibration tests as specified in ISO 7137.</p> <p>Carry out the tests in the three trirectangular axes of the specimens and in accordance with test procedures laid down in 8.3 and 8.4 of ISO 7137.</p> <p>Test severity: O or B</p> <p>Test duration for each axis: 3 h</p> <p>Examine and check whether the indicators are operating correctly during the vibration tests.</p> <p>In order to take into account the most usual conditions, maintain the magnetic indicators in the "working" position for 50 % of the total time of the tests.</p> <p>At the end of the tests, carry out a visual and operational check of the magnetic indicators.</p>	No damage shall be observed. The magnetic indicators shall work normally.
14	<b>Mechanical shock</b>	<p>Submit the magnetic indicators to a shock test as specified in 7.1.1. of ISO 7137.</p> <p>The impulse shall be half-sine wave and <math>11 \pm 2</math> ms long with the maximum acceleration occurring at about 5,5 ms. The transmitted shock is 15g.</p>	

Test No.	Title of test	Test procedure	Test results required
14	<b>Mechanical shock</b> <i>(concluded)</i>	<p>The complete test includes 18 shocks, i.e. three shocks in each of the six directions defined by a trirectangular reference system established according to the equipment.</p> <p>At the end of the test, carry out a visual and operational check of the magnetic indicators.</p> <p>Carry out an insulation resistance test (see test No. 5)</p>	No damage shall be observed. The magnetic indicators shall work normally.
15	<b>Magnetic effect</b>	Submit the magnetic indicators to a magnetic effect test as specified in clause 15 of ISO 7137 for class A equipment.	The compass safe distance shall not exceed 305 mm.
16	<b>Luminance</b>	<p>Submit the magnetic indicators to a luminance test in the conditions specified below.</p> <p>Supply each specimen at the rated voltage <math>\pm 1\%</math>.</p> <p>The display being tested shall have equal black and white areas arranged to allow the luminance of each to be measured by taking three readings in the white areas. The measurements shall be taken using a suitable photometer.</p> <p>Three luminance measurements are taken:</p> <ul style="list-style-type: none"> <li>— one at the centre</li> <li>— the two others at each end of the lighted sector in the length direction.</li> </ul> <p>Each time the luminance measured corresponds to a surface area of approximately <math>1\text{ mm}^2</math>.</p>	<p>The luminance values shall be between 17 and <math>40\text{ cd/m}^2</math> for white areas and not more than <math>0,34\text{ cd/m}^2</math> for the black areas.</p> <p>NOTE — Areas of the display coloured other than black or white can be expected to have luminance values between the above specified limit for black and white areas.</p>
17	<b>Temperature and altitude</b>	<p>Follow the same test procedure as specified for test No. 7 except for the following conditions:</p> <ul style="list-style-type: none"> <li>— a temperature of <math>-40 \pm 2\text{ }^\circ\text{C}</math> and a pressure equivalent to an altitude of 21 336 m;</li> <li>— a temperature of <math>+90 \pm 2\text{ }^\circ\text{C}</math> and a pressure equivalent to an altitude of 21 336 m.</li> </ul>	
18	<b>Resistance to fluids</b>	<p>After degreasing, place the equipment in a chamber in which the temperature has been maintained at <math>50 \pm 2\text{ }^\circ\text{C}</math>. Spray the equipment constantly with fluid and maintain these conditions for 7 days.</p> <p>NOTE — This temperature exceeds the critical flash point temperature. Testing should always be performed in a suitable pressure vessel.</p> <p>The fluids used shall be the fluids used to clean aircraft dashboards (alcohol and detergent), but excluding all aircraft circuit fluids themselves (fuel, oil, lubricant, etc.).</p> <p>At the end of the test, carry out a running test under extreme voltages at ambient temperature.</p>	

Test No.	Title of test	Test procedure	Test results required
19	<b>Fungus resistance</b>	Subject the magnetic indicators to a fungus resistance test, for category F equipment, as specified in clause 13 of ISO 7137.	
20	<b>Drip test</b>	<p>Use a vessel in which 20 equidistant holes (25 mm) have been drilled in the bottom over a 125 mm × 100 mm rectangle. Adjust the dripping water flow rate to produce an hourly water height of at least 340 mm. Place the specimen 1 m below the vessel with the longitudinal axis of the specimen horizontal.</p> <p>Test duration: 15 min</p> <p>At the end of the test, carry out a running test at extreme voltages.</p>	
21	<b>Sand and dust</b>	<p>NOTE — This test is compulsory only when the manufacturer claims that the product is suitable for special use conditions in places where it will be exposed to sand and dust.</p> <p>Submit the magnetic indicators to the sand and dust test as as specified in clause 12 of ISO 7137.</p> <p>At the end of the exposure period, take the specimen out of the chamber and bring back to the laboratory temperature.</p> <p>Remove collected dust by brushing, wiping or shaking, taking care to prevent extra dust from getting into the equipment during this operation. Never remove dust by suction or blowing.</p> <p>Carry out a visual and operational check of the indicator at the end of the test.</p>	No damage shall be observed. The magnetic indicator shall work normally.