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Revision OIML R 85

Automatic level gauges for measuring the level of liquid in stationary storage tanks

Part 2: Metrological Control and tests

TITLE OF THE CD (French):

Révision OIML R 85

Jaugeurs automatiques pour le mesurage des niveaux de liquide dans les réservoirs de
stockage fixes**Partie 2: Contrôles métrologiques et essais**

Original version in: English

Gelöscht: - -- Seitenumbruch - --

Part 2**Marked version**

Explanatory note

[Will be deleted in the final text]

For the explanatory notes concerning the previous drafts, please refer to the “Explanatory notes” in 4 CD R 85-1.

During the meeting of TC8/SC1 in March 2007 in Vienna, the draft was discussed and several changes were agreed. These changes have been effected in the next version..

In May 2007 the next draft was circulated among the members of TC8/SC1/WG2 and the convener of WG2 only received remarks from Messrs Hagg and Sochor, and he also had some remarks himself.

This resulted in this 4 CD. In the marked version, the changes compared to the 3 CD are indicated.

For practical reasons, this 4CD has been split in 3 separate drafts: a separate draft for each of the Parts. This has an extra advantage that each of these 3 Parts can be voted on as soon as this is appropriate.

In this stage, Parts 2 and 3 do not have a separate numbering of their own, as the way this shall be solved will depend on the final way of publication: in one “booklet” (file), or split in 2 or 3. This is an editorial / lay-out item to be decided by BIML together with the secretary at the last moment.

In all the previous versions of the draft, a first start for Part 3 (Test Report Format) was included with a remark “To be completed after Part 2 is (almost) ready.” So up to now, there were neither remarks nor discussions concerning this Part 3.

In the opinion of the convener, the time has come now to proceed with Part 3. And a fully revised version is included in a separate file. As from now on, Part 3 will be under discussion, this is called “1 CD R-85-3”.

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Foreword

To be added by BIML.

(See also the foreword in 4 CD R 85-1)

PART 2 Metrological controls and tests

8 Metrological controls

8.1 Type evaluation

8.1.1 Number of units submitted to type test

The applicant for the type test shall supply at least one production sample of the instrument for type testing.

In case the applicant wants to have approved several versions or measuring ranges, the national metrological service or related organisation decides which version(s) and range(s) shall be supplied.

Several tests can be carried out in parallel on different specimen. In this case, the national metrological service or related organisation decides which version or measuring range will be subjected to a specific test.

If a specimen does not pass a specific test and as a result, it has to be modified or repaired, the applicant shall carry out this modification to all the instruments supplied for test. If the testing laboratory has sound reasons to fear that the modification has negative influence on tests that already had a positive result, these tests shall be repeated.

8.1.2 Documentation

Gelöscht:

The documentation submitted with the application for type approval shall include:

- (a) A list of the electronic sub-assemblies with their essential characteristics;
- (b) A description of the electronic devices with drawings, diagrams and general software information explaining their characteristics and operation;
- (c) Mechanical drawings;
- (d) Installation and security sealing plan;
- (e) Operating instructions;
- (f) Test outputs, their use, and their relationships to the parameters being measured; and
- (g) Documentation or other evidence that supports the assumption that the design and characteristics of the measuring instrument comply with the requirements of this Recommendation.

8.1.3 Equipment under test (EUT)

Gelöscht:

As a rule, tests will be carried out on the complete automatic level gauge.

Simulation of any part of the automatic level gauge tested should be avoided. If this is not possible, all parts of the automatic level gauge that can be affected by the influence factor or disturbance shall play an active role in the measurements.

If the size or configuration of the automatic level gauge does not lend itself to testing as a whole unit, or if only a separate device of the measuring instrument is concerned, the tests, or certain tests, shall be carried out on the devices (modules) separately, provided that, in case of tests with the devices in operation, these devices are included in a simulated set-up, sufficiently representative of its normal operation.

Note: As a general rule, the dismantling of the automatic level gauge or devices for the tests is not intended.

8.1.4 Reference conditions

Except for the parameter being tested, the following reference conditions shall be kept by the testing laboratory during the tests:

	Influence	Value
a)	Temperature	20 °C ± 5 °C
b)	Relative humidity	< 85 %
c)	DC mains voltage (*)	Less than 10 % of the variation specified by the manufacturer of the EUT
d)	AC mains voltage (*)	$U_{\text{nom}} \pm 1 \%$
e)	AC mains frequency (*)	$f_{\text{nom}} \pm 0,5 \%$
(*) whatever is applicable		

Gelöscht: H

Gelöscht: RH

Tests are carried out under atmospheric pressure

8.1.5 Tests under reference conditions

Gelöscht: 4.1

8.1.5.1 General

Gelöscht: 4.1

The procedures described in 8.1 pertain to the tests to be carried out prior to installation of the ALG on the tank.

Gelöscht: this clause

The equipment under test shall be clean and free of moisture. It shall be mounted and put into operation in accordance with the manufacturer's specifications before the test is started. The EUT shall be in normal operation throughout the test. The EUT shall be thoroughly checked after the termination of each test and sufficient time shall be allowed for recovery.

Tests shall be performed under normal test conditions. When the effect of one influence factor or disturbance is being evaluated, all other factors are to be held relatively constant, at values within the reference conditions defined in 8.1.4.. The electromagnetic environment of the laboratory shall not influence the test results.

The temperature is considered to be constant when the difference between the extreme temperatures noted during the test does not exceed 5 °C, and the rate of change does not exceed 5 °C per hour.

When subjected to the effect of influence factors as provided for in 8.1.6, the instrument shall continue to operate correctly and the indications shall be within the maximum permissible errors.

Gelöscht: 5

Gelöscht: 4.1

Formatiert: Nummerierung und Aufzählungszeichen

Gelöscht: W

Gelöscht: ,

Gelöscht: shall be

Gelöscht: selected

Gelöscht: selected.

Gelöscht: and

Gelöscht: f

Gelöscht:

Formatiert: Nummerierung und Aufzählungszeichen

Gelöscht: during influence tests and 1 level during

Kommentar [MSOffice1]: Mee tpunten specificeren?

Gelöscht:

Gelöscht: shall be selected

Gelöscht: The evaluation consists of comparing the measurements in each point from the ALG to a certified reference traceable to national standards.

Gelöscht: .

8.1.5.2 Accuracy

Constitute levels rising from zero to a value close to the measuring range and similarly descending. These levels shall (as close as possible) be equally distributed over the measuring range.

The number of levels shall be at least as follows:

- when determining the initial intrinsic error: at least 10 levels;

For other determinations:

- influence tests: at least 3 levels;
- disturbance tests: at least 1 level (at about 50% of the measuring range);

8.1.5.3 Discrimination

ALG's without a movable liquid level detecting element are presumed to comply with the provisions in 6.2.5, without being subjected to this test. This justification shall be mentioned in the test report.

To test compliance with 6.2.5, constitute three different levels, (as close as possible) equally distributed over the measuring range, rising and descending. From a stable position, the level shall be changed in the same direction with the value of 6.2.5 (1 mm). The change of the indication is noted.

8.1.5.4 Hysteresis

ALG's without a movable liquid level detecting element are presumed to comply with the provisions in 6.2.3, without being subjected to this test. This justification shall be mentioned in the test report.

To test compliance with 6.2.3, this test shall be performed at three different levels, equally distributed between the first point of verification and the limit of the measuring range, upper or lower height according to the movement of the ALG.

Starting from the first point of verification, raise the level over a distance of about 1/3 of the measuring range, allow stabilization and read the indication. Then change the level about 1/10 of the measuring range and after that change the level until the first stabilized level is reached. Again allow stabilization and read the indication. Carry out this sequence two more times, now starting from the previous stabilized level.

Repeat these measurements starting from a value close to the measuring range and proceed inverting the direction of the movements. Evaluate the error.

8.1.5.5 Instruments with more than one indicating device

If the instrument has more than one indicating device, the indications of the various devices shall be compared during the performance tests and shall comply with 7.1.2.

8.1.6 Influence factor tests

The type of an automatic level gauge is presumed to comply with the provisions specified in 6.1 if it passes the test 8.1.6.1 to 8.1.6.4:

8.1.6.1 Maximum permissible error under reference conditions.

Before, during, and after the tests 8.1.6.2 - 8.1.6.4, all functions shall operate as designed and the error of the ALG shall not exceed the limits of the maximum permissible error "before installation" specified in 6.2 of Part 1 under the reference conditions in 8.1.4.

8.1.6.2 Static temperatures

8.1.6.2.1 Dry heat (non condensing)

This test is applied to verify compliance with the provisions in 6.1, a) under condition of dry heat (high environmental temperature).

Applicable standards	IEC 60068-2-2 [8] IEC 60068-3-1 [10]
▼	▼
▼	▼
<u>Test procedure in brief</u>	<u>The test consists of exposure to the specified high temperature under "free air" conditions for the time specified (the time specified is the time after</u>

Gelöscht: 4.1

Gelöscht: mechanical level sensor

Gelöscht: M

Gelöscht: e

Gelöscht: 4

Gelöscht: 3

Gelöscht: 3

Gelöscht: ?

Gelöscht: 3

Gelöscht: according to the accuracy class.

Gelöscht: 4.1

Gelöscht: M

Gelöscht: e

Gelöscht: mechanical level sensor

Gelöscht: 2

Gelöscht: 2

Gelöscht: a value close to zero

Gelöscht: at least 1/5

Gelöscht: raise

Gelöscht: further over

Gelöscht: lower

Gelöscht: 4.1

Gelöscht: 9

Gelöscht: 5

Gelöscht: of Part 1 of this Recommendation

Gelöscht: following

Gelöscht: 5

Gelöscht: 5.5

Gelöscht: 5

Gelöscht: following

Gelöscht: 5

Gelöscht: 5

Gelöscht: 5

Gelöscht: on initial verification

Gelöscht: of Part 1 of this Recommendation

Gelöscht: 5

Gelöscht: 5

Gelöscht: 7

Gelöscht: 9

Gelöscht: Test method

Gelöscht: Dry (heat non condensing)

Gelöscht: Object of the test

Gelöscht: To verify compliance with the provisions in 6

Gelöscht: 5

Gelöscht: .1 a) under cond ... [1]

	<u>the EUT has reached temperature stability).</u> <u>The change of temperature shall not exceed 1 °C/min during heating up and cooling down.</u> <u>The absolute humidity of the test atmosphere shall not exceed 20 g/m³.</u> <u>When testing is performed at temperatures lower than 35 °C, the relative humidity shall not exceed 50 %.</u> <u>After stabilization at the relevant temperature, the following tests shall be carried out:</u> <ul style="list-style-type: none"><u>an accuracy test at three different levels equally spaced in the measuring range;</u><u>a discrimination test at one level;</u><u>an hysteresis test at one level.</u>					Formatiert: Nummerierung und Aufzählungszeichen
Test severities	The following severities may be specified:					
Severity level	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	Unit	
Temperature	<u>30</u>	<u>40</u>	<u>55</u>	<u>70</u>	<u>°C</u>	Gelöscht: 2
Duration	<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>	<u>h</u>	Gelöscht: H
Condition of the EUT:	Normal power supplied and “on” for a time period equal to or greater than the warm-up time specified by the manufacturer. Power is to be “on” for the duration of the test.					Gelöscht: Temperature: Gelöscht: High temperature Gelöscht: Temperature sequence:
Stabilization:	2 hours at each temperature under “free air” conditions.					Gelöscht: Reference temperature of 20 °C; High temperature; Reference temperature of 20 °C.
						Gelöscht: Number of test cycles:
						Gelöscht: At least one cycle
						Gelöscht: .
Requirement	All functions shall operate as designed. All errors shall be within the maximum permissible errors specified in clause 6.2 of Part 1: <u>see 8.1.6.1.</u>					Gelöscht: Test Gelöscht: After stabilization at the relevant temperature, the following tests shall be carried out: - - an accuracy test at three different levels equally spaced in the measuring range; - - a discrimination test at one level; - - an hysteresis test at one level.

8.1.6.2.2 Cold

This test is applied to verify compliance with the provisions in 6.1, a) under condition of cold (low environmental temperature).

Applicable standards	IEC 60068-2-1 [7] IEC 60068-3-1 [10]	Gelöscht: apply at least five different test values equally spaced in the measuring range
		Gelöscht: .
		Gelöscht: 5
		Gelöscht: 6
		Gelöscht: 9
		Gelöscht: Test method
		Gelöscht: Cold
		Gelöscht: Object of the test
		Gelöscht: To verify compliance with the provisions in 6.1a
		Gelöscht: 5.1.1
		Gelöscht:
		Gelöscht: or 5.1.2
		Gelöscht: under conditions of low temperature
		Formatiert: Nummerierung und Aufzählungszeichen
Test procedure in brief	<u>The test consists of exposure to the specified low temperature under “free air” conditions for the time specified (the time specified is the time after the EUT has reached temperature stability).</u> <u>The change of temperature shall not exceed 1 °C/min during heating up and cooling down.</u> <u>IEC specifies that the power to the EUT shall be switched off before the temperature is raised.</u> <u>After stabilization at the relevant temperature, the following tests shall be carried out:</u> <ul style="list-style-type: none"><u>an accuracy test at three different levels equally spaced in the measuring range;</u><u>a discrimination test at one level;</u><u>an hysteresis test at one level.</u>	

Test severities	The following severities may be specified:				
Severity level	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	Unit
Temperature	<u>+5</u>	<u>-10</u>	<u>-25</u>	<u>-40</u>	<u>°C</u>
Duration	<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>	<u>h</u>
Condition of the EUT:	Normal power supplied and “on” for a time period equal to or greater than the warm-up time specified by the manufacturer. Power is to be “on” for the duration of the test.				
Stabilization:	2 hours at each temperature under “free air” conditions.				
Requirement	All functions shall operate as designed. All errors shall be within the maximum permissible errors specified in clause 6.2 of Part 1; see 8.1.6.1				

Gelöscht: 2

Gelöscht: H

Gelöscht: Temperature:

Gelöscht: Low temperature

Gelöscht: Temperature sequence:

Gelöscht: Reference temperature of 20 °C;¶
 Low temperature;¶
 Reference temperature of 20 °C

Gelöscht: .

Gelöscht: Number of test cycles:

Gelöscht: At least one cycle.

Gelöscht: Test:

Gelöscht: After stabilization at the relevant temperature, the following tests shall be carried out: „
 - an accuracy test at three different levels equally spaced in the measuring range; „
 - a discrimination test at one level; „
 - an hysteresis test at one level

Gelöscht: apply at least five different test values, equally spaced in the measuring range

Gelöscht: .

Gelöscht: 5

Gelöscht: 11

Gelöscht: Test method

Gelöscht: Variation in DC mains power voltage

Gelöscht: The EUT shall comply with the specified maximum permissible errors at voltage levels between the two levels.

Gelöscht: .

Gelöscht: 5

8.1.6.3 DC mains voltage variation

This test is only applicable for ALG's powered by DC networks and is applied to verify compliance with the provisions in 6.1, c) under condition of DC mains voltage variation.

In case this test is not applicable, the justification shall be mentioned in the test report.

Applicable standard	IEC 60654-2 [12]
Test procedure in brief	The test consists of exposure to the specified power supply condition for a period sufficient for establishing stability. For both the upper and the lower limit of DC level, an accuracy test at three different levels equally spaced in the measuring range shall be carried out.
Test severity	The upper limit will be the DC level at which the EUT has been manufactured to automatically detect high-level conditions. The lower limit will be the DC level at which the EUT has been manufactured to automatically detect low-level conditions.
Requirement	The EUT shall comply with the specified maximum permissible errors This applies at all voltage levels between the two levels; see 8.1.6.1

8.1.6.4 AC mains voltage variation

This test is only applicable for ALG's powered by public AC networks and is applied to verify compliance with the provisions in 6.1, d) under condition of AC mains voltage variation.

In case this test is not applicable, the justification shall be mentioned in the test report.

Applicable standards	IEC/TR3 61000-2-1 [13] IEC 61000-4-1 [14]
Test procedure in brief	The test consists of exposure to the specified power condition for a period sufficient for achieving temperature stability and for performing the required measurements.

Gelöscht: 12

Gelöscht: 13

Gelöscht: Test method

Gelöscht: Variation in AC mains power voltage (single phase)

	<u>For both the upper and the lower limit of AC level, an accuracy test at three different levels equally spaced in the measuring range shall be carried out.</u>	
Mains voltage (1), (2)	Upper limit	$U_{nom} + 10 \%$
	Lower limit	$U_{nom} - 15 \%$
Notes	<p>(1) In the case of three phase mains power, the voltage variation shall apply for each phase successively.</p> <p>(2) The values of U_{nom} are those marked on the measuring instrument. In case a range is specified, the “-” relates to the lowest value and the “+” to the highest value of the range.</p>	
Requirement	The EUT shall comply with the specified maximum permissible errors; <u>see 8.1.6.1. This applies at all</u> voltage levels between the two levels.	

8.1.7 Disturbances

The type of ALG is presumed to comply with the provisions specified in 7.8.2.1, if it passes the following tests:

Gelöscht: 6

Gelöscht: of Part 1 of this Recommendation

8.1.7.1 Damp heat, cyclic (condensing)

This test is applied to verify compliance with the provisions in 7.8.2.1, (10) after condition of condensing humidity, combined with cyclic temperature changes.

Gelöscht: 6

Gelöscht: 2

Gelöscht: under

Gelöscht: .

Gelöscht: 8

Gelöscht: 10

Gelöscht: Test method

Gelöscht: Damp heat, cyclic

Gelöscht: Object of the test

Gelöscht: To verify compliance with the provisions in 7.8.2.1.2, a) under conditions of high humidity when combined with cyclic temperature changes.

Applicable standards	IEC 60068-2-30 [9] IEC 60068-3-4 [11]	
▼	▼	
▼	▼	
Test procedure in brief	<p>The test consists of exposure to cyclic temperature variation between 25 °C and a temperature of + 55 °C, maintaining the relative humidity above 95 % during the temperature change and low temperature phases, and at 93 % at the upper temperature phases.</p> <p>Condensation should occur on the EUT during the temperature rise.</p> <p>The 24 h cycle consists of:</p> <ol style="list-style-type: none"> 1) temperature rise during 3 h; 2) temperature maintained at upper value until 12 h from the start of the cycle; 3) temperature lowered to lower value within 3 h to 6 h, the rate of fall during the first hour and a half being such that the lower value would be reached in 3 h; 4) temperature maintained at lower value until the 24 h cycle is completed. <p><u>5) Immediately after the 24 h cycle, the ALG shall be switched on and an accuracy test shall be carried out for at least one level about 50% of the measuring range.</u></p> <p>The stabilizing period before and recovery after the cyclic exposure shall be such that all parts of the EUT are within 3 °C of their final temperature.</p> <p><u>During the disturbance, the ALG shall be switched off.</u></p>	
▼	▼	
Severity level	2	unit
Upper temperature:	55	°C
Duration	2	cycles
Requirement	<u>After the disturbance, either:</u>	

Gelöscht: Test severities

Gelöscht: Depending on the humidity classification (see 8.1.4.2.3) specified by the manufacturer, either of the 2 following severity levels shall be applied during the test:

Gelöscht: s

	<p>(a) Significant faults do not occur, or</p> <p>(b) Significant faults are detected and acted upon by means of a checking facility.</p>
--	---

Note: this test shall not be confused with the temperature test.

Gelöscht: All functions shall operate as designed. All errors shall be within the maximum permissible errors specified in clause 6.2 of Part 1

Gelöscht: 6

8.1.7.2 Electromagnetic susceptibility

8.1.7.2.1 Radiated, radio-frequency, electromagnetic fields

For instruments containing electronics, this test is applied to verify compliance with the provisions in 7.8.2.1.(1) under conditions of radiated electromagnetic fields.

Instruments that do not contain any active electronic circuits (transistors, IC's, radio tubes), are presumed to comply with the provisions in 7.8.2.1, (1), without being subjected to this test.

In case this test is not applicable, the justification shall be mentioned in the test report.

Gelöscht: Notes:¶
 1) , For EUT having no mains or other input port available, the lower limit of the radiation test should be 26 MHz taking into account that the test cannot be applied (refer to Annex H of IEC 61000-4-3 [15]). In all other cases both 8.1.6.2.1 and 8.1.6.2.2 shall apply.¶
 2) , IEC 61000-4-3 [15] only specifies test levels above 80 MHz.¶
 , For frequencies in the lower range the test methods for conducted radio frequency disturbances (8.1.6.2.2) are recommended

Gelöscht: ¶

Gelöscht: 8.1.6.2.1 , Radiated, radio-frequency, electromagnetic fields¶

Instruments that do not contain any active electronic circuits (transistors, IC's, radio tubes), are presumed to comply with the provisions in 7.8.2.1.1, a), without being subjected to this test. This justification shall be mentioned in the test report.¶
 For instruments containing electronics, this test is applied to verify compliance with the provisions in 7.8.2.1.1, a) under conditions of radiated electromagnetic fields.¶
 In addition to the information to the test procedures in IEC 61000-4-3 [15], the following test procedure in brief shall be applied:¶

The instrument shall be subjected to the following frequencies and field strength, the signal being modulated with 1 kHz, 80 % AM sine wave:¶

¶ Frequency ... [2]

Gelöscht:

<u>Applicable standard</u>	IEC 61000-4-3 [16]
<u>Test procedure in brief</u>	<p>The EUT shall be exposed to electromagnetic field strength as specified by the severity level (10 V/m) and a field uniformity as defined by the referred standard.</p> <p>The frequency ranges to be considered are swept with the modulated signal, pausing to adjust the RF signal level or to switch oscillators and antennas as necessary. Where the frequency range is swept incrementally, the step size shall not exceed 1 % of the preceding frequency value.</p> <p>The dwell time of the amplitude modulated carrier at each frequency shall not be less than the time necessary for the EUT to be exercised and to respond, but shall in no case be less than 0.5 s.</p> <p>The sensitive frequencies (e.g. clock frequencies) shall be analyzed separately. ⁽¹⁾</p> <p>During the disturbance, an accuracy test shall be carried out for at least one level at about 50 % of the measuring range.</p>
<u>Severity level</u>	3
<u>Field strength</u>	10 V/m
<u>Frequency range</u>	80 MHz - 2 GHz ⁽²⁾ 26 MHz - 2 GHz
<u>Modulation</u>	80 % AM, 1 kHz, sine wave
<u>Requirement</u>	<p>During the disturbance, either:</p> <p>(a) Significant faults do not occur, or</p> <p>(b) Significant faults are detected and acted upon by means of a checking facility</p>
<u>Notes</u>	<p>⁽¹⁾ Usually, these sensitive frequencies can be expected to be the frequencies emitted by the EUT.</p> <p>⁽²⁾ IEC 61000-4-3 [16] only specifies test levels above 80 MHz. For frequencies in the lower range the test methods for conducted radio frequency disturbances (8.1.7.2.2) are recommended.</p>

8.1.7.2.2 Conducted, radio-frequency, electromagnetic fields

Gelöscht: 6

For instruments containing electronics, this test is applied to verify compliance with the provisions in 7.8.2.1, (2) under conditions of conducted electromagnetic fields.

Instruments that do not contain any active electronic circuits (transistors, IC's, radio tubes) and/or mains or other input or output port, are presumed to comply with the provisions in 7.8.2.1, (2), without being subjected to this test.

In case this test is not applicable, the justification shall be mentioned in the test report.

Gelöscht: .1

Gelöscht: b

Gelöscht: This

Gelöscht: For instruments containing electronics, this test is applied to verify compliance with the provisions in 7.8.2.1, b) under conditions of conducted electromagnetic fields.

Gelöscht: 18

Gelöscht: Test method

Gelöscht: Conducted electromagnetic fields

Gelöscht: Object of the test

Gelöscht: To verify compliance with the provisions in 7.8.2.1.1, b) under conditions of conducted electromagnetic fields

Gelöscht:

Gelöscht: 5

Applicable standard	IEC 61000-4-6 [19]	
Test procedure in brief	Radio frequency EM current, simulating the influence of EM fields shall be coupled or injected into the power ports and I/O ports of the EUT using coupling/decoupling devices as defined in the referred standard. During the disturbance, an accuracy test shall be carried out for at least one level at about 50 % of the measuring range.	
Severity level	3	unit
RF amplitude (50 Ω)	10	V (e.m.f.)
Frequency range (2)	0.15 - 80	MHz
Modulation	80 % AM, 1 kHz sine wave	
Notes	¹⁾ If the EUT is composed of several elements, the tests shall be performed at each extremity of the cable if both of the elements are part of the EUT. ²⁾ For the frequency range 26 - 80 MHz, the testing laboratory can either carry out the test according to 8.1.7.2.1 or according to 8.1.7.2.2. But in case of a dispute, the results according to 8.1.7.2.2 shall prevail.	
Requirement	During the disturbance, either: (a) Significant faults do not occur, or (b) Significant faults are detected and acted upon by means of a checking facility	

Gelöscht: 6

Gelöscht: 6

Gelöscht: 6

8.1.7.2.3 Electrostatic discharge

Gelöscht: 6

For instruments containing electronics, this test is applied to verify compliance with the provisions in 7.8.2.1, (3) under conditions of electrostatic discharges.

Instruments that do not contain any active electronic circuits (transistors, IC's, radio tubes), are presumed to comply with the provisions in 7.8.2.1, (3), without being subjected to this test.

In case this test is not applicable, the justification shall be mentioned in the test report.

Gelöscht: .1

Gelöscht: c

Gelöscht: This

Gelöscht: 14

Gelöscht: Test method

Gelöscht: Electrostatic discharge (ESD)

Gelöscht: Object of the test

Gelöscht: To verify compliance with the provisions in 7.8.2.1.1, c) electrostatic discharges

Gelöscht: ¶
Before starting the tests, the performance of the generator shall be verified

Applicable standard	IEC 61000-4-2 [15]	
Test procedure in brief	An ESD generator shall be used with a performance as defined in the referred standard. At least 10 discharges shall be applied. The time interval between	

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	polarity. For the coupling of the bursts into the I/O and communication lines, a capacitive coupling clamp as defined in the standard shall be used. <u>During the disturbance, an accuracy test shall be carried out for at least one level at about 50 % of the measuring range.</u>	
Severity level	3	unit
Amplitude (peak value)	1	kV
Repetition rate	5	kHz
Requirement	During the disturbance, either: (a) Significant faults do not occur, or (b) Significant faults are detected and acted upon by means of a checking facility	

Gelöscht:

8.1.7.2.5 Surges on signal, data and control lines

Gelöscht: 6

For instruments containing electronics and provided with I/O or communication ports this test is applied to verify compliance with the provisions in 7.8.2.1, (5) under conditions where electrical surges are superimposed on I/O and communication ports.

Instruments that do not contain any active electronic circuits (transistors, IC's, radio tubes), and/or not being provided with external signal, data or control lines, are presumed to comply with the provisions in 7.8.2.1, (5), without being subjected to this test.

In case this test is not applicable, the justification shall be mentioned in the test report.

Gelöscht: .1

Gelöscht: e

Gelöscht: This

Gelöscht: 17

Gelöscht: Test method

Gelöscht: Electrical surges

Gelöscht: Object of the test

Gelöscht: To verify compliance with the provisions in 7.8.2.1.1, e) under conditions where electrical surges are superimposed on I/O and communication ports

Applicable standard	IEC 61000-4-5 [18]		
▼	▼	▼	▼
▼	▼	▼	▼
Test procedure in brief	A surge generator shall be used with the performance characteristics as specified in the referred standard. The test consists of exposure to surges for which the rise time, pulse width, peak values of the output voltage/current on high/low impedance load and minimum time interval between two successive pulses are defined in the referred standard. The characteristics of the generator shall be verified before connecting the EUT. At least 3 positive and 3 negative surges shall be applied. The injection network depends on the lines the surge is coupled into and is defined in the referred standard. <u>During the disturbance, an accuracy test shall be carried out for at least one level at about 50 % of the measuring range.</u>		
Severity level	(Installation class)	2	unit
Unbalanced lines	Line to line	0.5	kV
	Line to <u>ground</u>	1.0	kV
Balanced lines	Line to line	N.A.	kV
	Line to <u>ground</u>	1.0	kV
Requirement	During the disturbance, either: (a) Significant faults do not occur, or (b) Significant faults are detected and acted upon by means of a checking facility		

Gelöscht:

Gelöscht: earth

Gelöscht: earth

8.1.7.2.6 AC mains voltage dips, short interruptions and voltage variations

Gelöscht: 6

For instruments containing electronics, and powered by AC mains, this test is applied to verify compliance with the provisions in 7.8.2.1, (6) under conditions of short time mains voltage reductions.

In case this test is not applicable, the justification shall be mentioned in the test report.

Applicable standards		IEC 61000-4-11 [20]			Gelöscht: 19
		IEC 61000-6-1 [23]			Gelöscht: 22
					Gelöscht: Test method
					Gelöscht: Short-time reductions in mains voltage
Test procedure in brief		<p>A test generator suitable to reduce for a defined period of time the amplitude of the AC mains voltage is used.</p> <p>The performance of the test generator shall be verified before connecting the EUT.</p> <p>The mains voltage reductions shall be repeated 10 times with an interval of at least 10 seconds.</p> <p><u>During the disturbance, an accuracy test shall be carried out for at least one level at about 50 % of the measuring range.</u></p>			<p>Gelöscht: Object of the test</p> <p>Gelöscht: To verify compliance with the provisions in 7.8.2.1.1, f) f under conditions of short time mains voltage reductions</p>
					Gelöscht:
					Gelöscht: Test severities
Severity level			3	unit	Gelöscht: The following severities may be specified:
Voltage dips	Test a	Reduction to	0	%	
		Duration	0.5	cycles	
	Test b	Reduction to	0	%	
		Duration	1	cycles	
	Test c	Reduction to	40	%	
		Duration	10/12 ⁽¹⁾	cycles	
	Test d	Reduction to	70	%	
		Duration	25/30 ⁽¹⁾	cycles	
	Test e	Reduction to	80	%	
		Duration	250/300 ⁽¹⁾	cycles	
Short interruptions	Reduction <u>to</u>		0	%	
	Duration		250/300 ⁽¹⁾	cycles	
Note	⁽¹⁾ These values are for 50 Hz / 60 Hz respectively				Gelöscht: s
Requirement	<p>During tests a, b, c, d, and e and after the short interruption, either:</p> <p>(a) Significant faults do not occur, or</p> <p>(b) Significant faults are detected and acted upon by means of a checking facility</p>				Gelöscht: [to be discussed]

8.1.7.2.7 Bursts (transients) on AC and DC mains

Gelöscht: 6

For instruments containing electronics, and powered by AC or DC mains voltage, this test is applied to verify compliance with the provisions in 7.8.2.1, (7) under conditions where electrical bursts are superimposed on the mains voltage.

In case this test is not applicable, the justification shall be mentioned in the test report.

Applicable standards	IEC 61000-4-1 [14]
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	IEC 61000-4-4 [17]		Gelöscht: 6
			Gelöscht: Test method
			Gelöscht: Electrical bursts
			Gelöscht: Object of the test
Test procedure in brief	<p>A burst generator shall be used with the performance characteristics as specified in the referred standard.</p> <p>The test consist of exposure to bursts of voltage spikes for which the output voltage on 50 Ω and 1000 Ω load are defined in the referred standard.</p> <p>Both positive and negative polarity of the bursts shall be applied.</p> <p>The duration of the test shall not be less than 1 min for each amplitude and polarity. The injection network on the mains shall contain blocking filters to prevent the burst energy being dissipated in the mains.</p> <p><u>During the disturbance, an accuracy test shall be carried out for at least one level at about 50 % of the measuring range.</u></p>		Gelöscht: To verify compliance with the provisions in 7.8.2.1.1, g under conditions where electrical bursts are superimposed on the mains voltage.
Severity level	3	unit	Gelöscht:
Amplitude (peak value)	2	kV	Gelöscht: ¶
Repetition rate	5	kHz	Gelöscht: Supply lines,
Requirement	<p>During the disturbance, either:</p> <p>(a) Significant faults do not occur, or</p> <p>(b) Significant faults are detected and acted upon by means of a checking facility</p>		Gelöscht: Amplitude (peak value)
			Gelöscht: signal lines
			Gelöscht: ¶
			Gelöscht: Signal lines
			Gelöscht: Repetition rate¶
			Gelöscht: 6

8.1.7.2.8 Voltage dips, short interruptions and voltage variations on DC mains power

For instruments containing electronics, and powered by DC mains voltage, this test is applied to verify compliance with the provisions in 7.8.2.1, (8) under conditions where electrical bursts are superimposed on the mains voltage.

In case this test is not applicable, the justification shall be mentioned in the test report.

Applicable standard	IEC 61000-4-29 [22]		Gelöscht: 21
			Gelöscht: Test method
			Gelöscht: Voltage dips, short interruptions and voltage variations on DC mains power.
			Gelöscht: Object of the test
Test procedure in brief	<p>A test generator as defined in the referred standard shall be used. Before starting the tests, the performance of the generator shall be verified.</p> <p>The voltage dips and short interruptions shall be tested on the EUT, for each selected combination of test level and duration, with a sequence of tree dips/interruptions with intervals of 10 s minimum between each test event.</p> <p>The EUT shall be tested for each of the specified voltage variations, three times at 10 s intervals in the most representative operating modes.</p> <p><u>During the disturbance, an accuracy test shall be carried out for at least one level at about 50 % of the measuring range.</u></p>		Gelöscht: To verify compliance with the provisions in 7.8.2.1.1, h under conditions of voltage dips, voltage variations and short interruptions on DC mains power
Voltage dips	Severity level	1	Gelöscht: ¶
	Test levels	40 and 70	¶
	Duration	0.1	If the EUT is an integrating instrument, the test pulses shall be continuously applied during the measuring time.
Short interruptions	Test condition	High impedance and/or low impedance	Gelöscht:
			Gelöscht: (4)

	Test levels	0	% of the rated voltage
	Duration	0.01	s
Voltage variations	Severity levels	1	
	Test level	85 and 120	% of the rated voltage
	Duration	10	s
Requirement:	During the disturbance, either: (a) Significant faults do not occur, or (b) Significant faults are detected and acted upon by means of a checking facility		

8.1.7.2.9 Ripple on DC mains power

Gelöscht: 6

For instruments containing electronics, and powered by DC mains voltage, this test is applied to verify compliance with the provisions in 7.8.2.1, (9) under conditions of ripple on the low voltage DC mains power.

This test does not apply to instruments connected to battery charger systems incorporating switch mode converters.

In case this test is not applicable, the justification shall be mentioned in the test report.

Applicable standard	IEC 61000-4-17 [21]	Gelöscht: 20
		Gelöscht: Test method
		Gelöscht: Ripple on DC input power port.
Test procedure in brief	<p>A test generator as defined in the referred standard shall be used. Before starting the tests, the performance of the generator shall be verified.</p> <p>The test consist subjecting the EUT to ripple voltages such as those generated by rectifier systems and/or auxiliary service battery chargers overlaying on DC power supply sources. The frequency of the ripple is the power frequency. The waveform of the ripple, at the output of the test generator, has a sinusoid-linear character.</p> <p>The test shall be applied for at least 10 min or for the period time necessary to allow a complete verification of the EUT's operating performance.</p> <p><u>During the disturbance, an accuracy test shall be carried out for at least one level at about 50 % of the measuring range.</u></p>	<p>Gelöscht: Object of the test</p> <p>Gelöscht: To verify compliance with the provisions in 7.8.2.1.1, i under conditions of ripple on the low voltage DC mains power. ¶ This test does not apply to instruments connected to battery charger systems incorporating switch mode converters.</p>
Severity level	1	
Percentage of the nominal DC voltage ⁽¹⁾	2	
Note	⁽¹⁾ The test level is a peak-to-peak voltage expressed as a percentage of the nominal DC voltage.	
Requirement	During the disturbance, either: (a) Significant faults do not occur, or (b) Significant faults are detected and acted upon by means of a checking facility	

8.1.7.2.10 Surges on AC and DC mains power lines

Gelöscht: 6

For instruments containing electronics, and powered by AC or DC mains voltage, this test is applied to verify compliance with the provisions in 7.8.2.1, (11) after conditions where electrical surges were superimposed on the mains voltage.

In case this test is not applicable, the justification shall be mentioned in the test report.

Applicable standard	IEC 61000-4-5 [18]	Gelöscht: 17
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			Gelöscht: Test method
			Gelöscht: Electrical surges
			Gelöscht: Object of the test
Test procedure in brief	<p>A surge generator shall be used with the performance characteristics as specified in the referred standard. The test consists of exposure to surges for which the rise time, pulse width, peak values of the output voltage/current on high/low impedance load and minimum time interval between two successive pulses are defined in the referred standard.</p> <p>The characteristics of the generator shall be verified before connecting the EUT.</p> <p>On AC mains supply lines at least 3 positive and 3 negative surges shall be applied synchronously with AC supply voltage in angles 0°, 90°, 180° and 270°.</p> <p>On DC power lines, at least 3 positive and 3 negative surges shall be applied.</p> <p>The injection network depends on the lines the surge is coupled into and is defined in the referred standard.</p> <p><u>Immediately after the disturbance, an accuracy test shall be carried out for at least one level at about 50% of the measuring range.</u></p>		Gelöscht: To verify compliance with the provisions in 7.8.2.1.2, j under conditions where electrical surges are superimposed on the mains voltage
Severity level (installation class)	3	unit	
Line to line	1.0	kV	Gelöscht: earth
Line to <u>ground</u>	2.0	kV	Gelöscht: 8.2.1
Requirement	<p>After the disturbance, either:</p> <p>(a) Significant faults do not occur, or</p> <p>(b) Significant faults are detected and acted upon by means of a checking facility:</p>		Gelöscht: f
			Gelöscht: I
			Gelöscht: i
			Gelöscht: shall
			Gelöscht: be
			Gelöscht: this will be performed
			Gelöscht: .1
			Gelöscht: .¶

8.2 Initial verification

Initial verification is carried out in two stages, as follows.

8.2.1 Before installation

For the examination and testing of the ALG before installation on the tank (preliminary examination), the ALG shall be checked for conformity with the approved type.

Tests have to be done on accuracy, discrimination and hysteresis (see 8.1.5.2 through 8.1.5.5) to verify compliance with the requirements.

Tests shall be carried out within the rated operating conditions.

The ALG shall be sealed according the Certificate.

8.2.2 After installation

For the examination of installation and adjustment of the ALG on the tank:

- check that the requirements of 7.1- 7.3 are met;
- check that the conditions of the tank match with the rated operating conditions specified according to 6.1

If national regulations allow the use of an ALG under conditions outside the rated operating conditions (see 6.1) the metrological service shall ascertain that all necessary information to make the required corrections is available to the user and that this information is correct.

Gelöscht: earth
Gelöscht: 8.2.1
Gelöscht: f
Gelöscht: I
Gelöscht: i
Gelöscht: shall
Gelöscht: be
Gelöscht: this will be performed
Gelöscht: .1
Gelöscht: .¶
Gelöscht:
Gelöscht: 4.1
Gelöscht: 4
Gelöscht: 1.4
Gelöscht:
Gelöscht:
Gelöscht: To fix the configuration, the
Gelöscht: .1
Gelöscht: •
Formatiert: Nummerierung und Aufzählungszeichen
Gelöscht: , and
Gelöscht: •
Gelöscht: .1
Gelöscht: shall be given
Gelöscht: ¶
Gelöscht: The test method shall be in compliance with part 2
Gelöscht: .

The errors of the instrument shall be within the limits of the maximum permissible errors specified for ALG's installed on tanks (see 6.2.2 in Part 1).

Gelöscht: remain

The instrument shall be stamped and sealed in accordance with national regulations.

8.3 Maintenance

The owner of the ALG has the responsibility that the ALG is continuously in good working order.

This requires a periodic inspection of the ALG by the manufacturer or another competent expert.

8.4 Subsequent verification

8.4.1 Subsequent verification is to verify accuracy of an ALG mounted on a tank "in use", thus in general a partly filled tank. Therefore this is in practice only possible at one single level within the normal operating range (In general, this will be the actual level of the fluid in the tank at the moment of the verification).

Subsequent verification with a period of validity of 2 years or less is recommended.

But it must be noted that in practice, subsequent verification of an ALG used in a pressurized tank is only possible after removing the ALG from the tank. This can lead to considerable practical problems when subsequent verification is prescribed at fixed periodic intervals.

8.4.2 If subsequent verification is required by national legislation, this shall be carried out according to 8.2.2.

The maximum permissible errors to be applied for subsequent verification shall be in accordance with 6.2.2 "after installation".

If an ALG is adjusted or "reset" to match manual gauge (dip), the ALG should be verified following the "initial field verification" procedure – if ISO 4266 is followed.

8.5 Metrological supervision

Countries not having a system of mandatory subsequent verification according to 8.4.2, are suggested having a system of metrological supervision of measuring instrument in use.

This can consists of randomly checking the presence of the right and valid and undamaged verification marks and seals.

Gelöscht: 8.3 , Subsequent verification¶

8.3 and 8.4 ARE TO BE RECONSIDERED¶

In practice, subsequent verification is not possible for pressurized tanks.¶
8.3.1 Subsequent verification with a period of validity of 1 year is recommended.¶

Subsequent verification is to verify the ALG accuracy at one single level within the normal operating range (In practice, this will be the actual level of the fluid in the tank at the moment of the verification).¶

8.3.2 The ALG shall be inspected and examined to establish that it is in correct working order.¶

8.3.3 Subsequent verification shall be carried out according to 8.2.¶
In principal national authorities may require subsequent verification. If subsequent verification is required this verification shall be carried out according to 8.2.¶

The maximum permissible errors to be applied for subsequent verification shall be in accordance with 6.2.1 "after installation".¶
If an ALG is adjusted or "reset" to match manual gauge (dip), the ALG should be verified following the "initial field verification" procedure – if ISO 4266 is followed.¶

¶ 8.4 , Metrological supervision ¶ 8.3 and 8.4 ARE TO BE RECONSIDERED¶

¶
8.4.1 , For countries having a system of mandatory subsequent verification¶

Subsequent verification shall be carried out as specified in 8.3.¶
Metrological supervision of measuring instrument in use, consists of randomly checking the presence of the right and valid and undamaged verification marks and seals.¶

¶
8.4.2 , For countries not having a system of mandatory subsequent verification¶

Metrological supervision of measuring instrument in use, consists of randomly checking the presence of the right and valid and undamaged verification marks and seals.

.1 a) under conditions of high temperature

8.1.6.2.1 Radiated, radio-frequency, electromagnetic fields

Instruments that do not contain any active electronic circuits (transistors, IC's, radio tubes), are presumed to comply with the provisions in 7.8.2.1.1, a), without being subjected to this test. This justification shall be mentioned in the test report.

For instruments containing electronics, this test is applied to verify compliance with the provisions in 7.8.2.1.1, a) under conditions of radiated electromagnetic fields.

In addition to the information to the test procedures in IEC 61000-4-3 [15], the following test procedure in brief shall be applied:

The instrument shall be subjected to the following frequencies and field strength, the signal being modulated with 1 kHz, 80 % AM sine wave:

Frequency	Field strength	Remarks
26 26 Mhz- 800 MHz2 GHz	10 V/m	For EUT having no mains or other input port available, the lower limit of the radiation test should be 26 MHz taking into account that the test cannot be applied (refer to Annex H of IEC 61000-4-3 [15]). In all other cases both 8.1.6.1.1 and 8.1.6.1.2 shall apply.
80 Mhz - 800 MHz2 GHz	10 V/m	IEC 61000-4-3 [15] only specifies test levels above 80 MHz. For frequencies in the lower range the test methods for conducted radio frequency disturbances (8.1.6.1.2) are recommended
Requirement	During the disturbance, either: (a) Significant faults do not occur, or (b) Significant faults are detected and acted upon by means of a checking facility	