



COMMITTEE DRAFT 4CD OIML R 85-2

Date: 31 July 2007

Reference number:

Supersedes document: OIML R 85 3CD

OIML TC8 / SC1

Title: 4th Committee Draft
Revision OIML International Recommendation R85

Secretariat:
TC8/SC1: Austria/Germany

Circulated to P- and O-members and
liaison international bodies and external
organisations for:

☐discussion at (date and place of
meeting):☐

comments by:

☒**vote (P-members only) and
comments by 15 November 2007**

TITLE OF THE CD (English):

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

Part 2
Clean version

Explanatory note

[Will be deleted in the final text]

Contents:

Explanatory note	2
Foreword.....	3
PART 2 Metrological controls and tests.....	4
8 Metrological controls	4
8.1 Type evaluation	4
8.1.1 Number of units submitted to type test.....	4
8.1.2 Documentation	4
8.1.3 Equipment under test (EUT).....	4
8.1.4 Reference conditions	5
8.1.5 Tests under reference conditions	5
8.1.6 Influence factor tests.....	6
8.1.6.1 Maximum permissible error under reference conditions.....	6
8.1.6.2 Static temperatures	6
8.1.6.2.1 Dry heat (non condensing).....	6
8.1.6.2.2 Cold	7
8.1.6.3 DC mains voltage variation	8
8.1.6.4 AC mains voltage variation	9
8.1.7 Disturbances.....	9
8.1.7.1 Damp heat, cyclic (condensing).....	9
8.1.7.2 Electromagnetic susceptibility.....	10
8.1.7.2.1 Radiated, radio-frequency, electromagnetic fields.....	11
8.1.7.2.2 Conducted, radio-frequency, electromagnetic fields.....	12
8.1.7.2.3 Electrostatic discharge.....	13
8.1.7.2.4 Bursts (transients) on signal, data and control lines	14
8.1.7.2.5 Surges on signal, data and control lines.....	14
8.1.7.2.6 AC mains voltage dips, short interruptions and voltage variations ...	15
8.1.7.2.7 Bursts (transients) on AC and DC mains.....	16
8.1.7.2.8 Voltage dips, short interruptions and voltage variations on DC mains power	17
8.1.7.2.9 Ripple on DC mains power.....	17
8.1.7.2.10 Surges on AC and DC mains power lines.....	18
8.2 Initial verification	19
8.3 Maintenance	20
8.4 Subsequent verification.....	20
8.5 Metrological supervision.....	21

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

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)

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 disturbances 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	$20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$
b)	Humidity	$< 85\text{ \% RH}$
c)	DC mains voltage (*)	Less than 10 % of the variation specified by the manufacturer of the EUT
d)	AC mains voltage (*)	$U_{\text{nom}} \pm 1\text{ \%}$
e)	AC mains frequency (*)	$f_{\text{nom}} \pm 0,5\text{ \%}$
(*) whatever is applicable		

8.1.4.1 Tests under reference conditions

8.1.4.1.1 General

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

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 $5\text{ }^{\circ}\text{C}$, and the rate of change does not exceed $5\text{ }^{\circ}\text{C}$ per hour.

When subjected to the effect of influence factors as provided for in 8.1.5, the instrument shall continue to operate correctly and the indications shall be within the maximum permissible errors.

8.1.4.1.2 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.

- When determining the initial intrinsic error, at least 10 levels shall be selected and for other determinations at least 3 levels shall be selected. The evaluation consists of comparing the measurements in each point from the ALG to a certified reference traceable to national standards..

8.1.4.1.3 Discrimination

ALG's without a mechanical level sensor are presumed to comply with the provisions in 6.2.4, without being subjected to this test. This justification shall be mentioned in the test report.

To test compliance with 6.2.3, 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 6.2.3. according to the accuracy class. The change of the indication is noted.

8.1.4.1.4 Hysteresis

ALG's without a mechanical level sensor are presumed to comply with the provisions in 6.2.2, without being subjected to this test. This justification shall be mentioned in the test report.

To test compliance with 6.2.2, 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 a value close to zero, raise the level over a distance of at least 1/5 of the measuring range, allow stabilization and read the indication. Then raise the level further over 1/10 of the measuring range and after that lower 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.

8.1.4.1.5 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 7.1.9.

8.1.5 Influence factor tests

The type of an automatic level gauge is presumed to comply with the provisions specified in 6.1 of Part 1 of this Recommendation if it passes the following test 8.1.5.1 to 8.1.5.5:

8.1.5.1 Maximum permissible error under reference conditions.

Before, during, and after the following tests 8.1.5.2 - 8.1.5.5, the error of the ALG shall not exceed the maximum permissible error on initial verification specified in 6.2 of Part 1 of this Recommendation under the reference conditions in 8.1.4.

8.1.5.2 Static temperatures

8.1.5.2.1 Dry heat

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 [7] IEC 60068-3-1 [9]
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.
Temperature:	High temperature
Temperature sequence:	Reference temperature of 20 °C; High temperature; Reference temperature of 20 °C.

Number of test cycles:	At least one cycle.
Test	After stabilization at the relevant temperature, apply at least five different test values equally spaced in the measuring range.
Requirement	All functions shall operate as designed. All errors shall be within the maximum permissible errors specified in clause 6.2 of Part 1

8.1.5.2.2 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 [6] IEC 60068-3-1 [9]
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.
Temperature:	Low temperature
Temperature sequence:	Reference temperature of 20 °C; Low temperature; Reference temperature of 20 °C.
Number of test cycles:	At least one cycle.
Test:	After stabilization at the relevant temperature, apply at least five different test values, equally spaced in the measuring range.
Requirement	All functions shall operate as designed. All errors shall be within the maximum permissible errors specified in clause 6.2 of Part 1

8.1.5.3 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 [11]
Test method	Variation in DC mains power voltage
Test procedure in brief	The test consists of exposure to the specified power supply condition for a period sufficient for establishing stability.
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. The EUT shall comply with the specified maximum permissible errors at voltage levels between the two levels.
Requirement	The EUT shall comply with the specified maximum permissible errors at voltage levels between the two levels.

8.1.5.4 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 [12] IEC 61000-4-1 [13]	
Test method	Variation in AC mains power voltage (single phase)	
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.	
Mains voltage (1), (2)	Upper limit	$U_{nom} + 10 \%$
	Lower limit	$U_{nom} - 15 \%$
Notes	⁽¹⁾ In the case of three phase mains power, the voltage variation shall apply for each phase successively. ⁽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.	
Requirement	The EUT shall comply with the specified maximum permissible errors at voltage levels between the two levels.	

8.1.6 Disturbances

The type of ALG is presumed to comply with the provisions specified in 7.8.2.1, of Part 1 of this Recommendation if it passes the following tests:

8.1.6.1 Damp heat, cyclic (condensing)

This test is applied to verify compliance with the provisions in 7.8.2.1.2 under condition of condensing humidity..

Applicable standards	IEC 60068-2-30 [8] IEC 60068-3-4 [10]
Test method	Damp heat, cyclic
Object of the test	To verify compliance with the provisions in 7.8.2.1.2, a) under conditions of high humidity when combined with cyclic temperature changes.
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>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>
Test severities	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:	
Severity levels	2	unit
Upper temperature:	55	°C
Duration	2	cycles
Requirement	All functions shall operate as designed. All errors shall be within the maximum permissible errors specified in clause 6.2 of Part 1	

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

8.1.6.2 Electromagnetic susceptibility

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 - 800 MHz	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. 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
80 - 800 MHz	10 V/m	
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	

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

8.1.6.2.2 Conducted, radio-frequency, electromagnetic fields

Instruments that do not contain any mains or other input or output port, are presumed to comply with the provisions in 7.8.2.1.1, b), 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, b) under conditions of conducted electromagnetic fields.

Applicable standard	IEC 61000-4-6 [18]	
Test method	Conducted electromagnetic fields	
Object of the test	To verify compliance with the provisions in 7.8.2.1.1, b) under conditions of conducted electromagnetic fields	
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.	
Severity level	3	unit
RF amplitude (50 Ω)	10	V (e.m.f.)
Frequency range ⁽⁵⁾	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 8.1.6.2.1 or according to 8.1.6.2.2. But in case of a dispute, the results according to 8.1.6.2.2 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	

8.1.6.2.3 Electrostatic discharge

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, c), without being subjected to this test. This justification shall be mentioned in the test report.

Applicable standard	IEC 61000-4-2 [14]
Test method	Electrostatic discharge (ESD)
Object of the test	To verify compliance with the provisions in 7.8.2.1.1, c) electrostatic discharges
Test procedure in brief	<p>An ESD generator shall be used with a performance as defined in the referred standard.</p> <p>Before starting the tests, the performance of the generator shall be verified.</p> <p>At least 10 discharges shall be applied. The time interval between successive discharges shall be at least 10 seconds.</p> <p>For EUT not equipped with a ground terminal, the EUT shall be fully discharged between discharges.</p> <p>Contact discharge is the preferred test method. Air discharge shall be used where contact discharge cannot be applied.</p> <p>Direct application:</p> <p>In the contact discharge mode to be carried out on conductive surfaces, the electrode shall be in contact with the EUT.</p>

		In the air discharge mode on insulated surfaces, the electrode is approached to the EUT and the discharge occurs by spark. Indirect application: The discharges are applied in the contact mode to coupling planes mounted in the vicinity of the EUT.			
Severity levels ⁽¹⁾		1	2	3	unit
Test voltage	Contact discharge ⁽²⁾	2	4	6	kV
	Air discharge ⁽²⁾	2	4	8	kV
Notes		⁽¹⁾ In this case “level” means: up to and including the specified level (i.e. the test shall also be performed at the specified lower levels in the standard). ⁽²⁾ Contact discharges shall be applied on conductive surfaces. Air discharges shall be applied on non-conductive surfaces.			
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			

8.1.6.2.4 Bursts (transients) on signal, data and control lines

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

Applicable standard	IEC 61000-4-4 [16]	
Test method	Electrical bursts	
Object of the test	To verify compliance with the provisions in under conditions where electrical bursts are superimposed on I/O and communication ports	
Test procedure in brief	A burst generator shall be used with the performance characteristics as specified in the referred standard. 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. The characteristics of the generator shall be verified before connecting the EUT. Both positive and negative polarity of the bursts shall be applied. The duration of the test shall not be less than 1 min for each amplitude and 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.	
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
-------------	--

8.1.6.2.5 Surges on signal, data and control lines

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 7.8.2.1.1, e), without being subjected to this test. This justification shall be mentioned in the test report.

Applicable standard	IEC 61000-4-5 [17]		
Test method	Electrical surges		
Object of the test	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		
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>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.</p>		
Severity level	(Installation class)	2	unit
Unbalanced lines	Line to line	0.5	kV
	Line to earth	1.0	kV
Balanced lines	Line to line	N.A.	kV
	Line to earth	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		

8.1.6.2.6 AC mains voltage dips, short interruptions and voltage variations

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

Applicable standards	IEC 61000-4-11 [19] IEC 61000-6-1 [22]
Test method	Short-time reductions in mains voltage
Object of the test	To verify compliance with the provisions in 7.8.2.1.1, f) f under conditions of short time mains voltage reductions
Test procedure in brief	A test generator suitable to reduce for a defined period of time the

		<p>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>		
Test severities		The following severities may be specified:		
Severity level			3	unit
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
Short interruptions		Reduction	0	%
		Duration	250/300 ⁽¹⁾	cycles
Notes	⁽¹⁾ These values are for 50 Hz / 60 Hz respectively			
Requirement	<p>During tests a, b, c, d, and e and after the short interruption [to be discussed], 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>			

8.1.6.2.7 Bursts (transients) on AC and DC mains

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

Applicable standards	IEC 61000-4-1 [IEC 61000-4-4 [16]		
Test method	Electrical bursts		
Object of the test	To verify compliance with the provisions in 7.8.2.1.1, g under conditions where electrical bursts are superimposed on the mains voltage.		
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>		
Severity level	3	unit	

Amplitude (peak value)	Supply lines 2	kV
	Signal lines 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	

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

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

Applicable standard	IEC 61000-4-29 [21]		
Test method	Voltage dips, short interruptions and voltage variations on DC mains power.		
Object of the test	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		
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>If the EUT is an integrating instrument, the test pulses shall be continuously applied during the measuring time.</p>		
Voltage dips	Severity level	1	unit
	Test levels	40 and 70	% of the rated voltage
	Duration	0.1	s
Short interruptions (4)	Test condition	High impedance and/or low impedance	
	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		

8.1.6.2.9 Ripple on DC mains power

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

Applicable standard	IEC 61000-4-17 [20]
Test method	Ripple on DC input power port.

Object of the test	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.
Test procedure in brief	A test generator as defined in the referred standard shall be used. Before starting the tests, the performance of the generator shall be verified. 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. 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.
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

8.1.6.2.10 Surges on AC and DC mains power lines

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

Applicable standard	IEC 61000-4-5 [17]	
Test method	Electrical surges	
Object of the test	To verify compliance with the provisions in 7.8.2.1.2, j under conditions where electrical surges are superimposed on the mains voltage	
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>	
Severity level (installation class)	3	unit
Line to line	1.0	kV
Line to earth	2.0	kV

Requirement	After the disturbance, either: (a) Significant faults do not occur, or (b) Significant faults are detected and acted upon by means of a checking facility:
-------------	--

8.2 Initial verification

8.2.1 Initial verification shall be carried out in two stages, as follows.

8.2.1.1 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 8.1.4.1.2 through 8.1.4.1.4) to verify compliance with the requirements. Tests shall be carried out within the rated operating conditions. To fix the configuration, the ALG shall be sealed according the Certificate.

8.2.1.2 After installation

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

- check that the requirements of 7.1, and 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 6.1.1) all necessary information to make the required corrections shall be given to the user.

The test method shall be in compliance with part 2.

The instrument shall remain within the maximum permissible errors specified for ALG's installed on tanks.

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

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.