

IECEx Guide on Uncertainty of Measurement

Tests and measurements required in the Standards IEC 60079-series

(This draft results from practice in Germany and the experience of DMT/BVS in Dortmund and PTB in Braunschweig)

In the tables **(1)** means:

Measuring uncertainty of general industrial standard is sufficient, failure of the measuring devices will be detected easily. The measuring uncertainty of the devices has to provide the safe estimation of the values required in the standards taking into account the stated tolerances. Where no tolerances are given in the standard, a measuring uncertainty of 5% shall be adequate.

The tables at the moment only cover IEC 60079-0, 60079-5, 60079-6 and 60079-11. For most of the other standards, the tables could be provided in due time.

SPECIFIC TEST ITEMS						Sheet 1 (2)
Electrical apparatus for explosive gas atmospheres General requirements IEC 60079-0:1998						
1	2	3	4	5	6	7
Clause	Requirement	Kind of test, measurand where appropriate	Test equipment	Standard	Calibration	Remarks
23.4.3.1	resistance to impact test	- length - mass	folding rule (cf. Annex D)		no	no special measurement requirements from the safety view-point (1)
23.4.3.2	drop test		weighing instrument (cf. Annex D)			
23.4.4	degree of protection IP of enclosures	ingress of foreign matter and water	test bodies, dust test chamber, spray head or flushing pipe	IEC 60529	no	
23.4.5	torque test for bushings	torque measurement	torque wrench		no	(1)
23.4.6	temperature rise test	- electric power - temperature - time	current, voltage, power usual electro-technical equipment various measuring principles are possible stop watch		yes ± 1% yes ± 5 K no	Measurement uncertainty U shall not be added to result when type testing (U covered by 5K/10K increase required by standard)

SPECIFIC TEST ITEMS						Sheet 2 (2)
Electrical apparatus for explosive gas atmospheres General requirements IEC 60079-0:1998						
1	2	3	4	5	6	7
Clause	Requirement	Kind of test, measurand where appropriate	Test equipment	Standard	Cali-bration	Remarks
23.4.7 Nos. 1-4	non-metallic enclosures, aging stability	- cold - heat - humidity	climatic cabinet		yes	tolerances specified in IEC 60079-0
23.4.7.5	resistance to light		cf. standards ISO 4892-1 ISO 179		no	
23.4.7.6	resistance to chemical agents		liquids acc. to 23.4.7.6 ISO 1817		no	
23.4.7.7 cf. 23.4.3						
23.4.7.8	static electricity	insulation resistance	cf. IEC 60079-0 23.4.7.8		no	(1)

SPECIFIC TEST ITEMS						Sheet 1 (1)
Electrical apparatus for explosive gas atmospheres Oil-immersion "o" IEC 60079-6:1995						
1	2	3	4	5	6	7
Clause	Requirement	Kind of test, measurand where appropriate	Test equipment	Standard	Cali-bration	Remarks
5.1	sealing	pressure test IP test	pressure gauge cf. IEC 60079-0	IEC 60079-6	yes ± 5%	
5.2	leak rate < 5%	reduced pressure test	pressure gauge clock	IEC 60079-6	yes ± 1% no	
5.3	leak tightness IP 66	pressure test IP test	pressure gauge cf. IEC 60079-0	IEC 60079-6	yes ± 5%	

SPECIFIC TEST ITEMS						Sheet 1 (2)
Electrical apparatus for explosive gas atmospheres Powder filling "q" IEC 60079-5:1997						
1	2	3	4	5	6	7
Clause	Requirement	Kind of test, measurand where appropriate	Test equipment	Standard	Cali-bration	Remarks
5.1.1	mechanical strength	resistance to impact test (IEC 60079-0, 23.4.3.1) pressure type test of enclosure (5.1.1) - pressure - length - time	cf. IEC 60079-0 pressure measuring device length measuring device clock		no no no	(1) (1) (1)
5.1.2	degree of protection of enclosure	test of degree of protection of enclosure - IP degree of protection (IEC 60070-0, No. 23.4.4)	cf. IEC 60079-0	IEC 60529		
SPECIFIC TEST ITEMS						Sheet 2 (2)
Electrical apparatus for explosive gas atmospheres Powder filling "q" IEC 60079-5:1997						
1	2	3	4	5	6	7
Clause	Requirement	Kind of test, measurand where appropriate	Test equipment	Standard	Cali-bration	Remarks

5.1.4	electric strength test	electric strength test of filling material - voltage - current			yes ± 1% yes ± 1%	
5.1.3	flammability of materials	flamma-bility			ISO 1210 or UL 94 VO or IEC 707, FV method	

SPECIFIC TEST ITEMS						Sheet 1 (5)
Electrical apparatus for explosive gas atmospheres Intrinsic Safety "i" IEC 60079-11:1999						
1	2	3	4	5	6	7
Clause	Requirement	Kind of test, measurand where appropriate	Test equipment	Standard	Calibration	Remarks
6.2 8.7 6.3 6.4	Requirements as regards dimensions for the construction of components and apparatus, e.g.:	length determination of: lengths, cross-sections, thicknesses and widths of conducting tracks, surfaces, creepage distances and clearances, separation distances, partition thicknesses	length measuring device		no	Examined are: drawings, foils, samples (1)
10.1 to 10.3	spark ignition test	ignition test	spark-test apparatus gas mixing device	IEC 60079-11, 10.1 and Annex B	yes, cf. 10.3 yes	test gas must be of sufficient quality (1)

SPECIFIC TEST ITEMS						Sheet 2 (5)
Electrical apparatus for explosive gas atmospheres Intrinsic Safety "i" IEC 60079-11:1999						
1	2	3	4	5	6	7
Clause	Requirement	Kind of test, measurand where appropriate	Test equipment	Standard	Calibration	Remarks

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<p>10.5 6.2.4 8.1.4 8.2 10.9.3</p>	<p>temperature tests, temperature rise measurement determination of the max. surface temperature of cells and batteries</p>	<p>temperature measurement temperature rise test upon short-circuit</p>	<p>all conventional temperature measuring instruments all conventional temperature measuring instruments</p>	<p>IEC 60079-0</p>	<p>see IEC 60079-0</p>	<p>Influence of the measuring element on the temperature prevailing at the measuring point shall be largely excluded.</p>
<p>10.6, 6.4.12, 5.4, 6.4.4, 6.4.5, 6.4.11, 8.1.3, 8.1.4, 8.2, 8.5, 8.8</p>	<p>insulation voltage test, electric strength</p>	<p> voltage current</p>	<p>a.c. or d.c. voltage source, voltage detector, ammeter</p>	<p>HD 401S1 IEC 60079-11, 10.6</p>	<p> yes ± 2% yes ± 2%</p>	<p>AC 48 up to 62 Hz, DC ripple voltage max. 3%</p>
<p>10.7 6.2.4</p>	<p>small component ignition test</p>	<p>ignition test - no ignition due to small hot component</p>	<p>explosion chamber test mixture gas mixing device</p>	<p>IEC 60079-11, 10.7</p>	<p>no yes, special test</p>	<p>test gas must be of sufficient quality (1)</p>

SPECIFIC TEST ITEMS						Sheet 3 (5)
Electrical apparatus for explosive gas atmospheres Intrinsic Safety "i" IEC 60079-11:1999						
1	2	3	4	5	6	7
Clause	Requirement	Kind of test, measurand where appropriate	Test equipment	Standard	Cali-bration	Remarks
10.9 7.4	test for cells and batteries	determina-tion of open circuit voltage, determina-tion of internal resistance - voltage - current	voltmeter voltmeter ammeter		yes ± 2% yes ± 2% yes ± 2%	
10.9	including spark ignition test	ignition test	spark-test apparatus	IEC 60079-11, 10.2 and Annex B	yes, 10.3	
10.10.1 6.4.4, 6.7, 8.4, 8.6, 9.2.2	mechanical strength a)casting compounds: strength strength of free surfaces	force impact test	metal rod impact test apparatus	IEC 60079-11, 10.10.1 IEC 60079-0	no no	(1)

SPECIFIC TEST ITEMS						Sheet 4 (5)
Electrical apparatus for explosive gas atmospheres Intrinsic Safety "i" IEC 60079-11:1999						
1	2	3	4	5	6	7
Clause	Requirement	Kind of test, measurand where appropriate	Test equipment	Standard	Cali-bration	Remarks
10.10.2 6.3, 6.4	b) partitions: strength	force	massive test rod	IEC 60079-11, 10.10.2	no	(1)
7.4.7	c) drop test for portable electrical apparatus with batteries	drop test		IEC 60079-0 23.4.3.2	no	
10.11 7.7	d) for apparatus containing piezoelectric devices determination of the capacitance and voltage during impact test	impact test voltage capacitance	impact test apparatus voltmeter capacitance meter	IEC 60079-0	no yes ± 2% yes ± 2%	
10.13	e) cable pull test	pull test, force		IEC 60079-11, 10.13	no	(1)

SPECIFIC TEST ITEMS						Sheet 5 (5)
Electrical apparatus for explosive gas atmospheres Intrinsic Safety "i" IEC 60079-11:1999						
1	2	3	4	5	6	7

Clause	Requirement	Kind of test, measurand where appropriate	Test equipment	Standard	Calibration	Remarks
10.12 7.3, 8.6 and 9	determination of the characteristics of current-voltage transients type tests for diode safety barriers and safety shunts	voltage current time	pulsed current source, storage oscilloscope, current source, voltmeter		no no no yes $\pm 2\%$	(1) (1) (1)