
**Plastics — Small enclosures for
conditioning and testing using aqueous
solutions to maintain the humidity at
a constant value**

*Plastiques — Petites enceintes de conditionnement et d'essai utilisant
des solutions aqueuses pour maintenir l'humidité à une valeur
constante*

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 483 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 6, *Ageing, chemical and environmental resistance*.

This second edition cancels and replaces the first edition (ISO 483:1988), in which the values of the relative humidity above the saturated salt solutions have been corrected to the values given in Reference [1] (see the Bibliography) which are generally accepted as the most reliable values by national physical laboratories.

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Introduction

The properties of many plastics are strongly influenced by the relative humidity of the surrounding air.

This International Standard describes small cabinets for conditioning and testing of specimens at constant temperature and constant relative humidity above aqueous solutions of salts, sulfuric acid and glycerol.

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Plastics — Small enclosures for conditioning and testing using aqueous solutions to maintain the humidity at a constant value

1 Scope

This International Standard establishes guidelines for the construction and use of enclosures with volumes less than 200 dm³, in order to obtain atmospheres of constant relative humidity at given temperatures, using saturated aqueous salt solutions, glycerol/water solutions or sulfuric acid/water solutions, for conditioning and testing plastics.

It specifies the procedures to be followed to maintain the relative humidities of the conditioning and testing atmospheres within the required tolerances, at the temperatures specified by particular International Standards.

The procedures described are intended for conditioning small quantities of materials prior to test, and for such tests as may be carried out entirely within a small enclosure, e.g. electrical tests. The guidelines described do not apply to enclosures requiring frequent opening.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 3696:1987, *Water for analytical laboratory use — Specification and test methods*

3 Principle

In a relatively small, closed container, aqueous solutions of specified concentration can be used to produce atmospheres with specific relative humidities under equilibrium conditions. Such atmospheres can be generated by using binary saturated aqueous salt solutions (see method A and Table 1), by using specific concentrations of aqueous glycerol solutions (see method B and Table 2) or by using aqueous sulfuric acid solutions (see method C and Table 3). In the case of method B and method C, it is necessary to measure and control the concentrations of these solutions.

Information is given concerning the methods of producing desired relative humidities in these enclosures at temperatures from 0 °C to 70 °C.

The relative-humidity values indicated have been taken from the literature ^[1]. The uncertainties involved are discussed in Clause 9.

4 Materials

- 4.1 Salts**, of recognized analytical grade.
- 4.2 Glycerol**, of reagent quality.
- 4.3 Sulfuric acid**, of reagent quality.
- 4.4 Water**, grade 3 as defined in ISO 3696:1987.

NOTE The exact purity of the chemicals used when the original conditions were developed is not known, but any differences between those chemicals and reagent-grade chemicals are expected to be negligible.

5 Aqueous solutions

- 5.1 Saturated aqueous salt solutions** (see Table 1), with an excess of salt covered by the solution in order to keep the solution saturated.
- 5.2 Aqueous glycerol solutions** (see Table 2), of specified concentrations.
- 5.3 Aqueous sulfuric acid solutions** (see Table 3), of specified concentrations.

Table 1 (for use with method A) — Relative humidity of air over saturated aqueous salt solutions at temperatures between 5 °C and 70 °C

	Saturated aqueous salt solution	Relative humidity (%) at temperature θ										
		5 °C	10 °C	15 °C	20 °C	25 °C	30 °C	35 °C	40 °C	50 °C	60 °C	70 °C
1	Potassium hydroxide (KOH) ^a	14	12	11	9	8	7	7	6	6	6	
2	Lithium chloride (LiCl·xH ₂ O) ^b	11	11	11	11	11	11	11	11	11	11	
3	Potassium acetate (CH ₃ COOK)		23	23	23	23	22					
4	Magnesium chloride hexahydrate (MgCl ₂ ·6H ₂ O) ^b	34	34	33	33	33	32	32	32	31	29	
5	Potassium carbonate dihydrate (K ₂ CO ₃ ·2H ₂ O) ^b	43	43	43	43	43	43					
6	Magnesium nitrate hexahydrate [Mg(NO ₃) ₂ ·6H ₂ O] ^b	59	57	56	54	53	51	50	48	45		
7	Sodium bromide (NaBr)	64	62	61	59	58	56	55	53	51	50	
8	Potassium iodide (KI)	73	72	71	70	69	68	67	66	65	63	62
9	Sodium chloride (NaCl) ^b	76	76	76	75	75	75	75	75	74	75	
10	Ammonium sulfate [(NH ₄) ₂ SO ₄] ^{b, c}	82	82	82	81	81	81	80	80	79		
11	Potassium chloride (KCl)	88	87	86	85	84	84	83	82	81	80	
12	Potassium nitrate (KNO ₃) ^b	96	96	95	95	94	92	91	89	85		
13	Potassium sulfate (K ₂ SO ₄)	99	98	98	98	97	97	97	96	96		

^a Potassium hydroxide solution is corrosive and should not be allowed to come into contact with the skin.

^b These salts are recommended for particular humidity ranges because the change with temperature is very small over the range 20 °C to 30 °C.

^c Ammonium salts may cause corrosion of copper parts.

Table 2 (for use with method B) — Relative humidity of air over aqueous glycerol solutions at temperatures between 0 °C and 70 °C

Approximate glycerol concentration % (by mass)	Refractive index at 25 °C n_D^{25}	Relative humidity (%) at temperature θ			
		0 °C	25 °C	50 °C	70 °C
10	1,346 3	98	98	98	98
20	1,356 0	96	96	96	97
25	1,360 2	95	95	96	96
35	1,377 3	89	90	91	91
45	1,390 5	84	85	86	87
52	1,401 5	79	80	81	82
58	1,410 9	74	75	76	77
64	1,419 1	69	70	71	72
69	1,426 4	63	65	66	67
74	1,432 9	58	60	61	63
77	1,438 7	53	55	57	58
81	1,444 0	48	50	52	53
84,5	1,448 6	43	45	47	48
87,5	1,452 9	38	40	42	43

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Table 3 (for use with method C) — Relative humidity of air over aqueous sulfuric acid solutions at temperatures between 5 °C and 50 °C

Sulfuric acid concentration % (by mass)	Density at 23 °C g/cm ³	Density at 25 °C g/cm ³	Relative humidity (%) at temperature θ				
			5 °C	15 °C	25 °C	35 °C	50 °C
5	1,030 7	1,030 0	98	98	98	98	98
10	1,064 8	1,064 0	96	96	96	96	96
15	1,100 5	1,099 4	93	93	92	93	92
20	1,137 6	1,136 5	88	88	88	88	89
25	1,176 4	1,175 0	82	82	83	83	83
30	1,216 4	1,215 0	74	75	75	76	77
35	1,257 7	1,256 3	65	66	67	68	69
40	1,300 5	1,299 1	54	56	57	58	59
45	1,345 2	1,343 7	43	45	46	47	49
50	1,397 2	1,391 1	33	34	35	37	39
55	1,442 8	1,441 2	23	24	25	26	28
60	1,495 7	1,494 0	14	15	16	18	19
65	1,550 7	1,549 0	8	9	10	10	12
70	1,607 7	1,605 9	4	4	5	5	6