INTERNATIONAL STANDARD

ISO 11659-2

First edition
2004-10-01

Textile machinery and accessories — Machine parts in contact with textile processing oils —

Part 2: Determination of the impact on polymeric materials

Matériel pour l'industrie textile — Pièces de machines en contact avec des huiles textiles —

Partie 2: Détermination de l'impact sur les matériaux polymères

Reference number
ISO 11659-2:2004(E)

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

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

Published in Switzerland

Contents

Page

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 11659-2 was prepared by Technical Committee ISO/TC 72, *Textile machinery and machinery for dry-cleaning and industrial laundering*, Subcommittee SC 4, *Dyeing and finishing machinery and accessories*.

ISO 11659 consists of the following parts, under the general title *Textile machinery and accessories — Machine parts in contact with textile processing oils*:

— *Part 1: Determination of anticorrosive effect upon steel*

— *Part 2: Determination of the impact on polymeric materials*

— *Part 3: Determination of the impact on lacquers*

Textile machinery and accessories — Machine parts in contact with textile processing oils —

Part 2: Determination of the impact on polymeric materials

1 Scope

This part of ISO 11659 specifies tests for determining the impact of processing oils on textile machine parts made of polymeric materials. In view of the multitude of processing oils and polymeric materials, it addresses a selection of those substances and materials. However, testing of products not mentioned is also possible. It is applicable to textile processing oils used on fibres, yarns and the filaments prepared for their processing, and to polymeric materials in the thermoplastics, duroplastics, elastomers and thermoplastic elastomers groups.

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 37, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*

ISO 105-E14, *Textiles — Tests for colour fastness — Part E14: Colour fastness to acid-felting: Mild*

ISO 175, *Plastics — Methods of test for the determination of the effects of immersion in liquid chemicals*

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

ISO 471, *Rubber — Temperatures, humidities and times for conditioning and testing*

ISO 527-2, *Plastics — Determination of tensile properties — Part 2: test conditions for moulding and extrusion plastics*

ISO 815, *Rubber, vulcanized or thermoplastic — Determination of compression set at ambient, elevated or low temperatures*

ISO 868, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness)*

ISO 1043-1, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics*

ISO 1183 (all parts), *Plastics — Methods for determining the density and relative density of non-cellular plastics*

ISO 1628-2, *Plastics — Determination of the viscosity of polymers in dilute solution using capillary viscometers — Part 2: Poly(vinyl chloride) resins*

ISO 1629, *Rubber and lattices — Nomenclature*

ISO 2884-1, *Paints and varnishes — Determination of viscosity using rotary viscometers — Part 1: Cone-and-plate viscometer at a high rate of shear*

ISO 3146, *Plastics — Determination of melting behaviour (melting temperature or melting range) of semi-crystalline polymers by capillary tube and polarizing-microscope methods*

ISO 3205:1976, *Preferred test temperatures*

ISO 4599, *Plastics — Determination of resistance to environmental stress cracking (ESC) — Bent strip method*

ISO 4600, *Plastics — Determination of environmental stress cracking (ESC) — Ball or pin impression method*

ISO 4649, *Rubber, vulcanized or thermoplastic — Determination of abrasion resistance using a rotating cylindrical drum device*

ISO 5661, *Petroleum products — Hydrocarbon liquids — Determination of refractive index*

ISO 6252:1992, *Plastics — Determination of Environmental Stress Cracking (ESC) — Constant-tensile-stress method*

ISO 8295, *Plastics — Film and sheeting — Determination of coefficients of friction*

ISO 10336, *Crude petroleum — Determination of water — Potentiometric Karl-Fischer titration method*

ISO 10523, *Water quality — Determination of pH*

ISO 11357-2, *Plastics — Differential scanning calorimetry (DSC) — Part 2: Determination of glass transition temperature*

ISO 11357-3, *Plastics — Differential scanning calorimetry (DSC) — Part 3: Determination of temperature and enthalpy of melting and crystallization*

ISO 11659-1, *Textile machinery and accessories — Machine parts in contact with textile processing oils — Part 1: Determination of anticorrosive effect upon steel*

ISO 18064, *Thermoplastic elastomers — Nomenclature and abbreviated terms*

IEC 60893-1, *Insulating materials — Industrial rigid laminated sheets based on thermosetting resins for electrical purposes — Part 1: Definitions, designations and general requirements*

IEC 60893-2, *Insulating materials — Industrial rigid laminated sheets based on thermosetting resins for electrical purposes — Part 2: Methods of test*

DIN 51757, *Testing of mineral oils and related materials — Determination of density*

3 Principle

IMPORTANT — Comparisons between polymeric materials within one group of plastics (see Clause 1) on the basis of this test are permissible only if the test specimens are of the same dimensions (in particular of the same thickness) and, to the extent that this is possible, of the same physical condition (condition of the surface, inner stress, etc.) and in the same state of conditioning.

Total immersion of the test specimens in a test liquid during a fixed duration of test and at a fixed storage temperature with or without mechanical stress.

Checking of properties before and after impact and drying. If possible, properties shall be checked subsequently in the same test specimens.

4 Test method and general test conditions

4.1 Choice of test liquid and polymeric materials

4.1.1 Choice of test liquid

The test liquid shall be

— the processing oil in its original state, or

— a 10 % mixture of the processing oil with demineralized water (in cases where the polymeric materials concerned are usually in contact with aqueous formulations of the processing oils), or

— other formulations of processing oils (in cases where the polymeric materials concerned are usually in contact with such formulations),

selected in accordance with Annex A.

4.1.2 Choice of polymeric materials

Testing should be carried out on machine parts or material samples from defined polymeric materials. For systematic testing, select samples from the polymeric materials given in Annex B as test specimens.

4.2 Storage temperatures

Recommended temperatures for the storage of test specimens in the test liquid:

a) (23 ± 2) °C;

b) (70 ± 2) °C.

If another temperature is applied, the storage temperature should be according to ISO 3205.

NOTE For certain combinations of polymeric materials and test liquids, an increase in storage temperature to shorten the duration of test can lead to misjudgements in the evaluation.

4.3 Duration of test

The storage of test specimens in the test liquid shall last (24 ± 2) h, (48 ± 5) h, (96 ± 10) h, (168 ± 17) h or a multiple of 168 h.

4.4 Test specimens

Machine parts or shoulder sticks in accordance with ISO 527-2 shall be used as test specimens.

For elastomers and thermoplastic elastomers, rings according to ISO 37 shall additionally be used.

For thorough testing, in addition, test specimens according to ISO 175:1999, 5.2, shall be used.

4.5 Conditioning

4.5.1 Thermoplastics and thermoplastic elastomers

Conditioning shall be according to ISO 291 until the state of equilibrium is reached.

4.5.2 Duroplastics

Conditioning shall be according to ISO 527-2.

4.5.3 Elastomers

Conditioning shall be according to ISO 471.

4.6 Test procedure

4.6.1 Quantity of test liquid

Cover the test specimen completely by the test liquid.

4.6.2 Storage of test specimens

Store the test specimen in a closed or covered vessel in accordance with ISO 175:1999, 4.6.2.

4.6.3 Rinsing and drying of test specimens

Rinse and dry the test specimen in accordance with ISO 175:1999, 4.6.3.

5 Determination of changes of mass and/or dimensions and/or appearance

This determination shall be according to ISO 175.

6 Determination of changes in physical properties

6.1 General

The tests described here are carried out using machine parts or material samples. However, some tests are carried out only with specially designed test specimens. In such cases, test specimens made of the concerned polymeric materials may be used instead of machine parts.

6.2 Thermoplastics

6.2.1 The tensile test with shoulder sticks (elongation, tensile strength, E-module) shall be according to ISO 527-2.

6.2.2 The test of cracking resistance shall be according to either ISO 4600 or ISO 6252 or ISO 4599.

6.3 Duroplastics

The tensile test in shoulder sticks (elongation, tensile strength, E-module) shall be according to ISO 527-2.

6.4 Elastomers

6.4.1 The tensile test of rings (elongation, tensile strength) shall be according to ISO 37 or using shoulder sticks in accordance with ISO 527-2.

6.4.2 Shore hardness shall be A or D in accordance with ISO 868.

6.4.3 Compression strain shall be according to ISO 815.

6.4.4 Abrasion shall be according to ISO 4649.

6.4.5 Colour fastness shall be according to ISO 105-E 14.

6.4.6 Frictional behaviour shall be according to ISO 8295.

NOTE Only elastomers to steel, no conclusions for other combinations of materials (e.g. elastomer/elastomer or elastomer/fibres).

6.5 Thermoplastic elastomers

6.5.1 The tensile test of rings (elongation, tensile strength) shall be according to ISO 37 or using shoulder sticks in accordance with ISO 527-2.

6.5.2 If necessary, further tests as given in 6.4.2 to 6.4.6, shall be performed.

7 Test report

The test report shall include the following information:

a) reference to this part of ISO 11659 (i.e. “ISO 11659-2”);

b) complete identification of the tested polymeric material;

c) test specimens used — method of preparation, dimensions, surface condition, etc;

d) conditioning procedure;

e) complete identification of test liquids used, storage temperature and duration of test, as well as any other applicable conditions (e.g. illumination or darkness);

f) temperatures and duration of the applied drying procedure;

g) methods of visual examination;

h) properties investigated and test methods used, as well as measured values;

i) if prepared, graphs showing the properties (test results) as a function of time;

j) if requested, the results of the testing of the test liquid after storage according to ISO 175:1999, 4.6.3;

k) any occurrence that might have an influence on the results.

Annex A
(normative)

Selection of processing oils for testing

Code	Product	Recommended fibre type	**Density** determined according to DIN 51757	**Viscosity** determined according to ISO 2884-1	**Refraction** determined according to ISO 5661	**pH value** determined according to ISO 10523	**Water content** determined according to ISO 10336
			g/ml	mPa·s			%
A 1	Formulation based on ethylene-oxide-propylene-oxide-copolymers	synthetic textile filaments	1,012–1,018	150–200	1,455–1,459	6,0–8,0	max. 0,5
A 2	Formulation based on synthetic ester oils	synthetic textile and technical filaments	0,903–0,923	80–100	1,479–1,481	5,2–6,2	3,5–4,5
A 3	Formulation based on polyglycol esters and ethers	synthetic textured filaments for carpet production	1,03–1,04	215–275	1,442 0–1,449 0	7,0–7,5	18,5–19,5
A 4	Formulation based on synthetic oils with emulsifiers and additives	natural and synthetic filaments and fibre yarns	0,85–0,86	17,5–21,5	1,463–1,466	7,0–8,0	max. 2
A 5	Formulation based on phosphoric acid esters	synthetic fibre cables	—	10 000–13 000	—	9,0–10,5	51–55
A 6	Formulation based on polyglycol ester and ether with phosphoric acid esters	synthetic fibre cables and staple fibres	1,446–1,450	256–296	1,445 8–1,449 8	8,0–9,0	14–16
A 7	Alkylpolyalkylene-glycol ether, end-sealed	natural and synthetic filaments and fibre yarns	0,972–0,982	33–43	1,450–1,451	6,0–8,0	max. 0,5

Storage, handling and useful life shall be according to the manufacturer's instructions.

NOTE For information about sources of supply: Secretariat ISO/TC 72/SC 4, DIN Deutsches Institut für Normung, Burggrafenstraße 6, D-10787 Berlin.

Annex B
(normative)

Selection of polymeric materials for testing

Thermoplastics						
Code	**Product** [a]	**Density** determined according to ISO 1183 (all parts)	**Melting temperature** determined according to ISO 3146	**Glass transition temperature** determined according to ISO 11357-2	**Viscosity number** determined according to ISO 1628-2	**Tensile E-model** determined according to ISO 527-2
		g/cm^3	°C	°C	ml/g	MPa
B 1	Polyamide 6 [b] (PA 6)	1,12–1,14	215–225	55–65 (dry)	140–160	2 600–3 200 (dry)
B 2	Polyamide 6.6 [b] (PA 66)	1,13–1,15	258–268	65–75 (dry)	140–160	2 700–3 300 (dry)
B 3	Aromatic polyamide [PA6I/6T; (PAMXD6)] [b]	1,00–1,18	280–300	85–165	110–140	2 700–3 300 (dry)
B 4	Amorphous, transparent polyamide (PA12/MACMI; PAMACM12)	1,05–1,07	175–210 [c]	110–160	95–115	2 000–2 400
B 5	Polypropylene (PP)	0,89–0,91	160–170	0–10	150–300	1 100–1 500
B 6	Polyethylene, high density (PE-HD)	0,95–0,97	131–141	—	125–145	1 300–1 700
B 7	Polyethylene-Ultrahigh molecular weight (PE-UHMW)	0,93–0,94	130–135	—	—	500–800
B 8	Polyoxymethylene (POM)	1,41–143	172–182	60–70	—	2 800–3 200
B 9	Polystyrene (PS)	1,04–1,06	—	95–105	90–100	3 000–3 400
B 10	Acrylonitrile-butadiene-styrene plastic (ABS)	1,03–1,07	—	80–115	—	2 200–3 000
B 11	Styrene-acrylonitrile plastic (SAN)	1,07–1,08	—	85–110	75–120	3 500–3 900
B 12	Polycarbonate (PC)	1,20–1,24	220–260 [c]	140–150	45–65	2 200–2 600
B 13	Polyvinyl chloride (PVC-P), containing plasticizer	1,42–1,44	—	0–50	—	—
B 14	Polyvinyl chloride (PVC-U), unplasticized	1,38–1,40	—	80–90	—	2 700–3 200
B 15	Polymethyl metacrylate (PMMA)	1,17–1,19	—	105–115	52–72	3 100–3 300
B 16	Polybutylene terephthalate (PBTP)	1,30–1,32	220–225	60	—	2 500–2 800

Storage, handling and useful life shall be according to the manufacturer's instructions.

NOTE For information about sources of supply: Secretariat ISO/TC 72/SC 4, DIN Deutsches Institut für Normung, Burggrafenstraße 6, D-10787 Berlin.

[a] Term for material and abbreviated term according to ISO 1043-1.

[b] All types also applied in strengthen/reinforce and/or modified version.

[c] Determined according to ISO 11357-3:1999.

Duroplastics				
Code	**Product description**		**Density** determined according to ISO 1183-1 [a]	**Tensile strength** determined according to IEC 893-2
			g/cm^3	MPa
C 1	Duroplastic		[b]	[b]
C 2	Phenol-formaldehyde with cellulosic paper	(PF CP) [c]	1,3–1,4	at least 7 000
C 3	Phenol-formaldehyde with woven cotton cloth	(PF CC) [c]	1,3–1,4	at least 7 000
C 4	Epoxide (epoxy) with woven glass cloth	(EP GC) [c]	1,7–1,9	16 000–18 000
C 5	Silicone with woven glass cloth	(SI GC) [c]	1,6–1,7	13 000

[a] Use Method A according to ISO 1183-1.

[b] Currently no problems in the resistance to processing oils; there are no further details.

[c] Laminated sheets: Description and designation according to IEC 60893-1.

Elastomers					
Code	**Product description** [a]	**Density** determined according to ISO 1183 (all parts)	**Shore hardness A** determined according to ISO 868	**Tensile strength** determined according to ISO 37	**Elongation at tear** determined according to ISO 37
		g/cm^3	mN	MPa	%
D 1	Formulation based on polyurethane rubber (PUR) Polyester urethane (AU) Polyether urethane (EU)	1,20–1,40	65–95	45–55	550–650
D 2	Formulation based on terpolymer of ethylen propylene-diene (EPDM)	0,80–1,30	30–85	10–20	100–250
D 3	Formulation based on acrylonitrile-butadiene rubber (NBR34)	1,00–1,50	30–95	15–25	300–400
D 4	Formulation based on nature rubber (NR)	0,90–1,80	30–95	15–30	100–800
D 5	Formulation based on chloroprene rubber (CR)	1,20–1,60	40–95	15–25	100–800
D 6	Formulation based on copolymer of tetrafluoroethylene and propylene rubber (FEPM)	1,80–2,00	65–85	10–20	100–300
Storage, handling and useful life shall be according to the manufacturer's instructions. NOTE For information about sources of supply: Secretariat ISO/TC 72/SC 4, DIN Deutsches Institut für Normung, Burggrafenstraße 6, D-10787 Berlin.					
[a] Term for material and abbreviated term according to ISO 1043-1 and ISO 1629.					

Thermoplastic elastomers						
Code	**Product description** [a]	**Density** determined according to ISO 1183	**Shore hardness** determined according to ISO 868		**Tensile strength** determined according to ISO 527-2	**Elongation at break** determined according to ISO 527-2
		g/cm^3	mN			%
			A	**D**		
E 1	Urethane thermoplastic elastomer (TPU) Polyester urethane (AU) Polyether urethane (EU)	1,10–1,30	65	80	30–50	250–700
E 2	Thermoplastic rubber vulcanizate (TPV); combination of terpolymer of ethylen, propylene-diene (EPDM) and polypropylen (PP) TPV-(EPDM+PP)	0,95–0,99	35	80	7–9	400–500
E 3	Olefinic thermoplastic elastomer (TPO)	0,94–1,00	35	80	b	b
E 4	Copolyester thermoplastic elastomer (TPC)	0,90–1,10	50	70	b	b
E 5	Styrene thermoplastic elastomer (TPS)	0,90–1,20	10	40	b	b
E 6	Polyamide thermoplastic elastomer (TPA)	1,00–1,30	65	85	12–30	30–50

Storage, handling and useful life shall be according to the manufacturer's instructions.

NOTE For information about sources of supply: Secretariat ISO/TC 72/SC 4, DIN Deutsches Institut für Normung, Burggrafenstraße 6, D-10787 Berlin.

[a] Term for material and abbreviated term according to ISO 18064 and ISO 1629.

[b] No secured value can be given.

ICS 59.120.01

Price based on 12 pages