INTERNATIONAL STANDARD

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Specifications for industrial laundry machines — Definitions and testing of capacity and consumption characteristics —

Part 4: Washers-extractors

Spécifications pour les machines de blanchisserie industrielles — Définitions et contrôle des caractéristiques de capacité et de consommations —

Partie 4: Laveuses-essoreuses

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Foreword

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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.

International Standard ISO 9398-4 was prepared by Technical Committee ISO/TC 72, *Textile machinery and allied machinery and accessories*, Sub-Committee SC 4, *Dyeing, finishing and allied machinery and accessories*.

ISO 9398 consists of the following parts, under the general title *Specifications for industrial laundry machines — Definitions and testing of capacity and consumption characteristics*:

— *Part 1: Flatwork ironing machines*

— *Part 2: Batch drying tumblers*

— *Part 3: Washing tunnels*

— *Part 4: Washers-extractors*

Annex A of this part of ISO 9398 is for information only.

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Specifications for industrial laundry machines — Definitions and testing of capacity and consumption characteristics —

Part 4:
Washers-extractors

1 Scope

This part of ISO 9398 defines the characteristics of washers-extractors and gives the usual test methods for these characteristics with regard to the capacity, the power and water consumptions, and the hourly productivity of these machine.

It does not cover safety requirements, for which reference should be made to the appropriate national regulations and legal texts.

This part of ISO 9398 is used for reference in the drafting of purchasing orders for washers-extractors whose nominal capacity is at least 7 kg.

NOTE 1 If more detailed information on the effect of laundry machines on textiles is required, reference should be made to ISO 7772 after agreement between the parties involved.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 9398. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 9398 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 9398-1:1993, *Specifications for industrial laundry machines — Definitions and testing of capacity and consumption characteristics — Part 1: Flatwork ironing machines.*

IEC 335-2-7:1984, *Particular requirements for washing machines.*

3 Definitions

For the purposes of this part of ISO 9398, the definitions given in ISO 9398-1 and the following definitions apply.

3.1 nominal capacity of a washer-extractor: Maximum load, in kilograms, of decatized cotton articles as specified in 4.1 which may be washed and spin-dried in this machine under the specified test conditions.

This maximum load corresponds to the mass at (8 ± 0,5) % residual moisture content of these cotton articles.

NOTE 2 The value of this load is given on the rating plate of the machine.

3.2 cage (basket) volume (V): Inside volume of the cage, expressed in cubic decimetres (litres), minus all the inwardly projecting volumes (except those of baffles or bars).

3.3 volumetric ratio (v): Ratio of the *cage volume*, expressed in cubic decimetres (litres), to the *nominal capacity*, expressed in kilograms.

3.4 load ratio (c): Ratio of the *nominal capacity* of the washer-extractor, expressed in kilograms, to the *cage volume*, expressed in cubic decimetres (litres).

The optimum value of this ratio is 1/11.

4 General test conditions

4.1 Machine load

4.1.1 Amount of load

The test load shall correspond to the nominal capacity of the machine (3.1).

4.1.2 Nature of the load

The test load shall comprise decatized white cotton sheets with a mass per unit area of (175 ± 20) g/m^2 and dimensions of (250 ± 50) cm × (180 ± 36) cm.

4.1.3 Number of loads

Two identical loads are necessary for carrying out the tests.

4.2 Energy supply

Energy for the test shall be supplied by steam, gas, electricity or heat-transport fluid, as specified by the manufacturer.

4.3 Temperature of the feed water

The temperature of the feed water used in the test shall be (17 ± 7) °C.

4.4 Ambient air

The ambient air temperature during the test shall be (24 ± 6) °C and the relative humidity shall be (50 ± 10) %.

4.5 Condition of the machine

The washer-extractor shall be installed as indicated by the manufacturer and shall be clean.

4.6 Machine test cycles

Two test cycles shall be run, cycle A and cycle B, defined in tables 1 and 2 respectively.

Should a "manufacturer's cycle" be substituted for cycle A or cycle B, the operations to be carried out shall be specified together with the conditions under which these operations take place.

NOTE 3 The absence of any standard measure of the degree of soiling of the wash has lead to only two test cycles being required.

5 Determination of residual moisture content after extraction

5.1 Test method

5.1.1 Under the general test conditions as specified in 4.1 to 4.5, carry out one rinse cycle of 10 min duration, spin for 12 min and immediately weigh the laundry.

5.1.2 Carry out three such rinse-spin operations in succession.

5.1.3 Ascertain the mean value of the three extraction tests specified in 5.1.2.

5.2 Expression of results

Indicate the mean residual moisture value of the test load after extraction as determined in 5.1.

6 Energy consumption of the machine

6.1 General

The energy consumption of a washer-extractor is defined as the number of kilojoules or kilowatt-hours of steam, gas, electricity or heat-transport fluid energy required during washing and extraction of a load (4.1) in a machine operating at its nominal capacity during the time corresponding to cycle A or B (see 6.3).

6.2 Test method

6.2.1 Under the general test conditions as specified in clause 4, carry out two consecutive test cycles (either A or B or "manufacturer") with one test load (4.1) to condition the machine.

6.2.2 Run the cycle chosen in 6.2.1 three times in succession, using the same test load as specified in (4.1).

6.2.3 Using suitable instruments, check the values of parameters allowing the calculation of the corresponding energy consumption for a determined cycle (A or B or "manufacturer") and take the mean value of the three tests.

NOTE 4 For machines using electric or gas energy for heating, energy meters are reliable; for machines using steam as the heat source, for the preliminary wash and main wash, measure the water quantities to be heated, as well as the temperatures before and after steam injection.

Table 1 — Test cycle A for industrial washers-extractors

Operation	Duration[1] min	Temperature °C	Product added	Bath water level[2]
Wetting	5	≈ 20	Wetting agent 2 g/kg of washing	high
Preliminary wash	8	40 ± 3	Washing powder[3] 8 g/kg to 15 g/kg of washing	low
Wash	15	90 ± 3	Washing powder[3] 8 g/kg to 15 g/kg of washing	low
Spin	2	—	—	—
Rinse	5	70 ± 3	—	high
Disinfection	8	28 ± 3	48° Hypochlorite bleach[4] 10 cm^3/kg to 15 cm^3/kg of washing	high
Neutralization	5	≈ 20	Sodium hydrogen sulfite c [$NaHSO_3$] = 1,32 mg/l 1 cm^3 to 2 cm^3	high
Rinse	5	≈ 20	Acetic acid c_{max} [CH_3COOH] = 800 g/l 2 cm^3	high
Final rinse	5	≈ 20	—	high
Spin dry	10	—	—	—

1) Times measured once the desired levels and temperatures have been attained.
2) Low level = 3 litres of water per kg of washing; high level = 6 litres of water per kg of washing.
3) Washing powder as indicated in annex B of IEC 335-2-7.
4) 1° Hypochlorite corresponds to 3,17 g of active chlorine.

Table 2 — Test cycle B for industrial washers-extractors

Operation	Duration[1] min	Temperature °C	Product added	Bath water level[2]
Wash	8	80 ± 3	Washing powder[3] 8 g/kg to 15 g/kg of washing	low
Spin	2	—	—	—
Rinse	5	55 ± 3	—	high
Disinfection	6	28 ± 3	48° Hypochlorite bleach[4] 10 cm^3/kg to 15 cm^3/kg of washing	high
Neutralization	3	≈ 20	Sodium hydrogen sulfite c [$NaHSO_3$] = 1,32 mg/l 1 cm^3 to 2 cm^3	high
Final rinse	3	≈ 20	—	high
Spin dry	10	—	—	—

1) Times measured once the desired levels and temperatures have been attained.
2) Low level = 3 litres of water per kg of washing; high level = 6 litres of water per kg of washing.
3) Washing powder as indicated in annex B of IEC 335-2-7.
4) 1° Hypochlorite corresponds to 3,17 g of active chlorine.

6.3 Expression of results

6.3.1 Indicate the energy consumption, expressed as kilojoules or kilowatt-hours, per kilogram, for the washing and extraction of a test load of decatized cotton sheets as specified in 4.1.

6.3.2 Indicate the energy consumption required by the motor(s) for the mechanical drive of the cage during the washing/extraction phases.

6.3.3 The total energy consumption required by a washer-extractor is the sum of the mechanical and thermal energies required.

EXAMPLE

Washing cycle A (or B or "manufacturer")

Motor(s) ..... kWh
Heating ..... kWh

Total ..... kWh

7 Determination of water consumption

7.1 General

The water consumption[1] of a washer-extractor is defined as the number of litres of water necessary for washing one test load (4.1) in a machine operating at its nominal capacity in the specified test cycle (4.6) (see 7.3).

7.2 Test method

7.2.1 Under the general test conditions as specified in clause 4, carry out two consecutive cycles (A or B or "manufacturer") with one test load (4.1) to condition the machine.

7.2.2 Run the cycle chosen in 7.2.1 three times in succession, using the same test load, as specified in 4.1.

7.2.3 Using suitable instruments, record the corresponding water consumption required for each of the three tests and take the mean value.

1) Includes the water needed for both washing and rinsing.

7.3 Expression of results

Indicate the water consumption, expressed in litres per cycle (A or B or "manufacturer" to be specified) and per kilogram, required for the washing and extraction of decatized cotton sheets as specified in 4.1.

8 Hourly productivity of the machine

8.1 General

The hourly productivity of a washer-extractor is defined as the mass (in kilograms) of a load of decatized cotton sheets as specified in 4.1 that can be washed and extracted in 1 h, not including the time for loading and unloading the machine, using the test cycle (A or B or "manufacturer" to be specified).

8.2 Expression of results

Indicate the hourly productivity (in kilograms) of the machine per cycle (A or B or "manufacturer" to be specified) and the degree of residual moisture obtained after the final extraction.

9 Machine information

9.1 Identification

— manufacturer;

— manufacturer's address;

— machine type and reference number.

9.2 Specifications

— nominal capacity, in kilograms;

— volumetric ratio, in cubic decimetres (litres) per kilogram;

— load ratio, in kilograms per cubic decimetre (litre);

— net internal cage volume, in cubic decimetres (litres);

— internal cage diameter, in millimetres;

— internal cage length, in millimetres;

— number and arrangement of compartments;

— overall dimensions of length, height and width, in millimetres;

— gross mass, in kilograms;

— steam supply pipe diameter, in millimetres;

— maximum supply pipe diameter, in millimetres;

— maximum and minimum cage speeds, in revolutions per minute, and the value of the g factor.

Annex A
(informative)

Bibliography

[1] ISO 6348:1980, *Textiles — Determination of mass — Vocabulary.*

[2] ISO 6741-1:1989, *Textiles — Fibres and yarns — Determination of commercial mass of consignments — Part 1: Mass determination and calculations.*

[3] ISO 7772-1:—[2], *Assessment of industrial laundry machinery and its effect on textiles — Part 1: Washing machines.*

[4] ISO 7772-2:—[2], *Assessment of industrial laundry machinery and its effect on textiles — Part 2: Extracting machines.*

[5] ISO 7772-3:—[2], *Assessment of industrial laundry machinery and its effect on textiles — Part 3: Flatwork ironing machines.*

[6] ISO 7772-4:—[2], *Assessment of industrial laundry machinery and its effect on textiles — Part 4: Batch drying tumblers.*

2) To be published.

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