
British Standard

Industrial laundry machinery

Part 4. Methods for the assessment of the effect of
batch drying tumblers on textiles

Machines de blanchisserie automatiques

Partie 4. Méthodes d'évaluation de l'effet des laveuses-sécheuses sur les textiles

Industriewaschmaschinen

Teil 4. Verfahren zur Beurteilung der Wirkung von Trocknern (Tumbler) auf Textilien

Contents

	Page		Page
Foreword	Inside front cover	D. Conditions of test	5
Cooperating organizations	Back cover	E. Method of recording values of moisture removed	6
Methods		F. Example of method of recording values of moisture removed	7
1. Scope	1	G. Personnel required	7
2. Definitions	1	Tables	
3. Apparatus	1	1. Types of loading	4
4. Test articles	2	2. Record of values of moisture removed	7
5. Preparation	2	3. Example of record of values of moisture removed	7
6. Drying capacity evaluation	2	Figures	
7. Energy consumption	3	1. Typical drying tumbler	4
8. Test report	3	2. Percentage moisture removal against time	6
Appendices		3. Example of percentage moisture removal against time	7
A. Particular details of drying tumblers	4		
B. Wash process	5		
C. Details of test machine and running conditions	5		

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Foreword

This British Standard has been prepared under the direction of the Fibres, Yarns, Fabrics and Production Standards Committee. The rapid technical development of laundry machinery and the changes in the pattern of purchasing have led to an urgent need for a standard means of assessment of the effect of machine performance on textiles. It has therefore become necessary to draw up standard methods of test for rating or assessing the effects of the principal types of industrial laundry machinery.

Two different approaches to the provision of the necessary information were considered:

- (a) verification of the claims made by the manufacturer on the performance of the machine, using conditions arbitrarily agreed between the manufacturer and the user;
- (b) preparation of standard methods of test for rating and assessing the effect of the principal types of machines, so that the test results obtained on machines of similar type could be compared directly wherever the machines were located and whenever they were tested.

It was agreed to adopt the second of these options in the preparation of the various Parts of this British Standard, since the urgent need was for procedures that could be used on a range of machines to evaluate their effect under reproducible conditions, including specification of the loads to be used. Thus it will be possible to compare the basic effects of one machine against another and a machine against a performance specification quoted in a contract.

No performance level is set. Another advantage in the approach adopted is that the tests can be conducted at any location where the necessary services are available. Information on the number and qualification of the personnel required, where this is considered to be particularly relevant, is given in appendix G.

There are, at present, no existing British Standards in the industrial laundering industry on any facet of the work, although a few standards exist in the related textile and chemical fields. This lack of published work has led to the problem of breaking new ground and great use has been made of original work by the former British Launderers' Research Association (now incorporated into the Fabric Care Research Association). It is planned to publish the following four Parts to this standard:

- Part 1 Methods for the assessment of the effect of rotary washing machines on textiles
- Part 2 Methods for the assessment of the effect of extracting machines on textiles
- Part 3 Methods for the assessment of the effect of flatwork ironing machines on textiles
- Part 4 Methods for the assessment of the effect of batch drying tumblers on textiles

It is hoped that with the advance of techniques, and widespread use of this standard, updated methods can be incorporated.

British Standard

Industrial laundry machinery

Part 4. Methods for the assessment of the effect of batch drying tumblers on textiles

1. Scope

This Part of this British Standard describes methods that collectively provide a procedure for the evaluation of the effects on textiles processed on cylindrical, rotating, drying tumbler machines and similar machines in which the damp washing is loosened, and partially or completely dried under the action of heated air and mechanical energy.

This Part of this British Standard relates to the testing of batch drying tumbler machinery either within an operating laundry or any premises where the required services are available.

This standard excludes machines used for purposes below a rated capacity of 10 kg.

The test results provide an indication of a machine effect in terms of energy consumption (see clause 7) and an output rating independent of operator efficiency.

The following performance characteristics are determined:

- (a) the ability to dry textile test articles, expressed in kilograms of moisture removed or as a percentage of the bone-dry mass of the test load; this is expressed as output per drying cycle, which is expressed in minutes;
- (b) the total energy consumption, in terms of heat and electricity, per kilogram of moisture removed;
- (c) the average mass of moisture removed, per minute, from a load of textiles of a known mass.

NOTE. The title of the publication referred to in this standard is given on the inside back cover.

2. Definitions

For the purposes of this Part of this British Standard the following definitions apply.

NOTE. Particular details of drying tumblers are given in appendix A.

2.1 batch tumbler. A drying tumbler that has closed doors during the drying or conditioning process.

2.2 bone-dry mass. The mass of a textile article (or number of articles) after being dried in a specified manner, when successive determinations of mass after several drying procedures show no progressive change in mass greater than 0.10 %.

NOTE. Specified drying procedures include repeated processing of the article or articles in a heated tumbler from which the exhaust air reaches a temperature of not less than 80 °C nor more than 120 °C or by repeatedly passing the article or articles through a flatwork ironing machine. These temperatures are appropriate to cotton fabrics, which constitute the test loads and test pieces specified in this standard.

2.3 cage. The part in a drying tumbler that rotates and contains the load during the drying process.

2.4 case. The part in a drying tumbler that encloses the rotating cage.

2.5 final moisture content. The mass of the textile articles after the drying process, less the bone-dry mass.

2.6 initial moisture content. The mass of the textile articles before the drying process, less the bone-dry mass.

2.7 lifter. The step or ledge on the internal periphery of the cage, usually parallel with the cage axis.

2.8 load. The textile articles with which the drying tumbler is charged.

2.9 moisture content (percentage). The total mass of the damp articles less the bone-dry mass, expressed as a percentage of the bone-dry mass.

3. Apparatus

3.1 All machines

3.1.1 Integrating watt hour meter, two will be required for electrically heated machines.

3.1.2 Recording volt/ammeter.

3.1.3 Stopwatch.

3.1.4 Multi-point temperature recorder.

3.1.5 Air flow measurement apparatus.

3.1.6 Weighing machine.

3.1.7 Measuring tape.

3.2 Steam heated machines

3.2.1 Recording and integrating steam flow meter.

3.2.2 Recording steam pressure gauge.

3.2.3 Condensate pressure gauge.

3.3 Thermal fluid heated machines

3.3.1 Recording and integrating fluid flow meter.

3.3.2 Fluid inlet pressure gauge.

3.3.3 Fluid outlet pressure gauge.

3.3.4 Recording thermometer, for fluid inlet temperature.

3.3.5 Recording thermometer, for fluid outlet temperature.

3.4 Gas heated machines

3.4.1 Integrating gas flow meter.

3.4.2 Manometer, for gas pressure.

4. Test articles

The following test articles are required:

- (a) Sheets, complying with clause 6 of BS 5815 : 1979, cotton plain weave, SH5, 150 cm × 255 cm, 185 g/m²,
- (b) Towels, complying with clause 9 of BS 5815 : 1979, Terry cotton bleached, T3, 61 cm × 121 cm, 3.25 kg per dozen.

All new test articles shall be washed three times at a temperature of 90 °C before being used for the tests described in this standard. A suitable washing process for this purpose is described in appendix B.

Each test article shall be new and not in regular use and shall be discarded when the loss in bone-dry mass is more than 7 % when compared with the mass after the first three washings by the process described in appendix B.

5. Preparation

5.1 All lint screens, dust filters, fan blades and exhaust ducting shall be inspected and, if necessary, cleaned to ensure freedom of passage of air through the machine. All driving belts shall be correctly adjusted.

The manufacturer shall be requested to inspect, check and certify in the test report that the machine and all relevant aspects of its installation and functioning under test conditions are satisfactory.

5.2 A sufficient quantity of standard test articles (see clause 4) shall be provided to make up at least one test load.

5.3 The bone-dry mass of the test load shall be the mass recommended by the manufacturer for the machine under test.

5.4 The person responsible for the tests should ensure that all test apparatus is available and correctly installed.

5.5 The data required for the identification of the test machine shall be recorded in accordance with appendix C.

5.6 The data required for the conditions under which the test was carried out shall be recorded in accordance with appendix C.

5.7 The airflow rate shall be recorded at an acceptable location in the outflow ducting.

6. Drying capacity evaluation

6.1 Procedure for fully dried articles

6.1.1 Immediately before the test, condition the tumbler by drying a load under normal operating conditions, and at the same time prepare the test load using the process described in appendix B.

6.1.2 For the test, load the tumbler with the test load, (see item (b) of clause 4), having an initial moisture content within the range of 50 % to 56 %, based on the bone-dry mass.

6.1.3 Read the meters (see 3.1 and 3.2, 3.3 or 3.4, according to the type of machine being used) immediately before the test run and record the values.

6.1.4 Dry the test load so as to attain a final moisture content within the range of 4 % to 8 %, based on the bone-dry mass on removal from the tumbler.

NOTE. Some trial runs using a test load made up of test articles specified in item (b) of clause 4 may be needed to establish the approximate drying time required.

6.1.5 Read the meters (see 3.1 and 3.2, 3.3 or 3.4, according to the type of machine being used) immediately after the test run, and record the values specified in appendix D.

6.1.6 Determine the mass of the dried test load, and record the values in a table with the format shown by table 2.

6.1.7 Conduct three similar test runs using the same procedures.

NOTE. The initial moisture content of 50 % to 56 % and the final moisture content of 4 % to 8 % should vary as fully as possible over the range in the three tests in order to obtain a representative curve.

6.2 Procedure for conditioned or partially dried articles

6.2.1 Immediately before the test, condition the tumbler by drying a load under normal operating conditions, and at the same time prepare the test load using the process described in appendix B.

6.2.2 For the test, load the tumbler with the test load (see item (a) of clause 4), having an initial moisture content within the range of 50 % to 56 % based on the bone-dry mass.

6.2.3 Read the meters (see 3.1 and 3.2, 3.3 or 3.4, according to the type of machine being used) immediately before the test run, and record the values.

6.2.4 Dry the test load so as to attain a final moisture content within the range of 34 % to 38 %, based on the bone-dry mass on removal from the tumbler.

NOTE. Some trial runs using a test load made up of test articles specified in item (a) of clause 4 may be needed to establish the approximate drying time required.

6.2.5 Read the meters (see 3.1 and 3.2, 3.3 or 3.4, according to the type of machine being used) immediately after the test run, and record the values specified in appendix D.

6.2.6 Determine the mass of the dried test load, and record the values in a table with the format shown in table 2.

6.2.7 Conduct three similar test runs using the same procedures.

6.3 Calculation and expression of results. From the table of values recorded (see 6.1.6), prepare a graph to obtain a representative curve from which the drying time for removing 48 % moisture based on the bone-dry mass of the test load can be determined (see figure 2).

NOTE. An example of the completed table and graph showing the results of three test runs is shown in appendix F. This shows that on the particular machine tested the time required to remove 48 % of moisture was 11.4 min.