



DPC: 13 / 30265234 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

Date: 16 May 2013
Origin: International**Latest date for receipt of comments: 19 July 2013**

Project No. 2012/01495

Responsible committee: CPL/59/1 Dishwashers and washing machines

Interested committees:

Title: Draft BS EN 60436 ED 4 Electric dishwashers for household use - Methods for measuring the performance

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Responsible Committee Secretary: **Ms Snezhana Halacheva (BSI)**
Direct tel: **020 8996 7288**
E-mail: snezhana.halacheva@bsigroup.com

Introduction

This draft standard is based on international discussions in which the UK has taken an active part. Your comments on this draft are welcome and will assist in the preparation of the consequent standard. There is a high probability that this text could be adopted by CENELEC as a reference document for harmonization or as a European Standard. Recipients of this draft are requested to comment on the text bearing in mind this possibility.

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Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	(7)
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/ Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



59A/175/CD

COMMITTEE DRAFT (CD)

IEC/TC or SC: 59A		Project number IEC 60436 Ed.4	
Title of TC/SC: Electric dishwashers		Date of circulation 2013-05-10	Closing date for comments 2013-08-16
Also of interest to the following committees -		Supersedes document 59A/168A/CD & 59A/170A/CC	
Proposed horizontal standard ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the TC/SC secretary			
Functions concerned: ☐ Safety ☐ EMC ☒ Environment ☐ Quality assurance			
Secretary: D. Molina, Spain		THIS DOCUMENT IS STILL UNDER STUDY AND SUBJECT TO CHANGE. IT SHOULD NOT BE USED FOR REFERENCE PURPOSES. RECIPIENTS OF THIS DOCUMENT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION.	

Title:
IEC 60436:
Electric dishwashers for household use - Methods for measuring the performance

(Titre) :

Introductory note

The draft enclosed in the following pages is distributed among all NCs for their comments.

These comments will be discussed by WG2 in its next meeting, to be held on 2013-10-24 (full day) and 2013-10-25 (half day, morning) in New Delhi (IN).

Afterwards, they will be discussed by SC 59A in its meeting to be held on 2013-10-25 (half day, afternoon) also in New Delhi (IN), together with the recommendations from WG2.

The P-Members of SC 59A are invited to submit their comments on this CD document, saying also if they would agree on its content in case the draft had to be voted positively or negatively (a CD is not voted, only comments are accepted), through the IEC Electronic voting system by 2013-08-16.

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CONTENTS

1	1	Scope.....	6
2	2	Normative references	6
3	3	Terms, definitions and symbols	6
4	3.1	Terms and definitions.....	6
5	3.2	Symbols.....	10
6	3.2.1	Symbols related to the microwave calibration (Annex F)	10
7	3.2.2	Symbols related to the application of egg (6.4.5)	10
8	3.2.3	Symbols related to the calculation of the drying index (7.1.2.3).....	10
9	3.2.4	Symbols related to the calculation of the cleaning index (7.1.3.1)	11
10	3.2.5	Symbols related to the measurements (8).....	11
11	4	List of measurements	12
12	5	General conditions for measurements.....	12
13	5.1	General.....	12
14	5.1.1	Free standing dishwashers	13
15	5.1.2	Built-in and integrated dishwashers	13
16	5.2	Conditioning of the test machine and sequence of test procedures.....	13
17	5.3	Electricity supply for machines	13
18	5.3.1	Electricity supply for test machine.....	13
19	5.3.2	Electricity supply for the reference machine.....	14
20	5.4	Test programme	14
21	5.5	Ambient conditions.....	14
22	5.6	Water.....	14
23	5.6.1	General	14
24	5.6.2	Water temperature.....	14
25	5.6.3	Water hardness	15
26	5.6.4	Water pressure	15
27	5.7	Detergent.....	15
28	5.8	Rinse aid.....	16
29	5.9	Salt	16
30	6	Combined cleaning and drying performance tests	16
31	6.1	General and purpose.....	16
32	6.2	Load	17
33	6.2.1	Composition of the test load	17
34	6.2.2	Requirements for pre-conditioning of new tableware	17
35	6.2.3	Requirements for conditioning of tableware	17
36	6.2.4	Requirements for re-conditioning of tableware prior to a new test series.....	17
37	6.3	Soiling agents and preparation equipment.....	17
38	6.4	Preparation and application of soiling agents	18
39	6.4.1	General	18
40	6.4.2	Milk	18
41	6.4.3	Tea.....	20
42	6.4.4	Minced meat.....	21
43	6.4.5	Egg.....	22
44	6.4.6	Oat flakes	23
45	6.4.7	Spinach	24
46	6.4.8	Margarine	25

49	6.4.9	Coffee grounds	25
50	6.5	Drying of the soiled tableware items.....	26
51	6.5.1	Oven drying method.....	26
52	6.5.2	Air drying method	27
53	6.6	Loading and operating.....	27
54	6.6.1	Loading	27
55	6.6.2	Operating	28
56	7	Combined cleaning and drying performance assessment.....	28
57	7.1.1	General requirements	28
58	7.1.2	Determination of the drying performance	29
59	7.1.3	Determination of the cleaning performance	33
60	7.2	Results.....	38
61	7.2.1	Expressing drying results.....	38
62	7.2.2	Expressing cleaning results	38
63	8	Energy consumption, water consumption and cycle/programme time	38
64	8.1	General and purpose.....	38
65	8.2	Method of measurement.....	39
66	8.2.1	Regeneration operations.....	39
67	8.2.2	Cold water energy correction	39
68	8.2.3	Hot water energy	40
69	8.2.4	Energy consumption	41
70	8.2.5	Water consumption	41
71	8.2.6	Time	41
72	9	Airborne acoustical noise	41
73	Annex A (normative)	Place settings and serving pieces	42
74	A.1	General information.....	42
75	A.2	Test load specifications.....	42
76	Annex B (informative)	Tableware specifications	45
77	Annex C (normative)	Illustration of soil application quantities	53
78	C.1	Soil application	53
79	C.1.1	Soil application example for type A tableware items.....	53
80	C.1.2	Soil application example for type B tableware items.....	53
81	C.1.3	Soil application on the serving pieces	54
82	C.1.4	Soil application quantities for different rated dishwasher capacities	55
83	Annex D (informative)	Pictures of the soiled items	56
84	Annex E (normative)	Test additives.....	59
85	E.1	Detergent.....	59
86	E.2	Rinse aid.....	59
87	E.3	Salt	60
88	Annex F (normative)	Microwave oven	61
89	F.1	Specification of the microwave oven	61
90	F.2	Calibration of the microwave oven.....	61
91	Annex G (normative)	Through-circulation thermal cabinet	63
92	G.1	Specification of the thermal cabinet.....	63
93	Annex H (informative)	Alternate cleaning and drying assessment tables	65
94	H.1	Alternate drying performance table.....	65
95	H.2	Alternate cleaning performance table	66

96	Annex I (normative) Description of the reference machine	67
97	I.1 Specification of the reference machine	67
98	I.2 Installation and use of the reference machine	68
99	I.3 Calibration of the reference machine	68
100	I.3.1 Checking spray arm rotation	69
101	I.3.2 Checking the water hardness	69
102	I.3.3 Checking the energy consumption and water consumption	69
103	I.3.4 Checking the water level in the sump	69
104	I.3.5 Checking the water temperature in the sump	69
105	I.3.6 Checking the programme time	70
106	I.3.7 Checking the cleaning and drying performance	70
107	I.4 Reference machine loading plan	70
108	Annex J (normative) Shade chart	71
109	Annex K (normative) Additional aspects of energy consumption of dishwashers	72
110	K.1 General	72
111	K.2 Determination of left on mode power	73
112	K.3 Determination of off mode power	74
113	K.4 Determination of left on mode duration	74
114	K.5 Determination of delay start mode power	75
115	Annex L (informative) Addresses of suppliers	76
116	L.1 General suppliers	76
117	L.2 Alternative suppliers	80
118	Annex M (informative) Test report format	81
119	M.1 Machine description	81
120	M.2 Laboratory details	81
121	M.3 Test Conditions	81
122	M.4 Test Results and measurements	82
123	M.4.1 Setup	82
124	M.4.2 Results	82
125	Annex N (normative) Test enclosure for built-in and integrated dishwashers	83
126	Annex O (informative) Internal evaluation guideline	84
127	Development of internal evaluation guides	84
128	Annex P (informative) Test procedure for sensing programmes	85
129	Annex Q (informative) Additional rinse performance evaluation	87
130	Annex R (informative) Flow chart – test sequence for IEC 60436	90
131	Annex S (normative) Instrumentation and accuracy	91
132		
133	Table 1 - Evaluation to determine the drying performance	31
134	Table 2 - Evaluation of the cleaning performance	34
135	Table 3 - Evaluation to determine the cleaning performance	35
136	Table 4 - Numerical Values of the t-factor for statistical calculations	37
137	Table A. 1 - Specifications of tableware items	43
138	Table A. 2 - Composition of test loads	44

139	Table B. 1 - Tableware specifications.....	45
140	Table C. 1 - Soil application example for type A tableware items.....	53
141	Table C. 2 - Soil application example for type B tableware items.....	54
142	Table C. 3 - Soil application on the serving pieces	54
143	Table C. 4 - Soil application quantities for different rated dishwasher capacities	55
144	Table E. 1 - Ingredients of reference detergent type D	59
145	Table E. 2 - Ingredients of reference rinse aid III.....	60
146	Table H. 1 - Alternate drying performance table	65
147	Table H. 2 - Alternate cleaning performance table.....	66
148	Table J. 1 - Shade chart.....	71
149	Table P. 1 - Test scenarios for testing the sensing programme	85
150	Table P. 2 - Proposal for a one week schedule	85
151	Table Q. 1 - Unsoiled items for the rinse performance evaluation.....	87
152	Table S. 1 - Specification of instruments	91
153		
154	Figure 1 - Position of the glasses on the microwave turntable	20
155	Figure 2 - Schematic view of the different beef pieces	21
156	Figure 3 - The thermal cabinet with soiled load items (27 place settings)	26
157	Figure K. 1 - Measurement procedure for the low power modes (left on mode and off mode)	73
158	Figure N. 1 - Test enclosure for built-in and integrated dishwashers	83
159	Figure Q. 1 - Example for an assessment light box	88
160	Figure Q. 2 - Photo catalogue to assess spots on glasses	89
161		

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRIC DISHWASHERS FOR HOUSEHOLD USE –
METHODS FOR MEASURING THE PERFORMANCE**

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ELECTRIC DISHWASHERS FOR HOUSEHOLD USE – METHODS FOR MEASURING THE PERFORMANCE

1 Scope

This international standard applies to electric dishwashers for household and similar use that are supplied with hot and/or cold water.

The object is to state and define the principal performance characteristics of electric dishwashers for household and similar use and to describe the standard methods of measuring these characteristics.

This standard is concerned neither with safety nor with minimum performance requirements.

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.

IEC 60350, *Electric cooking ranges, hobs, ovens and grills for household use – Methods for measuring performance*

IEC 60704-2-3, *Household and similar electrical appliances – Test code for the determination of airborne acoustical noise – Part 2-3: Particular requirements for dishwashers*

IEC 60704-3, *Test code for the determination of airborne acoustical noise emitted by household and similar electrical appliances – Part 3: Procedure for determining and verifying declared noise emission values*

IEC 60705, *Household microwave ovens – Methods for measuring performance*

IEC 60734, *Household electrical appliances – Performance – Hard water for testing*

IEC 62301, *Household electrical appliances – Measurement of standby power*

ISO 607, *Surface active agents and detergents – Methods of sample division*

ISO 3310, *Test sieves - Technical requirements and testing*

ISO 80000-1, *Quantities and Units*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1 dishwasher

242 machine which cleans, rinses and dries tableware by chemical, mechanical, thermal, and
243 electric means

244 Note to Entry 1: A dishwasher may or may not have a specific drying operation at the end of the programme.

245 Note to Entry 2: Different dishwasher types are designated by manufacturers e.g. free-standing, built-in or
246 integrated.

247 3.1.2

248 **free-standing dishwasher**

249 dishwasher which is intended to be installed without an enclosing structure

250 3.1.3

251 **built-in dishwasher**

252 dishwasher which is intended to be installed inside an enclosing structure such as a kitchen
253 cupboard

254 3.1.4

255 **integrated dishwasher**

256 built-in dishwasher which is designed to have a board fitted to the dishwasher door

257 3.1.5

258 **test machine**

259 dishwasher under test

260

261 3.1.6

262 **reference machine**

263 dishwasher used to standardise cleaning and drying performance measurements

264

265 Note to Entry 1: A reference machine is specified for use in this standard (see Annex I).

266

267 3.1.7

268 **test run**

269 single performance assessment on a test machine as specified in Clauses 6 and 7

270

271 3.1.8

272 **test series**

273 set of test runs on a test machine which collectively are used to assess the performance of a
274 dishwasher

275 3.1.9

276 **tableware**

277 dishware, glassware, cutlery and serving pieces used according to this standard to test a
278 dishwasher

279 3.1.10

280 **place setting**

281 set of tableware for the use by one person, not including serving pieces

282 Note to Entry 1: A place setting is comprised of different items used for breakfast and lunch (type A); and dessert
283 and dinner (type B).

284 3.1.11

285 **serving pieces**

286 set of items for preparation and serving of food which may include pots, serving bowls,
287 serving cutlery and a platter

288 3.1.12

289 **rated dishwasher capacity**

290 whole number of place settings together with the serving pieces which can be cleaned and
291 dried in one cycle when loaded in accordance with the manufacturer's instructions

292 Note to Entry 1: The rated dishwasher capacity is declared by the manufacturer and expressed as a number of
293 place settings.

294 **3.1.13**
295 **operation**
296 each event that occurs during the dishwasher programme such as cleaning, rinsing or drying

297 **3.1.14**
298 **programme**
299 series of operations which are pre-defined within the dishwasher and which are declared as
300 suitable for specified levels of soil and/or type of load and together form a complete cycle

301 **3.1.15**
302 **cycle**
303 complete cleaning, rinsing, and drying process, as defined by the programme selected,
304 consisting of a series of operations

305 **3.1.16**
306 **cycle time**
307 cycle time is measured from the initiation of the programme (excluding any user programmed
308 delay) until all activity ceases (e.g. the end of the cycle)

309 **3.1.17**
310 **programme time**
311 programme time is measured from the initiation of the programme, excluding any user
312 programmed delay, until an end of programme indicator is activated

313 Note to Entry 1: If there is no end of programme indicator, the programme time is equal to the cycle time.

314 **3.1.18**
315 **automatic dispenser**
316 device activated automatically which injects or dispenses detergent or rinse aid, one or more
317 times into the dishwasher at predetermined points in the dishwasher cycle

318 **3.1.19**
319 **non-automatic dispenser**
320 device, usually a fixed cup or cavity on the dishwasher door, cover, or rack, which deposits a
321 previously measured amount of detergent or rinse aid, into the dishwasher at the beginning of
322 the dishwasher cycle

323 **3.1.20**
324 **water softener**
325 device which reduces the hardness of water

326 **3.1.21**
327 **regeneration**
328 process by which softening capacity is restored to a water softener
329

330 **3.1.22**
331 **rack**
332 support for holding dishware, cutlery, and/or glassware in the dishwasher

3.1.23**detergent**

cleaning agent for use in dishwashers to aid in the removal of food soils by chemical means

Note to Entry 1: A reference detergent in powder form is specified for use in this standard (see 5.7).

3.1.24**rinse aid**

chemical agent added to the water in the last rinsing operation to improve the drying effect and reduce water marks

Note to Entry 1: A reference rinse aid is specified for use in this standard (see Clause 5.8).

3.1.25**left on mode**

the power consumption that occurs after the completion of the programme, with the door opened and unlatched, without any further intervention of the user. This mode may persist or may be of limited duration where a power management system is present

Note to Entry 1: In some products this mode may be an equivalent power to off mode.

3.1.26**off mode**

mode where the product is switched off using appliance controls or switches that are accessible and intended for operation by the user during normal use to attain the lowest power consumption that may persist for an indefinite time while connected to a mains power source and used in accordance with the manufacturer's instructions. Where there are no controls, the dishwasher is left to revert to a steady state power consumption of its own accord

Note to Entry 1: If an appliance is equipped with a power management system, the lowest power consumption that may persist for an indefinite time will be reached automatically.

3.1.27**delay start mode**

mode where the user has selected a specified delay to the commencement of the programme. This mode is only applicable to dishwashers that provide a delay start function for the user

3.1.28**left on mode duration**

time for the dishwasher to revert automatically to off mode after the end of the programme with the door unlatched and opened; mode applies if the test dishwasher is equipped with a power management system

Note to Entry 1: The left on mode duration is declared by the manufacturer.

Note to Entry 2: End of programme is reached when end of programme indicator is activated or when all activities cease if there is no end of programme indicator (according to 3.14 and 3.17).

3.1.29**power management system**

system within the dishwasher which allows it to revert automatically to off mode after the completion of the programme

377 3.2 Symbols

378 3.2.1 Symbols related to the microwave calibration (Annex F)

379

380	$t_{u,1}$	the required cooking time in min at the nominal output power P_1 ;
381	P_1	the nominal output power of 780 W;
382	t_1	the nominal cooking time at the nominal output power P_1 of 4 min;
383	$P_{u,1}$	the measured the power output in W at the nominal output power P_1 ;
384	$t_{u,2}$	the required cooking time in min at the nominal output power P_2 ;
385	P_2	the nominal output power of 150 W;
386	t_2	the nominal cooking time at the nominal output power P_2 of 10 min;
387	$P_{u,2}$	the measured power output in W at the nominal output power P_2 .

388 3.2.2 Symbols related to the application of egg (6.4.5)

389

390	A_t	the total amount of soil to be applied to all the items to be soiled for each item
391		type
392	N_t	the number of items of type t to be soiled with egg
393	M_t	the average mass of egg to be applied to each item of type t

394 3.2.3 Symbols related to the calculation of the drying index (7.1.2.3)

395

396	N	the total number of scores for all items;
397	n	the number of test runs;
398	s	the total number of scores per item number;
399	$D_{R,z}$	the sum of drying scores of the reference machine;
400	$D_{T,z}$	the sum of drying scores of the test machine;
401	$D_{R,i}$	the average drying score for one test run of the reference machine;
402	$D_{T,i}$	the average drying score for one test run of the test machine;
403	$\ln P_{D,i}$	the logarithm of the drying performance index for one test run of the test
404		machine;
405	$\ln P_D$	the arithmetical average of $\ln P_{D,i}$;
406	$\ln S_D$	the drying standard deviation of the $\ln P_{D,i}$;

407	$\ln W_D$	the half range of the logarithmic drying confidence interval;
408	$t_{f;1-\alpha/2}$	a numerical factor, depending on the number $f = n - 1$ degrees of freedom for
409		the chosen confidence level $1 - \alpha = 0,95$ with two-sided demarcation (see
410		Table 4);
411	P_D	the drying performance index for the test series.

412 **3.2.4 Symbols related to the calculation of the cleaning index (7.1.3.1)**

413		
414	N	the total number of scores for all items;
415	n	the number of test runs;
416	s	the total number of scores per item number;
417	$C_{R,z}$	the sum of cleaning scores of the reference machine;
418	$C_{T,z}$	the sum of cleaning scores of the test machine;
419	$C_{R,i}$	the average cleaning score for one test run of the reference machine;
420	$C_{T,i}$	the average cleaning score for one test run of the test machine;
421	$\ln P_{C,i}$	the logarithm of the cleaning performance index for one test run of the test
422		machine;
423	$\ln P_C$	the arithmetical average of $\ln P_{C,i}$;
424	$\ln S_C$	the cleaning standard deviation of the $\ln P_{C,i}$;
425	$\ln W_C$	the half range of the logarithmic drying confidence interval;
426	$t_{f;1-\alpha/2}$	a numerical factor, depending on the number $f = n - 1$ degrees of freedom for
427		the chosen confidence level $1 - \alpha = 0,95$ with two-sided demarcation (see
428		Table 4);
429	P_C	the cleaning performance index for the test series.

430 **3.2.5 Symbols related to the measurements (8)**

431		
432	E	the energy consumption for the whole test run;
433	E_e	the electrical energy;
434	E_c	the cold water correction energy;
435	E_h	the hot water energy;
436	t_c	the volume-weighted average inlet temperature;
437	Q_c	the volume of the cold water supplied to the test machine;

438	t_h	the volume-weighted average inlet temperature of all hot water;
439	Q_h	the volume of hot water supplied to the test machine;
440	E_{va}	the energy adjusted for verification;
441	t_{hc}	the hot water temperature in original test;
442	t_{hv}	the hot water temperature in verification test;
443	Q_t	the total water volume.

444 **4 List of measurements**

445 Standard methods of measuring the performance characteristics are determined as follows:

- 446 – combined cleaning and drying performance according to Clause 6 and 7;
- 447 – energy consumption, water consumption and cycle/programme time according to Clause 8;
- 448 – airborne acoustical noise according to Clause 9;
- 449 – additional aspects of energy consumption of dishwashers (low power modes) according to
- 450 Annex K.

451 **5 General conditions for measurements**

452 **5.1 General**

453 The dishwasher manufacturer's instructions regarding installation and use of the dishwasher
454 shall be followed, except where there is a conflict, in which case this standard shall prevail.

455 Performance tests according to this standard are generally carried out on a new machine, with
456 a reference machine running parallel with the test machine(s), i.e., at the same time under the
457 same conditions using soil prepared at the same time from the same batch. The reference
458 machine shall be in accordance with the description given in Annex I.

459 The reference machine shall always be installed as a free standing machine independent of
460 the type of test machine.

461 Before commencing a test series, the dishwasher and the reference machine shall be checked
462 to ensure that they are operating properly.

463 All tests shall be started with the appliances at the ambient temperature according to 5.5.

464
465 The tolerances specified for parameters within this document, using the symbol "±", indicate
466 the allowable limits of variation from the specified parameter outside which the test or results
467 shall be invalid. The statement of tolerance does not permit the deliberate variation of these
468 specified parameters.

469 Rounding shall not be applied to the results of intermediate calculations. If numbers have to
470 be rounded, they shall be rounded to the nearest number according to ISO 8000-1, Clause
471 B.3 Rule B. If the rounding takes place to the right of the comma, the omitted places shall not
472 be filled with zeros.

473 Requirements for measurements and instrumentation and their accuracy are described in
474 Table S. 1.

475 **5.1.1 Free standing dishwashers**

476 Dishwashers shall be tested as free standing except where they are designated as built-in or
477 integrated (refer to 5.1.2). Dishwashers that can be installed as either free standing or built-
478 in/integrated shall be tested as free standing.

479 **5.1.2 Built-in and integrated dishwashers**

480 Built-in and integrated dishwashers shall be installed in an enclosure according to Annex N.

481 **5.2 Conditioning of the test machine and sequence of test procedures**

482 Before conducting the performance tests, the dishwasher shall be operated for at least 3
483 complete cycles using a clean load with reference detergent (specified in Clause 5.7) and
484 without rinse aid. If noise measurements should be done, they should be carried out before
485 any performance measurements and in accordance to Clause 9. No additional cycles shall be
486 carried out on the test machine between the sequential steps specified in the following
487 procedure.

488 The assessment of the cleaning and drying performance shall be performed in the same test
489 runs. The determination of energy consumption, water consumption and cycle/programme
490 time (Clause 8) shall be done concurrently with the combined cleaning and drying
491 performance test (Clause 6 and 7).

492
493 Between two test series the reference and test machines shall be cleaned by operating for at
494 least two test programme cycles with reference detergent (specified in Clause 5.7). Prior to
495 starting a new test series, ensure that the filters and all visible areas of the machine are
496 clean.
497

498 If recommended by the manufacturer, adjust the water softener and add salt per Clause 5.9.

499
500 NOTE 1 Any cycles or operations performed on the appliance during the manufacture of the product are ignored.

501 NOTE 2 Noise tests require that the test should be carried out before the rinse aid dispenser is filled for the first
502 time.

503 NOTE 3 Cleaning and drying assessment may be performed individually using soiled tableware.

504 NOTE 4 When checking for soil residue in the dishwasher, particular attention should be paid to accumulations of
505 coffee grounds in locations such as filters, sump, door seals and rack rails.

506

507 **5.3 Electricity supply for machines**

508 **5.3.1 Electricity supply for test machine**

509 **5.3.1.1 Voltage**

510 The test voltage shall be set at the rated voltage of the test machine and maintained within
511 the range of $\pm 2\%$ throughout the test. If a voltage range is indicated, then the test voltage
512 shall be set at the nominal voltage of the country in which the appliance is intended to be
513 used. The measured voltage shall be reported.

514 NOTE If the rated voltage of the test machine differs from the system voltage of the country of intended use,
515 measurements should be carried out at the nominal voltage of the country of intended use.

516 **5.3.1.2 Frequency**

517 The supply frequency shall be set at the rated frequency of the test machine and maintained
518 within the range $\pm 1\%$ throughout the test. If a frequency range is indicated, then the testing

519 shall be carried out at the nominal frequency of the country in which the appliance is intended
520 to be used. The measured frequency shall be reported.

521 NOTE If the rated frequency of the test machine differs from the system frequency of the country of intended use,
522 measurements should be carried out at the nominal frequency of the country of intended use.

523 5.3.2 Electricity supply for the reference machine

524 5.3.2.1 Voltage

525 The supply voltage shall be set at 230 V a.c. and maintained within ± 2 % throughout the test.
526 The measured voltage shall be reported.

527 5.3.2.2 Frequency

528 The supply frequency shall be set at 50 Hz and maintained within ± 1 % throughout the test.
529 The measured frequency shall be reported.

530 5.4 Test programme

531 The first programme to be tested shall be the one recommended by the manufacturer for a
532 normally soiled load.

533 NOTE In some countries the manufacturer has to declare the programme to be used for the purpose of energy
534 labelling (which may not be for a normally soiled load). In this case this programme is the one tested first.

535 The same programme shall be used for measuring the combined cleaning and drying
536 performance according to Clause 6 and 7; the energy consumption, water consumption and
537 cycle/programme time according to Clause 8; and the noise according to Clause 9, if tested.

538 Additional programmes may then be tested.

539 The name of the programme tested shall be reported.

540 5.5 Ambient conditions

541 The following ambient conditions shall be maintained throughout the soiling, drying and
542 measurement process. The conditions shall be reported.

543 – Ambient temperature of the room: $(23 \pm 2) ^\circ\text{C}$

544 – Relative humidity: $(55 \pm 10) \% \text{ RH}$

545 5.6 Water

546 5.6.1 General

547 This clause describes the characteristics of the water supply to be connected to the
548 dishwasher while it is being prepared for testing and throughout the testing process. It also
549 includes a specification for water to be used in the preparation of soil (e.g. tea according to
550 6.4.3, minced meat according to 6.4.4 and oat flakes according to 6.4.6).

551 The actual water conditions (temperature, hardness, and pressure) maintained during the
552 tests shall be reported.

553 5.6.2 Water temperature

554 The temperature of the supply water shall be:

- 555 – cold water feed temperature:
556 • $(15 \pm 2) ^\circ\text{C}$.
- 557 – hot water feed temperature:
558 • temperature indicated by the manufacturer $\pm 2 ^\circ\text{C}$, or
559 • where a range is specified by the manufacturer which does include $60 ^\circ\text{C}$, $(60 \pm 2) ^\circ\text{C}$,
560 or
561 • where a range is specified by the manufacturer which does not include $60 ^\circ\text{C}$, the
562 value nearest to $60 ^\circ\text{C} \pm 2 ^\circ\text{C}$, or
563 • $(60 \pm 2) ^\circ\text{C}$, if instructions are not given.

564 NOTE Some countries specify a hot water temperature for regulatory purposes, in which case this water
565 temperature should be used for testing.

566 The volume of the water pipe between the measurement device for temperature and the
567 connection point to the water inlet hose of the test dishwasher shall not exceed 250 ml.
568 If a bypass to ensure water supply temperature is installed, at each connection to the water
569 inlet hose(s) of the dishwasher, the bypass shall be opened before starting tests until the
570 water inlet temperature is in the required range. If the temperature is measured in the
571 circulation loop the volume of the spur taking the water from the circulation loop shall not
572 exceed 250 ml.

573 5.6.3 Water hardness

574 If hard water is used it shall have a total water hardness of $(2,5 \pm 0,5)$ mmol/l. If soft water is
575 used it shall have a total water hardness of $\leq 0,7$ mmol/l. If water hardness needs to be
576 adjusted to meet these specifications, it shall be prepared according to IEC 60734 – Method B
577 or C. The measured water hardness shall be reported. The water hardness used in the test
578 shall be the one most applicable to the country of intended use.

579 5.6.4 Water pressure

580 The pressure of the water supply at each water inlet shall be set at 240 kPa and shall be
581 maintained within the range ± 20 kPa during all fills. The measured water pressure shall
582 be reported. Where the manufacturer specifies a range of water pressure that does not
583 include $240 \text{ kPa} \pm 20 \text{ kPa}$, the water pressure shall be set at the end of the pressure range
584 closest to $240 \text{ kPa} \pm 20 \text{ kPa}$.

585 5.7 Detergent

586 The reference detergent D, as described in Annex E, shall be used in the reference and test
587 machines. The quantity for one test run shall be as recommended by the manufacturer, but
588 not more than

589 - $8,0 \text{ g} + x \text{ g}$ per place setting,

590 where x is the number of place settings loaded.

591 The maximum amount stated above shall be used if no recommendation is given by the
592 manufacturer.

593 NOTE For dishwashers not equipped with a water softener and being tested with hard water (see 5.6.3) the same
594 dosage should be used.
595

596 The quantity of detergent used during the tests shall be reported.

597 The detergent shall be placed in the dishwasher immediately prior to starting the programme.
598 If a dispenser is incorporated in the dishwasher it shall be used. The dispenser shall be clean
599 and dry prior to the placement of detergent. In the absence of manufacturer's
600 recommendations, the detergent shall be placed in the main compartment of the dispenser.

601 Detergent from the same batch shall be used for the reference and test machine.

602 Before use the detergent shall be homogenized in accordance with ISO 607 (refer to Annex L
603 for suitable equipment).

604 **5.8 Rinse aid**

605 The rinse aid Formula "III", as described in Annex E, shall be used.

606 For dishwashers with an adjustable automatic dispenser, the setting shall be as recommended
607 by the manufacturer. In the absence of such an indication, the setting shall be used which
608 gives the lowest quantity of rinse aid.

609 Any requirement or recommendation to experiment with the setting by the laboratory shall be
610 ignored.

611 For machines without automatic dispensers, the rinse aid shall be added manually, if so
612 recommended by the manufacturer and in accordance with their instructions.

613 **5.9 Salt**

614 If the dishwasher is equipped with a water softener that requires salt, fill the salt reservoir in
615 accordance with the manufacturer's instructions. For specification of the salt, see Annex E.

616 For dishwashers with an adjustable water softener, the setting shall be as recommended by
617 the manufacturer for the water hardness used for the test. Where there is no recommendation,
618 use the lowest setting.

619 **6 Combined cleaning and drying performance tests**

620 **6.1 General and purpose**

621 The purpose of this test is to measure how well the appliance cleans and dries normally soiled
622 place settings and serving pieces.

623 The tests are carried out in parallel with the reference machine specified in Annex I; under
624 conditions described in Clause 5. The reference and test machines shall be prepared
625 according to Clause 5 using a load as specified in Clause 6.2 and soiled according to Clause
626 6.4 with soils specified in Clause 6.3. The tableware is dried (using either the air drying or
627 oven drying method) according to Clause 6.5 and placed into the machines according to
628 Clause 6.6. The test results shall be evaluated according to Clause 7.

629 The sequence of the test procedure as specified in Clause 5.2 shall be followed.

630 Soiling of the test loads for the reference and test machine(s) shall be prepared in parallel.

631 For a large number of test loads, it may be necessary to have more than one person
632 preparing soils, but one person shall prepare each soil type for all loads. Similarly, one person
633 shall apply each soil type for all loads (person preparing soils may be different than the
634 person applying soils).

6.2 Load

6.2.1 Composition of the test load

The test load shall comprise specific numbers of each tableware item according to the rated capacity of the test machine as described in Annex A. The physical condition of the tableware items shall meet the description in Annex A.

6.2.2 Requirements for pre-conditioning of new tableware

New tableware items shall be pre-conditioned by washing them for five cycles using detergent (specified in Clause 5.7) and rinse aid (specified in Clause 5.8).

6.2.3 Requirements for conditioning of tableware

All tableware items shall be clean, dry and conditioned prior to the test run. In this case 'clean' means that an item would score 5 if assessed according to Clause 7 and 'dry' means that an item would score 2 if assessed according to Clause 7.

NOTE Special attention should be paid to soup plates (specified in A.2) soiled with oat flakes (specified in clause 6.4.6) to verify they are free of starch residue from previous tests. This can be checked by Lugols solution after each cleaning performance test. Lugols solution is a 1 % Iodine/potassium iodide solution (Merck 109261), which may be obtained from supplier mentioned in L.1.15.

The tableware items shall be conditioned in a dishwasher that dispenses rinse aid (specified in Clause 5.8) in the final operation prior to the next test.

NOTE Conditioning in a dishwasher should be done using detergent specified in Clause 5.7.

6.2.4 Requirements for re-conditioning of tableware prior to a new test series

After each test series with five to eight test runs, a re-conditioning cycle shall be performed in order to avoid residual scale formation on the test load. For this purpose the clean load is loaded into a dishwasher other than the test machine or reference machine having a normal / daily use programme. This programme is run with 30 g of anhydrous fine granular citric acid (Supplier see L1.15) instead of detergent for one cycle.

6.3 Soiling agents and preparation equipment

The following soiling agents are required:

- milk;
- tea;
- minced meat;
- egg;
- oat flakes;
- spinach;
- margarine;
- coffee grounds.

All food products, at the time they are used for the preparation of soiling agents to this standard, shall be within the "use-by" date or before their expiry date stated on the product.

All soiling agents used for the reference and for test machine shall be from the same batch. To ensure a high level of comparability and reproducibility of the results it is necessary that

674 the soil have the same properties in all laboratories. Soils from the same batch may be
675 obtained from the supplier identified in L.1.11.

676 If the specified product is not available, the use of a similar product which provides equivalent
677 results is permitted. Equivalency shall be proven through testing.

678 **6.4 Preparation and application of soiling agents**

679 **6.4.1 General**

680 This clause describes how the soiling agents are prepared and applied to the test load items.

681 Unless specifically stated otherwise, all soiling agents shall be freshly prepared for each test.

682 The final preparation and application of the soils to the tableware items shall be done on the
683 same day except where specified otherwise.

684 Based on the number place settings, calculate the total weight of soil that will be needed
685 (grams/item × number of tableware items).

686 For all soiling agents, except milk, tea and coffee grounds, place an amount of soil, slightly
687 more than required, in a container along with the application tool e.g. fork or pastry brush.
688 Weigh the container, soiling agent and application tool. Apply the soil to the load items with
689 the application tool until the required amount of soil has been applied. For the soiling agents
690 milk, tea and coffee grounds refer to the specific clauses.

691 Soils shall be evenly distributed. Soil can be added or removed to ensure the exact amount
692 until drying of soil (by appearance) begins.

693 It is then recommended to start by pre-heating the microwave oven for the milk soiling. During
694 this time prepare the tea soiling. During the pre-drying period for the tea (one hour) prepare
695 and apply the rest of the soiling agents.

696 Refer to Annex C for an illustration of soil application and quantities.

697
698 For guidance, Annex D contains pictures showing how soiled tableware should look.
699

700 **6.4.2 Milk**

701 U.H.T. milk with 1,5 % – 2 % fat content shall be used. U.H.T. milk shall not be used within
702 1,5 months of its expiry date. U.H.T. milk shall be kept refrigerated after opening and used
703 within 2 days of opening.
704

705 Alternatively fresh 2 % fat content homogenized milk may be used and shall be kept
706 refrigerated after opening.

707 **6.4.2.1 Items required for preparation**

- 708 – Microwave ovens with a glass turntable as specified in Annex F;
 - 709 – Glasses (specified in Annex A);
 - 710 – Pipette (10 ml; specified in Annex L1.14.).
- 711

712 **6.4.2.2 Pre-heating the microwave oven**

713 Before cooking the milk in the glasses, heat up the microwave oven as follows:

- 714
715 – Place six glasses each filled with 50 ml of water at a temperature of $23 \pm 2^\circ\text{C}$, in the
716 microwave oven;
717 – Place the glasses symmetrically in a circle with a radius of 160 mm (centre of the circle =
718 centre of the glass turntable). See Figure 1.
719 – As described in Annex F, operate the microwave oven for $t_{u,1}$ min depending on the oven
720 type at a nominal power setting of 780 W ($P_{u,1}$) and then for $t_{u,2}$ min at a nominal power
721 setting of 150 W ($P_{u,2}$).
722

723 After pre-cooking, take the water-filled glasses out of the microwave oven.

724 6.4.2.3 Application

- 725 – Items to be soiled:

726 The type A glasses shall be soiled with milk (as described in Annex C).

- 727 – Quantity of soil:

728 10 ml of milk is used to soil each glass.

- 729 – Method of soiling the glasses:

730 Upon removal from the refrigerator, shake the milk well for approximately 30 s before each
731 application. Immediately after the shaking, add 10 ml to each glass using a pipette and
732 immediately carry out the cooking process.

733 NOTE Details for a suitable pipette are given in Annex L Supplier L1.14.

734 Any remaining milk shall be put back into the refrigerator, without delay.

735 6.4.2.4 Cooking process

736 Immediately after the pre-heating has been completed, place 6 glasses with milk in the
737 microwave oven and cook the glasses continuously under the same conditions, i.e., for 4 min
738 at 780 W and 10 min at 150 W, or at the corrected conditions.

739 During each cooking operation there shall always be 6 glasses, with milk, in the microwave
740 oven. The glasses shall be placed on the turntable as shown in Figure 1 and the base of
741 beaker shall remain flat on the turntable.

742 NOTE If more than 6 glasses are required for testing, an additional 6 may be cooked immediately after the first
743 set of 6 glasses, without repeating the pre-heating process.

744 After the cooking period in the microwave oven, the colour of the cooked milk shall be
745 compared with the colour chart in Annex J. The colour at the bottom of the glass shall be at
746 least colour No. 4 on the colour chart and not exceed colour No. 6.

747 Small areas of the milk skin shall not be darker than 12 on the colour chart.

748 NOTE For colour comparing only original colour sheets should be used. They may be obtained from supplier
749 mentioned in L.1.7.

Center of the beakers to
lie on a circle of 160mm

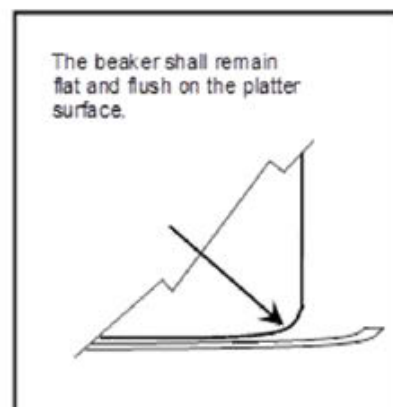
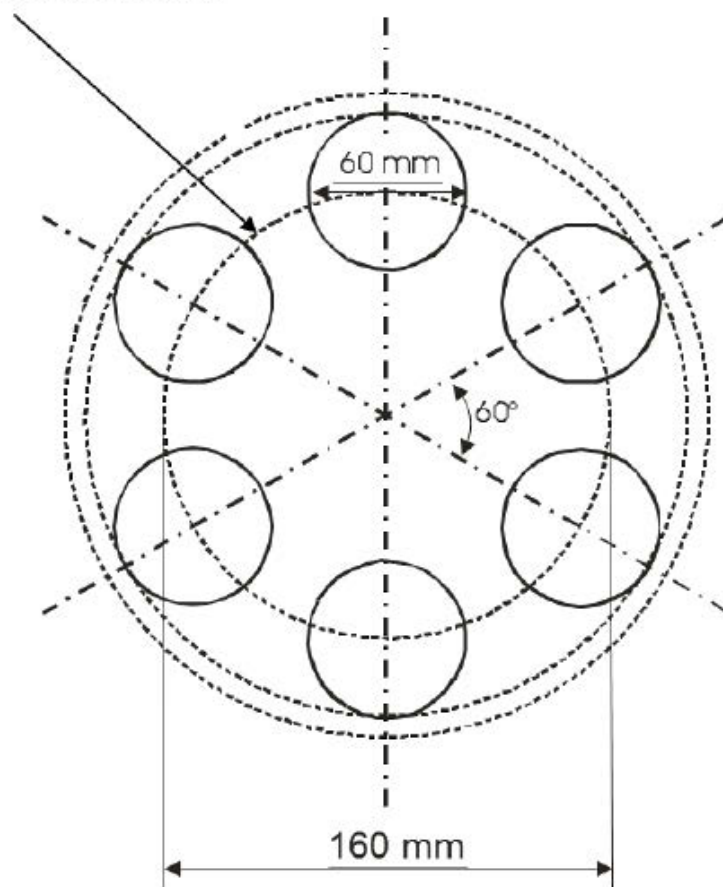


Figure 1 - Position of the glasses on the microwave turntable

6.4.3 Tea

Use tea with the following characteristics:

- tea type: black
- tea quality: ceylon
- leaf quality: orange pekoe
- leaf size: broken

The tea recommended in Annex L meets these requirements.

The remains of newly opened packets of tea may be used for subsequent tests for a period of up to 60 days after opening, when the contents are stored in a sealed container.

6.4.3.1 Preparation

Pour the calculated amount of boiling water (see Clause 5.6 for specification) over the tea (ratio: 1 l water to 6 g of tea) and allow to stand in a covered container, for a period of 5 min. Afterwards, pour the tea through a sieve (mesh aperture 1 mm) into a second container.

6.4.3.2 Application

Fill approximately 120 ml of tea into each mug, 80 ml into each cup and 40 ml onto each saucer. An even distribution over mugs, cups and saucers can be ensured by using a proportioning pump with 40 ml dosage.

NOTE Details for a suitable dosing pump are given in Annex L Supplier L.1.16.

6.4.3.3 Pre-drying for oven drying method

After the tea is poured into the last item (cup, saucer and mug), immediately place items in the preheated to 80 °C thermal cabinet (see Annex G). While loading, the power shall be switched off. Ensure that the items are not placed too closely together. The loading shall be completed 3 min after opening the doors of the thermal cabinet. Leave the items soiled with tea to dry for a period of 1 hour. After 1 hour remove the items from the thermal cabinet and empty out any remaining tea, and discard.

6.4.3.4 Pre-drying for air drying method

After 1 hour of pre-drying at ambient conditions carefully decant 100 ml from each mug, 60 ml from each cup, and 20 ml from each saucer using a syringe. During the process as many particles as possible should be retained on the load items. The decanted tea is discarded.

6.4.4 Minced meat

The cuts of the beef used to prepare the minced meat should be taken from parts 11 or 13 (Figure 2) and depending on country can be called round, silverside, topside, thick flank, etc.

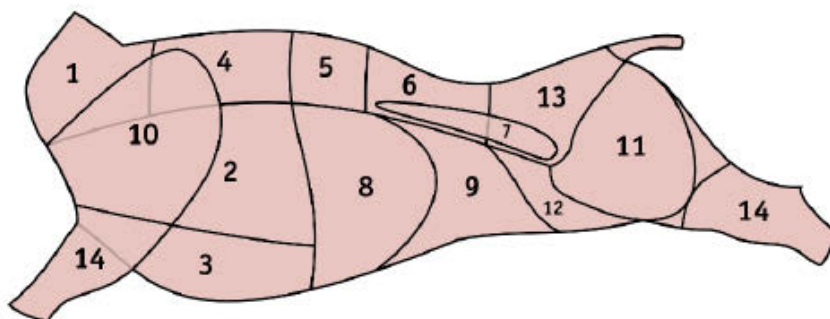


Figure 2 - Schematic view of the different beef pieces

Prepare a sufficiently large amount of minced beef, to ensure a homogeneous mix. Remove all fat and sinew from the meat before mincing. Use an electric meat grinder, with a perforated disc, with approximately 50 holes of 4.5mm diameter. Choose a setting where the amount of minced meat production is approximately 700 g per min (approximately 150 rpm).

6.4.4.1 Preparation and Storage

Mix 50 g of whisked whole egg to every 150 g minced meat (see 6.4.4 for specification); ensure that the eggs are refrigerated before use. Mix well and divide into 60 g portions. Wrap in aluminum foil, or place in closed containers, or place in sealed plastic bags and freeze. Before use, allow the meat to defrost to ambient conditions and mix with water (see 5.6 for specification) at a ratio of 30 g of minced meat to 8 g of water, until homogeneous.

6.4.4.2 Application

- Items to be soiled:

The oval platter, the glass bowl and the oven pot are soiled with minced meat.

- Quantity of soil:

8 g of minced meat for the oval platter, 8 g for the glass bowl and 6 g for the oven pot.

- Method of soiling:

Refer to 6.4.1 and use a plastic fork as an application tool.

- Oval platter:

The minced meat soil is applied evenly to the upper surface of the platter, ensuring that a space of 20 mm around the edge is left clean.

- Glass bowl:

The minced meat soil is applied to the bottom and inner sides, ensuring that a space of 40 mm around the edge is left clean.

- Oven pot:

The minced meat is applied on the bottom and the inner sides of the oven pot, ensuring that a space of 10 mm around the edge is left clean.

6.4.5 Egg

Use good quality hen's eggs weighing 50 g to 65 g each. Eggs shall be at least 7 days old. Eggs shall be stored in the refrigerator until required. Eggs shall be at ambient temperature prior to use.

NOTE Tests have shown that very fresh eggs change in their consistency over the first few days after laying: a minimum of 7 days after laying ensures stability.

6.4.5.1 Preparation

Use at least three eggs and separate the egg white from the egg yolk. Discard the yolk sack, and mix egg yolks with a fork in a bowl.

6.4.5.2 Application

- Items to be soiled:

The melamine dessert plates, the dinner plates and the forks are soiled with egg yolk.

- Quantity of soil:

Calculate the total amount of soil to be applied to all the items to be soiled for each item type A_t as follows:

$$A_t = N_t \times M_t$$

where

N_t is the number of items of type t to be soiled with egg

M_t is the average mass of egg to be applied to each item of type t

For forks, $M_t = 0,16$ g,

834 For melamine dessert plates, $M_t = 1,5$ g

835 For dinner plates, $M_t = 2,16$ g

836

837 When applying the egg, distribute the total amount A_t as equally as is reasonably practical
838 between all the items of type t. The total quantity applied shall be A_t .

839 • Method of soiling:

840 Refer to 6.4.1 and use a pastry brush with a width of approximately 25 mm as an application
841 tool.

842 – Forks:

843 Apply a thin, even layer of egg soil to both sides of the head of each fork. Place the forks
844 on an extra plate, not belonging to the test load, prong down. Allow to dry in this position.

845 – Melamine dessert plates:

846 The egg soil is applied evenly to the upper surface of each plate ensuring that a space of
847 20 mm around the edge is left clean.

848 – Dinner plate:

849 The egg soil is applied evenly to the upper surface of each plate, ensuring that a space of
850 20 mm around the edge is left clean.

851 **6.4.6 Oat flakes**

852 Use uncooked small oat flakes.

853 The oat flakes recommended in Annex L meet this requirement.

854 The remains of newly opened packets of oat flakes may be used for subsequent tests for a
855 period of up to 60 days after opening, when the contents are stored in a sealed container.

856 **6.4.6.1 Preparation**

857 Add 50 g of thoroughly mixed oat flakes with 750 ml of cold water (see 5.6 for specification)
858 and 250 ml of milk (see 6.4.2 for specification). Prepare porridge by bringing the mixture to
859 the boiling point and allow simmering for 10 min, stirring continuously from the very beginning
860 of heating, using a wooden spoon. Apply the porridge immediately after preparation.

861 NOTE The immediate application of hot porridge guarantees that the amount of water is not reduced due to
862 evaporation and the porridge has a defined consistency.

863 **6.4.6.2 Application**

864 – Items to be soiled:

865 The soup plates, the small dessert bowls and the type B soup spoons shall be soiled with
866 porridge (as described in Annex C).

867 • Quantity of soil:

868 Soup spoons are dipped in the prepared soil.

869 3 g of porridge are applied on each soup plate and on each dessert bowl.

870 • Method of soiling:

871 – Soup spoons:

872 Dip the bowl part of the soup spoons into the freshly made hot porridge and place on an
873 extra plate, not belonging to the test load, with the back of the spoon bowl facing
874 upwards. Allow to dry in this position.

875 – Soup plates and dessert bowls:

876 Refer to 6.4.1 and use a pastry brush with a width of approximately 25 mm as an application
877 tool.

878 The porridge soil is applied evenly to the upper surface of each soup plate, ensuring that the
879 higher rim with a space of 25 mm is left clean.

880 The porridge soil is also applied evenly to the upper surface of each dessert bowl, ensuring
881 that a rim with a space of 5 mm is left clean.

882
883 Alternate load item: The soup plates in the test machine may be replaced by dinner plates.
884 The same application method is used for the dinner plates as is used for the soup plates. The
885 porridge soil is applied evenly to the upper surface of each dinner plate, ensuring that a rim
886 with a space of 20 mm is left clean.

887 **6.4.7 Spinach**

888 Use frozen young spinach, finely minced and with no other additives or ingredients.

889 The spinach recommended in Annex L meets these requirements.

890 **6.4.7.1 Preparation and storage**

891 Allow the spinach to defrost at ambient temperature. Afterwards, place the spinach in a sieve
892 with a mesh size of 2 mm and allow to drip for 5 min. Pass the spinach completely through a
893 grinder (use same grinder described in 6.4.4) having a perforated disc with 180 holes with
894 3 mm diameter. Choose a setting where the amount of minced spinach production is
895 approximately 170 g per minute, the no-load speed for the grinder is approximately 160 rpm.
896 Divide the spinach into convenient portions and keep it in containers with the lid closed in the
897 refrigerator until use. Ensure that the prepared spinach is not used for more than three days
898 after preparation. Stir the spinach before use.

899 NOTE A comparison with the picture in Annex D may be helpful to evaluate if the prepared and applied spinach has
900 the same particle size and can be distributed similar to that depicted on the load items in the pictures.

901 **6.4.7.2 Application**

902 • Items to be soiled:

903 The dessert plates and the small pot are soiled with spinach.

904 • Quantity of soil:

905 Each dessert plate is soiled with 4 g of spinach. The small pot is soiled with a mixture of 1 g
906 of margarine (see 6.4.8 for specifications) and 6 g of spinach.

907 • Method of soiling dessert plates:

908 Refer to 6.4.1 and use a pastry brush with a width of approximately 25 mm as an application
909 tool. The spinach soil is applied evenly to the upper surface of each plate, ensuring that a
910 space of 20 mm around the edge is left clean.

911 • Method of soiling the small pot:

Spinach and margarine (ratio: 6 g to 1 g) are placed into a container and mixed with a plastic fork until homogeneous. The margarine shall be at ambient conditions. With a clean plastic fork or a rubber spatula, 7 g of this mixture is applied on the small pot. The spinach-margarine-mixture is applied to the bottom and inner sides of the pot, ensuring that a space of 40 mm around the edge is left clean.

6.4.8 Margarine

Household margarine with a total fat content of 60 % to 85 %, which also meets the following requirements, shall be used:

- saturated fat (33 ± 10) %
- polyunsaturated (33 ± 20) %
- monounsaturated (33 ± 20) %

NOTE Trans fats belong to the unsaturated fats.

6.4.8.1 Preparation and storage

The margarine shall be refrigerated prior to applying it to the bowls. The margarine for the spinach-margarine-mixture (see Clause 6.4.7) shall be at ambient condition.

6.4.8.2 Application

- Items to be soiled:

The small pot and the melamine bowls are soiled with margarine.

- Quantity of soil:

1 g of margarine is used for the small pot and 5,5 g per melamine bowl.

- Method of soiling the melamine bowls:

Refer to 6.4.1 and use a scraper or rubber spatula as an application tool. Leave a 10 mm unsoiled rim.

The margarine shall be applied shortly before the start of the test run (Clause 6.6.1) and then the bowls are placed into the machine.

- Method of soiling the small pot:

The application of the spinach-margarine mixture shall be done as described in Clause 6.4.7.2.

6.4.9 Coffee grounds

Natural caffeinated coffee shall be used.

6.4.9.1 Preparation and storage

Before usage the coffee shall be stored sealed at ambient conditions. Coffee grounds shall be sieved to obtain the required particle size of 0,5 to 1,0 mm.

NOTE 1 Avoid overloading the sieves. The bottom or mesh of the sieve with the required mesh size of 0.5 mm should be at least partly visible after the sieving process.

NOTE 2 Details for suitable sieves are given in Annex L Supplier L1.17.

The coffee grounds which fulfil these requirements shall then be used for the performance tests.

6.4.9.2 Application

- Items to be soiled:

The melamine bowls are soiled with the coffee grounds.

- Quantity of soil:

Each melamine bowl is soiled with 2 g of coffee grounds.

- Method of soiling:

Weigh out 2 g of coffee grounds and sprinkle them on top of the margarine layer (specified in Clause 6.4.8.2) for each melamine bowl.

The melamine bowls shall be soiled with margarine and coffee grounds shortly before the start of the test run and then placed into the machine (Clause 6.6.1).

6.5 Drying of the soiled tableware items

6.5.1 Oven drying method

All tableware items soiled according to Clause 6.4, except the melamine bowls, shall be dried according to the procedure described below.

The oven drying method shall be carried out using a thermal cabinet specified in Annex G. The thermal cabinet shall always be fully loaded according to Figure 3. If necessary additional unsoiled tableware items shall be included to ensure that the thermal cabinet is fully loaded.

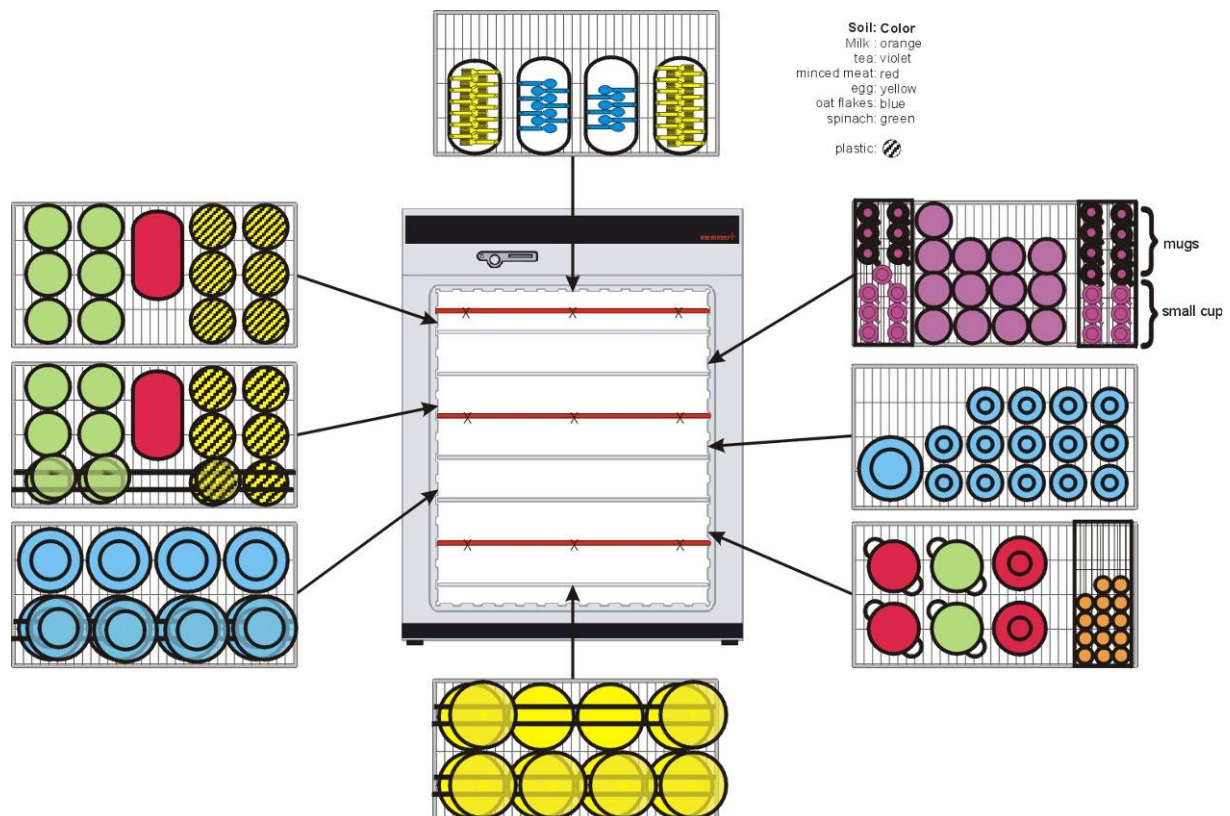


Figure 3 - The thermal cabinet with soiled load items (27 place settings)