

Detail specification for

**Multi-contact circular
electrical connectors
for d.c. and low
frequency
applications —
Bayonet coupling with
front release, rear
removable crimp
contacts —
Full assessment level**

UDC 621.315.683

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 45 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Amendments issued since publication

Amd. No.	Date of issue	Comments
6821	September 1991	Indicated by a sideline in the margin

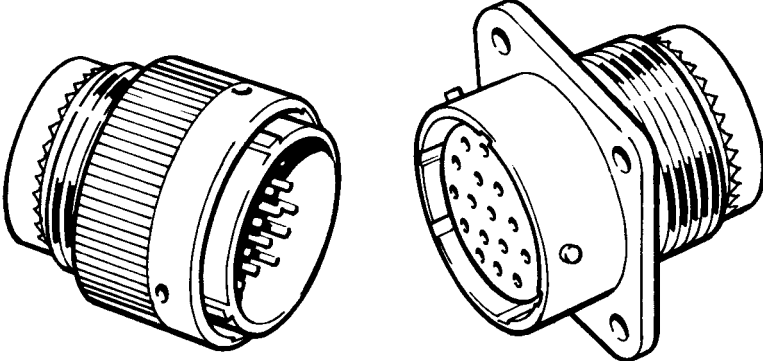
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Specification obtainable from: BRITISH STANDARDS INSTITUTION 101 PENTONVILLE ROAD LONDON N1 9ND TELEPHONE 01-837-8801: TELEX 23218	45 pages
ELECTRONIC COMPONENTS OF ASSESSED QUALITY DETAIL SPECIFICATION IN ACCORDANCE WITH BS 9520.	MANUFACTURER'S TYPE NUMBER PD 9002
TYPICAL CONNECTORS 	For ordering information see clause 5
	MULTI-CONTACT CIRCULAR ELECTRICAL CONNECTORS. Bayonet coupling with front release rear removable crimp contacts.
	ENVIRONMENTAL CATEGORY 55/125/56
For marking information see clause 4 For outline drawings see A.2	FULL ASSESSMENT

1 Pattern number

The specification number without the letters BS is used as the pattern number. This range of connectors is known as Pattern 9522 N0001.

2 Related documents

BS 6001, *Sampling procedures and tables for inspection by attributes.*

BS 9000, *General requirements for electronic components of assessed quality.*

BS 9520:1982, *Electrical connectors of assessed quality for frequencies below 3 MHz: generic data and methods of test.*

PD 9002, BS 9000 *component selection guide.*

BS G 210, *PTFE insulated equipment wires C with silver plated copper conductors.*

3 Description of connector and intended application

Multi-contact circular connectors with bayonet coupling and front release rear removable crimp contacts, for d.c. or a.c. applications.

Environment resistant (non-barrier sealed) for general purpose applications.

The connectors employ contacts that are rear insertable, front release and rear removable using the appropriate insertion and removal tools. To ensure compliance with this specification, connectors shall always have a full complement of contacts fitted, with filler plugs behind unwired contacts.

Refer to Qualified Products List PD 9002 for details of manufacturers approved to this specification.

Polarization is effected by housing (shell) keys and keyways, or by angular disposition of the insert. The preferred method is housing (shell) keys and keyways, which provides up to four different polarizations other than normal (N); these are designated B, C, E and F. The alternative method is angular disposition of the insert which provides up to four different polarizations other than normal (N); these are designated W, X, Y and Z and are intended for replacement purposes only.

See Appendix A of this specification for polarization arrangement drawings and availability for each connector.

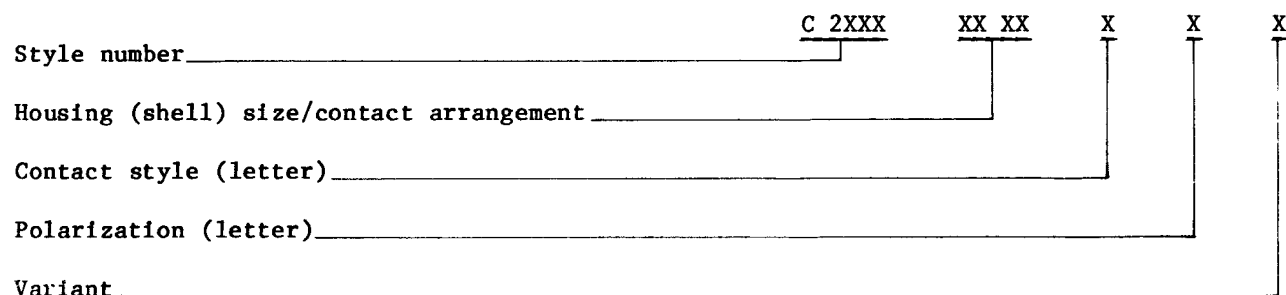
Housing (shell) material is aluminium alloy with a standard finish of olive drab chromate conversion over the plating finishes as specified in 4.1.

The performance of connectors is normally only assessed using mated pairs with the same plating finish and from the same source.

Galvanic corrosion may occur if connectors with dissimilar metal finishes are intermated. It is the users responsibility to ensure compatibility between alternative finishes.

4 Marking of the component and package

4.1 Connector reference numbers. The marking shall be in accordance with 1.1.6 of BS 9520. The individual reference number required by 1.1.6 c) of BS 9520 consists of abbreviations to identify individual connectors, accessories or tools in accordance with 4.1 and 4.2.



Style number: As shown in A.2.

Housing (shell) size/contact arrangement: Four digits as shown on the appropriate outline drawing in A.1.

Contact style: M = male contact. F = female contact.

Polarization: Letter assigned to a particular arrangement of housing (shell) keys and keyways or to a particular angular disposition of an insert (see A.1).

Variant: A digit denoting any variation from the basic specification.

0 = standard connector — cadmium plated

1 = standard connector — zinc cobalt plated

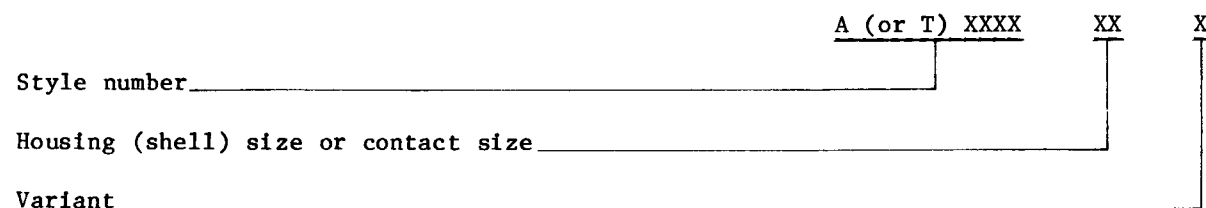
2 = standard connector — pure zinc plated.

Example reference number: C 2002 22 55 MNO.

NOTE Where the connector is supplied complete with an accessory, the reference number shall also include the applicable accessory style number (see 4.2 and A.3).

Example reference number: C 2002 22 55 MNO A 2010

4.2 Accessory and tool reference numbers. The individual reference numbers consist of abbreviations as follows.



Style number: As shown in A.3 for accessories and A.4 for tools. (A = accessory, T = tool).

Housing (shell) size: Quoted for accessories. Two digits as in A.1.

Contact size: Quoted for filler plugs or tools. Two digits as in **A.3** or **A.4**.

Variant: Quoted for accessories. Use the following code:

- 0 = accessories for the standard connector — cadmium plated
- 1 = accessories for the standard connector — zinc cobalt plated
- 2 = accessories for the standard connector — pure zinc plated.

Example reference numbers: A 2009 08 0 T 2017 16

4.3 Packaging. Packaging shall include the manufacturer's assembly instructions, including wire preparation, crimping and contact insertion if requested.

5 Ordering information

The following information shall be given when ordering parts complying with the requirements of this detail specification.

- a) The number of this detail specification, i.e. BS 9522 N0001.
- b) The individual reference number as described in clause 4.
- c) Details of marking that may be required in addition to or as an alternative to that specified in clause 4.
- d) Requirements for the provision of assembly instructions.

6 Outline drawings

See Appendix A of this specification for the following.

- A.1** Contact arrangements and polarization availability
- A.2** Connector outline dimensions, panel cut-outs and mass
- A.3** Accessories and contacts, outline dimensions and mass
- A.4** Assembly tools
- A.5** Gauges

NOTE Outline drawings include a cross-reference to the relevant National Supervising Inspectorate control drawings.

7 Ratings

7.1 Electrical

7.1.1 Current

- a) Maximum current per individual contact in isolation¹⁾ at an ambient temperature of 85 °C:
 - contact size 20: 7.5A
 - contact size 16: 10A
 - contact size 12: 20A
- b) Maximum current per contact through all contacts simultaneously at an ambient temperature of 85 °C:
 - contact size 20: 5 A
 - contact size 16: 10 A
 - contact size 12: 20 A

The performance of any connectors listed in this detail specification shall at all times exceed the maximum continuous bunched rating of the appropriate size wire or cable of equivalent temperature rating, and this bunched rating shall be the determining factor.

¹⁾ That is, when only one contact per connector is electrically loaded.

7.1.2 Voltage

	Sea level 1 013 mbar ^a		8 500 m (27 900 ft) 320 mbar		21 340 m (70 000 ft) 44 mbar	
Voltage rating ^b	I	II	I	II	I	II
Working voltage ^c (nominal) d.c. or a.c. peak	700	1 200	550	650	330	380
Voltage proof d.c. or a.c. peak	2 100	3 000	1 100	1 300	660	760
^a 1 mbar = 10 ² N/m ² = 100 PA. ^b See A.1. ^c Establishment of electrical safety factors is the responsibility of the user.						

7.2 Environmental

Environmental classification	55/125/56
Low air pressure severity	44 mbar
Vibration severity	10 Hz to 5 000 Hz, 0.75 mm (10 g _n) Duration 30 h
Shock severity	981 m/s ² (100g _n) Duration 6 ms
Acceleration severity	490 m/s ² (50g _n)
Bump severity	390 m/s ² (40g _n) 4 000 ± 10 bumps

7.3 Endurance

Mechanical operation	500 operations
Electrical load and temperature, long term [current as in 7.1.1 b)]	1 000 h at 85 °C
Electrical load and temperature, short term (no electrical load)	250 h at 125 °C

8 Characteristics

8.1 Connector range (see A.1 and A.2)

8.2 Electrical

Maximum contact resistance (initially)	5 mΩ
Maximum contact resistance (after conditioning)	10 mΩ
Minimum insulation resistance (initially)	5 000 MΩ, method A or method B ^a (see 1.2.4.4 of BS 9520)
Minimum insulation resistance (after conditioning)	100 MΩ, method A or method B ^a (see 1.2.4.4 of BS 9520)
Minimum insulation resistance (hot, mated)	3 MΩ, method A or method B ^a (see 1.2.4.4 of BS 9520)
Maximum housing (shell) electrical continuity (mated specimens which include C 2002 or C 2004) (initially)	5 mΩ
Maximum housing (shell) electrical continuity (mated specimens which include C 2002 or C 2004) (after conditioning)	10 mΩ
Maximum housing (shell) electrical continuity (mated specimens which include C 2001 or C 2003) (initially and after conditioning)	200 mΩ

^a Method B values shall be recorded.

8.3 Mechanical

Engaging and separating force, connector

Housing (shell) size	N m		(lbf in)	
	max.	min.	max.	min.
08	0.90	0.22	(8)	(2)
10	1.36	0.22	(12)	(2)
12	1.80	0.46	(16)	(4)
14	2.26	0.90	(20)	(8)
16	2.71	0.90	(24)	(8)
18	3.16	0.90	(28)	(8)
20	3.61	1.13	(32)	(10)
22	4.06	1.36	(36)	(12)
24	4.97	1.58	(44)	(14)

Insert retention in housing (shell), axial

517 kN/m² (75 lbf in²) min.

Contact retention (in insert)

Contact size	N min.	(lbf) min.
20	67	(15)
16	112	(25)
12	112	(25)

Contact holding force

Contact size	N min.
20	0.21
16	0.56
12	0.83

Insert retention in housing (shell), torsional

Housing (shell) size	N m min.	(lbf in) min.
08	0.90	(8)
10	1.13	(10)
12	1.36	(12)
14	1.58	(14)
16	1.81	(16)
18	2.04	(18)
20	2.26	(20)
22	2.48	(22)
24	2.71	(24)

Grounding contact spring holding force²⁾

Housing (shell) size	N min.
08	1.17
10	1.37
12	1.57
14	1.76
16	1.96
18	2.15
20	2.35
22	2.55
24	2.74

Wire seal and conductor accommodation

Contact size	Wire insulation				Conductor ^a	
	min. o.d.		max. o.d.		min. o.d.	max. o.d.
	mm	(in)	mm	(in)	mm	mm
20	1.19	(0.047)	2.16	(0.085)	0.56	1.06
16	1.68	(0.066)	2.77	(0.109)	0.81	1.56
12	2.46	(0.097)	3.61	(0.142)	1.63	2.23

^a See manufacturer's assembly instructions, which may extend the ranges of conductor diameters.

8.4 Fluid resistance. The connectors shall be resistant to the following fluids.

Isopropanol, white spirit, dichloromethane, trichloroethylene, kerosene, petrol, hydraulic fluids (normal and silicone based), lubricating oils (mineral and ester based), petroleum jelly and de-icing fluids.

9 Certified test records (CTR's)

Certified test records (CTR's) shall be prepared in accordance with 1.1.11 of BS 9520.

10 Quality assessment procedure

Group C tests need not be carried out for Qualification Approval or when subsequent group D tests are performed.

11 Inspection requirements

Samples subjected to tests marked "(D)" shall not be accepted for release under BS 9000 (see 20.2 of BS 9000-1:1981).

Unless otherwise specified, tests shall be performed at an ambient temperature of between 15 °C and 35 °C.

Fitting (and wiring) of contacts shall be in accordance with the manufacturer's instructions.

Polytetrafluoroethylene (PTFE) extruded wire complying with the requirements of BS G 210 shall be used. (To ensure that the wiring operation has been carried out satisfactorily it is advisable to apply insulation resistance and contact resistance tests.)

²⁾ Applicable only to styles C 2002 and C 2004.

Inspection	BS 9520 reference and conditions of test	Requirements as in BS 9520
GROUP A	To be applied on a sampling basis lot-by-lot except subgroup A0 Subgroups A2, A3 and A4 are not applicable	
<u>Subgroup A0</u>	<u>100 % inspection</u> Unless required for test, contacts need not be fitted	
Voltage proof	1.2.4.5 Method A or B Voltage as in 7.1.2 of this specification. Duration = 5 s (This requirement may be demonstrated immediately prior to final assembly)	As in 1.2.4.5
Visual examination	1.2.2 a)	As in 1.2.2 a)
<u>Subgroup A1</u>	<u>Inspection level S-3, AQL 1.5 %</u> Contacts need not be fitted	
Visual examination	1.2.2 b)	As in 1.2.2 b)
<u>Subgroup A5</u>		
CTR information	1.1.11 The result from the test in subgroup A1 shall be reported as attributes information	
GROUP B	To be applied on a sampling basis lot-by-lot Subgroups B3 to B7 are not applicable	
<u>Subgroup B1</u>	<u>Inspection level S-4, AQL 1 %</u>	
Gauging procedure	1.2.3.3.2	As in 1.2.3.3.2
Insulation resistance	1.2.4.4 Method A (500 ± 50 V) or Method B (500 ± 50 V)	5 000 MΩ min. ^a
Engaging and separating force, connector	1.2.5.3 Forces are specified in 8.3 of this specification	As in 1.2.5.3
Contact holding force	1.2.5.9 With 3 sizings and using gauges as prescribed in A.5 of this specification	As in 1.2.5.9
<u>Subgroup B2 (D)</u>	<u>Inspection level S-4, AQL 4 %</u> Samples from subgroup B1 may be used. Only contacts required for test need be fitted	
Housing (shell) electrical continuity	1.2.4.3 Mated specimens which include C 2002 or C 2004 Mated specimens which include C 2001 or C 2003	5 mΩ max. 200 mΩ min.
Insert retention in housing (shell), axial	1.2.5.5 Pressure as specified in 8.3 of this specification	As in 1.2.5.5
Insert retention in housing (shell), torsional	1.2.5.6 Torque as specified in 8.3 of this specification	As in 1.2.5.6
Grounding contact spring holding force ^b	1.2.5.16 Using gauges as specified in A.5.4 and A.5.5 of this specification	As in 1.2.5.16

^a Method B values shall be recorded.^b Applicable only to styles C 2002 and C 2004.

Inspection	BS 9520 reference and conditions of test	Requirements as in BS 9520
<u>Subgroup B8</u> CTR information	1.1.11 Results from the tests in subgroup B1 shall be reported as attributes information. Results from the contact resistance, housing (shell) continuity and insert ageing tests of subgroup B2 shall be reported as attributes information	
GROUP C	To be applied on a sampling basis at three-monthly intervals The issue number of the manufacturing drawing shall be checked against that on the approval certificate	
<u>Subgroup C1</u> Dimensions, outline	<u>Inspection level S-3, AQL 4 %</u> Contacts need not be fitted 1.2.3.1	As in A.2 and A.3 of this specification
<u>Subgroup C3</u> Contact resistance Rapid change of temperature Damp heat, steady state <u>Final measurements</u>	<u>Inspection level S-3, AQL 4 %</u> Samples from subgroup C1 with contacts fitted may be used 1.2.4.2 a) 1.2.6.8 – 55 °C to 125 °C 1.2.6.15 21 days. Working voltage as specified in 7.1.2 of this specification. Polarizing voltage 60 V d.c. 1.2.6.15.2 a) After 1½ h to 2 h recovery 1.2.6.15.3 a. Method A (500 ± 50 V) or Method B (500 ± 50 V) b. Mated specimens which include C 2002 or C 2004 Mated specimens which include C 2001 or C 2003 c. As in 1.2.4.2 a) d. e. f. Not applicable g. Not applicable h. Method A or B. Voltage as in 7.1.2 of this specification	5 mΩ max. As in 1.2.6.15.2 a) 100 mΩ min. ^a 10 mΩ max. 200 mΩ max. 10 mΩ max. By hand As in 1.2.6.15.3 e) As in 1.2.6.15.3 h)
<u>Subgroup C5 (D)</u> Mechanical operation	<u>Inspection level S-3, AQL 4 %</u> 1.2.7.1 50 operations at 15 operations per min max.	

^a Method B values shall be recorded.

Inspection	BS 9520 reference and conditions of test	Requirements as in BS 9520
Subgroup C5 (D) (cont'd)		
Electrical load and temperature	1.2.7.2 250 h duration at 125 °C. No electrical load. During the conditioning the following measurements shall be made	
Insulation resistance	1.2.4.4 Method A (500 ± 50 V) or Method B (500 ± 50 V) mated at 125 °C, measured 8 times at intervals of not less than 24 h After 1½ h to 2 h recovery	3 MΩ min. ^a
Final measurements		
Housing (shell) electrical continuity	1.2.4.3 Mated specimens which include C 2002 or C 2004 Mated specimen which include C 2001 or C 2003	10 mΩ max. 200 mΩ max.
Contact resistance	1.2.4.2 a)	10 mΩ max.
Voltage proof	1.2.4.5 Method B Voltage as in 7.1.2 of this specification	As in 1.2.4.5
Engaging and separating force, connector	1.2.4.3 Forces as in 8.3 of this specification	As in 1.2.5.3
Visual examination	1.2.2 c) 1.2.2 d)	As in 1.2.2 c) As in 1.2.2 d)
Subgroup C6		
CTR information	1.1.11 The results from the final measurements in subgroups C3 and C5 shall be reported as attributes information The final contact resistance and insulation resistance results of the tests in subgroups C3 and C5 and the minimum insulation resistance at upper category temperature in subgroup C5 shall be reported as measurements information	
GROUP D	To be applied at three-yearly intervals For sampling plan see Appendix B of this specification Wire or cable of maximum insulation diameter shall be used for approximately 50 % of the test specimens, the minimum insulation diameter for the remainder. See 8.3 of this specification The issue number of the manufacturing drawing shall be checked and recorded	
^a Method B values shall be recorded.		

Inspection	BS 9520 reference and conditions of test	Requirements as in BS 9520
<u>Subgroup D0</u>	Sample size: one set of piece parts for the connector range submitted for approval tests. Common piece parts need not be duplicated. No failure allowed	
Dimensions, detail, and materials	1.2.3.2	As in 1.2.3.2
<u>Subgroup D1</u>	For samples see Appendix B of this specification. No failure allowed	
Dimensions, outline	1.2.3.1	As in A.2 and A.3 of this specification
Mass ^a	1.2.5.2 (Including contacts)	As in A.2 and A.3 of this specification
Gauging procedure	1.2.3.3.1 See also Appendix C of this specification for the selection of samples of types within the range for submission to National Supervising Inspectorate for compatibility control	As in 1.2.3.3.1
	1.2.3.3.3	As in 1.2.3.3.3
	1.2.3.3.4 By hand. Polarization W, X, Y and X only	As in 1.2.3.3.4
Compass safe distance ^a	1.2.5.12 One mated pair of each of the largest and smallest connectors, including accessories	As in 1.2.5.12
<u>Subgroup D2 (D)</u>	For samples see Appendix B of this specification. One failure allowed	
Insert ageing	1.2.5.11 Contact retention forces as specified in 8.3 of this specification Nine insertions and withdrawals using the recommended tools in A.4 of this specification Contact retention forces as specified in 8.3 of this specification	As in 1.2.5.4 Maximum axial displacement under load = 0.3 mm As in 1.2.5.4 Maximum axial displacement under load = 0.3 mm
Probe damage	1.2.5.10 Use tool and test probes specified in A.5.3 of this specification	As in 1.2.5.10
Mechanical impact	1.2.5.7 Five impacts. Drop height 1 m 1) Not applicable 2)	By hand
<u>Subgroup D3 (D)</u>	For samples see Appendix B of this specification. One failure allowed	
Bump	1.2.6.2 390 m/s ² (40g _n) 4 000 ± 10 bumps	As in 1.2.6.2
Vibration, general	1.2.6.3.1 Procedure A, 10 Hz to 5 000 Hz, 0.75 mm/10g _n Duration 30 h	As in 1.2.6.3.1

^a This test shall be carried out for initial Qualification Approval only.

Inspection	BS 9520 reference and conditions of test	Requirements as in BS 9520
<u>Subgroup D3 (D) (cont'd)</u>		
Shock	1.2.6.4 981 m/s ² (100g _n) Duration 6 ms	As in 1.2.6.4 As in 1.2.6.5
Acceleration, steady state	1.2.6.5 490 m/s ² (50g _n)	
<u>Final measurements</u>		As in 1.2.2 d)
Visual examination	1.2.2 d)	10 mΩ max.
Contact resistance	1.2.4.2 a)	
<u>Subgroup D4 (D)</u>	For samples see Appendix B of this specification	
<u>Subgroup D4 (i)</u>	One failure allowed	
Rapid change of temperature	1.2.6.8 – 55 °C to 125 °C	
Climatic sequence, general	1.2.6.12 Severity 55/125/56 1) – 25 °C 2) Not applicable 3) Method A or B Voltage as in 7.1.2 of this specification	By hand As in 1.2.4.5
<u>Final measurements</u>	After 1½ h to 2 h recovery 1.2.6.12.2 a) Method A (500 ± 50 V) or Method B (500 ± 50 V) b) Method A or B. Voltage as in 7.1.2 of this specification c) As in 1.2.4.1 1) d) Mated specimens which include C 2002 or C 2004. Mated specimens which include C 2001 or C 2003 e) f) g) Not applicable	100 MΩ min. ^a As in 1.2.6.11 a) ii) 10 mΩ max. 10 mΩ max. By hand As in 1.2.6.12.2 a)
<u>Subgroup D4 (ii)</u>	Sample size: one fixed and one free mating connector and the largest shell size for which approval is sought. Sample may be taken from subgroup D4 (i). No failure allowed	
Flammability ^b	1.2.6.9 Direct flame against a) mating face and b) unprotected rear (accessories removed) of each connector	As in 1.2.6.9
<u>Subgroup D5 (D)</u>	For samples see Appendix B of this specification. One failure allowed	
Contact resistance	1.2.4.2 a)	
Immersion (at low air pressure) ^c	1.2.6.13 a) Cable as specified in 8.3 of this specification	
^a Method B values shall be recorded. ^b This test shall be carried out for initial Qualification Approval only. ^c Alternatively, this test may be carried out after 1.2.6.15.2 of Damp heat, steady state and preceding the recovery period for 1.2.6.15.3 , Final measurements.		