BS EN 857:2015

BSI Standards Publication

Rubber hoses and hose assemblies — Wire braid reinforced compact type for hydraulic applications — Specification

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National foreword

This British Standard is the UK implementation of EN 857:2015. It supersedes BS EN 857:1997, which is withdrawn.

BSI, as a member of CEN, is obliged to publish EN 857 as a British Standard. However, attention is drawn to the fact that during the development of this European Standard, the UK committee voted against its approval as a European Standard.

This is due to concerns about the abrasion test method detailed in Annex A (normative). It is the opinion of the UK committee that the abrasion test method is not reliable and gives inconsistent results.

The UK participation in its preparation was entrusted to Technical Committee PRI/66, Rubber and plastics tubing, hoses and hose assemblies.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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English Version

Rubber hoses and hose assemblies - Wire braid reinforced compact type for hydraulic applications - Specification

Tuyaux et flexibles en caoutchouc - Type hydraulique compact avec armature de fils métalliques - Spécification

Gummischläuche und -schlauchleitungen - Kompakthydraulikschläuche mit Drahtgeflechteinlage - Spezifikation

This European Standard was approved by CEN on 31 January 2015.

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Foreword

This document (EN 857:2015) has been prepared by Technical Committee CEN/TC 218 “Rubber and plastics hoses and hose assemblies”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2015 and conflicting national standards shall be withdrawn at the latest by October 2015.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 857:1996.

In comparison with EN 857:1996, the following significant changes have been made:

— updated normative references;

— tolerances for inside diameter in Table 1;

— added Annex A;

— added Annex B;

— added Annex C.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies requirements for two types of wire braid reinforced compact hoses and hose assemblies of nominal bore from 6 to 25, types 1SC and 2SC.

They are suitable for use with:

— hydraulic fluids in accordance with ISO 6743-4 with the exception of HFD R, HFD S and HFD T at temperatures ranging from -40 °C to +100 °C;

— water based fluids at temperatures ranging from -40 °C to +70 °C;

— water at temperatures ranging from 0 °C to +70 °C.

This European Standard does not include requirements for end fittings. It is limited to the performance of hoses and hose assemblies.

NOTE 1 The hoses are not suitable for use with castor oil based nor ester based fluids.

NOTE 2 Hoses and hose assemblies are not be operated outside the limits of this standard.

NOTE 3 Requirements for hydraulic hoses for underground mining are standardised in separate standards.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN ISO 1302, *Geometrical Product Specifications (GPS) - Indication of surface texture in technical product documentation (ISO 1302)*

EN ISO 1402:2009, *Rubber and plastics hoses and hose assemblies - Hydrostatic testing (ISO 1402:2009)*

EN ISO 4671, *Rubber and plastics hoses and hose assemblies - Methods of measurement of the dimensions of hoses and the lengths of hose assemblies (ISO 4671)*

EN ISO 6743-4, *Lubricants, industrial oils and related products (class L) - Classification - Part 4: Family H (Hydraulic systems) (ISO 6743-4)*

EN ISO 6803, *Rubber or plastics hoses and hose assemblies - Hydraulic-pressure impulse test without flexing (ISO 6803)*

EN ISO 7233, *Rubber and plastics hoses and hose assemblies - Determination of resistance to vacuum (ISO 7233)*

EN ISO 7326, *Rubber and plastics hoses - Assessment of ozone resistance under static conditions (ISO 7326)*

EN ISO 8033:2006, *Rubber and plastics hoses - Determination of adhesion between components (ISO 8033:2006)*

EN ISO 10619-2, *Rubber and plastics hoses and tubing - Measurement of flexibility and stiffness - Part 2: Bending tests at sub-ambient temperatures (ISO 10619-2)*

ISO 1817:2005, *Rubber, vulcanized - Determination of the effect of liquids*

ISO 23529, *Rubber - General procedures for preparing and conditioning test pieces for physical test methods*

3 Types of hoses

Two types of hoses are specified:

1) type 1SC – hoses with a single braid of wire reinforcement;

2) type 2SC – hoses with two braids of wire reinforcement.

4 Materials and construction

4.1 Hoses

Hoses shall consist of an oil and water resistant synthetic rubber lining, one or two layers of high tensile steel wire and an oil and weather resistant synthetic rubber cover.

4.2 Hose assemblies

Hose assemblies shall only be manufactured with those hose fittings whose functionality has been verified in accordance with subclauses 6.1, 6.3, 6.4 and 6.5 of this European Standard.

5 Dimensions

5.1 Diameters and concentricity

When measured in accordance with EN ISO 4671, the diameters of the hoses shall conform to the values given in Table 1.

Table 1 — Diameters of hoses

Dimensions in millimetres, except nominal bore

Nominal bore	All types		Type 1SC			Type 2SC		
	Inside diameter		Diameter over reinforcement		Outside diameter of hose	Diameter over reinforcement		Outside diameter of hose
	min.	max.	min.	max.	max.	min.	max.	max.
6	6,4	6,9	9,6	10,8	13,5	10,6	11,7	14,2
8	7,9	8,5	10,9	12,1	14,5	12,1	13,3	16,0
10	9,5	10,1	12,7	14,5	16,9	14,4	15,6	18,3
12	12,7	13,5	15,9	18,1	20,4	17,5	19,1	21,5
16	15,8	16,7	19,8	21,0	23,0	20,5	22,3	24,7
19	18,8	19,8	23,2	24,4	26,7	24,6	26,4	28,6
25	25,4	26,4	30,7	31,9	34,9	32,5	34,3	36,6

When measured in accordance with EN ISO 4671, the concentricity of the hoses shall conform to the values given in Table 2.

Table 2 — Concentricity of hoses

Dimensions in millimetres, except nominal bore

Nominal bore	Maximum variation in wall thickness	
	Between inside diameter and outside diameter	Between inside diameter and reinforcement diameter
6	0,8	0,4
Over 6 and including 19	1,0	0,6
Over 19	1,3	0,8

5.2 Length

5.2.1 Hoses

Hoses shall be supplied in lengths as specified by the purchaser, subject to a tolerance on the specified lengths of ± 2 %.

When no specific hose lengths have been ordered, the percentages of different lengths in any given delivery shall be as follows:

— over 20 m : not less than 80 % of total length;

— over 10 m, up to and including 20 m : not more than 20 % of total length;

— 1 m, up to and including 10 m : not more than 3 % of total length.

The length of hose shall be at least 1 m.

5.2.2 Hose assemblies

The tolerances on the length of hose assemblies shall conform to the values given in Table 3.

Table 3 — Tolerances of length of hose assemblies

Hose assembly length mm	Tolerances
Up to and including 630	+ 7 mm − 3 mm
Over 630, up to and including 1 250	+ 12 mm − 4 mm
Over 1 250, up to and including 2 500	+ 20 mm − 6 mm
Over 2 500, up to and including 8 000	+ 1,5 % − 0,5 %
Over 8 000	+ 3 % − 1 %

6 Requirements

6.1 Hydrostatic requirements

6.1.1 When tested in accordance with EN ISO 1402, the maximum working pressure, the proof pressure and burst pressure of the hoses and hose assemblies shall conform to the values given in Table 4.

Table 4 — Maximum working pressure, proof pressure and burst pressure

Nominal bore	Maximum working pressure bar [a]		Proof pressure bar		Burst pressure bar	
	Type		Type		Type	
	1SC	2SC	1SC	2SC	1SC	2SC
6	225	400	450	800	900	1 600
8	215	350	430	700	860	1 400
10	180	330	360	660	720	1 320
12	160	275	320	550	640	1 100
16	130	250	260	500	520	1 000
19	105	215	210	430	420	860
25	88	165	176	330	352	660

[a] 1 bar = 0,1 MPa.

6.1.2 When tested in accordance with EN ISO 1402, the change in length of hose at the maximum working pressure shall not exceed +2 % to -4 %.

6.2 Minimum bend radius

When bent to the minimum bend radius given in Table 5, measured on the inside of the bend, the flatness shall not exceed 10 % of the original outside diameter.

Measure the hose outside diameter with a calliper before bending the hose. Bend the hose to the minimum bend radius and measure the flatness with the calliper.

Table 5 — Minimum bend radius

Nominal bore	Minimum bend radius mm	
	Type 1SC	Type 2SC
6	75	75
8	85	85
10	90	90
12	130	130
16	150	170
19	180	200
25	230	250

6.3 Impulse test requirements

6.3.1 The impulse test shall be in accordance with EN ISO 6803. The test temperature shall be 100 °C.

6.3.2 For type 1SC hose, when tested at impulse pressure equal to 125 % of the maximum working pressure, the hose shall withstand a minimum of 150 000 impulse cycles.

For type 2SC hose, when tested at impulse pressure equal to 133 % of the maximum working pressure, the hose shall withstand a minimum of 200 000 impulse cycles.

6.3.3 There shall be no leakage or other malfunction before reaching the specified number of cycles.

6.3.4 This test shall be considered a destructive test and the test piece shall be disposed of in accordance with local environmental guidelines.

6.4 Leakage of hose assemblies

When tested in accordance with EN ISO 1402:2009, 8.4, there shall be no leakage or evidence of failure. This test shall be considered a destructive test and the test piece shall be disposed of in accordance with local environmental guidelines.

6.5 Cold flexibility

When tested in accordance with Method B of EN ISO 10619-2 at a temperature of -40 ˚C there shall be no cracking of the lining or cover. The test piece shall not leak or crack when subjected to a proof pressure test in accordance with EN ISO 1402 after regaining ambient temperature.

6.6 Adhesion between components

When tested in accordance with EN ISO 8033:2006, the adhesion between lining and reinforcement and between cover and reinforcement shall not be less than 2,5 kN/m.

Test pieces shall be type 5 for lining and reinforcement and type 2 or type 6 for cover and reinforcement as described in Table 1 of EN ISO 8033:2006.

6.7 Vacuum resistance

When tested in accordance with EN ISO 7233 the hose and hose assemblies shall conform to the values given in Table 6.

Table 6 — Degree of vacuum

<table>
<tr><th rowspan="2">Nominal bore</th><th colspan="2">Negative gauge pressure bar [a] max.</th></tr>
<tr><th>Type 1SC</th><th>Type 2SC</th></tr>
<tr><td rowspan="2">6
8
10
12
16
19
25</td><td rowspan="2">−0,8</td><td>−0,95</td></tr>
<tr><td>-</td></tr>
<tr><td colspan="3">[a] 1 bar = 0,1 MPa.</td></tr>
</table>

6.8 Abrasion resistance

All hose types shall be tested in accordance with Annex A.

For all hose types when tested with a vertical force of (25 ± 0,5) N the loss of mass after 2 000 cycles shall not be greater than 0,5 g for the average value of three or more test pieces.

6.9 Fluid resistance

6.9.1 Test pieces

The fluid resistance tests shall be carried out on moulded sheets of lining and cover compound, 2 mm minimum thickness, of equivalent cure state to that of the hose.

6.9.2 Oil resistance

When tested in accordance with ISO 1817, the lining immersed in Oil No. 3 for 168 h at a temperature of 100 ˚C shall show no shrinkage and no volume swelling greater than 25 %.

When tested in accordance with ISO 1817, the cover immersed in Oil No. 3 for 168 h at a temperature of 70 ˚C shall show no shrinkage and no volume swelling greater than 100 %.

6.9.3 Water based fluid resistance

When tested in accordance with ISO 1817, the lining and cover immersed in a test liquid made up of equal volumes of 1,2-ethanediol and distilled water for 168 h at a temperature of 70 ˚C shall show no shrinkage. The volume swelling shall be not greater than 25 % for lining and 100 % for cover.

6.9.4 Water resistance

When tested in accordance with ISO 1817, the lining and cover immersed in distilled water for 168 h at a temperature of 70 °C shall show no shrinkage. The volume swelling shall be not greater than 25 % for lining and 100 % for cover.

6.10 Ozone resistance

The test shall be in accordance with EN ISO 7326, Method 1 or 2, depending on the nominal bore of the hose. There shall be no cracking and no deterioration of the cover visible under x2 magnification.

7 Designation

Hoses shall be designated as the following example.

Designation of a Type 1SC hydraulic hose with wire braid reinforcement and a nominal bore of 10:

Hose EN 857 — 1SC 10

8 Marking

8.1 Hoses

Hoses shall be marked at a maximum spacing of 500 mm with at least the following information:

a) manufacturer's name or identification, e.g. XXX;

b) the number of this European Standard "EN 857";

c) type, e.g. 1SC;

d) nominal bore, e.g. 16;

e) quarter and last two digits of year of manufacture, e. g. 1Q15.

EXAMPLE XXX/EN 857/16/1Q15.

NOTE Other information, as agreed between the purchaser and the manufacturer, may be included, if requested.

8.2 Hose assemblies

Hose assemblies shall be marked with at least the following information:

a) Hose assembler’s name or identification, e.g. XXX;

b) maximum working pressure of the assemblies, in bar, e.g. 160 bar;

c) the last two digits of year and month of assembly, e.g. 1501.

EXAMPLE XXX/160bar/1501.

NOTE Other information, as agreed between the purchaser and the hose assembler, may be included, if requested.

Annex A
(normative)

Procedure for the measurement of abrasion

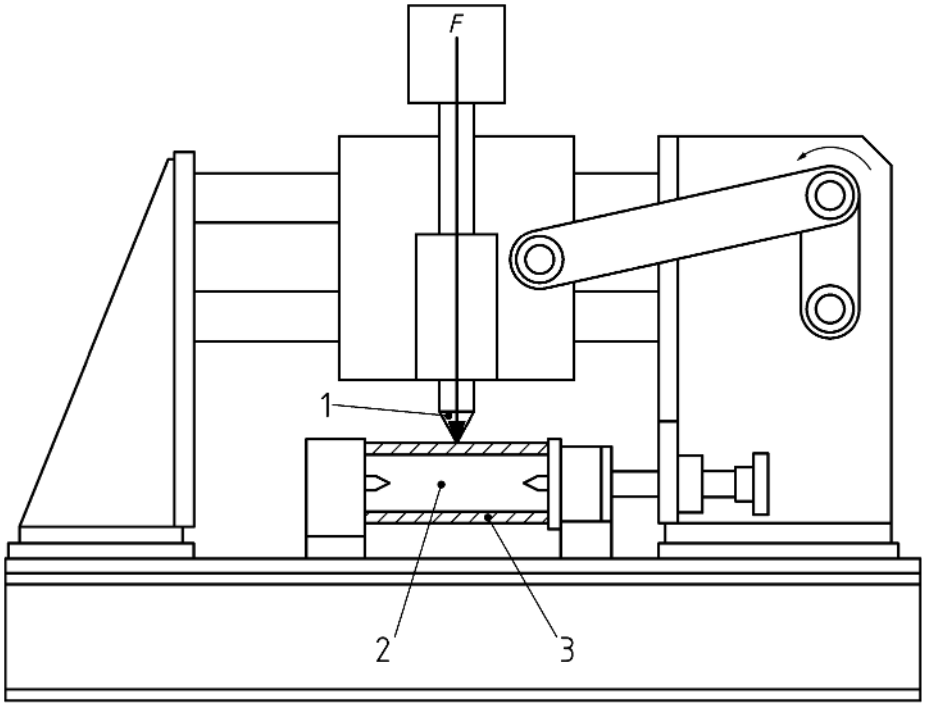
A.1 Apparatus

This method uses an apparatus consisting of a wheel and crank arrangement, capable of moving the abrading tool 100 mm back and forth along the test piece with sinusoidal motion at a rate of 1,25 Hz (one cycle equals 200 mm of travel). A typical arrangement is shown in Figure A.1. The traversing arrangement shall be designed to ensure that:

a) the mid-point of the traversed length is coincident with the mid-point of the assembled hose and mandrel;

b) the axes of the abrading tool and hose are mutually perpendicular at the mid-point;

c) the plane of travel is parallel to the longitudinal axis of the test piece.



Key

1 abrading tool
2 mandrel
3 hose test piece

Figure A.1 — Typical test apparatus

This method requires a recording device, to record the number of cycles completed, and capable of being pre-set to terminate the test after completion of the specified number of cycles.

This method requires means of applying a vertical force *F*, as specified in this product standard, to the abrading tool at the point of contact with the test piece.

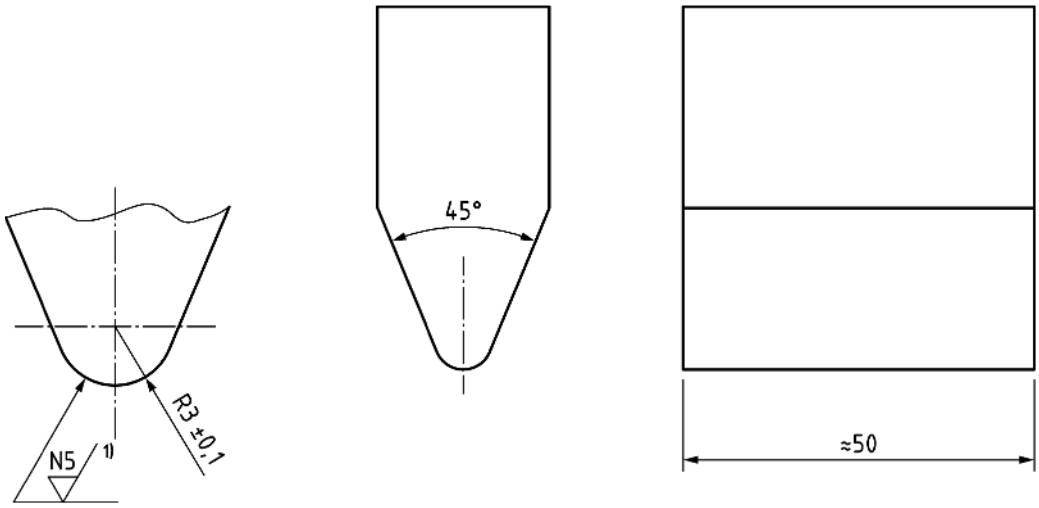
This method requires a mandrel, 150 mm long, on to which the test piece will fit tightly. It is essential that the mandrel is a tight fit in the test piece to prevent distortion of the test piece under the action of the reciprocating abrading tool. For accurate determinations, it is recommended that the mandrel is made of lightweight materials and is of hollow section, so that it is capable of supporting the abrading load but its mass is kept to an absolute minimum. If a solid mandrel is used, this shall be removed prior to weighing the test piece, taking care to avoid loss of material from the hose lining.

A.2 Method

This method uses an abrading tool manufactured from tool steel, heat-treated to give a minimum hardness of HV 890.

The principal dimensions shall be as shown in Figure A.2. It is essential that the specified profile and surface finish are maintained, and that any extraneous material on the surface of the abrading tool is cleaned off before testing is started.

Dimensions in millimetres



[1)] The roughness grade N5 in accordance with EN ISO 1302 corresponds to a roughness value Ra of 0,4 µm.

Figure A.2 — Abrading tool

A.3 Test pieces

Each test piece shall be a sample of hose of length 150 mm ± 0,5 mm. A minimum of three test pieces shall be tested.

NOTE Selection of test pieces is permitted to ensure that there are no surface irregularities greater than 0,5 mm and that they are free from surface contamination.

A.4 Condition of test pieces

No test shall be carried out within 24 h of manufacture. For evaluations which are intended to be comparable, the test shall, as far as possible, be carried out after the same time interval after manufacture. Before testing,

test pieces shall be conditioned for at least 3 h at the standard temperature and humidity of 23 °C ± 2 °C and (50 ± 5) % relative humidity or 27 °C ± 2 °C and (65 ± 5) % relative humidity, in accordance with ISO 23529; this 3 h period may be part of the 24 h interval after manufacture.

A.5 Procedure

Weigh each test piece on or off the mandrel and record the mass ($m1$). Mount the assembled test piece and mandrel in the apparatus, ensuring that the test piece is restrained from axial and/or rotational movement. Place the abrading tool in contact with the test piece, apply the vertical static force F as specified in this product standard, and start the machine. Continue until the specified number of cycles has been completed, then remove the test assembly from the apparatus and reweigh the test piece, either on or off the mandrel, as for the initial weighing. It is important to remove any loose particles of cover compound prior to weighing. Record the mass ($m2$) and the number of cycles completed.

For guidance in preparing requirements in product standards, the static force should be 50 N or 100 N, the latter being selected where higher abrasion resistance if the cover is expected. If it becomes evident during the test that wear has taken place to an extent that the reinforcement is exposed, stop the test, remove the test assembly from the apparatus and reweigh. Record the mass and the number of cycles completed. All weighings shall be carried out to an accuracy of ± 0,01 g.

A.6 Expression of results

The loss of mass Δm, in grams, is given by the formula:

$$\Delta m = m1 - m2$$

where

$m1$ is the mass, in grams, of the test piece before testing;

$m2$ is the mass, in grams, of the test piece after testing.

A.7 Test report

The test report shall include the following information:

a) a reference to this European Standard;

b) a full description of the hose tested;

c) the temperature at which the test was carried out;

d) the number of cycles specified;

e) the number of cycles completed on each test piece;

f) the vertical static force F applied;

g) the mass of each test piece before the test;

h) the mass of each test piece after completion of the specified number of cycles or after discontinuation of the test;

i) the loss of mass from each test piece;

j) the average loss in mass of the three (or more) test pieces;

k) any observations on the nature of wear, particularly any evidence of exposure of reinforcement;

l) the date of the test.

Annex B
(normative)

Type and routine testing of production hoses

Property	Type tests Frequency (for each hose type and size): at initial product qualification, in the event of product changes after initial qualification and after 5 years	Routine tests Performed on each length of finished hose prior to warehousing or sale
Dimensions		
Measurement of inside diameter	X	X
Measurement of outside diameter	X	X
Measurement of outer cover thickness (if applicable – see Table 1)	X	N/A
Measurement of concentricity	X	N/A
Hose tests		
Proof test	X	X
Burst test	X	N/A
Minimum bend radius test	X	N/A
Change in length test (see 6.1.2)	X	X
Impulse test	X	N/A
Leakage test (hose assemblies)	X	N/A
Cold flexibility test	X	N/A
Adhesion (cover)	X	N/A
Adhesion (lining)	X	N/A
Vacuum resistance test	X	N/A
Fluid resistance test for cover	X	N/A
Fluid resistance test for lining	X	N/A
Ozone resistance test	X	N/A
Visual examination	X	X
X Test shall be carried out. N/A Test not applicable		

Annex C
(informative)

Production acceptance testing

Property	Productions tests	
	Frequency: every 3 000m produced of each hose type and size	Frequency: every 12 months of production for each hose type and size
Dimensions		
Measurement of inside diameter	X	X
Measurement of outside diameter	X	X
Measurement of outer cover thickness (if applicable – see Table 1)	X	X
Measurement of concentricity	X	X
Hose tests		
Proof test	X	X
Burst test	X	X
Minimum bend radius test	N/A	X
Change in length test (see 6.1.2)	X	X
Impulse test	N/A	X
Leakage test (hose assemblies)	N/A	X
Cold flexibility test	N/A	X
Adhesion (cover)	N/A	X
Adhesion (lining)	N/A	X
Vacuum resistance test	N/A	X
Fluid resistance test for cover	N/A	X
Fluid resistance test for lining	N/A	X
Ozone resistance test	N/A	X
Visual examination	X	X
X Test shall be carried out. N/A Test not applicable		

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