Plascoat

TECHNICAL CENTRE REPORT

CONFIDENTIAL

Report No: 858/02
Date: 25/10/95
Class: 01.4

Subject: Determining the hardness of Plascoat PPA 571.

Test Mehods and results.

Personnel: S. Adams, W.G. O'Donnell

Summary/Action:

This report detils the procedures carried out by Plascoat Systems when determining the Shore A and Shore D hardness of Plascoat PPA 571 using the general procedure outlined in BS 903: Part A 26.

Circulation: J. Beever, K. Bilham, J.F. Blaise, S. Dartee, N. den Broeder, D. Wiltshire, FILE.

Test Method - Shore A

Equipment used for determining the Shore A hardness of Plascoat PPA 571 was a Wallace Deadload hardness testing machine.

Plascoat PPA 571 powder was compression moulded to a thickness of 9 ± 1mm. This moulding was conditioned for 24 hours in a temperature controlled room maintained at 23 ± 2°C.

Testing was carried out by placing the moulded specimen on the table of the Wallace Deadload tester. The indentor was lowered until the pointer stopped moving. The dial was then set at 100 and after five seconds the indentor was lowered further. After a further 30 seconds the hardness reading of the Plascoat PPA 571 test specimen was read from the dial.

Test Method - Shore D

Equipment used for determining the Shore D hardness of Plascoat PPA 571 is a zwick Shore D hardness tester conforming to ASTM D-2240.

Plascoat PPA 571 powder was compression moulded to a thickness of 6 ± 0.5mm. This moulding was conditioned for 24 hours in a temperature controlled room maintained at 23 ± 2°C.

Testing was carried out by placing the pointer of the hardness tester on the test specimen and by pressing down firmly. After 30 seconds the hardness reading of the Plascoat PPA 571 test specimen was read from the dial.

Test Results

A test result of Shore A 95 was recorded for Plascoat PPA 571.

A test result of Shore D 44 was recorded for Plascoat PPA 571.

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TECHNICAL CENTRE REPORT

CONFIDENTIAL

Report No: 858/04
Date: 25/10/95
Class: 01.4

Subject: Determining the Environmental Stress Crack Resistance of Plascoat PPA 571.

Test Method and results.

Personnel: S. Adams, W.G. O'Donnell

Summary/Action:

This report details the procedures carried out by Plascoat Systems when testing the Environmental Stress Crack Resistance of Plascoat PPA 571 using the general procedure outlined in ASTM D 1693-70 (88).

Circulation: J. Beever, K. Bilham, J.F. Blaise, S. Dartee, N. den Broeder, D. Wiltshire, FILE.

Test Method

Ten test specimens measuring 38 ± 2.5 x 13 ± 0.8 x 3.15 ± 0.15mm were cut from a compression moulded sheet of Plascoat PPA 571 and were conditioned for 24 hours in a temperature controlled room maintained at 23 ± 2°C.

The test specimens were then notched (see fig 2(A)) to a depth of 0.575 ± 0.075mm using a nicking Jig as shown in Fig 1. The test specimens were then bent and inserted in the specimen holder as shown in Fig 2. and the test apparatus was then immersed in Empimim LR 28 solution (41.5 pts Empimim LR 28: 58.5 pts deionised water) as shown in Fig 2 (C).

The test assembly shown in Fig 2 (C) was then sealed and immersed in a water-filled beaker and the whole apparatus was sealed to prevent evaporation.

The test apparatus was left in an oven maintained at 50 ± 2°C and the samples were checked regularly for signs of cracking.

Test Result

After 1000 hours of test duration none of the Plascoat PPA 571 test specimens had failed. The test was discontinued and the F50 value for PPA 571 is reported as "greater than 1000 hours".

Designation: D 1693 – 70 (Reapproved 1988)ε1

Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics[1]

This standard is issued under the fixed designation D 1693; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This test method has been approved for use by agencies of the Department of Defense. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

ε1 NOTE—Section 1.3 was added editorially in October 1988.

1. Scope

1.1 This test method covers the determination of the susceptibility of ethylene plastics, as defined in Terminology D 883, to environmental stress-cracking when subjected to the conditions herein specified. Under certain conditions of stress and in the presence of environments such as soaps, wetting agents, oils, or detergents, ethylene plastics may exhibit mechanical failure by cracking.

1.2 The values stated in SI units are to be regarded as the standard.

1.3 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing[2]

D 883 Terminology Relating to Plastics[2]

D 1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature[2]

D 1248 Specification for Polyethylene Plastics Molding and Extrusion Materials[2]

D 1928 Practice for Preparation of Compression-Molded Polyethylene Test Sheets and Test Specimens[2]

3. Terminology

3.1 *Definitions:*

3.1.1 *stress-crack*—an external or internal rupture in a plastic caused by tensile stresses less than its short-time mechanical strength.

NOTE 1—The development of such cracks is frequently accelerated by the environment to which the plastic is exposed. The stresses which cause cracking may be present internally or externally, or may be a combination of these stresses. The appearance of a network of fine cracks is called crazing.

3.1.2 *stress-crack failure*—for purposes of this test, any crack visible to an observer with normal eyesight shall be interpreted as a failure of the entire specimen (1). Extension of the controlled imperfection shall not be construed as a failure. The appearance of more than one crack in a single specimen shall be construed as a single failure.

NOTE 2—Cracks generally develop at the controlled imperfection and run to the outer edge of the specimen approximately at right angles to it (2). The cracks need not extend completely through the specimen to constitute failure. Cracks sometimes develop under the polymer surface, manifesting themselves as depressions on the surface. The time when this occurs should be noted, and if the depression later develops into a crack, the time of dimpling should be considered as the failure time.

4. Summary of Test Method

4.1 Bent specimens of the plastic, each having a controlled imperfection on one surface, are exposed to the action of a surface-active agent. The proportion of the total number of specimens that crack in a given time is observed.

5. Significance and Use

5.1 This test method may be used for routine inspection purposes by subjecting a required number of specimens to the test conditions for a specified time and noting the number that fail. The cracking obtained with the test reagent is indicative of what may be expected from a wide variety of surface-active agents, soaps, and organic substances that are not absorbed appreciably by the polymer.

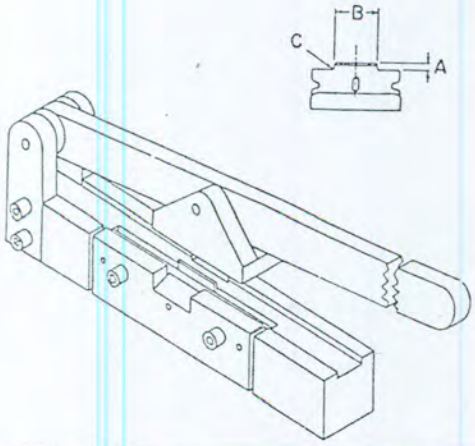
5.2 Environmental stress-cracking is a property that is highly dependent upon the nature and level of the stresses applied and on the thermal history of the specimen (1).[3] Under the conditions of the test, high local multiaxial stresses are developed through the introduction of a controlled imperfection (2,3). Environmental stress-cracking has been found to occur most readily under such conditions.

NOTE 3—Different types of polyethylene plastics as defined in Specification D 1248, are generally tested under different levels of strain and stress. When it is expressly desired to compare the types at equal levels of strain, the specimens for all types should be tested under Condition B, Table 1 (4).

[1] This test method is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.12 on Olefin Plastics.
Current edition approved Jan. 22, 1970. Published March 1970. Originally published as D 1693 – 59 T. Last previous edition D 1693 – 66.

[2] *Annual Book of ASTM Standards*, Vol 08.01.

[3] The boldface numbers in parentheses refer to the list of references at the end of the test method.



	mm	in.
A	3	⅛
B	18.9–19.2	0.745–0.755
C (radius)	1.5 max	1/16 max

FIG. 1 Nicking Jig

5.3 Information from this test method is not intended to be used for direct application to engineering problems.

NOTE 4—Caution should be used in comparing and ranking various ethylene plastics into distinct and separate groups by this test method (see Section 13 and Note 11).

As thermal history is recognized as an important variable, test results by this method employing laboratory molded samples cannot necessarily be expected to show agreement with test results from samples obtained by other means. The true performance potential of a given ethylene plastic may, however, best be determined with specimens obtained from commercially prepared items (5).

6. Apparatus

6.1 *Blanking Die*—A rectangular die or other means suitable for cutting specimens 38 ± 2.5 mm by 13 ± 0.08 mm (1.5 ± 0.1 in. by 0.50 ± 0.03 in.). These specimens must be cut with square edges. Beveled ends in particular are to be avoided.

6.2 *Jig*—A jig for making a controlled imperfection in specimens of the dimensions shown in Table 1, parallel to the long edges of the specimen and centered on one of the broad faces. The jig shown in Fig. 1[4] shall be used.

6.3 *Specimen Holders*—Lengths of hard or half-hard brass channel having the dimensions shown in (*B*) of Fig. 2 shall be used. The sides of the channel shall be parallel and the inside corners sharp and square. Any burrs present on the inside of the channel shall be removed. The inside width is critical (see dimension F in Fig. 2).

6.4 *Test Tubes*—Hard glass tubes nominally 200 mm long with an outside diameter of 32 mm.

NOTE 5—Hard glass (borosilicate) tubes have been found satisfactory.

6.5 *Corks*—No. 15.

6.6 *Aluminum Foil*—Approximately 0.08 to 0.13 mm (0.003 to 0.005 in.) thick, for wrapping.

[4] Detail drawings of the apparatus are available from ASTM Headquarters. Request PCN 12-416931-00, 12-416932-00, and 12-416933-00. This apparatus may be purchased from Custom Scientific Instruments, Inc., 13 Wing Drive, Whippany, NJ 07981.

TABLE 1 Standard Test Conditions

Condition		Specimen Thickness		Notch Depth		Bath Temperature, °C
		mm[A]	in.	mm[A]	in.	
A	min	3.00	0.120	0.50	0.020	50
	max	3.30	0.130	0.65	0.025	
B	min	1.75	0.070	0.30	0.012	50
	max	2.00	0.080	0.40	0.015	
C[B]	min	1.75	0.070	0.30	0.012	100[B]
	max	2.00	0.080	0.40	0.015	

[A] Dimensional values are not exactly equivalent. However, for referee purposes the metric units shall apply.

[B] At a temperature of 100°C, a full-strength reagent, rather than an aqueous solution of a reagent, is generally used because solutions tend to change their compositions by water evaporation losses during the period of test.

6.7 *Constant-Temperature Bath*—A constant-temperature liquid bath maintained at 50.0 ± 0.5°C for Conditions A and B of Table 1 and 100.0 ± 0.5°C for Condition C of Table 1.

6.8 *Test Tube Rack*—A rack to hold test tubes immersed to reagent level.

6.9 *Bending Clamp*[4]—As shown in Fig. 3.

6.10 *Transfer Tool*[4]—As shown in Fig. 4.

7. Reagent

7.1 The test reagent may be a surface-active agent, soap, or any liquid organic substance that is not absorbed appreciably by the polymer.[5]

NOTE 6—This is a nonylphenoxy poly(ethyleneoxy)ethanol. The reagent should be stored in closed metal or glass containers because it is somewhat hygroscopic.

8. Preparation of Test Specimen

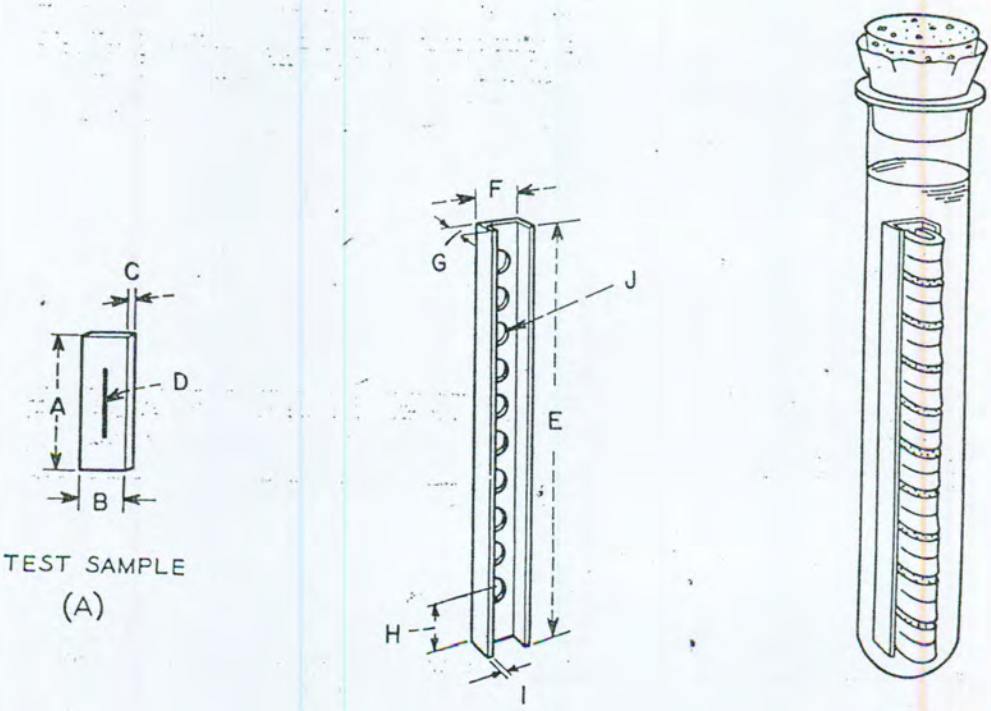
8.1 Unless otherwise specified the test specimens shall be molded in accordance with Procedure C of Method D 1928.

NOTE 7—Use no liquid release agents, waxes, polishes, etc., when molding. However, inert materials such as polyester film, unplasticized cellophane, polytetrafluoroethylene, and aluminum foil have been found satisfactory.

8.2 Sheets may be examined for internal stresses by taking specimens from random locations in the sheet and placing them in a Petri dish containing 3 mm (⅛ in.) of talc and setting the dish in an air oven at 130°C for Types I and II polyethylene plastic and at 150°C for Types III and IV polyethylene plastic for 30 min. If shrinkage of the specimens is less than 10 % in the lengthwise direction, the molded sheet can be considered satisfactory. See also Test Method D 1204.

8.3 Cut specimens from smooth sheet pressed from granules or mill-massed material to the dimensions given in Fig. 2 (*A*). Use a die or other device that produces specimens with clean-cut, square, unbeveled edges. The specimens should be

[5] For referee purposes Igepal CO-630 (Antarox CO-630) obtained from GAF Corp., Dyestuff and Chemical Div., 140 West 51 St., New York, NY 10020 shall be used. Use at full strength unless otherwise specified.



	Dimensions	
	mm	in.
A	38 ± 2.5	1.5 ± 0.1
B	13 ± 0.8	0.5 ± 0.03
C	See Table 1	
D	See Table 1	
E	165	6½
F		
(outside)	16	⅝
(inside)	11.75 ± .05	0.463 ± 0.002
G	10	⅜
H	15	37/64
I	2	0.081 (12 B &S)
J	Ten 5-mm holes 15-mm centers	Ten 3/16-in. holes, 19/32-in. centers

FIG. 2 Test Equipment

cut within 24 h after the sheets are prepared.

9. Conditioning

9.1 Unless otherwise specified the test specimens should be conditioned in accordance with Procedure A of Practice D 618. Do not bend the test specimens, nick or treat them with the reagent until immediately prior to the test. Testing should be started a minimum of 40 h and a maximum of 96 h after conditioning the specimens has begun.

10. Procedure

10.1 Select the condition desired from Table 1.

NOTE 8—Generally Type I polyethylene plastic as defined in Specification D 1248 is tested under Condition A. Types II, III, and IV polyethylene plastics are tested under Condition B. Very high viscosity Types III and IV polyethylene plastics, such as those meeting pipe grade P34 requirements as stated in Specification D 1248, Note 4 and Table 3, are tested under Condition C. (See also Note 1.) Ethylene plastics not defined as polyethylene plastics are tested under Condition A.

10.2 Give each conditioned specimen a controlled imperfection (notch) on one surface as shown in (*A*) of Fig. 2. Use a sharp blade, mounted in the jig shown in Fig. 1, for making this imperfection. A depth micrometer may be used for setting the blade in the jig so that the notch depth is controlled as specified in Table 1. The difference between the height at the top of the blade edge and the channel of the jig where the top of the specimen rests when being nicked is measured to ensure the proper setting of the blade.

NOTE 9—Where it is desired to nick specimens to a notch depth required by Conditions B and C in Table 1 and the available jig has been designed for nicking specimens to a notch depth required by Condition A in Table 1, brass shim stock 0.21 mm (0.008 in.) thick may be used to make the more shallow notch. Brass shim stock is cut wide enough so that it fits snugly inside the jig channel where the specimen rests when nicked. The length of the shim should be such that it extends over the blade, around the end of the jig and under the end so that the jig will rest on about 1 or 2 in. of the shim stock. The weight of the jig resting on the

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TECHNICAL CENTRE REPORT

CONFIDENTIAL

Report No: 858/05
Date: 25/10/95
Class: 01.4

Subject:

Impact testing of Plascoat PPA 571.

Test Method and results.

Personnel: S. Adams, W.G. O'Donnell

Summary/Action:

This report details the procedures carried out by Plascoat Systems when examining the impact resistance of Plascoat PPA 571 using the general procedure outlined in ASTM D 2794-93.

Circulation: J. Beever, K. Bilham, J.F. Blaise, S. Dartee, N. den Broeder, D. Wiltshire, FILE.

Test Method

Equipment used for impact testing is an Erichsen drop-weight impact tester that conforms to the general description outlined in Section 6 of ASTM D2794-93.

Test specimens were prepared using mild steel plates measuring 50 x 50 x 3mm which had been shot-blasted and solvent degreased. The mild steel plates were pre-heated to 320°C for 10 minutes before being dipped in the Plascoat PPA 571 powder. The test specimens were left to air-cool to room temperature. The coating thickness of each test specimen was checked using an Eleometer 325 digital coating thickness gauge. Forty test specimens were selected with coating thicknesses of 0.35 $\pm$ 0.025mm. Twenty test specimens were conditioned for 24 hours in a temperature controlled room maintained at 23 $\pm$ 2°C. The other twenty test specimens were conditioned in a refrigeration cabinet maintained at 0 $\pm$ 2°C.

Impact testing was carried out using the procedure detailed in Section 10 of ASTM D-2794-93. Examination of the impacted area was made using a microscope with x 20 magnification and by use of an Elcometer holiday detector using a test voltage of 1 Kv.

Test Results

Direct failure (ie. failure on impacted side) did not occur on any of the PPA 571 specimens tested at 23°C below an impact force of 2.7 Joules.

Indirect failure (ie. failure on reverse side) did not occur on any of the PPA 571 specimens tested at 0°C below an impact force of 18 Joules.

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TECHNICAL CENTRE REPORT

CONFIDENTIAL

Report No: 858/06
Date: 25/10/95
Class: 01.4

Subject:

Testing the Abrasion Resistance of Plascoat PPA 571.

Test Method and Results.

Personnel: S. Adams, W.G. O'Donnell

Summary/Action:

This report details the procedures carried out by Plascoat Systems when examining the abrasion resistance of Plascoat PPA 571 using the general procedure outlined in ASTM D 4060-90.

Circulation: J. Beever, K. Bilham, J.F. Blaise, S. Dartee, N. den Broeder, D. Wiltshire, FILE.

Test Method

Equipment used to test the abrasion resistance of Plascoat PPA 571 is a Taber abrader supplied by Teledyne Taber and conforming to that referred to in Section 6 of ASTM D 4060-90.

A test specimen was prepared using a mild steel plate measuring 100 x 100 x 3mm which had been shot-blasted and solvent de-greased. The mild steel plate was pre-heated to 320°C for 10 minutes before being dipped in the Plascoat PPA 571 powder for 4 seconds. The test specimen was left to air-cool to room temperature. After cooling a 6.5mm diameter hold was drilled through the centre of the test specimen so that it could be mounted on the taber abrader. The test specimen was conditioned for 24 hours in a temperature controlled room maintained at 23 $\pm$ 2°C.

Testing was carried out by abrading the surface of the test specimen until an even surface was achieved. The test specimen was then weighed (W1). The test specimen was then returned to the taber abrader and the prepared surface of the test specimen was abraded using a new set of H18 wheels under a 500g load for 1000 cycles. At all stages where the abrader was in use a vacuum was applied to the abraded surface to remove debris. After completing the 1000 cycles of abrasion the test specimen was removed and re-weighed (W2).

The test result is reported as weight loss (ie. W1 - W2) per 1000 cycles.

Test Result

After 1000 cycles using H18 abrasive wheels under a 500g load 60mg of material had been abraded from the surface of the Plascoat PPA 571 coating.

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TECHNICAL CENTRE REPORT

CONFIDENTIAL

Report No: 858/07
Date: 25/10/95
Class: 01.4

Subject: Testing the Salt Spray resistance of Plascoat PPA 571.

Test Method and Results.

Personnel: S. Adams, W.G. O'Donnell

Summary/Action:

This report details the procedures carried out by Plascoat Systems when testing Plascoat PPA 571 for Salt Spray Resistance using the general procedure outlined in ASTM B-117/85.

Circulation: J. Beever, K. Bilham, J.F. Blaise, S. Dartee, N. den Broeder, D. Wiltshire, FILE.

Registered office:
Silvertown House,
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London SW1P 2PL
Incorporated in England No. 807284

Test Method

Equipment used for Salt Spray testing is an SF/4 cabinet supplied by C&W Specialist equipment.

Salt solution (Sodium Chloride 50g/l) enters the salt spray chamber from a reservoir and is atomized to form an intense salt fog evenly distributed throughout the chamber.

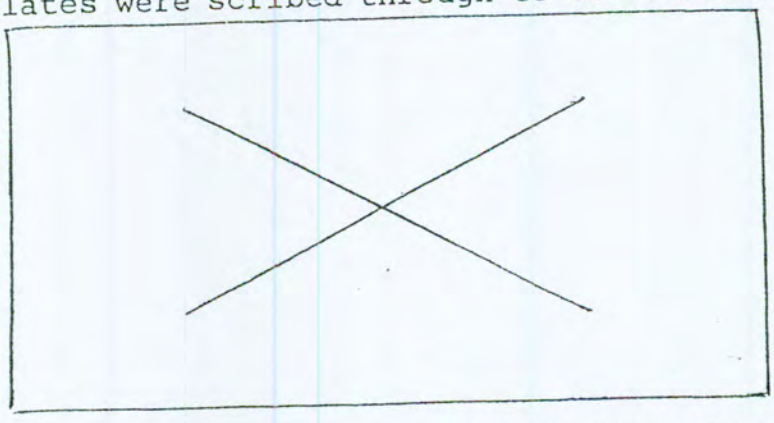
The concentration and distribution of the salt fog is monitored on a regular basis. The ambient temperature in the salt spray chamber is maintained at 35 $\pm$ 1°C. Test duration is monitored by reference to a counter-clock incorporated in the salt spray test apparatus.

Six test specimens were prepared using mild steel plates measuring 100 x 50 x 3mm which had been shot-blasted and solvent de-greased. The mild steel plates were pre-heated at 320°C for 10 minutes before being dipped in the Plascoat PPA 571 powder for 4 seconds. The test specimens were left to air-cool to room temperature.

Six test specimens were prepared using aluminium plates measuring 100 x 50 x 3mm which had been solvent de-greased. The aluminium plates were pre-heated at 350°C for 8 minutes before being dipped in the Plascoat PPA 571 powder for 4 seconds. The test specimens were left to air-cool to room temperature.

Three of the coated mild steel plates and three of the coated aluminium plates were left in an unscribed condition.

Three of the coated mild steel plates and three of the coated aluminium plates were scribed through to the base metal as shown below:



The scribed test specimens were mounted in the salt spray chamber so that the scribed side faced upwards at an angle of 30° from the vertical. The unscribed test specimens were also mounted in the salt spray chamber so that one side faced upwards at an angle of 30° from the vertical.

After the test period the test specimens were removed from the cabinet, washed in water and dried.

On each of the unscribed test specimens two lines were cut ½" apart and parallel to each other through the coating to the substrate. Another cut, 90° to the first two and bisecting them was made through the coating to the substrate so that a "tab" of the coating could be lifted away from the substrate using a stanley knife. This "tab" was then gripped between finger and thumb and an attempt was made to separate the Plascoat PPA 571 coating from the substrate.

On each of the scribed specimens a knife was inserted in the scribe between the coating and the substrate. The coating was lifted with the aid of the knife as far as possible and the portion of the coating separated from the substrate removed.

The substrate was then examined for corrosion and the distance between the scribe and the furthest edge of the corroded area recorded as "underfilm corrosion" in millimetres.

Test Results

Mild Steel Plates

Scribed - No more than 10mm loss of adhesion was recorded on any of the test plates after 1000 hours of salt spray exposure. No more than 3mm of underfilm corrosion was recorded on any of the test plates after 1000 hours of salt spray exposure.

Unscribed - The adhesive bond to the substrates was stronger than the tensile strengths of the coatings and the coating could not be peeled off on any of the test plates after 1000 hours of salt spray exposure.

Aluminium Plates

Scribed - No loss of adhesion was recorded on any of the test plates after 1000 hours of salt spray exposure. No underfilm corrosion was recorded on any of the test plates after 1000 hours of salt spray exposure.

Unscribed - The adhesive bond to the substrates was stronger than the tensile strengths of the coatings and the coating could not be peeled off on any of the test plates after 1000 hours of salt spray exposure.

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TECHNICAL CENTRE REPORT

CONFIDENTIAL

Report No: 858/09
Date: 25/10/95
Class: 01.4

Subject: The Accelerated Weathering of Plascoat PPA 571 Grey 613.

Test method and Results.

Personnel: S. Adams, W.G. O'Donnell

Summary/Action:

This report details the procedures carried out by Plascoat Systems when examining the Weathering Resistance of Plascoat PPA 571 Grey 613 using the general procedure outlined in ASTM G 53-88.

Circulation: J. Beever, K. Bilham, J. F. Blaise, S. Dartee, N. den Broeder, D. Wiltshire, FILE.

Test Method

Equipment used for QUV testing is a Q-U-V Accelerated Weathering tester manufactured by the Q-Panel company to ASTM G53-88 standard.

Ultra-violet radiation is generated by UVB-313 lamps which are rotated every 400 light hours with a new lamp replacing the oldest lamp so that an even spread of ultra-violet radiation is maintained across the whole of the test area.

Test duration is measured in hours of UV radiation and is monitored by use of a counter-clock incorporated in the test machine.

A test specimen was prepared using a mild steel plate measuring 100 x 50 x 3mm which had been shot-blasted and solvent de-greased. The mild steel plate was pre-heated to 320°C for 10 minutes before being dipped in the Plascoat PPA 571 Grey 613 powder. The test specimen was left to air-cool to room temperature before being mounted in the test apparatus.

The test specimen was exposed to a test regime consisting of 8 hours of ultra-violet radiation at 60°C followed by 4 hours of condensation at 40°C.

Gloss readings were taken from the test specimen prior to the start of the test and at intervals of 500, 1000, 1500 and 2000 light hours. Gloss was measured using a 60° gloss meter conforming to ASTM D 523-85.

At each test interval the surface of the test specimen was examined with the aid of a microscope for micro-crazing or other surface defects.

Result

After 2000 light hours of testing the Plascoat PPA 571 Grey 613 coating showed no micro-crazing or other surface defects and gave a gloss reading of 68 compared to an original gloss reading of 76.

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TECHNICAL CENTRE REPORT

CONFIDENTIAL

Report No: 858/10
Date: 25/10/95
Class: 01.4

Subject: Testing the electrical properties of Plascoat PPA 571.

Test Method and Results.

Personnel: S. Adams, W.G. O'Donnell

Summary/Action:

This report covers the testing of Plascoat PPA 571 to
IEC 243 : Dielectric Strength
: Breakdown Voltage

Circulation: J. Beever, K. Bilham, J.F. Blaise, S. Dartee,
N. den Broeder, D. Wiltshire, FILE.

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ERA TECHNOLOGY

POWER SYSTEMS DIVISION

ELECTRICAL STRENGTH OF STEEL PLATES COATED WITH PLASCOAT PPA 571 WHITE 110

J W Billing

ERA Report : 95-1246
ERA Project : 44-01-4579
Commercial-in-Confidence

Client : Plascoat Systems Ltd
Client Representative : Mr S. Adams
Purchase Order No : 2710774

Report approved by :

R J Dean
Manager
Distribution Systems

December, 1995
Ref: 44/887/4579/JWB

Client : Plascoat Systems Ltd.

Test Method : Electric Strength measured to IEC 243 : 1988, with rapid voltage rise.

Equipment used : ERA Medium voltage test system, No.76-023. Calibration date 21/4/95.

Material : Metal substrate with a coating of Plascoat PPA 571 white 110.

Specimen dimensions : Five specimens tested, approx. 150 x 150 mm . Coating thickness value, provided by Plascoat, 370 ±10 µm.

Electrodes : Stainless steel 25 mm diameter upper electrode. Metal substrate used as earth electrode, connection made by grinding away some of the coating on the reverse side of specimen.

Electrode cleaning : Initially cleaned with tissue and isopropyl alcohol and after each breakdown wiped with dry paper towel.

Preconditioning : > 24 hours at 50 ±5% RH and 23 ±2°C.

Rate of rise of test voltage : Rate of voltage rise selected to produce failure in 10 to 20 s.

Surrounding medium : Clean transformer oil

Results

Specimen No.	Breakdown Voltage kV rms	Thickness near Breakdown mm	Electric strength kV rms/mm
1	16.0	0.37	43.2
2	18.8	0.37	50.8
3	17.4	0.37	47.0
4	16.6	0.37	44.9
5	19.6	0.37	53.0
Electric strength median value			47.0 kV/mm
Mean electric strength value			47.8 kV/mm

Date : 8 December 1995

Tester : J. Hornsby

Plascoat

TECHNICAL CENTRE REPORT

CONFIDENTIAL

Report No: 858/11
Date: 25/10/95
Class: 01.4

Subject: Testing the burning characteristics of Plascoat PPA 571.

Test Methods and Results.

Personnel: S. Adams, W.G. O'Donnell

Summary/Action:

This report covers the testing of Plascoat PPA 571 to: BS 476: Pt 5: 1979 Ignitability
BS 476: Pt 6: 1979 Fire Propagation
and BS 476: Pt 7: 1979 Surface Spread of Flame.

Circulation: J. Beever, K. Bilham, J.F. Blaise, S. Dartee, N. den Broeder, D. Wiltshire, FILE.

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METHOD OF TEST FOR IGNITABILITY TO BS 476: PART 5: 1979 ON A SAMPLE OF PPA 571 COATING ON STEEL PLATE

TEST REPORT NO. J 89006/3

Prepared for: Plascoat Systems Ltd.,
Trading Estate,
Farnham,
Surrey GU9 9NY

Date: 13th December 1991

NAMAS
TESTING
No. 0036

METHOD OF TEST FOR IGNITABILITY TO BS 476: PART 5: 1979 ON A SAMPLE OF PPA 571 COATING ON STEEL PLATE

SUMMARY

A sample of a white PPA 571 coating on steel plate has been tested and classified in accordance with BS 476: Part 5: 1979, as amended.

A "P" result was obtained.

The Sponsor's Order No. 003580 of 17th October 1991 refers.

1. MATERIAL SUBMITTED

The material received for testing on 29th October 1991 was stated by the Sponsor to be:-

Mild steel plate (1/8 inch thick) overcoated with PPA 571 white 110 white plastic coating.

2. TEST METHOD

3 specimens were tested on 11th December 1991 according to BS 476: Part 5: 1979 as amended by AMD 3478 of 28th November 1990, by exposure of one face to the test flame.

3. OBSERVATIONS

No flaming occurred during any of these tests.

4. CONCLUSION

In accordance with Clause 9.1 of the Standard the samples described in designation "P".

"The test results relate only to the behaviour of the test specimen of the product under the particular conditions of test; they are not intended to be the sole critria for assessing the potential fire hazard of the product in use".

REPORTED BY E. Wyn-Thomas
E. WYN-THOMAS (Miss)
Fire Testing Department

CHECKED BY N. Rowan
N.T. ROWAN
Manager, Fire Testing Department

AUTHORISED BY .....
D.B.S. BERRY
Divisional Manager

pk

SGS Yarsley Ltd.

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FIRE PROPAGATION TEST ON A SAMPLE OF A WHITE COATING ON STEEL PLATE

TEST REPORT NO. J 89006/2

Prepared for:

Plascoat Systems Ltd.,
Trading Estate,
Farnham,
Surrey GU9 9NY

Date:

13th December 1991

NAMAS
TESTING
No. 0036

FIRE PROPAGATION TEST ON A SAMPLE OF A WHITE COATING ON STEEL PLATE

1. INTRODUCTION

A sample of a white coating on steel plate has been tested for Fire Propagation in accordance with BS 476: Part 6: 1989.

The Sponsor's Order No. 003580 of 17th October 1991 refers.

2. MATERIAL SUBMITTED

The material received on 29th October 1991 was stated by the Sponsor to be:-

Mild steel plate (1/8 inch thick) overcoated with PPA 571 white 110 white plastic coating.

The overall thickness was determined as 4.1mm.

3. TEST METHOD

Three specimens were tested on 6th and 10th December 1991 according to the method laid down in BS 476: Part 6: 1989 by exposure of one face to the heating conditions.

4. OBSERVATIONS

Light coloured smoke was emitted during the tests and melting and trickling of the coating occurred, leaving the steel plates bare at the termination of each test.

5. CONCLUSION

5.1 In accordance with the Standard, the material tested has a final Fire Propagation index, intermediate indices and individual specimen result as follows:-

Final I	0.2
i_1	0.2
i_2	0.0
i_3	0.0

FINAL S

SPECIMEN 1	2	3
S_1 0.0	0.6	0.0
S_2 0.0	0.6	0.0
S_3 0.0	0.0	0.0
0.0	0.0	0.0

"The test results relate only to the behaviour of the test specimens of the product under the particular conditions of test; they are not intended to be the sole criteria for assessing the potential fire hazard of the product in use".

REPORTED BY ..... E. Wyn-Thomas

E. WYN-THOMAS (Miss)

Fire Testing Department

CHECKED BY ..... N. Rowan .....

N.T. ROWAN

Manager, Fire Testing Department

AUTHORISED BY .....

D.B.S. BERRY

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Plascoat Systems Limited
Trading Estate
Farnham
Surrey GU9 9NY

Date: 28th November 1991

SURFACE SPREAD OF FLAME TEST ON A SAMPLE OF A WHITE COATING ON STEEL PLATE

1. INTRODUCTION

A sample of a white coating on steel plate has been tested for Surface Spread of Flame in accordance with BS 476: Part 7: 1987.

The Sponsor's Order No. 003580 of 17th October 1991 refers.

2. MATERIAL SUBMITTED

The material received on 29th October 1991 was stated by the Sponsor to be:-

Mild steel plate (1/8 inch thick) overcoated with PPA 571 white 110 white plastic coating.

The overall thickness was determined as 4.1mm.

3. TEST METHOD

Six specimens were tested on 13th and 21st November 1991 according to BS 476: Part 7: 1987, as amended by AMD 6249 of 31st January 1990, by exposure of one face to thermal radiation.

4. OBSERVATIONS

Each specimen ignited by 6 minutes 2 seconds and did not extinguish until after the termination of the test at 10 minutes. Discolouring of coating occurred before ignition. Melting of the coating occurred and light coloured smoke was emitted.

NAMAS
TESTING
No. 0036

5. RESULTS

Surface Spread of Flame (mm)		Specimen Number					
		1	2	3	4	5	6
	1.5 minutes	NIL	NIL	NIL	NIL	NIL	NIL
	10 minutes	295	265	285	280	260	300

FLAME SPREAD CLASSIFICATION

Classification	Flame Spread at 1.5mins		Final Flame Spread	
	Limit	Limit for one Specimen in sample	Limit	Limit for one Specimen in sample
	mm	mm	mm	mm
1	165	+25	165	+25
2	215	+25	455	+45
3	265	+25	710	+75
4		Exceeding Class 3 Limits		

6. CONCLUSION

In accordance with the Flame Spread Classification given in the Standard and reproduced above, the results show that the material has a Class 2 surface.

"The test results relate only to the behaviour of the test specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use".

REPORTED BY ..E. Wyn-Thomas.....
MISS E. WYN-THOMAS
Fire Testing Department

AUTHORISED BY .....
D.B.S. BERRY
Divisional Manager

ew

Plascoat

TECHNICAL CENTRE REPORT

CONFIDENTIAL

Report No: 858/12
Date: 25/10/95
Class: 01.4

Subject:

Flammability testing of Plascoat PPA 571.

Test Method and Results.

Personnel: S. Adams, W.G. O'Donnell

Summary/Action:

This report details the procedures carried out by Plascoat Systems when testing the flammability of Plascoat PPA 571 using the general procedure outlined in UL 94.

Circulation: J. Beever, K. Bilham, J.F. Blaise, S. Dartee, N. den Broeder, D. Wiltshire, FILE.

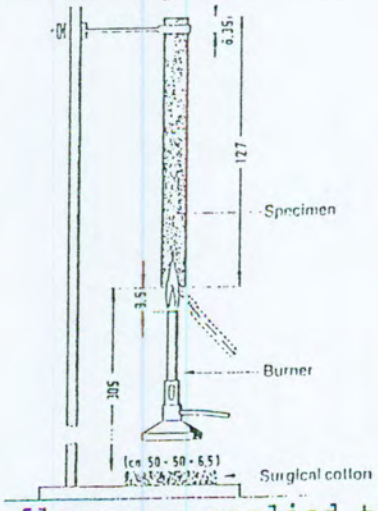
Test Method

Five test specimens measuring 127 x 12.7 x 3.2 ± 0.05mm were prepared from a compression moulded sheet of Plascoat PPA 571.

Five other test specimens were prepared using mild steel substrates measuring 127 x 12.7 x 3.2 ± 0.05mm which had been shot-blasted and solvent degreased. The mild steel substrates were pre-heated at 320°C for 10 minutes before being dipped for four seconds in Plascoat PPA 571 powder. The test specimens were left to air-cool to room temperature. The coating thickness of the test specimens was measured along the whole length of each test specimen with an Elcometer 345 digital coating thickness gauge. Both sides of each test specimen were examined. All coating thickness measurements on each of the five test specimens were 0.4 ± 0.025mm.

All ten test specimens (ie. both moulded and coated) were conditioned for 48 hours in a temperature controlled room maintained at 23 ± 2°C.

Testing was carried out by mounting each of the test specimens as shown below:



The bunsen burner flame was applied to each test specimen for a period of 10 seconds before being removed. If the test specimen self-extinguished after the first flame application then the flame was re-applied for a further period of 10 seconds. After each application of the flame the length of time the test specimen continued to burn was recorded with the aid of the stopwatch.

Results are classified as follows:

Vo Rating - If the mean afterburn time of the five test specimens does not exceed five seconds per flame application and no burning drops occur.

V1 Rating - If the mean afterburn time of the five test specimens does not exceed twenty-five seconds per flame application and no burning drops occur.

V2 Rating - If the mean afterburn time of the five test

Plascoat

TECHNICAL CENTRE REPORT

CONFIDENTIAL

Report No: 858/13
Date: 22.03.96
Class: 01.4.

Subject: Corrosivness of smoke of PPA 571
Test methods and results

Personnel: S. Adams. W.G. O'Donnell

Summary/Action:

This report covers the testing of Plascoat PPA 571 to:
NF C20-453:1985
Basic environmental testing procedures
Conventional determination of corrosiveness of smoke.

Circulation: J.Beever,K.Bilham,S.F.Blaise,S.Dartee,N. Den Broeder,D.Wiltshire,File.

TEST REPORT

WARRES NO. L14883

NF C20-453: 1985
BASIC ENVIRONMENTAL TESTING PROCEDURES
CONVENTIONAL DETERMINATION OF
CORROSIVENESS OF SMOKE

SPONSORED BY

PLASCOAT SYSTEMS LTD
Trading Estate, Farnham, Surrey GU9 9NY

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Warrington FIRE research
CONSULTANCY • TESTING

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TEST REPORT

WARRES NO. L14883

NF C20-453: 1985
BASIC ENVIRONMENTAL TESTING PROCEDURES
CONVENTIONAL DETERMINATION OF
CORROSIVENESS OF SMOKE

SPONSORED BY

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Trading Estate, Farnham, Surrey GU9 9NY

PURPOSE OF TEST

To determine the performance of specimens of a material when it is subjected to the conditions of the test specified in NF c20-453: 1985 "Basic environmental testing procedures, conventional determination of corrosiveness of smoke".

SCOPE OF TEST

NF C20-453 specifies a method of test for the determination of the degree of acidity of gases evolved during the combustion of materials.

DESCRIPTION OF THE MATERIAL

The description of the material given below has been prepared from information provided by the sponsor of the test. All values quoted are nominal, unless tolerances are given.

The product was "Plascoat PPA 571 Grey 654" an acid modified polyolefin stabilised and pigmented.

The sponsor of the test did not provide further details of the composition of the product.

The material was supplied by the sponsor of the test on 22 November 1995. Warrington Fire Research Centre was not involved in any selection or sampling procedure.

DATE OF TEST

The test was performed on 5 January 1996.

TEST PROCEDURE

The test was performed in accordance with the procedure specified in NF C20-453 and this report should be read in conjunction with that Standard.

TEST RESULTS

The test results relate only to the behaviour of the specimens under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential hazard of the product in use.

The test results relate only to the specimens of the cable component in the form in which they were tested. Small differences in the composition of the product may significantly affect the performance during the test and may therefore invalidate the test results. Care should be taken to ensure that any product which is supplied or used is fully represented by the specimens which were tested.

The results obtained are given in Table 1.

TABLE 1

	pH
Run 1	4.47
Run 2	4.44
Run 3	4.48
Mean	4.46

CONCLUSION

The average pH value obtained was 4.46.

Responsible Officer

S. KUMAR
Manager - Standard Testing

Approved

pp R. J. SHAW
Director
for and on behalf of
WARRINGTON FIRE RESEARCH CENTRE

Date of issue: 19 January 1996

Warrington FIRE research
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Plascoat

TECHNICAL CENTRE REPORT

CONFIDENTIAL

Report No: 858/14
Date: 22.03.96
Class: 01.4.

Subject: Toxicity index of products of combustion NES 713

Personnel: S. Adams. W.G. O'Donnell

Summary/Action:

This report covers the testing of Plascoat PPA 571 to:
Standard 713: Issue 3
Determination of the toxicity index of the products of combustion from small specimens of materials naval engineering.

Circulation: J.Beever,K.Bilham,S.F.Blaise,S.Dartee,N. Den Broeder,D.Wiltshire,File.

TEST REPORT

WARRES NO. L11623

STANDARD 713: ISSUE 3
DETERMINATION OF THE TOXICITY INDEX OF THE PRODUCTS OF COMBUSTION FROM SMALL SPECIMENS OF MATERIALS NAVAL ENGINEERING

SPONSORED BY

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TEST REPORT

WARRES NO. L11623

STANDARD 713: ISSUE 3
DETERMINATION OF THE TOXICITY INDEX OF THE PRODUCTS OF COMBUSTION FROM SMALL SPECIMENS OF MATERIALS NAVAL ENGINEERING

SPONSORED BY

PLASCOAT
Farnham, Surrey GU9 9NY

PURPOSE OF TEST

To determine the performance of a specimen of a material when it is subjected to the conditions of test specified in Naval Engineering Standard 713, Issue 3 "Determination of the toxicity index of the products of combustion from small specimens of materials".

SCOPE OF TEST

NES 713: Issue 3 specifies a test method for determining the combustion characteristics of materials. The test explores the toxicity of the products of combustion in terms of small molecular species arising when a small sample of material is completely burnt in excess air under specified conditions of the test. The test does not necessarily determine the total toxicity of all constituents of the product of combustion.

The test may be used to compare the particular combustion characteristics of a series of material, both natural and synthetic types. Combustion characteristics tests alone are not suitable for assessing the total fire hazard of products under actual fire.

DEFINITION

Naval Engineering Standard 713 defines Toxicity Index as follows:-

The numeric summation of the toxicity factors of selected gases produced by complete combustion of the material in air under the conditions specified. The toxicity factors are derived from the calculated quantity of each gas that would be produced when 100g of the material is burnt in air in a volume of $1m^3$ and the resulting concentration fatal to man at a 30 minute exposure time. An index of 1 for a given volume will, on average, bring about death in 30 minutes.

These values are given the symbol C in this report and are taken from Appendix A, Paragraph 3 of NES 713 Issue 3.

DESCRIPTION OF TEST SPECIMEN

The description of the specimen given below has been prepared from information provided by the sponsor of the test.

The specimen was "Plascoat PPA571", a one coat thermoplastic alloy of acid modified polyorfine.

The specimen was supplied by the sponsor of the test. Warrington Fire Research Centre was not involved in any selection or sampling procedure.

CONDITIONING OF SPECIMEN

The specimen was received on 10 April 1992.

Prior to the test the specimen was conditioned at a temperature of 23 ± 2°C and 50 ± 5% for 24 hours.

DATE OF TEST

The test was performed on 16 April 1992.

TEST PROCEDURE

The test was performed in accordance with the procedure specified in NES 713: Issue 3 and this report should be read in conjunction with that Standard.

TEST RESULTS

The test results relate only to the behaviour of the specimen under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.

The test results relate only to the specimen of the product in the form in which it was tested. Small differences in the composition of the product may significantly affect the performance during the test and may therefore invalidate the test results. Care should be taken to ensure that any product which is supplied or used is fully represented by the specimen which was tested.

This test result alone does not assess the fire hazard of the material, or a product made from this material, under actual fire conditions. Consequently, the results of this test alone are not to be quoted in support of claims with respect to the fire hazard of the material or product under actual fire conditions. The results when used alone are only to be used for research and development, quality control and material specifications.

Toxicity index per 100g material:-

Test Run 1	1.80
Test Run 2	1.85
Test Run 3	1.62
Average	1.76

Table 1, 2 and 3 gives the individual toxicity index for all gases found on each test run and also the total toxicity index. Figures in () in column 3 of the tables are for the concentration from the background determination.

CONCLUSION

The test results show an toxicity index of 1.76.

Responsible Officer

A.F.LOVELL
Technical Officer

Approved

pp R. J. SHAW
Director
for and on behalf of
WARRINGTON FIRE RESEARCH CENTRE

Date of issue: 15 May 1992.

Test No: 1

Test Mass: 5.12965g

TABLE 1

GAS	ANALYSIS METHOD	LIMIT OF DETECTION (ppm)	CONCENTRATION OBSERVED ppm (Background)	Co	Cf	Co/Cf
Carbon Dioxide	CIT	2.0	15000(10,000)	97473	10000	0.97
Carbon Monoxide	CIT	1.0	70 (5)	1267	4000	0.32
Phenol	CIT	5.0	0	0	250	0.00
Phosgene	CIT	1.0	0	0	25	0.00
Ammonia	CIT	1.0	0	0	750	0.00
Hydrogen Sulphide	CIT	0.5	0	0	750	0.00
Sulphur Dioxide	CIT	0.1	0	0	400	0.00
Formaldehyde	CIT	0.5	1	19	500	0.04
Hydrogen Chloride	CIT	0.2	0	0	500	0.00
Hydrogen Bromide[3]	CIT	-	0	0	150	0.00
Hydrogen Cyanide	CIT	0.2	0	0	150	0.00
Nitrogen Oxides	CIT	0.1	11(5)	117	250	0.47
Hydrogen Fluoride	CIT	1.0	0	0	100	0.00
Acrylonitrile	CIT	0.5	0	0	25	0.00

Toxicity Index = 1.80

Notes

1. CIT = Colorimetric Indicator Tube
2. A concentration of zero is assumed for a CIT showing no reaction.
3. The absence of hydrogen chloride may be taken as a reliable indication of the absence of hydrogen bromide.

Test No: 2

Test Mass: 5.33910g

TABLE 2

GAS	ANALYSIS METHOD	LIMIT OF DETECTION (ppm)	CONCENTRATION OBSERVED ppm (Background)	Co	Cf	Co/Cf
Carbon Dioxide	CIT	2.0	15000(10,000)	93649	10000	0.94
Carbon Monoxide	CIT	1.0	110(5)	1967	4000	0.49
Phenol	CIT	5.0	0	0	250	0.00
Phosgene	CIT	1.0	0	0	25	0.00
Ammonia	CIT	1.0	0	0	750	0.00
Hydrogen Sulphide	CIT	0.5	0	0	750	0.00
Sulphur Dioxide	CIT	0.1	0	0	400	0.00
Formaldehyde	CIT	0.5	1.0	19	500	0.04
Hydrogen Chloride	CIT	0.2	0	0	500	0.00
Hydrogen Bromide[3]	CIT		0	0	150	0.00
Hydrogen Cyanide	CIT	0.2	0	0	150	0.00
Nitrogen Oxides	CIT	0.1	10(9)	94	250	0.38
Hydrogen Fluoride	CIT	1.0	0	0	100	0.00
Acrylonitrile	CIT	0.5	0	0	25	0.00

Toxicity Index = 1.85

Notes

1. CIT = Colorimetric Indicator Tube
2. A concentration of zero is assumed for a CIT showing no reaction.
3. The absence of hydrogen chloride may be taken as a reliable indication of the absence of hydrogen bromide.

Test No: 3

Test Mass: 5.51745g

TABLE 3

GAS	ANALYSIS METHOD	LIMIT OF DETECTION (ppm)	CONCENTRATION OBSERVED ppm (Background)	Co	Cf	Co/Cf
Carbon Dioxide	CIT	2.0	14500(10,000)	81559	10000	0.82
Carbon Monoxide	CIT	1.0	90 (5)	1541	4000	0.39
Phenol	CIT	5.0	0	0	250	0.00
Phosgene	CIT	1.0	0	0	25	0.00
Ammonia	CIT	1.0	0	0	750	0.00
Hydrogen Sulphide	CIT	0.5	0	0	750	0.00
Sulphur Dioxide	CIT	0.1	0	0	400	0.00
Formaldehyde	CIT	0.5	1.5	27	500	0.05
Hydrogen Chloride	CIT	0.2	0	0	500	0.00
Hydrogen Bromide[3]	CIT		0	0	150	0.00
Hydrogen Cyanide	CIT	0.2	0	0	150	0.00
Nitrogen Oxides	CIT	0.1	10(5)	91	250	0.36
Hydrogen Fluoride	CIT	1.0	0	0	100	0.00
Acrylonitrile	CIT	0.5	0	0	25	0.00

Toxicity Index = 1.62

Notes

1. CIT = Colorimetric Indicator Tube
2. A concentration of zero is assumed for a CIT showing no reaction.
3. The absence of hydrogen chloride may be taken as a reliable indication of the absence of hydrogen bromide.

Plascoat

TECHNICAL CENTRE REPORT

CONFIDENTIAL

Report No: 858/15
Date: 22.03.96
Class: 01.4.

Subject: Analysis of gases evolved during pyrolysis NF C20-454

Personnel: S.Adams,W.G.O'Donnell

Summary/Action: This report covers the testing of Plascoat PPA 571 tc:
NF C20-454:1984
Analyses and titrations of gases evolved during pyrolysis or by the materials used in electrotechnics exposure to abnormal heat or fire tube furnace method.

Circulation: J.Beever,K.Bilham,S.F.Blaise,S.Dartee,N. Den Broeder,D.Wiltshire,File.

TEST REPORT

WARRES NO. L14882

NF C20-454: 1984
ANALYSES AND TITRATIONS OF GASES EVOLVED DURING PYROLYSIS OR BY THE COMBUSTION OF THE MATERIALS USED IN ELECTROTECHNICS
EXPOSURE TO ABNORMAL HEAT OR FIRE
TUBE FURNACE METHOD

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TEST PROCEDURE

The tests were performed in accordance with the procedure specified in NF C 20-454 and this report should be read in conjunction with that Standard.

TEST RESULTS

The test results relate only to the behaviour of the specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.

The test results relate only to the specimens of the product in the form in which they were tested. Small differences in the composition of the product may significantly affect the performance during the test and may therefore invalidate the test results. Care should be taken to ensure that any product which is supplied or used is fully represented by the specimens which were tested.

The quantities of gas liberated by the test specimen are expressed in mg/g: these values are in relation to the unit of weight of the material in question. The results are the mean of the values obtained following at least three determinations.

The results obtained are given in Table 1.

TABLE 1

GASES	mg/g
CARBON MONOXIDE	75.64
CARBON DIOXIDE	344.08
HYDROGEN CHLORIDE	N.D.
HYDROGEN BROMIDE	N.D.
HYDROGEN CYANIDE	N.D.
HYDROGEN FLUORIDE	0.4
SULPHUR DIOXIDE	N.D.

N.D : Not Detected.

Limit of detection: HCl, HBr and SO_2 = 2mg/g; HCN = 0.5mg/g and HF = 0.2mg/g.

Responsible Officer

S. KUMAR
Manager - Standard Testing

Approved

pp R. J. SHAW
Director
for and on behalf of
WARRINGTON FIRE RESEARCH CENTRE

Date of issue: 23 January 1996

Warrington FIRE research CONSULTANCY • TESTING

Plascoat

TECHNICAL CENTRE REPORT

CONFIDENTIAL

Report No: 858/08
Date: 25/10/95
Class: 01.4

Subject: Testing the adhesive properties of Plascoat PPA 571.

Test Method and Results.

Personnel: S. Adams, W.G. O'Donnell

Summary/Action:

This report details the procedures carried out by Plascoat Systems when testing the adhesive properties of Plascoat PPA 571.

Circulation: J. Beever, K. Bilham, J.F. Blaise, S. Dartee, N. den Broeder, D. Wiltshire, FILE.

Test Method

Five test specimens were prepared using mild steel plates measuring 100 x 50 x 3mm which had been shot-blasted and solvent de-greased. The mild steel plates were pre-heated at 320°C for 10 minutes before being dipped in the Plascoat PPA 571 powder for 4 seconds. The test specimens were left to air-cool to room temperature. On each test specimen two lines were cut ½" apart and parallel to each other through the coating to the substrate. Another cut, 90° to the first two and bi-secting them was then made through the coating to the substrate so that a "tab" of the coating could be lifted away from the substrate using a stanley knife. This "tab" was then gripped between finger and thumb and an attempt was made to separate the Plascoat PPA 571 coating from the substrate. The level of adhesion was assessed as follows:

A1 - The adhesive bond to the substrate is stronger than the tensile strength of the coating and the coating can not be peeled off.

A2 - The coating can be peeled off but pieces of the coating are left adhering to the substrate.

A3 - The coating can be peeled off without damaging the coating but still showing signs of adhesion (sellotape level of adhesion).

A4 - The coating shows no signs of adhesion at all.

Test Result

On all five test specimens the Plascoat PPA 571 coating gave an A-1 level of adhesion to the substrate.

Plascoat

TECHNICAL CENTRE REPORT

CONFIDENTIAL

Report No: 858/01
Date: 25/10/95
Class: 01.4

Subject:

Tensile testing of Plascoat PPA 571.

Test Method and result.

Personnel: S. Adams, W.G. O'Donnell

Summary/Action:

This report details the procedures carried out by Plascoat Systems when examining the tensile properties of Plascoat PPA 571 using the general procedure outlined in BS 2782: Part 3: Methods 320A to 320F: 1976.

Circulation:

J. Beever, K. Bilham, J.F. Blaise, S. Dartee, N. den Broeder, D. Wiltshire, FILE.

Test Method

Equipment used for tensile testing is a Davenport Tensometer conforming to test apparatus outlined in BS 2782: Part 3: Methods 320 A to 320 F: 1976, Section 5.

Test specimens identical to ISO/R 527 Type 2 test pieces were cut from compression moulded sheet of Plascoat PPA 571. The thickness of all test specimens within the gauge length of the test pieces was 2 ± 0.05mm. The thickness of each test specimen was recorded with the aid of a digital micrometer accurate to ± 0.001mm. Test specimens were conditioned for 24 hours in a temperature controlled room maintained at 23 ± 2°C.

Testing was carried out using the extemometer grips and a test speed of 500mm/min.

Test Result

The mean tensile strength of the five Plascoat PPA 571 test specimens was 12 Mpa.

The mean elongation at break of the five Plascoat PPA 571 test specimens was 800%.

Plascoat

TECHNICAL CENTRE REPORT

CONFIDENTIAL

Report No: 858/03
Date: 25/10/95
Class: 01.4

Subject: Determining the Tear Strenth of Plascoat PPA 571.

Test Method and results.

Personnel: S. Adams, W.G. O'Donnell

Summary/Action:

This report details the procedures carried out by Plascoat Systems when testing the tear strenth of Plascoat PPA 571 using the general procedure outlined in ASTM D 1938-93.

Circulation: J. Beever, K. Bilham, J.F. Blaise, S. Dartee, N. den Broeder, D. Wiltshire, FILE

Test Method

Equipment used to determine the tear strength of Plascoat PPA 571 is a Davenport Tensometer conforming to the "constant rate of grip separation" machine referred to in Section 4 of ASTM D 1938-93.

Five test specimens were cut from a compression moulded sheet of Plascoat PPA 571 of 1 ± 0.025mm thickness and conforming to Fig 1. of ASTM D 1938-93.

The test specimens were conditioned for 24 hours in a temperature controlled room maintained at 23 ± 2°C.

Testing was carried out to the procedure outlined in Section 9 of ASTM D 1938-93. A test speed of 250mm/min was used and average tear strength was measured from the load/time charts produced.

Test Result

The mean average tear strength of the five Plascoat PPA 571 test specimens was 22 N/mm.