रक्षा मंत्रालय
MINISTRY OF DEFENCE

संयुक्त सेवा स्पेसिफिकेशन
JOINT SERVICES SPECIFICATION

ON

DETAILED SPECIFICATION FOR WIRE ELECTRICAL, HIGH TEMPERATURE FLUOROPOLYMER INSULATED

JSS 51034 : 1992
Reaffirmed 2012

मानकीकरण निदेशालय
रक्षा उत्पादन विभाग
रक्षा मंत्रालय
'एच' ब्लॉक, डाकघर निर्माण भवन
नई दिल्ली – 110 011

DIRECTORATE OF STANDARDISATION
DEPARTMENT OF DEFENCE PRODUCTION
MINISTRY OF DEFENCE
'H' BLOCK, NIRMAN BHAWAN PO,
NEW DELHI - 110 011

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LIST OF MEMBERS ASSOCIATED WITH FORMULATION OF THIS STANDARD

1. This Joint Services Specification has been approved by Sh. K.S Manjunath, Addl DGQA (L), Chairman, Electronic Standardisation Sub Committee.

2. The following members have been present / consulted in approving the draft :-

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2.	Shri P Raghavendra Rao, Sc, 'F'	DLRL, Hyderabad (Head, Microwave wing)
3.	Shri Ramachandra Kuloor, Sc 'G'	LRDE, Bangalore
4.	Sh A K Shukla, Sc 'G'	DEAL Dehradun
5.	Mr R.K Singh, AGM	ITI, Bangalore
6.	Shri H V Srinivasarao	ISSA, Delhi
7.	Shri A K Bhatte, Regional Director	ALISDA, Bangalore
8.	Shri U K Agrawal	DGOS (OS - 17), New Delhi
9.	Col B Chatterjee	DWE (WE - 7), New Delhi
10.	Shri Prakash Chand, Sc 'G'	DEAL, Dehradun
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12.	Shri A Balaji Sc 'F'	LCSO, Bangalore
13.	Shri V Gopala Krishnan, Sc 'F'	LRDE, Bangalore
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27.	Cdr Amit Bhargava	DQA(N), New Delhi
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RECORD OF AMENDMENTS

Amendment		Amendment pertains to : Sl. No. / Para No. / Column No.	Authority	Amended by	Signature & Date
Sl. No.	Date			Name & Appointment (IN BLOCK LETTERS)	

0. FOREWORD

0.1 This specification has been prepared by the Electronic Components Standardisation Organisation (LCSO), on the authority of the Standardisation Committee, Ministry of Defence.

0.2 This specification is approved by the Ministry of Defence and is mandatory for use of components in Service Electronic Equipment.

0.3 Quality Assurance Authority for the item covered by this specification is CQA (L) for Army, DQA (N) for Navy and DGAQA for Air Force respectively. Enquiries regarding technical parameter shall be addressed to the Quality Assurance Authority, while other enquiries shall be referred to :-

The Director
Directorate of Standardisation
Ministry of Defence
'H' Block, Nirman Bhawan PO
New Delhi – 110 011

0.4 Non registered users can obtain the following on payment :-

(a) Copies of IS from :-

Bureau of Indian Standards,
Manak Bhavan,
9, Bahadur Shah Zafar Marg,
New Delhi – 110 002.
or
Their regional offices

(b) Copies of JSS/JSG from :-

The Director
Directorate of Standardisation
Standardisation Documents Centre
Room No. 05, 'J' Block,
Nirman Bhawan PO, New Delhi – 110 011

0.5 Indian Standard (IS) specifications are available free of cost for registered users on :-

Directorate of Standardisation Website :-
www.defstand.gov.in
For registration visit our website.

0.6 This specification holds good only for the supply order for which it is issued.

0.7 **Directorate of Standardisation Website** - All the approved JSS / JSGs are available on the Directorate of Standardisation Website **www.defstand.gov.in.** Defence organisations desirous of procuring a copy of this document are requested to approach the Directorate of Standardisation for obtaining User ID / password to access the website.

1. SCOPE

1.1 This specification relates to the requirements of Wire Electrical, High Temperature, Fluoropolymer Insulated for applications in electrical and electronic equipment used by the Service. Both extruded or spiral wrapped and fused poly Tetra Fluoro Ethylene (PTFE), and extruded Fluorinated Ethylene Propylene (FEP) insulated wires, for hook - up and interconnection applications are covered. This specification also supersedes JSS 51004 : 1976, Amdt 1, 1983 - Detailed specifications for Equipment Wires, PTPE Insulated.

1.2 For the purpose of interpretation or construction in case of any omission, conflicts, ambiguities or inconsistencies to the extends that the contract consists of any or all of the following documents, such documents shall rank in the following order of precedence :-

(a) This specifications, and

(b) Other applicable documents

2. RELATED SPECIFICATIONS

2.1 Joint Services Specifications

Sl. No.	Specification No.	Nomenclature
1.	JSS 50101 : 1996 (Revision No.1) Reaffirmed 2012	Environmental test methods for service electronic components.
2.	JSS 5999 -10 : 2010 (Rev No.1) Supersedes JSS 50102 : 1985	Procedure for the Qualification approval and acceptance of standard Electronic components.
3.	JSS 50111 : 1985 Reaffirmed 2010	Procedure for preparation and updating of JSS on electronic components and associated practices.

2.2 Other Specification

Sl. No.	IS No.	Nomenclature
1.	IS 9938:1981 Reaffirmed 2007	Recommended colours for PVC insulation for LF wires and cables.
2.	IS 10673 : 1983 Reaffirmed 2007	Sampling plans and procedures for inspection by attributes for electronic items.

3. INFORMATION TO BE SUPPLIED BY THE PURCHASER

3.1 When ordering wire electrical, high temperature covered in this specification it is essential to quote :-

(a) Title and number of this specification.

(b) Style reference and colour of insulation.

(c) Defence Stores catalogue Number and

(d) Quantity on order (length).

4. ILLUSTRATIONS AND DRAWINGS

4.1 Purpose : The essential purpose of the illustrations and drawings in this specification is to ensure mechanical interchangeability.

4.2 Dimensions : Dimensions are in millimeters.

4.3 Drawings : Where drawings are quoted, they are mandatory. Copies of such drawings are obtainable from the Officer - in - Charge, LCSO.

5. PATENTS

5.1 Patents or Design rights or copy right may subsist in connection with items defined as standards and issue of this specification which is the subject of such rights.

6. DEFINITIONS

6.0 For the purpose of this specification the definitions contained in JSS 50101, JSS 5999 -10 : 2010 (Rev No.1) Supersedes JSS 50102 and JSS 50111 together with the following shall apply.

6.1 Style Reference : The Style references used in this specifications are abbreviations to Identify families of wire Electrical, high temperature of defined characteristics. These are derived as follow :-

(a) The first letter ‘W’ represents ‘Wire Electrical’.

(b) The second letter ‘H’ represents ‘High Temperature application’.

(c) The following number represents the Voltage Ratings, as given in Table 1.

TABLE 1 : VOLTAGE RATINGS

Code Number	Voltage Rating Ac (rms)
1	250 V
2	600 V
3	1000 V

(d) The subsequent letter represents the dielectric material used for the wire insulation as follows :-

P - Extruded or Spiral Wrapped and Fused Poly Tetra Fluoro Ethylene (PTFE).

F - Extruded Fluorinated Ethylene Propylene (FEP)

(e) The single digit and a letter combination following as hyphen (after the coding at (a) to (d) above) represents the applicable conductor details (material and coating) as in Table 2, and together with the preceding coding constitutes the pattern.

TABLE 2

CONDUCTOR MATERIAL AND COATING

Code Digit and Letter Combinations)	CONDUCTOR	
	Material	Coating
1A	Soft or Annealed Copper	Silver
2A	High Strength Copper Alloy (H.S.C.A)	Silver
3A	Copper clad Steel (C.C.C)	Silver
1B	Soft or Annealed Copper	Nickel
2B	High Strength Copper Alloy (H.S.C.A)	Nickel
3B	Copper clad Steel (C.C.S)	Nickel

(f) The subsequent digits which follow denote the conductor size code (examples given in Table 3) which in combination with the pattern defines the Style reference (see clause 16). The conductor size code consists of a series of digits (minimum of three upto a maximum of five) the final two digits being, incidentally the approximate conductor strand size in AWG; the preceding digits denoting the number of strands in the conductor covered.

TABLE 3

EXAMPLES OF CONDUCTOR SIZE CODE

Conductor Size code	Stranding (NO of strands / Dia of each strand (mm))
132	1 / 0.20
130	1 / 0.25
128	1 / 0.32
740	7 / 0.08
726	7 / 0.40
1938	19 / 0.10
1936	19 / 0.13
1934	19 / 0.16
10530	105 / 0.25
13326	133 / 0.29
13327	133 / 0.36

Examples of Style References

WH2P - 1A 1934 Wire Electrical, High Temperature, 600 V, PTPE Insulated with silver coated, soft or annealed copper, conductor size 19 / 0.16 mm.

WH3F - 1A 13327 Wire Electrical, High temperature 1000V, FEP Insulated, with silver coated soft or annealed copper, conductor size 133 / 0.36 mm.

7. MATERIAL, PROCESS AND FINISHES

7.0 General : Where materials processes and finishes are specified in this specification they are mandatory. Attention is drawn to the requirements in JSS 5999 -10 : 2010 (Rev No.1) Supersedes JSS 50102 : 1985 that materials processes and finishes shall not be changed significantly without prior approval.

7.1 Workmanship, Processes and Finishes : Wire electrical, High Temperature, shall be manufactured and processed in a careful and workmanlike manner. The wire shall be free of kinks, abrasions and cracked or peeled surfaces. It shall be free uniform in quality and free from defects which will adversely affect its serviceability. The insulation shall be from splinters, blisters and non homogeneities visible to the normal eye (20 - 20 vision corrected). The colour of the insulated wires shall be as specified in clause 16. The details of the colour scheme applicable and colour coding shall be as specified in Appendix ‘A.

7.2 Material and constructions : The materials for principle components of the wire Electrical, high Temperature shall specified in clause 16. when a definite material is not specified, a material shall be used that will unable the finished wires to meet the performance requirements for the manufacture of the finished wires shall be of such quality and form that the finished product conforms to the requirements specified herein.

7.3 Conductor : The conductor shall consists of single stranded or bunched soft or annealed high conductivity copper wires, coated in accordance with the clause 16 and covered with a uniform concentric layer of insulation, and shall have the same coating. The stranding shall be in accordance with Table (see pages 34 to 36) after insulation. The conductor shall be round in shape, uniform in cross section and free from flaws, scales and other imperfections.

Conductor material : It shall be one of the following in clause 16 :-

Type 1 – soft or annealed copper
Type 2 – High strength copper alloy
Type 3 – Copper clad steel

7.2.1.2 Conductor Coating : The conductor coating shall be either silver or nickel, as specified in clause 16. Silver coatings shall be minimum 1 mm thick. The individual wires shall be coated before stranding. The addition of metallic coating after stranding shall not be permitted. Silver plated conductor strands shall pass the 'Continuity of costing and coating thickness over conductor's test (See clause 13.9).

7.2.1.3 Conductor splicing : Splices shall not be made in a standard conductor as a whole. However, individual strands had solid conductors may be spliced. Splices shall be made by solid conductors may be spliced. Splices shall be made by electro - welding or brazing with silver composition solder. Splices shall be of the butt type, except for 0.32 mm and smaller conductors where the solid conductor strand may be twisted, in which case they shall have a minimum overlay of 15 mm.

7.2.2 Insulation : A tight fitting continuous coating shall be added over the conductor and so cured and processed or maintained so as to provide for accurate centering of the conductor (see clause 7.2.3) and retention of circular cross section. The insulation shall be free be free from defects and shall have an adequate finish (see clause 7.1) and capable of being readily stripped from the conductor by standard methods leaving the conductor clean for soldering or crimping.

7.2.2.1 Insulation material : Either spiral wrapped and fuzed, or extruded/poly Tetra / Fluoro Ethylene (PTFE) or extruded Fluorinated Ethylene Propylene (FEP) insulation, as specified in clause 16 shall meet the requirements of this specification.

7.2.2.2 Insulation Colour : Colour of the finished wires shall generally correspond to the shades defined as per IS:9938 'Recommended colours for PVC Insulation for LF Wires and cables'. When insulation surfaces have been coloured with inks or dyes they shall be non - conductive, permanently fast and shall not change, fade, run or bleed when used in direct sunlight and within specific temperature rating of the insulation used. The colour code stripe (s) shall meet the requirements of Stripe Durability' test (Test No. 13.14) satisfactorily (see clause 7.1 also)

7.2.3 Outer Coverings : Outer coverings applied when specified shall be as follow :

7.2.3.1 Braid : Braids shall be closely woven of glass yarn or synthetic yarn. The angle of application and yarn tensions shall be such to avoid twisting, kinking and damage to the primary insulation when the wires is operated at the rated temperature. Braids shall be saturated or filled and coated with non-tarnishing, fungus resistant, heat, flame and moisture resistant lacquers with smooth finish which will prevent fraying at cut ends under conditions, incident to handling while being installed and during normal service. The braid and finish shall have sufficient colour stability to retain circuit identification during operation at rated temperature. Unless the finishing compounds are coloured for circuit identification they shall be sufficiently transparent so as not to impair underlying colour coding of the braid. The addition of a braid shall add to the specific maximum diameter under the braid not more than 0.38 mm for core diameters upto 3.175 mm, not more than 0.50 mm for cores 3.20 mm to 6.35 mm, and not more than 0.89 mm for cores over 6.35 mm diameter.

7.2.3.2 Jacket : When a polyamide, polyvinyl, FEP Fluoropolymer or TEF Fluoropoolymer jacket is specified, a tight fitting concentric tube shall be not less than one half the specified minimum increase in diameter.

(a) Polyamide jacket : Polyamide jacket unless circuit identification is applied to the jacket, shall be sufficiently transparent so as not to impair any underlying colour coding.

(b) Poluvinyl jacket : Polyvinyl jacket material shall be a polyvinyl chloride or its copolymer with polyvinyl acetate.

(c) FEP Fluoropolymer jacket : FEP Fluoropolymer jacket material shall be Fluorinated Ethylene propylene. Unless circuit identification is applied to the jacket, it shall be sufficiently transparent so as not to impair any underlying colour coding.

(d) TFE - Fluoropolymer Jacket : TFE Fluoropolymer jacket material shall be Poly tetra Fluoro Ethylene.

7.2.3.3 Shield : When shield is specifically required, a closely braid of coated copper strands shall be applied to provide coverage of not less than 90 percent when determined by the following formula :-

$$K = [2R - F^2] \times 100$$

Where :

K = Percent coverage
F = Npd / Sin (a)
A = angle of braid with axis of cable
Tan (a) = 2 R x (D + 2 d) X P / C
d = Diameter of individual braid wire (mm)

c = Number of carriers
D = Diameter of cable under shield (mm)
N = Number of wires per carrier
P = Picks per mm.

Before braiding, strands shall conform to the requirements for conductors. The metallic coating on the copper strands of shield shall be similar to the metallic coating of the conductor of the wire to which the shield is applied, unless otherwise specified. The braided shield shall not increase the maximum diameter of the wire specified by more than 0.76 mm

7.2.4 Spark Test : Spark test in accordance with clauses 13.3 shall be performed upon 100 percent of the insulated wires supplied under this specification. Insulation breakdowns resulting from this test and ends of portions not subjected to this test shall be marked and cut out of the finished wire.

8. MARKING

8.1 A label containing the following information shall be security attached to each reel / unit pack of the wire :-

(a) Nomenclature, i.e, Wire Electrical High Temperature. V FEP Insulated.

(b) Style reference and colour

(c) JSS number

(d) Defence stores Catalogue Number

(e) Manufacturer's Code & Date and

(f) Length in meters, in case a reel / unit pack contains more than one no. of lengths, length and location of each piece shall be indicated.

Marking done on the Reel shall be located on the flange area, and shall not become illegible during use.

8.2 When each unit length of the shall be identify by a printing applied to surface of the visible through the outer surface. The printing identification shall consists of the following, at intervals of 20 cm to 150 cm, as measured from the beginning of one complete marking to the beginning of the succeeding complete marking.

(a) JSS Number and Style Reference

(b) Manufacturer's Code and Date

The printing shall be in a contrasting colour (black or white is preferable) and of a permanent type of ink or dye. Printed characters shall be complete and legible.

9. PACKAGING

9.1 Packaging (preservation, identification and packing) shall be in accordance with the terms of the contract.

9.2 Unless otherwise specified, the wires shall be supplied in continuous lengths of 100 m wound on non - returnable bobbins or reels. Both ends of the wires shall be available for inspection. For bulk supplies, the nominal lengths of 100 to 300m, except that not more than 20 percent of the total length in any size may be supplied at random lengths of 20m to 100 m. lengths of less than 50m shall not be acceptable.

9.3 Both the flanges of such reels shall show the length of each individual piece in meters as also its position on the reel.

9.4 Bulk supplies shall be packed in a manner which will ensure acceptance by a common carrier and will afford protection against physical and mechanical damage during transit from supply source to the first receiving activity for immediate use.

10. QUALIFICATION APPROVAL AND MAINTENANCE OF QUALIFICATION APPROVAL PROCEDURE

10.0 Qualification approval and Maintenance of Qualification Approval shall be obtained as described in JSS 5999 - 10 : 2010 (Rev No.1) Supersedes JSS 50102 and this specification.

10.1 Provision of samples : The manufactures shall submit 100 m of the complete length of finished wire in each of the highest and lowest sizes, separately in each pattern for which approval is desired. For each pair of samples, one of the samples shall be in any one of the single colours specified and the other shall be in multicolour.

10.1.1 Ten metre lengths of representative silver coated strands used in the construction of each of the finished wire samples, prior to stranding, shall also be provided.

10.2 Certificate of Constriction : When submitting samples for qualification approval testing the manufacturer shall certify that 100 percent of the finished wire passes the Spark Test (See clauses 7.2.4 and 13.3), Splices Test (See clauses 7.2.1.3 and 3.4) conductor continuity Test (see clause 13.5), after verification.

10.3 Grouping of Specimens : The full lengths of sample shall be subjected to the group ‘0’ test as in Table 4. Specimens shall then be taken from the sample as required and subjected to the remaining tests.

10.4 Test Incidence : The specimens shall be subjected to the tests specified in Table 4.

QUALIFICATION APPROVAL TEST
(Clauses 10.1, 10.3, 10.4)

No. of Specimens	Title of Test	Test Number
	Visual Examination	13.1.1
	Dimensions	13.1.2
	Concentricity of Insulation	13.2
FULL LENGTH	Spark Test *	13.3
	Splices *	13.4
	Conductor Continuity	13.5
	GROUP '1'	
	Conductor Resistance	13.6
	Dielectric Withstanding Voltage	13.7
	Insulation Resistance	13.8
	GROUP '2'	
	Continuity of Coating and Coating	13.9
	Thickness over Conductor	
	Conductor tensile strength and Elongation	13.10
	GROUP '3'	
	Insulation Dielectric Constant and power Factor	13.11
	Insulation Tensile Strength and Elongation	13.12
	Surface Resistance	13.13
	Stripe durability	13.14
	GROUP '4'	
	Cold Bend	13.15
	Heat Resistance	13.16
	Wrap Back	13.17
	Resistance to soldering Heat	13.18
	Flammability	13.19
	GROUP '5'	
	Mould Growth	13.20

* Production Test to be based on certification by manufactures.

11. BATCH ACCEPTANCE PROCEDURE

11.0 Batch Acceptance shall be performed as described in JSS 5999 - 10 : 2010 (Rev No.1) Supersedes JSS 50102and in this specification.

11.1 Inspection Batch : An inspection shall be all wires of one specific reference and colour, produced under essentially the same conditions and offered for inspection at one time. The batch size shall be the numbers of reel / unit packs of each wire.

11.2 100 percent Acceptance Tests : These tests shall be performed as given in given in Table 5.

Table 5

100 PERCENT ACCEPTANCE TEST

(Clause 11.2)

Test Number	**Title of Test**
13.1.1	Visual Examination
13.3	Spark Test *
13.4	Splices *
13.5	Conductor Continuity

* Production Test - to be based on certification by manufactures

11.3 Sampling Test : Sampling tests shall consists of group ‘A’ and Group ‘B’ as given in clause 11.3.1 and 11.3.2 respectively. Information on resubmission of rejected batches is given in IS 10673.

11.3.1 Group ‘A’ Tests : These tests shall be performed as given in Table 6.

TABLE 6

Group 'A' Tests

(Clauses 11.3.1)

Test Number	Title of Test	AQL (Percent Defective)	Inspection Level
13.1.2	Dimensions		
13.6	Conductor Resistance		
13.7	Dielectric withstanding Voltage *		
13.8	Insulation Resistance *		
13.9	Continuity of coating & coating Thickness over conductor		
13.10	Conductor Transit strength and Elongation		

* The Length of the specimens for these tests shall be a minimum of 10m.

11.3.2 Group 'B' Tests : These tests shall be performed as given in Table 7.

TABLE 7

GROUP 'B' TESTS

Test Number	Title of Test	AQL (Percent Defective)	Inspection Level
13.2	Concentricity		
13.11	Dielectric Constant and power factor		
13.12	Insulation Tensile Strength and Elongation		
13.13	Surface Resistance	4	S3
13.15	Cold Bend		
13.16	Heat Resistance		
13.17	Wrap Back		
13.18	Resistance to Soldering Heat		

12. TEST PROCEDURE

12.1 Atmospheric Conditions for Testing : Unless otherwise specified, all tests shall be performed under standard atmosphere conditions defined in section 2 of JSS 50101.

13. TEST DETAILS

Test Number	Title of Test	Description	Requirements
13.1	General Examination		
13.1.1	Visual Examination	The Wire shall be visually examined for its general condition, construction and finish	The appearances, construction, finish, colour and marking shall be satisfactory. The wire shall be uniform in quality and free of kinks, abrasion and cracked or peeled surface. The wire insulation shall be free from splinters, blisters and non - homogeneities.
13.1.2	Dimensions	The dimensions shall be checked as under :-	
13.1.2.1	Conductor Diameter	The diameter of the conductor shall be checked. The conductor shall be either solid or standard as applicable as specified in clause 16 in the case of Standard conductors, measurements on the individual strands shall also be made. Test Apparatus Micro - meter caliper graduated to read 0.0025 mm (o.1 mil) and having flat surface on both anvil and end of spindle, each approximately 6 mm in diameter. The surface of the anvil and spindle shall be parallel to within 0.0025 mm.	The dimensions shall be conform to these specified in clause 16 and fall within the limits defined in Table 9 at pages 34 to 36 refer.

Test Number	Title of Test	Description	Requirements
		Test specimens : Test specimens removed from the finished wire shall be free from mechanical damage. Any dirt, grease or other extraneous materials shall be removed from the specimen by means of a soft wiping cloth using chloroform or any other suitable solvent. One specimen each at least 15 cm in length removed from each end of the sample unit of wire shall be tested. Test Procedure : The micrometer caliper shall be applied directly over the wire so that the anvil and spindle are just brought in contact with the specimen in such a manner that the wire is not distorted. The criterion of contact is the initial development of frictional resistance to movement of the wire between the micrometer caliper scale and the value recorded. Two measurements of the diameter at position approximately 90^{o} apart on the specimens are required. Three sets of measurements at point equally spaced along the length of the specimen shall be made. Test Results : The average diameter of the conductor sample unit shall be the average of the results obtained from the specimen tested. The minimum diameter of the conductor sample unit shall be the smallest of all values averaged in determining the average diameter, as above. These diameter values shall be recorded to the nearest 0.025 mm (1mil).	

Test Number	Title of Test	Description	Requirements
13.1.2.2	Overall diameter	The diameter of the finished wire shall be measured with a micrometer caliper with the some defined characteristics as in clause 13.1.2.1. Each sample unit of the wire shall be measured at three places, one measurement near each end of the unit and one measurement near the midpoint. Two measurements of diameter at positions approximately 90^{o} apart at each of the above three points shall be made.	The dimensions shall be within the limits specified in clause 16.
13.2	Concentricity	The concentricity of insulating shall be measured on a cross wire at 10 X magnification. If the wire Construction includes additional layers (e.g Jacket or insulation coating) outside the primary insulation separate determination shall be made for the primary insulation and finished wire. The cross section of the wire. Both the minimum thickness and maximum thickness of the primary insulation or total insulation wall, as applicable shall be located for the same cross section and measured. The percentage concentricity is 100 times the ratio of the minimum measurement to the corresponding maximum measurement. Three different cross sections shall be measured in each sample unit.	The concentricity of wire insulating shall be 70 percent minimum.
13.3	Spark Test	The test shall be conducted on a complete length of wire in the manner specified below :-	There shall be no breakdown.

Test Number	Title of Test	Description	Requirements
		(a) Test Electrode : The electrode shall make an intimate contact with the surface of the insulated wire and shall preferably consist of a fine link or bead chain. (b) Running Speed : The speed of the wire through the electrode shall be such that the insulation is subjected to the specified Test Voltage (see clause 16) applied between the conductor and every point is in contact with the electrode for not less than 0.1 second / both ends of the wire conductor shall be grounded. (c) Fault Indicator : A suitable fault indicating device for detection of insulation flaws shall be provided. The detector shall be arranged so as to maintain its indication even after the fault has passed out of the electrodes. NOTE : Production Test Compliance to be certified by the manufacturer (see clause 10.2).	
13.4	Splices	Full length of the wire shall be examined for conformity to the requirements for conductor splicing (see clause 7.2.1.3) NOTE : Production test Compliance for insulated wires to be certified by the manufacturer. (see clause 10.2).	The Stipulation of clause 7.2.1.3 shall be met.
13.5	Conductor Continuity	The complete length of wire shall be tested for conductor continuity with an ohmmeter or other suitable testing device.	There shall be no discontinuity.

Test Number	Title of Test	Description	Requirements
13.6	Conductor Resistance	The Electrical resistance shall be measured on the complete length of wire. The resistance measuring device shall be capable of measuring accurately within 0.5 percent of the value of determined. The measured value corrected proportionately to the length and expressed in ohms / kilometer shall be referred to the standard temperature of the 20^{o} C. for copper conductors the resistance shall be corrected to the standard temperature by multiplying the measured value by the factor R, where $R = \frac{1}{1 + 0.00393(t - 20)}$ 't' being the temperature in degrees Celsius at which the measurement is made. NOTE : To correct the value proportionately to the length, the measured resistance shall be multiplied by the factor 1, L being the length of the wire in kilometres.	The value shall be between the limits specified in Table 9.
13.7	Dielectric withstanding voltage	The test voltage shall be ac as the waveform being approximately sinusoidal and the frequency shall be 40 and 60 Hz and the voltage to be taken into consideration shall be expressed as an ras value. Test Specimens : The specimens shall be a 10 meter minimum length of insulated wire, with the ends prepared for the electronic connection (2 cm insulation being removed from each end), selected from each sample unit.	The insulated wire shall withstand the specific test voltage and there shall be no evidence or flash over.

Test Number	Title of Test	Description	Requirements
		Test Procedures : The test specimen of the insulated wire shall be immersed, in a water bath (5 percent by weight solution of sodium chloride in water) at 20^{o} C $\pm$ 5^{o} C, with atleast 4 cm of insulted wire at each end of the specimen extending above the water, for a minimum period of 1 hour. The insulated wire shall then be tested between the two conductors joined together and an electrode in contact with the water by an application of the test voltage specified at 60 Hz, as follows : - Application of Test Voltage : the test voltage shall be uniformly increased from zero to the specific peak voltage (see clause 16) in 30 seconds and maintained at that voltage continuously for a period of 1 minute ± 5 seconds and uniformly reduced to zero in 30 seconds. Following the test, the specimen shall be examined.	
13.8	Insulation Resistance	This test shall be conducted immediately after the dielectric withstanding voltage test (see clause 13.7). the test voltage shall be 500 $\pm$ 50 Vdc with the conductor maintained at high potential. The period of immersion in the water bath will be the same (1 hour minimum) as specified in clause 13.7. the insulation resistance shall be measured after an electrification of 1 minute + 5 second - 0 seconds	The insulation resistance shall be not less than the resistance value specified in clause 16 expressed in Megohms / km.

Test Number	Title of Test	Description	Requirements
		At a temperature of 20^{o} C ± 5^{o} C. in case of dispute on value of resistance the measurement shall be repeated at 20^{o} C ± 1^{o} C. The minimum requirement of Insulation Resistance Value X, in Meg Ohms / km, shall be calculated as follows :- $X = X. \text{Log}_{10} (D / d)$at 20^{o} C (in Megaohms / km) where K = 15290 D = maximum average diameter of finished wire in mm. d = conductor of diameter in mm.	
13.9	Continuity of coating and coating thickness over conductor	Test procedures as given in appendices B & C shall be followed.	As in clause 7.2.1.2
13.10	Conductor tensile strength and Elongation	These tests shall be carried out on specimen of coated conductors removed from the finished wire. Five specimens from each sample unit shall be tested. The test procedure specified in appendix 'D' shall be followed.	The conductor tensile strength and elongation values shall be within the limits specified in table 9. **NOTE :** Conductor tensile strength values will be presenting treated as ' for information only'
13.11	Insulation Dielectric Constant & Power Factor	The specimen shall be of sufficient length so that the measured capacitance is not less than 100 pice - farads. The external surface shall be grounded by application of sprayed metal or by immersion in mercury except when the wire is shielded in which case the shield shall be the ground electrode.	

Test Number	Title of Test	Description	Requirements
		The power factor and the capacitance shall be either the bridge method or the resonant circuit substitution method at room temperature and at a frequency of 1 MHz. the method shall permit determination of the power factor with an accuracy of plus or minus 5 percent of the measurement value. The power factor shall be measured directly. The dielectric constant shall be calculated from the capacitance measurement and from the formula given below: $K = 41.4\ C \log_{10} (D / d)$ Where K = Dielectric constant C = Capacitance of specimen in microfarads per 1000 m. D = Average outside diameter over dielectric d = Average diameter of conductor.	
13.12	Insulation Tensile strength and Elongation	These tests shall be made on 125 mm insulation specimens prepared by cutting specimens of finished insulated wire that length and removing the conductor without damage to the insulation. Five specimens from each sample unit shall be tested. The test procedure specified in appendix 'E' shall be followed and the results averaged to determine compliance. The speed of traverse of the jaws shall be 50 mm / minute minimum and 500 mm / minute maximum and the initial separation of the gauge marks for elongation	The insulation tensile strength and elongation values shall not be less than the minimum values specified in clause 16.

Test Number	Title of Test	Description	Requirements
		shall be 25.4 ± 0.076 mm. the tensile strength which shall be calculated on the original cross sectional area of the specimen (based on the diameter of the conductor in mm and the thickness of insulation) and the elongation at break shall be recorded for each piece.	
13.13	Surface Resistance	The specimens shall consists of 150 mm length of finished wire provided with either two 6 mm ring type metal foil electrodes or for a small wires, several turns of fine tin coated wire wrapped snugly around the axis of the specimen and bound with take off leads for electrical testing of the surface between the electrodes. The two electrodes shall be spaced 25 mm apart between nearest edges and shall be approximately located near the middle of the test specimen. Conditioning - the specimens shall be conditioned for 96 hours at 25^{o} C ± 5^{o} C at 95 percent relative humidity. The surface resistance shall be calculated while the specimen is still in the conditioning chamber with a d.c. potential of 200 to 500 volts, by noting the potential and leakage current after one minute electrification. Surface Resistance = $\frac{V \times D}{I \times 25}$ (in mega ohm mm) Where V = d.c potential in volts D = Measured overall diameter of the wire in mm, and I = Leakage current in microamperes.	The surface resistance value shall not be less than the value specified in clause 16. clause (13.13.1) need not be carried out if the initial value is grater than 40 Mega ohm mm.

Test Number	Title of Test	Description	Requirements
13.13.1	Final Measurement		
13.13.1.1	Dielectric strength	After the initial measurement of resistance, a 2500V ras 50 Hz potential shall be applied for one minute between the electrodes.	There shall be no evidence of distress such as arcing, smoking or burning, flash over or dielectric failures.
13.13.1.2	Surface Resistance	After a discharge interval of 15 to 20 minutes, following the above test, the surface resistance shall be re - measured.	The value shall not have changed more than 50 percent from the initial value.
13.14	Stripe Durability	Durability of the coloured stripe shall be evaluated using a repeated scrape abrasion tester. In this instrument a short specimen of coloured marking to be tested is firmly clamped in a horizontal position with its upper longitudinal surface area freely exposed. A 0.64 mm diameter steel mandrel, usually a needle is then repeatedly subbed over the insulation surface at the stripe so that the longitudinal axis of mandrel and specimen are at right angles to each other, and the point of tangency between the two is very small. A specified weight affixed to a jig above mandrel controls the thrust exported to the insulation surface. By employing a motor driven reciprocating can mechanism and counter, the machine permits an accurately measured number of abrasion strokes all equivalent in thrust magnitude to be delivered in a conveniently short time. A test specimen of previously un - tested wire sample shall be mounted on the specimen	The colour code stripes shall with stand a minimum of 125 cycles (250 strokes)

Test Number	Title of Test	Description	Requirements
		clamp. 500 g (total weight) shall be applied through the rubbing needle to the insulation surface for wires with non conductor sizes 0.51mm and larger and 250 g for wires with non conductor sizes 0.10 mm and smaller. The counter shall be set at zero and the drive motor started. This test shall be run for a minimum of 125 cycles (250 strokes) NOTE : 1 This test does not apply to constructions which have clear jackets or braids over the colour coded primary insulation NOTE : 2 the needle shall be changed every 25000 cycles (50000 strokes).	
13.15	Cold Bend	Specimens of the completed wire each having a length of 300 mm plus the length required for wrapping on the mandrel with 25mm insulation stripped down at each end of the conductor, shall be conditioned in a chamber maintained at -65^{o} C ± 1^{o}C for 4 hours with one end attached to the mandrel. After conditioning and while still in the chamber at the above specified temperature the specimens shall be tested by bending over a mandrel of the size specified in the Table 8, without opening the chamber, specimens for which a 75 mm or larger mandrel is specified shall be subjected to a 180 degree in the opposite direction over the mandrel. For specimens for which a mandrel smaller	No readily visible derangement shall result from this conditioning and bending. The specimen shall withstand for one minute the dielectric test as specified for primary insulation of the applicable type. Additionally in the case of shielded wire with a sheath over the shield the sheath shall with – stand for 1 minute, a potential of 200 volts from sheath to water

<table>
<tr><th>Test Number</th><th>Title of Test</th><th>Description</th><th>Requirements</th></tr>
<tr><td></td><td></td><td>than 75mm in a diameter is specified the mandrel shall be rotated at the approximate rate of 15 revolutions per minute so as to wind atleast three turns of wore on the mandrel and rewrapped in the opposite direction in a similar manner,

Weight shall be attached to the free end of the specimens to keep the wire taut during the bending operation so that close turns of the specimens upon the mandrel will be obtained. The coiled specimens shall be removed from the mandrel without straightening and brought to the room temperature and visually examined. The coiled or bent sections of the wires shall then be immersed, except for approximately 50mm at each end, in tap water at room temperature for 1 hour.

TABLE – 8 COLD BEND TEST MANDREL SIZES
<table>
<tr><th>Wire Sizes</th><th>Diameter of Mandrel (Max)</th></tr>
<tr><td>Wires with conductor size nominal dia (mm)</td><td>(mm)</td></tr>
<tr><td>0.20 through 1.83 2.36 2.82 through</td><td>1.52 25
50
5.41 75</td></tr>
</table></td><td></td></tr>
</table>

Test Number	Title of Test	Description	Requirements
13.16	Heat Resistance	Specimens of finished insulated wire, each having a length of 300 mm plus the length required for winding on the mandrel shall be subjected to a temperature of 200^{o} C (for wires with PTFE insulation or 230^{o} C (for wires with FEP insulation) as applicable (see clause 16) for a period of 96 hours +1 hour - 0 hour. The specimens shall than be removed from the conditioning chamber and allowed to return to room temperature. Following the oven ageing, specimens shall be wound tightly around mandrel(approximately but not less than three times of the overall diameter of the wire) for five close turns and removed s as helical coil. The coiled specimen shall be immersed (except for approximately 50mm at each end) for one hour in tap water at room temperature and shall then withstand for one minute the dielectric withstanding voltage test (see clause 13.7)	No readily visible derangement shall result from this heating and coiling. There shall be no cracking or delamination of the insulation. Slight discolouration shall be considered normal and acceptable. Server discolouration or colour change is sufficient cause for rejection. The wire shall withstand the dielectric withstanding voltage test.
13.17	Wrap Back (For wires with PTEF insulation only)	The centre portion of a 300mm minimum length specimen of finished PRFE insulated wire shall be tightly would back on itself for a total of four close turns (see Fig. 1). The specimen shall then be placed in an oven and heated for two hours at 307^{o} C $\pm$ 5° C. At the end of this period the specimen shall be visually examined without magnification and then subjected to the dielectric withstanding voltage test (see clause 13.7)	The specimen shall show no evidence of cracks and the wire shall withstand the Dielectric withstanding voltage test.

Fig.1 Test specimen for Wrap Back Test

Test Number	Title of Test	Description	Requirements
13.18	Resistance to soldering Heat	Specimens of finished wire, each 150 mm in length shall be prepared for soldering heat test by removing 12 mm of the end of the insulation, the specimens shall be given 90 degree bend over mandrels of their own diameters. These ends shall be immersed for 5 seconds to within 3mm of the insulation in a pot of moten 60 - 40 (tin - lead) solder maintained at a temperature of approximately 320^{o} C. There shall be no flux used in preparing the wire for soldering.	The insulation shall not flare away from the conductor, open up over the bent portion nor shrink back more than the value as specified in clause 16 for the applicable wire.
13.19	Flammability	Five specimens of wire shall be cut consecutively from the same coil and shall be freely exposed in an atmosphere of 75 percent relative humidity at a temperature of 20° C $\pm$ 5° C for a period of 16 hours before testing. Each specimen of wire shall then be supported to an angle of 45 deg in a draught free chamber. The hottest point of a vertical 75 mm non - luminous flame from a 9.5 mm bunsen burner with a blue cone 25mm high, shall be arranged to	After the source of the flame has been removed, the wire shall cease to burn within 10 seconds and the total length burned or charred shall not exceed 75mm.

		impinge on the central portion of the specimen for 15 seconds. NOTE 1 : Satisfactory operation of the flame may be confirmed by inserting a bare copper wire 0.71 ± 0.025 mm diameter having a free length of not less than 100mm in the flame in the position to be occupied by the specimen. The flame is satisfactory for the test if the wire melts in not more than 6 seconds and not less than 4 seconds. **NOTE 2 :** Care shall be exercised in making this test as toxic fumes are given off from the wire.	
13.20	Mould Growth (for information only)	As in JSS 50101 Test Number 14. Three test specimen (each 65 cm ± 15 mm long) shall be used.	As in JSS 50101 Test Number 14.

14. LIST OF PATTERNS

14.1 Preferred Pattern

15. TECHNICAL NOTES

15.1 Intended Use : The PTFE and FEP insulated single core wire covered by this specification is intended for high temperature applications, is suitable for use in internal wiring of the electrical and electronic equipment and switch boards. PTFE insulation has good resistance to hot soldering irons except in the case of wire styles under pattern WHIP - 1A where the limitations mentioned under clause 15.2 apply. FEP insulation does not resist hot soldering irons.

15.2 Thin wall Insulation : Wires having thin wall insulation of 0.18mm thickness and less are intended for limited low voltage applications. They are relatively fragile and easily damaged, and should not be used where mechanical stress or abrasive environment exists. These wires are not suitable in circuits requiring the highest degree of reliability. In order to appear consistent, the temperature rating is the same as that assigned to wires with. Thicker walls of the same dielectric material. However, care must be taken during installation and using hot soldering iron, to avoid damage to the dielectric and to leave no residual physical strain on the dielectric wall, as plastic flow could result in failures.

15.3 Solid Conductors : The use of solid conductor wires requires caution. Usage should be limited to lengths of less than 15 to 25 cm, and is not recommended where flexing is likely to occur or the wire subjected to different vibratory modes along its length, i.e., between different chassis.

15.4 Current Carrying Capability of Wires : The power dissented in a wire, when carrying current, is I^2R. This produce a rise in conductor temperature, which will be added to the ambient temperature at which the chassis is operating. In covered wire or wires in sleeving the temperature rise will depend on the thermal resistance of the covering, its position in the chassis, the amount of free air circulating and whether it is part of a cable form. This is extremely difficult to calculate and the safety factor to be allowed is often arbitrary.

Given an allowable temperature rise over ambient operating conditions, the conductor must be chosen to have sufficient cross sectional area to carry the required current.

15.5 Voltage drop : Voltage drop should also be considered in selecting conductor sizes. In heater circuits where large numbers of values are used, or in aircraft wiring installations where long runs are necessary, the effect of the voltage drop can be important. It is difficult to calculate because temperature can efficient of the wire have to be taken into account in addition to the ambient and operational temperatures. For instance the resistance of copper is approximately 20 percent higher at 75^oC than it is at 20^oC, introducing a considerable error if the voltage drop were to be calculated on a basis of constant resistance. Where voltage drop is excessive a larger diameter wire is generally used, although this increases weight and cost.

15.6 Operating Temperature : The total allowable rise due to the passage of current added to the maximum ambient temperature of the chassis gives the required operating temperature of the covered wire. The practical limit is always determined by the covering and not by the wire.

15.7 Voltage Rating : The voltage rating specified (see clause 16) is the maximum recommended rms voltage at sea level between conductor and ground for continuous operation. The corresponding allowable direct current potential is approximately 40 percent greater.

15.8 Maximum Temperature Rating : The temperature rating at sea level is the maximum recommended hot spot for continuous operation.

15.9 Multicore Cables : Although this specification does not cover multicore, will manufactured in conformity with this specification are suitable for use as component parts in making up cables as needed. It must however be noted that the components before cable assembly and do not cover the performance requirement of multicore cable constructions to assure compatibility with the required operating conditions are beyond the preview of this specification.

16. LIST OF STANDARDS

16.0 This list gives details of Wire Electrical, High Temperature, which have been selected as standards for use in service electronic equipment.

16.1 Pattern WH1P - 1A : Wire Electrical, High Temperature, 250V, PTFE Insulated

16.1.1	Temperature severity	:	T 65 / 200 * /

* / Based on the maximum permissible continuous operating temperature of the conductor and Cold Test (see clause 13.15) conditioning Temperature.

16.1.2	Voltage rating	:	250 V rms
16.1.3	Spark Test	:	2.5 KV rms.
16.1.4	Conductor material	:	Type 1A, Silver plated soft or Annealed copper (See Table 2 And Table 3)
	Conductor Resistance	:	See table 9
	Conductor Tensile Strength	:	See table 9
	Conductor Elongation	:	See table 9
16.1.5	Dielectric Withstanding Voltage	:	1.5 KV rms.

TABLE : 9 CONDUCTOR REQUIREMENTS

(Type 1A silver plated soft or annealed Copper)

Conductor Size code	Stranding (No. of Strands) / Diameter of each strand 1/ (mm)	Area of Conductor 2 (mm)	Diameter of Strands (mm)	Diameter of conductor (mm)			Conductor resistance 140 per 1000m at 20^{o} C (Test No 13.6) (Max) 2/ (ohm)	Conductor (strand) 3/ Tensile Strength (Max) 4/ (N / m^2)	Elongation (min) %
				Min	Max	Nom 1 (as in clause 16 with values rounded upto second decimal			
1	2	3	4	5	6	7	8	9	10
CONDUCTOR STYLES									
132	1 / 0.20	0.0324	0.202	0.190	0.229	0.20	557.7	303×10^6	9.0
130	1 / 0.25	0.0507	0.254	0.241	0.279	0.25	356.4	296×10^6	13.5
128	1 / 0.32	0.0806	0.320	0.305	0.330	0.31	224.4	296×10^6	13.5
126	1 / 0.40	0.1282	0.404	0.381	0.432	0.40	140.9	296×10^6	13.5
124	1 / 0.51	0.2047	0.511	0.483	0.559	0.51	88.4	290×10^6	15
122	1 / 0.64	0.3243	0.644	0.6274	0.6604	0.64	56.1	290×10^6	20
120	1 / 0.81	0.5168	0.812	0.787	0.838	0.81	34.7	276×10^6	20
118	1 / 1.02	0.8209	1.024	0.991	1.041	1.02	21.8	276×10^6	20
116	1 / 1.29	1.3073	1.29	1.270	1.321	1.29	13.9		
114	1 / 1.63	2.0825	1.63	1.600	1.651	1.63	8.5		

TABLE : 9 CONDUCTOR REQUIREMENTS (Contd…)

(Type 1A silver plated soft or annealed Copper)

Conductor Size code	Stranding (No. of Strands) / Diameter of each strand 1/ (mm)	Area of Conductor 2 (mm)	Diameter of Strands (mm)	Diameter of conductor (mm)			Conductor resistance 140 per 1000m at 20° C (Test No 13.6) (Max) 2/ (ohm)	Conductor (strand) 3/ Tensile Strength (Max) 4/ (N / m^2)	Elongation (min) %
				Min	Max	Nom 1 (as in clause 16 with values rounded upto second decimal			
1	2	3	4	5	6	7	8	9	10
STANDARD CONDUCTOR STYLE									
740 5/	7 / 0.08	0.0340	0.787	0.2235	0.2790	0.25	570.9	325×10^6	5.5
738 5/	7 / 0.10	0.0568	0.102	0.2790	0.3300	0.31	332.3	325×10^6	5.5
736 5/	7 / 0.13	0.0887	0.127	0.356	0.406	0.38	210.5	325×10^6	5.5
734	7 / 0.16	0.1409	0.160	0.457	0.508	0.48	133.7	303×10^6	9.0
1930 5/	19 / 0.10	0.1540	0.101	0.457	0.559	0.51	126.7	335×10^6	5.5
732	7 / 0.20	0.2270	0.202	0.584	0.635	0.61	83.2	303×10^6	9.0
1936 5/	19 / 0.13	0.2487	0.127	0.584	0.686	0.64	80.2	325×10^6	5.5
730	7 / 0.25	03547	0.254	0.711	0.787	0.76	52.5	296×10^6	13.5
1934 5/	19 / 0.16	0.3820	0.160	0.737	0.838	0.81	49.8	303×10^6	9.0

5/ See notes at the end of the Table.

TABLE 9 : CONDUCTOR REQUIREMENT (Contd.)

(Type 1A Silver Plated Soft or Annealed Copper)

Conductor Size code	Stranding (No. of Strands) / Diameter of each strand 1/ (mm)	Area of Conductor 2 (mm)	Diameter of Strands (mm)	Diameter of conductor (mm)			Conductor resistance 140 per 1000m at 20° C (Test No 13.6) (max) 2/ (ohm)	Conductor (strand) 3/ Tensile Strength (max) 4/ (n / m^2)	Elongation (min) %
				Min	Max	Nom 1 (as in clause 16 with values rounded upto second decimal			
1	2	3	4	5	6	7	8	9 4	10
	STANDARD CONDUCTOR STYLES (Contd)								
728	7 / 0.32	0.5630	0.320	0.914	0.991	0.97	33.0	296 x 10^6	13.5
1932 5/	19 / 0.20	0.6162	0.202	0.940	1.041	0.02	30.3	303 x 10^6	9.0
726	7 / 0.40	0.8969	0.404	1.194	1.270	1.22	20.7	296 x 10^6	13.5
1930 5/	19 / 0.25	0.9627	0.254	1.168	1.321	1.27	19.1	296 x 10^6	13.5
1929 5/	19 / 0.29	1.2293	0.286	1.346	1.499	1.45	14.9	296 x 10^6	13.5
2630	26 / 0.25	1.3174	0.254	1.448	1.575	1.52	14.2	296 x 10^6	13.5
1927 5/	19 / 0.36	1.9412	0.361	1.651	1.854	1.83	9.5	296 x 10^6	13.5
4130	41 / 0.25	2.0774	0.254	1.829	2.057	1.93	9.0	296 x 10^6	13.5
1925	19 / 0.45	3.0848	0.456	2.159	2.362	2.31	6.0	296 x 10^6	13.5

TABLE : 9 CONDUCTOR REQUIREMENTS (Contd…)
(Type 1A silver plated soft or annealed Copper)

Conductor Size code	Stranding (No. of Strands) / Diameter of each strand 1/ (mm)	Area of Conductor 2 (mm)	Diameter of Strands (mm)	Diameter of conductor (mm)			Conductor resistance 140 per 1000m at 20^{o} C (Test No 13.6) (max) 2/ (ohm)	Conductor (strand) 3/ Tensile Strength (max) 4/ (n / m^2)	Elongation (min) %
				Min	Max	Nom 1 (as in clause 16 with values rounded upto second decimal			
1	2	3	4	5	6	7	8	9	10
3728	37 / 0.32	2.9763	0.320	2.134	2.311	2.26	5.3	296×10^6	13.5
6530	65 / 0.25	3.29.3	0.254	2.362	2.515	2.36	5.7	296×10^6	13.5
3726	37 / 0.40	4.7397	0.404	2.692	2.921	2.82	3.9	296×10^6	13.5
10530	105 / 0.25	5.3204	0.254	2.997	3.302	3.05	3.5	296×10^6	13.5
13329 5/	133 / 0.29	8.6054	0.286	4.013	4.394	4.29	2.2	296×10^6	13.5
13327 5/	133 / 0.36	13.5889	0.361	5.029	5.512	5.41	1.4	296×10^6	13.5

Notes :

1/ Nominal Values are for information only. Nominal values are not requirement.

2/ Applies to measurement done on the conductor of the finished wire.

3/ Requirements apply to strand taken from the conductor of the finished wire.

4/ Tensile strength values 'for information only'

5/ Preferred stranding for associated size.

16.1.6 Insulating Resistance (X) will be calculated as

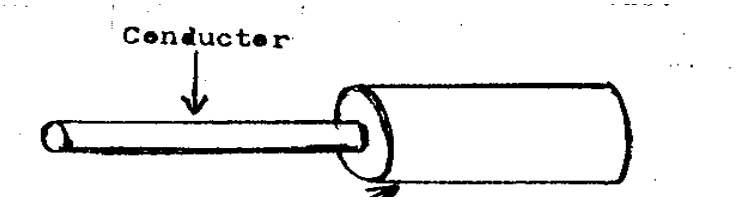
$X = k \log_{10} (D / d)$ Mega ohms / km (Min) at 20^{o} C

Where

K = 15290
D = maximum average diameter of finished wire
d = Conductor diameter

16.1.7	Insulating Material	:	Extruded or Spiral Wrapped and fused Poly Tetra Fluoro Ethylene (PTFE)
	Concentricity of Insulation	:	70 percent (Min).
	Insulation Dielectric constant	:	2.2 (Max)
	Insulation Power factor	:	0.005 (Max) or 0.5 percent
	Insulation Tensile Strength	:	21×10^{6} N / m^2 (Min)
	Insulation Elongation	:	150 percent (Min)
	Surface Resistance	:	0.2 Mega ohms mm (Min)
	Insulation Colour	:	As in Table 11
16.1.8	Cold Bend	:	4 hours at b $\pm$ 1° C
16.1.9	Heat Resistance	:	96 hours at 290^{o} C Insulation shrinkage 3.17 mm Max
16.1.10	Wrap Back	:	As Applicable
16.1.11	Resistance to soldering Heat	:	Insulation shrinkage 3.17 mm Max

16.1.12 Outline Drawings and Dimensions



Extruded or Spiral Wrapped and Fused PTFE Insulation

Fig. 2 - Outline Drawings for Pattern WH1P - 1A

NOTE 1 : All dimensions are in millimeter. See Table 10 for dimensions

NOTE 2 : Conductor will be either solid or stranded as specified. Conductor dimensional limits, etc., have been defined in Table 9 on pages 34 to 36.

16.1.13 List of standards : As in Table 10 supplemented By the range as applicable in Table 11 for each style Reference covered.

TABLE 10 DIMENSIONS

Style Reference	Conductor		Finished Wire	
	Stranding (No of Strands / Diameter of each strands)	Diameter (Nominal)	Diameter over Insulation	
			Minimum	Maximum
SOLID CONDUCTOR STYLES				
WH1P - 1A 130	1 / 0.25	0.25	0.51	0.61
WH1P - 1A 128	1 / 0.32	0.32	0.58	0.69
WH1P - 1A 126	1 / 0.40	0.40	0.66	0.76
WH1P - 1A 124	1 / 0.51	0.51	0.76	0.86
WH1P - 1A 122	1 / 0.64	0.64	0.89	1.02
WH1P - 1A 120	1 / 0.81	0.81	1.07	1.17
STANDARD CONDUCTOR STYLES				
WH1P - 1A 740	7 / 0.08	0.25	0.51	0.61
WH1P - 1A 738	7 / 0.10	0.31	0.56	0.66
WH1P - 1A 736	7 / 0.13	0.38	0.64	0.74
WH1P - 1A 734	7 / 0.16	0.48	0.74	0.84
WH1P - 1A 1938	19 / 0.10	0.51	0.74	0.84
WH1P - 1A 732	7 / 0.20	0.61	0.86	0.97
WH1P - 1A 1936	19 / 0.13	0.64	0.86	0.97
WH1P - 1A 730	7 / 0.25	0.76	1.02	1.12
WH1P - 1A 1934	19 / 0.16	0.81	1.02	1.12
WH1P - 1A 728	7 / 0.32	0.97	1.22	1.32
WH1P - 1A 1932	19 / 0.20	1.02	1.22	1.32

16.1.14. Range : As in Table 11 Being insulated wires the Defence Stores code Letters Numbers vary in accordance with the different colours and dated under each size (style reference). Covered under Table 10.

Table 11 RANGE

(Clause 16.1.13 and 16.1.14 See clause 7.1 also)

Colour / Style Code / Reference Number	Colour if Insulation	WH1P - 1A 130	Defence Stores Catalogue Number 6145 -
0	Black		
1	Brown		
2	Red		
3	Orange		
4	Yellow		No. of styles under 16.2.13 (Table 10) - 17
5	Green		
6	Blue		
7	Violet		Total No. of DS Cat Nos. to be included : 17 x 19 - 323
8	Grey	19 Nos.	
9	White		
90	White / Black		
91	White / Brown		
92	White / Red		
93	White / Orange		
94	White / Yellow		
95	White / Green		
96	White / Blue		
97	White / Violet		
98	White / Grey		
			Total Ds Cat Nos. = 323 Under Pattern Nos. WH1P - 1A

NOTE 1 : See Appendix 'A' for colour coding.

16.2 Pattern WH2P - 1A : Wire Electrical, High Temperature, 600 V, PTFE Insulated.

16.2.1 Temperature severity : T 65 / 200 *

* Based on the maximum permissible continuous operating temperature of the conductor and Bend Test (see clause 13.15) conditioning Temperature.

16.2.2 Voltage rating : 600 V rms.

16.2.3 Spark Test : 3.4 KV rms.

16.2.4	Conductor material	:	Type 1A, silver plated soft annealed copper (see table 2 (6.1e) and table 9 on page 34 to 36).
	Conductor Resistance	:	See Table 9
	Conductor Tensile Strength	:	See Table 9
	Conductor Elongation	:	See Table 9
16.2.5	Dielectric Withstanding Voltage	:	2.0 kV rms.
16.2.6	Insulation Resistance	:	X [2/] Megohms / km (Min)

2/ Values of X Shall be calculated as follows :

$X = k \log (D / d)$ at 20^{o} C where

$K = 15290^{10}$

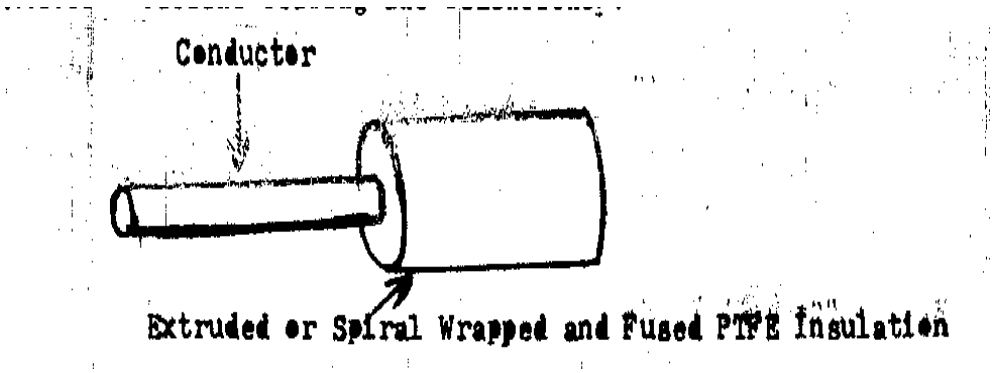
D = Maximum average diameter of finished wire.

d = Conductor diameter

16.2.7	Insulation material	:	Extruded or Spiral wrapped and fused Poly Tetra Fluoro Ethylene (PTFE)
	Concentricity of Insulation	:	70 percent (Min)
	Insulation Dielectric constant	:	2.2 (max)
	Insulation Power Factor	:	0.005 (max) or 0.5 percent
	Insulation Tensile Strength	:	21 x 10 N / m (Min)
	Insulation Elongation	:	150 percent (Min)
	Surface Resistance	:	0.2 Mega ohm mm (Min)
	Insulation colour	:	As in Table 13

16.2.8	Cold Bend	:	4 hours at - 65° C ± 1° C
16.2.9	Heat Resistance	:	96 hours at 290° C Insulation Shrinkage 3.17 mm Max.
16.2.10	Wrap Back	:	Applicable
16.2.11	Resistance to Soldering Heat	:	Insulation shrinkage 3.17 mm Max

16.2.12 Outline Drawing and Dimensions :-



Extruded or Spiral Wrapped and Fused PTFE Insulation

Fig. 3 - Outline Drawings for Pattern WH1P - 1A

NOTE 1 : All dimensions are in millimeter. See Table 12 for dimensions

NOTE 2 : Conductor will be either solid or stranded as specified. Conductor dimensional limits, etc., have been defined in Table 9 on pages 34 to 36.

16.2.13	List of standards	:	As in Table 12 supplemented by the range as applicable in Table 13 for each style reference covered.

Style Reference	Conductor		Finished Wire	
	Stranding (No of Strands / Diameter of each strands)	Diameter (Nominal)	Diameter over Insulation	
			Minimum	Maximum
1	2	3	4	5
SOLID CONDUCTOR STYLES				
WH2P - 1A 132	1 / 0.20	0.20	0.64	0.86
WH2P - 1A 130	1 / 0.25	0.25	0.67	0.86
WH2P - 1A 128	1 / 0.32	0.32	0.74	0.94
WH2P - 1A 126	1 / 0.40	0.40	0.81	1.02
WH2P - 1A 124	1 / 0.51	0.51	0.91	1.12
WH2P - 1A 122	1 / 0.64	0.645	1.04	1.27
WH2P - 1A 120	1 / 0.81	0.81	1.22	1.42
WH2P - 1A 118	1 / 1.02	1.02	1.42	1.68
WH2P - 1A 116	1 / 1.29	1.29	1.70	2.06
STRANDED CONDUCTOR STYLES				
WH2P - 1A 740	7 / 0.08	0.25	0.66	0.86
WH2P - 1A 738	7 / 0.10	0.31	0.71	0.91
WH2P - 1A 736	7 / 0.13	0.38	0.79	0.99
WH2P - 1A 734	7 / 0.16	0.48	0.89	1.09
WH2P - 1A 1938	19 / 0.10	0.51	0.89	1.09
WH2P - 1A 732	7 / 0.20	0.61	1.02	1.22
WH2P - 1A 1936	19 / 0.13	0.64	1.02	1.22
WH2P - 1A 730	7 / 0.25	0.76	1.17	1.37
WH2P - 1A 1934	19 / 0.16	0.81	1.17	1.37
WH2P - 1A 728	7 / 0.32	0.97	1.37	1.58
WH2P - 1A 1932	19 / 0.20	1.02	1.37	1.58
WH2P - 1A 726	7 / 0.4	1.22	1.63	1.88
WH2P - 1A 1930	19 / 0.25	1.27	1.63	1.88
WH2P - 1A 1929	19 / 0.29	1.45	1.85	2.21
WH2P - 1A 1927	19 / 0.36	1.83	2.24	2.59
WH2P - 1A 1925	19 / 0.45	2.31	2.72	3.07
WH2P - 1A 3728	37 / 0.32	2.26	2.67	3.02
WH2P - 1A 3726	37 / 0.40	2.82	3.23	3.58

16.2.14 Range : As in Table 13 Being insulated wires the Defence Stores code Letters Numbers vary in accordance with the different colours and dated under each size (style reference) covered under Table 12.

Table 13 RANGE
(Clause 16.2.13 and 16.2.14 See clause 7.1 also)

Colour / style Code / Reference Number	Colour if Insulation	WH1P - 1A 132	Defence Stores Catalogue Number 6145
0	Black		
1	Brown		
2	Red		
3	Orange		
4	Yellow		No. of styles under 16.3.13 (Table 12) - 27
5	Green		
6	Blue		
7	Violet		Total No. of DS Cat Nos. to be included : 27 x 19 - 513
8	Grey	19 Nos.	
9	White		
90	White / Black		
91	White / Brown		
92	White / Red		
93	White / Orange		
94	White / Yellow		
95	White / Green		
96	White / Blue		
97	White / Violet		
98	White / Grey		
			Total Ds Cat Nos. = 513 Under Pattern Nos. WH2P - 1A

NOTE 1 : See Appendix ‘A’ for colour coding.

NOTE 2 : DS Cat Nos. will be included later.

16.3 Pattern WH3P - 1A : Wire Electrical, High Temperature, 1000 V, PTFE Insulated.

16.3.1	Temperature severity	:	T 65 / 200 *

* Based on the maximum permissible continuous operating temperature of the conductor and Bend Test (see clause 13.15) conditioning Temperature.

16.3.2	Voltage rating	:	1000 V rms.
16.3.3	Spark Test	:	5.0 KV rms.
16.3.4	Conductor material	:	Type 1A, silver plated soft annealed copper (see table 2 6.1e) and table 5.
	Conductor Resistance	:	See Table 9
	Conductor Tensile Strength	:	See Table 9
	Conductor Elongation	:	See Table 9
16.3.5	Dielectric Withstanding Voltage	:	3.0 KV rms.
16.3.6	Insulation Resistance	:	X 2 / Megaohms / km (Min)

2 / Values of X Shall be calculated as follows

$X = k \log (D / d)$ at 20^{o} C where

10

D = Maximum average diameter of finished wire.

d = conductor diameter

16.3.7	Insulation material	:	Extruded or Spiral wrapped and fused Poly Tetra Fluoro Ethylene (PTFE).
	Concentricity of Insulation	:	70 percent (Min)
	Insulation Dielectric constant	:	2.2 (Max)
	Insulation Power Factor	:	0.005 (Max) or 0.5 percent
	Insulation Tensile Strength	:	21×10^{6} N / m^{2} (Min)

	Insulation Elongation	:	150 percent (Min)
	Surface Resistance	:	0.2 Mega ohm mm (Min)
	Insulation colour	:	As in Table 15
16.3.8	Cold Bend	:	4 hours at – 65° C ± 1° C
16.3.9	Heat Resistance	:	96 hours at 200°C Insulation Shrinkage 3.17 mm Max.
16.3.10	Wrap Back	:	Applicable
16.3.11	Resistance to Soldering Heat	:	Insulation shrinkage 3.17 mm Max

16.3.12 Outline Drawing and Dimensions :-

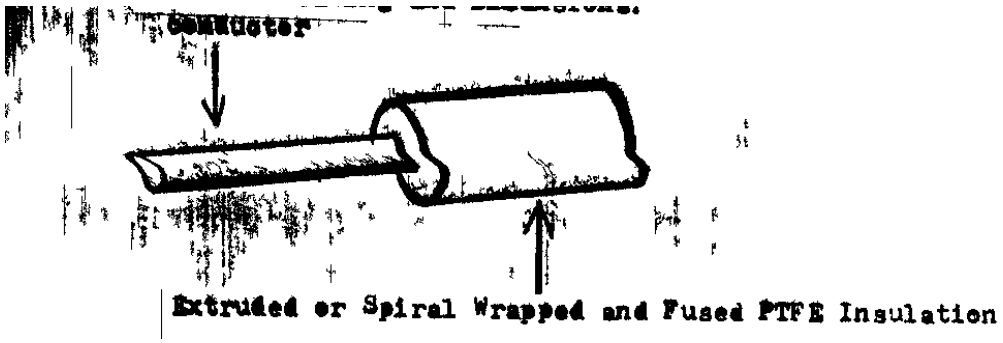


Fig. 4 – Outline Drawings for Pattern WH3P – 1A

NOTE 1 : All dimensions are in millimeter. See Table 14 for dimensions

NOTE 2 : Conductor will be either solid or stranded as specified. Conductor dimensional limits, etc., have been defined in Table 9 on pages 34 to 36.

16.3.13	List of standards	:	As in Table 14 supplemented by the range as applicable in Table 15 for each style reference covered.

TABLE 14 DIMENSIONS

Style Reference	Conductor		Finished Wire	
	Stranding (No of Strands / Diameter of each strands)	Diameter (Nominal)	Diameter over Insulation	
			Minimum	Maximum
1	2	3	4	5
SOLID CONDUCTOR STYLES				
WH3P - 1A 132	1 / 0.20	0.20	0.86	1.07
WH3P - 1A 130	1 / 0.25	0.25	0.91	1.12
WH3P - 1A 128	1 / 0.32	0.32	0.99	1.19
WH3P - 1A 126	1 / 0.40	0.40	1.07	1.27
WH3P - 1A 124	1 / 0.51	0.51	1.17	1.37
WH3P - 1A 122	1 / 0.64	0.645	1.30	1.52
WH3P - 1A 120	1 / 0.81	0.81	1.47	1.68
WH3P - 1A 118	1 / 1.02	1.02	1.68	1.93
WH3P - 1A 116	1 / 1.29	1.29	1.96	2.26
STRANDED CONDUCTOR STYLES				
WH3P - 1A 740	7 / 0.08	0.25	0.91	1.12
WH3P - 1A 738	7 / 0.10	0.31	0.97	1.17
WH3P - 1A 736	7 / 0.13	0.38	1.04	1.25
WH3P - 1A 734	7 / 0.16	0.48	1.14	1.35
WH3P - 1A 1938	19 / 0.10	0.51	1.14	1.35
WH3P - 1A 732	7 / 0.20	0.61	1.27	1.47
WH3P - 1A 1936	19 / 0.13	0.64	1.27	1.47
WH3P - 1A 730	7 / 0.25	0.76	1.42	1.63
WH3P - 1A 1934	19 / 0.16	0.81	1.42	1.63
WH3P - 1A 728	7 / 0.32	0.97	1.63	1.83
WH3P - 1A 1932	19 / 0.20	1.02	1.63	1.83
WH3P - 1A 726	7 / 0.4	1.22	1.88	2.13
WH3P - 1A 1930	19 / 0.25	1.27	1.88	2.13
WH3P - 1A 1929	19 / 0.29	1.45	2.11	2.41
WH3P - 1A 2630	19 / 0.25	1.52	2.18	2.49
WH3P - 1A 1927	19 / 0.36	1.83	2.49	2.90

WH3P - 1A 1925	19 / 0.45	2.31	2.97	3.38
WH3P - 1A 3728	37 / 0.32	2.26	2.92	2.33
WH3P - 1A 6530	65 / 0.25	2.36	3.02	3.43
WH3P - 1A 3726	37 / 0.40	2.82	3.48	3.89
WH3P - 1A 13329	133 / 0.29	4.29	5.06	5.56
WH3P -1A 13327	133 / 0.36	5.41	6.43	6.93

16.3.14. Range : As in Table 15 Being insulated wires the Defence Stores code Letters Numbers vary in accordance with the different colours and dated under each size (style reference) covered under Table 14.

Table 15 RANGE

(Clause 16.3.13 and 16.3.14 See clause 7.1 also)

Colour / Style Code / Reference Number /	Colour if Insulation	WH1P - 1A 132	Defence Stores Catalogue Number 6145 -
0	Black		
1	Brown		
2	Red		
3	Orange		
4	Yellow		No. of styles under 16.3.13 (Table 14) - 31
5	Green		
6	Blue		
7	Violet		Total No. of DS Cat Nos. to be included : 31 x 19 - 589
8	Grey	19 Nos.	
9	White		
90	White / Black		
91	White / Brown		
92	White / Red		
93	White / Orange		
94	White / Yellow		
95	White / Green		
96	White / Blue		
97	White / Violet		
98	White / Grey		
			Total Ds Cat Nos. = 589 Under Pattern Nos. WH3P - 1A

NOTE 1 : See Appendix ‘A’ for colour coding.

NOTE 2 : DS Cat Nos. will be included later.

16.4 Pattern WH1F - 1A : Wire Electrical, High Temperature, 250 V, FEP Insulated.

16.4.1	Temperature severity	:	T 65 / 200 *

* Based on the maximum permissible continuous operating temperature of the conductor and Bend Test (see clause 13.15) conditioning Temperature.

16.4.2	Voltage rating	:	250 V rms.
16.4.3	Spark Test	:	2.5 KV rms.
16.4.4	Conductor material	:	Type 1A, silver plated soft annealed copper (See table 2, 6.1e) and table 5
	Conductor Resistance	:	see Table 9
	Conductor Tensile Strength	:	See Table 9
	Conductor Elongation	:	See Table 9
16.4.5	Dielectric Withstanding Voltage	:	1.5 kV rms.
16.4.6	Insulation Resistance	:	2 / X Megohms / km (Min)

2 / Values of X Shall be calculated as follows

$X = k \log (D / d)$ at 20^{o} C where

10

K = 15290

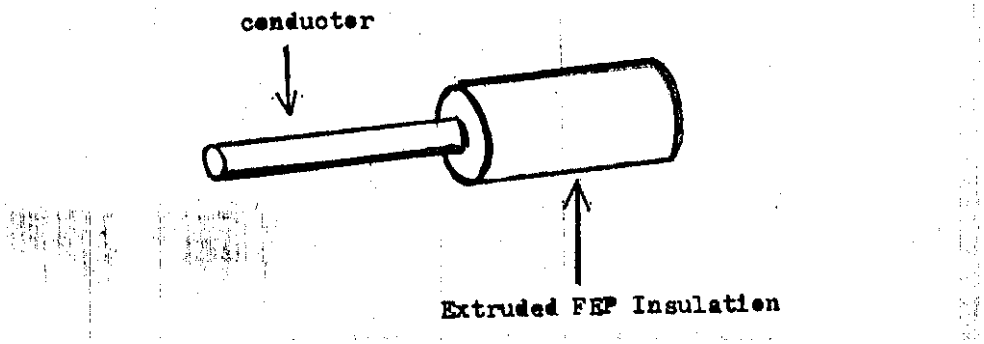
D = Maximum average diameter of finished wire.

d = Conductor diameter

16.4.7	Insulation material	:	Extruded Fluorinated Ethylene Propylene (FEP)
	Concentricity of Insulation	:	70 percent (Min)
	Insulation Dielectric Constant	:	2.2 (Max)
	Insulation Power Factor	:	0.005 (Max) or 0.5 percent
	Insulation Tensile Strength	:	14×10^{6} N / m^{2} (Min)

	Insulation Elongation	:	100 percent (Min)
	Surface Resistance	:	0.2 Mega ohm mm (Min)
	Insulation colour	:	As in Table 17
16.4.8	Cold Bend	:	4 hours at - 65° C ± 1° C
16.4.9	Heat Resistance	:	96 hours at 230° C Insulation Shrinkage 3.17 mm Max.
16.4.10	Wrap Back	:	Not Applicable
16.4.11	Resistance to Soldering Heat	:	Insulation shrinkage 3.17 mm Max

16.4.12 Outline Drawing and Dimensions :-



Extruded FEP Insulation

Fig. 5 – Outline Drawings for Pattern WH1F – 1A

NOTE 1: All dimensions are in millimeter. See Table 16 for dimensions

NOTE 2: Conductor will be either solid or stranded as specified. Conductor dimensional limits, etc., have been defined in Table 8.

16.4.13 List of standards : As in Table 16 supplemented by the range as applicable in Table 17 for each style Reference covered.

TABLE 16 DIMENSIONS

Style Reference	Conductor		Finished Wire	
	Stranding (No of Strands / Diameter of each strands)	Diameter (Nominal)	Diameter over Insulation	
			Minimum	Maximum
1	2	3	4	5
SOLID CONDUCTOR STYLES				
WH1F - 1A 132	1 / 0.20	0.20	0.46	0.56
WH1F - 1A 130	1 / 0.25	0.25	0.51	0.61
WH1F - 1A 128	1 / 0.32	0.32	0.58	0.69
WH1F - 1A 126	1 / 0.40	0.40	0.66	0.76
WH1F - 1A 124	1 / 0.51	0.51	0.76	0.86
WH1F - 1A 122	1 / 0.64	0.64	0.89	1.02
WH1F - 1A 120	1 / 0.81	0.81	1.07	1.17
STRANDED CONDUCTOR STYLES				
WH1F - 1A 740	7 / 0.08	0.25	0.51	0.61
WH1F - 1A 738	7 / 0.10	0.31	0.56	0.66
WH1F - 1A 736	7 / 0.13	0.38	0.64	0.74
WH1F - 1A 734	7 / 0.16	0.48	0.74	0.84
WH1F - 1A 1938	19 / 0.10	0.51	0.74	0.84
WH1F - 1A 732	7 / 0.20	0.61	0.86	0.965
WH1F - 1A 1936	19 / 0.13	0.64	0.86	0.965
WH1F - 1A 730	7 / 0.25	0.76	1.02	1.12
WH1F - 1A 1934	19 / 0.16	0.81	1.02	1.12
WH1F - 1A 728	7 / 0.32	0.97	1.22	1.32
WH1F - 1A 1932	19 / 0.20	1.02	1.22	1.32

16.4.14 Range : As in Table 17. Being insulated wires the Defence Stores Catalogue Numbers vary in accordance with the different colours accommodated under each size (style reference) covered under the table 16.

TABLE 17

(Clauses 16.4.13 and 16.4.14, See clause 7.1 also)

Colour / Style Code / Reference Number /	Colour if Insulation	WH1F - 1A 132	Defence Stores Catalogue Number 6145 –
0	Black		
1	Brown		
2	Red		
3	Orange		
4	Yellow		No. of styles under 16.4.13 (Table 16) - 18
5	Green		
6	Blue		
7	Violet		Total No. of DS Cat Nos.19 Nos. to be included : 18 x 19 – 342
8	Grey	19 Nos.	
9	White		
90	White / Black		
91	White / Brown		
92	White / Red		
93	White / Orange		
94	White / Yellow		
95	White / Green		
96	White / Blue		
97	White / Violet		
98	White / Grey		
			Total Ds Cat Nos. = 342 Under Pattern Nos. WH1F - 1A

NOTE 1 : See Appendix ‘A’ for colour coding.

16.5 Pattern WH2F-1A : Wire Electrical, High Temperature, 600 V, FEP Insulated.

16.5.1	Temperature severity	:	T 65 / 200 *

* Based on the maximum permissible continuous operating temperature of the conductor and Bend Test (see clause 13.15) conditioning Temperature.

16.5.2	Voltage rating	:	600 V rms.
16.5.3	Spark Test	:	3.4 KV rms.
16.5.4	Conductor material	:	Type 1A, silver plated soft annealed copper (see table 2 6.1.e) and table 9.
	Conductor Resistance	:	See Table 9
	Conductor Tensile Strength	:	See Table 9
	Conductor Elongation	:	See Table 9
16.5.5	Dielectric Withstanding Voltage	:	2.0 kV rms.
16.5.6	Insulation Resistance	:	2 / X Megohms / km (Min)

2 / Values of X Shall be calculated as follows

$X = k \log (D / d)$ at 20^{o} C where

10

K = 15290

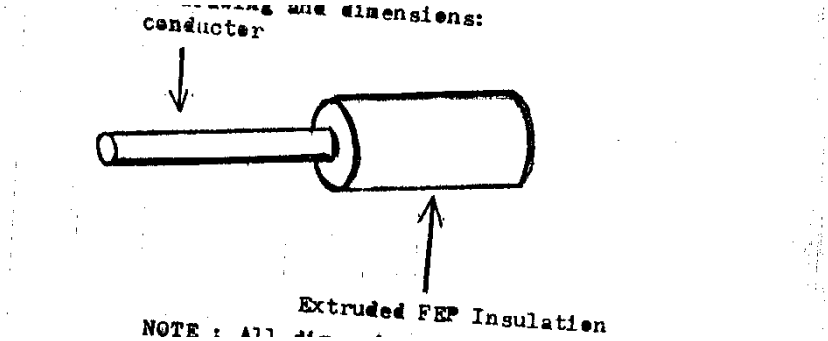
D = Maximum average diameter of finished wire.

d = conductor diameter

16.5.7	Insulation material	:	Extruded Fluorinated Ethylene Propylene (FEP)
	Concentricity of Insulation	:	70 percent (Min)
	Insulation Dielectric constant	:	2.2 (Max)
	Insulation Power Factor	:	0.005 (Max) or 0.5 percent
	Insulation Tensile Strength	:	14×10^{6} N / m^{2} (Min)
	Insulation Elongation	:	100 percent (Min)

	Surface Resistance	:	0.2 Mega ohm mm (Min)
	Insulation colour	:	As in Table 19
16.5.8	Cold Bend	:	4 hours at - 65^{o} C $\pm$ 1^{o} C
16.5.9	Heat Resistance	:	96 hours at 230^{o} C Insulation Shrinkage 3.17 mm Max.
16.5.10	Wrap Back	:	Not Applicable
16.5.11	Resistance to Soldering Heat	:	Insulation shrinkage 3.17 mm Max

16.5.12 Outline Drawing and Dimensions :-



Extruded FEP Insulation

Fig. 5 – Outline Drawings for Pattern WH1F – 1A

NOTE 1 : All dimensions are in millimeter. See Table 18 for dimensions

NOTE 2 : Conductor will be either solid or stranded as specified. Conductor dimensional limits, etc., have been defined in Table 9.

16.5.13 List of standards : As in Table 18 supplemented by the range as applicable in Table 17 for each style Reference covered.

TABLE 18 DIMENSIONS

Style Reference	Conductor		Finished Wire	
	Stranding (No of Strands / Diameter of each strands)	Diameter (Nominal)	Diameter over Insulation	
			Minimum	Maximum
1	2	3	4	5
SOLID CONDUCTOR STYLES				
WH2F - 1A 132	1 / 0.20	0.20	0.61	0.81
WH2F - 1A 130	1 / 0.25	0.25	0.66	0.86
WH2F - 1A 128	1 / 0.32	0.32	0.74	0.94
WH2F - 1A 126	1 / 0.40	0.40	0.81	1.02
WH2F - 1A 124	1 / 0.51	0.51	0.91	1.12
WH2F - 1A 122	1 / 0.64	0.64	1.04	1.27
WH2F - 1A 120	1 / 0.81	0.81	1.47	1.68
WH2F - 1A 118	1 / 1.02	1.02	1.42	1.68
WH2F - 1A 116	1 / 1.29	1.29	1.70	2.06
WH2F - 1A 114	1 / 1.63	1.63	2.03	2.39
STRANDED CONDUCTOR STYLES				
WH2F - 1A 740	7 / 0.08	0.25	0.66	0.86
WH2F - 1A 738	7 / 0.10	0.31	0.71	0.91
WH2F - 1A 736	7 / 0.13	0.38	0.79	0.99
WH2F - 1A 734	7 / 0.16	0.48	0.89	1.09
WH2F - 1A 1938	19 / 0.10	0.51	0.89	1.09
WH2F - 1A 732	7 / 0.20	0.61	1.02	1.22
WH2F - 1A 1936	19 / 0.13	0.64	1.02	1.22
WH2F - 1A 730	7 / 0.25	0.76	1.17	1.37
WH2F - 1A 1934	19 / 0.16	0.81	1.17	1.37
WH2F - 1A 728	7 / 0.32	0.97	1.63	1.83
WH2F - 1A 1932	19 / 0.20	1.02	1.63	1.83
WH2F - 1A 726	7 / 0.40	1.22	1.63	1.88
WH2F - 1A1930	19 / 0.25	1.27	1.63	1.88
WH2F - 1A 1929	19 / 0.29	1.45	1.85	2.21
WH2F - 1A 1927	19 / 0.36	1.83	2.24	2.59

16.5.14 Range : As in Table 19. Being insulated wires the Defence Stores Catalogue Numbers vary in accordance with the different colours accommodated under each size (style reference) covered under the table 18.

TABLE 19

(Clauses 16.5.13 and 16.5.14, See clause 7.1 also)

Colour / Style Code / Reference Number	Colour if Insulation	WH2F - 1A 132	Defence Stores Catalogue Number 6145
0	Black		
1	Brown		
2	Red		
3	Orange		
4	Yellow		No. of styles under 16.5.13 (Table 19) -28
5	Green		
6	Blue		
7	Violet		Total No. of DS Cat Nos.19 Nos. to be included : 28 x 19 – 532
8	Grey	19 Nos.	
9	White		
90	White / Black		
91	White / Brown		
92	White / Red		
93	White / Orange		
94	White / Yellow		
95	White / Green		
96	White / Blue		
97	White / Violet		
98	White / Grey		
			Total Ds Cat Nos. = 532 Under Pattern Nos. WH2F - 1A

NOTE 1 : See Appendix ‘A’ for colour coding.

NOTE 2 : DS Cat Nos. will be included later.

16.6 Pattern WH3F-1A : Wire Electrical, High Temperature, 1000 V, FEP Insulated.

16.5.1	Temperature severity	:	T 65 / 200*

* Based on the maximum permissible continuous operating temperature of the conductor and Bend Test (see clause 13.15) conditioning Temperature.

16.6.2	Voltage rating	:	1000 V rms.
16.6.3	Spark Test	:	5.0 KV rms.
16.6.4	Conductor material	:	Type 1A, silver plated soft annealed copper (see table 2 6.1e) and table 5
	Conductor Resistance	:	See Table 9
	Conductor Tensile Strength	:	See Table 9
	Conductor Elongation	:	See Table 9
16.6.5	Dielectric Withstanding Voltage	:	3.0 kV rms.
16.6.6	Insulation Resistance	:	X Megohms / km (Min) 2 /

2 / Values of X Shall be calculated as follows

$X = k \log (D / d)$ at 20^{o} C where

10

K = 15290

D = Maximum average diameter of finished wire.

d = conductor diameter

16.6.7	Insulation material	:	Extruded Fluorinated Ethylene Propylene (FEP)
	Concentricity of Insulation	:	70 percent (Min)
	Insulation Dielectric constant	:	2.2 (Max)
	Insulation Power Factor	:	0.005 (Max) or 0.5 percent
	Insulation Tensile Strength	:	14×10^{6} N / m^{2} (Min)
	Insulation Elongation	:	100 percent (Min)

	Surface Resistance	:	0.2 Mega ohm mm (Min)
	Insulation colour	:	As in Table 21
16.6.8	Cold Bend	:	4 hours at - 65^{o} C $\pm$ 1^{o} C
16.6.9	Heat Resistance	:	96 hours at 230^{o} C Insulation Shrinkage 3.17 mm Max.
16.6.10	Wrap Back	:	Not Applicable
16.6.11	Resistance to Soldering Heat	:	Insulation shrinkage 3.17 mm Max

16.6.12 Outline Drawing and Dimensions :-

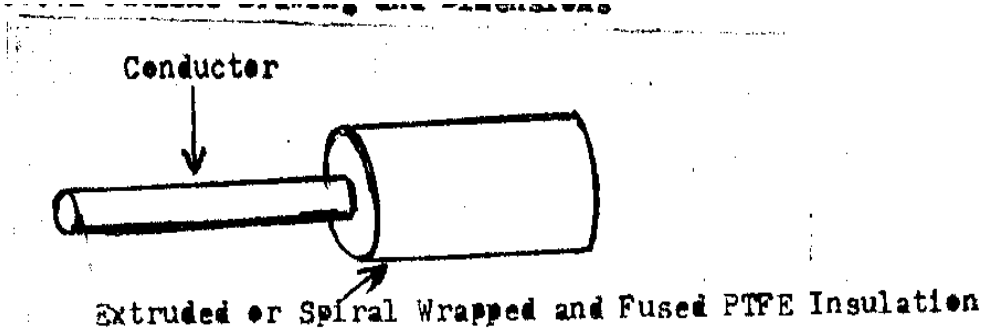


Fig. 5 – Outline Drawings for Pattern WH3F – 1A

Extruded or Spiral Wrapped and Fused PTFE Insulation

NOTE : All dimensions are in millimeter. See Table 21 for dimensions

NOTE : Conductor will be either solid or stranded as specified. Conductor dimensional limits, etc., have been defined in Table 9.

16.6.13	List of standards	:	As in Table 20 supplemented by the range as applicable in Table 21 for each style reference covered.

TABLE 20 DIMENSIONS

Style Reference	Conductor		Finished Wire	
	Stranding (No of Strands / Diameter of each strands)	Diameter (Nominal)	Diameter over Insulation	
			Minimum	Maximum
1	2	3	4	5
SOLID CONDUCTOR STYLES				
WH3F - 1A 132	1 / 0.20	0.20	0.84	1.04
WH3F - 1A 130	1 / 0.25	0.25	0.91	1.12
WH3F - 1A 128	1 / 0.32	0.32	0.99	1.19
WH3F - 1A 126	1 / 0.40	0.40	1.09	1.27
WH3F - 1A 124	1 / 0.51	0.51	1.17	1.37
WH3F - 1A 122	1 / 0.64	0.64	1.30	1.52
WH3F - 1A 120	1 / 0.81	0.81	1.47	1.68
WH3F - 1A 118	1 / 1.02	1.02	1.68	1.96
WH3F - 1A 116	1 / 1.29	1.29	1.96	2.26
WH3F - 1A 114	1 / 1.63	1.63	2.29	2.69
STRANDED CONDUCTOR STYLES				
WH3F - 1A 740	7 / 0.08	0.20	0.89	1.09
WH3F - 1A 738	7 / 0.10	0.31	0.97	1.17
WH3F - 1A 736	7 / 0.13	0.38	1.04	1.25
WH3F - 1A 734	7 / 0.16	0.48	1.14	1.35
WH3F - 1A 1938	19 / 0.10	0.51	1.14	1.35
STRANDED CONDUCTOR STYLES				
WH3F - 1A1936	19 / 0.13	0.64	1.27	1.47
WH3F - 1A 732	7 / 0.20	0.61	1.27	1.47
WH3F - 1A 730	7 / 0.25	0.76	1.42	1.63
WH3F - 1A 1934	19 / 0.16	0.81	1.42	1.63
WH3F - 1A 728	7 / 0.32	0.97	1.63	1.83
WH3F - 1A 1932	19 / 0.20	1.02	1.63	1.83
WH3F - 1A 726	7 / 0.40	1.22	1.88	2.13
WH3F - 1A 1930	19 / 0.25	1.27	1.88	2.13
WH3F - 1A 1929	19 / 0.29	1.45	2.11	2.41
WH3F - 1A 2630	26 / 0.25	1.52	2.18	2.49
WH3F - 1A 1927	19 / 0.36	1.83	2.49	2.90

WH3F - 1A 4130	41 / 0.25	1.93	2.59	3.00
WH3F - 1A 1925	19 / 0.45	2.31	2.97	3.38
WH3F - 1A 6530	65 / 0.25	2.36	3.02	3.43
WH3F - 1A 3726	37 / 0.40	2.82	3.48	3.89
WH3F - 1A10530	105 / 0.25	3.05	3.71	4.12
WH3F - 1A13329	133 / 0.29	4.29	5.06	5.56
WH3F - 1A13327	133 / 0.36	5.51	7.26	7.65

16.6.14 Range : As in Fig. 21 Being insulated wires the Defence Catalogue Numbers vary in accordance with the different colours accommodated under each size (Style Reference) served under Table 20.

TABLE 21 RANGE

(Clauses 16.6.13 and 16.6.14, See clause 7.1 also)

Colour / Style Code / Reference Number /	Colour if Insulation	WH3F-1A 132	Defence Stores Catalogue Number 6145 -
0	Black		
1	Brown		
2	Red		
3	Orange		
4	Yellow		No. of styles under 16.6.13 (Table 20) - 33
5	Green		
6	Blue		
7	Violet		Total No. of DS Cat Nos. 19 Nos. to be included 33 x 19 = 627
8	Grey	19 Nos.	
9	White		
90	White / Black		
91	White / Brown		
92	White / Red		
93	White / Orange		
94	White / Yellow		
95	White / Green		
96	White / Blue		
97	White / Violet		
98	White / Grey		
			Total DS Cat Nos. Under Pattern Nos. WH3F - 1A = 627 Nos.

NOTE 1 : See Appendix ‘A’ for colour coding.

17.0 SUGGESTIONS FOR IMPROVEMENT

17.1 Any suggestions for improvement of this document may be addressed to :-

The Director
Directorate of Standardisation
Ministry of Defence
'H' Block, Nirman Bhawan PO
New Delhi - 110011

APPENDIX 'A'

COLOUR SCHEME AND COLOUR CODING

A.0 Scope : This appendix describes the colour Scheme and Colour coding to be followed for solid coloured wires and those wires using coloured helical stripes or bands for insulation colouring.

A.1 Colour Scheme for Identification of Cores (Striping and Banding) : Colour identification shall be accomplished by use of solid colour insulation as specified in clause 16 or as an alternate method, by use of a single coloured helical stripes or circumferential band over white insulation. Coloured helical stripes or circumferential bends shall be based only on all white insulation whenever colour combination other than solid coloured wires are necessary. Not more than three stripes or bends shall be used. Stripes and bands shall be applied in the same direction.

A.1.1 Sequence : In the sequence of applying helical stripes or circumferential bands on a wire, the first stripe or band shall be distinguishably wider than the second third stripe or band within the group. Helical stripes shall run parallel to each other and shall be continues, clearly defined and constant in width and spacing throughout the length of the wire. Circumferential bands shall be parallel to each other around the circumference of the wire, shall be clearly defined shall be constant in width and spacing, and shall be continues in repeated colour groupings for the length of the wire unless otherwise specified.

A.1.2 Stripe or bandwidth : The width of the stripe or band shall be measured perpendicular to the axis (center line) of the stripe or band. The width of the wide (first) stripe or band shall be not less than two third (2 / 3) the nominal diameter of the wire. The narrow (second) stripe or band shall be not less than one half (1 / 2) nor more than three quarters (3 / 4) the width of the wide (first) stripe or band. The third stripe shall be of the same width or band as the second stripe or band.

A.1.3 Stripe or band spacing : On single stripe or band colouring the spacing between each stripe or band shall be not less than twice the width of the individual stripe or band. On multiple stripe or band colouring, the spacing between stripes or band within a grouping shall be not less than the width of the narrow stripe or band.

A.1.4 Length of Lay (spacing between groups) : The length of lay of each stripe shall not exceed 50m.

A.1.5 Spacing between groups or bands : The spacing between groups of bands shall be at regular intervals along the wire. The spacing separating a group of bands from the next grouping shall be not exceeds 75mm.

A.2 Colour Coding

A.2.1 Colour Coding shall be as specified in Table 22.

TABLE 22 COLOUR CODING

BASE COLOUR	FIRST STRIPE OR BAND	SECOND STRIPE OR BAND	COLOUR CODE NUMBER
Black			0
Brown			1
Red			2
Orange			3
Yellow			4
Green			5
Blue			6
Violet			7
Grey			8
White			9
White	Black		90
White	Brown		91
White	Red		92
White	Orange		93
White	Yellow		94
White	Green		95
White	Blue		96
White	Violet		97
White	Grey		98
White	Black	Brown	901
White	Black	Red	902
White	Black	Orange	903
White	Black	Yellow	904
White	Black	Green	905
White	Black	Blue	906

BASE COLOUR	FIRST STRIPE OR BAND	SECOND STRIPE OR BAND	THIRD STRIPE OR BAND	COLOUR CODE NUMBER
White	Black	Violet		907
White	Black	Grey		908
White	Brown	Red		912
White	Brown	Orange		913
White	Brown	Yellow		914
White	Brown	Green		915
White	Brown	Blue		916
White	Brown	Violet		917
White	Brown	Grey		918
White	Red	Orange		923
White	Red	Yellow		924
White	Red	Green		925
White	Red	Blue		926
White	Red	Violet		927
White	Red	Grey		928
White	Orange	Yellow		934
White	Orange	Green		935
White	Orange	Blue		936
White	Orange	Violet		937
White	Orange	Grey		938
White	Yellow	Green		945
White	Yellow	Blue		946
White	Yellow	Violet		947
White	Yellow	Grey		948
White	Green	Blue		956
White	Green	Violet		957
White	Green	Grey		958
White	Blue	Violet		967
White	Blue	Grey		968
White	Violet	Grey		978
White	Black	Brown	Red	9012
White	Black	Brown	Orange	9013
White	Black	Brown	Yellow	9014
White	Black	Brown	Green	9015
White	Black	Brown	Blue	9016
White	Black	Brown	Violet	9017
White	Black	Brown	Grey	9018

BASE COLOUR	FIRST STRIPE OR BAND	SECOND STRIPE OR BAND	THIRD STRIPE OR BAND	COLOUR CODE NUMBER
White	Black	Red	Orange	9023
White	Black	Red	Yellow	9024
White	Black	Red	Green	9025
White	Black	Red	Blue	9026
White	Black	Red	Violet	9027
White	Black	Red	Grey	9028
White	Black	Orange	Yellow	9034
White	Black	Orange	Green	9035
White	Black	Orange	Blue	9036
White	Black	Orange	Violet	9037
White	Black	Orange	Grey	9038
White	Black	Yellow	Green	9045
White	Black	Yellow	Blue	9046
White	Black	Yellow	Violet	9047
White	Black	Yellow	Grey	9048
White	Black	Green	Blue	9056
White	Black	Green	Violet	9057
White	Black	Green	Grey	9058
White	Black	Blue	Violet	9067
White	Black	Blue	Grey	9068
White	Black	Violet	Grey	9078
White	Brown	Red	Orange	9123
White	Brown	Red	Yellow	9124
White	Brown	Red	Green	9125
White	Brown	Red	Blue	9126
White	Brown	Red	Violet	9127
White	Brown	Red	Grey	9128
White	Brown	Orange	Yellow	9134
White	Brown	Orange	Green	9135
White	Brown	Orange	Blue	9136
White	Brown	Orange	Violet	9137
White	Brown	Orange	Grey	9138
White	Brown	Yellow	Green	9145
White	Brown	Yellow	Blue	9146
White	Brown	Yellow	Violet	9147
White	Brown	Yellow	Grey	9148

BASE COLOUR	FIRST STRIPE OR BAND	SECOND STRIPE OR BAND	THIRD STRIPE OR BAND	COLOUR CODE NUMBER
White	Brown	Green	Blue	9156
White	Brown	Green	Violet	9157
White	Brown	Green	Grey	9158
White	Brown	Blue	Yellow	9167
White	Brown	Blue	Grey	9168
White	Brown	Violet	Grey	9178
White	Red	Orange	Yellow	9234
White	Red	Orange	Green	9235
White	Red	Orange	Blue	9236
White	Red	Orange	Violet	9237
White	Red	Orange	Grey	9238
White	Red	Yellow	Green	9245
White	Red	Yellow	Blue	9246
White	Red	Yellow	Violet	9247
White	Red	Yellow	Grey	9248
White	Red	Green	Blue	9256
White	Red	Green	Violet	9257
White	Red	Green	Grey	9258
White	Red	Blue	Violet	9267
White	Red	Blue	Grey	9268
White	Red	Violet	Grey	9278
White	Orange	Yellow	Green	9345
White	Orange	Yellow	Blue	9346
White	Orange	Yellow	Violet	9347
White	Orange	Yellow	Grey	9348
White	Orange	Green	Blue	9356
White	Orange	Green	Violet	9357
White	Orange	Green	Grey	9358
White	Orange	Blue	Violet	9367
White	Orange	Blue	Grey	9368
White	Orange	Violet	Grey	9378
White	Yellow	Green	Blue	9456
White	Yellow	Green	Violet	9457
White	Yellow	Green	Grey	9458
White	Yellow	Blue	Violet	9467
White	Yellow	Blue	Grey	9468
White	Yellow	Violet	Grey	9478
White	Green	Blue	Violet	9567
White	Green	Blue	Grey	9568
White	Green	Violet	Grey	9578
White	Blue	Violet	Grey	9678

APPENDIX 'B'

CONTINUITY OF COATING OF SILVER

B.0 Scope : This Appendix describes the method of test for the determination of continuity of silver coating on copper.

B.1 Testing

B.1.1 Test Specimen : Test specimens shall each have length of 150mm. they shall be tagged or marked to correspond with the coil, spool or reel from which they were cut.

B.1.1.1 Treatment of Specimens : The specimens shall be thoroughly cleaned by immersion in a suitable organic solvent such as benzine, other or trichloroethylene for atleast 3 minutes, then removed and wiped dry with clean, soft cloth (Caution : Note 1). The specimens thus cleaned shall be kept wrapped in a clean, dry cloth until tested. The part of the specimen to be immersed in the test solution shall not be handled. Care shall be taken to avoid abrasion by the cut end.

B.1.2 Special Solutions

B.1.2.1 Sodium Polysulphide Solution : A concentrated solution shall be made by dissolving sodium sulphide crystals in distilled water until the solution is saturated at about 21^{o}C and adding sufficient flowers of sulphur (in excess of 250 g per liter of solution) to provide complete saturation as shown by the presence in solution of an excess of sulphur after the solution has been allowed to stand for atleast 24 hours. The test solution shall be made by diluting as portion of the concentrated solution with distilled water to a specific gravity of 1.142 at 15.6^{o} C. the sodium polysulphide test solution should have sufficient strength to blacken thoroughly a piece of clean uncoated copper wire in 5 sec. a portion of the test solution used for testing samples shall not be considered to be exhausted until it fails to blacken a piece of clean copper as described above. (see Note 2).

B.1.2.2 Hydrochoric Acid Solution : (sp gr 1.088) – Commercial HCL (sp gr 1.12) shall be diluted with distilled water to a specific gravity of 1.088 measured at 15.6^{o} C. a portion of the HCL solution having a volume of 180 ml shall be considered exhausted if it falls to remove within 15 sec., the discolouration of the silver due to the polysulphide immersion.

B.1.3 Procedure

B.1.3.1 Immersion in Polysulphide Solution : A length of atleast 110 mm from each of the clean specimens shall be immersed for 30 sec., in the sodium polysulphide solution. Describes in para B.1.2.1, maintained at a temperature between 15.6^{o} C and 21^{o} C.

B.1.3.2 Washing : After the immersion, the specimens shall be immediately be thoroughly washed in clean water and wiped dry with a clean, soft cloth.

B1.3.3 Immersion in Hydrochloric Acid : After washing, the specimen immediately be immersed for 15 sec in the HCL solution described in paragraph B.1.2.2 thoroughly washed in clean water, and wiped dry with a clean, soft cloth.

B.1.3.4 Examination of Specimens : After immersion and washing, the specimen shall be examined to ascertain if copper exposed through penings in the silver coating has been blackened by action of the sodium polysulphide. The specimen is examined with the normal eye against a white background. The specimens shall be considered to have failed if, by such blackening, exposed copper is revealed. No attention shall be paid to blackening within 13 mm, of the cut end.

APPENDIX 'C'

THICKNESS OF COATING OF SILVER

C.0 Scope : This appendix describes the method of test for the determination of thickness of silver coating over copper wires.

C.1 Testing

C.1.1 Reagents

C.1.1.1 Nitric acid (1: 4)

C.1.1.2 Nitric acid wash solution (1: 99)

C.1.1.3 Sodium chloride solution (100g of NaCl per litre)

C1.1.4 Alcohol wash solution : Mix equal volumes of special denatured alcohol and water.

C.1.2 Procedure

C.1.2.1 Weight to the nearest 0.1 mg, a portion of the sample of silver coated wire of a length equivalent to 40 mg of silver. Transfer the sample to a 600ml chemically resistant glass beaker and add 20 ml of HNO3 (1 : 4) to sample. Cover the beaker, warm gently until solution is complete, and boil to expel brown fumes. Dilute the solution with distilled water using approximately 50 ml of water per gram of sample. Heat to boiling, remove from the hot plate, and add slowly with rapid stirring, 10 ml of NaCl solution. Boil the solution to 2 to 3 minutes to catalogue, the AgCl precipitate. Allow to cool and the precipitate to settle.

C.1.2.2 Filter using a tared No. 10 porosity filtering crucible. Wash free of copper salts with HNO3 wash solution followed by two to four washings with alcohol wash solution. Dry in an oven at 205^{o}C to constant weight. Cool and weight as AgCl.

C.1.3 Calculation

The Weight of silver used = A x 0.7526
Where A is the weight of Agcl in g

Volume of silver used = $\frac{\text{Weight of silver}}{\text{Density of silver (10.5 g / cc)}}$

Thickness of silver = $\frac{\text{Volume of silver}}{D \times 1}$
Where D is the diameter and 1 length the wire over which silver is Coated.

NOTE 1 Caution : Consideration should be given to toxicity and flammability when selecting solvent cleaners.

NOTE 2 It is important that the polysulphate solution be of proper composition and strength at the time of test. A solution which is not saturated with sulphur or which has been made from decomposed sodium sulphide crystals may give a false indication of failure. Therefore, the requirement that the solution be tested by observing its blackening effect on a bright copper wire is significant. Significant also is the requirement that the solution be saturated with sulphur by allowing the solution to stand atleast 24 hours after preparation. Attention is called also to the necessity for the use of sodium sulphide which has not deteriorated through exposure to air, and if exposure has occurred the crystals should be tested for purity.

NOTE 3 Whether the silver is applied by electroplating or by mechanical classing, cladding, coatings less than 1 µm in thickness will not pass the 'Continuity of Coating' test.

APPENDIX 'D'

TENSILE STRENGTH AND ELONGATION OF STRANDED CONDUCTORS

D.0 This appendix describes the test procedure for determining the tensile strength and elongation of conductor strands used for the stranded conductors of finished wire.

D.1 Test Specimens : Five specimens shall be taken for testing. Each specimen shall be atleast 50 cm in length.

NOTE : In case of difficulties in removing longer length of conductor strands from the finished wire, use of representative samples of conductor strands prior to twisting is permitted.

D.2 Test apparatus : The test apparatus shall consist of a test machine and a steel scale graduated to 1 mm or finer.

D.2.1 Test machine : The test machine shall be designed to meet the following requirements.

The grip of the machine shall be power actuated and of spool type which can produce as nearly as possible uniformly distributed pure axial tension in the specimen. The applied tension shall be indicated by a dial, scale or automatic recorder to within ± 1 %, when properly calibrated. The indicator shall remain at the position of maximum force after rapture of the specimen. A spring balanced type of machine is satisfactory if equipped to prevent recoil of the spring. The rate of travel of grips shall be 25± 5 cm per minute under no load and shall be uniform. The machine shall accommodate spacemen of 25 cm bench length. The machine shall be of such capacity that the maximum load required to break the specimen is not greater than 85 percent nor less than 15 percent of the rated capacity.

D.3 Test procedure : Two parallel bench marks 25 cm ± 1 mm apart shall be placed on the specimen without damaging the conductor. The conductor diameter shall be measured with a micrometer caliper graduated to 0.0025 mm at a place equally distributed between the bench marks, the minimum value recorded as D. after measuring the diameter, the specimen shall be placed on the machine such that the bench marks are between the spools but not in contract with the spools. The grips shall be actuated and shall move at the rate of 25 ± 5 cm per minute. After the rupture of the specimen, the breaking force shall be read from the indicator to the nearest grams and the value recorded as F / If the specimens breaks.

Outside the within 2.5 cm of either bench marks, the shall be discarded and optional specimen tested until the breaks are obtained within the breaks are obtained within the prescribed portion. The broken specimen shall be placed immediately on a smooth surface and the ruptured areas fitted together as closely as possible with the two portions placed on the straight line and the distance between the bench marks measured to the nearest 1 mm. the length shall be recorded as L.

D.4 Calculations

The tensile strength of the specimen shall be calculated as follows :

Tensile strength

$$(N / m^2) = \frac{4F}{\Pi (D)^2} \times 10^4$$

Where,

F = Breaking force in grams.
D = Minimum diameter of the specimen in mm

D.4.2 The elongation shall be calculated as follows

$$\text{Elongation percent} = \frac{(L - 25) \times 100}{25}$$

D.5 Test Results

D.5.1 The tensile strength or elongation of the conductor specimen shall be the average of the results obtained from the specimen tested.

APPENDIX 'E'

INSULATION TENSILE STRENGTH AND ELONGATION

E.0 Scope : This appendix describes the method of test for determination of tensile strength and elongation insulation of the finished wire.

E.1 Testing

E.1.1 Testing machine : A testing machine which meet the following requirements shall be used.

(a) The machine shall be power driven.

(b) The applied tension shall be indicated to within ± 1 percent by a dial or scale or automatic recorder when properly calibrated

(c) The indicator shall remain at the point of maximum force after rupture of the specimens.

(d) The rate of travel of the power actuated grip shall be 500 mm ± 25 mm per minute and shall be uniform at all times.

(e) The machine when used for given specimen, shall be such capacity that the maximum load required to break the specimen is not greater than 85 nor less than 15 percent of the rated capacity.

E.1.2 Test Specimens : As preparation of dump bell - shaped specimens is not practicable, straight specimens of insulation in the form of as tube shall be used for testing. These shall be free from nicks. If possible, the specimens shall be cut with a single stroke of the cutting pool. For cutting support use of rubber belting, leather belting, light card-board, or other material with a smooth, slighting yielding surface that will not injure the cutting edge during the cutting is permitted.

E.1.3 Test procedure : The specimen shall be placed in the grips of the machine and adjusted symmetrically in order that the tension will be distributed uniformly over the cross section. If the tension is greater on the side of the specimen than the other, the maximum strength of the specimen will not be developed. The force shall be applied to the specimen at such a rate that the power actuated grip will travel at as uniform speed of 50 mm min and 500 mm ± 25 mm max per minute. The grips shall be either wedged type or toggle clamps shall be used. Following additional details shall be applicable.

E.1.3.1 Tensile strength test : The distance between the edge of the clamp at the start of the test shall be 76 mm ± 3 mm. After rupture of the specimen the breaking force shall be noted from the dial or scale or by means of an autographic or spark recorder and the value noted.

E.1.3.2 Elongation test : The test specimens shall have two parallel bench marks symmetrically on the straight contrasting coloured ink such that the distance between the bench (gauge) marks is 25.4 ± 0.076 mm. The marks shall be not more than 0.25 mm wide. Care shall be taken not to injure the specimens. Other details being the same as the procedure for the tensile Strength Test the test specimen shall be placed on the grips of the testing machine and the force applied. The distance between the two bench marks on the test specimen shall be noted continuously to the nearest 2 mm by means of the manner as not to touch the specimen or only very lightly touch it on the front or back. Two operators may be required to conduct this test. The distance between the bench marks when the specimen ruptures together with the original distance between the bench marks shall be recorded.

NOTE : Unless otherwise specified, the elongation shall be determined on the same specimen and at the same time as the tensile strength.

E.1.4 Test results and calculations

E.1.4.1 For tensile strength test : The cross - sectional area 'C' of the test specimen shall be determined in square mm using the formula :

$$C_2 \text{ (mm)} = \frac{\pi}{4}(D^2 - d^2)$$

Where,

D = measured overall diameter of the finished wire measured as in clause 13.1.2.2 in mm.

d = nominal diameter of conductor as specified in clause 16 and measured as in clause 13.1.2.1 in mm.

The tensile strength of the specimen shall be calculated as follows :

Tensile Strength

$$(N / m^2) = f \times \frac{10^7}{C}$$

Where,

F = breaking force in kg.
C = Cross - sectional area of the unstretched specimen in mm.

E.1.4.2 For Elongation Test

The elongation of the specimen shall be calculated as follows :

Elongation percent : $\frac{D - G}{G} \times 100$

Where,

D = Distance between the bench marks at the moments of rupture of the specimen in mm.

G = Distance between the bench marks on the unstretched specimen in mm.

REPLACEMENT GUIDE

WH1P 1A 1/	MIL - W - 16878E / 20
	MIL - W - 16878E / 6B
WH2P 1A 1/	MIL - W - 16878E / 21
	MIL - W - 16878E / 4B
WH3P 1A 1/	MIL - W - 16878E / 22
	MIL - W - 16878E / 5B
WH1F - 1A	MIL - W - 16878E / 13A
WH2F - 1A	MIL - W - 16878E / 11A
WH3F - 1A	MIL - W - 16878E / 12C

(1) These JSS Patterns will also replace the equivalent earlier JSS 51004 Patterns as follows :-

	JSS 51004 FEB 1976
WH1P - 1A	WE1TD
WH2P - 1A	WE2TD
WH3P - 1A	WE3TD