



**GOVERNMENT OF INDIA
MINISTRY OF DEFENCE**

JOINT SERVICES SPECIFICATION

ON

**POLYETHYLENE LOW DENSITY, LINEAR LOW
DENSITY AND HIGH DENSITY**

**JSS 9330-03: 2007
Revision No. 2
(Supersedes JSS 9330-03: 1995)**

**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 ARMAMENT STANDARDISATION
SUB COMMITTEE**

1. This Joint Services Specification has been approved by Dr. BR Gandhe, Director, Directorate of Armaments (R&D), Chairman Armament Standardisation Sub Committee by circulation.

2. The following members were present/consulted in approving the document: -

Sl No.	Name & Designation	Organisation
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2.	Col SK Mohan	ADGWE/GS (WE-2/3), New Delhi
3.	Col NC Mehta	Dte of Arty (GS/Artillery-5), New Delhi
4.	Shri K Raja, Jt Director	Dte Gen of Naval Armt, Naval HQ, New Delhi
5	Air Cmde R Kumar, PDA	Dte of Armt & Safety Eqpt, Air HQ, New Delhi
6.	Dir EME (Armt)	DGEME, Army HQ, New Delhi
7.	Lt Cdr Srinivas	DGNAL, Naval HQ, New Delhi
8.	Shri Yogesh Kumar, SSO – II	DGAQA, DD(Armt) Gp, New Delhi
9.	Shri DV Singhal, Controller	CQA(ME), Pune
10	Col AK Mehta, Jt Controller	CQA(Amn), Pune
11.	Shri SC Madhu, JTO	CQA(SA), Ichapur, West Bengal
12.	Col VK Sinha	CQA(W), Jabalpur
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14.	Shri GC Adhikari, Sc ‘F’	ARDE/DRDO Orgn, Pune
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16.	-	Ordnance Factory Board (QC & Std), Kolkata
17.	Lt Col R K Talwar	Secretary ASSC

RECORD OF AMENDMENTS

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

CONTENTS

	Page No.
0. <u>FOREWORD</u>	1
1. <u>SCOPE</u>	2
2. <u>RELATED SPECIFICATIONS</u>	2
3. <u>MATERIAL</u>	4
4. <u>MANUFACTURE</u>	4
5. <u>TENDER SAMPLE</u>	4
6. <u>PRE-INSPECTION OF STORES / CONSIGNMENT</u>	4
7. <u>QUALITY ASSURANCE</u>	5
8. <u>WARRANTY</u>	8
9. <u>PACKAGING</u>	8
10. <u>MARKING</u>	8
11. <u>SAFETY OF OPERATIONS</u>	9
12. <u>DEFENCE STORES CATALOGUE NUMBERS</u>	9
13. <u>SUGGESTIONS FOR IMPROVEMENT</u>	9
<u>APPENDIX 'A'</u>	10
<u>APPENDIX 'B'</u>	11
<u>APPENDIX 'C'</u>	12
<u>APPENDIX 'D'</u>	13
<u>APPENDIX 'E'</u>	14

0. FOREWORD

0.1 This Joint Services Specification has been prepared by the Armament Standardisation Sub Committee on the authority of the Standardisation Committee, Ministry of Defence.

0.2 This specification has been approved by the Ministry of Defence and is mandatory for use by the Defence Services.

0.3 The JSS 9330-03:1995 (Revision No.1) was issued in Feb 1995. The JSS 9330-03: 2007 (Revision No.2) is the revision of JSS 9330-03:1995 (Revision No.1) and supersedes the same.

0.4 This specification would be used for manufacture, supply and quality assurance of Polyethylene, Low Density, Linear Low Density, and High Density.

0.5 Quality Assurance Authority for the item covered by this specification is the Controller, Controllerate of Quality Assurance (Military Explosives) , Aundh Road, Kirkee, Pune – 411 020. Enquiries regarding this specification relating to any contractual conditions should be addressed to the Quality Assurance Authority named in the tender or contract. Other enquiries should be referred to:-

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

0.6 Copies of this specification can be obtained on payment from:-

The Director,
Directorate of Standardisation,
Ministry of Defence,
Standardisation Documents Centre,
Room No.5 'J' Block,
Nirman Bhawan PO,
New Delhi – 110 011

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

JSS 9330-03: 2007
Revision No. 2
(Supersedes JSS 9330-03: 1995)

1. SCOPE

1.1 This specification is meant to govern manufacture supply and quality assurance of the following grades of polyethylene:-

- (a) Low density polyethylene type 1 for use in the manufacture of sheets, lay flat tubing, bags used for packing ammunition, ammunition components, ammunition chemical and Explosives and wax special No. 8.
- (b) Low density polyethylene type 2 for use in the manufacture of carriers, containers and other moulded components.
- (c) Linear low density polyethylene for use in the manufacture of carriers, containers and other moulded components.
- (d) High density polyethylene type 1 for use in packing of ammunition components and in the manufacture of washers, sleeves etc used in ammunition.
- (e) High density polyethylene type 2 for use in the manufacture of carrier, containers and barmines.

2. RELATED SPECIFICATIONS

2.1 Reference is made in this specification to:-

i)	IS 138: 1992	Ready mixed paint, marking for packages and petrol containers (third revision)(Amendments 1) Reaffirmed 2004
ii)	IS 1060 (Part 1): 1966	Methods of sampling and test for paper and allied products: Part 1 (revised) (Amendments 4) Reaffirmed 1992
iii)	IS 1060 (Part 2): 1960	Methods of sampling and test for paper and allied products: Part 2 Reaffirmed 1997
iv)	IS 13360(Part 5 Sec 1): 1996	Plastics - Methods of Testing Part 5: Mechanical Properties Sec 1 Determination of Tensile Properties- General Principles Reaffirmed 2003

JSS 9330-03: 2007
Revision No. 2
(Supersedes JSS 9330-03: 1995)

v)	IS 13360(Part 5 Sec 2): 1996	Plastics - Methods of Testing Part 5: Mechanical Properties Sec 2 Determination of Tensile Properties- Test Conditions for Moulding and Extrusion Plastics Reaffirmed 2003
vi)	IS 13360 (Part 5 Sec 4):1996	Plastics - Methods of Testing Part 5: Mechanical Properties Sec 4 Determination of Izod Impact Strength Reaffirmed 2003
vii)	IS 13360 (Part 5 Sec 5):1996	Plastics - Methods of Testing Part 5: Mechanical Properties Sec 5 Determination of Charpy Impact Strength Reaffirmed 2003
viii)	ASTM-D 256	Test Method for impact resistance of plastics and electrical insulating materials
ix)	ASTM-D 638	Test Method for tensile properties of plastics
x)	ASTM-D 648	Test Method for deflection temperature of plastics under flexural load
xi)	ASTM-D 1238	Test Method for flow rates of thermoplastics by extrusion plastometer

2.2 Copies of Indian Standards and British Standards are obtained on payment from:-

Bureau of Indian Standards,
Manak Bhavan,
9, Bahadur Shah Zafar Marg,
New Delhi – 110 002

Or

their regional / branch offices.

JSS 9330-03: 2007
Revision No. 2
(Supersedes JSS 9330-03: 1995)

2.3 Copies of ASTM Standards are obtainable on payment from:-

Americal Society for Testing and Materials,
1916 Race Street,
Philadelphia PA 19103 – 1887 USA.

Or

Their Official Distributors in India viz.

Book Supply Bureau,
D 44, South Extension-1,
New Delhi – 110 049

3. MATERIAL

3.1 Polyethylene Low density, Linear low density and High density shall essentially consist of polymer of Ethylene and shall be free from pigment and plasticizers like Polyisobutylene.

4. MANUFACTURE

4.1 Polyethylene Low density, Linear low density and High density shall be manufactured by a process which will produce the product conforming to this specification.

5. TENDER SAMPLE

5.1 The manufacturer / supplier / contractor shall submit a tender sample of 1 kg of moulding powder essentially from the same batch/lot of manufacture alongwith test specimen for the tests mentioned in clause 7.4 free of all charges and conforming to this specification, to the Quality Assurance Authority / Quality Assurance Officer as stated in the contract.

6. PRE-INSPECTION OF STORES / CONSIGNMENT

6.1 Manufacturers / Contractors must satisfy themselves that the stores are in accordance with the terms of the contract and fully conform to the required specification, by carrying out a thorough pre-inspection of each lot before actually tendering the same for inspection to the Quality Assurance Officer nominated under the terms of the contract. A declaration by the contractor that necessary pre-inspection has been carried out on the stores tendered will be submitted alongwith the challan. The declaration will also indicate the method followed in carrying out pre-inspection showing the features checked/tested and will have the test certificate attached to the challan/declaration.

6.2 If the Quality Assurance Officer finds that the pre-inspection of the consignment as required above has not been carried out, the consignment is liable for rejection.

7. QUALITY ASSURANCE

7.1 Inspection

7.1.1 Polyethylene Low density, Linear low density and High density and the packages in which it is packed shall be subject to inspection by and to the final approval of the Quality Assurance Officer / Quality Assurance Authority.

7.1.2 Samples of the material and of the packages may be taken from any portion of the batch/lot/consignment.

7.2 Sampling

7.2.1 The representative sample of 500 g shall be taken from each package selected for sampling from the batch/lot. The number of packages to be selected to draw the samples from the lot are as under:-

<u>Lot Size</u>	<u>No. of containers to be selected</u>
Upto 3	Each container
4 to 15	3
16 to 50	4
51 to 100	5
101 to 300	7
301 to 500	10
501 & above	15

7.3 Criteria for Conformity

7.3.1 If on examination, any sample is found not conforming to this specification, the whole batch/lot/consignment may be rejected.

7.4 Test Requirements

7.4.1 Samples taken from any portion of the batch/lot/consignment of material shall conform to clause 3 and in addition shall conform to the test requirements shown in the following tables:-

JSS 9330-03: 2007
Revision No. 2
(Supersedes JSS 9330-03: 1995)

(a) Chemical Requirements

Sl. No.	Characteristic	Passing Standard			Test Method
		(Low density)	(Linear low density)	(High density)	
(a)	Ash, per cent by mass	Max 0.05	0.5	0.05	IS 1060 (Part 1) Method 11
(b)	ph of water extract	Min 5 Max 8	5 8	5 8	IS 1060 (Part 1) Method 10
(c)	Water soluble matter, per cent by mass	Max 0.2	0.2	0.2	Appendix 'A'
(d)	Water soluble chlorides calculated as Sodium Chloride, per cent by mass	Max 0.05	0.05	0.05	IS 1060 (Part 2) Method 17
(e)	Water soluble sulphates, calculated as anhydrous Sodium sulphate, per Cent by mass	Max 0.1	0.1	0.1	IS 1060 (Part 2) Method 18
(f)	Solubility in Toluene at 80°C ± 1 degC	Soluble	Partially soluble	Insoluble	Appendix 'B'
(g)	Extractable matter in Toluene at 25° C ± 1 deg C, per cent by mass	Max 6.0	6.0	---	Appendix 'C'
(h)	Solubility in Ethyl acetate, Acetone at 25 °C ± 1 deg C	Insoluble	Insoluble	Insoluble	Appendix 'D'
(j)	Effect of organic solvents	Resistant below 60°C	Resistant below 60°C	Resistant below 80°C	Appendix 'E'

(b) Physical Requirements

Sl. No.	Characteristic	Passing Standard					Test Method
		(Low density)		(Linear low density)	(High density)		
		Type			Type		
		1	2		1	2	
(a)	Melt flow index	--	2±20%	2±20%	--	8±20%	ASTM-D 1238
(b)	Density g/ml Min Max	0.910 0.925	0.918 0.922	0.916 0.920	0.941 0.965	0.955 0.959	BS 2782 Pt 6 Method No. 620 A: 1991
(c)	Yield stress, MPa Min	7	12	20	21	23	BS 2782 Pt 3 Method 320 A : 1976 (1986)
(d)	Elongation% at yield Min	90	560	500	15	10	-- do --
(e)	Impact strength (Notched) in Mj/mm Min	--	--	--	--	2.7	ASTM-D 256 Method A
*(f)	Melting temperature, °C Min Max	98 115	98 115	122 124	128 133	128 133	--
*(g)	Tensile modulus in MPa Min	98	98	350	530	530	ASTM-D-638
*(h)	Heat deflection temperature at 4.6 kg/cm ² load, °C Min	60	60	68	83	83	ASTM-D-648

Note:- i) The tests mentioned at Sl. No. (f), (g) & (h) are for information only. The limits for the same will be finalized after generation of date.

ii) The width of specimen for yield stress and elongation should be 6 mm and rate of traverse of the machine while testing should be 50 mm/minute.

8. WARRANTY

8.1 The stores supplied against the contract shall be deemed to be warranted against the defective material and performance by the contractor for a period of 12 months from the date of receipt of the stores at the consignee's end and shall retain the properties described above. If during this period any of the stores supplied is found defective, the same shall be replaced by the manufacturer / supplier / contractor free of charges at the consignee's premises.

9. PACKAGING

9.1 The packaging shall be in accordance with the terms of the contract or as agreed to between the purchaser and contractor.

10. MARKING

10.1 All packages containing the material shall be indelibly and legibly marked with the following details:-

- i) Nomenclature and specification number
- ii) Name and address of the consignee
- iii) A/T. or S.O. number and date
- iv) Consignment Number
- v) Lot/Batch number and date of manufacture.
- vi) Gross and net mass
- vii) Consecutive number of package and total number of packages in the consignment.
- viii) Date of Supply.
- ix) Contractor's initials or recognized trademark.

10.2 In addition to the above the Quality Assurance Officer / Quality Assurance Authority may suggest some more marking / identification considered suitable at the time of inspection.

10.3 The paint used for marking should conform to IS 138.

11. SAFETY OF OPERATIONS

11.1 Nothing in this specification shall relieve the manufacture / supplier / contractor of his responsibility for the safety of operations in the manufacture, storage, transit use of this store.

12. DEFENCE STORES CATALOGUE NUMBERS

12.1 Defence Stores Catalogue Numbers allotted to the stores are as under:-

Nomenclature	DS Cat No.
Polyethylene Low Density Type 1	9330-000 115
Polyethylene Low Density Type 2	9330-000 131
Polyethylene Linear Low Density	9330-000 130
Polyethylene High Density Type 1	9330-000 117
Polyethylene High Density Type 2	9330-000 119

Applicability of the Amendment: (a) Applicable to existing service stores and stores under manufacture.

(b) Specification can be amended locally.

13. SUGGESTIONS FOR IMPROVEMENT

13.1 Any suggestion for improvement in this document may be forwarded to:-

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

APPENDIX 'A'

A. PREPARATION OF AQUEOUS EXTRACT AND ESTIMATION OF WATER SOLUBLE MATTER, CHLORIDES AND SULPHATES

A.1 Cover 10 g of sample, cut to small pieces passing through 200 micrometer IS sieve, with 100 ml of boiling distilled water. Allow to stand in a stoppered conical flask for a hour with occasional shaking. Filter through No. 1 Whatman filter paper. Evaporate 25 ml of the above solution in a previously cleaned, dried and weighed glass evaporating dish (M1). On sand bath, keep the dish at 100 °C for 30 minutes. Cool in a desiccators and weigh (M2).

$$\text{Water soluble matter \%} = \frac{(M2-M1) \times 100 \times 100}{\text{Mass of the sample taken} \times 25}$$

A.2 Using the remaining extract, estimate chlorides and sulphates as per method 17 and method 18 of IS 1060 (Part 2) respectively.

APPENDIX 'B'

B. SOLUBILITY IN TOLUENE AT 80 °C ± 1 deg C

B.1 Samples shall be tested at 80 °C ± 1degC with Toluene. Three samples of the material 1.5 g each shall be accurately weighed. These are transferred to three Erlenmeyer flasks of 125 ml capacity. To each sample shall then be closed with ground glass stoppers or with rubber stoppers wrapped with Aluminium foil to eliminate any effect of Toluene on the rubber. The mixture shall be stored for 16 hours at 80 °C ± 1degC. The solubility of polyethylene in Toluene at 80 °C ± 1degC shall be observed at this temperature. The polyethylene shall be classed as soluble in Toluene at 80 °C if a clear, homogenous solution with no undissolved residue is obtained.

APPENDIX 'C'

C. EXTRACTABLE MATTER IN TOLUENE AT 25 °C ± 1deg C

C.1 Polyethylene – Toluene mixture from Appendix 'B' shall be allowed to cool to 25 °C ± 1 degC. It is advisable not to accelerate the cooling operation. The solution shall be filtered through a sintered glass crucible (G-3) which has been previously treated in order to remove any Toluene soluble material and to bring it to constant mass by heating at 50 °C ± 1 degC (M2). The solution shall then be transferred to the tared crucible and suction applied to hasten the filtration followed by rinsing of flask with Toluene three times using 15 ml of Toluene each time. After the transfer and rinsing are complete, the final traces of Toluene are completely removed by applying suction.

C.2 The crucible shall then be heated in an oven at 50 °C ± 1degC to constant mass (M3). During the period when crucible and/or residue is not being heated or weighed, it shall be kept in a desiccators with anhydrous Calcium chloride as desiccant.

C.3 The per cent extractable matter in Toluene shall be calculated by the following formula:-

$$\text{Per cent insoluble matter} = \frac{(M3-M2)}{M1} \times 100$$

Where, M1 = The mass of the sample taken for test for Solubility at 80 °C ± 1degC in Toluene at Appendix 'B'.

C.4 If the value is less than 6.0%, the material shall be considered insoluble at 25°C in Toluene and also to have complied with the requirement for extractable matter.

APPENDIX 'D'

D. SOLUBILITY AT 25 °C ± 1deg C IN ETHYL ACETATE, ACETONE

D.1 1.5 g of sample is stored with Acetone and Ethyl acetate separately at 25°C ± 1degC for 20 hours with approximately 60 ml of reagent. The solubility shall then be observed by evaporating the solvent or visually.

E. EFFECTS OF ORGANIC SOLVENTS

E.1 Immerse a piece of the sample (weighed quantity if in powder form) in an organic solvent (normally Toluene or Ethyl acetate or Amylacetate and in special cases if required Methanol, carbon tetra chloride or dioxine) and maintain at the required temperature (60 °C for grades A & B, low, density and linear low density polyethylene and 80 °C for grade C, High density polyethylene) for 1 hour. Take out the sample and examine it visually. The sample shall not become soft or deformed or no appreciable portion of it shall dissolve in the solvent.