DC No. 6009-ME

03.02.2017

IND/ME/973(a):2016

ACRYLIC RAYON CLOTH

MASTER COPY

(FOR 155 mm PROPELLANT CHARGE BAGS)

(DS Cat No. Gde 'A' - 8305-000 725
Gde 'B' - 8305-000 724)

सत्यमेव जयते

CONTROLLERATE OF QUALITY ASSURANCE (MILITARY EXPLOSIVES)

AUNDH ROAD, PUNE - 411 020

DEPARTMENT OF DEFENCE PRODUCTION

MINISTRY OF DEFENCE

MASTER COPY

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(FOR 155 mm PROPELLANT CHARGE BAGS)

AMENDMENT RECORD

Amendment		Authority letter	Clauses Affected	Remarks
D.C. No.	DATE			

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CONTENTS

THIS SPECIFICATION OR ANY OTHER PATTERN, DRAWINGS OR ANY OTHER INFORMATION ISSUED IN CONNECTION THEREWITH MAY ONLY BE USED FOR A SPECIFIC ORDER PLACED BY THE COMPETENT AUTHORITY. IT IS NOT TO BE USED FOR ANY OTHER PURPOSE WHATSOEVER WITHOUT THE EXPRESS WRITTEN SANCTION OF THE DIRECTOR GENERAL OF QUALITY ASSURANCE, MINISTRY OF DEFENCE, NEW DELHI - 110 011.

0. FOREWORD

0.1 This specification has been prepared by the Controllerate of Quality Assurance (Military Explosives) Aundh Road, Pune - 411 020.

0.2 This specification is a revision of IND/ME/973(a)(Prov) and supersedes the same.

0.3 For additional copies or any other enquiry regarding this specification, reference should be made to the Quality Assurance Authority i. e. CQA (ME) Aundh Road, Pune - 411 020.

1. SCOPE

1.1 This specification is meant to govern manufacture, supply and Quality Assurance of Cloth Acrylic Rayon.

1.2 The material is suitable for use in the manufacture of propellant bags of 155 mm Ammunition. Gde 'A' material is used for propellant bags of propellant M_3A_1 & M_4A_2 and Gde 'B' material is used for propellant bags of charge 8 and charge 9.

2. RELATED SPECIFICATION AND DOCUMENTS

2.1 The related documents as mentioned in clause 2.2 are those applicable at the date of publication, of this specification. It is manufacturer's/contractor's responsibility to confirm their current applicability and to obtain from CQA(ME) Aundh Road, Pune - 411 020 information concerning any change that may be necessary due to cancellation, replacement or supersession of any of these documents.

2.2 The following related specifications have been referred to in preparation of this IND/ME specification.

(i)	IS 138 : 1992, AMD-1 Reaffirmed 2009	-	Ready mixed Paint, Marking for packages and petrol containers
(ii)	JSG 0114 : 2015 (Revision No. 1)	-	Methods of Tests for Textile used in Ammunition

2.3 Copies of this specification and of related specifications are obtainable on payment basis as follows : -

SPECIFICATION		SOURCE OF SUPPLY
(i) IND/ME/ Specification	:	C. Q. A. (ME), AUNDH ROAD, PUNE - 411 020.
(ii) JSS / JSG	:	The Director Directorate of Standardization Standardization Documents Centre Ministry of Defence Room no 05, 'J' Block Nirman Bhawan PO New Delhi – 110 011
(iii) IS Specification	:	Bureau of Indian Standards, Manak Bhawan 9, Bahadur Shah Zafar Marg, NEW DELHI – 110 002 or Their regional / Branch offices

3. MATERIAL

3.1 Acrylic rayon cloth shall be woven of acrylic viscose rayon yarn spun from a blend of acrylic fibres containing 85% minimum polyacrylonitrile and viscose fibres. It shall also satisfy the requirements mentioned at Sl.No.1 of clause 6.3.1.

3.2 Colour -unless otherwise specified in the contract the Colour of the cloth shall be white or off white.

4. MANUFACTURE

4.1 The acrylic rayon cloth shall be manufactured by a process which has received Authoritative approval. The Quality Assurance Officer shall be informed regarding the process used and shall be informed with prior notification of any proposed deviation therefrom. All the deviations from the approved process however slight, shall be recorded immediately & all the material affected shall be kept aside pending the decision of Quality Assurance Officer/Quality Assurance Authority.

5. TENDER SAMPLE

5.1 The Contractor/Manufacturer shall submit a tender sample in duplicate measuring 2 metres length x full width, free of all charges and conforming to this specification alongwith test certificate.

6. QUALITY ASSURANCE

6.1 INSPECTION

6.1.1. The acrylic rayon cloth & the packages in which it is contained shall be subject to inspection by and to the approval of QA Officer/QA Authority.

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

6.1.3 If on examination any sample be found not to conform to this specification, the whole batch/lot/consignment shall be rejected.

6.1.4 The foregoing provisions shall equally apply to the prime contractors and sub contractors, if any.

6.2. SAMPLING

6.2.1 The sampling shall be done in good light and in an enclosed space free from dust, acid and other fumes. Utmost cleanliness shall be observed while handling the cloth so that cloth does not acquire acidity/alkalinity, chlorides and stains. If the roll/than is not uniform in appearance, samples will be drawn to represent extreme variations.

6.2.2 Samples shall be drawn preferably from beginning, middle and end of the roll/than selected for sampling.

6.2.3 Three representative samples measuring 2 metres length x full width each shall be drawn from beginning, middle and end portion from each roll/than selected for sampling. The number of rolls / thans for drawing samples from batch/lot shall be as follows :-

Batch/Lot size (No. of rolls / thans)	**No. of rolls / thans to be selected.**
2 to 8	2
9 to 15	3
16 to 25	5
26 and above	8

6.3 TEST REQUIREMENTS

6.3.1 The samples taken from any portion of the batch/lot/consignment shall conform to the clause 3.1 above and in addition shall satisfy the following test requirements.

		PASSING STANDARD		
Sl. No.	**Test**	**Grade A**	**Grade B**	**Test Method**
1.	Visual Exam. (permissible defects) Major Max.	----------2----------		Appendix 'A'
	Combined (Major + Minor but not containing more than 2 major defects) Max.	----------7----------		
2.	Ether Soluble Matter Percent by mass Max.	10	10	Appendix 'B'
3.	Starch Percent by mass Min. Max.	2 6	2 6	Appendix 'C'
4.	Acrylic fibre content Percent by mass Min. Max.	50 60	50 60	Appendix 'D'
5.	pH of water extract Min. Max.	5 9	5 9	Appendix 'E'
6.	Acidity as CH_3COOH % (If pH of Water extract is between 5. 0 to 7. 0) Max.	0. 1	0. 1	Appendix 'F'
7.	Alkalinity as Na_2CO_3 % (If pH of water extract is between 7.0 to 9.0) Max.	0. 1	0. 1	Appendix 'F'
8.	Ash, Percent by mass Max	2. 0	2. 0	Appendix 'G'

		PASSING STANDARD		
Sl. No.	**Test**	**Grade A**	**Grade B**	**Test Method**
9.	Halogen content	Nil	Nil	Appendix 'H'
10.	Moisture / regain Percent by mass Max.	10	10	JSG:0114 Method 4
11.	Mass in g per sq. metre Min. max.	 160 180	 280 310	 JSG:0114 Method 1
12.	Thread/cm Warp Min. Weft Min.	 14 14	 18 18	
*13.	Breaking strength Newtons, Min. Warp Weft	 480 480	 960 960	Appendix 'J'
14.	Elongation at break % Max. Warp Weft	 25 25	 25 25	

(*) NOTE: The breaking strength shall be carried out at a constant rate of traverse of machine of 300 plus minus 15 mm/minutes. The revelled strip to be cut as 325 x 60 mm and test to be carried out keeping the jaw distance 200 mm and width after revelling 50 mm.

7. SUPPLIER'S INSPECTION OF STORES/CONSIGNMENT

7.1 Before tendering the store for inspection, the supplier shall carry out a thorough inspection of each delivery to satisfy himself that the store fully conforms to this specification and shall render a certificate to that effect to the QA Officer/QA Authority.

8. WARRANTY

8.1 The store supplied against the contract shall deem to have been warranted against defective material and performance by the manufacturer/contractor for a period of 12 months from the date of receipt of the store at the consignee's end and if during this period any of the store supplied is found defective, the same shall be replaced by the manufacturer/contractor free of charge at the consignee's premises.

9. PACKAGING

9.1 The acrylic rayon cloth shall be packed in continuous length of 20 metres or such continuous lengths as agreed between the supplier and the purchaser. Each roll will be wrapped all over with chemically neutral strong packing paper or in polythene film of thickness min 0.13 mm. A suitable number of such rolls will be made into bales/bundles and each bale/bundle will be wrapped in gunny or cloth and tied securely with Nylon/iron bands in such a way that there is no damage to the contents.

9.2 Any other form of packages shall have prior approval of QA officer/QA Authority.

9.3 The inclusion of any foreign matter or impurities in any of the package shall render the whole batch/consignment liable for rejection.

10. MARKING

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

i) Nomenclature and specification number of the store.

ii) Name and address of the consignee.

iii) A/T No. or S. O. No. & date.

iv) Lot/Batch No

v) Consignment No.

vi) Gross & Net mass.

vii) Consecutive no of package and total No. of packages.

viii) Date of Supply.

ix) Contractor's initials or recognised trade mark.

10.2 In addition to the above the QA Officer/QA Authority may suggest some more marking/Identification suitable at the time of inspection.

10.3 The paint used for marking shall conform to IS 138 (Latest Issue) & to the satisfaction of QA Officer/QA Authority.

11. DEFENCE STORES CATALOGUE NUMBER

11.1 The Defence stores catalogue number allotted to this store is Grade 'A' 8305 – 000 725 & Grade 'B' 8305 – 000 724.

12. SUGGESTIONS FOR IMPROVEMENT

12.1 Any suggestion for improvement in this document shall be forwarded to The Controller, CQA(ME) Aundh Road, Pune – 411 020.

Date : 24.01.2017

(Mrs. MGP DHANRAJ)
CONTROLLER
CQA(ME), Aundh Road
Pune - 411 020

13. APPENDICES

APPENDIX 'A'

The cloth shall be opened out and examined 100% for visual defects and short lengths. Following is the classification of defects. The defects below shall be noted and counted per 100 metre length of cloth.

Classification of defects

Major	Minor
i) Broken ends/picks	i) Knots, Floats
ii) Missing ends/picks	ii) Thick uneven fluffy yarn
iii) Cut salvadges	iii) Stains
iv) Thin uneven fine yarn	iv) Wrinkles, crease, hard embeded.
v) Puncture. holes, thin cuts	v) Width less than specified.
vi) Abrasion marks or weak spots- any open place or any area visibly thinner or weaker than surrounding normal cloth.	

APPENDIX ' B'

DETERMINATION OF ETHER SOLUBLE MATTER

Two Specimen weighing approximately 0.5 g each shall be cut from each of the pieces comprising sample. The specimen shall be weighed together and transferred to the extraction chamber of a soxhlet extraction apparatus having ground glass connections. The extraction chamber shall be assembled to a tared receiving flask and ether transferred to the extraction chamber until the specimen are covered and ether siphons over into the flask. Approximately 25 ml more ether shall be added to the extraction chamber, a condenser assembled to it and the assembled apparatus placed on a steam bath. The extraction shall be allowed to proceed for 1 ½ hour. Heating shall be discontinued at a time when the ether content of the extraction chamber is nearly sufficient to cause the ether to siphon over into the receiving flask. The flask containing the oily extract, shall be heated on steam bath until the ether is removed. The flask and the residue shall be dried in an oven at 100 plus minus 2 degree C for 1 hour. Cooled in a desiccator & weighed.

$$\text{Ether soluble matter, Percent by mass} = \frac{\text{mass of the residue}}{\text{mass of the sample}} \times 100$$

APPENDIX 'C'

DETERMINATION OF STARCH

1. The sample after ether extraction as given in appendix 'B' is dried in an oven at 100 to 105 deg C for 1 hour cooled in a desiccator and weighed (A).

2. The sample is extracted for 1 hour with chloroform in soxhlet apparatus. The sample is then exposed to air until the chloroform has been evaporated.

3. The sample is then washed in hot distilled water & squeezed. It is then immersed in boiling water for one hour and rinsed thoroughly in hot distilled water.

4. The sample is then immersed in an aqueous solution of diastase enzyme at 50 degree C (prepared by using 5.0 g of diastase and 10 g NaCl per litre with pH 6.5 to 7.7). It is squeezed while immersing, removed and squeezed again. This procedure is repeated with the same solution for 3 times. This enzyme solution is then heated at 70 degree C. The sample is immersed for 15 minutes to hydrolize starch completely as indicated by iodine test. The sample is then rinsed 12 times in fresh portions of hot distilled water, squeezing after each rinse and then dried to constant mass at 100 plus or minus 5 deg C (B).

$$\text{Starch Content, Percent by mass} = \frac{A - B}{C} \times 100$$

Where,

A = mass of the sample after ether extraction

B = mass of the sample after desizing

C = mass of the sample before ether extraction

APPENDIX 'D'

DETERMINATION OF ACRYLIC FIBRE CONTENT

The desized weighed cloth specimen shall be placed in 500 ml beaker and 150 ml of Dimethyl formamide (DMF) added. This beaker and the contents shall be placed on a steam bath and heated for 15 minutes. The liquid shall be decanted and the addition of DMF, heating & decanting repeated for 5 times. The contents of the beaker shall be washed with distilled water until the odour of DMF has been removed. The specimen shall be transferred to a tared 250 ml beaker. The beaker and the contents shall be placed in an oven maintained at 100 to 105 deg C for 1 hour, cooled in a desiccator & weighed. The difference between this mass and that of the tared beaker represents the mass of the nonacrylic fibrous portion of the specimen.

$$\text{Acrylic fibre content, Percent by mass} = \frac{(A - B) \times 100}{A} \times 100$$

A = Mass of desized specimen
B = Mass of desized specimen after extraction with DMF.

APPENDIX 'E'

DETERMINATION OF (pH) OF WATER EXTRACT

A sample weighing 1.5 g is transferred to a 250 ml beaker. 150 ml of boiled & cooled distilled water is added & it is covered with watch glass. The water alongwith contents is boiled for ½ hour. It is cooled to 25 to 30 degree C without agitating the content. The volume of the water is made to 150 ml using freshly boiled cooled distilled water. The pH of water extract is determined by using glass electrode pH electrometer. The pH is to be determined within one hour after removing the beaker from the source of heat.

APPENDIX 'F'

DETERMINATION OF ACIDITY AND ALKALINITY

The solution used in the pH determination shall be filtered. If the pH of the solution is between 7.0 to 9.0, the solution shall be titrated with N/10 HCl using methyl red as indicator. If the pH of the solution is between 5.0 to 7.0 then it is titrated with N/10 NaOH using phenolphthalein as indicator. Acidity is calculated as CH_3COOH & Alkalinity is calculated as Na_2CO_3.

1 ml of N/10 NaOH = 0.006 g of CH_3COOH

& 1 ml of N/10 HCl = 0.0053 g of Na_2CO_3

APPENDIX 'G'

DETERMINATION OF ASH

Transfer 2 g of sample to a previously cleaned, dried and weighed (M_1) porcelain crucible and weigh accurately (M_2). Moisten the contents with concentrated Nitric Acid. The crucible shall then be heated on a steam bath for one hour & then heated carefully over a flame so as to avoid any loss. When the contents of the crucible have been charred, heat to dull redness until all carbonaceous matter has been burnt off. The crucible shall then be cooled in a desiccator & weighed (M_3).

$$\text{Ash Content, Percent by mass} = \frac{M_3 - M_1}{M_2 - M_1} \times 100$$

WHERE,

M_1 = mass of empty crucible.

M_2 = mass of the crucible + sample.

M_3 = mass of the crucible + Ash

APPENDIX 'H'

DETERMINATION OF HALOGEN CONTENT

A copper wire shall be heated in a bunsen flame till all green colouration disappears. The wire shall then be removed from the flame. The strands of the yarn are wound around the hot end of wire & it is then introduced in the flame. The presence of green colouration persists for more than 3 seconds indicates the presence of halogens.

APPENDIX 'J'

DETERMINATION OF BREAKING STRENGTH AND ELONGATION AT BREAK BY RAVELLED STRIP METHOD

From each sample two sets of test specimens shall be cut, one set in the warp direction and the other in the weft direction and each set shall consist of atleast 5 specimens. The specimens shall be as representative of the sample as possible. No two specimens shall contain the same longitudinal threads and no warp direction specimen shall be cut from nearer either salvedge than one tenth of the width of the test sample.

Each specimen shall be cut with its length parallel to warp or the weft of the fabric and sufficiently wide to allow the necessary fringes, and threads shall be removed in approximately equal numbers from each of the long edges of the cut strip until the width of the specimen is 50 mm. 5 mm of 15 threads fringing will be sufficient.

The specimen shall be marked 200 mm from the middle keeping 50 mm minimum in both ends to mount the specimen in the testing machine. Keep the specimen in standard atmosphere of 27 ± 2 deg C and 65 ± 2 % RH for 24 hours.

Mount the specimen centrally in the testing machine so that the longitudinal axis of the specimen is at right angles to the edges of the clamps. Apply pre-tensioning of 5N and take the scale reading in mm. Set the machine at 300 ± 15 mm rate of traverse per minute.

The load range of machine shall be such that all the observed values would lie between 10 and 90 percent of the full scale load.

Set the clamps of the testing machine so that the distance between them is 200 mm.

Operate the machine and carry the test to rupture and record the breaking load and elongation of the specimen.

NOTE : 1 - If the specimen slips in the jaw, breaks in the jaws or breaks within 5 mm from the edge of the jaws, the results shall be discarded and another specimen tested in lieu thereof.

NOTE : 2 - To avoid the chances of slippage or damage of the specimen, packing material like paper, felt, leather or rubber sheet may be used alongwith the faces of the jaws.

Calculation of average breaking strength and elongation at break

For each set of five specimens in the warp and weft direction, calculate separately the following :-

(a) Average breaking strength using the formula

$$\bar{F} = \frac{F_1}{n}$$

Where

$\bar{F}$ is average breaking strength, in newton per 50mm strip.

F1 is sum of the observed value of breaking strength in newton per 50 mm strip.

n is the number of observations (5).

(b) Percentage elongation of individual specimen using the formula

$$E1 = \frac{100 \times l}{L}$$

Where

E1 = % elongation

l = diff of total observed elongation and original length.

L = Original length of strip viz – 200 mm

(c) Average percentage elongation at break, using the formula

$$\bar{E} = \frac{E_1}{n}$$

Where

$\bar{E}$ is the average percentage elongation at break.

E1 is the sum of the calculated percentage elongation at break as obtained in (b).

n is the number of observations.

INSPECTION AND TEST SCHEDULE FOR CLOTH ACRYLIC RAYON

The cloth Acrylic Rayon shall be supplied in roll form or in the form of than in continuous length of 20 metres or of such continuous length as agreed between the supplier and purchaser.

Before offering the store to QA Officer for inspection, the supplier shall carry out a thorough inspection of the store and shall render a pre-inspection certificate to the QA Officer that the store offered, fully conforms to the relevant specification.

For inspection and sampling the following procedure shall be strictly adhered to :-

1. VISUAL EXAMINATION

The cloth shall be opened out and examined 100% for visual defects and short lengths. Following is the classification of defects and acceptance criteria :

a) **Classification of defects**

Major	Minor
(i) Broken ends/picks	i) Knots, floats
(ii) Missing ends/picks	ii) Thick uneven fluffy yarn
(iii) Cut salvadges	iii) Stains
(iv) Thin uneven fine yarn	iv) Wrinkles or crease, hard embeded
(v) Puncture, holes, thin cuts	v) Width less than specified
(vi) Abrasion marks or weak Spots :- any open place or any area visibly thinner or weaker than surrounding normal cloth.	---

Visual examination shall be carried out on each metre length of roll/than. The defects mentioned above shall be noted and counted.

b) **Acceptance Criteria**

The maximum permissible defects per 100 metres length of the cloth are as follows :-

Major	:	2
Combined (Major + Minor)	:	7 (shall not contain more than 2 major defects).

2. The width of the cloth shall be measured to a nearest 1 mm. The width shall be as specified in the contract.

3. Samples shall be drawn as per relevant specification. Samples shall be drawn preferably from beginning, middle and end of the pieces selected for sampling.

The sampling shall be done in good light, in an enclosed space free from dust, acid and other fumes. Utmost cleanliness shall be observed while handling the cloth so that the cloth does not acquire acidity/alkalinity, chlorides and stains. If the roll/than is not uniform in appearance, sample will be drawn to represent extreme variations. An assessment of the extent of variations will be given by the sampler to enable correct verdicting by the QA Office/QA Authority.

4. The packing and marking shall be as mentioned in the specification.

5. The samples drawn are then tested to relevant specification.

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