DIRECTORATE GENERAL NATIONAL DISASTER RESPONSE FORCE
NDCC-II BUILDING, JAI SINGH ROAD, NEW DELHI-110003

CORRIGENDUM NOTICE NO. 02

(Consisting of 28 page only)

With reference to HQ NDRF Tender Enquiry No.1-17018/Proc./1520/HQ-NDRF/2021/**1309** dated 27/10/2021, Corrigendum No.-01 dated 18/11/2021 and Corrigendum No.-02 dated 29/11/2021 for procurement of 4074 Nos NBC Permeable Suit MK-V for NDRF Units.

2. In partial modification/amendments be incorporated in the relevant terms and conditions given in our above CPP Portal Tender Enquiry No.1-17018/Proc./1520/HQ-NDRF/2021/**1309** dated 27/10/2021, Corrigendum No.-01 dated 18/11/2021 and Corrigendum No.-02 dated 29/11/2021 is as under:-

SN	FOR CLAUSE	SN	READ AS
01	**Critical date sheet at page No-01 & Corrigendum notice No. 02** Bid submission End Date: **21/12/2021 at 1500 hrs.**	01	**Critical date sheet at page No-01 & Corrigendum notice No. 02** Bid submission End Date: **30/12/2021 at 1500 hrs.**
02	**Critical date sheet at page No-01 & Corrigendum notice No. 02** Bid Opening Date: **22/12/2021 at 1500 hrs.**	02	**Critical date sheet at page No-01 & Corrigendum notice No. 02** Bid Opening Date: **31/12/2021 at 1500 hrs.**
03	**Eligibility and Qualification Criteria** Only those firms who are having valid Transfer of Technology (ToT) from the DRDO lab, or past supplier of items and registered with DGQA for NBC items are eligible to participate in the tender.	03	**Eligibility and Qualification Criteria** DRDE (DRDO) is the AHSP holder for NBC Suit MK-V, hence registration with DRDE (DRDO) is required in place of DGQA.
04	**Technical specifications of NBC Permeable Suit MK-V** (TE page from 19 to 31)	04	**Technical specifications of NBC Permeable Suit MK-V.** Specifications as per **Appendix-'A'** (printed pages from **3 to 29**)

Note: - (a) Remaining terms and conditions of the TE will remain unchanged.
(b) **Any changes/modifications in this Tender enquiry will be intimated through CPPP portal https://eprocure.gov.in./eprocure/app and our websites www.ndrf@gov.in.** As such, the tenderers are requested to visit our websites regularly.

No. 1-17018/Proc./1520/HQ-NDRF/2021/..1526
Dated, the 17 Dec, 2021

(V V N Prasanna Kumar)
Commandant (Proc.)
For and on Behalf of President of India

Copy to:-
In-Charge (IT Cell), HQ NDRF : Upload the corrigendum on NDRF website please.

SPECIFICATION
FOR
NBC SUIT PERMEABLE MK V

1. THIS SPECIFICATION IS INTENDED TO GUIDE MANUFACTURING OF NBC SUIT PERMEABLE Mk-V AGAINST DEFENCE REQUIREMENT.

2. THIS SPECIFICATION OR ANY OTHER INFORMATION ISSUED IN CONNECTION THEREWITH SHALL ONLY BE USED FOR SPECIFIC ORDER PLACED BY A COMPETENT AUTHORITY.

3. ALL CLAUSES IN THIS SPECIFICATION SHALL BE COMPLIED IN EVERY ASPECT, IRRESPECTIVE OF THE SOURCE OF SUPPLY OF THE MATERIAL.

4. IN CASE OF ANY DISCREPANCY BETWEEN THIS SPECIFICATION AND SAMPLE LOANED FOR ANY PURPOSE, THIS SPECIFICATION ALONG WITH OTHER CONNECTED SPECIFICATION SHALL BE TAKEN AS CORRECT AT THE TIME OF FINALISATION OF A CONTRACT.

5. IN CASE OF ANY CONFLICT BETWEEN THIS SPECIFICATION AND TEXT OF ANY QUOTED/CONNECTED STANDARD THIS DOCUMENT SHALL PREVAIL.

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1. SCOPE AND DRAWINGS

This specification covers the requirement of NBC Suit Permeable Mk-V to provide protection against toxic chemicals. The suit is in the form of a coverall. This is available in four sizes viz. Small (S), Medium (M), Large (L) and Extra Large (XL). Technical Specification of all the input materials required in manufacturing of suit along with design details are included/referred in this specifications. The dimensions of overall of various sizes have been laid down (Table 1). The dimensions common to all sizes of suits has been laid down in Table 2.

In case NBC suit is ordered along with NBC socks the parameters of the socks will be governed by the specification of NBC socks.

Table 1: Size details (in cm) of NBC Suit Permeable Mk-V.

FINAL DIMENSIONS OF NBC SUIT Mk V					
S. No.	Particulars	XL	L	M	S
1	Chest	130	126	124	116
2	Shoulder Breadth	57	54	53	50
3	Sleeve length	67	66	65	62
4	Arm Hole (Arm Scye)	62	62	60	60
5	Waist (Hip)	132	130	128	118
6	Waist	120	118	116	105
7	Thigh (Circumference)	84	82	80	78
8	Neck (Circumference)	64	60	58	58
9	Crotch height	94	90	88	82
10	High point shoulder (HPS) to thigh pocket distance	72	71	70	69
11	HPS to waist rope distance	64	61	58	57
12	Armpit point to front flap joint	20	18	17	16
13	HPS to outer bottom open	168	160	158	155
14	Total Height (From Hood to outer bottom open)	198	190	188	185
15	Zip length (Along the zip)	98	92	87	84
16	Inner flap length	89	83	78	75
17	Outer flap length	101	96	90	85
	Note: All dimensions in cm. Tolerance as mentioned in drawings				

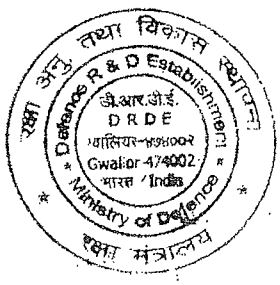
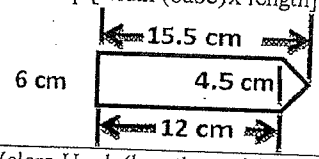
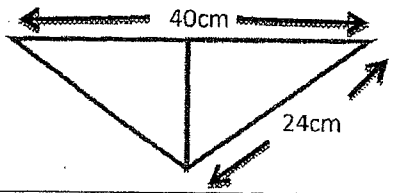


Table 2: The dimension common to all sizes of suit.

FINAL DIMENSIONS COMMON TO ALL SUIT SIZES OF NBC SUIT Mk V		
S. No.	Particulars	Dimension (cm)
1	Zip flap width	8 (outer) 6 (inner)
2	(a) Shoulder to Sleeve pen/pencil pocket distance (Right side) (b) Sleeve Pocket, (length x width) (c) Shoulder to Sleeve dosimeter pocket distance (left side) (d) Dosimeter pocket (length x width) (e) Dosimeter flap (f) Dosimeter pocket gusset on 3 side (g) Width of velcro on 3 sides for pocket flap (U shaped)	10 14x5 10 10x10 15x11 4 2.5
3	High point shoulder (HPS) to Front Pocket Distance	25
4	Sleeve Hem	4
5	Bottom Hem	4
6	(a) Front Pocket (height x width) (b) Front pocket flap (length x width)	25x22 22x7
7	Front name tag velro (length x width)	22x2.5
8	Back Rescue loop housing depth	10
9	Rescue loop tape length	40
10	Back name tag velcro (length x width)	22x2.5
11	Rescue loop pocket opening tab (length x width)	10x4
12	Shoulder flap Velcro loop [length x width (base)] Shoulder flap [width (base)x length]  	10x2.5 6 x 15.5
13	Hip Velcro Hook (length x width)	16x5
14	HPS to hip velcro length	50
15	Bottom velcro loop (length x width)	16x5
16	Hood measurement	
	(a) Face dia	13x13
	(b) Central Panel	
	(i) Bottom at back	19
	(ii) Middle part	11
	(iii) Front end	14
	(c)Total hood base (back)	15
	(d)Total Hood base at HPS (back)	30
17	(a) Wrist Inner sleeve length (b) Top circumference	19 40

18	(a)Thigh pocket, (length x width) (b) Flap, (length x width) (c) Velcro, (length x width) (d) Gusset	25x22 22x7 22x2.5 5
19	a. Hood draw cord toggle b. Hood draw cord length c. Termination of cord	Plastic single bore (black/OG) 85 Both the end should be stitched with fabric puller.
20	a. Inner Bottom b. Ankle loop tape (length x width)	2.5 cm elastic tape reinforced with fabric on outer side 20x2.5
21	Waist cord channel length from each side	10 (Left) 10 (Right)
22	a. Waist draw cord length b. Waist draw cord with toggle plastic with single bore and fabric puller	140
23	Outer wrist sleeve open (Circumference)	34
24	Inner wrist sleeve (Circumference)	20
25	Outer bottom open (Circumference)	50
26	Inner bottom (Circumference)	30
27	Knee (Circumference)	66
28	• Neck flap (rectangular), dimensions, (length X width) • Neck Flap and associated velcro loop top edge distance from periphery of the chin • Distance of the neck flap from the stitched zip • Neck flap Velcro hook (length x width) • Velcro Loop size (length x width) • Distance of Velcro loop from stitched Zip	15x5 4 6 8 X 5 (Right Side) 5 X 5 (Left side) 2
29	Triangular patches at crotch (2 pieces) having a dimension: 	
Note: All dimensions in cm; Tolerance as mentioned in drawings.		

NBC SUIT PERMEABLE Mk-V

The drawing of NBC Suit Permeable Mk-V is shown in Figures 1.1.

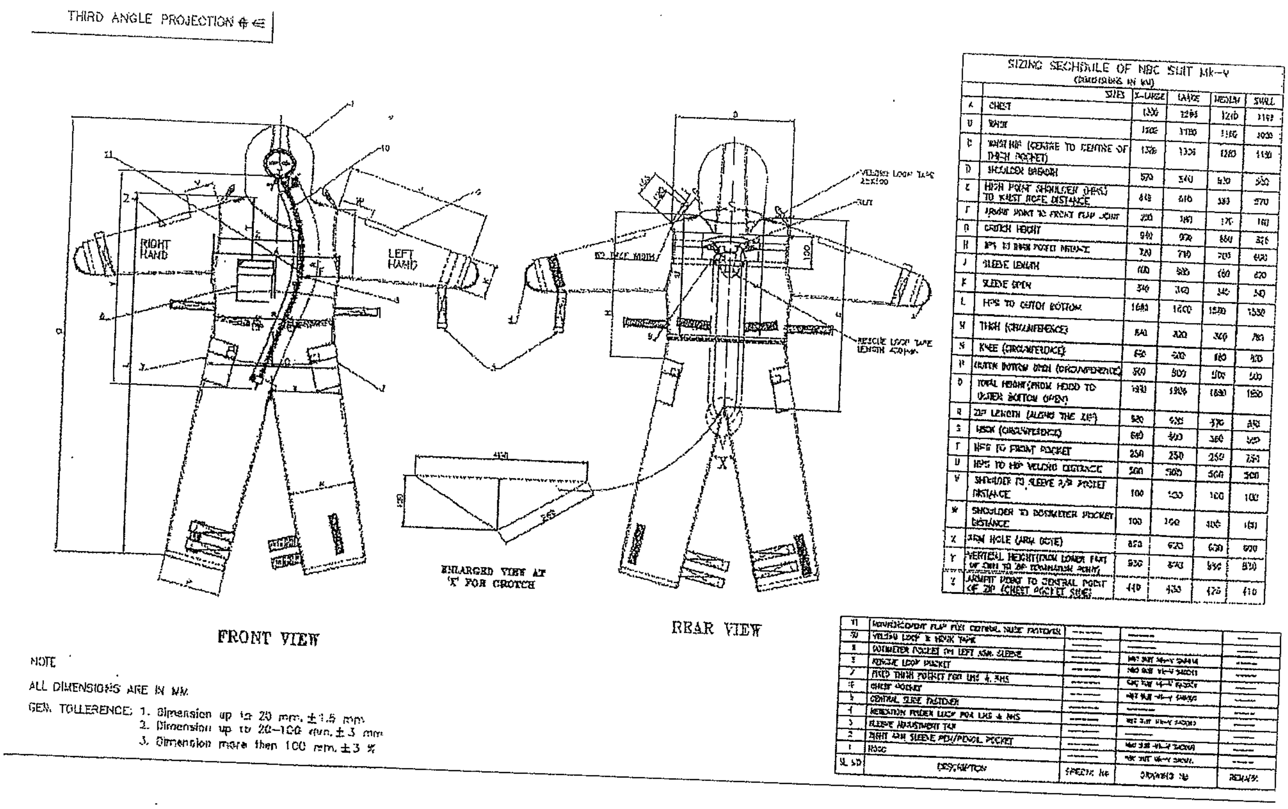


Figure 1.1: General Assembly of NBC Suit Permeable Mk-V

2. BRIEF INTRODUCTION

NBC Suit Permeable Mk-V is a new generation indigenous suit which was developed by DRDO as per specification number DRDE/0287/NBCD/SuitMk-V/2015/41 followed by successful bulk production for Indian Army. Present specification has been upgraded based on experience gained during bulk production. The inner adsorbent layer is made of Activated Carbon Spheres adhered to a fabric laminated with non woven fabric. The outer fabric is light weight, multifunctional viz. fire retardant, oil & water repellent, antistatic and printed based on user requirements.

3. MATERIAL USED IN NBC SUIT PERMEABLE Mk-V

Details of materials used in the NBC Suit Permeable Mk-V are given below in Table 3. Specifications of each of these materials are given in subsequent sections.

अनु तथा विकास
Defence R & D Establishment
डीआरडीई
Gwalior-474002
भारत/India
Ministry of Defence
रक्षा मंत्रालय

Table 3: Details of materials used for NBC Suit Permeable Mk-V

S. No.	Material
1	Multifunctional outer fabric
2	Activated Carbon Spheres
3	Non woven
4	Base fabric : Knitted or Woven
5	ACS adhered laminated fabric
6	Sewing Thread
7	Fastener Hook Tape and Loop Tape
8	Tape
9	Cord Braided
10	Buckle on Hood Cord
11	Tape Elastic
12	Laminated Packing Pouch, inner
13	Packing Pouch, outer
14	Corrugated Box
15	Zipper

4. STANDARD PATTERN

The NBC Suit Permeable Mk-V shall conform in every respect to the terms of the specification and in all other aspects not defined in this specification, to the sealed sample in the custody of AHSP.

5. MATERIALS

5.1 The NBC Suit Permeable Mk-V shall be manufactured from the materials as per specification at clause 3 above. The requirement of colour & print pattern, in respect of material listed in tables may be varied for some specific user/application e.g. Army/ Naval / Air Force/ Para Military Forces and regarding this change the decision will be taken by AHSP based on User requirement which shall be binding on the manufacturers.

5.2 The manufacturers is required to submit samples of the above materials to AHSP for inspection and approval before using this material in the manufacturing of NBC Suit Permeable Mk-V.

6. MANUFACTURING

6.1 GENERAL STITCHING

6.1.1 The manufacturing of various components and suit is required to be done as per the drawings attached as Appendix 'A'. In case of any discrepancy, the sealed suits samples available with AHSP should be referred.

6.1.2 The Suit coverall shall be made of composite fabric consisting of two layers viz; (i) Outer Layer multifunctional fabric, (ii) Inner (adsorbent) layer of ACS adhered laminated fabric (Three Layers). Both inner and outer layers, when used together, are referred as composite fabrics.

6.1.3 The layers of the fabric shall always be stitched together followed by over-locking in such a way that the knitted or woven surface of inner layer faces/touch the body. For stitching of coverall and their components, only specified sewing thread will be used.

6.1.4 The additional attachments (such as front & thigh pocket, dosimeter, pen/pencil pocket, Velcro etc.) on the outer fabric should be stitched separately with outer fabric only and not with the outer fabric and laminated fabric together so as to avoid direct passage of contaminants through stitching points.

6.1.5 NBC Suit Permeable Mk-V (Coverall) shall be fabricated throughout by double stitching and cross stitching on tapes. The item shall be assembled throughout with lock stitches regulated as 30 to 35 stitches per decimetre with even tension. For the reinforcement of stitches, all the stitch lines at the start and at the end shall have return stitch. The loose end of fabric shall be hemmed to avoid fraying. The ends of loose threads shall be properly trimmed off.

6.1.6 Heat sealing of all loose ends of tapes shall be properly cut and heat sealed.

6.2 LABELLING

6.2.1 Label, shall be stitched on the inside of right side pocket of coverall, marked in (English & Hindi) as under:-

Label 1-Size, Serial No., Opening date of sealed bag, Name of User, Care Instruction

Label 2-Developed by, Manufactured by, Order date, Month & Year of Manufacturing, Lot No., Details of outer and laminated fabric

Label 3: Laundering Number (For Example) Cut the Laundry number after each wash

Stitched End

CUT AFTER LAUNDRY - 6
CUT AFTER LAUNDRY - 5
CUT AFTER LAUNDRY - 4
CUT AFTER LAUNDRY - 3
CUT AFTER LAUNDRY - 2
CUT AFTER LAUNDRY - 1

Cut after each wash

6.2.2 The label shall be woven with white art silk/white printable films for background and red print/art silk for the letters. There shall be a clear gap of 5 mm from the edges all-around.

7. FABRICATION OF COVERALL SUIT

In, shape, workmanship and finish, and in all other aspects not defined in the specification, the suit shall conform to sealed sample held in the custody of AHSP. The description of stitching of main parts of the suit is given in subsequent paragraphs. The Suit shall be stitched by integrating these parts. For finer details, the relevant drawings shall be referred. Drawings are attached as Appendix A.

8. TECHNICAL REQUIREMENTS

The complete technical parameters used for evaluation of NBC Suit Permeable Mk-V are given in Table 10 of this specification.

8.1 DIMENSIONS

The major details and main dimensions of the item are provided in the attached sketch. Drawings are attached as Appendix A.For further fine details, the sealed sample shall be referred for manufacturing and final approval. All measurements shall lie within tolerance limit as mentioned in the attached drawings.

8.2 WEIGHT

The weight of complete suit (Coverall), without packing, of any of the four sizes i.e., small, medium, large and extra large shall be not more than 2.75 kg.

9. INSTRUCTION USER HANDBOOK

9.1 A User Handbook duly printed providing details of suit, material, salient features, technical data, instructions for using, and Dos and Don'ts, shall be placed in each multiple pack on the top of unit pack of overall packed. The type, design and format of text of hand book shall be bilingual (English & Hindi).

9.2 Field Washing Method - Take 40 liter of lukewarm water (38 ±3°C), add 2 ml of soft liquid detergent like Ezee or Genteel and stir. Soak the suit in solution for 15 minutes. After gentle rinsing, dipwash the suit in plain clean water two to three times till no signs of detergent are noticed. The suit to be line dried thereafter under sun. This method will only be applicable for field wash and not for any laboratory evaluation for acceptance.

9.3 A washing method instruction label printed in English and Hindi will be stitched inside the NBC coverall.

10. WORKMANSHIP AND FINISH

10.1 In appearance, shape, workmanship and finish, and in all other aspects not defined in this specification, the suit shall conform to sealed sample held in the custody of AHSP.

11. PACKING & MARKINGS

11.1 Vacuum Packing – To ensure shelf life of 10 years and service life of NBC Suit Mk-V, it should be packaged in a two layer packing system. In case NBC socks is ordered along with NBC suits then specified nos. of NBC socks to be packed individually in a transparent polyethylene bag (with a small hole for air to escape during

vacuum packing) with air tight zip lock and these four packed socks are to kept with each suit inside the inner laminated packing pouch. The inner layer is nitrogen flushed vacuum packed with layered film laminate. The outer packaging bag should have zipper (with air lock) and will be utilized along with the inner laminated pouch for storage of suit in between use.

The whole sealed packet is placed inside a PP corrugated box with a moisture adsorbent (8 pouches of 25 gm each preferably colour indicating silica gel) and suitable cushioning material (grey expanded polyethylene foam) to avoid damage during transportation, handling and storage. Each polypropylene (PP) corrugated box should hold five nos. of suit.

The packed corrugated box is to be sealed using a fabric reinforced transparent adhesive tapes (min 5 cm width) followed by two HDPE strapping in both the directions. Storage instructions (Temp, RH, maximum permissible stackings etc.) and up side arrow marking for direction of placement are to be mentioned on each box.

The inner laminated packing pouch is made from four layered laminated film comprising of polyester, aluminium, polyester and blend of LDPE & HDPE. The thickness of each layer and inter lamination strength should be such as to ensure the desired shelf life. The rectangular pouch should be sealed from all four sides. One side is required to have zip lock before the sealed area and also have provision of 'V' notch for ease of opening. PP box should have opening length wise such that all the five pockets are visible. At the time of packing the suits in the box should be lined with suitable cushioning material (grey expanded polyethylene foam) of thickness 14 ± 2 mm and mass 250 gsm (min) to avoid damage during transportation, handling and storage.

11.2 Three white printable films/ white art silk to be stitched inside the chest pocket, each of size 12X6cm containing the following permanently printed (black) description in English on one side and hindi on another side:

a) Details of Suit- Title, Size, serial number, year of manufacturing, name of the development agency with logo, name of manufacturer and expiry date. Marking will be printed on outer side in English and reverse side in Hindi.

b) Brief/pictorial washing instructions.

c) Pre-printed polyester film to be stitched. Provision for punch hole / cut in one of the six printed boxes as per the sequence on the polyester film after every wash.

11.3 Before dispatch, each laminated pouch and corrugated box will be marked with the following details:

Details to be mentioned on Laminated Pouch:

- Nomenclature and Size
- Name and monogram of the Developing Agency
- Name and trade mark of the manufacturer
- Serial number and Batch no.
- Month/ year of manufacture
- Month/Year of expiry
-

Details to be mentioned on corrugated box:

- Nomenclature and Size
- Quantity packed in the box
- Lot and serial number of the box
- Month and year of packing
- Name and monogram of the Developing Agency
- Name and trade mark of the manufacturer
- Gross weight of the box in kg.
- Name and address of the consignee
- Inspection note no and date
- Cat/Part No
- Month/ year of manufacture
- Month/Year of expiry
- Contract/Supply Order No.
- Storage conditions and maximum permissible vertical stackings
- Up side arrow marking for direction of placement

12. PRE-INSPECTION OF STORE/CONSIGNMENT

Before tendering for inspection, the supplier shall carry out a thorough pre-inspection from accredited lab for the verification at component level and final product of each delivery to satisfy themselves that the store fully conforms to the specifications and the sealed sample. The pre-inspection data is to be submitted along with each challan/offering note for QA to the AHSP.

13. QUALITY ASSURANCE

13.1 The quantity of store offered against one dispatch note shall constitute a lot.

13.2 The details of sampling and testing of the same should be carried out as mentioned in ATP (DRDE/0287/NBCD/Suit Mk-V/2015/41/ATP) for the purpose of quality assurance.

14. GUARANTEE &WARRANTY

14.1 Manufacturers have to ensure the performance quality from the date of manufacture of NBC Suit Permeable Mk-V.

14.2 The stores supplied against the contract shall be deemed to bear warranty for 18 months by the contractor against defective design, material and workmanship for the receipt of each consignment of the NBC Suit Permeable Mk-V. In the case of receipt of substandard or defective suit, the same shall be replaced by the contractor free of cost at consignees end without delay after the receipt of information. In no case the period of replacement shall exceed six months.

14.3. Manufactures will provide Shelf Life Certificate for the specified life for every lot.

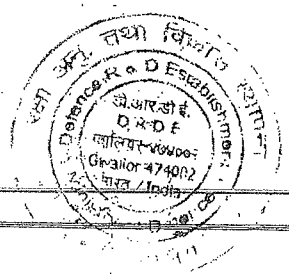
15. STORAGE AND SHELF LIFE

Shelf life of NBC Suit Permeable Mk-V is 10 years under standard packing and storage conditions (Temperature: 25 ± 2°C, RH: 65 ± 5%, maximum permissible vertical stacking 3, avoid exposure to UV, moth etc.). After 5 years of storage, one suit sample from accepted batch kept with AHSP will be tested for chemical protection (HD-BTT) only.

16. Test Requirements

16.1 Test equipments and general conditions

- The tests are in general to be done at DRDE, other DRDO lab or NABL accredited laboratories.
- In case of test being done elsewhere due to test setup not being available/working in DRDO or NABL accredited labs then the test equipment and conditions shall conform to the laid down standards and shall be approved by the inspection authority/AHSP prior to tests. All the tests shall be carried out under environmental conditions as laid down by the relevant standard and SOPs.
- The required performance of the NBC Suit Mk-V is given in specification of NBC Suit Mk-V.
- Any deviation from the documented test conditions shall have the prior approval of the AHSP.



16.2 Inspection and Certification

- Unless otherwise specified in contract order, the supplier is responsible for requirements as specified in specification and this document. The inspection authority reserves the right to perform any of the inspections mentioned in the specification and this document where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

- Thorough visual examination of the NBC Suit Mk-V is to be carried out for observable visual damage. The weight and overall dimensions of the unit [1% per batch, using representative (stratified) random sampling plan] is to be in accordance with the Specification and is to be recorded in the firms pre-inspection test report. Each suit is to be examined to determine conformance to the requirements of the latest issue of the specification document.

- For pilot/advance lot all raw materials (sampled randomly) offered for inspection should be checked for following points:

  - Completeness of raw materials.
  - Mechanical damage to all parts, coating defects, fabric defects,

- The manufacturer shall submit 36 nos of suit (9 nos of each size) at pilot/advance stage to the AHSP.

- The tests mentioned in the specification of NBC Suit Mk-V at **Table 10, Sr No 1-6** are **one time tests** and will be done during pilot/advance sample stage only.

- Bulk production of NBC Suit Mk-V shall be undertaken only after acceptance of pilot/advance sample and issue of Bulk Production Clearance (BPC) by the competent authority.

- All raw materials for pilot/advance suit only shall be inspected at the manufacturers' location before embodiment in the NBC Suit Mk-V or as may be required by the inspection authority. The raw materials shall be inspected in accordance with all requirements of referred documents unless otherwise excluded, amended or qualified in this document and specification.

- NBC Suit Mk-V shall be manufactured after the BPC, for which the suit manufacturers have to submit the satisfactory pre inspection test report from NABL accredited laboratory of offered suits and test reports of all the raw materials for the batch viz. outer fabric, Activated carbon spheres, ACS laminated fabric, base fabric and various components as mentioned in the specification of NBC Suit Mk V to AHSP. The manufacturers shall provide the list of sub-vendors for list of all components and materials used for suit production along with test certificates issued by accredited laboratories. The original manufacturer's certificate shall be submitted for all plastic, rubber and metal components.

- The sample requirements of raw materials in pilot /advance stage are given below:

- Outer fabric: 3 meters per roll (2 sample rolls, each of 100 meters length randomly sampled only for pilot/advance suit batch)
- ACS coated fabric: 3 meters per roll (2 sample rolls, each of 50 meters length randomly sampled only for pilot/advance suit batch)
- Activated Carbon Spheres: 0.5 Kg per 500 Kg lot (to be sampled after lot homogenization by mixing of the offered sample for pilot/advance suit batch only)
- Base fabric used for ACS coating: 3 meters per roll (2 sample rolls, each of 100 meters length randomly sampled only for pilot/advance suit batch)

- There would be two sets of cutting pattern for each size of NBC Suit Mk-V. About 50 numbers of pieces cut with the pattern would be inspected prior to bulk cutting and manufacturing. The cutting pattern would be approved and one set of each size of NBC Suit Mk-V pattern will be stamped and sealed by controlling authority for future reference.
- Stitching pattern should be as per standard specification. The dimensions for the four sizes are given in **Annexure A & B**, and the general assembly drawing is furnished in **Annexure C** as finalized during the User cum wearability trial at FCBRN CME, Pune.

- Inspection may be done during the production stage to ensure the proper manufacturing process is used.

- In bulk production, the samples will be selected using representative (stratified) random sampling plan as per the Table furnished below depending on the lot size. This number of samples required for destructive testing will be above the number of ordered quantity.

- The minimum numbers of samples are to be drawn in the following manner. The samples are to be duly sealed are to be stamped and marked with identification mark.

Lot Size (No suits)	**Sample size (No of suits) for non destructive test-Dimensions weight (1% of offered lot but keeping the minimum number 12 representing different sizes)**	**Sample size (No of suits) for destructive testing (As per MIL STD 1916 with Verification level (VL)I, but keeping the minimum number per lot to 09)**
0 to 100	12	9
101 to 250	12	9
251 to 500	12	9
501 to 1000	12	10
1001 to 3000	12	12

3001 and above	30	12

Note : The sample to contain all the sizes in approximately equal number.

- It is responsibility of the manufacturer to carry out proper pre-inspection of all components and final suit (whichever is applicable at different stages) as per specification and ATP before offering the stores for inspection. The Pre inspection by the manufacturer includes the pre inspection for testing of all the raw materials (separately if the production is taken in different lots) and offered suits (randomly picked one or two suits from the batch) from NABL accredited laboratory and physical/visual inspection report with respect to verification of dimensions and drawings of 100% suits of batch being offered. Every suit has to be assigned a unique number in such a way that the traceability with respect to inspection batch, production lot of important components like outer fabric and laminated fabric is feasible. The pre inspection report is required to have a mention of this unique number.

- The contractor shall submit a certificate of compliance for all those materials and components for which the requirements are not covered by a standard, conform to the specified requirement of the final product.

- Evaluation of raw material & pilot/advance sample of suit is applicable for new manufacturers and for those production agencies which did not manufacture the suit in the last three years.

DETAILS OF RAW MATERIALS FOR NBC SUIT PERMEABLE Mk-V

16. Multifunctional outer fabric

16.1 Scope

This specification covers the requirement of multifunctional outer fabric of NBC Suit Permeable Mk-V. Suitable materials and treatments shall be employed for the manufacturing of the fabric to meet the performance requirements as laid down in Table 4.

16.2 Sealed Sample

In appearance finish, shade/pattern and all other aspects not defined in this specification, the finished fabric shall conform to the sealed sample held in the custody of AHSP.

Table 4: Multifunctional outer fabric, camouflage printed.

S. No.	Test Parameter	Specified Requirement	Standard	Remark
1	Mass	100-140 gsm	ASTM D 3776	Test report from Accredited lab required
2	Nature of Material	It is an inherent flame retardant material with following blend compositions: a.93% Poly Metaphenylene iso pthalamide or Meta Aramid or equivalent b.5% Poly Paraphenylene iso pthalamide or Para Aramid or equivalent c.2%Antistatic Fiber or equivalent	Certificate from OEM.	
3	Breaking Strength (kgf), i Warp (min.) ii. Weft (min.)	 50 40	IS 1969	Test report from Accredited lab required
4	Flame Retardency After flame –(max.) After glow –(max.) Char length – (max.)	 5 sec. 5 sec 110 mm	IS 11871 (Procedure A)	Test report from Accredited lab required
5	Water repellency rating (min.)	90	IS 390	Test report from Accredited lab required
6	Air permeability at 0.5 inches (125 Pa) of water head (min.) (in combination with laminated fabric)	30 $cm^3/sec/cm^2$	ASTM D 737	Test report from Accredited lab required
7	Oil repellency rating (min.)	6	AATCC 118	Test report from Accredited lab required
8	Dimensional stability (max.)	Maximum 6%, shrinkage allowed, no critical defects on visual inspection after 06 laundering	AATCC 135	Test report from Accredited lab required
9	Color fastness to washing, Rating (min.) at 60°C, 30 min (Test.Conditions C3)	4	ISO 105 C10	Test report from Accredited lab required
10	Tear strength (kgf) (min.)	Warp 3.0 Weft 3.0	ASTM D 1424	Test report from Accredited lab required

11	Antistatic	$< 5.3 \times 10^{12}$ Ohm	(EN 1149-1)	Test report from Accredited lab required
12.	Outer fabric color/print	a. For Indian Army: Visual assessment of colour and pattern as per Indian Army disruptive pattern (Camouflage) as per Pantone Number- Khaki (17-0618 TCX) Black (19-4008 TCX) Green (19-0307 TCX) Brown (19-1116 TCX) b. For Indian Navy: Navy Blue as per shade No. 106 of IS:5. OR As agreed between buyer , seller and notified to AHSP $\Delta E \leq 8$ (in all cases)		Test report from Accredited lab required

17. ACTIVATED CARBON SPHERES

17.1 General requirements

The Activated Carbon shall be dry spherical form free from foreign materials and other such visible impurities.

17.2 Tests

All the samples taken from any portion of supply shall comply with the requirements of tests specification given below in table 5.

Table 5: Details of Activated Carbon Spheres

S. No.	Test Parameter	Specified Requirement	Standard
1	BET Surface Area (m^2/g)	≥800	ASTM D 6556
2	Iodine number (mg/g)	≥1,000	ASTM D 4607

3	Particle size (20×52 BSS) by wt, % Particle retained on 300 µm sieve (52 BSS) Particle retained on 800 µm sieve (20 BSS)	 >95 <5	ASTM D 2862
4.	Compressive strength (kg/sphere)	≥1.5	ASTM C 695

18. ACS ADHERED LAMINATED INNER FABRIC

The complete details of ACS adhered laminated fabric are given in table 6.

Table 6: Details of ACS adhered laminated inner fabric

S. No.	Test Parameter	Specified Requirement	Standard	Remark
1	Mass (max.)	400 gsm	ASTM D 3776	Test report from Accredited lab required
2a	Bursting strength, (min.) (with knitted base fabric)	500 kPa	ISO 13938-1	Test report from Accredited lab required
2b	Tear Strength, N (min) (with woven base fabric)	Warp-25 Weft- 25	ASTM D1424	Test report from Accredited lab required
3	Air permeability at 0.5 inches (125 Pa) of water head (min.)	30 cm^3 /sec/cm^2 (in combination with outer fabric)	ASTM D 737	Test report from Accredited lab required
4	% Carbon Loss (After 6 wash), (max.)	< 1% after each wash and < 3.0% after 6 wash.	MIL DTL 32102A	Test report from Accredited lab required
5	HD-BTT (min.)	24 h	UK/SC/3346G	DRDE, Gwalior

19. BASE FABRIC

The base fabric to be used in fabrication shall be either knitted or woven. The fabric shall be grey in color as per sealed sample. Suitable construction to meet the performance parameters listed below in table 7.

Table 7: Details of base fabric used for ACS lamination.

Table 7a: For knitted base fabric (Grey) used for ACS lamination

S. No	Test Parameter	Specified Requirement	Standard	Remark
1.	Mass (max.)	120 gsm	EN 12127	Test reports from Accredited lab required
2	Bursting strength (min.)	500 kPa	ISO 13938-1	-do-
3.	Wales per (cm), (min.)	17	EN 14971	-do-
4.	Coarse per (cm), (min.)	20	EN 14971	-do-
5.	Count of yarn (min.)	40^s	EN 14970	-do-
6.	Color fastness to washing (min.) at 60°C, 30 min (Test Conditions C3)	4 (rating)	ISO 105 C08	-do-

Table 7b: For woven base fabric (Grey) used for ACS lamination

S No.	Test Parameter	Specified Requirement	Standard	Remark
1.	Mass (max.)	110 gsm	ASTM D 3776	Test reports from Accredited lab required
2.	Tear strength (min.) 'N'	Warp- 25 Weft- 25	ASTM D1424	-do-
3	Weave	Plain	Visual	-do-
4	Color fastness to washing (min.) at 60°C, 30 min (Test Conditions C3)	4(rating)	ISO 105 C08	-do-

20. NON-WOVEN FABRIC

35-50 gsm Poly Propylene non-woven fabric, white color, shall be employed for the lamination of the ACS coated fabric.

Table 8: Non-Woven Fabric

S. No.	Test Parameter	Specified Requirement	Standard	Remark
1	Mass of non woven	35 - 50 gsm	ASTM D 3776	Test reports from Accredited lab required

21. ACCESSORIES

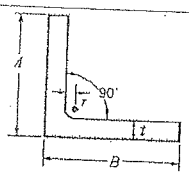
The details of accessories used in fabrication of NBC Suit Permeable Mk-V are given below. All the accessories should be as per the specification given in table 9.

Table 9: Details of accessories used for manufacturing of NBC Suit Permeable Mk-V

Sl. No	Test Parameter	Requirement	Standard	Remark
1.	Sewing Thread, ➢ Breaking Strength, min,	2.5 kgf	IS 4910 Part III	Test reports from accredited lab required.
2	Synthetic Fastener Hook and Loop Tape (Velcro), Width 25+1.5mm ➢ Peel Strength, min. ➢ Shear Strength, min. ➢ Shrinkage, max. a. Hook b. Loop	 125 g/cm 750 g/cm^2 3.0% 4.0%	IS 8156	Test reports from accredited Lab
3	Synthetic Fastener Hook and Loop Tape (Velcro), Width 50+1.5mm ➢ Peel Strength, min. ➢ Shear strength, min. ➢ Shrinkage, max. a.Hook b.Loop	 125 g/cm 750 g/cm^2 3.0% 4.0%	IS 8156	
4	Tape Nylon, 25 mm ➢ Breaking Load, min, ➢ Width	 400 kgf 25±1.0 mm	IS 4228	-do-
5	Cord Braided Elastic ➢ Breaking Strength, min	30 kgf	IS4227	Test reports from accredited lab required
6	Tape Elastic ➢ Width, ➢ Thickness, ➢ Stretch test a. Load (min.) per cm width to produce 50% ext, b. Limit of useful extension,	 25±2.5 mm 1.3±0.1 mm 350 gf	 IS 1954 IS 7702 IS 9686	Test reports from accredited lab required.

	min c. Tension decay under constant stretch, max. ➢ Fatigue test a. Stretches and relaxed for 500 times	120 % 5% No sign of rupture	IS 9686	
7	Packing Pouch a. Laminated (Inner) ➢ Thickness (at 200 g/cm^2) ➢ Mass, (min) ➢ Bursting strength, min. ➢ Peel Strength (per 5 cm width),min ➢ Air permeability, at 125 Pa of H_2O ➢ Pouch Size, rectangle (finished) ➢ Sealing Width, min (a) Lamination with polyester aluminium and blend of LDPE & HDPE. (b) It will have slide locking arrangement. (c) It will have 'V'cut for tearing the pouch. (d) The top 10mm sealing will be done after flushing with N2 and then vaccum.	0.1-0.2 mm 150 gsm 550 kPa 20 kgf Nil Width: 52 ±1cm Length: 62 ±1cm 10±1mm	IS 1060 Part 1 ASTM D-737	Test reports from accredited Lab
8	Packing Pouch Outer with Zip (air lock) ➢ Material ➢ Thickness, (at 200 g/cm^2) mm ➢ Mass, gsm, ➢ Size (a) Pouch will be sealed on three sides. (b) Top side will have self latching/sealing arrangement.	Polyethylene Film 0.20 ± 0.05mm 250±50 Width : 52 ±1cm Length: 66 ±1cm	IS 1060 Part 1	Test reports from accredited Lab

9	**Corrugated Box** a.Corrugated sheet for box 1. Mass, (min.) 2. Thickness, (min.) 3. Bursting strength, (min.) 4. Colour 5. Material b.Corrugated Box 1. Size (Inner dimensions) 2. Features of Box	 930 gsm 5 mm 15 kg/cm^2 Olive green 3 ply, single wall, two faces poly propylene (PP) corrugated sheet Higher ply materials are acceptable Width: 450±10mm Length: 540±10mm Height: 480±10mm a. Fabricated with the PP corrugated sheet with vertical orientation (load direction) of flutes/tubes with top opening. b. Only stainless steel /GI staples to be used in fabrication followed by covering the staple surfaces with fabric reinforced adhesive tape. c. Pillar with right angle section made of compressed multilayer paper / plastic to be used for reinforcement in four corners in vertical direction.	IS 1060 Part 1 ASTM D 3776 IS 7702 ISO 13938-1	Test reports from accredited Lab

		 A: 5cm min. B: 5 cm min. t: 0.4cm min.		
10.	Zipper ➢ Security attachment of puller to slider, min. ➢ Breaking strength (crosswise), min.	300 N 700 N	BS 3084	-do-

Note:

1.Colour of accessories at S.No 1-6 above is required to be Olive Green.
2.Colour of zipper and toggle are required to be Olive Green/Black.
3.Materials shall be accepted based on the test report from accredited lab and or OEM, whichever is applicable. AHSP may do validation testing at any point of time for any parameter.

20. Testing Parameters for NBC Suit Permeable Mk-V

Table 10: Overall Testing Parameters for NBC Suit Permeable Mk-V

S. No	Test	Standard	Specified Requirement	Remarks
1	Vapour challenge	ATEC TOP 8-2-501	Challenge level: 20 mg/m^{3}HD, 6 hours, maximum allowed penetration 500 mg. min/m^3	Swatch test,QTP*
2	Operating temperature	MIL-STD-810F	1. Hot-Dry: Conduct hot-dry cycle, 4 h per day for 45 days at 71°C, Relative Humidity, ≤5%, MIL-STD-810F 2. Hot-Humid: Conduct hot-humid cycle, 4 h per day for 45 days at 63°C, Relative Humidity, ≤10%, MIL-STD-810F 3. Cold: Conduct cold cycle 6 h per day for 45 days at -46°C, MIL- STD-810F, No degradation in protection	Suit test, QTP*
3	MIST (Man in Simulant Test)	ASTM F 2588-12	Physiological Protective Dosage Factor (PPDF sys) >800	Suit test, QTP*
4	Accelerated storage	MIL-STD-810F	Able to withstand hot and cold testing parameters without degradation below minimum protection levels For 60 days prior to wear Testing.	Suit test, QTP*

5	Wear Time	MIL-STD 810F	Able to withstand 45 days wear (720 hours cumulative wear time) without damage or degradation below minimum protection levels	Suit test QTP*
6	Thermal stress		Physiological testing: continuous wear for 24 hours without causing thermal stress levels sufficient to negatively affect performance (At 30°C temperature-JSQR)	Suit test, QTP*
7	Liquid chemical agent challenge	ATEC TOP 8-2-501	Challenge level: 10 g/m^{2}HD, 1 µL laid droplets, 24 hours, Maximum allowed penetration 4 µg/cm^2	Swatch test, ATP
8	HD BTT test	UK/SC/3346G	24 hour (min.)	Swatch test, ATP
9	Mandrel test	ATEC TOP 8-2-501	Fabric under stress, No penetration in 1 hour	Swatch test, ATP
10	Expulsion test	ATEC TOP 8-2-501	Fabric under pressure, No penetration in 1 hour	Swatch test, ATP
11	Inverted expulsion test	ATEC TOP 8-2-501	Fabric under pressure, No penetration in 1 hour	Swatch test, ATP
12	Carbon loss	SOP/DRDE/PD/Carbon loss/17 & MIL DTL-32102A	< 1% each wash, <3% after 6 washes	swatch test, ATP
13	Dimensional stability	AATCC135	Visual Evaluation, maximum 6% Shrinkage, no critical defect after 6 laundering	Suit/swatch test, ATP
14	Mechanical stability	SOP/DRDE/PD/Mechanical Stability/17 & MIL DTL-32102A	No delamination or puckering after 6 wash cycles	Suit/swatch test, ATP
15	Colour fastness to washing, Outer fabric, rating at 60°C, 30 min (Test.Conditions C3)	ISO 105 C10	4 and above	Suit/swatch test, ATP
16	Weight of suit	ASTM D 3776	≤2.75 kg (for XL size)	Suit test, ATP
17	Fabric system mass	ASTM D 3776	Not to exceed 18.2 oz/yd^2 (616 gsm)	Swatch test, ATP
18	Outer fabric mass	ASTM D 3776	100 -140 gsm	Swatch test, ATP
19	Tear strength (outer fabric)	ASTM D 1424	Warp 3.0 kgf (min.) Weft 3.0 kgf (min.)	Swatch test, ATP
20	Water repellency	IS 390	Rating 90 and above	Swatch test, ATP
21	Oil repellency	AATCC 118	Rating 6 and above	Swatch test, ATP

22	Flame retardancy	IS 11871, Procedure A	After flame, 5 sec. (max.) After glow, 5 sec. (max.) Char length, mm, maximum-110	Swatch test, ATP
23	Water vapor resistance	ISO 11092	Not to exceed 9.6 m^2Pa/W	Swatch test, ATP
24	Air permeability	ASTM D-737, at 0.5 inches (125 Pa) of water head (min.)	30 $cm^3/sec/cm^2$ (min.)	Suit/swatch test, ATP
25	Anti static	(EN 1149-1)	$< 5.3x10^{12}$ Ohm	Suit/swatch test, ATP
26	Outer fabric color/print		a. For Indian Army: Visual assessment of colour and pattern as per Indian Army disruptive pattern (Camouflage) as per Pantone Number- Khaki (17-0618 TCX) Black (19-4008 TCX) Green (19-0307 TCX) Brown (19-1116 TCX) b. For Indian Navy: Navy Blue as per shade No. 106 of IS:5. OR As agreed between buyer , seller and notified to AHSP $\Delta E \leq 8$ (in all cases)	Suit/swatch test, ATP
27	Material toxicity	NA	Documentation (MSDS)	Document Verification , ATP

QTP*: One time qualification test parameters to be done for development stage, pilot production , new Vender approval and in case of 3 years of non production of existing manufacturer, however, the ATP parameters must be done every time during development, pilot production, new vendor approval and bulk production.

Note:

a. There should be no deviation from above without the prior approval to the AHSP.

b. In case of any conflict between this specification and text of any quoted/connected standard this document shall prevail.

c. In case of any conflict, non availability or non-applicability of any specific test method/ test standard/ test specification / SOP, the decision of AHSP for equivalent test method/ test standard/ test specification / SOP existing or to be formulated will be final.

d. In case of test methods/ test specification/SOP the latest valid version will only be referred

d. In case of any discrepancy/ambiguity which is not addressed, the decision taken by AHSP will be final and binding.

e. AHSP is responsible for testing of all the test parameters given in this document. In case, outside agencies like accredited lab/AHSP approved lab or international agency are required for testing of any test parameters, the decision taken by AHSP will be final and binding.

f. After the BPC, vendor shall not change any source of supply, material or process without the prior approval of AHSP. In case of any change if necessary, the applicable/relevant tests from the QTP shall be applied.

g. Approved test facility at firm's premises may be used by AHSP, if required.