क्षा शरीरक्रिया एवं संबद्ध विज्ञान संस्थान
रक्षा अनुसंधान एवं विकास संगठन
रक्षा मंत्रालय, भारत सरकार
लखनऊ रोड, तीमारपुर, दिल्ली 110054

(ISO 9001 : 2008)

Defence Institute of Physiology & Allied Sciences
Defence Research & Development Organization
Ministry of Defence, Govt of India
Lucknow Road, Timarpur
Delhi 110054

Ref No : DIPAS/TMD/TECH(Prod)/347

Dated : 17 Sept 2019

To,
IG of Police
MHA (Govt. of India)
East Block-2, Level-6
R.K. Puram, Sector-1, New Delhi- 110066

Sub: REG. QRs/Specification of Full Body Protector and uploading on GeM portal

1. Reference to your office letter No. **L. VII.35/2019-20-RAF-Prov DA 5(Mahila)** dated 2nd Aug, 2019

2. Please find the enclosed copy of QRs/Specification and TDs of Full Body Protector for Female troops developed by DIPAS which are in course of action for uploading on GeM portal.

3. This is for your information and necessary action.

Dr Rajeev Varshney
Assoc. Director, DIPAS

Enclo:
1. QRs/ Specifications of FFBP

Director: 91-11-23946257, 23831053 Office: 91-11-2388 3107-108
FAX No: 91-11-2391 4790 E-mail : directordipas@gmail.com, director@dipas.drdo.in Telegram : DIPAS

प्रबला : Female Full Body Protector (FFBP)

Introduction:

Full Body Protector is the basic requirement for the police and security troops deployed especially in riot conditions.

In reference to the Indian scenario, the police forces recruit both males and females for controlling riot conditions. The existing ensembles for the safety of these forces by means of various protective gears are based upon prior inventions with poor fit and adjustability and materials not approved on recent security specification norms, also lacking gender specific design inputs.

Initially the Indian female troops had to wear the male FBP (full body protector), which was ill fitting and a glaring problem faced by the troops. Instead of safeguarding them and letting them give their best in such pressing conditions, the ensemble was a hindrance to their mobility and protection itself.

With an aim to provide a well suited FBP to the female troops, DIPAS initiated a study for anthropometric survey of female Indian troops working for riot control.

Consequently, the data collected was analyzed and with the aid of different designing tools, DIPAS came up with an ergonomically designed FFBP, tested and approved in various security specifications norms and undergone successful user trials.

Salient features of FFBP:

- A new lightweight protective ensemble that provides close combat protection to most vulnerable parts of the body in riot situations, against projectiles and possible threats.
- Ergonomically designed using anthropometric data of Indian female troops.
- Given in three sizes namely Small, Medium and Large to provide for female troops of all ethnicities.
- The FBP consist of different parts, as follows:
  - **Front shield** - Designed based on the female anatomy/ contours so as to accommodate user without hindrance in mobility
  - **Back shield** – Ergonomic design with embossing and grooves to decrease impact of projectile
  - **Shoulder pads and side shield** – Designed to safeguard shoulder region of user, with system to integrate and disintegrate quickly with torso guard.
  - **Arm guards (lower and upper)** - Designed in two segments: Upper arm guard for upper arm region and lower arm guard (with full coverage and adjustability) integrated with elbow protecting shield for both sides of the arm.

- **Leg protector (upper and lower)** - Designed in two segments: Thigh Guard associated with a belt safeguarding pelvic region and Lower Leg Guard (Ample coverage by means of shin guard and calves guard) associated with knee protection shield.

➢ Option of wearing upper, lower and peripheral protection separately as per riot situation demand.

➢ The unique design allows adjustability of all parts as per physique of user, with comfort and manoeuvrability.

➢ The FBP can withstand various threats with following properties:
  - **Anti Stab**
  - **Anti Puncture**
  - **Anti Impact**
  - **Fire Resistant**
  - **Acid Resistant**

SPECIFICATIONS OF FEMALE FULL BODY PROTECTOR

❖ A detailed description of the parts of Female Full body protector is as follows :

1. **CHEST PROTECTOR**

a) Upper plastic part, Lower front plastic part, Side plastic part, Back shield plastic part, Back side shield plastic part:

b) High quality breakage resistance plastic shield (Material: ABS and PC).
c) All sandwiches padding should have minimum 04 layers of virgin grade plastic and EVA (Ethylene and vinyl Acetylene based polymer) foam.
d) Inter stitchable so as to remain in place and not slip.

e) The word **प्रबला** should be embossed on the front lower plastic part of the chest protector

2. **ELBOW & FOREARM GUARD**

a) Inter stitchable so as to remain in place and not slip
b) Upper Arm guard should be flexible for easy wear.
c) Elbow guard attached with fore- arm guard should be flexible for easy movement.

3. **SHIN GUARD**

a) Knee plastics part, Knee upper plastic part, Calf plastic part:
b) Front leg plastic part: Made of virgin grade plastic.
c) Elastic stripes for easy wearing.
d) Hook & Loop closure/Adjusters (Adjusters are what we call the hardware pieces used to adjust the length of the straps. They usually also have a tab that you can pull outward to make it easier to loosen the straps).
e) Design for optimum movement, fit and comfort suitable to human body parts shape.

4. **UPPER ARM**

a) Hook & Loop closure/Adjusters (Adjusters are what we call the hardware pieces used to adjust the length of the straps. They usually also have a tab that you can pull outward to make it easier to loosen the straps).
b) Inter stitchable so as to remain in place and not slip.
c) Virgin grade plastic (ABS and PC) with EVA (Ethylene and vinyl Acetylene based polymer) foam padding.
d) High protection soft plastic inner protection with a flexible design for optimum movement, fit and comfort suitable to human body parts shape.

5. **SHOULDER PAD**

a) Hook & Loop closure/Adjusters (Adjusters are what we call the hardware pieces used to adjust the length of the straps. They usually also have a tab that you can pull outward to make it easier to loosen the straps).
b) Design for optimum movement, fit and comfort.
c) Poly foam above 8 mm thickness with specified Shore harness.
d) Outer lining fire retardant cloth.
e) Virgin grade plastic with shock absorbing EVA, Poly foam cushioning the shoulder.
f) Inter stitchable so as to remain in place and not slip.

6. **GROIN**

a) Making: The protection attachment should cover groin area from all ricocheted projectiles & allow comfortable sitting.
b) Inner stitch: Stitched so as to remain in place and not slip.
c) Groin guard: Groin guard must be segmented and will be attached with chest protector with Velcro (as per IS: 8156)

7. **THIGH GUARD AND PELVIC GUARD**

a) High protection unbreakable virgin grade plastic.
b) Adjustable straps: Adjustable straps fastening with durable elastic & Hook & Loop closure/Adjusters (Adjusters are the hardware pieces used to adjust the length of the straps. They usually also have a tab that can be pulled outward to make it easier to loosen the straps) fasteners.

❖ PRE-INSPECTION BY THE MANUFACTURER:

Manufacturer/ contactor must satisfy themselves first by carrying thorough inspection of each lot that the stores manufactured in accordance with contract and fully confirm to the specification requirements, before tendering to QA officer nominated under the terms of the contract.

A declaration by the contractor that necessary pre-inspection/ tests have been carried out on the stores tendered and the same are fit for inspection and test shall be rendered along the challan.

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.

❖ QUALITY ASSURANCE

For quality assurance samples will be picked randomly to confirm the requirements laid down in the specifications.

Manufacturer/ Contractor should get the approval for the raw material from the ASHP before proceeding for the fabrication to ensure quality of stores.

The supplier will provide the stores serially numbered and arranged in such a way that the entire lot is easily accessible to the sampling officer. The randomly selected FFBP will be checked for the specifications mentioned in the present document.

❖ WARRANTY :

Except as otherwise provided in the invitation to tender, the contractor / manufacturer hereby declares that the goods, stores articles sold/ supplied to the purchaser under this contract shall be of the best quality and workmanship and new in all respects and shall be strictly in accordance with the specifications and particulars contained/ mentioned in contract.

The contractor/seller hereby guarantees that the said stores would continue to conform to the description and quality aforesaid for a period of 24 months from the date of delivery to the purchaser. During the aforesaid period of 24 months the said stores if found not to conform to the description and quality aforesaid and not having satisfactory performance or have deteriorated; the decision of the purchaser in that behalf shall be final and binding on the contractor/ seller to rectify/replace by acceptable stores.

❖ TERMS AND CONDITIONS :

DRDO TOT holders of FFBP are only eligible to participate in tender.

DIMENSIONS FOR FBP

S.NO.	Parameter	Plastic (cm)	Foam Padding (cm)		
			S	**M**	**L**
1.	**Torso Protector**		Distance from centre		
	1.1 Chest Front Shield Length	Upper part (with curve) = 23.5 Lower part =12	42	45	48
			Distance from Shoulder		
			46	49	52
	1.2 Chest Front Shield Breadth	Upper=29 Lower=39 (with curve)	33	36	39
	1.3 Chest Back Shield Length	36	Distance from centre		
			42	45	48
			Distance from Shoulder		
			46	49	52
	1.4 Chest Back shield Breadth	28	33	36	39
	1.6 Shoulder Pad	Length (Curve) = 15	16.5	18.5	18.5
		Breadth= 7.5	13	13	13
	1.6 Groin Guard Length BrPeadth		29 12		
2.	**Arm Guard** **2.1 Upper arm guard** • Length • Breadth	 13 10	 18 16	 20 17.5	 22 19
	2.2 Forearm guard (Upper part) • Length (Curve) • Breadth (Curve)	11 17	Total Length (Upper +Lower)		
			29	32	34
			Total Breadth (Upper +Lower)		

	2.3 Forearm Guard (Lower part) • Length • Breadth at upper edge • Breadth at lower edge	 15 13 7	18	19	21
	2.4 Forearm Guard(Inner part) • Length • Breadth at upper edge • Breadth at lower edge	 14 7.5 4.5	 16 10	 18 11	 20 12
3.	**Leg protector** 3.1 Knee Guard • Upper part Length • Upper part Breadth • Lower part length (Curve) • Lower part length (Curve) 3.2 Shin Guard • Length • Breadth upper edge • Breadth lower edge	 5 15 13.5 18.5 19.5 13.0 8.5	Total Length (Knee +Shin) 45	 48	 50
	3.3 Calf Guard • Length • Breadth upper edge • Breadth lower edge	 18 13 7.5	 23	 25	 28
	3.6 Thigh Guard • Length • Breadth	 21.5 30.5	 22 32	 24 36	 26 40

Appendix A

Dimensions Requirements for Components of FFBP

Dimensions of Torso Protector Shield and Padding:-

S.NO.	Description	Female (Medium Size)	
		Length(cm)	**Breadth(cm)**
1.	Front Protector Shield Upper part(curve){ Ref Fig1} Lower part(curve){ Ref Fig2}	 23.5 12	 29 39
2.	Back Protector Shield {Fig3}	36	28
3.	Shoulder Pad Shield {Fig4}	15(curve)	7.5
4.	Front Padding {Fig5}	49	36
5.	Back Padding {Fig6}	49	36
6.	Shoulder Padding {Fig7}	18.5	13
7.	Groin Guard Padding {Fig8}	29	12
8	Side Guard (Rib Part) {Fig9}	13	22
9.	Neck Pad	Circumference=75	4

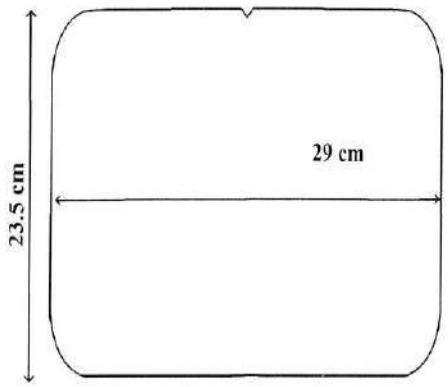

FIG1-FRONT PROTECTOR SHIELD (UPPER PART)

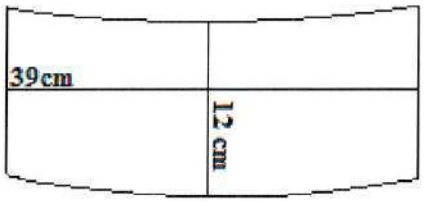

FIG2-FRONT PROTECTOR SHIELD (LOWER PART)

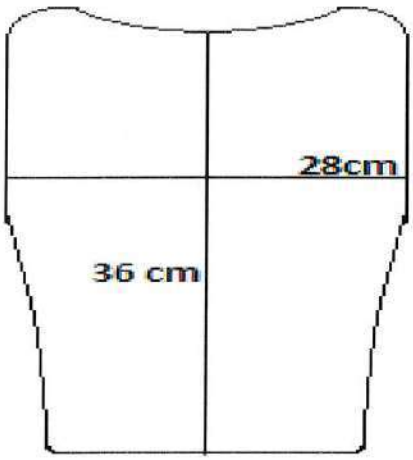

FIG3- BACK PROTECTOR SHIELD

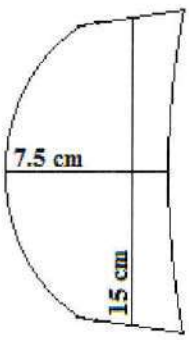

FIG 4- SHOULDER PAD SHIELD

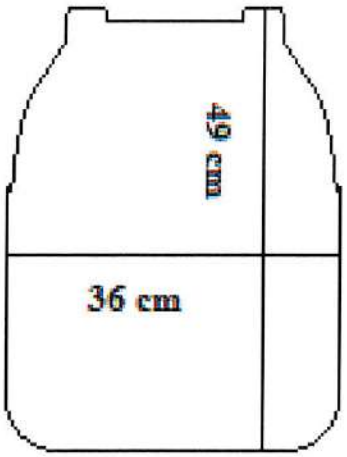

FIG 5- FRONT PROTECTOR PADDING

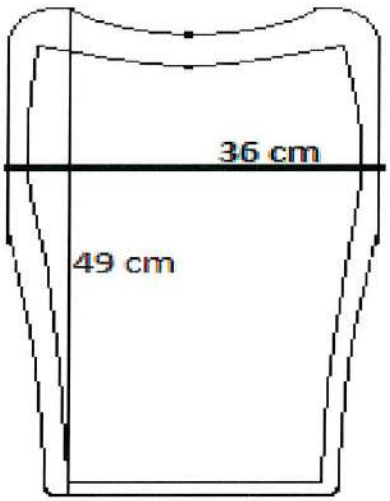

FIG 6- BACK PROTECTOR PADDING

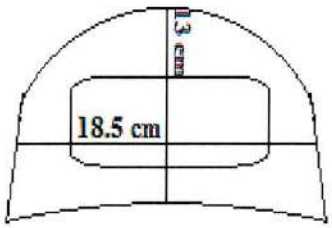

FIG 7- SHOULDER PADDING

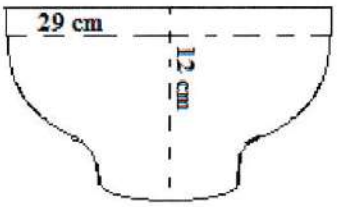

FIG 8 GROIN GUARD

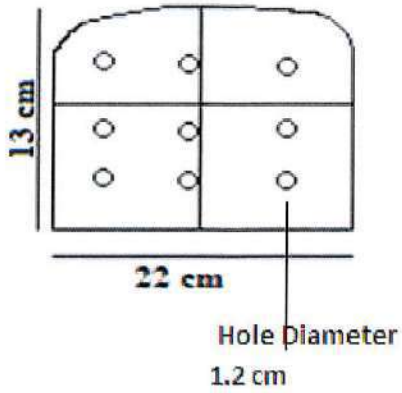

FIG 9- SIDE GUARD (RIB PART)

Dimensions of Arm Protector Shield and Padding:-

S.No	Descriptions	Female (Medium Size)	
		Length(cm)	**Breadth(cm)**
1.	Upper Arm Shield{Fig10}	13	Upper edge= 7.5 Lower edge= 10
2.	Forearm shield (upper region) {Fig11}	11	17
3.	Forearm shield(lower region) {Fig12}	15	Upper edge= 13 Lower edge= 7
4.	Forearm shield(inner region) {Fig13}	14	Upper edge= 7.5 Lower edge= 4.5
5.	Upper Arm Padding {Fig14}	20	Lower edge= 17.5
6.	Forearm Padding(Upper) {Fig15}	33	Middle edge= 19
7.	Forearm Padding(Inner) {Fig16}	18	Upper edge= 10.5

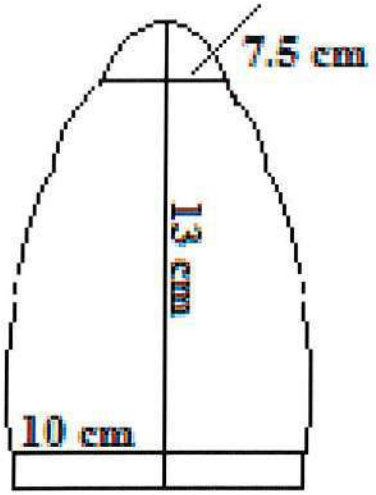

FIG 10- UPPER ARM SHIELD

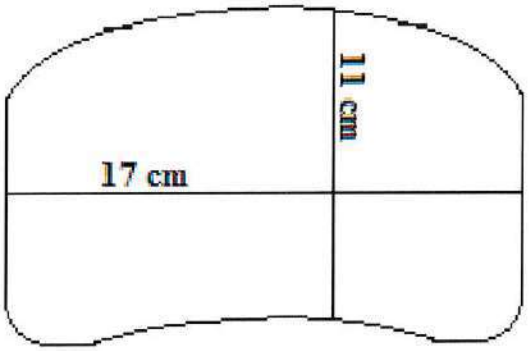

FIG 11 FOREARM SHIELD

(UPPER REGION)

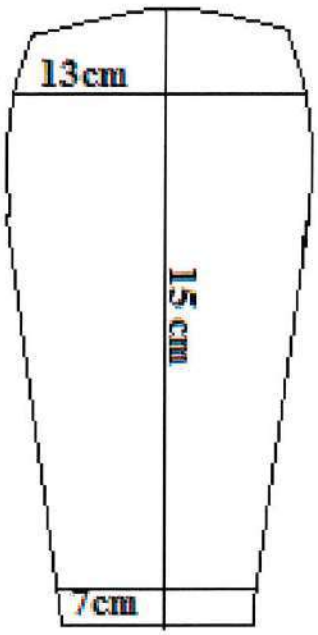

FIG 12 FOREARM SHIELD

(LOWER REGION)

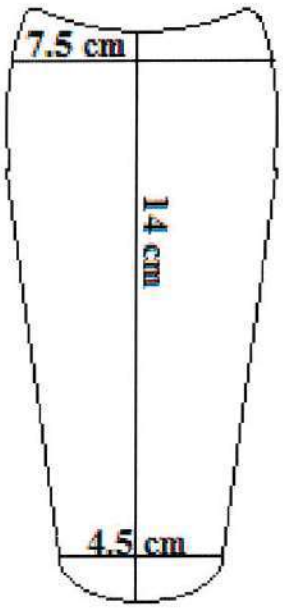

FIG 13 FOREARM SHIELD

(INNER REGION)

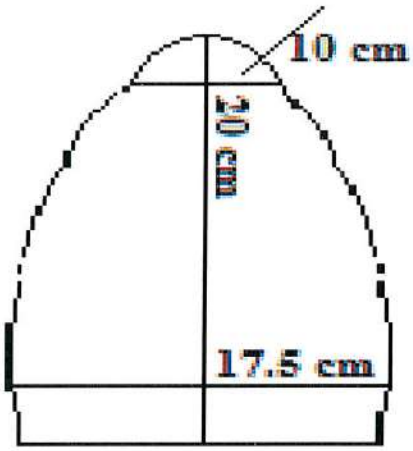

FIG 14 UPPER ARM PADDING

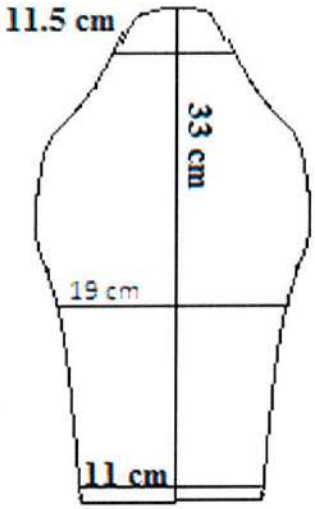

FIG 15 FOREARM PADDING (UPPER)

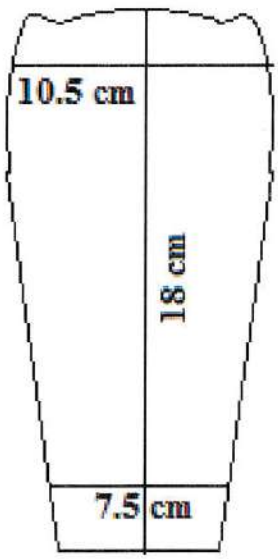

FIG 16 FOREARM PADDING (INNER)

Dimensions of Leg Protector Shield and Padding:-

S.No	Descriptions	Female (Medium Size)	
		Length(cm)	Breadth(cm)
1.	Knee Shield(lower curved part) {Fig17}	13.5	18.5
2.	Knee Shield(upper part) {Fig18}	5	15
3.	Shin guard Shield {Fig19}	19.5	Upper edge= 13 Lower edge= 8.5
4.	Calf guard shield {Fig20}	18	Upper edge= 13 Lower edge= 7.5
5.	Thigh guard shield {Fig21}	21.5	30.5
6.	Pelvic guard shield {Fig22}	19.5	8
7.	Front Padding (knee+ shin region) {Fig23}	47.5	
8.	Back Padding (calf region) {Fig24}	25	
9.	Thigh guard padding {Fig25}	24	36

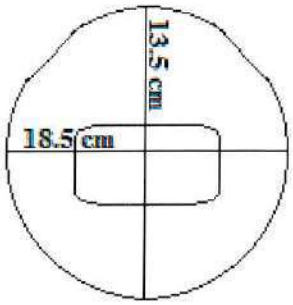

FIG 17 KNEE GUARD SHIELD
(LOWER PART)

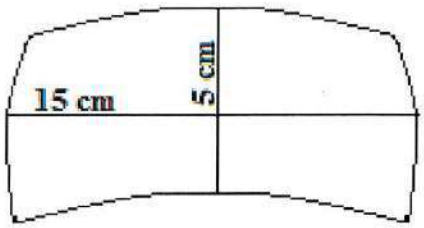

FIG 18 KNEE GUARD SHIELD
(UPPER PART)

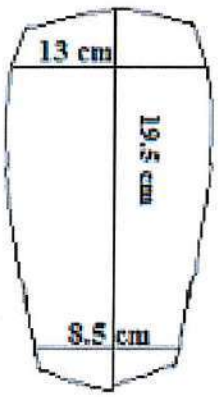

FIG 19 SHIN GUARD SHIELD

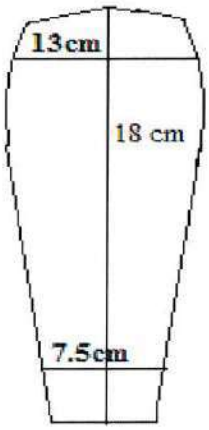

FIG 20 CALF GUARD SHIELD

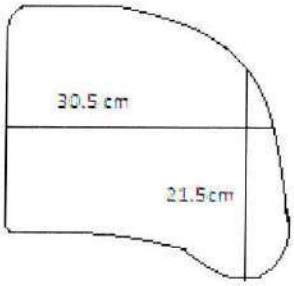

FIG 21 THIGH GUARD SHIELD

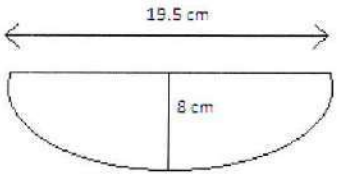

FIG 22 PELVIC GUARD SHIELD

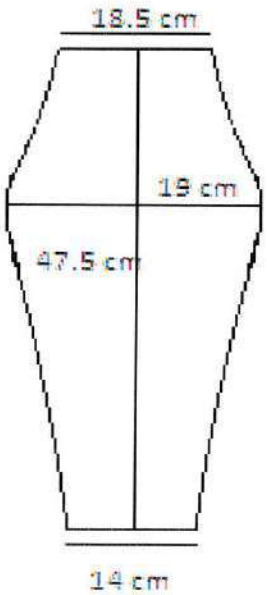

FIG 23 FRONT PADDING
(KNEE+SHIN)

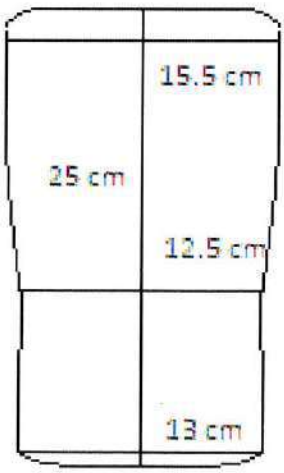

FIG 24 BACK PADDING
(CALF)

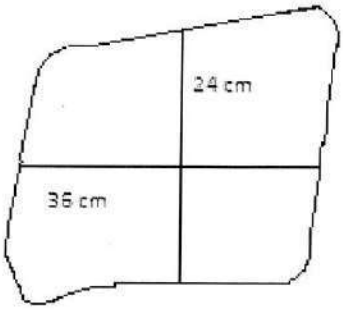

FIG 25 THIGH GUARD PADDING

APPENDIX –'B'

TRIAL DIRECTIVES (TDs) OF FULL BODY PROTECTOR (Female)

TRIAL PHILOSOPHY

The purpose of the Full body Protector (Female) is to protect the wearer from the various types of missiles that are thrown at her by the rioters most commonly. Such missiles range from stones or similar pieces of bricks/concrete, pieces of glass and glass bottles, acid bulbs/bottles containing sulphuric acid used in storage batteries and hydrochloric acid used for toilet cleaning purposes and burning rags/ bicycle tyres and Molotov Cocktails/ firebombs made basically by petrol/ diesel/ kerosene. The rioters may also attack with various types of wooden/ bamboo sticks and bicycle chains that would not be thrown but would be wielded by hands on coming close to the policemen. Therefore, the Full body protector must be able to provide her adequate protection from all above threats.

TRIAL METHODOLOGY

01. PHYSICAL TEST

The dimensions of Full Body Protector will be measured physically by board of officers as per figures mentioned in Appendix –B in QRs.

02. TESTS AS MENTIONED IN QRs FOR EACH TYPE OF RESISTANCE

To withstand various threats enumerated in trial philosophy, following tests will be Conducted:

2.1. **Anti Stab** – Full Body Protector shall meet the requirements given below in Table 1 when tested in accordance with VPAM KDIW 2004 Edition 18/05/2011, level K-3 Section 5.

2.2. **Anti Impact** – Full Body Protector shall meet the requirements given below in Table 1 when tested in accordance with VPAM KDIW 2004 Edition 18/05/2011 Class W-5 section-8.

Table – 1

Requirements of Mechanical Properties for Chest Protector and Back Protector

Sl. No.	Requirement	Strike energy/ Joules	Angle of Incidence (degrees)	Permitted value, mm	Reference Clause/ Annex/ IS
1	Stab Resistance	65	90 25	<20 (Penetration depth)	VPAM KDIW 2004:18/05/2011 Class K-3 Section - 5
2	Impact Resistance	100	90	<20 (Deformation depth)	VPAM KDIW 2004:18/05/2011 Class W-5 Section - 8

2.3. Flame Retardancey test - Full Body Protector shall meet the requirements of Flame Retardancy test for Outer fabric and fabric for neck protection/ collar when tested for 'flame retardance' by Surface ignition and Edge ignition in accordance with Procedure A and Procedure B of IS 15758 (Part-4) respectively.

Requirements for Surface Ignition

a) No specimen shall give hole formation.

b) No specimen shall give flaming to the top or either side edge.

c) No specimen shall melt or give flaming or molten debris

d) The mean value of after-flame time shall be ≤ 2 s.

e) The mean value of after-glow time shall be ≤ 2 s.

Requirements for Edge Ignition:

a) No specimen shall give flaming to the top or either side edge.

b) No specimen shall melt or give flaming or molten debris

c) The mean value of after – flame time shall be ≤ 2 s.

d) The mean value of after – glow time shall be ≤ 2 s.

2.4. Resistance to Chemicals -.

Full Body Protector shall be resistant to chemicals for Outer fabric and neck fabric when tested in accordance with IS 15758 (Part-3)2007 for

- 10 percent hydrochloric acid solution.
- 10 percent sulfuric acid solution.
- Kerosene, petrol, diesel and Molotov cocktail liquid.

When tested in accordance to IS 15758 (Part-3), the penetration index shall be ≤ 1 and Repellency Index shall be $\geq 95\%$.

Note:- Vendor shall provide 2 meter of each type of extra fabric (Woven and Knitted) used in the body protector for testing purposes.

2.5 Hook & Loop Fasteners test-

2.5.1 Strength of hook & Loop fasteners: Shear strength of hook & Loop fasteners minimum lengthwise-750, widthwise-750 as per Annx.-E of IS 8156:1994

2.5.2 Endurance test of hook and loop fasteners: Endurance test of hook and loop fasteners (after 5000 cycles of closing and opening operations). The shear strength shall not decrease by more than 10% of their original value as per Annx.-G of IS 8156:1994.

Note:- Vendor shall provide 5 meter of same Hook and Loop fastener which is used in the body protector sample for testing purposes.

03. <u>Certification</u>

a) Self certification by the manufacturer that all parts of FBP are made of same material.
b) Various tests mentioned in the trial directives can be conducted at one of the following laboratories.

i. NITRA, Ghaziabad(UP)
ii. ATIRA, Ahmadabad(Gujarat)
iii. DMSRDE/DRDO, Kanpur(UP)
iv. GFSU, Gujarat
v. CFSL, Labs
vi. CIPET Labs
vii. Any other NABL approved laboratory having scope for Parameters mentioned in QRs.

APPENDIX - "C"

QUALITATIVE REQUIREMENTS (QRs)/ SPECIFICATION OF FULL BODY PROTECTOR(Female)

01. Nomenclature:- Full Body Protector (Female)

It comprises of Chest protector, Shoulder Pad, Upper Arm guard, Elbow & Fore Arm guard, Thigh/ Pelvic guard, Groin guard and Shin guard.

02. Colour

Fabric and shield of required colour and required plain/ disruptive/ camouflage pattern as agreed to between the manufacturer and the user.

03. Weight

The overall weight of full body protector shall be $\leq$ 6.5 kg.

04. Life

06 Years.

05. Size:- Three sizes namely Small, Medium and Large.

5.1 Reference Size: Based on statistical data and based on ergonomics, dimensions for Small, Medium and Large Size of body protector have been arrived to as given in Appendix- A.

5.2 Sizes of components of Body Protector for Female: Medium size of components of body protector is taken as reference size for Female. Small size shall be 10% smaller than the reference size and large size shall be 10% larger than the reference size.

06. Dimensions of Full Body Protector

Components of Full Body Protector for Female should meet to the dimensional requirements of the size of the Full body protector given in Appendix-A. Tolerances for all the measurements shall be ± 5%.

07. Material:

7.1.1 Type of Fabric – The woven and knitted fabric should be made of cotton fiber. The fiber shall be identified as 'cotton' in accordance with IS 667: 1981.

7.1.2 a) Mass of Outer and Inner woven fabric shall be 230 ±5% g/ m² when tested in accordance with IS 1964:2001.

b) Mass of cotton knitted neck fabric shall be 150 ±5% g/ m².

7.1.3 Tear Strength – Tear Strength of woven fabric Mass: 230 ± 5% shall be 25 N (minimum) for Warp and 20 N (minimum) for weft when tested in accordance with IS 6489 (Part-1).

7.1.4 Tensile Strength – Tensile Strength of woven fabric Mass: 230 ± 5% shall be 770 N (minimum) for Warp and 450 N (minimum) for weft when tested in accordance with IS 1969 (Part-1).

Bursting strength of knitted fabric of GSM 150 ± 5% shall be minimum 240 KPa.

7.1.5 Flame Retardency – Outer fabric and fabric for neck protection/ collar shall pass the requirements when tested for Flame Retardance by Surface ignition and Edge ignition in accordance with Procedure A and Procedure B of IS 15758 (Part-4) respectively.

Requirements for Surface Ignition

a) No specimen shall give hole formation.

b) No specimen shall give flaming to the top or either side edge.

c) No specimen shall melt or give flaming or molten debris.

d) The mean value of after-flame time shall be ≤ 2 s.

e) The mean value of after-glow time shall be ≤ 2 s.

Requirements for Edge Ignition:

a) No specimen shall give flaming to the top or either side edge.

b) No specimen shall melt or give flaming or molten debris.

c) The mean value of after – flame time shall be ≤ 2 s.

d) The mean value of after – glow time shall be ≤ 2 s.

7.1.6 Flame Retardancy after washing – Both fabrics shall be washed for 30 washes in accordance with IS 15370 and shall be tested for Flame Retardancy as per clause 7.1.5 and meet the requirements as mentioned in clause 7.1.5.

7.1.7 Bacterial Filtration Efficiency – Inner Fabric shall have Bacterial Filtration Efficiency.

7.1.8 Resistance to Chemicals – Outer fabric and neck fabric shall be resistant to chemical when tested in accordance with IS 15758 (Part-3)2007 for

- 10 percent hydrochloric acid solution.
- 10 percent sulfuric acid solution.
- Kerosene, petrol, diesel and Molotov cocktail liquid.

When tested in accordance to IS 15758 (Part-3), the penetration index shall be ≤ 1 and Repellency Index shall be ≥ 95%.

7.2 Thread – Fire retardant sewing thread should be used.

7.3 Protector Shield – Plastic/ Composites/ Metal/ any other suitable material.

7.4 Full Body protector shall withstand stab and impact requirements given at Para 9.1 Table-1 when tested in accordance with the corresponding test methods prescribed in VPAM KDIW 2004: 18/05/2011.

7.5 Protective & Comfort Padding – Padding may be made of suitable material in single layer or made in combination of layers of foam, rubber, plastic or any other suitable material.

08. Construction

8.1 Number of stitches – Stitches shall be made of double thread. A minimum of 04 stitches per 2.5 cm shall be applied for all components of Full Body Protector and stitching to be provided in 'V' grooves. All the plastic must have dull or mate finishing.

8.2 Construction of Pads – Single or multilayer.

8.2.1 Multilayer of pads shall be inter- switchable together so as to remain in place and shall not slip. Outer side of pads shall be covered with outer fabric which is flame retardant. Inner side of pads (wearer side) shall be covered with inner fabric which is sweat absorbing and resistant to microbes.

8.2.3 Material coming into contact with the wearer's skin shall not be the type known to cause skin irritation or disease, and shall not undergo significant loss of strength, flexibility, or other physical change as a result of contact with perspiration or body oil.

8.2.4 Any material used in the construction of body protector shall not be adversely affected by ordinary household soap and water, mild household detergent, or cleaners.

09. Mechanical Properties

9.1 Full Body Protector shall meet the requirements give below in Table 1 when tested in accordance with VPAM KDIW 2004 Edition 18/05/2011.

Table - 1

Requirements of Mechanical Properties for Chest Protector and Back Protector

Sl. No.	Requirement	Strike energy/ Joules	Angle of Incidence (degrees)	Permitted value, mm	Reference Clause/ Annex/ IS
1	Stab Resistance	65	90 25	<20(Penetration depth)	VPAM KDIW 2004:18/05/2011 Class K-3 Section - 5
2	Impact Resistance	100	90	<20(Deformation depth)	VPAM KDIW 2004:18/05/2011 Class W-5 Section - 8

9.2 **Flame Retardancy** – Full Body Protector shall meet the requirements when tested in accordance with IS 15758 (Part 4) for Surface ignition and Edge ignition and shall meet requirements as mentioned in para 7.1.5. and 7.1.6.

9.3 **Resistance to chemicals** – Full Body Protector shall be resistant to chemicals when tested in accordance with IS- 15758(Part-3) 2007 and shall meet requirements as mentioned in para 7.1.8.

9.4 **Temperature** – Full Body Protector should be able to with stand when exposed to temperature of -20°C for 05 hours and 55° C ($\pm$ 2° C) for 05 hours separately. There should not be any deformation or cracks after the exposure.

10. Ergonomic Requirements

10.1 All the components of Full Body Protector shall be flexible for optimum movement, fit comfortable and suitable to female body parts shape. Body protector shall be designed for maximum wearing comfort and easy maneuverability.

10.2 Upper Arm Protector Shield shall be flexible for easy to wear. Elbow Protector Shield shall be attached with forearm Protector Shield.

10.3 Groin Protection Padding must be segmented and shall be attached to Chest protector Shield. The protection attachment shall cover groin area from the anticipated projectiles and shall be comfortable when sitting.

10.4 Thigh guard & pelvic guard shall be attached and flexible & easy to wear/ movement. It must be supported by kamarbandh to avoid slippage while running and during movement.

10.5 Side straps used for wearing/ tightening Chest Protector & Back Protector should be perforated for air flow. Further perforation should be fixed with eyelets to ensure durability of equipment.

11. Hook & Loop Fasteners

11.1 The components of the fasteners for securing attachments to the Full Body Protector shall not reduce the degree of protection afforded to the wearer by the protective padding or cushioning material of the Full Body Protector.

11.2 Hook and Loop fasteners (Velcro) shall be adjustable, durable and shall be attached to elastic strips.

11.3 Hook and Loop Fasteners shall withstand to 300 cycles of opening and closure operations.

11.4 Shear strength of Hook & Loop Fasteners: Minimum- Lengthwise – 750, Widthwise – 750 as per Annex-E of IS 8156: 1994

11.5 Endurance test of hook and loop fasteners (after 5000 cycles of closing and opening operations). The shear strength shall not decrease by more than 10% of their original value as per Annexure -G of IS 8156: 1994

डॉ॰ राजीव वार्ष्णेय
वैज्ञानिक 'जी' एवं
सह-निदेशक

Dr. Rajeev Varshney
Scientist 'G'
Associate Director

सत्यमेव जयते

स्वच्छ भारत
एक कदम स्वच्छता की ओर

भारत सरकार, रक्षा मंत्रालय
रक्षा अनुसंधान तथा विकास संगठन
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Government of India, Ministry of Defence
Defence Research & Development Organisation
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Lucknow Road, Delhi - 110 054

3343
26/7/19

दिनांक/Dated 23rd July, 2019

Ref No: DIPAS/TMD/TECH (Prod)/336

Subject: Joint Initiative for Full Body Protector for Female troopers

Dear Madame,

Ref: Product launch ceremony held at CRRF Headquarters, New Delhi on 19th July, 2019

1. The DIPAS, DRDO fraternity extends sincere thanks for organizing a great event towards the launching of FBP for female troops. We also appreciate the continued support for the induction of the FBP in CRPF.
2. Following the successful unveiling of Full Body Protector for females at CRPF HQs, DIPAS, DRDO has successfully transferred the technology to the following six firms on 19th July, 2019 :
   a) M/s Ajit Technoplast Pvt.Ltd.,104/430,P Road, Kanpur-208012, Uttar Pradesh, India
   b) M/s Netplast Pvt.Ltd. 2& 4 Uptron Estate, Panki, Kanpur-208022
   c) M/s Applied Systems 128, Shanti Industrial Estate, SN Road, Mulund, Mumbai-400080
   d) M/s Bhagwan Associates Gala No.117 Udyog Kshetra, Mulund Goregaon Link Road Mumbai-400080
   e) M/s Frontier Protective Wear Pvt. Ltd., 2/2A Ho Chin Minh Sarani, Kolkata-700071
   f) M/s Novex Industries 1724/125 Shanti Nagar, Tri Nagar, Delhi-110035
3. This is for your kind information and perusal.

with regards.

Rajeev Varshney

IG (Prov)
CRPF, CGO Complex
New Delhi

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IG RAF
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सहायक निदेशक (संपरण/लेखा)
AD (Prov. / Accts.)
कार्यालय अधीक्षक (संपरण) 26/7
OS (Prov.)
संबंधित सहायक
DA
प्राप्ति की तिथि
Date of Receipt

mtg for female IG (Prov).

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