

ITEM SPECIFICATION ITM CD :2101614067

ITEM CODE :-	2101614067	submit
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ITM CODE	DETAILED SPECIFICATION
2101614067	CLOTH COTTON POLYESTER LYCRA BLEND(80/18/2)220-235GSM WITH IAF DIGITAL PRINT-150CM WIDTH EXCLUDING SELVEDGES SPECIFICATION: As per Appendix - E of IAFS 09149 (Overall Ground Crew): 2025(May)
04	METRE

IAFS 09149 (Overall Ground Crew) : 2025 (May)

{This IAFS is inclusive of IAFS 01068 (FABRIC Field Dress - Jacket, Trousers & Cap): 2025 (Mar); which defines/governs the Tech Specs for the fabric (i.e BDU Fabric) to be used in stitching of 'Jacket Field Dress' & 'Trousers Field Dress'. Same fabric (i.e BDU Fabric) is to be used in stitching of Overall Ground Crew also}



Appendix 'E'

(Refers to Clause 5.1, 6.2 , 6.3, 11.1 & 11.3)

REQUIREMENTS FOR FABRIC

Note: In Appendix E, following notations are used for the various colours of the fabric

- (a) Colour 1 - For the 'DYED' colour of the 'fabric base'
- (b) Colour 2 - For the Colour of the 'Darker PRINT' of the fabric
- (c) Colour 3 - For the Colour of the 'Lighter PRINT' of the fabric

Wherever Colour 1, Colour 2 & Colour 3 is stated, the colour as per above mentioned notation should be construed against the respective colour

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**REQUIREMENTS FOR FABRIC**

PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
Blend Composition of the Fabric	PCL (Polyester, Cotton, Elastane) (i) Cotton : 80 % approx. (but cannot be less than 78%) (ii) Elastane : 2 % maximum (but cannot be less than 1.2 %) (iii) Polyester: 18 % approx. (but cannot be less than 16 %)	IS/A ATC C	IS 3416 (Part 1) : 1988 (based upon dry mass) (RA 2017) & FTIR OR AATCC 20/20A: 2021 + End point traceability documents i.r.o Elastane (dual core) would be required to be submitted during grant of BPC and during BPI for scrutiny by the O/o CQAO at HQ MC
Type of yarns to be used (i) Warp (ii) Weft	(a) <u>Warp</u> : (Only single type of yarn is to be used in warp direction) 2 ply Spun Yarn of Polyester Cotton blend (b) <u>Weft</u> : (Two different types of	--	Visually by NABL Lab (FTIR) + End point traceability documents i.r.o Elastane (dual core) would be

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
	yarns are to be used in weft direction) (i) 2 ply Spun Yarn of Polyester Cotton blend & (ii) 1 ply Elastomeric Dual Core Spun yarn of Polyester (0.9 D & 38 mm Fibre Staple length), Cotton and Elastane (i.e which should be dual core as per Appendix 'B' of this Tech Specs) blend		required to be submitted during grant of BPC and during BPI for scrutiny by the O/o CQAO at HQ MC
'Number of plies' and approximate value of 'Nominal Count' of 'Yarns' (to be used in weaving,) :- (a) Warp direction of the fabric (b) Weft direction of the fabric <i>(To be checked after removal of the yarn from finished fabric sample, during which minute variations from the specified count of yarn, would be admissible, subject to acceptance by the O/o CQAO based upon the recommendations of the NABL Lab)</i>	(a) <u>Warp</u> : 32s / 2 i.e 2 ply Spun Yarn of Polyester Cotton blend (i.e effective nominal count is 16 NeC) (b) <u>Weft</u> : (i) 32s / 2 i.e 2 ply Spun Yarn of Polyester Cotton blend (i.e effective nominal count is 16 NeC) &	IS	IS 3442 : 2023 Amdt No.1 (RA 2018) & FTIR + End point traceability documents i.r.o Elastane (dual core) would be required to be submitted during grant of BPC and during BPI for scrutiny by the O/o CQAO at

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
	(ii) 17 ± 1 s / 1 i.e 1 ply Elastomeric Dual Core Spun yarn of Polyester (0.9 D & 38 mm Fibre Staple length), Cotton and Elastane (i.e which should be dual core as per Appendix 'B' of this Tech Specs) blend (i.e effective nominal count is 17 ± 1 NeC)		HQ MC
Approximate value of 'Twist' of the yarns (to be used in weaving) :- (i) Warp direction of the fabric (ii) Weft direction of the fabric {To be checked after taking out the yarn from the weaved & finished fabric} { Note : Though values of this parameters are to be mandatorily tested and reported along with Technical Bids, these will not be used for evaluation}	(a) <u>For Warp Yarn (i.e for 32s / 2 ; 2 ply Spun Yarn of Polyester Cotton blend):</u> 21 twists/inch in 'Z' direction for 'Single' ply of the Yarn and 17 twists/inch in 'S' direction for 2 plies i.e finished yarn (b) <u>For Weft Yarns:</u> (i) <u>For 32s / 2 yarn ; i.e. 2 ply Spun Yarn of Polyester Cotton blend</u>	IS/ ISO	IS 832: 2021 (Part-1) / ISO 2061 : 2015 (* Approx. values for guidance only during development phase till sample is frozen for Bulk production)

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
	21 twists/inch in 'Z' direction for 'Single' ply of the Yarn and 17 twists/inch in 'S' direction for 2 plies i.e finished yarn (ii) For 17 ± 1 s / 1 yarn i.e 1 ply <u>Elastomeric Dual</u> <u>Core Spun yarn of</u> <u>Polyester, Cotton</u> <u>Elastane blend</u> 17 twists/inch in in 'S' direction for 'Single' Yarn i.e finished yarn		
Thread count of the fabric per dm (i) Warp direction (Ends/dm) (ii) Weft direction (Picks/dm) (Note : Only minor variations from the specified thread count per dm, would be admissible, subject to acceptance by the O/o CQAO based upon the recommendations of the NABL Lab)	(i) Warp (Ends / dm) : 390 (Min.) (ii) Weft (Picks /dm) : 180 (Min.)	IS	IS1963 : 1981 (RA 2023)

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
Mass of the fabric per unit area (i.e. in GSM or g/m ²)	(220 – 235) g/m ²	IS	IS 1964: 2001 (RA 2017)
Width in cm (usable width, excluding selvedge)	146 cm (Min.)	IS	IS1954 : 1990 (RA 2021)
Type of Weave & self design pattern	1up 1down Plain Weave with Rip Stop making equal sized squares with size of the each single square being 5 mm X 5 mm (approx. with a tolerance of ± 0.5 mm of each side of the square) . Note: The dimensions of the squares should be uniform along the entire fabric in a particular lot	SP	SP 45:1988 (Handbook on glossary of textile terms issued by BIS)
Tensile (Breaking) Strength of the Fabric: (i) Warp way direction (ii) Weft way direction (To be checked with 'Gauge length' i.e. distance between two effective clamping points of a testing device as 20 cm and size of testing strip being 5 cm X 35 cm)	(i) Warp (Ends / dm) : 1140 N / 50 mm (Min.) (ii) Weft (Picks /dm) : 415 N / 50 mm (Min.)	IS/ ISO	IS 1969 (Part-1) : 2018 RA 2023) { tested with 5.0 cm X 20 cm test piece of the fabric between grips of the vice } / ISO 13934-1 : 2013

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
% Elongation of the fabric at break	(i) Warp : 10 % (Min.) (ii) Weft: 25 % (Min.)	IS	IS 1969 (Part-1) : 2018 (RA 2023) { tested with 5.0 cm X 20 cm test piece of the fabric between grips of the vice }
Tearing Strength of fabric	(i) Warp : 60 N (Min.) (ii) Weft: 38 N (Min.)	IS/ ISO	IS 6489 (Part-1) : 2011 (Elmendorf method) / ISO 13937-1 : 2000
Abrasion resistance	- No thread break should be observed till 40000 cycles - Colour change (as per Grey Scale) (a) 3-4 or better for base colour of the fabric (b) 2 or better (as per Grey Scale) for both printed colours of the fabric	IS	12673 (Part 2): 2014

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
Pilling resistance / Pilling rate of the fabric (after 18000 revolutions as well as after 5 hours of test)	Average rating of 4-5 or better	IS	IS 10971, Part -1: 2011 (RA 2022)
Fuzziness	Average rating of 4 or better	IS	IS 10971, Part-1: 2011 (RA 2022)
Fabric's Colour fastness to light (Blue Wool rating)	(a) Colour (dyed colour) of the Base Fabric (Colour 1) : 5 or better (b) Dark Print of the Base Fabric (Colour 2) : 5 or better (c) Light Print of the Base Fabric (Colour 3) : 5 or better	IS/ ISO	IS 2454 : 1985 (RA 2017) / ISO 105 B 02 : 2014
Fabric's Colour fastness to washing (after FIVE repeated washing / drying cycles at 38 °C to 44 °C)	<u>Base Fabric (Colour 1)</u> (a) Change in Shade : 4-5 or better (b) Staining on (i) Acetate : 4-5 (ii) Cotton : 4-5 (iii) Nylon : 4-5 (iv) Polyester : 4-5 (v) Acrylic: 4-5	IS/ ISO	IS/ISO 105 C 10 : 2006 Test A1 (RA 2021), (after FIVE repeated washing / drying cycles at 38 °C to 44 °C) Gray Scale rating

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
	(vi) Wool : 4-5 (More than 4-5 is acceptable) <u>Dark Print of the Base Fabric</u> (Colour 2) (a) Change in Shade : 4 (b) Staining on (i) Acetate : 4-5 (ii) Cotton : 4-5 (iii) Nylon : 4-5 (iv) Polyester : 4-5 (v) Acrylic: 4-5 (vi) Wool : 4-5 (More than 4-5 is acceptable) <u>Light Print of the Base Fabric</u> (Colour 3) (a) Change in Shade : 3-4 (b) Staining on (i) Acetate : 4-5 (ii) Cotton : 4-5 (iii) Nylon : 4 (iv) Polyester : 4-5 (v) Acrylic: 4-5 (vi) Wool : 4-5 (More than 4-5 is acceptable)		

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
Fabric's Colour fastness to dry cleaning	<u>Base Fabric (Colour 1)</u> (a) Change in Shade : 4-5 or better (b) Staining on (i) Acetate : 4-5 (ii) Cotton : 4-5 (iii) Nylon : 4-5 (iv) Polyester : 4-5 (v) Acrylic: 4-5 (vi) Wool : 4-5 (More than 4-5 is acceptable)	IS	IS 4802 : 1988 (RA 2016) Grey Scale Rating
	<u>Print of the Base Fabric (Colour 2)</u> (a) Change in Shade : 4 or better (b) Staining on (i) Acetate : 4-5 (ii) Cotton : 4-5 (iii) Nylon : 4-5 (iv) Polyester : 4-5 (v) Acrylic: 4-5 (vi) Wool : 4-5 (More than 4-5 is acceptable)		
	<u>Print of the Base Fabric (Colour 3)</u> (a) Change		

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		STD	STD NO
	in Shade : 4 or better (b) Staining on (i) Acetate : 4-5 (ii) Cotton : 4-5 (iii) Nylon : 4-5 (iv) Polyester : 4-5 (v) Acrylic: 4-5 (vi) Wool : 4-5 (More than 4-5 is acceptable)		
Fabric's Colour fastness to perspiration (to be checked both in ALKALINE & ACIDIC simulated conditions)	<u>ACIDIC</u> <u>Base Fabric (Colour 1)</u> (a) Change in Shade : 4-5 or better (b) Staining on (i) Acetate : 4-5 (ii) Cotton : 4-5 (iii) Nylon : 4-5 (iv) Polyester : 4-5 (v) Acrylic: 4-5 (vi) Wool : 4-5 (More than 4-5 is acceptable) <u>Print of the Base Fabric (Colour 2)</u> (a) Change in Shade : 4 or better	ISO	ISO 105 E 04 : 2008 (RA 2019) Grey Scale Rating (Note : This standard has replaced IS 971 : 1983)

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
	(b) Staining on (i) Acetate : 4 (ii) Cotton : 4 (iii) Nylon : 4 (iv) Polyester : 4 (v) Acrylic: 4 (vi) Wool : 4 (More than 4-5 is acceptable) <u>Print of the Base Fabric(Colour 3)</u> (a) Change in Shade : 4 or better (b) Staining on (i) Acetate : 4 (ii) Cotton : 4 (iii) Nylon : 4 (iv) Polyester : 4 (v) Acrylic: 4 (vi) Wool : 4 (More than 4-5 is acceptable)		
Fabric's Colour fastness to perspiration (to be checked both in <i>ALKALINE & ACIDIC</i> simulated conditions)	<u>ALKALINE</u> <u>Base Fabric (Colour 1)</u> (a) Change in Shade : 4-5 or better (b) Staining on (i) Acetate : 4-5 (ii) Cotton : 4-5 (iii) Nylon : 4-5 (iv) Polyester : 4-5	ISO	ISO 105 E 04 : 2008 (RA 2019) Grey Scale Rating (Note : This standard has replaced IS 971 : 1983)

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		STD	STD NO
	(v) Acrylic: 4-5 (vi) Wool : 4-5 (More than 4-5 is acceptable) <u>Print of the Base Fabric (Colour 2)</u> (a) Change in Shade : 4 or better (b) Staining on (i) Acetate : 4 (ii) Cotton : 4 (iii) Nylon : 4 (iv) Polyester : 4 (v) Acrylic: 4 (vi) Wool : 4 (More than 4-5 is acceptable) <u>Print of the Base Fabric (Colour 3)</u> (a) Change in Shade : 4 or better (b) Staining on (i) Acetate : 4 (ii) Cotton : 4 (iii) Nylon : 4 (iv) Polyester : 4 (v) Acrylic: 4 (vi) Wool : 4 (More than 4-5 is acceptable)		

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
Fabric's Colour fastness to perspiration & light (both to be checked simultaneously) in ACIDIC & ALKALINE simulated conditions	<u>ACIDIC</u>	ISO	ISO 105 B 07 : 2009 After 40 hrs of exposure
	<u>Base Fabric (Colour 1)</u>		
	(a) Change in Shade : 4-5 or better		
	<u>Print of the Base Fabric (Colour 2)</u>		
	(a) Change in Shade : 4-5 or better		
	<u>Print of the Base Fabric (Colour 3)</u>		
	(a) Change in Shade : 4-5 or better	ISO	ISO 105 B 07 : 2009 After 40 hrs of exposure
	<u>ALKALINE</u>		
	<u>Base Fabric (Colour 1)</u>		
	(a) Change in Shade : 4-5 or better		
	<u>Print of the Base Fabric</u>		

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
	(Colour 2) (a) Change in Shade : 4-5 or better <u>Print of the Base Fabric</u> (Colour 3) (a) Change in Shade : 4-5 or better		
Fabric's Colour fastness to bleaching	<u>Base Fabric</u> (Colour 1) 4-5 or better <u>Print of the Base Fabric</u> (Colour 2) 4 or better <u>Print of the Base Fabric</u> (Colour 3) 3-4 or better	ISO	ISO 105 N 01 : 1993
Fabric's Colour fastness to hot pressing at 210° C ± 2°C, maintaining a pressure of 4 ± 1 kPa (a) Immediately	<u>IMMEDIATELY</u> <u>(COLOUR 1)</u> (a) Change in Colour of Base Fabric	IS/ ISO	ISO 105 X11: 1994 (RA 2020) (Note: This standard has replaced IS

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
(b) After conditioning of all three test specimens for 4 hours	(i) After Dry pressing for 15 s : 4-5 or better		689: 1988)
	(ii) After Damp pressing for 15 s : 4-5 or better		
	(iii) After Wet pressing for 15 s : 4 or better		
	(b) <u>Staining on the cotton (adjacent) white fabric after dry / damp / wet pressing for 15 seconds:</u> 4-5 /4-5/4-5 or better		
	<u>(COLOUR 2)</u>		
	<u>(c) Change in colour of the print of the Base Fabric</u>		
	(i) After Dry pressing for 15 s : 4-5 or better		
	(ii) After Damp pressing for 15 s : 4-5 or better		
	(iii) After Wet pressing for 15 s : 4 or better		
	<u>(d) Staining on the cotton (adjacent) white fabric after</u>		

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		STD	STD NO
	<u>dry / damp / wet pressing for 15 seconds:</u> 4-5 /4-5/4-5 or better <u>(COLOUR 3)</u> <u>(e) Change in colour of the print of the Base Fabric</u> (i) After Dry pressing for 15 s : 4-5 or better (ii) After Damp pressing for 15 s : 4-5 or better (iii) After Wet pressing for 15 s : 4 or better <u>(f) Staining on the cotton (adjacent) white fabric after dry / damp / wet pressing for 15 seconds:</u> 4-5 /4-5/4-5 or better <u>AFTER CONDITIONING OF ALL THREE TEST SPECIMENS FOR 4 HOURS</u> <u>(COLOUR 1)</u>		

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
	<u>(a) Change in Colour of Base Fabric</u> (i) After Dry pressing for 15 s : 4-5 or better (ii) After Damp pressing for 15 s : 4-5 or better (iii) After Wet pressing for 15 s : 4 or better <u>(b) Staining on the cotton (adjacent) white fabric after dry / damp / wet pressing for 15 seconds:</u> 4-5 /4-5/4-5 or better <u>(COLOUR 2)</u> <u>(c) Change in colour of the print of the Base Fabric</u> (i) After Dry pressing for 15 s : 4-5 or better (ii) After Damp pressing for 15 s : 4-5 or better (iii) After Wet pressing for 15 s : 4 or better		

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		STD	STD NO
	<u>(d) Staining on the cotton (adjacent) white fabric after dry / damp / wet pressing for 15 seconds:</u> 4-5 /4-5/4-5 or better <u>(COLOUR 3)</u> <u>(e) Change in colour of the print of the Base Fabric</u> (i) After Dry pressing for 15 s : 4-5 or better (ii) After Damp pressing for 15 s : 4-5 or better (iii) After Wet pressing for 15 s : 4 or better <u>(f) Staining on the cotton (adjacent) white fabric after dry / damp / wet pressing for 15 seconds:</u> 4-5 /4-5/4-5 or better		
Fabric's Colour fastness to rubbing	<u>Print of the Base Fabric(Colour 1)</u>	IS/ ISO	IS 766 : 1988 / ISO 105

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
	(i) Dry : 4-5 or better (ii) Wet : 4-5 or better <u>Print of the Base Fabric(Colour 2)</u> (i) Dry : 4-5 or better (ii) Wet : 4-5 or better <u>Print of the Base Fabric(Colour 3)</u> (i) Dry : 4-5 or better (ii) Wet : 4-5 or better		X12 : 2016 Grey Scale Rating
Fabric's Dimensional Change / stability (i.e Relaxation residual shrinkage / expansion) upon SOAKING in water (along with Wetting agent) for 3 hours and flat drying; as per the procedure mentioned in the specified test method; in (i) Warp direction (ii) Weft direction	(i) Warpwise : ± 1 % (i.e Max. Range is 1% inclusive of Shrinkage + Expansion) (ii) Weftwise : ± 1% (i.e Max. Range is 1% inclusive of Shrinkage + Expansion)	IS	IS 2977 :1989 (RA 2020) (Note: This is to be checked after SINGLE soaking & drying cycle only)

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
Fabric's Dimensional Change / stability (i.e Relaxation residual shrinkage / expansion) to repeated Domestic LAUNDRY i.e repeated washing & drying (i) Warp direction (ii) Weft direction (Note: This is to be checked after TEN repeated home laundering cycles i.e washing & drying)	(i) Warpwise : ± 3 % (i.e Max. Range is 3% inclusive of Shrinkage + Expansion) (ii) Weftwise : ± 3 % (i.e Max. Range is 3 % inclusive of Shrinkage + Expansion)	IS	IS 15370 : 2020 (at $41 \pm 3^{\circ}\text{C}$, using Type B washer) for domestic washing & drying (i.e domestic laundry) and IS 2977 :1989 (RA 2020) for calculation of the percentage shrinkage /expansion (Note: This is to be checked after TEN repeated home laundering cycles i.e washing & drying)
Fabric's Dimensional stability to Dry Heat , when tested for contact with heated plane metal plate at $150^{\circ} \pm 2^{\circ}\text{C}$, $180^{\circ} \pm 2^{\circ}\text{C}$ and $210^{\circ} \pm 2^{\circ}\text{C}$ (i) Warp direction (ii) Weft direction	(i) Warp : ± 1.0 % (i.e Max. Range is 1% inclusive of Shrinkage + Expansion) (ii) Weft : ± 1.0 % (i.e Max.	IS	IS 12170 : 1987 (RA 2020)

IAFS 09149 (Overall Ground Crew) : 2025 (May)

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
	Range is 1% inclusive of Shrinkage + Expansion)		
pH value of the aqueous extract of the Fabric (using Hot method)	5.0 – 9.0	IS/ISO	IS 1390 : 2022 (Hot method) / ISO 3071: 2020
Percentage (by mass) of Water soluble matter in the fabric	1% by mass (Max)	IS	IS 3456 : 2022
Scouring Loss	1% by mass (Max)	IS	IS 1383:2023 Mild method
Air permeability of fabric at a pressure differential of 100 Pa	3.75 cc/sec/cm ² (Min.)	IS	IS 11056 : 2013 at a pressure differential of 100 Pa
Moisture vapour transmission of fabric	2100 g/m ² /day (Min.)	ASTM	ASTM E-96:2023 (Water method), RH: 50 ± 2% , Temp. : 32 ± 3° C, Upright method, Air velocity 0.02-0.30 m/sec)

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
Crease Recovery angle of the fabric (<i>INITIALLY</i> without washing) in both Wet and Dry State w.r.t mechanical loading	<u>Dry State</u> Total (Warp + Weft): 140° (Min.) <u>Wet State</u> (iii) Total (Warp + Weft): 140° (Min.)	IS	IS 4681 : 1981 (RA 2023)
Crease Recovery angle of the fabric (after <i>THREE REPEATED</i> washings) in both Wet and Dry State w.r.t mechanical loading	<u>Dry State</u> Total (Warp + Weft): 110° (Min.) <u>Wet State</u> (iii) Total (Warp + Weft): 120° (Min.)	IS	IS 4681 : 1981 (RA 2023)
Smoothness of Seams (SS grading) i.e Degree of lack of puckering in a seamed specimen of the fabric after being subjected to home laundering (washing and drying to be simulated as per procedure given in AATCC 88B and checking / comparison of the visual impression of the planarity of the seamed specimen with Seam Pucker Scale)	Replica rating of SS-4 or better	AATCC	AATCC 88 B -2018t (Average grading of 05 different test specimens is to be taken, when each specimen has been subjected to five consecutive washing / drying cycles at 38° - 44° C. Average of 15

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
			<i>reading grades i.e. 03 readings per specimen is to be considered)</i>
Retention of 'Pressed –in-Crease' (CR grading) i.e Degree of absence of sharp folds /lines running in any direction in washed/dried fabric specimen after being subjected to home laundering <i>(washing and drying to be simulated as per procedure given in AATCC 88C and checking / comparison of the visual impression of the planarity of the laundered specimen with Replicas provided in the Standard)</i>	Replica rating of CR-2.5 or better	AATCC	AATCC 88 C -2018t <i>(Average grading of 05 different test specimens is to be taken, when each specimen has been subjected to five consecutive washing/ drying cycles at 38° - 44° C. Average of 15 reading grades i.e. 03 readings per specimen is to be considered)</i>

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
Smoothness Appearance (SA grading or DP i.e Durable press Rating) i.e visual impression of planarity of the flat fabric specimen after repeated home laundering (washing and drying to be simulated as per procedure given in AATCC 124 and checking / comparison of the visual impression of the planarity of the laundered specimen with Replicas provided in the Standard)	Replica rating of SA-4 or better (i.e DP rating should be 4 or above)	AATCC	AATCC - 124 (Average grading of 05 different test specimens is to be taken, when each specimen has been subjected to five consecutive washing/ drying cycles at 38° - 44° C. Average of 15 reading grades i.e. 03 readings per specimen is to be considered)
Drape* Coefficient of fabric (measurement of annular area of draped fabric as percentage of the annular area of the undraped fabric using Drape meter) (*Drape is the ability of the fabric to fall under its own weight into wavy folds of different nature. Soft fabric drapes closer to the body forming ripples whereas stiff fabric drapes away from the body. Thus stiffness is one of the factors which affect the	Average of Face & Back : 80 % (Max.) 60 % (Min.) (averaged after testing at-least 05 test specimens , making a total of 10 measurements)	IS	IS 8357 : 1977

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
<i>drape coefficient.)</i> <i>(Note : Any variations from the specified drape coefficient, would be admissible, subject to acceptance by the O/o CQAO based upon the recommendations of the NABL Lab)</i>			
Wrinkle Recovery of Fabric <i>(by inducing wrinkles in fabric specimen Under 3.5 kg mass for 20 minutes)</i>	- Replica rating of WR 2.5 or better (as observed by comparing with standard replicas after 5 minutes of free suspension of the wrinkled fabric specimen without load) - Replica rating of WR 3.0 or better (as observed by comparing with standard replicas after 24 hours of free suspension of the wrinkled fabric specimen without load)	AATCC	AATCC TM 128 -2018 e2 (Replica rating)
Mono-directional (i.e. either warp / weft) Stiffness* by Cantilever Test i.e checking the bending length 'c' (The values would also indicate how well the fabric would drape and	(a) Warpwise: 35 ± 15 mm i.e the bending length 'c' should be more than 20 mm and	ASTM	ASTM D 1388 : 2018 Option A (Cantilever Test & Tensile testing)

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
whether it would drape closer to the body or away from the body) { Note : Though values of this parameters are to be mandatorily tested and reported along with Technical Bids, these will not be used for evaluation}	less than 50 mm (correspondingly the overhang length 'O' should be more than 40 mm and less than 100 mm i.e twice the bending length range) (b) Weftwise : 30 ± 15 mm i.e the overhang length 'c' should be more than 15 mm and less than 45 mm (correspondingly the overhang length 'O' should be more than 30 mm and less than 90 mm i.e twice the bending length range)		Note: Average of 08 readings for bending length 'c' ; as noticed during Lab testing; each in Warp & Weft Directions; with 04 test specimens for each direction are to be taken
Glaze and Fading property (property to withstand frequent abrasive launderings at $100^{\circ} F \pm 5^{\circ} F$) after 10 (TEN) washing cycles – Accelerated laundering test	<u>Base Fabric (Colour 1)</u> Change in colour: 4-5 or better <u>Print of the Base Fabric (Colour 2)</u> Change in colour: 4	AAT CC / ISO	AATCC 61- Method 2A (as per ASTM F 1506) / ISO 105 - C06:2010 (Grey Scale Rating after 10 washing cycles)

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
	or better <u>Print of the Base Fabric</u> <u>(Colour 3)</u> Change in colour: 3-4 or better (After 05 th wash)		
Initial - Anti bacterial (microbial) activity Value after incubation period of 18 - 24 hrs (To tested with absorption method . The washing is to be carried out as per procedure 5 A and reference detergent specified in 4.1.2 of IS 15370:2005 and followed by drying as per 8.5 of IS 15370)	<u>Initial</u> (a) <i>Staphylococcus aureus</i> Strain no. ATCC 6358 (Gram Positive Bacteria) - <u>3.0 (minimum)</u> (b) <i>Klebsiella pneumoniae</i> aureus Strain no. ATCC 4352 (Gram Negative Bacteria) - <u>3.0 (minimum)</u>	ISO	ISO 20743 : 2021
After 30 washes - Anti bacterial (microbial) activity Value after incubation period of 18 - 24 hrs (To tested with absorption method . The washing is to be carried out as per procedure 5 A and reference detergent specified in 4.1.2 of IS 15370:2005 and followed by drying as per 8.5 of IS 15370)	<u>After 30 washes</u> (a) <i>Staphylococcus aureus</i> Strain no. ATCC 6358 (Gram Positive Bacteria) - <u>3.0 (minimum)</u> (iii) <i>Klebsiella</i>	ISO	ISO 20743 : 2021 Washing as per IS 15370:2020 at 40 degree Celcius



PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
(Gram Positive Bacteria) (b) <i>Klebsiella pneumoniae aureus</i> Strain no. ATCC 4352 (Gram Negative Bacteria)	<i>pneumoniase aureus</i> Strain no. ATCC 4352 (Gram Negative Bacteria) – <u>3.0</u> <u>(minimum)</u>		
Oily soil stain release efficiency after home laundering (after creating the stain on the fabric by using Maize corn oil as per IS 4055 , under weight of 2.26 kg for 55s-65s seconds, and washing thereafter as per procedure 5A and reference detergent specified in 4.1.2of is15370 and followed by drying as per 8.5 of IS 15370)	(a) Initial – Replica rating of (i) 4.5 or better for the base fabric (i.e colour 1) (ii) 4.5 or better colour 2 (iii) 4.5 or better colour 3 (b) After 10 washings – Replica rating of (i) 4.0 or better	AATCC	AATCC TM 130-2018t 130 (by comparison with standard replicas) & Annexure C of IS 15853 : 2009 & IS 4055 (for Maize Corn Oil) – Replica rating

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
	for the base fabric (i.e colour 1) (ii) 4.5 or better for colour 2 (iii) 4.5 or better for colour 3		
Type of Dye for the FABRIC BASE (i.e. whether Filament Dope dyed/ Fibre dyed/ Yarn dyed/ Fabric dyed) (a) For Polyester part (b) For Cotton Part	(a) <u>For POLYESTER Part</u> <i>Dope (Solution) dyeing at the time of polyester filament extrusion stage</i> OR <i>Disperse dyeing of the Polyester fibres</i> OR <i>Disperse dyeing of the polyester part of the yarn</i> OR <i>Disperse dyeing of the polyester part of the fabric</i> <i>i.e even FABRIC dyeing is allowed</i>	---	Note : The 'quality of the dye' and the 'process quality control' during dyeing will be evaluated by checking the compliance with the achievement of permissible values of Delta E and all colour fastness related properties' enumerated

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
	<u>Note</u> : However, irrespective of the method employed in dyeing, the DEFINED COLOUR and ALL COLOUR FASTNESS as well as OTHER RELATED PROPERTIES; as enumerated in this Appendix 'E'; SHOULD BE achieved within SPECIFIED LIMITS. <u>(b) For COTTON Part</u> Vat dyeing dyeing of the Cotton fibres OR Vat dyeing of the cotton part of the yarn OR Vat dyeing of the cotton part of the fabric. i.e even FABRIC dyeing is allowed <u>Note</u> : However, irrespective of the		below in this Appendix 'E'

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
	<i>method employed in dyeing, the DEFINED COLOUR and ALL COLOUR FASTNESS as well as OTHER RELATED PROPERTIES; as enumerated in this Appendix 'E'; SHOULD BE achieved within SPECIFIED LIMITS.</i>		
Nature of Dye (Dope /Disperse/ Vat / Acid Reactive) used for (a) DYEING of the Fabric Base and (i.e for Colour-1) (b) PRINTING of the digital pattern (i.e for Colour-2 & Colour-3)	<u>(a) DYEING of the fabric BASE</u> <u>(i) For Polyester Part</u> DOPE (SOLUTION) dyeing at the time of filament extrusion stage of polyester OR DISPERSE dyeing at fibre / yarn / fabric stages <u>(ii) For Cotton Part</u>	---	IS 4472-Part I, II & III : 2021 (Note : The 'quality of the dye' and the 'process quality control' during dyeing /printing will also be evaluated by checking the compliance with the achievement of permissible values of Delta E and all colour fastness related properties' enumerated

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
	VAT Dyeing at fibre/ yarn / fabric stages (b) <u>PRINTING of the fabric</u> - VAT printing only <u>Note</u> : The DEFINED COLOUR and ALL COLOUR FASTNESS as well as OTHER RELATED PROPERTIES; as enumerated in this Appendix 'E'; SHOULD BE achieved within SPECIFIED LIMITS post dyeing / printing.		<i>below in this Appendix 'E')</i>
COLOURS of the fabric BASE as well as the PRINTED PATTERN (a) Of the fabric BASE (DYED)	(a) COLOUR 1 (DYED) <u>(as per X,Y,Z, L,C,h°, a,b values mentioned below)</u>	AATCC	AATCC 173 : 2009 (Test Method for Calculation of Small Colour Differences for Acceptability) and AATCC EP6-2016e

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
(b) Of the DARKER SHADE print of the fabric (PRINTED)	(b) COLOUR 2 (PRINTED) <u>(as per X,Y,Z, L,C,h°, a,b values mentioned below)</u>		(Evaluation Procedure for Instrumental Colour measurement)
(c) Of the LIGHTER SHADE print of the fabric (PRINTED)	(c) COLOUR 3 (PRINTED) <u>(as per X,Y,Z, L,C,h°, a,b values mentioned below)</u>		
(* <u>Note</u> : - Matching / Variation in Colour will be checked at BPC as well as Bulk Production inspection stages only and will not be applicable at Technical Evaluation Stage . - For details refer Clauses 11.1, 11.2, 11.3, 11.4, 11.5 & 11.6 of the Main Body of this IAFS)		<u>Note:</u> The variation in Colours i.e Delta E cmc at BPC / BPI Lot evaluation stage shall not exceed the permissible limits mentioned below in this table	

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PROPERTY		REQUIRED VALUE			TEST METHOD	
					STD	STD NO
CIE Lab L C h° coordinates of COLOUR-1, COLOUR-2 COLOUR-3		For Fabric BASE (Dyed) COLOUR 1	For Darker Print COLOUR 2	For Lighter Print COLOUR 3	AATCC AATCC EP6-2016e (Evaluation Procedure for Instrumental Colour measurement) (Note 1: For measuring of the L C h° , X Y Z and L a b values , only single layer of the fabric against black background (of the instrument cover for the aperture) are to be used. The values	
	L	75.59	41.21	49.61		
	C	8.74	2.32	1.84		
	h°	66.61	102.92	89.42		
Tristimulus Values X Y Z of COLOUR-1, COLOUR-2 COLOUR-3		For Fabric BASE (Dyed) COLOUR 1	For Darker Print COLOUR 2	For Lighter Print COLOUR 3		
	X	47.92	11.30	17.16		
	Y	49.23	11.99	18.09		
	Z	45.18	12.01	18.49		
CIE Lab (Star) L a b coordinates of COLOUR-1, COLOUR-2 COLOUR-3		For Fabric BASE (Dyed) COLOUR 1	For Darker Print COLOUR 2	For Lighter Print COLOUR 3		
	L	75.59	41.21	49.61		
	a	3.47	- 0.52	0.02		
	b	8.02	2.26	1.83		
Tolerance		2:1				

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
Illuminant	D 65		obtained thereafter are then to be used for calculation of the Delta E_{cmc}
Standard Observer	10 Degree		
Geometry of the Spectrophotometer	Diffuse / 0 type, where the actual viewing angle is 8°.		
Number layers of the fabric to be used during colour measurement	Single against black background (of the instrument cover window for masking the aperture)		Note 2: The geometry of the spectrophotometer to be used during measurement should be diffuse / 0 type with Illuminant as D65 and Tolerance as 2 :1, where the actual viewing angle is 8° . The measurement made on other geometrics will likely produce different spectral results.

IAFS 09149 (Overall Ground Crew) : 2025 (May)

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
			Note 3: At-least 10 readings shall be taken for each of the three colours ; spread across at-least 1m² area of the fabric sample. The final value will be treated as the average of the 10 readings.)
Delta E_{cmc} i.e Permissible variation in colour of the fabric, APPLICABLE for ALL THREE of the following (a) Colour of the fabric BASE i.e COLOUR-1	<u>Permissible value of Delta E_{cmc}</u> (a) Delta E_{cmc} ≤ 1.0 for COLOUR-1 (and it should be visually acceptable to the Inspection Agency also)	AATCC	AATCC 173 : 2009 (Test Method for Calculation of Small Colour Differences for Acceptability) and AATCC EP6-2016e (Evaluation Procedure for Instrumental Colour

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
(b) Colour of the DARKER SHADE print of the fabric i.e COLOUR-2	(b) Delta $E_{cmc} \leq 2.3$ for COLOUR-2 (and it should be visually acceptable to the Inspection Agency also)		measurement)
(c) Colour of the LIGHTER SHADE print of the fabric i.e COLOUR-3	(c) Delta $E_{cmc} \leq 2.3$ for COLOUR-3 (and it should be visually acceptable to the Inspection Agency also)		(<u>Note 1</u> : For measuring of the $L^* a^* b^*$, $X^* Y^* Z^*$ and $L^* a^* b^*$ values , only single layer of the fabric against black background (of the instrument cover for the aperture) are to be used. The values obtained thereafter are then to be used for calculation of the Delta E_{cmc}
(<u>Note</u> : - Variation in Colour will be checked at BPC as well as Bulk Production inspection stages only and will not be applicable at Technical Evaluation Stage . - <u>For details refer Clauses 11.1,11.2,11.3, 11.4, 11.5 & 11.6 of the Main Body of this IAFS)</u>			<u>Note 2</u> : The geometry of the spectrophotometer to be used for this test should be diffuse / 0 type with

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
			Illuminant as D65 and Tolerance as 2 :1, where the actual viewing angle is 8°. The measurement made on other geometrics will likely produce different spectral results. Hence while reporting the test results by the lab, the 'instrument geometry type' that was used to measure the specimen(s) must also be mentioned in the test report. <u>Note 3:</u> At-least 10 readings

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
			shall be taken for each of the three colours ; spread uniformly across at-least 1m² area of the fabric sample. All these 10 readings for each colour needs to be reported in the lab report . The final value will be treated as the average of the 10 readings.)
Digital pixelated Print pattern / design	The repeat pattern of the 'pixelated digital print PATTERN print ' should be in exact conformity with the photograph given in Appendix 'D' . The Tag Image File Format (TIFF) OR	--	As approved the O/o CQAO during BPC stage and during Bulk Production Lot Stage

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PROPERTY	REQUIRED VALUE	TEST METHOD	
		STD	STD NO
	the representing sample can also be obtained (on returnable basis) from 93 AHSP at HQ MC; post award of contract; to ensure exact replication of the digital pixelated print pattern <i>(Note :This should be referred as a representing sample; that too for the digital pixelated print pattern only and not (R) not to be treated as the master sample for the colour though).</i>		