

ITEM SPECIFICATION ITM CD :2101614071

ITEM CODE :-	2101614071	submit
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ITM CODE	DETAILED SPECIFICATION
2101614071	CLOTH POLYESTER,COTTON,LYCRA BLEND (40/55/5)SINGLE JERSY PANTONE SHADE NO.18-4005 TCX (STEEL GREY) 185-205 GSM ANTI MICROBIAL FINISH - 160CM WIDTH As per Appendix E of IAF : 01003(BDU T-Shirt Half Sleeve) 2024(MAY)
37	KILOGRAM



Appendix 'E'
(Refers to Clause 6.2)

RAW MATERIAL (FABRIC , SEWING THREAD) & BROAD STITCHING/HEMMING/BAR TACKING REQUIREMENTS FOR BDU T-SHIRT (HALF SLEEVES)

PROPERTY / PARAMETER	REQUIRED VALUE	TEST METHOD	
		GOV STD	STD NO
<u>REQUIREMENTS FOR THE BASE FABRIC (To be used in both the sleeves and the main body of the BDU T Shirt)</u>			
Blend Composition of the Fabric	PCL (Polyester, Cotton, Lycra) (i) Cotton : 55% (minimum) (ii) Lycra : 5 % (maximum) but cannot be less than 3 % (iii) Polyester : Remaining % (but not exceeding 42 %)	IS/ AAT CC	IS 3416 (Part 1) : 1988 (based upon dry mass) (RA 2017) , and IS 667 : 1981 or AATCC 20 : 2011, AATCC 20 A : 2012
Type of finish on the fabric	Antimicrobial	AAT CC	AATCC - TM100
Type of yarns to be used while knitting of the fabric (i) Course wise (ii) Wales wise	(i) <u>Course wise</u> : PCL blend <i>Elastomeric Core Spun yarn</i> (ii) <u>Wales wise</u> : PCL blend <i>Elastomeric Core Spun yarn</i> ** <u>Note 1</u> : Yarn made of only Super Combed Cotton OR Compact cotton (as well as Polyester; since polyester being a part of the blend too) , with Very High Tenacity, post removal of short fibres after double combing, ensuring minimal hairiness and negligible tendency to pilling and fuzziness should be used (Average Cotton Fibre length of minimum 5 cm and		Visual for (i) & (ii) / End point traceability documents during Bulk Production Lot Inspection stage for Note-1



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	Polyester Staple Fibre length of 6.5 cm is recommended to be maintained during yarn manufacturing)		
Approximate value of ‘Nominal Count’ of Yarns (i.e Yarn size to be used in knitting of the fabric):- (i) Course direction of the fabric (ii) Wales direction of the fabric {To be checked from the yarn; taken out from the finished garment i.e BDU T Shirt}	(i) <u>Course wise</u> : 28 _s / 1 Ne + 20 D to 30 _s / 1 Ne + 20 D of Elastomeric Core Spun Yarn of PCL blend (ii) <u>Wales wise</u> : 28 _s / 1 Ne + 20 D to 30 _s / 1 Ne + 20 D of Elastomeric Core Spun Yarn of PCL blend	IS	IS 3442: 2023 Amdt No.1 (RA 2018) & End point traceability documents during Bulk Production Lot Inspection stage (Refer Note1 in the Row above)
Approximate value of ‘Twist’ of the yarns (to be used in knitting) of fabric: - (i) Course direction of the fabric (ii) Wales direction of the fabric { <u>Note</u> : Though, the Lab testing values of this parameter are also mandatory to be submitted along with Technical Bids, however, this will not be considered for evaluation}	(i) <u>Course wise</u> : 700 twists/m (in ‘Z’ direction for ‘Single’ Yarn) (ii) <u>Wales wise</u> : 700 twists/m (in ‘Z’ direction for ‘Single’ Yarn) (<u>Note</u> : These values are for illustration of the format only, and is to be disregarded. The actually observed values in the yarn used in the fabric used in garmenting the T-Shirt are to be reported)	IS/ ISO	IS 832: 2021 (Part-1) / ISO 2061 : 2015

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		GOV STD	STD NO
<u>REQUIREMENTS FOR THE BASE FABRIC (To be used in both the sleeves and the main body of the BDU T Shirt)</u>			
Type of knit (to be used while knitting of fabric) (i) Main classification (<i>Warp or Weft Knit</i>) (ii) Sub classification	(i) Main classification : Weft Knit (ii) Sub classification: Single Jersey knit (<i>however, it should be extremely closely knit, with high knit stitch density</i>)		SP 45:1988 (Handbook on glossary of terms issued by BIS)
Size of each loop (i.e Loop / Stitch length) in the knitted fabric <i>{Note: Though, the Lab testing values / Manufacturer's authenticated values of this parameter are also mandatory to be submitted along with Technical Bids, however, this will not be considered for evaluation}</i>	2.5 mm (Maximum) at 1300 turns/m <i>(Note: This value is for illustration of the format only, and is to be disregarded. The actually observed value in the fabric used in the T Shirt is to be reported)</i>		To be furnished by the NABL Lab
Type of stitch (used while knitting the fabric)	Single Jersey Knit stitch (<i>Interlock stitch is not required</i>)		To be furnished by the NABL Lab
Thread count (Knit Stitch density of the loops) of the fabric per dm (i) Course direction (<i>Courses / dm</i>) (ii) Wales direction (<i>Wales/dm</i>) <i>{Note: Though, the Lab testing values of this parameter are also mandatory to be submitted along with Technical Bids, however, this will not be considered for evaluation}</i>	(i) Courses / dm : 270 (Min.) (ii) Wales /dm : 200 (Min.) <i>(Note: These values are for illustration of the format only, and are to be disregarded and not to be treated even for guidance. The actually observed values of the fabric used in the T-Shirt are to be reported)</i>	IS	IS1963 : 1981 (RA 2023)

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<u>REQUIREMENTS FOR THE BASE FABRIC (To be used in both the sleeves and the main body of the BDU T Shirt)</u>			
Mass of the fabric per unit area (i.e. in GSM or g/m ²)	185 g/m ² - 205 g/m ²	IS	IS 1964: 2001 (RA 2017)
Usable width in cm of the fabric (Note : <i>*This is for guidance only. To be considered for evaluation, in case only fabric is being procured)</i>	160 cm (Min.)*	ISO/ IS	ISO 22198:2006 IS 1954:1990
Bursting Strength of the Fabric	550 kN/m ² (Min)	ISO / AST M	ISO : 2960 / ASTM D 3786 / ASTM
Abrasion resistance* of the fabric { <u>*Note:</u> Though, the Lab testing values of this parameter are also mandatory to be submitted along with Technical Bids, however, this will not be considered for evaluation}	- No thread break should be observed after 35000 cycles * (Actual number of cycles at which the thread broke needs to be reported) - Colour change during abrasion should be 4 or better (as per Grey Scale)*	IS	12673 (Part 2): 2022
Pilling resistance / Pilling rate of the fabric (tumble pilling for 2 hours) using tumble type pilling tester	Average rating of 4-5 or better	IS	IS 10971: 2011 (RA 2022) OR ASTM D 3512
Pilling resistance / Pilling rate of the fabric (after 5000 revolutions as well as after 2 hours of test) using Martindale tester	Average rating of 3.5 or better	ISO	ISO 12945-2:2020

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<u>REQUIREMENTS FOR THE BASE FABRIC (To be used in both the sleeves and the main body of the BDU T Shirt)</u>			
Fuzziness rating of the fabric	Average rating of 4 or better	IS	IS 10971: 2011 (RA 2022)
Fabric's Colour fastness to light (Blue Wool rating)	5 or better	IS/ISO	IS 2454 : 1985 IS/ISO 105 B 02 : 2014
Fabric's Colour fastness to washing (after 5 repeated washing / drying cycles at 38 °C to 44 °C)	(a) Change in Shade : 4-5 (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	IS/ISO	IS/ISO 105 C 10 : 2006 Test A1 (RA 2021)
Fabric's Colour fastness to perspiration (to be checked both in acidic and alkaline simulated conditions)	<u>ACIDIC</u> (a) Change in Shade : 4-5 (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 <u>ALKALINE</u> (a) Change in Shade : 4-5 (b) Staining on (i)Acetate : 4-5 (ii) Cotton : 4-5 (iii) Nylon : 4-5	ISO	ISO 105 E 04 : 2008 (RA 2019) (Note : This standard has replaced IS 971 : 1983)



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	(iv) Polyester : 4-5 (v) Acrylic: 4-5 (vi) Wool : 4-5		
Fabric's Colour fastness to perspiration & light (both to be checked simultaneously)	4	ISO	ISO 105 B 07 : 2009
Fabric's Colour fastness to rubbing	(i) Dry : 4-5 (ii) Wet :4-5	IS/ ISO	IS 766 : 1988 / ISO 105 X12 : 2016
Fabric's Colour fastness to hot pressing at 110° C ± 2°C, maintaining a pressure of 4 ± 1 kPa	(i) Immediately after Dry pressing for 15 s : 4 (ii) Immediately after Damp pressing for 15 s : 4 (iii) Immediately after Wet pressing for 15 s : 4 (iv) After conditioning of all three test specimens for 4 hours: 4 (v) Staining on the cotton (adjacent) fabric: 4	IS/ ISO	(RA 2009) / ISO 105 X11: 1994 (Note: This standard has replaced IS 689: 1988)
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) Course direction (ii) Wales direction (Note: This is to be checked after	<u>In case checked with the garmented T-Shirt (in which the fabric has been pre-treated / washed before garmenting to cater for the dimensional variation)</u> (i) Lengthwise : ± 3.0 % (i.e Max. Range is 3% inclusive of Shrinkage + Expansion) (ii) Widthwise :	IS	IS 2977 :1989 (RA 2020)



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<u>REQUIREMENTS FOR THE BASE FABRIC (To be used in both the sleeves and the main body of the BDU T Shirt)</u>			
single soaking & drying cycle only)	± 3.0 % (i.e Max. Range is 3 % inclusive of Shrinkage + Expansion) <u>In case checked with the fabric used in the garmented T-Shirt</u> (i) Course : ± 5.0 % (i.e Max. Range is 5% inclusive of Shrinkage + Expansion) (ii) Wales : ± 5.0 % (i.e Max. Range is 5 % inclusive of Shrinkage + Expansion)		
Fabric's Fabric's Dimensional Change / stability (i.e Relaxation residual shrinkage / expansion) to repeated Domestic LAUNDRY i.e repeated washing & drying (i) Course direction (ii) Wales direction (Note: This is to be checked after five repeated home laundering cycles i.e washing & drying)	<u>In case checked with the garmented T-Shirt (in which the fabric has been pre-treated / washed before garmenting to cater for the dimensional variation)</u> (i) Lengthwise : ± 3.0 % (i.e Max. Range is 3% inclusive of Shrinkage + Expansion) (ii) Widthwise : ± 3.0 % (i.e Max. Range is 3 % inclusive of Shrinkage + Expansion) <u>In case checked with the fabric used in the garmented T-Shirt</u>	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



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	(i) Course : ± 5.0 % (i.e Max. Range is 5% inclusive of Shrinkage + Expansion) (ii) Wales : ± 5.0 % (i.e Max. Range is 5 % inclusive of Shrinkage + Expansion)		/expansion OR AATCC 150
Initial Bowness and skewness in the woven fabric (in the initial , original unlaundered state) (<u>Note:</u> The manufacturer is to provide 2 m X 1.6 m i.e two metres of running length of the fabric , from the fabric roll, for this test along with a stitched garment, during stitching of which the fabric from the roll was not washed / treated to)	Fabric Skewness in unwashed state: 2.5% (max.)	AST M	ASTM D 3882:2008 (2020) , in case the fabric roll is used for testing OR ASTM D7811-13 (2017) using Bow Skew Tool with open slots (in case the garmented fabric is to be used for testing)
Dimensional stability w.r.t Spirality i.e change in skewness from the initial skew (due to skew movement / torqueing in the garment) after home laundering (after 03 laundering cycles) of the T-shirt as per ISO 6330-5A at 40 ° C followed by flat drying	Fabric skewness (Spirality) after 3rd laundering cycle : 3.0 % (max.)	AAT CC	AATCC-179:2004) OR IS/ISO 16322-1: 2005 (washing as per

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<u>REQUIREMENTS FOR THE BASE FABRIC (To be used in both the sleeves and the main body of the BDU T Shirt)</u>			
			ISO 6330-5A at 40 ° C followed by flat dry) AATCC TM 179 -2023
Stretch and recovery	15 % stretch (minimum) 90% recovery after 30 minutes	AST M	ASTM D 2594 (knitted fabric)
Fabric’s Dimensional stability to Dry Heat, when tested for contact with heated plane metal plate at 120° ± 2° C (i) Course direction (ii) Wales direction	(i) Course : ± 1.5 % (i.e Max. Range is 1.5% inclusive of Shrinkage + Expansion) (ii) Wales : ± 1.5 % (i.e Max. Range is 1.5% inclusive of Shrinkage + Expansion)	IS	IS 12170 : 1987 (RA 2020)
pH value of the aqueous extract of the Fabric (using Hot method)	5.0 – 7.5	IS/ ISO	IS 1390 : 1983 (RA 2009) / ISO 3071: 2020
Percentage (by mass) of Water soluble matter in the fabric	1% by mass (Max)	IS	IS 3456 : 1966
Air permeability of the fabric { <u>Note</u> : Though, the Lab testing values of this parameter are also mandatory to be submitted along with Technical Bids, however, this will not be considered for evaluation}	25 cc/sec/cm² (Min.)	IS	IS 11056 :2013



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Moisture vapour transmission of fabric (Water vapour permeability) { <u>Note</u> : Though, the Lab testing values of this parameter are also mandatory to be submitted along with Technical Bids, however, this will not be considered for evaluation}	2200 g/m ² /day (Min.)	AST M	ASTM E-96 (Water method), RH: 50 ± 2% and Temp. : 32 ± 3° C
Glaze and Fading property (property to withstand frequent abrasive launderings at 100° F ± 5° F) after 05 washing cycles – Accelerated laundering test	3 - 4 or better (After 05 th wash)	AAT CC / ISO	AATCC 61- Method 2A (as per ASTM F 1506) / ISO 105 - C06:2010
Initial - Anti bacterial (microbial) activity Value after incubation period of 18 - 24 hrs (To tested with <i>absorption method</i> . 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) (a) <i>Staphylococcus aureus</i> Strain no. ATCC 6358 (Gram Positive Bacteria) (b) <i>Klebsiella pneumoniae aureus</i> Strain no. ATCC 4352 (Gram Negative Bacteria)	<u>Initial</u> (a) <i>Staphylococcus aureus</i> Strain no. ATCC 6358 (Gram Positive Bacteria) - <u>3.0 (minimum)</u> (b) <i>Klebsiella pneumoniae aureus</i> Strain no. ATCC 4352 (Gram Negative Bacteria) - <u>3.0 (minimum)</u>	ISO	20743 : 2021
After 30 washes - Anti bacterial (microbial) activity Value after incubation period of 18 - 24 hrs (To tested with <i>absorption method</i> .	<u>After 30 washes</u> (a) <i>Staphylococcus aureus</i>	ISO	20743 : 2021



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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) (a) Staphylococcus aureus Strain no. ATCC 6358 (Gram Positive Bacteria) (b) Klebsiella pneumoniae aureus Strain no. ATCC 4352 (Gram Negative Bacteria)	Strain no. ATCC 6358 (Gram Positive Bacteria) - <u>2.0 (minimum)</u> (b) Klebsiella pneumoniae aureus Strain no. ATCC 4352 (Gram Negative Bacteria) – <u>2.0 (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) {Note: Though, the Lab testing values of this parameter are also mandatory to be submitted along with Technical Bids, however, this will not be considered for evaluation}	(a) Initial (after staining the fabric with corn oil)..... Observed grading – to be reported (b) After 10 washings Observed grading- to be reported	AAT CC	AATCC TM 130-2018t 130 (by comparison with standard replicas) & Annexure C of IS 15853 : 2009 & IS 4055 (for Maize Corn Oil)
Absorbency (a) Initial (in original fabric without laundering) (b) After 05 washes {Note: Though, the Lab testing	(a) Initial : Observed values are to be reported	AAT CC	AATCC TM 79



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<i>values of this parameter are also mandatory to be submitted along with Technical Bids, however, this will not be considered for evaluation}</i>	(b) After 05 washes : Observed values are to be reported		
Vertical wicking (a) Initial (in original fabric without laundering) (b) After 05 washes	(a) Initial : Must wick 10 cm in 30 minutes (b) After 05 washes : Must wick 10 cm in 30 minutes	AAT CC	AATCC TM 197
Horizontal wicking (a) Initial (in original fabric without laundering) (b) After 05 washes	(a) Initial : Must wick 10 cm in 30 minutes (b) After 05 washes : Must wick 10 cm in 30 minutes	AAT CC	AATCC TM 198
Antistatic properties (a) Electrostatic clinging (b)Electric surface resistivity { <u>Note</u> : Though, the Lab testing values of this parameter are also mandatory to be submitted along with Technical Bids, however, this will not be considered for evaluation}	(a) Electrostatic clinging: Observed values are to be reported (b) Electric surface resistivity: Observed values are to be reported	AAT CC	AATCC TM 115 & AATCC TM 76



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Type of Dye (Filament Dope/ Fiber/ Yarn/ Fabric) (* 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 below in this Appendix ‘E’)	(a) <u>For Polyester Part</u> Dope (Solution) dyeing at the time of FILAMENT extrusion stage OR Disperse dyeing of the POLYESTER FIBRES , provided the defined colour with MELANGE effect and ALL COLOUR FASTNESS as well as OTHER RELATED PROPERTIES as enumerated in this Appendix ‘E’ are achieved within SPECIFIED LIMITS. (b) <u>For Cotton Part</u> Vatdyeing OR Acid Reactive dyeing of the COTTON FIBRES, provided the defined colour with MELANGE effect and ALL COLOUR FASTNESS as well as OTHER RELATED PROPERTIES as enumerated in this Appendix ‘E’ are achieved within SPECIFIED LIMITS.	---	---
Nature of Dye (* 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 below in this	(a) <u>For Polyester Part</u> DOPE (SOLUTION) DYEING at the time of filament extrusion stage OR DISPERSE DYEING of fibres (b) <u>For Cotton Part</u> VAT OR ACID REACTIVE DYEING of fibres	---	IS 4472-Part I, II & III : 2021



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Appendix ‘E’)			
Colour of the fabric (* Note : - 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, 11.3 & 11.4 of the Main Body of this IAFS)	* PANTONE 18-4005 TCX (Steel Grey) with MELANGE effect Note: The variation in Colour i.e Delta E cmc at BPC / BPI Lot evaluation stage will be checked by comparing the LCH values observed in the Lab during testing of the fabric sample submitted by the firm with the reference values given below (which is applicable in case Methodology-II is adopted by the firm) OR with the reference values decided during Phase-1 of BPC (which is applicable in case Methodology-I is adopted by the firm)	AATCC	AATCC 173 : 2009 & AATCC Evaluation Procedure 7:2009



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CIE Lab L C h° coordinates	L: 47.91	AAT CC	AATCC 173 : 2009 & AATCC Evaluation Procedure 7:2009 (To be measured with single layer of fabric with white background)
	C: 1.84		
	h°: 64.75		
Tristimulus Values	X: 15.993		
X Y Z	Y: 16.725		
	Z: 17.146		
CIE Lab (Star) L a b coordinates	L: 47.91		
	a: 0.78		
	b: 1.66		
Tolerance	2:1		
Illuminant	D 65		
Standard Observer	10 Degree		
Delta E _{cmc} (Permissible variation in colour of the Fabric) <i>(when compared with Colour Spectrum coordinate / tri-stimulus values obtained with actual fabric, with Illuminant as D65, Standard Observer as</i>	≤ 1.0 * ; that too within the same quadrant <i>(Delta E_{cmc} ≤ 1.0, would be applicable, If Methodology –I is adopted by the firm)</i> ≤ 1.2 * ; that too within the same quadrant	AAT CC	AATCC 173 : 2009 & AATCC Evaluation Procedure 7:2009



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10 Degrees and Tolerance as 2 :1. Note 1: For measuring of the L C h° , X Y Z and L a b values , single layer of the fabric against white background (of the instrument cover) are to be used. The values obtained thereafter are then to be used for calculation of the Delta E_{cmc}) (* Note 2 : - 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, 11.3 & 11.4 of the Main Body of this IAFS)</u>	(Delta $E_{cmc} \leq 1.2$, would be applicable, If Methodology –II is adopted by the firm) *Note 3: The variation in Colour i.e Delta E_{cmc} at BPC / BPI Lot evaluation stage will be checked by comparing the LCH values observed in the Lab during testing of the fabric sample submitted by the firm with the reference values given above for PANTONE 18-4005 TCX (Steel Grey) with MELANGE effect (which is applicable in case Methodology-II is adopted by the firm) OR with the reference values decided during Phase-1 of BPC (which is applicable in case Methodology-I is adopted by the firm)		