# TEST REPORT

**Report No.: 66.430.24.0307.01**

**Dated: 2024-03-07**

中国认可
国际互认
检测
TESTING
CNAS L7038

| | |
|---|---|
| Applicant: | Gamilon (shandong) import and Export Co., Ltd |
| Address: | 2118, floor 21, east bank time solo, Southeast of the intersection of Nanjing East Road and Binbe. East Road, Hedong District, Linyi City, Shandong Province |
| Contact Person: | Zhang qinglun |
| Sample Submitted: | The sample(s) was (were) submitted by applicant and identified:<br>A. Four pieces of high visibility Yellow vests (the whole garment) |
| Sample Description: | Reflective vest |
| Colour: | Yellow + Silver |
| Manufactory: | Gamilon (shandong) import and Export Co., Ltd |
| Country of Origin: | Linyi |
| Care Label Provided: |  |
| Receipt Date of Sample: | 2024-02-27 |
| Date of Testing: | 2024-02-28 to 2024-03-04 |
| Test Result(s): | Refer to the Section 3 and 4 |

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## 1. Test Sample Photo(s)

Sample A

Front

Back

## 2. Identification of The Test Subject

| Sample | Description | Remark |
|---|---|---|
| 001 | Fluorescent Yellow knitted fabric (body) | Finshed Product (A) |
| 002 | Silver retroreflective tape (body) | Finshed Product (A) |

## 3. Conclusion

| No. | Test Parameter(s) | Conclusion |
|---|---|---|
| 1. | Design - Ergonomics | Pass |
| 2. | Design - Apparel Configuration | Pass |
| 3. | Construction Requirement | Pass |
| 4. | Criteria for Optional Features and Testing | Pass |
| 5. | Background and Combined-Performance Materials Prior to Exposure Tests | Pass |
| 6. | Background Material – Colorfastness to Crocking | Pass |
| 7. | Background Material – Colorfastness to Perspiration | Pass |
| 8. | Background Material – Colorfastness to Domestic Laundry | Pass |
| 9. | Background Material – Colorfastness to Hot-pressing | Pass |
| 10. | Background Material – Colorfastness to Water | Pass |
| 11. | Dimensional Change of Background Material | Pass |
| 12. | Mechanical Properties of Background Materials - Bursting Strength | Pass |
| 13. | Retroreflective Performance Requirements Prior to Test Exposure | Pass |
| 14. | Retroreflective Performance after Abrasion | Pass |
| 15. | Retroreflective Performance after Flexing | Pass |
| 16. | Retroreflective Performance after Folding at Cold Temperatures | Pass |
| 17. | Retroreflective Performance after Temperature Variation | Pass |
| 18. | Retroreflective Performance after Washing | Pass |
| 19. | Retroreflective Performance after Wet Performance | Pass |
| 20. | Types and Classes | Class 1 |
| 21. | Specific Design Requirements for Garments Covering Only the Torso | Pass |
| 22. | Size Designation | Pass |
| 23. | Colour Performance of New Material | Pass |
| 24. | Colour Fastness to Rubbing | Pass |
| 25. | Colour Fastness to Perspiration | Pass |
| 26. | Colour Fastness to Laundry | Pass |
| 27. | Colour Fastness to Hot Pressing | Pass |
| 28. | Dimensional Change | Pass |
| 29. | Bursting Strength of Knitted Materials | Pass |
| 30. | Retroreflective Performance of Separate Performance Retroreflective Material | Pass |
| 31. | Retroreflective Performance after Test Exposure for Separate Performance Retroreflective Material | Pass |

Notes: Pass = Meet Requirement
Fail = Below Requirement
# = No Comment
- = Did Not Perform
N/A = Not Applicable

Remark: (1) Samples are tested as received

Disclaimer Measurement Uncertainty:
Unless otherwise agreed upon, Pass or Fail verdicts are given based on the measured values without any considerations of measurement uncertainties. Please note, every test method has a measurement uncertainty which has been evaluated by the laboratory according to ISO/IEC 17025 requirements. By taking measurement uncertainties into account it might happen that measured values can neither be assessed as Pass nor as Fail.

TÜV SÜD Certification and Testing (China) Co., Ltd. Xiamen Branch

Approved by:

Damon Zheng
Softlines Department

## 4. Test Result(s)

### 4.1 Design - Ergonomics (ANSI/ISEA 107-2020 Clause 6.1)

| Sample | Results | Requirement | Conclusion |
|---|---|---|---|
| A | Yes | The materials and components of the garment should not be known to affect the wearer adversely. | Pass |
| | Yes | Parts of the garment that come into contact with the end user should be free of roughness, sharp edges and projections that could cause irritation or injuries. | Pass |
| | Yes | The garment should be designed for correct fit and positioning on the user and should be designed to ensure that it remains in place for the expected period of use, anticipating environmental factors as well as movements the wearer could adopt during the course of work. | Pass |

### 4.2 Design - Apparel Configuration (ANSI/ISEA 107-2020 Clause 6.2)

| Sample | Item | Garment Type | Performance Class | Material | Results | Requirement | Conclusion |
|---|---|---|---|---|---|---|---|
| A | General | Type R | Class 2 | Background material | 0.447 $m^2$ | * | Pass |
| | | | | Retroreflective or Combined-Performance Materials | 0.188 $m^2$ | | Pass |
| | | | | Minimum Width of Retroreflective Material | 50 mm | | Pass |

Remark: *=

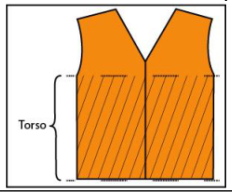
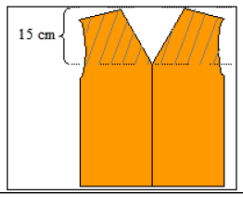
| Garment Type | Performance Class | Background Material | Retroreflective or Combined-Performance Materials | Minimum Width of Retroreflective Material |
|---|---|---|---|---|
| Type O | Class 1 | 0.14 $m^2$ | 0.10 $m^2$ | 25 mm |
| Type R | Class 2 | 0.35 $m^2$ (For smallest size), 0.50 $m^2$ | 0.13 $m^2$ | 25 mm#, 35 mm |
| | Class 3 | 0.65 $m^2$ (For smallest size), 0.80 $m^2$ | 0.20 $m^2$ | 25 mm#, 50 mm |
| Type P | Class 2 | 0.29 $m^2$ | 0.13 $m^2$ | 25 mm#, 50 mm |
| | Class 3 | 0.50 $m^2$ | 0.20 $m^2$ | 25 mm#, 50 mm |
| Supplemental Items | Class E | 0.30 $m^2$ | 0.07 $m^2$ | 25 mm#, 50 mm |

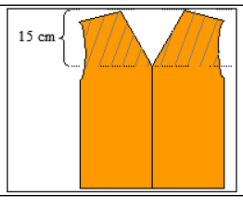
#: For use with split-trim designs

| Sample | HVSA Type | Results | Requirement | Conclusion |
|---|---|---|---|---|
| A | Type R Class 2 | Comply | Shall utilize at least one horizontal band of retroreflective or combined-performance material around the torso and shall include at least the minimum amounts of retroreflective or combined-performance material in the shoulder area if encircling bands are not present on sleeves. | Pass |

**4.3 Construction Requirement (ANSI/ISEA 107-2020 Clause 6.3)**

| Sample | Item | Parameters | Results | Requirement | Conclusion |
|---|---|---|---|---|---|
| A | Retroreflective and Combined-Performance Materials | Minimum Widths | Type R Class 2 Dimension: 50 mm | The width of the retroreflective or combined-performance materials incorporated into the HVSA shall not be less than the dimensions specified in the following table. | Pass |
| | | Split-trim designs | N/A | Retroreflective or combined-performance material may be utilized in a split-trim design. The split-trim design shall consist of two stripes of retroreflective or combined-performance material with minimum width of 25 mm (1 in.) that are positioned as a parallel pair on compliant fluorescent background material of the same or contrasting color, or on a non-compliant material of any color. The two paired stripes of retroreflective or combined-performance material shall not be separated by more than 50 mm (2 in.) | - |
| | | Spacing between Multiple Bands | Yes | Whenever multiple bands are placed on the HVSA, the minimum distance between bands of retroreflective or combined-performance material shall be at least equal to the width of the band. | Pass |
| | Placement of Retroreflective and Combined-Performance Materials | Distance from Bottom Edge of HVSA | 64 mm | Horizontal retroreflective or combined-performance materials shall be placed at least 50 mm (2 in.) above the bottom of the hem of the torso, long sleeve and long pant HVSA styles. | Pass |
| | | Encircling Arms and Legs | N/A | Horizontal retroreflective or combined-performance materials placed on arms or legs shall encircle them in such a manner to provide 360° visibility of the wearer at all viewing angles in a horizontal plane. | - |
| | | Long Sleeves | N/A | If upper bands of retroreflective or combined-performance materials are placed on long sleeves, the bands shall be placed between the elbow and the shoulder. Lower bands can be placed between the elbow and wrist but shall be at least 50 mm (2 in.) above the bottom of the sleeve. | - |
| | Gaps | | 20 mm | Gaps in retroreflective or combined-performance materials shall not be more than 50 mm (2 in.) horizontally to enable fastening or for seam allowance. | Pass |
| A | 360° Visibility | General | Yes | Retroreflective or combined-performance and background materials for all garment types and performance classes shall be positioned on items in such a way as to provide 360° visibility of the wearer at all viewing angles in a horizontal plane. | Pass |

| | | | | | |
|---|---|---|---|---|---|
| | | | 20 mm | A contiguous band of background or combined-performance material shall fully encircle the wearer. Retroreflective or combined-performance material that intersects this band shall be permitted. This band may be divided by other materials but the gap within the band shall not exceed 50 mm (2 in.). | |
| | | Performance Class 1 | N/A | This band shall fully encircle the torso and shall be a minimum of 25 mm (1 in.) wide. The torso is defined as the trunk of the body extending from the underarm to the hip area.   | - |
| | | Performance Class 2 | Fully encircle the torso. Type R Width: 50 mm. | This band shall fully encircle the torso and shall be a minimum of 35 mm (1.38 in.) wide for Type R and 50 mm (2 in.) wide for Type P. Additionally, a minimum of 150 cm² (23.3 in²) shall be present in the shoulder area for HVSA where encircling bands are not present on sleeves. Identification of the shoulder area as following.   | Pass |
| | | Performance Class 3 | N/A | This band shall fully encircle the torso and each arm and shall be a minimum of 50 mm (2 in.) wide. | - |
| | | Performance Class E | N/A | This band shall fully encircle each leg and shall be a minimum of 50 mm (2 in.) wide. | - |
| | Material Use and Balance of Design | | >40 % | Garments shall be balanced in design so that not less than 40% of the minimum required amount of retroreflective or combined-performance and background materials specified in following table is present on both the front and the back when laid flat. | Pass |
| A | Shoulder Area | | 282 $cm^2$ | HVSA without retroreflective or combined-performance material that encircles the arm shall have a minimum of 150 $cm^2$ (23.3 $in.^2$) of retroreflective material or combined-performance material in the shoulder area to provide 180° visibility of the wearer. | Pass |

| | | | | |
|---|---|---|---|---|
| | | |   | |

Remark: #: For use with split-trim designs
N/A = Not Applicable
*=

| Garment Type | Performance Class | Background Material | Retroreflective or Combined-Performance Materials | Minimum Width Retroreflective Material |
|---|---|---|---|---|
| Type O | Class 1 | 0.14 $m^2$ | 0.10 $m^2$ | 25 mm |
| Type R | Class 2 | 0.35 $m^2$ (For smallest size), 0.50 $m^2$ | 0.13 $m^2$ | 25 mm#, 35 mm |
| | Class 3 | 0.65 $m^2$ (For smallest size), 0.80 $m^2$ | 0.20 $m^2$ | 25 mm#, 50 mm |
| Type P | Class 2 | 0.29 $m^2$ | 0.13 $m^2$ | 25 mm#, 50 mm |
| | Class 3 | 0.50 $m^2$ | 0.20 $m^2$ | 25 mm#, 50 mm |
| Supplemental Items | Class E | 0.30 $m^2$ | 0.07 $m^2$ | 25 mm#, 50 mm |

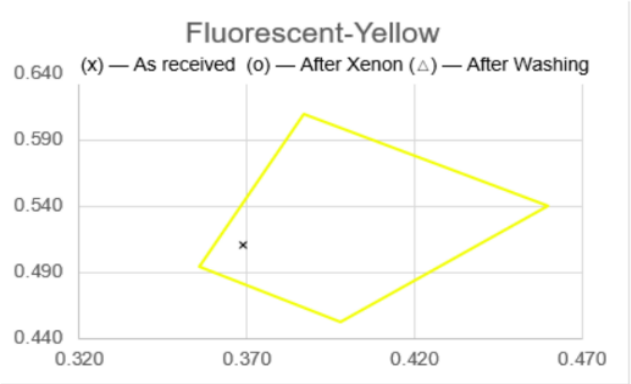
### 4.4 Criteria for Optional Features and Testing (ANSI/ISEA 107-2020 Clause 7)

| Sample | Item | Results | Requirement | Conclusion |
|---|---|---|---|---|
| A | Pockets | Gap: 0 mm | Pockets of matching or contrasting compliant high-visibility materials shall not create gaps in retroreflective or combined-performance material of more than 50 mm (2 in.) horizontally. | Pass |
| | Identification Panels, Lettering and Logos (Type R and P) | N/A | Identification panels, lettering and logos shall not create gaps in retroreflective or combined-performance material of more than 50 mm (2 in.) horizontally. | - |
| | | N/A | Identification panels, lettering and logos of contrasting non-compliant material shall not exceed a total of 465 $cm^2$ (72 $in^2$) on the front and/or rear of the HVSA and such total amount may contribute to the minimum amount of visible background material specified in Table 1. | - |

Remark: N/A = Not Applicable

### 4.5 Background and Combined-Performance Materials Prior to Exposure Tests (ANSI/ISEA 107-2020 Clause 8.1.1 & 10.2)

| Sample | Parameters | Results | Requirement | Conclusion |
|---|---|---|---|---|
| 001 | Chromaticity coordinates, x | 0.369 | * | Pass |
| | Chromaticity coordinates, y | 0.510 | | |
| | Total luminance factor, Y (%) | 0.76 | | |




Remark:

* =

| Colour | Chromaticity coordinates (x, y) | | Total luminance factor (Y) |
|---|---|---|---|
| Fluorescent yellow - green | 0.387 | 0.610 | ≥ 70% |
| | 0.356 | 0.494 | |
| | 0.398 | 0.452 | |
| | 0.460 | 0.540 | |
| Fluorescent orange - red | 0.610 | 0.390 | ≥ 40% |
| | 0.535 | 0.375 | |
| | 0.570 | 0.340 | |
| | 0.655 | 0.345 | |
| Fluorescent red | 0.655 | 0.345 | ≥ 25% |
| | 0.570 | 0.340 | |
| | 0.595 | 0.315 | |
| | 0.690 | 0.310 | |

### 4.6 Background Material – Colorfastness to Crocking (ANSI/ISEA 107-2020 Clause 8.2.1, AATCC TM8-2016)

| Sample | Parameters | Results (Grade) | Requirement | Conclusion |
|---|---|---|---|---|
| 001 | Dry | 4.5 | ≥ 3.0 Grade | Pass |
| | Wet | 4.5 | ≥ 3.0 Grade | Pass |

### 4.7 Background Material – Colorfastness to Perspiration (ANSI/ISEA 107-2020 Clause 8.2.2, AATCC TM15-2013)

| Sample | Parameters | | Results (Grade) | Requirement | Conclusion |
|---|---|---|---|---|---|
| 001 | Colour Change | | 4.5 | ≥ 4.0 Grade | Pass |
| | Colour Staining | Acetate | 4.5 | ≥ 3.0 Grade | |
| | | Cotton | 4.5 | | |
| | | Polyamide | 4.5 | | |
| | | Polyester | 4.5 | | |
| | | Acrylic | 4.5 | | |
| | | Wool | 4.5 | | |

### 4.8 Background Material – Colorfastness to Domestic Laundry (ANSI/ISEA 107-2020 Clause 8.2.3, AATCC TM61-2013)

| Sample | Parameters | | Results (Grade) | Requirement | Conclusion |
|---|---|---|---|---|---|
| 001 | Colour Change | | 4.5 | ≥ 4.5 Grade | Pass |
| | Colour Staining | Acetate | 4.5 | ≥ 3.0 Grade | |
| | | Cotton | 4.5 | | |
| | | Polyamide | 4.0 | | |
| | | Polyester | 4.5 | | |
| | | Acrylic | 4.5 | | |
| | | Wool | 4.5 | | |

Remark: Test No.: 2A; Machine wash at 105 °F with 0.15% '1993 AATCC standard reference detergent WOB' with 50 steel balls.

### 4.9 Background Material – Colorfastness to Hot-pressing (ANSI/ISEA 107-2020 Clause 8.2.3, AATCC TM133-2013)

Hotplate temperature: 110 °C

| Sample | Parameters | | Results (Grade) | Requirement | Conclusion |
|---|---|---|---|---|---|
| 001 | Immediately | Colour Change | 4.5 | ≥ 4.5 Grade | Pass |
| | After 4 hours | Colour Change | 4.5 | ≥ 4.5 Grade | |
| | | Colour Staining | 4.5 | ≥ 3.0 Grade | |

### 4.10 Background Material – Colorfastness to Water (ANSI/ISEA 107-2020 Clause 8.2.3, AATCC TM107-2013)

| Sample | Parameters | | Results (Grade) | Requirement | Conclusion |
|---|---|---|---|---|---|
| 001 | Colour Change | | 4.5 | ≥ 3.0 Grade | Pass |
| | Colour Staining | Acetate | 4.5 | ≥ 3.0 Grade | |
| | | Cotton | 4.5 | | |
| | | Polyamide | 4.5 | | |
| | | Polyester | 4.5 | | |
| | | Acrylic | 4.5 | | |
| | | Wool | 4.5 | | |

### 4.11 Dimensional Change of Background Material (ANSI/ISEA 107-2020 Clause 8.3)

Test method: AATCC TM135-2018 (3) (III) (A) (iii)
Washing cycles: 5 cycles

| Sample | Parameters | Results (%) | Requirement | Conclusion |
|---|---|---|---|---|
| 001 | Length | -0.3 | ≤ ±7 % | Pass |
| | Width | -1.7 | ≤ ±5 % | |

Remark: AATCC 135-2018t; Test No. (3) (III) (A) (iii), Machine wash at 105 °F with 4lb loading, Permanent press cycle, tumble dry.

### 4.12 Mechanical Properties of Background Materials - Bursting Strength (ANSI/ISEA 107-2020 Clause 8.4.1, ASTM D3787-16)

Steel ball diameter: 25.4mm

| Sample | Results (N) | Requirement | Conclusion |
|---|---|---|---|
| 001 | 660.4 | ≥ 178N | Pass |

### 4.13 Retroreflective Performance Requirements Prior to Test Exposure (ANSI/ISEA 107-2020 9.1 & 10.3)

Test method: ASTM E808-01(2016) & ASTM E809-08(2013)

| Sample | Parameters | | Results [cd/(lx.m²)] | | Requirement | Conclusion |
|---|---|---|---|---|---|---|
| | Entrance angle | Observation angle | Rotation angle $\varepsilon_1 = 0°$ | Rotation angle $\varepsilon_2 = 90°$ | | |
| 002 | 5° | 12' | 432 | 431 | 330 / 247.5 | Pass |
| | | 20' | 280 | 278 | 250 / 187.5 | |
| | | 1° | 55.7 | 54.1 | 25 / 18.75 | |
| | | 1° 30' | 15.9 | 15.4 | 10 / 7.5 | |
| | 20° | 12' | 460 | 448 | 290 / 217.5 | |
| | | 20' | 287 | 281 | 200 / 150 | |
| | | 1° | 49.3 | 50.6 | 15 / 11.25 | |
| | | 1° 30' | 14.3 | 14.4 | 7 / 5.25 | |
| | 30° | 12' | 455 | 436 | 180 / 135 | |
| | | 20' | 286 | 274 | 170 / 127.5 | |
| | | 1° | 50.0 | 49.9 | 12 / 9 | |
| | | 1° 30' | 14.0 | 14.1 | 5 / 3.75 | |
| | 40° | 12' | 411 | 383 | 65 / 48.75 | |
| | | 20' | 265 | 247 | 60 / 45 | |
| | | 1° | 47.4 | 44.5 | 10 / 7.5 | |
| | | 1° 30' | 13.3 | 12.6 | 4 / 3 | |

### 4.14 Retroreflective Performance after Abrasion (ANSI/ISEA 107-2020 9.2 & 10.4.1)

Abrasion method: ISO 12947-2:2016
Test cycles: 5,000 cycles.
Weight: 9 kPa

| Sample | Parameters | | Result [cd/(lx.m²)] | Requirement | Conclusion |
|---|---|---|---|---|---|
| 002 | Observation angle 12' Entrance angle 5° | Rotation angles ε1 = 0° | 460 | ≥ 100 cd/(lx·m²) | Pass |
| | | Rotation angles ε1 = 90° | 460 | ≥ 75 cd/(lx·m²) | |

### 4.15 Retroreflective Performance after Flexing (ANSI/ISEA 107-2020 9.2 & 10.4.2)

Flexing method: ISO 7854:1995 Method A
Test cycles: 7,500 cycles.

| Sample | Parameters | | Result [cd/(lx.m²)] | Requirement | Conclusion |
|---|---|---|---|---|---|
| 002 | Observation angle 12' Entrance angle 5° | Rotation angles ε1 = 0° | 403 | ≥ 100 cd/(lx·m²) | Pass |
| | | Rotation angles ε1 = 90° | 403 | ≥ 75 cd/(lx·m²) | |

### 4.16 Retroreflective Performance after Folding at Cold Temperatures (ANSI/ISEA 107-2020 9.2 & 10.4.3)

Fold method: ISO 4675:2017

Cold temperature: -20±1 °C

| Sample | Parameters | | Result [cd/(lx.m²)] | Requirement | Conclusion |
|---|---|---|---|---|---|
| 002 | Observation angle 12' Entrance angle 5° | Rotation angles ε1 = 0° | 439 | ≥ 100 cd/(lx·m²) | Pass |
| | | Rotation angles ε1 = 90° | 445 | ≥ 75 cd/(lx·m²) | |

### 4.17 Retroreflective Performance after Temperature Variation (ANSI/ISEA 107-2020 9.2 & 10.4.4)

Temperature variation: (50±2) °C for 12 hours immediately followed by (-30±2) °C for 20 hours.

| Sample | Parameters | | Result [cd/(lx.m²)] | Requirement | Conclusion |
|---|---|---|---|---|---|
| 002 | Observation angle 12' Entrance angle 5° | Rotation angles ε1 = 0° | 427 | ≥ 100 cd/(lx·m²) | Pass |
| | | Rotation angles ε1 = 90° | 424 | ≥ 75 cd/(lx·m²) | |

### 4.18 Retroreflective Performance after Washing (ANSI/ISEA 107-2020 9.2 & 10.4.5.2)

Washing method: ISO 6330:2012 Method 6N

Dry temperature: 50±5℃

Washing cycle: 5 cycles

| Sample | Parameters | | Result [cd/(lx.m²)] | Requirement | Conclusion |
|---|---|---|---|---|---|
| 002 | Observation angle 12' Entrance angle 5° | Rotation angles ε1 = 0° | 367 | ≥ 100 cd/(lx·m²) | Pass |
| | | Rotation angles ε1 = 90° | 341 | ≥ 75 cd/(lx·m²) | |

Remark: Washing procedure No: 6N. Using horizontal axis, front-loading type machine: Machine wash at 60 °C with 2 kg total dry mass (type III(100%polyester) + specimen) and "ECE(A)" detergent +sodium perborate + TAED, 50±5 °C oven dry.

### 4.19 Retroreflective Performance after Wet Performance (ANSI/ISEA 107-2020 9.2 & 10.4.6 & Appendix B)

| Sample | Parameters | | Result [cd/(lx.m²)] | Requirement | Conclusion |
|---|---|---|---|---|---|
| 002 | Observation angle 12' Entrance angle 5° | Rotation angles ε1 = 0° | 232 | ≥ 100 cd/(lx·m²) | Pass |
| | | Rotation angles ε1 = 90° | 217 | ≥ 75 cd/(lx·m²) | |

### 4.20 Types and Classes (EN ISO 20471:2013+A1:2016 Clause 4.1)

| Sample | Size | Parameters | Results | Requirement | Classification |
|---|---|---|---|---|---|
| A | M | Background material | 0.447 $m^2$ | * | Class 1 |
| | | Retroreflective material | 0.188 $m^2$ | | |
| | | Combined performance material | - | | |
| | | Background material on the front part | 145.0 % | ≥ 40%^ | Pass |
| | | Background material on the back part | 174.0 % | | |

Remark: ^ = this requirement is defined by the number of RfU: PPE-R/28-009
* =

| Material | Class 3 garments | Class 2 garments | Class 1 garments |
|---|---|---|---|
| Background material | 0.80 $m^2$ | 0.50 $m^2$ | 0.14 $m^2$ |
| Retroreflective material | 0.20 $m^2$ | 0.13 $m^2$ | 0.10 $m^2$ |
| Combined performance material | n. a. | n. a. | 0.20 $m^2$ |

### 4.21 Specific Design Requirements for Garments Covering Only the Torso (EN ISO 20471:2013+A1:2016 Clause 4.2.1)

| Sample | Results | Requirement | Conclusion |
|---|---|---|---|
| A | Comply | The background material shall encircle the torso and shall maintain a minimum width (height) of 50 mm. Interruptions of background material by retroreflective stripes are not counted. Bands of retroreflective material shall be at least 50 mm wide. | Pass |
| | Comply | Garments only covering the torso shall have one or more bands of retroreflective material encircling the torso with a maximum inclination of ± 20° to the horizontal and bands of retroreflective material joining the torso band from the front to the back over each shoulder. The bottom of the lowest torso band shall be at least 50 mm above the bottom edge. If more than one horizontal band is applied the horizontal bands shall be at least 50 mm apart.<br>Alternatively, garments covering only the torso shall have two bands of retroreflective material at least 50 mm apart and encircling the torso with a maximum inclination of ± 20° to the horizontal. The bottom of the lowest torso band shall be at least 50 mm above the bottom edge. | Pass |
| | Comply | Tabards shall be constructed so that a person of the size for which they are designed can wear the tabard so that any gaps at the sides shall not be greater than 50 mm horizontally. | Pass |
| | Comply | Any gap (for fastening systems and seams) in the lengthwise continuity of each band of retroreflective or combined performance material shall not be greater than 50 mm, measured parallel to the direction of the band, and the total of such gaps shall not be greater than 100 mm in any one band around the torso. | Pass |

### 4.22 Size Designation (EN ISO 20471:2013+A1:2016 Clause 4.3, ISO 13688:2013 Clause 6)

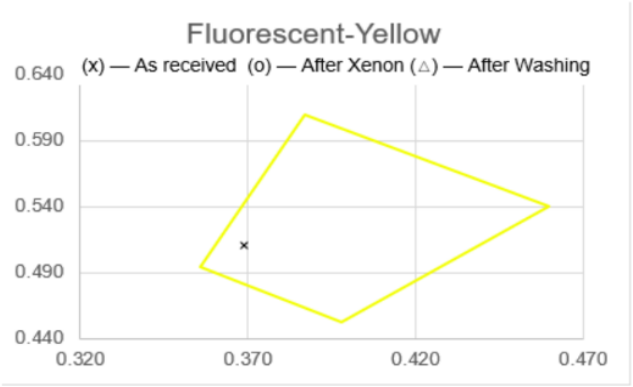
| Sample | Parameters | Results | Requirement | Conclusion |
|---|---|---|---|---|
| A | Protective clothing type | Vest | * | Pass |
| | Chest / Bust girth | 118-123 cm | | |
| | Height | 156-204 cm | | |

Remark: *=

| Protective clothing | Control dimensions (ranges expressed as cm or kg) |
|---|---|
| Jacket, Coat, Vest | Chest or Bust girth and Height |
| Trousers | Waist or Hip girth and Height |
| Coverall | Chest or Bust girth and height |
| Aprons | Chest or Bust girth, Waist girth and Height |
| Protective equipment (e.g. knee pads, back protectors, torso protector) | Select the relevant measurement:<br>- Chest or Bust girth, Waist girth and Height<br>- Knee girth<br>- Body weight<br>- Waist to waist over the shoulder length |

### 4.23 Colour Performance of New Material (EN ISO 20471:2013+A1:2016 Clause 5.1 & 7.2)

| Sample | Parameters | Results | Requirement | Conclusion |
|---|---|---|---|---|
| 001 | Chromaticity coordinates, x | 0.369 | * | Pass |
| | Chromaticity coordinates, y | 0.510 | | |
| | Luminance factor, β | 0.76 | | |




Remark: * =

| Colour | Chromaticity coordinates (x, y) | | Minimum luminance factor ($\beta_{min}$) |
|---|---|---|---|
| Fluorescent yellow | 0.387 | 0.610 | 0.70 |
| | 0.356 | 0.494 | |
| | 0.398 | 0.452 | |
| | 0.460 | 0.540 | |
| Fluorescent orange - red | 0.610 | 0.390 | 0.40 |
| | 0.535 | 0.375 | |
| | 0.570 | 0.340 | |
| | 0.655 | 0.345 | |
| Fluorescent red | 0.655 | 0.345 | 0.25 |
| | 0.570 | 0.340 | |
| | 0.595 | 0.315 | |
| | 0.690 | 0.310 | |

### 4.24 Colour Fastness to Rubbing (EN ISO 20471:2013+A1:2016 Clause 5.3.1, ISO 105-X12:2016)

| Sample | Parameters | Results (Grade) | Requirement | Conclusion |
|---|---|---|---|---|
| 001 | Dry | 4-5 | ≥ 4 Grade | Pass |

### 4.25 Colour Fastness to Perspiration (EN ISO 20471:2013+A1:2016 Clause 5.3.2, ISO 105-E04:2013)

| Sample | Parameters | | Results (Grade) | | Requirement | Conclusion |
|---|---|---|---|---|---|---|
| | | | Acid | Alkaline | | |
| 001 | Colour Change | | 4-5 | 4-5 | ≥ 4 Grade | Pass |
| | Colour Staining | Acetate | 4-5 | 4-5 | ≥ 4 Grade | |
| | | Cotton | 4-5 | 4-5 | | |
| | | Polyamide | 4-5 | 4-5 | | |
| | | Polyester | 4-5 | 4-5 | | |
| | | Acrylic | 4-5 | 4-5 | | |
| | | Wool | 4-5 | 4-5 | | |

### 4.26 Colour Fastness to Laundry (EN ISO 20471:2013+A1:2016 Clause 5.3.3, ISO 105-C06:2010)

| Sample | Parameters | | Results (Grade) | Requirement | Conclusion |
|---|---|---|---|---|---|
| 001 | Colour Change | | 4-5 | ≥ 4-5 Grade | Pass |
| | Colour Staining | Acetate | 4-5 | ≥ 4 Grade | |
| | | Cotton | 4-5 | | |
| | | Polyamide | 4 | | |
| | | Polyester | 4-5 | | |
| | | Acrylic | 4-5 | | |
| | | Wool | 4-5 | | |

Remark: Test No.: A2S, Machine wash at 40°C with 4g/l 'ECE(B)' detergent and 1g/l Sodium perborate solution with 10 steel balls.

### 4.27 Colour Fastness to Hot Pressing (EN ISO 20471:2013+A1:2016 Clause 5.3.3, ISO-105 X11:1994)

Test procedure: Dry pressing/Dry

Hot pressing temperature : 110 °C

| Sample | Parameters | | Results (Grade) | Requirement | Conclusion |
|---|---|---|---|---|---|
| 001 | Immediately | Colour Change | 4-5 | ≥ 4-5 Grade | Pass |
| | After 4 hours | Colour Change | 4-5 | ≥ 4-5 Grade | |
| | | Colour Staining | 4-5 | ≥ 4 Grade | |

### 4.28 Dimensional Change (EN ISO 20471:2013+A1:2016 Clause 5.4)

Washing test method: ISO 5077:2007/ ISO 3759:2011/ ISO 6330:2021
Washing cycles: 5 cycles

| Sample | Parameters | Results | | | Requirement | Conclusion |
|---|---|---|---|---|---|---|
| | | Original (cm) | After washing (cm) | Shrinkage (%) | | |
| A | Front length from high point shoulder | 67.0 | 67.0 | 0.0 | Knit and Nonwovens: ± 5% | Pass |
| | Centre back length | 65.0 | 65.0 | 0.0 | | |
| | Chest | 120.0 | 119.4 | -0.5 | | |
| | Hem | 116.4 | 115.0 | -1.2 | | |
| | Across shoulder | 45.5 | 45.2 | -0.7 | | |
| | Armhole | 60.0 | 60.0 | 0.0 | | |

Remark: Procedure No.: 4N; Using horizontal axis, front-loading type machine: Machine wash at 40 degree C with 2 kg total dry mass (type III (100% polyester) + specimen) and “ECE(A)” detergent +sodium perborate +TAED. Tumble dry low.

### 4.29 Bursting Strength of Knitted Materials (EN ISO 20471:2013+A1:2016 Clause 5.5.2, ISO 13938-1:2019)

Test area: 7.3 $cm^2$

| Sample | Results (kPa) | Requirement | Conclusion |
|---|---|---|---|
| 001 | 1292 | ≥ 200 kPa | Pass |

### 4.30 Retroreflective Performance of Separate Performance Retroreflective Material (EN ISO 20471:2013+A1:2016 Clause 6.1 & 7.3)

| Sample | Parameters | | Results [cd/(lx.m²)] | | | Requirement | Conclusion |
|---|---|---|---|---|---|---|---|
| | Entrance angle | Observation angle | Rotation angle $\varepsilon_1 = 0°$ | Rotation angle $\varepsilon_2 = 90°$ | Difference (%) | | |
| 002 | 5° | 12’ | 432 | 431 | 0.2 | * | Non-orientation sensitive |

Remark: *= Material having coefficients of retroreflection that differ by more than 15 % are defined as orientation sensitive when measured at the two rotation angles $\varepsilon_1 = 0°$ and $\varepsilon_2 = 90°$.

| Sample | Parameters | | Results [cd/(lx.m²)] | | Requirement [cd/(lx.m²)] | Conclusion |
|---|---|---|---|---|---|---|
| | Entrance angle | Observation angle | Rotation angle $\varepsilon_1 = 0°$ | Rotation angle $\varepsilon_2 = 90°$ | | |
| 002 | 5° | 12’ | 432 | 431 | 330 | Pass |
| | | 20’ | 280 | 278 | 250 | |
| | | 1° | 55.7 | 54.1 | 25 | |
| | | 1° 30’ | 15.9 | 15.4 | 10 | |
| | 20° | 12’ | 460 | 448 | 290 | |
| | | 20’ | 287 | 281 | 200 | |
| | | 1° | 49.3 | 50.6 | 15 | |
| | | 1° 30’ | 14.3 | 14.4 | 7 | |
| | 30° | 12’ | 455 | 436 | 180 | |
| | | 20’ | 286 | 274 | 170 | |
| | | 1° | 50.0 | 49.9 | 12 | |
| | | 1° 30’ | 14.0 | 14.1 | 5 | |
| | 40° | 12’ | 411 | 383 | 65 | |
| | | 20’ | 265 | 247 | 60 | |
| | | 1° | 47.4 | 44.5 | 10 | |
| | | 1° 30’ | 13.3 | 12.6 | 4 | |

### 4.31 Retroreflective Performance after Test Exposure for Separate Performance Retroreflective Material (EN ISO 20471:2013+A1:2016 Clause 6.2)

Non-orientation sensitive

Washing method: ISO 6330:2021 (Domestic)

| Sample | Test exposure | Parameters | | Results [cd/(lx.m²)] | | Requirement [cd/(lx.m²)] | Conclusion |
|---|---|---|---|---|---|---|---|
| | | Entrance angle | Observation angle | Rotation angle $\varepsilon_1 = 0°$ | Rotation angle $\varepsilon_2 = 90°$ | | |
| 002 | 7.4.1 Abrasion | 5° | 12’ | 466 | 460 | 100 | Pass |
| | 7.4.2 Flexing | 5° | 12’ | 403 | 403 | 100 | Pass |
| | 7.4.3 Folding at cold temperatures | 5° | 12’ | 439 | 445 | 100 | Pass |
| | 7.4.4 Temperature variation | 5° | 12’ | 427 | 424 | 100 | Pass |
| | 7.4.5 Rainfall | 5° | 12’ | 232 | 217 | 100 | Pass |
| | 7.5.2 Washing (5 cycles) | 5° | 12’ | 454 | 460 | 100 | Pass |

Remark: *= Domestic washing. Procedure No.: 4N, using horizontal axis, front-loading type machine: Machine wash at 40°C with 2 kg total dry mass [Type Ⅲ (100% polyester) + specimen] and “ECE(A)” detergent +sodium perborate + TAED, tumble dry low.

-- END OF THE TEST REPORT --