



## Abrasion Protection Textile Sleeves

### 1 Introduction

**Note:** Nothing in this standard supercedes applicable laws and regulations.

**Note:** In the event of conflict between the English and domestic language, the English language shall take precedence.

**1.1 Purpose.** This specification covers material and performance requirements for tubular and self-wrapping flexible textile (braided, woven, knit, or nonwoven) sleeving products used for abrasion resistant and anti-rattle applications. Typical applications include wiring bundling in passenger compartment and underhood applications, protection of hoses, insulated wires, rods and tubing.

**Note:** Thermal Resistant Sleeving is specified in GMW15608 (reference only).

**1.2 Applicability.** Protective sleeving products are used for abrasion resistant and anti-rattle applications. Typical applications include wiring bundling in passenger compartment and underhood applications, protection of hoses, insulated wires, rods and tubing.

#### 1.3 Remarks.

**1.3.1 Material Description.** Materials qualified to this specification shall be classified by a Material Type and a Temperature Class. Each product shall then be categorized by at least one (1) of two (2) abrasion testing methodologies, see 1.3.1.3. Products are then coded per call-outs found in Section 8. Specific material thicknesses and sleeving diameter will be called out on engineering drawing or math data file, if necessary.

##### 1.3.1.1 Material Types.

**1.3.1.1.1** Different materials and constructions are specified in this material standard. Depending on the usage and construction, the sleeve can be braided, knit or woven and delivered in closed or strip form. (Strip form products may have different closure measurements, e.g., wrappable, with adhesive strips, hook and loop).

**1.3.1.1.2** The color of the sleeving shall be black. For woven constructions the weft or transversal monofilaments can be natural color optionally.

**1.3.1.1.3** Types are listed in Table 1.

**Note:** If no Type is specified, Type A is requested.

##### 1.3.1.2 Temperature Classes.

**1.3.1.2.1** Class 0 Materials shall be specified for those applications with continuous operating temperatures of 125 °C

**1.3.1.2.2** Class 1 Materials shall be specified for those applications with continuous operating temperatures of 150 °C.

**1.3.1.2.3** Class 2 Materials shall be specified for those applications with continuous operating temperatures of 200 °C.

**1.3.1.2.4** Class 3 Material application temperature to be defined in drawing or math data file.

**Note:** Specific products may be usable for applications with short term excursion temperatures above their continuous operating temperature rating. For these situations, additional application specific testing should be run.

**Note:** Heat shrinkable sleeving to Type A is re-classified into Class 0 (former Class 1 with lower temperature requirements.)

Table 1: Material Types and Related Temperature Classes

| Type | Construction                          | Material 1                                                                               | Material 2                                                                               | Diameter of Strands               | Temperature Class | Code XYZW<br>Note 1 |
|------|---------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------------------------------|-------------------|---------------------|
| A    | Woven tubular heat-shrinkable sleeves | PET multifilament fibers in the longitudinal direction                                   | Modified polyolefin (PE) monofilament fibers in the transverse direction                 |                                   | 0                 | A0zw                |
| B    | Braided tubular sleeve                | PET monofilament fibers of two (2) different diameters                                   | Not applicable                                                                           | two (2) different diameters       | 1                 | B1zw                |
| C    | Braided tubular sleeve                | PET monofilament fibers of uniform diameter                                              | Not applicable                                                                           | uniform diameters                 | 1                 | C1zw                |
| D    | Braided tubular sleeve                | PA6.6 monofilament fibers of uniform diameter                                            | Not applicable                                                                           | uniform diameters                 | 1                 | D1zw                |
| E    | Braided tubular sleeve                | PET monofilament fibers of smaller diameter than the PA6.6 fibers                        | PA6.6 monofilament fibers of larger diameter than the PET fibers                         | each material different diameters | 1                 | E1zw                |
| F    | Braided tubular sleeve                | PPS monofilament fibers                                                                  | PEEK monofilament fibers                                                                 | each material different diameters | 2                 | F2zw                |
| G    | Woven self-wrappable sleeve           | PET monofilament longitudinal fibers                                                     | A combination of PET multifilament and monofilaments fibers in the transversal direction |                                   | 1                 | G1zw                |
| H    | Knit wrappable sleeve                 | A combination of PET monofilament and multifilament fibers                               | Not applicable                                                                           |                                   | 1                 | H1zw                |
| I    | Woven self-wrappable sleeve           | A combination of PET monofilament and multifilament fibers in the longitudinal direction | A combination of PET monofilament and multifilament fibers in the transverse direction   |                                   | 1                 | I1zw                |
| J    | Woven self-wrappable sleeve           | PET multifilament fibers in the longitudinal direction                                   | PET monofilaments fibers in the transversal direction                                    |                                   | 1                 | J1zw                |
| K    | Woven tubular sleeve                  | PA6.6 multifilament fibers in the longitudinal direction                                 | PA6.6 multifilament fibers in the transverse direction                                   |                                   | 1                 | K1zw                |
| L    | Woven wrappable sleeve                | PA6.6 multifilament fibers in the longitudinal direction                                 | PA6.6 multifilament fibers in the transverse direction                                   |                                   | 1                 | L1zw                |
| M    | Woven wrappable sleeve                | PET monofilament fibers in the longitudinal direction                                    | PET monofilament fibers in the transverse direction                                      |                                   | 1                 | M1zw                |
| O    | Braided tubular sleeve                | PET monofilament fibers abrasion resistance strands                                      | PET multifilament fibers noise suppression strands                                       |                                   | 1                 | O1zw                |

**Note 1:** z and w indicate respective abrasion category, see Table 2 and Table 3.

**PA6.6** = Polyamide, **PE** = Polyethylene, **PEEK** = Polyether Etherketone, **PET** = Polyethylene Terephthalate, **PPS** = Polyphenylene Sulfide.

**Note:** Each **Material Type** may contain multiple product offerings with varying closure mechanisms (adhesive strips, hook and loop, etc.) that are deployed to meet a range of application/installation needs. Protective sleeving can have additional coating for anti-fray properties (e.g., Vinyl acetate-based impregnation).

**Note:** Due to product advances and improvements, additional material types may be developed. This would require a letter of submission including the relevant product description and performance data. Signed approval of this submission will serve as product qualification until an official type letter can be assigned during the next specification update.

### 1.3.1.3 Abrasion Categories.

- Abrasion resistance of the sleeving material shall be categorized by at least one (1) of two (2) abrasion methodologies; the ISO 6722-1 scrape abrasion test, and the SAE ARP 1536A abrasion test. Testing shall be accomplished by installing the appropriate sized product over a 13 mm steel mandrel utilizing recommended production installation techniques.
- Abrasion categories are listed in Table 2 for test to ISO 6722-1 and Table 3 for test to SAE ARP 1536A.

**1.3.1.3.1** Sleeving shall be tested to the ISO 6722-1 scrape abrasion tested and categorized using Table 2.

**Table 2: Abrasion Categories per ISO 6722-1**

| Category (Code Z) | Cycles             |
|-------------------|--------------------|
| 1                 | <999               |
| 2                 | 1000 to 1999       |
| 3                 | 2000 to 3999       |
| 4                 | 4000 to 14 999     |
| 5                 | 15 000 to 29 999   |
| 6                 | 30 000 to 99 999   |
| 7                 | 100 000 to 199 999 |
| 8                 | >200 000           |

**1.3.1.3.2** Sleeving shall be tested to the SAE ARP 1536A abrasion tested and categorized using Table 3.

**Table 3: Abrasion Categories per SAE ARP 1536A**

| Category (Code W) | Cycles               |
|-------------------|----------------------|
| A                 | <50 000              |
| B                 | 50 000 to 199 999    |
| C                 | 200 000 to 399 999   |
| D                 | 400 000 to 1 000 000 |
| E                 | >1 000 000           |

## 2 References

**Note:** Only the latest approved standards are applicable unless otherwise specified.

### 2.1 External Standards/Specifications.

|           |         |            |               |
|-----------|---------|------------|---------------|
| FMVSS 302 | ISO 188 | ISO 6722-1 | SAE ARP 1536A |
|-----------|---------|------------|---------------|

### 2.2 GM Standards/Specifications.

|         |         |          |          |
|---------|---------|----------|----------|
| GMW3059 | GMW3221 | GMW14125 | GMW14914 |
| GMW3152 | GMW3232 | GMW14270 | GMW15634 |
| GMW3205 | GMW3235 | GMW14444 | GMW16955 |

## 3 Test Preparation and Evaluation

### 3.1 Resources.

#### 3.1.1 Facilities. Conforming to the relevant test procedure.

**3.1.1.1 Calibration.** The test facilities and equipment shall be in good working order and shall have a valid calibration label.

**3.1.1.2 Alternatives.** Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

**3.1.2 Equipment.** Conforming to the relevant test procedure and to the test sketches on the part drawings.

#### 3.1.3 Test Vehicle/Test Piece.

**3.1.3.1** Unless otherwise specified, the shape and size of test pieces shall be in accordance with the relevant test procedure. A minimum of three (3) test samples of the sleeve are required for initial product qualification testing to this specification per Table 4, Table 5 and Table 6. A minimum of two (2) test samples are required for inspection testing as defined per 4.1.4 for annual testing.

**Table 4: Material Properties for All Applications**

| Property                                | Test Method                                                                                                                                                                                                          | Unit | Value                                                     |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------------------------------------------------------|
| <b>Long Term Temperature Resistance</b> |                                                                                                                                                                                                                      |      |                                                           |
| Class 0                                 | ISO 188 Method B;<br>504 h +0 h/-2 h at 125 °C ± 3 °C<br>Samples shall then be wrapped 360 degrees around a mandrel whose diameter is 4x the diameter of the sleeve.<br>Visual examination.                          |      | No cracking or degradation<br>No delamination of adhesive |
| Class 1                                 | ISO 188 Method B;<br>504 h +0 h/-2 h at 150 °C ± 3 °C.<br>Samples shall then be wrapped 360 degrees around a mandrel whose diameter is 4x the diameter of the sleeve.<br>Visual examination.                         |      | No cracking or degradation<br>No delamination of adhesive |
| Class 2                                 | ISO 188 Method B;<br>504 h +0 h/-2 h at 200 °C ± 3 °C.<br>Samples shall then be wrapped 360 degrees around a mandrel whose diameter is 4x the diameter of the sleeve.<br>Visual examination.                         |      | No cracking or degradation<br>No delamination of adhesive |
| Class 3                                 | ISO 188 Method B;<br>504 h +0 h/-2 h at temperature defined on drawing ± 3 °C.<br>Samples shall then be wrapped 360 degrees around a mandrel whose diameter is 4x the diameter of the sleeve.<br>Visual Examination. |      | No cracking or degradation<br>No delamination of adhesive |
| <b>Abrasion Resistance</b>              |                                                                                                                                                                                                                      |      |                                                           |