AEROSPACE INFORMATION REPORT

AIR1490™ REV. C

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Superseding AIR1490B

(R) Environmental Degradation of Textiles

RATIONALE

AIR1490C has been updated to include new degradation results. The document has also been revised to the latest SAE standards format.

FOREWORD

The intent of this SAE Aerospace Information Report (AIR) is to make available information concerning the environmental degradation of textiles as used in unit load device (ULD) equipment common to the air cargo community.

1. SCOPE

1.1 Field of Application

Since cargo restraint devices made with textiles should have a predictable service life, there should be data available so that predictions can be made. This document compiles available information on textiles of the types used in air cargo restraint devices and reviews the degradation characteristics of each.

Textiles are used primarily in cargo restraint nets on air cargo pallets and nonstructural containers, restraint nets installed in cargo aircraft, and similar applications.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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http://standards.sae.org/AIR1490C

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AS1131 Air and Air/Surface (Platform) Cargo Pallet Nets

AS1492 Interline Air Cargo Pallet Nets

AS5385 Cargo Restraint Straps - Design Criteria and Testing Methods

AS6554 Cargo Stopper Devices

2.1.2 U.S. Government Publications

A-A-55242 Webbing, Textile; Polyester, Low Elongation

MIL-W-4088 Webbing, Textile, Woven Nylon

MIL-W-27265 Webbing, Textile, Woven Nylon, Impregnated

2.1.3 ANSI Accredited Publications

Copies of these documents are available online at http://webstore.ansi.org/.

ISO 4115 Air Cargo Equipment - Air/Land Pallet Nets

ISO 4170 Air Cargo Equipment - Interline Pallet Nets

ISO 8647 Environmental Degradation of Textiles Used in Air Cargo Restraint Equipment

ISO 16049-1 Air Cargo Equipment - Restraint Straps - Part 1: Design Criteria and Testing Methods

2.1.4 IATA Publications

Available from International Air Transport Association, Publications Assistant, 800 Place Victoria, P.O. Box 113. Montreal, Quebec H4Z 1M1, Canada, Tel: 1-514-874-0202, www.iata.org.

IATA, Unit Load Devices (ULD) Regulations

2.2 Applicable References

2.2.1 Sunlight Exposure of Nylon Webbing, Technical Note WCRT 54-249; Wright Air Development Center, ARDC, United States Air Force, Wright-Patterson AFB, Ohio, December 1954

2.2.2 Comparative Chemical Resistance of Fibers, Bulletin X-48. E.I. DuPont de Nemours & Co., Textile Fibers Department, March 1956

2.2.3 Comparative Heat Resistance of Fibers, Bulletin X-56. E.I. DuPont de Nemours & Co., Textile Fibers Department, September 1956

2.2.4 Tensile Stress-Strain Properties of Fibers, Bulletin X-82. E.I. DuPont de Nemours & Co., Textile Fibers Department, May 1958

2.2.5 Light Resistance of Industrial Fiber Products, Bulletin X-189. E.I. DuPont de Nemours & Co., Textile Fibers Department, April 1964

2.2.6 A Contribution to the Research on the Aging of Textiles, Internal Report 1B152-75/15. German Research and Testing Institution for Aeronautics and Astronautics, Plastics Section, Braunschweig, West Germany, June 25, 1975

2.2.7 The Effects of Ultraviolet Light on Products Based on Fibers of Kevlar® 29 and Kevlar® 49 Aramid, Information Report C-29, E.I. DuPont de Nemours & Co., Textile Fibers Department, Wilmington, Del. USA 1977

2.2.8 Lifing Trials to Compare the Performances of Nylon & Polyester Braids & Webbings, Report BG 067, Bridport-Gundry, Ltd., Bridport, Dorset, England, May 1981

2.2.9 Material Strength Report, Report 35 -22996, Bruggeman & Brand, Wetter, Ruhr Germany, January 1986

2.2.10 Tensile Strength Degradation Results - 5 Year Outdoor Exposure Trials, Report MTR 08/109 2nd issue, AmSafe Bridport , The Court, Bridport, Dorset, DT6, 3QU, England, November 2008

3. TYPES OF DEGRADATION

Many factors can contribute to the degradation process. They are as follows:

a. The natural environment factors of light and heat including ultraviolet exposure.

b. The atmospheric pollution from industrial emissions.

c. The exposure to various destructive chemicals.

d. The washing powders and immersion in saltwater.

4. FACTORS INFLUENCING DEGRADATION (see 2.2.1, 2.2.2, 2.2.3, 2.2.4, and 2.2.5)

Natural and man-made fibers can be degraded by exposure to sunlight or to light rays from other sources. Industrial fiber products such as rope and webbing degrade at a much slower rate than fibers in yarn form; nevertheless, prolonged exposure can cause a loss in breaking strength, breaking elongation, and toughness. These properties are especially important in industrial fiber products.

4.1 Influence of Wavelength

Tests conducted by DuPont as well as experience show the primary cause for light degradation of fibers is ultraviolet rays with wavelengths between 290 millimicron and 400 millimicron. Radiation of shorter wavelengths, including gamma rays, damages fibers; however, this radiation is seldom encountered by fiber products. Radiation of longer wavelengths (that is, the visible and infrared rays), also damages some fibers, but this damage is minor compared to that from ultraviolet rays. Such radiation could, however, cause an increase in fiber temperature, which might result either in heat degradation or in accelerated ultraviolet degradation of the fiber

The spectral distribution of the energy of the sun's radiation reaching the earth is about 5% in the ultraviolet region, 40% in the visible, and 55% in the infrared. These percentages vary with the seasons, time of day, atmospheric conditions, latitude, and altitude.

4.2 Influence of Other Factors

The deterioration of a fiber by sunlight or other radiation depends on a number of factors. A brief discussion of some of these factors follows:

4.2.1 Geographical Location of Exposure

Sunlight deterioration of fibers is more rapid at certain geographical locations than at others. This is due to differences in the duration and intensity of radiation in the particular wavelengths that damage fibers.