



Designation: F2821 – 15 (Reapproved 2020)

## Standard Test Methods for Basket Type Rescue Litters<sup>1</sup>

This standard is issued under the fixed designation F2821; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 These test methods enable the user to determine if a rescue litter meets the requirement for strength depending upon particular applications and methods of use.

1.2 The test methods described in this standard are designed to test several parameters under “manner of use” conditions.

1.3 The values stated in SI units are to be regarded as standard. The values given in parentheses are mathematical conversions to inch-pound units that are provided for information only and are not considered standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

### 2. Terminology

2.1 *Definitions of Terms Specific to This Standard:*

2.1.1 *basket type litter, n*—a conveyance for the sick or injured usually consisting of a tubular metal frame enclosing a molded plastic or wire shell. Also known as a *basket stretcher*.

2.1.2 *litter bridle, n*—a manufactured or improvised system that attaches the litter to the raising or lowering system.

2.1.3 *horizontal lift, n*—refers to the patient being in a horizontal position with the head and feet at approximately the same level. In this configuration the litter bridle attaches to the litter at four points.

2.1.4 *anchor plate, n*—a device installed inside the litter that is used to attach the litter to the bed of the test apparatus. It

must be of sufficient size and stiffness to distribute the forces on the litter shell or frame, thereby allowing the test of the attachment points

2.1.5 *vertical lift, n*—refers to the patient being in a head up and feet down position. In this configuration the litter bridle attaches to the litter at the head end only.

### 3. Summary of Test Method

3.1 Horizontal test method is designed to test the litter attachment points and the resistance of the litter to folding or curling.

3.2 Vertical test method is designed to test the structural strength of the head end of the litter or the manufacturer’s designated bridle attachment points or both, and for a two-piece litter, to also test the connection between the two sections of the litter.

3.3 These tests are destructive in nature and will require a new litter for each test.

### 4. Significance and Use

4.1 These test methods are intended to provide reproducible data from which acceptance criteria, design data, and specifications can be developed for basket type rescue litters.

### 5. Apparatus

5.1 *General*—Use calibrated electronic load measuring devices. The testing equipment shall have sufficient capacity to prevent yielding of its components under the anticipated ultimate load, and shall have sufficient stiffness to ensure that the applied tension loads remain parallel to the axis of the anchors.

5.2 *Anchor Plate*—Shall be installed in the litter in such a way that the force distributes equally and does not concentrate on a single element. The purpose is to test the attachment points of the litter bridle, the connection points that hold the halves of two-piece litter together, and the litter’s ability to resist folding or bending both longitudinally and laterally. The anchor plate size must be kept to a minimum so that it does not provide any increased resistance to the litter bending during a test. In cases where the litter does not have a frame, the plate shall span any ribs or other structural elements within the shell in order that the forces are distributed over a wide enough area that unintentional damage does not occur.

<sup>1</sup> These test methods are under the jurisdiction of ASTM Committee F32 on Search and Rescue and are the direct responsibility of Subcommittee F32.01 on Equipment, Testing, and Maintenance.

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**5.3 Sample Orientation**—The litter subject to test can be loaded either horizontally or vertically depending upon the test apparatus being used.

## **6. Hazards**

6.1 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

6.2 These tests are destructive in nature and there is the potential for injury from flying objects that are ejected during the tests. The person performing the tests shall wear appropriate safety equipment, the test apparatus shall be properly guarded, and the tests shall not be performed alone.

## **7. Procedure for Horizontal Litter Test**

7.1 Attach a 4 leg litter bridle to the litter at points designated by the litter manufacturer. Each individual bridle leg shall be of a fixed length.

7.1.1 The bridle shall be constructed of chain or 9.5 mm ( $\frac{3}{8}$ -in.) cable. If using cable, the individually terminated bridle legs shall be proof loaded to a force of 1.5 kN (350 lbf) pre-litter test to eliminate stretching or the potential for any slippage during the litter test.

7.1.2 The litter bridle configuration shall allow the suspended litter to be at zero degrees to the horizontal  $\pm 5^\circ$ .

7.2 Rest the litter on a uniform surface (floor). Measure and record the height from the reference surface to the top of the top litter rail of the litter assembly at the same relative location  $\pm 0.5$  cm ( $2 \pm 0.2$  in.) that the litter bridle used for testing is attached. This measurement shall take place at all four litter bridle connection points.

7.3 Secure the litter to the bed of the test machine using an anchor plate of approximately 40 by 40 cm (16 by 16 in.) inside the litter. The plate shall be centered in a manner that allows the litter to maintain a level orientation to the horizontal, between the rails and ends of the litter, and shall span at least two rails (or ribs) and cross rails (or ribs) to distribute the forces in the litter. In cases where the litter does not have a frame, or if the specified plate size does not span the frame rails, the size can be increased to span structural elements in the shell or the frame. In the event that the plate comes into contact with the side elements, the plate may be narrowed accordingly to eliminate interference.

7.3.1 The anchor plate shall have an integral center connection point. It is recommended that this attachment point have the ability to swivel independent of the anchor plate.

7.3.2 The anchor plate shall be connected to a suitable anchorage point on the test fixture or floor using chain or cable allowing for a vertically straight pull.

7.3.3 Reconfirm that the litter is at  $0 \pm 5^\circ$  to the horizontal.

7.4 Apply a pulling force of 11kN (2,473 lbf) to the bridle at the rate of  $30 \pm 2.5$  cm ( $12 \pm 1$  in.) per minute.

7.4.1 Failure of the litter prior to reaching the prescribed force shall constitute a failure.

7.4.2 After the load specified in 7.4 has been applied and released, remove the litter from the test apparatus and situate on the same uniform surface. Repeat the measurements at the same locations. Permanent deformation of the top rail or part of the main structural elements in excess of  $5 \pm 0.5$  cm ( $2 \pm 0.2$  in.) shall constitute a failure.

## **8. Procedure for Vertical Litter Test**

8.1 Rest the litter on a uniform surface (floor). Measure and record the overall length and width of the top litter rail of the litter assembly,  $\pm 0.5$  cm ( $0.2$  in.).

8.2 Attach test apparatus to the head end of the litter at points designated by the litter manufacturer. If the litter is equipped with designated connection points then those connection points shall be used. If the manufacturer suggests that the litter be attached with a system using rope or webbing wrapped around the frame rails, then those instructions shall be followed.

8.2.1 The bridle shall be constructed of chain or 9.5 mm ( $\frac{3}{8}$  in.) cable. If using cable, the individually terminated bridle legs shall be proof loaded to a force of 1.5 kN (350 lbf) pre-litter test to eliminate stretching or the potential for any slippage during the litter test. If rope or webbing is used it shall be of sufficient strength to minimize elongation and to insure that the litter is tested and not the attachment method or material.

8.3 The internal angle of the bridle shall be as small as possible. If manufactured connections on the litter are in such a location that the bridle contacts the shell of the litter, the bridle shall be extended just enough to eliminate contact with the litter shell.

8.4 Secure the litter to the bed of the test machine using an anchor plate of approximately 40 by 40 cm (16 by 16 in.) inside the litter. The plate shall be centered between the rails (or ribs) at the end of the litter opposite of the bridle. The plate shall span any rails or cross rails to distribute the load on the litter frame or shell. In cases where the litter does not have a frame, or if the specified plate size does not span the frame rails, the size can be increased to span structural elements in the shell or the frame. In the event that the plate comes into contact with the side elements, the plate may be narrowed accordingly to eliminate interference.

8.5 Apply a pulling force of 11kN (2,473 lbf) to the bridle at the rate of  $30 \pm 2.5$  cm ( $12 \pm 1$  in.) per minute.

8.5.1 Failure of the litter prior to reaching the prescribed force shall constitute a failure.

8.5.2 Upon reaching the specified pulling force, release the load and return the litter to the uniform surface. Record the overall length and width of the top litter rail of the assembly  $5 \pm 0.5$  cm ( $2 \pm 0.2$  in.). Permanent deformation is the difference between the final litter measurements and initial litter measurements. Permanent deformation of the top litter rail or part of the main structural elements in excess of  $5 \pm 0.5$  cm ( $2 \pm 0.2$  in.) shall constitute a failure.

## **9. Report**

9.1 Report the force on the litter at the time any structural element fails to the nearest 0.1 kN (23 lbf).

9.2 Report the amount of permanent deformation of any structural element to the nearest 0.5 cm (0.2 in.).

9.3 Report the attachment points used, location of the failure, the dimensions of the bridle before and after the test, the internal angle of the bridle before and after the test, and any special concerns observed.

## 10. Precision and Bias

10.1 Precision of the test procedures can be affected by dissymmetry in individual bridle leg length resulting in one section seeing higher loads than others.

## 11. Keywords

11.1 lifting bridle; rescue litter; rescue stretcher; stretcher

## APPENDIX

### (Nonmandatory Information)

#### X1. Sample Test Setups

##### X1.1 Horizontal Litter Test

X1.1.1 Fig. X1.1 shows a suggested schematic of a test setup. The key point to remember is that the reaction plate shall be large enough to span frame members or structural elements in the shell but not so large as to inhibit bending or curling of the frame, especially on the horizontal test.

##### X1.2 Vertical Litter Test

X1.2.1 Fig. X1.2 shows the bridle attached to a frame down tube but depending upon the litter and the manufacturer's instructions it may be connected to designated attachment points or other locations on the frame.

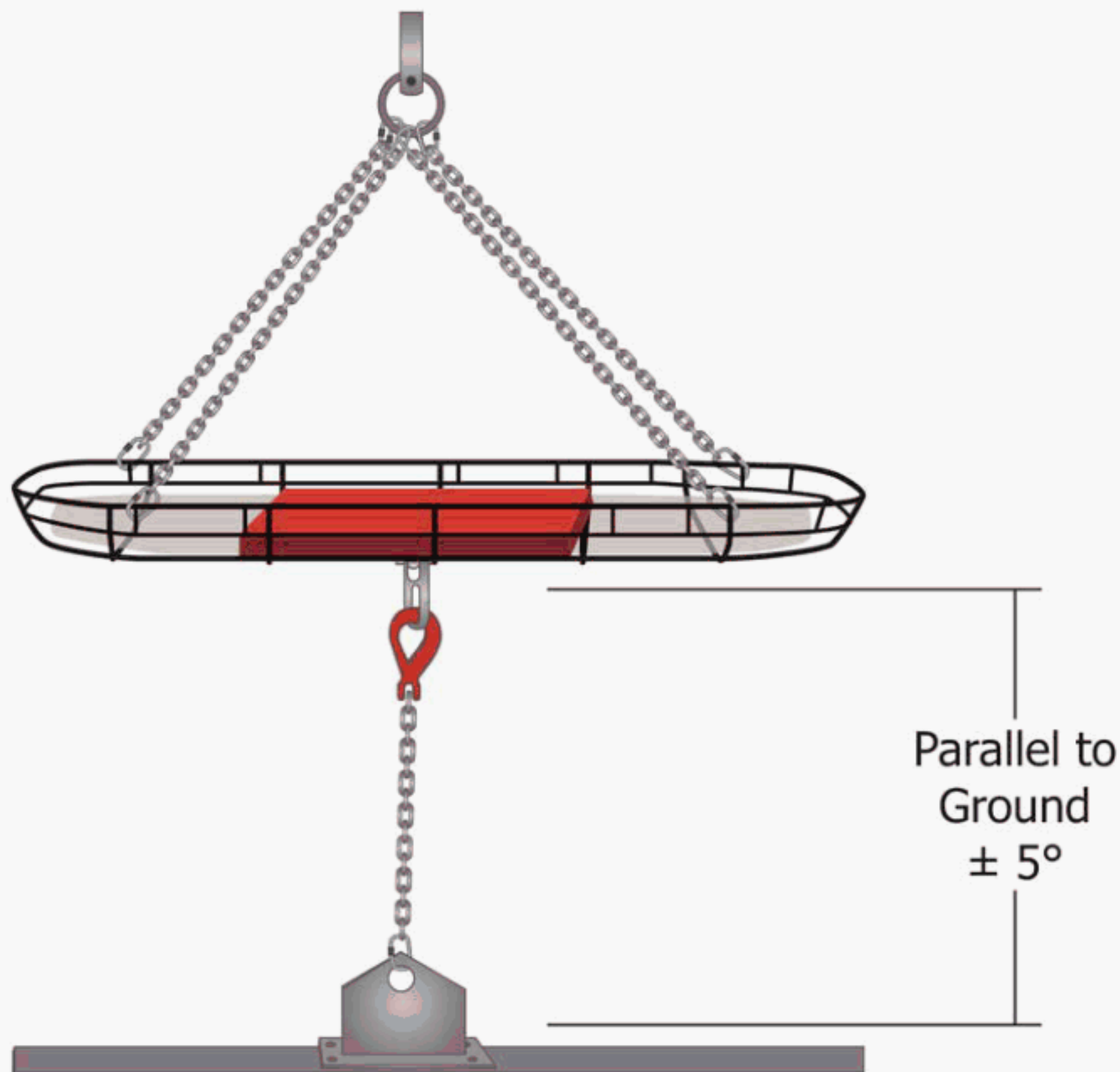
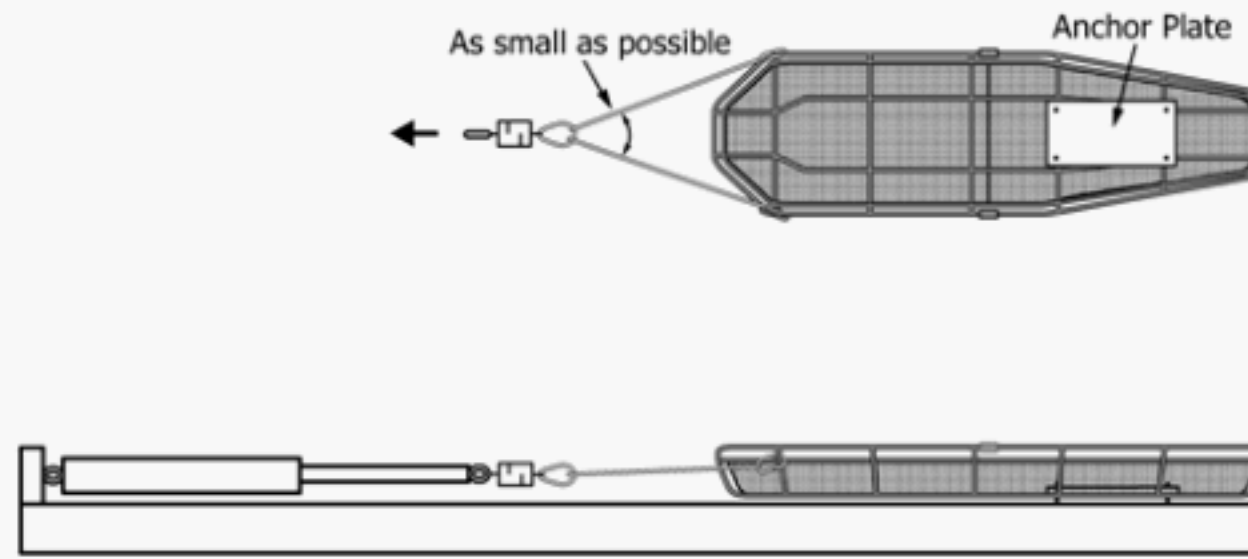


FIG. X1.1 Schematic of Test Setup



**FIG. X1.2 Bridle Attached to a Frame Down Tube**

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