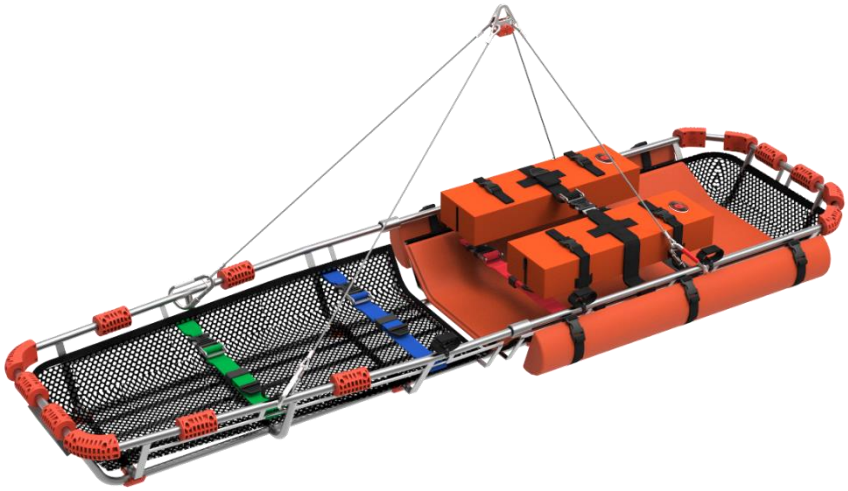
LIFESAVING SYSTEMS™
A Signia Aerospace Company

Report Number: F-730-406

Revision: B

Medevac II & II A Litters
Declaration of Design



PROPRIETARY & CONFINDENTIAL

THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OWNED BY LIFESAVING SYSTEMS AND MAY NOT BE DUPLICATED, COMMUNICATED TO OTHER PARTIES OR USED FOR ANY PURPOSE WITHOUT THE EXPRESS WRITTEN PERMISSION OF LIFESAVING SYSTEM, LLC.

I hereby certify that the following information, design data, tests, reports and drawings are a true and accurate representation of the Medevac II & IIA series of litters. This report contains information relevant to the range of part number within the 404 and 406 range.

Prepared by: **David Betts, Engineering** Date: 12 April 2024

Reviewed by: **Mario Vittone, GM** Date: 12 April 2024

Revision	Issue Date	Description of Revision/Modification	Revised by	Approved by
A	24 Apr 2020	Initial release	-	T. Beech
B	12 April 2024	Modified to address additional standards and recalculate SWL to meet transport category aviation standards.	D. Betts	M. Vittone

1.0 REFERENCES

2.0 PRODUCT DESCRIPTION & OUTLINE OF DESIGN COMPLIANCE

3.0 BASIC DATA

4.0 PART NUMBER DATA & MAIN FRAME MATERIAL SPECIFICATIONS

5.0 IDENTIFICATION

6.0 SUB-ASSEMBLY COMPONENT DATA

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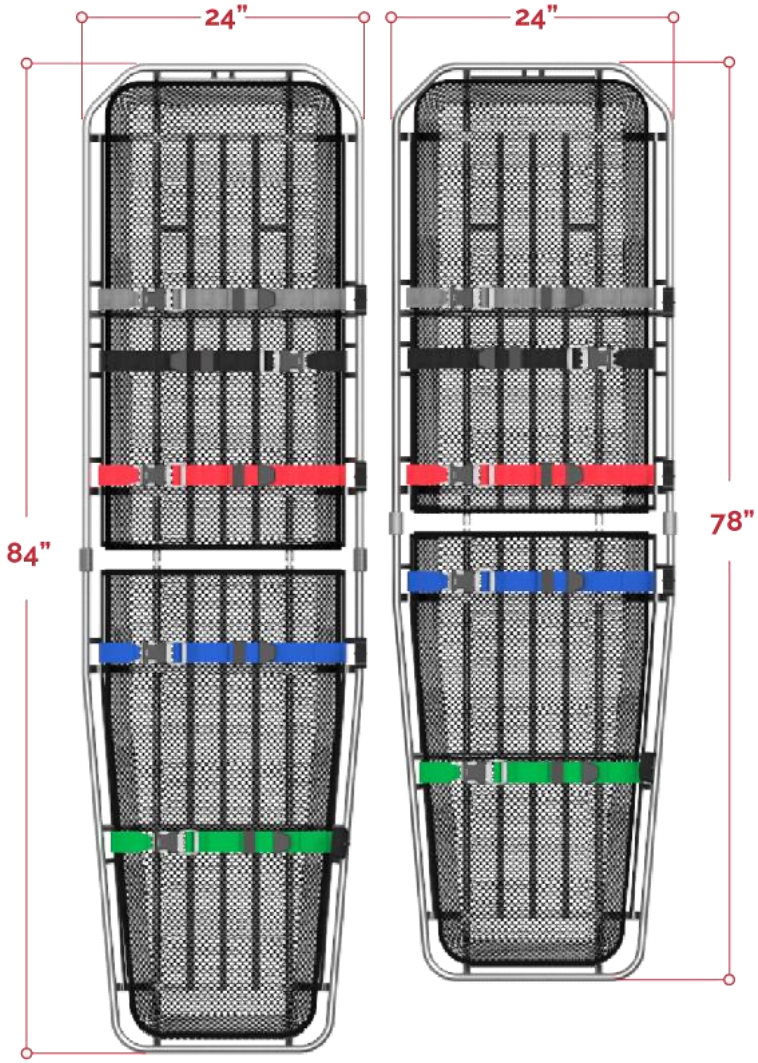
8.0 CONCLUSION

1.0 REFERENCES

1) SAE ASTM A554-16, Standard Specification for Welded Stainless-Steel Mechanical Tubing
2) ASTM F2821-15 – Standard Test Methods for Basket Type Rescue Litters
3) NATO AMedP-1.4, Edition A -NATO Standard, Transfer of Litters Ship to Ship or Ship to Shore
4) CFR - FAR Part 25 Airworthiness Standards: Transport Category Airplanes
5) CFR - FAR Part 29 Airworthiness Standards: Transport Category Rotorcraft
6) American National Standard AWS D17.1/D17.1M:2010-AMD1 - Specification for Fusion Welding for Aerospace Applications
7) SAE AS8043 B, Restraint Systems for Civil Aircraft
8) AC 25.1309-1A - System Design and Analysis
9) AC 27-1B Certification of Normal Category Rotorcraft
10) AC 29-2C - Certification of Transport Category Rotorcraft
11) AC 135-14B - Helicopter Air Ambulance Operations
12) Lifesaving Systems #406 Medevac II Litter Load Test Plan, 12-MAY-2016
13) U.S. Army AWR980
14) Lifesaving Systems V-Ring Environmental Test Report F-730-193-B Rev A. 16 June 2021.

2.0 Product Description & Outline of Design Compliance

The Medevac II & IIA series of litters are modern Commercial Off The Shelf (COTS) Stokes type litters, and have been purpose built to meet the requirements of transport category helicopters and maritime rescue operations. The scope of this document is to provide a supplemental summary of design data and tests performed.



The Medevac II & IIA Litters are constructed from either Stainless Steel or Titanium tube and flat bar (depending upon part number) that is Gas Tungsten Arc Welded in accordance with AWS D17.1/D17.1M:2010-AMD1. The litters use a flaw tolerant design via multiple load paths with no singular weld being catastrophic to the integrity of the litter.

The Litters are available in a rigid (P/N 404 base) and break-apart (P/N 406 base) to meet operational needs. The 406 utilises screw-couplers with self-aligning pins secure the top tubes firmly together, and the lower skid tubes attach with hook and pin-type fittings permitting quick assembly.

The 406 Break-Apart litter has been proof load tested to 3,000lbs with less than 50mm (2”) of deflection, to exceed ASTM F2821-15 vertical load test requirements. The lifting bridle assembly showed no signs of deformity when load tested to 5000lbs. The 3,000lbs static load test was performed at this weight due to the inability to stack more lead within the frame.

The patient restraint straps are made from solution dyed polyester to comply to FAR 25.852 (a), Appendix F, (a), (1), (iv). The safety buckles are double locking, quick release, and made from 100% corrosion resistant materials.

The Flotation Kit is constructed from high quality synthetic nylon material coverings and is designed to provide positive self-righting and head-up flotation characteristics to ensure that the patients airway remains clear of the water line. Covers for flotation components are international red/orange to meet NATO AMedP-1.4, Edition A, for Ship to Ship or Ship to Air requirements.

3.0 Basic Data

Maritime Rescue Working Load Limit (WLL).	600lbs / 270kg
Transport Category Helicopter Human External Cargo, Working Load Limit (WLL) recommendation	400lbs / 204Kg Note: Transport Category Helicopter Human External Cargo WLL recommendation is reduced to account for load, fatigue and safety factor requirements of aviation regulations.
Maximum Tested Static Load	3,000lbs / 1361kg for 5 minutes
Litter Weight	34lbs / 14.5kg
Flotation Kit Ballast Bar (used to keep head clear of water)	3 to 5 lbs. depending on part number
Dimensions	24” W x 7” D x 84” L
Dimensions (Stowed)	24” W x 7” D x 43” L
Service Life	20 years from date placed in service

4.0 Part Number Data & Main Frame Material Specifications

4.1 Titanium Medevac II & IIA Litters

Part Number	Material	Dimensions	Single Piece or Break Apart	Commercial Name
404-TI	Titanium	84” x 24”	Single Piece	Medevac II
404-D-TI	Titanium	78” x 24”	Single Piece	Medevac II
406-TI	Titanium	84” x 24”	Break Apart	Medevac IIA
406-D-TI	Titanium	78” x 24”	Break Apart	Medevac IIA

- Tube: Titanium Grade 9 per ASTM B338, Annealed
  - Size: 0.75” OD x 0.065” nominal wall

- Flat Bar: Titanium Grade 5 (TI-6AL-4V) flat bar per ASTM B265
  - Sizes: .125 x .500”, .125 x .625”, .125 x .750” (depending upon location of flat bat)

- Welds: Class C Welds per AWS D17.1/D17.1M:2010-AMD1

4.2 Stainless Steel Medevac II & IIA Litters

Part Number	Material	Dimensions	Single Piece or Break Apart	Commercial Name
404	Stainless Steel	84” x 24”	Single Piece	Medevac II
404-D	Stainless Steel	78” x 24”	Single Piece	Medevac II
406	Stainless Steel	84” x 24”	Break Apart	Medevac IIA
406-D	Stainless Steel	78” x 24”	Break Apart	Medevac IIA

- Tube: T-304 Stainless Steel per ASTM A554-16
  - Size: 0.75” OD x 0.065” nominal wall

- Flat Bar: T304 Stainless Steel per ASTM A240
  - Sizes: .125 x .500”, .125 x .625”, .125 x .750”

- Welds: Class C Welds per AWS D17.1/D17.1M:2010-AMD1

5.0 IDENTIFICATION

Each litter shall have a product label stamped, engraved, or otherwise permanently marked.

The following information shall be printed legibly on the litter. All letters shall be at least 2 mm (5/64”) high.

- Manufacturer’s name
- Country of manufacture
- Manufacturer’s product identification
- Serial number
- Date of Manufacture

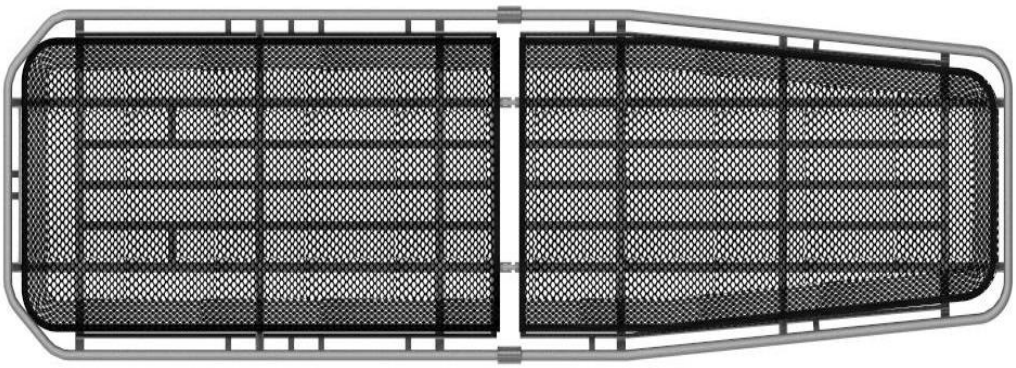
6.0 SUB-ASSEMBLY COMPONENT DATA

Generic across all part numbers

6.1 Mesh Liner

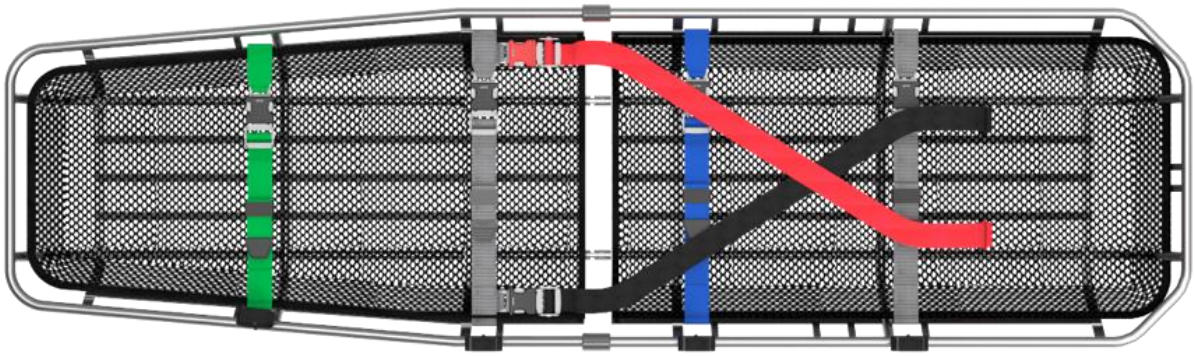
The lightweight plastic mesh is non-toxic and UV-stabilized, will not conduct electricity or corrode, even after extensive exposure to sunlight, heat, moisture or chemicals. The mesh construction allows airflow through the litter for increased stabilization during hoisting operations, and allows water to rapidly drain to not overload the hoist cable.

- Material: Duronet® Mesh
  - Size: ½”



6.2 Restraint Belts

Restrain belts are designed secure the patient in the litter with 5 lateral belts and an additional 2-belt torso restraints for helicopter operations, and to prevent fore/aft causality movement, with a singular belt having a mean breaking strength of 1,400lb / 635kg.



Note: Fifth belt not shown in above image as it is part of the float kit assembly, located mid torso and routing over the top of the float kit to secure the patient into the litter when in the water.

The restrain belts are constructed from UV stabilized, solution dyed polyester, with a breaking strength of 3,400kg, compliant to FAR 25.852 (a), Appendix F, (a), (1), (iv). The field replaceable belts are colored to provide ease of connections whilst undertaking a physically complex rescues as expected in environmentally challenging conditions such as the ocean at night.

Quick Release Safety Buckles have a unique dual action press design to prevent inadvertent disengagement and are fitted with the slide adjuster at the key for ease of use during rescue operations. The buckle and key made from T-304 stainless steel with an Acetal housing compliant to SAE AS8043 B – 8.2.2, Solvent Resistant requirements.

6.3 Component Data

Part Number:

- 140 - Main 5 straps
- 140-SH – Dual shoulder harness assembly

Webbing:

- Material: Solution Dyed Polyester, 1.75” width
- Colors: Black, Gray, Red, Blue, Green
- Breaking Strength: 7,480lbs / 3,400kgs

Stitching:

- Material: Anefil ® Nylon Thread
- Size: TEX 135
- Pattern: Box X - modified
- Construction: 420d x 3
- Strength: 23.8lbs / 10.8kg

Buckle and Adjuster Key:

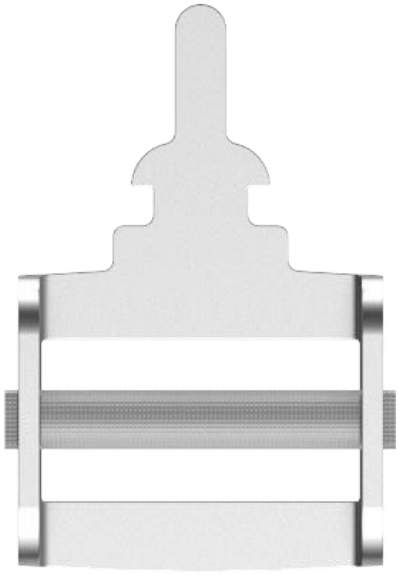
- Material: T-304 Stainless Steel
- Buckle Housing: Acetal
- Breaking Strength: 1,400lbs / 635kg



Solvent Resistance Compliant

IAW SAE AS8043 B Section 8.2.2

- Lacquer Thinner
- Methyl Ethyl Ketone (MEK)
- Acetone



6.4 Skid Shoes

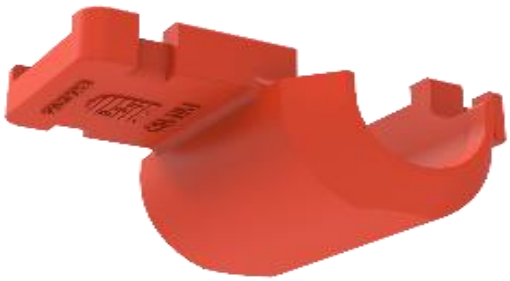
The Skid Shoes are retrofittable, field replaceable, and removable lower frame guards designed as a series of 8 wear pads to prevent deterioration of the tube of the main litter body. Manufactured from Polypropylene for high abrasion and wear resistance to mitigate the abrasion of the lower tubes experienced when dragging litters across rough abrasive surfaces experienced in rescue operations and some airframe decks.

The surface area of each individual pad is 1.5” x 0.44” and was designed to provide an increased surface contact area of the underside of the litter, as required on some airframe main deck areas.



6.4.1 Component Data

- Part Number: 181 (Kit of 8)
- Material: Polypropylene
- Color: Red/Orange
- Base contact area: 1.5” x .44”



6.5 Face Shield

The Face Shield is a retrofittable and removable light impact protection barrier to provide added protection from falling debris, provide rotor wash disbursement to the face of the causality, as well as providing adequate protection of the intubated patient during hoisting operations.

The Face Shield is designed to be folded down and stowed when not in use and extended to cover the face and head after the causality is secured in the litter.

6.5.1 Component Data

- Part number: 406-FS
- Mesh: Polyester
- Webbing: Nylon & Polypropylene, with hook & loop tape
- Flat Bar: Titanium Grade 5 as per ASTM B265



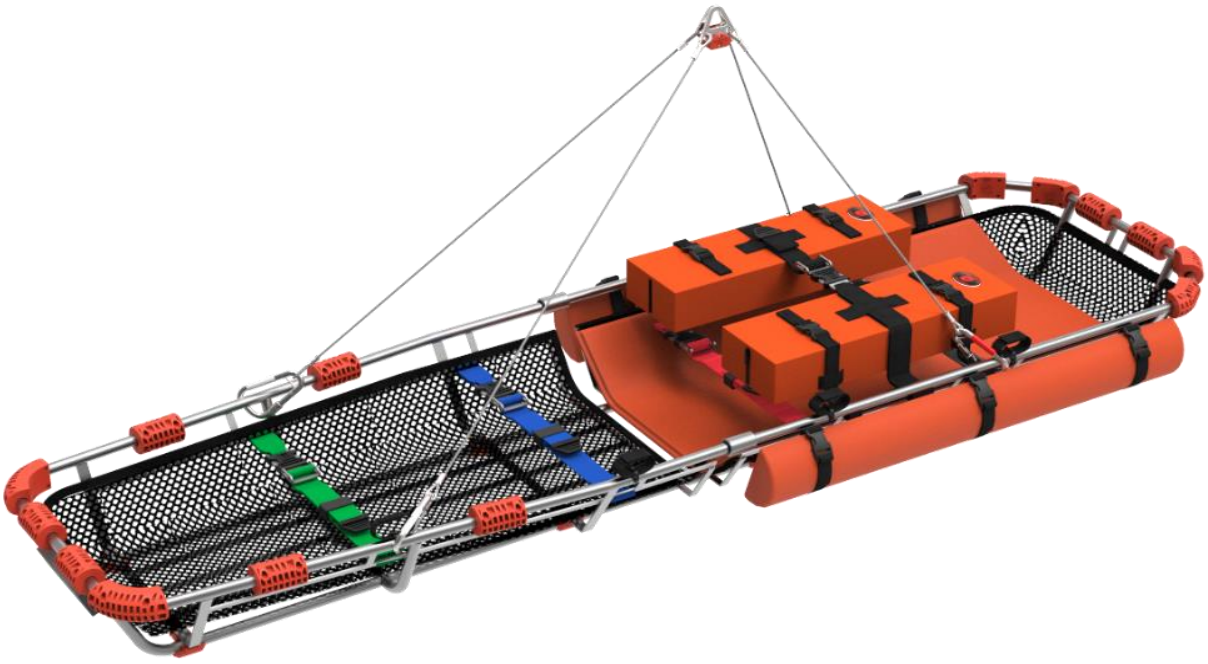
6.6 Bump Protection Rail Pad Kit

The Rail Pads are a brightly colored, soft polyurethane bump protector designed to prevent damage to the airframe on modern composite airframes. They are constructed to tolerate extremes of weather, be easily replaceable, and neutrally buoyant for water operations, whilst allowing operators to maintain a grip on the litter when maneuvering around a rescue scene, vessel or airframe. They are available as a kit with a series of part numbers to match operational requirements.

6.6.1 Component Data

- Part Numbers: 182 & 185
- Material: Polyurethane
- Color: Orange





6.7 Hoisting Sling

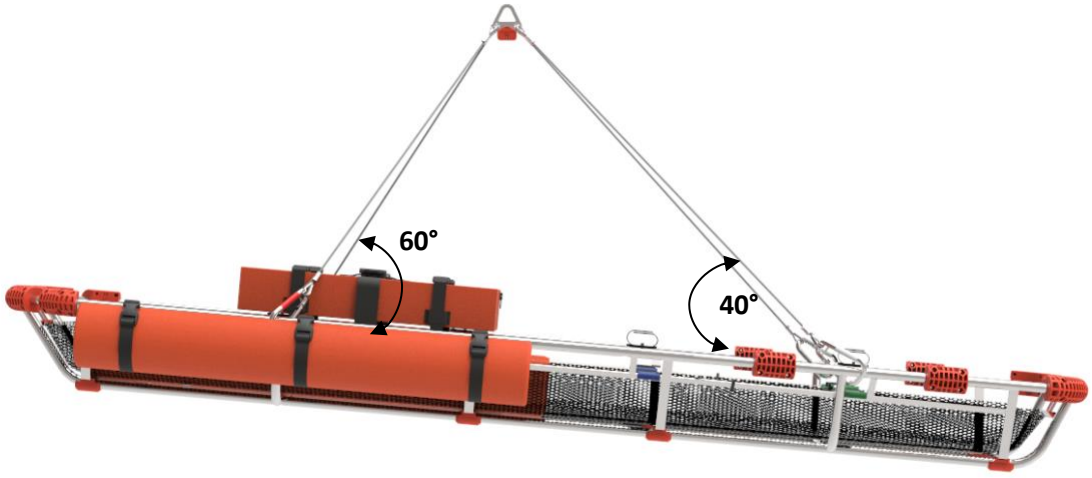
The Hoisting Sling is designed as a spider system to provide a means of attaching the litters to the hoist hook, to eliminate unwanted flight dynamics during operations. The Hoisting sling consists of four wire or webbing slings that act as load paths connecting to various points of the litter to equalize loading and prevent spinning, twisting, or other undesirable flight dynamics. It is designed to provide a 20 degree head up attitude to assist with downwash airflow dynamics in addition to providing optimal head up attitude to the patient to manage both the airway and/or a head injured patient.

The laser-cut, stainless steel magnetic coupler rings stay locked in position after hook-up allowing operators to prepare for the hoist without worrying about crossing cables or misalignment the sling. Connecting to the litter via semi-permanent connections, both stainless steel cable and webbing variations are available with the cable demonstrating a lower tendency to spin during HEC operations.

The hoisting sling and sub-components have been environmentally tested to assess for corrosion and weathering. In addition, the 193-B series has been exposed to a freezing load test by conditioning to -40 degrees Celsius and subsequently loaded to over 5000lbs, showing no signs of deformation.

<u>Load Calculations:</u>
Load Factor (60°) = .8660 (2,400lb) cable rating x (.866) = 2,078.4lbs

Load Factor (40°) = .6428 (2,400lb) cable rating x (.6428) = 1,542.7lbs
Load Configuration: (2,078.4lbs x 2 legs) + (1,542.7lbs x 2 legs) = 7,241.4lbs



6.7.1 Component Data

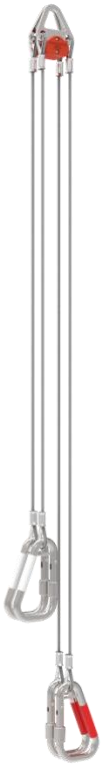


V-Ring:

- Material: Stainless Steel 304
- Size: 8 Ga
- Process: Laser Cut and Tumbled
- Breaking Strength: 5,000lbf (22.2kN)

Cable:

- Material: Stainless Steel 304
- Diameter: 5/32”
- Construction: 7 x 19 (Mil-W-83420 Type I, Class A)
- MIN Breaking Strength: 2,400lbf (10.6kN)



Sleeve:

- Material: Brass, Zinc Plated
- Size: 5/32”
- Type: Duplex Swage
- Meets U.S. Military Standard MS-51844

Snap Hook:

- Material: Stainless Steel 316
- Type: Screw Lock
- Breaking Strength: 4,400lbs



Magnetic Coupling:

- Magnets: Neodymium (NdFeB)
- Grade: N52
- Surface Field: 5,235 Gauss
- Size: 0.5 Diameter x 0.25 in

Webbing:

- 1’ Nylon HD Webbing
- Breaking Limit 2,500lbs / 1,134kg
- Thread Bonded Nylon TEX 70
- 1” Heavy Duty Slide Bar Adjuster

6.8 Floatation Kit

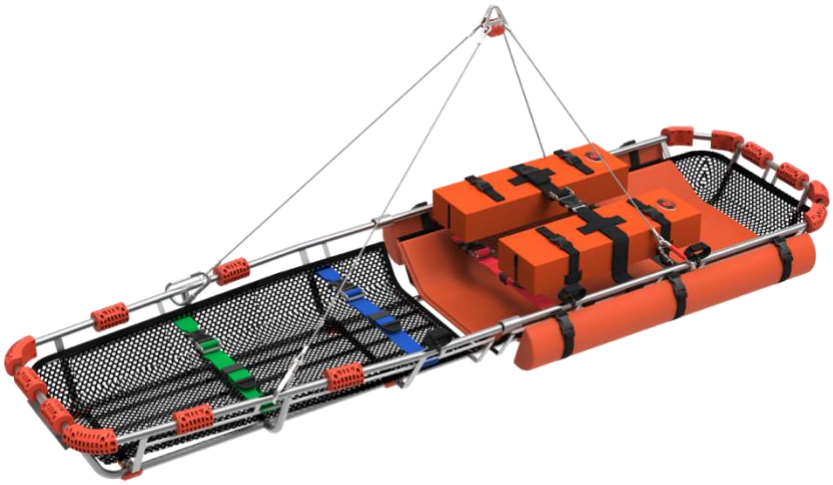
The Flotation Kit is designed to meet operational requirements of both recovering an incapacitated person from the water or near a body of water where a risk exists of the litter inadvertently entering the water with a causality secured within the litter. The Flotation Kit is designed to maintain a buoyant, upright, stable and self-righting capability, with adequate freeboard of the head and airway above the water, ensuring that the litter does not float face down.

The kit is comprised of a back pad, foam logs, chest pad and ballast bar, with each part numbered litter having a unique flotation kit to manage the buoyancy adequately. It is important to note that the ballast is essential to maintaining adequate freeboard and the airway clear of the water line, in addition to ensuring that the litter does not float face down at the waterline.

Operational considerations include the recovery of a spinally injured patient, such as an ejected fighter pilot, a person ejected from a high speed boat accident, a person who has jumped into a swimming hole and made contact with a submerged obstacle, or even a helicopter that has made a forced landing on water with successful deployment of floats.

6.8.1 Component Data

- Foam Material: Closed Cell Polyethylene Foam
- Fabric Cover: 420 Denier Nylon Cover
- Fabric: FAR 25.852 (a), Appendix F, (a), (1), (iv) compliant.
- Total Kit Buoyancy: Approximately 35lbs / 155N



6.9 Tie Down Straps

The 617 Adjustable Tie Down Straps are designed to allow operators to secure the litter to the deck of the helicopter. They are made from Mil Spec Type 13 and Type 8 webbing, with an individual working load limit of 700lbs. They are designed to be connected to the 4 corners of the tubular structure of the litter at one end and hard points within the helicopter at the other, thus securing the load in all directions.

6.9.1 Component Data

- Adjustable Range: 12” to 36” (30.48cm to 91.44cm)
- Working Load Limit: 700lbs (317.5kg)
- Break Strength: 3,500lbs (1587.57kg)
- FAR 25.852 (a), Appendix F, (a), (1), (iv) compliant



7.0 STATEMENTS ADDRESSING KNOWN STANDARDS FOR LITTERS

The below information represents a summary of known standards that are pertinent to helicopter and maritime rescue litters. For full understanding of the test methods of each standard it is recommended that a detailed review of each standard be undertaken and any applicable tests for compliance to be conducted as this information is a summary only. The Medevac II and IIA Litters have been designed with these standards in mind.

7.1 NATO AMedP-1.4, Edition A -NATO Standard, Transfer of Litters Ship to Ship or Ship to Shore

The NATO Standard AMedP-1.4 – lists a number of principles that are relevant to litters, including suitability for both over land or water use. The standard requires litters to be buoyant and self-righting, with the ability to keep the litter upright and stable so that the causality's face is maintained clear of the water and prevent floating face down or head down (feet up). Litters are to be hoisted with slight head upright attitude, revised capacity of 600lbs (noted in Record of Specifications), be designed to withstand environmental conditions normally encountered in causality-at-sea transfers, among other factors.

The Medevac II & IIA litters were designed to meet these requirements especially operations as sea, where recovering a causality directly from the ocean, or in the event a causality secure within a litter inadvertently enters the water by falling during a ship to ship or ship to air transfer. The float kit and weight bar ensure that the Medevac II & IIA series of litters float a causality in a head up orientation when in the water. The lifting bridles are designed to maintain a 20 degree head up attitude.

7.2 ASTM F2821-15 – Standard Test Methods for Basket Type Rescue Litters

The Medevac II & IIA litters have been shown to exceed the horizontal load testing of the ASTM F2821 standard of 11kN.

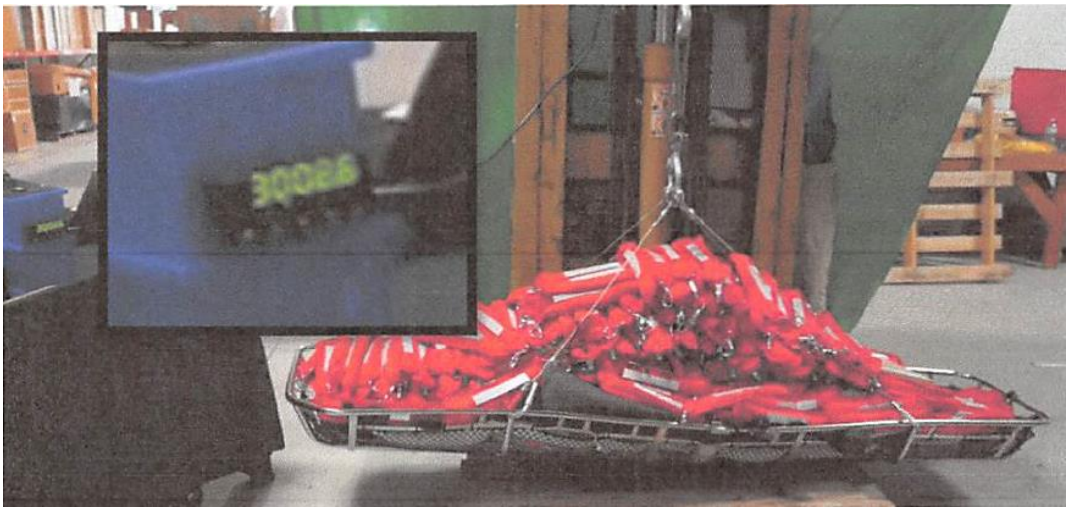
ASTM F2821 standard details test method of litter in a horizontal and vertical extraction scenario, without a lifting bridle. ASTM F2821 requires that the litter be load tested with a chain in place of the lifting bridle, allowing the litter to sit horizontally. A steel plate is installed in the litter and secured to a floor mounted hard point by chain. 11kn (2473lbf) of pull force is then exerted on the lifting chains to assess for frame deformity of not more than 2” / 50mm.

A modified variation of this test has been conducted to replicate the actual user application of the Medevac II & IIA litters. Testing via slow and repetitive loading, lifting, and suspending, at 1,000, 2,000, & 3,000lbs increments.

At each incremental loading point the litters were lifted, stabilized, and held in suspension, before being lowered and analyzed for deformation.

Static load testing to 3,000lbs demonstrated that less than 50mm (2 in.) of deformation is noted in the top tube for both the 406 and 406-TI litters only. This testing demonstrates a compliance to ASTM F282 of the Medevac II & II A litters as COTS Litters.

The 404 variation was not tested as the rigid design is considered structurally stronger than the 406 break apart Medevac IIA by design.



7.3 American National Standard AWS D17.1/D17.1M:2010-AMD1 - Specification for Fusion Welding for Aerospace Applications

Lifesaving Systems manufactures the Medevac II &IIA within a AS9100/ISO9001 certified Quality System with all welding processes and procedures being compliant to American Welding Society, AWS D17.1/D17.1M:2010-AMD1, Specifications for Fusion Welding for Aerospace Applications, Class C welds and applications.

The Medevac II & IIA litters are designed to be damage tolerant, with no single weld considered a critical structure to provide inherent redundancy. All welds are easily visible for inspection purposes, with the operational safe working load allowing for a fail-safe damage tolerance limit in addition to recommended inspection criteria that will ensure any crack propagation rate will be slow enough for at least two inspections to be feasible between crack initiation and discovery.

All welds, filler materials, gas settings, joist design, post weld treatments and inspections are described in Lifesaving Systems Welding Specification Procedure and referenced detailed on drawings comply to AWS requirements.

7.3.1 Aviation Considerations

Produced as a Commercial Off The Shelf (COTS), Medevac II & IIA Rescue Litters are designed for both maritime and aviation customers; the following information allows customers to make an engineering assessment to address relevant sections of their National Aviation Authorities regulations.

These statements do not represent an approval by the FAA or other National Aviation Authority. This information is provided as a guide to assist certifying engineers in demonstrating compliance to local regulations for both Human External Cargo (HEC) and Air Ambulance operations globally.

Due to the increased safety factor multiplications that are generally required for transport category helicopters, it is recommended that a reduced Working Load Limit of 400lbs be applied. By undertaking a reduced WLL engineers will be able to prove the litters are suitable to withstand the Strength Requirements of local regulations in addition to additional factors for fatigue and loading via the Static Strength tests performed by Lifesaving Systems as the OEM of the litters.

Furthermore, by adopting Lifesaving Systems recommended system of inspection both pre and post flight in addition to 90-day inspections for all welds, structures, lifting bridle components, securing belts and other components, the operators is able to assess airworthiness to ensure that no identification of damage, crack propagation or deformity exists prior to the next flight.

8.0 CONCLUSION

The Lifesaving Systems Medevac II & IIA series of litters are designed and constructed for use in both maritime and aviation rescue environments. This design and construction method allows engineers to understanding that the items are produced in accordance with recognized aviation quality standards, systems, and design processes. In addition, suitable pre and post use inspection criteria providing a process for continued airworthiness.

END