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TRI-SAR Harness Specification Report

P/N: 487 & 487-S Variant



Approval:

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PROPRIETARY & CONFINDENTIAL

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Contents

1.0 General: 3
2.0 Warning: 3
3.0 Description: 4
4.0 Inspection: 5
4.1 Visual: 5
4.2 Functional: 5
4.3 Leak: 5
5.0 User Instructions: 6
6.0 Maintenance: 6
7.0 Parts and Description: 7
7.1 Harness: 7
7.2 Vest: 8
8.0 Material Specifications: 9
8.1 Hardware: 9
8.2 Webbing: 9
8.3 Threads: 9
8.4 Stitch Patterns: 9
9.0 Construction: 10
9.1 Hoisting Strap: 10
9.2 Leg Straps: 10
9.3 Waist Strap: 11
9.4 Shoulder & Riser Straps: 11
9.5 Swimmer Attachment Point: 12
9.6 Construction Techniques: 12
10.0 Load Bearing Capability: 12
11.0 Drop Test Data: 13
11.1 Test Images: 14
12.0 Replacement Parts: 16
13.0 Warranty: 16

1.0 General:

The TRI-SAR harness covered in this test report is designed for use in rescue and survival situations. Inherent to all rescue and survival environments is an increased risk of injury or death to an individual or group of individuals. The TRI-SAR harness is intended to aid the professional rescuer(s) and/or survival victim(s). However, all risks cannot be completely eliminated or foreseen. Equipment training, including continued proficiency reviews and maintenance, is vital to the proper and safe use of all rescue and survival type equipment.

It is the responsibility of the purchasing and end-user organization or individual to define the operational procedures and safety guidelines associated with the proper utilization, maintenance (including service life) and storage of the rescue and survival equipment. All individuals must be thoroughly trained and familiarized with the intended purpose, correct use and function of the equipment. Failure to do so may result in serious injury or death.

2.0 Warning:

Use only 33-gram CO2 cylinders (LSC #484) or equal. Inspect the seal on the threaded end of the cylinders prior to installation. Discard any cylinder showing any sign of puncture. Ensure that the CO2 inflation valve lever arm is in the up (armed) position prior to cylinder installation. Check for proper routing of the CO2 inflation lanyard. The Rescue Swimmer's Vest must be visually inspected prior to use and functionally tested per inspection procedures.

- Do not allow the vest to become excessively soiled. Rinse the vest with fresh tap water after exposure to salt or chlorinated water.
- Do not enter the water from excessive heights with the bladder inflated. This could cause personal injury and/or damage to the vest.
- Do not inflate the bladder while below deck on a vessel or in the cabin of an aircraft. The additional buoyancy and bulk could restrict your egress.

3.0 Description:

The TRI-SAR was the the first harness designed to combine the security of a full body harness, comfort of a seat harness and safety of integrated flotation. The newly designed full body harness is constructed primarily of MIL-SPEC Types 8 and 13 nylon webbing and features LSC's exclusive low profile, quick adjusting stainless steel hardware.

When hoisted, the upright, slightly reclined seated position allows total use of the rescuer's hands. Ideally suited for rapid deployment-type missions in swift, cold water or cliff type rescues. The TRI-SAR incorporates LSC's proven designs for weight distribution and superior comfort.

Our integrated flotation vest features a low profile design to increase swim efficiency, with user variable buoyancy up to 35 lbs. The flotation cell is encased entirely in a heavyweight, puncture and abrasion resistant nylon case. Due to its encased design, the cell requires no repacking after use. Inflated manually with CO2 or orally with air. Available in Orange or Black. Generous storage pockets for critical rescue and emergency equipment are provided. Orange vest has SOLAS grade retro reflective panels. Utilizes a 33-gram CO2 cylinder (LSC #484).

The TRI-SAR is currently the standard equipment and approved for US Navy Aviation Rescue Swimmers and was used by U.S. Coast Guard helicopter rescue swimmers for over a decade.

Weight: Harness 4lb (1.81kg) with Inflatable vest 6lb (2.72kg)
Load Limit: 600lb (272kg)

Features:

- Helicopter Hoist-able
- Dual Recovery Capable
- Hands Free Usage
- Integrated Variable Buoyancy
- Flotation





4.0 Inspection:

While LSC has designed and manufactured the inflatable to be as reliable as possible, periodic testing and inspection are necessary to ensure functional reliability. The frequency of the inspection should be determined by the frequency and condition of use. However, the inspection shall not exceed six (6) months. Record inspections on the record inspection patch located on the inside fold on the left side of the vest.

4.1 Visual:

Prior to each use, inspect the entire vest, harness and components for excessive wear and the following: Adjustors, Snap Hook and Quick-Release Safety Buckle for proper operation. Apply a light coat of a light lubricant, such as WD-40 to Quick Release Safety Buckle and snap hook. Inspect knife for proper storage and pockets for proper equipment and security. Remove the CO2 cylinder and check the bottom for pin punctures in the seal of the cylinder. Discard the CO2 cylinder if punctured. Ensure that the inflator lever is in the up (armed) position and install a fully charged cylinder (1/4 turn after seal contact).

4.2 Functional:

1. Pull beaded lanyard to inflate the bladder. Both sides of the vest should fully deploy. Deflate the vest by depressing the oral inflation tube valve and vacuuming or squeezing out the CO2.

2. Inflate the vest through the oral tube with a low-pressure air source (2 psi max) or by oral inflation. CAUTION: DO NOT OVER INFLATE. Damage to the bladder will result from overpressure. After four (4) hours, recheck the bladder for pressure. If the bladder has lost pressure recheck for leaks and replace the vest if required. Deflate the vest.

3. After deflation, stow the oral tube valve. Reinstall a charged CO2 cylinder, and close side panels.

4.3 Leak:

Complete Steps 2 and 3 as above.

5.0 User Instructions:

Position the TRI-SAR with the front up. Open the chest buckle, remove V-Ring from keeper, re-close the keeper, fully extend waist, leg, and shoulder straps. Hold the vest open behind you with both hands. Step through the waist strap and through the proper leg strap with one foot then the other.

Pull the vest and harness into position. Put your arms through the shoulder straps. Adjust the shoulder and waist straps. Open the V-Ring keeper and secure the V-Ring. Adjust the leg straps. It is normally more comfortable to leave the leg straps slightly loose.

To inflate the vest, pull down rapidly on the beaded inflation lanyard. This action punctures the CO2 cylinder. The released gas immediately inflates the bladder. The cylinder will require replacement after inflation. Should a bladder not fully inflate, remove the oral tube from the cover and blow air into the bladder manually.

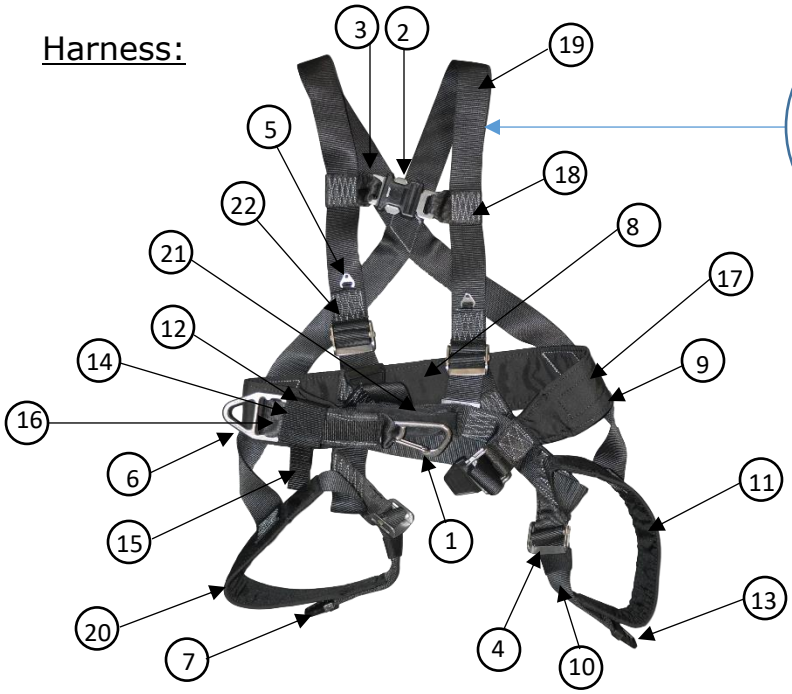
6.0 Maintenance:

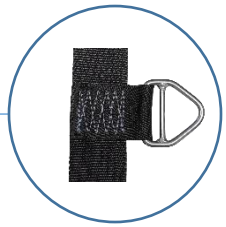
Perform this inspection after the last deployment of the day. Documentation is not required but recommended.

1. Remove all survival equipment from the pockets.
2. Rinse the harness and survival items with fresh water.
    a. Remove CO2 cartridge and rinse cartridge and inflation valve assembly interior with fresh water.
3. Dry the survival items with paper towels.
    a. Chest and leg bayonet fittings and buckles
    b. Talon II hook
    c. CO2 cartridge threads
    d. Any appropriate survival items in need of protection (knives, clips, etc.)
4. Hang the harness on a wooden hanger until dry.
5. Stow the survival items in the equipment pockets.
6. Screw the CO2 cartridge into the inflation valve until it is fully seated, plus 1/4 turn.

7.0 Parts and Description:

7.1 Harness:

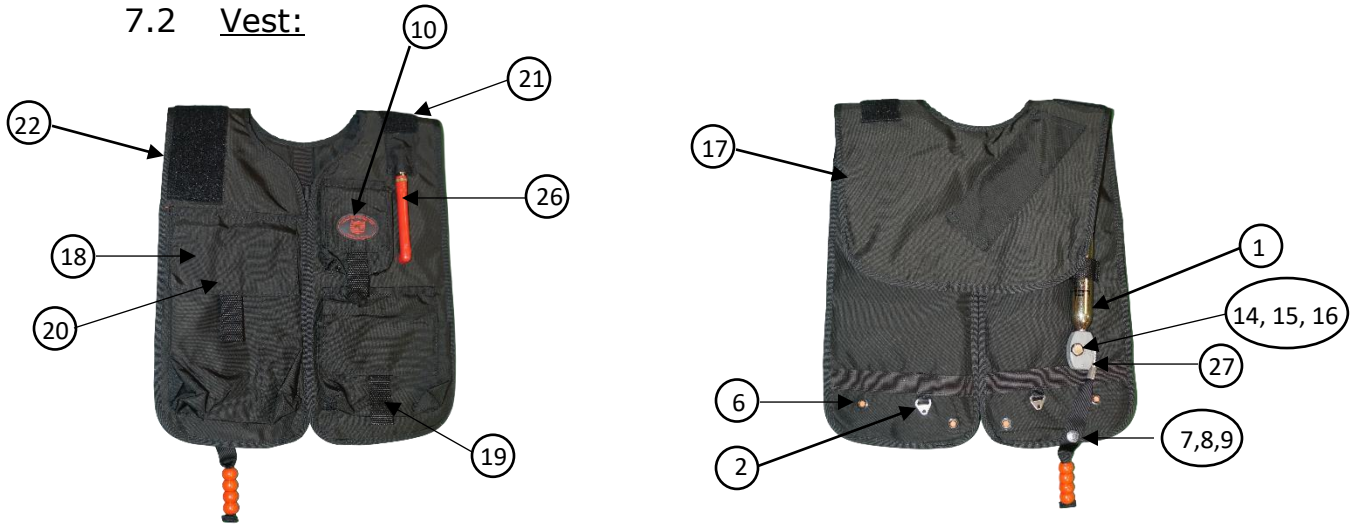




*V-Ring (#384-1) Added to #487-S Variant Model

Item	Part Number	Part Description
1	365	SNAP HOOK, WICHARD, 3-5/32"
2	393	QRS BUCKLE
3	401-2	LINK w/QRSB KEY, 1" SS
4	451	SL BAR ADJ, 1.75"
5	487-12	LINK, TRI-SAR
6	487-13C	V-RING, TRI-BAR, CAST TI
7	HP007	PULL TAB
8	L001	LABEL, LSC OVAL PVC
9	M004	420 DEN NYL BLK MIL-SPEC
10	NF003	1" BLK ELASTIC
11	NFHL006	1-1/2" BLK LOOP
12	NFHL008	2" BLK LOOP
13	NFHL020	1-1/2" BLACK POWERHOOK
14	NFHL021	2" POWERHOOK BLACK
15	NFW002	1" 16PT POLY PRO WEB BLK
16	NFW005	2" BLK PP WEBBING HD 1220
17	NFW009	3" HD 1220 BLK PP WEBBING
18	NFW016	1.75" BLK NYL T-8
19	NFW017	1.75"BLK NYL T-13, MIL-W-4088 1/AU
20	NFW019	3" BLK NYL T-9 HD
21	NFW020	3" BLK NYL WEB TYPE IV 1A
22	NFW046	1/2" NYLON WEBBING BLK

7.2 Vest:



*Items 3, 4, and 5 are hardware for attaching vest to harness. Not shown in pictures.

Item	Part Number	Part Description
1	484	CO2 CYL/CARTRIDGE, 33gr
2	487-12	LINK, TRI-SAR
3	H007	#0 WASHERS DULL BLK
4	H089	8-32 THIN LOCK NUT 18-8
5	H090	8-32 x 5/16 TRUSS PH M/S
6	H130	EYELET, BRASS
7	HP011	HYBRID SOCKET, BLK PLASTC
8	HP012	HYBRID STUD, BLK PLASTIC
9	HP013	HYBRID CAP/POST, BK BRASS
10	L001	LABEL, LSC OVAL PVC
11	NFB002	3/4" BLK POLY BIND
12	NFW021	1" BLK NYL WEBBING LD
13	Z014	ZIPPER 7.0" 580 BLK/O
14	HI014	NUT, PLATED f/C02 STEM
15	HI019	8491 AM GASKET, UPPER SOFT
16	HI020	8492 AM GASKET, LOWER
17	M004	420 DEN NYL BLK MIL-SPEC
18	NFHL007	2" BLK HOOK
19	NFW002	1" 16PT POLY PRO WEB BLK
20	NFW006	2" BLK 12 PT. POLY PRO WEB
21	NFHL008	2" BLK LOOP
22	NFHL023	3" BLK LOOP
23	NFW047	1/2" POLYESTER WEBBING
24	NFW016	1.75" BLK NYL T-8
25	NFW044	1-1/4" BLK LD NYL WEBBING
26	487-1-1	BLADDER for #487/#486
27	487-1-3	TRI-SAR INFLATOR ASSEMBLY

8.0 Material Specifications:

8.1 Hardware:

Lifting V-Ring	#487-13C Cast Titanium, breaking limit exceeds 10,000lbs. - HIP'd (Hot Isostatic Press). - Chemically milled to remove alpha casing. - Proof loaded to 3,300 lbs.
Attachment V-Ring	#384 stainless steel, breaking limit 4,000lb
Chest Buckle	#393 stainless steel QRSB buckle, breaking limit 1,000lbs.
Adjusters	#451 stamped stainless steel adjuster, breaking limit 2,200lbs.
Utility Hook	Wichard 3-5/32-inch stainless steel snap hook, non-locking design. Breaking limit 3,750lbs.

8.2 Webbing:

Nylon Webbing	MIL-SPEC, MIL-W-4088 Type 13, 1-3/4" @ 6,300lb test
Nylon Webbing	MIL-SPEC, MIL-W-4088 Type 8, 1-3/4" @ 3,600lb test
Nylon Webbing	MIL-SPEC, MIL-W-4088 Type 9, 3" @ 8,200lb test

8.3 Threads:

Thread	TEX Size 270 (#3 Cord), twisted multifilament nylon (6,6). - Contrasting color to webbing. - Used on all load bearing stitch patterns. - Average breaking strength approx. 35 lbs.
Thread	TEX Size 70 (E cord), twisted multifilament nylon (6,6). - Used in assembly of non-load bearing components.
Thread	TEX Size 90 (F cord), twisted multifilament nylon (6,6). - Used in assembly of non-load bearing components.

8.4 Stitch Patterns:

Primary Stitch Pattern 1.5" x 1.5", 6pt Double "W"	Minimum breaking strength at 3,500lbs. - Forces applied in linear pull/shear. - Tex-210 nylon thread. - Pattern sewn in 2 layers Type 13 webbing.
Leg Adjuster Pattern 5pt Zig-Zag	Minimum breaking strength of 3000lbs (calculated). - Forces applied in linear pull/shear. - Tex-210 nylon thread

9.0 Construction:

9.1 Hoisting Strap:

Constructed of one continuous piece of Type 13 nylon webbing. Forming the hoisting apex of the strap, the lifting V-ring is centered in the strap and anchored by a six-point double "W" pattern of Tex-210 nylon thread.

A contiguous piece of Type 8 nylon webbing is used to secure the utility snap hook strap to middle bar of the V-ring. Using ten, 2-3/4 inch rows of #210 nylon thread, the strap anchors the stainless steel snap hook and lifting V-ring together.

A pocket is attached to one side of the hoisting strap to stow the snap hook & strap when not in use. For leg strap adjustment, a stamped frame LSC #451 adjuster is attached to the lower section of the hoisting strap with Type 8 nylon webbing and a five-point zig-zag pattern of Tex-210 nylon thread.

9.2 Leg Straps:

Constructed of nylon Type 13, nylon Type 9, 3 inch 16-point polypropylene webbing, black 420-denier urethane coated nylon material, and 1.5" nylon pile tape. Leg straps are created by anchoring each end of the hoisting strap into the respective type 9 (3 inch) heavy duty nylon webbing leg strap using a size-point double "W" pattern of #210 nylon thread.

A piece of type 13 nylon webbing is then attached to the opposite end of the 3-inch Type 9 nylon webbing using six-point double "W" pattern of #210 nylon thread. A piece of 3-inch polypropylene webbing is sewn to the 3-inch Type 9 nylon webbing between the two double “W” patterns with Tex-70 nylon thread to serve as a stiffener and provide a wide load bearing surface.

The 420-denier nylon cover encases the leg strap using Tex-70 nylon thread. Hook and pile tape are sewn to ends of the leg straps with Tex-70 nylon thread.

9.3 Waist Strap:

Constructed of nylon Type 8, nylon Type 13, nylon Type 9, 3 inch 16-point polypropylene webbing, black 420-denier urethane coated nylon material, and 1.5" nylon pile tape. The waist strap is created by anchoring a piece of type 8 nylon webbing and #451 stainless steel adjuster at one end of nylon Type 9, 3-inch webbing using a six-point double "W" pattern of Tex-210 nylon thread.

A piece of Type 13 nylon webbing is then attached to the opposite end of the 3-inch nylon webbing using a six-point double "W" pattern of Tex-210 nylon thread. A piece of 3-inch polypropylene webbing is sewn to the 3-inch nylon webbing between the two double "W" patterns with Tex-70 nylon thread to serve as a stiffener and provide a wide load bearing surface.

A 420-denier nylon cover encases the waist strap using Tex-70 nylon thread. Hook and pile tape are sewn to the Type 13 nylon webbing withTex-70 nylon thread. A Stowage strap is created using a piece of 2-inch polypropylene webbing, hook and pile tape, and sewn using Tex-90 nylon thread.

9.4 Shoulder & Riser Straps:

Constructed of Type 13 nylon webbing. The shoulder straps are anchored to the leg straps using a six-point double "W" pattern of Tex-210 nylon thread. The shoulder straps are also anchored to the waist strap for position purpose only using a "parallelogram" pattern with Tex-210 nylon thread. Crossing at the back, the shoulder straps are joined together using for position purpose only using a "diamond" pattern with Tex-210 nylon thread.

LSC #393 QRSB buckle joins the two shoulder straps together at the wearer's chest. The buckle halves are attached to the shoulder straps with Type 8 nylon webbing sew using a six-point double "W" pattern of Tex-210 nylon thread.

LSC #451 stainless steel adjuster is anchored to the bottom of each shoulder strap with a five-point double "W" pattern of Tex-210 nylon thread. Two pieces of Type 13 nylon webbing serve as riser straps and join the front of the waist belt to the should straps by means of the

#451 adjuster on the bottom of the shoulder, thereby allowing torso length adjustment. The riser straps are anchored to both the hoisting strap and waist strap using a six-point double "W" pattern of Tex-210 nylon thread.

9.5 Swimmer Attachment Point:

Constructed of Type 8 nylon webbing and a stainless steel V-Ring with webbing box (LSC #384) attached to the left-shoulder riser strap using two double "W" stitch patterns of contrasting TEX 210 (3 cord) thread.

9.6 Construction Techniques:

All construction is controlled and monitored under the guidelines of the Lifesaving Systems Quality System, which meets or exceeds MIL-I-45208A requirements.

All sewing is performed on commercial 301 lock-stitch sewing machines to Fed. Std. 751. Patterns are sewn using computer controlled automated pattern tackers. Webbing is cut with an automated, hot-knife, cutter. All Material certifications are on file.

10.0 Load Bearing Capability:

The TRI-SAR is design from a system perspective, which includes attachment to the helicopter hoist system. The harness has significant safety factor and is designed such that other components in the system (specifically the helicopter hoist cable) will fail well before the design capabilities of the TRI-SAR harness are exceeded.

The design and construction of the TRI-SAR is such that the primary load is carried by the main hoisting (lifting) strap and transferred into the leg straps. The weakest point in the system becomes the stainless steel adjusting hardware on the leg straps. As noted in the material listing, the adjusters have a breaking limit of 2,200 lbs. However, each adjuster is subjected to ¼ of the total load applied to the lifting v-ring.

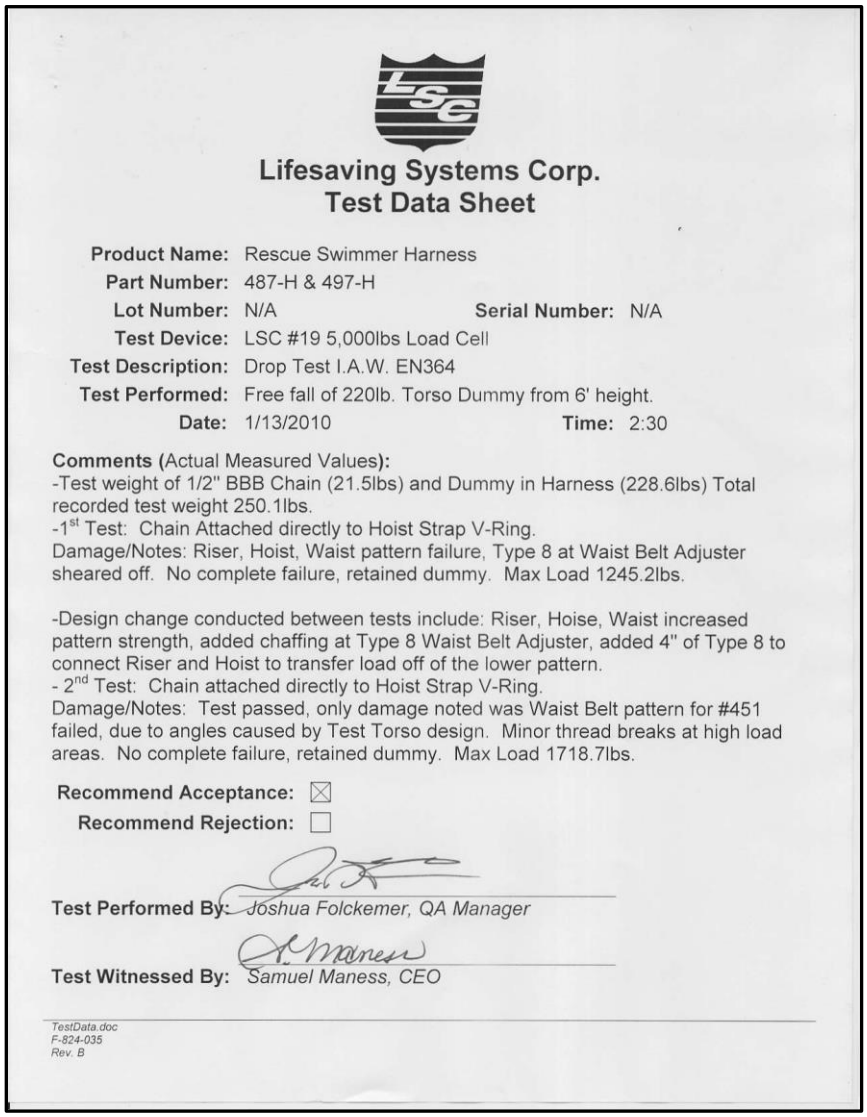
When properly worn and adjusted each leg carries ½ of the total load subjected to the harness. Further, since each leg strap forms a loop, each side of the loop carries ½ of the load subjected to that leg strap assembly.

Therefore, the adjuster hardware in each leg strap will only be subjected to ¼ (½ x ½) of the total load placed on the harness when properly fitted.

This provides for a calculated ultimate load bearing capability of the harness at approx. 8,800 lbs. A safety factory of 29+ is achieved for a person weighing 300lbs or less. Additionally, the ultimate load bearing capability exceeds the breaking limit of the hoist cable which is rated at 3,300lbs breaking strength.

11.0 Drop Test Data:

Drop test was performed at LSC on January, 13th 2010. The results of the test were documented (F-824-035) and attached to this report for reference.



Lifesaving Systems Corp.
Test Data Sheet

Product Name: Rescue Swimmer Harness
Part Number: 487-H & 497-H
Lot Number: N/A **Serial Number:** N/A
Test Device: LSC #19 5,000lbs Load Cell
Test Description: Drop Test I.A.W. EN364
Test Performed: Free fall of 220lb. Torso Dummy from 6' height.
Date: 1/13/2010 **Time:** 2:30

Comments (Actual Measured Values**):**
-Test weight of 1/2" BBB Chain (21.5lbs) and Dummy in Harness (228.6lbs) Total recorded test weight 250.1lbs.
-1st Test: Chain Attached directly to Hoist Strap V-Ring.
Damage/Notes: Riser, Hoist, Waist pattern failure, Type 8 at Waist Belt Adjuster sheared off. No complete failure, retained dummy. Max Load 1245.2lbs.

-Design change conducted between tests include: Riser, Hoise, Waist increased pattern strength, added chaffing at Type 8 Waist Belt Adjuster, added 4" of Type 8 to connect Riser and Hoist to transfer load off of the lower pattern.
- 2nd Test: Chain attached directly to Hoist Strap V-Ring.
Damage/Notes: Test passed, only damage noted was Waist Belt pattern for #451 failed, due to angles caused by Test Torso design. Minor thread breaks at high load areas. No complete failure, retained dummy. Max Load 1718.7lbs.

Recommend Acceptance: ☒
Recommend Rejection: ☐

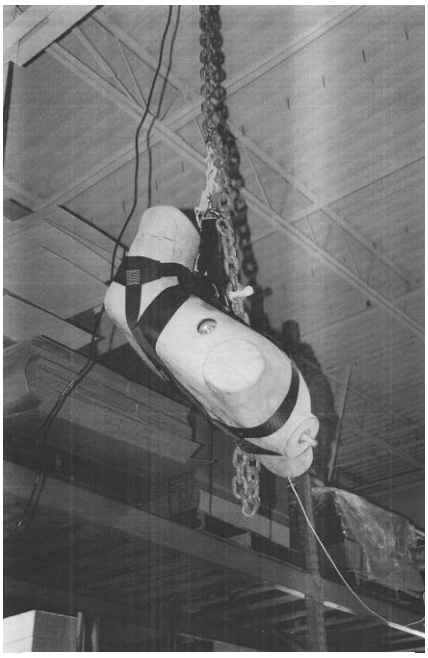
Test Performed By: *Joshua Folckemer, QA Manager*

Test Witnessed By: *Samuel Maness, CEO*

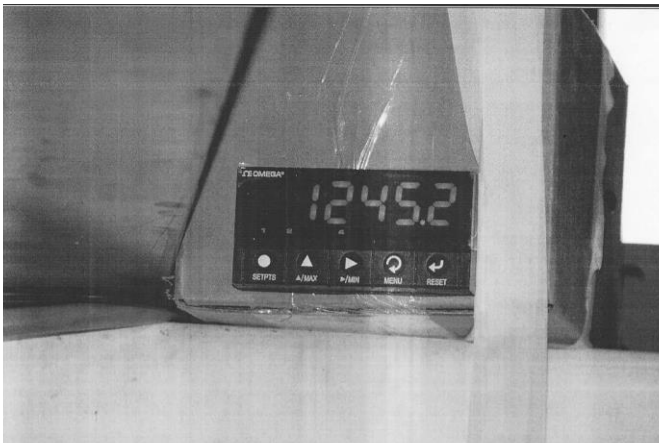
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Rev. B

11.1 Test Images:

Test 1:



Torso Dummy in Harness

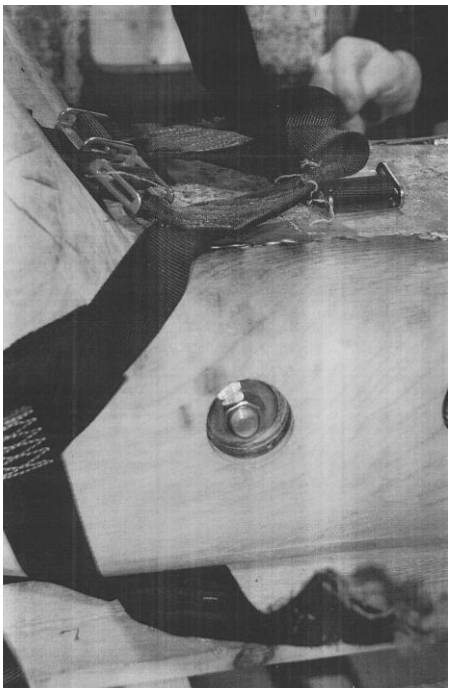


Load Cell Reading 1,245.2lbs. (First Test)

-Harness Retained Dummy

-Stitch Pattern Failure

-Cut Webbing at Waist Adjuster

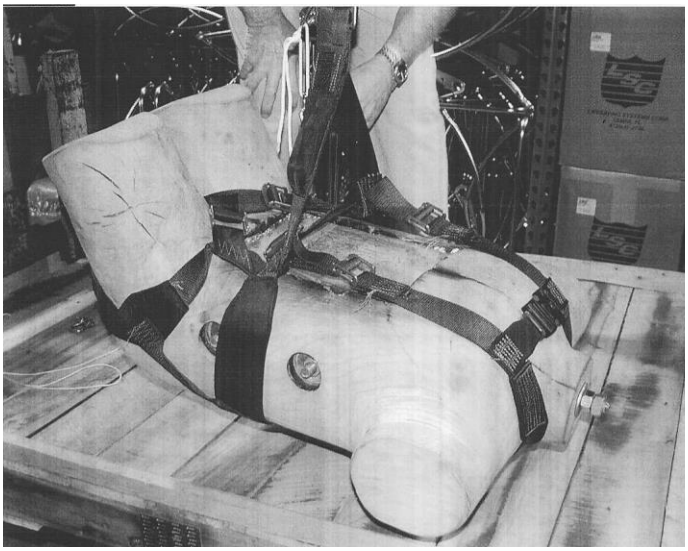


Type 8 Webbing Sheared off from Waist Belt Adjuster



Broken Stitching

Test 2:



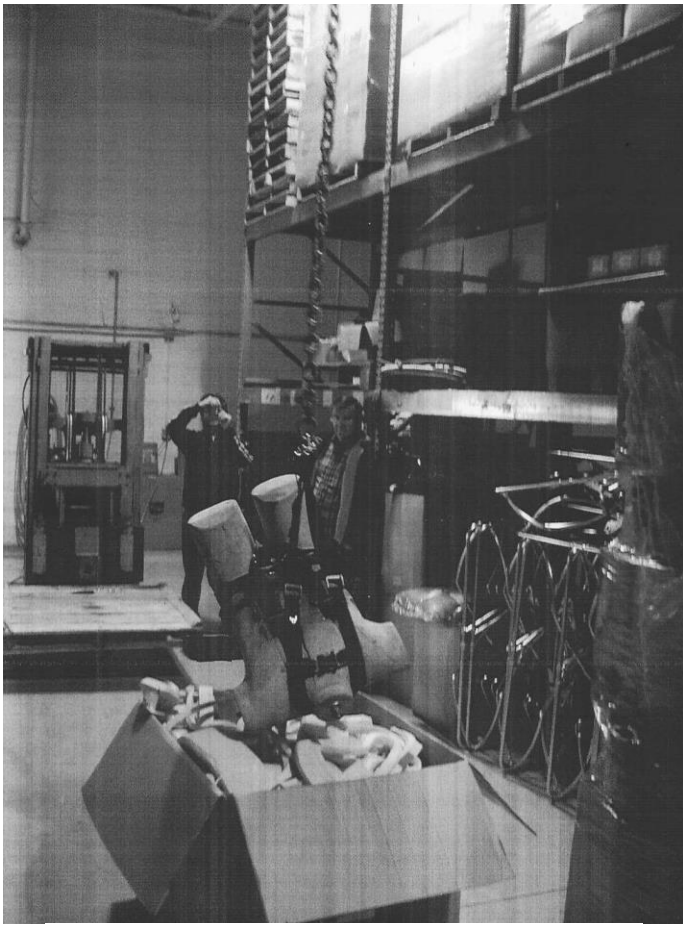
Torso in Harness after Design Change.

Design Changes:

-Riser, Hoist, Waist Increase Pattern Strength

-Added Chaffing at Type 8 Waist Adjuster

-Added 4” Type 8 to connect Riser to Hoist to transfer load off of lower pattern



Retained Dummy, Max Load 1,718.7lbs.

12.0 Replacement Parts:

Part Number:	Part Description:
487-HS	Harness, Small, less than 64” in height
487-HM	Harness, Medium, 64”-69” in height
487-HL	Harness, Large, 68”-73” in height
487-HXL	Harness, X-Large, 72”-78” in height
487-HXX	Harness, XX-Large, 74”-80” in height
487-VB	Black Inflatable Bladder US Navy Pockets
487-VBC	Black Inflatable Bladder USCG Pockets
487-VO	Orange Inflatable Bladder USCG Pockets
358	Rescue and Survival Knife
484 CO2	Cylinder, 33 Grams
487-1-3	Tri-SAR Inflator Assembly
HI015	Pin, Safety, Red
487-NB	Nut and Bolt, Vest/Harness Attachment, 50 Pack
H089-50	Lock Nut, Vest/Harness Attachment, 50 Pack
H050	Bolt, Vest/Harness Attachment, 50 Pack

13.0 Warranty:

LSC products are warranted to the first consumer purchaser to be free from defects in material or workmanship for a period of twelve (12) months. Please contact LSC for our complete warranty information and policies, or visit our website for product support.