TULMAR ENGINEERED FOR PROTECTION

SINGLE AND DUAL LANE GENERIC TRAINING SLIDE/RAFT

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MANUAL P/N 6709-MAN, REV D

REVISION HISTORY

This revision history is to serve as a record of the changes to this manual. The record includes the revision letter, the date of the revision, the page(s) affected, and a brief description of the change.

Rev	Date	Pages affected	Brief Description
NR	January 10, 2006	All	Original release
A	June 5, 2006	6	Change part number of Tss 6340 top-up valve to Tss 63408. This is a running change and does not affect previous Slide/Rafts.
B	June 30, 2006	All	Added Single lane slides to operation and maintenance manual.
C	June 15, 2010	All	Added 3252-001 inflation/deflation tool for canopy struts
D	June 25, 2013	All	Reformatting, update service parts list

TABLE OF CONTENTS

LIST OF FIGURES

1. TRAINING SLIDE OVERVIEW

Tulmar Safety Systems Single Lane and Dual Lane Slide/Raft has been designed to simulate an OEM evacuation slide by replicating the factors essential for training and is constructed from robust materials more suitable to the training environment. In terms of length and width it is very similar to the OEM slides found on small jets and wide body jets such as the A340, A330, and 747 aircraft.

The canopy attachment methods and procedures are identical to the OEM as are the methods of boarding, mooring, use of supplementary pumps, canopy erection, use of survival kits and use of ELTS. The sliding surface is dimensionally the same as the OEM.

The basic slide/raft comes with canopy supports on the side rails, two inlet valves, two relief valves, two top-up valves, two pressure sensor ports and a girt assembly. The basic slide can be configured for pool training as opposed to straight slide training. With the addition of some optional equipment, it can be used to simulate the OEM slide in the water.

The inflatable chambers are made of Hypalon/neoprene fabric for increased resistance against abrasion and water conditions found in training pools. The slide floor is made from the same conductive material as that used for OEM slides. The floor is designed for easy replacement as this is the component most subject to wear. Tulmar slide/rafts can be used for pool training as all joints are double seamed to mitigate the effect of chlorine on the adhesive.

Dual Lane Slide

Single Lane Slide

Figure 1: Single vs Dual Lane

2. OUTLINE DRAWING

Dual Lane Slide Drawing

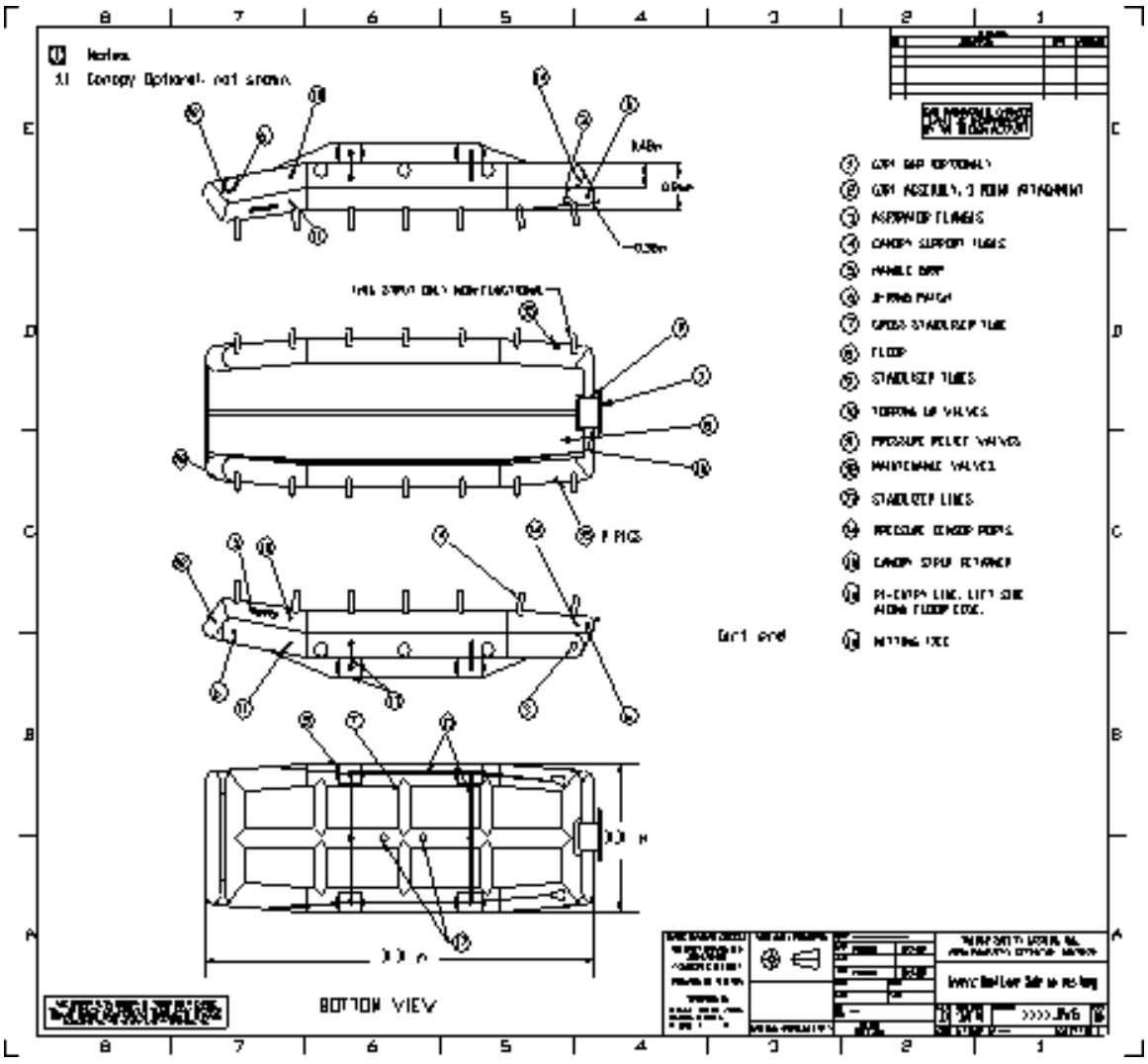


Figure 2: Dual Lane Slide Drawing

Note:

- Some details shown are optional.
- Quantity and location of valves may be different from drawing.
- Aspirators are generally used when rapid inflation is required.

<u>DRAWING IS FOR REFERENCE ONLY</u>

Single Lane Slide Drawing

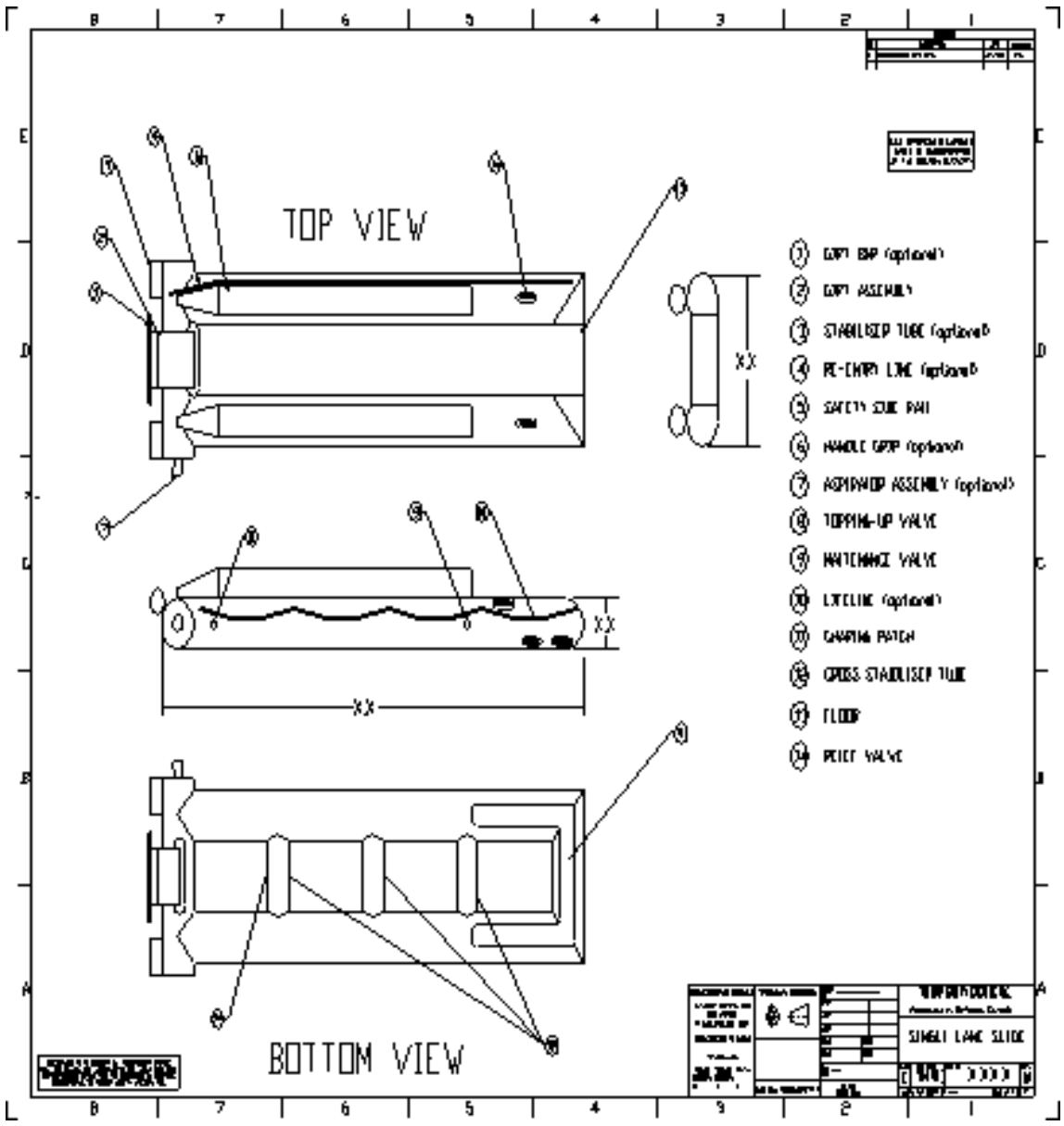


Figure 3: Single Lane Slide Drawing

Note:

- Some details shown are optional.
- Quantity and location of valves may be different from drawing.
- Aspirators are generally used when rapid inflation is required.

DRAWING IS FOR REFERENCE ONLY

3. GENERAL OPERATION

3.1 Inflation

3.1.1 Unpack the slide and roll it out to its full length. Make sure that there are no sharp foreign articles underneath or near the slide.

3.1.2 Inflate the slide through the aspirators, or the top-up valves, or a flange with the valve removed. Inflation can be achieved using clean dry air from a compressor, or industrial blower or vacuum cleaner until the slide is fully extended. The air source must be free from moisture.

3.1.3 Fill the slide with approximately 2.3 psi. of air. The relief valves will open once the operating pressure has been exceeded and will close at approximately 2.0 psi.

3.1.4 For permanent inflation, it is ideal to attach the slide to compressed air regulated at 2.3 psi.

3.1.5 To accommodate customer preference, the top-up, maintenance and relief valves may be relocated in different positions on the slide. The valves can be interchanged by unscrewing them with the supplied socket wrench and interchanging them. Make sure that each chamber has a relief valve, a top-up valve, a maintenance valve. The top and bottom chambers are separate air holding chambers.

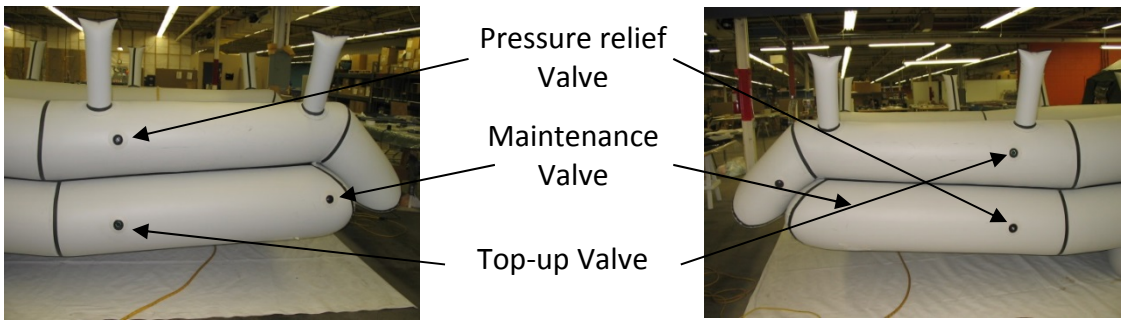


Figure 4: Valve Locations

3.2 Installation

3.2.1 Attach the slide girt to the crew cabin trainer using a standard girt bar, or equivalent.

3.2.2 Although the bottom of a slide/raft used for slide training is reinforced with additional material, it is recommended that gymnastic pads or their equivalent be placed underneath the slide from the crew cabin trainer door extending to underneath the bottom of the slide. This is for safety reasons as well as to prevent excessive wear on the bottom of the slide itself.

3.2.3 It is recommended that a safety net be installed beneath the slide as an extra safety precaution.

3.2.4 Tether the slide to the trainer and the floor using the D-ring at each corner. This will add stability to the slide during training. Make sure that the attachment to the D-rings allows for full mobility of the slide during all training scenarios, without placing undue stress on the D-ring patches.

3.3 Pool Use of the Slide/Raft

When using the raft in a chlorinated public pool it is important to observe the following procedures:

3.3.1 Make sure the pool deck is devoid of all objects that could cause damage to the slide prior to inflation.

3.3.2 When inflating the slide, be sure that the inlet valves and aspirators are not near the water. Ensure that all inflating devices are not near or can make contact the water.

3.3.3 After use in the pool, wash the slide/raft down with fresh water, particularly the seams. This will ensure that any residual chlorine is removed.

3.3.4 Once the raft is brought back to base it should be hung to dry prior to repacking.

3.4 Deflation

3.4.1 Install the nylon adapter into the top-up valve or use the socket tool to remove the maintenance or top-up valve.

3.4.2 Hold on firmly to the valve upon removal, as the internal pressure in the slide will try to expel the valve.

3.4.3 Once the air has been almost completely removed, use a vacuum to remove any remaining air.

3.5 Packing

Repack the slide/raft as per the following diagrams:

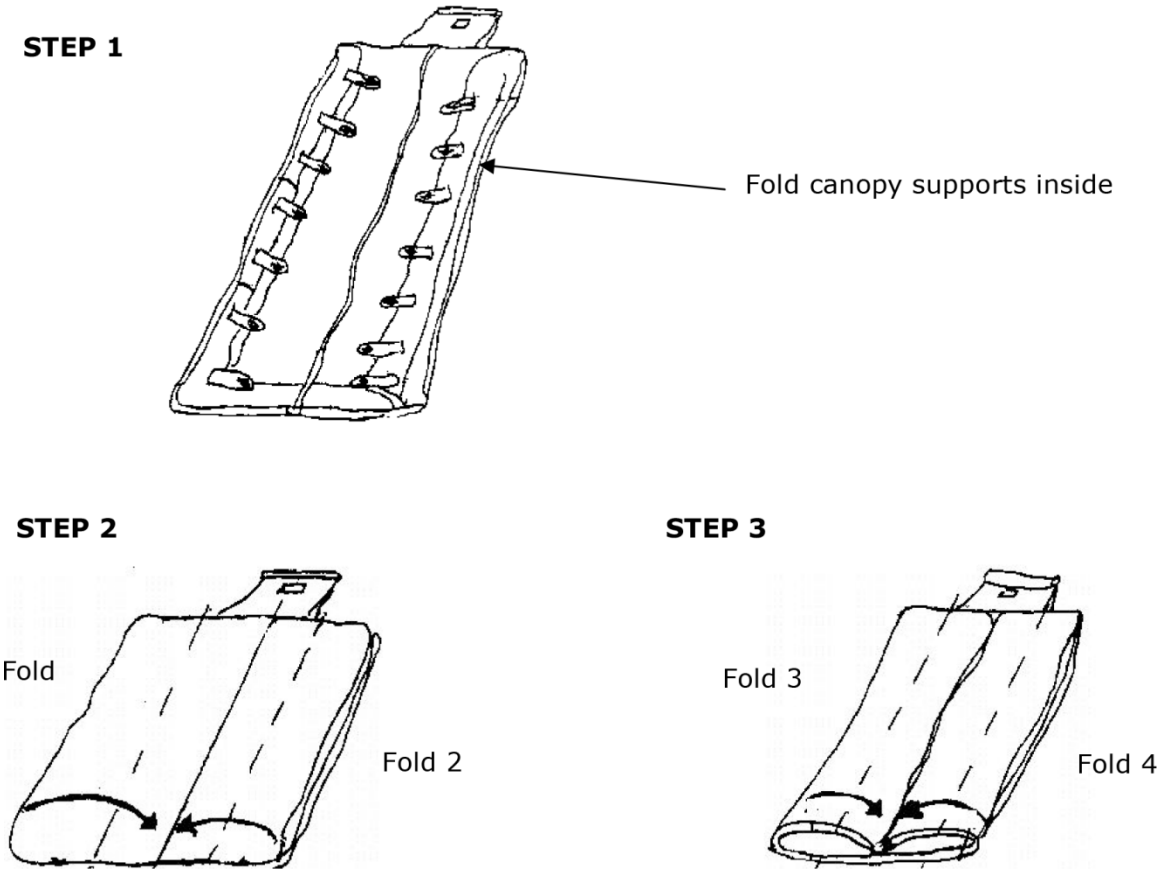
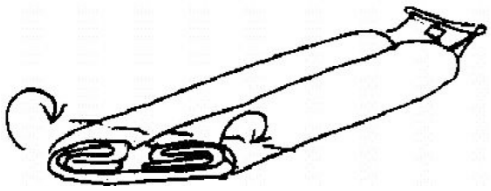


Figure 5: Packing Steps (1-3)

STEP 4

Roll and fold from toe to girt



STEP 5

Use knees to square off roll to fit into valise (optional).

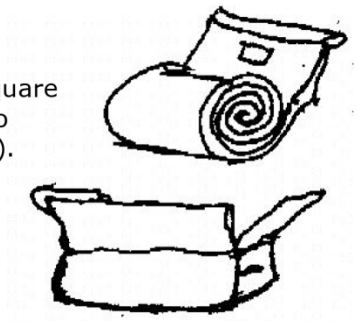


Figure 6: Packing Steps (4-5)

4. CANOPY (OPTIONAL)

4.1 Canopy Overview

The canopy is made from lightweight waterproof orange fabric. It is designed to protect the occupants from the elements. The canopy is removable and is identified with markings that assist the occupants in installing the canopy to the slide.

The canopy is supported in the center in 4 places by inflatable yellow "CANOPY END SUPPORTS" and "CANOPY CENTER SUPPORTS", and supported along the sides by 14 numbered supports on the top of the slides inflatable structure.

The canopy is tied to the slide on the outer top edge by tying the cords on the canopy to the loops on the outer numbered supports. The "CANOPY END SUPPORTS" and "CANOPY CENTER SUPPORTS" are tied at both ends, the top to the cord on the canopy, and the bottom to the "CANOPY MAST" patch on the slide.

Optional rubber buttons can be installed on the slide. The rubber buttons can then be used instead of the webbing loops for attaching the canopy. The cords on the canopy may then be wrapped around the buttons to hold the canopy in place.

Figure 7: Canopy Installed

4.1 Canopy Markings

The canopy is marked with:

- Odd numbers on one side and even numbers on the other side. These numbers correspond with the numbers on the slides outer canopy supports.
- “CANOPY MAST END SUPPORT” at each end, indicating the location for attaching the two yellow “CANOPY END SUPPORTS”.
- “CANOPY MAST CENTER SUPPORT” at 2 locations in the center, indicating the location for attaching the two yellow “CANOPY CENTER SUPPORTS”.
- “THIS SIDE DOWN” is marked at both ends. This indicates that the marked side faces down when installed on the slide. The cords on the canopy will all be facing inwards.
- “AIRCRAFT DOOR END” is marked on one end only. This identifies the end of the slide which attaches to the aircraft door (the girt end)

Even Number on Canopy (right side)

Canopy Mast End Support
marking on canopy

Even Number on Canopy Support
(right side)

Canopy End Support
(Canopy Center support is similar)

End identifying Aircraft door end
And side facing down when installed

Loop patch on end of Canopy Center and
End Support to tie to canopy and slide

Figure 8: Canopy Markings

4.3 Canopy Installation

The canopy is installed according to the identifying markings.

4.3.1 Open up the canopy and locate the end marked “AIRCRAFT DOOR END”. Place this end at the girt end of the slide.

4.3.2 Place the side marked “THIS SIDE DOWN” towards the slide, the cords and all marking will be facing towards the slide.

4.3.3 Place the canopy over the outer canopy support struts on the slide. The numbers on the slide supports will align with the numbers on the canopy. Odd numbers are on the left and even numbers are on the right when sitting at the girt end and facing the foot end (the opposite end) of the slide.

4.3.4 Tie the cords on the canopy to the to the loop patches on the slide. The cords along the lower edge of the canopy tie to loop patches along the outboard centerline of the slide tubes.

4.3.5 For training purposes the cords should be tied with a knot that is easily undone, and a minimal amount of cords can be tied.

4.3.6 Follow the marking on the yellow canopy center and end supports, inflate all tubes orally. They should be firm but not hard, DO NOT over inflate as they do not have pressure relief valves. Halkey Roberts p/n TV73703 or Tulmar p/n 3252-001 is to be used to inflate/deflate during maintenance (ie with compressed air / vacuum) as long as a regulated air supply, set to the operation pressure of the slide, is used.

4.3.7 Tie one end of the “CANOPY END SUPPORT” to the “CANOPY MAST” patch at each end of the slide, and the other end to the canopy where marked. Tie the other “CANOPY END SUPPORT” to the opposite end of the slide and canopy.

4.3.8 Tie one end of the “CANOPY CENTER SUPPORT” to the “CANOPY MAST” patch in the center of the slide, and the other end to the canopy where marked. Tie the other “CANOPY CENTER SUPPORT” to the other patch on the center of the slide and canopy.

5. SERVICE INSPECTION PROCEDURES

5.1 Periodic Maintenance Inspection

5.1.1 Service inspection should be performed once per year in accordance with the test procedures outlined below.

5.1.2 Service inspection includes a Visual Inspection and a Leakage Test. The Leakage Test will uncover any porosity in the fabric or loss of integrity in the inflation chamber seams.

5.2 Supplementary Tests

5.2.1 The Pressure Relief Valve Test may be performed if the operation of the relief valves is questionable.

5.2.2 The Pressure Test indicated on the Product Inspection Forms #193-6728 is **ONLY** to be performed by Tulmar Safety Systems.

5.3 Testing Environment

5.2.1 Testing should be performed in a draught-free room away from direct sunlight.

5.2.2 The temperature of the testing room should be approximately 70^0F.

5.2.3 Floors should be clean and cleared of any sharp objects or cement defects.

5.4 Test Equipment

The following equipment and materials are required:

- Calibrated pressure gauge;
- Testing adapters;
- Relief valve locking clips;
- Thermometer and barometer;
- Non-detergent soap;

- Paint brushes;
- Air supply;
- Test report (copy of sheet provided in this manual)

5.5 Visual Inspection

6.5.1 Inspect the inflation chambers for tears, holes, abrasions, pigment-peeling, loose seam tape, etc.

6.5.2 Inspect the accessories and webbing straps for tears, loose stitching, etc.

6.5.3 Inspect the slide hardware for damage to the valves, flanges, caps or fittings.

6.5.4 Repair any damages to the slide in accordance with Section Repair Procedures.

5.6 Leakage Test

5.6.1 Adjust the slide inflation pressure to 2.0 psi.

5.6.2 Stabilize for 15 minutes minimum, stabilizing for up to 1 hour will allow the slide more time to adjust to the pressure, and allow the air to reach ambient temperature.

5.6.3 Readjust pressure to 2.0 psi and record the slide/raft pressure, temperature, barometric pressure and time and date.

5.6.4 Allow the slide/raft to stand undisturbed for the desired test interval (6 hrs. Minimum is recommended).

5.6.5 Record the slide pressure, temperature, barometric pressure, and time at the end of the pressure test.

5.6.6 Correct for temperature variations by subtracting 0. 03 psi. (0.02 N/cm^2 for every 1.8^0 F. (1.0^0 C.) rise in temperature or by adding 0.03 psi. (0.02N/cm^2) for every 1.8^0 F. (1.0^0 C.) fall in temperature.

5.6.7 Correct for barometric changes. If the barometric pressure decreased, subtract 0.049 psi., (0.035 N/cm^2) from the final gauge reading for every 0.1 inches (2.54

mm) of mercury decrease. If the barometric pressure increased, add 0.049 psi (0.035 N/cm^2) to the final gauge reading for every 0.1 inches (2.54 mm) of mercury increase.

5.6.8 The minimum permissible slide/raft pressure is 1.83psi after correction for temperature and pressure variations.

5.6.9 If the pressure has fallen below specified limits, re-inflate the slide/raft until the pressure relief valves open and then close. Check all valves, pressure sensor port, aspirators for leakage. Check for leaks in the inflatable chambers by swabbing the tubes with leak test solution.

5.8 Pressure Relief Valve Test

5.8.1 Inflate the slide using oil-free shop air until the relief valve opens. Air can be heard escaping from the valve indicating that excess pressure is being vented by the relief valve.

5.8.2 Non-detergent soap can be applied to the valve surface to aid in detecting the opening of the valve. Bubbles will appear on the valve surface indicating that air is being vented.

5.8.3 Record the valve opening pressure. The relief valve should open at a pressure between 2.15 psi and 2.6 psi.

5.8.4 When the valve opens, shut off the air supply and continue to observe the relief valve until air stops venting or bubbles cease to form indicating closure of the valve.

5.8.5 Record the pressure at time of closure. The relief valve should close at 2.0 psi.

5.8.6 If a relief valve fails to open or close at the specified pressure or pressure interval, remove and replace the relief valve.

5.9 Topping Up Valve & Maintenance Valve Test

5.9.1 Fully inflate the slide to 2.0 psi.

5.9.2 Slowly apply soapy water with a brush onto the top of the valve to generate the least amount of bubbles as possible.

5.9.3 Monitor valve and check for generation of new bubbles. Valve should be airtight allowing no new bubbles to form.

5.9.4 Note location of any leaks found for repair; if the leak origin appears to be from the valve, replace valve and repeat valve test. If the origin of leak is from the flange, the slide should be returned to TULMAR.

6. REPAIR PROCEDURES

6.1 General

7.1.1 Repairs to evacuation training slides normally consist of patching the damaged area with fabric patches.

7.1.2 When there is a lot of damage in a single location, then part panel replacement or total panel replacement is necessary. For part or whole panel replacement, the slide should be returned to TULMAR.

7.1.3 Patches and panels are bonded with a self-curing neoprene adhesive.

6.2 Repair Environment

6.2.1 Repairs are to be carried out in a room with the following characteristics:

- Temperature 20 °C +/-5 °C;
- Barometric pressure between 94.8 and 108.4 Kpa (28 to 32 inches of mercury);
- Relative humidity of less than 80 %;
- Free from direct sunlight;
- Free from draughts;
- Equipped with an area with a clean smooth surface, such as a table with a melamine top;
- Free from projections and having a clean, dry floor.

6.2.2 It is imperative that the tools used for repairs are always clean and free from abrasives. Service personnel should wear rubber or felt-soled footwear.

6.3 Repair Assessment

6.3.1 The area of damage is estimated by the size of the patch required to repair it.

6.3.2 Pigment removal that does not affect the base cloth (textile) is treated as an abrasion and can be adequately repaired with tape, or a small patch. If the base cloth is damaged it is treated as a hole.

6.3.3 Deteriorated and/or porous fabric is treated as a hole.

6.3.4 Coated fabric that has been contaminated with a substance which has deteriorated the coating and/or base cloth shall be treated as a hole. The affected area shall be cut out, cutting 1” (25 mm) larger than the damaged area.

If contamination exists, the remainder of the slide shall be checked for additional contamination.

6.3.5 Replacement of panels should not be attempted. For part or whole panel replacement, the slide should be returned to TULMAR.

6.4 Materials

6.4.1 Repairs must be made with the same materials as the section being repaired, except that seam tape can be used for abrasions, chafing or pigment-peeling damage.

6.4.2 French chalk is used to prevent over-cemented areas from sticking together after bonding has been completed.

6.4.3 A two (2) part self-curing adhesive or approved equivalent is used. The adhesive must be mixed according to the manufacturer's instructions and kept in a sealed, airtight container. The mixed life of the adhesive must be complied with.

6.4.4 Sand-paper, #80-grit, is used for surface preparation prior to applying adhesive.

6.5 Surface Preparation

6.5.1 Sanding is necessary to rough up the surface of the fabric being bonded. Sanding enables the adhesive to better bond with the fabric by providing more surface area. Good sanding is indicated by the removal of the shine on the surface of the fabric, and by the feeling of more drag as you slide a finger across the sanded area. Sanding is not to expose the base cloth of the fabric for inflatable structures.

6.5.2 Both surfaces to be bonded are to be sanded. Sanding should run parallel to the seam or to the edges of the fabric. Sand paper must be checked periodically to ensure it is not worn or filled with sanding debris. Sanding must raise hairs on the surface, but not go through the base cloth.

6.5.3 After sanding, the area must be thoroughly cleaned using MEK, Toluene or equivalent degreasing solvent. Clean surface to be joined with a pad wet (not dripping) with the solvent. Make sure that there is no sanding dust left on the fabric after cleaning. A clean cloth indicates a properly cleaned surface.

6.6 Patch Application

6.6.1 Sanding is necessary to rough up the surface of the fabric being bonded. Sanding enables the adhesive to better bond with the fabric by providing more surface area. Good sanding is indicated by the removal of the shine on the surface of the fabric, and by the feeling of more drag as you slide a finger across the sanded area. Sanding is not to expose the base cloth of the fabric for inflatable structures.

6.6.2 Cut the patch to size; the patch is to extend 1 inch beyond the damaged area on all sides. The corners are to be rounded and not square. For example if there were a slit ¼ inch long, the patch would be 2 ¼ inches long by 2 inches wide.

6.6.3 Use the patch centered over the area to lightly mark the location of the patch.

6.6.4 Apply two coats of adhesive to both the patch and the area to be patched. Allow at least 20 minutes between the coats for the adhesive to properly dry.

6.6.5 Apply the last (third coat) to both surfaces. Allow this coat to dry until it is tacky, but not wet to the touch. If the adhesive has dried so that it has lost its tackiness, another coat must be applied and allowed to reach a tacky state before applying the patch. If the adhesive is too wet or dry, it will not bond properly. It will be very hard to get a good bond on large areas, you may want to work on a square foot maximum when applying the third coat and applying the patch.

6.6.6 Apply the patch to the area; start by centering the patch over the area. Then apply pressure to the center of the patch using an object with a smooth flat surface or a roller with a hard surface. Apply pressure working from the center to the outer edges and removing any bubbles between the two surfaces.

6.6.7 Allow the adhesive to cure for the time recommended by the manufacturer of the adhesive, typically 7 days.

6.7 Accessory Repairs

6.7.1 **Sewing**

- Broken or missing stitches can be re-sewn if there is no sign of damage to the components.
- All sewing should be lock-stitching, using 6-10 stitches per inch.

- The thread should be nylon, to V-T-295, size F (11-12 lbs. breaking strength) or equivalent.
- All stitching should be ended with a minimum of ½" overstitch (reverse direction).

6.7.2 **Webbing**

- Damaged webbing may be replaced or repaired with a splice.
- When replacing the webbing, it must be carefully unstitched without damaging the fabric or any other components.
- A new piece of webbing can be cut, using the old piece as a pattern, and re-sewn.
- The webbing should be similar in type, colour and width and have a minimum breaking strength of at least 500 lbs. The webbing should work well with the hardware.

6.7.3 **Hardware & Valves**

- Replace any hardware or valves showing damage or rough edges with new parts.
- To replace a valve, remove the valve using the socket tool provided by turning counter clockwise. It is recommended to vent out the slide chambers prior to completely removing the valve.
- Replace with new valve, turning clockwise. Tighten with the socket tool hand tight.
- Check the valve for leaks after installation, if there is leaking re-tighten the valve.

6.8 Floor Replacement

6.8.1 The floor of the training slide has strips of Velcro loop fastening tape installed along both sides, across the top and bottom and down the center.

6.8.2 When the slide floor requires replacement due to wear, a replacement floor should be ordered from Tulmar.

6.8.3 To install the replacement floor, place it over the original floor taking care to align the Velcro hook attachments on the underside of the replacement floor with the loop attachments on the slide floor.

6.8.4 Press firmly along the complete perimeter of the floor to achieve a secure fastening.

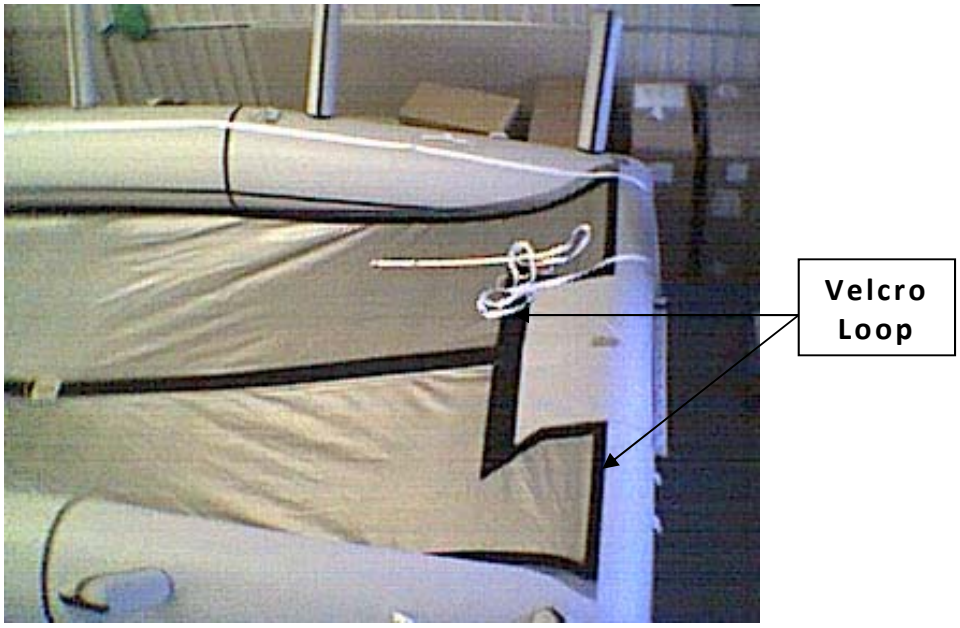


Figure 9: Floor Replacement

6.9 Adjusting Decent Speed

6.9.1 To increase the friction on the sliding surface (slower sliding speed):

6.9.2 First, wash any Armor All off of the slide floor with soap and water. Then rinse with water. Try the sliding speed.

6.9.3 If you still need a slower sliding speed you can re-activate the adhesive in the deceleration strips. Using appropriate safety measures dampen a rag with Toluene and gently wipe the deceleration strips. Do not rub as you may start to rub off the deceleration strip. Try the sliding speed.

6.9.4 Over time, the deceleration strips may wear out prior to the slide floor wearing out. The deceleration strips can be re-applied to the slide floor with neoprene adhesive and ink. Contact Tulmar for products or specifications.

6.9.5 To decrease the friction on the sliding surface (faster sliding speed):

6.9.6 Using appropriate safety measures dampen a clean rag with Armor All Original Protectant or equivalent and wipe the slide floor and deceleration strips conservatively. Beware that Armor All is very slippery and you will want to apply small amounts at a time. Try the sliding speed before applying more Armor All.

6.9.1 To increase the friction on the sliding surface (slower sliding speed):

7. SERVICE PARTS LIST

The following table lists components available to standard training slides and 'raft' outfitted slides. If you are looking to replace a part that is not listed below, please contact the manufacturer.

SERVICE PARTS

Part No.	Description
2200	Stabilizer webbing line, white, 2" wide, 1700 lbs breaking strength
2225	Re-entry line, webbing, white, 1" wide, 2800 lbs breaking strength
3252-001	Inflate/deflate tool for canopy strut
3851	Brass fitting for pressure sensor port
5513-1406	Patch Kit
6314	Pump Adapter for top-up valve
6339	Maintenance plug
63408	Top-up valve
6348	Pressure relief valve
6366	Socket Tool

Figure 10: Service Parts

Table provided for reference only, information may change without notice

8. APPENDICES

Inspection Test Report

Product Inspection Form # 193

Form Revision: August 08, 2005

Description: Dual Lane Slide/Raft -**Items are to be 100% inspected I.A.W. P.I.P. 001**

SFO: **TSS P/N:** **Qty.: 1** **Date:** _____

Test No. 1: Pressure Test

There shall be no evidence of permanent distortion or damage to the slide over a 5 min[illegible] Pressure test to be completed prior to Leakage test.

Pressure Test to be performed by Tulmar Safety Systems Inc.

Chamber	Pressure	Time On	Time Off	Read'g	Temp.	Pass / Fail
Top	4 psi			psi	°C	
Bottom	4 psi			psi	°C	

Inspection Stamp/Date/Remarks:

Test No. 2: Pressure Relief Valve Test

Valve must open between 2.15 and 2.6 psi.
The valve should close at approximately 2 psi.

Chamber	Open Pressure Read'g	Pass / Fail
Top	psi	
Bottom	psi	

Inspection Stamp/Date/Remarks:

Test No. 3: Leakage Test

The maximum pressure loss after 6 hours is 0.17 psi after compensated pressure. Temperature: -0.03 psi for 1 deg C increase in temp. +0.03 psi for 1 deg C decrease in temp. Pressure correction: +0.049 psi for each 0.1" barometric increase, -0.049 for each 0.1" barometric decrease

Chamber	Pressure	Time On	Time Off	Read'g	Temp. Start	Temp. End	Temp. Var.	Baro. Start	Baro. End	Baro. Var.	Final Read'g	Pass/Fail
Top	2 psi			PSI	°C	°C	°C					
Bottom	2 psi			PSI	°C	°C	°C					

Inspection Stamp/Date/Remarks:

Final Inspection Check List: **Actual Details may be different.**

- Boarding Handles qty 4 ❒
- Girt qty 1 ❒
- Maintenance valves qty 2 ❒
- Top-up valves qty 2 ❒
- D-Ring patch qty 4 ❒
- Chafing patch foot end qty 1 ❒
- RE-entry mooring line qty 1 ❒
- Aspirator port qty 2 ❒
- End Strut Holders qty 2 ❒
- **Date of MFG:** _____
- Velcro loop for replacement floor qty 45 mrs ❒
- Deceleration strips on floor qty 4 ❒
- Girt Release Handle (not operational) qty 1 ❒
- Relief valves (s/n# _____ & _____) qty 2 ❒
- Pressure sensing port with fitting qty 2 ❒
- Chafing patch head end with 2 leather strips qty 2 ❒
- Non-operational right girt end strut qty 1 ❒
- Aspirator adapter from 106 mm to 93 mm qty 2 ❒
- Impression of the Serial Number, Ex: 6728-YR-XXX

Figure 11: Inspection Test Report