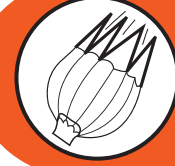
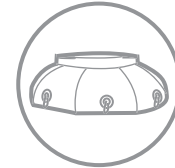


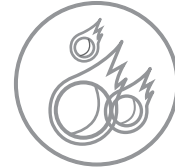
# AQUALANCHE OPERATIONS MANUAL



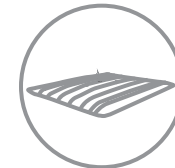
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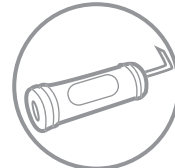
Fireflex



Dragon



Remote Site



Environmental



Emergency Response



**Bambi**  
BUCKET®

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## **AQUALANCHE OPERATIONS MANUAL - Version B**

**Issue Date: June 2011**

**PLEASE READ BEFORE USING.**

### **SEI INDUSTRIES LTD.**

7400 Wilson Avenue  
Delta, B.C. Canada  
V4G 1E5

Phone: (604) 946-3131

Fax: (604) 940-9566

E-Mail: [seisales@sei-ind.com](mailto:seisales@sei-ind.com)

Website: [www.sei-ind.com](http://www.sei-ind.com)

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# Section 1: Overview of the Aqualanche

## Introduction

This manual provides helicopter operators with specific information on the operation and maintenance of the Aqualanche-equipped Bambi bucket.

Since its introduction in 1983, the Bambi bucket has become the industry standard for helicopter fire fighting for more than 1,000 commercial operators and government agencies worldwide. This acceptance by the industry is a direct result of the Bambi bucket's effectiveness, reliability, simplicity and ease of use. With the addition of the new Aqualanche model, the already renowned Bambi bucket family can boost its fire suppression capabilities, thus making it an indispensable tool for attacking wildland and urban fires.

By simply opening or closing the Aqualanche, the operator can control a variable flow rate and/or multiple drops of water from the bucket. The bucket can also be bottom-filled easily by holding the valve in the open position.

No prior experience is required to quickly master the operation of the Aqualanche and the bucket requires no assembly. Once airborne, the operator can quickly become familiar with the flight characteristics of the bucket. Several fills will provide familiarity with the variable fill capability of the bucket as well as with the multi-dump capability of the Aqualanche.

Please read this manual prior to flying with the bucket, particularly the sections on deploying, filling and dumping. If you experience problems, please refer to *Sections 13 and 14, Maintenance and Troubleshooting* which may be especially helpful.

For your own protection and for longer bucket life, always read the instructions and warnings. Ignoring these instructions could result in personal injury, bucket damage or aircraft damage.

SEI offers complete parts supply and repair facilities for the Bambi bucket. For maintenance and repair purposes, parts lists and descriptions are provided in *Section 16: Aqualanche Parts*.

Please contact SEI Industries for more copies of this manual or visit our website ([www.sei-ind.com](http://www.sei-ind.com)) for more information on our products.

## Section 2: Aqualanche Installation

### Standard Valve Removal

Please follow these step-by-step instructions to remove the standard Bambi bucket valve before installing the new Aqualanche valve.

1. Disconnect the suspension lines from one side of the standard control head by removing the nylock nut and bolt from the control head.



*Disconnected control head and suspension lines.*

2. Next, remove the lines from the standard valve and install in the Aqualanche head ensuring that the order of the lines remains the same.
3. Repeat the procedure for the suspension lines on the other side of the control head.

4. Disconnect the tripline from the riser by removing the shackle near the control head.



5. Remove the standard control head and store away.
6. Disconnect the two IDS hub restrainer cables from the bucket by removing the clevis pins and cotter pins which secure the cables to the restrainer brackets in the bucket shell.



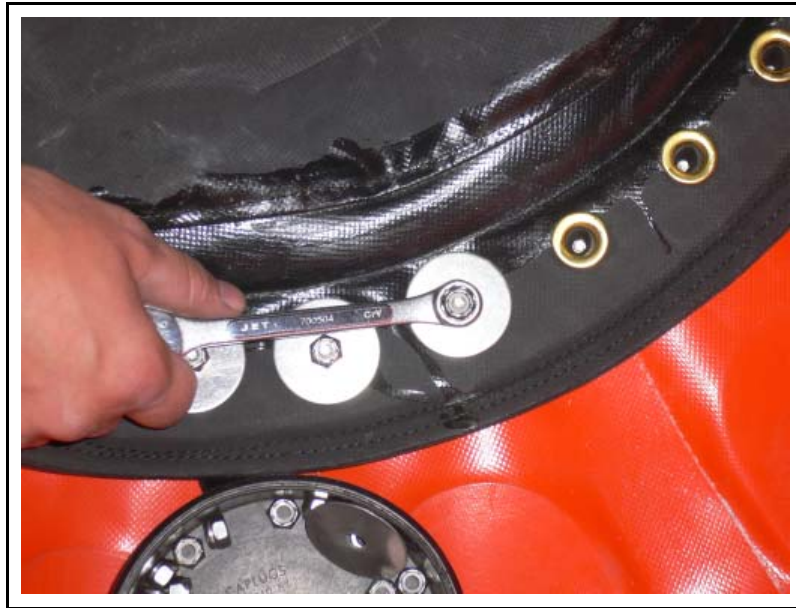
7. Mark the outer ends of two IDS spokes and their corresponding brackets to aid in reassembly.
8. Disconnect the outer ends of the eight IDS spokes by removing the clevis pins and cotter pins which secure the spokes to the brackets in the bucket shell. Remove the IDS assembly from the bucket and place to one side.



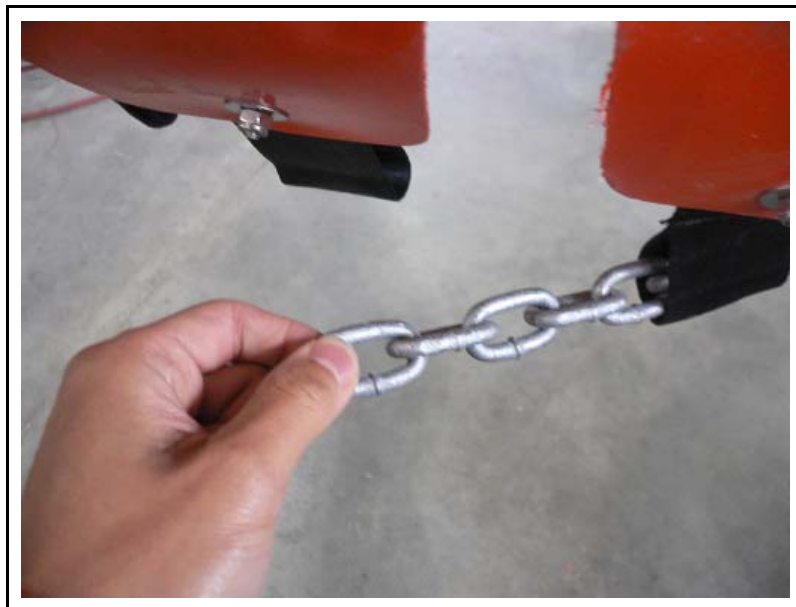
9. Disconnect the two valve restrainer cables by removing them from the shackles that attach them to the suspension chains. To open the shackle, drive the pin out with a punch.



10. Remove the 35 bolts which secure the standard valve assembly into the bucket.

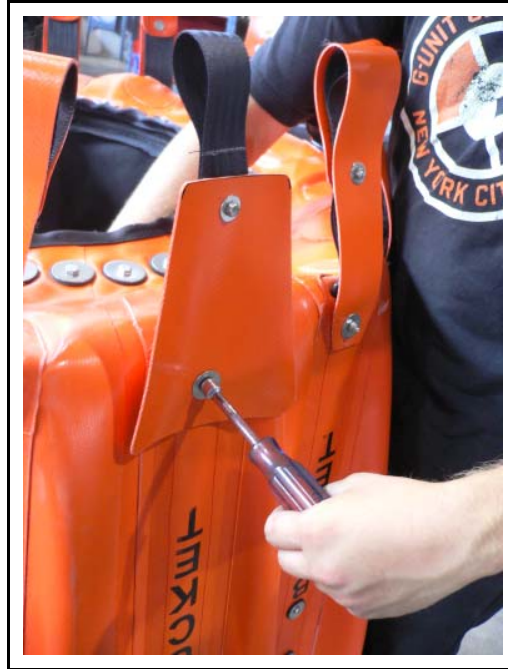


11. Remove the valve assembly from the bucket. The valve is sealed to the bucket shell with butyl tape and may be damaged during this process. Remove all remaining butyl tape from the inside of the bucket shell.
12. Remove the shackle which secures the lower chain and remove the lower chain.



## Aqualanche Valve Installation

1. Turn the bucket upside down. Remove the sixteen long wear strips and replace them with sixteen short wear strips.



2. Install the new chain which is smaller. Adjust the chain to the correct length and secure with the new shackle.



3. Install two rings of butyl tape onto the inside of the bucket. Cover every second grommet with tape. At the end, there should be two adjacent grommets that are uncovered.



4. Remove the four bolts and washers which secure the base ring to the support rods of the valve.



5. Place the base ring inside of the bucket, aligning the two adjacent uncovered grommets with the two holes in the ring that are closest together.



6. Install the short bumper block in the two holes that are closest together. Sandwich the bucket shell and straps between the bumper block and the base ring.



7. Install two 3/8" x 1-3/4" hex head bolts, four 3/8" x 1" flat washers and two 3/8" nylock nuts. Clamp the base ring and bumper block together and tighten the nuts.
8. Repeat the procedure for the remaining four long bumper blocks.



9. Place the new valve assembly into the bucket and align the support rods with the mounting points on the base ring.
10. Install four 1/2" x 7/8" flat washers, four 1/2" lock washers and four 1/2" x 1" hex head bolts but do not tighten. Place the alignment jig on the rods and tighten the bolts then remove the jig.



11. Replace the IDS assembly into the bucket using the alignment marks you made earlier to ensure the correct orientation. Secure the IDS spokes with clevis pins and new cotter pins.



12. Re-attach the IDS restrainer cables to the bucket using clevis pins and new cotter pins.



13. Secure the power cable to the control head using the wire clip provided. Ensure that, when the suspension lines are taut, there is no tension on the power cable. The installation of the Aqualanche is now complete.

## Section 3: Electrical Installation

### Aircraft Electrical System Interface

An Aqualanche installation requires a power supply from the helicopter and it may also require some modification to the aircraft wiring, depending on the control configuration chosen. The standard Bambi bucket electrical installation will not work with the Aqualanche without modification. However, if the installation is modified in accordance with this manual to suit an Aqualanche, the modified installation will also work with the standard Bambi bucket valve. Prior approval, issued for the operation of the Bambi bucket and related systems, may have precedence over and may supersede information contained in this manual.

#### **Power Supply**

The connection to the aircraft power supply should be done in accordance with AC43.13-1B and AC43.13-2A as well as any other applicable aircraft manufacturers instructions. The requirements are:

**Voltage:** 28VDC    **Current:** 10A    **Duty Cycle:** Six second intermittent

#### **Warning**

Do not connect the Aqualanche system to any aircraft bus bar that is used for emergency or essential loads. After installation, amend the aircraft electrical load analysis to ensure that the generator capacity is adequate to operate the system.

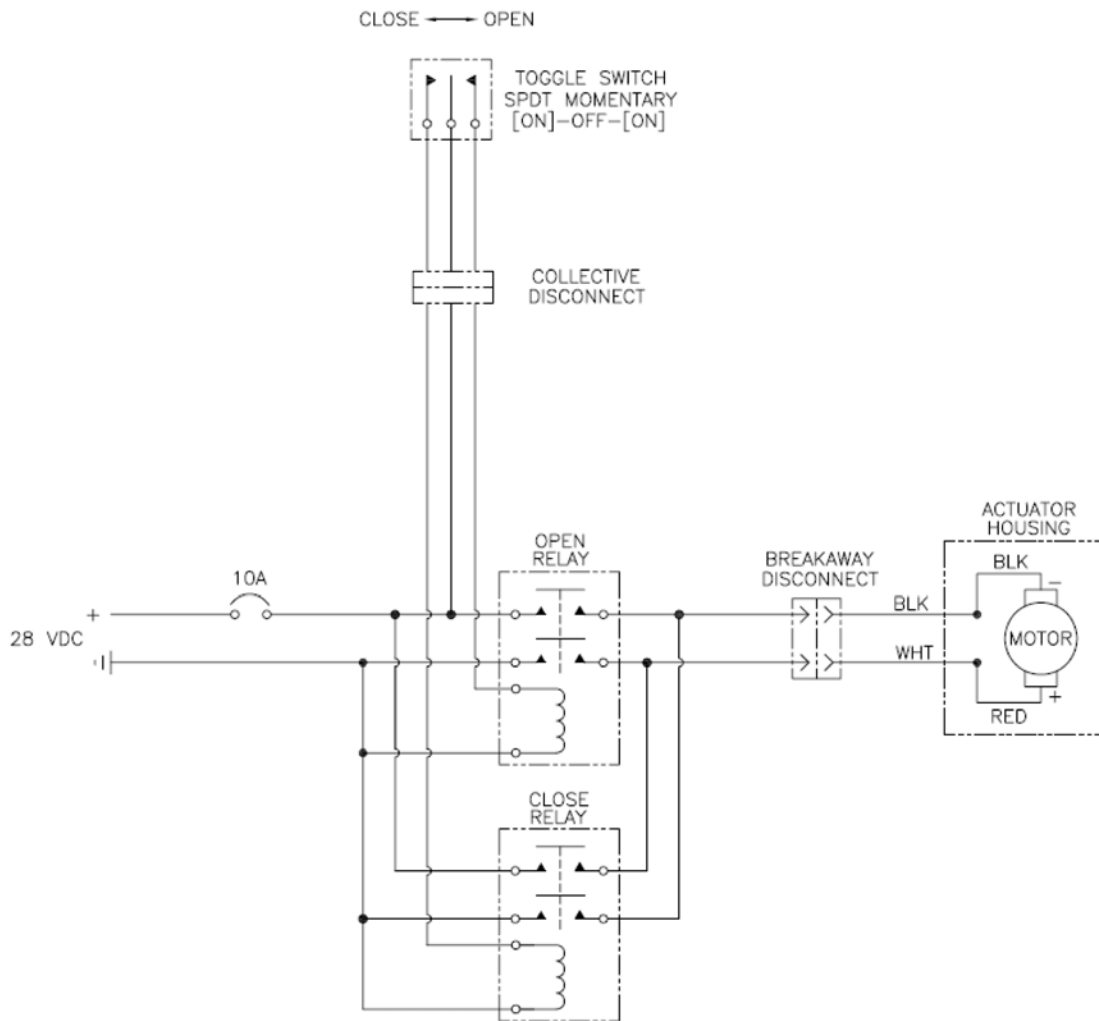
#### **Valve Control Configuration**

The valve can be configured to be operated by the pilot using a switch on the flight controls or by a second crewman using an optional hand control. Each configuration requires a different type of electrical installation in the aircraft.

#### **Pilot Operated Controls**

This configuration requires the installation of a toggle switch on the flight controls, a circuit breaker, and two switching relays. These components are not supplied by SEI.

*Pilot Wiring Diagram*



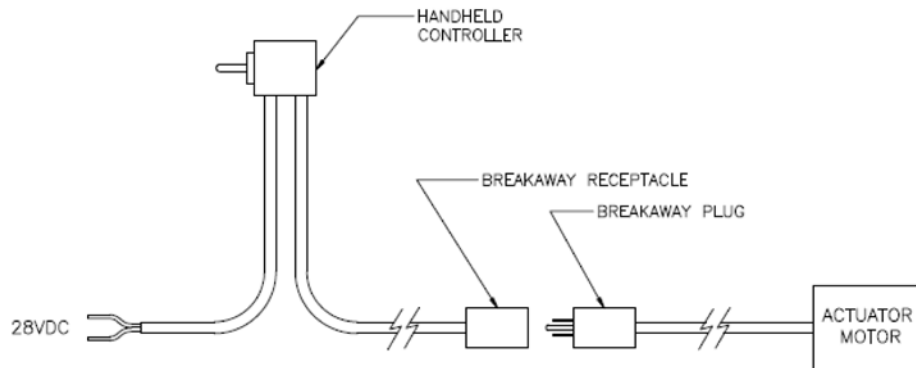
- NOTES  
 1. RELAYS RATED FOR 10A MOTOR CURRENT @ 28VDC.

**Crew Member Operated Controls**

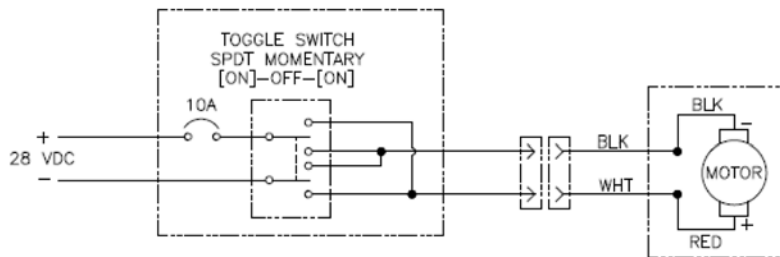
Where another flight crew member is available to operate the Aqualanche, an optional control box is available. This control box is hand-held and can be connected into the circuit between the aircraft power supply and the valve.

Use of this control box does not require the installation of switching relays or modifications to the flight controls. This control box is also useful for maintenance checks when the bucket system is removed from the aircraft.

**Crew Block Diagram**



**Crew Wiring Diagram**



***Breakaway Connectors***

In case of an aircraft emergency that requires the jettisoning of the Bambi Bucket, the electrical connection to the bucket must have a breakaway connector. Due to varying operating requirements and conditions, the operator must specify and supply this connector.

The connector must:

1. Be of sufficient capacity to accept 16 AWG or larger wire gauges, as may be required for extension of the electrical conductors for long line operations.
2. Where installed adjacent to and in conjunction with the load release mechanism, be able to separate cleanly and with minimal force in the event of an emergency jettison.

The control head of the Aqualanche comes equipped with a short length of two conductor electrical cables. One half of the breakaway connector can be installed to this cable and the other half installed to the cable from the belly of the aircraft.

## Section 4: Safety

### Preflight Safety Check

#### Caution

Make sure the Bambi bucket shell does not rub against the valve on the inside of the bucket. This may impede the movement of the valve and may damage the valve.

1. As the pilot pre-flights the aircraft, the Bambi bucket should also receive a pre-flight check.
2. Check the bottom chain and look for any tears in the fabric straps; check the lockwire or tie wraps on the shackles.
3. Check for loose bolts around the bucket shell: IDS brackets at the top, cinch strap brackets at the mid-point, wear strips at the bottom.
4. Check the diagonal M-straps that connect the suspension cables to the top of the bucket and examine for any wear.
5. Visually check the multi-dump valve, particularly the seals.
6. Check the internal or external Frusto-Conical Arrest system (FCAS or cinch strap).
7. Check the suspension cables for frays, kinks or loose swages.
8. Check that the solid metal ballast bars are securely attached.
9. Check the control head for secure fittings.

## Section 5: Deploying the Bambi Bucket

### Deployment Procedures

#### *Attaching to Cargo Hook*

The Bambi bucket is rigged for a lateral cargo hook. Correct attachment is indicated when the serial number plate on the control head faces FORWARD in flight. This ensures that the ballast on the Bambi will face forward in flight.

#### **Warning**

It is essential that the ballast faces forward in flight. This will avoid twisting of the suspension lines.

#### **Warning**

If using a second shackle, it must have a load rating equivalent to the top shackle supplied with the head. Using a shackle with a lower load rating could result in a shackle failure. If using a swivel hook, operate in the “locked” position to assure that the ballast is always facing forward.

#### **Caution**

The Bambi bucket may not be suitable for a direct hook-up to the cargo hook. The actual hook-up will be different for various aircraft and operators must comply to all instructions and bulletins supplied by the aircraft manufacturer. It is the operator’s responsibility to ensure that the Bambi bucket is correctly fitted to the helicopter.

### **Connecting Power**

Connect power to the valve by connecting the two parts of the user-installed breakaway connector.

Press the control switch to the open and closed positions and verify that the valve is responding to the control signals.

### **Longline Conductor Specifications**

Many operators of bucket systems use longline lifting cables. Consult the table below to determine the wire gauge required.

Length	Wire
0 – 50 ft	16/2 SOW
50 – 100 ft	16/2 SOW

### **Checking Suspension Cable Length**

#### **Warning**

Using a Bambi bucket with a greater overall length than the distance from the cargo hook to the front tip of the tail rotor on your helicopter could result in a tail rotor strike and possible loss of control of the helicopter.

### **Determining Bambi Bucket Overall Length**

Overall lengths of Bambi buckets with standard rigging are provided in the table on the next page. Before using the Bambi bucket, check for *maximum total length*. To determine it, measure the distance from the cargo hook to the front tip of the tail rotor on the helicopter you will be using and subtract 6” (152 mm).

*To determine overall bucket length:*

- Stretch out the bucket on the ground; secure the control head.
- Measure the distance from the shackle on the control head to the bottom of the dump valve. This measurement should be less than the *maximum total length* determined above.

Model	Overall Length	
1518	15'-2"	4.62m
1821	15'-5"	4.70m
2024	19'-5"	5.92m
2024S	16'-4"	4.98m
2226	19'-7"	5.97m
2226S	16'-6"	5.03m
2732	23'-0"	7.01m
2732S		
3542	23'-5"	7.29m
4453	23'-8"	7.14m

**Important Note**

To avoid potential rotor strikes when using the Bambi bucket, the operator must measure the extended length of the Bambi bucket and the distance from the belly hook to the closest possible point of the tail rotor.

- Always measure the overall, extended length of your Bambi bucket.
- Measure the distance from the belly hook to the closest possible point on the tail rotor.

Length "B" must always exceed length "A" by at least six inches.

## Instant Deployment System (IDS)

The Instant Deployment System (IDS) uses a hub and spoke mechanism to automatically expand the mouth of the bucket as soon as the suspension cables take the weight of the Bambi. On Aqualanche-equipped buckets, it is recommended that the IDS be deployed before flight so that a full function check of the valve can be performed.

### Caution

Operating the Aqualanche with the bucket collapsed may cause damage to the valve.

When the bucket is full, the IDS deployment cable and hub restrainer cables should be slack and should not bear any load. Their function is to position the hub and spoke mechanism to hold the bucket open.

To deploy the IDS system on the ground, reach into the bucket, grasp the hub of the IDS and pull outward fully until the two cables from the hub to the lower bucket shell are tight.

---

## Section 6: Flying the Bambi Bucket

### Flight Procedures

You may fly with the Aqualanche in the “open” or “closed” position, depending on your preference.

#### Caution

To protect the bottom valve seal, we recommend that the valve be closed during take-off and landing procedures.

#### *Flying Empty*

The Bambi bucket has been flown (and remained stable) at speeds up to 110 mph (176 kph). Nevertheless, we suggest you build up speed slowly with the Bambi bucket installed on the helicopter under the prevailing operating conditions to determine a safe maximum speed.

#### *Flying Full*

The dead weight of the load creates different handling characteristics compared to when flying empty. The Bambi bucket does not “pulse” or “throb” under load in flight.

## Section 7: Filling the Bucket

### Filling Instructions

The Bambi bucket, with the Aqualanche, can be filled either by tipping the bucket with the valve “closed” or by filling from the bottom up with the valve “open.” The method used is based on operator preference, speed of fill and water source.

The Aqualanche must be “closed” prior to liftout from the source. It is not necessary to tow the Bambi bucket to make it sink.

#### Warning

When filling the Bambi bucket, do not execute an abrupt 90 degree pedal turn with the helicopter close to the water while towing the bucket. In this attitude, there is a danger that the Bambi bucket suspension lines (as with any other load) could get caught on a rear skid resulting in a dynamic roll over on liftout. This could cause personal injury and helicopter damage. Check the load and suspension cables with your mirrors before liftout.

#### Warning

Do not allow too much slack to occur on the Bambi bucket suspension lines when dipping. Lines could snag on submerged objects or parts of the bucket.

### *Variable Fill Capability*

The pilot can vary the bucket’s volume, up to the maximum rated capacity, by the speed at which it is pulled from the water. As the submerged bucket is lifted, water pressure bends the bucket shell outward, increasing the bucket’s volume. The greater the upward velocity, the greater the volume of the bucket.

### **FCAS System**

The Frusto-Conical Arrest System (FCAS) allows the operator to reduce the volume of the bucket to a preset percentage of its maximum capacity. The FCAS is composed of a cinch strap attached to the waist (vertical mid-point) of the bucket. The cinch strap is marked with one or more load levels.

**Caution**

Do not tighten the cinch strap past the smallest load marking. Overtightening can damage the bucket shell.

Water volume can be adjusted on a Aqualanche bucket by opening and closing the valve to release water. See *Section 9: Dumping the Bucket*.

***Shallow Fill Capability***

Filling the bucket from the bottom is an advantage of the Aqualanche model that the standard Bambi bucket models do not offer.

***Filling from a Fireflex or Heliwell Tank***

The Heliwell tank is a transportable, field-erected water tank of sufficient size to dip all models of the Bambi bucket. The tank consists of up to ten aluminium panels with an internal vinyl fabric liner. There are three different sizes of Heliwell tanks: 5,650; 9,425 and 14,900 USG.

The Fireflex tank is a self-supported open top tank that can be used as a dip tank for helicopters equipped with the Bambi bucket. See the table on the next page for recommended tank sizes for use with different models of the Bambi bucket.

**Caution**

Snagging the Bambi bucket on submerged objects could result in bucket shell damage.

*Fireflex Tank Sizes for Bambi Buckets*

Bambi Bucket Model No.	Empty Bucket Height (in/mm)	Recommended Fireflex Tank	
		Tank Model	Full Height
1518	39/1.00	FFTF-3036	57/1.45
1821	41/1.04	FFTF-3036	57/1.45
2024	43/1.09	FFTF-4048	60/1.52
2226	45/1.14	FFTF-4048	60/1.52
2732	48/1.22	FFTF-80100	79/2.00
3542	57/1.45	FFTF-80100	79/2.00
4453	57/1.45	FFTF-80100	79/2.00

## Section 8: Using Foam

### Sacksafoam Injection System

The Bambi bucket is designed to be used with foam. All materials used in the manufacture of the Bambi bucket are resistant to the chemical action of foam.

#### Caution

After using foam or retardant, cycle through several dumps with water only or hose down with fresh water. This will prolong the bucket's life.

The Sacksafoam is SEI Industries state-of-the-art foam dispensing system for use with Bambi buckets. This system, exclusive to Bambi, allows foam to be dispensed into the bucket enroute from the filling source to the fire site.

- There are two models of Sacksafoam to fit the full range of Aqualanche-equipped Bambi buckets (Sacksafoam I and II).
- The operation of the Sacksafoam II is controlled by the pilot through a control unit which is mounted in the cockpit.
- Sacksafoam I contains the foam reservoir directly installed inside the bucket.

#### **Sacksafoam/Bambi Size Requirements**

Model	For Bambi Bucket Models	Reservoir Capacity	
		USG	L
<b>Sacksafoam I</b>			
SFF01-8018	1518-1821	12	45
SFF01-2044	2024-4453	30	114
<b>Sacksafoam II</b>			
SFF02-8044	1518-4453	10	38

For further instructions on operating various Sacksafoam units, please refer to the applicable Sacksafoam operator's manual.

## Section 9: Dumping the Bucket

### Emptying the Bucket

#### *Dump Pattern*

As with the standard Bambi bucket, the dump pattern is affected by height and airspeed. It is most concentrated at lower altitudes above ground level (AGL) and at a hover. The pattern will “spread” with height and speed. Operators can take advantage of these characteristics to maximize assault on the fire line.

#### **Warning**

Never dump onto ground personnel as the water impact could result in injury.

#### *Dump Speed*

It is suggested that you get familiar with flight characteristics while dumping from your particular helicopter. Make dumps at slower speeds before progressing to faster dumps.

#### *Operation of the Dump Valve*

- The valve is operated by a SPDT momentary switch with a center off position. This switch is located in either the flight controls or the optional hand control, depending on the installation.
- To open the valve, push and hold the toggle switch in the open direction. Releasing the toggle switch, at any time, will stop the valve in its current position. The water flow can be metered in this manner for any desired flow rate up to the maximum.
- To dump at 100% flow, push and hold the switch in the open direction for 3-4 seconds. Holding the switch longer will not damage the valve as the actuator has an overrunning clutch which protects the motor when the valve is fully open or fully closed.

- To close the valve, push and hold the toggle switch in the closed direction. Releasing the toggle switch, at any time, will stop the valve in its current position. To close the valve from the fully open position, push and hold the switch for 3-4 seconds.
- Alternately, pushing the open and close switches, in succession, can be used to make multiple dumps of various volumes and flow rates depending on the time the switch is held open and the delay time before it is closed. After a few dumps, the operator will become quite adept at controlling the drop pattern.

## Section 10: Landing with the Bucket

### Landing Procedures

The recommended landing procedure is to allow the bucket to touch down ahead of the helicopter and then maintain tension on the suspension lines by backing up slightly, thereby keeping the control head at an angle while landing.

Do not release the control head from the cargo hook while hovering. This could damage the control head. If the control head must be released while hovering, have ground personnel support the control head before releasing.

Do not drag the Bambi over rough surfaces when landing or during ground handling. Avoid landing at high speeds as this may damage the bucket shell, Aqualanche valve and the control head.

#### Caution

To avoid damage to helicopters with low skids, never land on a vertical control head. This could damage the helicopter and/or the control head. The head is approximately 24" (610mm) in length.

#### Caution

If the control head has experienced a severe impact, it is necessary to visually examine all three shackle bosses on the control head base to determine if they have been bent or otherwise damaged.

If any of the shackle bosses have been damaged, the control head base requires replacement.

Operating with a damaged control head base casting could result in failure and unintentional release of the bucket.

#### Caution

To protect the bottom valve seal, it is recommend that the valve be closed during take-off and landing procedures.

## Section 11: Packing the Bambi Bucket

### Bucket Packing Instructions

10. Grab the control head and pull the suspension lines taut.
11. Gather the suspension lines into a coil and stow inside the bucket. Placing the control head outside and the lines inside prevents the possibility of the lines tangling.
12. Bring the control head back and place on collapsed bucket.
13. Roll the bucket into a bundle and wrap with rope supplied.
14. Take the carrying bag and drape it over the bucket.
15. Roll the bucket over into the open bag and zip up the bag.
16. The carrying bag with the Bambi bucket makes a suitable shipping container when shipping via air freight.
17. Because of the compactness of the Bambi, many operators carry it aboard the helicopter, at all times, during the fire season. This allows a very rapid response to a fire call.

## Section 12: Storing the Bucket

### Storage Instructions

We suggest that you follow these guidelines to ensure the longevity of your Bambi bucket:

1. Do not pile heavy objects on the bucket.
2. If foam has been used, wash the bucket prior to storing it.
3. Do not store a wet bucket. This will result in the growth of mildew and the corrosion of aluminium and steel parts.
4. Store the bucket indoors in an unfolded position, preferably by suspending the main shackle from an overhead hook. An alternative is to suspend the bucket upside down from its bottom chain.
5. Before storing the bucket for an extended period, perform the seasonal maintenance procedures as outlined in *Section 13: Maintenance*.

## Section 13: Maintenance

### Maintenance Overview

#### *Introduction*

The maintenance and repair of the Aqualanche should only be undertaken by mechanics and technicians with a level of competency commensurate with this class of product. Some proficiency with basic hand tools and knowledge of basic mechanical maintenance practices is essential.

If work on the Aqualanche electrical controls is undertaken, further knowledge and experience in the area of 28 volt DC electric circuitry is necessary. This manual includes a wiring diagram to assist operators in troubleshooting the electrical system. Before commencing work, we recommend that technicians familiarize themselves with the wiring diagram and the layout of the major components in the system.

#### *Valve Description*

The Aqualanche is essentially a sleeve that moves vertically to expose an open annulus for the water in the bucket to flow through. The vertical position of the valve sleeve and the level of water or “head” in the Bambi bucket determine the speed at which the water flows through. The vertical position, or the valve opening, is fully controllable by the operator from 0 to 100% of the available valve travel.

- The approximate transit time for the valve to move from the full “closed” position to the “full open” position is three seconds. This transit time allows the operator to distribute a single load of water into several full “open” drops. If desired, the operator may also extend the length of a water drop by opening the valve partially.
- The Aqualanche is mounted to an aluminium ring that is bolted to the bottom of the bucket shell. This “base” ring supports pillars, at the top of which a round aluminium plate or “top plate” is attached.
- The base ring, pillars and top plate form the “fixed” or rigid part of the valve on which the valve tube slides up and down. The large diameter valve tube has seals mounted top and bottom that prevent water leakage when the valve is in the fully “closed” position.

- The sliding valve tube is supported at two points by engineered polymer bushings that minimize sliding friction when the valve sleeve is in transit.
- Two of the support pillars serve to keep the valve sleeve aligned with the fixed structure of the valve.

### ***Actuator Description***

The valve is opened and closed by a linear actuator located in a watertight housing. The actuator is driven by a DC motor via a worm gear. When the actuator is fully extended or fully retracted, a clutch mechanism allows the motor to continue to run without damaging the actuator. The direction of actuation is controlled by reversing the polarity of the power supply to the motor.

### ***Aqualanche Electrical System Description***

The electrical system for the Aqualanche consists of a 28V DC power supply driving the actuator motor. Opening and closing of the valve is accomplished by reversing the polarity of the power supply with a control circuit. A 10 amp circuit breaker protects the motor from overload.

## **Routine Maintenance Procedures**

In addition to routine daily preflight inspections as outlined in *Section 4: Preflight Safety*, the following procedures should also be performed when the bucket is in use:

### ***Operational Inspections (every 20 hours or three days of continuous use)***

1. Inspect all electrical cables for damage.
2. Thoroughly inspect the top and bottom valve seals for wear and damage.

**Seasonal Inspections** *(every six months)*

1. Remove any surface corrosion from aluminium parts with “Scotchbrite” or similar abrasive pad.
2. Thoroughly clean and dry the entire bucket and control head, particularly if the bucket is being put into storage.

**Preparation for Storage** *(in addition to seasonal maintenance)*

1. Perform all major repairs to the bucket and Aqualanche before storage to ensure operational readiness when the bucket is needed next.
2. If the bucket will be stored in a high-humidity environment, all aluminium and steel parts should be given a light coat of a corrosion preventative compound such as ACF-50 or WD-40.
3. Place a small block of wood between the valve lift bar and base ring to lift the valve slightly open. This will prevent the seals from taking a “set” during storage.
4. It is highly recommended that the bucket be stored indoors when not in use. This will minimize deterioration of the bucket components due to temperature change, UV light and atmospheric moisture.
5. The bucket should be hung upside down to dry out completely before being folded for storage. For maximum longevity, store the bucket in the deployed position, away from direct sunlight. This will ensure the bucket components remain dry for the duration of storage.

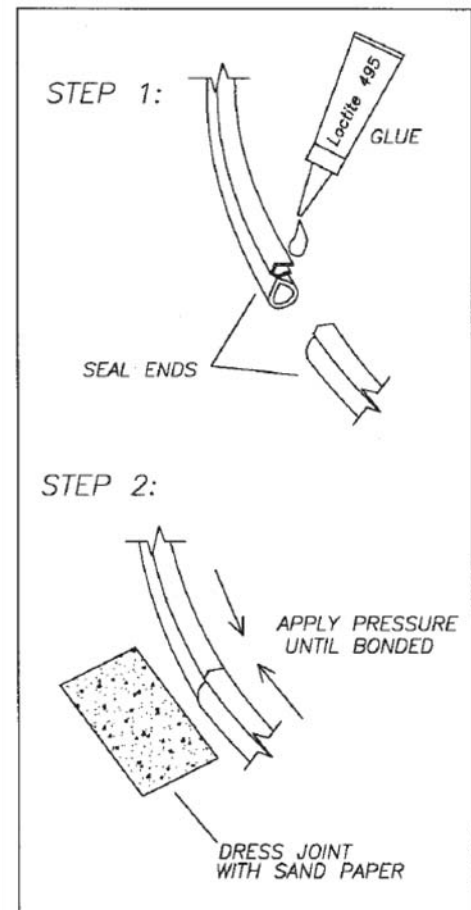
## Section 14: Troubleshooting and Repairs

### Seal Repair and Replacement

#### Field Repairs

If a top or bottom valve seal has been damaged, it may be possible to perform a sufficient temporary repair, if the damage is limited to small tears or rips.

1. If the area to be repaired is wet, dry thoroughly with forced hot air.
2. Position the two sides of the tear or rip so that the edges line up.
3. Apply a small quantity of cyanoacrylate adhesive (SEI Industries will supply Loctite 495, other common brands include Super Glue, Crazy Glue, Zap!, etc.) along the tear and press gently together until a bond is achieved. Please observe the warning labels on the adhesive container.
4. If the edge of the glue joint is rough or protrudes above the surface of the seal, it may be smoothed lightly with medium-grit sandpaper.
5. Seal replacement is recommended if repairs fail to restore full seal function.



Joining seal ends.

#### Top Seal Replacement

#### Important Note

If the replacement valve seal comes pre-joined, the power cable must be removed from the head and the new seal slipped down the power cable. If the seal comes as an un-joined length, follow steps 1 through 8 below.

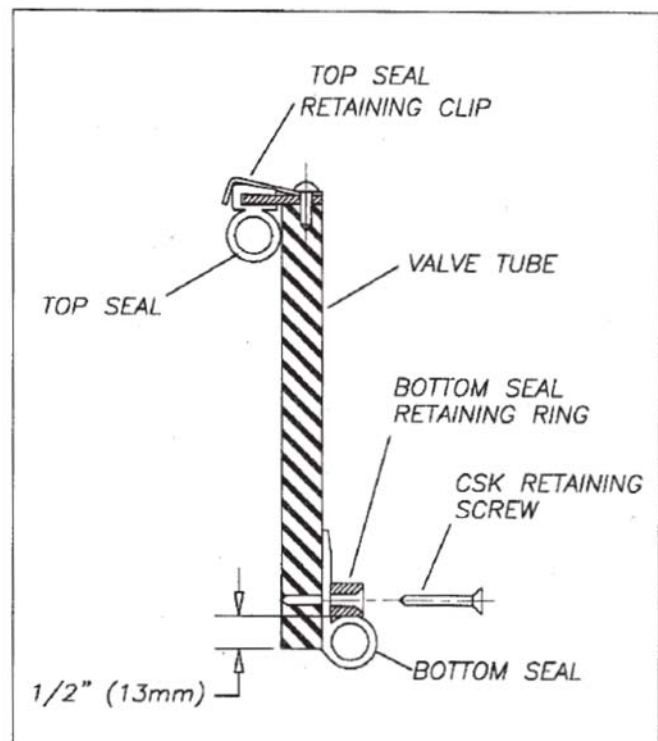
1. With the valve tube being held open in place by the actuator, remove the four seal retaining clips along the top edge of the valve.
2. Pull the seal off the retaining ring, cut the seal and remove it from the valve.
3. Position the new length of valve seal on the seal retaining ring. It will be necessary to “push” or compress the seal as you install it on the retaining ring. This will ensure the new seal sits tight on the ring and will not slip off.
4. Check that the ends of the seal are pushed together snugly when the seal is fully seated on the ring. If they are too tight, trim the seal back a bit with a sharp knife.
5. When satisfied, pull the free ends of the seal several inches inward from the seal ring.
6. Carefully mate the two ends of the seal. If the seal ends are not fully square, take the time to trim them, using a very sharp knife.
7. Apply Locktite 495 to one end of the seal and carefully mate the seal ends to make a nearly seamless joint. Apply pressure until a bond is made (approximately 60 seconds). The joint may be smooth with medium grit sandpaper to remove roughness.
8. Push the seal fully onto the seal ring and re-install the seal retaining clips.

### Bottom Seal Replacement

The bottom seal is held in place on the valve sleeve by a 1/2" (13 mm) square aluminium ring and countersunk retaining screws. The holes in the valve tube are match-drilled to the retaining ring. The retaining ring can only be installed in its original position.

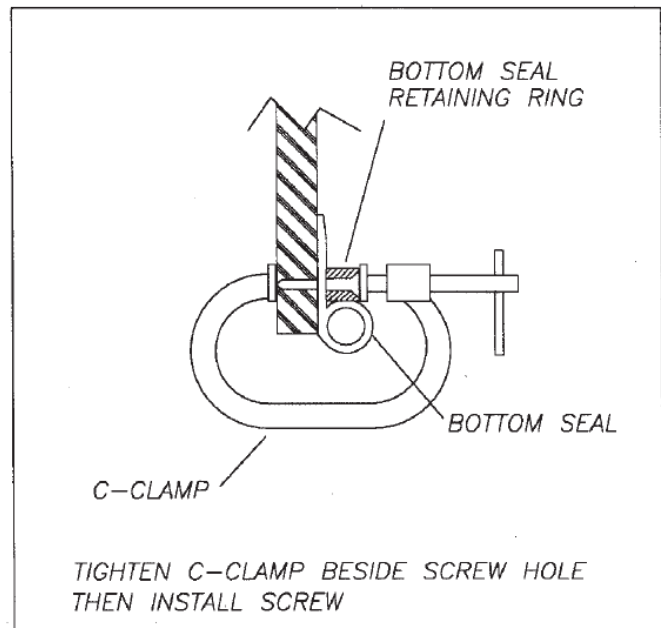
If the new valve seal comes pre-joined, the four support pillar retaining bolts must be removed to facilitate installation of the seal. If desired, the valve can be easily removed from the bucket shell by removing two IDS spokes and lifting the top portion of the valve out of the bucket.

1. Hold the valve open in place with the actuator.
2. Mark the orientation of the seal retaining ring on the valve sleeve by match-marking a screw location with a point on the valve tube.



Seal position.

3. Starting at the seal ring gap, and working around, remove all retaining screws
4. Trial fit the new valve seal to the valve tube. If the valve seal is not pre-joined, you must join the ends as described in the *Top Seal Replacement* instructions. It is desirable to make the seal a snug fit around the valve tube, so that you must stretch the seal slightly to slip it onto the valve tube.
5. Remove the valve seal and place the retaining ring onto the tube in its correct orientation. Place the seal back on the valve tube and position the surface of the ring so that it is 1/2" (13mm) from the bottom surface of the valve tube.
6. Open the retaining ring and place it around the hard part of the seal, so that the bottom surface of the ring is 1/2" (13mm) from the bottom surface of the valve tube.
7. Using a sharp awl or small sharp screwdriver, poke through the alignment hole in the retaining ring (pre-marked at removal) and, then, through the valve seal to find the first screw hole in the valve tube.
8. Reinstall the screw and place a screw clamp onto the valve seal retaining ring to hold it down for the next screw. Locate the next screw hole using the awl and install the screw.
9. Replace all the remaining screws in the manner described above, taking care to ensure that the seal is evenly placed all the way around. It is possible to relocate the seal retaining screw holes in the valve tube if some of the original screw holes are stripped by rotating the retaining ring approx. 1".  
**Note:** It is recommended that you drill 3/32" (2.4 mm) pilot holes for the screws, taking care not to drill all the way through the tube.



*Using a clamp to assist with new seal installation.*

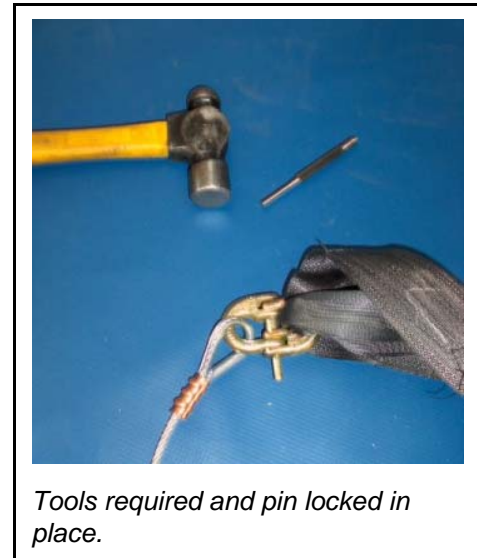
## Shell/Suspension Line Repairs

A Bambi bucket repair assessment manual is available from SEI Industries. This manual is intended to provide the user with information that will allow for the proper repair evaluation and can be ordered by contacting SEI Industries for a copy or by downloading one from the SEI website ([www.sei-ind.com](http://www.sei-ind.com)).

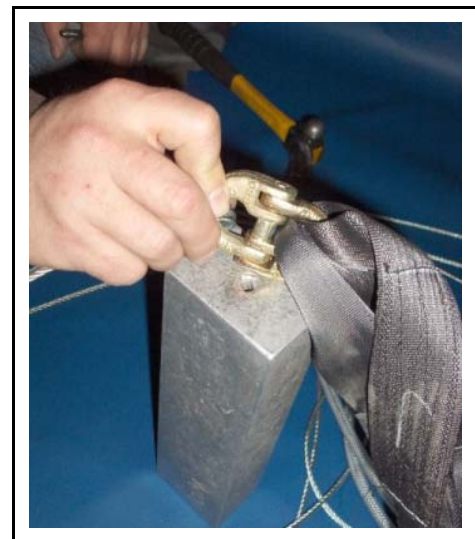
### ***Suspension Line Replacement***

A suspension line should be replaced whenever it displays noticeable kinking or fraying. Factory replacement lines come pre-swaged with connection links to make replacing quick and easy.

To remove the shackle connecting the suspension line to the M-strap, follow the procedures outlined below.



1. Locate a metal bar with a 5/6" hole (or drill a 5/6" hole into any metal bar). If you are unable to locate a metal bar, a wooden block will work, however, make sure to drill the hole into the end grain.



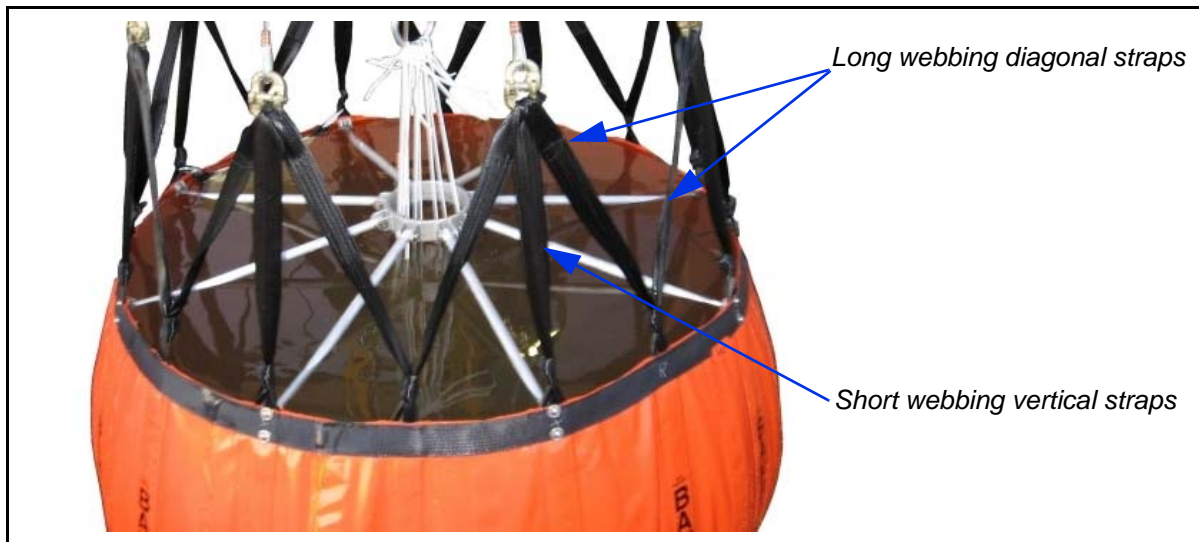
2. Place the shackle with the pin located over the hole and, using a 3/6" punch, drive the pin through the center holding sleeve.
  
3. After the pin is free, remove the old suspension line. Place the new line in the shackle by inserting the pin into one side of the shackle and then inserting the locking sleeve. Using a hammer, drive the pin in until it is flush with both sides of the shackle.



### ***M-Strap Replacement***

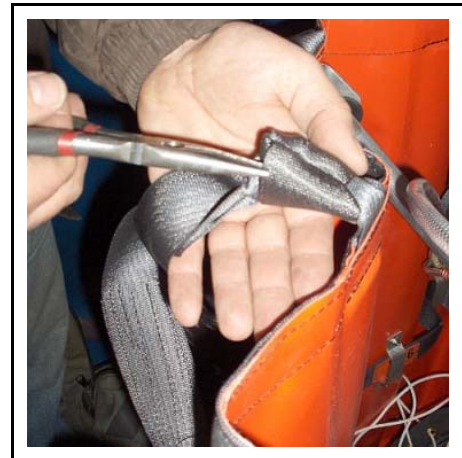
Replace M-straps if they become noticeably worn. M-straps may be repaired, if frayed, by melting the fray with a lighter to stop the fray from spreading. The length of the M-strap is critical to the proper functioning of the Bambi bucket and we recommend that you replace worn straps with factory-supplied equipment.

There are two types of straps; long webbing and short webbing. Long webbing are used for the diagonal straps while short webbing are used for the vertical straps. When replacing straps, do one set at a time to avoid confusion. Cut off the old straps from the shackle and un-tie them from the top of the bucket shell. Attach replacement straps as per the originals.



### ***Removing Old M-Straps***

1. Using needle nose pliers, insert the tip under the top webbing layer.



2. Fully insert the pliers at the far left hand side of the top layer.



3. Holding the pliers tight, turn your hand clockwise. Repeat the operation until the knot is loose enough to remove the strap.



### ***Installing New M-Straps (Short)***

Once the old straps have been removed, the new strap installation can begin.

1. Rotate the strap until the joint is centered.



2. Pass the strap through the loop.



3. Twist the loop eye 180 degrees.



4. Rotate the eye to the opposite side.



5. Pull strap end through the eye.



6. Pull strap tight.



### ***Installing New M-Straps (Long)***

Once the old straps have been removed, the new strap installation can begin.

1. Locate the center of the strap.



2. Pass the strap through the loop.



3. Twist the loop eye 180 degrees.



4. Rotate the eye to the opposite side.



5. Pull strap end through the eye.



6. Pull the strap tight.



7. The M strap set should now look like this. The suspension line attaches to the top of each M-strap set.



### ***IDS Hub/Spokes Replacement***

There are two different IDS hub sizes. The small hub fits the Aqualanche bucket models 1518 to 1821. The medium hub is found on models 2024 through 4453.

The IDS system can be purchased either as a complete kit or as individual pieces, as required. Here's how to replace the entire assembly:

1. Start by removing the old IDS including the shell brackets and the old restrainer cable brackets.
2. For re-assembly, first install the new shell brackets. Install bolts through the bucket shell. Next, fit the fabric wear strips onto the bolts. Fit the brackets to the bolts and install and tighten the nylock nuts.
3. Install the two restrainer cable brackets. One is found below the ballast and the other is at the 6 o'clock position directly opposite. No wear strips are required for the restrainer cable brackets.
4. With the ballast oriented at the 6 o'clock position, rotate the IDS assembly so that the deployment cable faces upward and is at the 3 o'clock position.
5. Attach the two spokes either side of the 12 o'clock position using the stainless steel clevis pins. Some models use rubber washers between the spoke and the brackets. Check the old assembly. Complete by fitting the fender washer and cotter pin. Working around the bucket perimeter, attach the rest of the spokes.

6. Attach the two restrainer cables. Attach the IDS deployment cable to the control head small adjustment chain.
7. Once the IDS is fully installed, test for fit. You should be able to pull the hub past the midpoint position with a slight effort. If the IDS is either too loose or too tight, it will require adjustment.
8. If the IDS is too tight, adjust two of the spokes as follows:
  - Cut off the spoke just above the existing hole. Then, redrill a new hole centered the same distance from the new end of the spoke as the other spokes. This will likely produce a good fit.
  - If the IDS is still too tight or too loose, there are two extra adjustment spokes provided with your IDS kit which have one end that is undrilled. The spoke is also over length. Utilizing a piece of scrap tubing, wood dowelling or broom handle to experiment with, determine a suitable spoke length. Then, cut and drill the proper adjustment spokes to the corrected dimensions.

### ***Load Test on the Hook***

Deployment cable adjustment can only be properly assessed on the hook of the helicopter or otherwise suspended with a full load of water. Under full load, the deployment cable should feel relaxed but not slack. The hub should be free to move up or down about ½" (13 mm).

## Making Bucket Repairs

Please read these instructions carefully and follow them exactly to obtain a good repair. Failure to follow these instructions or poor repair workmanship can lead to failed repairs and/or more damage to the bucket.

Before commencing repairs using glue, the weather should be warm (above 60 deg. F or 15 deg. C) and dry.

### Important Note

Try a test repair before attempting to repair the bucket. This will verify your technique without risking damage to the bucket. It is much harder to fix a repair once a failed attempt has been made as the hardened glue is difficult to remove.

### Repair Failures

Repairs will likely fail if:

- The area to be repaired is not perfectly clean and scrubbed to a matte finish before applying the patch.
- Repairs are attempted during wet or cold weather.
- The glue and patch are not properly placed, creating air bubbles between the glue and patch.
- The patch is not weighed down for 24 hours.
- The bucket is used before the glue has set.

### Important Note

Dura-Seal glue has been designed specifically for the SEI family of fabrics. The shelf life of this adhesive is about one year. Fresh adhesive can be obtained directly from SEI Industries Ltd.

### ***Repairing in High Humidity***

In conditions of high humidity, a proper technique is essential for securing the bond strength desired. The presence of surface moisture can destroy the effectiveness of the cemented bond.

The evaporation of solvent from the adhesive may reduce surface temperature below the dew point resulting in condensation of water vapour on the surface of the adhesive. This is often visible as fogging or a milky white appearance on the surface.

The use of a solvent to clean the surface prior to cementing can also reduce temperatures below the dew point.

To overcome the high humidity problem, raise the temperature of the patch area. This can be accomplished with a warm air fan.

#### **Warning**

Glue vapours are highly explosive! Explosive vapours may occur causing fire and/or injury. Keep away from all sparks, flame, lighters or cigarettes.

Solvent and glue are both extremely hazardous. Use solvent and glue under well ventilated conditions only.

Use an approved respirator mask to avoid breathing fumes.

When using a warm air fan, either use one which is rated EXPLOSION PROOF or make sure that there is a steady flow of air past the work area to remove fumes as they are generated.

## **Temporary Repairs with Sealing Clamps**

Repair clamps are used for an immediate repair to prevent the loss of liquid through large rips or holes. For example, if a vehicle accidentally backed into a bucket and caused a 3" (76 mm) long rip in the bucket, a repair clamp could be inserted to stop the loss of liquid.

Repair clamps are only used for temporary repairs. The damage should be permanently repaired with a patch when the bucket can be emptied.

**Important Note**

Leaving the clamp's string on makes it easier to remove the repair clamp when placing a permanent patch on the bucket.

1. Select the largest clamp that will just slip through the hole in the item. The size of cut or hole will determine the size of the sealing clamp to use.
  - For a cut or hole up to 2" (5 cm), use a 3" (7.6 cm) clamp.
  - For a cut or hole up to 4" (10 cm), use a 5" (12.7 cm) clamp.
  - For a cut or hole up to 6" (15 cm), use a 7.5" (19 cm) clamp.

**Caution**

If you are repairing a bucket, use caution if deciding to enlarge the slit to insert a clamp. It is very easy to make the slit too large.

2. Keeping hold of the string, slip one half of the repair clamp through the hole as indicated.



3. Pull the bolt up through the hole. Turn it until the clamp lines up with the hole.



4. Place the top of the clamp over the bolt.



5. Tighten the nut by hand.



#### Caution

Tightening the nut with tools may break the bolt away from the lower clamp. Overtightening can also deform the clamp and cause leaks.

## Temporary Repairs Using Glue

### *Applying the Glue*

Small scrapes, damaged fabric coating or pinholes, which are not leaking, can be repaired with glue only. They do not require a patch. (A small scrape is defined as damage to the outer fabric coating only. A pinhole is defined as a small puncture that is not leaking.) However, damage to the base fabric must be repaired with a patch.

1. Fill the weight bag with water prior to beginning repairs.
2. Clean the area to be repaired with an abrasive pad dampened with solvent. Remove all traces of masking tape, if previously used. If possible, place a piece of masking tape on the back side of the item being repaired.



*Apply masking tape on the backside of tear.*

3. Paint the damaged area with glue. Use a thick coat of glue, overlapping the edges of the repair by 1" (25 mm). Be sure that the edges are well coated. A damaged coating should be given two coats of glue. Apply the second coat within four hours of the first coat.



*Squeeze glue around tear and spread with fingers.*

### **Important Note**

Allow repair to harden for 24 hours at room temperature before using the item.

### Gluing with Patches

If liquid is escaping or there is dampness around the damaged area, the item must be drained. If the damaged area is still dry, it will be possible to obtain a good bond without draining the item. Any loose coating should be cut back with scissors. Trim to a point where there is a solid bond between the reinforcing fabric or scrim and the coating.

1. Support the damaged area on a flat, solid platform. If the item is drained, the damaged area should be supported above the rest of the item. This allows residual liquid to drain away from the damaged area. This platform should be strong enough to support the fabric (flat) and allow the patch to be rolled once it is in place.



2. Scrub the damaged area with an abrasive pad dampened with solvent (isopropyl rubbing alcohol is recommended). Scrub vigorously to remove the cured surface. The area should be clean and dry with a dull matte finish.



**Caution**

Solvent will damage the fabric if too much is used or if the fabric is left exposed to solvent residue.

3. Wipe with a rag, dampened with solvent, to remove any residue from cleaning. Check to see if the area is totally clean and all coated surfaces and edges are dull. If not, repeat the cleaning. This is critical for a good glue bond.

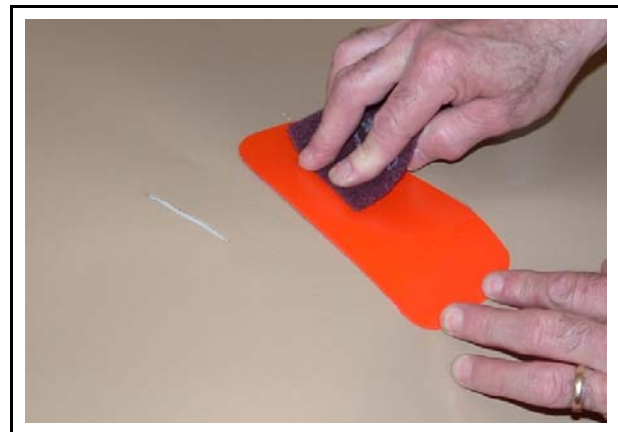
**Cutting the Patch**

1. Cut the patch. The patch should be at least 2" (50 mm) larger in every direction from the damaged area. A round patch is recommended but, if a rectangular patch covers the damage better, then round all corners.



*The color of patch will vary, depending on the product repair kit.*

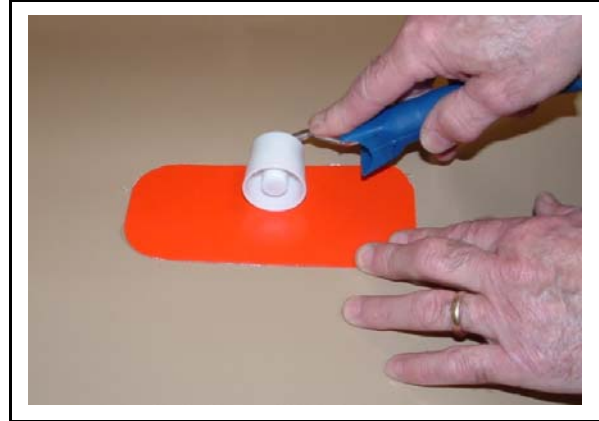
2. Clean the patch by scrubbing with a pad dampened with solvent. Rub vigorously to remove the gloss from the fabric. Clean both sides of the patch, as it is easy to get the patch turned over during installation. The patch should also be cleaned on the outside since it will be painted with glue later.



### Applying the Patch

1. Apply the Dura-Seal glue to the patch and damaged area. Wait 30 minutes (at 75 deg. F or 22 deg. C) for some of the solvent to evaporate from the glue. The glue should become thicker but still be quite wet. If it has been allowed to dry too long, give both sides another thin coat. If the glue has dried too long, it will be difficult to avoid entrapping air bubbles in the bonded joint.

2. Place the patch and roll out with the roller. Place the centre of the patch down first, then roll it out towards the edges with the roller. This expels trapped air. Once the patch is rolled down, do not let it lift up. This will prevent air from getting under the patch which causes a weak bond.



3. If the item is sloped during the repair, tape the patch in place while holding it down. This stops the patch from sliding away from the damaged area.

4. Weigh the patch down. Place a plastic cover sheet over the patch followed by a weight bag for 12 hours at room temperature. The item can then be moved but should not be filled until the glue has cured for 24 hours. The weight bag should hold the patch tight against the item while the glue sets. The plastic cover sheet will prevent the glue from sticking to the weight bag.



5. If the patch will be subjected to abrasion after 24 hours, paint over the patch with glue. Painting the patch also provides protection from ultra violet light and weather. Allow the bond to harden for 24 hours at room temperature before using the item.

### ***Using Other Glues***

If you do not have any Dura-Seal available, there are two other glues that can be used and are typically easy to purchase locally.

1. Loctite 495 can be used on Chem-Shield fabric to provide a quick patch repair but it will make a long term repair difficult at a later date as all 495 glue must be removed before applying Dura-Seal. This can prove to be a time-consuming, stubborn task.

#### **Warning**

Loctite 495 carries the following warning. Irritating by inhalation. Eye irritant. Combustible liquid. Contains cyanoacrylate ester which may cause allergic skin reactions. Skin contact through clothing may cause burns. Use adequate ventilation in case of eye or body contact. Flush with water. Get medical attention for eye or internal contact.

2. The other glue option is 3M's 420 glue which has the advantage of creating a more permanent repair. If using this glue, follow the same instructions in this manual as for Dura-Seal adhesive.

## **Hot Air Gun Patching Procedure**

On most items, hot air gun patching is the preferred method because it provides the most durable, permanent repair possible.

### ***Tools and Materials Required***

- Patches
- One plastic hand-held roller
- One hot air gun, Steinel HL 1800 E or equivalent: 120 V-1500 W (800 to 1100 deg. F, 450 litres per min.)
- One wide surface nozzle
- Isopropyl alcohol
- Scissors

**Warning**

It is extremely dangerous to use a hot air gun in the presence of flammable fumes such as gasoline or paint thinner. There is a high risk of explosion and/or burns.

**Warning**

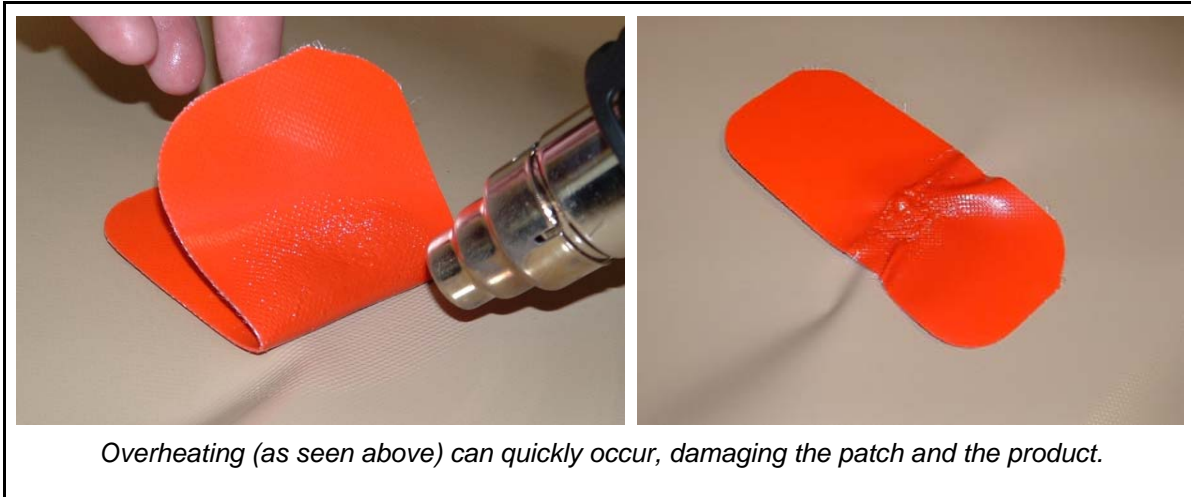
Injury, especially to hands and fingers, can occur when using a hot air gun. Most welding will occur at temperatures of 800-1000 degrees F. Wear gloves to protect skin from overheating, burning and blistering.

**Hot Air Gun Procedure**

1. In a well-ventilated location, clean the area to be repaired as well as one side of the patch with an abrasive pad. Wipe down the repair area and patch with isopropyl alcohol.
2. Mount a wide surface air nozzle on the hot air gun so as to direct the heat flow in a large pattern. Turn the power on, adjust the temperature in the low range first and let the hot air gun warm up. Increase the temperature as required during the operation. **Do not overheat or blacken the fabric.**

**Caution**

Overheating can occur quickly and can damage the product.



3. Starting from the centre of the patch (held down by the roller), concentrate the heat flow equally to patch and fabric. Apply a light pressure with the roller when the fabric starts melting. This can be seen as small bubbles. **Do not overheat.**



4. Roll the patch down to fuse it to the fabric, moving roller and gun simultaneously. Repeat on the unfused portion of the patch. Let the repaired area cool down. Attempt to peel off at the edges with your fingers. If there is even a slight peel, repeat the operation locally. Otherwise, the repair is finished.

## Repair Kits

### **Bambi Repair Kit REPKM001**

(used for Bambi buckets or other product lines as per customer request)

### **Bambi Repair Kit REPKM001NG (no glue)**

(used for Bambi buckets or other product lines where no glue is required or allowed.)



#### **Important Note**

It is the responsibility of the dealer and end user to ensure that the importation of glue is allowed in the country of use.

PART #	DESCRIPTION	QTY.
REPM100	FABRIC REPAIR MANUAL	1
REPP001B	POUCH FOR BAMBI REPAIR KIT	1
REP001	WEIGHT BAG	1
PP504	ABBRASIVE PAD	2
PK030	ZIPLOCK BAG	2
PP510	ROLLER PLASTIC 1 ¼"	1
PP513	SCISSORS	1
TT105	CLAMP SMALL	1
PP525	ADHESIVE, DURA-SEAL 1oz. (see note above)	2
REPP100	PATCHES FOR ALL BAMBI'S AFTER 2001	3

**Carrying Bags**

Part No.	Description
BB850T	Bag, carrying, 1518-1821
BB856T	Bag, carrying, 2024-4453

**Optional Accessories**

Optional Repair Accessories
TT-105 - Small clamp
TT-106 - Medium clamp
TT-107 - Large clamp
PP-510 - Roller
Special Order - Hot air gun
Special Order - Glue-specify model/fabric type

*Note: Always specify model and serial number when ordering parts and accessories.*

## Section 15: Specifications

### Model Specifications

#### Caution

The selection of a Bambi bucket model for a specific aircraft is dependent on many factors including aircraft weight, fuel weight, operation elevation and atmospheric conditions.

The helicopter operator must select a bucket model which is appropriate for their specific situation.

The operator must also ensure that the bucket selected does not pose a tail rotor strike hazard.

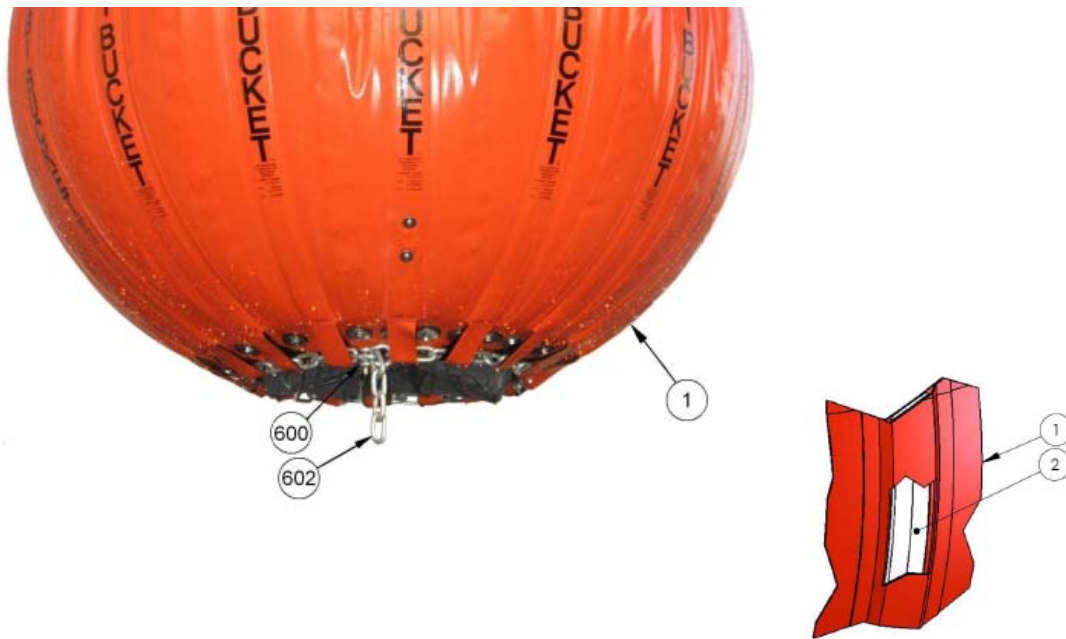
### Aqualanche Bucket Specifications

Model	Capacity			Gross Weight		Empty Weight	
	US Gals	Imp Gals	Liters	lbs	kg	lbs	kg
BBTL1518	180	150	670	1600	720	110	52
BBTL1821	210	180	795	1940	880	140	64
BBTL2024	240	200	910	2160	980	160	73
BBTL2024S	240	200	910	2160	980	158	72
BBTL2226	260	220	1000	2376	1080	176	80
BBTL2226S	260	220	1000	2376	1080	174	79
BBTL2732	315	265	1190	2845	1295	183	83
BBTL2732S	315	265	1190	2845	1295	181	82
BBTL3542	410	345	1555	3660	1665	197	89
BBTL4453	520	435	1960	4580	2080	217	98

## Section 16: Aqualanche Parts

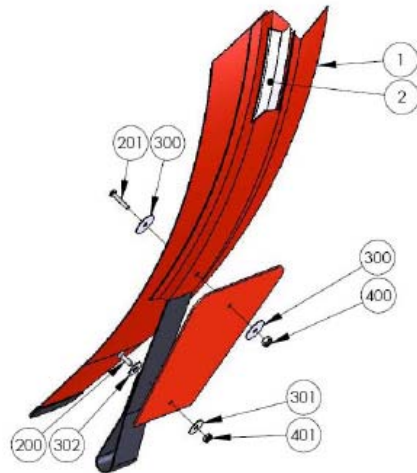
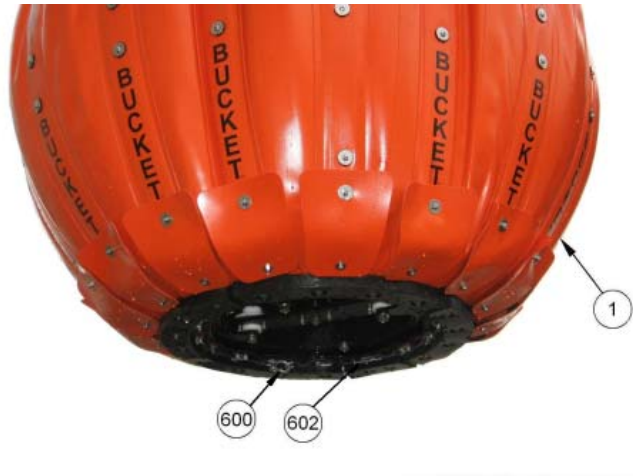
### Bucket Shell and Rigging Parts Lists

#### *Bucket Shell, Models 1518-1821*



ITEM	MODEL	PART #	DESCRIPTION	QTY
1	1518	BB954	SHELL	1
	1821	BB955		
2	1518	BB604	BATTEN, 32-5/8"	16
	1821	BB605	BATTEN, 34-3/4"	
600	ALL	FTAG001	SHACKLE, ANCHOR, GALV, 1/4	1
602	ALL	RMCG001	CHAIN, GALV, GR30, 3/16	60"

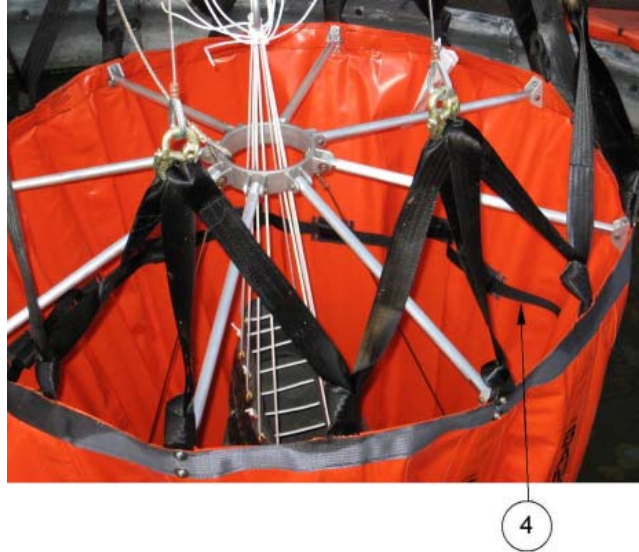
*Bucket Shell, Models 2024-4453*



**Bucket Shell, Models 2024-4453 (continued)**

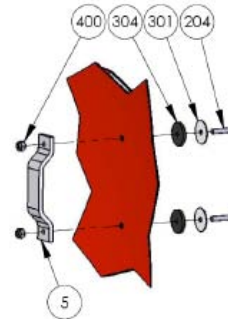
ITEM	MODEL	PART #	DESCRIPTION	QTY
1	2024	BB960	SHELL	1
	2024S			
	2226	BB959		
	2226S			
	2732	BB961		
	2732S			
	3542	BB962		
4453	BB963			
2	2024	BB610	BATTEN, 34-1/2"	16
	2024S			
	2226			
	2226S			
	2732	BB611	BATTEN, 38-1/2"	
	2732S			
	3542	BB612	BATTEN, 48-1/2"	
4453	BB613	BATTEN, 47-1/2"		
3	ALL	BB082TL	WEAR STRIP, LOWER	16
200	ALL	FBSC030305	MACHINE SCREW, FLATPHIL, SS, 10-24 X 5/8	16
201	ALL	FBSC040307	MACHINE SCREW, PAN PHIL, SS, 10-24 X 7/8	14
300	ALL	FWS060310	WASHER, FLAT, SS, 3/16 X 1	28
301	ALL	FWS060306	WASHER, FLAT, SS, 3/16 X 3/4	16
302	ALL	FWS01040	WASHER, FLAT, SS, 1/4 X 11/16	16
400	ALL	FNSC0203	NUT, NYLOCK, SS, 10-24	14
401	ALL	FNSC02032	NUT, NYLOCK JAM, SS, 10-24	16
600	ALL	FTAG001	SHACKLE, ANCHOR, GALV, 1/4	1
602	2024	RMCG003	CHAIN, GALV, GR30, 1/4	65"
	2024S			
	2226			
	2226S			72"
	2732			
	2732S			
	320C			
	3542			
4453	80"			

*Cinch Strap, Models 1518-1821*



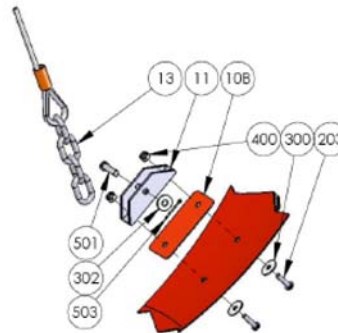
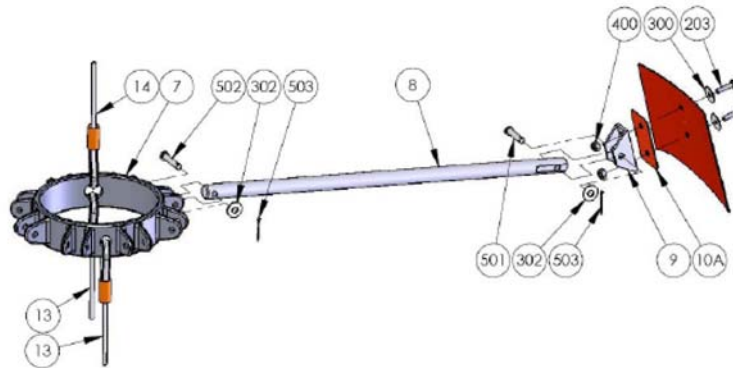
ITEM	MODEL	PART #	DESCRIPTION	QTY
4	1518	BB704	CINCH STRAP, 143"	1
	1821	BB705	CINCH STRAP, 146"	

**Cinch Strap, Models 2024-4453**



ITEM	MODEL	PART #	DESCRIPTION	QTY	
4	2024-2226S	BB710	CINCH STRAP, 144"	1	
	2024S				
	2226				
	2226S				
	2732	BB711			CINCH STRAP, 168"
	2732S				
	3542	BB712			CINCH STRAP, 188"
	4453	BB713			CINCH STRAP, 193"
5	ALL	BB749	CINCH STRAP BRACKET	16	
204	ALL	FBSC040310	MACHINE SCREW, PAN PHIL, SS, 10-24 X 1	32	
301	ALL	FWS060310	WASHER, FLAT, SS, 3/16 X 1	32	
304	ALL	FWR0103	WASHER, FLAT, RUBBER, 3/16 X 1	32	
400	ALL	FNSC0203	NUT, NYLOCK, SS, 10-24	32	

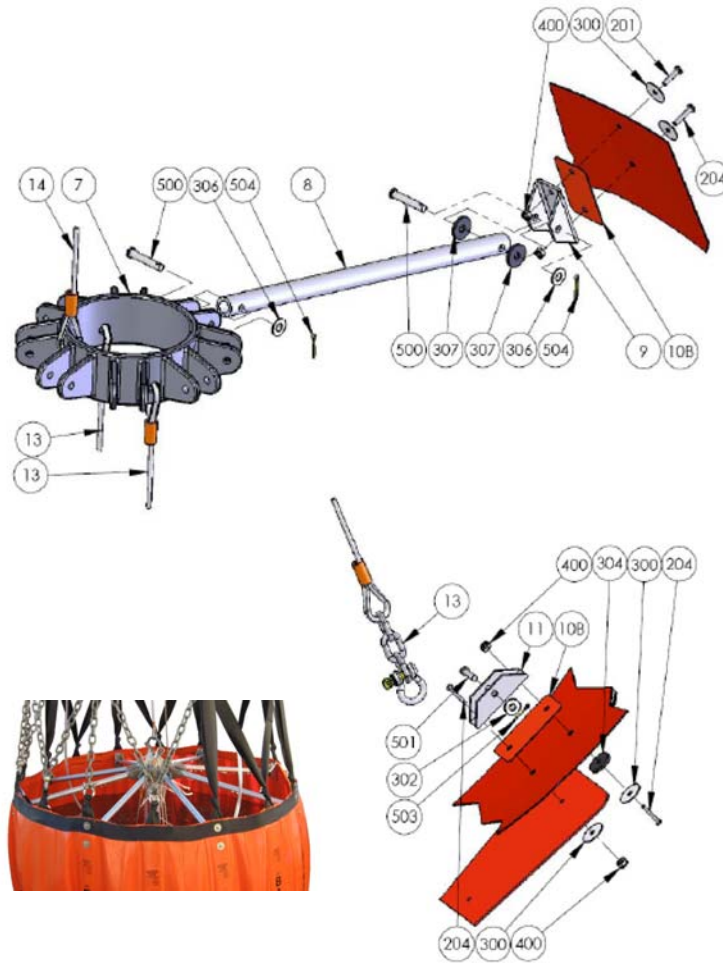
**IDS System, Models 1518-1821**



ITEM	MODEL	PART #	DESCRIPTION	QTY
7	ALL	BB451	HUB	1
8	1518	BB404	SPOKE, SOLID, 17-1/2"	8
	1821			
9	ALL	BB454	SHELL BRACKET	8
10A	ALL	BB467	WEAR STRIP, SMALL	8
10B	ALL	BB468	WEAR STRIP, MEDIUM	2
11	ALL	BB330	RESTRAINER BRACKET	2
13	1518	BB302	RESTRAINER CABLE ASSY	2
	1821			
203	ALL	FBSC040306	MACHINE SCREW, PAN PHIL, SS, 10-24 X 3/4	20
300	ALL	FWS060306	WASHER, FLAT, SS, 3/16 X 3/4	20
302	ALL	FWS01040	WASHER, FLAT, SS, 1/4 X 11/16	18
400	ALL	FNCS0203	NUT, NYLOCK, SS, 10-24	20
501	ALL	FPCS004	CLEVIS PIN, SS, 1/4 X 1-1/8	10
502	ALL	FPCS005	CLEVIS PIN, SS, 1/4 X 1-1/4	8
503	ALL	FPDB001	COTTER PIN, PLATED, 1/16 X 3/4	18

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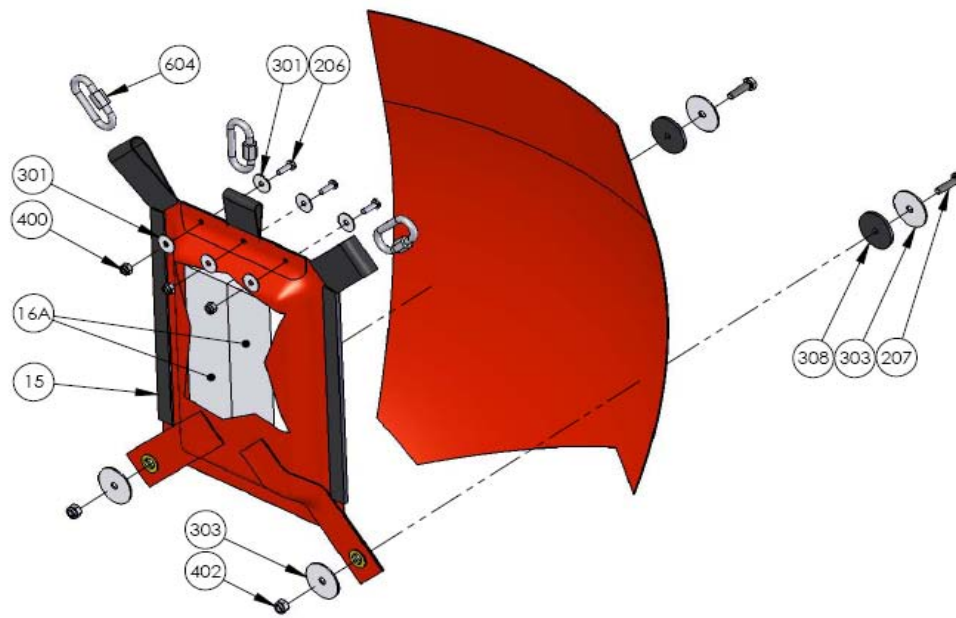
IDS System, Models 2024-4453



*IDS System, Models 2024-4453 (continued)*

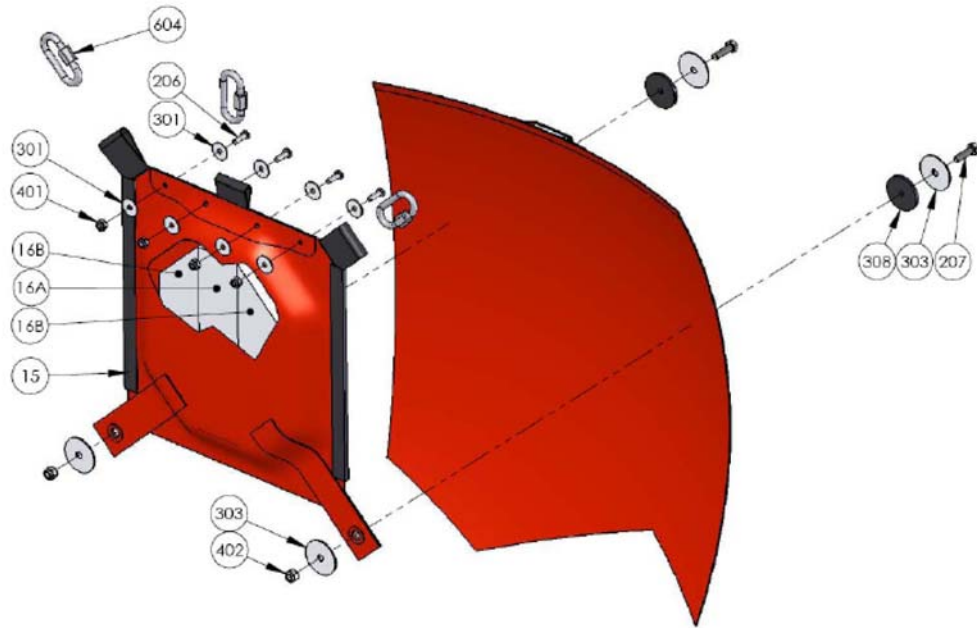
ITEM	MODEL	PART #	DESCRIPTION	QTY	
7	ALL	BB456	HUB	1	
8	2024	BB410	SPOKE, TUBE, 16-7/8"	8	
	2024S				
	2226	BB4105			
	2226S				
	2732	BB411			SPOKE, TUBE, 20-1/8"
	2732S				
3542	BB412	SPOKE, TUBE, 21-3/4"			
4453	BB413	SPOKE, TUBE, 24-3/4"			
9	ALL	BB465	SHELL BRACKET	8	
10B	ALL	BB468	WEAR STRIP, MEDIUM	10	
11	ALL	BB330	RESTRAINER BRACKET	2	
13	2024	BB310	RESTRAINER CABLE ASSY	2	
	2024S				
	2226				
	2226S	BB311			
	2732				
	2732S				
	3542				BB312
4453	BB313				
201	ALL	FBSC040307	MACHINE SCREW, PAN PHIL, SS, 10-24 X 7/8	8	
204	ALL	FBSC040310	MACHINE SCREW, PAN PHIL, SS, 10-24 X 1	12	
300	ALL	FWS060310	WASHER, FLAT, SS, 3/16 X 1	20	
302	ALL	FWS01040	WASHER, FLAT, SS, 1/4 X 11/16	2	
304	ALL	FWR0103	WASHER, FLAT, RUBBER, 3/16 X 1	2	
306	ALL	FWS060506	WASHER, FLAT, SS, 5/16 X 3/4	16	
307	ALL	FWR0105	WASHER, FLAT, RUBBER, 5/16 X 1	16	
400	ALL	FNCS0203	NUT, NYLOCK, SS, 10-24	20	
500	ALL	FPCC020	CLEVIS PIN, PLATED, 5/16 X 1-3/4	16	
501	ALL	FPCS004	CLEVIS PIN, SS, 1/4 X 1-1/8	2	
503	ALL	FPDB001	COTTER PIN, PLATED, 1/16 X 3/4	2	
504	ALL	FPDC002	COTTER PIN, PLATED, 3/32 X 3/4	16	

**Ballast Systems, Model 1518**



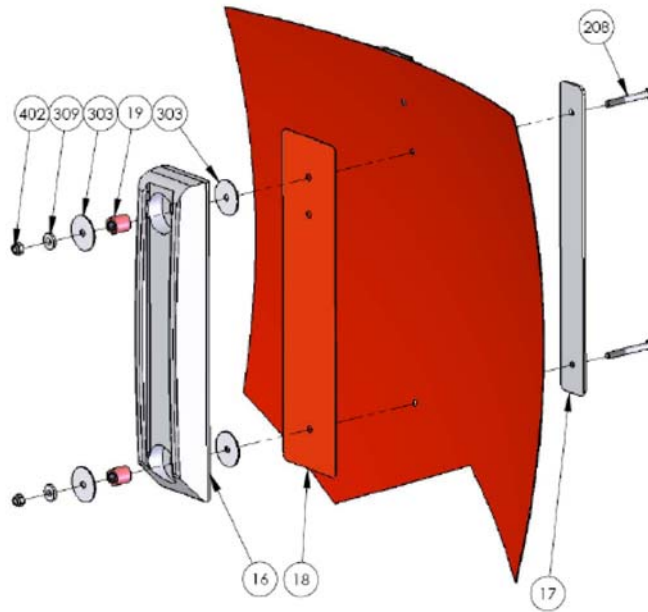
ITEM	MODEL	PART #	DESCRIPTION	QTY
15	1518	BB64693	BALLAST POUCH	1
16A	ALL	BB661	BALLAST BAR, SQUARE, GALV, 10 LB	2
604	ALL	PP203	QUICK LINK, 1/4	3
207	ALL	FBSC010410	BOLT, HEX HEAD, SS, 1/4-20 X 1	2
303	ALL	FWS0604	WASHER, FLAT, SS, 1/4 X 1-1/2	4
308	ALL	FWR0107	WASHER, FLAT, RUBBER, 1/4 X 1-1/2	2
402	ALL	FNCS0204	NUT, NYLOCK , SS, 1/4-20	2
206	ALL	FBSC040305	MACHINE SCREW, PAN PHIL, SS, 10-24 X 5/8	3
301	ALL	FWS060306	WASHER, FLAT, SS, 3/16 X 3/4	6
400	ALL	FNCS0203	NUT, NYLOCK, SS, 10-24	3

**Ballast Systems, Models 1821-3542**



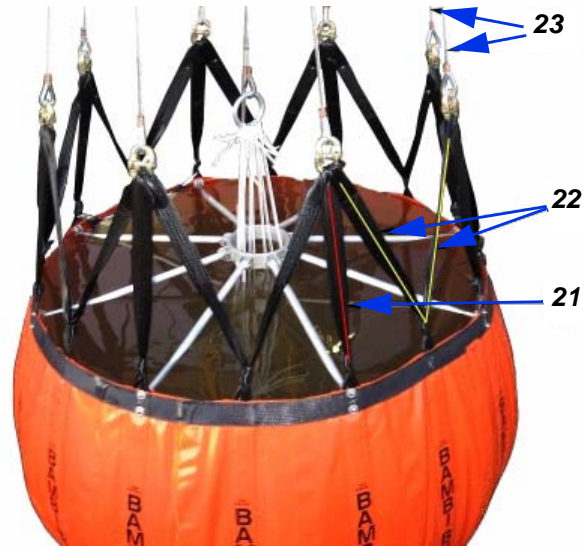
ITEM	MODEL	PART #	DESCRIPTION	QTY
15	1821	BB64681	BALLAST POUCH	1
	2024	BB64682		
	2024S			
	2226	BB64683		
	2226S			
	2732			
	2732S			
3542	BB64684			
16A	ALL	BB661	BALLAST BAR, SQUARE, GALV, 10 LB	1
16B	ALL	BB662	BALLAST BAR, TAPER, GALV, 10 LB	2
604	ALL	PP203	QUICK LINK, 1/4	3
207	ALL	FBSC010410	BOLT, HEX HEAD, SS, 1/4-20 X 1	2
303	ALL	FWS0604	WASHER, FLAT, SS, 1/4 X 1-1/2	4
308	ALL	FWR0107	WASHER, FLAT, RUBBER, 1/4 X 1-1/2	2
402	ALL	FNCS0204	NUT, NYLOCK , SS, 1/4-20	2
206	ALL	FBSC040305	MACHINE SCREW, PAN PHIL, SS, 10-24 X 5/8	4
301	ALL	FWS060306	WASHER, FLAT, SS, 3/16 X 3/4	8
400	ALL	FNCS0203	NUT, NYLOCK, SS, 10-24	4

**Ballast Systems, Model 4453**



ITEM	MODEL	PART #	DESCRIPTION	QTY
16	4453	BB655A	BALLAST BAR, GALV STEEL, 16 LB	3
17	4453	BB655B	BACKING PLATE, BALLAST BAR	3
18	4453	BB659	WEAR STRIP, BALLAST BAR	3
19	4453		SPACER, BALLAST BAR	6
208	4453	FBSC010422	BOLT, HEX HEAD, SS, 1/4-20 X 2-1/4	6
309	4453	FWS0104H	WASHER, FLAT, SS, 1/4 X 3/4 X 1/8	6
303	4453	FWS0604	WASHER, FLAT, SS, 1/4 X 1-1/2	12
402	4453	FNCS0204	NUT, NYLOCK , SS, 1/4-20	6

*Rigging, Models 1518-1821*



ITEM	MODEL	PART #	DESCRIPTION	QTY
21	ALL	BB670	M-STRAP, LOOP, 16"	8
22	ALL	BB671	M-STRAP, STRAIGHT, 35"	8
23	ALL	BB800	SUSPENSION LINE PAIR	4

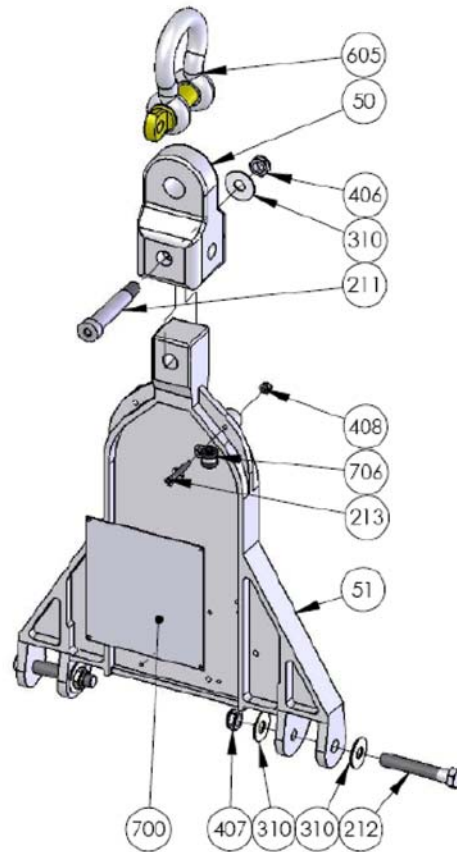
*Rigging, Models 2024-4453*



*Rigging, Models 2024-4453 (continued)*

ITEM	MODEL	PART #	DESCRIPTION	QTY
21	2024	BB674	M-STRAP, LOOP, 18-3/8"	6
	2024S			
	2226			
	2226S			
	2732	BB677	M-STRAP, LOOP, 22-1/4"	
	2732S			
	3542			
	4453			
22	2024	BB675	M-STRAP, STRAIGHT, 40-3/4"	5
	2024S			
	2226			
	2226S			
	2732	BB678	M-STRAP, STRAIGHT, 46-1/2"	
	2732S			
	3542			
	4453			
23	2024	BB805	SUSPENSION LINE, PAIR	4
	2024S	BB805S		
	2226	BB805		
	2226S	BB805S		
	2732	BB806		
	2732S	BB806S		
	3542	BB806		
	4453			
25A	2024	BB780	CHAIN, TOP, 14-1/2"	2
	2024S			
	2226			
	2226S			
	2732	BB782	CHAIN, TOP, 18-1/2"	
	2732S			
	3542			
	4453			
25B	2024	BB781	CHAIN, TOP, 16-1/2"	6
	2024S			
	2226			
	2226S			
	2732	BB783	CHAIN, TOP, 20-1/2"	
	2732S			
	3542			
	4453			
601	ALL	FTAG002	SHACKLE, ANCHOR, GALV, 5/16	5

**Control Head Assembly, Models 1518-4453**

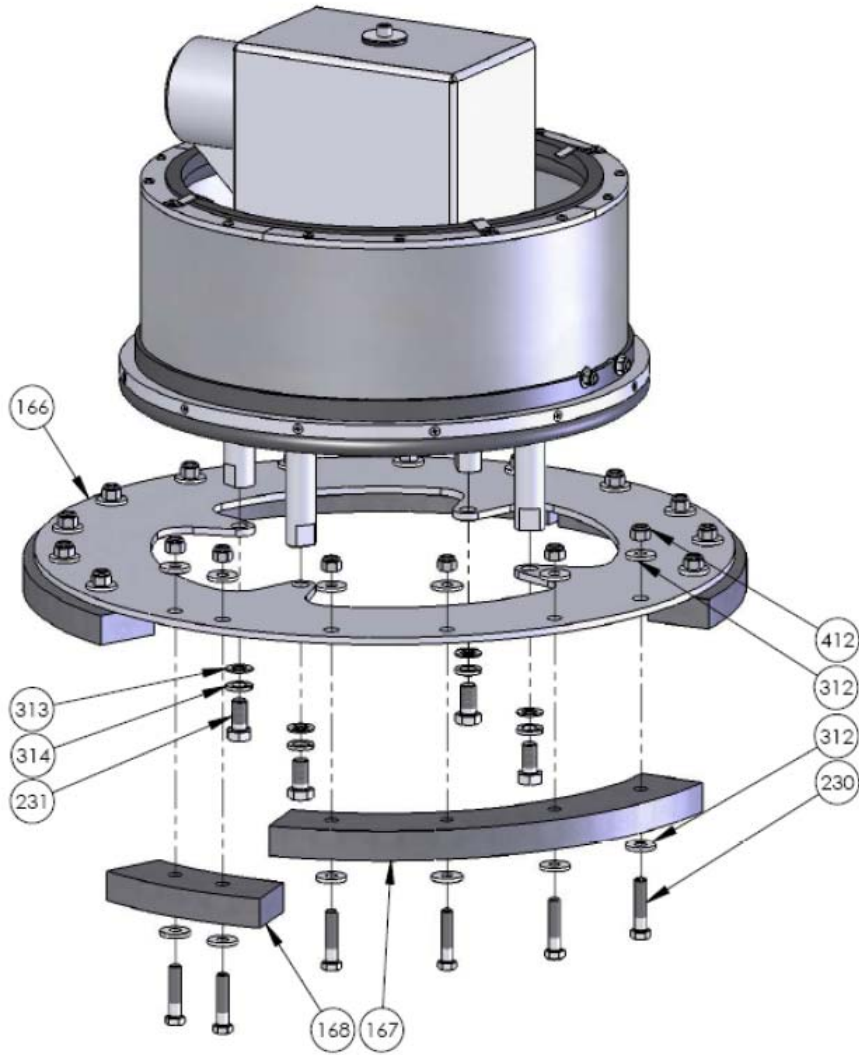


ITEM	MODEL	PART #	DESCRIPTION	QTY
50	ALL	BB068	YOKE	1
51	ALL	BB051	HEAD	1
211	ALL	Fbcc021026	BOLT, SHOULDER, SOCHD, 5/8 X 2-3/4 X 1/2-13	1
212	ALL	Fbcf010830	BOLT, HEX HEAD, PLATED, 1/2-20 X 3	2
213	ALL	Fbsf070314	CAPSCREW, SOC HD, SS, 10-32 X 1-1/2	4
310	ALL	Fws0208	WASHER, FLAT, SS, 1/2 X 1-1/4	5
406	ALL	Fnsc0308	NUT, NYLOCK JAM, SS, 1/2-13	1
407	ALL	Fnsf02082	NUT, NYLOCK JAM, SS, 1/2-20	2
408	ALL	Fnsf0203	NUT, NYLOCK, SS, 10-32	1
605	ALL	Ftag003	SHACKLE, ANCHOR, GALV, 3/4	1
700	ALL	Lb001E	SPECIFICATION PLATE, ENGRAVED	1
706	ALL	Pp013	CABLE CLAMP, RUBBER LINED, 3/8	1

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## Valve Assembly Parts Lists

### Base Rings



**Base Ring, Models 1518-1821**

ITEM	MODEL	PART NUMBER	DESCRIPTION	QTY
166	ALL	BAD1940	BASE RING	1
167	ALL	BAB165	BUMPER BLOCK, LONG	3
168	ALL	BAB1651	BUMPER BLOCK, SHORT	1
230	ALL	FBSC010616	BOLT, HEX HEAD, SS, 3/8-16 X 1-3/4	17
231	ALL	FBSC010810	BOLT, HEX HEAD, SS, 1/2-13 X 1	4
312	ALL	FWS0306	WASHER, FLAT, SS, 3/8 X 1	34
313	ALL	FWS02082	WASHER, FLAT, SS, 1/2 X 7/8	4
314	ALL	FWS0508	WASHER, SPLIT LOCK, SS, 1/2	4
412	ALL	FNPC0206	NUT, NYLOCK, PLATED, 3/8-16	17

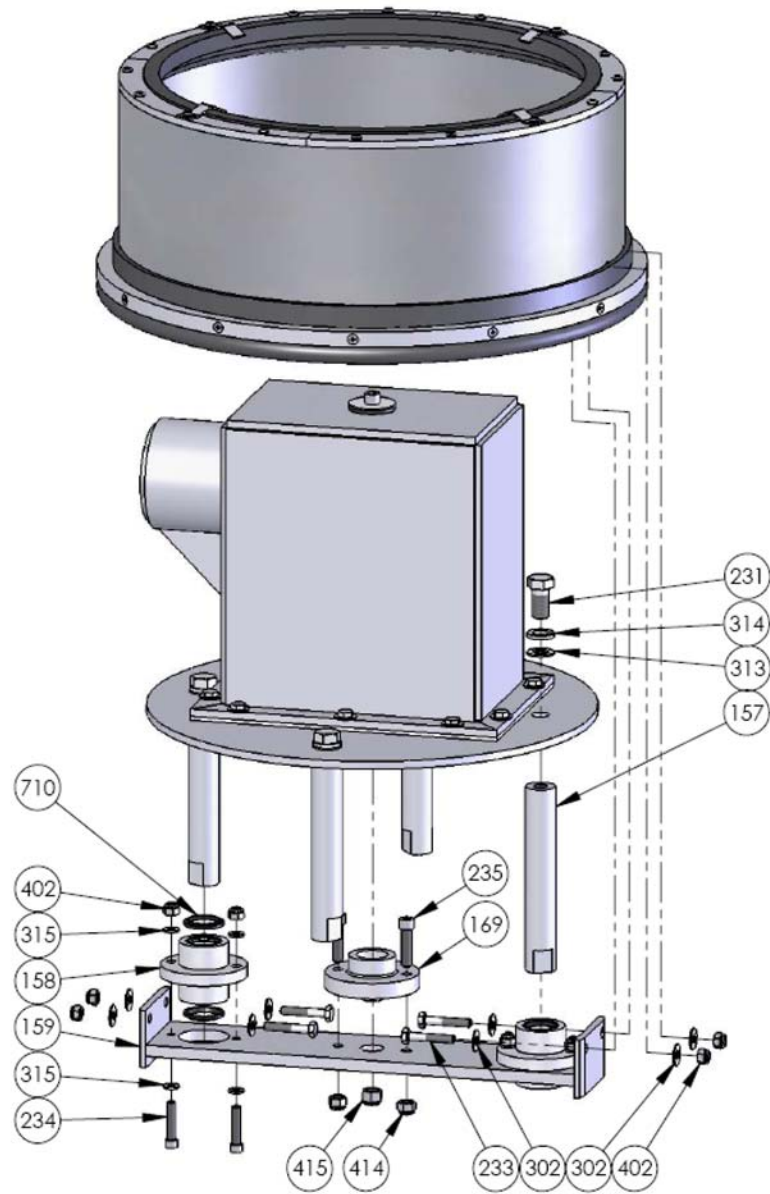
**Base Ring, Models 2024-3542**

ITEM	MODEL	PART NUMBER	DESCRIPTION	QTY
166	ALL	BAD1941	BASE RING	1
167	ALL	BAB166	BUMPER BLOCK, LONG	4
168	ALL	BAB1661	BUMPER BLOCK, SHORT	1
230	ALL	FBSC010616	BOLT, HEX HEAD, SS, 3/8-16 X 1-3/4	18
231	ALL	FBSC010810	BOLT, HEX HEAD, SS, 1/2-13 X 1	4
312	ALL	FWS0306	WASHER, FLAT, SS, 3/8 X 1	36
313	ALL	FWS02082	WASHER, FLAT, SS, 1/2 X 7/8	4
314	ALL	FWS0508	WASHER, SPLIT LOCK, SS, 1/2	4
412	ALL	FNPC0206	NUT, NYLOCK, PLATED, 3/8-16	18

**Base Ring, Model 4453**

ITEM	MODEL	PART NUMBER	DESCRIPTION	QTY
166	ALL	BAD1942	BASE RING	1
167	ALL	BAB167	BUMPER BLOCK, LONG	3
230	ALL	FBSC010616	BOLT, HEX HEAD, SS, 3/8-16 X 1-3/4	20
231	ALL	FBSC010810	BOLT, HEX HEAD, SS, 1/2-13 X 1	4
312	ALL	FWS0306	WASHER, FLAT, SS, 3/8 X 1	40
313	ALL	FWS02082	WASHER, FLAT, SS, 1/2 X 7/8	4
314	ALL	FWS0508	WASHER, SPLIT LOCK, SS, 1/2	4
412	ALL	FNPC0206	NUT, NYLOCK, PLATED, 3/8-16	20

Valve Assembly, Models 1518-4453



*Valve Assembly, Models 1518-4453 (continued)*

ITEM	PART #	DESCRIPTION	QTY
157	BAB149	SUPPORT ROD	4
158	BAB157	LIFT BAR BUSHING	2
159	BAB195	LIFT BAR ASSEMBLY	1
169	BAD242	ACTUATOR HUB	1
231	FBSC010810	BOLT, HEX HEAD, SS, 1/2-13 X 1	4
233	FBSC010414	BOLT, HEX HEAD, SS, 1/4-20 X 1-1/2	4
234	FBSC020412	CAPSCREW, SOC HD, SS, 1/4-20 X 1-1/4	4
235	FBSC020512	CAPSCREW, SOC HD, SS, 5/16 X 1-1/4	2
302	FWS01040	WASHER, FLAT, SS, 1/4 X 11/16	8
313	FWS02082	WASHER, FLAT, SS, 1/2 X 7/8	4
314	FWS0508	WASHER, SPLIT LOCK, SS, 1/2	4
315	FWS0204	WASHER, FLAT, SS, 1/4 X 1/2	8
402	FNSC0204	NUT, NYLOCK, SS, 1/4-20	8
414	FNSC0205	NUT, NYLOCK, SS, 5/16-18	2
415	FNSF0206	NUT, NYLOCK, SS, 3/8-24	1
710	BAB1571	WIPER RING	4

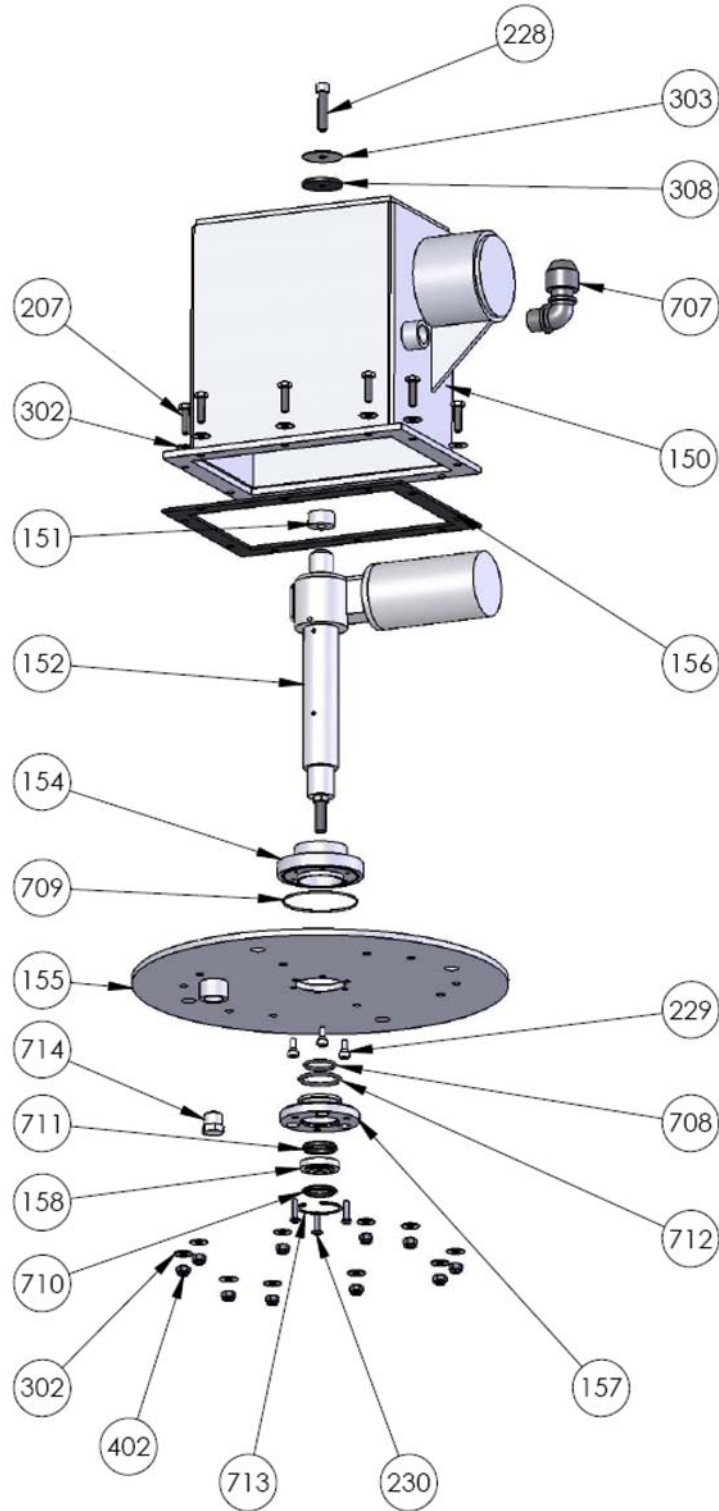
*Valve Tube, Models 1518-4453*



ITEM	PART #	DESCRIPTION	QTY
160	BAB200	VALVE TUBE	1
161	BAD219201	TOP SEAL	1
162	BAB205	SEAL RING SEGMENT	4
163	BAB207	SEAL CLIP	4
164	BAD219202	BOTTOM SEAL	1
165	BAB203	SEAL HOOP	1
218	FSS060206	SCREW, PANPHIL, #8 X 3/4	16
232	FSS030212	SCREW, FLAT PHIL, #8 X 1-1/4	13

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Actuator, Models 1518-4453



*Actuator, Models 1518-4453 (continued)*

ITEM	PART #	DESCRIPTION	QTY.
150	BAD240	ACTUATOR HOUSING	1
151	BAB302	ACTUATOR SPACER	1
152	BAD239A	LINEAR ACTUATOR ASSEMBLY	1
154	BAD666	SEAL HOUSING	1
155	BAB202	TOP PLATE	1
156	BAB341	GASKET, ACTUATOR HOUSING	1
157	BAD667	BUSHING - ROD SEAL	1
158	BAD668	BUSHING - WIPER RING	1
207	FBSC010410	BOLT, HEX HEAD, SS, 1/4-20 X 1	10
228	FBSC020515	CAPSCREW, SOC HD, SS, 5/16-18 X 1-1/2	1
229	FBSC020302	SHOULDER BOLT, SS, 10-24, 1/8"SHLD, 1/4"DIA.	3
230	FBSC040306	MACHINE SCREW, PAN PHIL, SS, 10-24 X 3/4	3
302	FWS01040	WASHER, FLAT, SS, 1/4 X 11/16	20
303	FWS0604	WASHER, FLAT, SS, 1/4 X 1-1/2	1
308	FWR0107	WASHER, FLAT, RUBBER, 1/4 X 1-1/2	1
402	FNSC0204	NUT, NYLOCK, SS, 1/4-20	10
707	BAD17725AL	STRAIN RELIEF, AL., LIQUID TITE, 1/2 NPT X 90°	1
708	006518	O-RING, 1/8"DIA X 1"ID	1
709	DEDA1039	O-RING, BUNA N, #039	1
710	BAB1571	WIPER RING, AN STYLE, 1" DIA.	1
711	006520	ROD SEAL, 1"ID X 1/8"W X 1 1/64"H	1
712	006519	O-RING, 1/8"DIA X 1.375"ID	1
713	006521	RESTRAINER RING, INTERNAL, 1-1/2"	1
714	006435	PLUG, 3/8"MNPT, NYLON-6	1

# Section 17: Warranty

SEI Industries Ltd. (the company) agrees to grant a warranty for a period of one year from the date of purchase of Bambi bucket systems on the following conditions:

- a) The company's sole obligation under this warranty is limited to repairing or replacing, at the company's sole discretion, any product shown to be defective.
- b) The company's products are not guaranteed for any specific length of time or measure of service, but are warranted only to be free from defects in workmanship and material for a period of one year to the original purchaser.
- c) To the extent allowable under applicable law, the company's liability for consequential and incidental damages is expressly disclaimed. **The company's liability in all events is limited to, and shall not exceed, the purchase price paid.**
- d) This warranty is granted to the original purchaser of Bambi bucket systems and does not extend to a subsequent purchaser or assignee.
- e) The company must receive notification in writing of any claims of warranty from the original purchaser which must give details of the claimed defect in the product.
- f) Where the original purchaser is claiming under warranty, the product must be returned to the company for inspection with all transportation and duty charges prepaid.
- g) The warranty does not extend to any product that has been accidentally damaged, abraded, altered, punctured, abused, misused or used for a purpose which has not been approved by the company.
- h) This warranty does not apply to any accessories used with the product that are not supplied by the company and any warranty on such accessories must be requested from the manufacturer or dealer of the accessories.
- i) In the event the original purchaser does not give notice of a warranty claim, within one year of the original purchase of the product, it is understood that the purchaser has waived the claim for warranty and the purchaser and/or any subsequent purchaser must accept the condition of the product, without warranty.
- j) Any technical information supplied by the company regarding the product is not a condition of warranty but rather is information provided by the company to the best of its knowledge.
- k) There are no implied warranties nor is there any warranty that can be assumed from any representation of any person, except the company itself.

### Exclusions

- l) This warranty is void if the product is not installed, used and/or maintained in accordance with the operations manual supplied by SEI.
- m) All Bambi buckets are designed and manufactured with substantial safety margins. It is the responsibility of the user to ensure that the bucket is maintained to a safe standard.