



PowerFill I™

FOR THE

Torrentula Valve™ Bambi Bucket®

With Model B electrical controls

OPERATOR'S MANUAL

Issue date: JUNE 2003
REVISION C



PowerFill I™

For The
Torrentula Valve™ **Bambi Bucket**®

With Model B electrical controls

**Models: 2732, 3542, 4453, 5566, 5870
6578, 7590, HL5000, HL7600, HL9800**

OPERATOR'S MANUAL

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1.1 Introduction to the PowerFill I system

The PowerFill I system is designed to allow the operator to fill a Torrentula Valve-equipped bucket fully and quickly from shallow water sources such as streams, rivers, canals, ponds and low profile dip tanks. In combination with the variable flow, multiple drop capabilities of the Torrentula Valve, aerial firefighters can draw any amount of water from a variety of water sources and distribute the water load in any way desired. The PowerFill I system is compact and lightweight, comprising only a small percentage of full bucket payload. The system can be supplied already installed in a Torrentula Valve Bambi Bucket or can be installed by the operator as a full retrofit kit into an existing Torrentula Valve.

Introduced June, 2003 are the new Model B electrical controls for the operation of the pumps. Model B controls feature a number of upgrades, including: microprocessor-based control logic, all aluminum enclosure, Mil-W-22759/16 wiring, Mil-C-5809 Circuit protection and convenient, all unique, Mil-C-5015 wire harness connections. The electrical system information in this manual pertains only to systems originally equipped with the Model "B" electrical controls. For systems equipped with model "A" controls, refer to the Operator's Manual originally supplied with the equipment.

No prior experience is required to quickly master the PowerFill I. The operator simply presses a push-button for the duration of the fill. Alternatively, the operator may wish to install their own switch or switches or use an existing utility circuit in the cockpit for ease of operation by pilots. This manual contains a simple reference wiring diagram to assist operators who wish to use a different switch arrangement.

Please read this manual prior to flying a bucket with the PowerFill I system. If you experience problems, refer to section 5, *Maintenance and Troubleshooting*.

For your own protection and for longer system life, always read the instructions and warnings. Ignoring them could result in personal injury and damage to the bucket or aircraft. The warning notices are divided by the severity of the outcome into *WARNING* and *CAUTION*.

WARNING: Hazards or unsafe practices that could result in personal injury or death

CAUTION: Hazards or practices that could result in minor personal injury or property damage

SEI offers complete parts supply and repair facilities for the Bambi Bucket and PowerFill I system. For maintenance and repair purposes, parts diagrams and wiring diagrams are provided in sections 8 and 9. When ordering please provide the model and serial number of your Bambi Bucket.

Additional copies of this manual are available from SEI Industries Ltd.

1. INTRODUCTION

1.2 System overview

The PowerFill I system is comprised of a set of electrically driven high-efficiency pumps mounted within the confines of the valve structure on a Torrentula Valve-equipped Bambi Bucket. The pumps can fill the bucket rapidly and completely in shallow water sources as low as 18" (0.45m) deep, and can draw water sources down to as low as 6" (0.15m)

Retrofit Kit

The PowerFill I system can be supplied as a kit for installation on any existing Torrentula Valve-equipped Bambi Bucket. Installation instructions are contained in section 3 of this manual.

Applicable bucket models

Bucket Models 2732 thru 6578 receive a 2 pump system, while the larger size buckets, 7590 thru HL9800 receive 4 pumps. The optimal water pumping rate for each pump is 400 to 450 GPM (25 - 28 L/sec).

Configuration

Each system is supplied with a bottom stand-off that supports the bucket helps to maintain flow into the pump intakes when the bucket is resting on the bottom of the water source. To prevent damage to the pump impellers, each system has large-area filter screens mounted inside the valve structure.

Each pump is equipped with a low restriction, one-way valve to prevent back flow through the pumps when they are not running.

The PowerFill I systems come complete with all the required electrical equipment and wire leads for operation of the pumps. See section 3.2 for helicopter power supply requirements.

Factory installation

The PowerFill I system can be supplied as original equipment on any Torrentula Valve-equipped Bambi Bucket.

2. PRE-FLIGHT SAFETY CHECK

In addition to performing the pre-flight check on the Torrentula Valve (as outlined in the Torrentula Valve Operator's Manual) perform the following checks on the Power Fill and Power Fill II systems:

1. Check that the electrical junction box are secure in the aircraft
2. Inspect the conductor wires for damage, chafing or wear. Confirm that the conductor cables are firmly secured to the Torrentula Valve actuator cable, and also to the long line cable, if used. Repair any damage before operating the system

Warning: Do not operate with damaged cables. Damage to an electrical cable that leaves the conductor exposed can result in fire if it comes in contact with another conductor or metal object

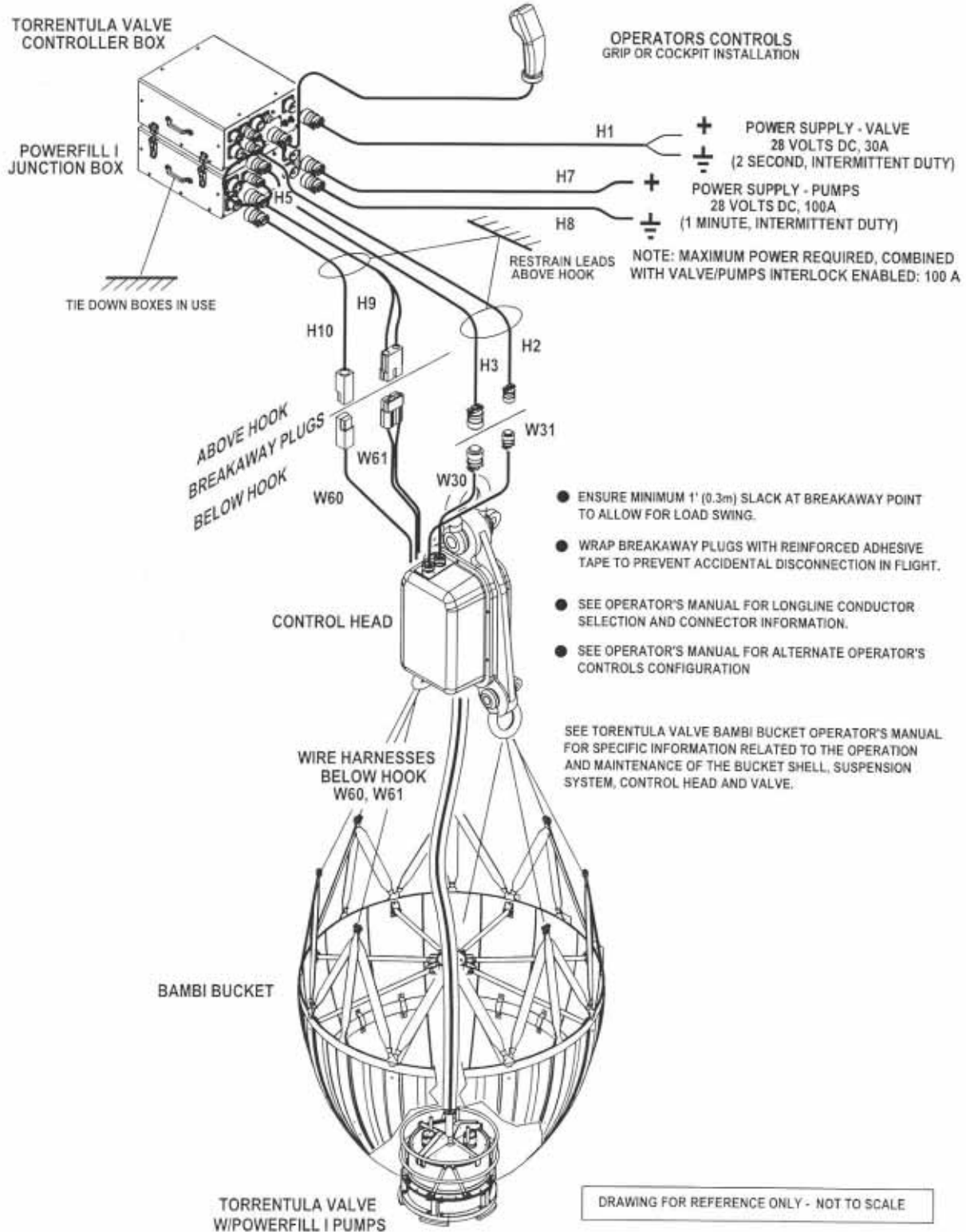
3. Inspect the cable connectors for damage and ensure proper connections

Warning: Do not put your fingers or other objects into the pump impeller while the pump is running. Personal injury or damage to the pump could occur

4. With power "on" check the function of the pumps by pressing the pumps "on" button for 4 or 5 seconds. The pumps should turn on, one after the other, until all are running. The pumps will be audible within a few feet of the bucket. Listen for abnormal noises that are not consistent with smooth operation. If you are operating in a noisy environment, you can confirm the pumps are running by lifting up the flap of the one-way valve to view the spinning pump impeller
5. Check the filter screen for debris accumulation, and clear as necessary
6. Check the pump motor exterior for signs of damage or wear.

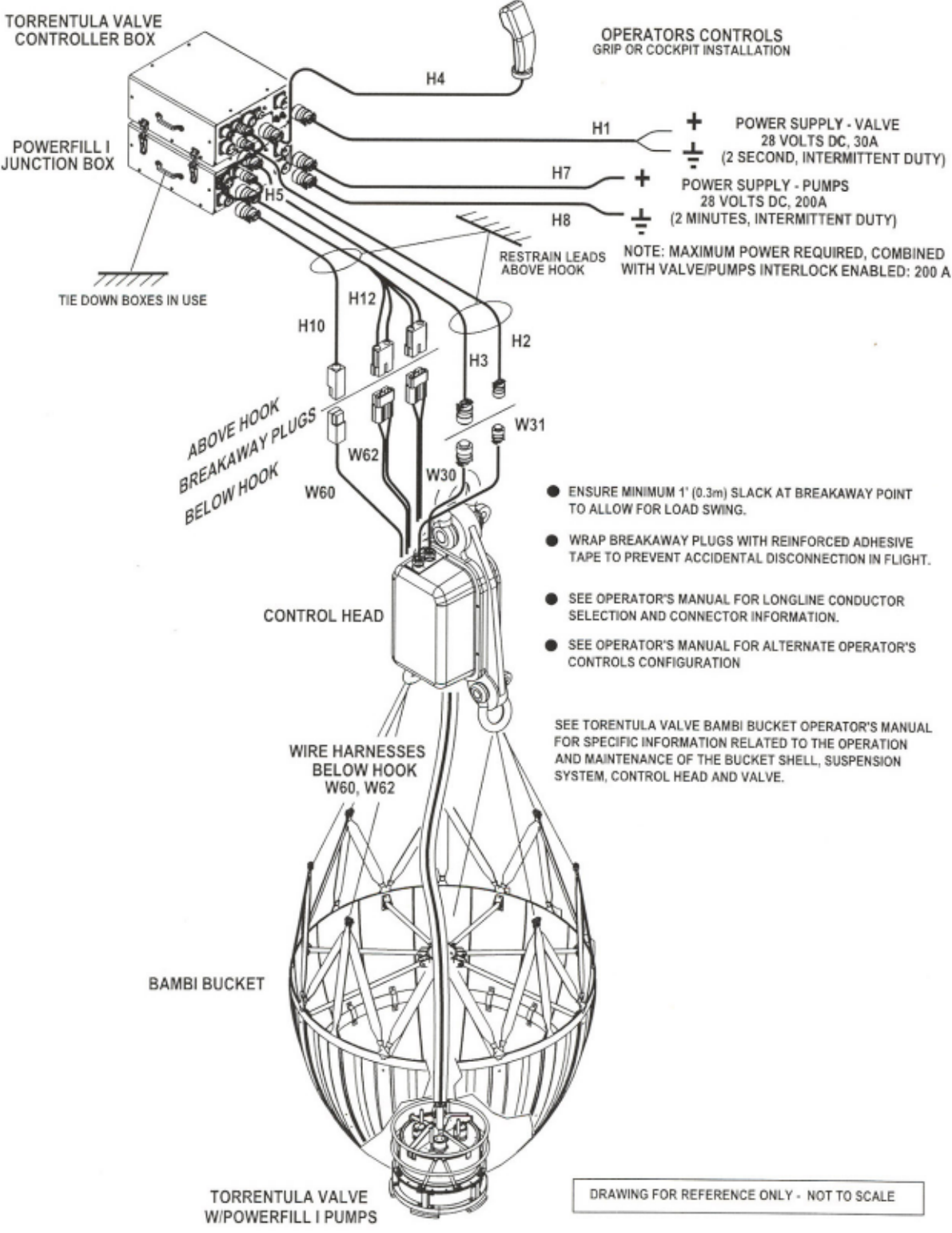
3. INSTALLATION

Fig. 3.1 Torrentula Valve Bambi bucket with PowerFill I pump system, suggested installation diagram Models 2732, 3542, 4453, 5566, 5870, 6578



3. INSTALLATION

Fig. 3.2 Torrentula Valve Bambi bucket with PowerFill I pump system, suggested installation diagram Models 7590, HL5000, HL7600, HL9800



3. INSTALLATION

3.1 Introduction

Please refer to the enclosed parts drawings that are applicable to your PowerFill I system and bucket model. For additional information on the electrical system refer to the wiring diagrams in section 9, *Wiring Diagrams*.

Installing the system as a kit

If you are currently operating a Torrentula Valve-equipped bucket and are upgrading the system to include the PowerFill I, please refer to the installation parts diagrams contained further in this section.

To minimize installation time, the majority of the pump system assembly is done at SEI Industries. The installation of the pump system in the bucket is straightforward and can be accomplished in approximately 4 hours using ordinary hand tools. Allow extra time for the electrical system interface with the helicopter, specifically regarding any necessary approvals and for longline conductor cable installation.

Deploying a bucket with a factory-installed PowerFill I system

Thoroughly read the Torrentula Valve Operator's Manual before deploying the bucket. The PowerFill I system is a modular addition to the Torrentula Valve and this Operator's Manual does not contain information pertaining to the operation of the Bucket and Valve, except where influenced by the addition of the pump system.

3. INSTALLATION

3.2 Interfacing with the aircraft power supply

Please refer to Fig. 3.1, and 3.2 Torrentula Valve Bambi Bucket with PowerFill I sytem suggested helicopter installation diagrams.

Connection to the aircraft power supply should be done in accordance with FAA Advisory Circulars AC43.13-1B and AC43.13-2A and any applicable aircraft manufacturers instructions.

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

Prior approvals issued for the operation of the Bambi Bucket and related systems may have precedence over and may supersede information contained in this manual.

Power Requirements

The PowerFill I system is designed to run on standard 28 Volt DC aircraft electrical current. The system requirements by bucket size are as follows:

Models 2732, 3542, 4453, 5566, 5870 and 6578: 28 VDC supply, 100 Amps continuous output for 60 seconds, intermittent.

Models 7590, HL5000, HL7600 and HL9800: 28 VDC supply, 200 Amps continuous output for 120 seconds, intermittent.

Power requirements for the Torrentula Valve (Reference)

28 VDC supply, 30 Amps for 2 seconds – see Torrentula valve Operator’s Manual for more information

Maximum combined power requirements

With the pumps/valve interlock enabled (default configuration) the maximum requirements are the same as those listed for the PowerFill I system.

Effect of Longlines

Use of a longline lifting cable will reduce the actual current draw of the PowerFill I pumps.

A slight reduction of the pumping rate can be expected when longlines are used. The performance loss wil be proportional to the voltage drop in the longline conductors, and can be minimized with the correct selection of conductor wire gages.

See section 3.6 *Longline conductor selection.*

3. INSTALLATION

3.3 Electrical controls

Control logic

The control logic for operation of the pumps is contained within the printed circuit board inside the Torrentula Valve Controller. The Interface to the PowerFill I junction box consists of wire harness H5, that transfers the signal to operate the pump contactors (power relays) that are located in the PowerFill I Junction Box. When activated, the pumps turn on sequentially with a 0.4 second delay between each. The sequential delay reduces the strain on the power supply upon start-up.

The PowerFill Junction box does not contain any electrical control logic, and cannot operate in isolation from the Torrentula Valve Controller.

Power input

The power input for operation of the PowerFill I pumps consists of receptacles R7 (+) and R8 (Gnd) on the face panel of the Junction box. The power input for the the operation of the Torrentula Valve is receptacle R1 on the Torrentula Controller box. The standard configuration for operation of both systems consists of two connections to the power supply. A single connection to the power supply can be accommodated with the installation of wire harness H11. H11 connects R1 to R11 and provides power to operate the valve through PowerFill I junction box. See the wiring diagrams in section 9.

Mounting the electrical enclosures (boxes)

The PowerFill I junction box has latches for easy mounting with the Torrentula Valve Controller box in a “stacked” configuration. This allows the operator to tie down the systems as a single unit. Alternatively, the operator may wish to locate the two boxes separate from one another, depending on space constraints. Located on each side of the boxes is a tie-down eye strap for the attachment of restraining straps.

By design, it is the intent that the electrical boxes and associated hire harnesses be removed easily from the aircraft when the bucket systems are not in use.

Wire harness routing and restraint

The supplied wire harnesses conduct current and electrical signals from the electrical boxes to the bucket systems via breakaway connectors. These connectors will separate cleanly and with minimal strain in the event of an emergency jettison. Where required, the wire harnesses are enclosed with an abrasion resistant covering that prevents damage to the cables during normal use and handling.

The wire harnesses should be routed neatly and in a manner that does not interfere with the operation of flight controls or the load release mechanism.

Breakaway connectors

The breakaway connectors should be located adjacent to the load release hook, and there should be some slack in the harnesses to allow for load swing in flight. The wire harnesses should be sufficiently restrained above the load hook to prevent strain on the electrical boxes in the event of a load jettison.

Tape all breakaway connections lightly with reinforced adhesive tape. This will prevent accidental disconnection in flight, while still allowing for positive emergency disconnection should it be required.

3. INSTALLATION

3.4 Pump control options

Control logic for operation of the pumps can be configured in several ways. The configuration chosen will depend on the operating parameters and operator preferences:

1. Default configuration

As supplied with original equipment

Who would use it: Operators who specify a dedicated crewmember, other than a pilot, for operation of the bucket systems. This configuration would include the use of the Operator's Control Grip supplied with the Torrentula Valve system.

The pump and valve controls have an **interlock** feature that prevents simultaneous operation of the pumps and dump valve. The intent of the interlock is to limit the maximum power supply output to that required to run the pumps. In normal operations, there is no need to have simultaneous control of the pumps and dump valve.

The method of operating the pumps is a push button switch on the control grip (trigger). The button must be depressed for the duration of the fill.

2. Interlock disable

Requires installation of interlock disable Options Plug on Torrentula Controller printed circuit card

Who would use it: Operators who specify a dedicated crewmember, other than a pilot, for operation of the buckets systems and/or where simultaneous operation of the dump valve and pumps is specified, provided the power supply is of sufficient capacity to support it.

3. Pumps latch "on"

Requires installation of latch "on" Options Plug on Torrentula Controller printed circuit card, and the addition of a pumps "off" push button switch.

Who would use it: Operators who specify pilot control of the bucket systems.

The "latch on" feature runs the pumps with a single momentary "on" signal from a push button switch. The pumps are turned "off" with a momentary signal from a second switch. The intent of the latch is to reduce operator fatigue while the pumps are filling the bucket.

The latch "on" feature has an automatic timed shut-off in the event the pilot neglects to shut off the pumps after the fill is complete. The shut off can be set at either 60 seconds or 120 seconds, depending on which bucket model is in use. Specify the desired time delay when ordering the Options Plug.

Options combinations

The interlock disable option can be combined with the pumps latch "on" option, as long as a single time delay is specified.

Caution: Do not install the latch "on" option where the Operator's Control Grip is used to operate the bucket systems. The control grip does not have a pumps "off" switch installed as a standard feature

3. INSTALLATION

3.5 Installation of the PowerFill I pumps in the Bambi Bucket

Unpack the PowerFill I system and confirm you have received the following:

PowerFill I pumps installed in top plate assembly, complete with wire harnesses, one way valves and filter screen.

Motor guard(s) and mounting hardware

Base stand off assembly

Replacement lift bar assembly - 2732, 3542, 4453 models only

Pump ground cable with attached ground block and hardware

Electrical Junction box with associated attached wire harnesses

Hardware kit

Electrical cable conduit cover

Operators Manual.

3.5.1 Removal and Disassembly of the Torrentula Valve, all models

Caution: When removing the Torrentula Valve from the bucket and when handling the freed valve assembly, always pay close attention to the bottom valve seal and ensure that it does not snag or drag on the bucket shell or other object.

1. Remove the Torrentula valve assembly from the Bambi Bucket.

Note: A hoist capable of lifting up to 150 lb. (68kg) can be useful for lifting the valve assembly out of the bucket. Use the two ¼-20 UNC holes at the top of the top slider pipe to affix a lifting lug or short piece of chain with large washers. Otherwise, have one or two people on hand to help out during this procedure. If using a hoist, stand the bucket upright. If no hoist is available, lay the bucket on its side.

2. Disconnect the outboard end of one IDS spoke. Keep the hardware and note assembly sequence

3. Detach the valve actuator cable from the valve

4. Remove the 4 bolts that hold the support rods to the valve base ring

5. Lift the freed valve assembly through the space provided by the missing spoke. Take care not to drag the bottom valve seal on the bucket shell

6. Place the valve assembly on a large, clean work surface. Assess the condition of the Torrentula Valve structure and perform any necessary maintenance or repairs before continuing.

7. Remove the lift bar assembly from the valve tube

8. Remove the spring brackets that hold the constant force springs to the slider pipe flange

3. INSTALLATION

9. The valve tube and spider assemblies are now free from the top plate. Pull the top plate and support rods out through the bottom of the valve. Note: Assess the condition of the top valve seal. Now is the time to replace it if it is worn or damaged
 10. Remove the support rods from the top plate
 11. Remove the top slider pipe and flange from the top plate by undoing the remaining 4 flange bolts
 12. **Models 2732 - 4453 only:** Remove the top slider pipe from the flange using a water pump wrench or pair of channel lock pliers. Apply the tool near the base of the pipe to avoid damaging the slider bushing bearing area.
6. Lower the completed valve/pumps assembly back into the bucket and line up the support rods with the corresponding gussets on the base ring. This step is accomplished with ease if the bucket is fully supported in the upright position, with the base resting on stands, high enough to allow full access to the underside
 7. Install the supplied motor isolator mounts in the threaded bosses on the bottom of the pump motors. Tighten them firmly by hand
 8. Install the pump motor guards along with the new valve attachment bolts, and secure the isolator mount studs with the supplied nylock nuts

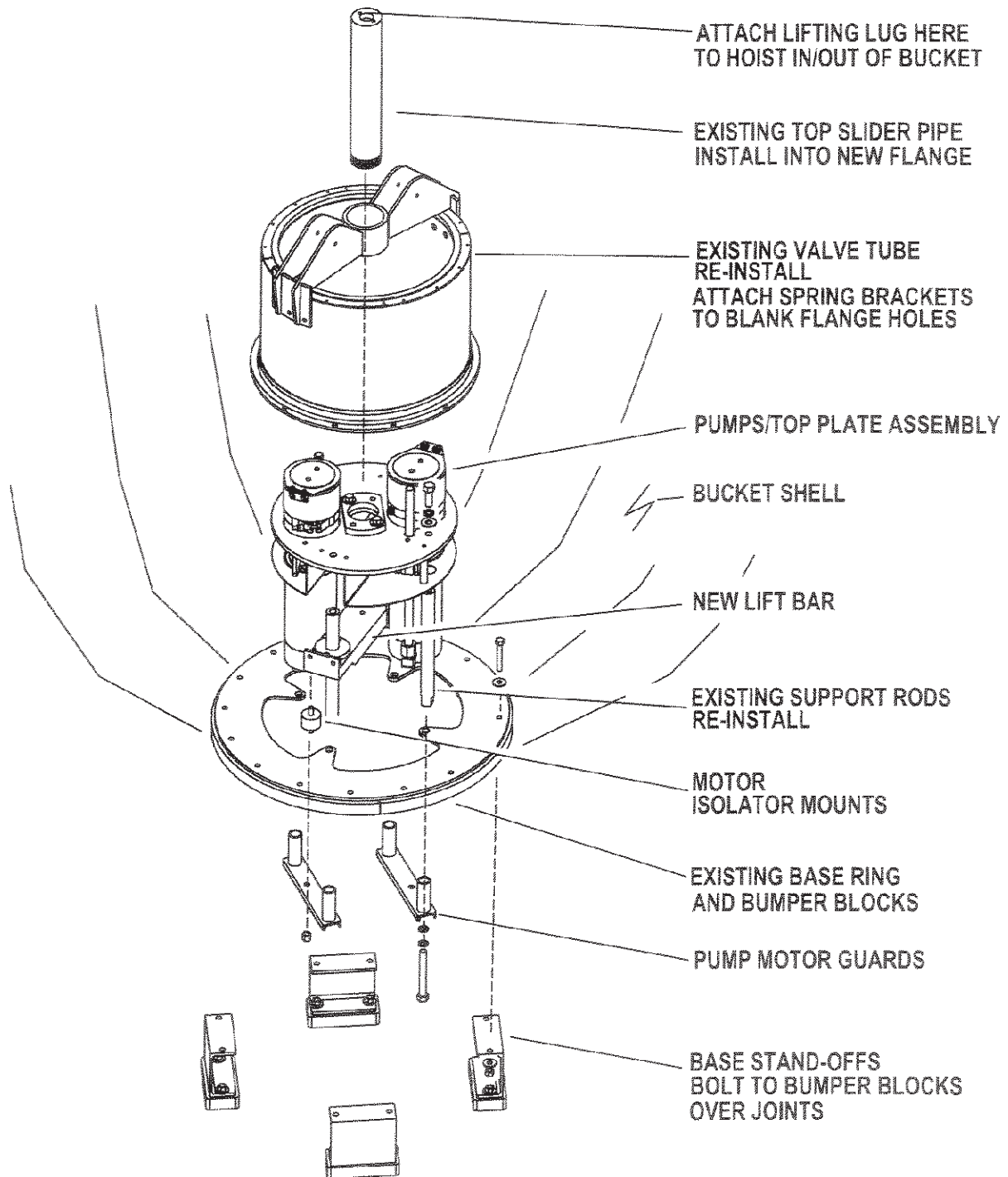
3.5.2 Models 2732 to 4453: Installation of the PowerFill pump assemblies into the Torrentula Valve

Please refer to fig. 3.3

1. Install the base stand-offs with the hardware supplied
 2. Re-install the support rods onto the new PowerFill I pump top plate assembly
 3. Install the top slider pipe onto the (installed) new flange on the PowerFill I pump top plate assembly.
 4. Place the valve tube assembly onto the new pumps/top plate assembly and attach the spring brackets to the slider pipe flange. Ensure that the spring bracket attachment bolts face downwards and that the spring brackets are square along an imaginary line between the pillar bolt holes
 5. Install the supplied *new* lift bar with new hardware. The bolts face inwards
9. Check that the Valve slides up and down on the slider bushing freely, without binding anywhere through the full travel, and that the valve seats squarely on the base ring. No parts of the valve should rub or contact the pump assemblies. Adjust the lift bar slider bushings as required. Please refer to the maintenance procedures in the Torrentula Operator's manual
 10. Re-install the valve actuator cable
 11. Secure the motor ground leads to ground jumper cable terminal with the ¼"UNC bolt supplied
 12. Secure the motor power leads and the ground jumper lead to the valve actuator cable, with the supplied zip ties, every 24" (0.6m), from the valve up to the control head
 13. Secure the free ends of the power cables and ground cable to the control head using the supplied cable clamps. Use zip ties on each end of the power cable bundle to keep the installation tidy.
 14. Install the supplied Velcro conduit cover over the conductor cable/actuator cable bundle.

3. INSTALLATION

Fig. 3.3 Pump installation into Torrentula Valve Bambi Bucket, models 2732, 3542, 4453



3. INSTALLATION

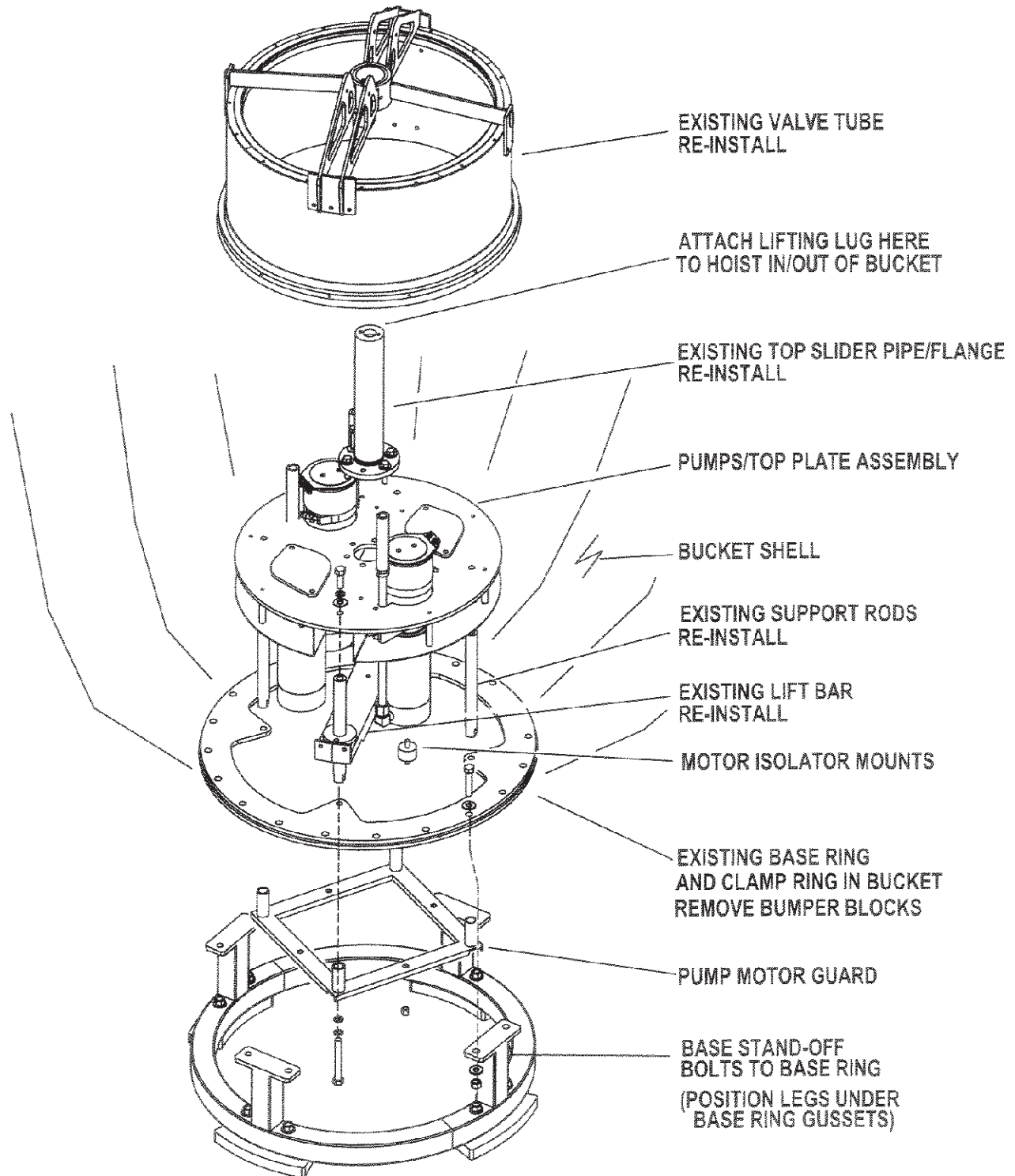
3.5.3 Models 5566 to 7590: Installation of the PowerFill I pump assemblies in the Torrentula valve:

Please refer to Fig. 3.4 for the following steps:

1. Install the base stand-off with the hardware supplied.
2. Re-install the support rods onto the new PowerFill I pump top plate assembly.
3. Install the top slider pipe and flange assembly onto the PowerFill I pump top plate assembly, leaving the spring bracket bolts out. The bolts must face downwards.
4. Place the valve tube and spider assembly onto the new pumps/top plate assembly and attach the spring brackets to the slider pipe flange. Ensure that the spring bracket attachment bolts face downwards and that the spring brackets are square along an imaginary line between the pillar bolt holes.
5. Reinstall the lift bar. The mounting bolts face inwards.
6. Lower the completed valve/pumps assembly back into the bucket and line up the support rods with the corresponding gussets on the base ring. This step is accomplished with ease if the bucket is fully supported in the upright position, with the base resting on stands, high enough to allow full access to the underside.
7. Install the supplied motor isolator mounts in the threaded bosses on the bottom of the pump motors. Tighten them firmly by hand.
8. Install the pump motor guard along with the new valve attachment bolts, and secure the isolator mount studs with the supplied nylock nuts.
9. Check that the Valve slides up and down on the slider bushing freely, without binding anywhere through the full travel, and that the valve seats squarely on the base ring. No parts of the valve should rub or contact the pump assemblies. Adjust the lift bar slider bushings as required. Please refer to the maintenance procedures in the Torrentula Operator's manual.
10. Re-install the valve actuator cable.
11. Secure the motor ground leads to ground jumper cable terminal with the ¼"UNC bolt supplied.
12. Secure the motor power leads and the ground jumper lead to the valve actuator cable.
13. Secure the free ends of the power cables and ground cable to the control head using the supplied cable clamps. Use zip ties on each end of the power cable bundle to keep the installation tidy.
14. Install the supplied Velcro conduit cover over the conductor cable/actuator cable bundle.

3. INSTALLATION

Fig. 3.4 Pump installation into Torrentula Valve Bambi Bucket, models 5566, 5870, 6578, 7590



3. INSTALLATION

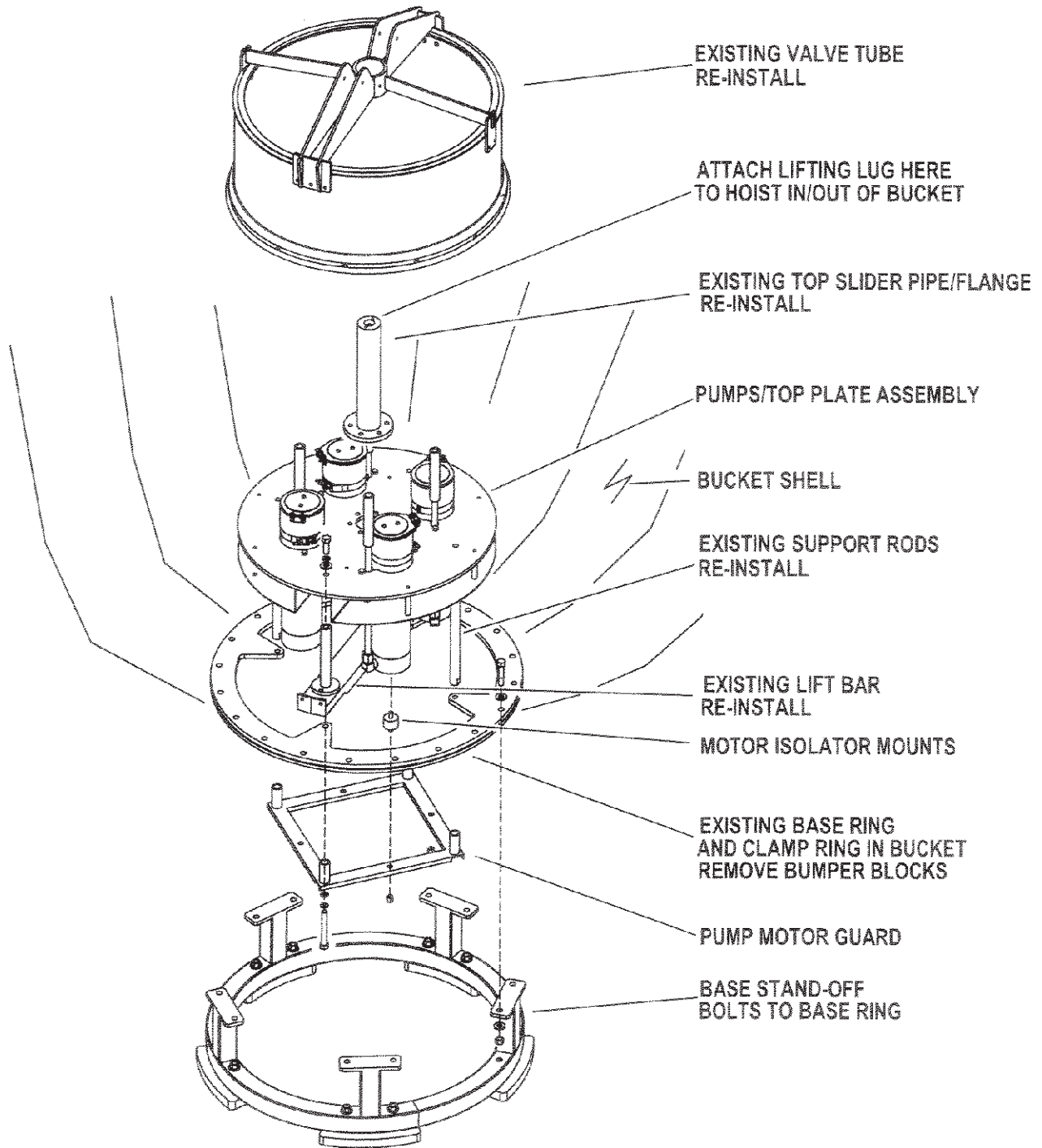
3.5.4 Models HL7600 and HL9800: Installation of the Power Fill pump assemblies in the Torrentula Valve

Please refer to Fig. 3.5 for the following steps:

1. Install the base stand off with the hardware supplied.
2. Re-install the support rods onto the new PowerFill I pump top plate assembly.
3. Suspend the valve tube assembly over the pumps/top plate assembly with a hoist. Tilt the valve tube to the side to allow the bottom seal retainer screws to get past the top plate and to rest on the filter screens (the valve tube may need to be shifted several times to accomplish this step). Align the valve tube spider to be square with the support rod bolt holes, in the same position as it would be when fully installed. Mark the locations of the bottom seal retainer screws where they meet the screens, and cut 3/8" to 1/2" (9 – 13mm) square notches in the screens. When finished, lift the valve assembly free of the top plate. Note: The notches must be cut to allow the valve tube to slide freely for the last 2 inches (50 mm) of "open" travel.
4. Slide the slider pipe and flange assembly into the center bushing on the valve spider.
5. Lower the valve tube and slider pipe onto the pumps/top plate assembly and again, tilt the valve tube to the side to allow the bottom seal retainer screws to pass over the top plate.
6. Attach the slider pipe and flange assembly to the top plate. The bolts must face downwards. Ensure that the spring brackets are square along an imaginary line between the support rod bolt holes before tightening the bolts.
7. Reinstall the lift bar. The mounting bolts face inwards.
8. Lower the completed valve/pumps assembly back into the bucket and line up the support rods with the gussets on the base ring. This step is accomplished with ease if the bucket is fully supported in the upright position, with the base resting on stands, high enough to allow full access to the underside.
9. Install the supplied motor isolator mounts in the threaded bosses on the bottom of the pump motors. Tighten them firmly by hand
10. Install the motor guard along with the new valve attachment bolts, and secure the isolator mount studs with the supplied nylock nuts.
11. Check that the valve slides up and down on the slider bushings freely, without binding anywhere through the full travel, and that the valve seats squarely on the base ring. No parts of the valve should rub or contact the pump assemblies. Check that the notches cut in the filter screens clear the bottom seal retainer screws. If not, trim the screen as required. Adjust the lift bar slider bushings as required. Please refer to the maintenance procedures in the Torrentula Operator's manual
12. Re-install the valve actuator cable.
13. Secure the motor ground leads to ground jumper cable terminal with the 1/4"UNC bolt supplied.
14. Secure the motor power leads and the ground jumper lead to the valve actuator cable, with the supplied zip ties, every 24" (0.6m), from the valve up to the control head.
15. Secure the free ends of the power cables and ground cable to the control head using the supplied cable clamps. Use zip ties on each end of the power cable bundle to keep the installation tidy.
16. Install the supplied Velcro conduit cover over the conductor cable/actuator cable bundle.

3. INSTALLATION

Fig. 3.5 Pump installation into Torrentula Valve Bambi Bucket, models HL5000, HL7600, HL9800



3.6 Longline conductor selection

Voltage drop Vs. fill performance

If the PowerFill I system is installed on a bucket deployed on a long line, the conductor cables used to supply power to the pumps must be sized to allow for satisfactory fill performance. The fill performance is proportional to the percentage of full voltage supplied to the pumps, and will vary depending on the “voltage drop” in the long line conductor cables. The recommended conductor sizes are based on the aircraft power supply giving a minimum of 24.5 volts under full pump load and a minimum pump performance of 90% of optimal. The optimal fill performance (no longline voltage drop) can be found in Section 7, *Specifications*. Output voltage can vary between power supply type. Higher pump performance can be expected if power supply voltage under load is higher than 24.5 volts.

Long line conductor configuration

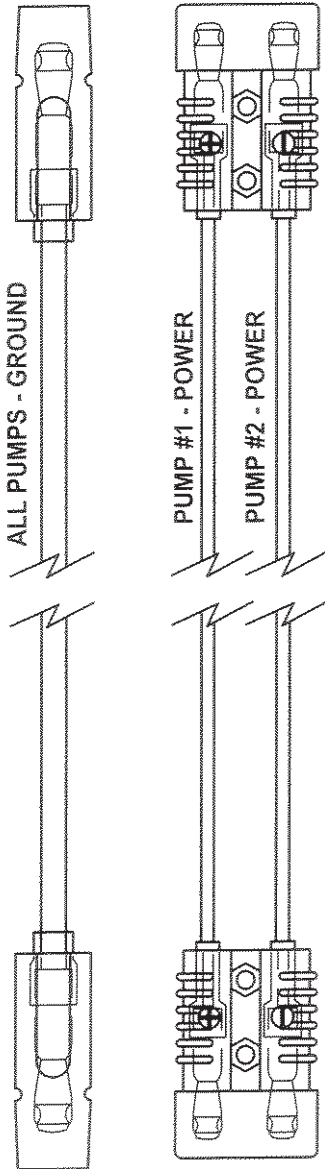
The basic long line conductor cable arrangement consists of 1 power cable per pump with a common ground return cable for all pumps. Each pair of pumps shares a common 2-contact breakaway connector, while the ground cable has a single breakaway connector to serve all pumps. See fig 3.6, and 3.7 for longline conductor assemblies and recommended sizes. SEI Industries can supply complete longline conductor assemblies on request.

3. INSTALLATION

Fig. 3.6 Recommended longline conductor assemblies, models 2732, 3542, 4453, 5566, 5870, 6578

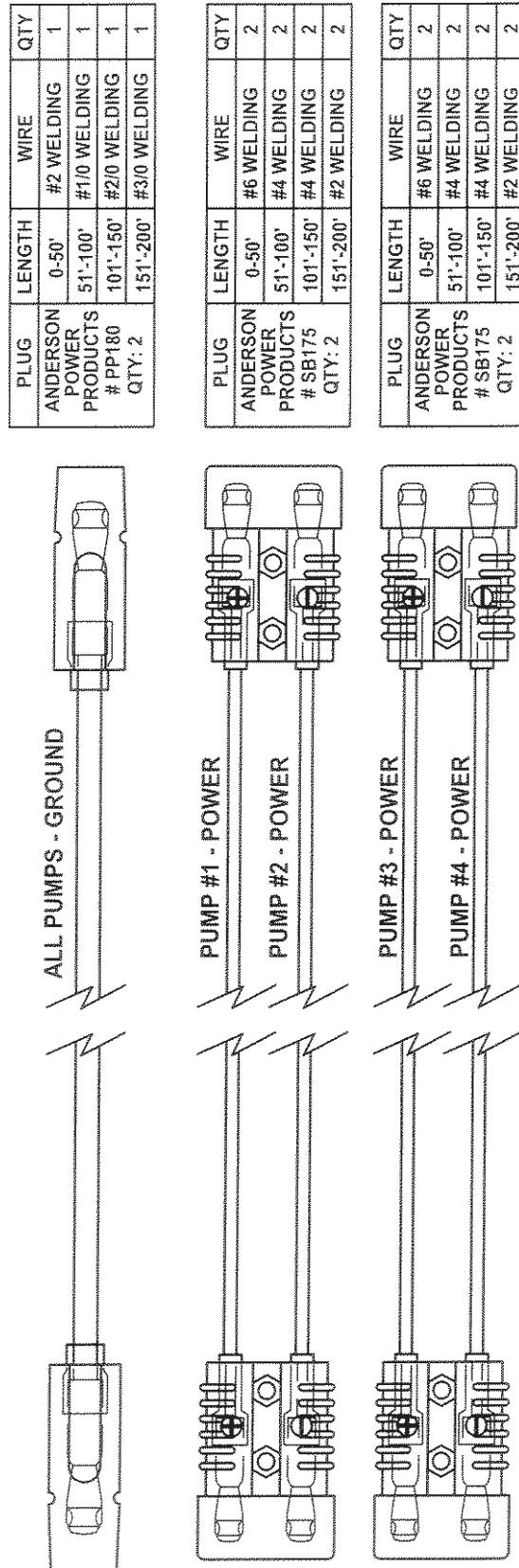
PLUG	LENGTH	WIRE	QTY
ANDERSON POWER PRODUCTS # PP180 QTY: 2	0-50'	#4 WELDING	1
	51'-100'	#2 WELDING	1
	101'-150'	#1 WELDING	1
	151'-200'	#1/0 WELDING	1

PLUG	LENGTH	WIRE	QTY
ANDERSON POWER PRODUCTS # SB175 QTY: 2	0-50'	#6 WELDING	2
	51'-100'	#4 WELDING	2
	101'-150'	#4 WELDING	2
	151'-200'	#2 WELDING	2



3. INSTALLATION

Fig. 3.7 Recommended longline conductor assemblies, models 7590, HL5000, HL7600, HL9800





4. OPERATION

4.1 Flying with the PowerFill I system

The addition of the PowerFill I system will not adversely affect the flight characteristics of the Bambi Bucket. Please see the Bambi Bucket Operator's manual for information on flying the Bambi Bucket.

4.2 Filling the Bambi Bucket with PowerFill I

Initiating a fill is simple and can be quickly mastered. Operation of the pumps is accomplished by simply pressing the pumps "on" button for as long as it takes to fill the bucket. There are a few key points to keep in mind:

To initiate a fill, the pump impellers must be immersed. For models 2732 to 4453 it may not be possible to fill from water sources less than 16" (0.41m) deep. For models 5566 to HL9800 it may not be possible to fill from sources less than 18" (0.46m) deep. The fill will be initiated more quickly if the valve is open as the bucket is lowered into the water source. Close the valve when pumps are fully immersed. Fig. 4.1.

Once a fill has been started, the bucket will need to be supported by maintaining some tension on the suspension lines, particularly when the bucket is nearly full. If the bucket is not supported, the flexible nature of the bucket shell may allow it to collapse to one side as the water load increases. Fig 4.2

Once a fill has been started, the bucket can be raised or lowered relative to the water line without losing the prime, as long as the bottom seal of the dump valve is not lifted completely out of the water. Fig 4.3.

The filter screens are designed to filter out objects large enough to damage the pump impellers, and to prevent weeds and debris from clogging the pump intakes. If operating the pumps in extremely dirty or swampy water sources, more frequent inspections of the pump impellers and filter screens may be required to maintain optimal function.

The pumps can be run "dry" without damage. However, maximum life can be obtained from the pump motors if the run time is limited only to filling the bucket. Excessive run time will require more frequent lubrication of the pump output shaft. See Section 5, *Maintenance and Troubleshooting*, for shaft seal lubrication procedure.

4. OPERATION

Fig 4.1 Initiating fill with valve open

Open the dump valve as bucket is lowered into the source

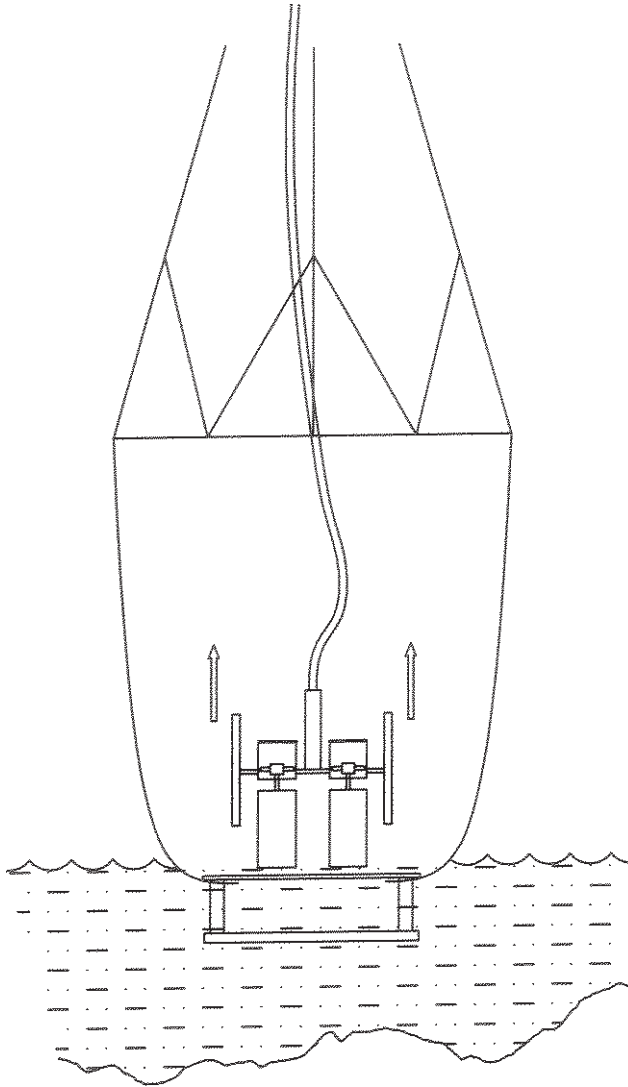
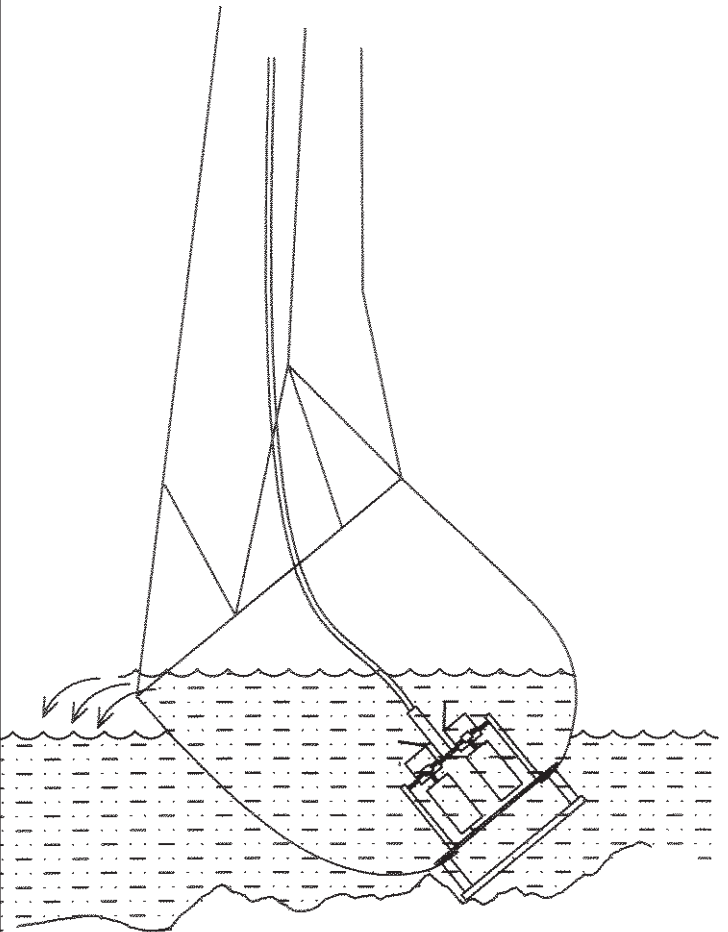


Fig 4.2 Maintaining suspension line tension

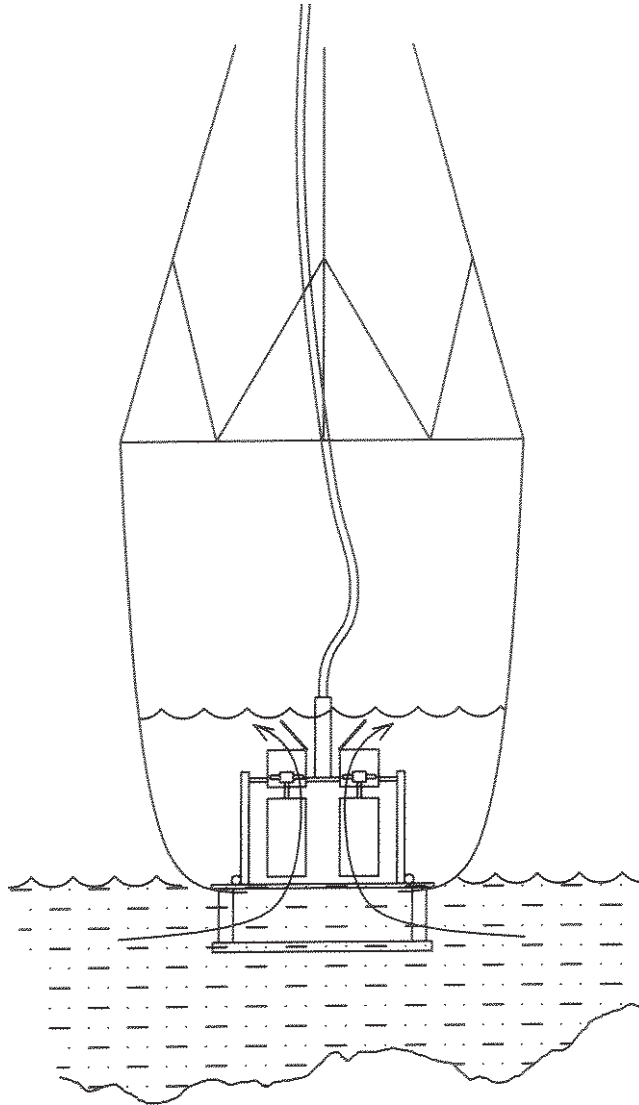
Slack in suspension lines may allow bucket to tip over



4. OPERATION

Fig 4.3 Maintaining prime on pumps

Keep bottom valve seal at or below waterline to maintain prime





5.1 Introduction

The Maintenance and repair of the PowerFill I system 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 maintenance practices is essential.

If work on the electrical controls is undertaken, further knowledge and experience in the area of 28 volt DC electric circuitry is necessary. Included in section 9 is 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.

5.2 System description

The System consists of the following main components: 1) 2 - 4 (depending on Model) 28 volt DC driven pumps; 2) Conductor wiring and breakaway plugs; 3) Electrical junction box.

1. Pumps

The 28 Volt DC-powered pumps are very compact, light weight and efficient. Each pump draws 45 Amps of current and can pump between 400 and 450 US Gallons per minute (25 to 28 liters per second), depending on bucket size. The power can be supplied by direct 28 Volt DC power from the aircraft non-essential or utility bus, or from AC to DC Transformer/Rectifiers with 28 volt DC output. The pumps are isolated individually by separate circuit breakers. The pumps work by drawing water up through the cavity of the Torrentula Valve, through the impeller intakes and directly into the bucket. This method of bottom-up filling reduces fill times by minimizing the “head” pressure the pumps must maintain to fill the bucket cavity. This in turn minimizes the absolute power required to run the pumps and

eliminates the need for complex and inefficient intermediate power sources.

The pumps are mounted into the Torrentula Valve via a modified plate, which is installed in place of the standard Torrentula Valve top plate. The pumps are completely enclosed and protected by the valve structure. Additional guards are installed on the bottom of the valve to protect the pump motors from rocks. On the bottom of the bucket is mounted a “stand off” structure that provides an annular intake area for the pumps when the bucket is resting on the bottom of the water source. The pumps draw water through a common debris filter screen, and past low-restriction one-way valves into the cavity of the bucket. The one-way valves prevent water from escaping the bucket when the pumps are not running. The pumps can be run “Dry” without damage. The pump motors are fully waterproof in operation to a depth of 10 feet (3.0 m) and have a standard hydraulic grease nipple provision to extend the life of the motor output shaft seals.

2. Conductor wiring and plugs

Each PowerFill I motor has its own protective waterproof conduit that houses the conductor wires to a point above dump valve. The Lower portion of the conduit, inside the valve structure, consists of a tough metal tube and elbow fitting that resists damage from rocks and debris. The conductor wires are split into positive (power) and negative (ground) The ground leads connect to a common ground cable just above the dump valve while individual power leads run directly to the breakaway plug at the control head. All conductors are sized to allow for minimal voltage drop and safe operation under load.

3. Electrical junction box

All connections and electrical control components are housed in a two-piece anodized aluminum enclosure. The enclosure is splash-proof and impact resistant. Four latches and an interface lead (H5) are supplied with the box to allow it to be coupled to the Torrentula Valve Controller box. This allows the two boxes to function effectively as a single unit.

Note: The Torrentula Valve can operate as a completely independent system if the PowerFill I system is not in use

The PowerFill I Junction Box contains the circuit breakers and power contactors required to run the pumps. Each pump is backed by a dedicated circuit breaker. Current overload to one pump only will not affect the operation of the other pump or pumps. The pump contactors close sequentially, one after the other, with a delay of 0.4 seconds between each. The purpose of this delay is to limit the initial “inrush” current to the pump motors, thereby putting less strain on the power supply during start-up.

5.3 Routine maintenance procedures

In addition to the daily pre-flight inspections as outlined in Section 2, *Pre-flight Safety Check*, follow the weekly inspection procedure in periods when the bucket is in continuous use.

Caution: Critical to the longevity and performance of the pumps is the lubrication of the pump output shaft seals. Failure to follow the recommended lubrication intervals may result in premature pump failure. See section 5.3.2 *Pump output shaft lubrication*

5.3.1 Weekly inspection

1. Check all parts of the system for visible damage or defects.
2. Clean all debris from the pump motor impellers and debris screen.
3. Inspect the entire length of all electrical cables for damage.
4. Assess the function of the pumps by running each one in turn. Isolate each pump by turning the other pump circuit breakers “off” during the test.

Warning: Disconnect power to the pump motors before performing visual inspections of the pump impellers.

5. Inspect each pump impeller for signs of damage, particularly on the leading (lower) edge of the impeller blades.
6. Inspect the one-way “flapper” valves on the pump exit ducts (inside the bucket) for cuts or tears.
7. Inspect the motor conductors for cuts or signs of chafing or wear. Immediately repair any damage to conductor cable insulation.
8. Ensure each cable connector is securely attached to its cable and free from cracks or damage.

5.3.2 Pump output shaft lubrication

The pump output shaft must be lubricated periodically to preserve the life of the seals. Good seal condition will prolong the life of the pump motors by preventing moisture and other contaminants from entering the case. Lubrication will require a hand pump grease gun with a 12" (30 cm) flexible extension and standard hydraulic coupler.

Grease selection

Any multi-purpose wheel bearing grease that has Good-to-Excellent water-resistant properties is suitable. Following is a list containing suitable lubricants from several manufacturers:

- AEROSHELL 5
- BP Energrease LC-2
- Castrol Multi-purpose Wheel Bearing Grease
- Chevron Black Pearl Grease EP
- Exxon Multipurpose Grease EP 2
- Quaker State Multi-purpose Grease & WB #2
- Mobil Mobilgrease XHP 222
- Pennzoil #302 Multi-purpose grease
- Shell Darina XL series

Grease procedure

Intervals:

Models 2732, 3542, 4453, 5566, 5870, 6578:
Every 400 fill cycles

Models 7590, HL5000, HL7600, HL9800:
Every 250 fill cycles

Note: Regular dip fills do not count as fill cycles if pumps are not operated

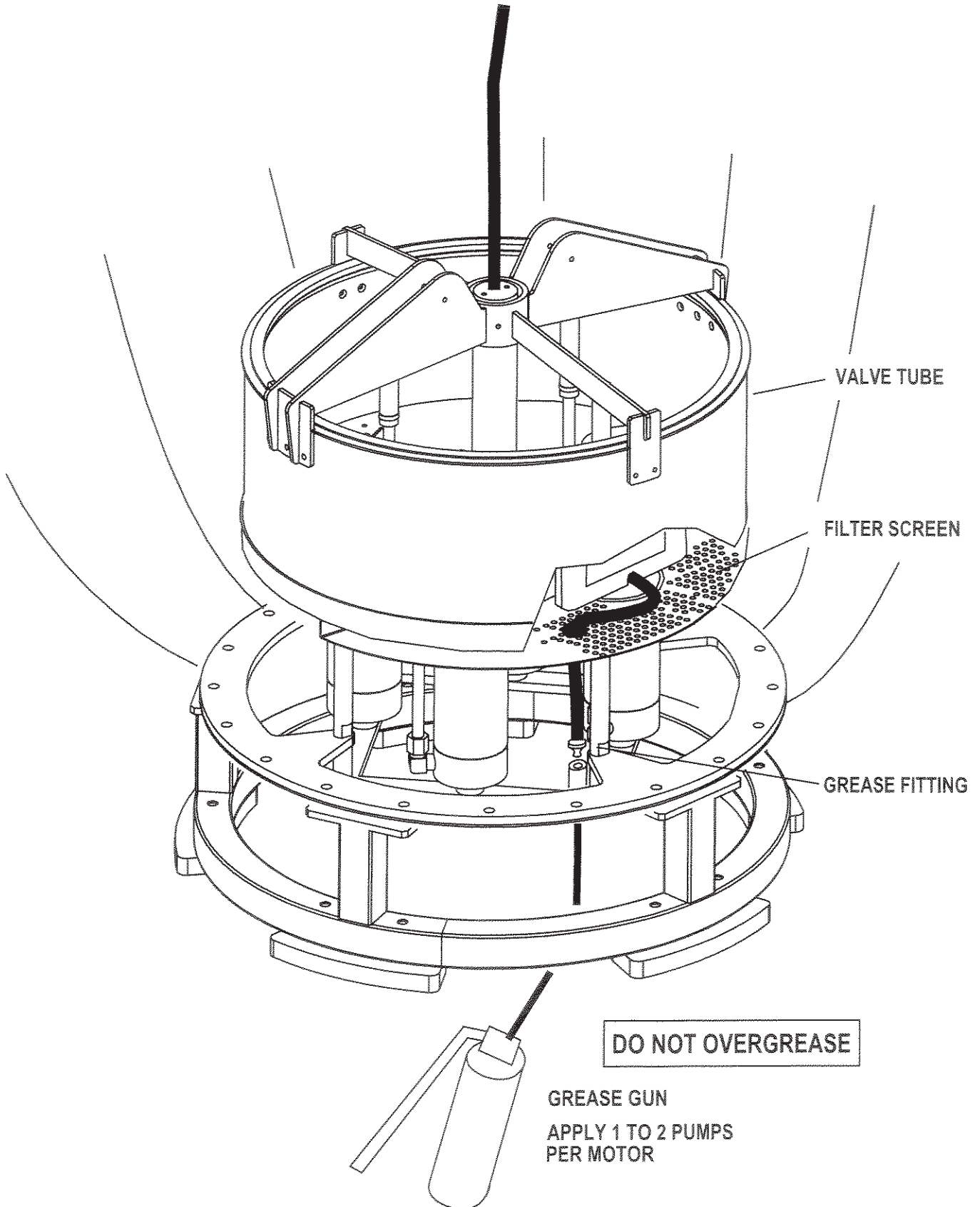
1. Gently apply 1 or 2 pumps of grease to the grease nipple extension for each pump motor shaft - just enough to purge grease through the seal. See fig 5.1

Do not overgrease. Excessive grease and or grease pressure may force grease into the motor case.

2. Check for and remove any dirt or gravel accumulation near the pump intake. Clean if required. Avoid applying high-pressure water spray in the seal area.

5. MAINTENANCE AND TROUBLESHOOTING

Fig. 5.1 Pump output shaft lubrication



5.3.3 Yearly maintenance and preparation for long term storage

1. Clean and dry the bucket and all components
2. Perform a functional check of the PowerFill I system
3. Perform any necessary repairs to ensure optimal function of the bucket
4. Lubricate the pump output shaft seals.

5. MAINTENANCE AND TROUBLESHOOTING

Fig. 5.2 Troubleshooting chart

Problem	Possible cause(s)	Check/Repair
Pump or pumps will not run when first connected	<ol style="list-style-type: none"> 1) incorrect connection to power supply 2) Incompatible power supply 3) Circuit breaker (s) in the "off" position 	<ol style="list-style-type: none"> 1) Re-check connections as per fig. 3.1, check control circuit fuse 2) Compare power supply output with requirements, See section 7, <i>Specifications</i> 3) Re-set breaker(s) to "on" position
Pump or pump(s) fail to operate or suddenly stop in use	<ol style="list-style-type: none"> 1) Disconnected conductor cables 2) Over-load current to motor 3) Debris jamming or clogging pump 	<ol style="list-style-type: none"> 1) Check all cable connections 2) Check motor circuit breakers for tripped breaker, check motor 3) Remove debris
Average bucket fill times increase over time	<ol style="list-style-type: none"> 1) Debris filter clogged 2) One or more pumps disabled 3) Pump impellers worn or damaged 4) Wear/Damage to cable connections or cable 	<ol style="list-style-type: none"> 1) Clean debris filter 2) Assess pump function 3) Inspect and repair/replace pump impellers 4) Inspect, repair connectors, cable as reqd.
Pump or pumps noisy in operation	<ol style="list-style-type: none"> 1) Damaged pump assembly or impeller 2) Debris in impeller housing 	<ol style="list-style-type: none"> 1) Inspect and repair/replace pump components as req'd 2) Remove debris
Fill times longer than expected when used on long line	Excessive voltage drop in long line cables	Measure cable resistance, compare cable sizes with recommended. See section 3.6 <i>Longline conductor selection</i>

5. MAINTENANCE AND TROUBLESHOOTING

5.4 Unscheduled Maintenance procedures: Checking, Repair and Replacement of PowerFill system components

When performing repairs or replacements of PowerFill I pump components, it is recommended the Torrentula Valve assembly is removed from the Bambi Bucket shell. This simple procedure, outlined in Section 3, will allow much easier access to the pump components. It is recommended that you use a hoist capable of lifting up to 150 lb, when lifting or lowering the valve and pump assembly. Use the two ¼-20 UNC holes at the top of the top slider pipe to affix a lifting lug or chain.

5.4.1 Removal and disassembly of the PowerFill I pump units

Please refer to parts diagrams in section 8

1. Disconnect the motor conductor cables from the valve actuator cable and the control head
2. Remove the valve assembly from the bucket, and remove the valve tube from the valve assembly
3. Remove the debris filter screen
4. Remove the exit duct / flapper valve assembly from the pump impeller housing
5. Remove the two 5/16-18UNC nuts that secure the motor adapter to the top plate
6. Gently pull the motor assembly downwards approximately 2" (50mm), tilt the assembly toward the center of the hole, and pull the motor / adapter assembly away from the top plate. Coil the conductor cable neatly for easier handling
7. The impeller housing is a slight press fit into the adapter. Use a large screwdriver to apply a gentle upward prying force between the impeller housing and the adapter to free the impeller housing from the assembly
8. Place a wooden or plastic block between the impeller and motor adapter, and undo the ¼-28 UNF bolt that secures the impeller to the motor output shaft
9. Remove the impeller from the motor output shaft. If the impeller does not come free with gentle upwards prying, use a small 3-Jaw puller, setting the claws between each impeller blade, with the center screw pressing on the (loosened) output shaft bolt.
10. Undo the two 5/16-18UNC nuts that secure the motor adapter to the motor
11. Slide the adapter up off the motor shaft and turn the adapter 180 degrees to expose the seal cup
12. Slide the seal cup off the motor output shaft. Take care not to damage the seal lip.

This is the extent of disassembly recommended. Do not attempt to perform maintenance on the conductor wire leads attached to the motor, or to disassemble the motor case, without specific instruction from SEI Industries.

Caution: do not lift the pump assembly by the conductor cables

5.4.2 Inspection and replacement of pump motors

The pump motors are sealed units and cannot be repaired in the field. Any repairs to the motors must be carried out under supervision of SEI Industries. Inspections of the pump motors are limited to an external assessment of the pump condition, and a check for water entry into the motor case

External assessment

Check for dents, cracks, punctures or missing coating on the motor case and components. Turn the motor shaft slowly to see if it is bent or turns roughly. Some light resistance to turning is normal, rough or intermittent resistance indicates internal damage.

Motor shaft inspection

Thoroughly inspect the pump motor shaft for nicks or scoring, particularly at the seal line. Dress any minor imperfections with fine emery cloth, 600 grit or finer, being careful to work perpendicular to (around) the shaft.

Check for water entry

Check the condition of the grease inside the seal cup. Some discoloration of the grease is normal, but obvious trapped water is of concern. If the seal mounted in the seal cup is damaged, water may have entered the seal cup. If water entry into the motor is suspected, remove one case bolt from the bottom of the motor (the rubberized coating will have to be scraped out of the recess to insert the socket). Turn the motor upright and check for signs of water. Also, inspect the bolt shaft for excessive corrosion. If the water has been in the motor for only a short period, the interior of the motor may be dried using forced, low-pressure, warm air (not hot) from a heat gun, applied for at least 8 hours. When reinstalling the case bolt be sure to install a new seal washer under the head. The cause of the water entry must also be rectified before the motor is returned to service. If water is allowed to stay in the motor for too long, there will be permanent damage to the motor shaft bearings and motor replacement or rebuild will be necessary.

5.4.3 Inspection and replacement of pump impellers

The pump impellers rotate at high speeds and are dynamically balanced during manufacture. If during repairs, too much material is removed from the blades, the impeller may become unbalanced and may cause premature failure of the pump. Minor repairs to the impeller blades are intended to restore lost efficiency, and should not be done if the efficiency of the pumps has not been diminished. Lost efficiency is indicated if fill times are longer, or if current draw is higher than normal.

Inspection

Visually inspect the pump impellers, paying particular attention to the leading edge of the blades. The pumps will be more efficient if the leading edge of the blades is relatively sharp, so check for dents and nicks caused by foreign objects.

Repairs

- Nicks smaller than 1/32" (0.8mm) across can be filed smooth with a small round file, taking care not to remove more material than is necessary.
- Dents up to 3/16" (4.8mm) can be gently flattened with a small ball peen hammer prior to some minor dressing.
- Larger deformities than those covered above must be assessed individually to see if blade distortion has occurred. Deformities that cannot be straightened and dressed out indicate the need for impeller replacement.

Re-installing the impellers

1. Before re-installation of the pump impellers, check the motor shaft for burrs or dents on the splines. Dress them out as necessary.
2. Apply grease or anti-seize compound the splines and bolt hole threads. Reinstall the shim washers - use the same number that were found upon disassembly.
3. Torque the retaining bolt to 5 ft-lb. (7Nm).

5.4.4 Replacement of secondary motor shaft seal

The secondary motor shaft seal is located inside the seal cup that resides at the base of the motor output shaft. The secondary seal serves to provide a grease cavity above the primary shaft seal. The grease lubricates the seals and provides a long service life for the motor.

Any time disassembly of the pump progresses to the point that the seal cup is removed, it is recommended that the secondary seal and base o-ring be replaced.

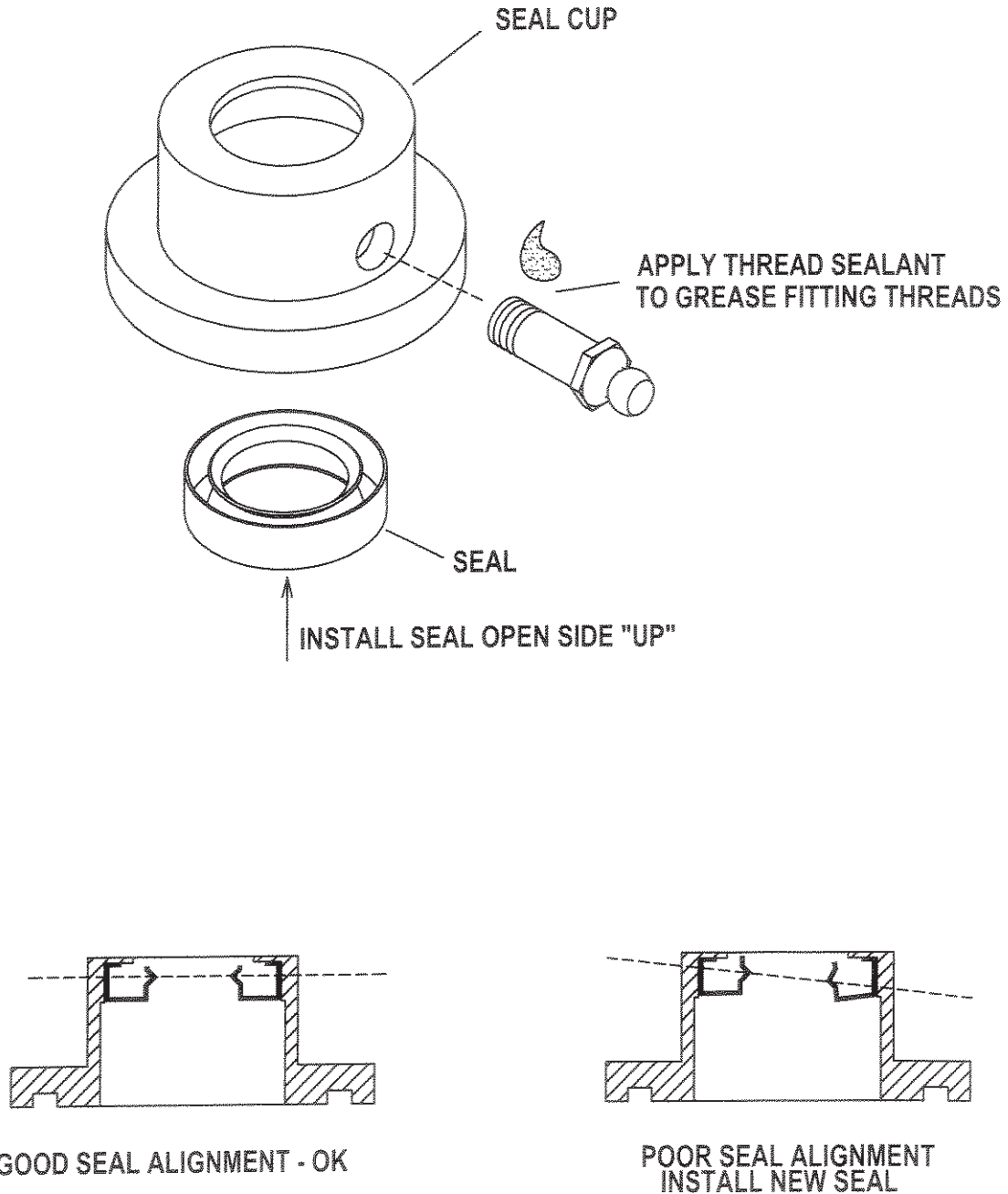
New seals and o-rings are available from SEI Industries.

Seal replacement

Refer to fig 5.3

1. Use a small wrench to remove the grease fitting from the seal cup. The grease line adapter will rotate as the nipple is turned. Do not disconnect the grease line adapter.
2. Tap the old seal out with a pin punch, from the top side. Take care not to damage the seal cup bore or O-ring groove. The seal itself can be discarded.
3. Clean the bore in the seal cup with cleaning solvent.

Fig. 5.3 Secondary seal replacement



5. MAINTENANCE AND TROUBLESHOOTING

4. Press in the new seal using a tool socket or spacer of approx 0.94" to 0.97" (24 to 25 mm) diameter, with a wall thickness of at least 0.20" (5 mm) , ensuring that the open side of the seal faces outward from the cup cavity. If available, use a large bench vise and press the seal in slowly. It is critical that the seal body does not get distorted as it is pressed in. Once installed, inspect the lip of the seal from the top side, checking for distortion relative to the seal cup. Any visible misalignment is cause for rejection, and a new seal must be installed. See fig. 5.3.
5. Apply Loctite 545 or other waterproof sealant the threads of the grease fitting, and reinstall.
6. Fill the cavity of the seal cup with appropriate grease (See section 5.3.2 for recommended greases), install a new o-ring seal in the cup and place the assembly back on the motor output shaft.
7. After final assembly, gently purge the seal cup again with fresh grease before returning the pumps to service.

Inspection and replacement of one-way flapper valves

The exit duct valves are simple neoprene rubber flappers that seal the opening of the exit ducts under the pressure of water in the bucket.

Inspection

Check the flapper material for tears, cuts or cracks.

Inspect the narrow top edge of the exit duct for dents that may allow water to pass through.

Replacement

To replace the flapper, simply remove the old flapper from the bracket, and install the new one, taking care not to over tighten the screws. Ensure the flapper is centered on the exit duct after pulling it open and releasing it a few times. If the flapper needs re-aligning, loosen the screws and re-position it, until good alignment is achieved.

Re-assembly of Pumps

Assembly is the reverse of disassembly. Please note:

1. The impeller housing has two alignment cut-outs: one to align the housing with a pin on the motor adapter and the other to align with a fastener on the exit duct.
2. Inspect the adapter gasket for damage. The gasket may be re-used if it is intact. If replacement is required, cut the replacement gasket on one side of the largest hole, place it over the electrical conduit, and join the ends of the cut with a drop of Loctite 495 or other cyanoacrylate adhesive.
3. When assembly is complete, cycle the valve up and down to check for interference with the pump components.

5.5 Electrical components inspections and checks

5.5.1 Introduction to troubleshooting the electrical system

Please refer to section 9 for PowerFill I wiring diagrams.

Please have the Torrentula Valve operator's manual handy.

Troubleshooting faults in the electrical system will require at least a basic knowledge of DC electrical theory and some understanding of the function of switches, relays and electric motors. Some experience in the art of troubleshooting is essential. For these reasons, we highly recommend that only qualified mechanics and or electrical technicians attempt to repair the electrical system without the assistance of technical support from SEI Industries.

Electrical faults are usually simple and the result of a discontinuity in electrical flow. The most likely place to start is an inspection of all external electrical conduits, checking for breaks in wires or tell-tale damage. Also, check connectors for signs of damage or corrosion. If all external appearances are normal, then an assessment of the function of each component may be required.

For troubleshooting we recommend you have on hand the following tools:

1. Electrical Multi-meter for checking voltage, resistance and continuity.
2. Some form of 24-28 volts DC power supply (other than the aircraft power supply) for checking individual component function.

Warning: Observe all precautions when testing components with live DC power. Failure to do so could result in serious personal injury Use extreme care when performing any disassembly and re-assembly of the electrical system.

Keep the wiring diagram handy at all times when working on the electrical system. Before performing any checks, be sure to understand the function of each component within the system.

5.5.2 Electrical component function checks

The function of the junction box components can be checked with a 5 Amp power supply, as long as the motor conductor leads are disconnected. It is possible to check the function of each motor separately by having only one Circuit breaker “on” at one time, thereby requiring only a 10 Amp power supply to do a full function check of the system, including the motors.

Circuit breakers

Location: center front panel of junction box

In the “off” position there should be no continuity between the top (line) and bottom terminals. In the “on” position, there should be very low resistance across the terminals.

Power relays (aka contactors)

Location: Middle rear of junction box

Check the resistance across the coil terminals. The resistance should be around 50 ohms. With the relay isolated, apply power across the coil contacts – if it is functioning correctly there will be an audible “click”. With power on the relay coil there should be low resistance continuity across the main terminals.

Pump motors

Apply power to each motor in isolation. The motors should spin smoothly. Investigate any audible discrepancies between the motors. Correct polarity is indicated when the shaft turns Counter-clockwise (CCW), looking down.

6. STORAGE

Repair as required

To ensure operational readiness, carry out any required repairs before putting the system in storage. SEI Industries offer comprehensive repair services for all Bambi Bucket operators.

Perform yearly maintenance

Perform the yearly maintenance procedures, as outlined in Section 5.3.3

Store indoors

It is highly recommended that the Bambi Bucket and Power Fill I system components are stored indoors when not in use. This will minimize deterioration due to temperature change, UV light, and atmospheric moisture.



7. SPECIFICATIONS

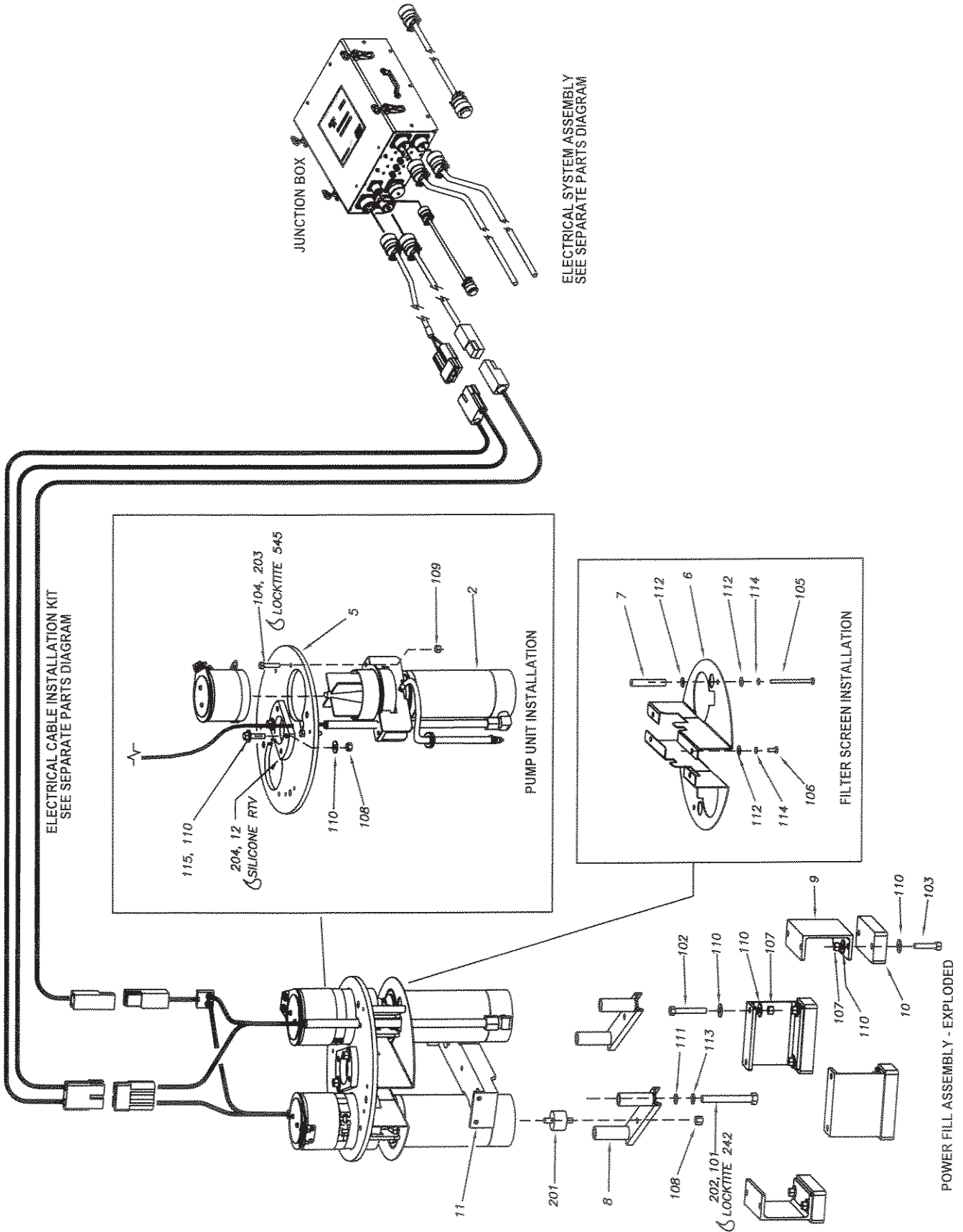
Bucket Model	# Of Pumps	Current (Amps)	Fill Time (sec.)	Wt. Pump Sys lbs. (kg)	Wt. Bucket lbs. (kg)	Gross wt. lbs. (kg)
2732	2	90	20	95 (43)	278 (126)	2940 (1334)
3542	2	90	26	95 (43)	292 (132)	3755 (1703)
4453	2	90	33	95 (43)	312 (142)	4675 (2121)
5566	2	90	44	130 (59)	555 (252)	5907 (2679)
5870	2	90	47	130 (59)	581 (264)	6254 (2837)
6578	2	90	51	130 (59)	606 (275)	6940 (3151)
7590	4	180	30	190 (86)	685 (311)	7937 (3600)
HL5000	4	180	50	190 (86)	700 (318)	11552 (5240)
HL7600	4	180	76	200 (91)	785 (356)	17287 (7841)
HL9800	4	180	98	200 (91)	850 (386)	22352 (10139)

Note: specifications subject to change. Check bucket control head serial number plate for capacity, add listed PowerFill I system weight to Empty, Gross weights.

- Fill time and current draw listed are based on pumping clean fresh water at Standard Atmospheric conditions
- Recommended Aircraft circuit protection: 50 Amps per pump
- Maximum immersion depth, pumps running: 8 feet (2.4 m)
- Maximum immersion depth, pumps "off": 20 feet (6.1 m)
- Listed weight does not include longline conductors. See section 3.6 for recommended longline conductor configuration.

8. PARTS DIAGRAMS

Fig. 8.1 PowerFill I general assembly Models 2732, 3542, 4453



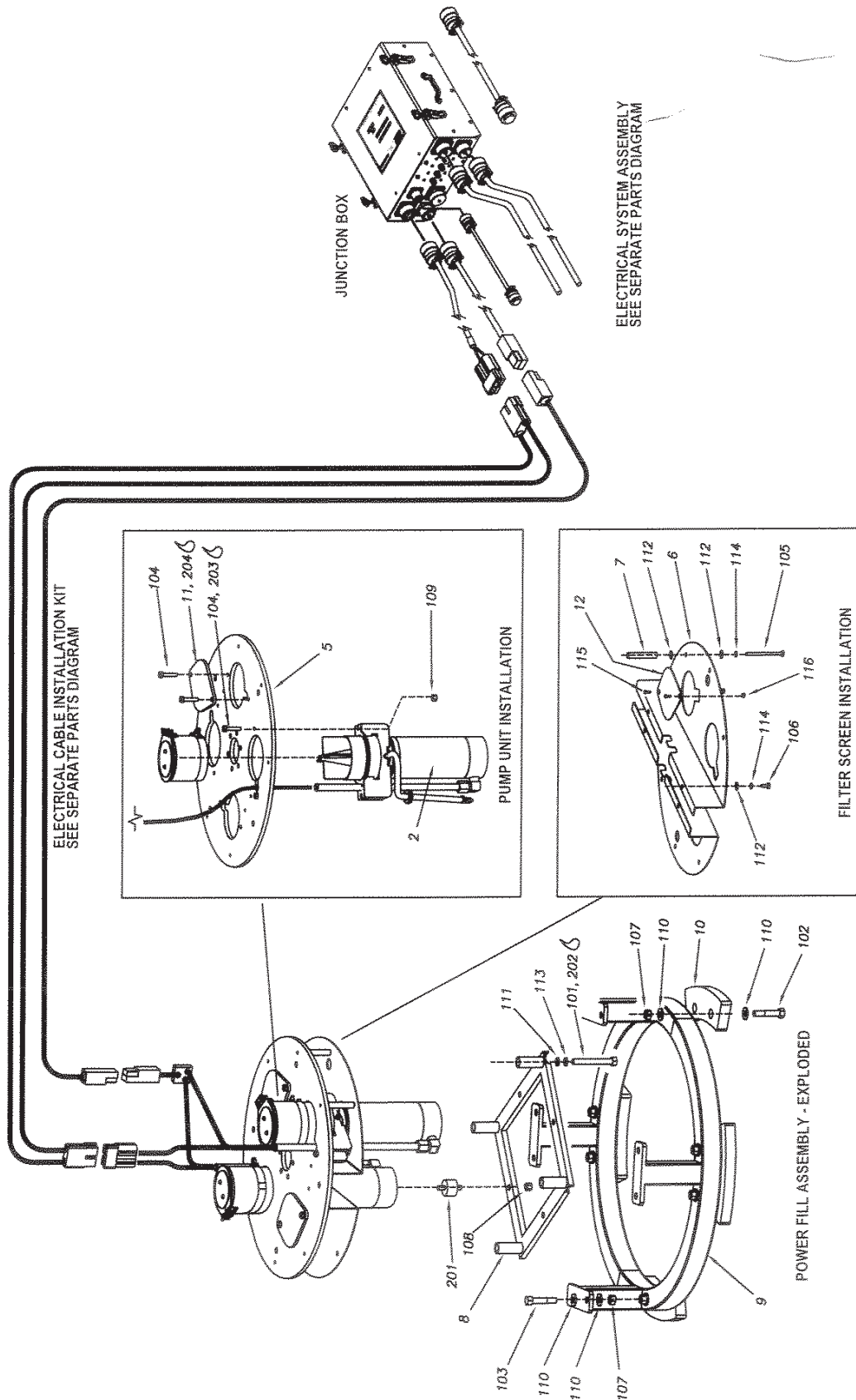
8. PARTS DIAGRAMS

Table 8.1 PowerFill I General assembly Parts list Models 2732, 3542, 4453

Item	Part No.	Description	Qty.
1	BPSK27441	PowerFill I assembly, complete	1
2	BAD286	Pump unit assembly	2
3	BPSK00205	Electrical system assembly	1
4	BAD293	Cable installation kit (spec model #)	1
5	BAD296	Top plate	1
6	BAD300	Filter screen	2
7	BAD303	Filter screen spacer	2
8	BAB304	Motor guard	2
9	BAB315	Bucket base stand off	4
10	BAB307	Bumper block	4
11	BAB310	Lift bar	1
12	BAB314	Slider pipe flange	1
101		Hex head bolt, 1/2unc x 4" long	4
102		Hex head bolt, 3/8unc x 2-1/2" long	8
103		Hex head bolt, 3/8unc x 1-3/4" long	8
104		Hex head cap screw, 5/16unc x 1-1/2" long	4
105		Hex head bolt, 1/4unc x 3-1/2" long	2
106		Hex head cap screw, 1/4unc x 3/4" long	4
107		Nylock nut, 3/8unc, plated	16
108		Nylock nut, 3/8unc, stainless steel	2
109		Nylock nut, 5/16unc	4
110		Plain washer, 3/8id 1"od	32
111		Plain washer, 1/2id 7/8od	4
112		Plain washer, 1/4 id 1"od	10
113		Split lock washer, 1/2id	4
114		Split lock washer, 1/4id	6
115		Hex head bolt, 3/8unc x 1-1/2" long	2
116		Nylock nut, 10-24unc	2
201		Isolator mount	2
202		Thread locker, locktite 242	as req
203		Thread sealant, locktite 545	as req
204		Silicone rtv sealant	as req

8. PARTS DIAGRAMS

Fig. 8.2 PowerFill I General assembly Models 5566, 5870, 6578



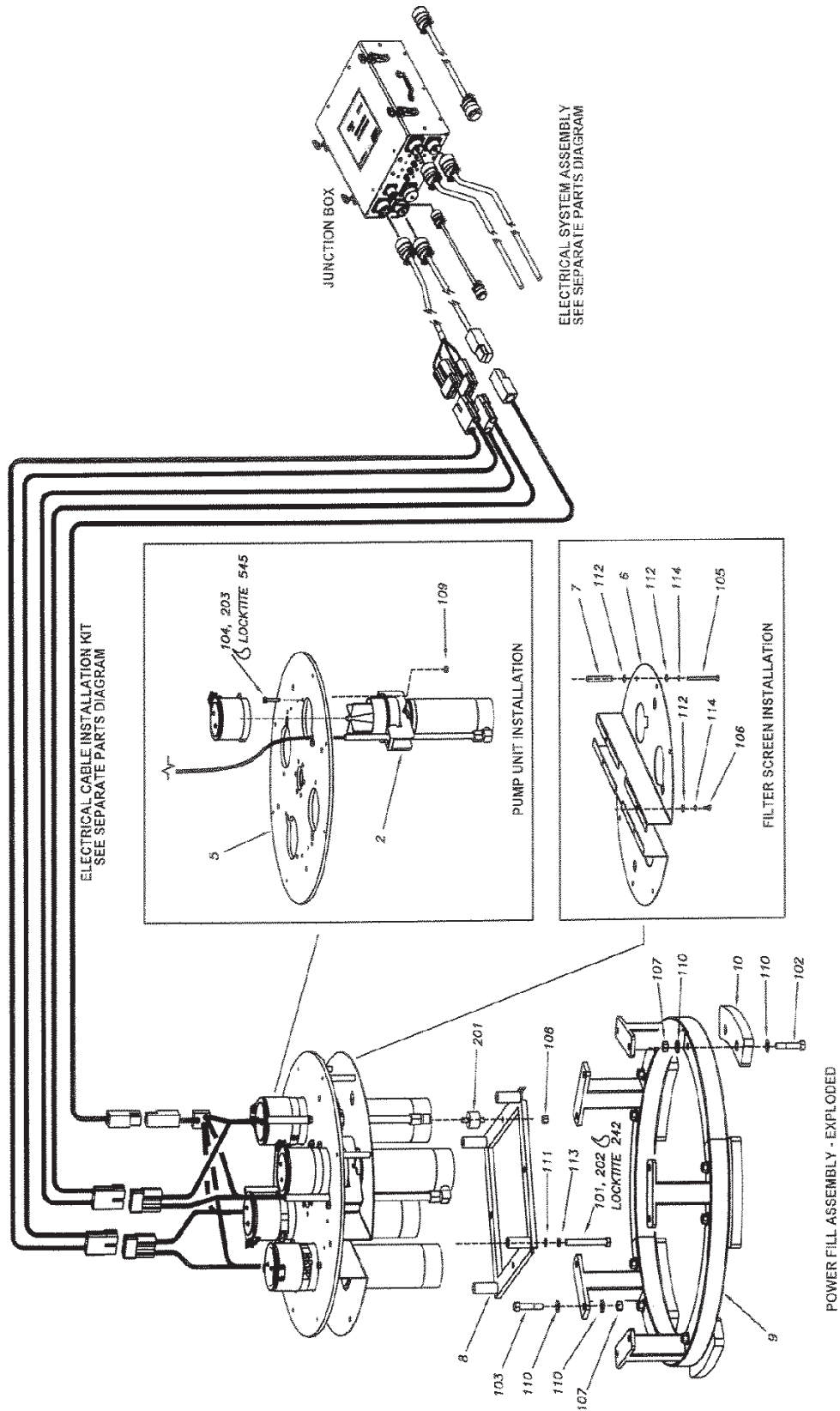
8. PARTS DIAGRAMS

Table 8.2 PowerFill I General assembly Parts list Models 5566, 5870, 6578

Item	Part No.	Description	Qty.
1	BPSK55651	PowerFill I assembly, complete	1
2	BAD286	Pump unit assembly (spec model #)	2
3	BPSK00205	Electrical system assembly	1
4	BAD293	Cable installation kit	1
5	BAD297	Top plate	1
6	BAD301	Filter screen	2
7	BAB303	Filter screen spacer	6
8	BAD305	Motor guard	1
9	BAD308	Bucket base stand off	1
10	BAB371	Bumper block	4
11	BAB311	Pump blank plate	2
12	BAB312	Filter screen blank plate	2
101		Hex head bolt, 1/2unc x 4" long	4
102		Hex head bolt, 1/2unc x 3-1/2" long	8
103		Hex head bolt, 1/2unc x 2-1/2" long	8
104		Hex head cap screw, 5/16unc x 1-1/2" long	8
105		Hex head bolt, 1/4unc x 3-1/2" long	6
106		Hex head cap screw, 1/4unc x 3/4" long	4
107		Nylock nut, 1/2unc	16
108		Nylock nut, 3/8unc	4
109		Nylock nut, 5/16unc	8
110		Plain washer, 1/2id 1-1/2od	30
111		Plain washer, 1/2id 7/8od	4
112		Plain washer, 1/4 id 1od	10
113		Split lock washer, 1/2id	4
114		Split lock washer, 1/4id	10
115		Pan head screw, 10-24unc	2
116		Nylock nut, 10-24unc	2
201		Isolator mount	3,4
202		Thread locker, locktite 242	as req
203		Thread sealant, locktite 545	as req

8. PARTS DIAGRAMS

Fig. 8.3 PowerFill I General assembly Model 7590



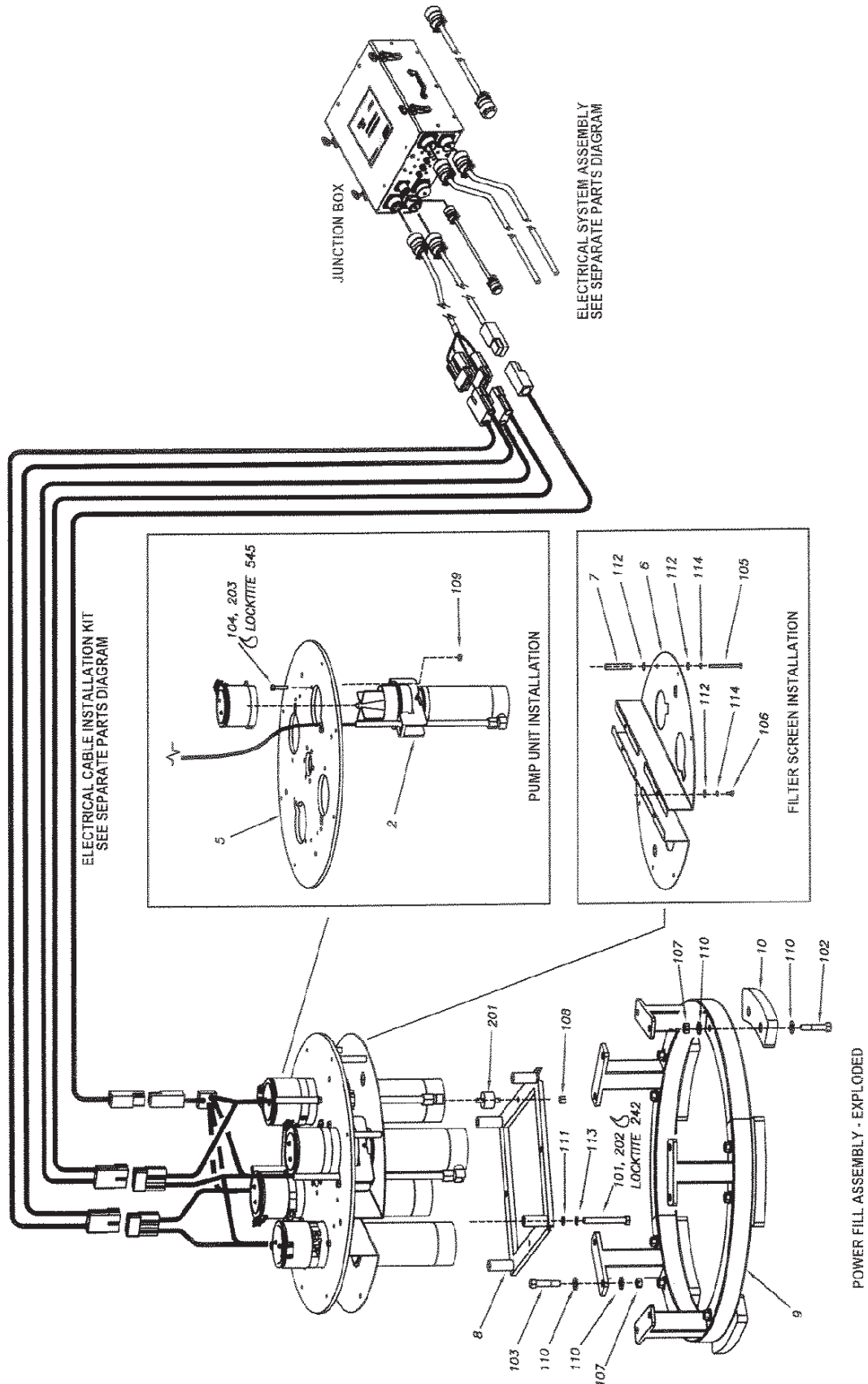
8. PARTS DIAGRAMS

Table 8.3 PowerFill I General assembly Parts list Model 7590

Item	Part No.	Description	Qty.
1	BPSK55651	PowerFill I assembly, complete	1
2	BAD286	Pump unit assembly (spec model #)	4
3	BPSK00205	Electrical system assembly	1
4	BAD293	Cable installation kit	1
5	BAD297	Top plate	1
6	BAD301	Filter screen	2
7	BAB303	Filter screen spacer	6
8	BAD305	Motor guard	1
9	BAD308	Bucket base stand off	1
10	BAB371	Bumper block	4
101		Hex head bolt, 1/2unc x 4" long	4
102		Hex head bolt, 1/2unc x 3-1/2" long	8
103		Hex head bolt, 1/2unc x 2-1/2" long	8
104		Hex head cap screw, 5/16unc x 1-1/2" long	8
105		Hex head bolt, 1/4unc x 3-1/2" long	6
106		Hex head cap screw, 1/4unc x 3/4" long	4
107		Nylock nut, 1/2unc	16
108		Nylock nut, 3/8unc	4
109		Nylock nut, 5/16unc	8
110		Plain washer, 1/2id 1-1/2od	30
111		Plain washer, 1/2id 7/8od	4
112		Plain washer, 1/4 id 1od	10
113		Split lock washer, 1/2id	4
114		Split lock washer, 1/4id	10
115		Pan head screw, 10-24unc	2
116		Nylock nut, 10-24unc	2
201		Isolator mount	3,4
202		Thread locker, locktite 242	as req
203		Thread sealant, locktite 545	as req

8. PARTS DIAGRAMS

Fig. 8.4 PowerFill I General assembly Models HL5000, HL7600, HL9800



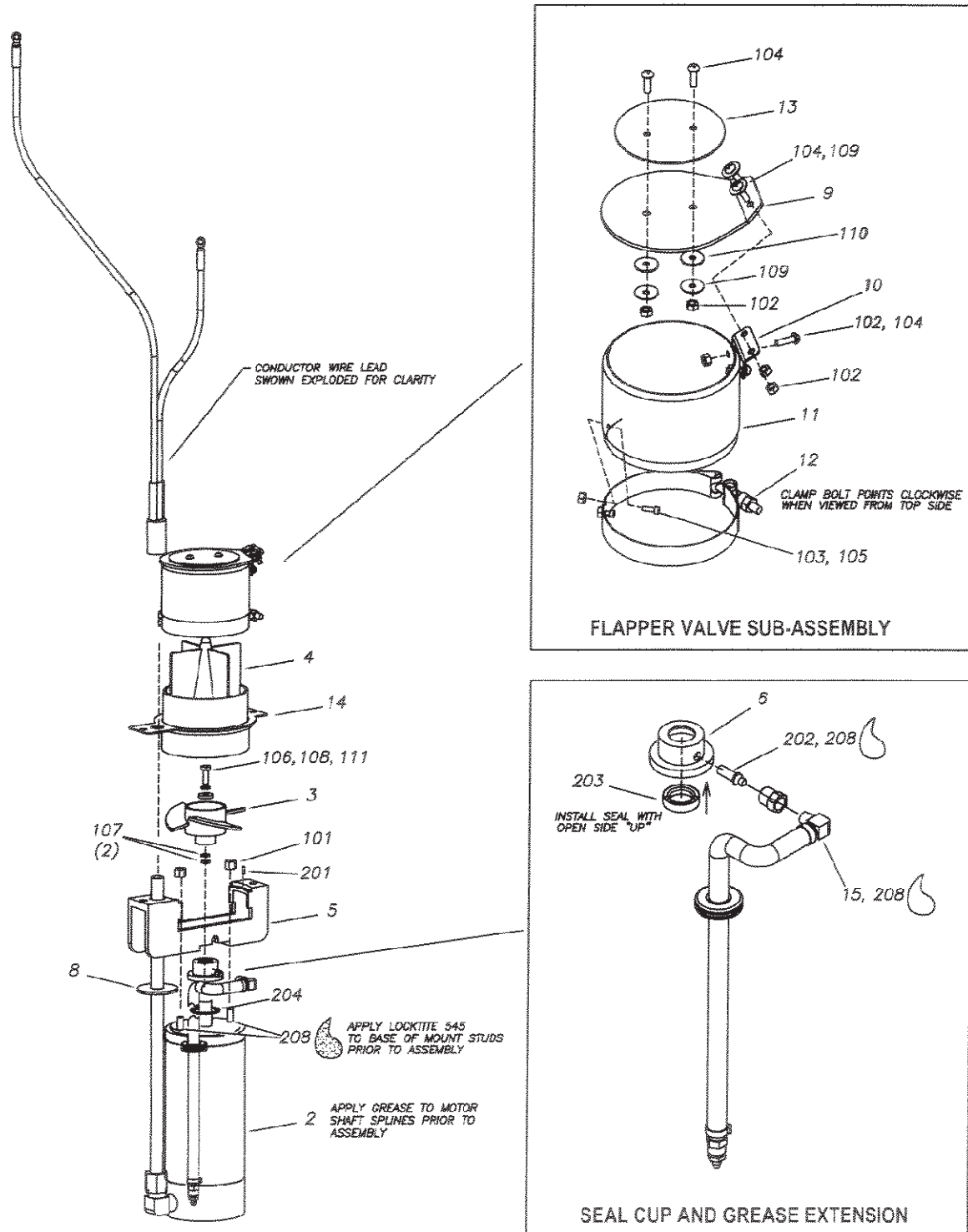
8. PARTS DIAGRAMS

Table 8.4 PowerFill I General assembly Parts list Models HL5000, HL7600, HL9800

Item	Part No.	Description	Qty.
1	BPSK50001	PowerFill I assembly, complete, Model HL5000	1
1	BPSK76981	PowerFill I assembly, complete, Models HL7600 H9800	1
2	BAD286	Pump unit assembly	4
3	BPSK00206	Electrical system assembly	1
4	BAD293	Cable installation kit	1
5	BAD298	Top plate	1
6	BAD302	Filter screen	2
7	BAB303	Filter screen spacer	2
8	BAD306	Motor guard	1
9	BAD309	Bucket base stand off	1
10	BAB373	Bumper block	5
101		Hex head bolt, 1/2unc x 4" long	4
102		Hex head bolt, 1/2unc x 3-1/2" long	10
103		Hex head bolt, 1/2unc x 2-1/2" long	10
104		Hex head cap screw, 5/16unc x 1-1/2" long	8
105		Hex head bolt, 1/4unc x 3-1/2" long	6
106		Hex head cap screw, 1/4unc x 3/4" long	4
107		Nylock nut, 1/2unc	20
108		Nylock nut, 3/8unc	4
109		Nylock nut, 5/16unc	8
110		Plain washer, 1/2id 1-1/2od	30
111		Plain washer, 1/2id 7/8od	4
112		Plain washer, 1/4 id 1od	16
113		Split lock washer, 1/2id	4
114		Split lock washer, 1/4id	10
201		Isolator mount	4
202		Thread locker, locktite 242	as req
203		Thread sealant, locktite 545	as req

8. PARTS DIAGRAMS

Fig. 8.5 PowerFill I Pump unit assembly All Models



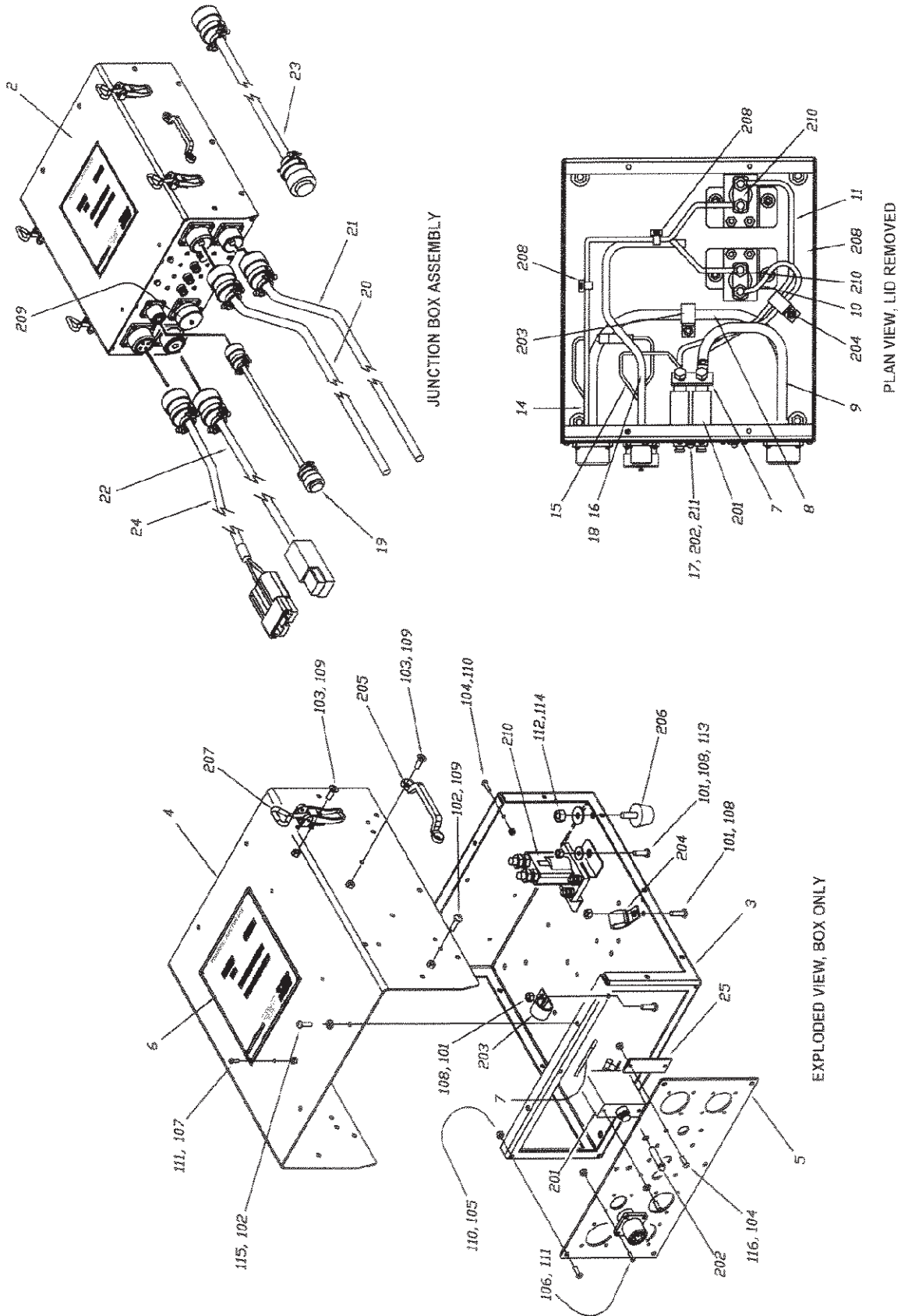
8. PARTS DIAGRAMS

Table 8.5 PowerFill I Pump unit assembly parts list All Models

Item	Part No.	Description	Qty.
1	BAD286	Pump assembly, complete	1
2	BAD430	Motor	1
3	BAD359	Impeller	1
4	BAD299	Recuperator	1
5	BAD360	Pump motor adapter	1
6	BAD361	Seal cup	1
8	BAB363	Conductor conduit grommet	1
9	BAB365	Flapper valve	1
10	BAB366	Flapper valve bracket	1
11	BAB367	Flapper valve duct	1
12	BAB368	Flapper valve clamp	1
13	BAB369	Flapper valve brace disc	1
14	BAB370	Adapter gasket	1
15	BAB455	Grease extension assembly	1
101		Nylock nut, 5/16unc	2
102		Nylock nut, 10-24unc	6
103		Nylock nut, 6-32unc	2
104		Panphil screw, 10-24unc x 5/8" long	6
105		Socket head screw, 6-32unc x 1/2" long	2
106		Hex head bolt, 1/4-28unf x 3/4" long	1
107		Plain washer, 1/4" id an type	1
108		1/8" thick washer, 1/4id, 3/4od	1
109		Plain washer, 3/16id, 3/4od	4
110		Rubber washer, 1/4id, 1"od	2
111		Split lock washer, 1/4id	1
201		Split roll pin, 1/8 od x 3/8 long	1
202		Grease fitting	1
203		Lip seal	1
204		O-ring	1
208		Thread sealant, locktite 545	as req

8. PARTS DIAGRAMS

Fig. 8.6 PowerFill I Junction box assembly Models 2732, 3543, 4453, 5566, 5870, 6578 (2 pump systems)



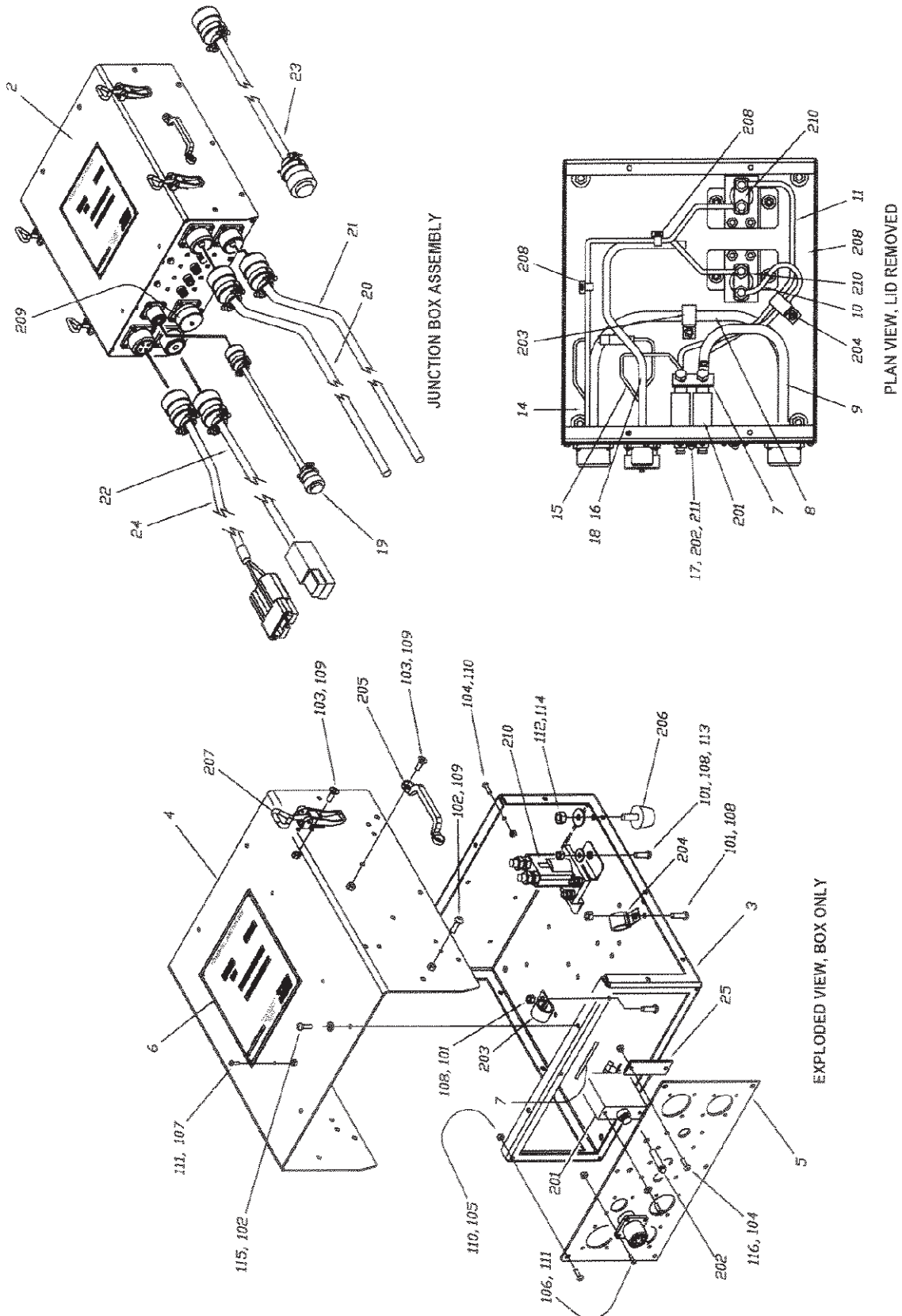
8. PARTS DIAGRAMS

Table 8.6 PowerFill I Electrical controls assembly parts list Models 2732, 3543, 4453, 5566, 5870, 6578 (2 pump systems)

Item	Part No.	Description	Qty.
1	BPSK00205	Electrical controls assembly	1
2	BPSA00207	Junction box	1
3	BTSP00420	Enclosure base	1
4	BTSP00421	Enclosure lid	1
5	BPSP00221	Face plate	1
6	BPSP00223	Machine tag	1
7	BPSP00224	Bus bar	1
8	BPSA00240	Wire Harness W40	1
9	BPSA00241	Wire Harness W41	1
10	BPSA00242	Wire Harness W42	1
11	BPSA00243	Wire Harness W43	1
14	BPSA00247	Wire Harness W47	1
15	BPSA00248	Wire Harness W48	1
16	BPSA00249	Wire Harness W49	1
17	BPSA00250	Wire Harness W50	1
18	BPSA00251	Wire Harness W51	1
19	BPSA00305	Wire Harness H5	1
20	BPSA00307	Wire Harness H7	1
21	BPSA00308	Wire Harness H8	1
22	BPSA00310	Wire Harness H10	1
23	BPSA00311	Wire Harness H11	1
24	BPSA00309	Wire Harness H9	1
25	BPSP00222	Blank plate	2
101		Panphil screw 10-24 x 5/8"	18
102		Panphil screw 8-32 x 3/8"	20
103		CSK Panphil screw 8-32 x 1/2"	12
104		Panphil screw 6-32 x 3/8"	14
105		Panphil screw 6-32 x 1/2"	6
106		Panphil screw 4-40 x 5/8"	24
107		Panphil screw 4-40 x 3/8"	4
108		Nylock nut 10-24	18
109		Nylock nut 8-32	28
110		Nylock nut 6-32	12
111		Nylock nut 4-40	28
112		Nylock nut 1/4-20	4
113		Plain washer #10 ID x 3/4 OD	8
114		Plain washer 1/4 ID x 11/16 OD	4
115		Split lock washer #8 ID	14
116		Split lock washer #6 ID	8
201		Circuit breaker, 50 A MS25361-50	2
202		LED indicator	2
203		Cable clamp 3/8 ID	1
204		Cable clamp 1/2 ID	1
205		Tie down eye strap	2
206		Rubber pad	4
207		Catch	4
208		Cable tie	4
209		Receptacle cap, #20 shell	1
210		Contactora, SPST	2
211		Wire terminal, #18 AWG 1/4 stud	1

8. PARTS DIAGRAMS

Fig. 8.7 PowerFill I Junction box assembly Models 7590, HL5000, HL7600, HL9800 (4 pump systems)



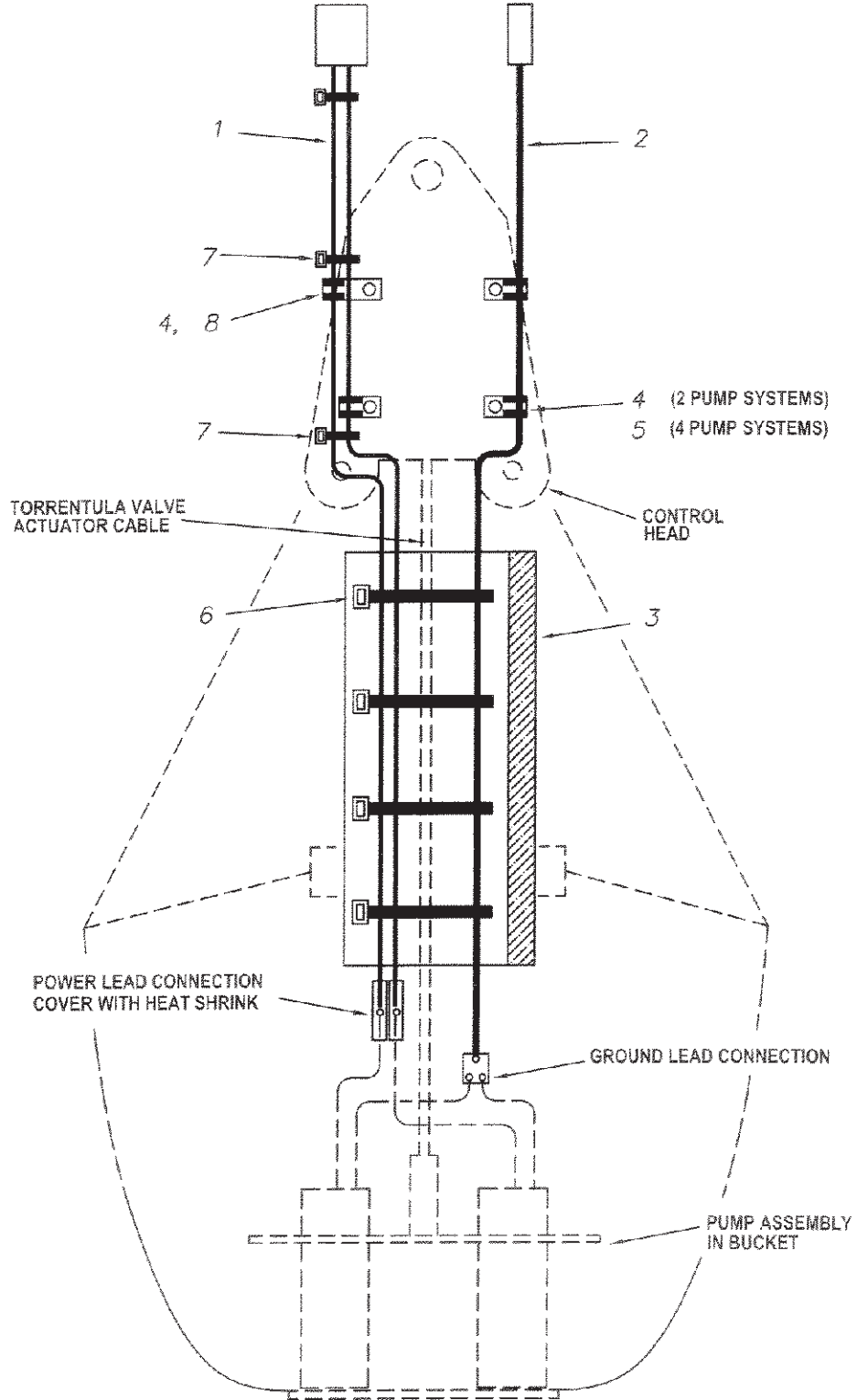
8. PARTS DIAGRAMS

Table 8.7 PowerFill I Electrical controls assembly parts list Models 7590, HL5000, HL7600, HL9800 (4 pump systems)

Item	Part No.	Description	Qty.
1	BPSK00205	Electrical controls assembly	1
2	BPSA00207	Junction box only	1
3	BTSP00420	Enclosure base	1
4	BTSP00421	Enclosure lid	1
5	BPSP00221	Face plate	1
6	BPSP00223	Machine tag	1
7	BPSP00224	Bus bar	1
8	BPSA00240	Wire Harness W40	1
9	BPSA00241	Wire Harness W41	1
10	BPSA00242	Wire Harness W42	1
11	BPSA00243	Wire Harness W43	1
12	BPSA00244	Wire Harness W44	1
13	BPSA00245	Wire Harness W45	1
14	BPSA00247	Wire Harness W47	1
15	BPSA00248	Wire Harness W48	1
16	BPSA00249	Wire Harness W49	1
17	BPSA00250	Wire Harness W50	1
18	BPSA00251	Wire Harness W51	1
19	BPSA00305	Wire Harness H5	1
20	BPSA00307	Wire Harness H7	1
21	BPSA00308	Wire Harness H8	1
22	BPSA00310	Wire Harness H10	1
23	BPSA00311	Wire Harness H11	1
24	BPSA00309	Wire Harness H9	1
25	BPSP00222	Blank plate	2
101		Panphil screw 10-24 x 5/8"	18
102		Panphil screw 8-32 x 3/8"	20
103		CSK Panphil screw 8-32 x 1/2"	12
104		Panphil screw 6-32 x 3/8"	14
105		Panphil screw 6-32 x 1/2"	6
106		Panphil screw 4-40 x 5/8"	24
107		Panphil screw 4-40 x 3/8"	4
108		Nylock nut 10-24	18
109		Nylock nut 8-32	28
110		Nylock nut 6-32	12
111		Nylock nut 4-40	28
112		Nylock nut 1/4-20	4
113		Plain washer #10 ID x 3/4 OD	8
114		Plain washer 1/4 ID x 11/16 OD	4
115		Split lock washer #8 ID	14
116		Split lock washer #6 ID	8
201		Circuit breaker, 50 A MS25361-50	4
202		LED indicator	2
203		Cable clamp 3/8 ID	1
204		Cable clamp 1/2 ID	1
205		Tie down eye strap	2
206		Rubber pad	4
207		Catch	4
208		Cable tie	4
209		Receptacle cap, #20 shell	1
210		Contact, SPST	2
211		Wire terminal, #18 AWG 1/4 stud	1

8. PARTS DIAGRAMS

Fig. 8.8 PowerFill I Cable installation kit All Models (bucket side)



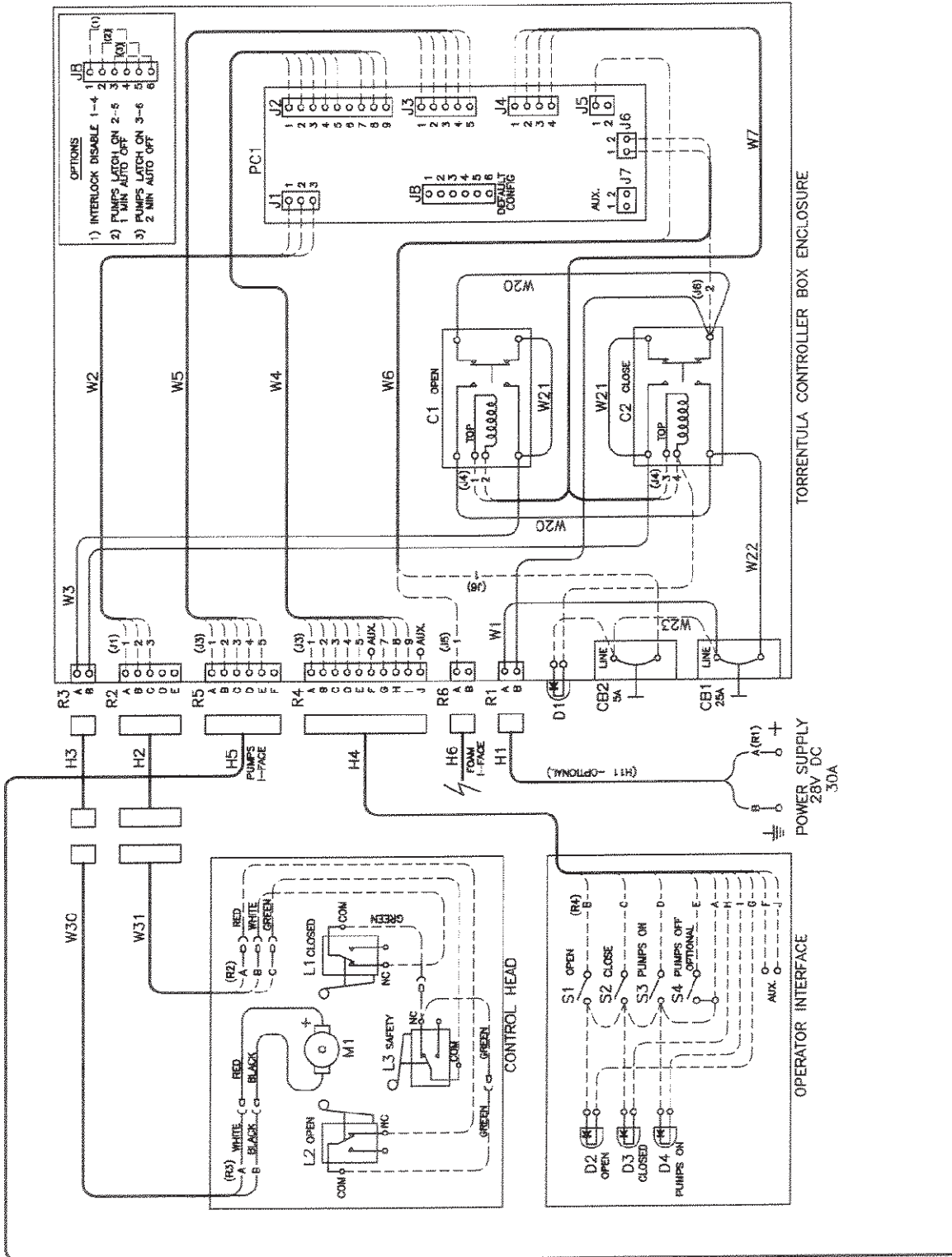
8. PARTS DIAGRAMS

Table 8.8 PowerFill I Cable installation kit parts list All Models (bucket side)

Item	Part No.	Description	Qty.
1	BPSA00261	Wire Harness W61, Models 2732-6578 (spec model #)	1
1	BPSA00262	Wire Harness W62, Models 7590-HL9800 (spec model #)	1
2	BPSA00260	Wire Harness W60 (spec model #)	1
3	BAD313	Actuator cable sleeve (spec model #)	1
4		Cable clamp, 3/8 ID	4
5		Cable clamp, 1/2 ID, models 7590-HL9800	2
6		Large tie wrap	15
7		Small tie wrap	15
8		Hex hd bolt 1/4-20 x 1"	2

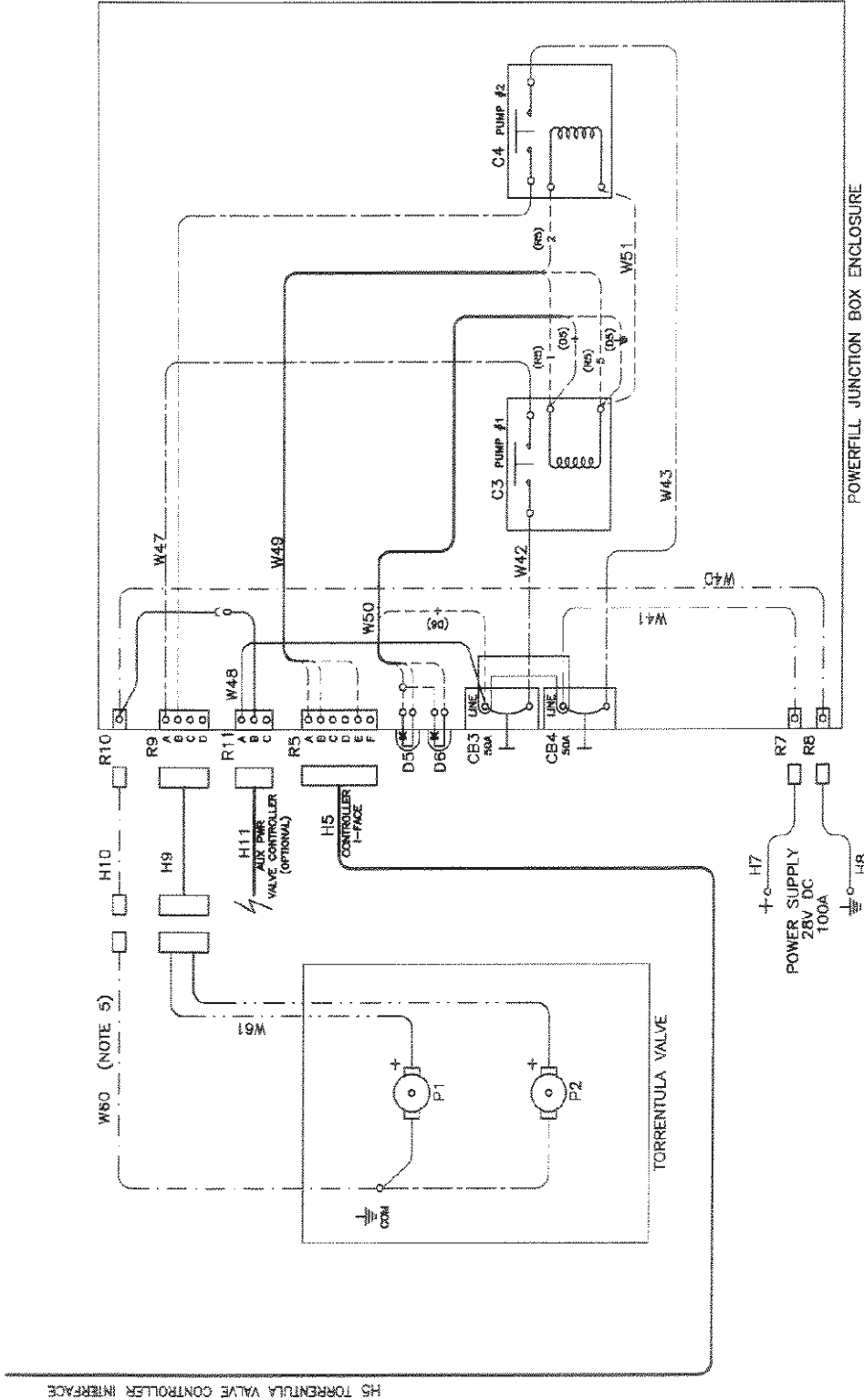
9. WIRING DIAGRAMS

Fig. 9.1 Wiring diagram Models 2732, 3543, 4453, 5566, 5870, 6578 (2 pump systems)
Page 1 of 2



9. WIRING DIAGRAMS

Fig. 9.1 Continued Page 2 of 2



H5 TORRENTULA VALVE CONTROLLER INTERFACE

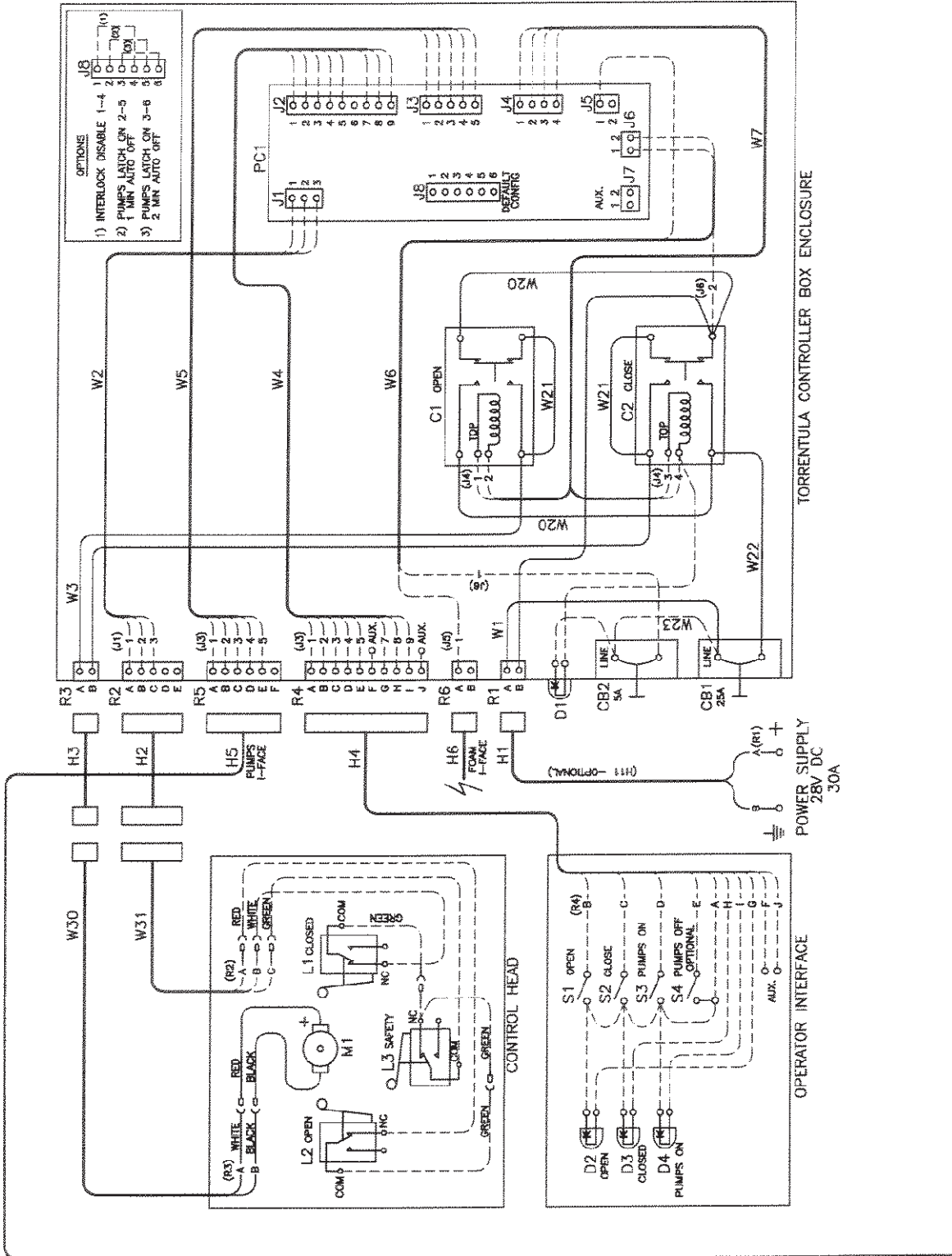
NOTES

- 1) ALL ABOVE-HOOK WIRE LEADS CONFORM TO MIL-W-22759/16
- 2) ALL CIRCUIT BREAKERS MIL-C-5809
- 3) ALL BOX CONNECTIONS MIL-C-5015
- 4) WIRE LEGEND
 - 18 AWG: _____
 - 10 AWG: _____
 - 8 AWG: _____
 - 6 AWG: _____
 - 1 AWG: _____
- 5) W60: #4 AWG ON MODELS 2732, 3542, 4453
- 6) ALTERNATE POWER TO TORRENTULA VALVE CONTROLLER (R11) FROM AUX. RECEPTACLE R11 FOR USE ONLY WITH VALVE/PUMPS INTERLOCK ENABLED. SPEC WIRE HARNESS H11.

HARNESS (LABELLED):

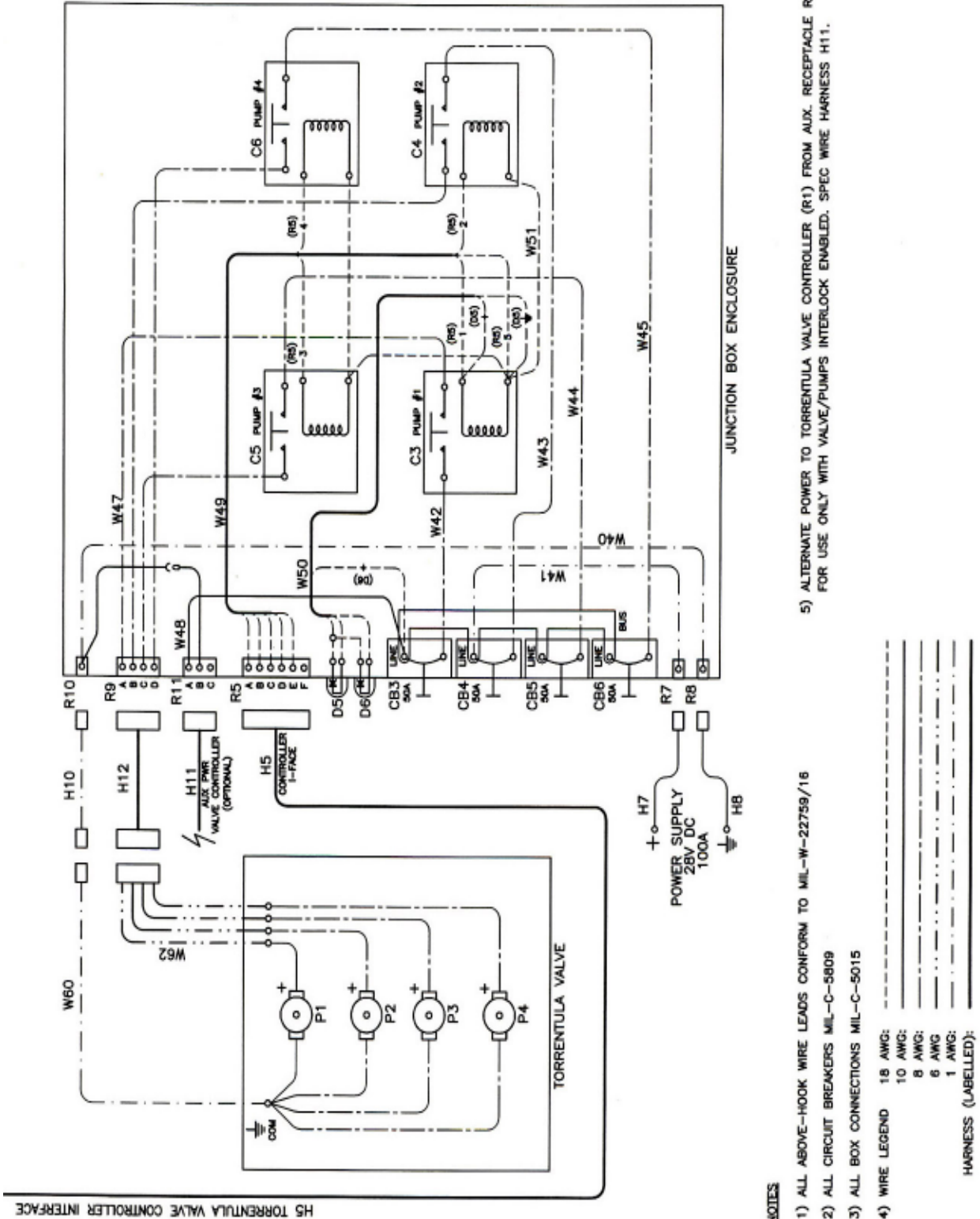
9. WIRING DIAGRAMS

Fig. 9.2 Wiring diagram Models 7590, HL5000, HL7600, HL9800 (4 pump systems)
Page 1 of 2



9. WIRING DIAGRAMS

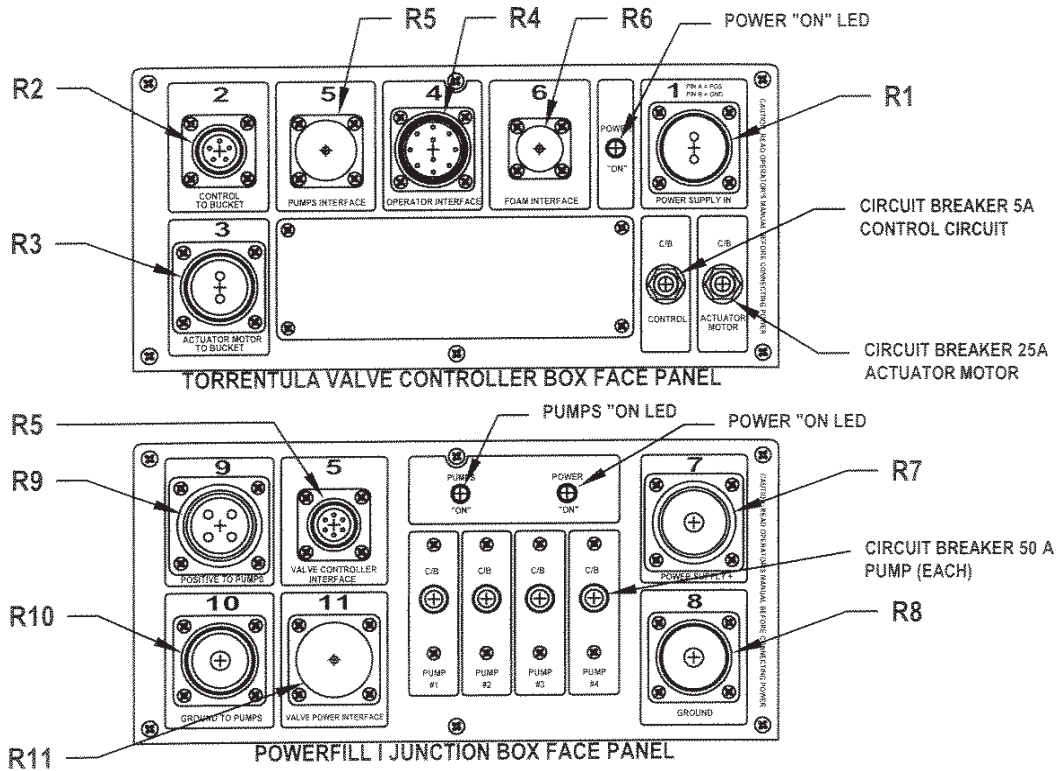
Fig. 9.2 Continued Page 2 of 2



5) ALTERNATE POWER TO TORRENTULA VALVE CONTROLLER (R1) FROM AUX. RECEPTACLE R11 FOR USE ONLY WITH VALVE/PUMPS INTERLOCK ENABLED. SPEC WIRE HARNESS H11.

9. WIRING DIAGRAMS

Fig. 9.3 Junction box and Torrentula Controller box receptacle pin-outs



RECEPTACLE PIN-OUTS:

TORRENTULA CONTROLLER BOX		POWERFILL I JUNCTION BOX	
R1	POWER SUPPLY INPUT	R5	VALVE CONTROLLER INTERFACE
A	POWER INPUT, +28 VOLTS DC	A	PUMP #1 CONTACTOR
B	GROUND	B	PUMP #2 CONTACTOR
R2	CONTROL - TO BUCKET	C	PUMP #3 CONTACTOR
A	OPEN LIMIT	D	PUMP #4 CONTACTOR
B	CLOSE LIMIT	E	CONTACTOR COMMON, GROUND
C	LIMIT COMMON	R7	POWER SUPPLY, + 28 VOLTS DC
R3	ACTUATOR MOTOR - TO BUCKET	R8	POWER SUPPLY GROUND
A	ACTUATOR MOTOR +28 VOLTS DC "OPEN" (B GROUND)	R10	GROUND - TO PUMPS
B	ACTUATOR MOTOR +28 VOLTS DC "CLOSE" (A GROUND)	R9	POSITIVE TO PUMPS
R4	OPERATOR INTERFACE	A	PUMP #1 +28 VOLTS DC
A	OPERATOR SWITCH, LED COMMON, +28 VOLTS DC	B	PUMP #2 +28 VOLTS DC
B	VALVE "OPEN"	C	PUMP #3 +28 VOLTS DC
C	VALVE "CLOSE"	D	PUMP #4 +28 VOLTS DC
D	PUMPS "ON"	R11	VALVE POWER INTERFACE (AUXILIARY)
E	PUMPS "OFF" (LATCH ENABLED)	A	+ 28 VOLTS DC
F	AUXILIARY	B	GROUND
G	VALVE "OPEN" LED INDICATOR		
H	VALVE "CLOSED" LED INDICATOR		
I	PUMPS "ON" LED INDICATOR		
J	AUXILIARY		
R5	PUMPS INTERFACE		
A	PUMP #1 CONTACTOR +28 VOLTS DC		
B	PUMP #2 CONTACTOR +28 VOLTS DC		
C	PUMP #3 CONTACTOR +28 VOLTS DC		
D	PUMP #4 CONTACTOR +28 VOLTS DC		
E	GROUND, COMMON		
R6	CLASS "A" FOAM SYSTEM INTERFACE		
A	DISPENSE CYCLE CANCEL, +28 VOLTS DC		

10. SPARES KITS

Table 10.1 PowerFill I Spares kits

Models 2732, 3542, 4453, 5566, 5870, 6578 (2 pump systems)

Part No. BPSK00231

Item	Qty.
Motor output shaft seal	1
Seal Cup O-ring	1
Motor bolt seal washer	2
Seal cup grease fitting	1
Adapter gasket	1
175 amp plug, 2 contact	1
180 Amp plug 1 contact	1
Power contactor	1
Flapper valve	1
LED indicator, Red, 28 volt	1

Models 2732, 3542, 4453, 5566, 5870, 6578 (4 pump systems)

Part No. BPSK00232

Item	Qty.
Motor output shaft seal	2
Seal Cup O-ring	2
Motor bolt seal washer	4
Seal cup grease fitting	2
Adapter gasket	2
175 amp plug, 2 contact	1
180 Amp plug 1 contact	1
Power contactor	2
Flapper valve	2
LED indicator, Red, 28 volt	1



11. 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 proved to be defective.
- b) The Company's products are not guaranteed for any specific length of time or measure of service, but are warranted 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) The 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 who 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 as it may be, 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 Field manual supplied by SEI Industries Ltd.
- m) All Bambi Buckets are designed and manufactured with substantial safety margins. It is the responsibility of the user to ensure the bucket is maintained to a safe standard.