Posi-Plus Technologies

10, Artisan Blvd
Victoriaville (Quebec), G6P 7E4
Tel.: (819)758-5717, Fax.: (819)758-9529

Service center : _____
Rep :: _____
Address : _____
_____
Phone : _____
Fax : _____

For internal use only

WARRANTY CLAIM # : _____

Authorized by : _____
Problem # : _____
Job # _____

Unit owner : _____
Rep : _____
Address : _____
_____
Phone : _____
Fax : _____

Make : _____
Model : _____
Serial # : _____
Vehicle # : _____
In-service date : _____

Description of problem: _____ Date of problem: _____

Possible cause : _____

Labor details : _____

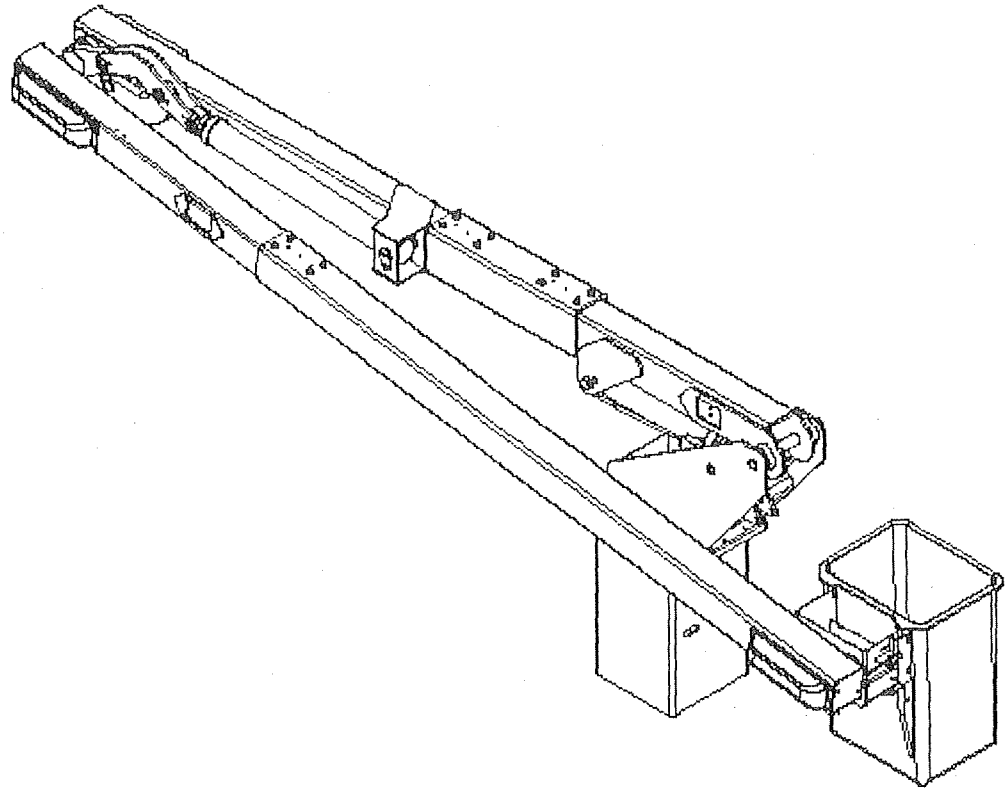
Qty	Part number	Description

Estimated labor	Real labor	Allotted labor*	Credit applicable*
Hr	Hr	Hr	$

* For internal use only

POSI-PLUS
TECHNOLOGIES INC.

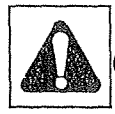
MAINTENANCE MANUAL
MODEL 200



Preface

This unit is the result of Posi-Plus advanced technology and quality awareness in design, engineering and manufacturing. At the time of delivery from the factory, this unit met or exceeded all applicable standards published by both the Canadian Standards Association and the American National Standards Institute. All information, illustrations and specifications contained within this manual are based on the latest product information available at the time of publication. It is mandatory that all operators read and understand this manual to operate the machine in a safe and efficient manner.

This unit should never be altered or modified in any way that might affect the structural integrity or operational characteristics without the specific written approval of Posi-Plus. Any unauthorized alterations or modifications will void the warranty. Of greater concern, is the possibility that unauthorized modification could adversely affect the safe operation of this unit, resulting in property damage and/or personal injury.



CAUTION

*Insulated aerial devices **Rated 46kV & below, Category "B" or "C" as per ANSI A92.2-2001 and CSA C225-00** manufactured by Posi-Plus are designed to provide a work platform for a trained operator. Applicable regulations and standards are considered in the design and manufacture of this aerial device.*

*No aerial device can provide absolute safety when placed in proximity to energized conductors. The standard aerial device is to be considered an insulated aerial device as per **ANSI A92.2-2001 and CSA C225-00 Rated 46kV & below, Category "B" or "C" dielectric rating** (refer to the unit placard for the applicable dielectric rating of your unit). No aerial device is designed or intended to replace or supersede any protective device or safe work practice relating to work methods, safety procedures and protective equipment. Training manuals are available form a variety of sources such as "Safety Manual for an Electric Utility" published by the American Public Power Association[1].*

The operator shall be responsible for determining the set-up requirements, lineman work procedures and safety for each particular situation.

[1] American Public Power Association, 2301 M Street N.W. Washington, D.C., 20037-1484, Phone (202) 467-2900

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Section 1 - Unit Specifications

General Specifications

The major structural components of the 200 Series aerial device are the subframe, outriggers (if applicable), pedestal, turntable or turret, lower boom, upper boom and platform mounting bracket.

The lower boom is capable of movement up to 120 degrees above horizontal. The upper boom is capable of movement from 0 to 270 degrees relative to the lower boom.

This aerial device is manufactured with nonconductive components that, when properly used and maintained, will perform its function as an aerial work platform for use by trained linemen. The equipment is designed and manufactured to meet the dielectric standards of the American National Standards Institute (ANSI) in effect at the time of its manufacture. The dielectric rating of the unit must be known and understood by its users. Refer to the Identification placard for the dielectric rating of the unit.

This aerial device shall be used near energized conductors only by qualified operators who are fully trained and proficient as electrical linemen. Personnel using this equipment must be familiar with the hazards of contact with energized for the protection of themselves, their coworkers/workers and the public. The nature of electrical hazards is described in the Operators Manual. Personnel using this equipment on or near energized conductors must be familiar with these hazards for their own protection.

Terminology Definitions

1. Upper Controls
These controls are located beside the platform, designed for the boom, platform and jib functions of the aerial device.

2. Platform
The personnel-carrying component of the unit.

3. Platform Shaft
The horizontal shaft about which the platform rotates relative to the upper boom.

4. Upper Boom Tip
The end of the upper boom to which the platform is attached.

5. Upper Boom
The structural member attached to the lower boom that supports the platform.

6. Upper Boom Cylinder
The hydraulic cylinder that moves the upper boom.

7. Upper Boom Drive Mechanism
The components used to produce upper boom movement.

8. Elbow
The structure connecting the upper boom to the lower boom about which one moves relative to the other.

9. Elbow Pin
The horizontal pin about which the upper boom rotates relative to the lower boom.

10.Lower Boom
The structural member, attached to the turntable or turret, that supports the upper boom.

11.Lower Boom Insert
The part of the lower boom made of high dielectric strength material (fiberglass reinforced plastic).

12.Lower Boom Cylinder
The hydraulic cylinder that moves the lower boom.

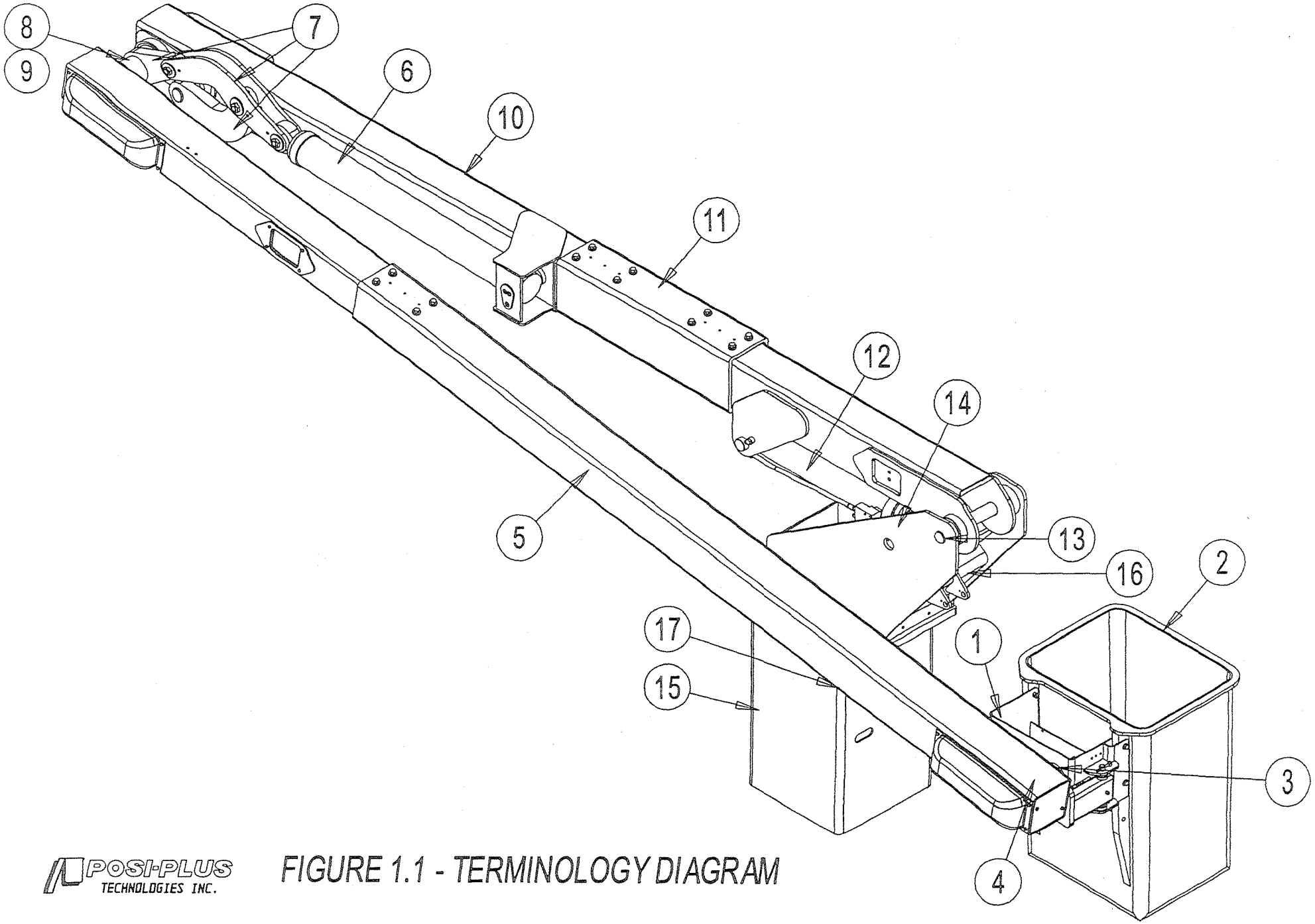
13.Lower Boom Pin
The horizontal pin that connects the lower boom to the turntable.

14.Turntable (or Turret)
The rotating base of the aerial device that supports the booms.

15.Pedestal
The stationary base of the aerial device that supports the turntable.

16.Lower Controls Station
The controls on the utility body, turntable or pedestal, used to move the aerial device.

17.Upper Boom Rest
The structural member that supports the upper boom in the rest or travel position.



POSI-PLUS TECHNOLOGIES INC.

FIGURE 1.1 - TERMINOLOGY DIAGRAM

Safety instructions

This "safety alert symbol" is used throughout this manual to call your attention to danger, warning, caution and attention instructions. These instructions must be followed to prevent the possibility of personal injury and/or property damage.

The terms "danger, warning, caution and attention" represent varying degrees of personal and/or property damage that could possibly result if the preventative instructions are not followed, The following paragraphs from ANSI Z535.4-1991 explain these terms.

Danger

Indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury. This signal word is to be used in the most extreme situations.

Warning

Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.

Caution

Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

The term "attention" is used to alert personnel of instructions that must be followed to prevent the possibility of property damage. Property damage could include structural damage to the unit, component failure or damage to nearby property. Read and follow all danger, warning, caution and attention instructions.

Safety Information and Warnings

The following section describes safety warnings and information concerning operating and maintaining the aerial device. Following these instructions will mean safer operating and maintenance practices.

These warnings serve only as examples of good work practices to assist maintenance personnel and servicemen in doing their job more efficiently.

Most hydraulic ports and fittings on the unit are SAE or JIC straight thread, do not attempt to connect pipe thread fitting to these types of fittings without being certain it is intended to be pipe thread connection.

Cleanliness is extremely important in a hydraulic system. When hydraulic lines are disconnected or components are removed, the ports should be plugged or other precautions taken to prevent contaminants from entering the hydraulic system.

Even new hydraulic oil from the petroleum company may be contaminated compared to the filtered oil of the unit's hydraulic system. All oil being added to the reservoir must be filtered before using it to power the unit. This is most effectively done by filtering the oil through a 10 micron filter as it is pumped into the reservoir. If a filter is not available, the oil should be allowed to circulate through the system for approximately 15 minutes before operation. This may be done by positioning the ground level tools control handle in the On position. This may also be accomplished by connecting the oil warming kit to the tool connections and turning the tools valve "ON". Make sure the needle valve on the oil warming kit is turned all the way out (counterclockwise) to avoid unnecessary warming of the hydraulic oil. A new barrel of oil should be moisture free. However, this may not be true of improperly stored barrels. The hydraulic oil used must always be prefiltered to ISO 14/12 before being introduces into the hydraulic circuit.

Always be certain that the shutoff valve between the reservoir and the pump inlet, and any shutoff valves found before or after the return line filter, are completely open before operating the pump.

Inspect hydraulic hoses and wires frequently to be certain they are properly routed to avoid sharp cutting edges, kinking or scuffing.

Serious pump damage and machine malfunctions are likely to occur, if conditions are present which allow air into the suction side of the pump.

Do not make any modifications to this aerial device that might affect its structural soundness or operational characteristics without specific written permission from Posi-Plus Technologies, Inc. Unauthorized alterations or modifications may prevent the unit from operating safely and properly as designed.

Always wear the proper protective equipment for the task being performed. For example, safety shoes, eye and hearing protection, gloves, dust mask, etc.

Never place your finger, hand, foot or any part of your body in an area where it could be injured.

Never move an outrigger, boom or vehicle unless you have a clear and unobstructed view.

Never remove the fasteners of a component until you have supported the component with a hoist or other means to safely support the component.

Never use air pressure to move a hydraulic component.

Always purge air from an actuator (hydraulic cylinder or motor) before installing it on the aerial device. Failure to purge a component may result in free and uncontrolled movement of that component.

After replacing any major component, such as cylinders, booms, leveling rods or chains, it is recommended that a structural test be performed. This test verifies the structural soundness of the component before putting the unit back in service.

Do not permit anyone to occupy the platform until operational and structural tests have been completed.

Danger

It is impossible to foresee all possible situations and combinations for the use of this unit. The operator bears ultimate responsibility for following all regulations and safety rules of their employer or any state or federal law.

While servicing the aerial device, personnel may be exposed to hazards that cannot be protected against by any mechanical means. The use of care, common sense and safe work practices provide the best protection from accidents.

It is essential to have service personnel who are competent and trained in safe service procedures.

This aerial device does not provide protection from contact with or proximity to an electrically charged conductor when you are in contact with or in proximity to another conductor or any grounded device, material or equipment. Death or serious injury will result from such contact or inadequate clearance from an energized conductor.

Nonconductive hoses must be non-pin perforated. Never substitute a conductive type hose for any insulated or nonconductive hose. Death or serious injury may result from the bridging of an insulated gap with a conductive hose.

This aerial device has been tested per stability requirements of ANSI A92.2 and CSA C225. The unit may be operated, in accordance with the following, on firm and level surfaces.

Warning

Park the unit on a level surface before operating the aerial device. Always use wheel chocks and parking brakes. Extend the outriggers into firm contact with the ground (If applicable). Adjust the outriggers to or beyond their minimum stability marks and level the vehicle to provide maximum stability. Pads must be used on all unpaved surfaces, asphalt pavement and other soft surfaces.

It is impossible to foresee all possible situations and combinations for set up of the unit. The operator bears the ultimate responsibility for insuring the unit is properly set up for the particular conditions encountered.

Anyone occupying the aerial device platform must wear an OSHA approved fall restraint device with a lanyard securely connected to the boom tip lanyard attachment anchor.

Any holes in the platform, whether intentional or by accidental damage, are a violation of ANSI A92.2 and CSA C225, Section 4.9.7 and should never be permitted. Holes in the liner render them useless as a protective device. Dielectric integrity therefore will not be possible.

Only use hydraulic oils as recommended. Other fluids added to the hydraulic system may increase component wear, effect the lubricating characteristics of the oil, or may destroy the insulating capability of the aerial device.

Pilot operated check valves are not adjustable and must be replaced if defective.

When removing a hydraulic line from a cylinder, do not operate the aerial device from the upper controls until you are certain all the air is purged from the cylinder after the hydraulic lines are installed. The presence of air in the cylinder may cause inadvertent retraction or extension of the cylinder, resulting in serious injury or death.

Do not move the upper boom overcenter until you are certain all the air is purged from the rod end of the upper boom cylinder. The presence of air in the cylinder may cause inadvertent extension of the cylinder when the upper boom is overcenter, resulting in serious injury or death.

Failure to fully unload the cylinder, or position it so that it cannot move, before removing a counterbalance valve can result in sudden, uncontrolled movement of the cylinder and/or booms. This may result in property damage and/or personal injury.

Under torquing or over torquing a cylinder piston nut or head gland may cause cylinder failure. Improper installation of a piston nut or end gland retention device may also

cause cylinder failure. Cylinder failure may result in property damage and/or personal injury.

If a piston nut is removed from a cylinder, replace the piston nut retention device. Removing piston nut retention devices can damage their retaining characteristics. If the piston nut is self-locking, replace the piston nut. Removing a self-locking piston nut damages the locking material. A faulty self-locking piston nut or retention device may cause cylinder failure. Cylinder failure may result in property damage and/or personal injury.

If the internal size tolerance of the cylinder barrel is exceeded, the piston seal could be pushed out (extruded) when the cylinder is put under a load. This will cause cylinder failure. A cylinder failure may result in property damage and/or personal injury.

While performing a structural test, proper procedures must be followed to assure that the stability of the unit is maintained. This test will load the unit to the ANSI and CSA requirement for normal stability. Damage to the unit and injury to the operator could result if proper procedures are not followed. Use extreme caution when performing a structural test.

Hands and fingers must be kept off the pinion and rotation bearing gear teeth to avoid serious injury.

Do not operate a cylinder that has a dented barrel or a damaged rod. Operation of a cylinder with such defects could lead to cylinder failure. Cylinder failure may result in property damage and/or personal injury.

Caution

Do not adjust the pressure of the tools circuit above the hydraulic power tools manufacturers' rating for the tool that is to be used. Hydraulic pressure above the tool pressure rating may cause the tool hoses to burst and/or the tool to rupture. This may result in hydraulic oil escaping under pressure. Hydraulic oil escaping under pressure can have enough force to inject oil into the flesh.

Failure to remove pressure before loosening a valve cartridge hydraulic fitting or hose from its housing will cause oil to spray out under pressure as the connection is loosened. Hydraulic oil escaping under pressure can have enough force to infect oil into the flesh.

Hydraulic oil escaping under high pressure from a faulty connection, hose, pinhole, cracked tube, etc. may not be visible, but can have enough force to penetrate the skin

and inject into the flesh. Never use your hands, or any other body parts, to check hydraulic lines and fittings for leaks under pressure that are not visually obvious.

In case of injury by escaping hydraulic oil, seek medical attention at once. Serious infection or reaction can result if medical treatment is not given immediately.

Keep the unit and work areas clean. Spilled hydraulic oil creates slick surfaces and may cause personnel to slip and/or fall.

Do not attempt to adjust a counterbalance valve without a test block. Using a test block and pressure gauge is the only accurate way to determine that the proper setting has been obtained.

Failure to keep the rotation bearing cap screws properly tightened may lead to fatigue failure of the cap screws and consequent damage to the aerial device. Insufficient or uneven cap screw tightness may also contribute to reduced life of the rotation bearing.

Eye protection must be worn at all times to prevent particles of dirt or metal from entering the eyes.

Do not coat a fiberglass surface with any product that will reduce its dielectric characteristics or cause a surface flashover.

Never loosen a load bearing component until you have supported the component with a hoist or other means to safely support the component.

Wear safety glasses and a dust mask while sanding. Small dust particles can get into your eyes and lungs. These particles may be hazardous to your health.

Never loosen a hydraulic hose or fitting unless you have disengaged the hydraulic pump, released the hydraulic pressure from the system and provided a safe alternative support for any load supported by the hydraulic component.

Use extreme caution when access covers have been removed to service the unit. Pinch points and shear points may exist between moving parts. Replace the access covers immediately after servicing.

Use care when getting on and off the unit and/or when entering and exiting the platform to avoid slipping and/or falling.

Even with 12 Volts, severe arcing can occur. Use caution when working with any electrical device.

To prevent electrical shock, turn the truck ignition switch off to remove the power supply to the control box before servicing.

Disclaimer of Liability

Posi-Plus will not be liable for unauthorized modifications or alterations of the aerial device. Posi-Plus will not be liable for improper or abusive operation of the aerial device.

Do not alter or modify this unit in any way that might affect its structural integrity, dielectric integrity or operational characteristics without the specific written approval from Posi-Plus.

Unauthorized alterations or modifications will void the warranty. Of greater concern is the possibility that unauthorized modifications may cause unsafe operating conditions. These unsafe conditions could result in death, personal injury and/or property damage. Posi-Plus will not be responsible for unauthorized alterations or modifications that cause property damage, personal injury or death.

Posi-Plus assumes no liability for any personal injury and/or property damage related to the use of this manual when performing testing, maintenance or repair procedures on the aerial device.

Accident Prevention Signs

Your aerial device was complete with accident prevention signs when it was delivered to you. These accident prevention signs were prepared by an industry council. If for any reason any of the accident prevention signs are lost or become illegible, replacements may be obtained from any Posi-Plus service representative.

Caution

OSHA regulations require that employers provide accident prevention signs or instruction markings. The use of aerial devices is subject to certain hazards which cannot be protected against by mechanical means, but only by the exercise of intelligence, care and common sense. It is essential, therefore, to have competent and careful operators, who are physically and mentally fit and thoroughly trained in the safe operation of aerial devices.

The following paragraphs from ANSI A92.2 and CSA C225 are presented here for reference by the operator and the employer:

6.5.4 *Instructional Markings (6.5.5 CSA)*

Markings shall be determined by the manufacturer or the manufacturer and user jointly to indicate hazards inherent in the operation of an aerial device. Instructional markings shall be provided for :

1. *Electrical hazards involved in the operation of the machine to warn that an aerial device does not provide protection to the operator from contact with or in proximity to electrically charged equipment, conductor or other components when the operator is in contact with or in proximity to another electrical component.*
2. *Electrical hazards involved in the operation of the machine to warn that an aerial device, when working on or in proximity to energized conductors, shall be considered energized, and that contact with the aerial device or vehicle (including attached trailers) under those conditions may cause serious injuries.*
3. *Hazards that result from failure to operate the equipment in the prescribed manner.*
4. *Information related to the use and load rating of the equipment for material handling.*
5. *Information related to the use and load rating of the aerial device for multiple configurations.*
6. *Information related to operator cautions.*
7. *Information related to the use of the aerial device for mobile operation.*

The location, part numbers and descriptions of all placards and decals are listed in the Parts Manual applicable to this unit.

Section 2 – Preventive Maintenance and Inspection

Maintenance Schedule

This section provides a recommended preventive maintenance and inspection schedule for the aerial device. It is important to follow this schedule. Safety alone justifies the cost of a preventive maintenance program. The expenses incurred will be regained many times over. Such a program can reduce downtime and lower operating costs. It can also lower repair costs and extend equipment life. Early discovery of problems will be less expensive than allowing the problems to develop into major problems. Also, a machine that is well maintained and functioning properly is more likely to be treated with respect by the operator.

The following section provides the preventive maintenance items in a checklist. The items are separated into three different intervals. The items should be performed at the interval (PTO hours or months) that comes first. These intervals are listed below.

- 85 PTO hours or monthly
- 340 PTO hours or every 4 months
- 1,000 PTO hours or annually

More frequent inspections may be needed if the unit is operated under severe conditions. This schedule should be considered the maximum period before performing routine maintenance. The unit may be inspected more often, if desired.

Keep permanent, written and dated records of all service performed on the aerial device. When performing routine inspections, the use of the Preventive Maintenance and Inspections Checklist insures that no areas are overlooked. It also provides a ready-made form for your service records.

Preventive Maintenance and Inspection Checklist

The form on the following pages is the recommended checklist for the aerial device.

Besides the items on the checklist, there is an additional maintenance item that should be performed on a new unit. **Change the return line filter after the first 15 to 25 hours of operation.**

Some items included in this form may not be exactly applicable to your unit due to the options selected.

Preventive Maintenance and Inspection Checklist

Truck No. _____ Location _____ Date _____

Model Number _____ Serial Number _____

Odometer _____ PTO/Pump Hours _____ Inspector _____

All Inspections, adjustments, repairs and lubrication must be performed in accordance with Posi-Plus specifications.
Refer to applicable Manual.

Intervals

- ❑ 85 PTO hours/1 month
- ❑ 1,000 PTO hours/1 year
- ❑ 340 PTO hours/4 months
- ❑ Other _____

Symbols

- √ = Okay or completed
- R= Repair or replacement required
- X= See remarks
- C= Corrected by inspector
- U= Unsafe to operate
- N/A= Not applicable

85 Hours or 1 Month, 340 Hours or 4 Months and 1,000 Hours or 1 Year			
Hydraulic Reservoir		**General Condition**	
	Oil level		Clean debris from around upper boom cylinder
Hydraulic System			Clean debris from around platform leveling sprockets
	Oil leaks at pedestal	**Lubrication**	
	Oil leaks at turntable		Booms linkage pivot points
	Oil leaks at elbow		Upper boom lift cylinder pivot bearings
	Oil leaks at platform		Lower boom lift cylinder pivot bearings
			Rotation pinion and rotation bearing gear teeth
			Leveling system sprockets
			Platform shaft bushings
340 Hours or 4 Months and 1,000 Hours or 1 Year			
PTO		**Hydraulic Reservoir**	
	Operation		Mounting (bolts tight, welds intact, no cracks)
	Noise level		No leaks
	Mounting bolts tight		Both shutoff valves fully open
	No leaks		Drain water from bottom
Chassis Underside			Collect oil sample for analysis
	Hoses (routing, condition, no leaks)	**Filters**	
	Exhaust shields		Change return line filter
Pump		**Ground Level Tools Circuit (Optional)**	
	Mounting bolts tight		Operation
	Flange bolts tight		No leaks
	Drive line (condition, lubrication)		Hoses (routing, condition)
	Noise level		Quick couplers (condition, operation, dust caps)
	No leaks	**Hydraulic System Pressure**	
Unit Mounting			Main system pressure 3000 PSI
	Subbase mounting (no cracks, welds intact, bolt tight)		Tool system pressure 2000 PSI (standard)
	Subbase structure (welds intact, no cracks)		
	Pedestal mounting (welds intact, no cracks)		
	Boom rest (welds intact, no deformation or cracks)		
	Utility body mounting (bolts tight, welds intact, no cracks)		

340 Hours or 4 Months and 1,000 Hours or 1 Year			
Lower Control Station		**Lower Boom**	
	Placards and decals (condition, readable)		Structure (welds intact, no deformation or cracks)
	Emergency lowering DC pump switch operation		Lift cylinder pivot pin (Forged pin retainer condition, bolt tight)
	Lower controls valve (operation, no leaks)		Check leveling chains (lubricate if necessary)
	Tools control valve (operation, no leaks) (optional)		Jam nuts on leveling chain turnbuckles (in place, tight)
	Emergency Stop/dump operation		Remove any debris from inside lower boom
	Engine Start/Stop system operation		Leveling rods (wear, cracks, end joint)
	Two-speed throttle system operation		
Pedestal			
	Structure (welds intact, no deformation or cracks)	**Upper boom lift cylinder**	
	Hoses and tubes (routing, condition)		Cylinder attachment pins (retainer condition, welds intact on flange, bolts tight, lock nut in place)
	No leaks		Pivot bearings secure within cylinder eyes
	Rotation bearing capscrews (properly torqued)		Operation
	Rotary joint mounting bolts tight		No leaks
	Slip ring mounting bolts tight		Holding valves (operation, no leaks)
	Rotary joint drive pin (condition, bolts tight)		Chromed rod condition
Turntable		**Elbow**	
	Structure (welds intact, no deformation or cracks)		Elbow pin (bolt tight, welds intact on flange, retaining rings in place, lock nut tight)
	Main boom pivot pin (Forged pin retainer condition, bolt tight)		Pins securing upper boom drive mechanism (bolts tight, welds intact on flanges, retaining rings in place, lock nut tight)
	Lower boom cylinder pivot pin (forged pin retainer condition, bolt tight)	**Upper Boom**	
	Hoses and tubes (routing, condition)		Structure (welds intact, no deformation or cracks)
	No leaks		Check leveling chain (lubricate if necessary)
	Leveling chain anchor pin (retainer condition, in place)		Jam nuts on leveling turnbuckles (in place, tight)
Rotating Bearing and Gearbox			Leveling rods (wear, cracks, end joint)
	Gearbox mounting bolts tight		Hose assembly (no leaks, securely attached to tension rod)
	Rotation motor mounting bolts tight		Tension rod (securely attached, tightened)
	No leaks		No leaks
	Gearbox oil level		All covers in place
	Pinion gear teeth condition		Upper boom stow lock down system (condition, all parts in place, lock works)
	Rotation bearing gear teeth condition		Upper boom stow pad (condition, in place)
	Pinion to rotation gear backlash		Boom tip weldment (welds intact, no deformation or cracks)
	Gearbox internal lost motion		Boom tip fasteners (tight)
	Operation (smoothness and noise level)		Boom tip sprocket (condition, looseness)
	Turntable tilt measurement		Boom tip cover (condition, in place)
Lower Boom Lift Cylinder			Lanyard attachment welds
	Pivot bearings secure within cylinder eyes		Remove any debris from inside upper boom
	Operation		
	No leaks		
	Holding valves (operation, no leaks)		
	Chromed rod condition		

340 Hours or 4 Months and 1,000 Hours or 1 Year			
Platform		**Tools at Platform (optional)**	
	Mounting bracket (welds intact, no deformation or cracks)		Quick disconnects (conditions, operation, no leaks)
	Mounting bracket covers (condition, mounting)		Quick disconnect dust caps (condition, in place)
	Platform mounting bolts tight		Hoses (condition, routing, no leaks)
	Platform (condition, cleanliness)	**Platform Tilt System**	
	Platform angle (leveling system tension correct)		Operation with ball lock pin
	Liner (condition, cleanliness) (optional)		Lock pin
	Placards and decals (condition, in place, readable)	**Lubrication**	
	Platform cover (condition, mounting) (optional)		Rotation bearing ball race
	Platform control cover (condition, mounting) (optional)		Platform rotation pivot pin
			Platform rotation cylinder mounting points
	Platform rotation cylinder or actuator (no leaks, noise level, holding its position, rotation range)	**Welds**	
	Valves (condition, mounting)		Lower boom cylinder mount on lower boom
	Hoses (no leaks, routing, not pinched or pulled)		Lower boom cylinder mount on turntable
	Safety lanyard(s) (condition, in place)		Upper boom cylinder mounts
	Safety belt(s) (condition, furnished)		Upper boom end weldments
	Platform accessory mounting brackets (condition, mounting)		
Upper Controls Station		**Outriggers (if applicable)**	
	Operation (metering, proper direction)		Structure (welds intact, no deformation or cracks)
	Operation placard (condition, readable)		No leaks
	No leaks		Stability marks readable
	Mechanical linkage (operation, adjustment, lubrication)		Cylinder attachment pins (retainer condition, bolts tight)
	Rubber boot (condition, in place)		Operation
	Interlock linkage (condition, adjustment, lubrication)		Holding valves (operation, no leaks)
	Blocking section of upper control valve (operation, no leaks)		
1,000 Hours or 1 Year			
Hydraulic Reservoir and System		**Lubrication**	
	Change hydraulic oil		Change rotation gear box oil
	Flush hydraulic system		Lubricate pump input shaft splines
	Clean inside of reservoir	**General**	
	Clean suction filter		Rotation bearing capscrews torque
	Change filler breather cap		Dielectric test unit
	Clean or change filler hole strainer		Inclinometer (condition, in place)
	Reservoir cover gasket condition		

Section 3 – Hydraulic Oil

Hydraulic System

Maintaining the hydraulic system is critical to the proper operation of the aerial device. Most of the maintenance for the hydraulic system focuses on the upkeep of the hydraulic oil. Using the proper type of oil helps to prevent many hydraulic system problems. Maintaining the oil is also important. If the oil is dirty or contaminated, components may be damaged.

Cleanliness precautions

Contamination will ruin any hydraulic system. It is very important that no contamination enter the system. Dirt, water and air are different types of contaminants. They can enter the hydraulic system in many ways. Contaminants can enter the system when filling the reservoir or changing filters. They can also enter when changing components or performing other service procedures.

Following the precautions listed will protect the cleanliness of the hydraulic system.

- Filter new oil with a 10 micron filter as it is added to the reservoir.
- Clean off hydraulic connections before opening them.
- Plug or cap ports and lines opened for service.
- Keep replacement hoses, tubes and other components plugged while stored.
- Make sure components are clean before installing them.
- Clean the reservoir and return line filter covers before opening them.
- Clean the filler breather cap before opening it.
- After servicing the reservoir, immediately replace the cover when finished.
- Make sure quick disconnect couplers are clean before connecting them.
- Do not spray water on the filler breather cap on the reservoir. This could force contaminants into the reservoir.

Filtration

The aerial devices is equipped with a complete filtration system. When properly maintained, this system will reduce contamination of the hydraulic system. The filtration system must be serviced regularly. If it is not, the filters will not be effective.

Each part of the filtration system is explained in this section. Servicing of each filter is also covered.

Section 3 – Hydraulic Oil

Hydraulic System

Maintaining the hydraulic system is critical to the proper operation of the aerial device. Most of the maintenance for the hydraulic system focuses on the upkeep of the hydraulic oil. Using the proper type of oil helps to prevent many hydraulic system problems. Maintaining the oil is also important. If the oil is dirty or contaminated, components may be damaged.

Cleanliness precautions

Contamination will ruin any hydraulic system. It is very important that no contamination enter the system. Dirt, water and air are different types of contaminants. They can enter the hydraulic system in many ways. Contaminants can enter the system when filling the reservoir or changing filters. They can also enter when changing components or performing other service procedures.

Following the precautions listed will protect the cleanliness of the hydraulic system.

- Filter new oil with a 10 micron filter as it is added to the reservoir.
- Clean off hydraulic connections before opening them.
- Plug or cap ports and lines opened for service.
- Keep replacement hoses, tubes and other components plugged while stored.
- Make sure components are clean before installing them.
- Clean the reservoir and return line filter covers before opening them.
- Clean the filler breather cap before opening it.
- After servicing the reservoir, immediately replace the cover when finished.
- Make sure quick disconnect couplers are clean before connecting them.
- Do not spray water on the filler breather cap on the reservoir. This could force contaminants into the reservoir.

Filtration

The aerial devices is equipped with a complete filtration system. When properly maintained, this system will reduce contamination of the hydraulic system. The filtration system must be serviced regularly. If it is not, the filters will not be effective.

Each part of the filtration system is explained in this section. Servicing of each filter is also covered.

Filler Breather Cap and Strainer Basket

The filler breather cap is located on top of the reservoir, It is illustrated in Figure 3.1.

The cap has three purposes. It allows air to flow in and out of the reservoir as the oil level changes. The cap contains a filter that cleans the air as it enters the hydraulic system. The cap also has a strainer basket that keeps large particles from entering the reservoir when oil is poured into it. Refer to the marks on the level sight gauge to determine the oil level of the reservoir as described in Section 3 under Hydraulic Oil Specifications.

The filler breather cap is replaced as one component. Replace the filler breather cap once a year. If your unit is operated in an extremely dusty environment, you may need to change it more often.

Remove and flush out or replace the strainer basket when you change the hydraulic oil. Any time you notice the strainer has dirt in it, remove it and flush the strainer basket out.

Suction Filter

A suction filter is located under the subframe (refer to **Figure 3.1**). This filter is mounted on the suction line between the reservoir and the pump. The suction line filter element is a spin-on type. It resembles an automotive filter.

The filter has a cellulose cartridge. This cartridge prevents particles that are 10 microns or larger from entering the pump. One micron is 0.000039 of one inch. To put this into perspective, one grain of salt is approximately 70 microns. The filter should be removed and replaced every 340 PTO/pump hours or every 4 months, whenever the hydraulic oil is changed, and at any other time it has collected dirt or other foreign matter. If the filter is not replaced, it will become clogged. Oil will not flow into the pump at a fast enough rate. If the pump does not receive sufficient flow, it can be badly damaged.

Return Line Filter

The return line filter cleans the oil as it enters the reservoir. It is located on the top of the reservoir (refer to Figure 3.1). This filter is mounted in the return line connected to the reservoir. The return line filter element is a spin-on type. It resembles an automotive filter.

The return line filter is a 3 microns filter. This means that particles that are 3 microns or larger will be trapped by the filter.

Particles that are trapped by the return line filter are collected in the filter element. This element is disposable.

The return line filter is equipped with a bypass valve. The bypass valve opens when there is a pressure drop of 25 psi (or more) across the filter element. When the valve is open, oil flows directly into the reservoir. It does not flow through the filter. This prevents the element from collapsing during cold oil start-ups or if it is clogged.

If the filter becomes clogged, oil will flow directly into the reservoir through this valve. The lack of oil filtration will eventually cause serious damage to hydraulic components.

During the initial break-in period of a new machine, the hydraulic components will deposit run-in wear particles in the return line filter. **Change the return line filter after the first 15 to 25 hours of operation**. Thereafter, change the filter ever 4 months or 340 PTO hours of operation. If the unit is operated in very dusty conditions, replace the return line filter more often. Also, replace the filter after new oil has circulated trough the system for the first time.

Replace the return line filter element with a genuine Posi-Plus replacement part. Other filters may screw into the filter housing, but it may not have the same micron rating. Also, other filters may allow oil to bypass at a different rate.

Hydraulic Oil Specifications

Use high quality prefiltered oil in the hydraulic system. The oil should contain rust, oxidation and corrosion inhibitors. It should also contain anti-foam and anti-wear additives.

Check the oil level in the reservoir with the vehicle leveled, boom in the stowed position, and outriggers retracted. Under these conditions, the proper oil level is approximately four to seven inches from the top of the reservoir. Sight level gauge on the reservoir to determine the oil level.

Hydraulic oils used in insulated equipment must possess high demulsibility. This means the oil will expel water. This allows the oil to separate from the water in the reservoir.

Figure 3.2 shows hydraulic oil viscosity recommendations for different temperature ranges.

Specification	Cold Weather Oil	All Weather Oil	Warm Weather Oil
Ambient temperature range	-50°F to 60°F	-15°F to 95°F	40°F and above
Viscosity @ 100°F	85-102 SSU	110-188 SSU	300-340 SSU
Viscosity @ 210°F	39-47 SSU	43-53 SSU	53-56 SSU
Viscosity @ 40°C	17-22 cST	23-37 cST	61-67 cST
Viscosity @ 100°C	4.0-6.4 cST	5.1-8.1 cST	8.1-8.7 cST
Minimum viscosity index	195	140	95
Pour point	-80°F	-55°F	-30°F
Type	Multiviscosity	Multiviscosity	Straight Grade

Figure 3.2 - Hydraulic Oil Viscosity Recommendations

One way hydraulic oil is classified is by viscosity. Viscosity can be defined as the oil's ability to flow at a certain temperature. It may also be described as the oil's thickness or consistency. An oil's viscosity index indicates the extent of change in oil thickness due to temperature changes.

A high viscosity index indicates that the oil will experience little change in viscosity as the temperature changes. This means the consistency or thickness of the oil will change very little as the temperature changes.

A multiviscosity oil changes its ability to flow as the temperature changes. This allows the oil to be used during a wider range of outside temperatures.

The viscosity ratings in Figure 3.2 are measured in SSU and cST.

An abbreviation for Saybolt Second Universal is SSU. To assign an SSU rating, a quantity of oil is heated to a certain temperature. It is then poured through a standard size orifice. The time in seconds for the oil to run through the orifice is the SSU viscosity rating.
An abbreviation for centistokes is cST. To assign a cST rating, a quantity of oil is heated to a specific temperature. It is then poured through a standard size tube. The amount of oil that flows through the tube is measured in millimeters squared per second (mm^2 per second). The cST measurement is a more scientific way of measuring viscosity.

Typical brands that have published specifications are listed. The brands meet the recommendations for additives and viscosity that are in Figure 3.2. Most major companies can supply equivalent oils.

Cold Weather Oils (Below 0°C)
Amalie Low Temperature Hydraulic Oil
Emery Frigid-Go SLT Hydraulic Fluid

All Weather Oils
Mobil DTE 11
Shell Tellus T 22
CITGO CP Hydraulic Fluid
Mobil Hydraulic Oil 12

Warm Weather Oils (Above 20°C)
Mobil DTE 13
Champlin Hydrol AW150

Warning

Only use hydraulic oils as recommended. Other fluids added to the hydraulic system may increase component wear, effect the lubricating characteristics of the oil, or may destroy the insulating capability of the aerial device.

Attention

Oils meeting the viscosity rating for military specification MIL-5606 may be used in extremely cold climates. Since these oils have less anti-wear characteristics, they are not recommended for full time use. If a cold weather oil meeting MIL-5606 is used, change it as soon as weather permits to one of the oils recommended under Warm Weather Oils or All Weather Oils.

The hydraulic oil characteristics needed for a Posi-Plus aerial device are no different from those required for other brands of aerial devices. If long term experience with a particular oil in other aerial devices has been satisfactory, consider using it for the Posi-Plus aerial device. If the aerial device has the same type of pump and pressures, you can expect similar results in the Posi-Plus aerial device.

Determining Hydraulic Oil Condition

An important part of hydraulic system preventive maintenance includes checking the condition of the prefiltered hydraulic oil.

Cleanliness Precautions in Section 3 described many of the ways contaminants can get into the hydraulic oil. Other contaminants form during normal operation. Excessive levels of contaminants will ruin a hydraulic system. Therefore, it is important to check the condition of the oil regularly. Check the oil every 4 months or 340 PTO hours, whichever comes first.

Laboratory analysis is the most accurate way to determine oil condition. Your hydraulic oil supplier should be able to do this testing or recommend a testing facility. The analysis report should include data on the level of wear metal and particles in the oil. It should also contain information on water content, viscosity and acidity.

You may also use a visual inspection to check oil condition. However, it is less accurate than a laboratory analysis.

Before you take a sample of oil, operate the unit to circulate the oil. Warm it to operating temperature. If you are sending the oil into a laboratory, they will probably provide you with a sample container. Otherwise, use a wide mouth, screw top, clear glass container. Clean it with hot water and detergent. Rinse it thoroughly and let it air dry before putting oil into it.

It is better to take the sample from the middle level of the reservoir. You can do this by using a clean hand pump, such as a disposable syringe, and a piece of plastic tubing. If this is not available, the sample can be drained from the bottom of the reservoir. Allow

several quarts of oil to flow out of the drain pipe before collecting the sample. This will remove any dirt and water the drain pipe has collected.

If you are using laboratory analysis, send the sample to the testing facility. The laboratory should provide the following information in report form.

- Particle count
- Trace element analysis (component wear, outside contaminants and oil additive concentrations)
- Viscosity test
- Water content test

Once you receive your report, compare it to previous oil analysis reports for the same unit. This information will provide trends toward deterioration of the oil. It may give early warnings of a problem developing within hydraulic system components.

If you are making a visual inspection, compare the sample of oil to a sample of new oil that is the same type. Also, compare it to previous samples taken from the same unit. Look for the signs of oil deterioration listed in Figure 3.3.

Oxidation is a chemical reaction that occurs when air reacts with various compounds that are in the oil. This chemical reaction produces varnishes that bake onto hot surfaces. These oxidation products are acidic and tend to attack metal surfaces. This can cause damage to parts in pumps, motors and valves.

High operating temperatures will increase the rate of oxidation of the oil. The presence of water or air in the hydraulic oil also causes oxidation.

The presence of water may cause rust and corrosion.

Condition	Possible Cause
Dark color	Oxidation; contamination
Cloudiness or milky appearance	Presence of water or wax
Rancid or burned odor	Oxidation
Increase in viscosity	Oxidation; addition of improper fluids; presence of water
Decrease in viscosity	Addition of improper fluids; additive deterioration
Separation of water or other fluids from the oil	Presence of water; addition of improper fluids
Foreign particles or other visible contamination	Contamination; emulsion of water with oil additives

Figure 3.3 - Hydraulic Oil Conditions

Attention

Change the oil, if the sample has any of the characteristics listed in Figure 3.3.

If laboratory analysis or visual inspection show that the oil is deteriorating prematurely, determine the cause of the problem and correct it.

Changing Oil and Flushing the Hydraulic System

Properly maintained, the filtration system greatly extends the useful life of the prefiltered hydraulic oil. However, the hydraulic oil will eventually need to be replaced due to contaminants that form during the normal operation of the unit.

Due to the wide variety of conditions the aerial device may be used in, it is impossible to recommend an exact time interval for an oil change that applies to all situations. Use the guidelines listed to determine if the hydraulic oil should be changed.

- It is best to check the condition of the oil regularly as described in Section 3 under Determining Hydraulic Oil Condition. This section fully describes the characteristics of worn out and contaminated hydraulic oil. Change the oil if it has any of these characteristics.

- If oil condition is not monitored regularly, change the oil at least once a year.

- If a hydraulic component fails and contaminates the system with metallic particles, change the oil immediately.

- If your climate has a wide variation in operating temperatures between summer and winter months, change to an appropriate weight oil each spring and fall.

Replace the return line filter element and filler breather cap every time the hydraulic oil is changed. Also, change the suction filter (refer to Filtration in Section 3).

A significant quantity of old oil remains in the cylinders and lines of the hydraulic system when the reservoir is drained. Therefore, flush the system when the oil is changed. This is especially important if the system is heavily contaminated with metal particles.

If the oil is heavily contaminated with water, it may not be necessary to change the hydraulic oil and flush the system. Follow the instructions later in this section for removing water from the hydraulic system.

You will need the following equipment and supplies to properly flush the hydraulic system.

- Hydraulic oil of the proper grade
- 45 gallons for a 35 gallon reservoir
- 35 gallons for a 28 gallon reservoir
- Two return line filter elements
- Two suction line filter elements
- Clean, lint-free rags
- Reservoir cover O-ring
- Filler breather cap and strainer basket (if component has not been replaced within one year)

Caution

Keep the unit and work areas clean. Spilled hydraulic oil creates slick surfaces and may cause personnel to slip and/or fall.

Flush the hydraulic system by using the following steps.

1. If the oil is being changed because of contamination from a hydraulic component failure, go to Step 2. Otherwise, operate the unit to circulate the oil and warm it to operating temperature. This will allow as much of the impurities as possible to drain off in suspension.

2. Locate the drain pipe in the bottom of the reservoir. Open the pipe and drain the oil reservoir completely.

3. Wipe off the top of the reservoir, reservoir cover and filler breather cap.

4. Remove the strainer basket. If the filler breather cap and strainer basket has not been replaced in one year, or is damaged, it will be necessary to use a new one when reassembling the reservoir in Steps 8 and 9. If the filler breather cap and strainer basket is less than one year old, and is not damaged, clean the basket.

5. Change the suction line filter element as described in Section 3 under Filtration.

6. Remove the reservoir cover and Inspect the inside of the reservoir. If sludge or other contamination is found, clean it using solvent and lint-free rags. Disconnect the pump suction line from the bottom of the reservoir while cleaning. This will keep dirt and solvent out of the suction line.

7. Reconnect the suction line immediately after cleaning.

8. Install the suction filter and strainer basket.

9. Install the filler breather cap. Check the reservoir cover O-ring. If it is not in good condition, use a new one. Install the reservoir cover.

10. If a hydraulic component failure has contaminated the system, change the return line filter. Filtration in Section 3 describes how to change this filter.

11. Add a "short fill" of six or seven gallons of new prefiltered hydraulic oil of the proper grade to the reservoir. If possible, the new oil should be run through a 10 micron filter as it is put into the reservoir.

12. If the new oil was not filtered as it was put into the reservoir, allow the new oil to circulate through the tools circuit for about 15 minutes. To do this, connect an open center tool or service hose to the tools outlets.

13. Using a slow engine speed, cycle all the cylinders and the rotation motor. This flushes the contaminated oil from the lines and components of the hydraulic system.

14. Change the return line filter element (refer to Figure 3.1).

15. Drain the reservoir completely again.

16. Fill the reservoir to the full mark on the dipstick with new hydraulic oil. Make sure the hydraulic oil is the proper grade. Run the oil through a 10 micron filter as it is put into the reservoir. If the new oil was not filtered as it was put into the reservoir, circulate the oil through the tools circuit as described in Step 12.

17. Change the return line filter element after approximately 25 hours of machine operation.

Removing Water from the Hydraulic System

If the hydraulic system was heavily contaminated with water, special water removal filtration may be necessary. To determine this, have the oil analyzed by the oil supplier or a qualified laboratory. They can determine whether water has caused excessive oil oxidation or additive deterioration.

If analysis shows that the oil has deteriorated beyond an acceptable level, drain the reservoir and flush the system as described earlier in this section. Use a water removal filter cartridge during the flushing process to remove any residual water from the system. When the flushing process is complete, replace the water removal filter cartridge with a regular cartridge.

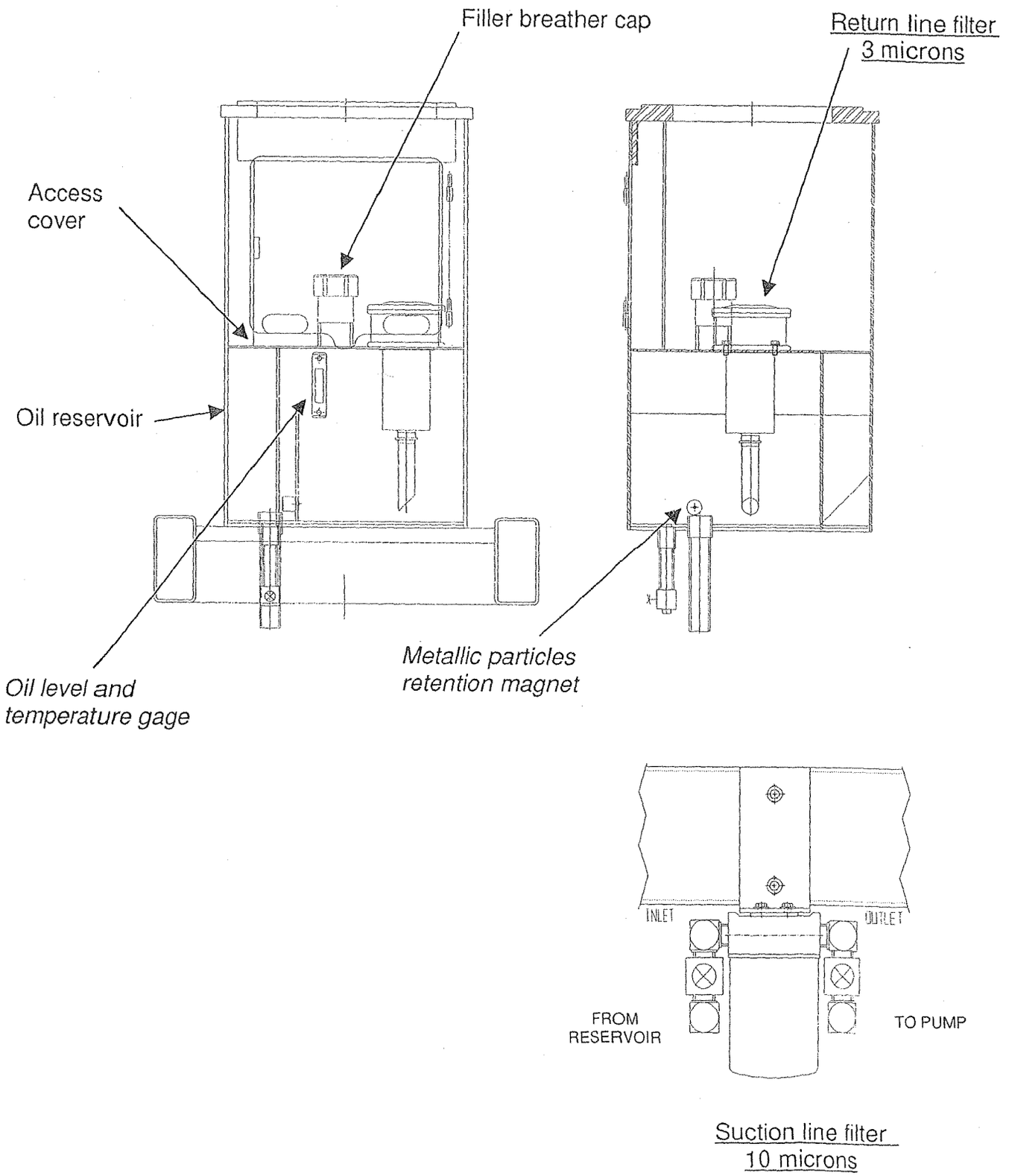
If the condition of the oil is acceptable except for the water content, allow time for it to separate out of the oil. Then drain the water off the bottom of the reservoir. Circulate the oil in the reservoir through a separate water removal filter cartridge. This may require two or more water removal filter cartridges, depending on the amount of water content. The cartridge's capacity is approximately one cup of water. Once the cartridge has accumulated this amount of water, it needs to be replaced. Change the water removal cartridge a minimum of every other day. Continue this process until the water content in the oil is reduced to an acceptable level.

There are only two methods which can be used to determine an acceptable water content level. The preferred method of determining the water content in the oil is laboratory testing. Another method is a dielectric test. Once the water has been reduced to an acceptable level, replace the cartridge with a new filter element.

Warning

Only use prefiltered hydraulic oils as recommended. Other fluids added to the hydraulic system may increase component wear, effect the lubricating characteristics of the oil, or may destroy the insulating capability of the aerial device.

Figure 3.1 - Oil reservoir and filters



Section 4 – Lubrication

Proper lubrication of the components of the aerial device on a regular basis will extend the life of the equipment. It will also help to avoid future maintenance problems.

The frequency of lubrication will depend upon the amount of use the unit receives. The Lubrication Chart and Diagram in this section recommends lubrication intervals for service under normal conditions. Equipment operated in very dusty, rainy or sandy conditions may need lubrication more often.

As described in Section 5 under Bearings, one type of bearing used on the aerial device is a prelubricated bearing. Lubrication chart and diagram illustrates all the points that use prelubricated bearings. These bearings contact plated shafts. These points require lubrication as described in the Lubrication chart.

Self-Aligning bearings are used in several places on the aerial device. These types of bearings are used at the rod end mounting points of the upper and lower boom /cylinders. It is very important to grease this type of bearing regularly as described in the notes of the Lubrication Chart and Diagram. If they are not greased, these bearings can produce enough twisting force on the mounting pins to break the pin retainers.

The rotation gear box requires EP 80W90 gear oil. The oil level should be checked at the 340 PTO/Pump hours or 4 months inspection. The oil level must be high enough to cover the internal gears and leave space for warm oil expansion. The need to add oil regularly to the rotation gearbox is a sign of a leakage problem. Determine the cause of the leakage and correct it. If the leak is ignored, the internal components of the gearbox could be damaged by the low oil level. If the oil level of a gearbox seems to be increasing, this could be a sigh of an internal hydraulic leak from a bad motor shaft seal.

The overall life expectancy of each gearbox may be extended by regularly draining and refilling the oil. The best time to drain a gearbox is right after it has been operating. At this time, the oil is warm and the wear particles are suspended in the oil. **An initial oil change is recommended after the first 15 to 25 hours of operation**. Thereafter, change the oil every 1,000 hours of operation or yearly, whichever comes first. If a gearbox is overheated and the oil smells burned, change the oil immediately. Also, change the oil if the gearbox oil becomes diluted with hydraulic oil from a leaking seal.

If the aerial device is stored for a length of time, apply fresh lubricant at all points shown on the Lubrication Chart and Diagram. This will help prevent corrosion during the idle period.

Lubricant Specifications

Use the lubricants in Table 4.5 to grease the unit as directed in the Lubrication Chart and Diagram. The sources shown are for reference only. Any brand that meets or exceeds the specifications of the products listed is acceptable. The letter symbol next to each type of lubricant corresponds to the letter symbol used on the Lubrication Chart.

Symbol	Lubricant
A	Anti-Seize Compound - Bostik – Never Seeze (regular grade)
C	Multipurpose lithium base grease with good water resistance, rust inhibition, oxidation stability and extreme pressure properties. - Shell – Albida LC EP2
G	Open Face Gear Lubricant - Walter open gear
S	Water-repellant Spray Lubricant - Orapi CTSI 809
W	Automotive gear oil - Shell – Spirax HD 80W90
F	Water resistant filler type grease with good adhesion to metal under wet conditions -Esso Arcan 1

Table 4.1 - Lubricant Symbols and Specifications

Lubrication Chart

Item #	Component Description	# of Points	Application Method	Interval	Symbol
1	Rotation bearing ball race	1	Grease gun	340 hours/4 months	C
2	Rotation pinion gear teeth	1	Spray	85 hours/1 month	G
3	Rotation bearing gear teeth	1	Spray	85 hours/1 month	G
4	Outrigger cylinder pin (base end only) (if applicable)	2	Grease gun	85 hours/1 month	C
5	Outrigger inner legs (if applicable)	2	Brush on	85 hours/1 month	F
6	Lower boom cylinder mounting points	2	Grease gun	85 hours/1 month	C
7	Upper boom cylinder mounting points	2	Grease gun	85 hours/1 month	C
8	Platform rotation pivot pin	1	Grease gun	340 hours/4 months	C
9	Platform rotation cylinder mounting points	2	Grease gun	340 hours/4 months	C
10	Lower boom leveling system sprockets	2	Grease gun	85 hours/1 month	C
11	Upper and lower boom linkage	3	Grease gun	85 hours/1 month	C
12	Upper boom platform rotation shaft	2	Grease gun	85 hours/1 month	C
13	Upper boom leveling chains (if needed)	2	Brush	340 hours/4 months	C
14	Lower boom leveling chains (if needed)	2	Brush	340 hours/4 months	C
15	Single handle controller linkage	Pivot points	Spray	340 hours/4 months	S
16	Platform control handle linkage	As req'd	Spray	340 hours/4 months	S
17	Rotation gearbox oil	1	Fill to level plug if low	340 hours/4 months	W
			Change oil	1000 hours/1 year	
18	Lubricate pump input shaft splines	1	Brush on	1,000 hours/1 year	A

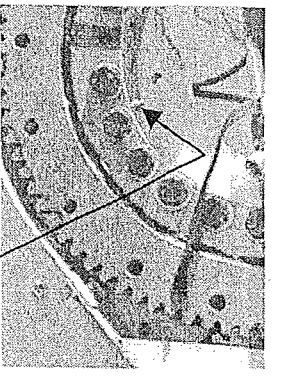
Refer to Table 4.1 for lubrication specifications. Units in heavy service or operated in extremely dusty, sandy or rainy conditions will require more frequent lubrication than noted above.

Notes

1. Wipe all grease fittings clean before greasing. This keeps contamination from entering the lubrication points. After removing the grease gun, wipe the fittings clean again. Any grease left on the fittings will collect dirt.

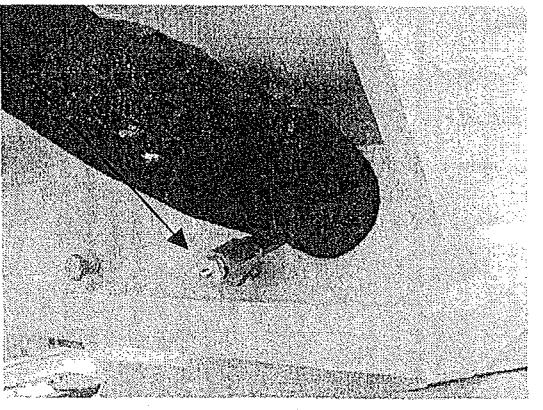
2. Wipe all gearboxes clean before removing the lube oil fill or check plugs. Tighten the plugs securely after checking or filling. Wipe excess lubricant off the gearbox. Any oil left on the gearbox will collect dirt.

3. The rotation bearing grease fitting is located in the inner part of the rotation bearing and can be accessed at the pedestal door. An optional tube can be installed to give easier access. While lubricating the rotation bearing ball race, rotate the turntable to 360 degree revolutions, stopping periodically to lubricate. **Caution**: Do not lubricate while operating the machine. Stop turntable movement before lubricating.



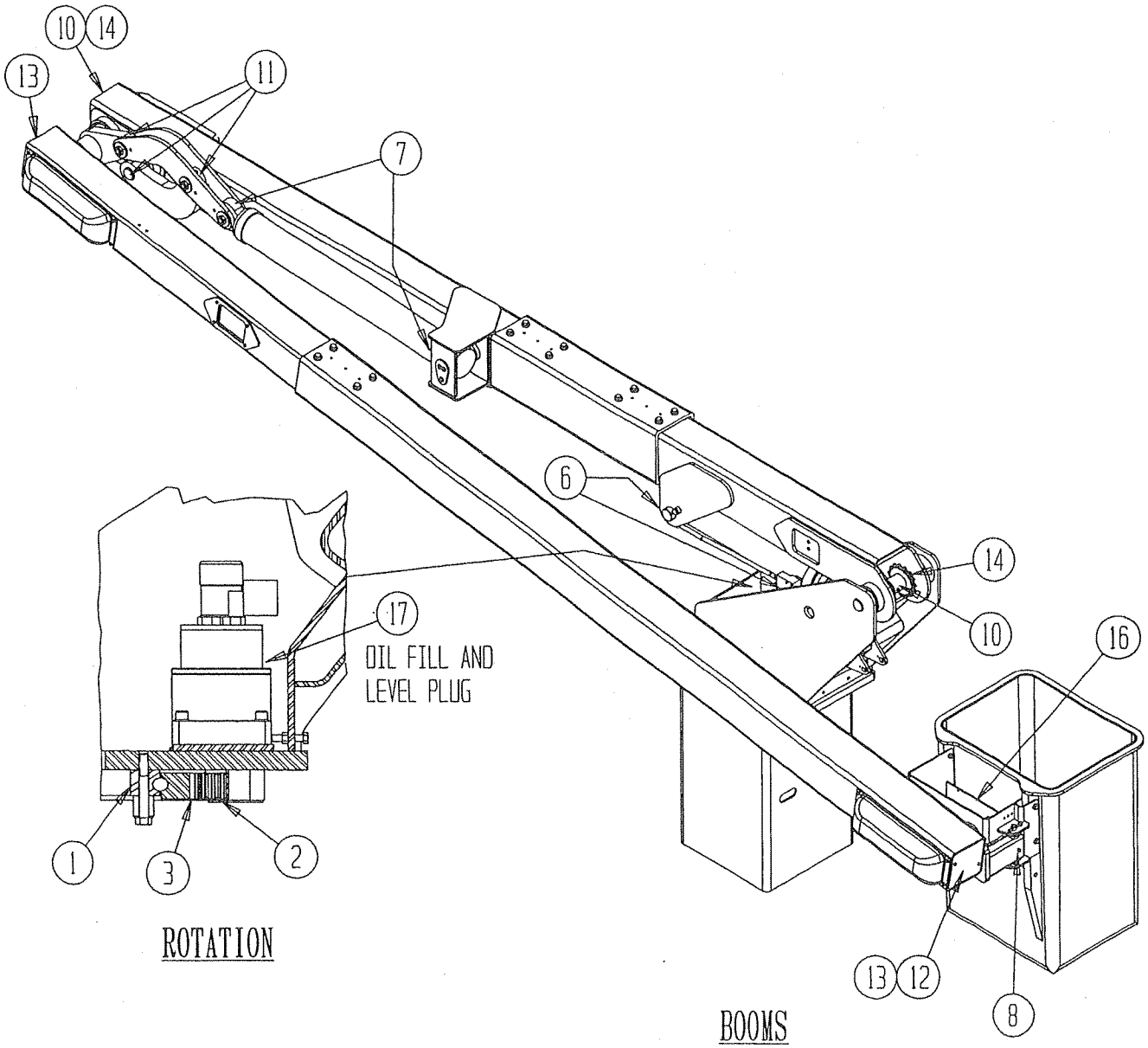
4. The rotation gearbox has a vent plug that must be kept free of paint and dirt. The vent prevents excessive pressure build up inside the gearbox as the oil warms up and expands during operation.

5. For maximum life, change gearbox oil immediately if it has overheated, causing it to smell burned, or if it has become diluted with hydraulic oil from a leaking motor shaft.



6. Lubricate any spool end (pin) connection and pivot point at each control station.

7. To lubricate pump input shaft splines, unbolt the two capscrews connecting the pump to the PTO, remove the pump and apply anti-seize compound on the splines.



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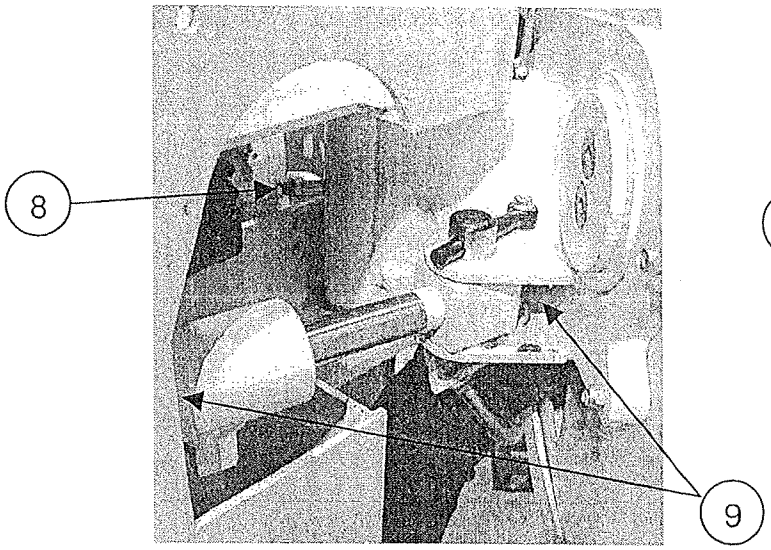
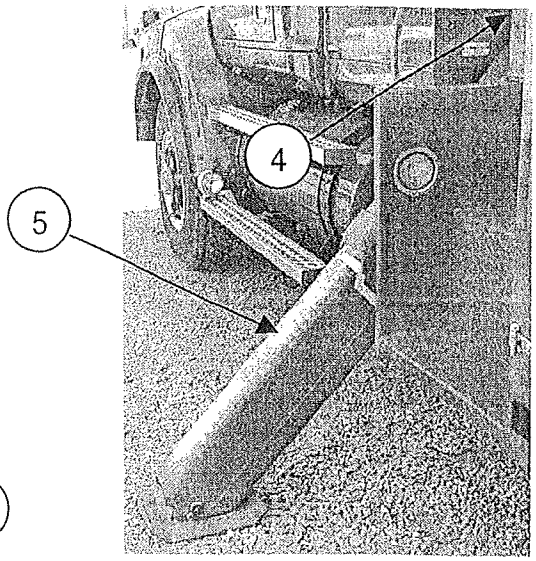
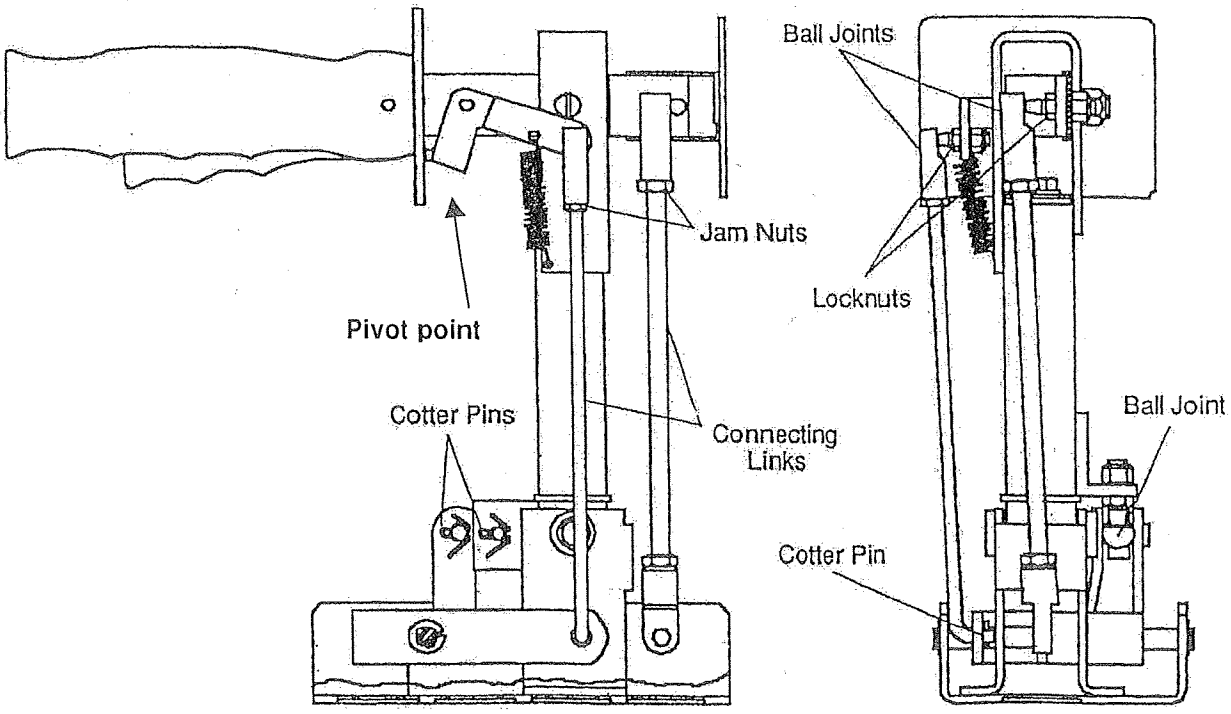


Platform rotation



Outriggers



Note — Any spool end (pin) connections and pivot points need to be lubricated

Item 15 - Single handle controller linkage

Section 5 – Mechanical Parts

Structures

The structural components of the aerial device are identified in the Terminology Diagram in Section 1. The aerial device has been designed to meet or exceed the specifications for vehicle mounted rotating and elevating aerial devices. All welding done on the aerial device at the factory conforms to the standards of the American Welding Society. Regular inspection of the welds and structures is required. This will insure that components maintain their strength. Periodic cleaning of the structures is also recommended. This will prevent damage that can occur from dirt accumulation.

Components

The basic structures of the aerial device are the outriggers, pedestal, turntable, upper boom and lower boom.

The steel structures are manufactured in the form of a closed box or tubular construction. This construction resists torsional loading. It also resists tension, compression and bending loads.

Careful consideration has been given to the design and manufacturing process to minimize the possibility of fatigue cracks forming on the structures.

Cleaning

Keeping the aerial device clean reflects that a maintenance department has pride in its work. It will also positively affect the machine operators. They will be more likely to treat the machine with reasonable care if it is well maintained.

Caution

Keep the unit and work areas clean. Spilled hydraulic oil creates slick surfaces and may cause personnel to slip and/or fall.

It is common for dirt, trash, wire clippings, etc. to accumulate in the bottom of the platform and liners. Clear out all such items from the platform and liner. When the operator stands on such debris, the weight of the operator and the trash may overload the platform.

If you use a pressure washer or steam cleaner to clean the aerial device, be careful where you direct the spray. Do not direct the spray at the filler breather cap of the reservoir. The high pressure can force water and cleaning liquid into the reservoir. This will contaminate the hydraulic oil. Also, do not point the nozzle at any area that may allow cleaning liquid to enter electrical components. This includes electrical connections, switches and lights.

Inspection

The inspection of the aerial device is the responsibility of the personnel that operate and maintain the unit.

The Operators Manual recommends that a daily pre-operational inspection be done every day before the unit is driven to the work site. Refer to the Operators Manual for information on the daily pre-operational inspection.

> ***Caution***
>
> Use care when getting on and off the unit and/or when entering and exiting the platform to avoid slipping and/or falling.

Regularly inspect the structures and welds every 4 months or 340 PTO hours, whichever comes first. This is included in the Preventive Maintenance and Inspection Checklist in Section 2. Figure 5.1A and 5.1B, at the end of this section, illustrates the welds listed in the checklist.

When inspecting the structures, make sure there is no interference between moving parts. Also check for deformation, abnormal wear or abrasions on the structures. Check all welds for cracking. Pay close attention to welds that are located where changes in cross section take place. Also, check the welds located near the attachment points of highly loaded components, such as the lift cylinder. Use a bright light so the inspection area is visible.

A visual inspection of the welds is very effective when done properly. Clean the area to be inspected thoroughly. Use a bright light so the weld area is visible. Look for visible cracks in the weld. Also, look for cracks at the weld to parent metal joint.

If you see rust or paint that has lifted off a weld, a closer inspection is necessary. Remove any rust or loose paint with a stiff wire brush. Clean the area with a solvent, such as acetone. Inspect the area closely.

Welds on the aerial device at the time of factory assembly are thoroughly checked for proper weld formation. However, if weld repair work has been performed on your aerial device, these welds should be checked.

Welds

Welds should be inspected periodically with particular attention focused on welds where ultimate failure could cause injury to personnel or damage to the unit. Check the welds located near the attachment points of highly loaded components, such as the lift cylinders (refer to Figure 5.1A and 5.1B).

Caution

Observe the platform capacity and lower boom lifting eye capacity. Do not exceed it.

Attention

Using this unit in an unsafe manner or overloading the unit can cause weld fatigue and eventual failure.

If you find any other abnormal condition while inspecting the aerial device structures, report it to your Posi-Plus service representative. It will help you determine the cause of the condition and recommend necessary repairs. Your Posi-Plus service representative can also recommend steps that will prevent the problem from reoccurring.

Repairs

If the inspection locates a problem, such as a hydraulic leak, loose fastener or a cracked weld, the problem must be corrected before putting the unit back into service.

Both the maintenance personnel and the operators of this unit should be familiar with and understand the safety information in both the Operators Manual and the Maintenance Manual and all placards before using or repairing this equipment. Failure to follow the information and placards could result in property damage, personal injury and/or death.

The recommended repair method for a steel structure may include welding. If you are welding on the aerial device, the welding ground clamp must be attached to the same structure that the welding is being performed on. This is necessary to prevent electrical current from being sent through components.

Components such as the rotation bearing, rotary joint and hydraulic cylinders can be damaged by electrical current. Wire braid hoses can also be damaged by electrical current. Electrical current flowing through a component can be very intense, which causes serious internal damage to the component.

Respect the following list of safety precautions when servicing the unit.

1. Always select a work site large enough to operate the required functions.

2. Apply the parking brake, chock the wheels, extend the outriggers (if equipped), check the hydraulic fluid level, engage the PTO before operating the unit.

3. Use a hoist to safely support heavy components before loosening the fasteners on that particular component and/or the components supported by that particular component.

4. Never loosen or remove a hose or fitting that is pressurized.

> ***Caution***
>
> Hydraulic oil escaping under high pressure from a faulty connection, hose, pinhole, cracked tube, etc. may not be visible, but can have enough force to penetrate the skin and inject oil into the flesh. Never use your hands, or any other body parts, to check hydraulic lines and fittings for leaks under pressure that are not visually obvious.

In case of injury by escaping hydraulic oil, seek medical attention at once. Serious infection or reaction can result if medical treatment is not given immediately.

Keep the unit and work areas clean. Spilled hydraulic oil creates slick surfaces and may cause personnel to slip and/or fall.

5. After replacing a major component, the unit should be subjected to load test. Hydraulic cylinders, pivot pins, rotation bearing and leveling system parts are examples of items that require load testing after installation. For specific instructions on performing this test, refer to Structural Testing in Section 11.

6. Be alert – accidents happen when minds wander or when tired. Working safely must be a part of your daily routine.

Bolts, Cap screws and Nuts

A variety of fasteners are used on the aerial device. Depending on their use and design, different bolts have different inspection and installation requirements. This section explains different bolts used on the aerial device, torque specifications, use of thread locking and anti-seize compounds, and lock wiring techniques.

The standard grade of fastener used on the aerial device is a zinc plated, SAE Grade 5 steel cap screw. On highly loaded areas, SAE Gr.8 cap screws are used. These bolts are gray plated, Dacromet type without paint requirement, or standard black with paint applied on heads after installation.

The gray Dacromet type cap screws, because of their surface finish, have a lower torque need compared to the black cap screws. When verifying or retorquing these bolts, be sure to apply the torque value corresponding to its finish, refer to Critical torque chart.

A variety of other fasteners such as socket head, flat countersunk head and button head cap screws are also used on the machine.

It is good maintenance practice to regularly check all fasteners for tightness; proper torque value and procedure of various size bolts are shown on drawings in the parts manual.

Check the fasteners every 4 months or 340 PTO hours, whichever comes first. Inspecting the fasteners for tightness is included in the Preventive Maintenance and Inspection Checklist in Section 2.

When inspecting fasteners, pay attention to the fasteners described in the **Critical torque chart** (Refer to **Figure 5.2 for location)**.

Rotation Bearing Mounting Cap Screws

Special high strength 3/4" cap screws are used to secure the rotation bearing to the pedestal and turntable. The cap screws and special hardened washers are coated with an anti-seize compound at the time of installation. These cap screws require special inspection procedures. The information under Rotation Bearing in Section 8 fully describes these inspection procedures. Do not reuse these cap screws if they are removed. Do not substitute other types of bolts or washers.

Torque Chart

The proper torque value of various size bolts is shown on the Critical Torque Chart following and on drawings in the parts manual. Torque is the twisting force required to overcome the friction of the threads and develop clamping force. The torque values on the chart are for dry (not lubricated) threads unless otherwise noted.

When a cap screw is properly installed, it applies a clamping force equal to or greater than the load that is applied to it. If the cap screw is installed at less than the recommended torque value, there is not enough clamping force. The cap screw may fatigue, which will cause it to loosen or fail. If the cap screw is torqued beyond the recommended torque value, the elastic range of the cap screw may be exceeded. This will also result in premature failure of the cap screws.

When checking fastener torque value during inspections, check the torque value at 90 percent of the original value. This prevents breaking the locking bond of the thread-locking adhesive. For example, if the torque value for a bolt is 100 foot-pounds, the bolt would be checked for tightness at 90 foot-pounds.

Refer to the **Critical Torque Chart** following for torque values and installation procedure.

Thread Locking Adhesives and Anti-Seize Compounds

Thread locking adhesive is recommended for certain fasteners and hydraulic connections. Upon curing, thread-locking adhesive provides a powerful locking action.

Anti-seize compound is also recommended for certain fasteners and static connections. It prevents rust and corrosion from forming on stationary connections. Anti-seize compound also makes future disassembly of the component much easier. It is recommended for certain fasteners to reduce friction during torquing. This gives increased clamping load.

Apply medium strength thread locking adhesive to all pivot pin retainer bolts. Also apply it to the rotation gearbox mounting bolts and washers. Use low strength thread locking adhesive on all 37-degree flare hydraulic fittings.

Rotation bearing cap screws and other components require an anti-seize compound. Apply anti-seize compound to the following components.

- Outrigger cylinder pins
- Rotation bearing cap screws and washers
- Rotary actuator mounting pin
- Pump output shaft splines

When a bolt is removed, reapply the adhesive or anti-seize compound before reinstalling the bolt. However, before applying the thread locking adhesive or anti-seize compound, clean the area that the compound will be applied to. If it is to be applied to a fastener, clean the threads of the fastener and the tapped hole with solvent. Blow-dry the threads and hole with compressed air. Grease and oil can reduce the effectiveness of both types of lubricants.
In addition, make sure to follow the specific procedure indicated on the adhesive or compound.

CRITICAL TORQUE CHART (values in ft-lb); MODEL 200

(Please refer to Figure 5.2 for the bolts location)

					Torque (ft-lb)	
					Bolt type	
Item	Location	Mounting	Bolt	Procedure	Black finish	Gray finish
1	Platform	Hex. head +flat washer	1/2"-13NC Gr.8	Loctite 262	60	50
2	Insulating booms	Glued assembly + Hex.head + flat + lock washer	5/8"-11NC	Orapi HT600 Lubricant or equivalent	165	140
3*	Rotation bearing	Hex. head + Fedalloy washer + spacer	3/4"-10NC Gr.8	Orapi HT600 Lubricant or equivalent	340	280*
4	Rotation gearbox	Socket head + lock washer	5/8"-11NC	Orapi HT600 Lubricant or equivalent	150	125
5	Rotation motor	Hex. head +flat washer	1/2"-13NC Gr.5	Orapi HT600 Lubricant or equivalent	58	58
6	Holding valves on hydraulic cylinders	Socket or hex. head	5/16"-18NC (Gr.5)	Orapi HT600 Lubricant or equivalent	13	13
7	Subframe	Hex. head +flat washer +lock nut	3/4"-10NC Gr.8	Orapi HT600 Lubricant or equivalent	250	210
8	Upper boom drive mechanism (4 nuts)	Lock nut + washer	1"-14UNS	Loctite 262	125	N/A

Caution

Eye protection must be worn when operating a compressed air nozzle to prevent particles of metal, dirt or other matter from entering the eyes.

After installing the bolt, properly torque the bolt. If applying thread-locking adhesive, torque the bolt before the lubricant cures, which occurs within 15 minutes of application or according to the manufacturer's specification.

When installing a pin into pre-lubricated bearings, apply anti-seize compound to the surface of the pin only where the pin and steel pin bosses contact. Pins and Pin Retainers in the following section describe this pin installation procedure.

Pins and Pin Retainers

A variety of different types of pins and pin retainers are used on the aerial device. The type of pin or pin retainer used depends upon the particular application.

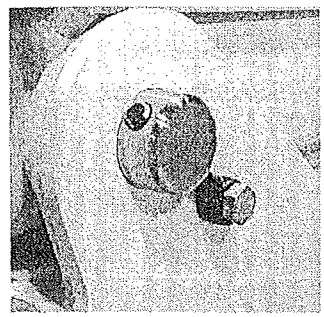
Chrome plated pins are used, such as the lower boom pivot pin. The chrome plating provides long wear for pins used with pre-lubricated bearings. It also prevents rust.

Pay close attention to the information in the Lubrication Chart and Diagram concerning pin lubrication. Proper lubrication of the pins that require it will protect them from corrosion and wear.

Inspect all pivot and mounting pins regularly as described in the Preventive Maintenance and Inspection Checklist.

Pin Retainers and retaining rings are used in several places on the aerial device. A flange and lug type retaining system secures the links of the upper boom drive mechanism. The platform pin is keyed to the leveling chain sprocket at the boom tip.

Forged Pin Retainers

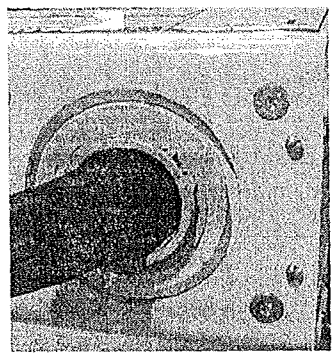


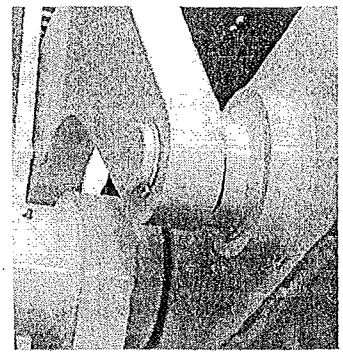
Forged pin retainers are used to retain the pivot pins on the lower boom lift cylinders and on the platform tilt and platform rotation cylinders. It is also known as a buckeye fastener.

During inspection, look for a bent or broken stem next to the eye of the pin retainer. A broken or bent stem may indicate that the bearings within the joint are worn out. Also, if the pin binds within the joint and tries to turn, the stem could bend or break. This is usually caused by a lack of lubrication. Check the bolt through the eye of the retainer. Make sure it is tight.

If you find a damaged forged pin retainer, take the connection apart and replace the necessary parts.

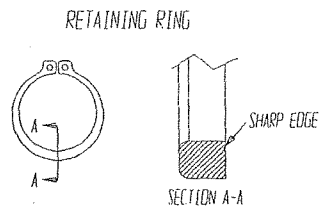
Retaining Rings





Retaining rings are used as a backup retaining system for some pins and as the primary retaining system for other pins. They are commonly called snap rings.

Retaining ring is used as a backup method on the upper boom link pivot pin and as a primary method for the platform mounting bracket.



Install retaining rings with the sharp edge out. This helps prevent the pin from being forced through the pin boss and out the other side.

The pins that secure the links for the upper boom drive mechanism also use a flange and lug retaining system. On the other end of these pins, a lock nut maintains the link in place.

When inspecting any of the pins, check for cracking of the flange weld. Make sure the cap screw is tight.
Any of these conditions are signs that the bearings are binding the pin.

Bearings

The aerial device is equipped with a variety of bearings that are described in this section.

Tapered Roller Bearings

Tapered roller bearings are used at the boom elbow (knuckle). This assembly has two tapered roller bearings with conical seats, two seals, a washer and a lock nut with two set screws (Refer to the following figure 5).

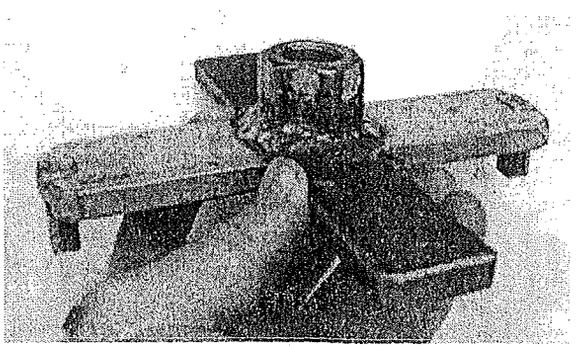
The bearings are lubricated at assembly, and require no further lubrication.

When lateral swing movement happens to the upper boom, the bearing assembly may require adjustment.

A special tool available from Posi-Plus is needed to perform the torquing procedure.

Adjustment procedure:

- Remove the two set screws on the lock ring nut.
- Tighten the lock ring nut to 100 lb-ft (136N-m) while applying a slight side load to the upper boom. This will assist in aligning and preload of link assembly.



Torque tool

- Loosen the lock nut 1/16 turn (approximately 23 degrees).
- Install the two set screws on the lock ring nut, apply Loctite #242 on the threads.

If this adjustment doesn't fix the problem, the elbow will have to be dismantled completely and its components will have to be inspected for wear or cracks. Replace the faulty components, clean and apply a good wheel bearing grease on the bearings and follow the above adjustment procedure.

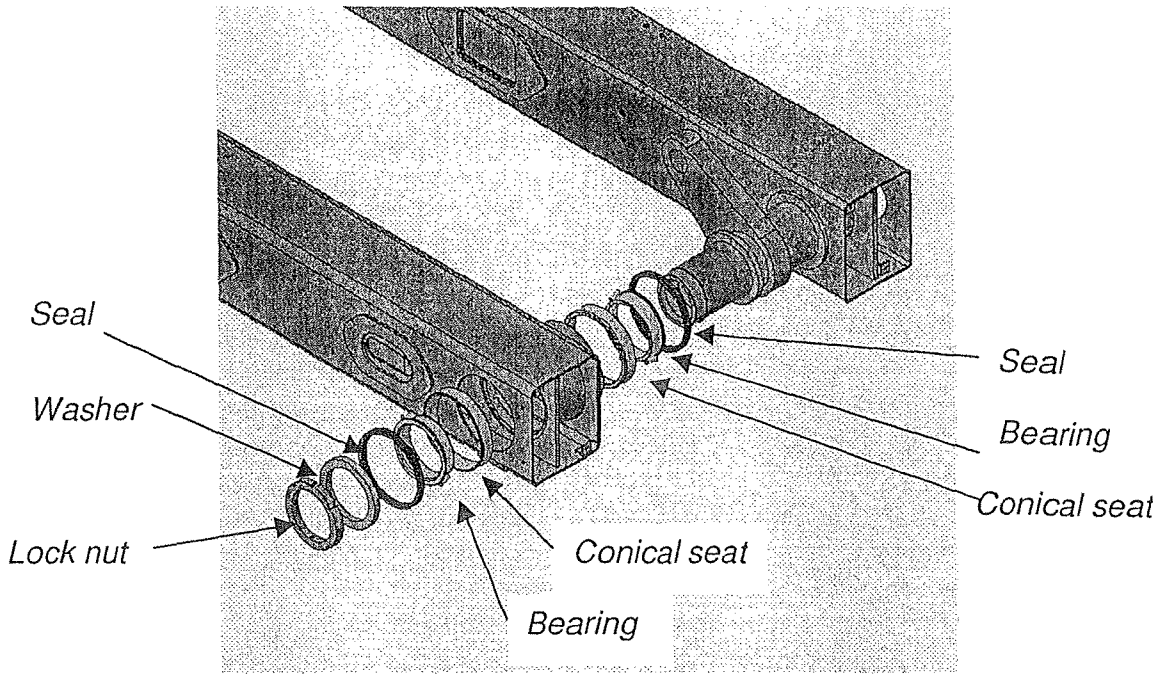


Figure 5 Boom elbow

Spherical Bearings

Spherical bearings are used at rod ends of the upper and lower boom lift cylinders. These bearings are self-aligning and allow the cylinder to follow the movement of the structure, without applying a side load to the internal components of the cylinder. Periodic lubrication of this bearing is required to prevent seizing. It should be lubricated as indicated in the Lubrication Table 4.1, Section 4 of this manual.

Lubricated Bushings

Lubricated bushings are used at the pivot point on the platform shaft, on the boom elbow (knuckle) and on the optional platform rotation assembly. These bushings are made of brass or zinc-aluminum alloy and require a periodic lubrication as stated in the Lubrication Table 4.1, Section 4 of this manual.
These lubricated bushings should last until the overhaul of the unit is done (5 to 7 years). If they are properly maintained and if the unit is never overload.

Pre-Lubricated Bearings

Pre-lubricated bearings are used in several places on the aerial device. They are used at the upper and lower boom link pins, at the cap end of the upper and lower boom cylinders, at all others cylinders' hands and on leveling system sprockets.

The standard pre-lubricated bearing consists in steel backing, a porous bronze inner structure and a covering layer of acetal resin. This layer of acetal resin has pockets, which serve as grease reservoirs.

These bearings should be lubricated initially with grease. It is not necessary to relubricate after the initial application, but the presence or continuous supply of lubricating fluid or grease does considerably extend bearing life. Posi-Plus recommends lubricating these bearings at the interval stated in the Lubrication Table 4.1, section 4 of this manual.

After many years of service, it may be desirable to replace these bearings if the components are disassembled for other purposes. Replacement of this type of bearing due to wear is not a normal consideration.

Measurements

If you desire to measure the bearing to determine when it is worn, several factors must be considered. The only accurate way to measure bearing wear is to keep a record of the clearance between the chrome pin and the bearing. Do this by placing the magnetic base of a dial indicator in a position that allows the clearance between the pin and the bearing to be measured while under load. Take an initial measurement when the unit is

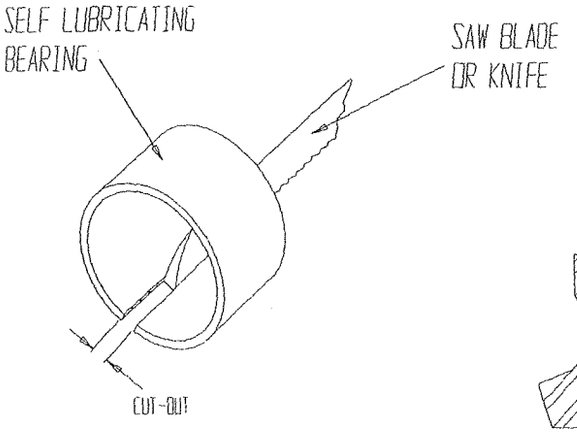
new. This will provide you with a reference point. Then monitor the change in bearing clearance with subsequent measurements.

For pre-lubricated bearings, clearance wear of 0.005" (0,13 mm) from the original diameter of the bearing probably indicates that the bearing needs to be replaced. This figure takes into account only the wear of the bearing. Through the course of time there may also be pin and pin boss wear. Considering the wear of all the components, an overall change in the clearance between the pin and the bearing of 0.020"(0,51 mm) or more indicates that the pin and bearing both need to be replaced.

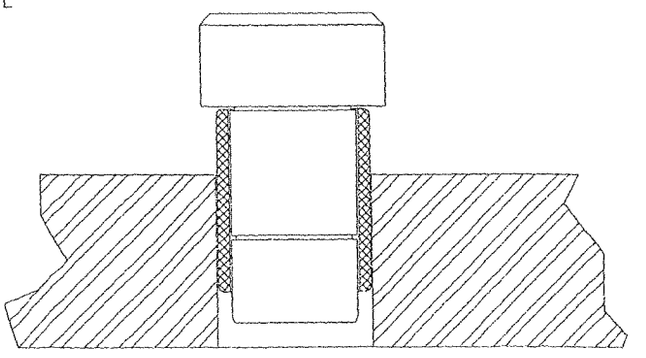
Replacement

The following steps describe how to remove and install pre-lubricated bearings.

1. Drive out the old bearing. If this is not possible, remove it with a die grinder, cut point chisel or hacksaw blade. Be careful not to damage the inside diameter of the bearing boss.
2. Use a screwdriver and needle nose pliers to collapse the bearing and pull it out of the bearing boss.
3. Clean the bearing boss. Do not remove any metal from the inside diameter of the boss surface. If metal is removed from the boss, the new bearing may not fit property in the boss.
4. Place the new bearing on a bearing driver. Line it up with the bearing boss and drive the bearing into place using a dead blow hammer. An old pin may be used as a driver.
5. Inspect the pin before installing the pin into the bearing. If the chrome is flaked, cracked or galled, a new pin must be used.
6. Place the pin through the first pin boss and through the bearing to the second pin boss.
7. Lubricate the open pin boss bore and the head of the pin with an anti-seize compound.
8. Insert the pin through the second pin boss and install the pin retainers.



Removal



Installation

Rotation Bearing

The turntable rotates on a shear ball bearing called the rotation bearing. The inner race is mounted to the turntable. The outer race of the rotation bearing is mounted to the pedestal. The bearing provides for very low torque rotation. Properly maintained, the bearing should provide many years of satisfactory service.

Lubricate the bearing race every four months or 340 PTO hours as described in Section 4 under Lubrication. Also lubricate the rotation bearing gear teeth and the rotation pinion at the same interval.

Two areas of rotation bearing inspection are important. Regular measurement of the clearance between the inner and outer races of the bearing is important. This is referred to as turntable tilt. This measurement can give a good indication of the condition of the bearing. Inspection of the rotation bearing mounting cap screws must be performed to discover any loosening of fasteners.

Rotation Bearing Mounting Cap Screws

Special high-strength cap screws are used to secure the rotation bearing to the pedestal and the turntable. The threads and special hardened flat washers are coated with an anti-seize compound at the time of assembly. The lubrication provided by the anti-seize compound allows for proper tightening of the cap screws when they are tightened with the correct torque procedure. This helps to provide the maximum life of the rotation bearing and the cap screws when the unit is operated properly as recommended in the Operators Manual. The use of lubrication also reduces the torque required to obtain the proper cap screw tightness. It also makes possible an accurate check of the torque of the cap screws when they are inspected during regular maintenance procedures.

Attention

Only use Posi-Plus supplied cap screws to mount the rotation bearing. Do not substitute other types of cap screws.

A torque inspection must be performed 4 months or 340 PTO hours after a new aerial device is put in service. A torque inspection must also be done after this interval if the rotation bearing is replaced or removed and reinstalled. During this torque inspection, the cap screws will be spot checked to be sure they are still at the proper torque. After this initial inspection, a visual inspection is required every three months and a torque inspection is required annually. The following sections describe how these inspections are done.

Caution

Failure to keep the cap screws properly tightened may lead to fatigue failure of the cap screws and consequent damage to the aerial device. Insufficient or uneven cap screw tightness may also contribute to reduced life of the rotation bearing.

Turntable Tilt

The rotation bearing is designed with a tightly controlled internal clearance. The bearing clearance will increase slightly during the initial break-in period. It should then remain essentially constant for many years if it is lubricated properly and not overloaded. As the bearing raceway begins to wear out, the clearance will increase. It should increase steadily at first and accelerate toward the end of bearing life. At this point, operators may notice an increase in the tilting or rocking of the turntable.

The turntable tilt may be measured under load reversal using a magnetic base dial indicator. This is a good way of determining the condition of the rotation bearing. The following section fully describes how to measure the turntable tilt.

Turntable Tilt Measurement

Perform this turntable tilt measurement procedure every 4 months or 340 PTO hours, whichever comes first. Ideally, an initial measurement should also be taken when the machine is delivered.

The following procedure describes how to take the turntable measurement.

1. Lower the outriggers as for normal operation (if equipped). Set the parking brake, chock the wheels and engage the PTO.

2. Raise the lower boom out of the boom rest. Unfold the upper boom until it is vertical. If the aerial device is normally operated most of the time within a particular area of movement, then measure the tilt with the booms rotated to this area. This position should be used each time the tilt is measured.

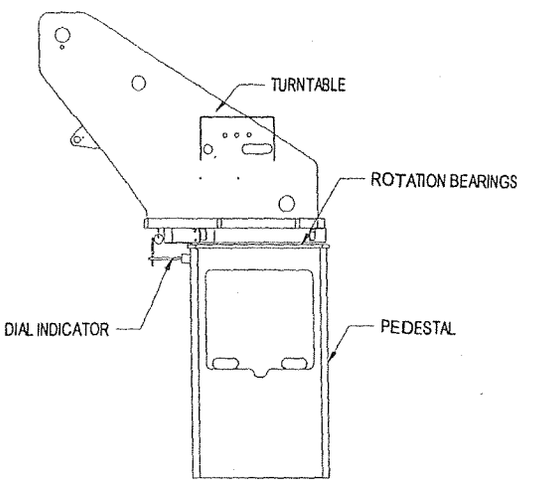
3. Attach the magnetic base of the dial indicator to the side of the pedestal near the top plate, under the front of the turntable. Position the stem of the dial indicator against the underside of the turntable base plate. Center the dial indicator under the lower boom lift cylinder attachment point. Locate it as close as possible to the rotation bearing pinion cover. It may be difficult to position the dial indicator and pointer in some areas without interference of the turntable or pedestal. In this case, position the dial indicator and pointer to the area as close as possible to the recommended position. For consistency of measurement, the same position should be used each time the tilt is measured.

4. Zero the dial indicator in the position.

5. Raise the lower boom until it goes overcenter and stops. Record the indicator reading and date.

6. Repeat Steps 2 through 5 again. Be sure that you have an accurate reading.

7. Remove the dial indicator immediately after this procedure is completed. This will avoid damaging the dial indicator by accidentally rotating the aerial device with the indicator still attached.



The measurement obtained from this procedure includes the affect of deflection of the structures along with the clearance in the bearing. Therefore, it is best if the turntable tilt is measured initially when the rotation bearing is new. By taking the difference between the initial reading and subsequent readings, the constant affect of deflection is removed. This gives a good indication of the increase in bearing clearance. An increase in turntable tilt of 0.065" (1,5 mm) above the initial tilt measurement indicates that the bearing is nearing the end of its useful life. However, in making a decision whether to replace the bearing, you should also consider other factors.

Consider the "feel" of the unit during load reversals. Also, consider any presence of roughness or noise in the rotation, and your experience with other similar units.

If the turntable tilt is measured on a unit suspected of having a worn out bearing without an initial new bearing reading for comparison, it is difficult to know how much is due to deflection. A total turntable tilt measurement of 0.125" (3 mm) or greater is a probable indication of a worn out bearing. However, the factors of feel, roughness, noise and experience must play a large part in the decision to replace the bearing. Also be aware of other factors that cause looseness, such as loose or broken bearing bolts and other mechanical causes.

Initial Torque Inspection Procedure

Perform this initial inspection on new aerial devices after the first 4 months or 340 PTO hours of operation. Perform this inspection at the same interval on aerial devices that have had a new rotation bearing installed.

Attention

It is recommended that a manual torque wrench, accurately calibrated, be used for the inspection of these cap screws. Torque all cap screws to the appropriate torque (Refer to Critical Torque Chart) by applying a smooth pull on the torque wrench without jerking. Do not overtighten the cap screws.

Some seating in of the cap screw threads and mounting surfaces may occur in any bolted joint during the initial break-in period. This causes a partial loss of cap screw tightness without any rotation of the cap screws. A spot check of the cap screw torque is required at 4 months or 340 PTO hours.

Randomly select four to five cap screws on both the outer and inner race of the rotation bearing. Select cap screws that are easily accessible with a torque wrench. Preferably, select cap screws that are evenly spaced around the cap screw pattern.

Apply a torque of 90% of the final torque value with a smooth pull on the torque wrench without jerking. This checks the selected cap screws to be sure they are torqued to 90 percent of the normal installation **(Refer to Critical Torque Chart)**. An accurate torque wrench, calibrated on a regular basis, must be used. If one of these cap screws turns during this procedure, it will be necessary to check the torque on all the cap screws as described under Annual Torque Inspection Procedure. Thereafter, annual inspection and retightening of the cap screws is required. If the rotation bearing is replaced or removed, the same inspection intervals must be followed.

Visual Inspection Procedure

Perform this visual inspection procedure every 4 months or 340 PTO hours, whichever comes first. Visually inspect all rotation bearing cap screws looking for any evidence that a cap screw is loose. Check for loose washers under the heads of the cap screws by trying to turn each washer by hand. If movement is shown, all the cap screws must be retorqued using the following annual torque inspection procedure.

Annual Torque Inspection Procedure

Perform this procedure yearly or if any loose cap screws were found at the initial or visual inspections.

> ***Caution***
>
> Use extreme caution when access covers have been removed to service the unit. Pinch points and shear points may exist between moving parts. Replace the access covers immediately after servicing.

> ***Attention***
>
> It is recommended that a manual torque wrench, accurately calibrated, be used for the inspection of these cap screws. Torque all cap screws to foot-pounds by applying a smooth pull on the torque wrench without jerking. Do not overtighten the cap screws.

Some components may need to be removed inside the pedestal to make the rotation bearing cap screws accessible for retorquing. It is important that only experienced, trained mechanics perform this procedure. They must be aware of the process needed to properly torque rotation bearing cap screws.

1. Understand the entire procedure before starting the torque inspection.

2. Inspection should be done according to the pattern shown in Figure 5.2.

3. Begin with cap screw number one and torque it to the appropriate torque value **(Refer to Critical Torque Chart)**. Watch to see if it rotates before reaching this torque. If a cap screw rotates, it must be replaced with a new cap screw.

   Only use Posi-Plus supplied cap screws to mount the rotation bearing. Do not substitute other types of cap screws. Coat the new cap screw with anti-seize compound on the threads, shank and underside of the head before putting on the washer. Look at the hole in the washer. Notice that it has a more rounded edge on one side of the washer. Install the washer with the rounded edge of the washer toward the cap screw head. Coat the bottom of each washer with the compound after installing it on the cap screw. Reinstall it into the bearing and torque it to the appropriate torque value **(Refer to Critical Torque Chart)**.

4. Torque cap screw number two to the appropriate torque value **(Refer to Critical Torque Chart)**. Check for cap screw rotation.

5. Continue around the pattern, torquing each cap screw and watching it for rotation until the entire pattern is complete.

6. If any of the cap screws rotated when being torqued in Steps 3 through 5, retorque all cap screws again, beginning at number one. Go around in a circular pattern this time instead of in the numbered order.

7. Do Steps 1 through 6 on the inner race of the rotation bearing, referring to Figure 5.2 for the torque pattern.

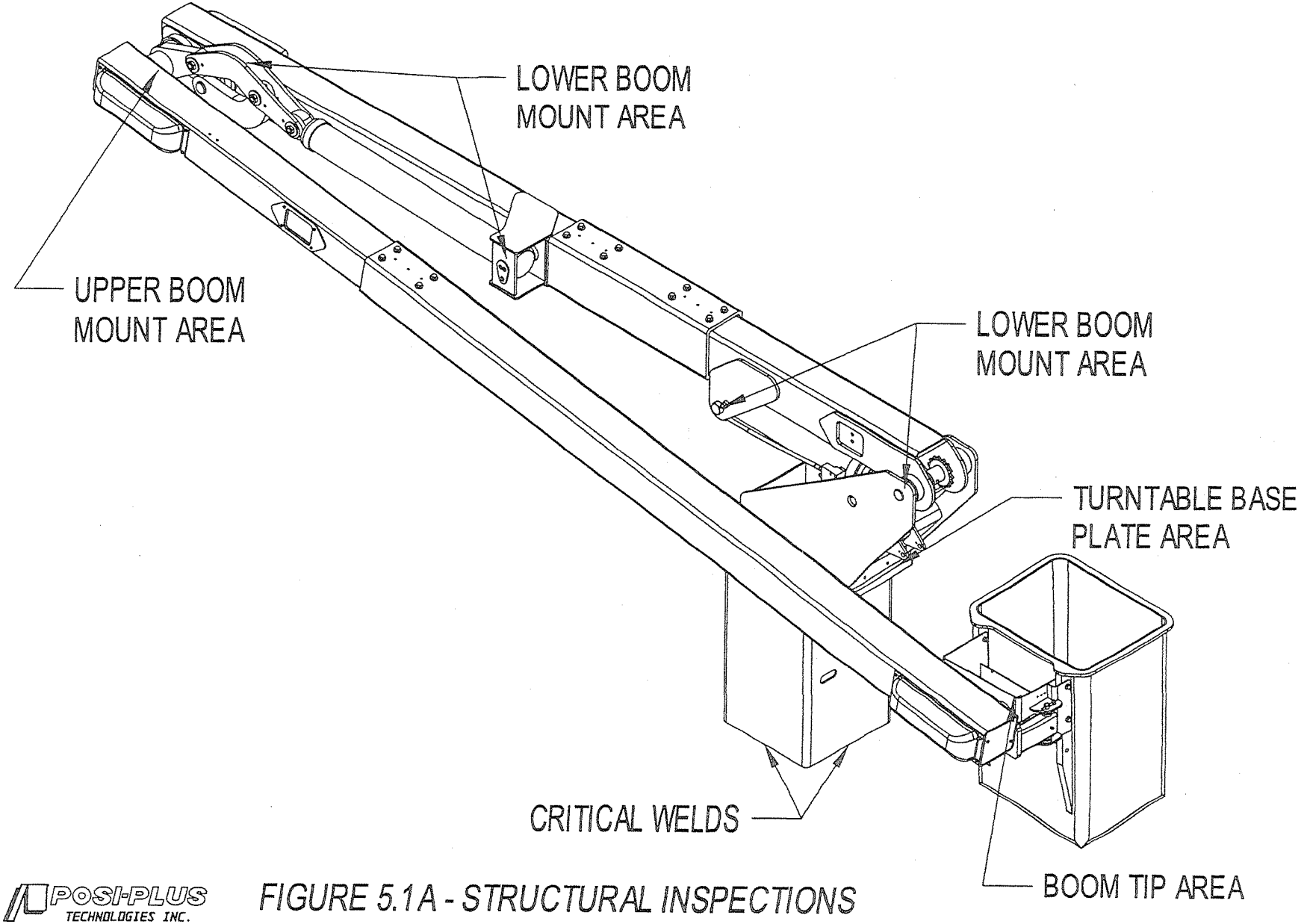


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FIGURE 5.1A - STRUCTURAL INSPECTIONS

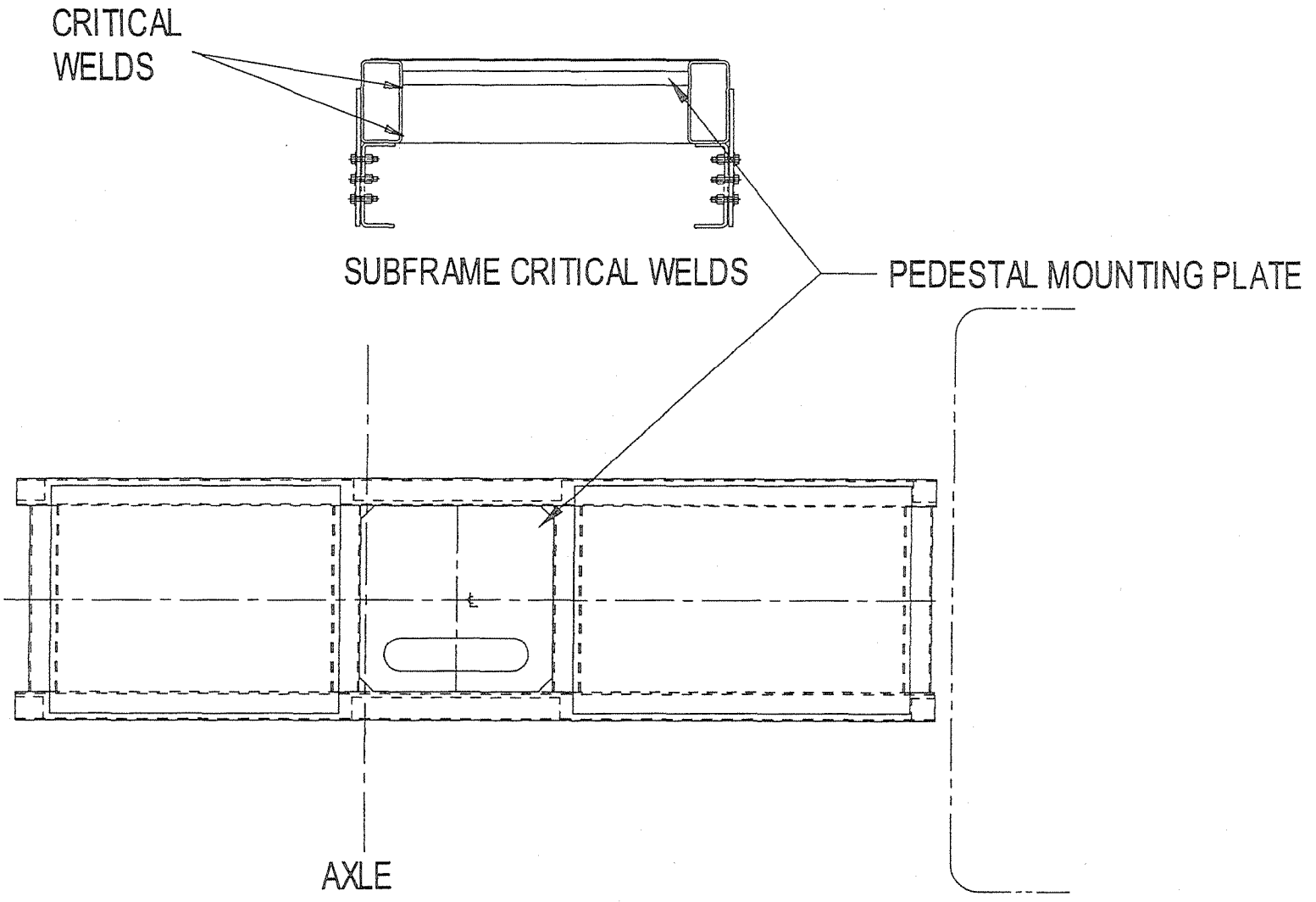

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FIGURE 5.1B- SUBFRAME WELD INSPECTIONS

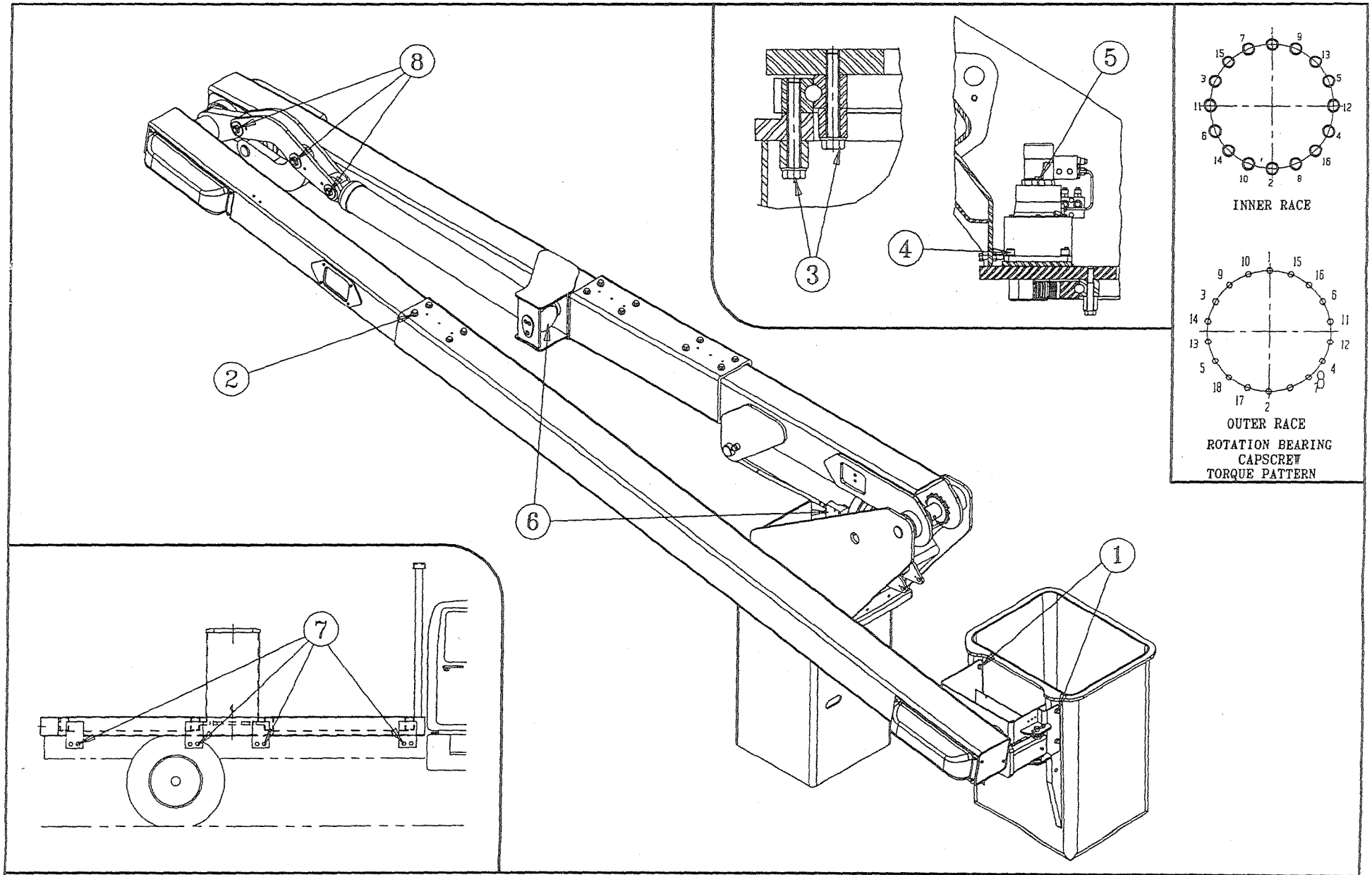

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FIGURE 5.2 - CRITICAL TORQUE DIAGRAM FOR MODEL 200

Section 6 - Fiberglass Components

Fiberglass Care

The fiberglass components are either covered with gelcoat or polyurethane paint to protect the fiberglass and resin composite. The gelcoat contains ultraviolet inhibitors to retard the effect of ultraviolet light on the fiberglass that will lead to fiberglass delaminating. With minimal care, the sealing and ultraviolet properties of the fiberglass can be maintained for many years. The following sections include information on the inspection, cleaning and repair of all the fiberglass components found on Posi-Plus units.

The fiberglass components include :

- Upper boom
- Lower boom insert
- Leveling rods (no gelcoat and not repairable)
- Platform
- upper boom tip covers

Upper and lower boom insert cleaning

The interior and exterior of the fiberglass upper boom and lower boom insert must be kept clean and in good condition to preserve their dielectric properties and appearance. Be certain to clean all components passing through the upper boom fiberglass section. The interior may be cleaned, as necessary, using a pressure washer and directing the stream of soapy water inside the boom. Rinsing with clean water will then remove any detergent residue. Elevate the booms to a vertical position for draining and drying. The booms should be allowed to dry thoroughly before operating the unit.

Warning

Solvents can be extremely hazardous. Follow the manufacturer's label for proper use and disposal.

Attention

Cylinders and other hydraulic components (i.e. hoses) should not have high-pressure water pointed directly at them as water could be forced into the hydraulic system and components could be deteriorated.

In some situations, pressure washing may not remove all of the contaminants from the boom interior. A solvent may be used to clean this type of contamination with some

type of swab device. Suitable solvents, such as acetone or MEK (Methyl Ethyl Ketone), may be used to get at these stub boom areas. Please refer to the precautions and instructions on the solvent selected for this cleaning procedure. This may require removal of some interior boom components, such as leveling rods, chains and hoses. After the contaminated area is swabbed, use the pressure washer and follow up with a thorough rinsing with clean water.

Caution

Use of solvents should be done only with adequate ventilation and with adequate fire protection. Solvents can pose a hazardous breathing situation to the individual. Solvents can also cause fire or explosion if handled incorrectly.

The exterior of the upper boom, lower boom insert and the balance of the fiberglass components previously listed, may be washed with a mild detergent like Costrol degreaser – cleaner or equivalent. When washing these components, take care not to create any surface scratches. Do not use petroleum based products to clean the fiberglass components. Petroleum products will leave an oily residue that attracts dust.

After the exterior surfaces are clean and dry, they should be polished with Formula 5 Clean and Glaze Compound. For the best results, the upper boom and the lower boom insert should be polished by hand.

Caution

Do not coat a fiberglass surface with any product that will reduce its dielectric characteristics or cause surface flashover. (i.e. any product that contains metallic particles)

Attention

Exercise caution when using a power buffer to polish the fiberglass booms. Overuse of the buffer can overheat and damage the gelcoat surface of the fiberglass.

Surface flashover occurs when a substance causes an arcing of electricity between two points on the boom. If this occurs, the dielectric integrity of the boom is permanently damaged.

Inspection of FRP booms

Inspect fiberglass components for cleanliness and any visible damage such as scratched, cracked or chipped gelcoat. Repair minor defects to maintain the cosmetic beauty of the booms. Surface irregularities may trap dirt and contaminants, which over time may reduce the dielectric properties of the fiberglass section. Of particular concern are irregularities running lengthwise on the boom. Trapped contaminants (dust particles and water) may cause tracking, providing a path to ground or possible dielectric failure.

Search for signs of looseness or movement at the bond areas (fiberglass to steel connections) at the upper boom elbow, lower boom insert and ends of the leveling rods. If the fasteners on the booms are properly tightened and the chemical bond is good (wherever applicable), it is very unlikely any damage will be found. If the chemical bond has failed, and the aerial device is operated for a prolonged period using the mechanical backup fasteners only, cracks or elongation of the holes may develop in the fiberglass around the fasteners and the fasteners will begin to show frictional wear. The chemical bond is present on some models. The units that do not have a chemical bond, have sufficient fasteners torqued to prevent any noticeable boom movement, thus any wear.

Gelcoat damage such as chips and scratches on the booms, jibboom and material handling jib covers, are examples of repairable damage. If no fiberglass cloth fibers are cut or damaged, determine if the scratch or nick affects only the gelcoat or if it is through to the resin. To do this, look at the color at the bottom of the scratch. If the color at the bottom of the scratch is white, the damage is on the surface. This damage is minor and can be sanded out as described in this section under Surface Damage.

If the color at the bottom of the scratch or nick is dark, and there is no visible damage to the layers of fiberglass cloth, the damage is through the gelcoat and just into the resin. This requires a more thorough repair of the gelcoat and is described in this section under Gelcoat.

If a boom has several inner fiberglass cloth layers damaged or cut, it may not be repairable. At this point, the boom's strength may have been reduced and repairs will not regain the original strength. If such damage is discovered, do not attempt any repairs until a Posi-Plus engineer has been contacted. Only the Posi-Plus engineers are authorized to evaluate the effect of the damage on the structural integrity of the boom and determine if the damage is repairable or if the boom must be replaced.

Follow these steps in order to determine the degree of boom damage:

1- Identify the wall on which the damage has occurred (i.e. bottom, top, side).

2- Identify the exact area along the boom's length (or the lower boom insert) where the damage occurred. To do this, measure from the low end of the boom to the damage site (i.e. - 24" from the low end of the boom).

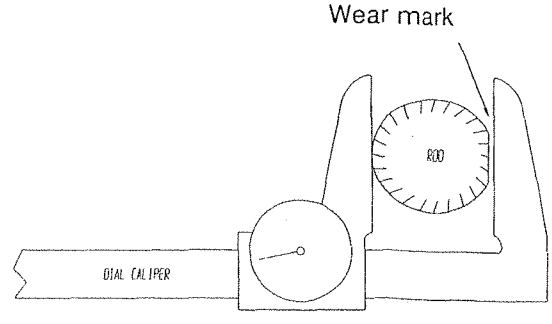
3- Define the size and the cause of the damage (i.e. - 3" long x 1/2" wide x 1/8" deep).

4- When calling your Posi-Plus service representative to describe the damage in question, be certain to explain where the defect is in relation to the unit (i.e. - curbside of unit, facing the low end of the boom in the stowed position).

If the top lip, mounting flange (or rib), or bottom of the platform is damaged, repair should not be attempted. For information on repairable platform damage, refer to the information under "Repairs".

Leveling Rod Inspection

The leveling rod's entire length must be inspected for wear marks. Wear marks will have a dull appearance. This dull area may show a flat, worn into the round surface of the rod.



The causes(s) of the wear must be determined and corrected. Generally, wear marks are caused by the rod contacting a steel edge. Wear marks are not usually caused by the inside diameter of the fiberglass boom. Be certain all metal edges have the burrs removed.

Should a significant wear flat area or several wear flat areas be discovered along the length of a leveling rod, contact your Posi-Plus service representative. The recommended method for determining an accurate measurement of the wear is to use a dial caliper.

Use the following instructions to determine an accurate measurement of leveling rod wear:

1. Measure an unworn section of the leveling rod to establish its true diameter.

2. Measure the wear groove. Use the deepest portion of the wear groove in the wear mark for this measurement. Subtract the measurement found in Step 1 from this measurement. This difference is the depth of the wear groove.

These measurements are an invaluable tool for Posi-Plus to assist in the decision regarding the allowable wear standards on the leveling rod(s) in question. One possibility is to recommend that the rod(s) be placed on a 4 months or 340 PTO hours inspection list to ensure that these wear marks do not continue to increase. The other possibility, of course, is replacement of the rod(s) before the unit can be safely placed back into service.

Normal operation and maintenance should minimize the possibility of wear or scratches on the leveling rods. Small wear marks need to be documented, their possible causes(s) corrected, and rechecked at another inspection to make sure that they have not increased in size.

The leveling rods are crimped onto steel rod ends. The leveling rods are first machined, then the appropriate steel rod end is crimped (or compressed) on the fiberglass rod end. A jig is used to position the fiberglass rod end precisely into the steel rod end. This jig aligns the groove on the rod with the compression points on the jig.

A silicon joint is made around the circumference of the rod to join the steel rod end to the fiberglass rod. This silicon joint is a guide that shows if the fiberglass rods have been over stressed.

It is very important to note that prior to obtain a complete separation from the rod end assembly, the fiberglass rod will have longitudinal cracks that will confirm that the fiberglass rod has collapsed. Eventually this will induce the failure of the rod end assembly.

If the silicon joint has separated by 1/16" or more from the rod end, then the leveling rod assembly must be replaced. However, a fiberglass rod must not be replaced before the cause of the silicon joint separation has been found and that the problem has been resolved.

The fiberglass assembly lengths may vary without affecting the leveling system assembly. This is possible because of the use of the turnbuckles. These turnbuckles can take up to a total of 1" in fiberglass rod assembly lengths.

Replacement of the leveling rods and adjustment of the leveling system is explained in Section 8 under Leveling System.

Repairs

Repair procedures for all of the fiberglass components on the unit are described in the following text.

Surface Damage

Minor scratches in the surface of the gelcoat may be easily repaired. If the bottom of the scratch is the same color as the gelcoat pigment, repair according to the following instructions:

> ***Caution***
>
> Wear safety glasses and a dust mask while sanding. Small dust particles can get into your eyes and lungs. These particles may be hazardous to your health.

1. Use a dual acting sander with 320 grit sandpaper to sand the scratched area. Move the sander to sand around the perimeter of the boom. Do not sand lengthwise on the boom.

2. When the scratch has almost disappeared, sand by hand with a 600 grit wet or dry sandpaper until the scratch is no longer visible.

3. Use Formula 5 Clean`n Glaze to finish polishing the area.

Gelcoat repairs

Before making any repairs to the fiberglass on the upper boom or the lower boom insert, first determine how serious the damage is. To do this, inspect the damaged area thoroughly as previously detailed in this section.

Any scratch that is dark at the bottom is through the gelcoat and into the resin below.

In order for the gelcoat repairs to cure properly, the following special considerations to temperature must be understood:

1. The temperature must be 70°F (20°C) or higher. Ideally, the highest quality gelcoat repairs are accomplished indoors in a well-ventilated and heated area.

2. If the vehicle has been outside and the temperature is less than 70°F (20°C) or if this is a field repair, the boom area must be warmed up before proceeding. To do this, use a heat gun to warm the fiberglass area to be repaired. Warm the fiberglass until it is warm to the touch. It will take approximately 40 minutes to do this. A paint stripper gun will provide a faster method of warning the fiberglass. Do not concentrate the heat of the gun in one specific area for any length of time.

Attention

Take great care not to burn the gelcoat. Continually move the heat gun and/or the paint stripper gun during this warning process.

3. If the weather is extremely cold, a field gelcoat repair is not suggested. Make shift tents over the repair area will not hold sufficient heat and will prevent a proper curing process. Please follow the specific gelcoat repair suggestions listed previously.

Caution

Wear safety glasses and a dust mask while sanding. Small dust particles can get into your eyes and lungs. These particles may be hazardous to your health.

The following steps describe how to repair scratches and nicks in the gel coat:

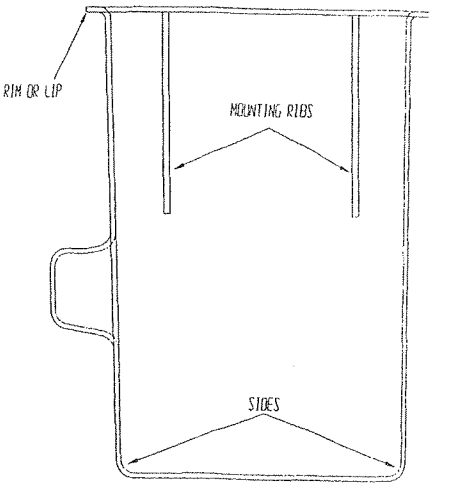
1. Use a die grinder to widen the scratch to 1/8" (3 mm). Do not grind to deep. Keep the opening above the fiberglass cloth.
2. Inspect the scratch. Make sure that no fiberglass cloth is cut. If the fiberglass cloth is cut, contact your Posi-Plus service representative. If no fiberglass cloth is damaged, bevel the edges of the 1/8" (3 mm) cut to about 45 degrees.
3. Lightly sand the damaged area by hand to rough it up. This will help the resin bond to the surface.
4. Use acetone to clean the area and remove any dust.
5. Repair pin holes and notches with polyester putty, such as "Wurth Fins spartel" # 9931020 or equivalent
6. Apply one coat of "Poly surfacer", let dry for 2 hours and sand with paper # 220 and # 320.
7. Apply the "Primer surfacer EP" and let dry for 30 minutes. Verify the surface and correct it if necessary.
8. Apply one coat of polyurethane paint and let dry for 30 minutes.
9. Apply another coat of paint and let dry for 8 hours.
10. Use Formula 5 Clean`n Glaze Compound to polish the area.

Material recommended (or equivalent):

"Poly surfacer": Sikkens # 002006 with hardener Sikkens UN # 3105 (1 liter of primer - 50 ml of hardener).
"Primer surfacer EP": Sikkens # T001097 with Sikkens Autocryl epoxy hardener rapid # 04113 and Autocryl Reducer slow US # 005108 (2 primer - 1 hardener - 10% reducer).
Paint: Sikkens Autocryl with Sikkens Autocryl epoxy hardener rapid # 04113 and Autocryl Reducer slow US # 005108 (3 paint - 1 hardener - 1 reducer).

Platform

The first step in successful repair is to analyze the damage and determine the cause. Cracks in the gelcoat or outer surface of the platform are easily repaired. Damage to the fiberglass structure can be more serious and should be carefully evaluated before attempting to repair the platform.



Structural components of the platform include the lip area, mounting flanges or ribs, platform sides and the bottom. The structural integrity of the platform is critical in determining whether or not the platform can be successfully repaired. The platform bottom and the side with the mounting ribs are substantially thicker than the other three sides. The mounting ribs are the area where the platform mounting bracket bolts to the platform. These factors must be considered when determining whether a successful repair can be made on the platform bottom or mounting rib side.

Your Posi-Plus service representative cannot determine how to repair the platforms in the field. You must evaluate the platform damage and determine whether it can be repaired and safely used for future service. Posi-Plus Technologies does not recommend that repairs be made to platforms which have the following damage:

- Cracks through the fiberglass of the mounting ribs, and/or;
- Cracks through the fiberglass of the lip, and/or;
- A hole through the floor or mounting rib side of the platform.

Warning

Any holes in the platform, whether intentional or by accidental damage, are a violation of ANSI A92.2 or CSA C225, Section 4.9.5 and should never be permitted. Holes in the liner render them useless as a protective device. Dielectric integrity therefore will not be possible.

If a customer elects to make repairs in any of the non-recommended areas, Posi-Plus Technologies assumes no responsibility. Posi-Plus Technologies also assumes no responsibility for platform repair performed by persons other than Posi-Plus trained personnel. Platform that are returned to Posi-Plus Technologies for repair are evaluated by Posi-Plus personnel and then may either be repaired or removed from service, depending on the extent of the damage.

The following equipment and materials are required to perform field repair of the platform:

- Circular grinder with 24 grit sandpaper
- Dual acting (D.A.) sander with 320 grit sandpaper
- Acetone (cleaning solvent)
- Fiberglass cloth or mat
- Polyester resin
- Good quality rubber gloves
- Dust mask
- Safety glasses
- Spray paint to match the platform (must be non-metallic, such as Dupont Imron)

The steps listed below may be used as a guide in making a quality field repair:

1. Outline the damage with a box that is one inch wider on all sides of the damaged area. (i.e. - If the damage is 1" x 3" (25 x 75 mm), the box would be 3" x 5" (75 x 125 mm)).

Caution

Wear safety glasses and a dust mask while sanding. Small dust particles can get into your eyes and lungs. These particles may be hazardous to your health.

2. While wearing a dust mask for breathing protection and safety glasses, grind the area within the box to a depth of approximately 1/8" (3 mm).

3. Cut strips of fiberglass cloth to fit the box area.

4. Clean the area thoroughly with acetone.

5. While wearing rubber gloves, mix the approximate amount of polyester resin and catalyst according to the directions in the fiberglass repair kit.

6. While wearing rubber gloves, saturate the fiberglass cloth with the mixed resin and apply it to the damaged area. Work the area to squeeze out any trapped air bubbles.

7. After the resin has set up completely, grind off any rough areas or high spots.

8. Measure an additional cup of resin and catalyst according to the directions in the repair kit and apply smoothly to completely cover the affected area.

9. Sand the area with the dual acting sander and 320 grit sandpaper.

10. Paint the area to match the platform.

Danger

Do not apply metallic paint to the platform. Metallic paint conducts electricity. Occupying a platform that conducts electricity and is in proximity to electrical conductors may result in serious Injury or death.

Damage to the gelcoat layer of the platform may be repaired using the instructions under "Gelcoat repairs" section. The gelcoat is for cosmetic purposes, as well as providing a protective layer of ultraviolet inhibitors. The gelcoat layer has no inherent strength.

More specific repair information for a particular situation should be requested from your Posi-Plus service representative. Before making any repair, the structural integrity of the platform and the safety of the operator must be kept in mind.

Upper Boom Tip Covers

The repair procedures described for platform repairs may also be used for repairs on the various types of fiberglass upper boom tip covers.

Excessive Current Leakage

A) The most frequent reasons to justify the reduction in dielectric strength are stated below:

- Dirty boom sections (water, soot, grease, etc.).
- Contaminated hydraulic oil.
- Dielectric breakdown of leveling rods.
- Hydraulic hoses in booms.
- Bridged boom section. (i.e. rope, tools, steel wires).
- Dielectric breakdown of fiberglass boom sections.

B) Here are the approach in correcting the above problems:

- Thoroughly wash booms per Section "Fiberglass Components" of this manual. Wash outside first; then, if necessary, remove hosing and leveling system and wash the inside of the boom sections.
- Send a sample of the hydraulic oil taken from the drain outlet for analysis. The results of the testing will indicate action to be taken. If the oil is contaminated, then the replacement oil must be installed, as the complete hydraulic oil system is being purged.
- Replace leveling rods.
- Check all hydraulic hoses; replace any braided hoses that enter the booms by non-conductive hoses only.
- Eliminate what is creating the bridge.
- Replace fiberglass section.

The F.R.P. upper boom and the lower boom insert are periodically dielectric tested to verify their current leakage amperage. This current leakage indicates the dielectric strength of the F.R.P. booms.

If the current leakage exceeds the maximum allowable current leakage establish by the ANSI A92.2 or CSA-C225 standard (whichever is applicable), then the causes of this reduction in dielectric strength must be found and the problem must be corrected.

UPPER BOOMS' CONTROLS

UPPER TOOLS OUTLETS
192-1151-010-XX-1

4 -6 GPH
2000 PSI

TOOLS OUTLETS/
AERIAL DEVICE/
EMERGENCY STOP
100-107-305

100-107-311

100-127-201

192-0004-004-XX-1
100-066-035

LOWER BOOM CYLINDER
500-3320-013-XX-2

BOOM ROTATION
194-9111-001-XX-2

UPPER BOOM CYLINDER
500-9142-006-XX-2

500-9142-006-XX-2

BOOM DOWN PRESSURE
192-0020-001-XX-2

UPPER CONTROL

UPPER CONTROLS/
LOWER CONTROLS/
EMERGENCY STOP
100-107-300

3500 PSI
PWR BYD

100-006-303

100-090-002

ABOVE ROTATION
BELOW ROTATION

100-093-015

100-115-008
100-093-002

100-320-157
7.5 - 10.7 GPM
IDLE: 700 RPM
1000 RPM

100-010-002
5 PSI

HIGH PRESSURE FILTER
100-355-030

EMERGENCY PUMP
100-349-015

192-6014-004-XX-1
199-6001-001-XX-1
ORIFICE (0.120")

AUTOMATIC THROTTLE PRESSURE SWITCH
(100-348-021)
1250 RPM
400 PSI

C ---- CONTINOUS ROTATION

POSI-PLUS TECHNOLOGIES INC.

TITLE:
HYDRAULIC SCHEMATIC AERIAL LIFT 200 SERIES

DRAWN BY: JF S	APP: S.L.	SCALE: 1:1	DATE: 02-11-27
REF.: JOB 101954-101962		DRAWING NUMBER:	JOB 1-954-001-00-4

REV.	DESCRIPTION	DATE	BY

Section 7 – Hydraulic System

General Operation

The 200 series aerial device uses a full pressure hydraulic system with opened center valves.

The boom functions at the upper controls and the lower controls are configured as an open center system. This means that oil will flow through the valve in the neutral position as soon as the PTO / Pump is engaged.

The outriggers and ground level tools valves are also open center. When the controls are in the neutral position and the Aerial device/Outriggers-Tools selector is in the Outriggers-Tools position, oil circulates through the outriggers and tools control valves and back to the tank.

The hydraulic system is described as a full pressure system. This means when a boom function is operating, the hydraulic system pressure increases to full system pressure.

All the control handles on the unit are connected to the control valves. The control valves direct hydraulic pressure and flow to operate the actuators. Actuators are cylinders and motors that power the unit's functions.

When a control handle is moved, a spool inside the control valve is manually shifted. The spool directs hydraulic pressure and flow to the actuator. The pump responds by increasing output pressure. The maximum pressure on the pump compensator is set at 3000 PSI.

As the function operates, the control handle meters hydraulic oil flow and pressure as oil passes through the spool to the actuator. The pump compensator regulates flow from the pump to maintain an output pressure of 3000 PSI. Therefore, the pump will provide the flow needed to move the function at the desired speed.

If the aerial device is not equipped with an automatic throttle, when the high-speed throttle is not necessary, the low speed throttle should be selected. This will avoid both, the full flow to circulate back to the tank and build up excessive heat in the system.

External Leakage

If components and connections are installed properly, leakage can be kept to a minimum. Small external leaks are usually easy to find because dust will collect on the hydraulic oil film.

External hydraulic leakage is leakage of hydraulic oil to the environment outside the hydraulic system. Fittings that are improperly tightened are a primary cause of external

leakage. Keep all hydraulic connections tight to prevent external oil leakage. Follow the torque and tightening specifications explained in this section under "Hoses, Tubes and Fittings" to properly tighten hydraulic fittings.

Caution

Hydraulic oil escaping under pressure from a faulty connection, hose, pinhole, cracked tube, etc. may not be visible, but can have enough force to penetrate the skin and inject oil into the flesh. Never use your hands, or any body parts, to check hydraulic lines and fittings for leaks under pressure that are not visually obvious.

In case of injury by escaping hydraulic oil, seek medical attention at once. Serious infection or reaction can result if medical attention is not given immediately.

Keep the unit and work areas clean. Spilled hydraulic oil creates slick surfaces and may cause personnel to slip and/or fall.

If a connection is properly tightened but continues to leak, disassemble the connection. Seal the necessary parts and/or replace the part that is the source of the leakage.

Worn or damaged parts also may cause leakage. For example, scratched cylinder rods will cause leakage. A worn or scratched output shaft on a hydraulic motor will also cause leakage. Such conditions must be repaired or replaced. The parts should also have a new seal.

The component drawings in the Parts Manual give the Posi-Plus part number for the seal kits. Disassembly and repair of such components must be performed by skilled mechanics who are trained and qualified by Posi-Plus Technologies Inc. in such procedures. Repair and disassembly must be performed in a clean, properly equipped shop.

Hydraulic cylinder piston nuts and end glands must be torqued to the proper values at assembly. Torque specifications for cylinder end glands are given on the corresponding parts pages in the Parts Manual. Many cylinders have piston nut and end gland retention devices such as cotter pins and setscrews. These retention devices must be installed properly.

Warning

Under torquing or over torquing a cylinder piston nut or end gland retention device may cause cylinder failure. Improper installation of a piston nut or end gland retention device may also cause cylinder failure. Cylinder failure may result in property damage and/or personal injury.

Internal Leakage

Internal leakage allows pressurized hydraulic oil to escape to tank or another hydraulic circuit.

Internal leakage can cause a variety of problems in a hydraulic system. Internal leakage in a cylinder can cause drifting or malfunction of a cylinder. Leakage past a holding valve in a cylinder can also cause drifting or malfunction of the cylinder. Internal leakage in a rotary joint will cause functions to slow down and/or fail to build pressure.

Internal leakage can usually be stopped by replacing the seals in the leaking component. It may also be stopped by replacing the holding valves in the component. However, there are some types of damage, such as scoring of the inside of a cylinder barrel, that require more extensive repair.

Only qualified and trained professionals are permitted to remove scratches from the inside of the cylinder barrel.

> ***Warning***
>
> If the internal size tolerance of the cylinder barrel is exceeded, the piston seal could be pushed out (extruded) when the cylinder is put under a load. This will cause cylinder failure. Cylinder failure may result in property damage and/or personal injury.

The component drawings in the Parts Manual give the Posi-Plus part number for the seal kits. Posi-Plus does not recommend disassembly and/or repair of cylinders in the field. Disassembly and repair of such components must be performed by skilled mechanics who are trained and qualified by Posi-Plus Technologies Inc. in these procedures. Repair and disassembly must be done in a clean, properly equipped shop.

Cylinder piston nuts and end glands must be torqued to the proper values at assembly. Torque specifications for cylinder end glands and piston nuts are given on the component drawings in the Parts Manual. Many piston nuts and end glands have retention devices, such as cotter pins and setscrews. These retention devices must be installed properly.

Heat Generation

Internal leakage allows pressurized hydraulic oil to escape to tank. This creates excessive heat in the system. The amount of heat in the system has a direct relationship to the pressure and volume of leakage.

If excessive heat occurs, find and correct the cause immediately. Overheating reduces the operating efficiency of the aerial device. It may cause functions to stop working. It damages seals throughout the system. Heat also shortens the life of the hydraulic oil.

The following conditions cause heat generation:

- Excessive pump speed during high flow operations;
- Worn or faulty pump;
- Defective relief valve cartridge in the machine/ground level functions selector valve;
- Contaminated spool in a control valve;
- Low hydraulic oil level;
- Improper hydraulic oil;
- Internal leakage in the unit/ground level functions selector valve;
- Internal leakage in the station selector valve;
- Internal leakage in the rotary joint;
- High speed throttle selected without operating functions.

Hydraulic Components

The 200 model can be equipped with many optional or custom equipments. The following sections describe each major component of the hydraulic system for the standard aerial device equipped with the standard options. Always refer to the specific hydraulic schematic of your unit for the controls installed and their adjustments.

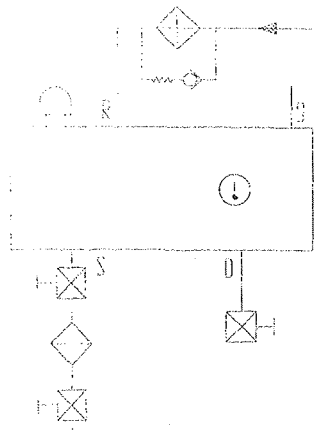
Each of the following sections gives a description of the component, the JIC symbol for that component and a picture of the component.

The term "position" describes the number of possible operating positions of a hydraulic valve. For example, a blocking valve has two positions, open and closed. An outrigger valve has three positions, centered (neutral), extend and retract.

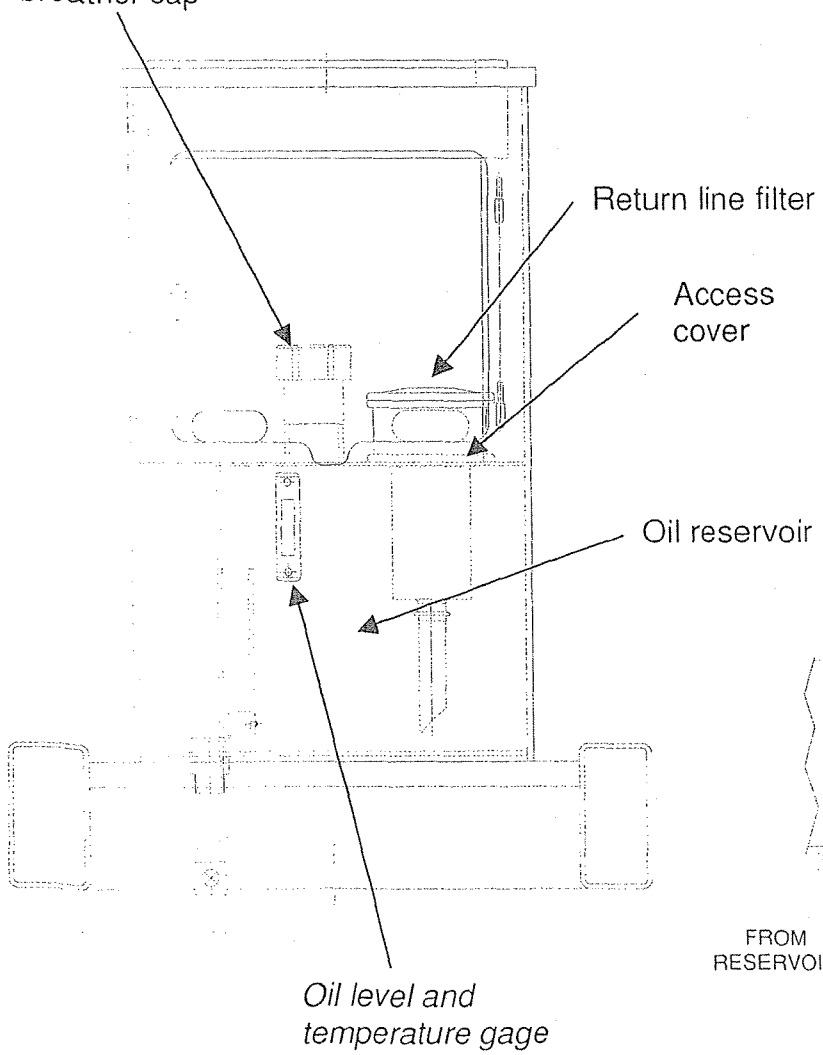
The term "way" describes how many ports are in the valve section. For example, a four-way valve has four ports. One port is a pressure connection. Another port is connected to tank. The other two ports are "work ports". They are connected to actuators.

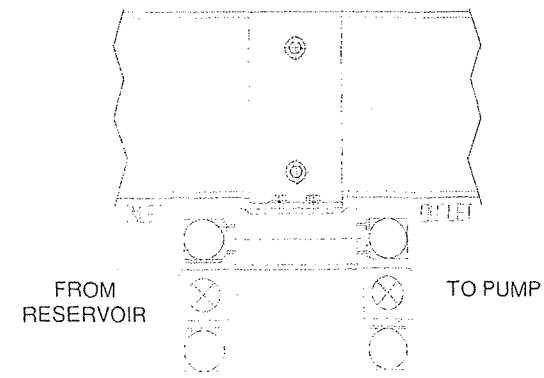
Hydraulic Oil Reservoir

The standard reservoir for the aerial device has a 27 U.S. gallons (102 liters) capacity.
A 10 microns suction filter is located at the outlet of the reservoir and a 3 microns return filter is located at the inlet. A filler breather cap is also located on top of the fill hole of the reservoir. The cap contains a filter that cleans the air as it enters the hydraulic system. The cap also has a strainer basket that keeps large particles from entering the reservoir when oil is poured into it. The reservoir has a level sight gauge and a drain valve. Refer to Section 3 under Filtration for more information on the oil filters.



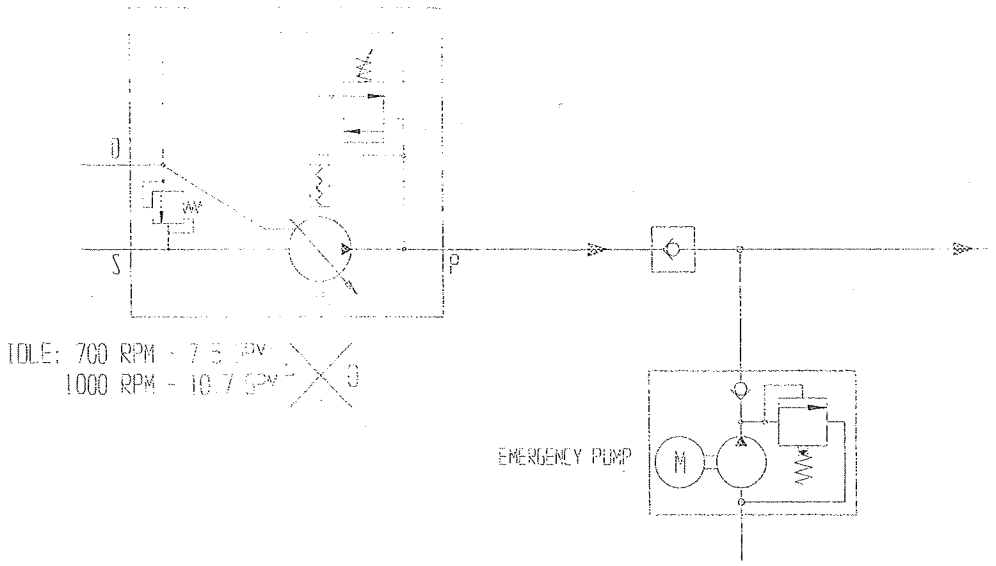
Filler breather cap



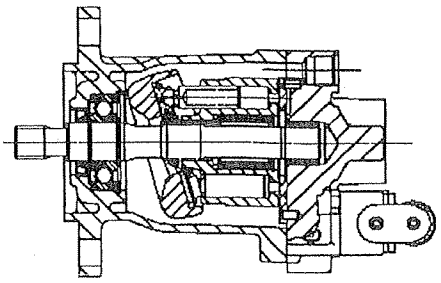


Suction line filter
10 microns

Hydraulic Pump



The variable displacement piston pump is equipped with a pressure compensator control. This control automatically varies the pump displacement to meet the system flow demand for a constant system pressure. Displacement start to reduce to zero within 200 PSI of the compensator setting. The pump has three hydraulic ports: inlet (suction), the outlet (pressure) and the case drain.
The pump maximum pressure in the hydraulic system is limited to 3000 PSI.



PVE12

Hydraulic Pump Start-Up

Before starting pump, the case and the hydraulic lines **MUST** be completely filled with clean and prefiltered hydraulic oil.

Make sure that the suction line is filled all the way to the pump inlet port. Crack a fitting on the outlet side of the pump to purge trapped air. With a minimum engine speed of 650 RPM, a pump should prime almost immediately.

Drain line should be connected at the highest possible point of the pump case to allow evacuation of air and maintain maximum lubrication of moving parts. Drain line should also be free back to tank and has the outlet located below oil level.

NOTE: Failure to prime within a short length of time **WILL** result in pump damage due to lack of lubrication or pump cavitations. Inlet lines must be tight and free from air leaks.

Care

Cavitations and aeration are two problems that can cause pump damage. However, pump damage can be prevented or minimized by promptly finding the source of the problem and repairing it.

Pump cavitations occurs when inlet oil does not entirely fill the cavities that open during the intake part of the pumping cycle. The characteristic sound of cavitations is a high-pitched scream. This sound increases with the degree of cavitations and increased flow. The following is a list of possible causes of cavitations:

- Excessive pump operating speed;
- Clogged suction filter;
- Excessive oil viscosity (thickness);
- Restrictions, sharp bends or excessive length of inlet hose;
- Pump inlet too high above reservoir level;
- Shutoff valve in suction line not fully open.

> ***Attention***
>
> Cavitations can very quickly destroy the pump. If you notice signs of pump cavitations, determine the cause of the problem. Promptly repair the problem.

If you have pump cavitations from excessive oil viscosity because of cold temperature, allow the oil to warm up at a slow pump speed.

Aeration is another condition that can damage the pump. Aeration occurs when air bubbles are introduces into the hydraulic oil and carried along as the oil flows through the pump. Aeration can be caused by the following conditions:

- Low oil level in the reservoir. This causes a whirlpool at the suction line opening, which sucks air into the system along with oil.

- Leaking connections in the suction line between the reservoir and the pump.

- Return line outlet is located above the oil level in the reservoir. This causes turbulence as the return oil stream discharges above the surface of the oil.

Attention

Promptly repair conditions that allow air to enter the suction side of the pump. Serious pump damage is likely if the pump continues to run with air circulating through it.

An air leak in the suction line can occur even if there is no oil leakage when the system is shut down. A leak in the suction line can often be located by slowly squirting clean hydraulic oil around each connection in the suction line. Do this with the pump running at normal operating speed. A suction leak will suck the oil in, and the pump may temporarily run quietly as the oil seals the air leak. The leak can then be eliminated.

When aeration is occurring, the oil in the reservoir is likely to become foamy. The pump may also become noisy.

Loose pump mounting bolts can permit misalignment of the pump shaft. This may lead to excessive shaft seal wear and bearing failure. Check the mounting bolts for tightness every 4 months or 340 PTO hours, whichever comes first.

In case of catastrophic pump failure, the hydraulic system must be flushed. This procedure is described in Section 3 under Changing Oil and Flushing the Hydraulic System. Flushing the hydraulic system will remove most of the metallic contamination from the system.

Before servicing the pump, close the shutoff valve in the suction line between the reservoir and the pump to be serviced or removed without draining the reservoir. When service is completed, replace the cover and open the shutoff valve.

Attention

The shutoff valves in the suction line between the reservoir and the pump must be completely opened before engaging the PTO. Failure to do so will cause serious damage to the pump.

A slow down in aerial device movement may indicate a worn of faulty pump. To determine the full flow output of the pump, perform the following steps:

1. Put a tee in the pressure line of the pump. Connect the other port of the tee fitting to a flowmeter. The flowmeter should then be connected to tank.
2. Observe the reading on the flowmeter. It should read approximately 7 GPM at 700 engine RPM on standard units. If pump flow is less than this, the pump may be faulty or worn out. Refer to the applicable hydraulic schematic for the pump flow

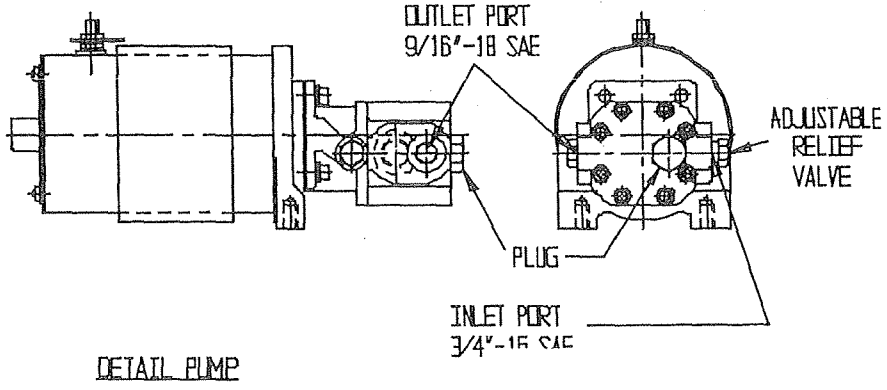
applicable to this unit. Determine the cause of the problem. Repair or replace the pump.

Emergency Lowering DC Pump

The emergency lowering DC pump and motor assembly has two hydraulic connections: the inlet (suction) and the outlet (pressure). This assembly has an internal check valve to prevent oil from entering the pump during normal operation. The pump also has an internal relief valve which is set during installation. The pump is a fixed displacement pump with an output of less than 1.2 GPM. The motor may receive its 12 Volt DC power from the truck battery or an auxiliary battery.

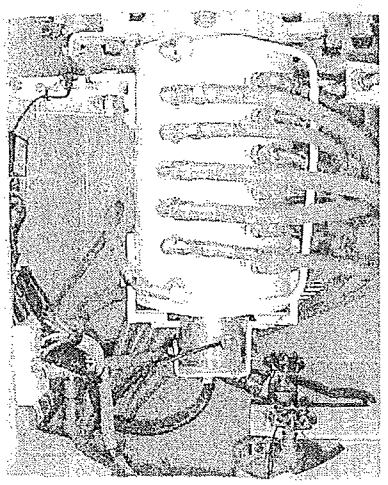
Attention

This pump and motor assembly is intended to be used for emergency lowering use only.



Emergency pump and motor assembly

Hydraulic Rotary Joint



The hydraulic rotary joint permits continuous rotation of the turntable without imposing torsion or twisting loads on the hydraulic hoses. This hydraulic rotary joint assembly consists of a housing, body and seals. As shown, the housing contains ports for pressure and tank line connections. The body is machined and drilled to match the hydraulic ports of the housing.

The inner core or body of the rotary joint is fastened to the turntable. The outer housing is held stationary by fixing it to the pedestal. As the turntable is rotated, the inner body of the rotary joint rotates with the turntable.

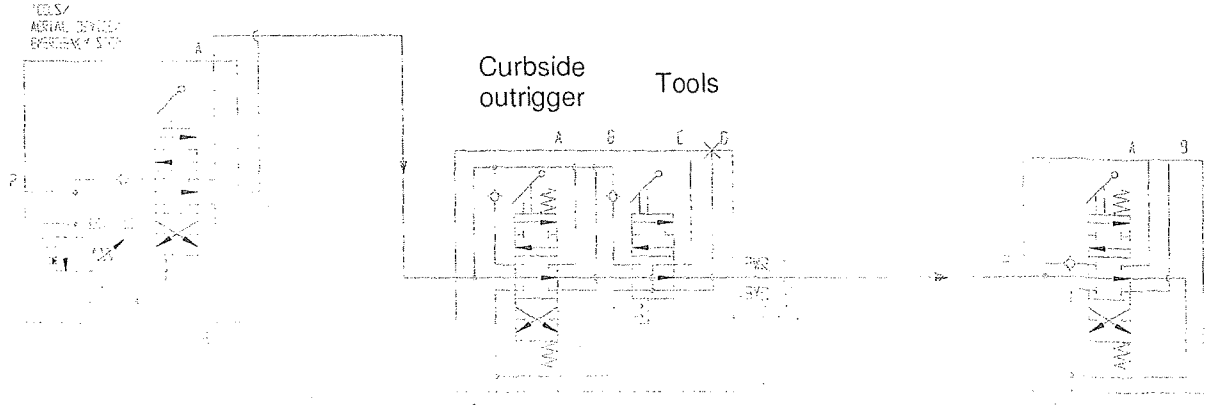
Outriggers-Tools/Aerial device selector Valve

If the unit is equipped with outriggers, the "Outriggers-Tools/Aerial device" control valves are located at the tailshelf. The main valve located on the curbside has three spools, which activates the "Aerial device / Outriggers-Tools / Emergency Stop" selector, the curbside outrigger and the lower tool outlet (when equipped). An integrated relief valve is set to 3500 PSI and act as a security back-up relief valve for the main circuit.

The other valve located on the streetside has one spool, which activates the roadside outrigger.

The selector and outriggers spool valves are open centered and four ways, three-position valves. The Tool valve is open centered, four ways and two positions.

The optional tool outlet has a built-in adjustable flow control and pressure relief valve. Refer to your hydraulic schematic for the options installed.



Main curbside valves

Streetside outrigger valve

When the station selector is in the "Outriggers-Tools" position, the entire oil flows through the valve to the tank.

When a outrigger controller is moved, hydraulic oil flow passes through the spool valve to the appropriate outrigger cylinder.

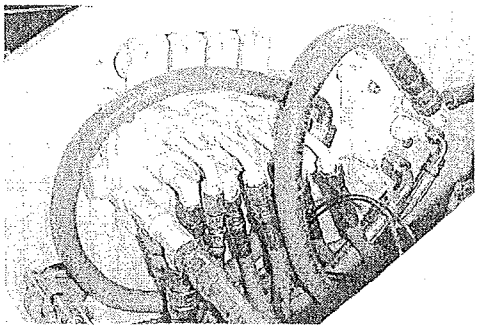
When the "Tool" lever is moved, the flow passes through an adjustable flow control and the desired flow is available at the tool outlet. A pressure relief valve is incorporated and lowers the operation pressure for the tools.

This valve configuration can vary depending on the tool outlet option (refer to the applicable hydraulic schematic of this unit).

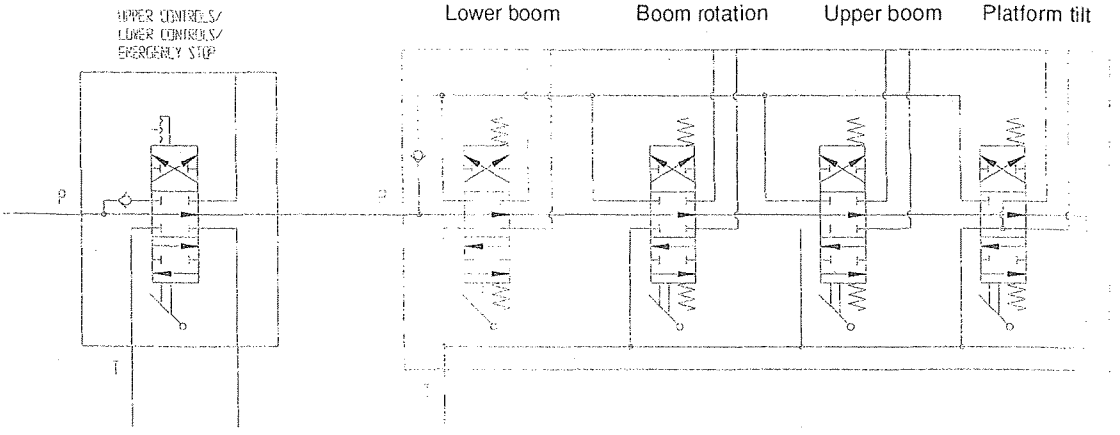
"Emergency Stop" position directs the flow to the tank, blocking all aerial device functions.

"Aerial Device" position directs the flow to the lower control panel valve blocking both the "Outriggers" and "Tools" functions.

Lower Controls' boom function Valve



The lower controls' boom function valve is located on the street side of the turntable (stowed unit). As an option, it can be located at the tailshelf. Depending on the options installed, this valve can have five spools, which activates the Emergency Stop, the Upper/Lower control selector, the boom functions and the platform tilt.



The lower control's boom function valves are four-way, three-position valves. Each spool valve is connected to a control handle. The spool valves are open centered.

When the selector lever is in the "Lower Controls" position and another lower control handle is shifted, the corresponding spool valve directs hydraulic oil flow to operate the appropriate function.

When the station selector is in the "Lower Controls" position and no lower control handle is shifted, oil flows through the lower control valve and back to tank.

The "Emergency Stop" position directs the flow to the tank, blocking both the upper and lower controls functions.

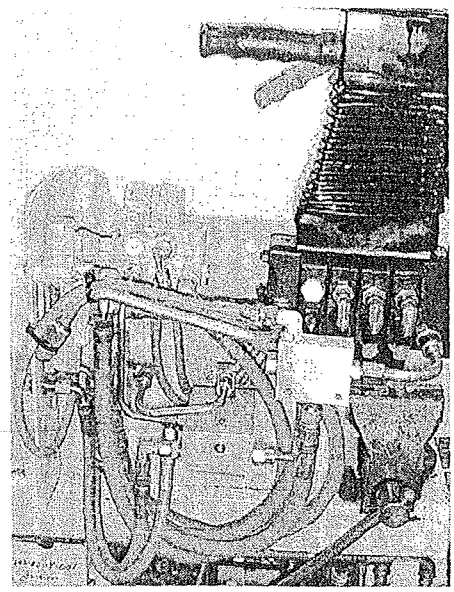
The "Upper Controls" position direct the flow to the upper controls station valve, blocking the lower controls functions.

Upper Controls Valve

The upper controls valves are located at the platform. It consists of a four spools valve operating the booms' functions, a single spool Selector valve and a one or two spools valve operating the tool circuit and the platform rotation if equipped.

When the Selector is on the "Aerial Device" position and no booms' function is activated, oil flows to the tank and through the tool and platform rotation valve (if equipped).

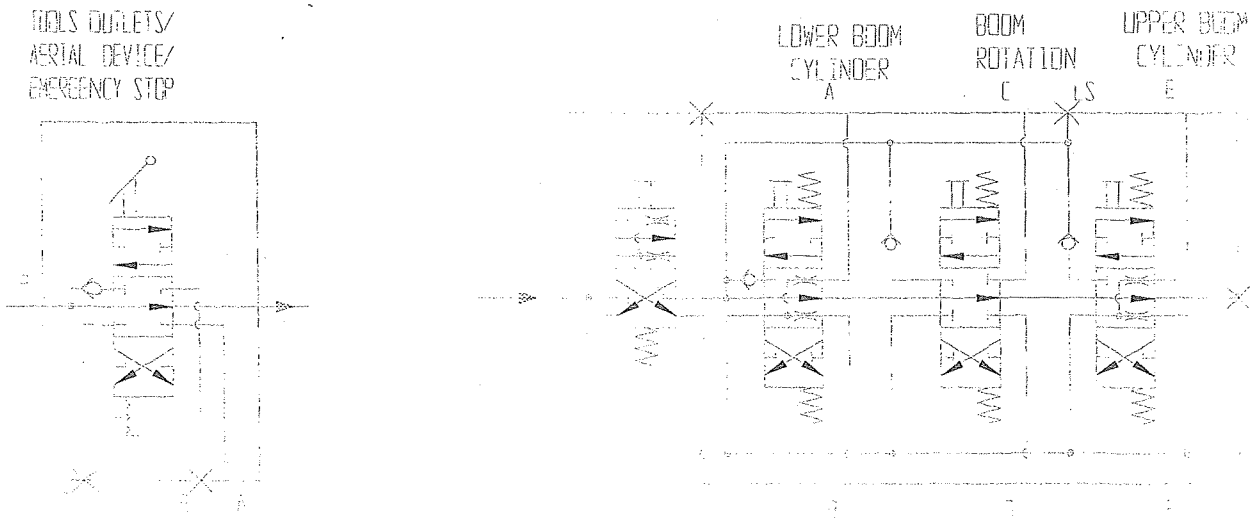
When the interlock trigger on the standard single handle controller is depressed, the blocking section is manually shifted. The valve directs hydraulic oil flow to the boom function spool valves. When the single handle controller is moved, hydraulic oil flow passes through the spool valve to the appropriate boom actuator.



Upper controls valves

When the single handle controller (joystick control) is moved to the neutral position and the interlock trigger is released, the blocking section is closed and the valve spool is shifted to neutral. Oil flow is blocked from the boom function valve sections of the upper control valve. Then it is routed back to the reservoir.

The "Emergency Stop" position blocks all the upper control functions and the oil is directed to the tank.



Tool and Platform Rotation option Valve

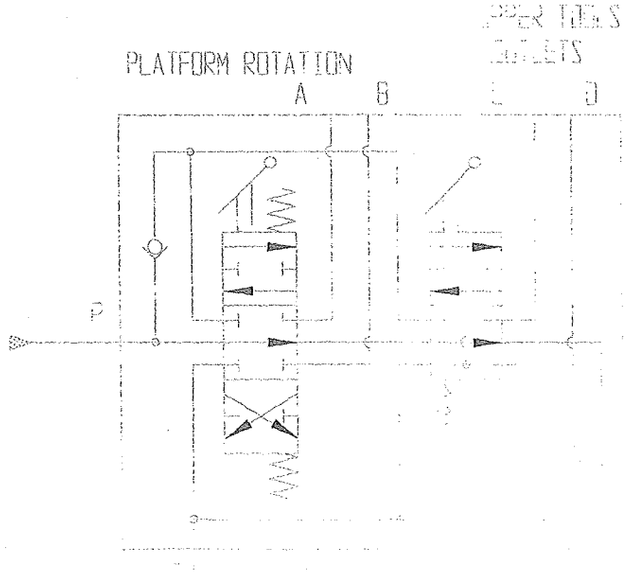
When tool(s) and platform rotation options are installed, the valve consists of a two spools valve and is located at the platform (refer to the applicable hydraulic schematic of this unit). This valve operates the Platform Rotation function or direct oil to the tool outlet.

To operate either of these functions, it is first necessary to put the upper Selector valve to the "Platform/Tools" position. The flow is directed through the Tool/Platform valve and flows to the tank. Oil flow is blocked from the booms functions spool valve.

When the tool outlet control handle is shifted, the flow is directed to the tool circuit. The tool circuit has a pressure and flow adjustable controls preset at the factory. Do not leave the tool circuit activated when the tool is not operated, excessive heat may build up in the hydraulic system.

Caution

Do not adjust the pressure of the tools circuit above the hydraulic power tools manufacturers' rating for the tool that is to be used. Hydraulic pressure above the tool pressure rating may cause the tool hoses to burst and/or the tool to rupture. This may result in hydraulic oil escaping under pressure. Hydraulic oil escaping under pressure can have enough force to inject oil into the flesh.



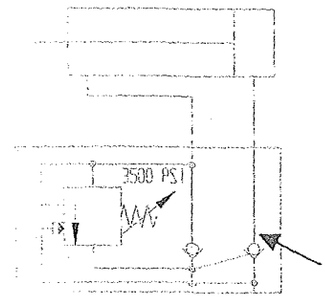
Holding Valves

The aerial device uses holding valves to insure that various actuators will hold their position under load and maintain their position if there is hydraulic line failure. These holding valves block the hydraulic oil in the cylinder or the motor to prevent movement. The types of holding valves used are pilot operated check valves and counterbalance valves.

Testing of pilot operated check valves and counterbalance valves is fully described in this section under Hydraulic System Adjustments.

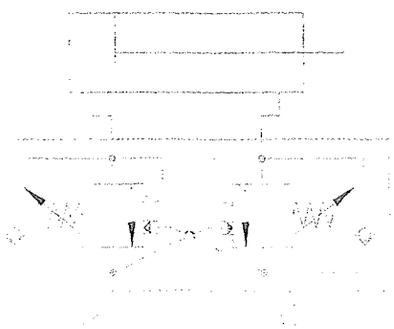
Pilot Operated Check Valves

Pilot operated check valves are used to block flow out of the platform rotation, platform tilt and outriggers actuators on the cylinder-piston side inlet. A pilot operated check valve allows free flow into the actuator and then blocks the flow from coming back out. This means that the oil sent to one work port of the actuator is used to pilot open the check valve for the other work port of the actuator.

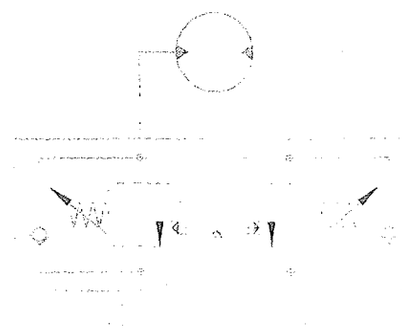


Counterbalance Valves

Counterbalance valves are used to block flow out of the upper and lower boom lift cylinders and of the booms rotation motor. Also the platform rotation, platform tilt and outriggers cylinders have a counterbalance valve at their rod side inlet.
A counterbalance valve is a combination of a check valve and a relief valve. The check valve allows free flow into the cylinder and blocks the flow from coming back out.
The relief valve function can be piloted open to allow flow cut of the function. It also allows the valve to relieve excess pressure and prevents damage from thermal expansion of the oil.
The counterbalance valves used with the lower and upper boom lift cylinders are installed in pairs and are cross-ported. This means that the oil sent to one side of the cylinder is used to pilot open the counterbalance valve for the other side of the cylinder.



Counterbalance valve on cylinders

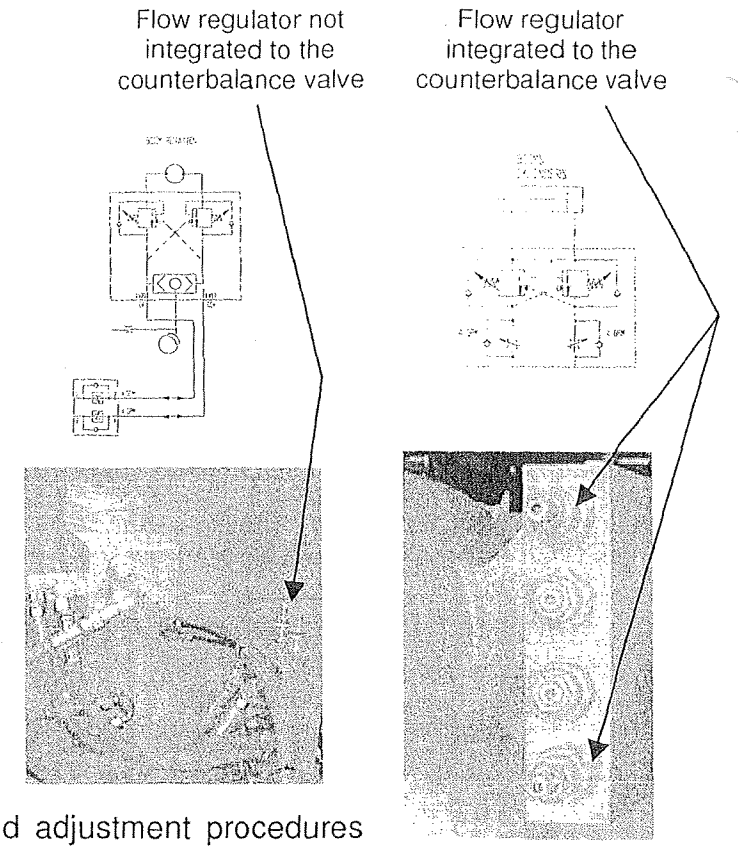


Counterbalance valve on motors

Flow regulator valves

Flow regulator valves with pressure compensator are used to maintain a constant flow of 4 GPM on booms' functions, since the pump can allow up to 10 GPM. This arrangement allows operating more than one booms' function at a time and maintaining a good operating speed.

These valves can be integrated to the counterbalance valve or to an individual block.



Hydraulic System Adjustments

The following sections describe testing and adjustment procedures for the components of the hydraulic system.

When using a gauge to test the pressure or flow of a particular circuit, use a well-calibrated gauge. A calibrated gauge will provide an accurate reading, which is essential for proper hydraulic adjustments.

Valve Cartridge Installation

When installing a valve cartridge into a valve body, it must be tightened to the proper torque value. Tightening the cartridge to less than the specified torque value may lead to leakage. Tightening the cartridge over the specified torque value will cause damage to the valve or valve body. A damaged valve may not perform its intended job properly.

To properly install a valve cartridge, lubricate the threads and O-rings with clean hydraulic oil from the same system. Use the chart in Table 7.1 to determine the correct torque value for the cartridge that you are installing.

Wrench Size	Cartridge Fitting Size	Torque (ft. lbs.)
7/8"	-8	20
1"	-10	25
1-1/8"	-10	25
1-1/4"	-12	35
1-1/2"	-16	50
2"	-20	65

Table 7.1 - Valve Cartridge Torque Chart

System/Compensator Pressure

The system pressure is controlled by the compensator spring in the compensator valve housing mounted on the pump. System pressure is set to 3000 PSI. System pressure is also referred to as the compensator pressure.

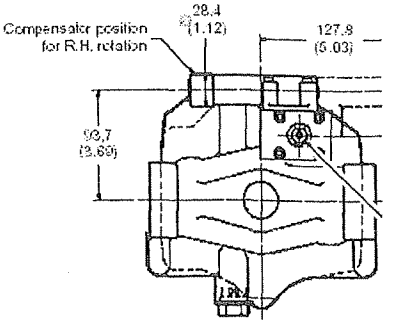
When the output pressure of the pump reaches 3000 PSI, it overcomes the spring tension of the compensator spool. Pressure is then directed to the stroking piston to either stop pump flow or to control flow at the level necessary to maintain 3000 PSI output pressure.

Testing the System/Compensator pressure setting

1. Start the engine. From the upper controls, depress the joystick trigger without operating any function.

2. Check the pressure indicated on the gauge located at the lower controls station. The system/compensator pressure should be 3000 PSI. If the pressure reading is above or below this value, the system/compensator pressure needs adjusting.

Adjustment of the compensator pressure setting



1. Turn off the engine.

2. Adjustment of the system/compensator pressure is done on the hydraulic pump compensator.

3. Remove the protective cap to the compensator adjustment. Use a screwdriver to turn the compensator adjustment screw clockwise to increase the system/compensator pressure or counterclockwise to lower the pressure.

4. Test the compensator pressure as described above. If the pressure cannot be raised by adjusting the compensator, then the relief valve in the main selector valve assembly may be set too low. (Refer to the applicable hydraulic schematic).

5. When the correct pressure has been reached, reinstall the protective cap to the compensator adjustment.

Flow regulators

Flow regulators are used for the functions given in Table 7.2.

Function	Operation	Standard Cycle Time (± 5 sec)
Rotation of booms	360° CW & CCW	60 sec
Upper boom articulation	Fold & unfold	55 & 50 sec
Lower boom articulation	Up & down	40 sec

Table 7.2 – Function speeds

Testing and adjustment

1. Start the truck engine, engage the PTO and, if equipped, extend the outriggers.

2. Select the function and take the time required to make an operation (example: fold the upper boom).

3. If the speed is too fast or too slow, screw in the flow regulator cartridge to decrease or screw out to increase the flow.

Pilot Operated Check Valves

Pilot operated check valves are used to block flow out of the optional platform tilt, platform rotation and the outrigger cylinders on their barrel side. There is no adjustment possible on the pilot operated check valves.

If this type of holding valve does not hold the load, or malfunctions in some other way, it is likely contaminated with dirt or other foreign matter.

Warning

Pilot operated check valves are not adjustable and must be replaced if defective.

When removing a P.O. check valve cartridge, do not allow dirt, water or other foreign matter to enter the holding valve cavity when the cartridge is removed.

Testing

The preferred method of testing a pilot operated check valve is to use a test block.

Alternate Test Method for P.O. Check Valves

If a test block is not available, the P.O. check valves may be tested by the following method:

1. Make sure the booms are stowed.
2. Remove the hydraulic load from the P.O. check valve before removing the valve cartridge from its housing. This can be done by shifting the control handle for that function in both directions for several seconds. If the check valve is used with a cylinder, shift the control handle until the pressure is removed in the lines.
3. Slowly loosen the mounting bolts securing the holding valve manifold to the motor or base end of the cylinder. Do not unscrew the mounting bolts quickly. If the cylinder is under pressure and the mounting bolts are removed out quickly, hydraulic oil may spray out from the bolt holes.

> ***Caution***
>
> Hydraulic oil escaping under high pressure from a faulty connection, hose, pinhole, cracked tube, etc. may not be visible, but can have enough force to penetrate the skin and inject oil into the flesh. Never use your hands, or any other body parts, to check hydraulic lines and fittings for leaks under pressure that are not visually obvious.

In case of injury by escaping hydraulic oil, seek medical attention at once. Serious infection or reaction can result if medical treatment is not given immediately.

Keep the unit and work areas clean. Spilled hydraulic oil creates slick surfaces and may cause personnel to slip and/or fall.

4. Support the structure, such as the outrigger leg, that the pilot operated check valve supports. Remove and replace the valve cartridge with one from another cylinder by proceeding the same way.

> ***Caution***
>
> Failure to fully unload the actuator, or position it so that it cannot move, before removing a P.O. check valve can result in sudden, uncontrolled movement of the actuator and/or booms. This may result in personal and/or property damage.

5. If the problem moves to the other location, replace the valve cartridge. If the problem did not move, the pilot operated check valve is not the cause of the malfunction.

Counterbalance Valves

A counterbalance valve provides a positive lock against hydraulic flow or leakage until it is opened by pressure from a control valve.

This type of holding valve is used on the upper and lower boom lift cylinders, on the rotation motor and on the rod side of the outrigger cylinders, the platform tilt and the platform rotation cylinders. The counterbalance valves assures that the cylinder will maintain its position even if there is hydraulic hose failure.

Do not attempt to disassemble a cartridge in the field. Counterbalance valve cartridges should only be disassembled by the cartridge manufacturer.

Removing a Counterbalance Valve

Before removing a counterbalance valve, the cylinder must be fully unloaded. The following steps describe how to remove a counterbalance valve:

1. Position the boom where it cannot move. For the upper boom or lower boom cylinder, rest the boom on the respective boom rest.
2. Operate the lower controls until the pressure is removed in the lines.
3. Slowly and carefully unscrew the cartridge from its housing. It is very important to do this slowly to allow the pressure to bleed off before the cartridge is fully removed from the cylinder.

A counterbalance cartridge on the booms cylinders may contain significant internal trapped pressure for some time after it is operated. This is due to having a counterbalance valve on both the extend and retract sides of the cylinder. The rush of oil past the cartridge seals as the cartridge is fully unscrewed may blow one or more of the seals off the cartridge. If this happens, obtain the proper cartridge seal kit and replace the seals before installing the cartridge.

Do not allow dirt, water or other foreign matter to enter the holding valve cavity when the cartridge is removed.

> ***Warning***
>
> Failure to fully unload the actuator, or position it so that it cannot move, before removing a counterbalance valve can result in sudden, uncontrolled movement of the actuator and/or booms. This may result in personal and/or property damage.

> ***Caution***
>
> Hydraulic oil escaping under high pressure from a faulty connection, hose, pinhole, cracked tube, etc. may not be visible, but can have enough force to penetrate the skin and inject oil into the flesh. Never use your hands, or any other body parts, to check hydraulic lines and fittings for leaks under pressure that are not visually obvious.

In case of injury by escaping hydraulic oil, seek medical attention at once. Serious infection or reaction can result if medical treatment is not given immediately.

Keep the unit and work areas clean. Spilled hydraulic oil creates slick surfaces and may cause personnel to slip and/or fall.

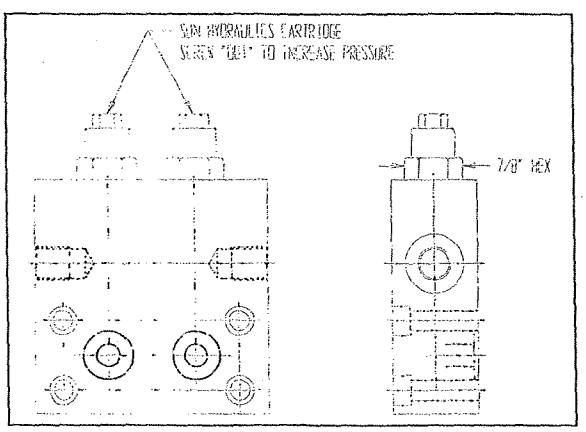
Testing and Adjustment

The preferred method of counterbalance testing is to use a test block.

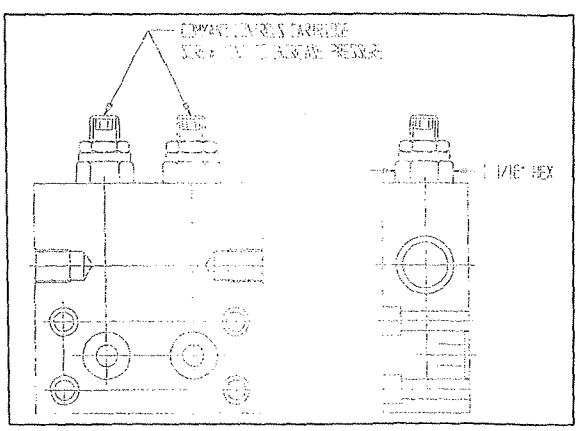
Place the counterbalance valve in the appropriate test block. Connect a port-a-power or other hydraulic pressure source to the valve. Apply pressure to test the check valve, relief valve and pilot operation of the valve. The relief function can be adjusted by loosening the jam nut and turning the adjusting screw counterclockwise to increase the setting and clockwise to reduce the setting.

The counterbalance valves for the different actuators are factory set to the values given in Table 7.3, and should not be adjusted in the field. The only exception is adjusting the counterbalance valves for emergency boom lowering as described in the Operators Manual. If the setting on a counterbalance valve has been changed, the cartridge must be removed and adjusted with a test block or replaced.
For the options' actuators (i.e. jib functions), refer to the hydraulic schematic to find the cartridge adjustment.

Note that two different brand of cartridges are used on the lower boom and upper boom cylinders. Please refer to the following figures to determine how to adjust the cartridge applicable to your unit. The Sun Hydraulics cartridge has a hexagonal head of 7/8" while the Command Controls cartridge has a hexagonal head of 1 1/16".



Sun Hydraulics



Command Controls

Function	Cartridge adjustment
Lower boom cylinder "Command Controls" cartridge	4500 PSI
Lower boom cylinder "Sun Hydraulics" cartridge	3900 PSI
Boom rotation	1800 PSI
Upper boom cylinder "Sun Hydraulics" cartridge	3900 PSI
Upper boom cylinder "Command Controls" cartridge	4500 PSI
Platform rotation cylinder	3500 PSI
Platform tilt cylinder (at the turret)	3500 PSI
Outrigger cylinder	3500 PSI

Table 7.3 – Counterbalance valve adjustment

Caution

Do not attempt to adjust a counterbalance valve without a test block. Using a test block and pressure gauge is the only accurate way to determine that the proper setting has been obtained.

Alternate Test Methods

The counterbalance valves may be tested for proper holding by loading the function protected by the counterbalance valve. Turn the engine off and move the manual control handle on the main control valve to connect that function to tank. If the function moves, the counterbalance valve is leaking and must be replaced or reset using a test block.

Tool circuits

Different tool circuit's options are available at the platform and at the ground level. The single or dual tool outlets are adjustable in pressure and flow. The following pressure and flow adjustments are the standard preset. Always refer to your hydraulic schematic for the options installed and for their control valves' adjustments.

Ground Level Tool Circuit – Pressure adjustment

For units with the optional ground level tool circuit, a pressure-reducing valve controls the tool pressure. This valve is usually located in the tool outlet manifold.

Testing the pressure

1. Shift the tool control handle to the "On" position.

Function	Cartridge adjustment
Lower boom cylinder "Command Controls" cartridge	4500 PSI
Lower boom cylinder "Sun Hydraulics" cartridge	3900 PSI
Boom rotation	1800 PSI
Upper boom cylinder "Sun Hydraulics" cartridge	3900 PSI
Upper boom cylinder "Command Controls" cartridge	4500 PSI
Platform rotation cylinder	3500 PSI
Platform tilt cylinder (at the turret)	3500 PSI
Outrigger cylinder	3500 PSI

Table 7.3 – Counterbalance valve adjustment

Caution

Do not attempt to adjust a counterbalance valve without a test block. Using a test block and pressure gauge is the only accurate way to determine that the proper setting has been obtained.

Alternate Test Methods

The counterbalance valves may be tested for proper holding by loading the function protected by the counterbalance valve. Turn the engine off and move the manual control handle on the main control valve to connect that function to tank. If the function moves, the counterbalance valve is leaking and must be replaced or reset using a test block.

Tool circuits

Different tool circuit's options are available at the platform and at the ground level. The single or dual tool outlets are adjustable in pressure and flow. The following pressure and flow adjustments are the standard preset. Always refer to your hydraulic schematic for the options installed and for their control valves' adjustments.

Ground Level Tool Circuit – Pressure adjustment

For units with the optional ground level tool circuit, a pressure-reducing valve controls the tool pressure. This valve is usually located in the tool outlet manifold.

Testing the pressure

1. Shift the tool control handle to the "On" position.

2. Check the reading of the gauge. The gauge should read 2000 PSI. If the pressure reading is above or below this value the pressure reducing valve cartridge needs adjusting.

Adjustment

1. Disengage the PTO and turn the engine off.

2. Loosen the jam nut on the pressure-reducing valve. Turn the adjusting screw with an Allen wrench. Turning the screw clockwise will increase the pressure. Turning the screw counterclockwise will reduce the pressure.

3. Tighten the jam nut, start the engine and engage the PTO. Check the pressure gauge reading again. If necessary, repeat Step 2 until the pressure gauge reading is 2000 PSI.

> ***Warning***
>
> Do not adjust the pressure of the tool circuit above the hydraulic power tool manufacturers' rating for the tool that is to be used. Hydraulic pressure above the tool pressure rating may cause the tool hoses to burst and/or the tool to rupture. This may result in hydraulic oil escaping under pressure. Hydraulic oil escaping under pressure can have enough force to inject oil into the flesh.

In case of injury by escaping hydraulic oil, seek medical attention at once. Serious infection or reaction can result if medical attention is not given immediately.

Keep the unit and work areas clean. Spilled hydraulic oil creates slick surfaces and may cause personnel to slip and/or fall.

Ground Level Tool Circuit – Flow adjustment

For units with optional ground level tool circuit, a flow regulator valve controls the ground tool flow.

Testing

1. Connect flow meter to the tool outlet at the ground level. Start the truck engine and engage the PTO.

2. Move the tool control handle to the "On" position.

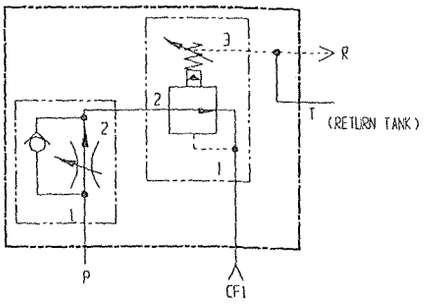
3. Check the reading on the flow meter. The flow meter should read 5 gpm (plus or minus 10 percent). If the reading is above or below this value, the flow can be adjusted.

Adjustment

The tool circuit flow is adjustable by turning the cartridge screw in to decrease or out to increase the flow.

Platform Tool Circuit – Pressure adjustment

A pressure-reducing valve cartridge located at the platform, in the tool outlet manifold, controls the tool pressure circuit.



Tool manifold

Testing

1. Shift the tool control handle to the "On" position (or P1 and P2 when equipped) with the selector in the Upper Controls position.

2. Check the reading of the gauge located at the outriggers or lower controls station. The gauge should read 2000 PSI. If the pressure reading is above or below this value, the pressure reducing valve cartridge needs adjusting.

Adjustment

1. Disengage the PTO and turn the engine off.

2. Loosen the jam nut on the pressure-reducing valve. Use an Allen wrench to turn the adjusting screw. Turning the screw clockwise will increase the pressure. Turning the screw counterclockwise will reduce the pressure.

3. Tighten the jam nut, start the engine and engage the PTO. Check the pressure gauge reading again.

> ***Caution***
>
> Do not adjust the pressure of the tool circuit above the hydraulic power tool manufacturers' rating for the tool that is to be used. Hydraulic pressure above the tool pressure rating may cause the tool hoses to burst and/or the tool to rupture. This may result in hydraulic oil escaping under pressure. Hydraulic oil escaping under pressure can have enough force to inject oil into the flesh.

In case of injury by escaping hydraulic oil, seek medical attention at once. Serious infection or reaction can result if medical attention is not given immediately.

Keep the unit and work areas clean. Spilled hydraulic oil creates slick surfaces and may cause personnel to slip and/or fall.

Platform Tool Circuit – Flow adjustment

A flow regulator valve controls hydraulic oil flow for the platform tool outlet.

Testing

1. Connect a flow meter to the tool outlets at the platform. Start the truck engine and engage the PTO.

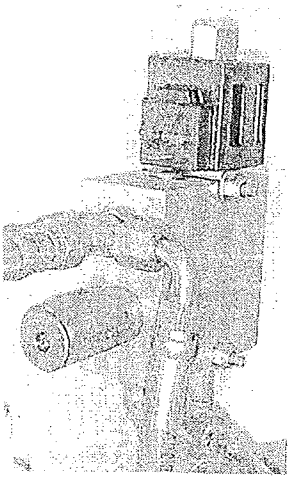
2. Move the tools control handle to the On position with the selector in the Upper controls position.

3. Check the reading on the flow meter. The flow meter should read 5 gpm (plus or minus 10 percent). If the reading is above or below this value, the flow regulator is faulty.

Adjustment

The tool circuit flow is adjustable by turning the cartridge screw in to decrease or out to increase the flow.

Boom Stow Valve



The upper boom stow valve is mandatory with the parallel booms stow configuration and is optional for the low stow configuration or for the lower boom stow protection. It is usually located inside the turret.

The boom stow valve consists of two-position, two way spool valve and a pressure reducing valve. It is normally open. This means that in the neutral position, oil passes through the valve.

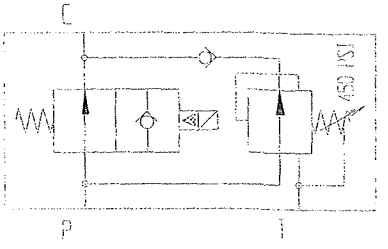
An improperly adjusted boom stow valve allows excessive hydraulic pressure to be applied to the boom during stowing.

The boom stow valve contains a low pressure reducing valve. The pressure reducing valve limits the hydraulic pressure that may be applied to the boom as it is lowered into the boom rest.

The boom stow valve is electrically activated when the boom weldment contacts a limit switch located on the boom support.

The boom should slow and lower into its rest with 450 psi on the gauge, refer to your hydraulic schematic for the exact pressure setting. A certain amount of hydraulic pressure is needed to open the counterbalance valve in the boom cylinder to lower the boom into the rest. The pressure setting will provide enough hydraulic pressure to lower the boom into the rest without excessive pressure being applied to the boom.

Pressure Reducing Adjustment Procedure



1. Using a tee, install a pressure gauge into the "C" port of the boom stow valve.
2. Engage the PTO so that the unit may be operated.
3. Extend the outriggers if equipped.
4. Raise the boom above the position where it contacts the boom support.
5. Lower the boom. Observe the pressure gauge reading before and after the boom contact the boom stow valve.
6. The boom should slow down and lower into the rest with the pressure setting indicated on the gauge. With the boom in its rest and the control handle in the boom down position, the pressure should not build up more than 150 psi above or under the setting.

7. The pressure reducing valve has an adjusting screw and jam nut. If the pressure reading taken in Step 6 was over 500 psi, you need to lower the relief pressure. To do this, loosen the jam nut and turn the adjusting screw counterclockwise. If the pressure reading taken in Step 6 is under 300 psi, you need to raise the relief pressure. To do this, loosen the jam nut and turn the adjusting screw clockwise. After the adjustment has been made, tighten the jam nut.

8. With the gauge still attached, raise and lower the boom several times. At the same time, check for the correct boom stow pressure relief setting on the gauge. Make sure you stow the boom firmly each time you lower the boom, so that an accurate reading may be taken on the gauge.

9. With the booms in the rest, retract the outriggers. Disengage the PTO and remove the pressure gauge.

Hoses, Tubes and Fittings

Fittings and hose are used to connect various components of the hydraulic system.

Fittings

Most hydraulic ports and fittings are SAE straight thread O-ring or 37 degree flared JIC straight thread. These types of fittings provide a good seal. They also resist vibration.

Hoses

Inspect all hoses every 4 months or 340 PTO hours, whichever comes first. Inspect the hoses for wear and physical damage. Make sure they are routed to avoid sharp edges, kinking and scuffing.

Hose identification

Most hoses have a lay line on them. The lay line contains the following information about the hose.

- Manufacturer's name
- Manufacturer's part number
- SAE rating
- Working pressure
- Burst pressure (sometimes)
- If the hose is nonconductive, the word "nonconductive" appears on the hose

Hose Replacement

It is very important that hoses be replaced only with hoses of the same type and size. Replacement fittings, lines, tubes, etc. should be the same type and size that were furnished with the unit. Before replacing a hose or tube with a different diameter part, consider the effect it will have on the hydraulic system. If hose size is doubled, four times the amount of fluid will increase. The increase in back pressure will cause heat to build up in the system. When replacing a hose, it is best to use a hose of the same size and length. If there is any doubt concerning the proper hose to be used for replacement, contact your POSI-PLUS service representative.

When disconnecting lines or removing parts, plug all ports and lines. This will prevent contaminants from entering the hydraulic system. It also prevents damage to the sealing surfaces and fitting threads.

Warning

Never grasp a pressurized hose or tube. Make sure all pressure is removed from a hydraulic circuit before disconnecting a line or fitting.

Remove all pressure from a hydraulic circuit before disconnecting hydraulic lines or fittings.

Caution

Failure to remove all pressure from a hydraulic circuit will cause oil to spray out under pressure as the connection is loosened. Hydraulic oil escaping under pressure can have enough force to penetrate the skin and inject oil into the flesh.

In case of injury by escaping hydraulic oil, seek medical attention at once. If medical treatment is not given immediately, serious infection or reaction can result.

Keep the unit and work areas clean. Spilled hydraulic oil creates slick surfaces and may cause personnel to slip and/or fail.

Torques and Tightening Procedures

Tube and fitting abuse is one of the major causes of leakage in a hydraulic system. Be sure to use the proper torque and tightening specifications when installing a hydraulic fitting, as this will reduce the possibility of leaks in the system. Caps and plugs should be used during the handling and storage of hydraulic components to prevent damage to sealing surfaces and fitting threads.

Overtorquing a component most often will distort the part and cause leakage. Thinking that if fitting leaks, tightening it a little more will solve the problem is not always correct. When you find a fitting that is leaking, first check to see if it is tight. If it is not tight, torque it to the correct value. If the fitting is tight, stop the unit, determine the cause of the leak and take corrective action to solve the problem. The following instructions describe proper torque and tightening specifications for various types of hydraulic fittings.

Installation of Tapered Thread (Pipe Thread) Fittings

1. Clean the male threads of the fitting with a cleaning solvent.

2. Apply pipe sealant to the male threads of the fitting. Do not apply sealant to the first two male threads. Apply enough sealant so that a ring of sealant will form on the outside of the connection when the threads are tightened into the mating body.

3. Screws the fitting into the mating part and finger tighten.

4. Turn the fitting with a wrench the appropriate turns from finger tight (T.F.F.T.), taking the final position of the tube end into consideration (refer to Table 7.4).

Size	T.F.F.T.	Size	T.F.F.T.
-2	2.0 - 2.5	-12	1.5 - 2.0
-3	2.0 - 2.5	-14	1.5 - 2.0
-4	2.0 - 2.5	-16	1.5 - 2.0
-5	1.5 - 2.0	-20	1.5 - 2.0
-6	1.5 - 2.0	-24	1.5 - 2.0
-8	2.0 - 2.5	-32	1.5 - 2.0
-10	2.0 - 2.5		

Table 7.4 - T.F.F.T. Torque Chart

5. Follow the sealant manufacturer's directions for cure time. The ring of sealant described in Step 2 will not completely harden due to its exposure to air.

Installation of SAE O-Ring Fittings With Lock nuts

1. Lubricate the O-ring with hydraulic oil or light grease such as petroleum jelly.
2. Screw the fitting into the SAE straight thread boss until the backup washer bottoms on the boss face with the O-ring squeezed into the boss cavity.
3. Unscrew the fitting (maximum of one full turn) in order to align the fitting with the mating part.
4. Tighten the locknut with a wrench and torque to the proper value for the size and material (stainless steel or steel) so the backup washer contacts the boss face.

Installation of Tube Fittings and JIC Fittings

1. Clean the male threads of the fitting with a cleaning solvent.

2. Tighten the nut finger tight until it bottoms out on the flare seat.

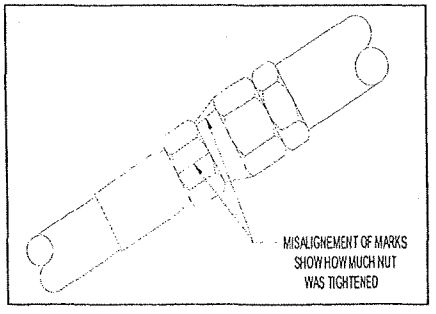
3. Using a felt tip pen or marker, mark a line lengthwise on the nut and extend it onto the adapter body.

4. Using the Table 7.5, determine the correct number of hex flats the nut must be turned with a wrench. Using a wrench to hold the adapter body, rotate the nut with another wrench the correct number of hex flats.

Nominal Tube Size	Fitting Size	Rotate Number of Hex Flats
1/4"	-4	2-1/2
5/16"	-5	2-1/2
3/8"	-6	2
1/2"	-8	2
5/8"	-10	1-1/2 to 2
3/4"	-12	1
1"	-16	3/4 to 1
1-1/4"	-20	3/4 to 1
1-1/2"	-24	1/2 to 3/4

Table 7.5 - Hex Flat Torque Chart

5. The marks made in Step 3 are used to count the correct number of hex. flats that the nut must be turned. The marks also serve as a visual indicator that the fitting has been tightened correctly.



Marks Used to Count Hex Flats

Installation of Compression Fittings

1. The tubing should be cut to length, allowing for bend, equipment movement, etc.

2. The brass insert should be fitted into the nylon pilot tubing with the flanged end out. The insert should fit snug in the pilot tubing. The color coded 5/16" O.D. tubing requires the use of an insert.

3. With the threaded end of the compression nut facing the fitting body, slide the nut onto the nylon tubing, followed by the compression sleeve.

4. The tubing can now be inserted into the fitting body. Making sure the tubing rests firmly on the shoulder of the fitting, hand tighten the compression nut. Tighten the compression nut the correct number of turns as indicated in the Table 7.6.

Tube size	Fitting Size	Turns Required to Seal from Finger Tight
1/8" thru 1/4"	2 thru 4	1-1/4
5/16"	5	1-3/4
3/8" thru 1"	6 thru 16	2-1/4

Table 7.6 - Compression Fitting Torque Chart

Attention

Do not overtighten as damage to nut and threads will occur. To ensure a proper seal, do not reuse fitting body or compression nut if overtightening has occurred.

Cylinders

Hydraulic cylinders are used to raise and lower the booms and outriggers.

All the cylinders on the aerial device are double acting cylinders. This means that they produce force in both, the extend and the retract directions.

All the cylinders on the aerial device are equipped with holding valves. The holding valves allow the cylinders to maintain their position if there is hydraulic line failure.

The upper and lower boom lift cylinders use counterbalance holding valves.

The holding valves may be installed in a valve manifold that is "in-line" and connected to the cylinder or directly mounted on the cylinder.

All cylinder rods are chrome plated to prevent rust and corrosion. The chrome plating also provides a smooth surface for the end gland bearing and seal.

A cylinder should never be installed with side loading on the rod, such as misalignment. Do not operate a cylinder, if the cylinder barrel has a dent in it and/or if the rod is damaged.

> ***Warning***
>
> Do not operate a cylinder that has a dented barrel or a damaged rod. Operation of a cylinder with such defects could lead to cylinder failure. Cylinder failure may result in property damage and/or personal injury.

Posi-Plus does not recommend repairing cylinders in the field. Most repairs require disassembly of the cylinder. Disassembly and repair of cylinders must be performed by skilled mechanics who are trained and qualified by Posi-Plus Technologies Inc. in such procedures. It should be done in a clean, properly equipped shop.

The Parts manual contains a drawing of each hydraulic cylinder. The drawing lists the Posi-Plus part numbers for the seal kits. The drawing also gives torque specifications for piston nuts and heads.

> ***Warning***
>
> If a piston self-locking nut is removed from a cylinder, replace the piston nut. Removing a self-locking piston nut damages the locking material. A faulty self-locking piston nut may cause cylinder failure. Cylinder failure may result in property damage and/or personal injury.

Undertorquing or overtorquing the cylinder piston nut may cause cylinder failure. Cylinder failure may result in property damage and/or personal injury.

Only trained and qualified professionals are permitted to remove scratches from the inside of the cylinder barrel.

Warning

If the internal size tolerance of the cylinder barrel is exceeded, the piston seal could be pushed out (extruded) when the cylinder is put under a load. This will cause cylinder failure. Cylinder failure may result in property damage and/or personal injury.

When replacing a major component, such as an upper or lower boom lift cylinder, structurally test the unit as described in Section 11 - Testing.

After reconnecting a hydraulic line from any cylinder, make sure to extend and retract the cylinder five to six times to purge the air out of the cylinder and to check for hydraulic leaks. The easiest way to accomplish this may be to connect the cylinder to a hydraulic source, such as a port-a-power or ground level tools circuit. To purge the air from the upper boom cylinder, position the lower boom vertically and cycle the upper boom cylinder up and down approximately 60 degrees from the lower boom stow. This purges any air that may be in the cylinder. Do not move the boom in the overcenter positions.

Warning

When removing a hydraulic line from a cylinder, do not operate the aerial device from the upper controls until you are certain all the air is purged from the cylinder after the hydraulic line is installed. The presence of air in the cylinder may cause inadvertent retraction or extension of the cylinder, resulting in serious injury or death.

Do not move the upper boom overcenter until you are certain all the air be purged from the rod end of the upper boom cylinder. The presence of air in the cylinder may cause inadvertent extension of the cylinder when the upper boom is overcenter, resulting in serious injury or death.

Warning

Pinch points exist at both the rod end and the base end of the cylinders. Be extremely careful when removing or installing the upper and lower boom cylinders.

Lower Boom cylinder

Removal

1. Position the unit on a level surface. Apply the parking brake, chock the wheels and engage the PTO. Extend the outriggers (if equipped). Make sure the booms are stowed.

2. Use a hoist and sling to support the lower boom (refer to Fig. 7.1).

3. Start the engine and engage the PTO. Using the lower controls, shift the lower boom control handle until the lower boom cylinder is fully retracted.

4. Shut off engine and disengage the PTO. Release any pressure built up in the hoses connected to the lower boom lift cylinder. This is done by shifting the lower boom control handle on the lower control valve in both directions for several minutes.

> ***Caution***
>
> Failure to remove pressure before removing a hydraulic hose will cause oil to spray out under pressure as the connection is loosened. Hydraulic oil escaping under pressure can have enough force to inject oil into the flesh.

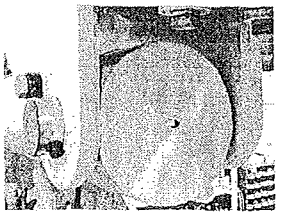
In case of injury by escaping hydraulic oil, seek medical attention at once. Serious infection or reaction can result if medical treatment is not given immediately.

Keep the unit and work areas clean. Spilled hydraulic oil creates slick surfaces and may cause personnel to slip and/or fall.

5. Remove the two hoses that are connected to the lower boom lift cylinder. Mark the hose connections to ease installation later. Cap the open ports.

6. Remove the cap screw and forged pin retainer from the rod end cylinder pin.

7. Making sure the cylinder is supported, remove the pin from the rod end of the cylinder and the cylinder attachment bracket.



8. Remove the cap screw and forged pin from the cap end pin of the cylinder.

9. Marking sure the cylinder is supported, carefully remove the pin from the cap end of the cylinder and the cylinder attachment bracket.

10. Immediately lower the cylinder to the ground.

Installation

1. With the new cylinder on the ground, secure the sling around the cylinder housing.

2. Lift the cylinder with the hoist and align the rod end of the cylinder with the cylinder attachment bracket on the turntable. Install the cylinder pin through the first hole of the attachment bracket, the rod end of the cylinder and the second pin hole in the cylinder attachment bracket.

3. Insert the forged pin retainer through the cylinder pin. Install the cap screw through the forged pin retainer. (Refer to the parts manual for torque)

4. Connect the two hydraulic hoses to the cylinder that were removed.

5. Reposition the hoist in the center of the cylinder housing. Align the cap end of the cylinder with the cylinder attachment bracket on the lower boom. You may need to start the engine, engage the PTO and operate the lower controls to extend the rod to help in alignment. Install the cap end cylinder pin through the first hole in the cylinder attachment bracket, the cap end of the cylinder, and the second hole in the cylinder attachment bracket.

6. Insert the forged pin retainer through the cylinder pin. Install the cap screw through the forged pin retainer. (Refer to the parts manual for torque)

7. Start the engine and engage the PTO. Using the lower controls, raise and lower the boom five to six cycles while checking the lower boom lift cylinder for leaks and proper operation. This purges any air that may be in the cylinder.

Warning

The lower boom lift cylinder hydraulic hoses must be securely connected to the cylinder before engaging the lower controls. Failure to properly cap or connect the lines could result in hydraulic oil spraying out of the open hoses. Serious personal injury could result.

Do not operate the aerial device from the upper controls until you are certain all the air is purged from the lower boom cylinder. The presence of air in the cylinder may cause inadvertent retraction or extension of the cylinder, resulting in serious injury or death.

Structurally test the unit as described in Section 11 - Testing.

Upper Boom

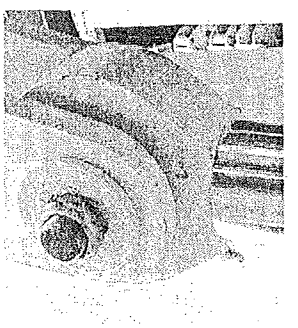
> ***Warning***
>
> Pinch points exist at both the rod end and the base end of the cylinders. Be extremely careful when removing or installing the upper and lower boom cylinders.

Removal

1. Prepare a safe work area. Park the unit on a level area and extend the outriggers if equipped. A hoist or other lifting device will be needed.

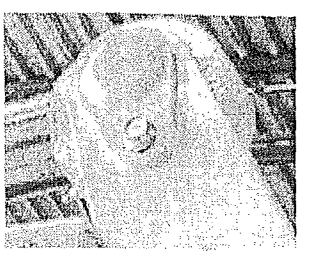
2. With the lower boom in the rest, unfold the upper boom so that the platform rests approximately three inches from the ground. Place a board or pallet under the platform. Shut off the PTO and truck engine (refer to Figure 7.2).

3. Secure a sling and hoist around the center of the upper boom cylinder housing.



4. The rod end of the upper boom cylinder has a flange and lug system on one side and a lock nut at the other side. Remove the capscrew and remove the lock nut from pin end. Spacers are installed between links and rod end, identify them for reinstallation ease.

5. Making sure the cylinder is supported, remove the pin from the link and the rod end of the cylinder.



6. Using the lower controls, carefully retract the upper boom cylinder by engaging the upper boom fold function.

7. Shut off the engine and disengage the PTO. Release any pressure that is built up in the upper boom cylinder. Do this by engaging the upper boom control handle on the lower control valve in both directions for several minutes.

8. Remove the two hydraulic hoses connected to the cylinder. Mark the hose connections to ease installation later. Cap or plug all open ports.

> **Caution**
>
> Failure to remove pressure before disconnecting hydraulic lines or fittings will cause oil to spray out under pressure as the connection is loosened. Hydraulic oil escaping under pressure can have enough force to inject oil into the flesh.

In case of injury by escaping hydraulic oil, seek medical attention at once. Serious infection or reaction can result if medical treatment is not given immediately.

Keep the unit and work areas clean. Spilled hydraulic oil creates slick surfaces and may cause personnel to slip and/or fall.

9. Remove the countersunk head capscrew from the pin at the cap end of the cylinder (refer to Figure 7.2).

10. Making sure the cylinder is supported, carefully remove the pin from the cap end of the cylinder.

11. Immediately lower the cylinder to the ground.

Installation

1. With the cylinder on the ground, secure the hoist around the cylinder housing.

2. Lift the cylinder with the hoist and align the cap end of the cylinder with the cylinder attachment bracket on the upper boom. Install the cylinder pin through the first hole in the cylinder attachment bracket, the cap end of the cylinder, and the second hole in the cylinder attachment bracket.

3. Install the countersunk head capscrew through the flange and lug retainer (Refer to Figure 7.2 for the torque value).

4. Connect the two hydraulic hoses to the cylinder.

5. Reposition the hoist so that the cylinder is tilted upward 10 degrees.

6. Using the lower controls, engage the upper boom unfold and fold functions to extend and retract the upper boom cylinder five to six times. Check the cylinder for hydraulic leakage. If leaks are found, the source of the leakage must be determined and corrected before continuing with the procedure.

Warning

The cylinder hydraulic hoses must be securely connected to the upper boom cylinder before engaging the lower controls. Failure to properly cap or connect the lines could result in hydraulic oil spraying out of the open lines. Serious personal injury could result.

7. Using the lower controls, carefully extend the upper boom cylinder by engaging the upper boom unfold function. Extend the cylinder rod until the rod is aligned with links. Shut off the engine.

8. Release any pressure that may be built up in the cylinder by shifting the upper boom control handle in both directions for several minutes.

9. Align the rod end of the cylinder with the three links of the upper boom drive mechanism. Install the rod end cylinder pin through the links, spacers and cylinder eye.

10. Install the washer and the lock nut at end of the cylinder pin. Insert a capscrew through the flange and lug at the other side of the cylinder pin. (Refer to the Parts manual for the torque value)

11. Start the engine and engage the PTO. Position the lower boom vertically. Using the lower controls, operate the upper boom five to six cycles. During each cycle, unfold the upper boom to approximately 60 degrees from the lower boom stow. This will purge any air that may be in the rod side of the cylinder. Do not move the upper boom overcenter. Also check the upper boom cylinder for hydraulic leaks and proper operation.

Warning

Do not move the upper boom overcenter until you are certain all the air be purged from the rod end of the upper boom cylinder. The presence of air in the cylinder may cause inadvertent extension of the cylinder when the upper boom is overcenter, resulting in serious injury or death.

12. Structurally test the unit as described in Section 11 - Testing.

Air Bleeding

The presence of air in any hydraulic system will cause abnormal operation, noise and damage to the pump. The presence of air in the hydraulic system can usually be traced to one of the following listed below:

- If the oil level in the reservoir is allowed to get too low, the pump suction can cause a vortex to form in the reservoir, which will allow air to be sucked into the system along with the oil.

- A leak in the plumbing between the reservoir and the pump can suck air even though it will not leak out when the system is shut down. These leaks may be found by filling a pump type oil can with clean hydraulic oil and squirting oil slowly at each connection in the suction line with the pump operating at normal operating speed. A suction leak will suck the oil in. To avoid contamination, make sure the oil can and the suction line connections are clean before checking for leaks using this method. Be sure to check the connection at the attachment to the pump.

Air entering the system, due to low oil levels or leaks in the suction line, will cause the most problems and should be corrected immediately.

> ***Warning***
>
> Serious pump damage and machine malfunctions are likely to occur if conditions allowing air to enter the suction side of the pump are present.

- Loose connections in the pressure system normally will leak externally during machine operation, but can suck air into the system after the machine is shut down as the oil tries to find its way to the low points of the system.

- Hydraulic lines taken loose during maintenance operations will contain air until it is worked out of the system.

After reconnecting a hydraulic line from any cylinder, make sure to extend and retract the cylinder five to six times to purge the air out of the cylinder and to check for hydraulic leaks. The easiest way to accomplish this may be a port-a-power or ground level tools circuit. On the upper boom cylinder, position the lower boom vertically and cycle the cylinder up and down approximately 60 degrees from the boom stow. This purges any air that may be in the cylinder. Do not move the boom in the overcenter positions.

Warning

When removing a hydraulic line from a cylinder, do not operate the aerial device from the upper controls until you are certain all the air is purged from the cylinder after the hydraulic line is installed. The presence of air in the cylinder may cause inadvertent retraction or extension of the cylinder, resulting in serious injury or death.

Do not move the upper boom overcenter until you are certain all the air be purged from the rod end of the upper boom cylinder. The presence of air in the cylinder may cause inadvertent extension of the cylinder when the upper booms is in the overcenter positions, resulting in serious injury or death.

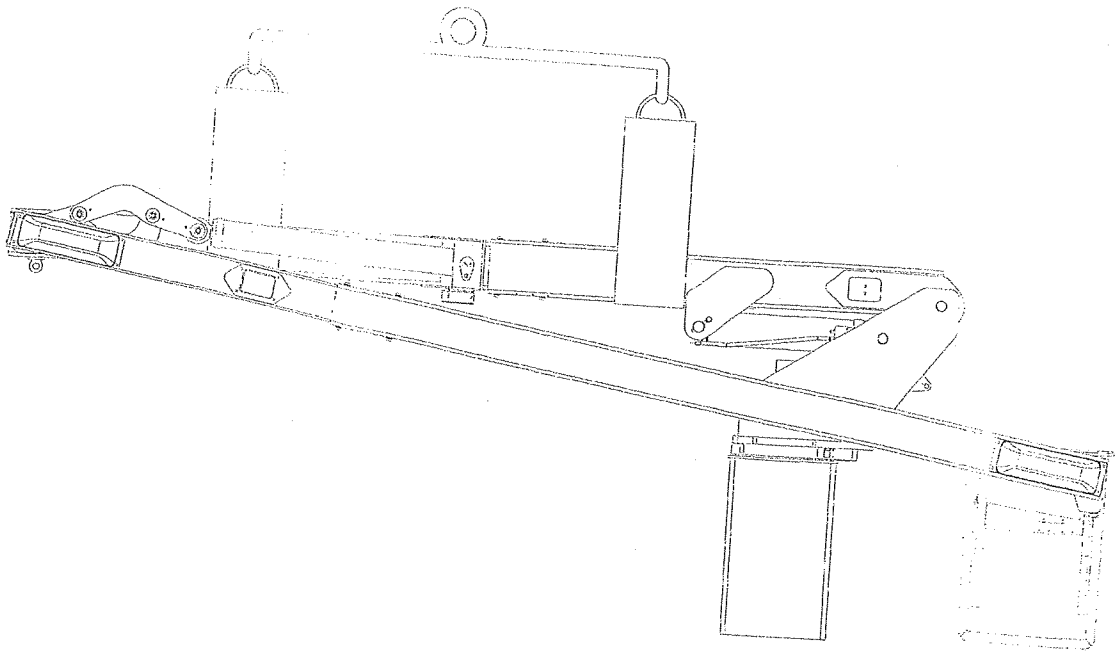


Figure 7.1 Lower boom cylinder

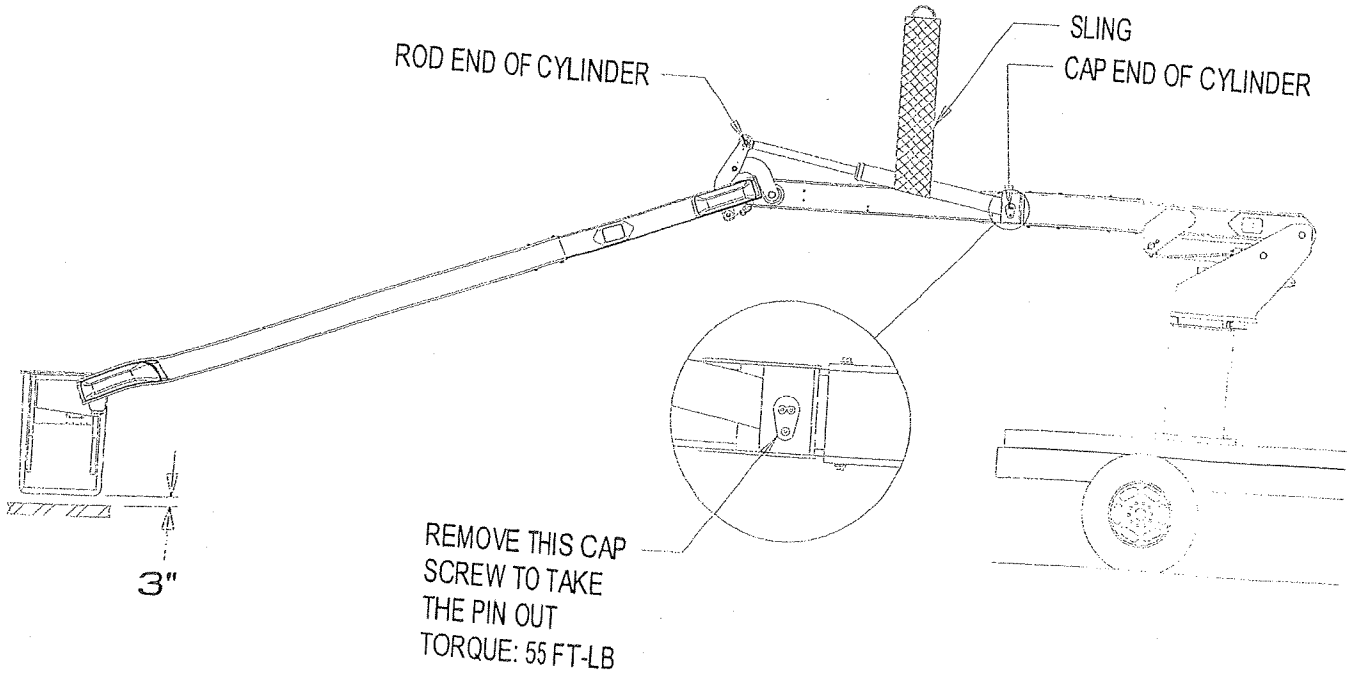
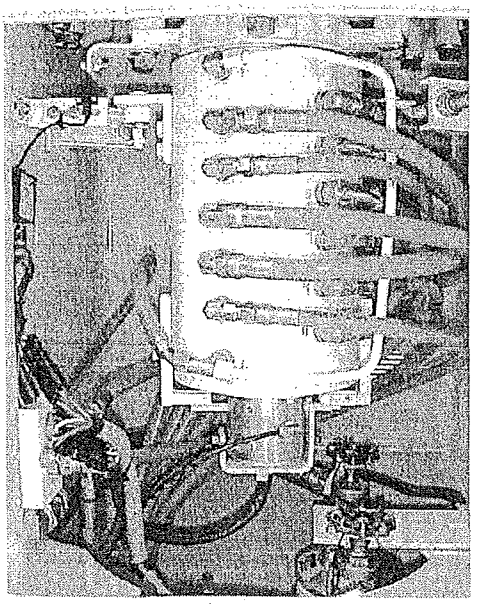


Figure 7.2 Upper boom cylinder

Section 8 - Mechanical Systems

Rotary Joints (or swivels)



The rotary joints installed in the pedestal permits continuous rotation of the turntable without twisting the hydraulic hoses, the pneumatic hoses and the electric wires inside the pedestal and the turntable.

The inner core of the hydraulic rotary joint is bolted to the rotary joint mounting plate. The mounting plate is bolted to the bottom plate of the turntable. As the turntable rotates, the inner core of the hydraulic rotary joint also rotates.

The outer housing of the hydraulic rotary joint is stationary. Two mounting brackets are attached to the outer housing of the rotary joint. As the inner core rotates with the turntable, the outer housing is stationary within the pedestal.

Depending on the options installed, the hydraulic rotary joint can have up to 15 passages. The hydraulic lines connected through the rotary joint include the pressure lines and the system return lines. The rotary joint uses SAE straight thread type fittings. Pipe fittings do not fit in these ports. Do not attempt to install pipe fittings in the rotary joint ports.

If your unit is equipped with an emergency lowering DC pump system and/or engine start/stop system and/or two-speed throttle system, various electrical circuits will also pass through the centerline of rotation by way of the slip ring. If present, the slip ring is mounted to the bottom lip of the rotary joint.

If your unit is equipped with a pneumatic booms latch system, a pneumatic rotary joint is installed under the hydraulic rotary joint.

Do not allow trash, leaves, etc., to accumulate around the rotary joints and the slip ring. If debris is allowed to accumulate, it could damage the hoses and the wires connected to the rotary joints.

Removal

1. Turn off the engine and disengage the PTO. Move the station selector handle on the side of the turntable to the "Lower Controls" position. Release any pressure built up in the hoses. This may be done by moving the control handles on the lower control valve in both directions several times. Close the gate valves at the hydraulic reservoir ports.

> ***Caution***
>
> Failure to remove pressure before disconnecting hydraulic lines or fittings will cause oil to spray out under pressure as the connection is loosened. Hydraulic oil escaping under pressure can have enough force to inject oil onto the flesh.

In case of injury by escaping hydraulic oil, seek medical attention at once. Serious infection or reaction can result if medical treatment is not given immediately.

Keep the unit and work areas clean. Spilled hydraulic oil creates slick surfaces and may cause personnel to slip and/or fall.

2. Disconnect the hydraulic and pneumatic hoses that are connected to the rotary joints. Cap or plug all open ports and hoses.

3. Depending upon the options provided on your unit, there may be electrical circuits that are routed from a slip ring through the rotary joint. If your unit is equipped with a slip ring, disconnect the wires in the turntable from the emergency lowering DC pump switch and/or engine start/stop switch and/or the two-speed throttle switch. Do not cut away any of the wires when removing the slip ring. The hole in the rotary joint is large enough to allow the wires to pass through. Remove the wires from the rotary joint.

4. Remove the slip ring from the rotary joint.

5. Remove the cap screws that mount the inner core of the rotary joint to the rotary joint mounting plate and the cap screws that mount the outer core of the rotary joint to its mounting plate.

6. Remove the rotary joint through the access door in the pedestal.

Installation

1. Remove the hydraulic fittings from the old rotary joint and install them on the new rotary joint.

2. Transfer the pneumatic rotary joint on the new hydraulic rotary joint.

3. Position the rotary joint in the pedestal. Line up the holes in the rotary joint with the holes in the plate on the bottom of the turntable.

4. Install the cap screws through the rotary mounting plate and into the rotary joint.

5. Position the slip ring below the rotary joint. Route the wires through the rotary joint.

6. Insert a slip ring mounting cap screw through a spacer tube. Install the cap screw through the bottom lip of the rotary joint and into the slip ring. Repeat this step for the other two cap screws and spacer tubes that mount the slip ring to the rotary joint.

7. Connect the appropriate wires to the emergency lowering DC pump switch and engine start/stop switch.

8. Connect all the hydraulic and pneumatic hoses to the respective rotary joints.

9. Be sure to open the gate valves at the hydraulic reservoir outlets when the work has been completed. Engage the PTO, start the engine. Operate the unit while checking for leaks at the rotary joint.

Attention

Serious pump or return line filter damage may result if you attempt to operate the unit with either or both of the gate valves closed.

Rotation System

The aerial device rotates on a large shear ball bearing. It is referred to as the rotation bearing. The inner race of the bearing is bolted to the turntable. The outer race of the bearing is bolted to the pedestal. It has gear teeth cut on the outside surface of the outer race.

Operation

Rotation is accomplished through a planetary gear drive driven by a hydraulic motor. This has an output gear called the rotation pinion. The rotation pinion meshes with the teeth on the rotation bearing.

A spring applied brake with an hydraulic release is located between the rotation motor and the planetary gearbox on the turret. The motion control valve, which is mounted directly to the hydraulic motor, consists of a shuttle and two counterbalance cartridge valves.

When the rotation control is in neutral, the counterbalance valves are closed and trap oil in the rotation motor. The spring applied brake also locks the planetary gearbox in place, since there is no pressure sent to the brake release port.

When the rotation function is operated either CW or CCW, the hydraulic oil pressure goes through the shuttle valve and applies to the brake piston port. The hydraulic pressure applied moves the piston against the springs, thus releasing the brake discs. The counterbalance valves open and allow hydraulic oil to flow through the rotation motor.

Two counterbalance valves control the motor of the aerial lift rotation in order to provide a smooth operation when the unit is on a 5-degree slope. The counterbalance valves improve motion control by converting the overrunning load into a positive load. The counterbalance cartridges are factory set at 1800 PSI and **must not** be adjusted in the field. If the setting on a counterbalance valve has been changed, the cartridge must be removed and adjusted with a test block or replaced.

Caution

Do not attempt to adjust a counterbalance valve without a test block. Using a test block and pressure gauge is the only accurate way to determine that the proper setting has been obtained.

The unit must always be operated in order to prevent developing any side loads on the booms. **This unit is not equipped with a side load protection system** that could prevent damage to the rotation mechanism or to the aerial device structures, when a side load is applied to the booms.

Caution

Never apply side loads to the booms. The booms must always rotate freely without any obstruction (against a pole for example).

Rotation Bearing

The rotation bearing provides a very low torque during rotation of the booms. If properly maintained, the rotation bearing will provide many years of satisfactory service.

A grease fitting is connected to the inner race of the rotation bearing. As listed in the Preventive Maintenance and Inspection Checklist in Section 2, lubricate the bearing race every 4 months or 340 PTO hours, whichever comes first. Also, lubricate the gear teeth on the outer race and the rotation pinion every month. Refer to Section 4 under Lubricant Specifications for instructions.

Two areas of rotation bearing inspection are important. A periodic measurement of the clearance between the inner and outer races of the bearing can give a good indication of the condition of the bearing. This measurement is commonly referred to as the turntable tilt. The inspection of the rotation bearing mounting cap screws must be performed to discover any loosening of the cap screws. The procedures for measuring the turntable tilt and the rotation bearing cap screws are covered in Section 5 of this manual.

Removal

Components will need to be removed to access the rotation bearing cap screws for removal. It is important that experienced, trained mechanics perform this procedure and are aware of the process needed to make the rotation bearing accessible for removal.

Caution

A hoist or other lifting device of suitable capacity will be required to support the turntable and booms during this procedure.

1. Disconnect the hydraulic lines and the electrical wires that are connected to the rotary joint and slip ring. Remove the rotary joints and the slip ring. Refer to the instructions in this section under "Rotary Joints".

2. Support the turntable (and booms, if still attached) to prevent it from accidentally coming off of the pedestal after the cap screws are removed. All of the rotation bearing cap screws are accessible from the pedestal side of the rotation bearing. Remove the cap screws and washers from the outer race.

3. Use a hoist or other lifting device to lift the booms and the rotation bearing. Secure of booms and allow space to work above and below rotation bearing.

4. Remove the planetary gear reducer.

5. Remove the cap screws and washers from the inner race of the rotation bearing.

6. Remove the bearing from the turret.

Installation

Caution

Failure to keep the rotation bearing cap screws properly tightened may lead to fatigue failure of the cap screws and consequent machine damage. Insufficient or uneven cap screw tightness may also contribute to reduced life of the rotation bearing.

Attention

Use a manual torque wrench, accurately calibrated, to install the rotation bearing cap screws. All cap screws are to be torqued to the appropriate torque value (Refer to the Critical Torque Chart) by applying a smooth pull on the torque wrench without jerking. Do not overtighten the cap screws.

1. Clean the weldments with a cloth and solvent to remove any dirt or grease.

2. Remove the grease fitting from the old rotation bearing and install it in the new bearing.

3. Position the new rotation bearing on the turret, locating the high tooth (marked by yellow or blue paint) in the proper position. Align the mounting holes with the mating cap screw holes in the bearing.

4. Apply anti-seize compound to the entire cap screw (threads, shank and underside of the head) for those cap screws that will be used around the inner race of the bearing. Look at the hole in the washer. Notice that it has a more rounded edge on one side of the washer. Install the washer with the rounded edge toward the cap screw head. Coat the bottom of each washer with the compound after installing it on the cap screw. Start a cap screw by hand through the turret and into the bearing. Install the remainder of the cap screws in the inner race of the bearing. Do not begin to torque the cap screws until all of them have been installed on the inner race.

Attention

The mounting cap screws for the outer race and the inner race of the rotation bearing must have the correct lengths. Make sure you use the correct cap screws in the correct locations on the inner and outer races of the rotation bearing.

5. You must use all new cap screws and washers. You must use genuine Posi-Plus replacement parts.

6. Torque the cap screws in three phases. First, start by torquing the cap screws to 85% of the total required torque **(Refer to the Critical Torque Chart)** using the alternating star pattern shown in Figure 5.2. For the second torque phase set the torque to the total required torque. Follow the same alternating start pattern. For the last torque phase, keep the torque wrench set for the required total torque. Torque each cap screw a third time using a circular pattern starting with cap screw number one.

7. Install the planetary gear reducer and adjust the pinion according to the procedure described in this section.

8. Use a hoist or other lifting device to position the turntable on top of the pedestal. Align the pedestal mounting holes with the mating cap screw holes in the bearing.

9. Install the cap screws in the outer race of the bearing in the same manner as you did the inner race cap screws. Apply anti-seize compound to the cap screws and washers as in Step 5. Install the washers and cap screws.

10. Torque the cap screws in three phases using the same torque values used on the inner race in Step 6. Follow the alternating star pattern shown in Figure 5.2.

11. Install the rotary joints (hydraulic pneumatic and electric). Reconnect all hydraulic and pneumatic lines and electrical wires.

12. Grease the rotation bearing raceway and gear teeth as described in Section 4 under Lubricant Specifications. Adjust the rotation pinion and the rotation bearing gear backlash, as described in the following section.

Rotation Drive Gearbox

Rotation is accomplished by a rotation gearbox, which is mounted on the turntable. The rotation gearbox houses a planetary gear-type set driven by a hydraulic motor. The planetary gear reducer has an output shaft called the rotation pinion. As the rotation pinion turns, it drives the rotation bearing and causes rotation of the turntable. Figure 8.1 illustrates the outer race of the rotation bearing as it meshes with the rotation pinion.

The rotation pinion is adjustable to mesh properly with the rotation bearing. Proper adjustment minimizes backlash, or mesh, between the pinion and rotation bearing gear teeth. Adjustment is accomplished with the adjustment bolts on the turret.

5. You must use all new cap screws and washers. You must use genuine Posi-Plus replacement parts.

6. Torque the cap screws in three phases. First, start by torquing the cap screws to 85% of the total required torque **(Refer to the Critical Torque Chart)** using the alternating star pattern shown in Figure 5.2. For the second torque phase set the torque to the total required torque. Follow the same alternating start pattern. For the last torque phase, keep the torque wrench set for the required total torque. Torque each cap screw a third time using a circular pattern starting with cap screw number one.

7. Install the planetary gear reducer and adjust the pinion according to the procedure described in this section.

8. Use a hoist or other lifting device to position the turntable on top of the pedestal. Align the pedestal mounting holes with the mating cap screw holes in the bearing.

9. Install the cap screws in the outer race of the bearing in the same manner as you did the inner race cap screws. Apply anti-seize compound to the cap screws and washers as in Step 5. Install the washers and cap screws.

10. Torque the cap screws in three phases using the same torque values used on the inner race in Step 6. Follow the alternating star pattern shown in Figure 5.2.

11. Install the rotary joints (hydraulic pneumatic and electric). Reconnect all hydraulic and pneumatic lines and electrical wires.

12. Grease the rotation bearing raceway and gear teeth as described in Section 4 under Lubricant Specifications. Adjust the rotation pinion and the rotation bearing gear backlash, as described in the following section.

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The rotation pinion is adjustable to mesh properly with the rotation bearing. Proper adjustment minimizes backlash, or mesh, between the pinion and rotation bearing gear teeth. Adjustment is accomplished with the adjustment bolts on the turret.

Adjustment of the Rotation Pinion and Rotation Gear Backlash

Excessive backlash will appear as excessive side-to-side boom movement when the rotation function is stopped. Adjustment of the backlash may be necessary to compensate for wear after extended operation. It is also necessary if a new rotation gearbox and/or rotation bearing is installed.

Use the following procedure to check and adjust the mesh between the rotation pinion and the rotation bearing.

> ***Warning***
>
> Hands and fingers must be kept off the pinion and rotation bearing gear teeth to avoid serious injury.

1. Turn on the engine, position the truck, engage the PTO and extend the outriggers (if equipped). Remove the pinion cover.

> ***Caution***
>
> Use extreme caution when access covers have been removed to service the unit. Pinch points and shear points may exist between moving parts. Replace the access covers immediately after servicing.

2. Rotate the booms to the position that seems to have the least amount of movement between the rotation pinion and the rotation bearing. This will normally be where the pinion meshes with the high tooth of the rotation bearing. The high tooth is the point on the bearing where the rotation pinion meshes with the rotation bearing when the booms are stowed. On a new rotation bearing, it is painted blue or yellow. However, the high tooth may not always be the area with the least amount of movement between the rotation pinion and the rotation bearing. In some situations, there has been a greater amount of concentrated wear in this area than on other areas of the bearing. If this is the case on your unit, rotate the booms to the area that does have the least amount of movement between the pinion and the bearing gear teeth.

3. With another person rocking the boom tip back and forth, observe the movement between the pinion and rotation gear teeth, if it is seen at the point of gear mesh, the mesh between the pinion and rotation bearing is loose. Do not confuse backlash with slight lost motion within the rotation gearbox. Internal gearbox backlash will cause the pinion to rotate back and forth slightly. This cannot be reduced externally. If it is

necessary to bring the pinion into closer mesh with the rotation bearing, continue with the following steps.

> **Caution**
>
> Eye protection must be worn while adjusting the eccentric ring to prevent particles of metal or dirt from entering the eyes.

4. Loosen, but do not remove, the four bolts that mount the rotation gearbox to the turntable base plate. If you are installing a new gearbox, apply anti-seize compound to each mounting cap screw (threads, shank and underside of the head) before installing the cap screw into the gearbox. Install the washer with the rounded edge of the washer hole toward the cap screw head. Coat the bottom of each washer with the compound after installing it on the cap screw. Start the cap screws and washers in the gearbox bolt mounting holes.

5. Loosen the two adjustment bolts, which are pushing the planetary gear drive flange toward the center of rotation. The gearbox mounting holes are 1/8" (3 mm) oversize to accommodate movement of the pinion toward or away from the rotation bearing.

6. Screw in the two adjustment bolts to move the pinion toward the rotation bearing. These two bolts have to be screwed in equally so that the planetary gear drive flange do not get stuck in the guiding grooves on the turret base. Release the internal brake and rotate the planetary input shaft with a splined adaptor. The torque required to rotate the reducer must be 30 to 40 in-lbf. If the torque registered is higher, the pinion has to be moved away from the rotation bearing. The adjustment bolts will have to be unscrewed. Otherwise, the adjustment is correct, lock the adjustment bolts in place torquing the nuts against the adjustment bolt support.

7. Tighten the gearbox mounting bolts to the required torque **(Refer to the Critical Torque Chart)**. Rotate the machine slowly through at least two revolutions.

    A. If the unit rotates smoothly, go to Step 8.

    B. If rotation binds or hesitates in any position, the backlash may have been set too tight. Loosen the mounting bolts. Repeat Step 6.

8. If a new gearbox was installed, or if the rotation teeth are dry, apply an open face gear lubricant as recommended in Section 4 under "Lubricant Specifications".

9. Install the pinion cover.

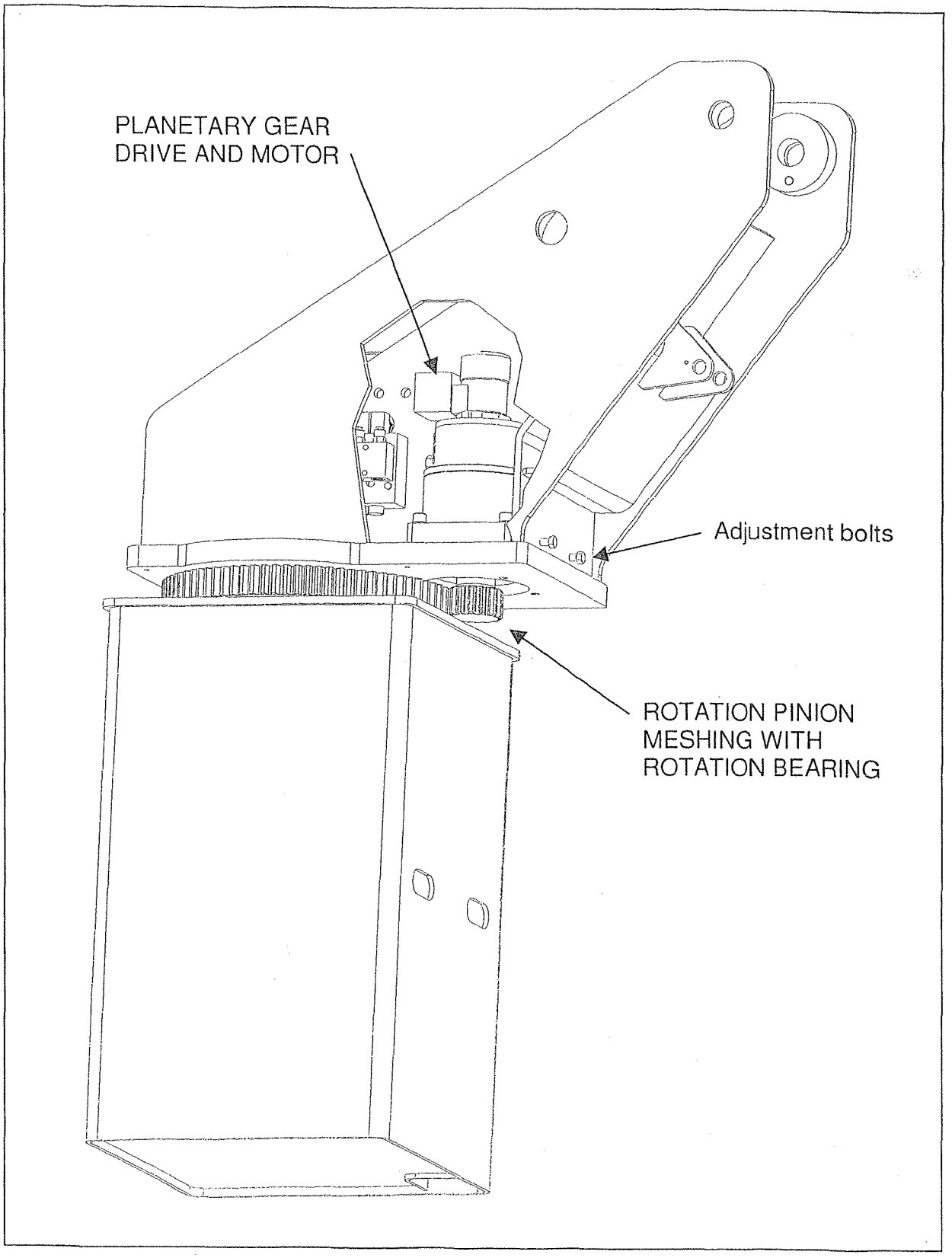


FIGURE 8.1 ROTATION MECHANISM

Leveling System

The aerial device is equipped with a mechanical leveling system. It maintains the floor of the platform parallel to the turntable base. This is a positive, mechanical system consisting of roller chains, sprockets, fiberglass rods, etc.

Operation

Due to the geometric arrangement of the leveling system, movement of the booms results in movement of the platform.

The platform is fastened to the platform shaft, which is keyed to the sprocket at the boom tip. A series of roller link chains, fiberglass rods, and sprockets transmit the movement of the booms to maintain the platform leveled with the base of the unit while the aerial device operates. As the booms are raised and lowered, each component of the leveling system is moved by the next component.

Adjustment

The leveling system is adjusted by the adjustable rod or adjustable rod end of the hydraulic platform tilt cylinder at the turret (Refer to Figure 8.2). Depending on the platform tilt option, an adjustable rod (for the manual platform tilt) or a hydraulic cylinder (for the hydraulic platform tilt) must be adjusted in length. If the aerial device is equipped with a hydraulic platform tilt, this cylinder length must be adjusted if the platform lip is not leveled with the base of the unit.

Use the following procedure to level the platform. For every adjustment:

1. Make sure the booms are stowed. Put weight in the platform equal to the rated capacity of the platform. The rated capacity of the platform is shown on the aerial device identification placard on the pedestal. Make sure that the platform is parallel (no platform rotation) with the booms, if the aerial device is equipped with a platform rotator.

2. Depending upon which direction the platform is tilting, follow the appropriate steps.

Caution

Use extreme caution when access covers have been removed to service the unit. Pinch points and shear points may exist between moving parts. Replace the access covers immediately after servicing.

Leveling System

The aerial device is equipped with a mechanical leveling system. It maintains the floor of the platform parallel to the turntable base. This is a positive, mechanical system consisting of roller chains, sprockets, fiberglass rods, etc.

Operation

Due to the geometric arrangement of the leveling system, movement of the booms results in movement of the platform.

The platform is fastened to the platform shaft, which is keyed to the sprocket at the boom tip. A series of roller link chains, fiberglass rods, and sprockets transmit the movement of the booms to maintain the platform leveled with the base of the unit while the aerial device operates. As the booms are raised and lowered, each component of the leveling system is moved by the next component.

Adjustment

The leveling system is adjusted by the adjustable rod or adjustable rod end of the hydraulic platform tilt cylinder at the turret (Refer to Figure 8.2). Depending on the platform tilt option, an adjustable rod (for the manual platform tilt) or a hydraulic cylinder (for the hydraulic platform tilt) must be adjusted in length. If the aerial device is equipped with a hydraulic platform tilt, this cylinder length must be adjusted if the platform lip is not leveled with the base of the unit.

Use the following procedure to level the platform. For every adjustment:

1. Make sure the booms are stowed. Put weight in the platform equal to the rated capacity of the platform. The rated capacity of the platform is shown on the aerial device identification placard on the pedestal. Make sure that the platform is parallel (no platform rotation) with the booms, if the aerial device is equipped with a platform rotator.

2. Depending upon which direction the platform is tilting, follow the appropriate steps.

Caution

Use extreme caution when access covers have been removed to service the unit. Pinch points and shear points may exist between moving parts. Replace the access covers immediately after servicing.

Platform Lip Tilted Toward Elbow (Adjustable rod - manual platform tilt)

a) Loosen the jam nuts on the adjustable rod or connecting link at the turret.

b) To adjust the rod, the yoke pin must first be removed. Then, screw in the yoke to make it shorter. Do not screw in beyond the minimum length of the adjustable rod, as specified on Figure 8.2. Otherwise, the leveling will not work properly.

c) Tighten the jam nuts when the platform is parallel with the base of the unit.

Platform Lip Tilted Toward Boom Tip (Adjustable rod - manual platform tilt)

a) Loosen the jam nuts on the adjustable rod or connecting link at the turret.

b) To adjust the rod, the yoke pin must first be removed. Then, unscrew the turnbuckle to make the adjustable rod longer. Make sure that the minimum length of threads inside the turnbuckle is maintained, as specified on Figure 8.2. Otherwise, the leveling system might fail during operation.

c) Tighten the jam nuts when the platform is parallel with the base of the unit.

Platform Lip Tilted Toward Elbow (Cylinder - hydraulic platform tilt)

a) Before adjusting the hydraulic platform tilt cylinder, retract it completely. Check the platform lip level with respect to the base of the unit.

b) To adjust the hydraulic platform tilt cylinder, the rod end pin must first be removed. The jam nut on the rod end has to be loosened to be able to screw in the rod end. This will make the cylinder shorter. Make sure that the maximum length of threads inside the cylinder rod is maintained, as specified on Figure 8.2 (i.e. the minimum closed length of the cylinder). Otherwise, the cylinder may damage the leveling system.

c) Tighten the jam nut as specified on Figure 8.2.

d) Reinstall and lock the cylinder rod end pin.

Platform Lip Tilted Toward Boom Tip (Cylinder - Hydraulic platform tilt)

a) Before adjusting the hydraulic platform tilt cylinder, retract it completely. Check the platform lip level with respect to the base of the unit.

b) To adjust the hydraulic platform tilt cylinder, the rod end pin must first be removed. The jam nut on the rod end has to be loosened to be able to unscrew the rod end. This will make the cylinder longer. Make sure that the minimum

length of threads inside the cylinder rod is maintained, as specified on Figure 8.2 (i.e. the maximum closed length of the cylinder).

c) Tighten the jam nut as specified on Figure 8.2.

d) Reinstall and lock the cylinder rod end pin.

3. Articulate the booms in every positions to make sure that the adjustment has been done properly.

Inspection

The Preventive Maintenance and Inspection Checklist in Section 2 lists various parts of the leveling system that must be inspected every 4 months or 340 PTO hours, whichever comes first. Inspect the condition of the leveling rods, the leveling chains and the retainer for the leveling system anchor pin. Check the condition of the boom tip sprocket and the tightness of the retainers. Also, make sure the jam nuts on the turnbuckle connections are in place and tight.

If the platform landing is loose, the turnbuckles in the booms may need to be tightened and/or one of the leveling rod end joint is broken. (Refer to section 6 under "Leveling rod inspection")

Caution

Use extreme caution when access covers have been removed to service the unit. Pinch points and shear points may exist between moving parts. Replace the access covers immediately after servicing.

Lubrication

As shown in the Lubrication Chart and Diagram in Section 4, lubricate the leveling chains every 4 months or 340 PTO hours, whichever comes first.

Lower Boom Leveling System Removal

Before any attempt is made to remove or replace leveling chains or rods, Figure 8.2 should be studied thoroughly and compared to the leveling system drawing in your Parts manual for this specific unit's adjustments. It is very important that the correct procedures are followed to assure proper routing of the chains. It is strongly recommended that all replacement parts be genuine Posi-Plus parts. You may need some paint to indicate the timing marks on the leveling chains and sprockets and also

some special tools to torque the turnbuckle (i.e. P/N 192-0013-001-00-1). Here are the steps to follow for the lower boom leveling system removal:

1. Set the wheel chocks and disengage the PTO. Make sure the booms are stowed.

2. Remove all of the access covers from the sides of the lower boom.

> ***Caution***
>
> Use extreme caution when access covers have been removed to service the unit. Pinch points and shear points may exist between moving parts. Replace the access covers immediately after servicing.

3. It may be helpful to remove the platform from the platform mounting bracket. This is done by removing the bolts that fasten the platform to the platform mounting bracket. This will prevent the platform from acting as a counterweight when removing and installing the leveling system. Do not remove the platform mounting bracket.

4. The leveling chains in the lower boom are timed with the sprockets. To ease installation later, paint timing marks on the sprockets and chains before removing the chain. Use the diagram in Figure 8.2 to locate the timing link and tooth at the elbow and turret ends of the lower boom. Mark these points with paint.

5. At the turret end of the lower boom, through the access hole, loosen the jam nuts on the leveling turnbuckle. Loosen the turnbuckle. While turning the turnbuckle, have someone hold the ends of the leveling rod and chain with wrenches to avoid twisting the rod or chain. Remove the turnbuckle.

6. At the turret end of the lower boom, unwrap the chain from the main pivot sprocket.

7. Through the same access hole, pull the top leveling rod toward you until the chain and rod connection can be reached. (Refer to Figure 8.2).

8. At the elbow end of the lower boom, lift off the chain of the lower boom elbow sprocket.

9. Pull the chain and leveling rods out of the elbow end of the lower boom.

Lower Boom Leveling System Installation

Here are the steps to follow to install the lower boom leveling system:

1. Use the leveling system pages in the Parts Manual to identify the rods and chains for the lower boom.

2. The top and the bottom leveling rods for the lower boom are different. Use the leveling system pages in the Parts Manual to identify the position of each rod. To ease installation, mark the rods top and bottom.

3. Insert the rods and chain assembly from the elbow into the lower boom. Wrap the chains around the sprocket according to Figure 8.2.

4. Loosely start the free end of the turnbuckle into the threaded end of the top leveling rod. Make sure that the turnbuckle is started equally with left hand and right hand threads.

5. The leveling chains in the lower boom are timed with the sprockets. Count off the links and pins as shown on Figure 8.2 (excluding the connecting link) from the bottom leveling rod. Figure 8.3 illustrates how to count the links and the pins. Mark the correct link with paint. If you are using an old chain that already has a timing mark painted on it, make sure the timing mark is in the correct location by counting the pins (Refer to Figure 8.2).

6. Position the marked link on the tooth shown in Figure 8.2 (it may also be marked with paint). Make sure the top and bottom leveling rods are in the correct position.

7. Count off the pins from the free end of the chain (the end without the adapter - refer to Figure 8.2). Mark the correct pin with paint. If you are using an old chain that already has a timing mark painted on it, make sure the timing mark is in the correct location by counting the pins. Figure 8.3 illustrates how to count the links and pins.

8. Through the access holes near the base of the lower boom, position the top and bottom ends of the leveling chain in the grooves of the chain guides (Refer to Figure 8.2).

9. Position the top of the leveling chain at the elbow in the groove of the chain guide (Refer to Figure 8.2).

10. Make sure the leveling rods and chains in the lower boom are routed as shown in Figure 8.2.

11. If the chains are timed correctly, the turnbuckle should be centered, check the timing of the chains and install all access covers.

12. Tighten the turnbuckle at the upper boom elbow as stated on Figure 8.2, using the special tool (P/N 192-0013-001-XX-1). While turning the turnbuckle, hold the ends of the leveling rod and chain with wrenches to avoid twisting the rod or chain. Tighten the jam nuts against the rod and chain.

13. Make sure that the turnbuckle is started equally with left hand and right hand threads.

14. Make sure the turnbuckle ends are screwed into the rod and chain ends to obtain the minimum threads requirements as shown in Figure 8.2.

15. Adjust the leveling system as described in this section under Adjustment.

16. Operate the booms in every position with the platform empty. With the lower boom at 0° and the upper boom at 270°, check if the rods clear the sprockets and chain guides everywhere (especially at the boom tip). With the lower boom at 120° and the upper boom at "-100°" position, look for the rod clearances (especially at the turret).

17. Check the same rod clearances as in step 16 above while operating the hydraulic platform tilt (if equipped).

18. Install the boom covers.

Upper Boom Leveling System Removal

Before any attempt is made to remove or replace leveling chains or rods, Figure 8.2 should be studied thoroughly and compared to the leveling system drawing in your Parts manual for this specific unit's adjustments. It is very important that the correct procedures be followed to assure proper routing of chains. It is strongly recommended that all replacement parts be genuine Posi-Plus parts. The following procedure requires paint to indicate the timing marks on the leveling chains and sprockets and also some special tools to torque the turnbuckle (i.e. P/N 192-0013-001-XX-1).

The following requires two personnel. It also requires paint to mark the timing marks on the leveling chains and sprockets.

Here are the steps to follow to remove the upper boom leveling system :

1. Remove all of the access covers on the upper boom.

Caution

Use extreme caution when access covers have been removed to service the unit. Pinch points and shear points may exist between moving parts. Replace the access covers immediately after servicing.

2. To gain access to the boom tip, remove the boom access cover.

3. The leveling chains in the upper boom are timed with the sprockets. To ease installation, paint timing marks on the sprockets and chain before removing the chain. Use Figure 8.2 to locate the timing link and tooth at the elbow and boom tip ends of the upper boom. Mark these points with paint.

4. At the access holes at the elbow end of the upper boom. Loosen the jam nuts and remove the turnbuckle from the rod and chain connections. While turning the turnbuckle, have someone hold the ends of the leveling rod and chain with wrenches to avoid twisting the rod or chain.

5. At the elbow, unwrap the leveling chain from the elbow sprocket.

6. At the boom tip, pull out the leveling rods and chains assembly.

Upper Boom Leveling System Installation

Here are the steps to follow to install the upper boom leveling system :

1. Use the Parts Manual to identify the rods and chains for the upper boom.

2. The rods are of different lengths. Use the leveling system page in the Parts Manual to identify the position of each rod. Mark the rods top and bottom.

3. Count the pins according to the details shown on Figure 8.2 from one end of the boom tip chain. Mark the correct link and pin with paint. If you are using an old chain that already has a timing mark painted on it, make sure the timing mark is in the correct location by counting the links. Figure 8.3 illustrates how to count the links.

4. From the elbow, pull on the chain and wrap it around the elbow sprocket.

5. Have one person pull the bottom leveling rod toward the elbow while you feed the remainder of the boom tip chain under the boom tip sprocket. Position the marked link on the tooth shown in Figure 8.2.

6. Route the elbow chain over the elbow chain guide and under the elbow sprocket, as shown in Figure 8.2. The timing mark on the chain should line up with the mark on the elbow sprocket (as shown in Figure 8.2) and the mark on the lower elbow chain.

7. Hold the bottom leveling rod and chain close enough together to loosely thread a turnbuckle into each. It may be necessary to remove one of the chain guides to make the turnbuckle connection (Refer to Figure 8.2). If this is done, be sure to install the chain guide after the turnbuckle connection is made.

8. Make sure that the elbow chain and the leveling rods are routed correctly (Refer to Figure 8.2).

9. Tighten the turnbuckle at the upper boom elbow as stated on Figure 8.2, using the special tool (P/N 192-0013-001-XX-1). While turning the turnbuckle, hold the ends of the leveling rod and chain with wrenches to avoid twisting the rod or chain. Tighten the jam nuts against the rod and chain.

10. Make sure that the turnbuckle is started equally with left hand and right hand threads.

11. Make sure the turnbuckle ends are screwed into the rod and chain ends to obtain the minimum threads requirements as shown in Figure 8.2.

12. Adjust the leveling system as described in this section under Adjustment.

13. Operate the booms in every position with the platform empty. With the lower boom at 0° and the upper boom at 270°, check if the rods clear the sprockets and chain guides everywhere (especially at the boom tip). With the lower boom at 120° and the upper boom at **"-100°"** position, look for the rod clearances (especially at the turret).

14. Check the same rod clearances as in step 13 above while operating the hydraulic platform tilt (if equipped).

15. Install the boom covers.

Lower Boom Leveling Rods Removal

Here are the steps to follow for the lower boom leveling rods removal:

Before any attempt is made to remove or replace leveling chains or rods, Figure 8.2 should be studied thoroughly. It is very important that the correct procedures be followed to assure proper routing of chains. It is strongly recommended that all replacement parts be genuine Posi-Plus parts. The following procedure requires paint to indicate the timing marks on the leveling chains and sprockets and also some special tools to torque the turnbuckle (i.e. P/N 192-0013-001-XX-1).

1. Set the wheel chocks, extend the outriggers and disengage the pump with the booms open (i.e. Lower boom lowered completely and upper boom unfolded until the platform is close to the ground) and rotated to the rear of the vehicle to ease the removal.

2. Remove all of the access covers from the sides of the lower boom.

> ***Caution***
>
> Use extreme caution when access covers have been removed to service the unit. Pinch points and shear points may exist between moving parts. Replace the access covers immediately after servicing.

3. It may be helpful to remove the platform from the platform mounting bracket. This is done by removing the bolts that fasten the platform to the platform mounting bracket. This will prevent the platform from acting as a counterweight when removing and installing the leveling system. Do not remove the platform mounting bracket.

4. The leveling chains in the lower boom are timed with the sprockets. To ease installation later, paint timing marks on the sprockets and chains before removing the chain. Use the diagram in Figure 8.2 to locate the timing link and tooth at the elbow and turret ends of the lower boom. Mark these points with paint.

5. At the turret end of the lower boom, reach through the access hole. Loosen the jam nuts on the leveling turnbuckle. Loosen the turnbuckle. While turning the turnbuckle, have someone hold the ends of the leveling rod and chain with wrenches to avoid twisting the rod or chain. Remove the turnbuckle.

6. Pull out partially the top rod through the open end at the elbow until the mounting bolt that joins the leveling rod and the chain together is attained. Make sure to note on which side the head of the bolt is installed with respect to the boom. Then, remove the bolt and the nut to free the rod. Leave the chain out of the boom, **but do not unwrap it from the sprocket**. Attach a solid rope through the end of the rod long enough to ease the installation of the new rod. Pull out the rod completely out through the open end at the turret. Keep the rope reachable at both ends of the boom.

7. Repeat step 6 above for the lower rod. The rod will need to be detached from the chain at both ends before pulling it out completely with the rope attached to it.

Lower Boom Leveling Rods Installation

Here are the steps to follow to install the lower boom leveling rods :

1. Use the leveling system page in the Parts Manual to identify the rods and chains for the lower boom.

2. The top and bottom leveling rods for the lower boom are different part numbers. Use the leveling system page in the Parts Manual to identify the position of each rod. To ease installation, mark the rods top and bottom.

3. Insert the rods by the end that the old rod came out of the boom. Attach the incoming end of the rod with the rope and pull on the rope at the opposite end until the rod end can be attached to the chain again. In other words, install the new rods exactly in the reverse sense that was used for the removal. Make sure that the bolt heads are installed on the correct side with respect to the boom.

4. Loosely start the free end of the turnbuckle into the threaded end of the top leveling rod. Make sure that the turnbuckle is started equally with left hand and right hand threads.

5. The leveling chains in the lower boom are timed with the sprockets. Count off the links and pins as shown on Figure 8.2 (excluding the connecting link) from the bottom leveling rod. Figure 8.3 illustrates how to count the links and the pins. Mark the correct link with paint. If you are using an old chain that already has a timing mark painted on it, make sure the timing mark is in the correct location by counting the pins (Refer to Figure 8.2).

6. Position the marked link on the tooth shown in Figure 8.2 (it may also be marked with paint). Make sure the top and bottom leveling rods are in the correct position.

7. Count off the pins from the free end of the chain (the end without the adapter – (Refer to Figure 8.2). Mark the correct pin with paint. If you are using an old chain that already has a timing mark painted on it, make sure the timing mark is in the correct location by counting the pins. Figure 8.3 illustrates how to count the links and pins.

8. Through the access holes near the base of the lower boom, position the top and bottom ends of the leveling chain in the grooves of the chain guides (Refer to Figure 8.2).

9. Position the top of the leveling chain at the elbow in the groove of the chain guide (Refer to Figure 8.2).

10. Make sure the leveling rods and chains in the lower boom are routed as shown in Figure 8.2.

11. If the chains are timed correctly, the turnbuckle should be centered, check the timing of the chains install all access covers.

12. Tighten the turnbuckle at the upper boom elbow as stated on Figure 8.2, using the special tool (P/N 192-0013-001-XX-1). While turning the turnbuckle, hold the ends of the leveling rod and chain with wrenches to avoid twisting the rod or chain. Tighten the jam nuts against the rod and chain.

13. Make sure that the turnbuckle is started equally with left hand and right hand threads.

14. Make sure the turnbuckle ends are screwed into the rod and chain ends to obtain the minimum threads requirements as shown in Figure 8.2.

15. Adjust the leveling system as described in this section under Adjustment.

16. Operate the booms in every position with the platform empty. With the lower boom at 0°and the upper boom at 270°, check if the rods clear the sprockets and chain guides everywhere (especially at the boom tip). With the lower boom at 120° and the upper boom at **"-100°"**, look for the rod clearances (especially at the turret).

17. Check the same rod clearances as in step 16 above while operating the hydraulic platform tilt (if equipped).

18. Install the boom covers.

Upper Boom Leveling Rods Removal

Here are the steps to follow for the upper boom leveling rods removal:

Before any attempt is made to remove or replace leveling chains or rods, Figure 8.2 should be studied thoroughly. It is very important that the correct procedures be followed to assure proper routing of chains. It is strongly recommended that all replacement parts be genuine Posi-Plus parts. The following procedure requires paint to indicate the timing marks on the leveling chains and sprockets and also some special tools to torque the turnbuckle (i.e. P/N 192-0013-001-XX-1).

The following requires two personnel. It also requires paint to mark the timing marks on the leveling chains and sprockets.

1. Remove all of the access covers on the upper boom.

> ***Caution***
>
> Use extreme caution when access covers have been removed to service the unit. Pinch points and shear points may exist between moving parts. Replace the access covers immediately after servicing.

2. To gain access to the boom tip, remove the boom access cover.

3. The leveling chains in the upper boom are timed with the sprockets. To ease installation, paint timing marks on the sprockets and chain before removing the chain. Use Figure 8.2 to locate the timing link and tooth at the elbow and boom tip ends of the upper boom. Mark these points with paint.

4. At the access holes at the elbow end of the upper boom. Loosen the jam nuts and remove the turnbuckle from the rod and chain connections. While turning the turnbuckle, have someone hold the ends of the leveling rod and chain with wrenches to avoid twisting the rod or chain.

5. Pull out partially the top rod through the open end at the boom tip until the mounting bolt that joins the leveling rod and the chain together is attained. Make sure to take down on which side is the head of the bolt with respect to the boom. Then, remove the bolt and nut to free the rod. Leave the chain out of the boom, **but do not unwrap it from the sprocket**. Attach a solid rope through the end of the rod long enough to ease the installation of the new rod. Pull out the rod completely out through the open end at the boom tip. Keep the rope reachable at both ends of the boom.

6. Repeat step 5 above for the lower rod. The rod will need to be detached from the chain at both ends before pulling it out completely with the rope attached to it.

Upper Boom Leveling Rods Installation

Here are the steps to follow to install the upper boom leveling rods:

1. Use the Parts Manual to identify the rods and chains for the upper boom.

2. The rods are of different lengths. Use the leveling system page in the Parts Manual to identify the position of each rod. Mark the rods top and bottom.

3. Count the pins according to the details shown on Figure 8.2 from one end of the boom tip chain. Mark the correct link and pin with paint. If you are using an old chain that already has a timing mark painted on it, make sure the timing mark is in the correct location by counting the links. Figure 8.3 illustrates how to count the links.

4. Insert the rods by the end that the old rod came out. Attach the incoming end of the rod with the rope and pull on the rope at the opposite end until the rod end can be attached to the chain again. In other words, install the new rods exactly in the reverse sense that was used for the removal. Make sure that the bolt heads are installed on the correct side with respect to the boom.

5. Have one person pull the bottom leveling rod toward the elbow while you feed the remainder of the boom tip chain under the boom tip sprocket. Position the marked link on the tooth shown in Figure 8.2.

6. Route the elbow chain over the elbow chain guide and under the elbow sprocket, as shown in Figure 8.2. The timing mark on the chain should line up with the mark on the elbow sprocket (as shown in Figure 8.2) and the mark on the lower elbow chain.

7. Hold the bottom leveling rod and chain close enough together to loosely thread a turnbuckle into each. It may be necessary to remove one of the chain guides to make the turnbuckle connection (Refer to Figure 8.2). If this is done, be sure to install the chain guide after the turnbuckle connection is made.

8. Make sure the elbow chain and leveling rods are routed correctly (Refer to Figure 8.2).

9. Tighten the turnbuckle at the upper boom elbow as stated on Figure 8.2, using the special tool (P/N 192-0013-001-XX-1). While turning the turnbuckle, hold the ends of the leveling rod and chain with wrenches to avoid twisting the rod or chain. Tighten the jam nuts against the rod and chain.

10. Make sure that the turnbuckle is started equally with left hand and right hand threads.

11. Make sure the turnbuckle ends are screwed into the rod and chain ends to obtain the minimum threads requirements as shown in Figure 8.2.

12. Adjust the leveling system as described in this section under Adjustment.

13. Operate the booms in every position with the platform empty. With the lower boom at 0° and the upper boom at 270° , check if the rods clear the sprockets and chain guides everywhere (especially at the boom tip). With the lower boom at 120° and the upper boom at **"-100°"** position, look for the rod clearances (especially at the turret).

14. Check the same rod clearances as in step 13 above while operating the hydraulic platform tilt (if equipped).

15. Install the boom covers.

Platform Tilt System

The platform tilt system moves the platform from its upright position to a horizontal position. It may be used in an emergency to remove personnel from the platform. It may also be used to remove debris or liquid from the bottom of the platform.

The manual platform tilt system uses a ball lock pin and the main pivot assembly.

The manual platform tilt ball lock pin are located on platform support assembly.

⚠ WARNING

MANUAL PLATFORM TILT

1- BEFORE TILTING THE PLATFORM, MAKE SURE NO ONE NOR ANY OBJECT IS INSIDE THE PLATFORM.
2- TO TILT THE PLATFORM, PULL OUT THE LOCK PIN WHILE SUPPORTING THE BASE OF THE PLATFORM. THEN, TILT THE PLATFORM UNTIL THE LOCK PIN BLOCKS IT IN THE TILT POSITION.
3- TO TILT BACK THE PLATFORM, SUPPORT THE BASE OF THE PLATFORM AND THEN PULL OUT THE LOCK PIN.
4- MAKE SURE THE LOCK PIN SECURES THE PLATFORM IN ITS WORKING POSITION BEFORE ENTERING THE PLATFORM.

100-377-070

The platform tilt system may be used when the lower boom is horizontal and the upper boom is unfolded below horizontal. This positions the platform near the ground to remove an injured operator from the platform. It may also be used with the upper boom raised slightly from the rest and the lower boom stowed to remove debris or liquid from the platform.

The platform tilt can also be hydraulically operated with the control valve at the turret. This is an optional system.

The hydraulic platform tilt cylinder **(optional)** is located on the back of the turntable. The rod end of the cylinder is attached to the main pivot sprocket of the leveling system.

When the cylinder rod extends, the main pivot sprocket rotates. Thus, the entire leveling system rotates toward the boom tip. This action tilts the platform horizontal (tilted position). When the cylinder rod retracts, the platform returns to its normal upright position.

HYDRAULIC PLATFORM TILT OPERATION

IMPORTANT: THE PLATFORM MUST BE EMPTY BEFORE OPERATING THE PLATFORM TILT MECHANISM. ALSO, MAKE SURE THAT THE TILT AREA IS CLEAR SO THAT NO OBSTACLE WILL LIMIT THE PLATFORM TILT (I.E. PLATFORM SUPPORT AND ACCESS STEP) .

TO OPERATE:

1. ACTIVATE SIMULTANEOUSLY THE LOWER CONTROLS LEVER AND THE PLATFORM TILT LEVER TO TILT THE PLATFORM IN THE CHOSEN DIRECTION (TILTED OR WORKING POSITION.
2. TO STOP THE DISPLACEMENT, RELEASE BOTH LEVERS.
3. TILT BACK THE PLATFORM TO ITS NORMAL UPRIGHT POSITION BEFORE OPERATING THE AERIAL DEVICE.

100-377-046

Attention

Do not operate the booms while the platform is tilted. Damage to the leveling system may result.

Upper controls

The booms upper controls consist of a single handle controller to operate the booms functions from the platform.

Single Handle Controller

The single handle controller uses an interlock linkage to prevent unexpected platform movement that may result from accidental bumping of the controller.

When the single handle controller is operated, the interlock trigger on the bottom of the controller handle is depressed. Depressing the trigger causes a linkage inside the single handle controller assembly to manually shift the blocking section of the upper control valve. When the blocking section is shifted, it allows hydraulic oil flow to the boom function spools of the upper control valve.

When the controller is not operated, the blocking section of the upper control valve is spring centered to direct hydraulic oil flow to the reservoir.

Lubrication

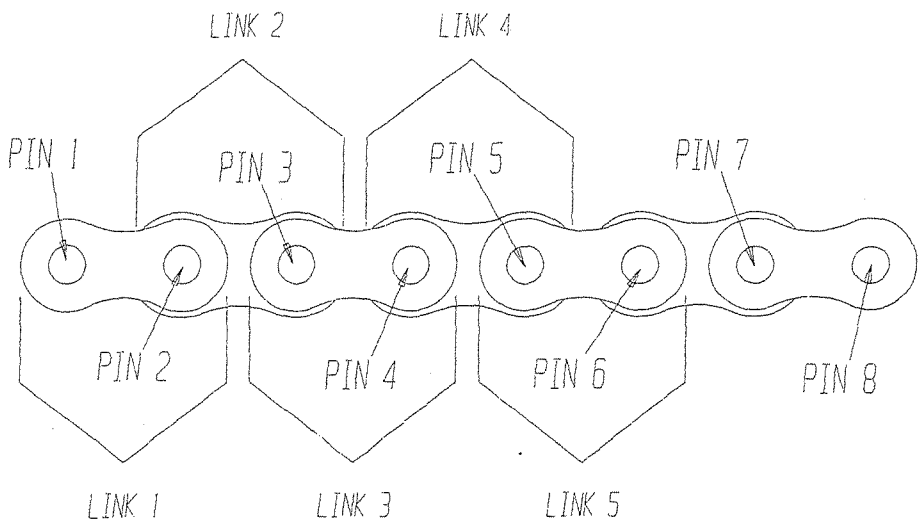
As listed under Lubricant Specifications, lubricate the entire single handle controller linkage every 4 months or 340 PTO hours (whichever comes first) with a water repellant spray lubricant such as Orapi CTSI 809. To do this, you will need to remove the rubber boot over the upper controls. Give special lubrication attention to all ball joints, pivot points and spool end (pin) connections.

Inspection

Inspect the upper controls every 4 months or 340 PTO hours (whichever comes first) as listed in the Preventive Maintenance and Inspection Checklist in Section 4. Check the controls for proper operation. Make sure the upper control valve is not leaking. During this inspection, check to see that all nuts, bolts and screws are tight and the cotter pins are firmly installed. There are no adjustments to control the free play of the handle, as this is factory set.

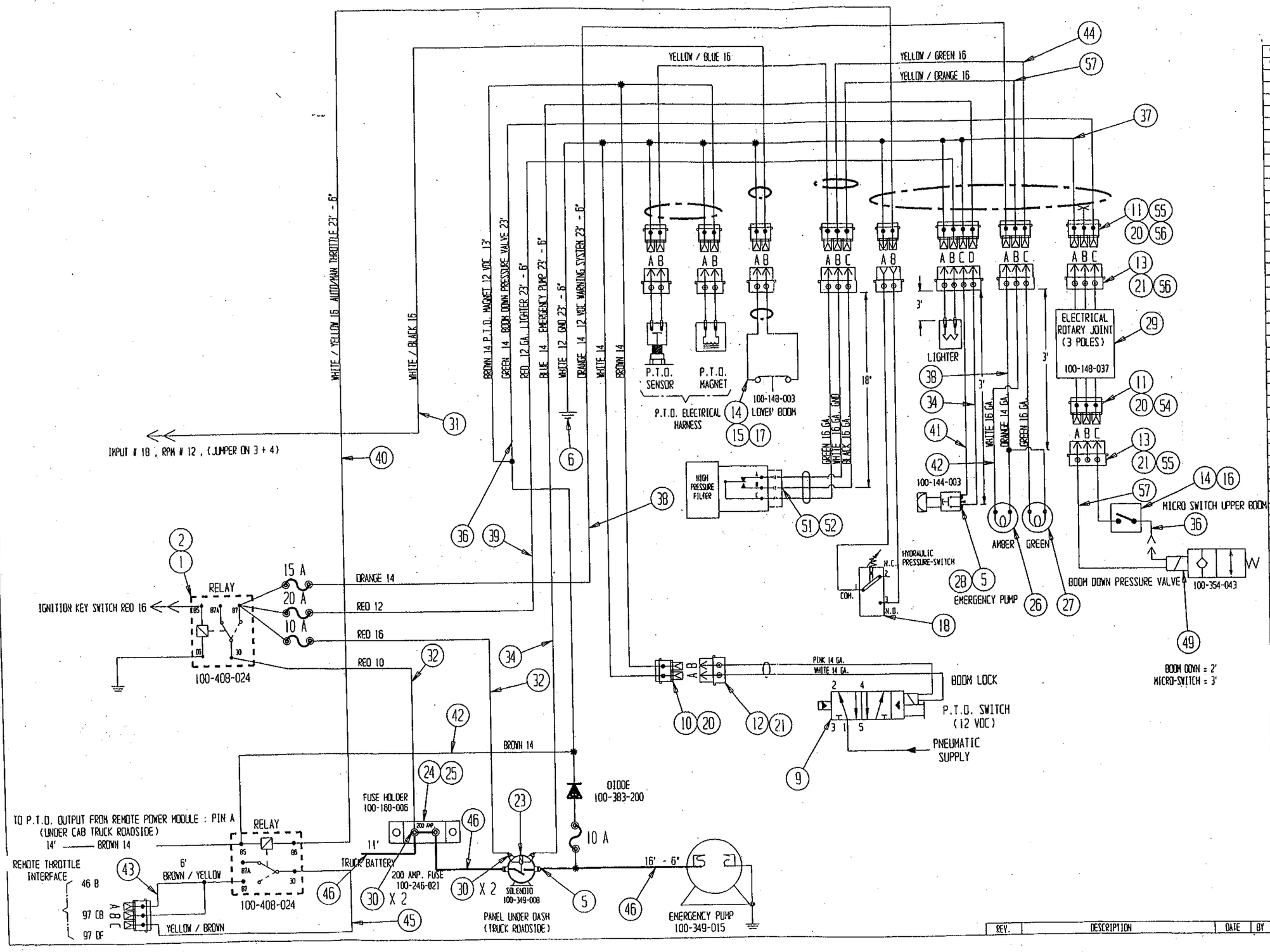
Check the interlock trigger for proper adjustment. The trigger on the single handle controller should show slightly when it is fully depressed into the handle. The trigger should not bottom out or completely disappear into the handle, the spool should rather bottom out stopping the trigger movement.

The single handle controller linkage should be adjusted to insure that the blocking section fully shifts when the trigger is actuated. If the spool is not being fully shifted, then the interlock linkage needs to be adjusted.



POSI-PLUS TECHNOLOGIES INC.

FIGURE 8.3 - LEVELING CHAIN LINKS AND PINS COUNTS



ITEM	DRAWING	DESCRIPTION	QTY
58			
57	100-169-001	16 GA.WHITE WIRE.	
56	100-280-302	SEAL	
55	100-280-300	SEAL	
54	100-280-301	SEAL	
53			
52	100-380-001	PLUG	1
51	100-379-001	FITTING	1
50	100-280-061	HEAT SHRINKABLE TUBING	4"
49	100-369-003	CONNECTOR RECEPTACLE	(1)
48	100-169-024	4 GA. RED WIRE	4'
47	100-170-008	16 - 2 WIRE	6'
46	100-169-011	RED 4 GA.	24'
45	100-169-XXX	18 GA. YELLOW/BROWN WIRE.	54'
44	100-169-006	16 GA. GREEN WIRE.	54'
43	100-169-043	18 GA. BROWN/YELLOW WIRE.	54'
42	100-169-XXX	14 GA. PINK WIRE	9'6"
41	100-169-020	14 GA.BLACK WIRE	25'
40	100-169-035	16 GA. ORANGE WIRE	16'
39	100-169-008	12 GA. RED WIRE	23'6"
38	100-169-026	14 GA. ORANGE WIRE	23'6"
37	100-169-014	12 GA. WHITE WIRE	23'6"
36	100-169-018	14 GA. GREEN WIRE	23'6"
35	100-169-003	16 GA. BLACK WIRE	54'
34	100-169-016	14 GA. BLUE WIRE	23'6"
33	100-169-004	16 GA. BROWN WIRE	54'
32	100-169-005	16 GA. RED WIRE	16'
31	100-169-028	18 GA. BLACK WIRE	17'6"
30	100-280-012	TERMINAL	
29	100-148-037	ELECTRICAL ROTARY JOINT (3 POLES)	(1)
28	100-144-003	PUSH BUTTON	(1)
27	100-153-002	GREEN INDICATOR LAMP	(1)
26	100-153-004	AMBER INDICATOR LAMP	(1)
25	100-246-021	FUSE	(1)
24	100-160-006	FUSE HOLDER	(1)
23	100-349-008	SOLENOID	(1)
22			
21	100-280-202	TERMINAL MALE	
20	100-280-252	TERMINAL FEMALE	
19			
18	100-348-021	PRESSURE SWITCH	(1)
17	100-148-016	LEVER ARM SWITCH	1
16	100-171-020	COUPLING	
15	100-171-001	COUPLING	
14	100-148-003	LIMIT SWITCH	(2)
13	100-280-405	CONNECTOR RECEPTACLE	4
12	100-280-403	TERMINAL	
11	100-280-404	CONNECTOR RECEPTACLE	4
10	100-280-402	TERMINAL	
9	100-348-029	PNEUMATIC VALVE	(1)
8			
7			
6	100-280-002	TERMINAL	
5	100-280-019	TERMINAL	
4			
3	100-408-024	RELAY	(1)
2	100-280-013	TERMINAL	
1	100-408-024	RELAY	1

POSI-PLUS TECHNOLOGIES INC.

TITLE: COMPLETE ELECTRICAL SCHEMATIC (MULTIPLEX INTER 4400)

DWN BY: R.C.	APP: S.D.	MAT'L: ---	GENERALES TOLERANC'
DATE: 03-05-14			MACHINING: +/- 0,4 mm
CADEX: ---	SUPERF. BRUTE: ---	WEIGHT (NET): ---	STRUCTURAL: +/- 1,5 MM
REF: ARTICLE (10) JOB # 102273-102287		SCALE: 1:1	WELDING: +/- 2,0 MM
		DRAWING NUMBER:	JOB 2-273-003-00-4

REV.	DESCRIPTION	DATE	BY

Section 9 - Electrical System

General Operation

Electrical power may be used on the aerial device to operate the optional remote start/stop system, the two-speed throttle system and the emergency lowering DC pump system. Electrical power is supplied from the vehicle battery. A comparison may be made between electrical and hydraulic components. This may be more familiar to a hydraulic equipment mechanic (refer to Table 9.1).

Voltage levels of this system are based on a constant vehicle power source of 12 Volts DC. Voltage may vary from 10.2 Volts to 13.8 Volts and still be considered normal.

On/Off Circuit (optional)

The "On/Off" circuit supplies 12 Volts of constant power to a solenoid or other component when a switch or relay is closed. When the circuit is opened the power is removed. All of the circuits on this unit are "On/Off" type electrical circuits.

Circuit Protection (optional)

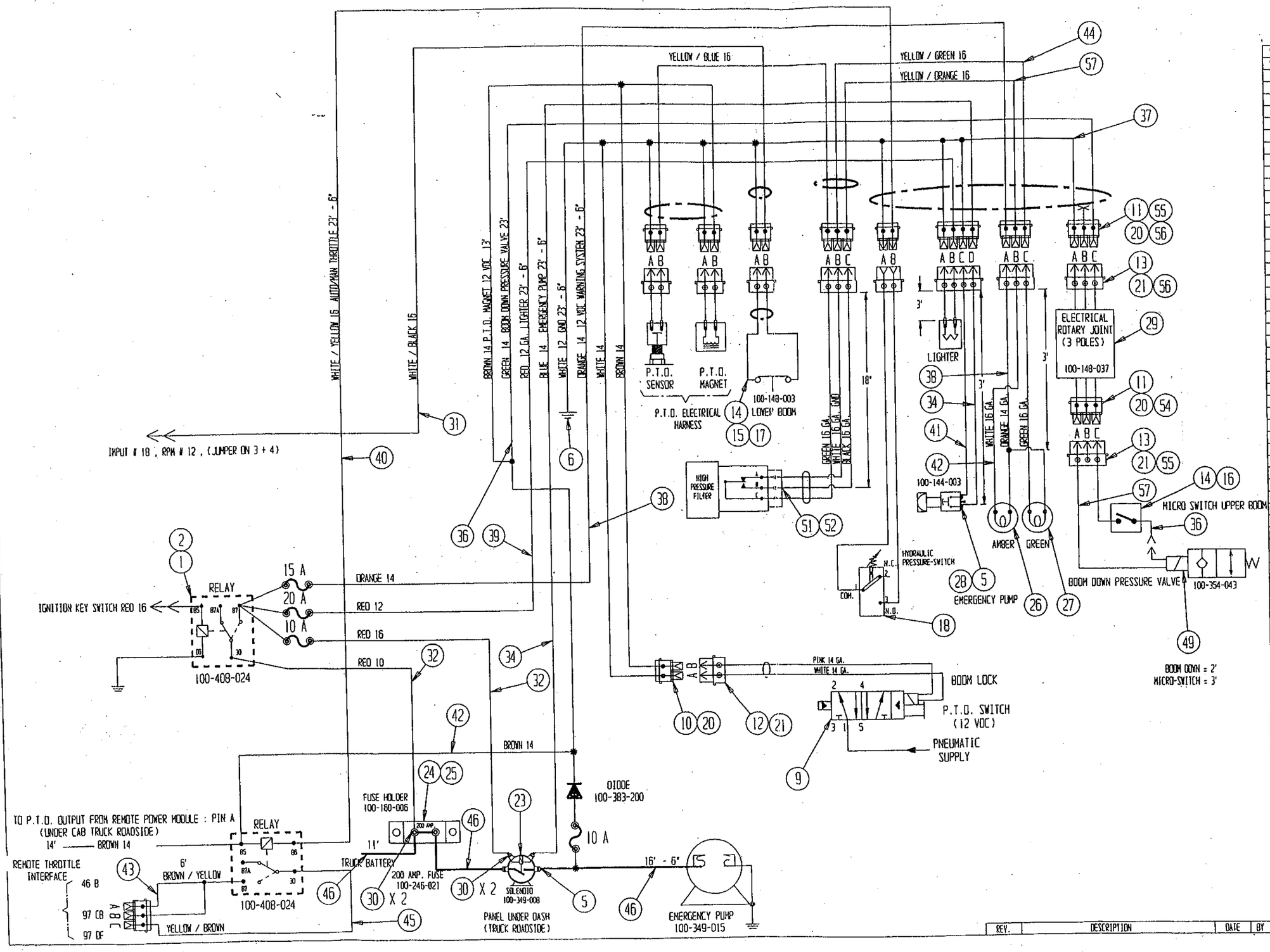
There may be some self-resetting thermal circuit breakers used in the electrical system to protect wiring and components from electrical overload in the case of a short circuit or other fault. These circuit breakers will normally reset within a few minutes if the electrical overload condition is removed. If a circuit breaker trips repeatedly, the cause of the problem must be determined to avoid serious damage to the electrical system.

A 20 Amp thermal circuit breaker is normally used to protect the ignition splice in the remote start/stop circuit.

The remote start/stop control box has an internal 5 amp circuit breaker in the line that connects the 12 Volt terminal in from the battery to the start relay and to the DC pump relay.

Caution

Even with 12 Volts, severe arcing can occur. Use caution when working with any electrical device.



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53			
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51	100-379-001	FITTING	1
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37	100-169-014	12 GA. WHITE WIRE	23'6"
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24	100-160-006	FUSE HOLDER	(1)
23	100-349-008	SOLENOID	(1)
22			
21	100-280-202	TERMINAL MALE	
20	100-280-252	TERMINAL FEMALE	
19			
18	100-348-021	PRESSURE SWITCH	(1)
17	100-148-016	LEVER ARM SWITCH	1
16	100-171-020	COUPLING	
15	100-171-001	COUPLING	
14	100-148-003	LIMIT SWITCH	(2)
13	100-280-405	CONNECTOR RECEPTACLE	4
12	100-280-403	TERMINAL	
11	100-280-404	CONNECTOR RECEPTACLE	4
10	100-280-402	TERMINAL	
9	100-348-029	PNEUMATIC VALVE	(1)
8			
7			
6	100-280-002	TERMINAL	
5	100-280-019	TERMINAL	
4			
3	100-408-024	RELAY	(1)
2	100-280-013	TERMINAL	
1	100-408-024	RELAY	1

POSI-PLUS TECHNOLOGIES INC.

TITLE: COMPLETE ELECTRICAL SCHEMATIC (MULTIPLEX INTER 4400)

DWN BY: R.C.	APP: S.D.	MAT'L: ---	GENERALES TOLERANC'
DATE: 03-05-14			MACHINING: +/- 0,4 mm
CADEX: ---	SUPERF. BRUTE: ---	WEIGHT (NET): ---	STRUCTURAL: +/- 1,5 MM
REF: ARTICLE (10) JOB # 102273-102287		SCALE: 1:1	WELDING: +/- 2,0 MM
		DRAWING NUMBER:	JOB 2-273-003-00-4

REV.	DESCRIPTION	DATE	BY

Electrical Components

The inter-wiring of the electrical components and their wiring to various valves, switches and relays installed by Posi-Plus are shown in the wiring line diagrams in the Parts manual, section 10. The major electrical components are also described in this section.

Electrical Component	Hydraulic Component	Function Performed
Battery	Pump	Source of energy or power
Voltage	Pressure	Creates a potential energy difference between two points in a system
Current	Oil flow	Allows potential energy to become kinetic and do useful work
Wire	Hose or tube	Transmits power from place to place
Fuse or circuit breaker	Relief valve	Protects system from overload
Diode	Check valve	Allows to flow through in one direction but not the other
Switch	Gate valve	Blocks power or allows it to flow
Controller	Control valve	Varies the amount of power which passes through it depending upon the distance the control handle is moved
Resistor	Orifice	Restricts the flow of power
Relay	Pilot operated directional control valve	Allows power to flow through upon receiving a signal from another source
Solenoid	Cylinder	Causes axial movement of its central element when power is applied to it
Rotary joint	Rotary joint	Transmits power through a continuously rotating connection

Table 9.1 - Electrical hydraulic comparison

Remote Start/Stop Control Box (optional)

The remote start/stop control box is the central connection point between the remote start/stop system and the vehicle electrical system. With suitable electrical controls for the engine and starter, the engine may be stopped or started by hand operation at the platform with a push button or a plunger.

> ***Caution***
>
> To prevent electrical shock, turn the truck ignition switch off to remove the power supply to the control box before servicing.

The control box uses 12 Volt components. This makes problems easy to troubleshoot with a voltmeter or a test light.

Electric rotary joint (optional)

If your unit is equipped with an emergency lowering DC pump system and/or a two-speed throttle system and/or an engine start/stop system, various electrical circuits will also pass through the center line of rotation by way of the rotary joint (electric swivel).

The inner part of the rotary joint (electric swivel) is mounted to the bottom inner part of the hydraulic rotary joint.

No maintenance is required.

Installation

1. Position the electric rotary joint below the hydraulic rotary joint. Route the wires through the rotary joint.

2. Mount the electric rotary joint onto its bracket which is bolted on the outer core of the hydraulic rotary joint.

3. Connect the appropriate wires to the emergency lowering DC pump switch and/or the engine start/stop switch and/or the two-speed throttle switch for appropriate functions.

Removal

1. There are electrical circuits that are routed from the electric rotary joint through the hydraulic rotary joint. Disconnect the wires in the turntable form the emergency lowering DC pump switch and/or the two-speed throttle switch and/or the engine start/stop switch and/or other functions. Do not cut away any of the wires when removing the electric rotary joint. The hole in the hydraulic rotary joint is large enough to allow the wires to pass through. Remove the wires from the hydraulic rotary joint.

2. Slack off the screw that holds the outer core of the electric rotary joint to its mounting bracket and pull out the electric rotary joint.

Section 10 - Troubleshooting

Troubleshooting Chart

Symptom	Possible Cause	Test Procedure/Corrective Action
Nothing operates	Hydraulic oil not reaching pump.	Check oil reservoir. If oil is below the Add mark, add the proper type of hydraulic oil to the Full mark.
	PTO not engaged.	Check PTO. If is not engaged, properly engage it.
	Pump not operating properly.	Connect flow meter to the pump as described in Section 7 under Hydraulic pump-Care. If pump flow is less than specified, determine the cause of the problem. Repair or replace the pump.
	Gate valve between pump and reservoir closed.	Check gate valve. If gate valve is closed, open it.
Cylinder drifts.	Internal leakage in cylinder.	Test the cylinder by following instructions under Internal Leakage in this section. If you determine that there is internal leakage in the cylinder, repair seals in the cylinder or replace the cylinder.
	Leakage past holding valve.	Test the cylinder by following instructions under Internal Leakage in this section to determine if the holding valve is the source of the leakage. If the holding valve is a counterbalance valve, test and adjust the valve by using test block or replace the valve cartridge. If the holding valve is a pilot operated check valve, replace the check cartridge (refer to Section 7 under Hydraulic System Adjustments).
Functions operate too slow from upper controls.	Restriction in the pressure line connected to the upper control valve.	Check for hot spots in the pressure line to the upper control valve. Restricted area will feel warmer than the rest of the hydraulic system. If a restriction is found, remove it.
	Blocking section of the upper control valve not fully shifted.	Remove the spool for the blocking section of the upper control valve. Inspect the spool for contamination. If contamination is found, replace the spool.
	Interlock trigger on the single handle controller is not properly adjusted.	Check the interlock trigger for proper placement - refer to Section 8 under Upper Controls. If necessary, adjust the interlock trigger to fully open the blocking section of the upper controls.

Symptom	Possible Cause	Test Procedure/Corrective Action
Functions are slow.	Station selector valve not fully shifted to the Upper Controls position.	Check position of upper/lower control lever on inside of turntable. If this lever is not in the Upper Controls position. The spring extend cap of the valve must be replaced.
	Internal leak in hydraulic rotary joint.	Test hydraulic rotary joint as described in this section under Internal Leakage. If you determine that a leaking hydraulic rotary joint is the source of the problem, repair the seals in the rotary joint or replace the hydraulic rotary joint.
Functions are slow.	Low pump flow.	Connect a flow meter to the pump and check pump flow as described in Section 7 under Hydraulic Pump care. If pump flow is less than specified, determine the cause of pump malfunction. Repair or replace the pump.
Excessive heat buildup.	There are many possible causes of heat generation. Internal Leakage in this section fully describes possible causes.	Check each possible cause listed under Internal Leakage. Correct the source of the heat generation.
Unit operated from the lower controls, but no functions are operational from the upper controls.	Selector remains in the Lower Controls position.	Replace the spring extend cap on the lower controls valve.
	Blocking section of the upper control valve not fully shifted.	Check the operation of the blocking section of the upper control valve. If faulty, replace the spool for the blocking section of the upper control valve.
All functions operate slow from the lower and upper controls.	Restriction in pressure line.	Check for hot spots in the pressure line. Restricted area will feel warmer than the rest of the hydraulic system. If a restriction is found, remove it.
Cannot achieve full system pressure.	Standby pressure is set too low. Relief valve adjusted to low.	Adjust relief valve at the lower main function valve.

Symptom	Possible Cause	Test Procedure/Corrective Action
Pump is noisy.	Reservoir oil level too low.	Fill reservoir to the correct level.
	Restriction in pump suction line.	Suction line gate valve not fully open. Suction hose kinked or plugged. Suction hose too small.
	Air entering suction line.	Low oil level. Hydraulic fitting is loose.
	PTO/pump connection misaligned.	Correct misalignment.
	Cavitation.	Restriction in suction line. Improper hydraulic oil viscosity. Excessive pump speed.
Severe hydraulic leak.	Hose, tube, fitting, seal failure, etc.	Replace faulty component.

Hydraulic System Troubleshooting

The successful way to troubleshoot any hydraulic system is to find the cause of the problem before making any changes.

When troubleshooting, remember that hydraulic oil flow is speed and hydraulic pressure is force. Both flow and pressure are required to operate a function.

The JIC schematic found in your Parts manual is an important tool for troubleshooting the hydraulic system. The JIC schematic identifies the paths of oil flow in the system. It also identifies the operation of every hydraulic component. To understand the JIC schematic, you must be familiar with the JIC hydraulic symbols.

Establish a troubleshooting procedure that you can follow any time there is a malfunction. Such a procedure will give you a starting point for determining the root cause of the malfunction. It may also help to increase the accuracy of your troubleshooting. Consider using the following procedure.

1. Check the oil level in the reservoir.

2. Position the aerial device on a level surface. Apply the parking brake ,install the wheel chocks and extend the outriggers. Engage the PTO.

Note - Before testing each function through its full travel capabilities, try small movements to be certain that the function is operating properly. Then, test each function for full travel capabilities.

3. Operate the aerial device from the lower controls. Experience the failed function.

> ***Warning***
>
> Wear an OSHA approved fall restraint device with the lanyard securely connected to the boom tip lanyard attachment anchor when operating the unit from the upper controls.

4. Operate the unit from the upper controls. In this manner, one may personally experience the malfunction.

5. Use the JIC schematic to determine the flow path required to operate the failed function. Make a list of the components used to operate the failed function. Cross off components used to operate other functions that are operating correctly. This should leave only three or four items to check.

6. Verify the correct operation of each component remaining on the list until you find the bad component. Check the easiest component first.

7. Use accurate pressure gauges and flow meters to verify flow and pressure.

When troubleshooting the unit, once the symptom has been positively identified, the troubleshooting chart in this section may be used for suggested causes and corrective actions.

Internal Leakage

Leakage in the hydraulic system may be internal or external.

Small external leaks are usually easy to detect. Dirt will collect at the point where oil is leaking.

You can prevent some external leaks by following the correct steps for installing hydraulic fittings (refer to Section 7 under Hoses, Tubes and Fittings).

Most hydraulic components have a small internal leak. This is due to machining tolerances. This type of leak generates a small amount of heat that is taken into account when the machine is designed.

Large internal leaks in the system may be caused by internal housing cracks, bad relief valves or leaking seals. This type of leak allows a large volume of pressurized oil to return to tank. This creates excessive heat in the hydraulic system. Continuous operation with excessive heat will damage seals and O-rings throughout the system. Immediately locate and fix this type of leak.

Internal leakage allows pressurized hydraulic oil to escape to tank or another hydraulic circuit.

Internal leakage may cause a variety of problems in a hydraulic system. Internal leakage in a cylinder can cause drifting or malfunction of a cylinder. Leakage past a holding valve in a cylinder. Internal leakage in a rotary joint will cause functions to slow down and/or fail to build pressure.

Internal leakage can usually be stopped by replacing the seals in the leaking component. It may also be stopped by replacing the holding valves in the component. However, there are some types of damage, such as scoring of the inside of a cylinder barrel, that require more extensive repair.

Only trained professionals should remove scratches from the inside of the cylinder barrel.

Warning

If the internal size tolerance of the cylinder barrel is exceeded, the piston seal could be push out (extruded) when the cylinder is put under a load. This will cause cylinder failure. Cylinder failure may result in property damage and/or personal injury.

The component drawings in the Parts Manual give the Posi-Plus part number for the seal kits. Posi-Plus does not recommend disassembly or repair of cylinder in the field. Disassembly and repair of these components must be performed by skilled mechanics who are trained and qualified by Posi-Plus Technologies Inc. in such procedures. Repair and disassembly should be done in a clean, properly equipped shop.

Torque specifications for cylinder end glands and piston nuts are given on the component drawings in the Parts Section.

Warning

If a piston nut is removed from a cylinder, replace the piston nut retention device. Removing piston nut retention devices can damage their retaining characteristics. If the piston nut is self-locking, removing the piston nut damages the locking material. A faulty self-locking piston nut or retention device may cause cylinder failure. Cylinder failure may result in property damage and/or personal injury.

Under torquing or over torquing a cylinder piston nut or end gland may cause cylinder failure. Improper installation of a piston nut or end gland retention device may also cause cylinder failure. Cylinder failure may result in property damage and/or personal injury.

Heat Generation

Internal leakage allows pressurized hydraulic oil to escape to tank. This creates excessive heat in the system. The amount of heat in the system has a direct relationship to the pressure and volume of leakage.

If excessive heat occurs, find and correct the cause immediately. Overheating reduces the operating efficiency of the aerial device. It may cause functions to stop working. It damages seals and O-rings throughout the system. Heat also shortens the life of the hydraulic oil.

The following conditions cause heat generation.

- Excessive pump speed during high flow operations
- Worn or faulty pump
- Defective relief valve cartridge in the main control valve
- Contaminated spool in a control valve
- Low hydraulic oil level
- Improper hydraulic oil
- Internal leakage in the main control valve
- Internal leakage in the rotary joint
- High speed throttle selected without operating functions.

Hydraulic rotary joint

A leakage seal in the hydraulic rotary joint can cause oil flowing to any hydraulic circuit above rotation to be diverted directly to the return line. This will cause functions to slow down and/or fail to build pressure. So if pressure cannot be built up to maximum relief pressure when a function is selected, this means that the hydraulic rotary joint has internal leakage.

If the lower or upper boom drifts down under load or under its own weight, first rule out external causes such as a control valve malfunction.

If the components controlling the cylinder are working properly, the problem may be caused by leakage past the counterbalance valve. It may also be caused by internal leakage in the cylinder. Use the following troubleshooting procedures to isolate the cause.

Lower Boom Lift Cylinder

1. Position the unit, apply the parking brake, place the wheel chocks start the engine, engage the PTO and extend the outriggers.

2. Place the rated load in the platform, raise the lower boom six to eight feet out of the rest and turn the engine off.

   a. If the boom drifts down, move the control valve handle to the "Lower" position. If the movement increases, this indicates a leaking counterbalance holding valve.

   b. If the boom drift speed remains the same, this indicates an internal cylinder leak.

Upper Boom Lift Cylinder

1. Position the unit, apply the parking brake, place the wheel chocks start the engine, engage the PTO and extend the outriggers.

2. Place the rated load in the platform, unfold the upper boom six to eight feet out of the rest and turn the engine off.

   a. If the boom drifts down, move the control valve handle to the "Fold" position. If the movement increases, this indicates a leaking counterbalance holding valve.

   b. If the boom drifts down slightly and stops, this indicates an internal cylinder leak.

3. To test the rod end of the cylinder, unfold the upper boom to an overcenter position (approximately horizontal) and shut the engine off.

   a. If the boom drifts toward the ground, move the control valve handle to the "Fold" position. If the speed of movement increases, this indicates a leaking counterbalance valve.

   b. If the speed does not change, this indicates an internal cylinder leak.

Electrical System Troubleshooting

This section includes procedures to aid in troubleshooting the electrical system.

Failure Identification

A short circuit, open circuit or component failure will cause the electrical system to operate improperly or may end further operation.

Short Circuit

A short circuit is caused when a contact of comparatively low resistance occurs between a power conductor and a ground, diverting the flow of current from its normal path through a component of greater resistance. The resulting high current flow through a short circuit will usually interrupt one or more circuit breakers or fuses.

Short circuits are usually caused by pinched wires, worn insulation, a loose connection touching a ground or a defective component.

To find the location of a short circuit, first analyze the location of the circuit breaker or fuse which is opening and what is being operated when it opens.

It may be necessary to progressively isolate the location of a short by disconnecting circuits until the short disappears. A short can also be detected by turning off power to the unit and using an ohmmeter to check the resistance to ground at pin connections and terminals that would have a voltage applied during operation of the machine. If a zero resistance is found between ground and one of these locations, this indicates a short circuit. This testing procedure should begin closest to the power source.

Open Circuit

An open circuit prevents the normal current flow through component(s) of the electrical system. Characteristics of open circuits are infinitely high resistance, resulting in zero current. An open circuit is usually caused by a wire being pulled from a connection, a broken wire, corrosion, or poor contact where an electrical component is grounded to the machine structure.

A search for an open circuit should begin at a point closest to the component that is not operating. Trace the wiring from the component, and look for a disconnected connection, corrosion or other visible damage to the cable or wires. If the component is grounded to the machine structure, make sure that the ground connection is good. If the wiring looks good and the ground contact is food, disconnect the leads to the component and check the resistance reading through the component with an ohmmeter. An open circuit will be indicated by a very high or infinite resistance.

Component Failure

A component malfunction is sometimes the most difficult problem to locate. It may appear as an open or a short circuit or the component may not perform to its design capacity. It first must be determined what functions are affected and what components in the system could be the cause of the problem. If no open or short circuits can be located, and the proper voltage is being applied to the component's electrical connections, the problem may be hydraulic or mechanical rather than electrical. Trial and error component replacement to isolate the problem can be very costly. Make every effort to locate the problem component before installing new parts.

Section 11 - Testing

Structural

After replacing any major component, such as cylinders, booms, leveling rods or chains, it is recommended that a structural test be performed before operating the unit or put the unit back in service. This test verifies the structural soundness of the component before putting the unit back into service.

The operation must be done from the lower controls station.

Never perform the structural test when the platform is occupied.

To perform a structural test on the aerial device, use the following procedure:

1. The area where the test is performed should be level and free from any overhead obstructions. Position the aerial device in the test area so that the platform may be accessed by a forklift or other lifting device to place the weight for the test.

2. Start the unit and properly set the wheel chocks and the outriggers (if equipped).

3. The position of the booms for the test is somewhat dependent upon the component(s) that have been replaced. If a component of the leveling system has been replaced, raise the booms approximately one foot out of each rest (refer to Figure 11.1, Position A). If other components have been replaced, you must perform two tests. Perform one structural test with the upper boom horizontal and the lower boom fully raised (refer to Figure 11.1, Position B). Perform an additional structural test with both booms horizontal (rotate the unit so that the lower boom is horizontal and not in the rest, position the upper boom overcenter flat out - refer to Figure 11.1, Position C).

Warning

Proper procedures must be followed to assure that stability of the unit is maintained while performing this test. Damage to the unit and injury to the operator could result if proper procedures are not followed. Use extreme caution when performing a structural test.

5. The test load must be equal to the maximum platform capacity (Refer to the identification placard for the platform capacity). Place a sling around the platform to suspend the corresponding platform capacity weight directly under their centerlines. Use a forklift or other lifting device to slowly apply the weight.

Note - If the unit is equipped with a platform liner, deduct 42 pounds from the maximum platform capacity.

Attention

Take care to apply a suitable material for the weight so as not to damage the platform or liner during the test. Concrete blocks or bags of sand are some easily obtained materials that can be handled and accurately weighed.

6. Apply the rated load test for 5 minutes. During that time, do not operate any function of the unit. This is only a static test.

7. Remove all weight from the platform. If any cracking or popping was heard during the test, inspect the unit for structural soundness. At this time, the platform may need to be leveled as described in Section 8 under Leveling System.

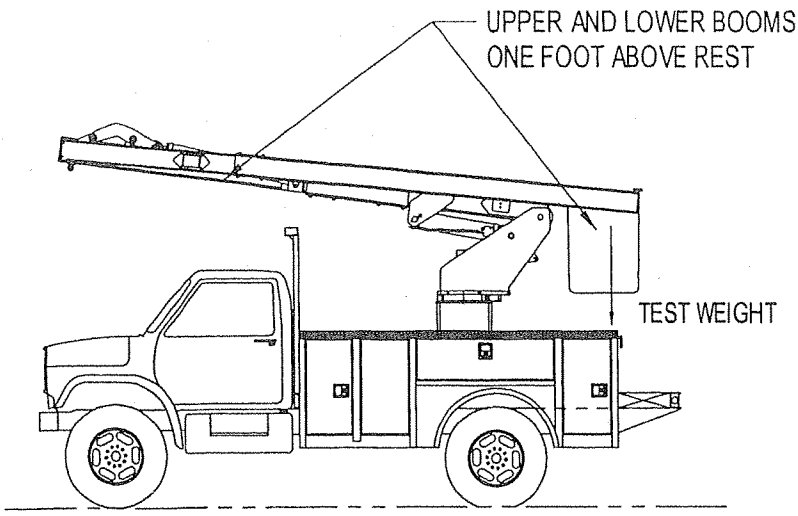
8. Operate the unit through its full range of functions before returning it to service.

Stability

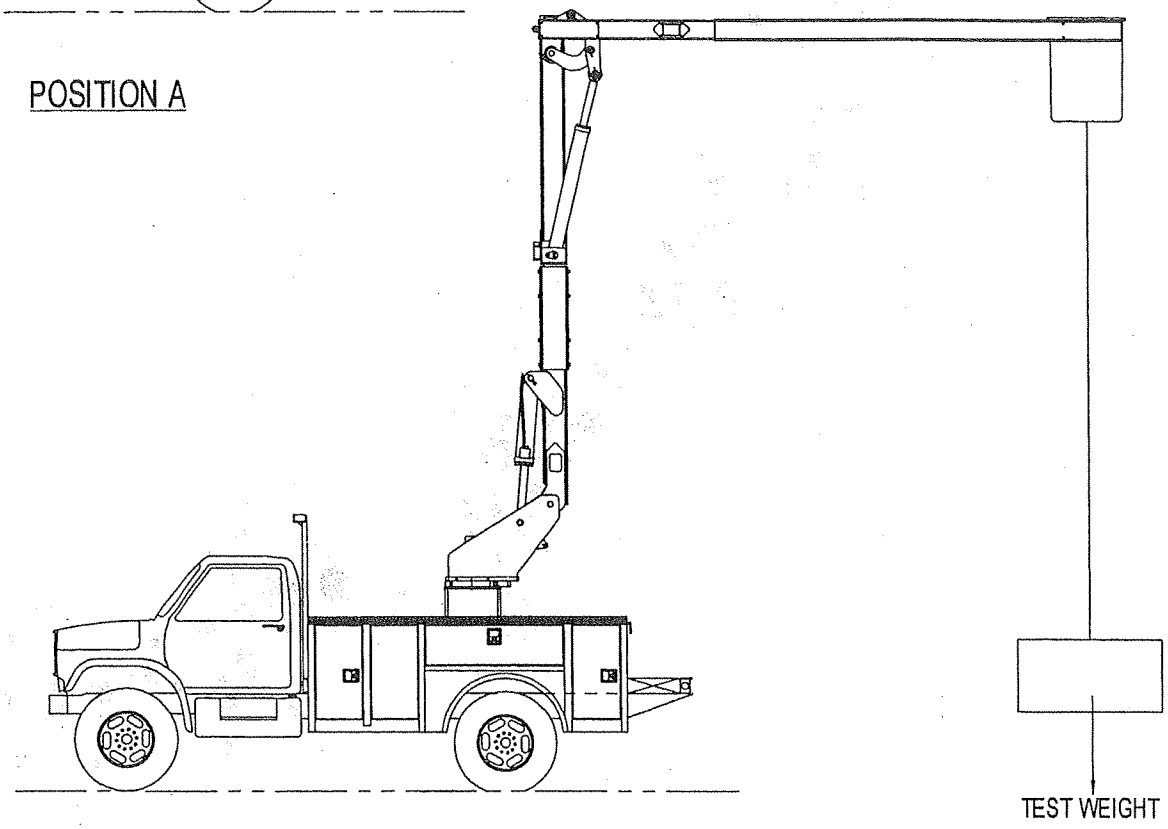
All applicable ANSI and CSA standards for stability have been met or exceeded at the time of manufacture. Component replacement with standard Posi-Plus parts will not affect the stability of this unit. Refer to the applicable stability requirements stated on the stability test report for all the details.

As long as the unit's components have not been modified or altered, this unit will continue to meet or exceed the ANSI and CSA requirements for stability.

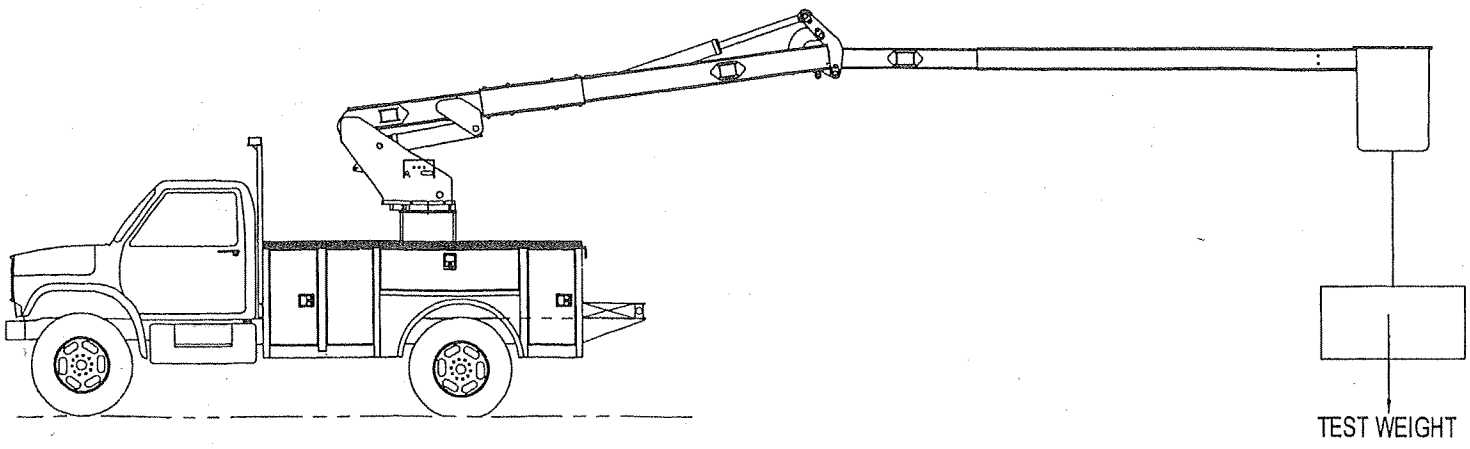
Due to the possible affect on stability, never should the aerial device be altered or modified without the specific written approval from Posi-Plus. This includes modifications to the chassis, subframe, aerial device and the utility body.



POSITION A



POSITION B



POSITION C

FIGURE 11.1 BOOM POSITIONS FOR STRUCTURAL TESTING

Section 12 - Introduction to the Parts Manual

Model and Serial Numbering

Each aerial device is assigned a serial number at the time it is assembled at the factory. This serial number will be stamped on the aerial device identification placard on the pedestal.

Whenever you are ordering parts or requesting service for a Posi-Plus unit, supply the model number and the serial number to your Posi-Plus service representative. This information assures that the correct parts will be supplied to you.

Parts Ordering

Following the Maintenance Manual is a Parts Manual. The Parts Manual contains illustrations that identify part numbers of component parts for the aerial device. Only Posi-Plus parts should be used to maintain and repair the aerial device.

Alternate Construction Drawings

Posi-Plus may have more than one supplier for some components. For a component with a given Posi-Plus part number, parts from different suppliers will be interchangeable as a complete unit. However, the parts may look slightly different. The parts may also have different internal construction and/or require different seal kits.

To determine the part to order, compare the part you are servicing to the Parts Manual illustrations.

Warranty and Core Credit

Components such as cylinders, gearboxes and valves may be returned to Posi-Plus for warranty consideration. The component will not be considered for warranty if it has been opened or disassembled in the field.

Posi-Plus offers core credit on certain parts after the warranty period is over. These parts must be returned to the factory in repairable condition to be considered for core credit.

Contact your Posi-Plus service representative for more information on warranty and core credit services.

Section 11 - Upper control's station, platform (s), upper jib + related accessories

Section 12 – boom's assembly and related accessories

Introduction

Model and Serial Numbering

Each aerial device is assigned a serial number at the time it is assembled at the factory. This serial number will be stamped on the aerial device identification placard on the turret or on the pedestal.

Whenever you are ordering parts or requesting service for a Posi-Plus unit, supply the model number and the serial number to your Posi-Plus representative. This information assures that the correct parts will be supplied to you.

Parts Ordering

The Parts Manual contains illustrations that identify part numbers of component parts for the aerial device. Only genuine Posi-Plus parts must be used to maintain and repair the aerial device. Otherwise, the warranty becomes null.

Revised components

Posi-Plus may have revised some components since their first time of manufacturing. For the components with a given Posi-Plus part number, the revised parts will be interchangeable as a complete unit. However, the parts may look slightly different. The parts may also have different internal construction and/or require different seal kits.

To determine the part to order, compare the part you are servicing to the Parts Section illustrations.

Warranty and Core Credit

Components such as cylinders, gearboxes and valves may be returned to Posi-Plus for warranty consideration. The component will not be considered for warranty if it has been opened or disassembled out in the field without any written authorization by Posi-Plus Technologies.

Posi-Plus offers core credit on certain parts after the warranty period is over. These parts must be returned to the factory in repairable condition to be considered for core credit.

Contact your Posi-Plus distributor for more information on warranty and core credit services.

Repair and Rebuild Services

Repair and rebuild services are available at the factory for many items.

Posi-Plus also has facilities for service of Posi-Plus equipment. Each facility has factory trained personnel to meet your service requirements.

Posi-Plus Locations

Posi-Plus service centers are located in the United States of America and Canada. Each service center will provide you with fast and efficient service.

Nationally, field service personnel live and work in each territory to respond quickly to customer needs.

Aerial lift identification

Owner information

Name:	Hydro One	Requisition #	
Order #	Memor022012	Vehicle #	907-809

Aerial lift information

Job #	102282	Posi-Plus model #	200-42-A
Serial #	03-05-282-1704	Rated voltage:	Below 69 kV

Vehicle information

Make:	International	**Transmission**	
Model #	4400 4x2	Make:	Allison
V.I.N.	1HTMKAAR74H606307	Model #	MD3560P
Year:	2003		

Pump information

Make:	Vickers CW
Model #	PVE12-R-B2-E-S-10-C21-10
Posi-Plus P/N	100-320-157

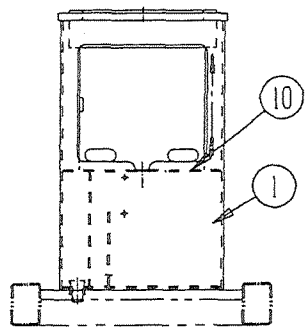
Power Take Off information

Make:	Muncie
Model #	CS20-A1012-H3KX
Posi-Plus P/N	100-134-175

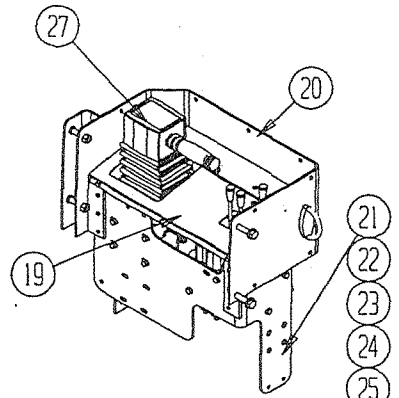
Hydraulic system components

Hydraulic oil	Esso Univis Extra		
Suction filter ass'y P/N	N/A	Return filter ass'y P/N	100-093-015
Suction filter head P/N	100-115-008	Return filter head P/N	N/A
Suction filter element P/N	100-093-002	eturn filter element P/N	100-093-016
High pressure filter ass'y P/N	N/A		
High pressure filter head P/N	100-115-008		
High pressure filter element P/N	100-115-007		

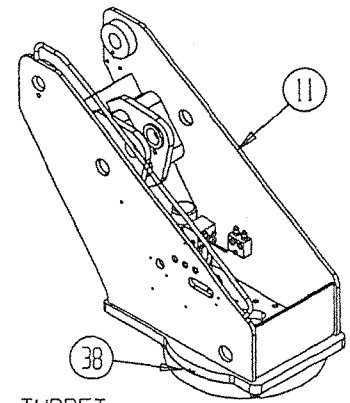
Engine speed RPM	P.T.O. Ratio	Volumetric Capacity	Flow		
			Pump	Main circuit	Auxiliary circuit
700	161%	1,54 po.cu./rev.	7,5 GPM	7,5 GPM	N/A
1000	161%	1,54 po.cu./rev.	10,7 GPM	10,7 GPM	N/A



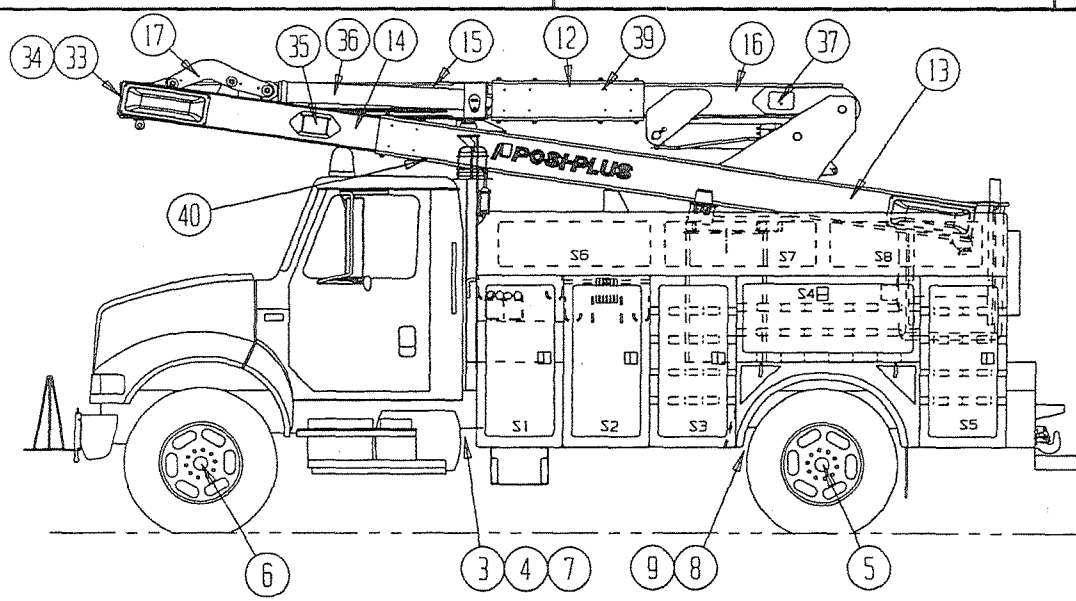
PEDESTAL

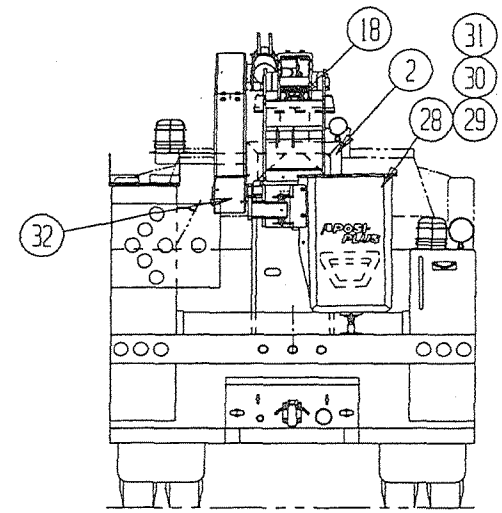


UPPER CONTROLS



TURRET





POSI-PLUS TECHNOLOGIES INC.

MAIN PARTS LIST FOR MODEL 200-42 (JOB-2-273-004-00-1)

Main parts list (Job 2-273-004-00-1)

ITEM #	QTÉ	DESCRIPTION	PIÈCE NO.
1	1	PEDESTAL ASS'Y	242-9010-001-01-4
2	1	BOOM REST ASS'Y	242-9500-007-00-2
3	1	POWER TAKE OFF	100-134-175
4	1	PUMP	100-320-157
5	1	STABILIZER BAR ASS'Y (REAR AXLE)	100-395-324
6	1	STABILIZER BAR ASS'Y (FRONT AXLE)	100-395-323
7	1	HIGH PRESSURE FILTER MOUNTING BRACKET	194-9137-003-00-1
8	1	RETURN LINE FILTER MOUNTING BRACKET	194-9156-002-01-1
9	1	SUCTION FILTER MOUNTING BRACKET	194-9156-002-01-1
10	1	RESERVOIR COVER	194-9197-006-02-2
11	1	TURRET ASS'Y	242-4001-002-01-4
12	1	LOWER BOOM	242-5001-001-01-1
13	1	UPPER BOOM	242-2001-002-01-2
14	1	LOWER ARM UPPER BOOM	242-2002-002-03-4
15	1	UPPER ARM LOWER BOOM	242-5033-002-02-4
16	1	LOWER ARM LOWER BOOM	242-5002-001-03-4
17	2	UPPER LINK	242-3001-001-00-1
18	1	LIMIT SWITCH ASS'Y	100-148-003
19	1	UPPER CONTROLS MOUNTING BRACKET	242-1119-002-00-2
20	1	MOUNTING BRACKET	242-1010-012-00-3
21	1	HYDRAULIC COUPLING FEMALE	100-374-001
22	1	HYDRAULIC COUPLING MALE	100-374-002
23	1	MALE PIPE NIPPLE	100-293-005
24	1	MALE PIPE NIPPLE	100-293-007
25	1	PLUG	100-375-001
26	1	CAP	100-375-002
27	1	P.T.E. JOYSTICK VALVE CONTROL (RIGHT HANDLE)	100-262-350
28	1	PLATFORM	100-003-045-O1
29	1	INSULATED PLATFORM LINER	100-002-007

Body utility main part list

ITEM #	QTY	DESCRIPTION	PART #
	2	NYLON LOCK NUT	100-025-027
	2	FLAT WASHER	100-036-022
	2	SHOULDER EYE BOLT	100-040-003
	1	SEAL BEAM	100-142-001
	1	WORK LIGHT	100-142-006
	2	ROTARY FLASHER - AMBER	100-143-027
	2	LIGHT GUARD KIT FOR FLASHER	100-143-029
	2	VISIBEAM II WORK LIGHT WITH 15 FT CONTROL CABLE	100-157-012
	1	FIRE EXTINGUISHER WITH REFILL CARTRIDGE	100-395-061
	1	FIRE EXTINGUISHER COVER	100-395-062
	1	FIRE EXTINGUISHER HOLDER	100-395-063
	1	FIRE EXTINGUISHER	100-395-064
	1	EMERGENCY TRIANGLE KIT	100-395-070
	4	FLARE	100-395-076
	1	FIRST AID KIT	100-395-077
	1	SOFT CASE FOR 4 FLARES	100-395-079
	1	GROUNDING LUG ASS'Y	JOB 2-071-014-00-2
	1	PINTLE HOOK ASS'Y	201-9200-002-00-2
	4	RUBBER WHEEL CHECK	RC450-S
	1	FILE BOX	8861-3

Body utility main part list

ITEM #	QTY	DESCRIPTION	PART #
	2	NYLON LOCK NUT	100-025-027
	2	FLAT WASHER	100-036-022
	2	SHOULDER EYE BOLT	100-040-003
	1	SEAL BEAM	100-142-001
	1	WORK LIGHT	100-142-006
	2	ROTARY FLASHER - AMBER	100-143-027
	2	LIGHT GUARD KIT FOR FLASHER	100-143-029
	2	VISIBEAM II WORK LIGHT WITH 15 FT CONTROL CABLE	100-157-012
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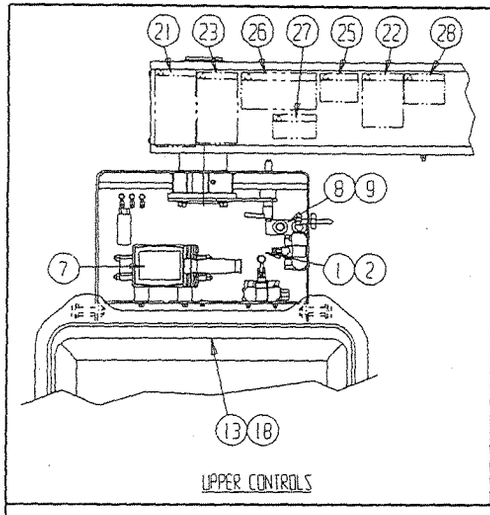
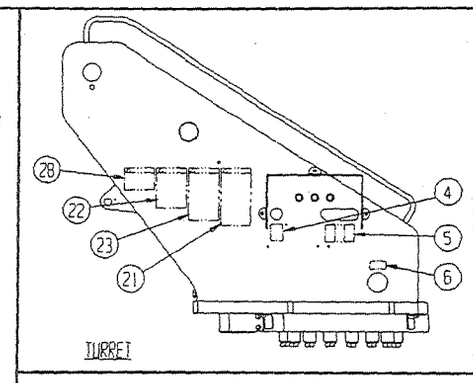
	1	FIRE EXTINGUISHER COVER	100-395-062
	1	FIRE EXTINGUISHER HOLDER	100-395-063
	1	FIRE EXTINGUISHER	100-395-064
	1	EMERGENCY TRIANGLE KIT	100-395-070
	4	FLARE	100-395-076
	1	FIRST AID KIT	100-395-077
	1	SOFT CASE FOR 4 FLARES	100-395-079
	1	GROUNDING LUG ASS'Y	JOB 2-071-014-00-2
	1	PINTLE HOOK ASS'Y	201-9200-002-00-2
	4	RUBBER WHEEL CHECK	RC450-S
	1	FILE BOX	8861-3



UPPER CONTROLS



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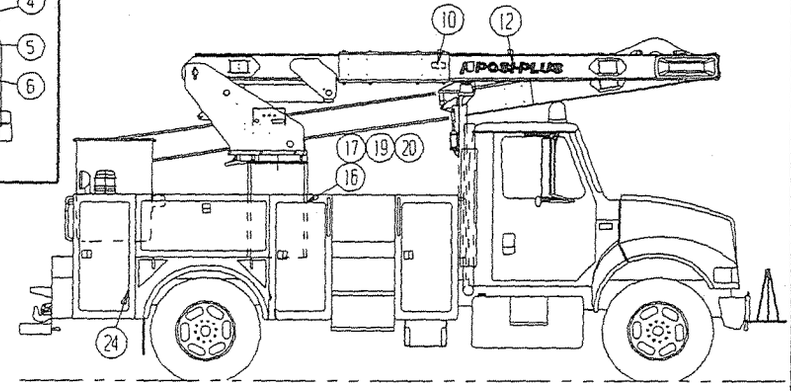

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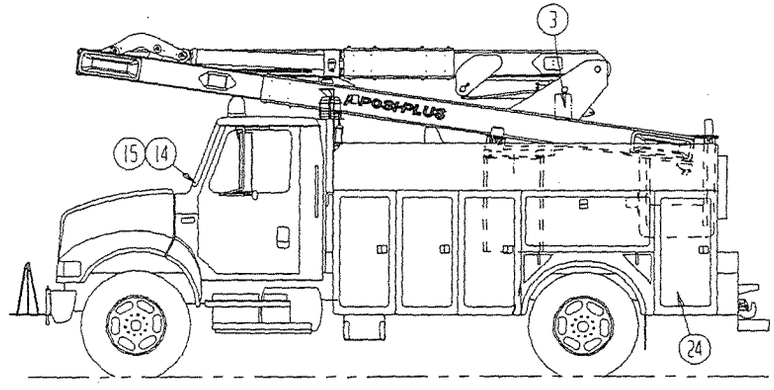

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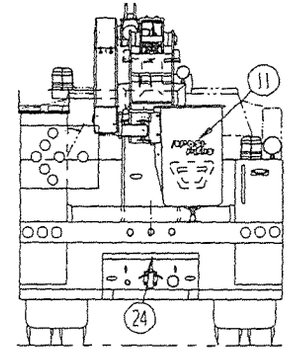


POSI-PLUS TECHNOLOGIES INC.

DECALS LIST FOR MODEL 242 (JOB 1-954-002-00-2)

List of decals - Decals' locations
Job: 1-954-002-00-2

Item #	Qté	Description	Pièce no.
1	1	Tools (Upper controls – single tools)	100-185-037-P2
2	1	Aerial device/tools/emergency stop (Upper controls)	100-185-063-P5
3	1	Aerial device identification (On turrët)	100-229-005-M1
4	1	Upper controls/Lower controls/Emergency stop (Lower controls)	100-230-017-P2
5	1	Lower controls (Lower controls)	100-231-045-P2
6	1	Main pressure (Lower controls)	100-233-003-P2
7	1	Joystick upper controls (Upper controls)	100-237-014-P2
8	1	Pressure (Upper tools)	100-277-001-P2
9	1	Return (Upper tools)	100-278-001-P2
10	1	Dielectric test – Date (On booms)	100-286-003-P5
11	1	Posi-Plus (On platform)	100-290-017-F3
12	2	Posi-Plus (On upper boom)	100-290-018-F3
13	1	Maximum platform capacity 350 lb (Inside the platform)	100-304-026-P2
14	1	Boom unstowed (Inside the cabin)	100-310-037-P2
15	1	P.T.O. (Inside the cabin)	100-314-044-P2
16	1	Esso Univis Extra (On reservoir)	100-310-045-P2
17	1	Emergency pump (Lower controls)	100-377-004-P2
18	1	Warning – Platform (Inside the platform)	100-377-047-V5
19	1	Emergency pump operation (Lower controls)	100-377-050-P2
20	1	High Pressure filter (Lower controls)	100-377-051-P2
21	2	Danger – Electrocution Hazard (Upper and lower controls)	100-377-053-V5
22	2	Danger – Trained personnel (Upper and lower controls)	100-377-054-V5
23	2	Danger – Operating precautions (Upper and lower controls)	100-377-055-V5
24	3	Danger – Electrocution Hazard (On the utility body)	100-377-057-V5
25	1	Danger – Conductive hoses (Upper controls)	100-377-060-V5
26	1	Danger – Body harness (Upper controls)	100-377-061-V5
27	1	Warning – Manual Platform tilt (Upper controls)	100-377-070-V6
28	2	Danger – Pinch points (Upper and lower controls)	100-377-098-V5

POSI-PLUS TECHNOLOGIES INC.
VICTORIAVILLE, QUEBEC, Canada

VEHICLE-MOUNTED AERIAL DEVICES

MODEL	200-42-A	SERIAL NUMBER	03-05-282-1704
PLATFORM HEIGHT	42 ft	HORIZONTAL REACH	34.6 ft

This aerial device complies with the requirements of the following standards:

ANSI N°: --------- CSA N°: CSA-C225-00

CAPACITY RATING

WHEN THE UNIT IS MOUNTED IN ACCORDANCE WITH FACTORY INSTRUCTIONS ON A VEHICLE TYPE APPROVED BY THE FACTORY AND IS IN SERVICE ON A FIRM AND LEVEL SURFACE WITH OUTRIGGERS EXTENDED (IF APPLICABLE) TO A SOLID FOOTING. ITS CAPACITY IS :

350 LB PER PLATFORM ------ TOTAL (BOTH PLATFORMS)

FOR RATINGS OTHER THAN ABOVE, CONSULT FACTORY FOR INFORMATION.

MAXIMUM HYDRAULIC PRESSURE	3000 PSI
RATED LINE VOLTAGE	Below 69 kV

NET LIFTING CAPACITY CHARTS

LOWER BOOM CHART # --------- UPPER BOOM CHART # ---------

WARNING: BEFORE OPERATING THIS UNIT, YOU MUST READ AND UNDERSTAND ALL OPERATING AND SAFETY INFORMATION IN REFERENCE MANUALS AND ALL INFORMATION ON THIS PLACARD.

DAILY CHECK:
1) CHECK LEVEL IN HYDRAULIC OIL RESERVOIR.
2) CHECK UNIT FOR VISIBLE DEFECTS OR LOOSE OBJECTS.
3) CHECK INSULATED BOOMS AND OTHER INSULATING MATERIAL FOR CLEANLINESS.

WEEKLY CHECK:
1) GREASE ALL FITTINGS.

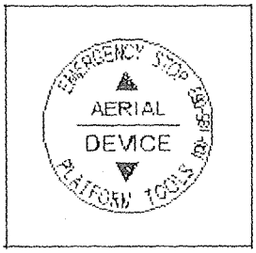
OPERATION

WARNING: DO NOT OPERATE THIS AERIAL DEVICE WITHOUT FIRST HAVING THE OUTRIGGERS IN CONTACT WITH THE GROUND (IF APPLICABLE). CAPACITIES MUST NEVER BE EXCEEDED. OVERLOADING CAN CAUSE DAMAGE TO THE UNIT AND SERIOUS PERSONAL INJURY MAY RESULT.

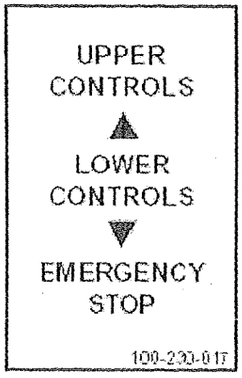
1) APPLY VEHICLE PARKING BRAKES AND SET WHEEL CHOCKS ON BOTH SIDES.
2) START ENGINE AND ENGAGE PTO.
3) EXTEND OUTRIGGERS TO A SOLID FOOTING (IF APPLICABLE).
4) OPERATE ALL HYDRAULIC CONTROLS SLOWLY AND DELIBERATELY FOR SMOOTH PLATFORM MOTION.

100-[illegible]-005

100-185-037-P2



100-185-063-P5



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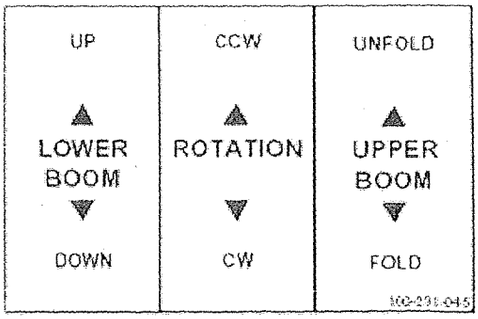

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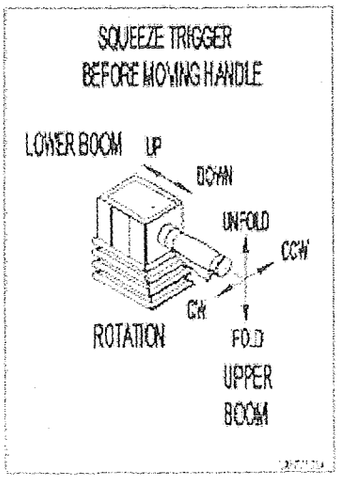
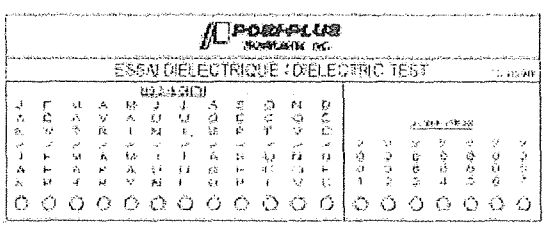
100-233-003-P2



100-237-014-P2

100-277-001-P2

100-278-001-P2



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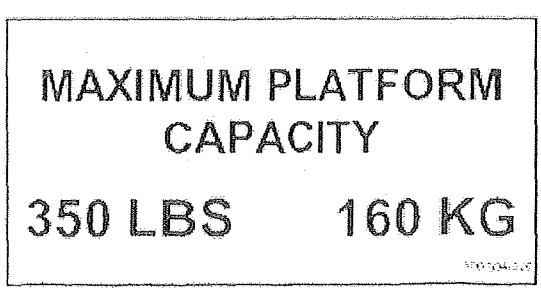
100-290-017-F3

100-290-018-F3



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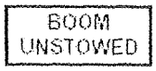
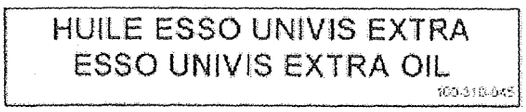


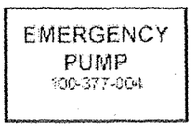
100-310-037

100-310-044

100-310-037-P2

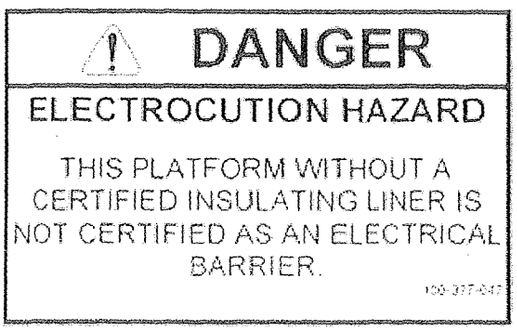
100-310-044-P2

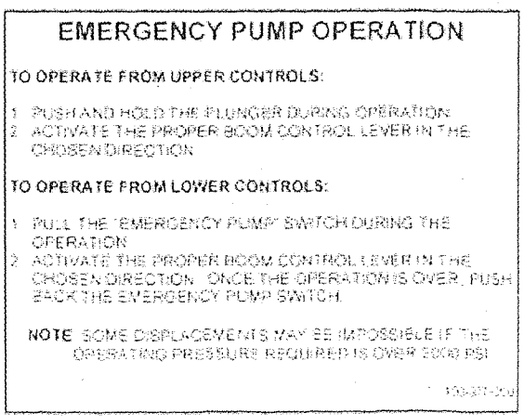




100-310-045-P2

100-377-004-P2





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100-377-050-P2

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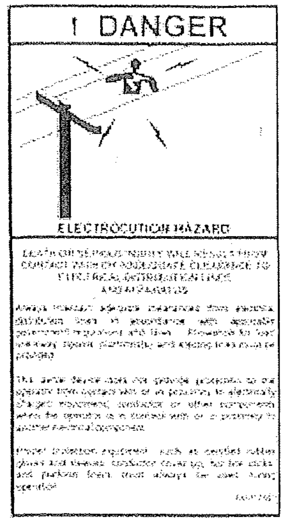

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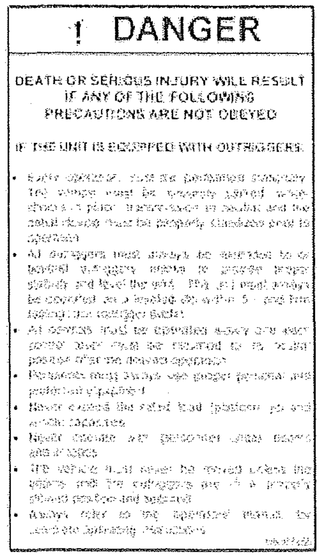
100-377-054-V5



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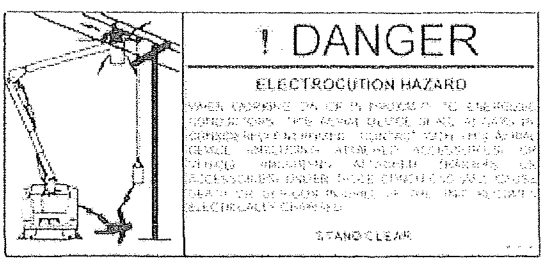

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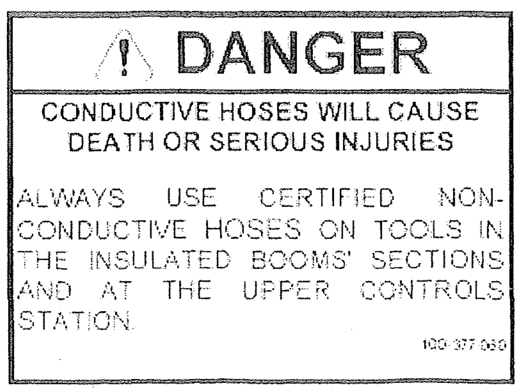

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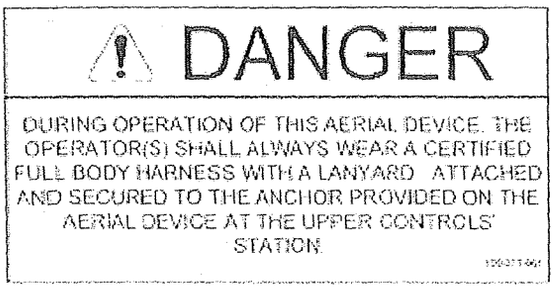

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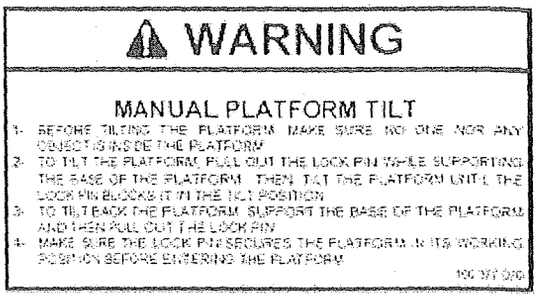

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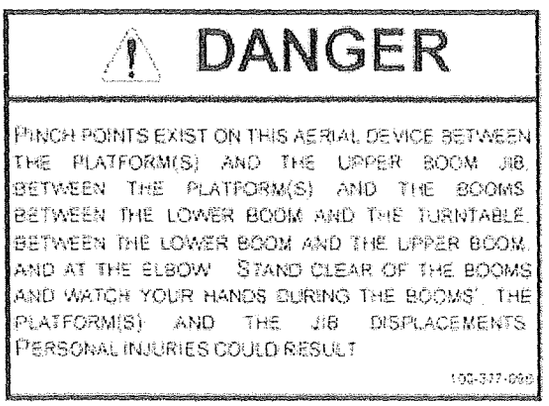
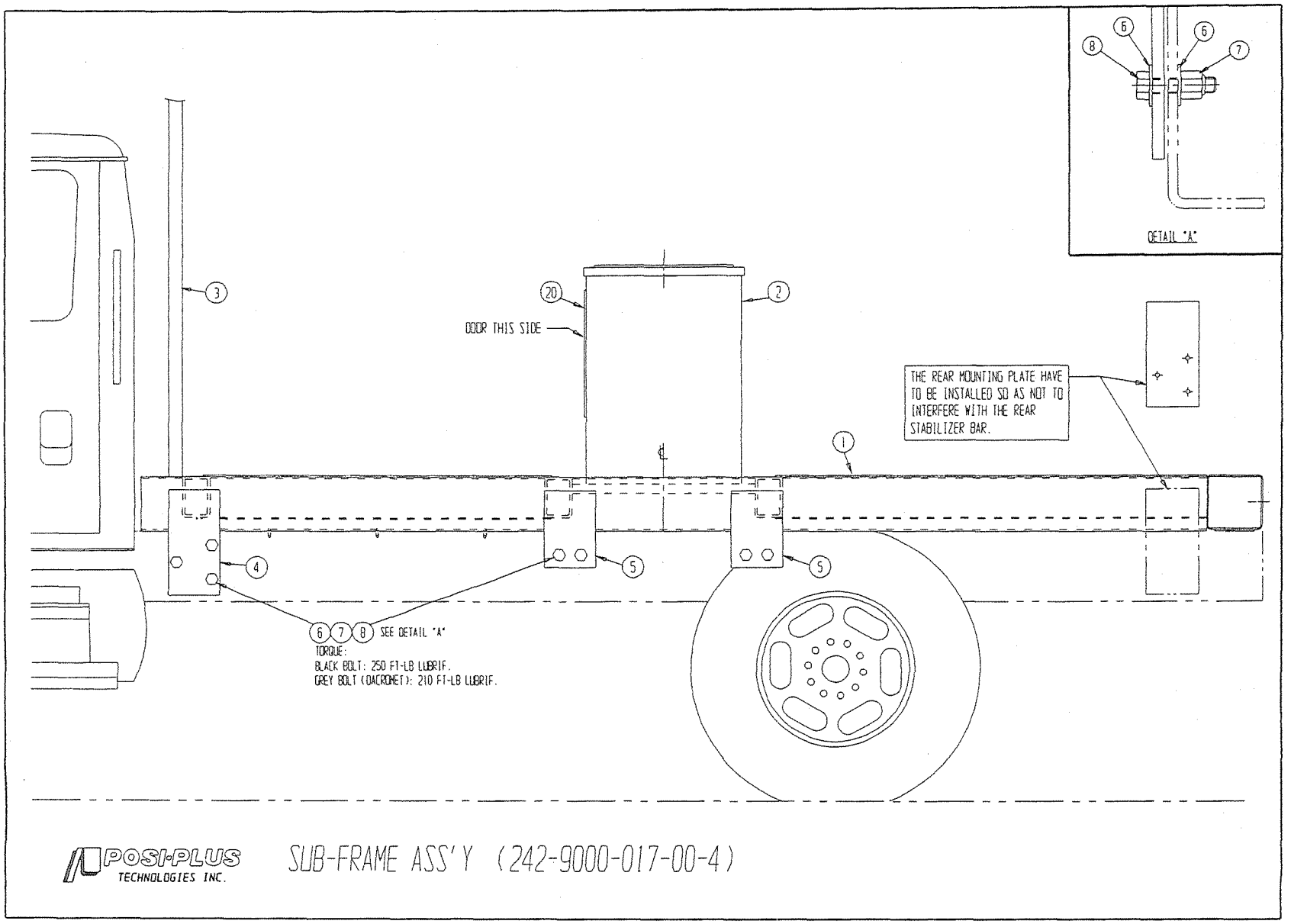
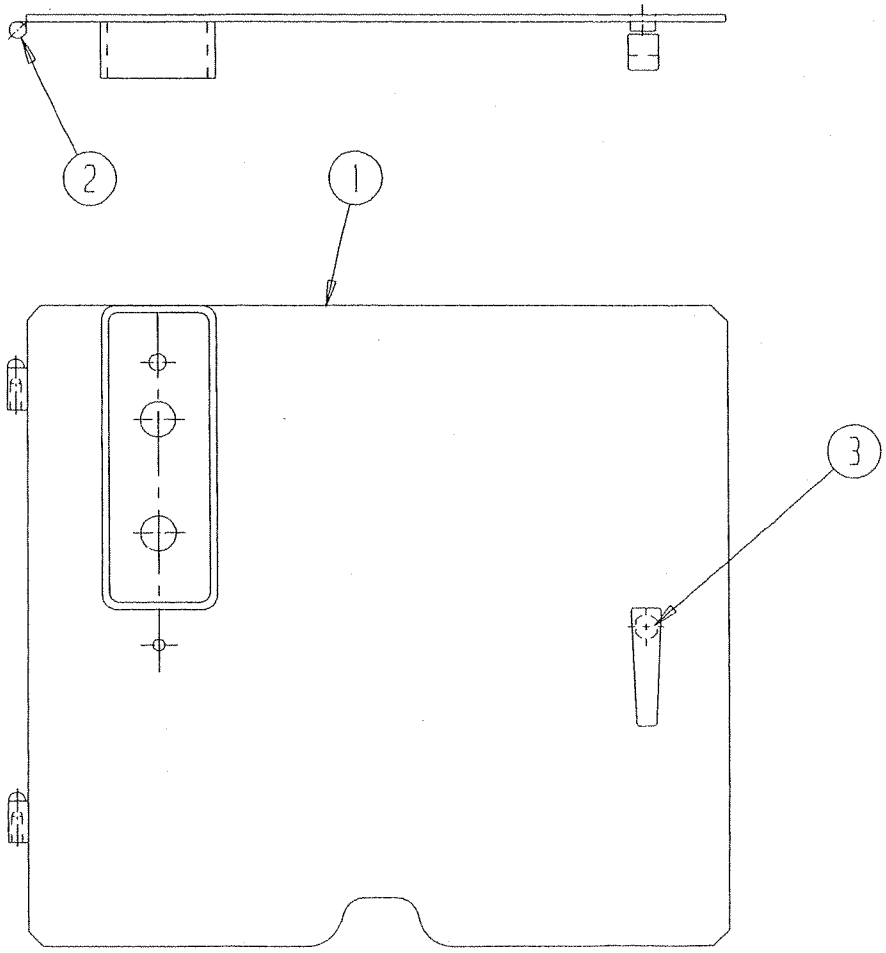


100-377-098-V5


DETAIL "A"
DOOR THIS SIDE
THE REAR MOUNTING PLATE HAVE TO BE INSTALLED SO AS NOT TO INTERFERE WITH THE REAR STABILIZER BAR.
SEE DETAIL "A"
TORQUE:
BLACK BOLT: 250 FT-LB LUBRIF.
GREY BOLT (DACROMET): 210 FT-LB LUBRIF.
POSI-PLUS TECHNOLOGIES INC.
SUB-FRAME ASS'Y (242-9000-017-00-4)

Sub-frame ass'y
242-9000-017-00-4

Item #	Qty	Description	Part #
1	1	Mounting bracket	242-9001-017-XX-4
2	1	Pedestal ass'y	See main parts list
3	1	Boom rest	See main parts list
4	4	Cover plate	194-9586-001-XX-1
5	4	Mounting plate	194-9121-012-XX-1
6	40	Flat washer	100-036-008
7	20	Nut lock	100-025-003
8	20	Hexagonal head bolt	100-006-035

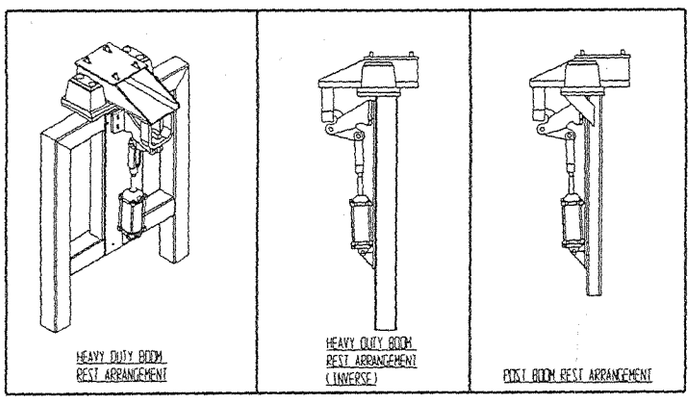


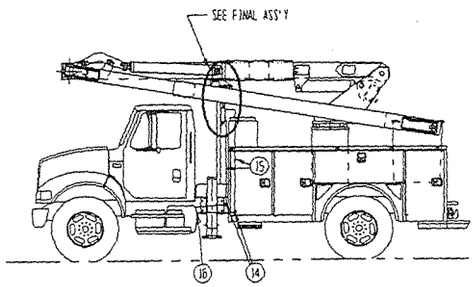
POSI-PLUS TECHNOLOGIES INC.

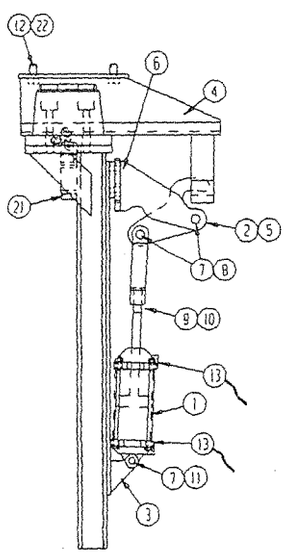
PEDESTAL DOOR (190-9212-016-00-2)

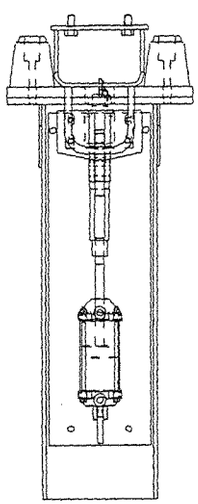
Pedestal door ass'y
190-9212-016-00-2

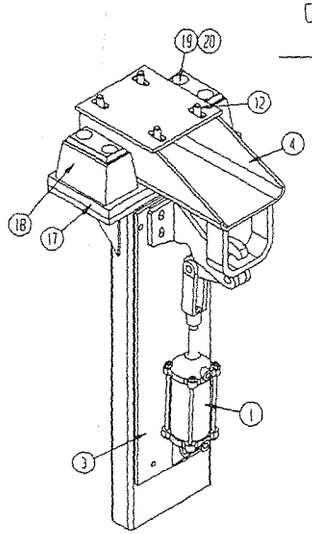
Item #	Qty	Description	Part #
1	1	Door	190-9210-004-XX-1
2	2	Hinge	100-055-004
3	1	Lift & turn latch	100-248-002

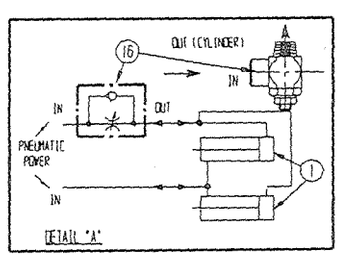












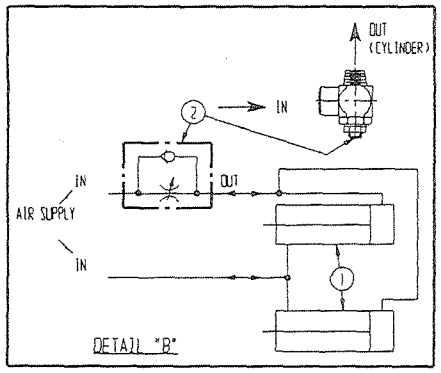
* FINAL ASS'Y

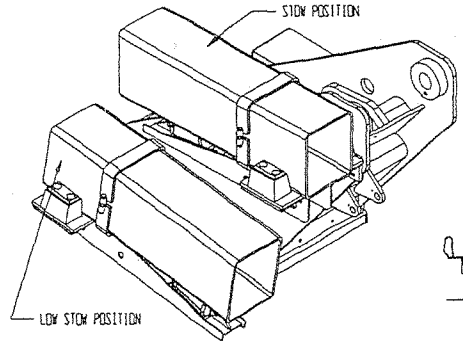
POSI-PLUS TECHNOLOGIES INC.

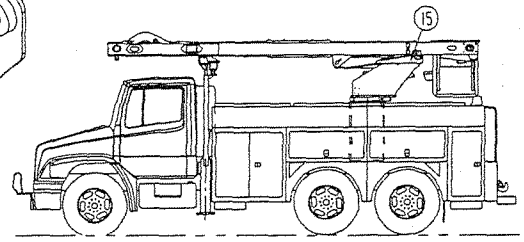
LOWER BOOM AUTOMATIC BOOM LOCK (242-1710-002-00-3)

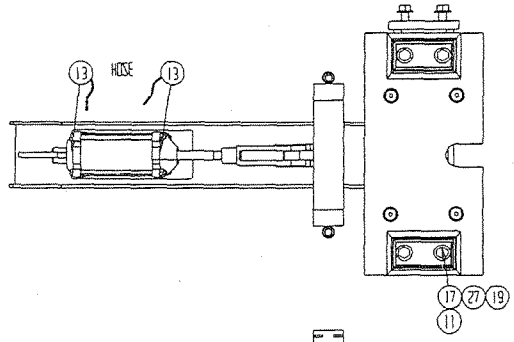
Automatic boom lock
242-1710-002-00-3

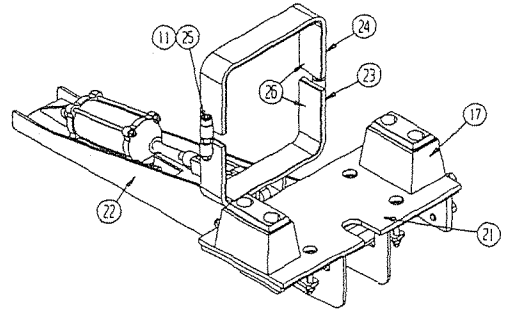
ITEM #	QTY	DESCRIPTION	PART #
1	1	AIR CYLINDER	100-362-030
2	1	HOOK LOCK	500-1701-002-XX-2
3	1	LOWER BOOM AIR CYLINDER MOUNTING BRACKET	500-1706-010-XX-2
4	1	UPPER BOOM ARM	242-9505-001-XX-2
5	1	HOOK	194-1707-002-XX-1
6	4	HEXAGONAL HEAD BOLT	100-006-189
7	3	COTTER PIN	100-023-003
8	2	CLEVIS PIN	100-022-011
9	1	HEXAGONAL NUT	100-004-017
10	1	CLEVIS YOKE	100-341-004
11	1	CLEVIS PIN	100-022-023
12	4	FLANGE WHIZ-LOCK SCREW	100-006-169
13	3	ELBOW MALE 90 FOR TUBING NYLON PIPE	100-350-071
14	2	TEE UNION	100-350-090
15		AIR TUBING	084-01
16	1	CHECK VALVE	100-010-021
17	2	ABSORBING PLATE	500-9043-018-XX-1
18	2	RUBBER PLATE	100-242-005
19	4	HEXAGONAL HEAD BOLT	100-006-245
20	4	FLAT WASHER	100-036-027
21	(1)	LOWER BOOM LIMIT SWITCH	SEE MAIN PARTS LIST
22	(1)	DRILLING DETAIL OF LOWER BOOM	242-1715-001-XX-2

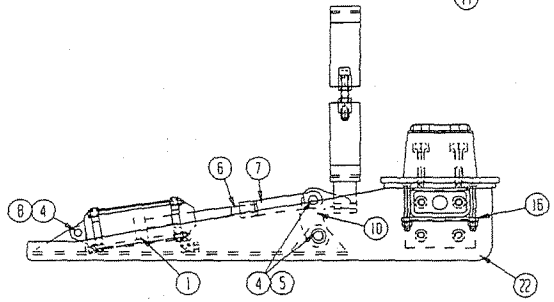


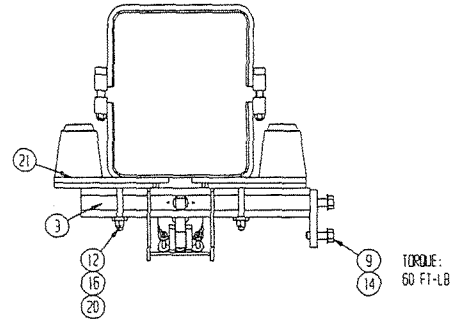










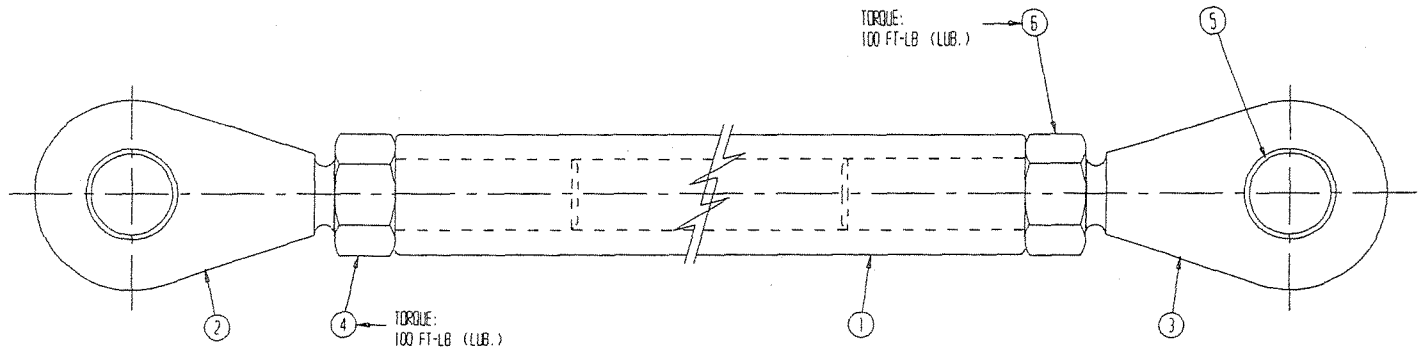


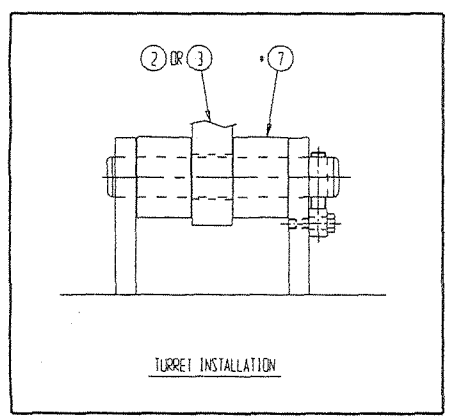
POSI-PLUS TECHNOLOGIES INC.

UPPER BOOM AUTOMATIC BOOM LOCK (242-1710-017-01-3)

Automatic boom lock
242-1710-017-01-3

ITEM #	QTY	DESCRIPTION	PART #
1	1	AIR CYLINDER	100-362-030
2	1	CHECK VALVE	100-010-021
3	1	UPPER BOOM RST MAIN TUBE	242-1725-003-XX-2
4	3	COTTER PIN	100-023-003
5	2	CLEVIS PIN	100-022-011
6	1	NUT	100-004-017
7	1	CLEVIS YOKE	100-341-004
8	1	CLEVIS PIN	100-022-023
9	4	HEXAGONAL HEAD BOLT	100-006-033
10	1	HOOK	194-1708-002-XX-1
11	4	NYLON INSERT LOCK NUT	100-025-020
12	4	BOLT	100-000-098
13	2	AIR ELBOW	100-350-071
14	4	LOCK WASHER	100-007-008
15	2	AIR TUBING	084-01
16	2	CONNECTING LINK	242-1735-001-XX-1
17	2	RUBBER PLATE	100-242-005
18			
19	4	FLAT WASHER	100-036-027
20	4	NYLON INSERT LOCK NUT	100-025-041
21	1	UPPER BOOM REST RUBBER PAD	500-9043-023-XX-1
22	1	LOCK SYSTEM SUPPORT	242-1728-004-XX-2
23	1	BELT ASS'Y WITH RING	242-1732-003-XX-2
24	1	BELT ASS'Y	242-1732-004-XX-2
25	2	CYLINDRICAL HEAD BOLT	100-001-086
26	2	RUBBER STICKERS	242-1724-002-XX-1
27	4	BOLT	100-000-099



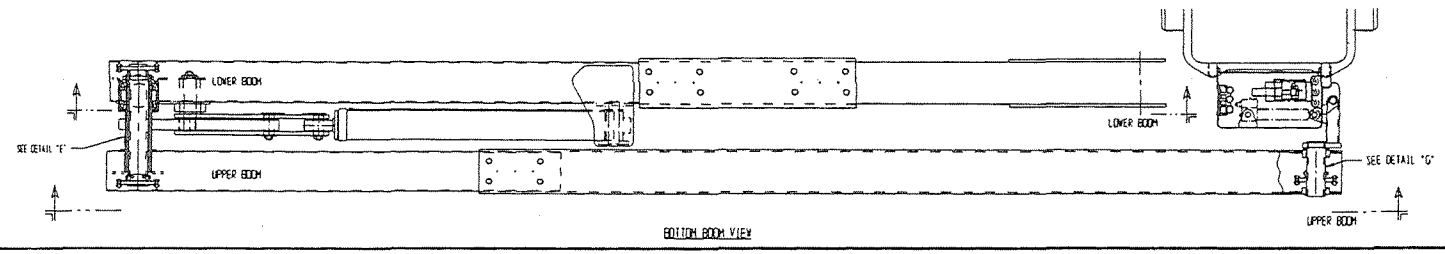


POSI-PLUS TECHNOLOGIES INC.

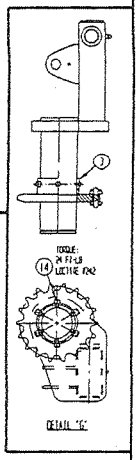
ADJUSTABLE CONNECTING LINK (500-7110-00X-01-3)

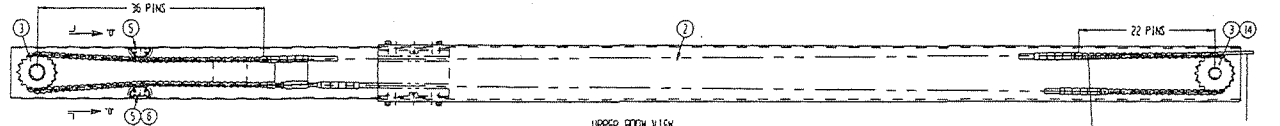
Adjustable connecting link
500-7110-003-01-3

Item #	Qty	Description	Part #
1	1	Square rod	500-7112-013-XX-2
2	1	Rod end	500-7111-002-XX-2
3	1	Rod end	500-7104-003-XX-2
4	1	Nut	100-004-085
5	2	Bushing glycodur	100-021-032
6	1	Nut	100-004-065
7	2	Spacer	500-7113-002-XX-1

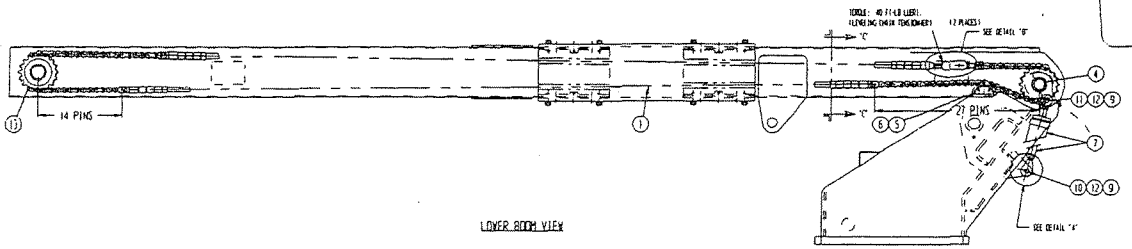


BOTTOM BOOM VIEW

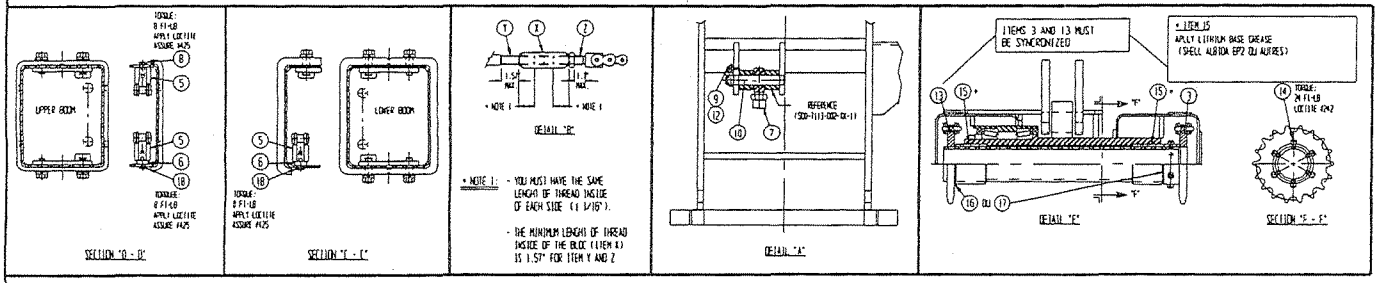




UPPER BOOM VIEW



LOWER BOOM VIEW



SECTION "D - D"

SECTION "E - E"

* NOTE 1: - YOU MUST HAVE THE SAME LENGHT OF THREAD INSIDE OF EACH SIDE (± 1/16").

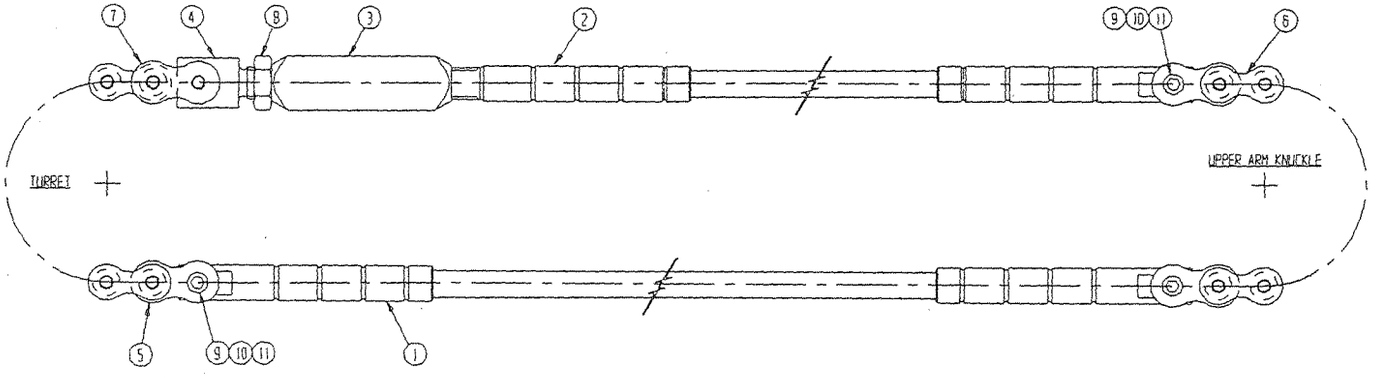
- THE MINIMUM LENGHT OF THREAD INSIDE OF THE BLOC (ITEM 1) IS 1.57" FOR ITEM Y AND Z

POSI-PLUS TECHNOLOGIES INC.

LEVELING SYSTEM ASS'Y (242-7000-102-00-4)

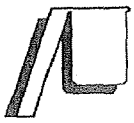
Leveling system
242-7000-102-00-4

ITEM #	QTY	DESCRIPTION	PART #
1	1	LOWER BOOM LEVELING SYSTEM	194-7023-107-XX-3
2	1	UPPER BOOM LEVELING SYSTEM	192-7024-107-XX-3
3	2	PINION	242-7015-002-XX-2
4	1	ADJUSTING LINKAGE ASS'Y	190-7003-006-XX-2
5	3	CHAIN TENSIONER	190-7019-005-XX-1
6	2	CHAIN TENSIONER	190-7019-006-XX-1
7	1	CYLINDER ASS'Y	REFER TO TABLE OF CONTENTS
8	2	BOLT	100-006-027
9	2	BOLT WHIZ-LOCK	100-006-149
10	1	SHAFT	500-7005-105-XX-1
11	1	SHAFT	500-7005-103-XX-1
12	2	LOCK PIN	500-7002-001-XX-1
13	1	PINION ASS'Y	242-7010-002-XX-2
14	12	BOLT	100-001-078
15	2	RING	242-7001-002-XX-1
16	2	SPACER	242-1006-001-XX-1
17	2	SPACER	242-1006-002-XX-1
18	4	BOLT	100-006-086



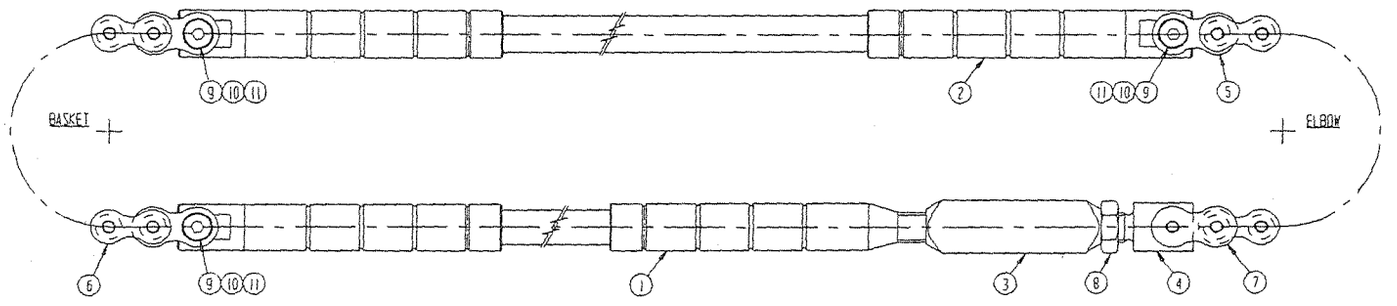
POSI-PLUS TECHNOLOGIES INC.

LEVELING SYSTEM ASS'Y - LOWER ARM (194-7023-10X-00-3)



Leveling system ass'y lower boom
194-7023-107-00-3

Item #	Qty	Description	Part #
1	1	Leveling rod	192-7030-131-XX-3
2	1	Leveling rod	192-7031-128-XX-3
3	1	Adjuster block	192-7004-001-XX-2
4	1	Leveling adjuster	192-7007-001-XX-2
5	1	Chain	192-7017-013-XX-2
6	1	Chain	192-7017-015-XX-2
7	1	Master link	100-054-001
8	1	Nut	100-004-007
9	3	Shoulder bolt	100-024-004
10	3	Nylon insert lock nut	100-025-010
11	3	Flat washer	100-036-001

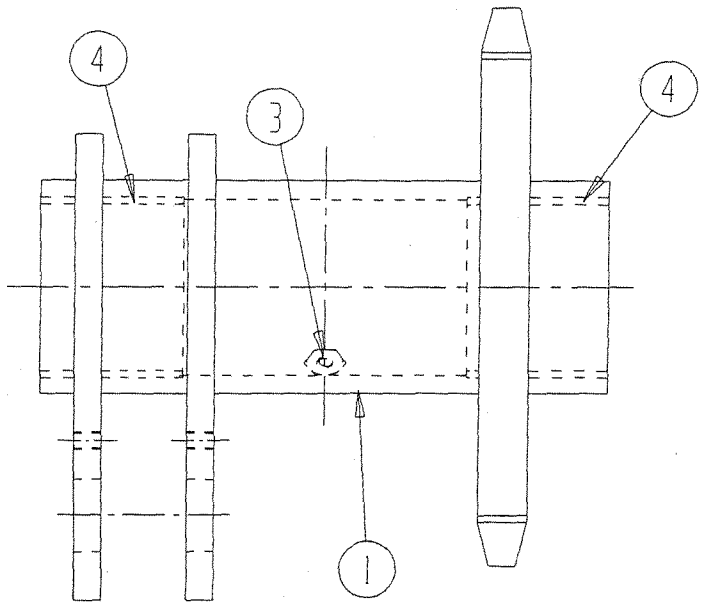


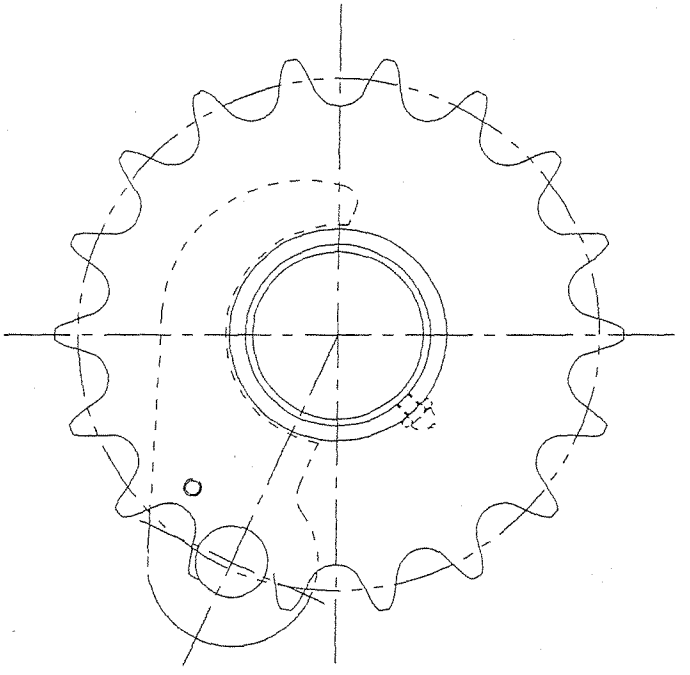
POSI-PLUS TECHNOLOGIES INC.

LEVELING SYSTEM ASS'Y UPPER BOOM (192-7024-106-00-3 / 192-7024-107-00-3)

Leveling system ass'y upper boom
192-7024-107-00-3

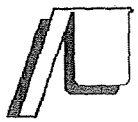
Item #	Qty	Description	Part #
1	1	Leveling rod ass'y	192-7031-122-XX-3
2	1	Leveling rod ass'y	192-7030-125-XX-3
3	1	Adjuster block	192-7004-001-XX-2
4	1	Leveling adjuster	192-7007-001-XX-2
5	1	Chain	192-7017-027-XX-2
6	1	Chain	192-7017-007-XX-2
7	1	Master link	100-054-001
8	1	Nut	100-004-007
9	3	Shoulder bolt	100-024-004
10	3	Nylon insert lock nut	100-025-010
11	3	Flat washer	100-036-001





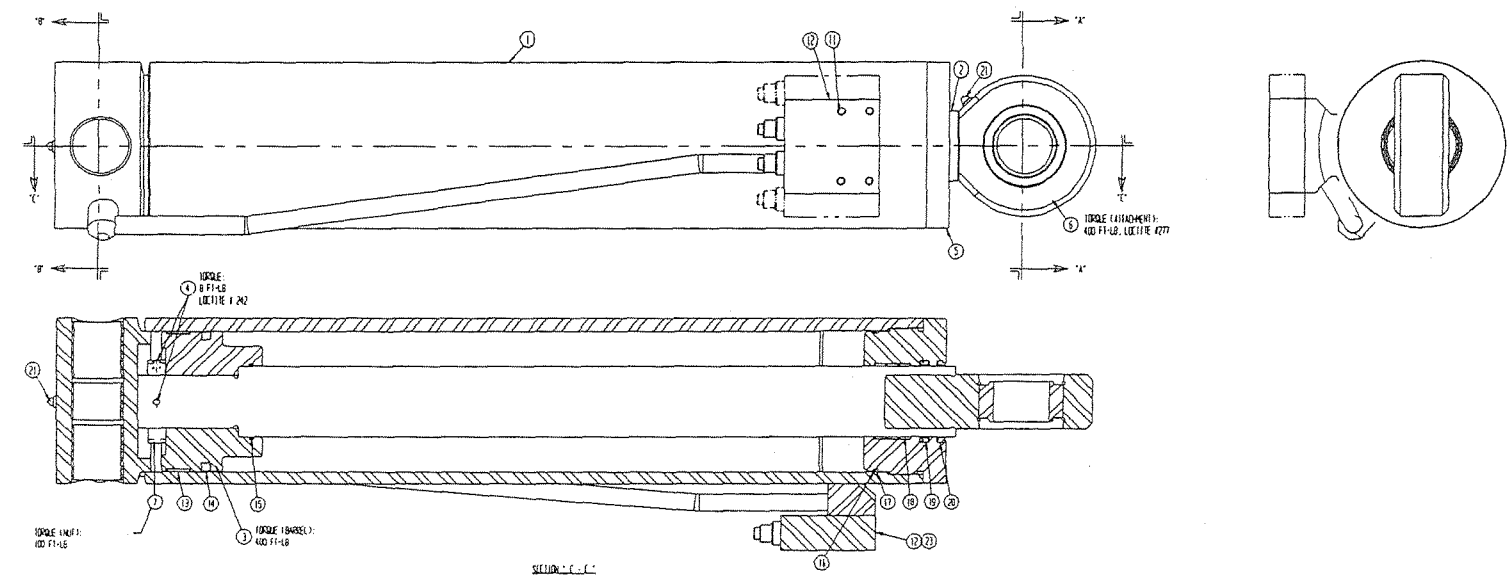
POSI-PLUS TECHNOLOGIES INC.

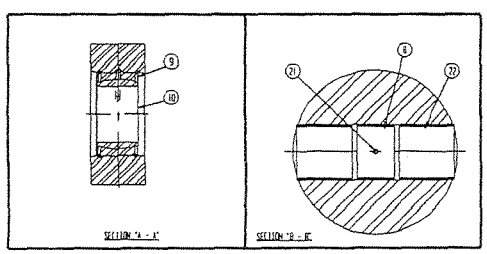
ADJUSTING LINKAGE ASS'Y (190-7003-006-02-2)

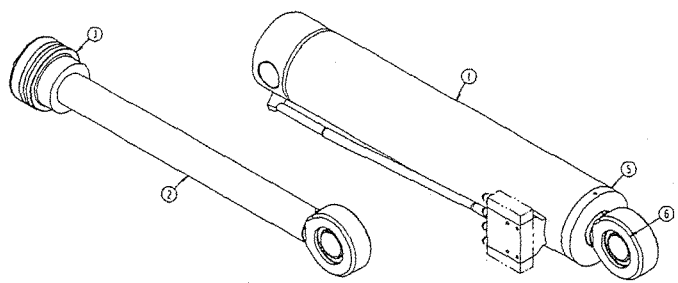


Adjusting linkage ass'y
190-7003-006-02-2

Item #	Qty	Description	Part #
1	1	ADJUSTING LINKAGE	190-7004-006-XX-2
3	1	GREASE FITTING	100-057-001
4	2	BUSHING GLYCODUR	100-021-024





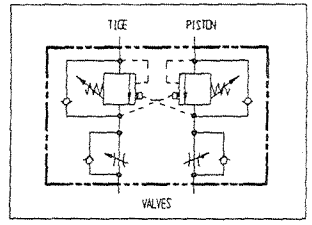


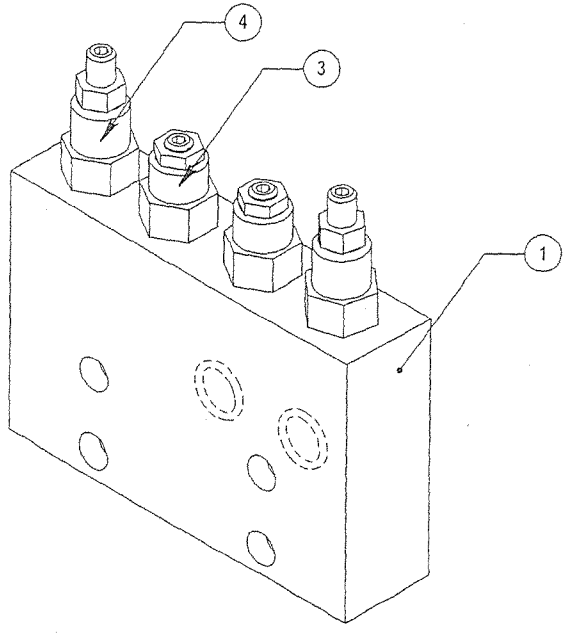
POSI-PLUS TECHNOLOGIES INC.

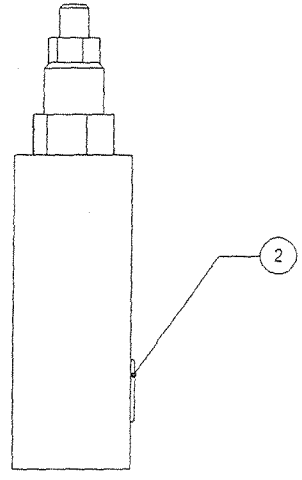
LOWER BOOM CYLINDER (242-3011-001-00-4, 242-3011-002-00-4)

Cylinder ass'y – (side-by-side)
242-3011-002-00-4

ITEM #	QTY	DESCRIPTION	PART #
1	1	CYLINDER	242-3020-001-XX-3
2	1	ROD	194-3026-106-XX-2
3	1	PISTON	194-3048-001-XX-2
4	2	HEX. SOCKET SET SCREWS	100-034-066
5	1	HEAD	194-3036-003-XX-2
6	1	CYLINDER ROD END	194-3031-003-XX-2
7	1	NYLON INSERT LOCK NUT	500-3302-002-XX-1
8	1	BUSHING GLYCODUR	100-021-022
9	2	SNAP RING	100-042-003
10	1	SPHERICAL PLAIN BEARING	100-038-007
11	4	BOLT	100-001-012
12	1	HYDRAULIC ASS'Y	500-3320-013-XX-2
	1	SEAL KIT	100-282-045
13	(1)	WEAR RING	(100-218-004)
14	(1)	PISTON SEAL	(100-284-012)
15	(1)	"O"-RING SEAL	(100-214-009)
16	(1)	BACK-UP RING	(100-216-006)
17	(1)	"O"-RING	(100-214-008)
18	(3)	WEAR RING	(100-218-021)
19	(1)	BT TYPE ROD SEAL	(100-212-045)
20	(1)	WIPER	(100-215-004)
21	2	GREASE FITTING	100-057-001
22	2	BUSHING GLYCODUR	100-021-023
23	2	FITTING	100-017-008

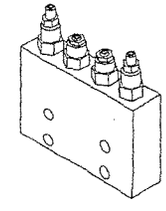






SCALE: 1:2	POSI-PLUS TECHNOLOGIES INC.	DWN: L C	TITLE: CYLINDER HOLDING VALVE ASS'Y
DATE: 2001-06-05		APP:	
	REF.: 500-3300-05X-XX-4	DRAWING NUMBER:	500-3320-013-01-2

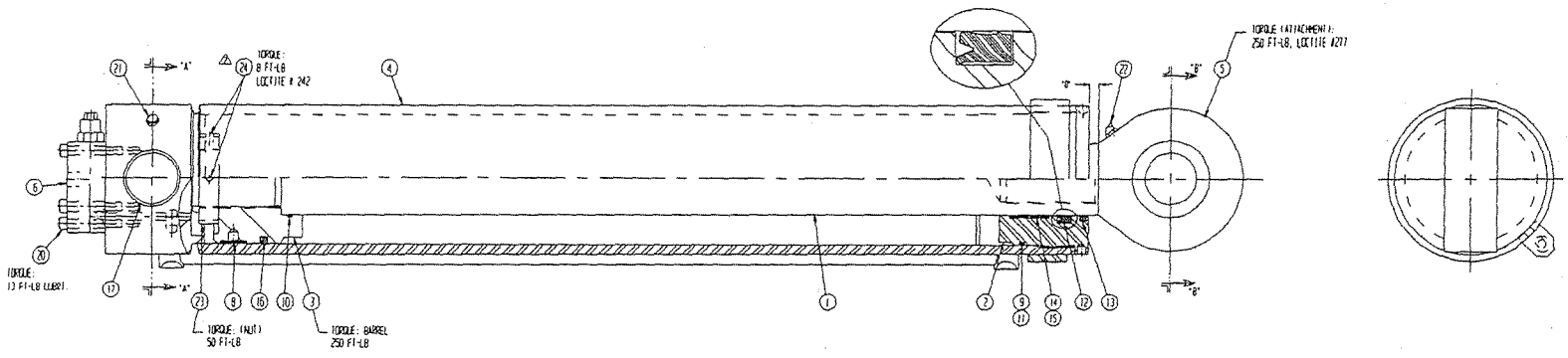
ITEM	DRAWING	DESCRIPTION	QTY
1	500-3319-012-00-2	HOLDING VALVE MANIFOLD	1
2	100-288-013	O-RING	2
3	100-066-012	CARTRIDGE	2
4	100-066-055	CARTRIDGE	2



POSI-PLUS TECHNOLOGIES INC.

TITLE CYLINDER HOLDING VALVE ASS'Y

PART NUMBER: 500-3320-013-01-2



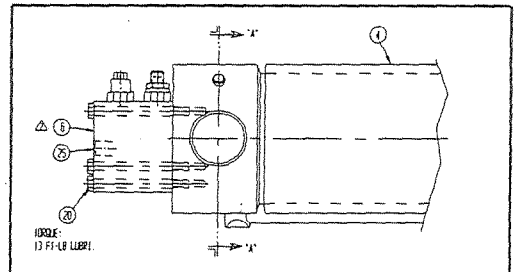
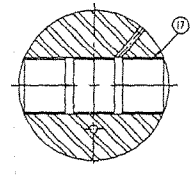
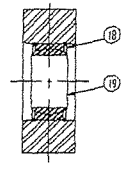


ILLUSTRATION OF 190-3011-302-02-4



SECTION "A - A"



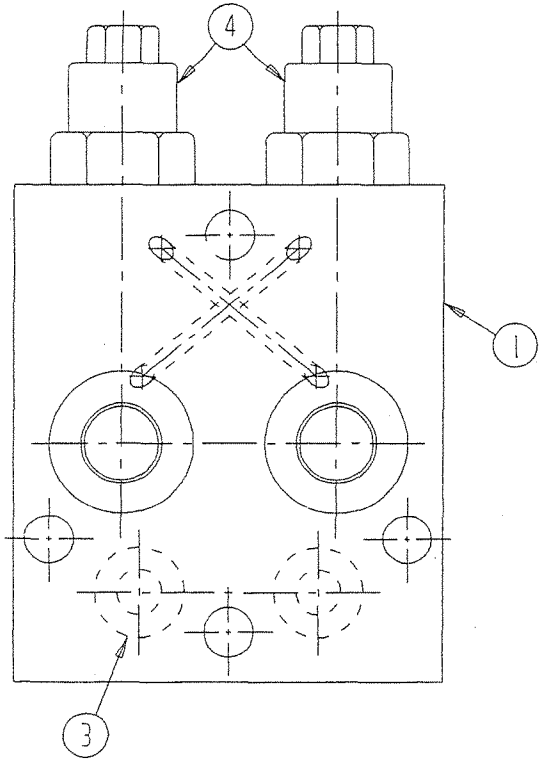
SECTION "B - B"

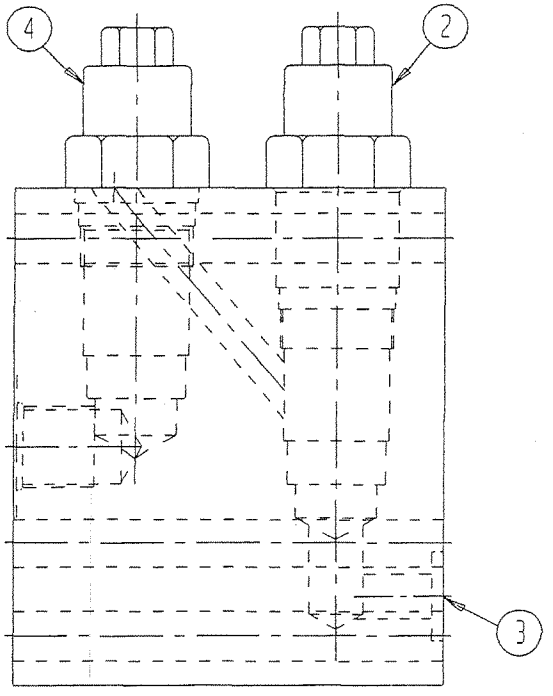
POSI-PLUS TECHNOLOGIES INC.

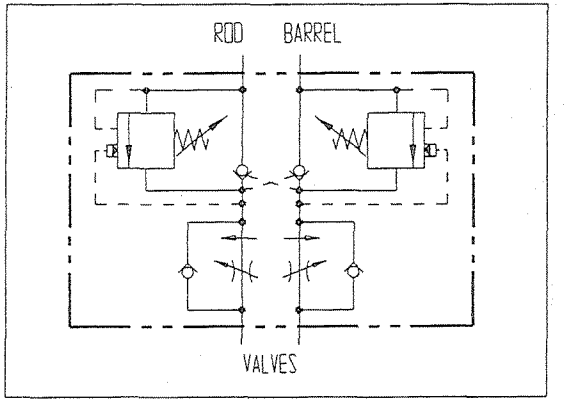
UPPER BOOM CYLINDER (190-3011-301-02-4, 190-3011-302-02-4)

Upper boom cylinder ass'y
190-3011-302-02-4

Item #	Qty	Description	Part #
1	1	Rod	192-3026-006-XX-2
2	1	Head	190-3027-002-XX-2
3	1	Piston	194-3049-003-XX-2
4	1	Cylinder ass'y	190-3020-302-XX-3
5	1	Cylinder rod end	192-3108-001-XX-2
6	1	Valve ass'y	500-9142-008-XX-2
7	1	Seal kit	100-282-038
8	(1)	Wear ring	(100-218-001)
9	(1)	O-ring	(100-214-003)
10	(1)	O-ring seal	(100-214-004)
11	(1)	Back-up ring	(100-216-002)
12	(1)	O-ring	(100-212-036)
13	(1)	Wiper	(100-215-002)
14	(1)	Wear ring	(100-218-002)
15	(1)	Wear ring	(100-218-010)
16	(1)	Square ring	(100-284-011)
17	3	Bushing glycodur	100-021-013
18	2	Snap ring	100-042-005
19	1	Spherical plain bearing	100-038-006
20	4	Bolt	100-006-264
21	1	Grease fitting	100-057-001
22	1	Grease fitting	100-057-002
23	1	Nylon insert lock nut	500-3302-002-XX-1
24	2	Set screw	100-034-066
25	2	Elbow	100-014-006







NOTES: - CARTRIDGE TORQUE: 20 FT-LB

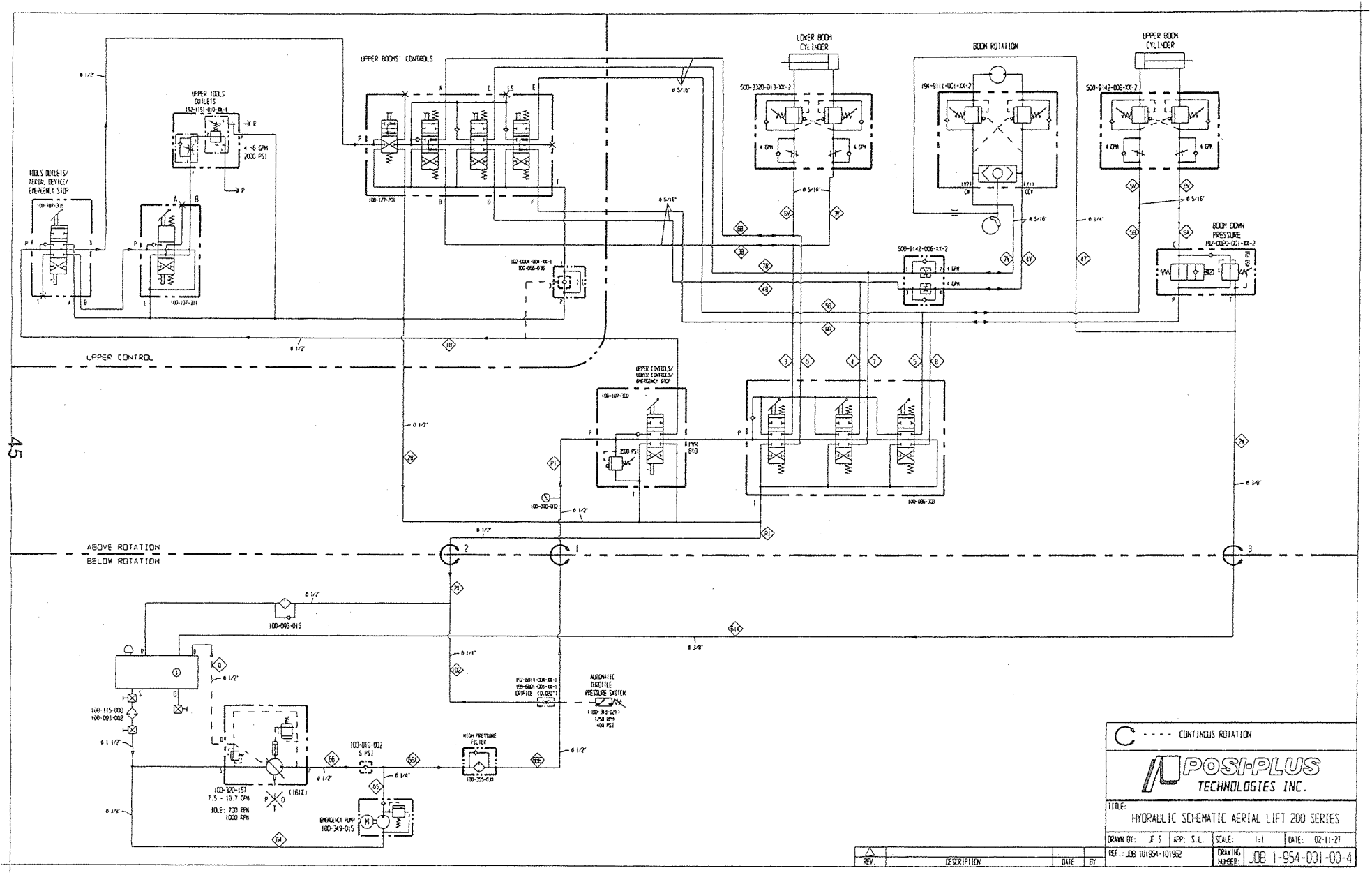
- FOR CARTRIDGE PRESSURE ADJUSTEMENT SEE WORK METHODS I409-016.XXA

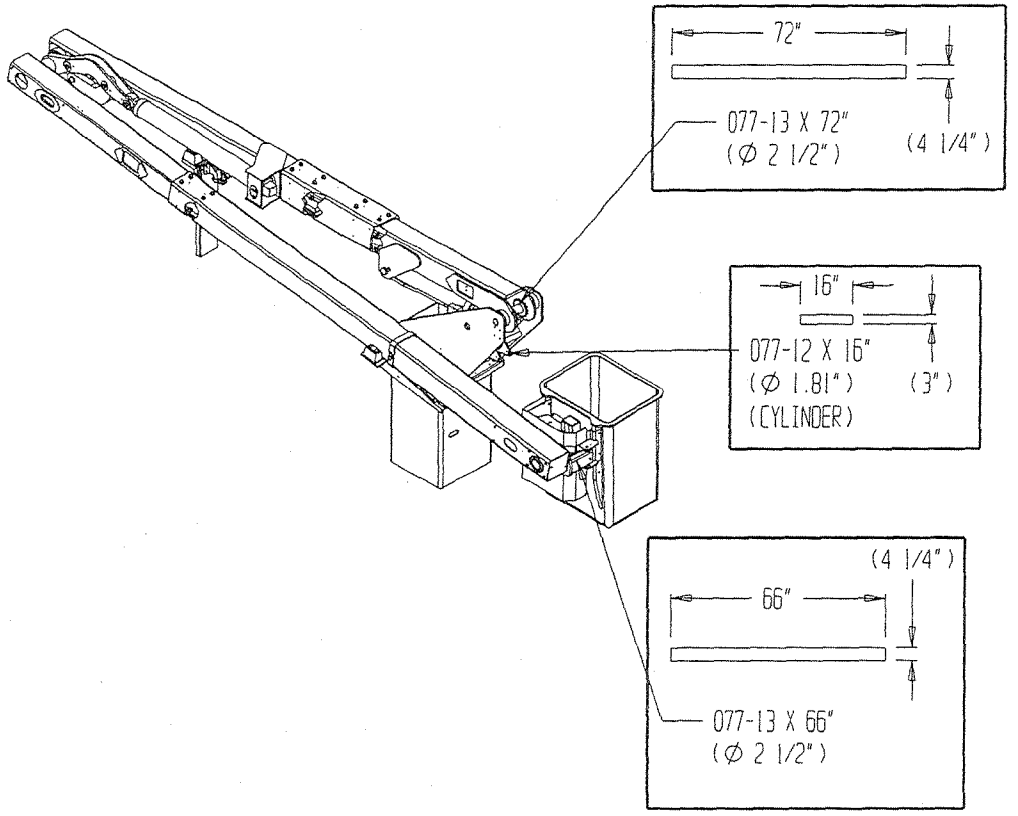
POSI-PLUS TECHNOLOGIES INC.

VALVE ASS'Y (500-9142-008-01-2)

Cylinder valve ass'y
500-9142-008-01-2

Item #	Qty	Description	Part #
1	1	Manifold	500-9143-004-XX-2
2	2	Cartridge	100-066-012
3	2	"O"-ring	100-288-015
4	2	Cartridge	100-066-055


UPPER BOOMS' CONTROLS
LOWER BOOM CYLINDER
BOOM ROTATION
UPPER BOOM CYLINDER
BOOM DOWN PRESSURE
TOOLS OUTLETS/ AERIAL DEVICE/ EMERGENCY STOP
UPPER TOOLS OUTLETS
4 - 6 GPM 2000 PSI
UPPER CONTROL
UPPER CONTROLS/ LOWER CONTROLS/ EMERGENCY STOP
ABOVE ROTATION
BELOW ROTATION
AUTOMATIC THROTTLE PRESSURE SWITCH
HIGH PRESSURE FILTER
EMERGENCY PUMP
CONTINOUS ROTATION
POSI-PLUS TECHNOLOGIES INC.
TITLE:
HYDRAULIC SCHEMATIC AERIAL LIFT 200 SERIES
DRAWN BY: JF S
APP: S.L.
SCALE: 1:1
DATE: 02-11-27
REF.: JOB 101954-101952
DRAWING NUMBER: JOB 1-954-001-00-4
REV
DESCRIPTION
DATE
BY

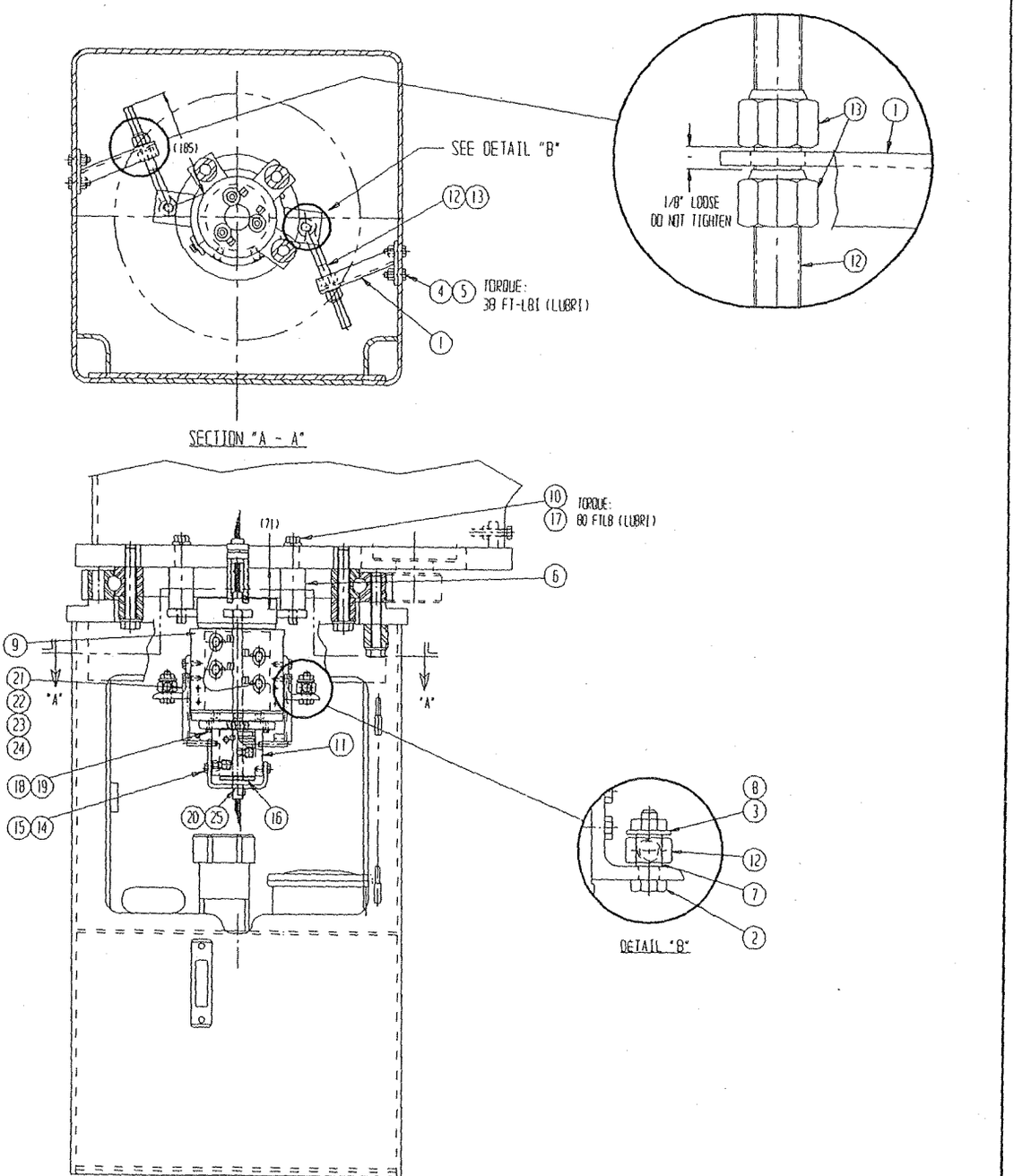


POSI-PLUS TECHNOLOGIES INC.

HOSE COVER FOR AERIAL DEVICE (MODEL 200) (242-6100-001-00-2)

Hose cover for aerial device
242-6100-001-00-2

Item #	Qty	Description	Part #
1	12'	NYLON HOSE PROTECTOR 2"	077-11
2	1.4'	NYLON HOSE PROTECTOR 1.81"	077-12
3	12'	NYLON HOSE PROTECTOR 2 ½"	077-13

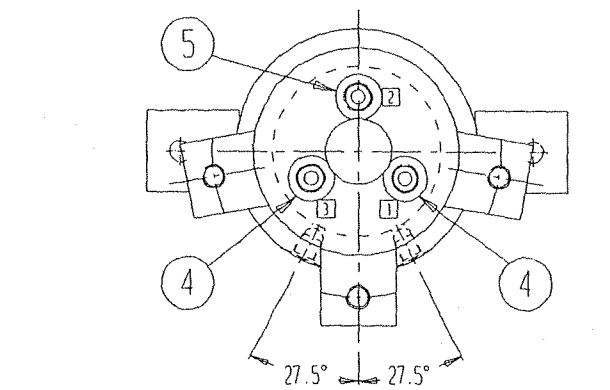


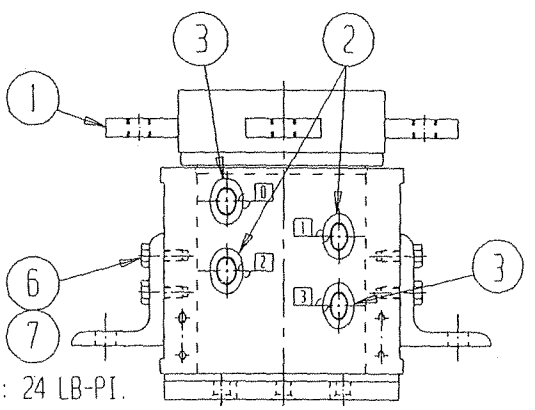
POSI-PLUS TECHNOLOGIES INC.

ROTARY JOINTS ASS'Y (242-9055-001-01-3)

Rotary joints ass'y
242-9055-001-01-3

ITEM #	QTY	DESCRIPTION	PART #
1	2	ROTATION BASE	194-9429-002-XX-1
2	2	BOLT	100-006-260
3	2	NYLON INSERT LOCK NUT	100-025-020
4	6	BOLT	100-006-086
5	6	NYLON INSERT LOCK NUT	100-025-010
6	3	SPACER	194-9013-006-XX-1
7	2	SPACER	194-9058-001-XX-1
8	2	FLAT WASHER	100-036-009
9	(1)	HYDRAULIC ROTARY JOINT ASS'Y	REFER TO TABLE OF CONTENTS
10	3	SPRING WASHER	100-007-005
11	(1)	PNEUMATIC ROTARY JOINT ASS'Y	REFER TO TABLE OF CONTENTS
12	2	BOLT	194-9057-002-XX-1
13	4	NYLON INSERT LOCK NUT	100-025-008
14	2	SET SCREW	100-034-007
15	2	NUT	100-004-030
16	(1)	ELECTRIC CONTINUOUS ROTATION	REFER TO TABLE OF CONTENTS
17	3	BOLT	100-006-014
18	3	BOLT	100-006-101
19	3	LOCK WASHER	100-007-018
20	1	ANCHORAGE PLATE	194-6041-002-XX-1
21	2	ANCHORAGE PLATE	194-6041-004-XX-1
22	4	BOLT	100-001-053
23	8	FLAT WASHER	100-036-046
24	4	LOCK WASHER	100-007-023
25	1	SET SCREW	100-034-016





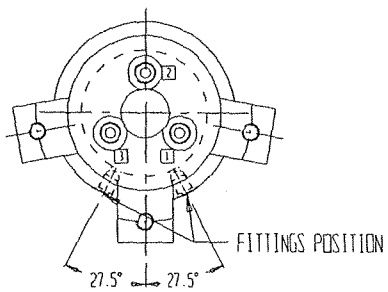
TORQUE: 24 LB-FT.
LOCTITE #262

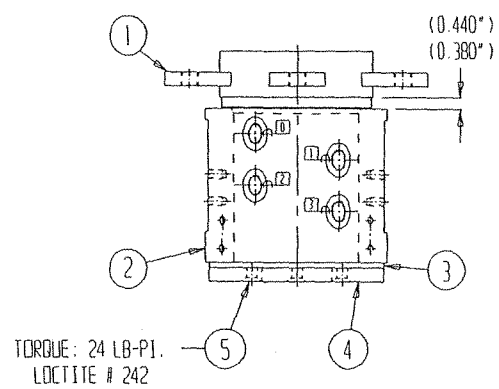
POSI-PLUS TECHNOLOGIES INC.

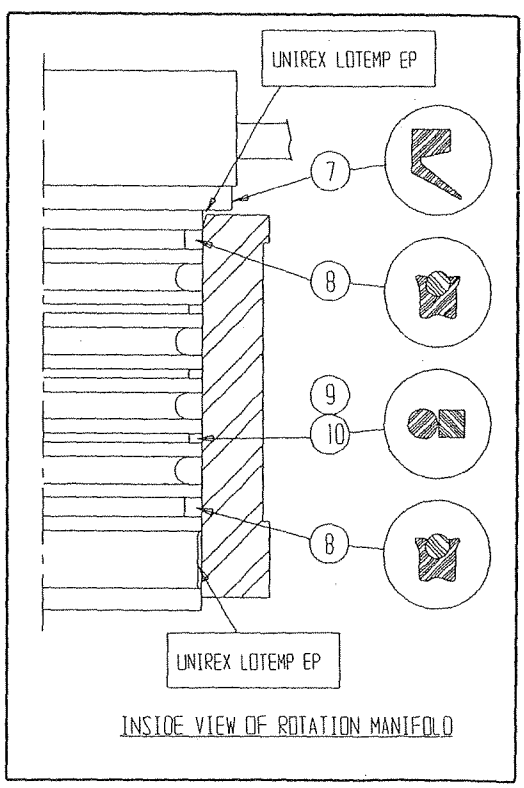
HYDRAULIC ROTARY JOINT ASS'Y (194-6050-020-00-3)

Hydraulic rotary joint ass'y
194-6050-020-00-3

ITEM #	QTY	DESCRIPTION	PART #
1	1	HYDRAULIC ROTATION ASS'Y	194-6053-001-XX-2
2	2	ELBOW	100-014-009
3	2	ELBOW	100-014-007
4	2	FITTING	100-017-013
5	1	FITTING	100-017-009
6	8	BOLT	100-006-189
7	2	"L" BRACKET	200-0094-004-XX-1







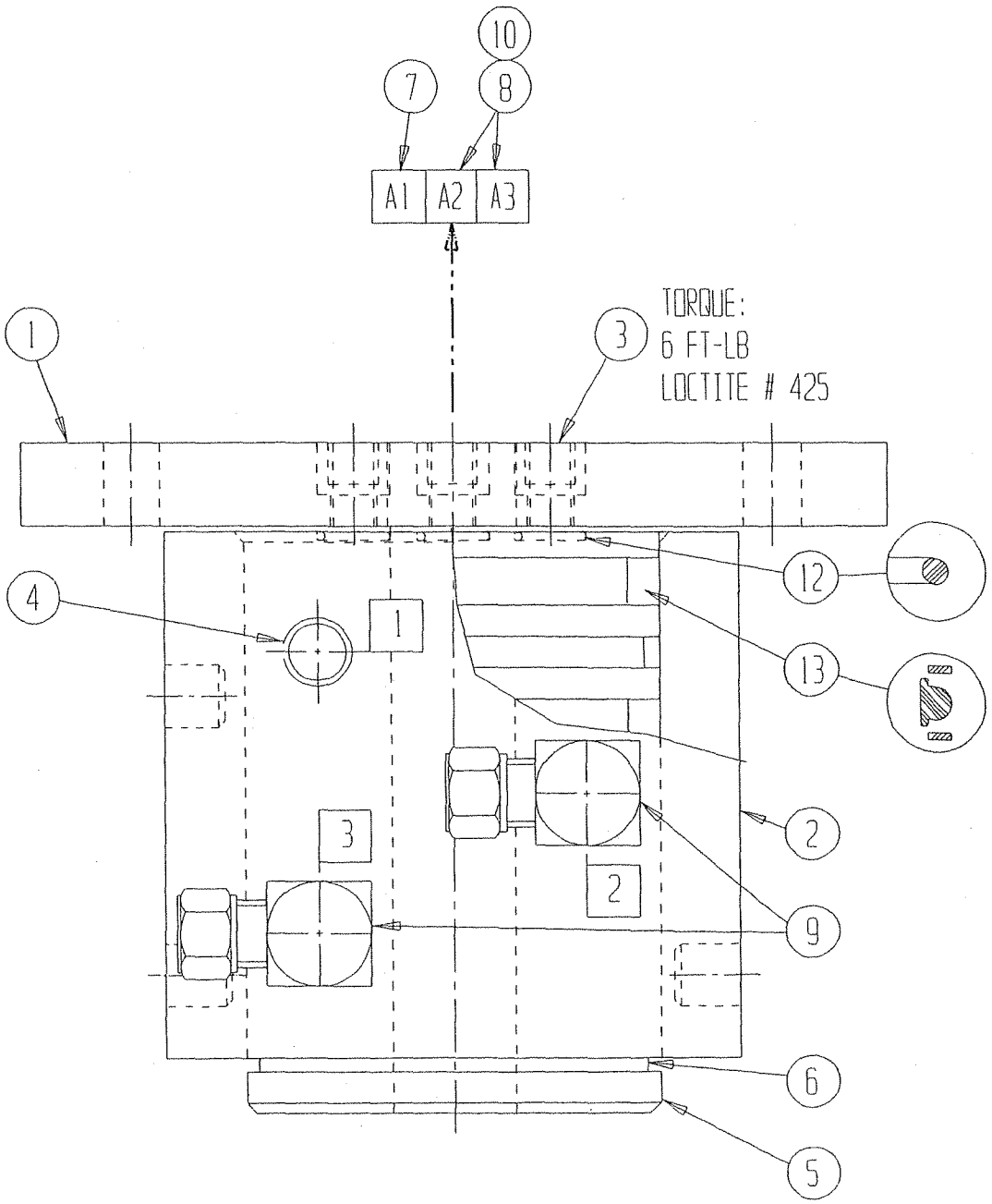
INSIDE VIEW OF ROTATION MANIFOLD

POSI-PLUS TECHNOLOGIES INC.

HYDRAULIC ROTARY JOINT ASS'Y (194-6053-001-01-2)

Hydraulic rotary joint ass'y
194-6053-001-01-2

Item #	Qty	Description	Part #
1	1	Outside manifold	194-6035-004-XX-3
2	1	Inside manifold	194-6038-002-XX-2
3	1	Bushing	194-6036-004-XX-1
4	1	Rotation base	194-6037-003-XX-1
5	3	Flat head hex. socket bolt	100-000-036
6	1	Seal kit	100-282-071
7	(1)	"V" ring	(100-041-011)
8	(2)	"U" cup seal	(100-212-052)
9	(3)	"O"-Ring	(100-214-041)
10	(3)	Piston ring	(100-284-008)

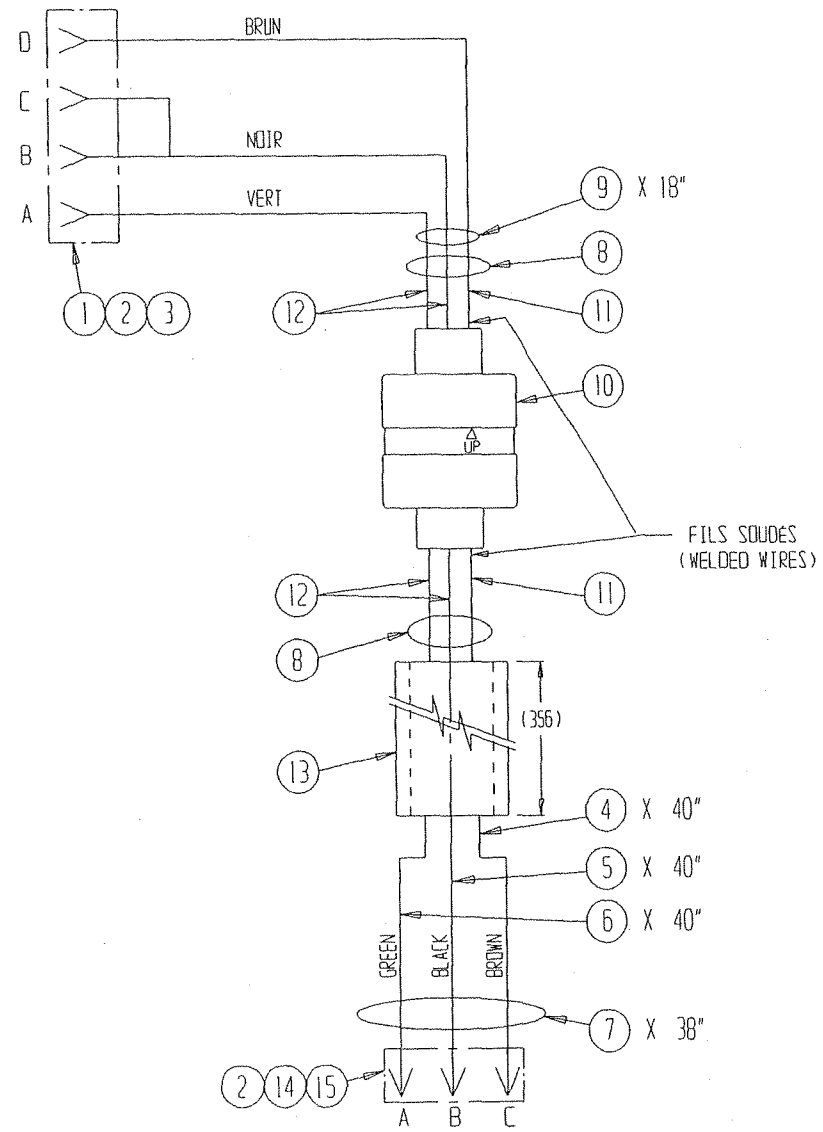


POSI-PLUS TECHNOLOGIES INC.

PNEUMATIC ROTARY JOINT ASS'Y
(194-6051-001-01-2)

Pneumatic rotary joint ass'y
194-6051-001-01-2

Item #	Qty	Description	Part #
1	1	Rotation base	194-6037-004-XX-1
2	1	Pneumatic swivel cylinder	194-6040-001-XX-2
3	3	Bolt	100-001-001
4	1	Hollow hex. plug	100-197-002
5	1	Pneumatic swivel piston	194-6039-002-XX-3
6	1	Snap ring external	100-301-014
7	1	Hollow hex. plug	100-197-004
8	2	Fitting	100-350-046
9	2	Elbow	100-350-070
10	(1)	Plastic tubing	084-01
11	1	Seal kit	100-282-074
12	(3)	O-ring	(100-288-046)
13	(4)	"T" seal	(100-284-101)

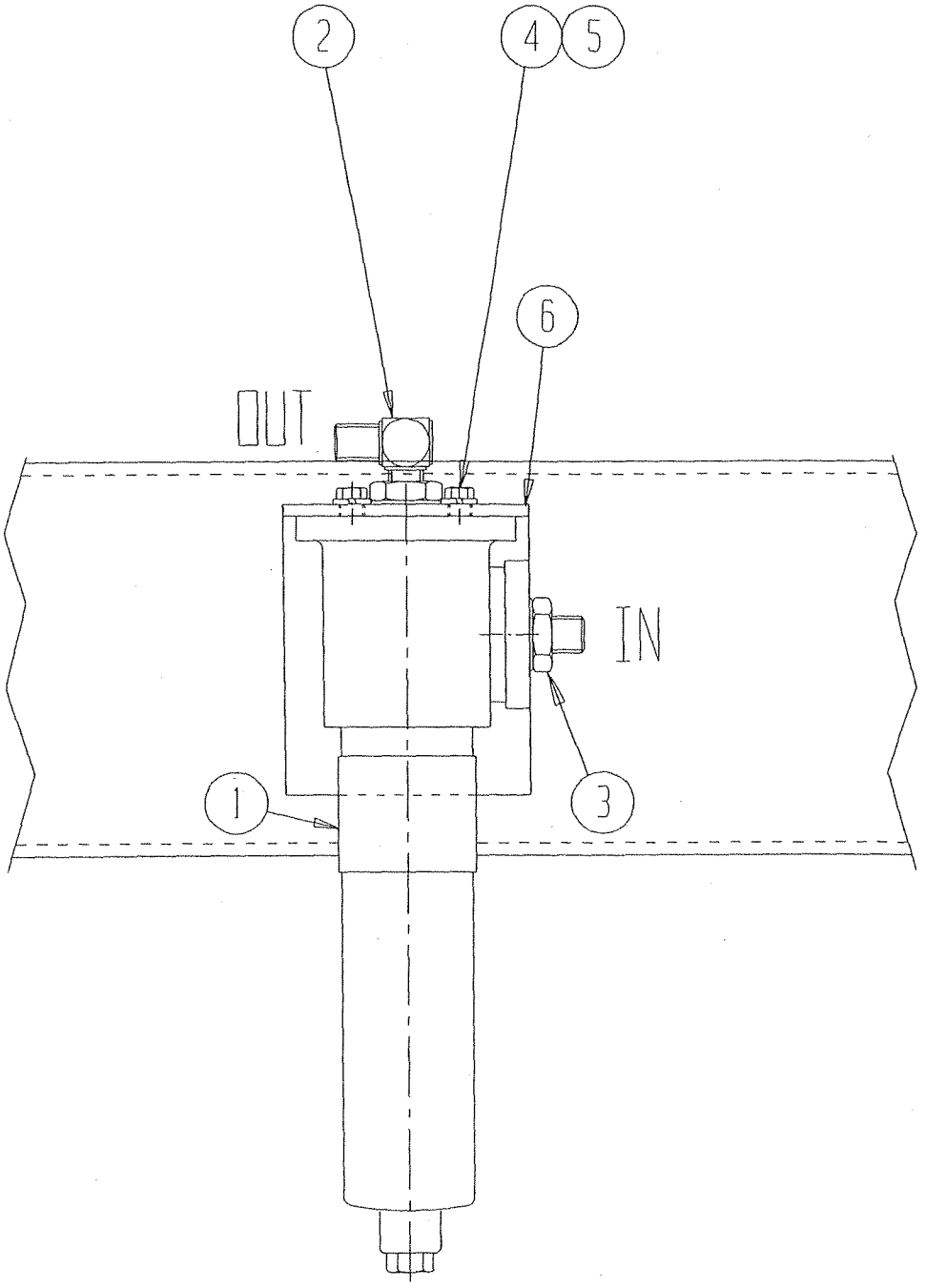


POSI-PLUS TECHNOLOGIES INC.

ROTATION CONTINUE ELECTRIQUE ASS'EE
(194-6625-007-00-2)

Electrical rotary joint ass'y
194-6625-007-00-2

ITEM #	QTY	DESCRIPTION	PART #
1	4	TERMINAL	100-280-252
2	7	TERMINAL	100-280-300
3	1	TERMINAL	100-280-406
4	3.4'	BROWN WIRE	100-169-010
5	3.4'	BLACK WIRE	100-169-020
6	3.4'	GREEN WIRE	100-169-018
7	3.2'	FLEXIBLE CONDUCT	100-064-012
8	1	HEAT SHRINKABLE SLEEVES	100-280-063
9	1.5'	WIRE	100-170-023
10	1	ELECTRICAL CONTINUOUS ROTATION	100-148-037
11	1	HEAT SHRINKABLE SLEEVES	100-280-060
12	1	HEAT SHRINKABLE SLEEVES	100-280-061
13	1	SPACER	194-9058-006-XX-1
14	4	TERMINAL	100-280-202
15	1	TERMINAL	100-280-405

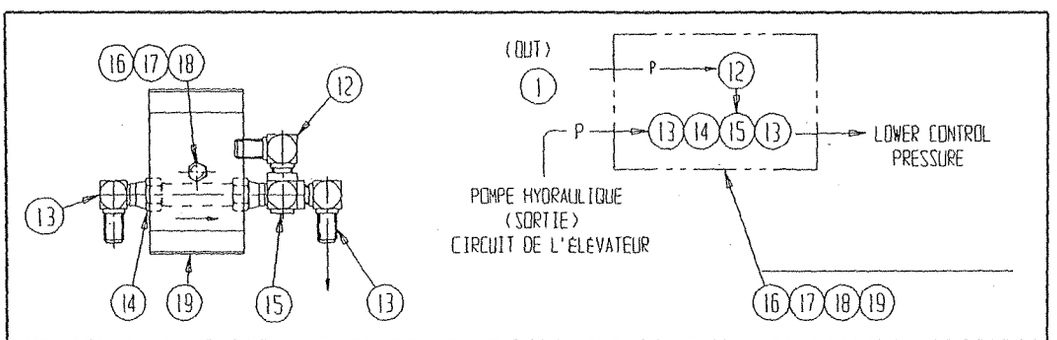


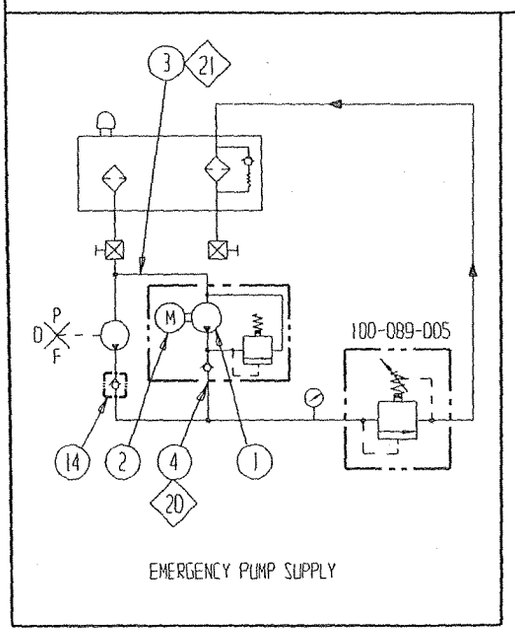
POSI-PLUS TECHNOLOGIES INC.

HIGH PRESSURE FILTER ASS'Y (194-6028-005-00-1)

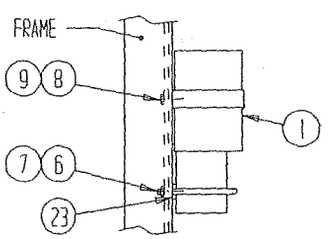
Pump installation details
194-8570-029-00-2

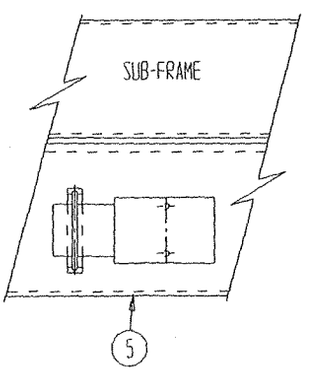
Item #	Qty	Description	Parts #
1	(1)	Pump	100-320-157
2	1	Fitting	100-017-015
3	1	Fitting	100-017-030
4	1	Elbow	100-014-009





EMERGENCY PUMP SUPPLY



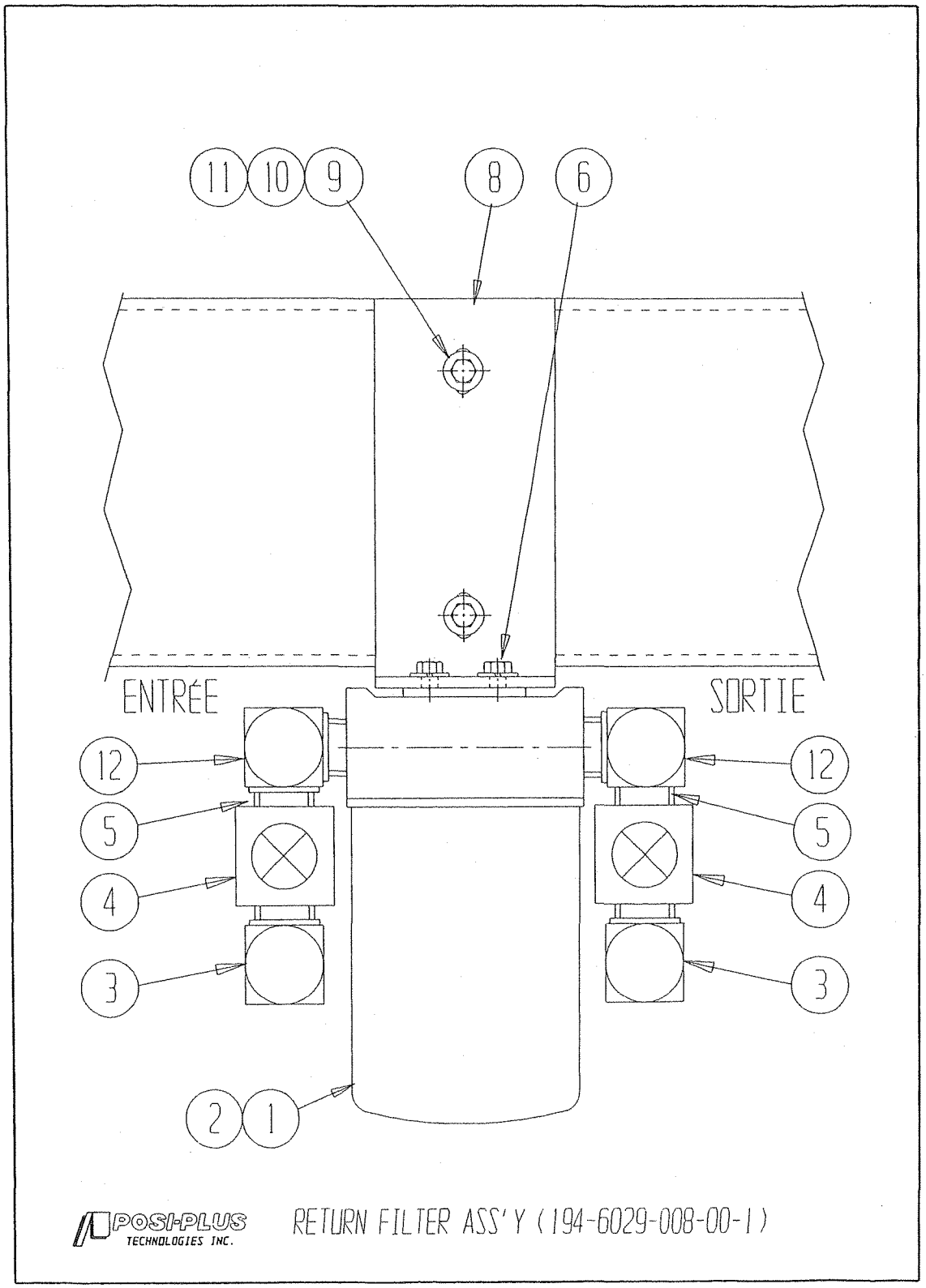


POSI-PLUS TECHNOLOGIES INC.

EMERGENCY LET DOWN SYSTEM (196-0006-002-00-2)

Emergency let down system
196-0006-002-00-2

ITEM #	QTY	DESCRIPTION	PART #
1	1	MOTOR AND PUMP ASS'Y	100-349-015
3	1	ELBOW	100-014-007
4	1	ELBOW	100-014-002
5	1	EMERGENCY LET-DOWN SUPPORT	194-9705-003-XX-2
6	1	CLAMP	100-303-003
7	1	"U"-PACKING	192-1109-005-XX-1
8	2	BOLT	100-006-027
9	2	LOCK WASHER	100-007-007
12	1	ELBOW	100-013-004
13	2	ELBOW	100-013-015
14	1	HIGH PRESSURE IN-LINE CHECK VALVE	100-010-018
15	1	TEE	100-397-004
16	1	BOLT	100-006-034
17	1	FLAT WASHER	100-036-021
18	1	NYLON INSERT LOCK NUT	100-025-011
19	1	BRACKET	194-6030-001-XX-1
20	REF	HOSE ASS'Y	034-01/11
21	REF	HOSE ASS'Y	032-01/11
22	REF	EMERGENCY LET DOWN CIRCUIT	196-6517-002-XX-2
23	1	SPACER	194-9649-011-XX-1

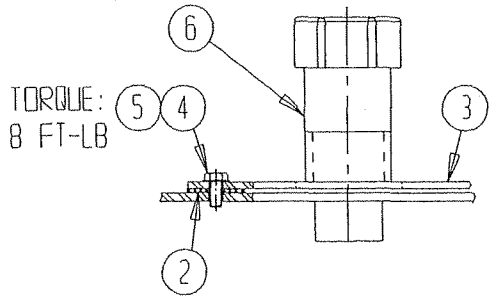


POSI-PLUS TECHNOLOGIES INC.

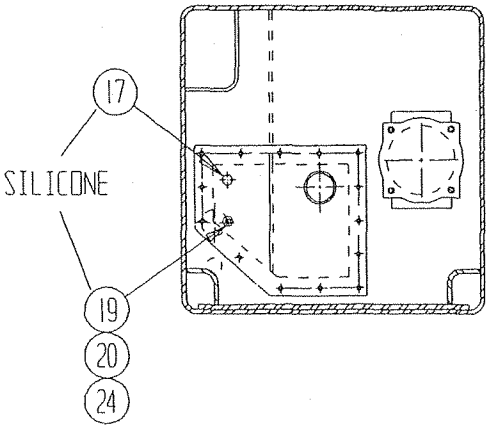
RETURN FILTER ASS'Y (194-6029-008-00-1)

In-line suction strainer ass'y
194-6029-008-00-1

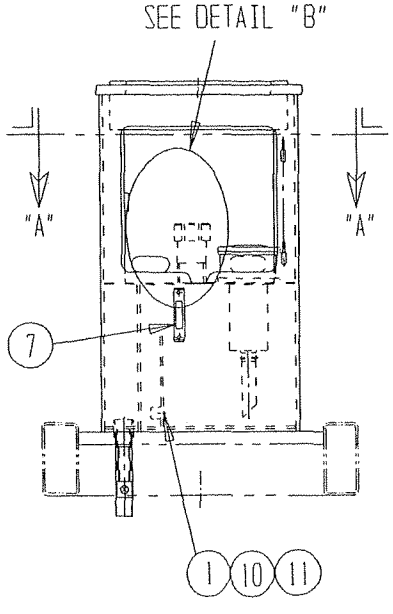
ITEM #	QTY	DESCRIPTION	PART #
1	1	HYDRAULIC FILTER HEAD	100-115-008
2	1	CARTRIDGE	100-093-002
3	2	ELBOW	100-013-043
4	2	BRASS GATES VALVES	100-114-002
5	2	CLOSE NIPPLE	100-035-026
6	3	BOLT	100-006-164
7			
8	1	SUPPORT	194-9158-011-XX-1
9	2	NYLON INSERT LOCK NUT	100-025-011
10	2	FLAT WASHER	100-036-021
11	2	BOLT	100-006-109
12	2	ELBOW	100-361-016

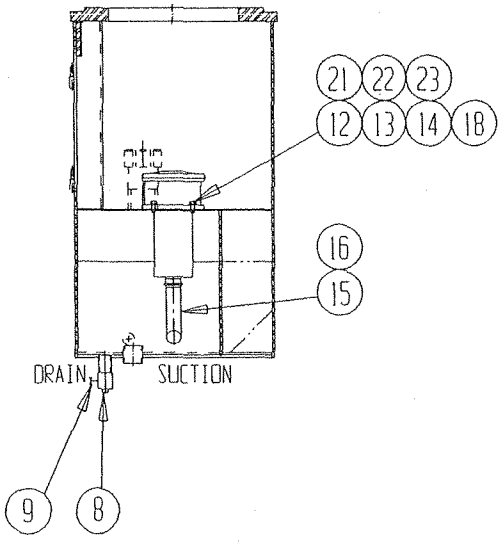


DETAIL "B"



SECTION "A - A"



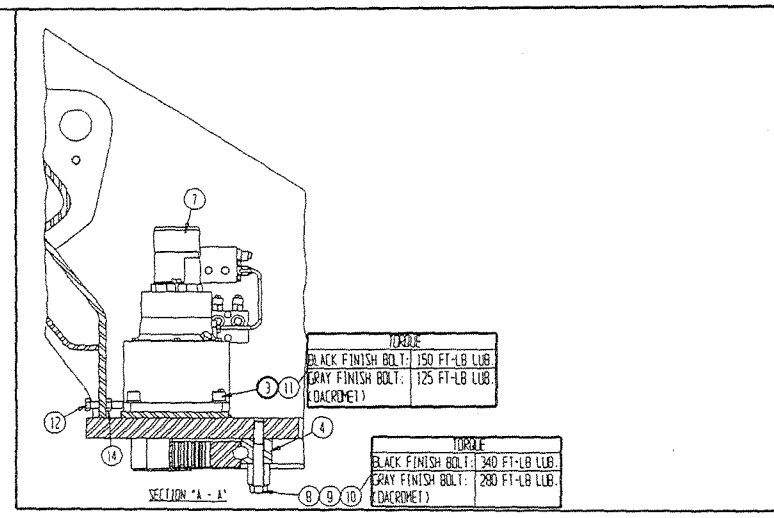


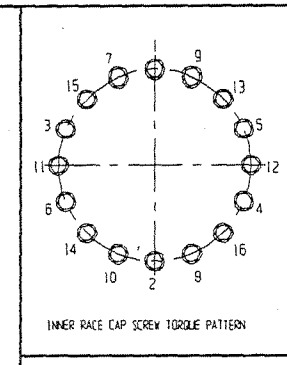
POSI-PLUS TECHNOLOGIES INC.

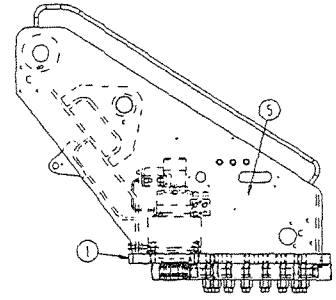
RESERVOIR ASS'Y (242-9765-002-01-2)

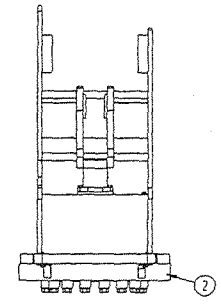
Reservoir ass'y
242-9765-002-01-2

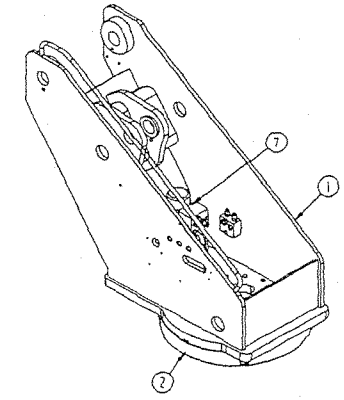
ITEM #	QTY	DESCRIPTION	PART #
1	1	MAGNET	100-243-001
2	1	GASKET	100-166-002
3	(1)	COVER ASS'Y	194-9197-006-XX-2
4	14	BOLT	100-006-100
5	14	WASHER	100-365-001
6	(1)	FILLER BREATHER	100-094-015
7	1	FLUID LEVEL	100-092-001
8	1	PLUG	100-110-001
9	1	VALVE	100-114-001
10	1	SET SCREW	100-065-016
11	1	LOCK WASHER	100-007-013
12	4	LOCK WASHER	100-007-007
13	4	BOLT	100-006-027
14	1	RETURN LINE FILTER	100-093-015
15	0.7'	HOSE	033-16
16	1	CLAMP	100-292-001
17	1	FITTING	100-247-004
18	1	FITTING	100-017-044
19	1	FITTING	100-247-001
20	(1)	PLUG	100-043-004

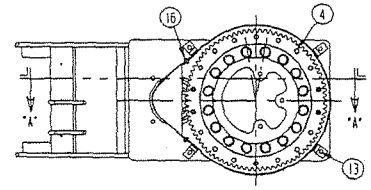










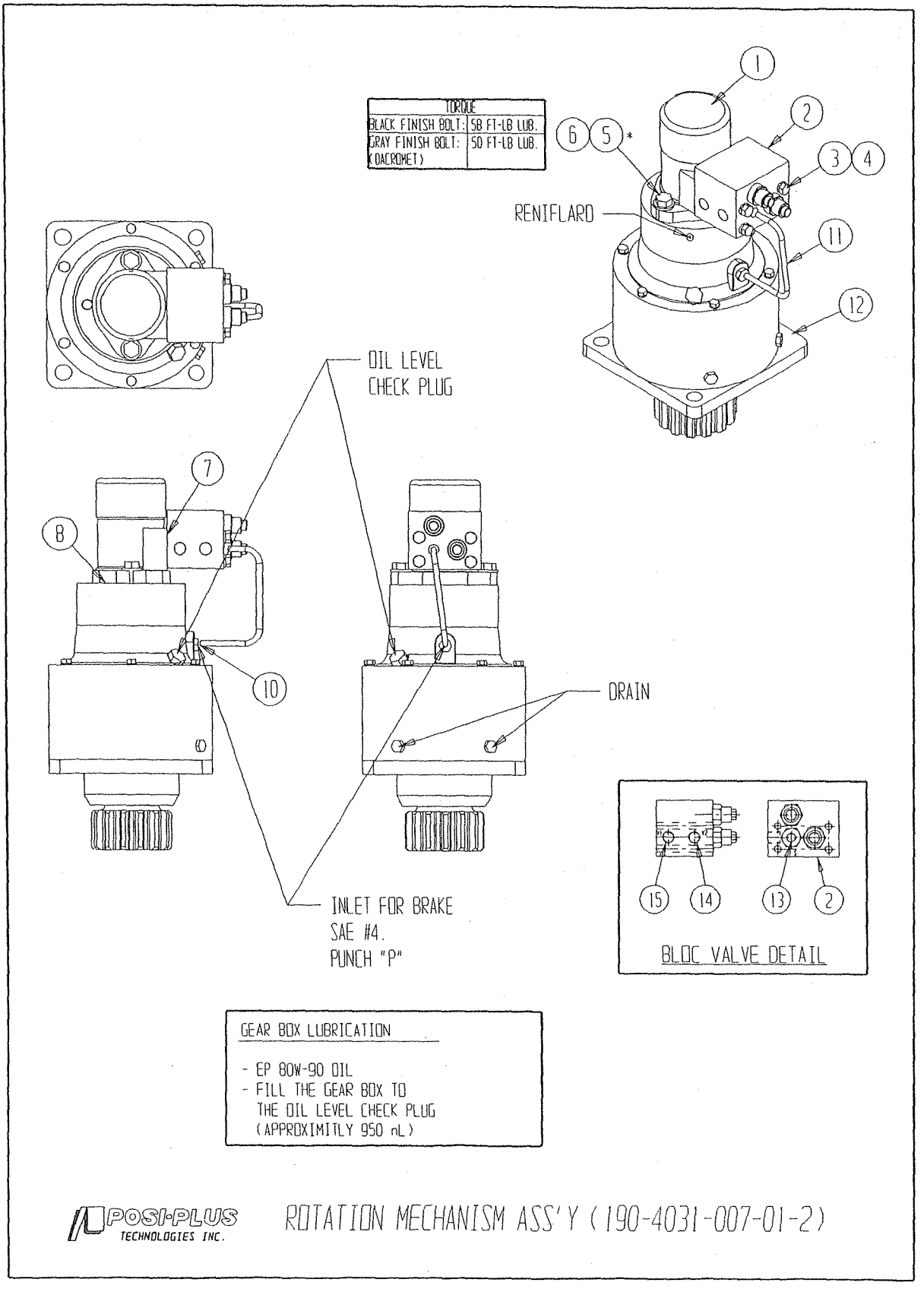


POSI-PLUS TECHNOLOGIES INC.

TURRET ASS'Y (242-4000-002-01-3)

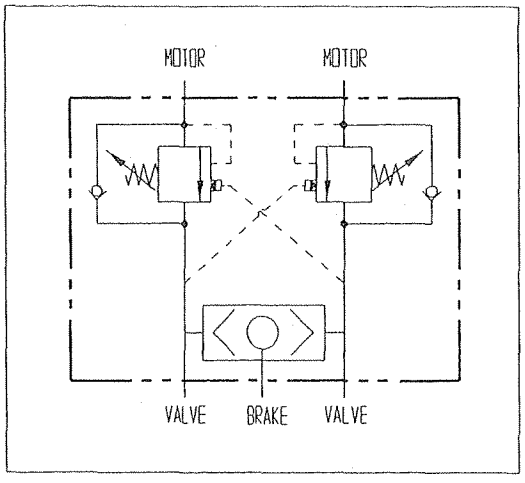
Turret ass'y
242-4000-002-01-4

Item #	Qty	Description	Part #
1	(1)	Turret ass'y	242-4001-001-XX-4
2	1	Guard and pinion ass'y	190-4018-002-XX-2
3	4	Lock washer	100-007-005
4	1	Turnable bearing	100-052-005
5	1	Hydraulic system at turret	Refer to table of
6	1	Boyaux flexible ass'é	contents
7	1	Rotation mechanism	PPT-0063-005-XX-1
8	16	Spacer	190-4031-007-XX-2
9	16	Flat washer	190-4029-001-XX-1
10	16	Bolt	100-036-008
11	4	Bolt	100-006-057
12	2	Bolt	100-001-064
13	4	Bolt	100-006-162
14	2	Nut	100-006-189
15			100-004-001
16	4	Bolt	100-006-176

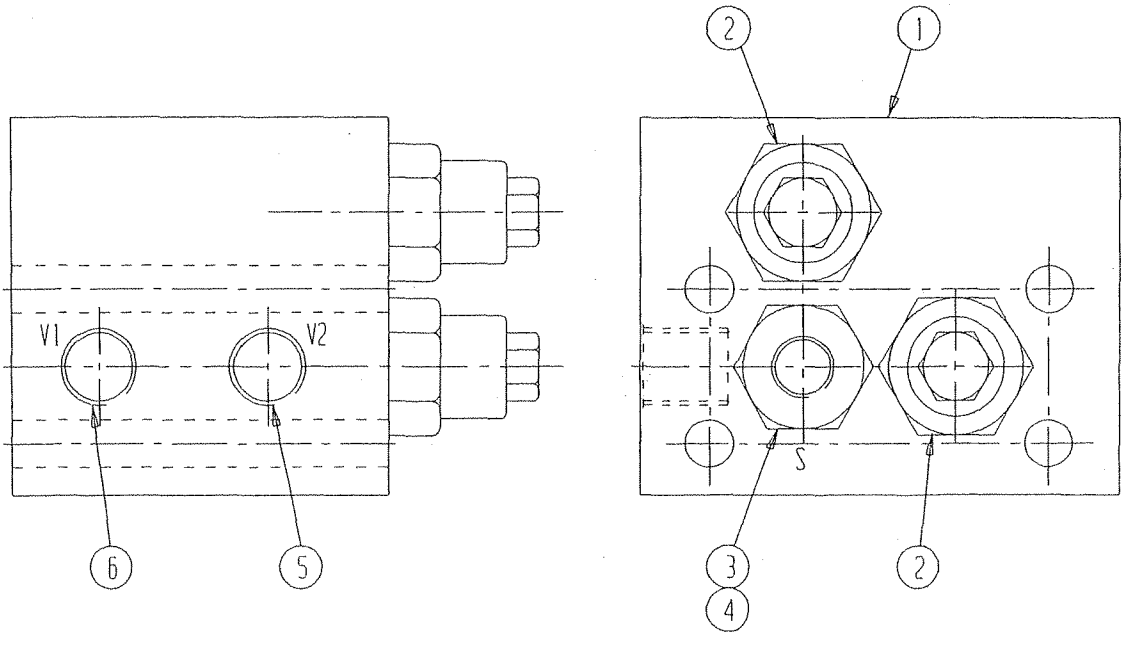

TORQUE
BLACK FINISH BOLT: 58 FT-LB LUB.
GRAY FINISH BOLT: (DACROMET) 50 FT-LB LUB.
1
2
3
4
5
6
*
RENIFLARD
11
12
OIL LEVEL CHECK PLUG
7
8
10
DRAIN
INLET FOR BRAKE SAE #4. PUNCH "P"
15
14
13
2
BLOC VALVE DETAIL
GEAR BOX LUBRICATION
- EP 80W-90 OIL
- FILL THE GEAR BOX TO THE OIL LEVEL CHECK PLUG (APPROXIMITLY 950 mL)
POSI-PLUS TECHNOLOGIES INC.
ROTATION MECHANISM ASS'Y (190-4031-007-01-2)

Rotation mechanism ass'y
190-4031-007-01-2

Item #	Qty	Description	Part #
1	1	Hydraulic motor	100-049-011
2	1	Valve ass'y	194-9111-001-XX-2
3	4	Bolt	100-006-110
4	4	Lock washer	100-007-018
5	2	Bolt	100-006-017
6	2	Flat washer	100-036-027
7	2	"O" ring	100-288-014
8	1	Gasket	100-048-046
9	1	Modified bolt	199-6001-008-XX-1
10	1	Modified tee	192-6014-017-XX-1
11	1	Hydraulic tubing ass'y	192-6008-380-XX-2
12	1	Planetary gear reducer	150-4029-002-XX-1
13	1	Elbow	100-014-001
14	1	Elbow	100-014-006
15	1	Elbow	100-074-002



NOTE: - TORQUE:
CARTRIDGE
20 FT-LB

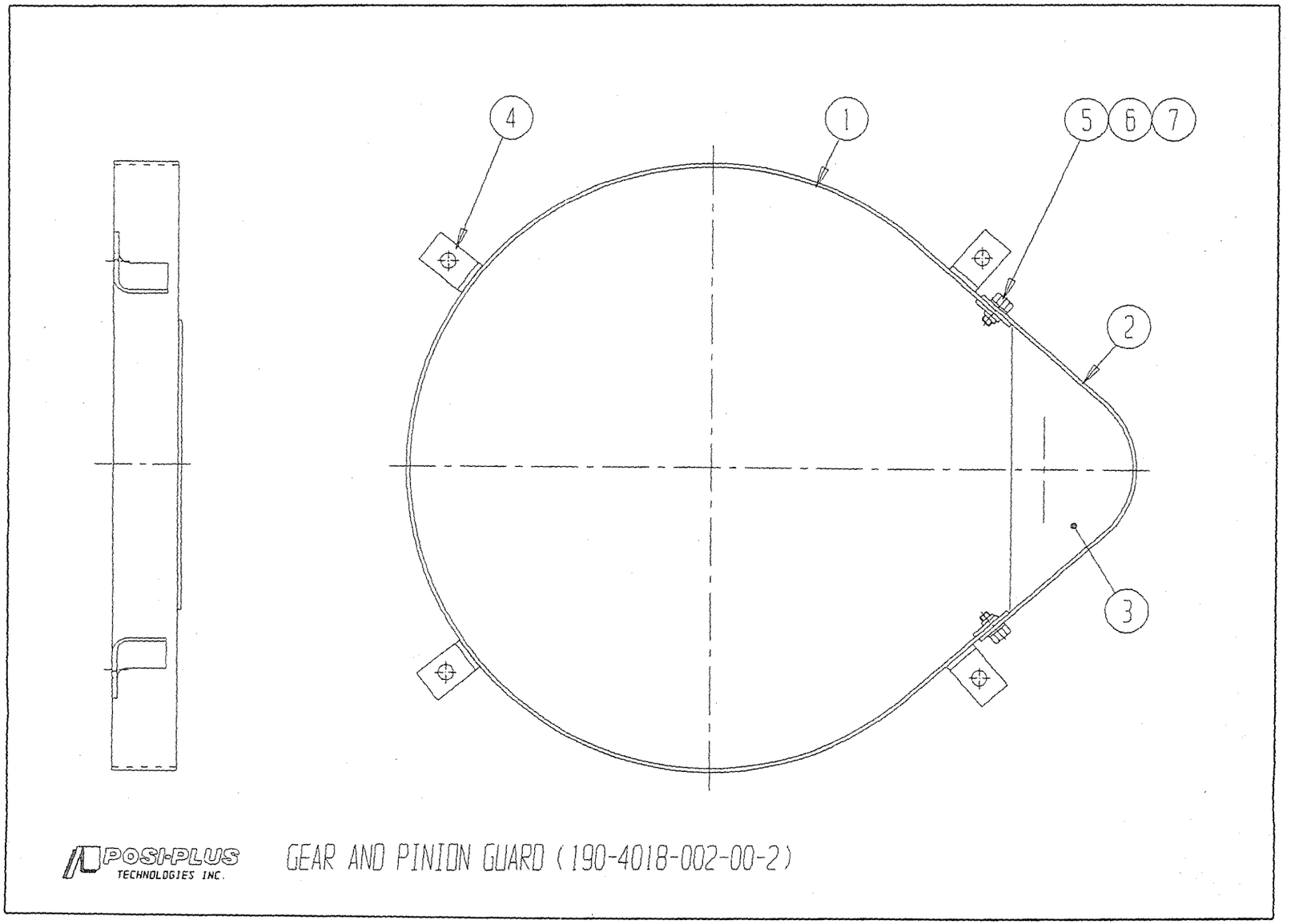


POSI-PLUS TECHNOLOGIES INC.

VALVE ASS'Y - MOTOR (194-9111-001-01-2)

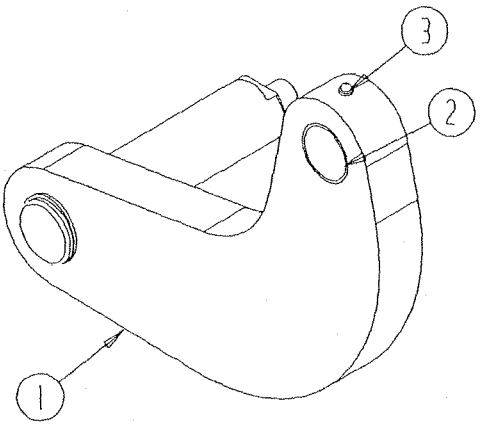
Valve ass'y
194-9111-001-01-2

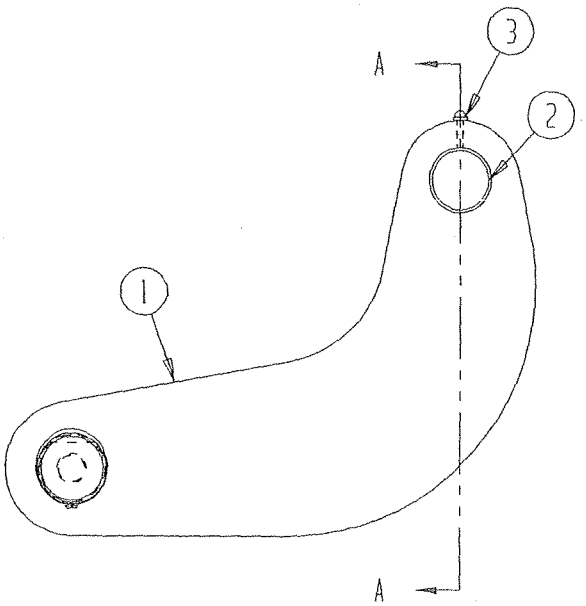
Item #	Qty	Description	Part #
1	1	Block valve	194-9110-001-XX-3
2	2	Cartridge	100-066-012
3	1	Cartridge	100-066-013

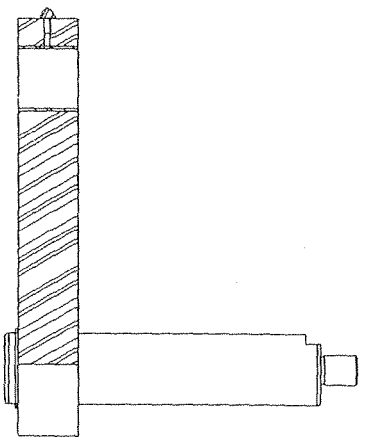

4
1
5
6
7
2
3
POSI-PLUS
TECHNOLOGIES INC.
GEAR AND PINION GUARD (190-4018-002-00-2)

Gear and pinion guard
190-4018-002-00-2

Item #	Qty	Description	Part #
1	1	Gear	190-4019-002-XX-1
2	1	Pinion guard	190-4020-002-XX-1
3	1	Guard bottom plate	190-4021-002-XX-1
4	4	Link	150-4022-001-XX-1
5	(4)	Bolt	100-006-013
6	4	Nut	100-044-001
7	(4)	Lock washer	100-007-004







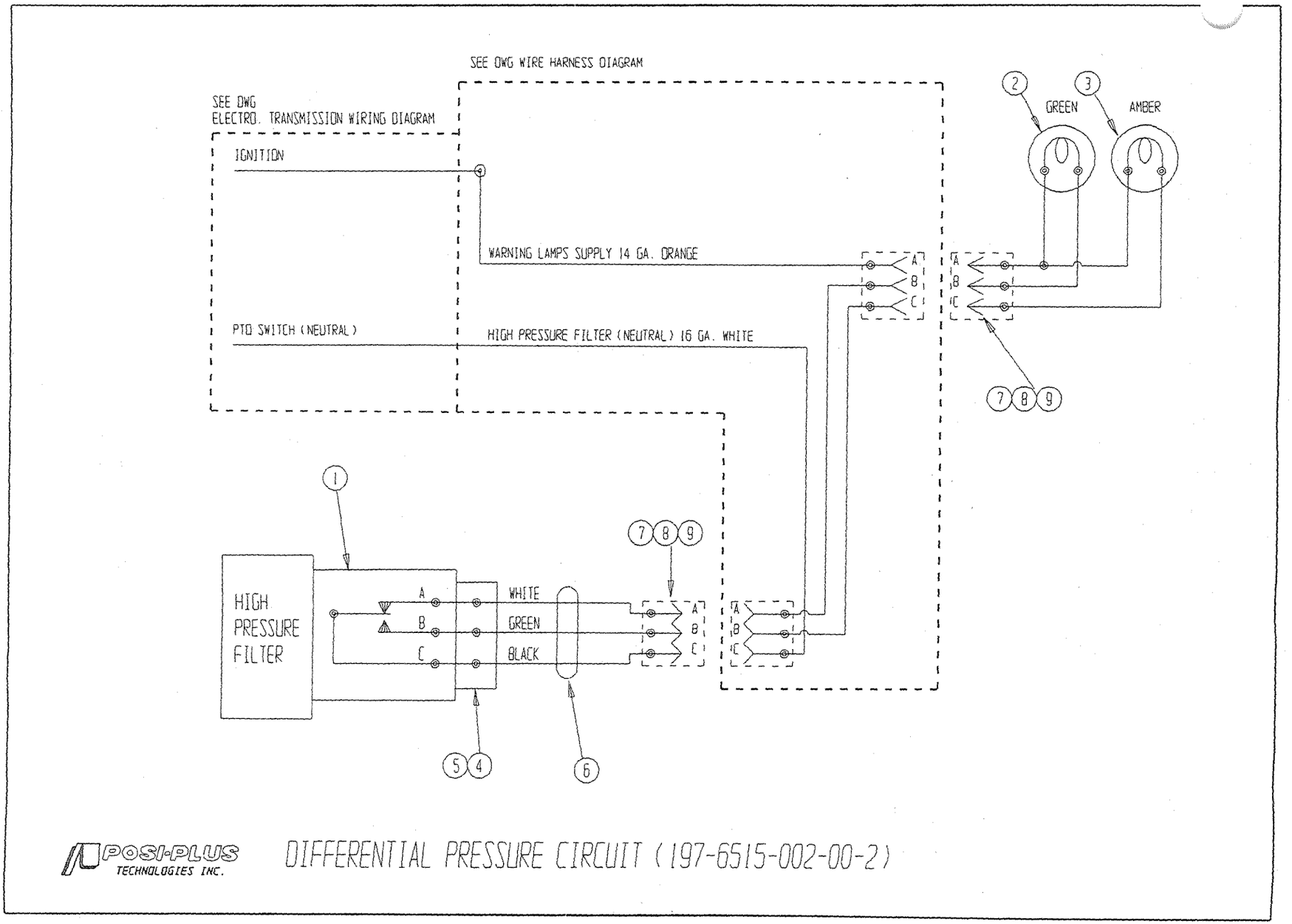
SECTION "A - A"

POSI-PLUS TECHNOLOGIES INC.

LOWER ARM CONNECTING LINK ASS'Y (242-3006-001-00-2)

Lower arm connecting link ass'y
242-3006-001-00-2

ITEM #	QTY	DESCRIPTION	PART #
1	1	LOWER LINK ASS'Y	242-3005-001-XX-2
2	1	RING	242-3003-001-XX-1
3	1	GREASE FITTING	100-057-001

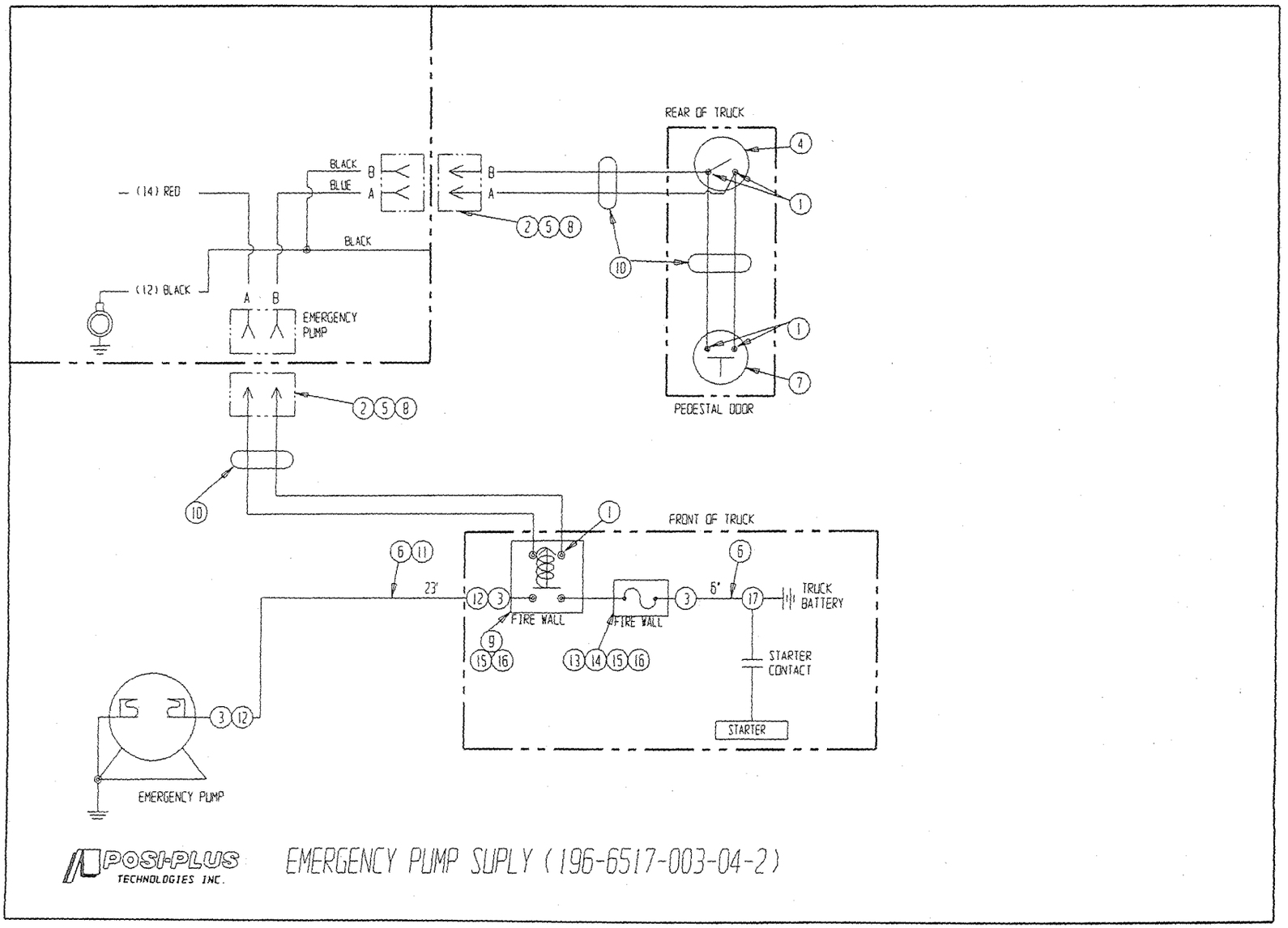


POSI-PLUS TECHNOLOGIES INC.

DIFFERENTIAL PRESSURE CIRCUIT (197-6515-002-00-2)

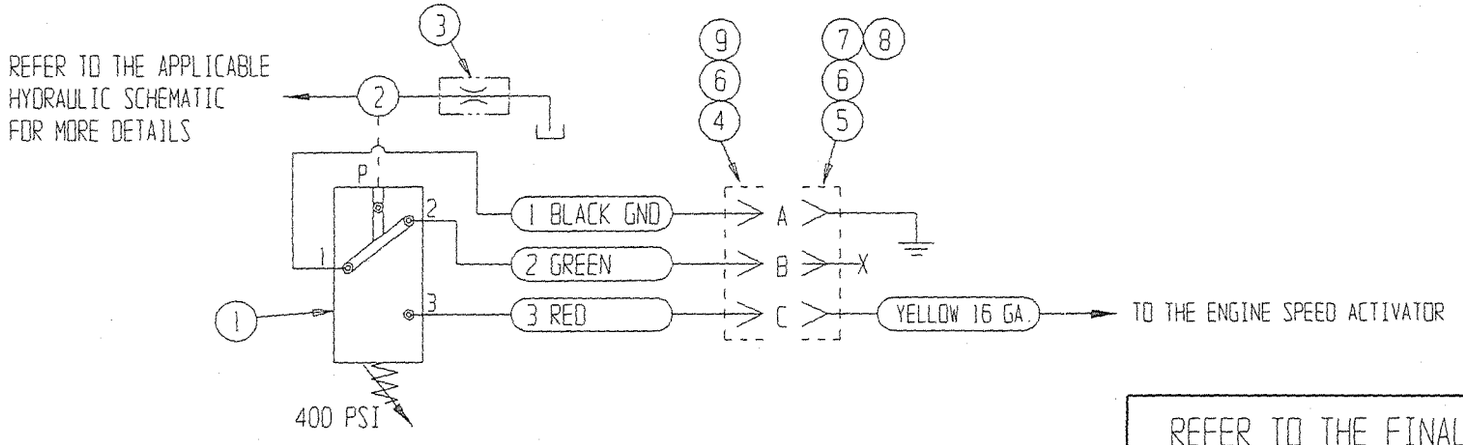
Differential pressure circuit
197-6515-002-00-2

Item #	Qty	Description	Part #
1	1	Pressure switch	--------
2	1	Green pilot light	100-153-002
3	1	Amber pilot light	100-153-004
4	1	Shell	100-379-001
5	1	Clamp + booth	100-380-001
6	1	Wire 18/3	100-381-001
7	6	Terminal	100-280-202
8	6	WPS 14	100-280-300
9	2	WPC 3M	100-280-405


REAR OF TRUCK
BLACK
BLUE
B
A
(14) RED
BLACK
(12) BLACK
A
B
EMERGENCY PUMP
2 5 8
4
1
10
1
7
PEDESTAL DOOR
2 5 8
10
1
FRONT OF TRUCK
6 11
23'
12 3
FIRE WALL
9
15 16
FIRE WALL
13 14 15 16
6
6'
3
17
TRUCK BATTERY
STARTER CONTACT
STARTER
3 12
EMERGENCY PUMP
POSI-PLUS TECHNOLOGIES INC.
EMERGENCY PUMP SUPLY (196-6517-003-04-2)

Emergency let down circuit
196-6517-003-04-2

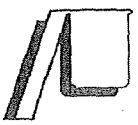
Item #	Qty	Description	Part #
1	4	Terminal	100-280-002
2	4	Terminal	100-280-202
3	3	Terminal	100-280-012
4	1	Switch	100-144-003
5	4	WPS 14	100-280-300
6	23'	Wire	100-169-011
7	0	Pressure switch	100-154-005
8	2	WPC 2M	100-280-403
9	Ref	Solenoide	100-349-008
10	12'	Fils 16-2	100-170-004
11	23'	Hose synflex	037-02
12	1	Terminal	100-280-006
13	1	Fuse	100-246-021
14	1	Fuse block	100-160-006
15	2	Nylon insert lock nut	100-025-009
16	1	Bolt	100-000-007
17	1	Terminal	100-280-166



REFER TO THE FINAL
INSTALLATION DRAWING
FOR MORE DETAILS

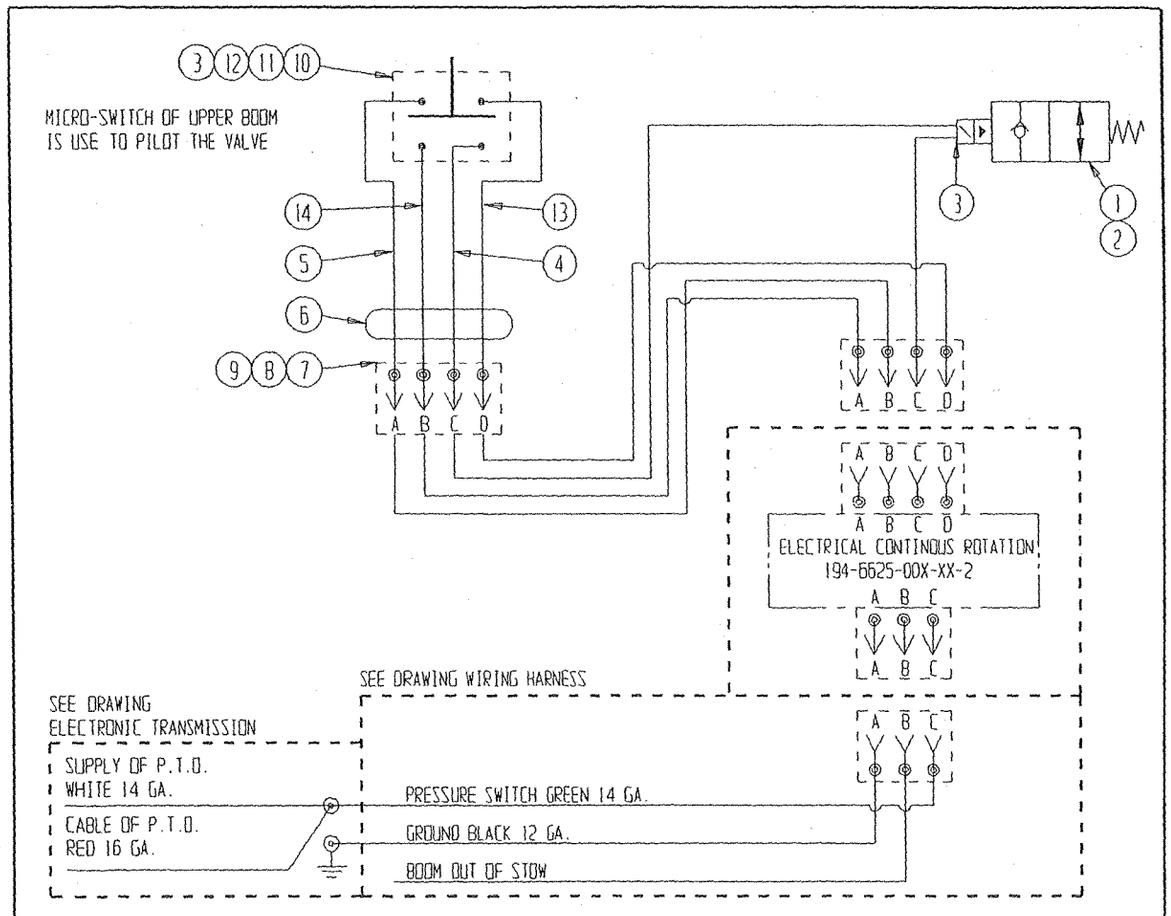
POSI-PLUS TECHNOLOGIES INC.

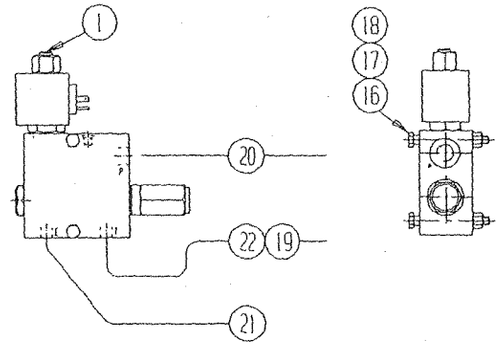
TWO SPEED THROTTLE ELECTRO-HYDRAULIC (194-6513-045-00-1)



Two speed-throttle electro-hydraulic
194-6513-045-00-1

Item #	Qty	Description	Part #
1	1	Pressure switch	100-348-021
2	1	Modified tee	192-6014-004-XX-1
3	1	Orifice	199-6001-001-XX-1
4	2	Terminal male	100-280-202
5	3	Terminal female	100-280-252
6	6	WPS 16 green	100-280-301
7	1	WPP 14-16 plug	100-280-330
8	1	WPC 3 female	100-280-404
9	1	WPC 3 male	100-280-405



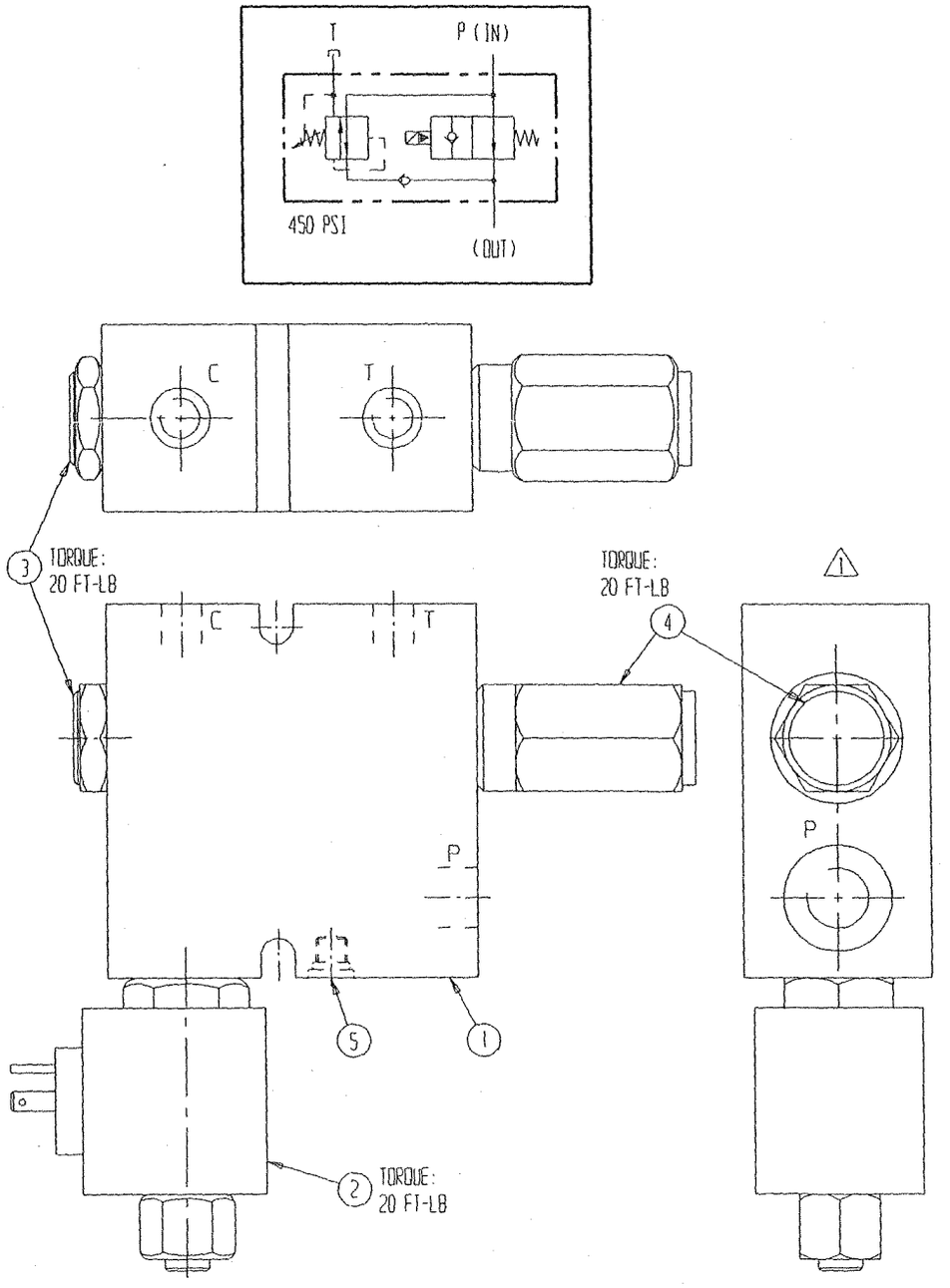


POSI-PLUS TECHNOLOGIES INC.

PRESSURE LIMITER SYSTEM (196-6526-019-00-2)

Pressure limiter system
196-6526-019-00-2

Item #	Qty	Description	Part #
1	(1)	Pressure reducing valve	192-0020-001-XX-2
2	1	Din connector	100-369-003
3	.5	Terminal	100-280-062
4	1	Wire 14 ga. red	100-169-030
5	2	Wire 14 ga. black	100-169-009
6	2	Flexible conductor	100-064-012
7	4	Terminal	100-280-202
8	4	Weather pack seal	100-280-300
9	1	Weather pack connector	100-280-406
10	1	Micro-switch	100-148-003
11	1	Spring lever	100-148-016
12	1	Fitting	100-171-007
13	1	Wire 14 ga. white	100-169-025
14	1	Wire 14 ga. green	100-169-019
16	2	Hexagonal head bolt	100-006-268
17	2	Flat washer	100-036-026
18	2	Nylon insert lock nut	100-025-009
19	1	Tee	100-070-003
20	1	Tee	100-011-003
21	1	Elbow	100-074-002
22	1	Elbow	100-014-006

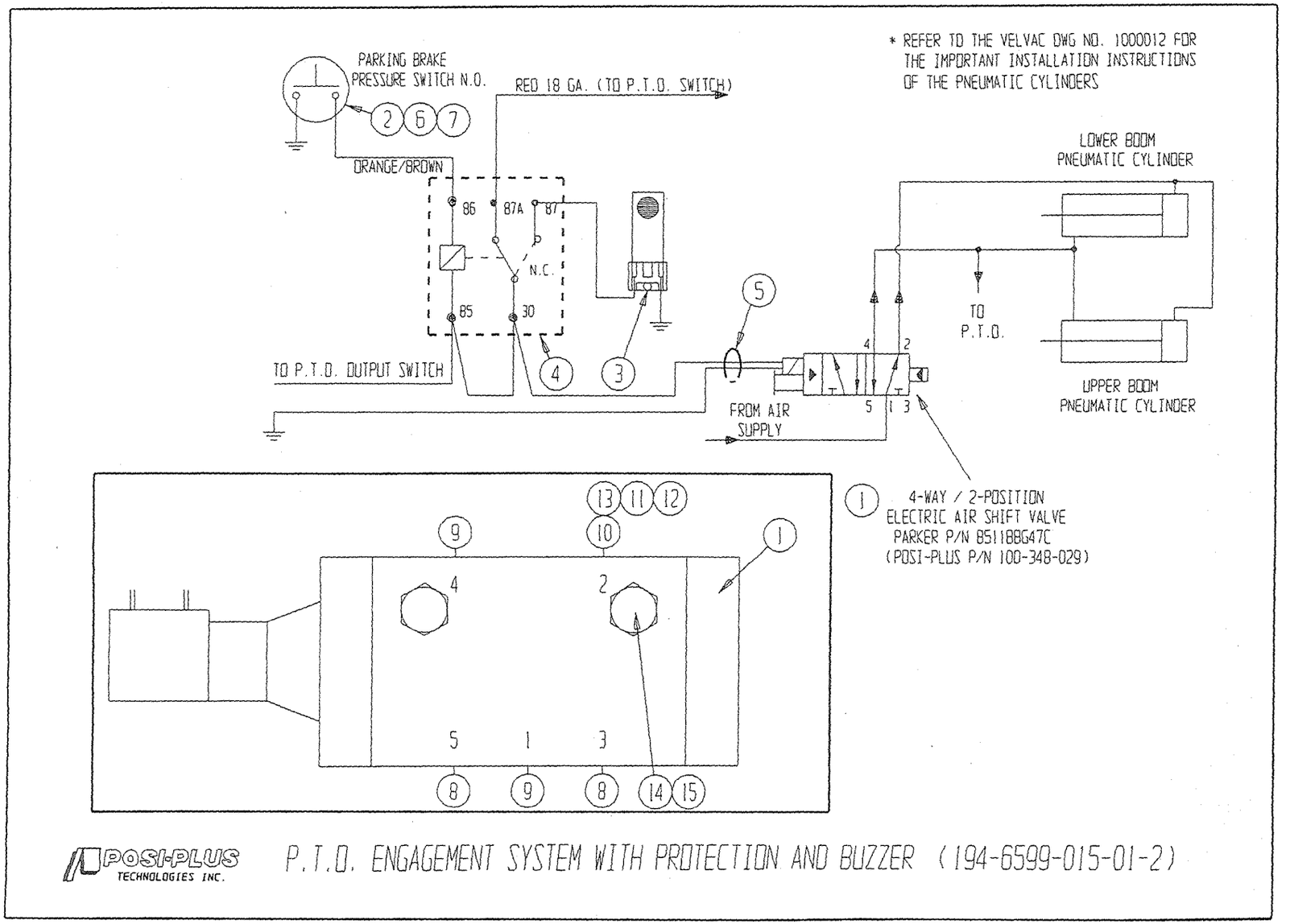


POSI-PLUS TECHNOLOGIES INC.

VALVE ASS'Y (192-0020-001-01-2)

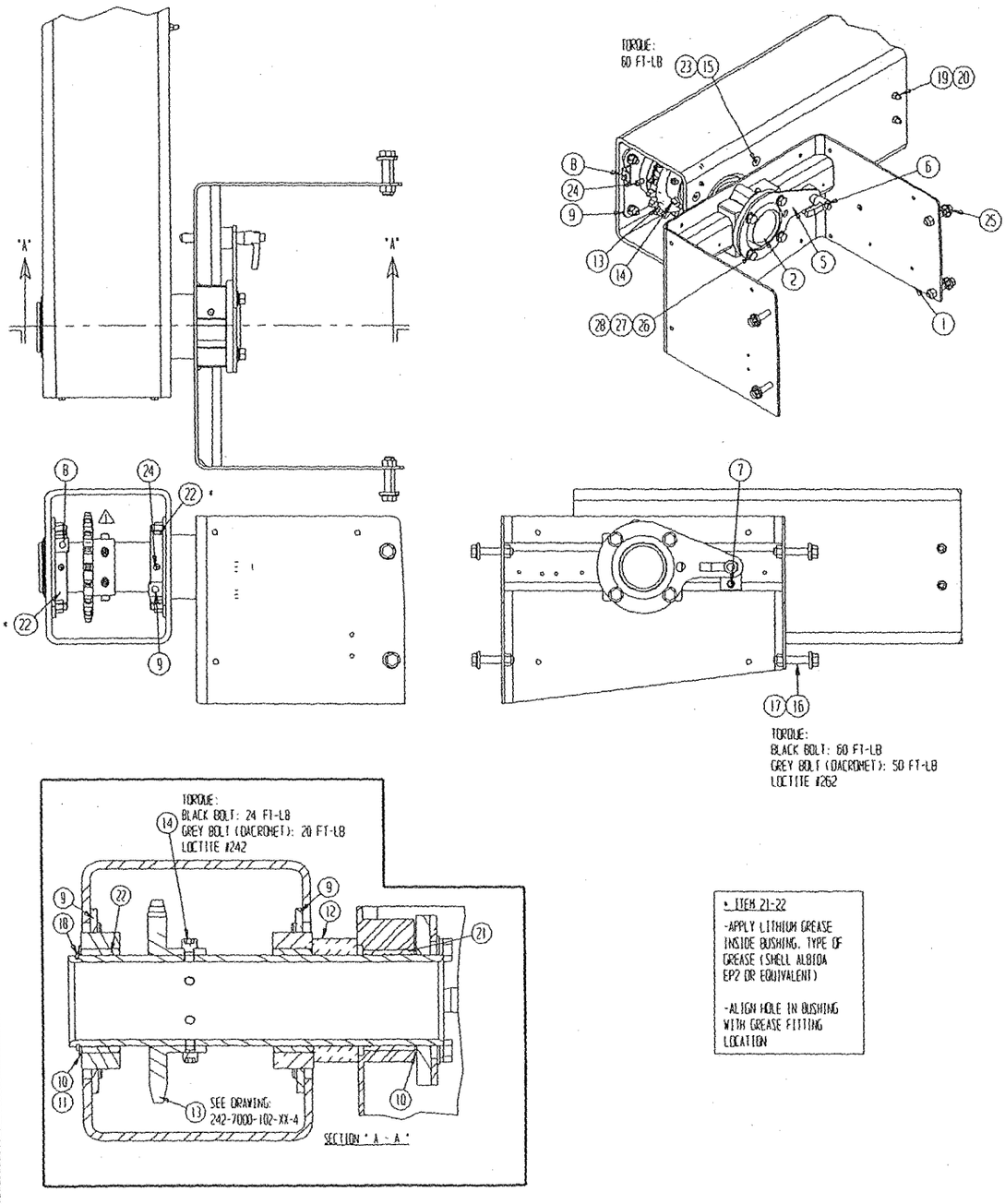
Pressure reducing valve
192-0020-001-01-2

ITEM #	QTY	DESCRIPTION	PART #.
1	1	BLOCK VALVE	192-0020-002-XX-2
2	1	CARTRIDGE SOLENOID SV3	100-354-043
3	1	CARTRIDGE CV1	100-063-003
4	1	CARTRIDGE PRV2	100-354-042
5	1	PIPE PLUG SAE-2	100-198-004


* REFER TO THE VELVAC DWG NO. 1000012 FOR THE IMPORTANT INSTALLATION INSTRUCTIONS OF THE PNEUMATIC CYLINDERS
PARKING BRAKE PRESSURE SWITCH N.O.
RED 18 GA. (TO P.T.O. SWITCH)
2 6 7
ORANGE/BROWN
86 87A 87
N.C.
85 30
TO P.T.O. OUTPUT SWITCH
4
3
5
FROM AIR SUPPLY
4 2
5 1 3
LOWER BOOM PNEUMATIC CYLINDER
TO P.T.O.
UPPER BOOM PNEUMATIC CYLINDER
13 11 12
9
10
1
4
2
5 1 3
8 9 8 14 15
1 4-WAY / 2-POSITION ELECTRIC AIR SHIFT VALVE PARKER P/N B51188G47C (POSI-PLUS P/N 100-348-029)
POSI-PLUS TECHNOLOGIES INC.
P.T.O. ENGAGEMENT SYSTEM WITH PROTECTION AND BUZZER (194-6599-015-01-2)

P.T.O. engagement system with protection and buzzer
194-6599-015-01-1

ITEM #	QTY	DESCRIPTION	PART #
1	1	PNEUMATIC VALVE	100-348-029
2	1	PRESSURE SWITCH	100-154-001
3	1	BUZZER	100-149-004
4	1	RELAY	100-408-024
5	6'	16-2 WIRE	100-170-008
6	1	FITTING	100-350-187
7	1	FITTING	100-350-190
8	1	PLUG	100-019-001
9	1	FITTING	100-350-071
10	1	FITTING	100-293-003
11	1	FITTING	100-072-002
12	1	FITTING	100-350-049
13	(1)	FLOW CONTROL VALVE WITH BY-PASS	100-010-021
14	2	HEXAGON CAP SCREW BOLT	100-006-055
15	2	LOCK NUT	100-025-009

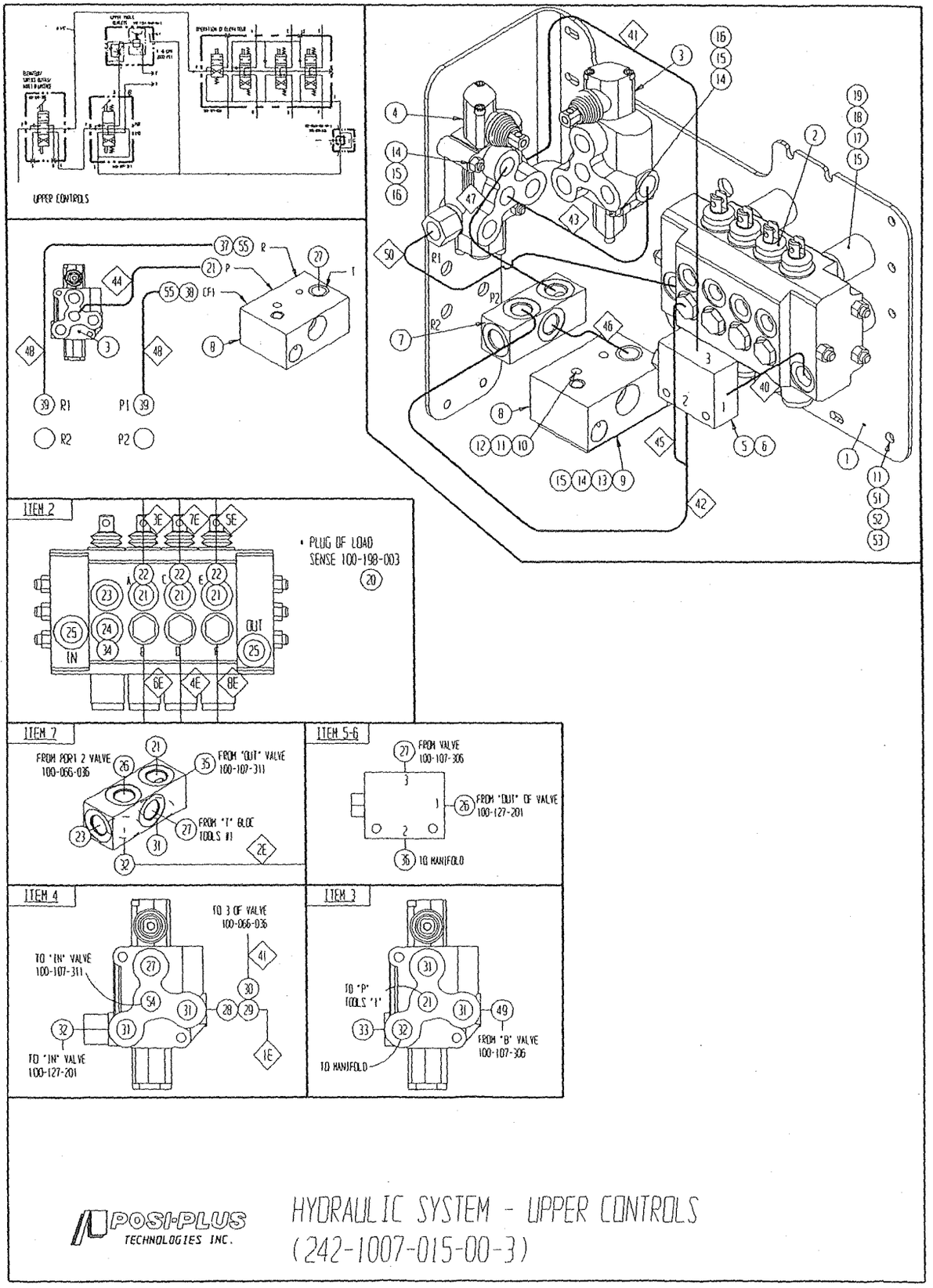


POSI-PLUS TECHNOLOGIES INC.

UPPER CONTROLS ASS'Y (242-1000-002-02-3)

Upper controls station ass'y
242-1000-002-02-3

ITEM #	QTY	DESCRIPTION	PART #
1	(1)	BUCKET ANCHORING PLATE	SEE MAIN PARTS LIST
2	(1)	UPPER CONTROLS MOUNTING BRACKET	SEE MAIN PARTS LIST
3	--	-------	-------
4	--	-------	-------
5	1	RETAINING COVER	242-1024-002-XX-1
6	1	SINGLE ACTING BALL LOCK PIN	100-026-059
7	1	HEX. SOCKET HEAD CAP SCREW	100-001-080
8	2	FLANGE WHIZ-LOCK SCREW	100-006-149
9	2	PLATFORM SHAFT MOUNTING BRACKET	242-1001-001-XX-2
10	2	SPACER	242-1006-001-XX-1
11	1	SPACER	242-1006-002-XX-1
12	1	SPACER	242-1005-002-XX-1
13	(1)	PINION	242-7015-002-XX-2
14	(6)	SOCKET CAP SCREW	100-001-078
15	8	FLAT SOCKET HEAD CAP SCREW	100-000-091
16	4	HEX. CAP SCREW	100-006-290
17	4	FLAT WASHER	100-036-020
18	1	SNAP RING	100-301-023
19	1	MUFFLER COLLAR	100-303-009
20	2	NYLON INSERT LOCK NUT	100-025-010
21	1	RING	242-7001-003-XX-1
22	2	RING	242-7001-001-XX-1
23	8	NYLON INSERT LOCK NUT	100-025-013
24	2	GREASE FITTING	100-057-002
25	4	SPACER	242-1020-001-XX-1
26	4	HEX. CAP SCREW	100-006-127
27	4	FLAT WASHER	100-036-001
28	4	LOCK WASHER	100-007-015



POSI-PLUS TECHNOLOGIES INC.

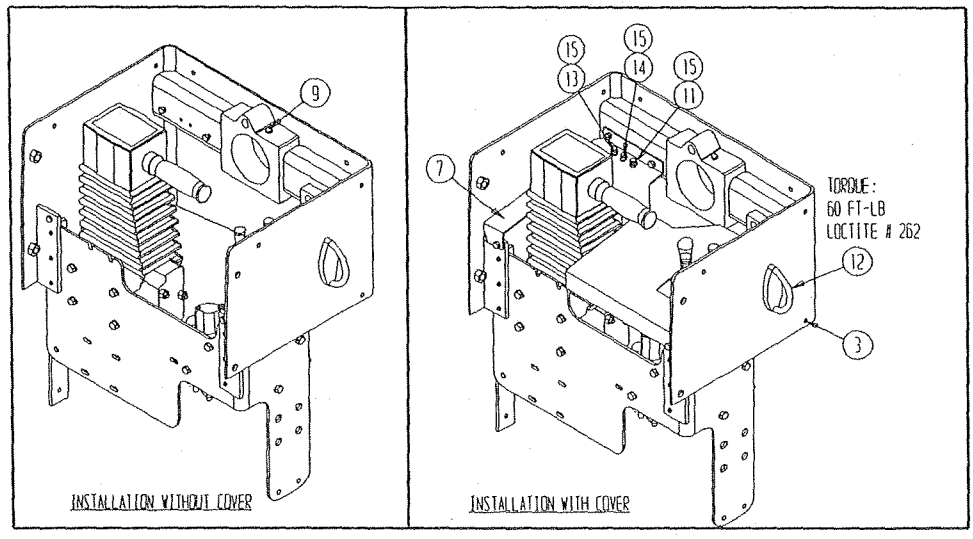
HYDRAULIC SYSTEM - UPPER CONTROLS (242-1007-015-00-3)

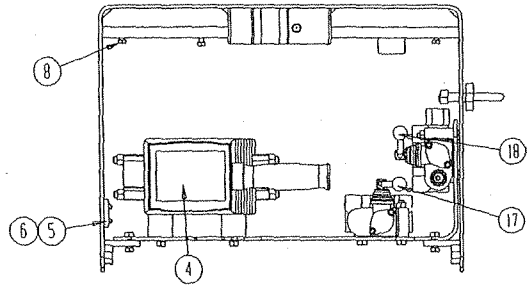
Hydraulic system – upper controls
242-1007-015-00-3

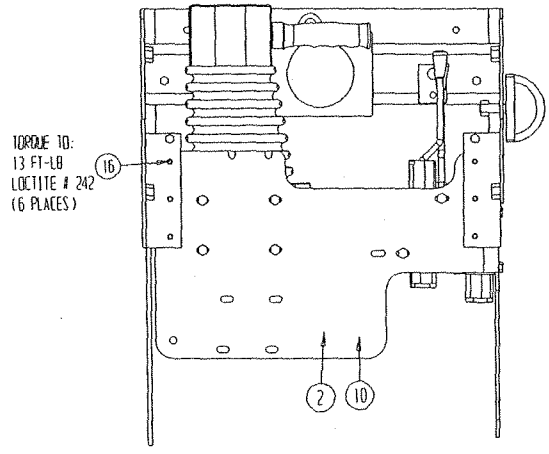
ITEM #	QTY	DESCRIPTION	PART #
1	1	LOCK PLATE	242-1012-002-XX-1
2	1	DANFOSS VALVE	100-127-201
3	1	VALVE BLB 1 SPOOL	100-107-311
4	1	VALVE BLB 1 SPOOL	100-107-306
5	1	CARTRIDGE	192-0004-004-XX-1
6	1	VALVE	100-066-036
7	1	HYDRAULIC DISTRIBUTOR (RETURN)	242-6003-001-XX-2
8	1	TOOLS HYDRAULIC MANIFOLD	REFER TO TABLE OF CONTENTS
9	1	TOOLS MANIFOLD MOUNTING BRACKET	500-1018-002-XX-1
10	2	HEXAGONAL HEAD BOLT	100-006-137
11	3	NYLON INSERT LOCK NUT	100-025-010
12	2	FLAT WASHER	100-036-012
13	2	HEXAGONAL HEAD BOLT	100-006-101
14	6	NYLON INSERT LOCK NUT	100-025-011
15	10	FLAT WASHER	100-036-021
16	4	HEXAGONAL HEAD BOLT	100-006-034
17	4	HEXAGONAL HEAD BOLT	100-006-322
18	4	LOCK WASHER	100-007-018
19	4	SPACER	195-1032-106-XX-1
20	1	PLUG	100-198-003
21	6	FITTING	100-017-009
22	3	ELBOW	100-012-003
23	2	PLUG	100-297-004
24	1	REDUCER	100-179-015
25	2	FITTING	100-017-014
26	2	FITTING	100-017-013
27	4	ELBOW	100-014-007
28	1	ELBOW	100-014-010

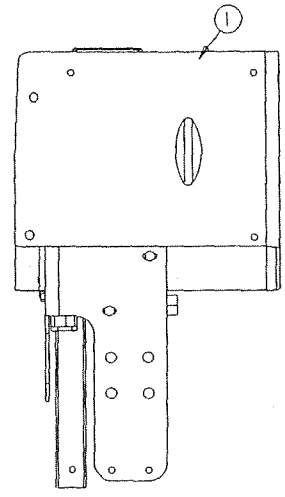
Hydraulic system – upper controls
242-1007-015-00-3

Item #	Qty	Description	Part #
29	1	Tee	100-070-004
30	1	Reducer	100-179-010
31	5	Plug	100-198-002
32	3	Elbow	100-014-009
33	1	Plug	100-198-005
34	1	Elbow	100-012-004
35	1	Fitting	100-428-033
36	1	Te	100-011-004
37	1	Elbow	100-013-010
38	1	Fitting	100-135-010
39	2	Buckhead fitting	100-079-007
40	1	Metallic tubing ass'y	192-9138-686-XX-1
41	1	Hydraulic hoses ass'y	192-6008-343-XX-2
42	1	Metallic tubing ass'y	192-9138-838-XX-2
43	1	Hydraulic hoses ass'y	192-6008-272-XX-2
44	1	Metallic tubing ass'y	192-9138-724-XX-1
45	1	Metallic tubing ass'y	192-9138-016-XX-1
46	1	Metallic tubing ass'y	192-9138-726-XX-1
47	1	Metallic tubing ass'y	192-9138-839-XX-1
48	2	Hydraulic hoses ass'y	192-6008-294-XX-2
49	1	Elbow	100-108-014
50	1	Metallic tubing ass'y	192-9138-727-XX-1
51	1	Hose retrainer	100-122-008
52	1	Hose bracket	190-2031-004-XX-1
53	1	Flange whiz lock-screw	100-006-189
54	1	Elbow	100-108-013
55	1	Elbow	100-012-003







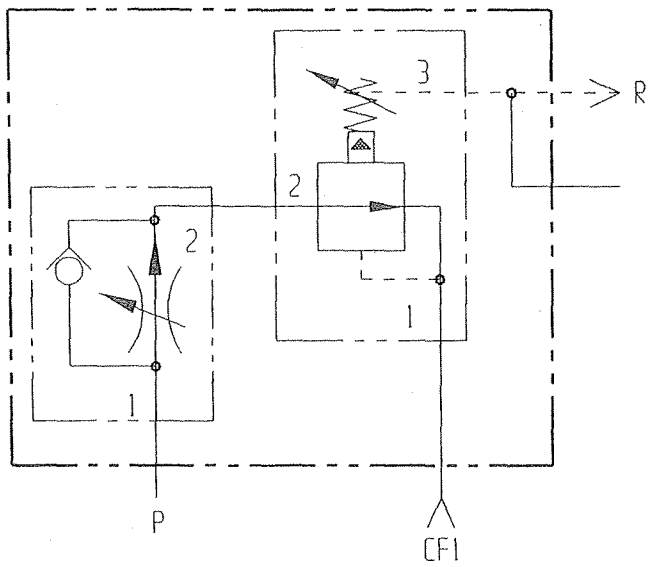


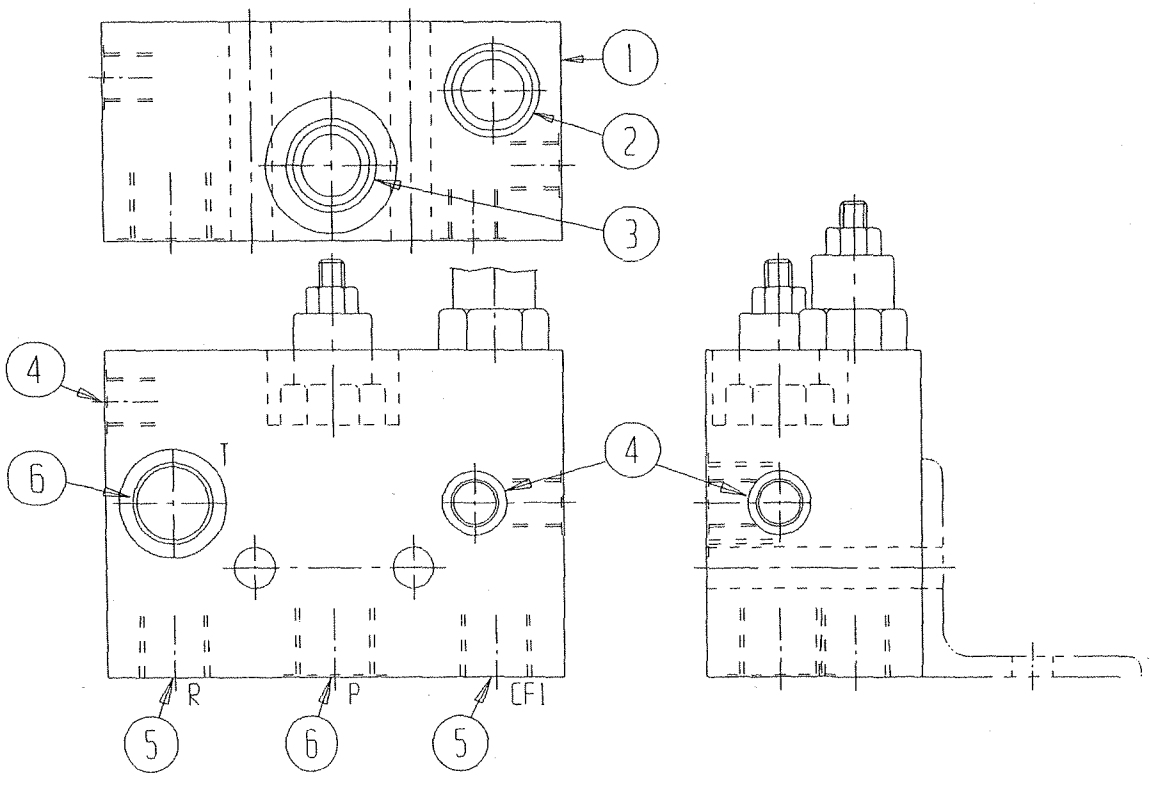
POSI-PLUS TECHNOLOGIES INC.

UPPER CONTROLS STATION WITH JOYSTICK AND WITHOUT PLATFORM ROTATION ASS'Y (242-1008-015-00-3)

Upper controls station with joystick and without platform rotation ass'y 242-1008-015-00-3

Item #	Qty	Description	Part #
1	1	Anchorage upper control ass'y	See main parts list
2	1	Upper control hydraulic ass'y	Refer to table of contents
3	1	Upper control guard	Refer to table of contents
4	1	Unique control ass'y	Refer to table of contents
5	1	Guard mounting bracket	190-1052-024-XX-1
6	2	Flat head hex-socket bolt	100-000-042
7	1	Steel control cover	242-1030-013-XX-1
8	5	Flange whiz-lock screw	100-006-148
9	1	Hydraulic lubrification fitting	100-057-001
10	1	Tools hydraulic manifold	See main parts list
11	1	Emergency let-down system	Refer to table of contents
12	1	D-ring anchorage connector	100-040-051
13	1	Start/stop system	Refer to table of contents
14	1	Two speed throttle	Refer to table of contents
15	1	Pneumatic distributor	Refer to table of contents
16	6	Hexagonal head bolt	100-006-176
17	1	Bent control arm	200-1832-122-XX-1
18	1	Bent control arm	200-1832-123-XX-1



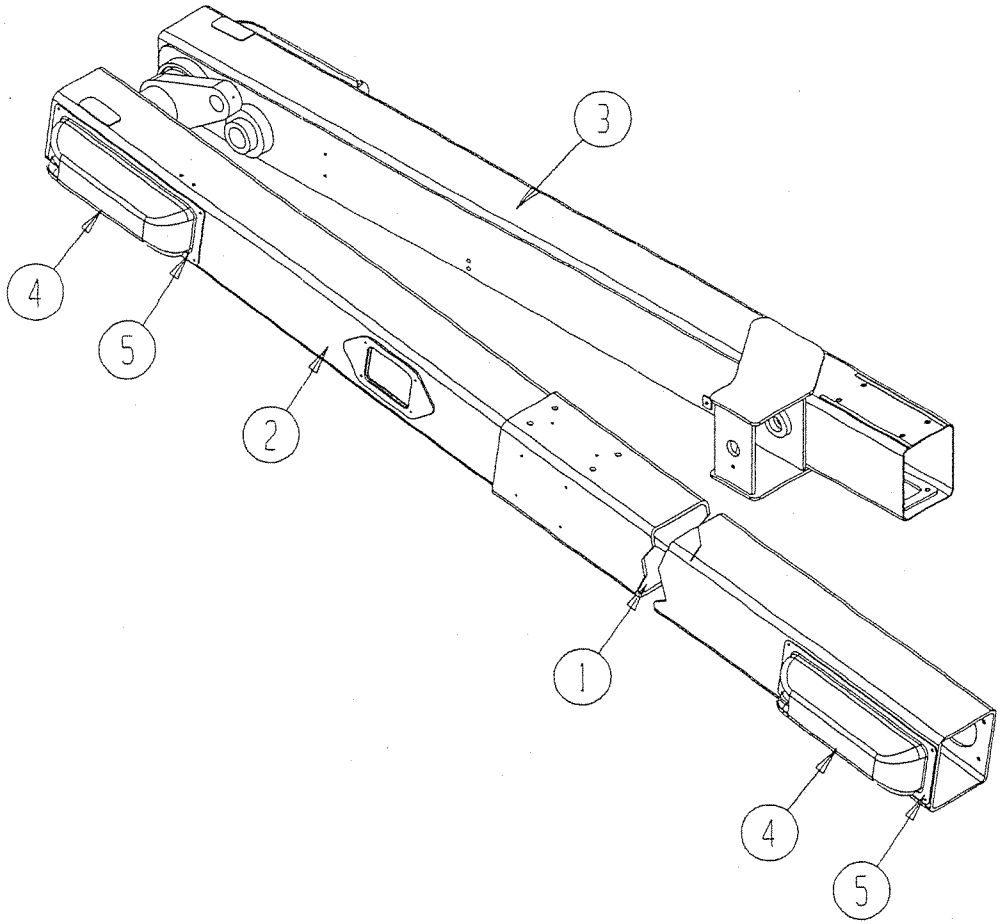


POSI-PLUS TECHNOLOGIES INC.

LOWER TOOLS MANIFOLD (192-1151-010-00-1)

Tools manifold ass'y
192-1151-010-00-1

ITEM #	QTY	DESCRIPTION	PART #
1	1	HYDRAULIC DISTRIBUTOR	192-1050-010-XX-2
2	1	CARTRIDGE	100-066-047
3	1	CARTRIDGE	100-066-055
4	3	PLUG	100-198-001
5	(2)	FITTING	100-293-007
6	2	FITTING	100-017-009

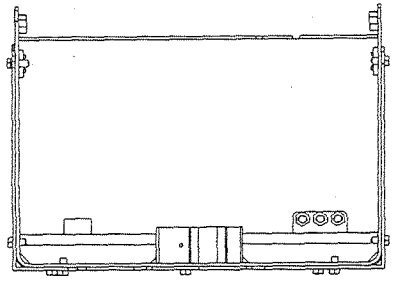


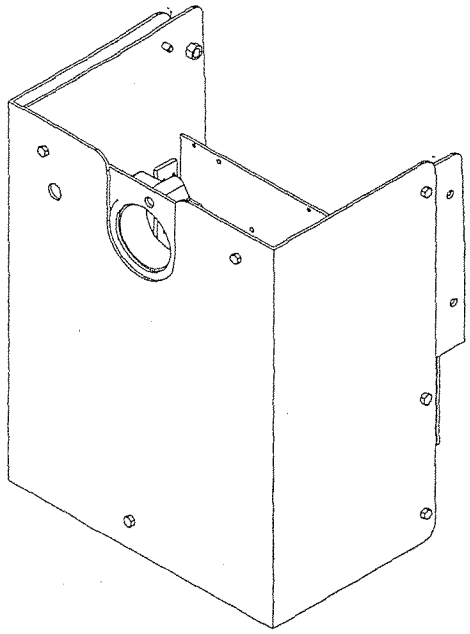
POSI-PLUS TECHNOLOGIES INC.

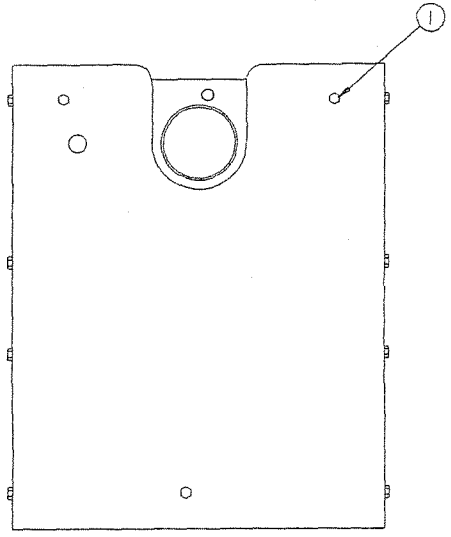
FIBERGLASS HOSE GUARD (242-1400-002-01-2)

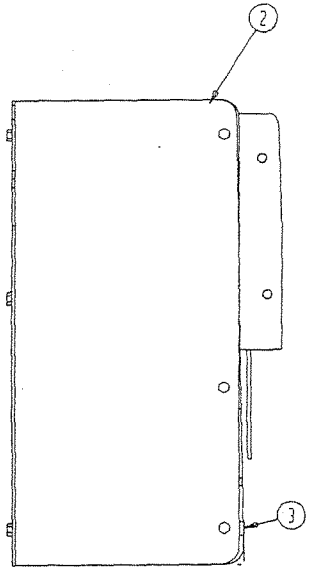
Fiberglass hose guard ass'y
242-1400-002-01-2

Item #	Qty	Description	Part #
1	1	Upper boom	See main parts list
2	1	Lower arm upper boom	See main parts list
3	1	Upper arm lower boom	See main parts list
4	3	Fiberglass hose guard	100-259-090
5	12	Machine screw	100-065-003







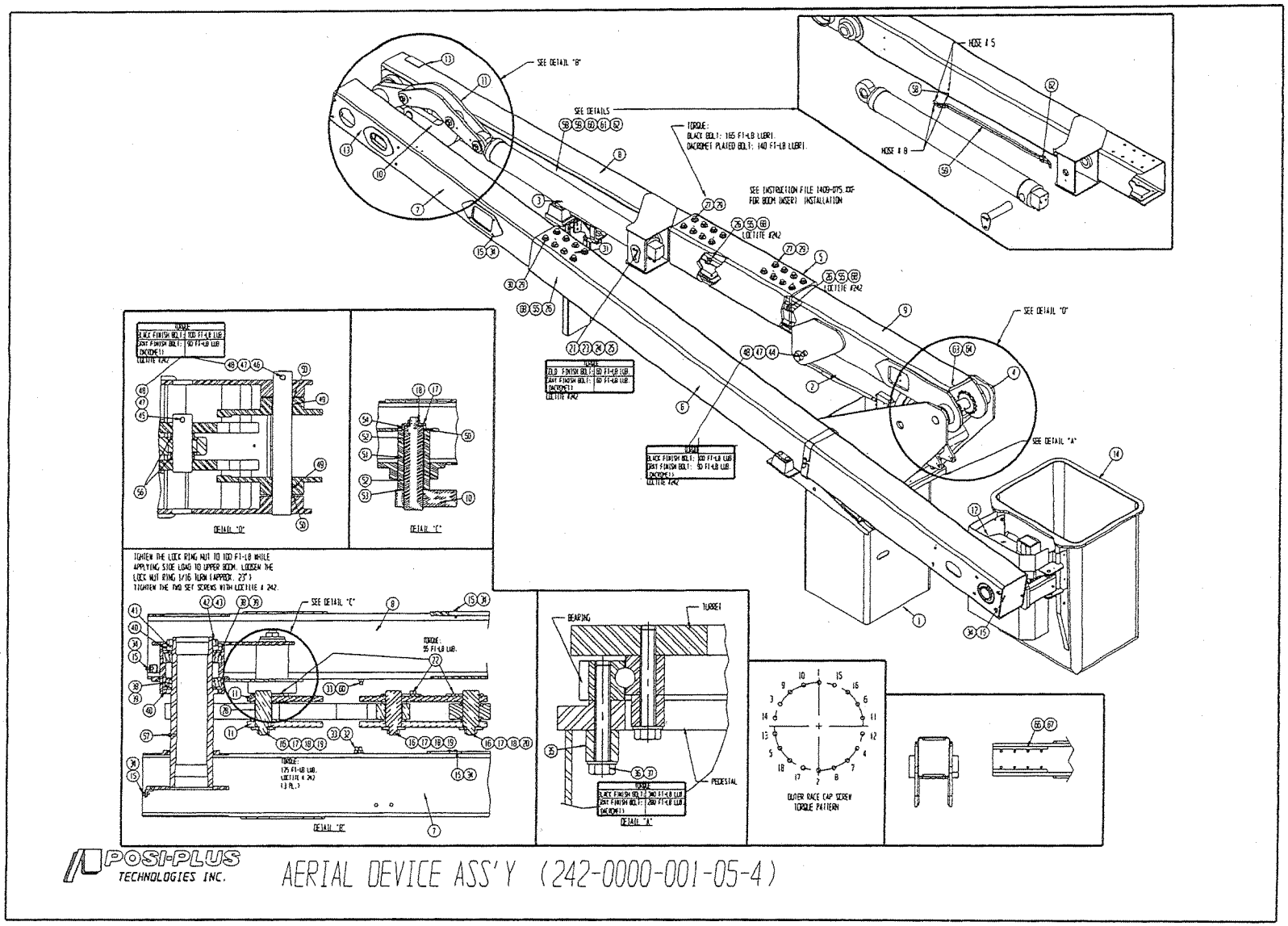


POSI-PLUS TECHNOLOGIES INC.

GUARD - UPPER CONTROL (242-1425-002-02-2)

Rotating upper control guard
242-1425-002-02-2

ITEM #	QTY	DESCRIPTION	PART #
1	9	HEXAGONAL HEAD BOLT	100-006-255
2	1	UPPER CONTROL COVER	100-204-003
3	1	UPPER CONTROLS COVER CONTOUR BRACKET	242-1019-002-XX-1



POSI-PLUS TECHNOLOGIES INC.

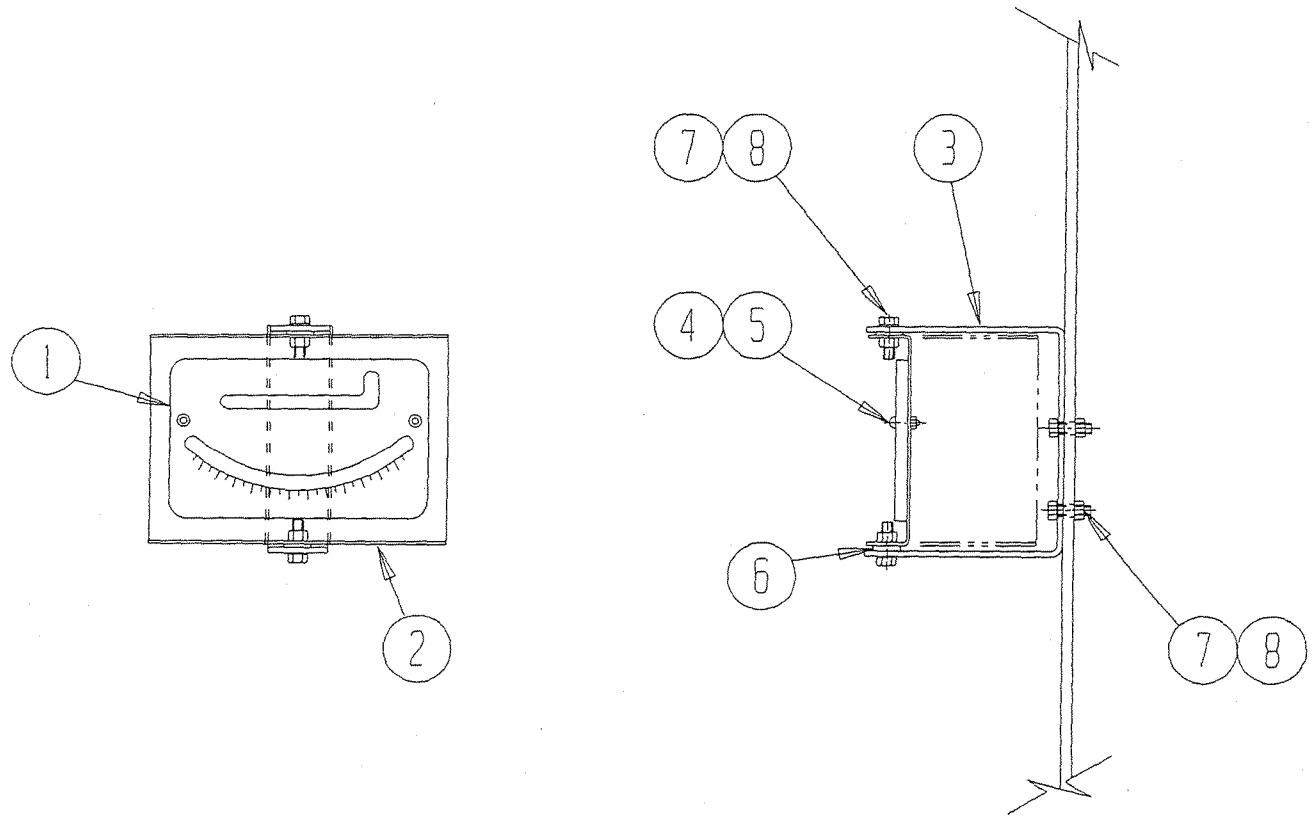
AERIAL DEVICE ASS'Y (242-0000-001-05-4)

Aerial device ass'y
242-0000-001-05-4

ITEM #	QTY	DESCRIPTION	PART #
1	1	PEDESTAL ASS'Y	SEE MAIN PARTS LIST
2	1	CYLINDER ASS'Y (SIDE-BY-SIDE)	REFER TO TABLE OF CONTENTS
3	1	UPPER BOOM CYLINDER ASS'Y	REFER TO TABLE OF CONTENTS
4	1	TURRET ASS'Y	REFER TO TABLE OF CONTENTS
5	1	INSULATED FIBERGLASS LOWER BOOM	SEE MAIN PARTS LIST
6	1	INSULATED FIBERGLASS UPPER BOOM	SEE MAIN PARTS LIST
7	1	LOWER ARM UPPER BOOM	SEE MAIN PARTS LIST
8	1	UPPER ARM LOWER BOOM	SEE MAIN PARTS LIST
9	1	LOWER ARM LOWER BOOM	SEE MAIN PARTS LIST
10	1	LOWER ARM CONNECTING LINK ASS'Y	REFER TO TABLE OF CONTENTS
11	2	UPPER ARM CONNECTING LINK	SEE MAIN PARTS LIST
12	1	UPPER CONTROLS STATION ASS'Y	REFER TO TABLE OF CONTENTS
13	1	HOSE GUARD ASS'Y	REFER TO TABLE OF CONTENTS
14	1	PLATFORM ASS'Y	REFER TO TABLE OF CONTENTS
15	1	ACCESS DOOR	SEE MAIN PARTS LIST
16	3	SHAFT	242-0003-001-XX-2
17	4	WASHER	570-7014-001-XX-1
18	4	NYLON INSERT LOCK NUT	100-321-010
19	4	SPACER	193-9317-005-XX-1
20	2	SPACER	190-3041-004-XX-1
21	2	SPACER	193-9317-002-XX-1
22	3	BOLT	100-006-169
23	1	SHAFT	242-0002-010-XX-1
24	1	RETAINING COVER	242-0001-002-XX-1
25	3	BOLT	100-000-073
26	6	RUBBER	100-242-006
27	32	BOLT	100-006-024
28	1	RING	242-3003-001-XX-1
29	48	FLAT WASHER	100-036-068

Aerial device ass'y
242-0000-001-05-4

ITEM #	QTY	DESCRIPTION	PART #
30	16	BOLT	100-006-047
31	36	SET SCREW	100-034-071
32	1	HOSE CLAMP	100-303-009
33	4	NYLON INSERT LOCK NUT	100-025-010
34	16	BOLT	100-006-148
35	18	SPACER	190-4029-001-XX-1
36	18	BOLT	100-006-057
37	18	FLAT WASHER	100-036-008
38	2	BEARING CONE	100-056-038
39	2	CUP FOR TAPERED ROLLER BEARING	100-056-039
40	2	"O" RING	100-041-013
41	1	SNAP RING	242-0004-001-XX-1
42	1	NUT	242-0005-001-XX-1
43	2	SET SCREW	100-034-066
44	1	SHAFT	192-7502-104-XX-1
45	1	SHAFT	400-0002-005-XX-1
46	1	SHAFT	192-7502-106-XX-1
47	3	LOCK SHAFT	192-3013-002-XX-1
48	3	BOLT	100-006-036
49	2	BUSHING GLYCODUR	100-021-044
50	3	SPACER	195-1233-001-XX-1
51	1	GREASE FITTING	100-057-021
52	2	RING	242-3003-002-XX-1
53	1	SPACER	195-1233-006-XX-1
54	1	WASHER	242-0006-001-XX-1
55	6	BOLT	100-000-080
56	2	SPACER	400-0004-002-XX-1
57	1	GREASE FITTING	100-057-001
58	2	ELBOW 90°	100-012-003



POSI-PLUS TECHNOLOGIES INC.

CLINOMETER AND SUPPORT ASS'Y (200-0045-003-01-2)

Swivel level indicator
200-0045-003-01-2

ITEM #	QTY	DESCRIPTION	PART #
1	1	INCLINOMETER	100-244-003
2	1	SUPPORT	200-0046-012-XX-2
3	1	HOOK	200-0047-004-XX-2
4	2	MACHINE SCREW	100-065-006
5	2	NYLON INSERT LOCK NUT	100-025-023
6	2	FLAT WASHER	100-036-026
7	4	BOLT	100-006-149
8	4	NYLON INSERT LOCK NUT	100-025-009