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WARRANTY:

VENDOR INSERTS:

Part 1: A Word to Owner, Operator, and Service Personnel About Safety

⚠ WARNING

FAILURE TO READ THIS BOOKLET IS A MISUSE OF THE EQUIPMENT. ANYONE WHO WILL OPERATE, SERVICE OR WORK AROUND THIS LOADER MUST FIRST READ THIS BOOKLET. DEATH OR SERIOUS INJURY MAY RESULT FROM IMPROPER USE OR MAINTENANCE OF THIS LOADER.

Introduction

Anyone who will operate, service or work around the loader should first read this manual. It is important that all workers understand the safety, operational, service, and repair requirements of the loader. Death or serious injury can result from improper use or maintenance of the loader.

As an owner or employer, it is your responsibility to know the specific requirements, governmental regulations, precautions, and work hazards that exist. You should make these known to all personnel working with the equipment or in the area. It is your responsibility to instruct the operator in the safe operation of the equipment and to provide the operator with properly maintained equipment.

It is the operator's responsibility to operate the loader with skill, good judgment and caution. Following recognized safety procedures helps to avoid accidents.

Do not allow untrained personnel, even on a temporary basis, to operate this equipment. Operators must be trained by an experienced trash loader operator who is familiar with all aspects of operation, safety, and maintenance of this equipment. Keep children, visitors and untrained personnel away from the equipment.

Modifications to any part of this loader can create a safety hazard and therefore shall not be made without the manufacturer's written approval. Use only factory approved parts to repair or maintain this equipment. If this equipment is rebuilt or remounted, mounting procedures and retesting is required in accordance with factory instructions.

⚠ WARNING

DO NOT OPERATE THE LOADER UNDER ANY CIRCUMSTANCE IF THERE IS REASON TO BELIEVE THE UNIT IS BROKEN OR MALFUNCTIONING. DO NOT ATTEMPT TO PLACE THE BOOM OF A BROKEN OR MALFUNCTIONING UNIT IN THE BODY OF THE LOADER UNIT WITHOUT ASSISTANCE FROM ANOTHER CRANE OR LIFTING DEVICE. ANY ATTEMPT TO USE OR MOVE THE BROKEN OR MALFUNCTIONING UNIT COULD RESULT IN SERIOUS BODILY INJURY OR DEATH.

The Rear Mount Loader is a truck that is equipped with a loader only. The Rear Mount Loader is designed to load into an attached trailer or to continuously load into other vehicles.

The bucket should always be racked when traveling without a tow trailer, or in the alternative, stowed in the tow trailer for travel.

The vehicle should not be moved when an operator is at the loader control station. The operator and any other workers should be in the truck cab during travel.

When using the loader to load debris into other transport vehicles, make sure that you establish a good means of communication between the trash loader operator, the transport truck driver, and any ground crew workers. Good communication between all members of the trash collection team improves productivity and reduces the chance of damage to equipment and/or serious injury to personnel.

Part 2: Daily Inspections - Before Leaving the Storage Facility

One of the most important factors in the prevention of accidents is a positive attitude towards safety. The habit of anticipating possible problems normally prevents many accidents from occurring.

Each morning, prior to leaving the storage facility or lot, the following inspections should be made:

1. Check oil level and battery.

2. Check the brakes and backup alarm. The backup alarm must always be sounding prior to backing up. If your unit is equipped with any additional alarms or warning lights, check these items also for proper operation.

3. Check rearview mirrors and adjust if necessary.

4. Check tires for proper inflation, cuts, and loose wheel nuts.

5. Check head and taillights, strobes, and flashers for proper operation.

6. Check the hydraulic system for any unusual conditions such as pools of hydraulic fluid or lubricating oil under the chassis, any outrigger which may have crept down, or any signs of damage or improper maintenance. The hydraulic hoses should be free from cuts and abrasions and there should be no evidence of binding or leakage.

7. Ensure that outriggers are fully retracted and the bucket is open and resting on the floor of the dump trailer, and the swing (float) valve is in the *"Disengaged"* or "Float" position. If the body contains debris, the bucket should be closed and at rest on the load. Ensure that most of the bucket and boom tip are below top of body.

8. If equipped with suspension locks ensure that the suspension lock switch is set to off and that the locks disengage once air pressure is built up within the air system.

   If no tow trailer is attached, then the bucket must be in the bucket rack for travel, and the swing (float) valve in the *"Engaged" or "Operate"* position.

   Note: RL Model Loaders without a towing package will not be equipped with a swing (float) valve.

Consult the truck manufacturer's manual for vehicle checks recommended by them.

Any insufficiencies found during this inspection must be corrected prior to use of the equipment.

Part 3: Safety Devices

We will now discuss some of the components designed into the loader system to ensure that safe loader control is maintained. There are hydraulic system flow devices designed into the loader system to control the flow of hydraulic fluid. Loader control and speed are essential to the safe operation of, and longevity of the loader.

To maintain safe loader control you must ensure that proper engine speed is observed, all oil flow restrictors are in place and have not been modified, and all valves are operating properly. You must not remove, or tamper with the manufacturer's recommended settings of oil flow devices.

Excessive operating speed causes erratic operation of the loader. Excessive operating speed decreases operator control and increases the stresses on the loader's supporting structures, which could cause unexpected component failure. The result of unexpected component failure could be damage to the equipment and/or serious bodily injury or death.

FLOW RESTRICTORS

Swing Actuator Restrictors: - The swing actuator flow restrictors control the swing speed of the loader boom. These restrictors are located on the swing drive motor, one on each port. These restrictors are factory preset and must not be removed or drilled out.

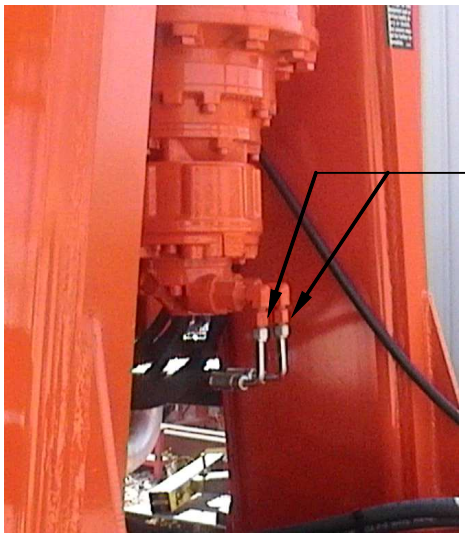
Model HA36 Rotary Actuator, Restrictor Size = .056
Model Planetary Gearbox Rotator, Restrictor Size = .110

Some signs of restrictor removal or modification are:

1. Excessive boom swing speed. Full travel time should be 20 seconds, ±3 seconds, from head stop to head stop.

2. Broken or bent head (swing) stops. Catastrophic actuator damage will result if head stops are damaged or missing.

3. Excessive swing speed causes excessive wear on the main boom/tip boom connecting bolt.



Swing Actuator Restrictors:

HA36 Actuator Restrictor Size = .056

SS40 Actuator Restrictor Size = .056

Planetary GB Restrictor Size = .110

Bucket Motor Restrictors: The bucket motor restrictors control the speed of the bucket rotation. These restrictors are located on the motor ports. These restrictors are factory preset and must not be removed or drilled out.

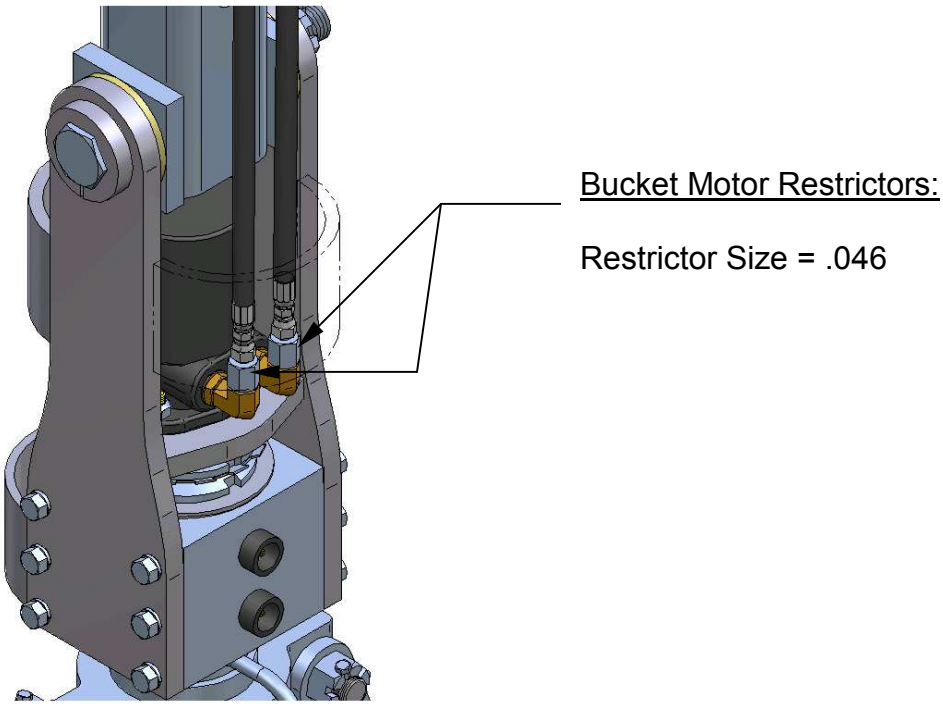
Restrictor Size: .046

Some signs of restrictor removal or modification are:

1. Excessive bucket rotation speed. Bucket rotation must not exceed 15 RPM.

2. Broken bucket rotator motor mounting bolts.

3. Broken bucket motor shaft and/or housing.



LOAD CONTROL VALVES

The load control valves are either a part of or plumbed directly onto load holding cylinders. These valves are found on the main boom lift cylinder, tip cylinder, tip extension, and the outrigger cylinders.

Main Boom Lift, Tip, and Tip Extension Cylinders:

Counter-balance Valves: - The counter-balance valve is a cartridge type valve, mounted directly into a housing that is welded to the lift, tip, and tip extension cylinders. These valves hold the load until hydraulic pressure is applied to it causing the valve to open. This ensures the load is held in case of hose rupture, or other hydraulic system failure.

Notice to Operators: If load control valve(s) malfunction, do not attempt to adjust valves, and/or continue to use the loader. Return to the maintenance facility for repair.

Counter-balance valve adjustment is not normally needed after initial installation. However, if adjustment is needed, first release load from valve and rest bucket on ground or floor of body. Turn valve screw far enough out so that valve will hold load when control valve is opened and truck PTO is off. The PTO should be off when adjusting the screw, back on to lift the boom, and off again to test load holding capability of the valve.

If the cartridge valve is replaced, you must first release the load from the valve. This means the boom must be at rest in the floor of the body or on the ground, prior to removing the cartridge valve.

⚠ WARNING

FAILURE TO FOLLOW THE PRECEDING INSTRUCTIONS REGARDING COUNTER-BALANCE VALVE ADJUSTMENT AND/OR REPLACEMENT, COULD RESULT IN THE BOOM FALLING ONCE THE CARTRIDGE VALVE IS REMOVED, WHICH COULD RESULT IN DAMAGE TO THE EQUIPMENT OR SERIOUS PERSONAL INJURY OR DEATH.

If the operator experiences hydraulic failure while on route, first try to get the hydraulic system working again. If you cannot get the hydraulic system working, we recommend that you call for the assistance of an auxiliary service vehicle that can provide a power source for the loader hydraulic system. The connections from the auxiliary power source should be made at the appropriate loader valve bank. Hydraulic pressure from the power source should go to the **"in"** at the loader valve bank, and return to the power source should come from the **"out"** at the loader valve bank. Using the auxiliary power source to run the hydraulics, replace all loader components to the travel position, and then return the loader to the shop for repair.

Outrigger Cylinders:

Pilot Operated Check Valve: - The outrigger cylinders use pilot operated check valves which are part of the cylinders. In the event of hose failure, these valves hold the load until hydraulic pressure is applied, causing the valve to open.

These valves are factory preset and are not serviceable.

If you need to remove this valve, make sure the load is released from the cylinder prior to removing the valve.

LOCK COLLAR

The lock collar is an integral part of the trash loader that holds the head and spindle assembly in the pedestal. The lock collar must be in place and the lock collar bolts properly torqued prior to use of the trash loader. The lock collar must be tight against the bottom of the spindle bearing housing with a maximum gap of one-quarter inch (1/4").

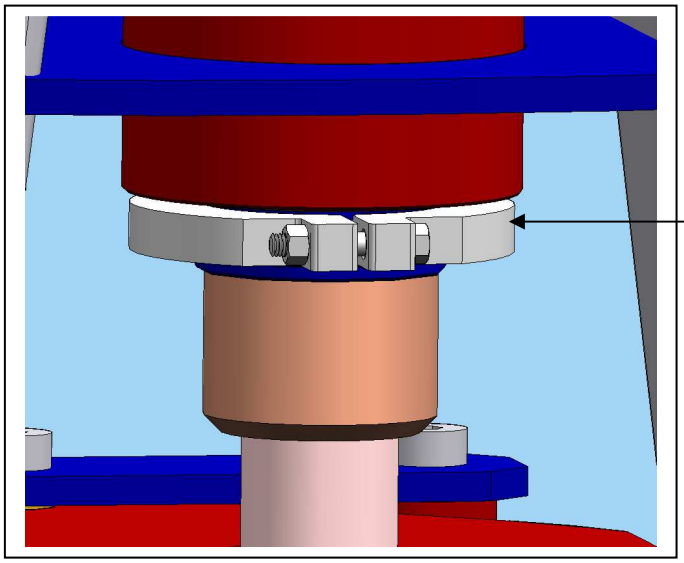
Under normal operating conditions, there is very little load applied to the lock collar. However, the following improper operating practices could put excess stress on the lock collar and therefore must be avoided.

- Excessively packing the load with the boom. Evidence of this may be the bulkhead of the trailer body may be bowed outward.

- Improper positioning of the boom prior to raising the trailer dump body. Evidence of this may be the underside of the main boom will be dented and scarred.

Improper lock collar installation and/or the improper operating practices listed above, could result in the head assembly being pulled up out of the pedestal assembly. The separation of these two loader components will result in equipment damage, and could result in serious personal injury or death.

Maintenance and shop personnel must continuously check for the above listed signs of abuse, and must report their observations to the person responsible for the operation practices of the trash loader operators. Corrective measures must be taken to stop abusive loading practices.



Lock Collar

(Also shown on the Head & Pedestal Drawing in “Dia. & Drawings” Section of this manual (see Item No. 9).

BACK-UP ALARM

All truck mounted loaders have back-up alarms that must sound any time the gear shift selector is in reverse “R”. The back-up alarm is on the daily checklist of items to be checked prior to leaving the storage facility. If the back-up alarm is not working, it must be repaired prior to putting the vehicle in service.

⚠ WARNING

ALARM MUST SOUND WHEN BACKING UP. DO NOT BACK UP WITHOUT HAVING SOMEONE CLEAR BEHIND THIS VEHICLE.

It is the operator’s responsibility to make sure that the area behind the loader is clear before backing up.

“BOOM-UP” ALARM

A warning system that alerts the loader operator when the boom is not stowed properly for travel. A sensor is installed on the boom, and an audible alarm and light in the truck cab. When the operator enters the truck cab after using the loader, the warning light and audible alarm will alert him if the boom travel height exceeds 13 feet.

This system should be viewed as a tool to help operators measure the height of their boom, but more importantly, to warn the loader operators that their boom is above safe height for travel. It is not intended to replace an operator’s good judgment on safe travel height of their boom.

Operators should always be aware that some routes may have streets, roads, alleys, etc., that do not comply with the legal height requirement of 13’6”, and should conduct their operations accordingly.

⚠ WARNING

BEFORE MOVING TRUCK, BOOM MUST BE STOWED TO LOWEST POSSIBLE HEIGHT; MAX. BOOM HEIGHT NOT TO EXCEED 13’6”.

This boom-up warning system became a standard feature of our loader in April, 2002. If you have an older model Lightning Loader® that does not have this boom-up warning system, you can contact our Parts Department and order a retro-fit kit to install this system.

SAFETY SYMBOLS

Your loader has required safety decals (see following pages) that alert those operating, working around, or performing maintenance on the loader of certain safety hazards. The safety decals are used to show the consequence of human interaction with a hazard in terms of:

1. The degree of severity.
   (minor injury, severe injury, death)

2. The probability of severity.
   (WILL result in, COULD result in)

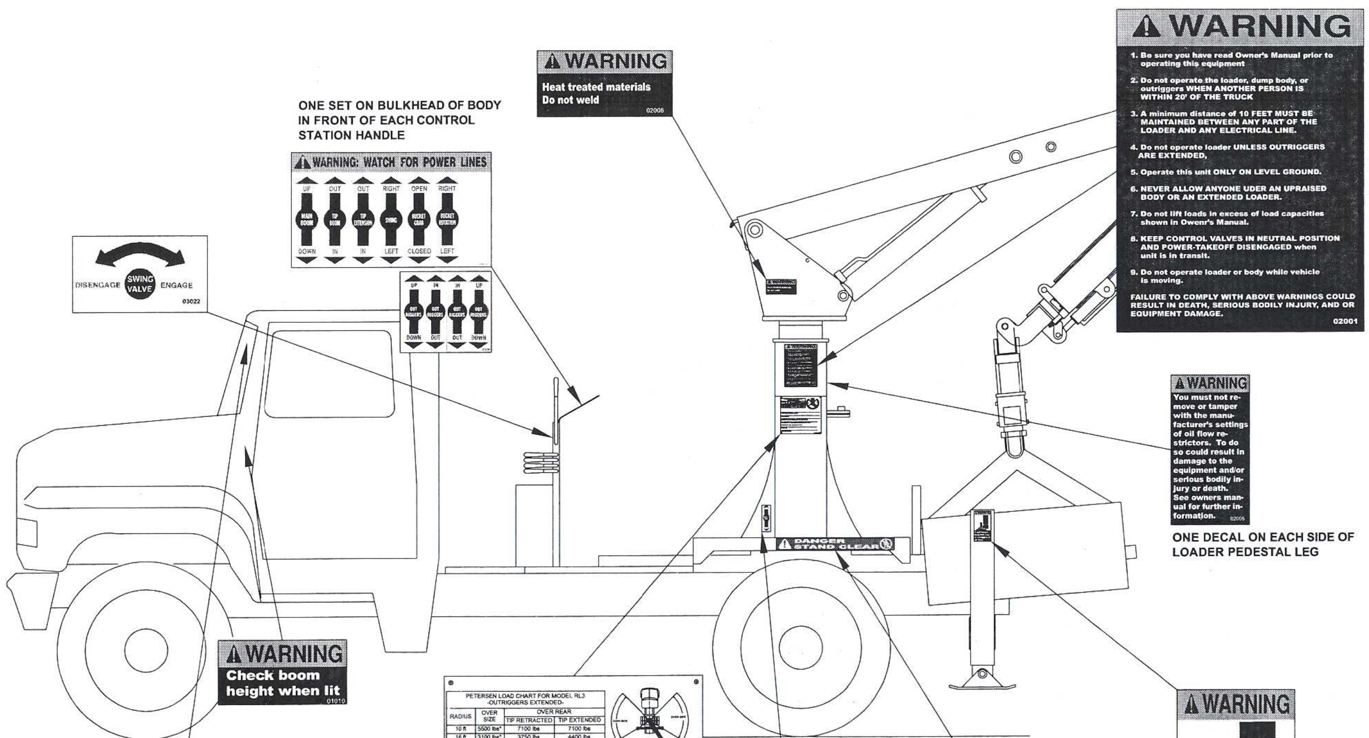
The following definitions for identifying hazard levels are provided with their respective signal words.

DANGER Immediate hazards which WILL result in severe personal injury or death.

WARNING Hazards or unsafe practices which COULD result in severe personal injury or death.

CAUTION Hazards or unsafe practices which COULD result in minor personal injury or product or property damage.

RL TRASH LOADER - REQUIRED SAFETY DECALS



PETERSEN LOAD CHART FOR MODEL RL3 -OUTRIGGERS EXTENDED-			
RADIUS	OVER SIZE	OVER REAR	
		TIP RETRACTED	TIP EXTENDED
10 ft	5500 lbs*	7100 lbs	7100 lbs
16 ft	3100 lbs*	3750 lbs	4400 lbs
20 ft	1800 lbs*	-	3200lbs

WEIGHT OF ATTACHMENT TO BE SUBTRACTED FROM LIFT CAPACITIES. STANDARD TRASH BUCKET WEIGHTS 1000 LBS.

RADII ARE MEASURED IN FEET FROM THE CENTER OF ROTATION TO THE CENTER OF THE BUCKET.

LOADS FROM THE LOADER ON OUTRIGGERS REPRESENT 85% OF VEHICLE TIPPING MOMENT WHEN THE VEHICLE IS ON FIRM LEVEL GROUND.

NO.1 OUTRIGGERS ONLY EXTEND UP AND DOWN. NO.3 OUTRIGGERS EXTEND HORIZONTALLY TO THE SIDES AND VERTICALLY UP AND DOWN.

BOOM LENGTH FULLY EXTENDED IS 16 FEET.

DO NOT USE THESE LOAD CHART VALUES TO PREDICT LOAD CAPACITIES AT OTHER RADII.

TIRE PRESSURES MUST BE IN ACCORDANCE TO THE TIRE MANUFACTURER'S RECOMMENDATIONS.

ON PEDESTAL LEG - DRIVER SIDE

WARNING
Alarm must sound when backing up. Do not back up without having someone clear behind this vehicle.

WARNING
Before moving truck, boom must be stowed to lowest possible height; max. boom height not to exceed 13'6"

POWER TAKE OFF OPERATION
POWER SHIFTED P.T.O.S

I. MANUALLY SHIFTED TRANS.
1) ENGAGE P.T.O. WITH ENGINE AT IDLE SPEED

II. AUTOMATIC TRANSMISSION
1) ENGAGE P.T.O. WITH ENGINE AT IDLE SPEED

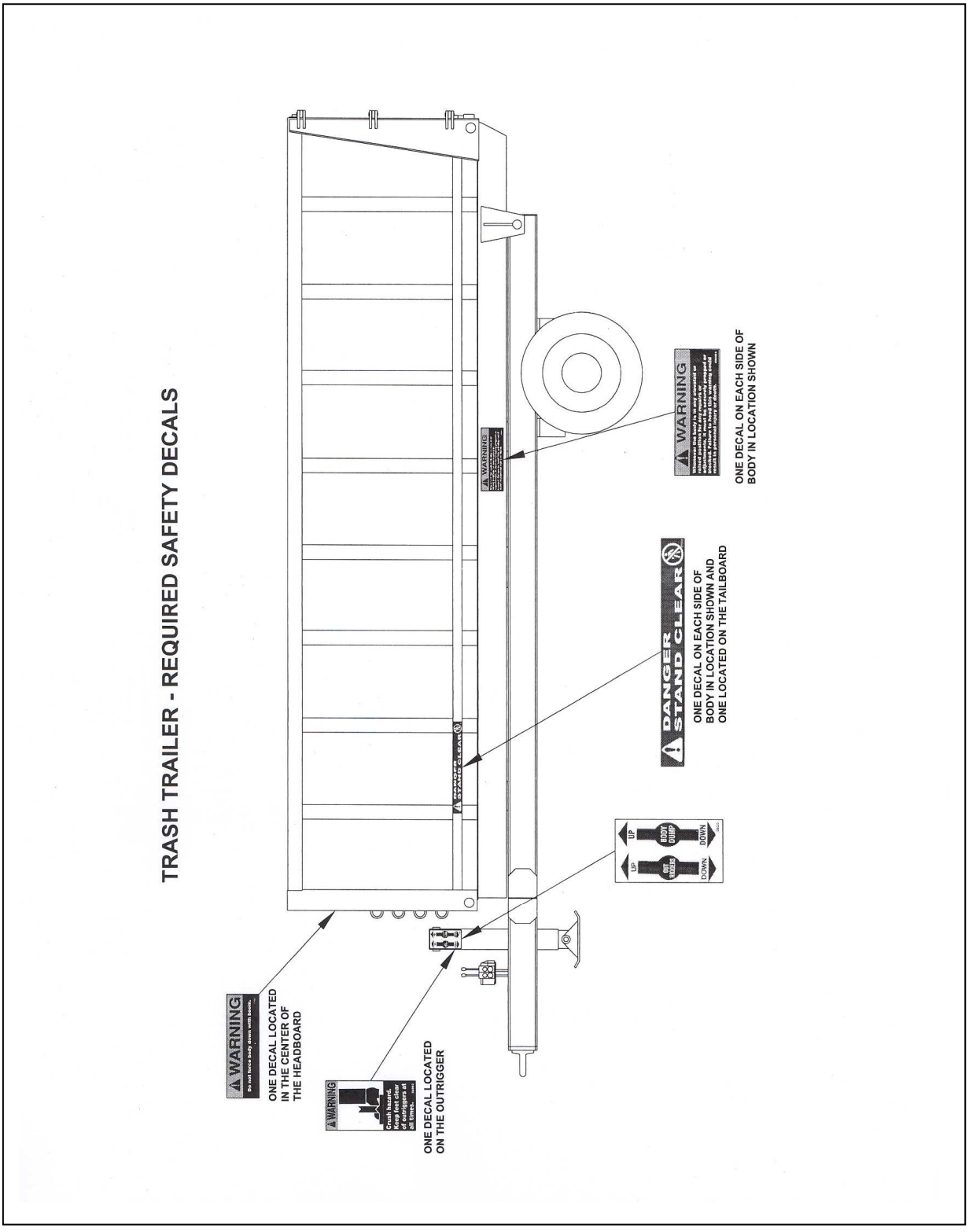
WARNING:
DURING EXTREMELY COLD WEATHER, 230, 270, 276, 300, 362, 355, AND 356 SERIES POWER TAKE OFFS MAY MOMENTARILY TRANSMIT POWER EVEN THOUGH IT'S DISENGAGED! Consult your owners manual for further explanation.

10-93

IMPORTANT
This vehicle is equipped with a POWER TAKE OFF
- READ OWNERS MANUAL LOCATED IN THE GLOVE BOX
- SEE SUN VISOR FOR OPERATING INSTRUCTIONS

CHELSEA®
DANA

ON CAB SUN VISOR


TRASH TRAILER - REQUIRED SAFETY DECALS
WARNING
ONE DECAL LOCATED IN THE CENTER OF THE HEADBOARD
WARNING
ONE DECAL LOCATED ON THE OUTRIGGER
DANGER STAND CLEAR
ONE DECAL ON EACH SIDE OF BODY IN LOCATION SHOWN AND ONE LOCATED ON THE TAILBOARD
WARNING
ONE DECAL ON EACH SIDE OF BODY IN LOCATION SHOWN
UP
BODY DUMP
DOWN
UP
GATE UNLOCK
DOWN

Part 4: Controls

THROTTLE CONTROL

Throttle controls are installed for loaders mounted on a truck chassis. For loaders mounted on trucks with mechanical engines, either a manual throttle or a Muncie Hydrothrottle is installed. For loaders mounted on trucks with electronically controlled engines, a manual switch is used to advance the engine speed. The engine speed is advanced to the preset RPM, thus increasing the volume of oil available for loader functions. The hydraulic system is designed for maximum oil flow of 18 gallons per minute.

Preset RPM = Never to exceed 1400

Exceeding preset RPM will cause excess oil flow, which may cause unsafe operating speeds, excessive oil temperature, undue wear and tear on the loader and chassis.

Some signs of throttle control mal-adjustment or tampering are:

1. Leaking hydraulic seals caused by excess heat.

2. Prematurely worn loader components caused by excess operating speed.

3. Sticks, bricks, rocks, etc. found in the truck cab may indicate the loader operator has purposely intended to exceed preset engine RPM by jamming the truck accelerator.

PTO OVER-SPEED CONTROL

The over-speed control is a device that disconnects the PTO or diverts the flow of oil back to tank rather than to the loader valves.

The purpose of this control device is to prevent excess oil flow to the hydraulic system, which could happen if the throttle control device is altered or over-ridden.

PRESET RPM = NOT TO EXCEED 1750

<u>Power Take-Off Manual Transmission:</u>

Manual Shift Control – The PTO is engaged when the knob on the dash or floor is pulled out and disengaged when the knob is pushed in. The truck gear shift lever must be in neutral and the clutch depressed whenever the knob is moved.

Air Shift Control – The PTO is engaged when the switch is moved to apply

air to PTO, the “On” position. The PTO is disengaged when the switch is in the “Off” position. The truck gear shift lever must be in neutral and the clutch depressed when the switch is moved.

Power Take-Off Automatic Transmission:

Electrical Shift Control – The recommended procedure is to bring the vehicle to a full stop, place the truck gear shift lever in the neutral position, set the parking brake, and then engage the PTO. At the completion of loading operations, disengage the PTO, apply the service brakes, disengage the parking brake, and then select the appropriate transmission gear.

PARK BRAKE

The truck brake must be set before leaving the cab for any reason.

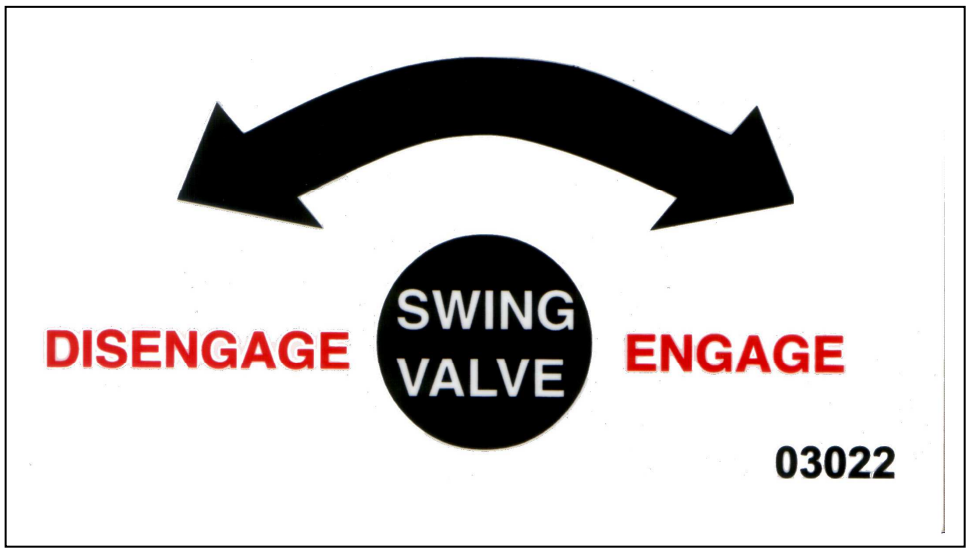
DIVERTER VALVE

The Rear Loader with a tow trailer has a diverter valve with two positions, up and down. Up, is the *"Trailer"* position, and down, is the *"Loader"* position.

The valve is set to the *"Loader"* position, any time you are going to activate any of the loader and/or outrigger functions from the operator's station.

The diverter valve is set to the *"Trailer"* position, any time you are dumping the trailer, or need to raise or lower the jack stand.

SWING (FLOAT) VALVE (Manual Valve)



The Rear Loader with a tow trailer has a swing (float) valve feature. When engaged, the swing (float) valve allows the main boom to swing with hydraulic resistance when activating the swing control handle. When disengaged, it allows the boom to "float" without hydraulic resistance, which enables the boom to pivot with the tow trailer when stowed within the trailer.

The valve has a toggle handle and is located near the operator's station.

The valve should always be set to the *"Engage" or "Operate"* position for loader and outrigger operations, and when the bucket is stowed in the bucket rack.

The valve should always be set to the *"Disengage"* or "Float" position for traveling when the bucket is stowed in the tow trailer. The *"Disengage" or "Float"* position allows the boom to float freely while it is resting in the trailer during travel.

It is imperative that the swing (float) valve is in the *"Engage"* or "Operate" position prior to raising the boom, otherwise the boom has the ability to swing freely with no hydraulic resistance, which can be particularly dangerous if you are not on level ground.

The boom and bucket must be stowed in accordance with instructions found in "Part 7: Loading Procedures" of this manual. Failure to stow the boom and bucket properly could allow the boom to slew (swing) and the bucket to fall outside of the body. Loss of boom control with the bucket outside of the dump body could result in damage to objects in the vicinity of the grapple truck, and/or serious injury or death to people in the vicinity of the grapple truck.

Failure to disengage the swing (float) valve when traveling with the bucket and boom stowed in the tow trailer could result in hydraulic actuator damage.

SWING (FLOAT) VALVE (Electric Valve)

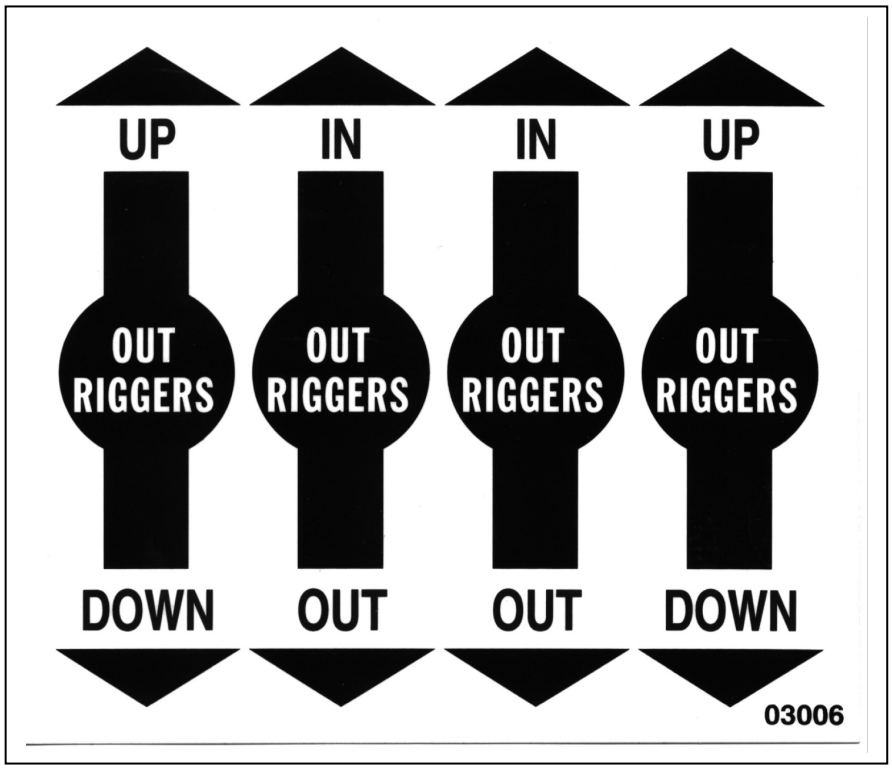
This valve serves the same purpose as the manual swing float valve as described above, however the operator is controlled by a truck cab mounted electric switch.

The switch should be set to the on position for loader and outrigger operations, and when the bucket is stowed in the bucket rack.

Controls for Model RL with Dual Walk-thru Controls:

Outriggers:

The Model RL2 and RL3 Loaders with the dual walk-thru control option have outrigger handles mounted below the other control handles. There is a set of four (4) handles on each side of the work platform, and they are configured the same on each side of the platform. In the four (4) handle configuration, the two (2) handles on the right operate the right outrigger, and the two (2) handles on the left operate the left outrigger. The following decal shows the control handle configuration, and the arrows indicate the direction to push or pull the handle for each function.



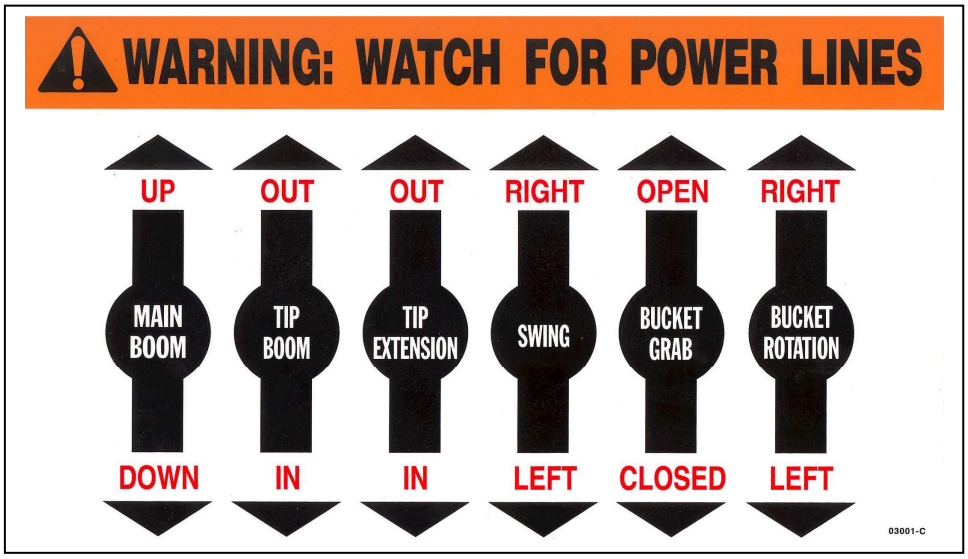
The outrigger placard gives visual instructions for horizontal outrigger in/out, and vertical outrigger up/down.

On units equipped with dual controls, always operate the loader on the side closest to the debris being loaded. Do not store any collectibles on the operator's platform, as they can create a tripping hazard or become lodged in the controls.

During all operations, the controls should be feathered when beginning or terminating a movement to prevent sudden starting or stopping which imposes undue shock loads on the equipment. Feather the controls by moving the valve handle smoothly from the neutral position to start motion. After a slow, smooth start, move the valve handle control to extreme for full speed. Just before stopping movement, move valve handle control smoothly back to the neutral position.

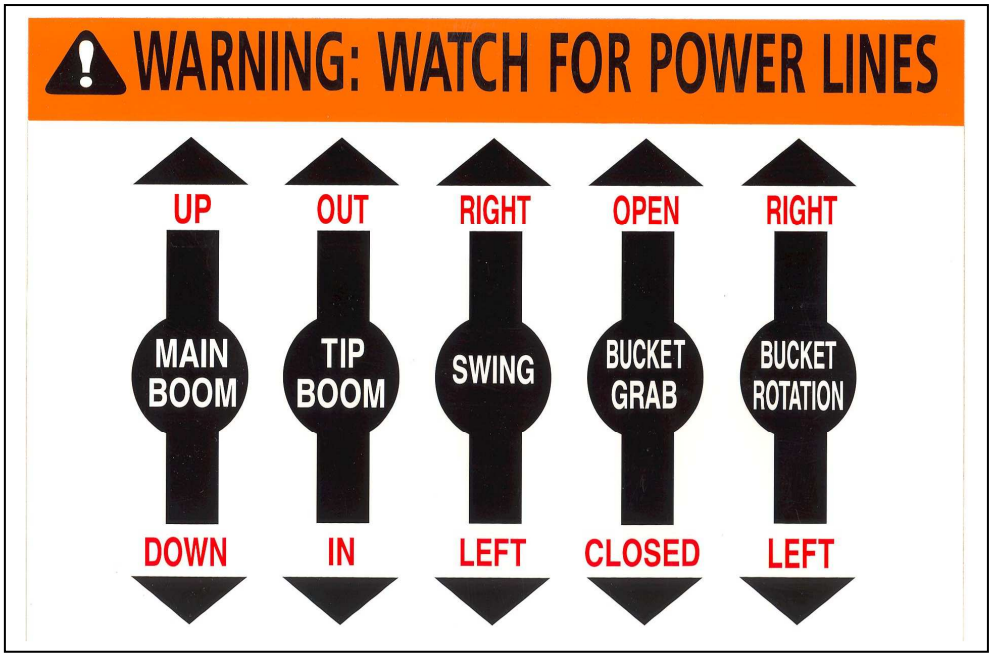
Model RL3 Loader :

The following decal shows the control handle configuration for the Model RL3 Loader, and the arrows indicate the direction to push or pull the handle for each function.



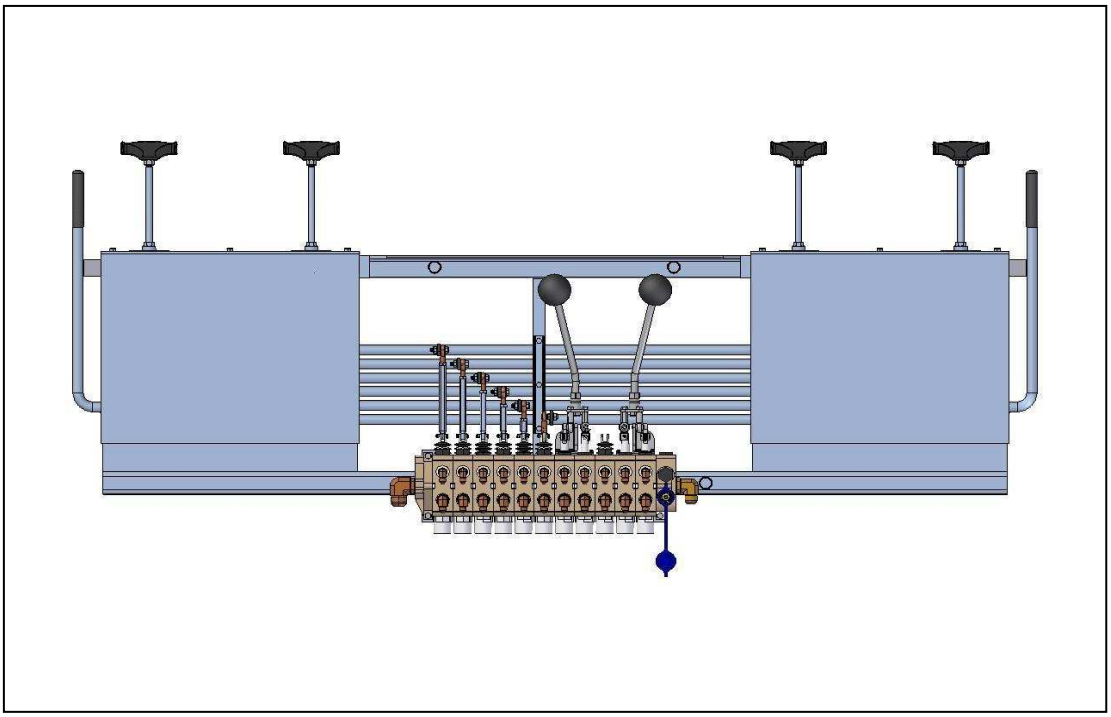
Model RL2 Loader:

The following decal shows the control handle configuration for the Model RL2 Loader, and the arrows indicate the direction to push or pull the handle for each function.



Controls for Model RL with Joystick Dual Walk-thru Controls:

There are two (2) joystick handles on each side of the operator's platform. The operating functions of the two sides are identical, so the operator uses the same movements on either side to control the boom elevation, boom swing, tip boom extension, bucket grab, and bucket rotation.

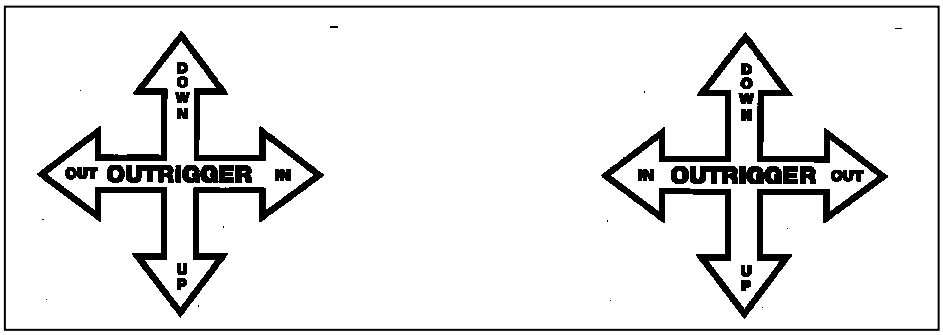


At the center of the work platform are two (2) control handles. The round knob on the left controls the left outrigger, and the round knob on the right controls the right outrigger.

The optimum, safe method of operating the controls is by feathering. **Do not jerk the control levers to full speed, or from one extreme to another.** Feather the controls by moving the joystick smoothly from the neutral position to start motion. After a slow, smooth start, move the joystick control to extreme for full speed. Just before stopping movement, move the joystick control smoothly back to the neutral position.

On units equipped with dual walk-thru controls, always operate the loader on the side closest to the debris being loaded. Do not store any collectibles on the operator's platform, as they can create a tripping hazard or become lodged in the controls.

Controls for Model RL with Joystick Dual Walk-thru Controls (continued):



Left Outrigger Right Outrigger

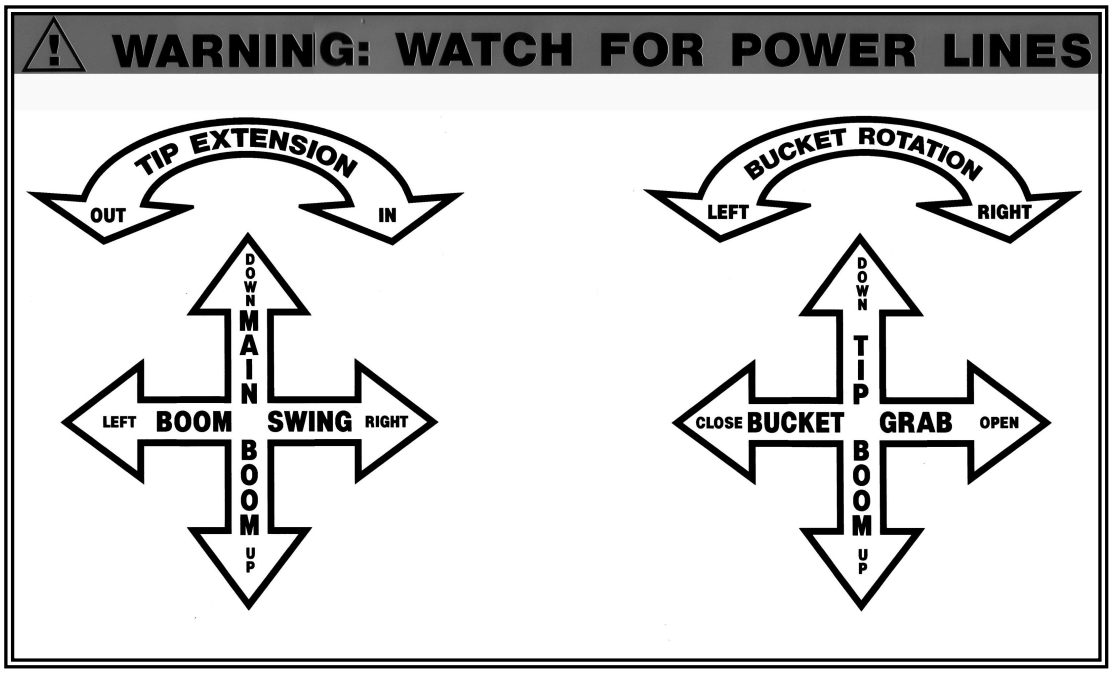
Left Outrigger Handle:

- Move the handle to the left to extend the left horizontal outrigger.
- Move the handle to the right to retract the left horizontal outrigger.
- Push the handle forward to lower the left vertical outrigger foot.
- Pull the handle back to raise the left vertical outrigger foot.

Right Outrigger Handle:

- Move the handle to the right to extend the right horizontal outrigger.
- Move the handle to the left to retract the right horizontal outrigger.
- Push the handle forward to lower the right vertical outrigger foot.
- Pull the handle back to raise the right vertical outrigger foot.

Loader Controls



Left Joystick:

Boom Swing: Move handle right to make boom swing right.
Move handle left to make boom swing left.

Main Boom: Pull handle back to raise boom.
Push handle forward to lower boom.

Tip Ext.: Twist handle counter-clockwise to extend tip extension out.
Twist handle clockwise to retract tip extension in.

Right Joystick:

Tip Boom: Pull the handle back to raise tip boom.
Push handle forward to lower tip boom.

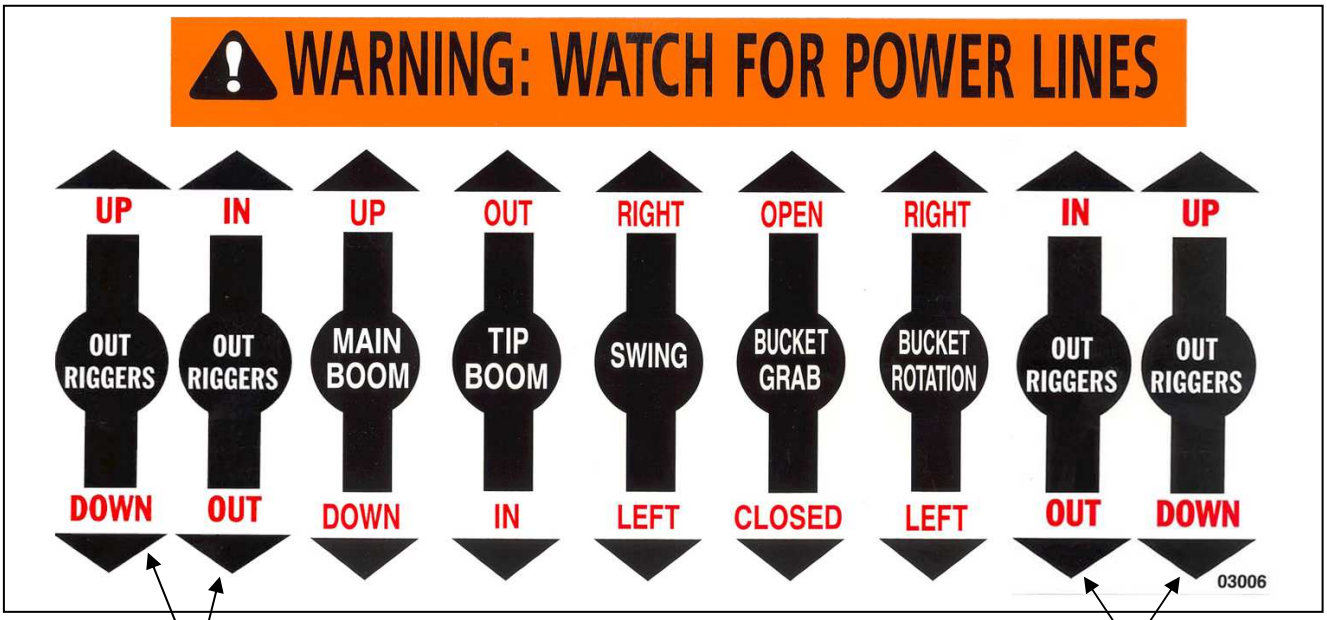
Bucket Grab: Move handle right to open bucket.
Move handle left to close bucket.

Bucket Rot.: Twist handle clockwise to rotate bucket right (clockwise).
Twist handle counter-clockwise to rotate bucket left (counter-clockwise).

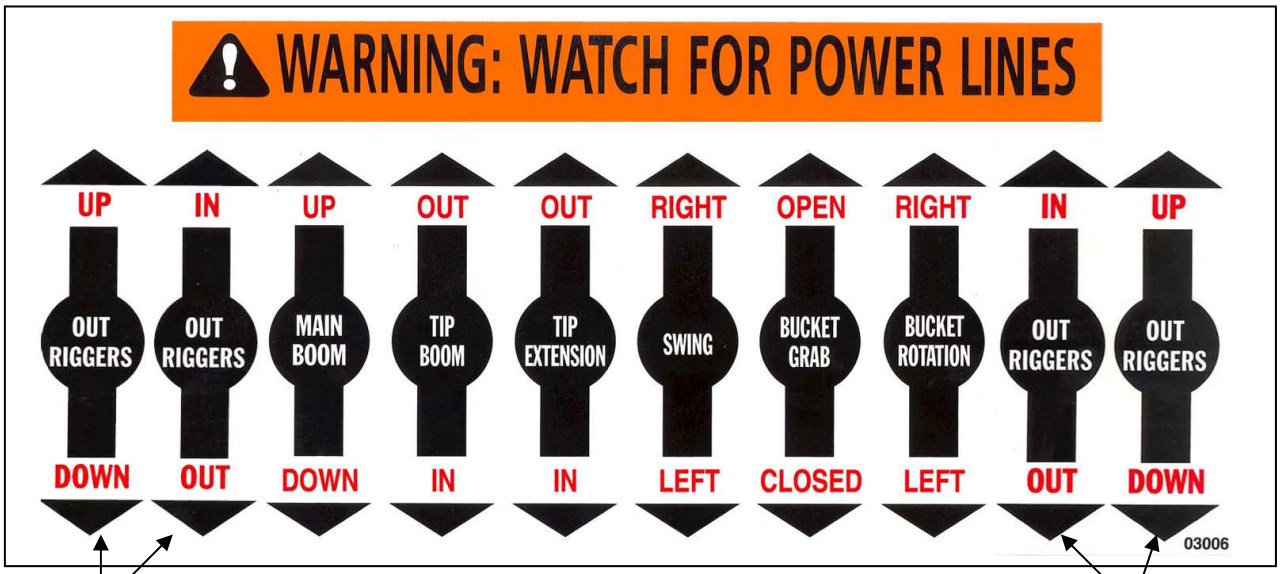
Controls for Model RL with Side Mount Seat:

The Model RL Loader with the side mount seat has the loader controls centered in front of the operator's seat. The right outrigger controls are mounted to the operator's lower right side, and the left outrigger controls are mounted to the operator's lower left side.

Operation Decals for RL2



Operation Decals for RL3



Left Outriggers

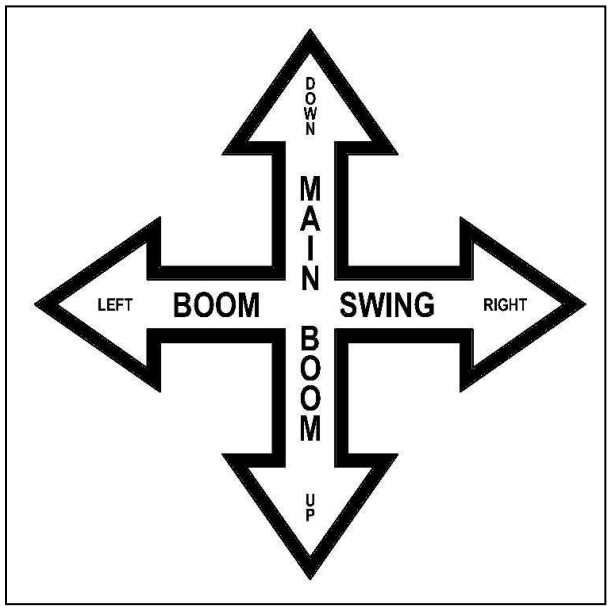
Right Outriggers

Model RL Loader with Foot Swing Control:

For RL models with a foot swing control option, the operation decals will be the same as those listed above for the RL2 and the RL3 except that there will not be a “SWING” function shown. The swing function is controlled by a foot pedal mounted on the control station floor at the operator’s feet. The operator will swing the boom to the right by pressing down on the right side of the pedal, and will swing the boom left by pressing down on the left side of the pedal.

Model RL Loader with Electronic Single Joystick Control

The electronic control modules have acceleration and deceleration factors built into the controls to prevent sudden movements that would cause stress to structural components of the boom. All six axes of control are done with the single joystick. The outrigger controls are to the right of the operators seat.

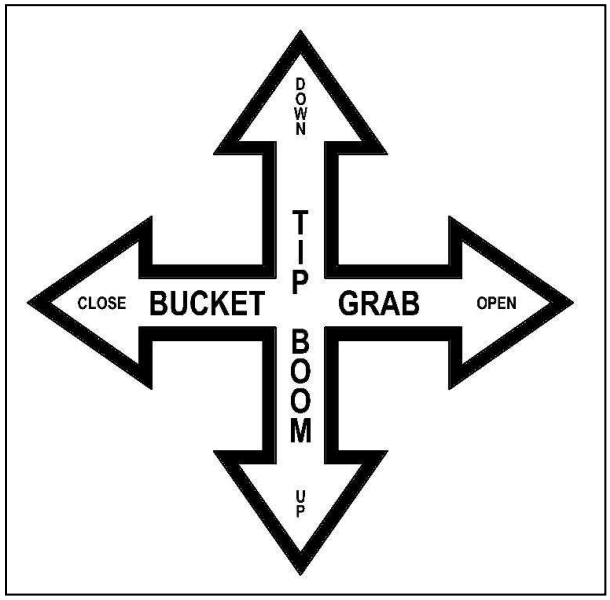


Joystick Base Control:

Boom Swing – Move the handle left to make the boom swing to the left. Move the handle right to make the boom swing to the right.

Boom Elevation – Pull the handle back to make the main boom to up. Push the handle forward to make the main boom go down.

Mini Joystick Primary Functions:



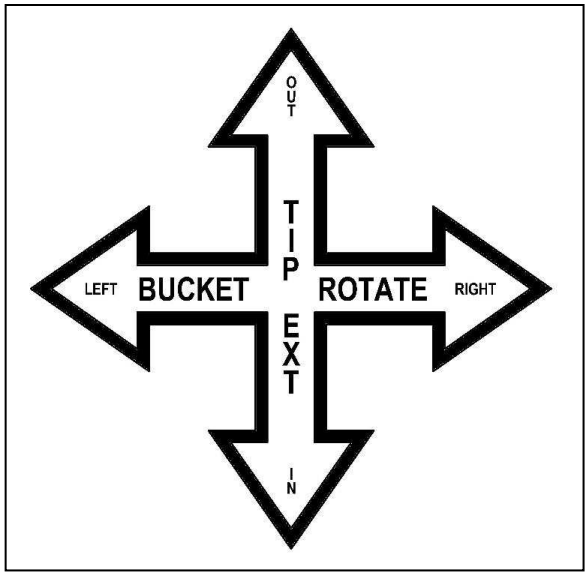
Bucket Grab – Move the mini joystick to the right to open the bucket. Move the mini joystick to the left to close the bucket.

Tip Boom Elevation – Move the mini joystick back to raise the tip boom. Move the mini joystick forward to lower the tip boom.

Model RL Loader with Electronic Single Joystick Control (continued)

Mini Joystick Secondary Functions:

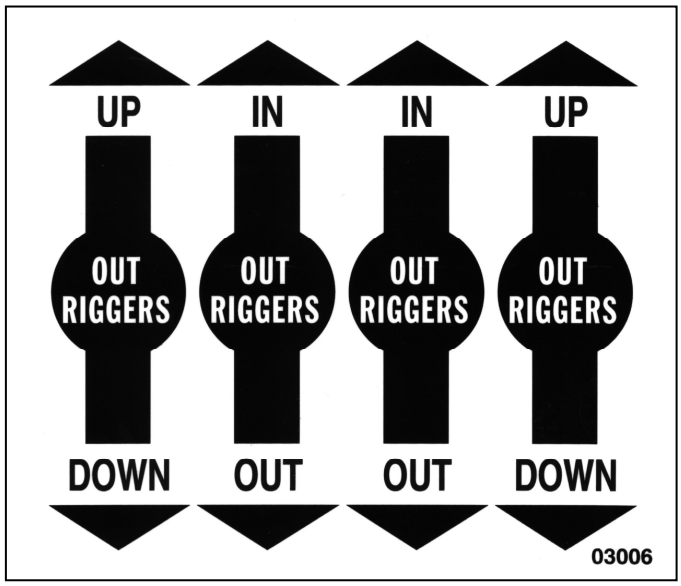
To activate these functions push and hold the trigger while activating the mini joystick. Releasing the trigger will allow the mini joystick to return back to primary functions.



Tip Extension – While holding the trigger move the mini joystick up to extend the tip extension or down to retract the tip extension.

Bucket Rotation – While holding the trigger move the mini joystick to the left to rotate the bucket to the left or to the right to rotate the bucket to the right.

Outrigger Operational Control Handles:



There are four handles. The two inside handles are for the outrigger in and out. The inside left is for the left outrigger, and the inside right is for the right outrigger. Pull the handle back to extend the outrigger horizontally and push the handle forward to retract the outrigger. The two outside handles are for the outrigger up and down functions. The outside left handle is for the left outrigger, and the outside right is for the right outrigger. Pull the handle back to extend the outrigger foot down and push the handle forward to retract the outrigger foot.

Controls for Model RL with Mechanical Joysticks (enclosed cab):

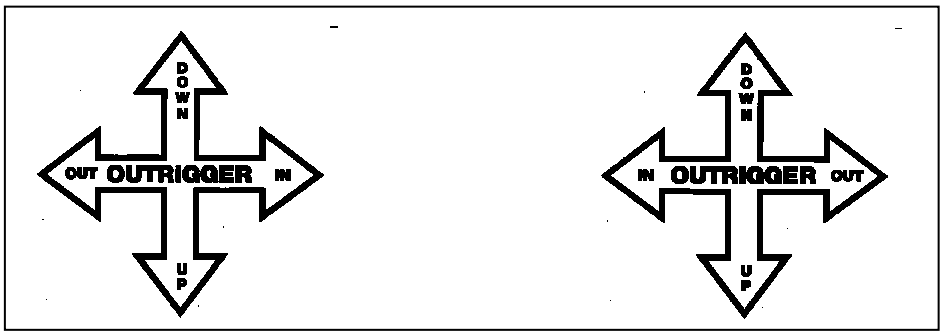
There is a joystick handles on each side of the operator's seat. The operating functions.

On the left side of the operator's seat toward the rear of the cab three are 4 levers to controls the outriggers. The round knob on the left controls the left outrigger, and the round knob on the right controls the right outrigger.

The optimum, safe method of operating the controls is by feathering. **Do not jerk the control levers to full speed, or from one extreme to another.** Feather the controls by moving the joystick smoothly from the neutral position to start motion. After a slow, smooth start, move the joystick control to extreme for full speed. Just before stopping movement, move the joystick control smoothly back to the neutral position.

On units equipped with dual walk-thru controls, always operate the loader on the side closest to the debris being loaded. Do not store any collectibles on the operator's platform, as they can create a tripping hazard or become lodged in the controls.

Controls for Model RL with Mechanical Joysticks (enclosed cab) (continued):



Left Outrigger Right Outrigger

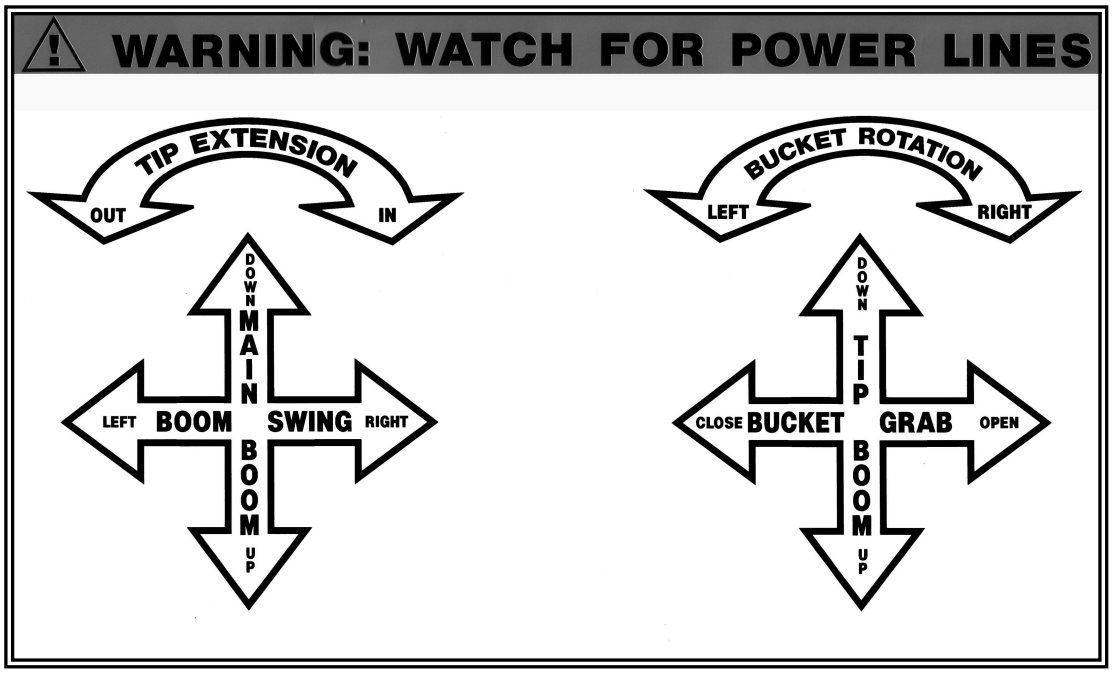
Left Outrigger Handle:

- Move the handle to the left to extend the left horizontal outrigger.
- Move the handle to the right to retract the left horizontal outrigger.
- Push the handle forward to lower the left vertical outrigger foot.
- Pull the handle back to raise the left vertical outrigger foot.

Right Outrigger Handle:

- Move the handle to the right to extend the right horizontal outrigger.
- Move the handle to the left to retract the right horizontal outrigger.
- Push the handle forward to lower the right vertical outrigger foot.
- Pull the handle back to raise the right vertical outrigger foot.

Loader Controls



Left Joystick:

Boom Swing: Move handle right to make boom swing right.
Move handle left to make boom swing left.

Main Boom: Pull handle back to raise boom.
Push handle forward to lower boom.

Tip Ext.: Twist handle counter-clockwise to extend tip extension out.
Twist handle clockwise to retract tip extension in.

Right Joystick:

Tip Boom: Pull the handle back to raise tip boom.
Push handle forward to lower tip boom.

Bucket Grab: Move handle right to open bucket.
Move handle left to close bucket.

Bucket Rot.: Twist handle clockwise to rotate bucket right (clockwise).
Twist handle counter-clockwise to rotate bucket left (counter-clockwise).

Model RL Loader with hydraulically driven HVAC system

This system consists of a rear cab wall mounted cooling and heating system. The cooling system is self-contained on back wall of the cab, no freon lines are ran from the chassis engine up to the loader cab. The heater uses coolant from the chassis engine to provide heat to the loader cab. The heater lines have an inline booster pump to facilitate the transfer the hot coolant up to the loader cab. The booster pump has a switch inside the chassis cab, which only needs to be turned on when heat is required in the loader cab.

Model RL Loader with hydraulic hitch

Some loaders may be built with a hydraulic pintle hitch that moves up and down using hydraulic power controlled by a controller mounted near the rear of the truck. A push-pull type switch is also mounted near the controller to ramp up the engine speed. This ramp up switch serves the same purpose as the switch near the operator's station. The engine is ramped based on pulling the switch up. You can also cancel the ramped engine speed from the other switch near the operator's station by pulling and then pushing the switch.

Model RL Loader with Suspension Locks

Suspension locks are a spring set, pneumatic released mechanism to lock out the truck rear suspension in order to improve stability when operating on tires. If equipped there is an air switch in the operators cab to engage the suspension locks. It is important that the truck tires be maintained at the maximum air pressure allowed by the tire manufacturer. The suspension lock valve switch has on and off positions. The suspension lock switch must be set to the "on" position prior to performing loader operations and set to off anytime the travel speed is over 10 mph. It may be necessary to slightly move the boom side to side in order for the teeth of the suspension lock to fully engage prior to commencing loader operation.

During normal trash loading operations, outriggers should not be required. Heavier loads at extended radii may require the use of outriggers. It is imperative for the operator to read, understand, and actively use the Load Capacity Chart. There is a Load Capacity Chart in the "Dia. & Drawings" section of this manual, and also one permanently installed inside the Upper Cab.

CAUTION: If you are in doubt of the weight of the load, use the outriggers. To achieve the full rated lifting capacity, the outriggers must be fully extended.

Part 5: Training

All members of the crew must become thoroughly familiar with the operation of controls, the correct operating procedures, maximum lifting capacities, and safety precautions before operating the loader. Operator training is essential. Always be prepared for an emergency. The following pages contain numerous safety precautions, information, and operating instructions that must be observed while performing work operations.

The health, safety and well-being of each member of the crew is of primary importance. Consequently, each member has an obligation to himself, and to his fellow workers, to make sure safe operating procedures are followed. All operating regulations recommended by the manufacturer, the employer and by municipal, state and federal agencies must be observed. The operating procedures set up in this manual are Petersen's recommendations and do not necessarily cover employer and governmental regulations. Each operator must know and observe those regulations.

Become familiar with all equipment checks. You should make daily equipment inspections and be able to spot any abnormality or malfunctions before beginning an assigned task, while working or after completing the task. There is a high degree of reliability built into your equipment, but there is always a possibility of mechanical failure or power failure due to incomplete service or abnormal wear. An operator should never take another's word. He should always thoroughly check the equipment himself.

Each crew member must receive thorough instructions on the care and maintenance of this machine, thus enabling him to identify and anticipate any problems that may occur. Knowing how the equipment operates will help you recognize when it is not operating properly and that repairs or adjustments are required.

Part 6: Setting Up at the Job Site

An important prerequisite to proper setting up at the job site is to thoroughly plan the lift before positioning the vehicle.

Always seek the best possible work site when parking the vehicle. An ideal parking location at a job site is firm, level dry ground or pavement, located in close proximity to the work station. Avoid uneven, rocky or muddy terrain, or steep grades. Location should be selected such that outriggers can be fully extended and the outrigger pad comes down on a firm, level surface. In the event that it is necessary to use the loader on an inclined surface, extreme care should be used. Loader slewing torque, stability, lifting capacity and other loader control functions may be affected adversely. Particular caution must be exercised with the swing function since a "downhill" inclined surface will increase the slewing speed and lengthen the time it takes to stop the motion. Your vehicle should be positioned in an area free from overhead obstructions and to allow performance of the entire task without repositioning, if possible. The operator must be familiar with the swing arc of the loader. You should position your vehicle so that the load is well within this arc. The swing arc is controlled by positive stops. Damaged or missing head and pedestal stops poses an unsafe condition by allowing the boom to swing too far resulting in damage to the swing actuator, which could also result in loss of boom swing control. Once the vehicle is in position for loading, please follow these precautions and procedures for loading:

<u>Precautions and Procedures for Loading:</u>

- Before leaving the cab, engage all safety lights, place the transmission in neutral, and set the truck brake.

- Always be aware of traffic conditions. Extreme caution should be taken when operating extendible outriggers where there is traffic. The operator should consider the possible safety hazard and take necessary precautions, such as using safety cones to mark the outriggers. The operator should also consider using safety cones to mark the vehicle, if the loading position interferes with traffic flow, or other conditions make the vehicle not easily visible.

- Before commencing work, make sure the debris you are going to load does not conceal any fixed objects, such as fire hydrants, guy wires, etc.

- The vehicle should be positioned so that it is impossible for any portion of the equipment to come within the minimum required safe distance to any energized power line. Maintain a clearance of at least 10 feet between any part of the loader and any electrical line. Remember, power lines deflect in winds and additional clearances must be allowed. Death or serious injury may result from contact or arcing due to inadequate clearance to anyone working on or around the loader. All overhead wires should be considered energized until the electrical utility authorities verify that they are not and the wires are visibly grounded.

- Do not operate the loader during electrical storms, when high wind conditions exist, or in poorly lighted conditions.

- Your loading area must be clear of people. Do not operate the loader, outriggers, or dump body if another person is within twenty feet of the equipment.

- Do not allow any person under a raised body or extended loader.

- If your model loader uses a ladder for access to the loader station, use provided handholds and steps. Face the steps when getting on and off. Never use controls as handholds. Do not mount the machine if handholds or steps are broken or missing. Repair them first.

Failure to heed these instructions can result in serious personal injury or death.

Part 7: Loading Procedures

Engage the power-take-off. For cold weather operation, allow the loader hydraulic system to reach operating temperature before commencing work.

For loaders with the tow package option, make sure the diverter valve is in the *"Loader "* position, and that you switch the swing (float) valve to the *"Engage"* or "Operate" position before beginning any loader functions.

<u>Caution:</u> Remember that when the swing (float) valve is in the *"Disengage"* or "Float" position, the boom will swing without hydraulic resistance. Therefore, it is imperative that you ensure that the swing (float) valve is in the *"Engage" or "Operate"* position prior to raising the boom.

Before conducting any boom operations, extend all outriggers to level the loader side to side. When extending outriggers out and down, ensure that the vehicle is stabilized. To develop rated load capacity, the outriggers should be fully extended. Provide blocks, if necessary, to level the unit on sloping ground or bearing pads if the outriggers tend to sink into soft terrain. Some concrete surfaces are relatively thin and cannot withstand outrigger loading. Concrete can break through and cause instability.

Remember this safety information regarding the outriggers:

- **Keep feet clear of outriggers at all times to avoid serious crushing injury.**
- **Failure to use the outriggers or suspension locks when loading may create an unstable condition, including the loader overturning, that could result in serious personal injury or death.**

Do you know the load capacity of the loader? Refer to the "Load Capacity Chart" in this manual for information regarding load capacities. The "Load Capacity Chart" is also riveted to the pedestal of the loader. Do not attempt to lift more than the capacities shown on the load chart for your model loader at the correct radius.

For loaders with manual throttle controls, set the throttle control to desired RPM, depending on loading conditions. Remember, DO NOT exceed the preset throttle control setting of 1400 rpm.

To make the lift:

1. Raise boom and swing to trash pile. Use tip extension, if needed, and rotate bucket so that it is aligned with trash.
2. Open the bucket, lower around trash, and close the bucket so that you have a firm grip on the trash. Raise the boom slightly and activate the bucket grab once again to make sure you have a firm grip on the trash.
3. Lift and swing the load over the dump body. In order to minimize the height and stress on the boom, it is recommended that the tip extension be retracted prior to swinging the load. It is recommended to load the front of the body first.

When loading the dump body, please follow these precautions:

- **Do not** use the bucket to crowd the load to the front of the dump body as you can damage the bucket and other loader components.
- **Do not** overload the dump body. For units with tow trailers, you must have room to stow the bucket within the body sides for travel.
- **Do not** allow limbs or other debris to protrude from the dump body.
- **Do not** excessively pack the load. Excess packing could result in dump body floor damage and loader damage.

Continue the loading procedure until all trash is loaded. If it is necessary for the operator to manually rake any remaining trash into a smaller pile, the boom must be stowed in the dump body or on the ground, and the PTO disengaged when the operator leaves the control station.

Please follow these additional loading precautions at all times:

- Do not leave a load suspended when the operator is away from the control station.
- Do not leave the bucket suspended during travel. Any time the loader vehicle is moving, the bucket must be stowed in the tow trailer. On units without a tow trailer, the bucket must be racked. **An unsupported, suspended bucket, could create a safety hazard that could result in damage to the equipment, damage to other structures in close proximity, and/or personal injury or death.**
- Only operate the loader from the operator's station. Do not attempt to operate the loader from any position other than the operator's station.
- Never climb on operator controls or other loader components.
- Do not sit or stand at operator control station when truck is in motion. The control station is to be manned only when the vehicle has been parked and the procedures we previously discussed have been followed for setting up to load.

To make the lift:

1. Raise boom and swing to trash pile. Use tip extension, if needed, and rotate bucket so that it is aligned with trash.
2. Open the bucket, lower around trash, and close the bucket so that you have a firm grip on the trash. Raise the boom slightly and activate the bucket grab once again to make sure you have a firm grip on the trash.
3. Lift and swing the load over the dump body. In order to minimize the height and stress on the boom, it is recommended that the tip extension be retracted prior to swinging the load. It is recommended to load the front of the body first.

When loading the dump body, please follow these precautions:

- **Do not** use the bucket to crowd the load to the front of the dump body as you can damage the bucket and other loader components.
- **Do not** overload the dump body. For units with tow trailers, you must have room to stow the bucket within the body sides for travel.
- **Do not** allow limbs or other debris to protrude from the dump body.
- **Do not** excessively pack the load. Excess packing could result in dump body floor damage and loader damage.
- **Do not** allow the bucket to swing beyond parallel to the tip boom. If the bucket flips up beyond parallel it can cause damage to loader components.

Continue the loading procedure until all trash is loaded. If it is necessary for the operator to manually rake any remaining trash into a smaller pile, the boom must be stowed in the dump body or on the ground, and the PTO disengaged when the operator leaves the control station.

Please follow these additional loading precautions at all times:

- Do not leave a load suspended when the operator is away from the control station.
- Do not leave the bucket suspended during travel. Any time the loader vehicle is moving, the bucket must be stowed in the tow trailer. On units without a tow trailer, the bucket must be racked. **An unsupported, suspended bucket, could create a safety hazard that could result in damage to the equipment, damage to other structures in close proximity, and/or personal injury or death.**
- Only operate the loader from the operator's station. Do not attempt to operate the loader from any position other than the operator's station.
- Never climb on operator controls or other loader components.

- Do not sit or stand at operator control station when truck is in motion. The control station is to be manned only when the vehicle has been parked and the procedures we previously discussed have been followed for setting up to load.
- Do not attempt to lift loads exceeding manufacturer's recommended safe working capacity.
- Do not impose lateral loads on the boom.
- Do not use stability to determine safe working load.

To cover the load:

When using a Petersen manufactured and installed load cover, please follow these procedures:

1. Knuckle the bucket to the front of the dump body.
2. Hook the tarp chain to the hook on the bucket.
3. Extend the boom to cover the debris, and rest the bucket on the load.

To stow the boom and bucket:

The boom and bucket must be racked when traveling without a tow trailer. To rack the bucket, follow these instructions.

1. Center the main boom over the bucket rack.
2. Open bucket, and rest on bucket rack.
3. Lower main boom. Boom height must not be above legal height of 13’6”.

When traveling with a tow trailer the boom and bucket must be stowed in the trailer. There are two proper ways to stow the bucket in the dump body. In each case the bucket sides should be parallel to sides of the dump body. The operator can either stow the bucket in the opened position on the body floor, or roll the closed bucket over on top of the load. In both cases it is necessary for the operator to leave room in the dump body to stow the boom and bucket. Always ensure that at least half of the bucket and tip of the boom are below the top of the body sides before travel.

Bucket Roll Method:

The rear of the dump body must be at least half full in order to use the bucket roll method for stowing the boom and bucket.

1. Use the control handles on the curb side.

2. Close the bucket and rotate until bucket sides are parallel to body sides.

3. Move the bucket to the curb side rear inside corner of the dump body.

4. Rest the bucket on the load.

5. Simultaneously boom down and swing the boom to the street side until the boom tip and at least half of the bucket are below top of body sides. Ensure that no part of the loader or load is over legal height of 13 ft. 6 in.

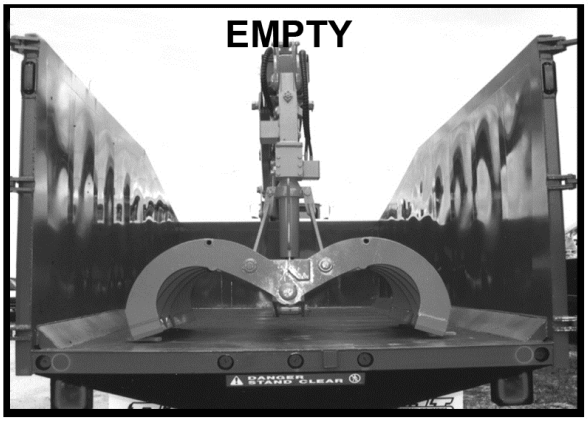
Once the boom and bucket have been stowed in the trailer for travel, remember to set the swing (float) valve to the *"Disengage"* or "*Float*" position.

Please see illustrations on the following page for examples of correct and incorrect ways to stow the bucket for travel.

WARNING! – Failure to stow the boom and bucket as instructed could allow the boom to slew (swing) and the bucket to fall outside of the body. Loss of boom control with the bucket outside of the dump body could result in damage to objects in the vicinity of the grapple truck, and/or serious injury or death to people in the vicinity of the grapple truck.

Once the bucket has been properly stowed for travel, retract all outriggers, disengage the PTO, and pickup any safety cones or markers that were used. Release the parking brake, and you're ready to travel to the dump site.

CORRECT METHODS OF STOWING THE BOOM & BUCKET



- BUCKET OPEN AND AT REST ON DUMP BODY FLOOR.

NOTE: FOR ILLUSTRATION PURPOSES REAR DUMP BODY DOORS ARE SHOWN OPEN. REAR DUMP BODY DOORS MUST BE CLOSED AND LOCKED EXCEPT WHEN DUMPING THE LOAD

- BUCKET ROLLED OVER WITH JAWS TO RIGHT REAR OF DUMP BODY
- BOOM AT SAFE TRAVEL HEIGHT & BOOM TIP BELOW TOP OF BODY SIDES
- MORE THAN 1/2 OF BUCKET MUST BE BELOW TOP OF BODY SIDES
- LOAD COVER DEPLOYED

INCORRECT METHODS OF STOWING THE BOOM & BUCKET

- BUCKET NOT CONFINED INSIDE OF DUMP BODY
- DEBRIS HANGING OUTSIDE OF DUMP BODY
- BOOM OVER LEGAL HEIGHT OF 13 FT. 6 IN.

- BOOM OVER LEGAL HEIGHT OF 13 FT. 6 IN.
- BUCKET NOT CONFINED INSIDE OF DUMP BODY
- DEBRIS HANGING OUTSIDE OF DUMP BODY

Part 8: Dumping the Load

As you prepare to dump the load, it is important that you choose a level, firm area. Each of the following steps must be followed precisely and in sequence. The procedure must not be done in a hurried manner.

1. Set the parking brake.

2. Open the rear dump body doors and latch them back. Use caution when opening doors, as items placed against doors could fall suddenly when doors are opened and cause injury.

3. Engage the power-take-off.

4. Set the diverter valve to the *"Loader"* position.

5. Set the swing (float) valve to the *"Engage" or "Operate"* position prior to raising the boom.

6. Extend the outrigger on both sides and lower to within six to eight inches of the ground. This allows for emergency stabilization, and movement of the truck.

7. Raise the main boom to the maximum elevation and keep it centered over the dump body during the entire dumping procedure.

8. Place the tip boom at a position so that it will not contact the bulkhead of the body when the body is raised. Do not swing the boom to either side during the dumping procedure, as the outriggers are not fully lowered

9. If your load is covered with a tarp, as discussed in "Covering the Load", retract the tarp.

10. Shift the diverter valve to the *"Trailer"* mode (if applicable).

11. Activate the body dump handle located on the trailer tongue. Slowly raise the body to empty the load. Make sure you avoid contact between the main boom and tip boom, and the dump body.

12. If the emptied pile prevents complete dumping of body contents, disengage the PTO. SLOWLY move the truck forward to complete dumping of the body. Remember, the outriggers are partially down and the boom is raised. Extreme caution should be used during this procedure.

    This is not a procedure to force debris out of the dump body. If there is debris stuck in the dump body, lower the dump body and dislodge the debris with the loader.

13. When you have finished dumping the load, lower the dump body. Shift the diverter valve to the *"Loader"* mode.

14. Stow the boom and bucket in the dump body with the bucket open and resting on the body floor. Raise and retract the outriggers. Set the swing (float) valve to the *"Disengage"* or "Float" position.

15. Disengage the power-take-off. Close and lock body rear doors.

Please note: The preceding instructions are for Petersen manufactured systems. Different dumping instructions may apply when using shuttle trucks and/or trailers of other manufacturers.

Safety Precautions Regarding Dumping Procedure:

- Do not dump the load until the rear body doors are latched open. The doors and body hinges can be damaged if doors are allowed to swing freely during the dumping procedure.

- Do not travel with rear body doors open. They must be closed and locked for travel.

Part 9: Procedures for Disconnecting and Connecting the Tow Trailer

Procedures for Disconnecting Trailer:

1) Park the truck and trailer on level ground. Engage the parking brake and power-take-off.

2) Shift the swing (float) valve to the *"Engage" or "Operate"* position. Raise the boom and bucket high enough to clear the bulkhead of the trailer.

3) Shift the diverter valve to the *"Trailer"* mode (if applicable).

4) Block trailer wheels to prevent trailer movement.

5) Disconnect the trailer brake lines, safety lights, and chains.

6) Unlatch pintle hook, lower jack stand or trailer hitch, and raise trailer tongue from pintle hook.

7) Shift the diverter valve to the *"Loader"* mode to prevent hydraulic oil from circulating through the trailer hoses when they are disconnected.

   CAUTION! – Hot hydraulic fluid can cause serious personal injury.

8) Disconnect the hydraulic lines.

9) Disengage the power-take-off, release the parking brake, and pull the truck forward.

If the operator is not going to hook up another trailer, he must set the parking brake, engage the power-take-off, and rack the boom and bucket for safe travel. Remember, the swing valve is in the *"Engage"* or "*Operate*" position when the bucket is racked for travel.

IMPORTANT NOTE! The preceding instructions for connecting, dumping, and disconnecting the trailer are for Petersen manufactured systems. Different dumping instructions may apply when using shuttle trucks of other manufacturers.

Procedures for Connecting the Trailer:

1) Block the trailer wheels to prevent trailer movement until the tow vehicle is connected.

   Caution: Weight of trailer tongue on jack stand is not a secure brake.

2) With the swing (float) valve in the *"Engage"* or "*Operate*" position, raise the boom and bucket into position so that they will clear the bulkhead of the trailer.

3) Back the truck up to align the pintle hook on the truck with the pintle eye on the trailer. If the pintle eye is not on the same level as the pintle hook, you must hook up the hydraulic lines to raise or lower the jack stand.

4) To raise or lower the jack stand, shift the diverter valve to the *"Trailer"* mode, engage the power-take-off, and raise or lower the jack stand to the correct height.

5) Back the truck until the pintle hook is below the pintle eye.

   CAUTION - If you need to back the truck, make sure the truck does not roll forward when you release the parking brake. If you allow the truck to roll forward, you may cause severe damage to the hydraulic lines.

6) Lower the trailer tongue onto pintle hook carefully, latch the pintle hook, then raise the jack stand to its maximum height for maximum ground clearance.

7) Connect the safety lights, chains, and brake connection.

8) Shift the diverter valve to the *"Loader"* mode, and connect the hydraulic lines if not done so previously. Lower the boom and bucket into the trailer. The bucket should be open, and at rest on the trailer floor.

9) Shift the swing valve to the *"Disengage" or "Float"* position so that it is in the traveling position.

10) Disengage the power-take-off and check the trailer lights to make sure they are operating properly.

Remember: Make sure the swing valve is in the *"Disengage"* or "Float" position for travel, when the bucket and boom are stowed in the trailer body. When the bucket is racked on the loader vehicle, the swing valve must be in the *"Engage"* or "Operate" position.

Part 1: Safety Procedures and Precautions for Service and Repair

A regular schedule of maintenance is essential to keep your unit at peak operating efficiency. Operators or service personnel responsible for the care of the unit must be completely familiar with the type and frequency of inspections, maintenance, and lubrication operations to be performed.

Always keep the loader free from sand and other foreign particles to ensure trouble-free operation and to avoid excessive wear. Air entering the oil tank carries with it small quantities of impurities and moisture. The hydraulic oil should be drained at least once a year to rid the system of any contamination and condensation.

The hydraulic circuit diagram is included in the "Dia. & Drawings" section of this manual for service or maintenance information.

Make sure you observe the following procedures and precautions when performing maintenance and/or repairs on your equipment.

Safety Procedures and Precautions for Service and Repair

- Do not perform any work on the loader unless you are qualified and authorized to do so.
- Loader is placed where it will cause the least interference with other equipment or operations in the area.
- All controls at the off position and all operating features in neutral position.
- Do not attempt to clean, oil or service a loader when the power-take-off is engaged.
- Deactivate means for starting. Use lockout-tagout procedure. See lock-out/tag-out procedures on following page.
- Bucket and boom at rest on ground or floor of dump body.
- Do not disconnect hydraulic connections under pressure. Hot hydraulic fluid can cause serious injury. Stay clear of hydraulic leaks as high pressure and hot hydraulic fluid can cause serious injury.
- Always use dump body prop(s) before servicing or repairing body or hoist. Never leave the body raised or partly raised while vehicle is unattended or while performing maintenance or service under the body, unless the body is braced to prevent accidental lowering.

Lock-out/Tag-out Procedure (LOTO)

1. With the vehicle parked on level firm ground, set the parking brake and chock the wheels.

2. Place operating equipment at lowest potential energy level or position so as not to be subject to possible free fall, and/or install additional blocking device(s) to prevent this potential for any raised or elevated equipment such as bodies, tail or side gates, booms, bucket or other attachments.

3. If work on the bucket is required, place the bucket outside the body by first setting the outriggers, second, positioning the bucket over the side of the truck and finally, lowering the boom until the bucket is on the ground.

4. If it is necessary to raise the body during LOTO, the body prop must be in place to secure the body from falling.

5. Disengage the PTO and shut down the truck engine.

6. Remove the key from the ignition.

7. Using a non-reusable fastener, secure a LOTO tag to the steering wheel indicating the vehicle is out of service.

8. Relieve stored energy from the hydraulic components by moving each control handle back and forth several times. Cylinders equipped with either pilot operated check or counterbalance valves will not function unless under hydraulic power.

Modification to any part of the loader can create a safety hazard and therefore shall not be made without the manufacturer's written approval. It is important that you use factory replacement parts to ensure that size and capacity are as the original parts.

It is important that hydraulic components be rated at proper flow and pressure. If your loader is rebuilt or remounted, mounting procedures and retesting is required in accordance with factory instructions.

Disconnecting, removing, or disabling any part or component which controls the speed of the loader is a misuse of the loader.

The following lists inspections and maintenance which are to be conducted on your unit to help assure it is operating properly and safely. These inspections are in addition to any inspections previously listed, such as daily inspections. Check all items at the frequency listed and make necessary repairs prior to operating.

The following are minimum service requirements. Hard use or dirty operating conditions dictate more frequent inspection and maintenance.

After service adjustment, and repairs, the loader shall not be returned to service until all guards have been reinstalled, trapped air removed from the hydraulic system if required, safety devices reactivated, and maintenance equipment removed.

Part 2: Service:

EVERY 40 HOURS	
Grease all fittings.	See Grease and Maintenance Diagram in the “Dia. & Drawings” section of this manual. Grease fittings that are worn and will not hold the grease gun, or those that have a stuck check ball, must be replaced. Grease = EP2 (Extreme Pressure)
Check hydraulic hoses for cuts or abrasions, or any evidence of binding or leakage.	Replace any damaged hoses.
Check all hydraulic fittings to make sure they are in place and do not show signs of leakage.	Replace any missing, damaged or modified fittings.
Tighten bucket brake pads.	If brake pads show excessive wear, replace. Tighten gimbal rotator bolt and tip boom gimbal bolt, if needed.
Check oil level.	All oil levels are to be checked with the loader parked on a level surface in transport position, and while the oil is cold, unless otherwise specified. Oil level should be two to three (2 to 3) inches from top of tank. Hydraulic Oil = AW32
Check engine overspeed control for proper setting.	Check by reving the engine to exceed 1750 RPM, at which point the PTO light should turn off if the engine overspeed is properly set. Reset if necessary.
Check the engine throttle control for proper setting.	1400 RPM
Check lock collar for excess clearance.	Lock collar must be tight against bottom of spindle bearing housing with maximum gap of one-quarter inch (1/4").
Check back-up and boom-up alarms to make	Repair or replace if needed.

sure they are working properly.	

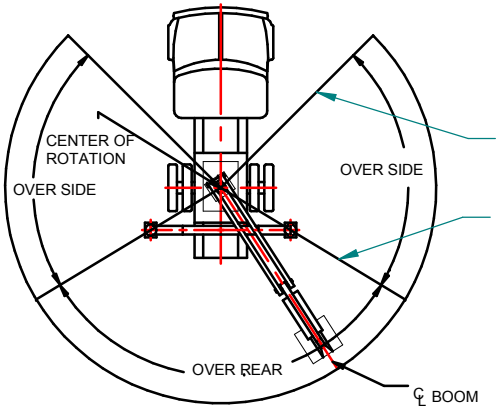
EVERY 80 HOURS *(These requirements are in addition to the 40 hour service requirements.)*	
Re-torque boom swing actuator bolts.	To 500 ft. lbs. (for HA36) To 250 ft. lbs. (for Planetary Gearbox)
Re-torque bucket rotator bolts.	To 110 ft. lbs. - dry threads

EVERY 160 HOURS *(These requirements are in addition to the 80 hour service requirements.)*	
Examine all loader pivot points (head and pedestal, main boom, tip boom, bucket and body) for visible play.	If visible play is observed at pivot points, bushings and/or pins must be replaced as needed.
Chassis - Check truck frame for cracks, loose or missing bolts, rivets, damaged springs or loose shackles.	See truck manufacturer's service manual for service and repair instructions.
Structurals - Visually inspect complete loader for damage, especially cracks in weldments.	It is necessary for your loader to clean of oil and grease for these inspections to be made. The Petersen rotating head assembly has special high strength steel components that are welded together. After welding, the entire assembly receives post-weld heat treatment. **Do not** weld on the rotating head assembly. Welding on the rotating head could reduce its load bearing capacity and fatigue life.
Fasteners - Check all pins, sheaves, retainers, bolts and nuts.	Replace damaged or missing parts.
Retighten main boom and tip boom connecting bolts.	Replace if needed.
Check PTO and pump drive train.	Check for loose or missing bolts. Replace seals if needed.
Re-torque loader tie-down bolts.	To 400 ft. lbs. - dry threads
Decals - Check for presence and legibility.	Check decal listing in "Part 3: Safety Devices – Safety Symbols" of this manual for required operational and safety decals. Replace missing or illegible decals.

EVERY 600 HOURS OR 6 MONTHS *(These requirements are in addition to the 160 hour service requirements.)*	
Clean hydraulic oil filter(s) on suction line, replace return line filter cartridge, replace breather. Note the breather may be integral with the oil tank cap.	

EVERY 3000 HOURS *(These requirements are in addition to the 600 hour service requirements.)*	
Change oil in the planetary gearbox	Drain existing oil from swing

REV.	DESCRIPTION	DATE	BY
1	ADD TO TL3 CHART LOADS WITH TIP EXT RETRACTED, CHANGE BUCKET WEIGHT 1000 LB	02/23/01	-
2	ADD TO RL3 AND SL3 LOADS WITH TIP EXT RETRACTED	02/27/01	-
3	ADD NOTES TO MEET ASME B30.22	02/07/02	-
4	ADD DL3 AND UPDATE RL3 TABLE	08/29/06	-



NOTE: THESE LINES DETERMINE THE LIMITING POSITION OF ANY LOAD FOR OPERATION WITHIN WORKING AREAS INDICATED

LOAD DIAGRAM FOR MODELS RL 2 & RL 3

MODEL TL 2		
RADIUS	No 1 OUTRIGGERS	No. 3 OUTRIGGERS
10 ft	5320 lb *	7100 lb
16 ft	2650 lb *	3750 lb

MODELS TL 3, PL 3, HL 3 & BL 3 & DL3 OUTRIGGERS EXTENDED		
RADIUS	TIP EXTENSION RETRACTED	TIP EXTENSION EXTENDED
10 ft	7100 lb	7100 lb
16 ft	3750 lb	4400 lb
20 ft	-	3200 lb

MODEL RL 2 WITH OUTRIGGERS EXTENDED		
RADIUS	OVER SIDE	OVER REAR
10 ft	5500 lb *	7100 lb
16 ft	3100 lb *	3750 lb

MODEL RL 3 WITH OUTRIGGERS EXTENDED			
RADIUS	OVER SIDE	OVER REAR	
		TIP EXTENSION RETRACTED	TIP EXTENSION EXTENDED
10 ft	5500 lb *	7100 lb	7100 lb
16 ft	3100 lb *	3750 lb	4400 lb
20 ft	1800 lb *	-	3200 lb

RADIUS	MODEL SL 2	MODEL SL 3	
		TIP EXTENSION RETRACTED	TIP EXTENSION EXTENDED
10 ft	7100 lb	7100 lb	7100 lb
16 ft	3750 lb	3750 lb	4400 lb
20 ft	-	-	3200 lb

Weight of attachment to be subtracted from lift capacities. Standard Trash bucket weighs 1000 lbs.

Radii are measured in feet from the center of rotation to the center of the bucket

Loads marked with (*) are limited by the stability of the loader.

Loads for the loader on outriggers represent 85% of vehicle tipping moment when the vehicle is on firm level ground.

Boom length with tip extension retracted is 16 feet. Boom length with tip extension extended is 20 feet.

Tip Boom Extension function is not to be used for load lifting. This function is only for load reaching or to improve load-lifting capacity.

Do not use these load chart values to predict load capacities at other radii.

Tire pressures must be in accordance to the tire manufacturer's recommendations.

TOLERANCES

1 DEC.	± 0.100
2 DEC.	± 0.050
3 DEC.	± 0.010
ANGLE:	± 1.000°
FRACTION:	± 1/32"
DIM. UNITS:	INCHES
SURFACE FINISH:	125/32

UNLESS OTHERWISE SPECIFIED

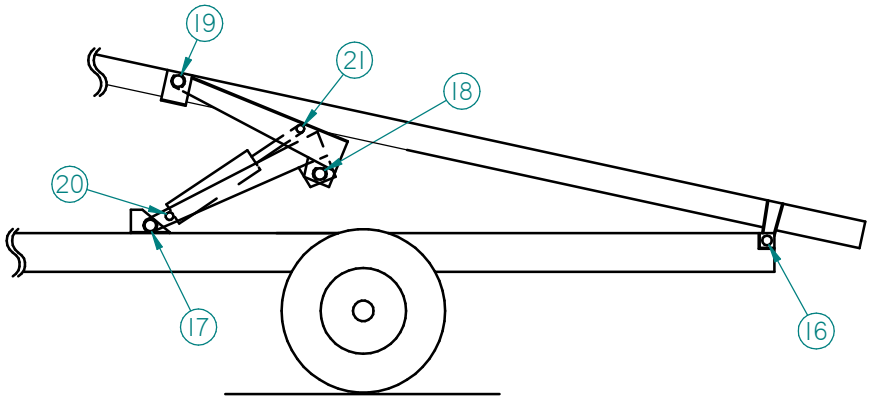
DEC. = DECIMAL PLACE(S)

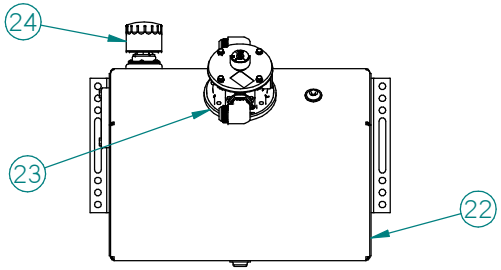
PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

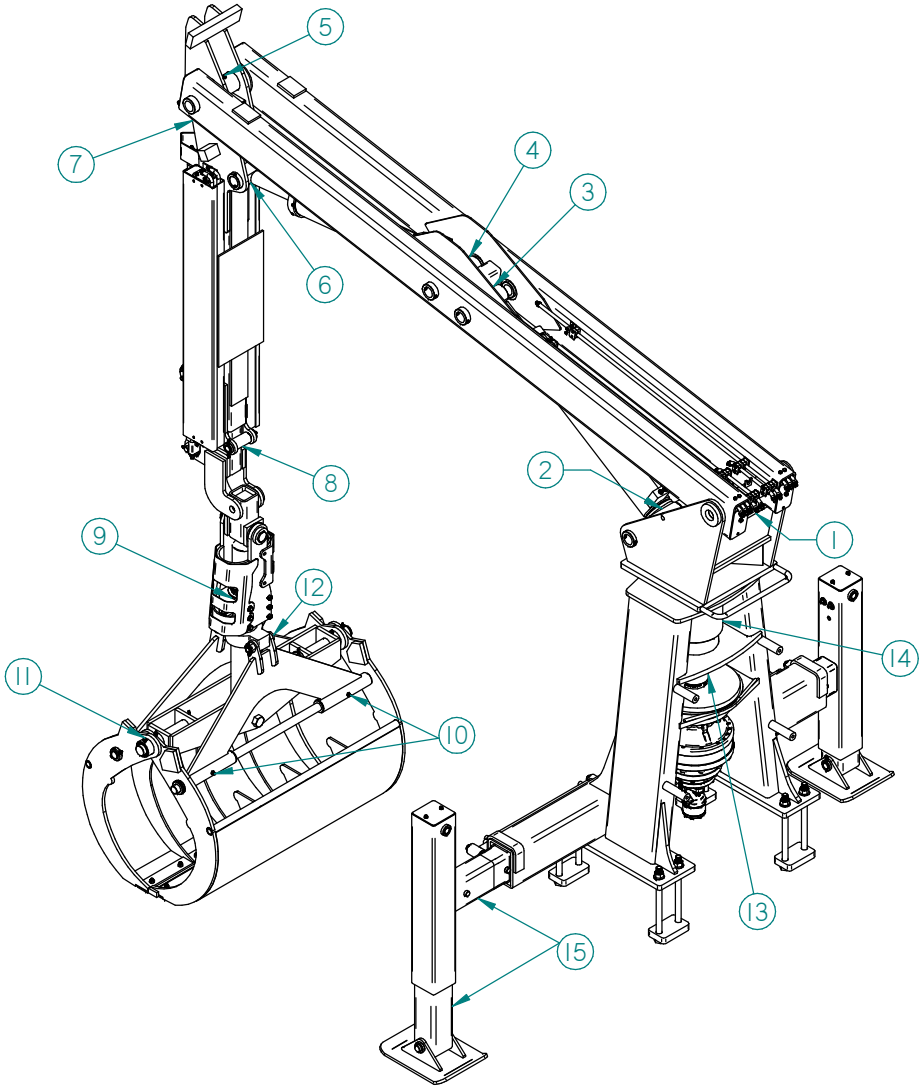
TITLE: LOAD CHART FOR TRASH LOADERS

PART NUMBER:	SCALE:
01 00 00 003 4	NA

DRAWN BY:	APPROVED BY:	DATE:	SHEET:
EJB		08/31/99	1 OF 1







Point Number	Maintenance Description	Number of Points	Lubricant	Application Method	Frequency
1	Main Boom Pivot	1	Grease	Pressure	40 Hours
2	Main Boom Lift Cylinder Base End	1	Grease	Pressure	40 Hours
3	Main Boom Lift Cylinder Rod End	1	Grease	Pressure	40 Hours
4	Tip Cylinder Base End	1	Grease	Pressure	40 Hours
5	Tip Boom to Main Pivot	1	Grease	Pressure	40 Hours
6	Tip Cylinder Rod End	1	Grease	Pressure	40 Hours
7	Tip Extension Tube	1	Grease	Pressure	40 Hours
8	Tip Extension Roller	1	Grease	Pressure	40 Hours
9	Rotator Housing Manifold	2	Grease	Pressure	40 Hrs / 20 Hrs Service
10	Bucket A Frame Spools	4	Grease	Pressure	40 Hrs / 20 Hrs Service
11	Bucket Main Pivot	4	Grease	Pressure	40 Hrs / 20 Hrs Service
12	Bucket A Frame Connect Pivot	2	Grease	Pressure	40 Hrs / 20 Hrs Service
13	Spindle Bottom Bearing Housing	1	Grease	Pressure	40 Hours
14	Spindle Top Bearing Housing	1	Grease	Pressure	40 Hours
15	Outrigger Inner Tubes	4	Grease	Brush	80 Hours
16	Rear Body Hinge	2	Grease	Pressure	40 Hours
17	Hoist Lower Pivot	2	Grease	Pressure	40 Hours
18	Hoist Scissors Pivot	3	Grease	Pressure	40 Hours
19	Hoist Upper Pivot	2	Grease	Pressure	40 Hours
20	Hoist Cylinder Lower Pivot	2	Grease	Pressure	40 Hours
21	Hoist Cylinder Upper Pivot	2	Grease	Pressure	40 Hours
22	Hydraulic Tank	1	ISO 32 Hyd. Oil	Fill to Max. Level	40 Hours
23	Hydraulic Filters	1	OT03007	Replace	1000 Hours
24	Hydraulic Tank Breather	1	OT05007	Replace	1000 Hours
25	Gearbox (if applicable)	1	80w Gearlube	Replace	3000 Hours

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TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: TL3 MAINTENANCE POINTS

PART NUMBER: 01 00 00 008 2

SCALE: 1:20

DRAWN BY: BRB

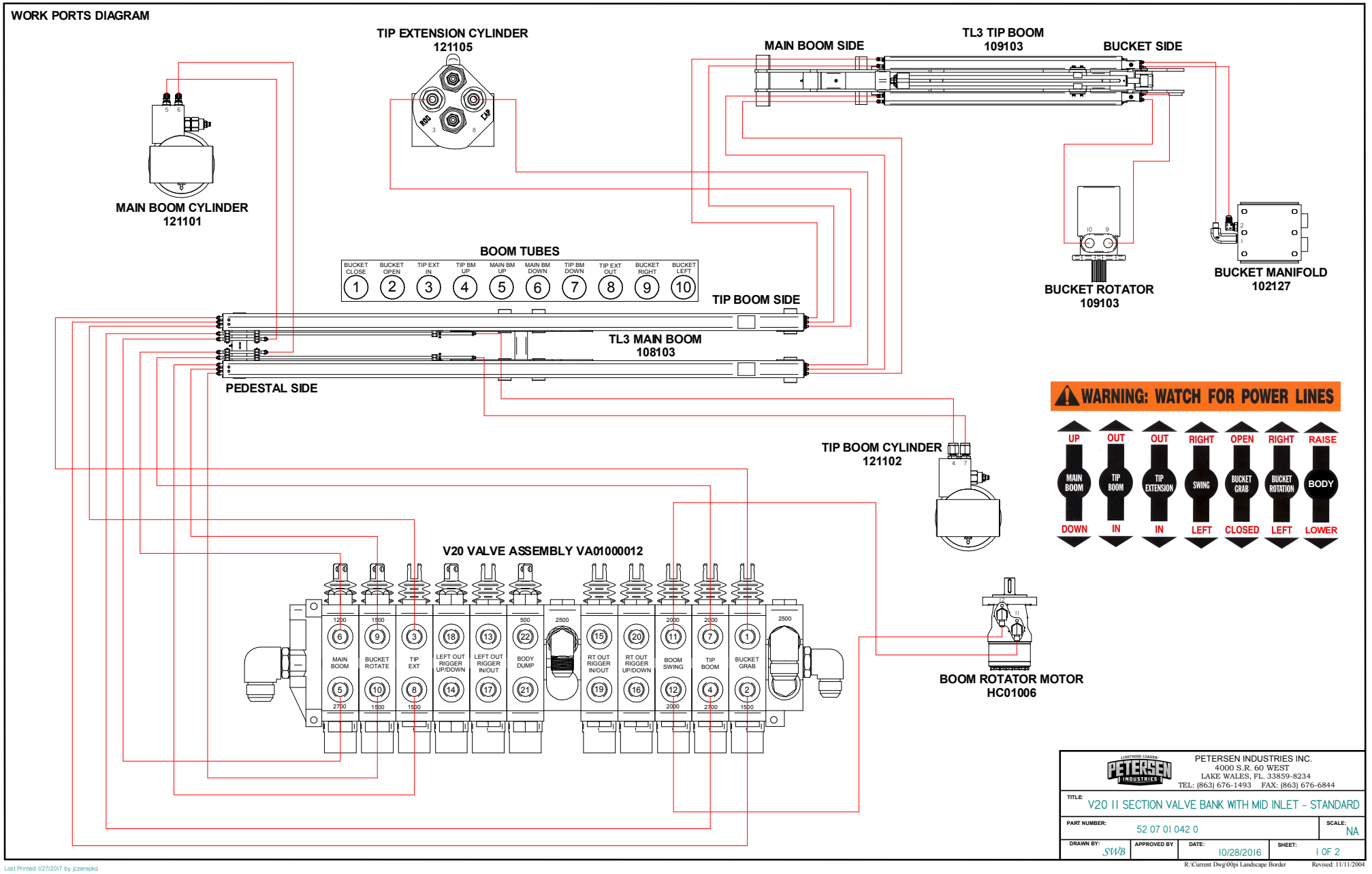
APPROVED BY:

DATE: 8/24/2016

SHEET: 1 OF 1

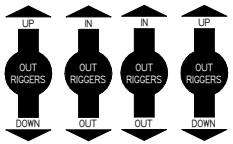
Labeled Wire and Color List			
Wire Label	**Part Number Printed on Wire**	**Wire Gauge**	**Wire Color**
TCM 143	EL03005LGR-143	16	Light Green
TCM 145	EL03005BL-145	16	Blue
TCM 130	EL03005YE-130	16	Yellow
ENGINE KILL	EL03005GY-K	16	Gray
THROTTLE	EL03005TN-THR	16	Tan
HORN	EL03005WH-H	16	White
STROBE	`	16	Orange
WORK LIGHT	EL03005OR-WL	16	Orange
STREET SIDE WORK LIGHT	EL03005OR-SWL	16	Orange
CURB SIDE WORK LIGHT	EL03005OR-CWL	16	Orange
12 VOLT IGN	EL03009RD-12v	14	Red
PTO LIGHT/FEEDBACK	EL03005LBLU-PTO	16	Light Blue
Ground	EL03005BLA-GR	16	Black
Use for Atlas Solenoids			
O/R Left Up	EL03005YE-LU	16	Yellow
O/R Left Down	EL03005GR-LD	16	Green
O/R Left In	EL03005BLA-LI	16	Black
O/R Left Out	EL03005BLU-LO	16	Blue
O/R Right Up	EL03005PI-RU	16	Pink
O/R Right Down	EL03005VI-RD	16	Violet
O/R Right In	EL03005BR-RI	16	Brown
O/R Right Out	EL03005OR-RO	16	Orange
Body Dump	EL03005LBLU-BD	16	Light Blue
Use For Rear Steer			
O/R Right Up	EL03005PI-RU	16	Pink
O/R Right Down	EL03005VI-RD	16	Violet
O/R Right In	EL03005BR-RI	16	Brown
O/R Right Out	EL03005OR-RO	16	Orange
Body Dump	EL03005LBLU-BD	16	Light Blue
REMOTE START/STOP	EL03005BR-SS	16	Brown
RS2 Throttle Voltage	EL03005RD-TH	16	Red
RS2 Throttle Ground	EL03005BLA-TH	16	Black
RS2 Throttle Signal	EL03005WH-TH	16	White

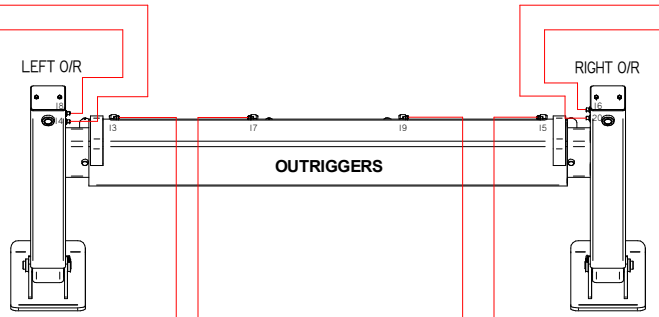
WORK PORTS DIAGRAM



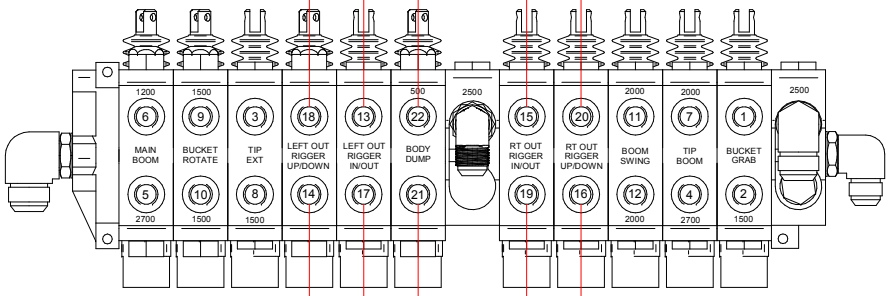
PETERSEN INDUSTRIES INC. 4000 S.R. 60 WEST LAKE WALES, FL. 33859-8234 TEL: (863) 676-1493 FAX: (863) 676-6844			
TITLE: V20 11 SECTION VALVE BANK WITH MID INLET - STANDARD			
PART NUMBER: 52 07 01 042 0			SCALE: NA
DRAWN BY: SWB	APPROVED BY	DATE: 10/28/2016	SHEET: 1 OF 2

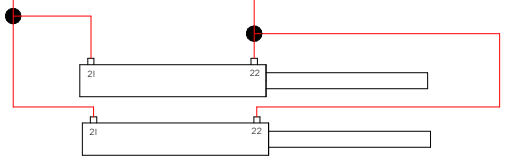
WORK PORTS DIAGRAM (CONTINUED)





V20 VALVE ASSEMBLY VA01000012





BODY HOIST CYLINDERS

NOTE: ON 22' BODIES AND LARGER HOIST IS POWER UP & GRAVITY DOWN. UP PORT RELIEF IS THEN SET TO 3100 PSI AND MAIN RELIEF IS SET TO 3000 PSI. DEPENDING ON CONTROL OPTION BODY HOIST VALVE MAYBE SEPERATE VALVE BANK.

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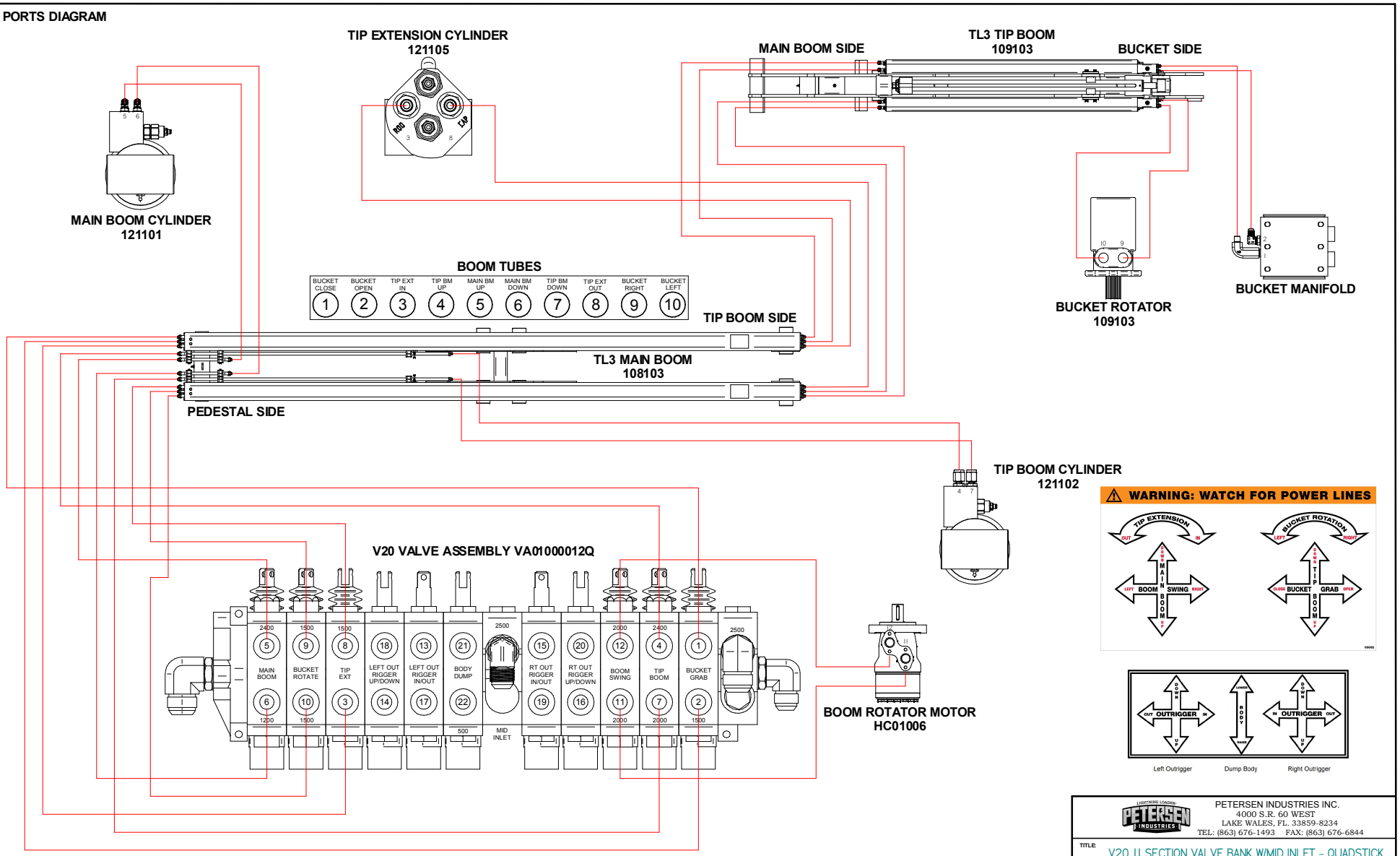
TITLE: V20 11 SECTION VALVE BANK WITH MID INLET - STANDARD			
PART NUMBER: 52 07 01 042 0			SCALE: NA
DRAWN BY: SWB	APPROVED BY	DATE: 10/28/2016	SHEET: 2 OF 2

WORK PORTS DIAGRAM



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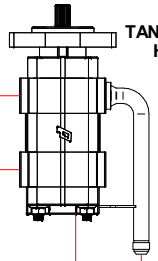
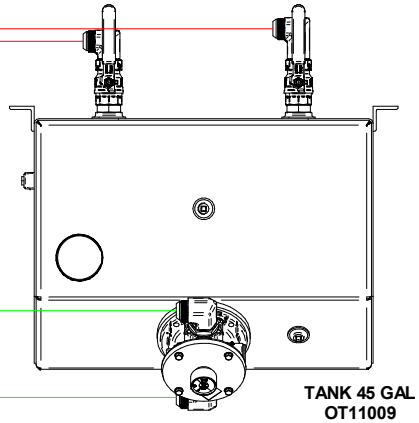
TITLE: V20 11 SECTION VALVE BANK W/MID INLET - QUADSTICK			
PART NUMBER: 52 07 01 040 0			SCALE: 1:4
DRAWN BY: SWB	APPROVED BY	DATE: 09/06/2016	SHEET: 1 OF 2

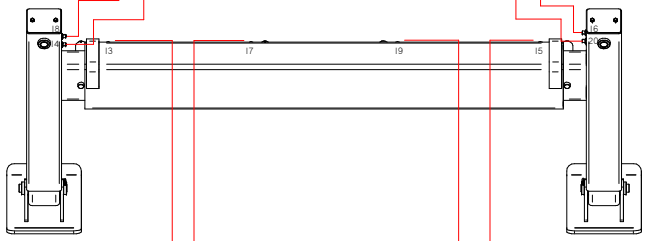
WORK PORTS DIAGRAM (CONTINUED)



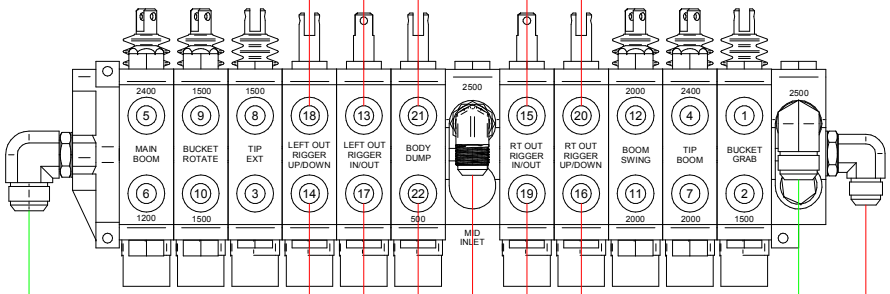
TANDEM PUMP
HC02013

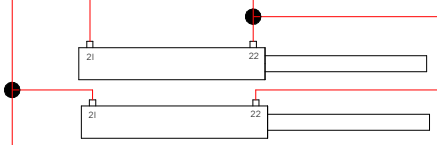


TANK 45 GAL
OT11009



V20 VALVE ASSEMBLY
VA01000012Q





BODY HOIST CYLINDERS

NOTE: ON 22' BODIES AND LARGER HOIST IS POWER UP & GRAVITY DOWN. UP PORT RELIEF IS THEN SET TO 3100 PSI AND MAIN RELIEF IS SET TO 3000 PSI. DEPENDING ON CONTROL OPTION BODY HOIST VALVE MAYBE SEPERATE VALVE BANK.

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TITLE: V20 11 SECTION VALVE BANK W/MID INLET - QUADSTICK			
PART NUMBER: 52 07 01 040 0			SCALE: NA
DRAWN BY: SWB	APPROVED BY	DATE: 09/06/2016	SHEET: 2 OF 2

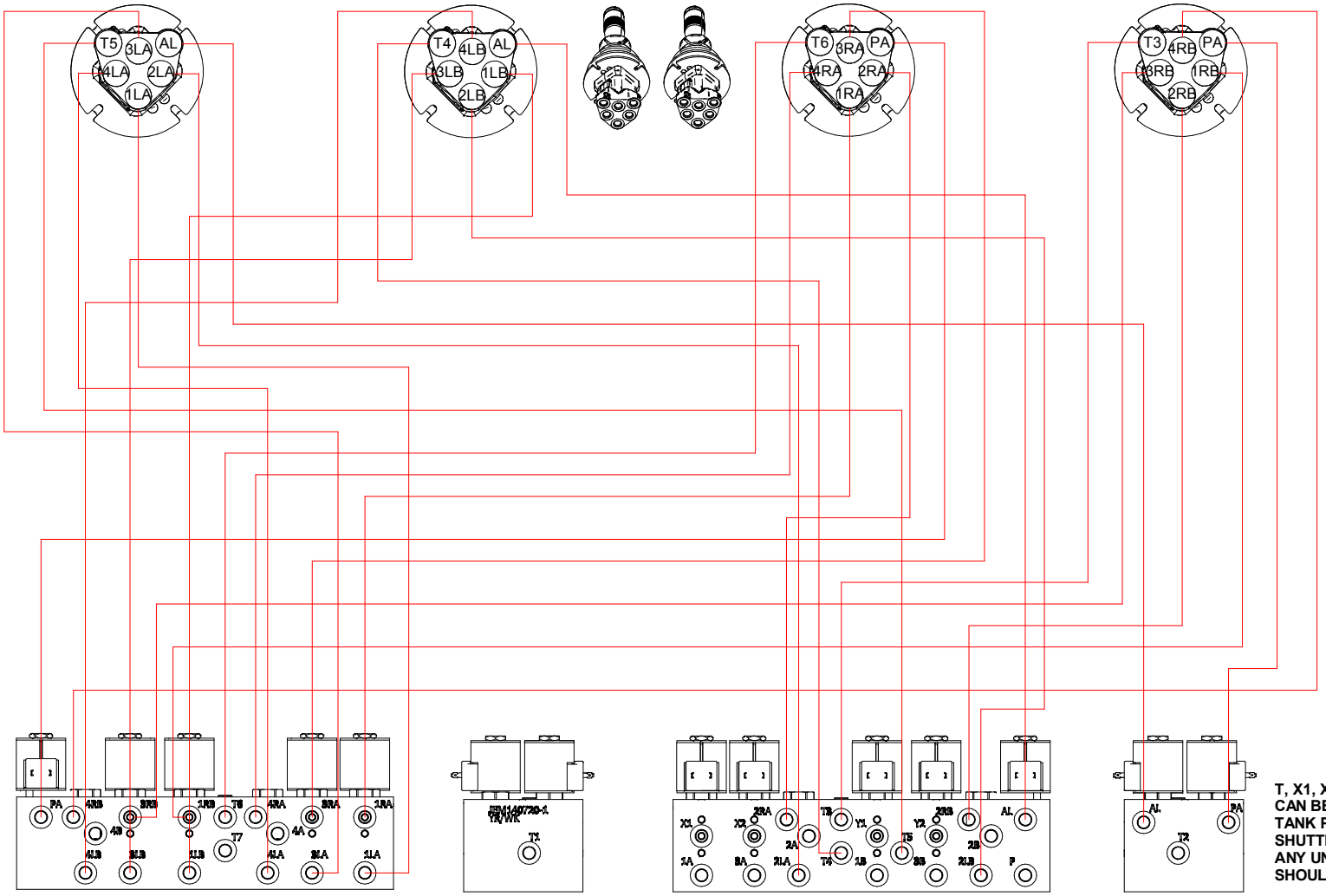
PILOT CONTROL DIAGRAM

PRESSURE

SUCTION

LEFT JOYSTICKS
VA02000004

RIGHTJOYSTICKS
VA02000004



SHUTTLE MANIFOLD
VA13001

T, X1, X2, Y1, Y2 CAN BE USED AS TANK PORTS ON SHUTTLE MANIFOLD. ANY UNUSED PORTS SHOULD BE PLUGGED.

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4000 S.R. 60 WEST
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TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: V20 DUAL WALK THRU PILOT HYD CNTRL PLUMBING/WIRING

PART NUMBER:	SCALE:
52 07 14 006 1	NA

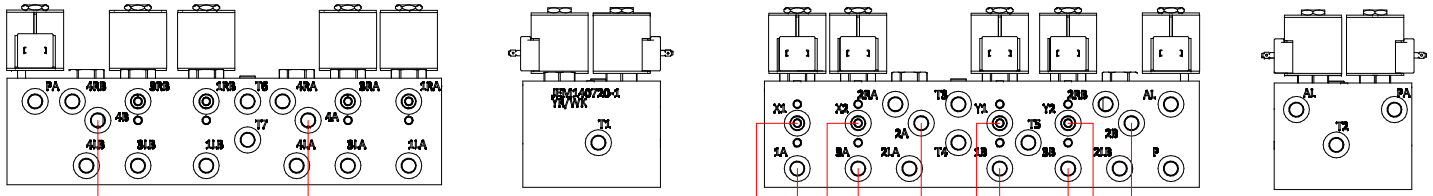
DRAWN BY:	APPROVED BY	DATE:	SHEET:
SWB		10/27/2016	1 OF 5

PILOT CONTROL DIAGRAM

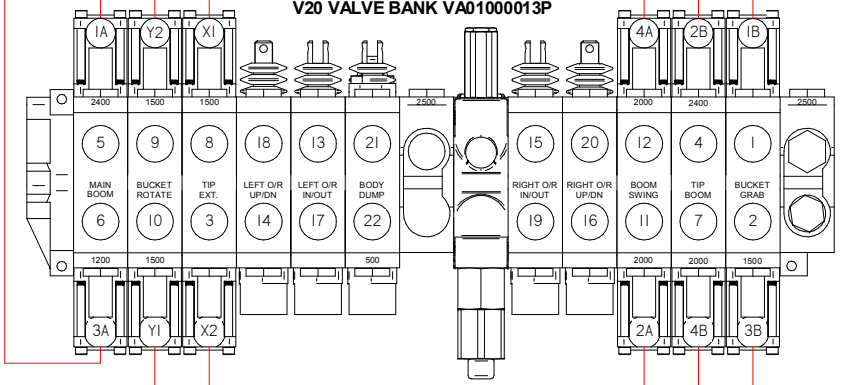
PRESSURE

SUCTION

SHUTTLE MANIFOLD VA13001



V20 VALVE BANK VA01000013P



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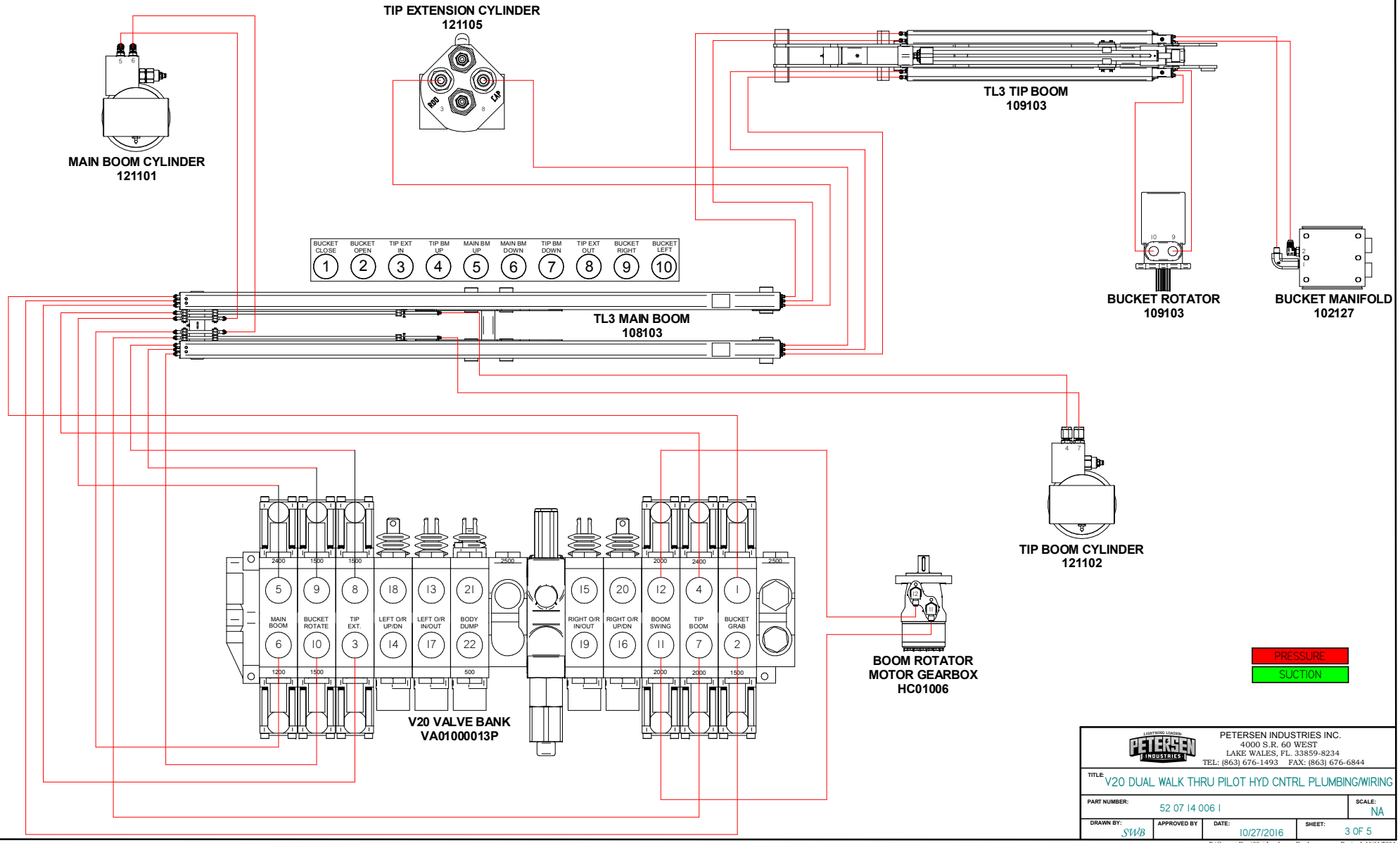
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: V20 DUAL WALK THRU PILOT HYD CNTRL PLUMBING/WIRING

PART NUMBER:	SCALE:
52 07 14 006 1	NA

DRAWN BY:	APPROVED BY	DATE:	SHEET:
SWB		10/27/2016	2 OF 5

WORK PORTS DIAGRAM



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LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

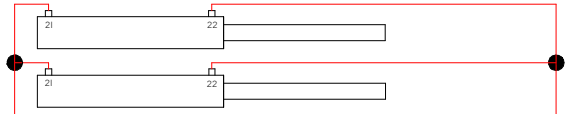
TITLE: V20 DUAL WALK THRU PILOT HYD CNTRL PLUMBING/WIRING			
PART NUMBER: 52 07 14 006 1			SCALE: NA
DRAWN BY: SWB	APPROVED BY	DATE: 10/27/2016	SHEET: 3 OF 5

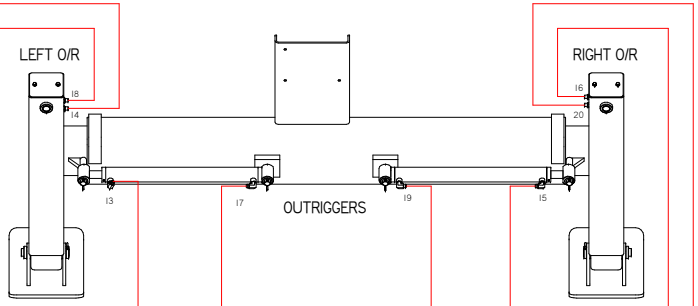
WORK PORTS DIAGRAM

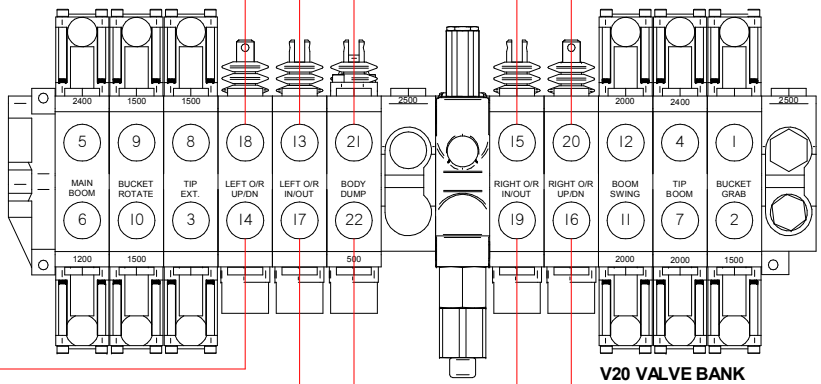
PRESSURE
SUCTION
LOAD SENSE
CONTROLS

BODY HOIST CYLINDERS

NOTE: ON 22' BODIES AND LARGER HOIST IS POWER UP & GRAVITY DOWN. UP PORT RELIEF IS THEN SET TO 3100 PSI AND MAIN RELIEF IS SET TO 3000 PSI. DEPENDING ON CONTROL OPTION BODY HOIST VALVE MAYBE SEPERATE VALVE BANK.



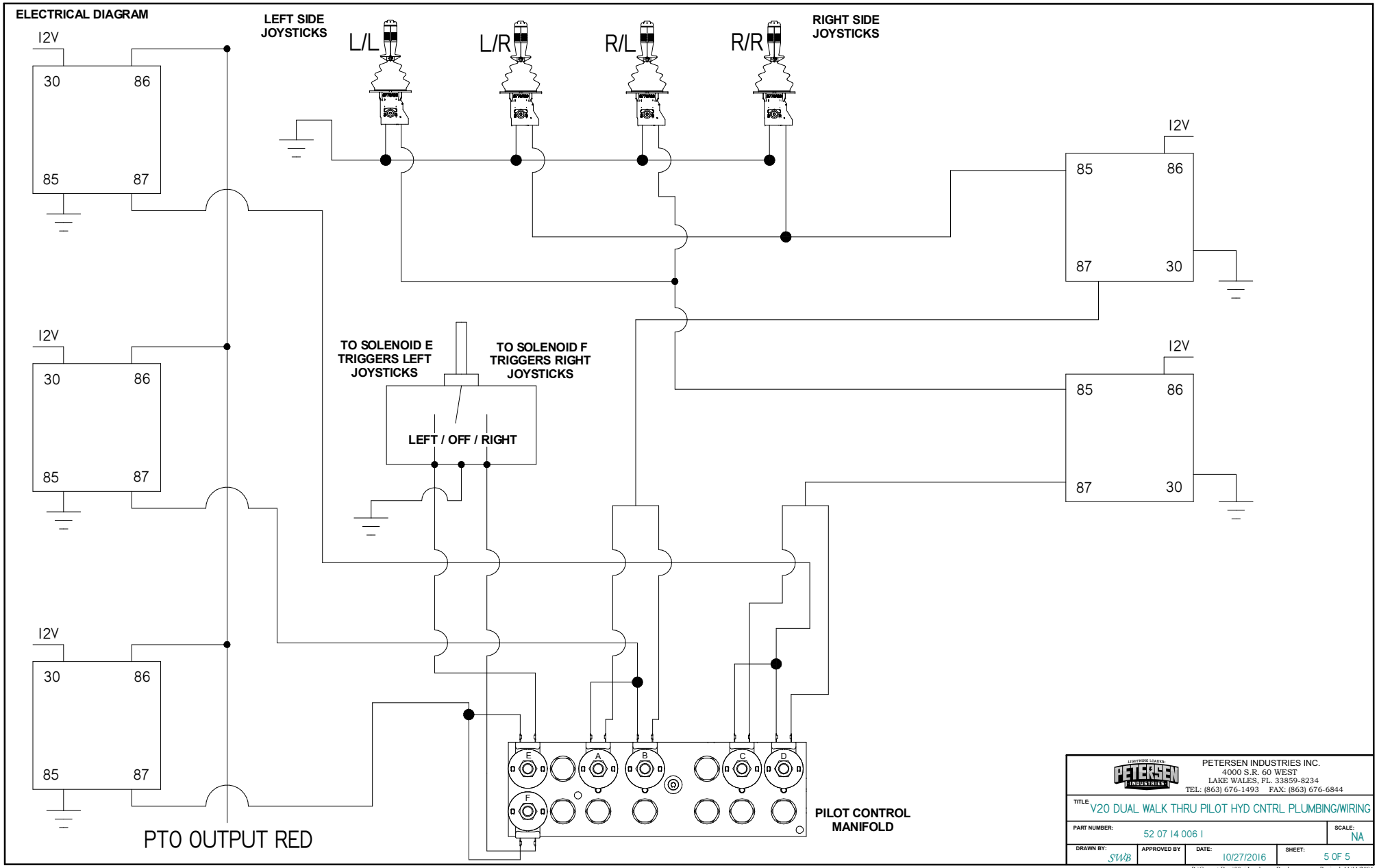




V20 VALVE BANK
VA01000013P

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: V20 DUAL WALK THRU PILOT HYD CNTRL PLUMBING/WIRING			
PART NUMBER: 52 07 14 006 1			SCALE: NA
DRAWN BY: SWB	APPROVED BY	DATE: 10/27/2016	SHEET: 4 OF 5



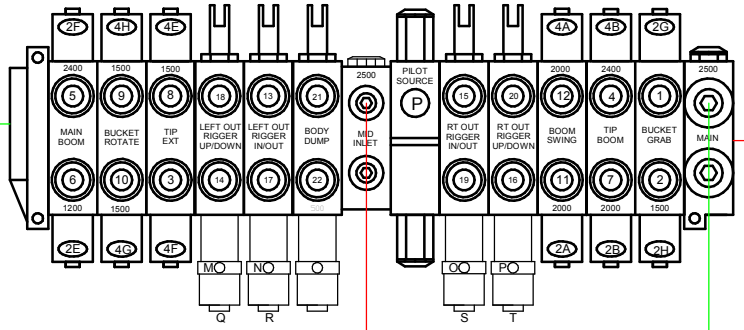
PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

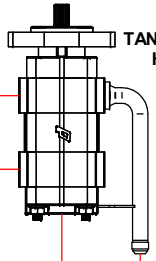
TITLE: V20 DUAL WALK THRU PILOT HYD CNTRL PLUMBING/WIRING

PART NUMBER	SCALE
52 07 14 006 1	NA

DRAWN BY	APPROVED BY	DATE	SHEET
SWB		10/27/2016	5 OF 5

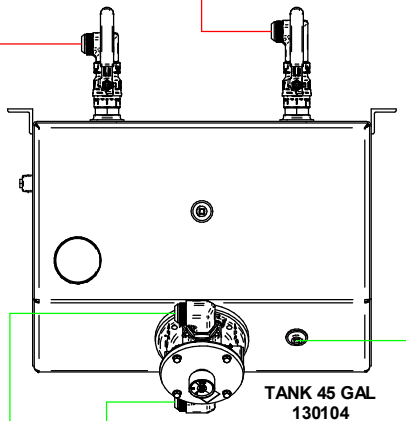
V20 VALVE ASSEMBLY
VA01000013P





TANDEM PUMP
HC02013

PUMP PIPE
TU04011



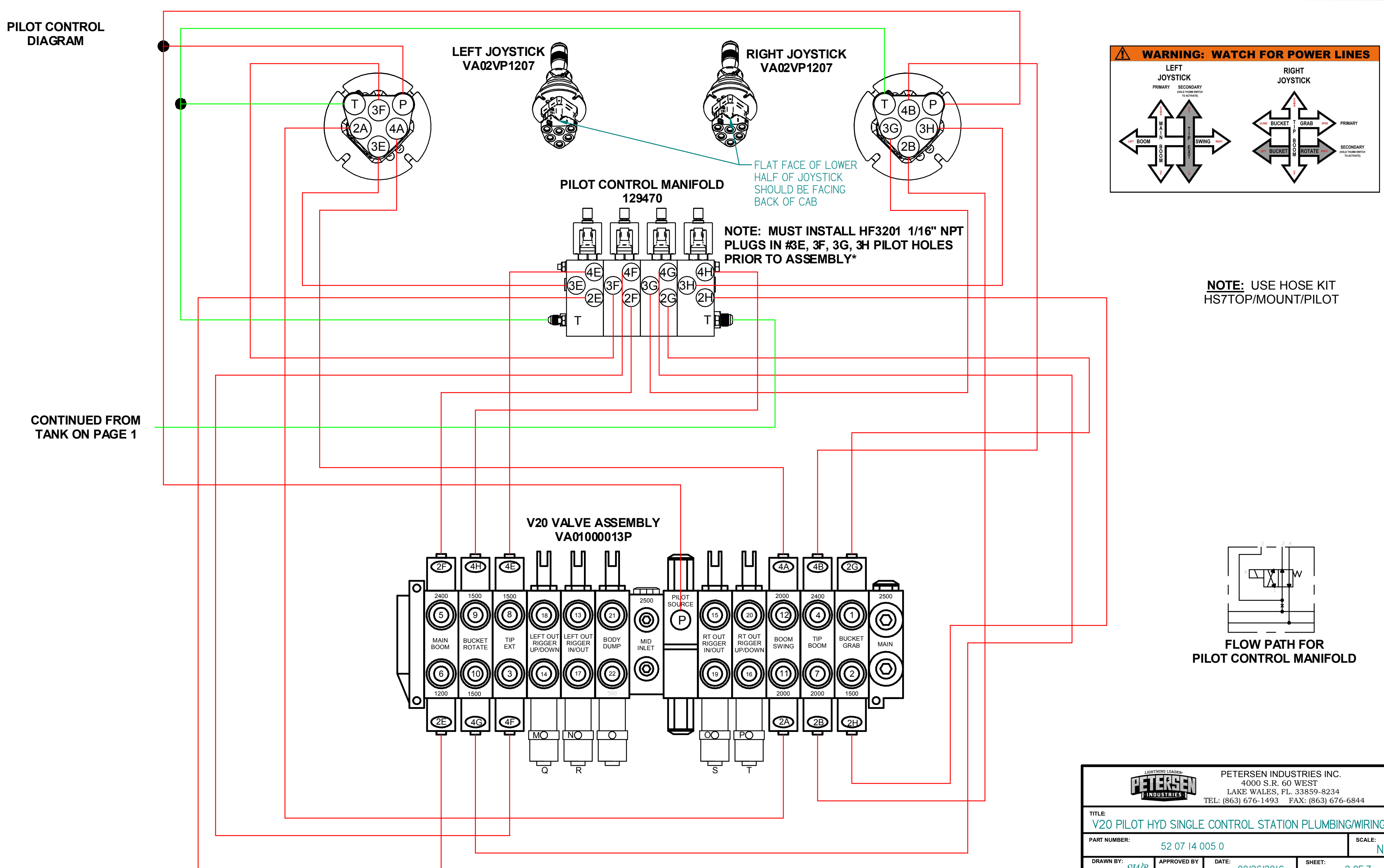
TANK 45 GAL
130104

CONTINUED ON PAGE 2

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: V20 PILOT HYD SINGLE CONTROL STATION PLUMBING/WIRING

PART NUMBER:	SCALE:	DRAWN BY:	APPROVED BY	DATE:	SHEET:
52 07 14 005 0	NA	SWB		08/26/2016	1 OF 7



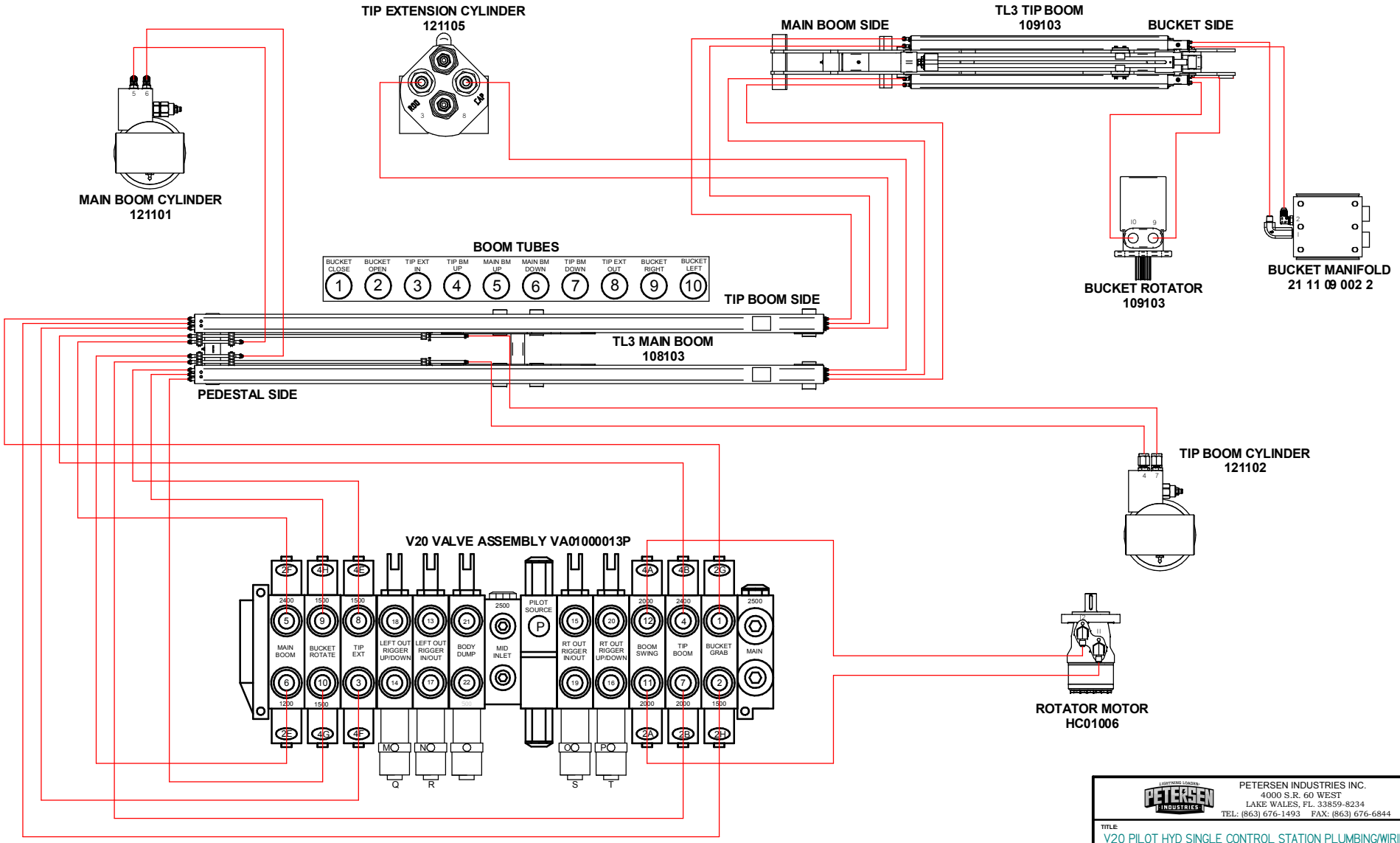
PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: V20 PILOT HYD SINGLE CONTROL STATION PLUMBING/WIRING				
PART NUMBER: 52 07 14 005 0				SCALE: NA
DRAWN BY: SWB	APPROVED BY	DATE: 08/26/2016	SHEET: 2 OF 7	

R:\Current Dwg\00pi Landscape Border Revised: 11/11/2004

Last Printed 7/31/2017 by sburchfield

WORK PORTS DIAGRAM



PETERSEN INDUSTRIES INC.
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TEL: (863) 676-1493 FAX: (863) 676-6844

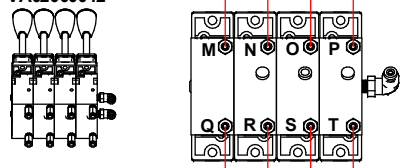
TITLE: V20 PILOT HYD SINGLE CONTROL STATION PLUMBING/WIRING

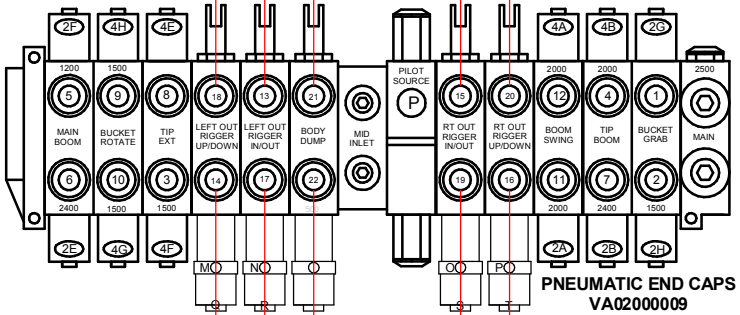
PART NUMBER	SCALE
52 07 14 005 0	NA

DRAWN BY	APPROVED BY	DATE	SHEET
SWB		08/26/2016	3 OF 7

PLUMBING DIAGRAM

OUTRIGGER AIR CONTROLS VA02000012



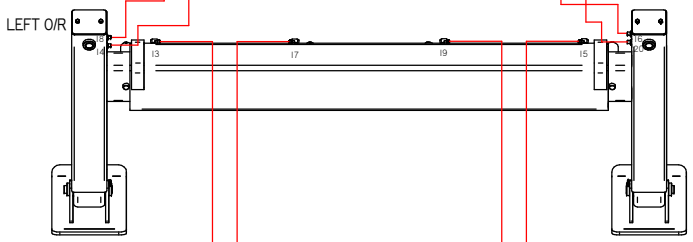


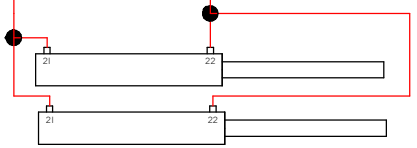
V20 VALVE ASSEMBLY VA01000013P

PNEUMATIC END CAPS VA02000009

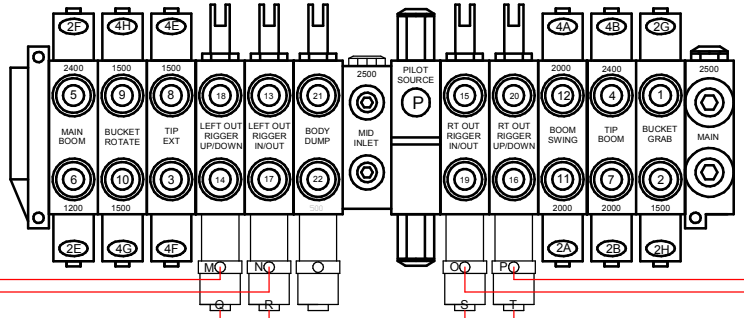
NOTE: IF HOIST IS POWER UP GRAVITY DOWN, BODY DUMP SPOOL TO BE SWAPPED WITH VA0312160R

OUTRIGGERS





BODY HOIST CYLINDERS



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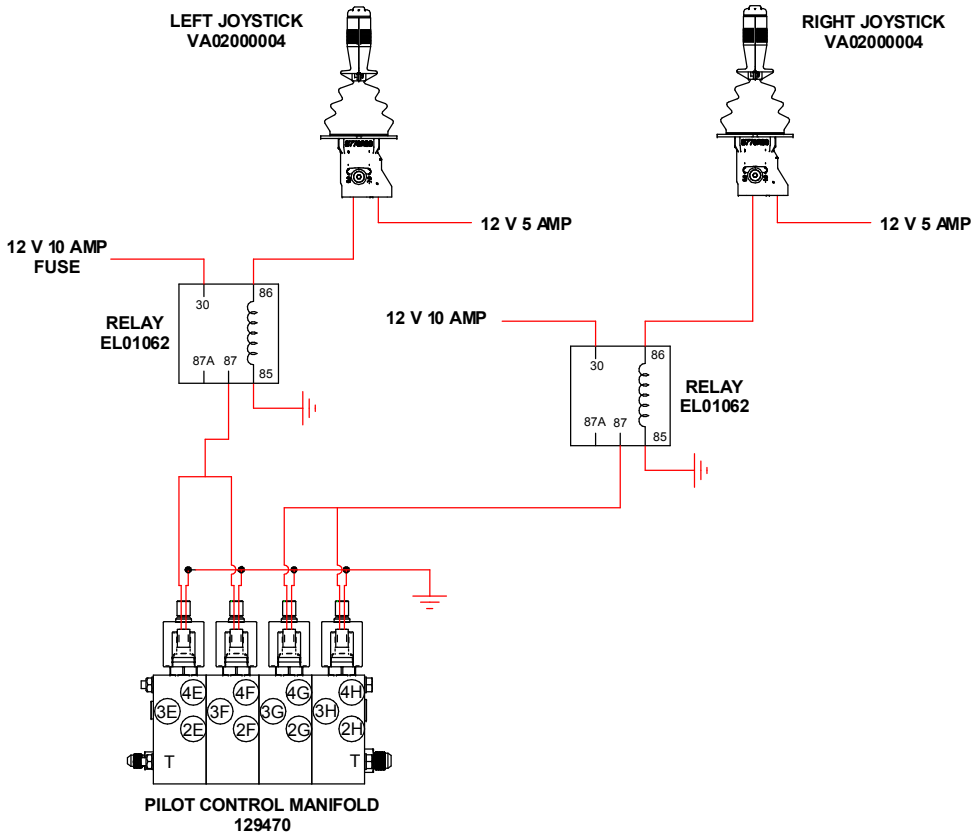
TITLE: V20 PILOT HYD SINGLE CONTROL STATION PLUMBING/WIRING			
PART NUMBER: 52 07 14 005 0			SCALE: NA
DRAWN BY: SWB	APPROVED BY	DATE: 08/26/2016	SHEET: 4 OF 7

ELECTRICAL DIAGRAM



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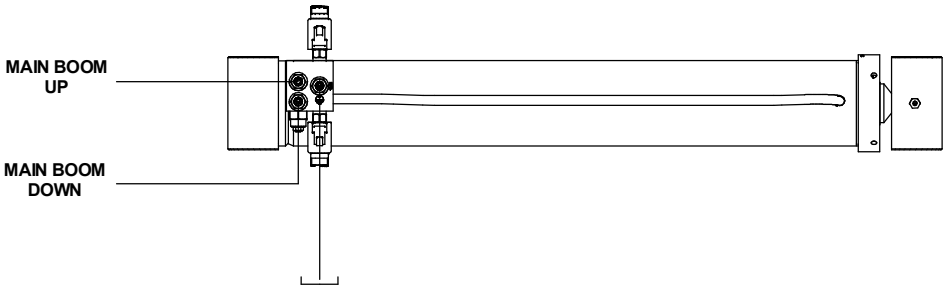
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: V20 PILOT HYD SINGLE CONTROL STATION PLUMBING/WIRING

PART NUMBER:	SCALE:
52 07 14 005 0	NA

DRAWN BY:	APPROVED BY	DATE:	SHEET:
SWB		08/26/2016	5 OF 7

MAIN BOOM CYLINDER
121236



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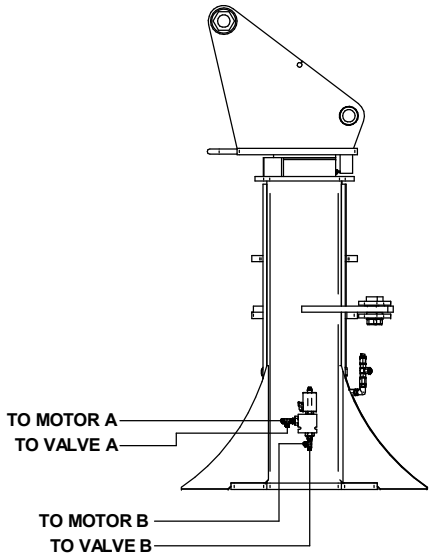
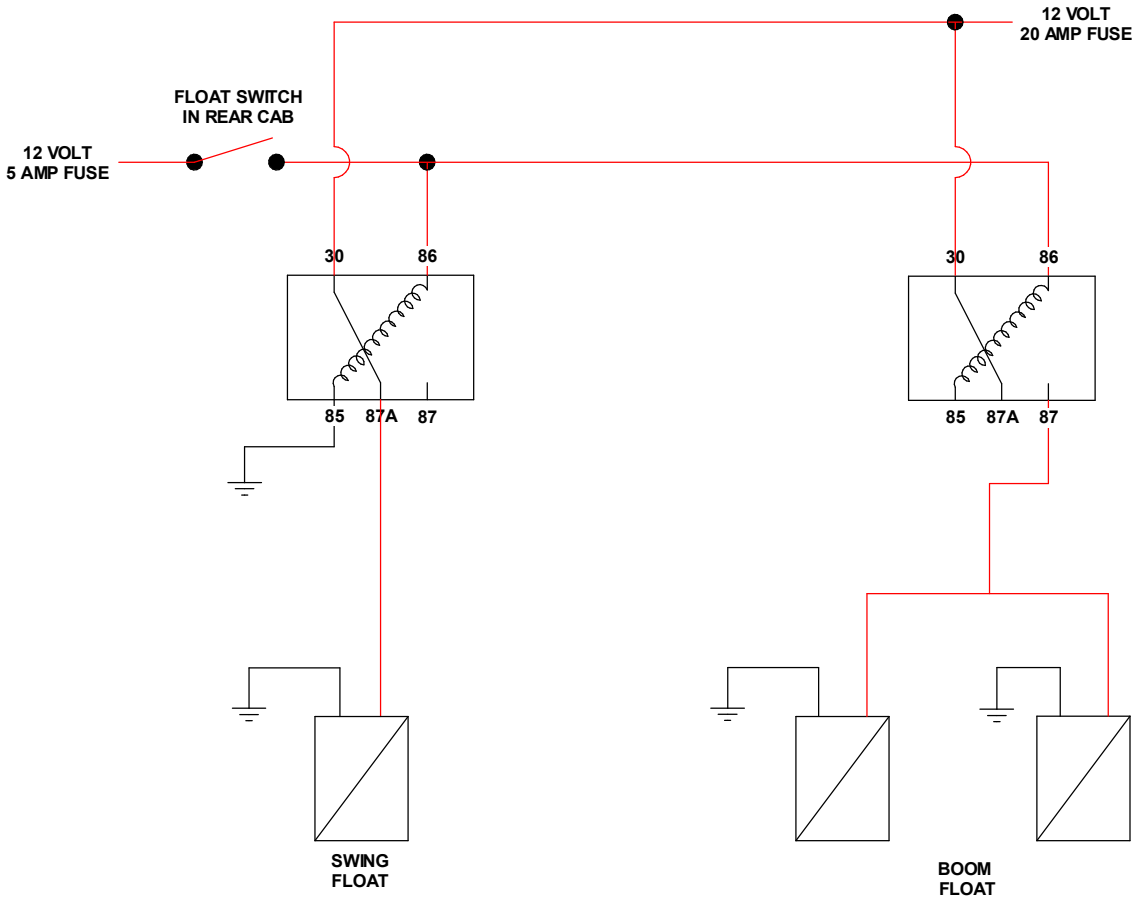


PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: V20 PILOT HYD SINGLE CONTROL STATION PLUMBING/WIRING

PART NUMBER:	SCALE:		
52 07 14 005 0	NA		
DRAWN BY: SWB	APPROVED BY	DATE: 08/26/2016	SHEET: 6 OF 7

OPEN = ENGAGED
CLOSED = FLOAT

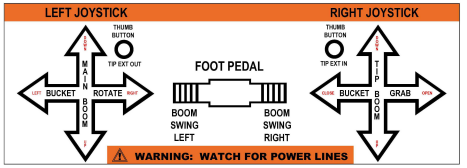


PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

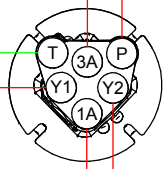
TITLE: V20 PILOT HYD SINGLE CONTROL STATION PLUMBING/WIRING

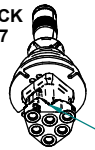
PART NUMBER:	SCALE:	DRAWN BY:	APPROVED BY	DATE:	SHEET:
52 07 14 005 0	NA	SWB		08/26/2016	7 OF 7

PILOT CONTROL DIAGRAM

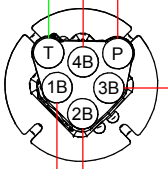


LEFT JOYSTICK
VA02VP1207





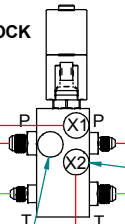
RIGHT JOYSTICK
VA02VP1207



FLAT FACE OF LOWER HALF OF JOYSTICK SHOULD BE FACING BACK OF CAB

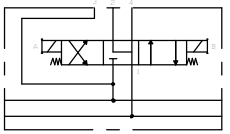
JOYSTICK PORT LABELS CORROSPOND TO THE PILOT CONTROL MANIFOLD AND PILOT END CAPS ON V20 VALVE ASSEMBLY.

PILOT CONTROL BLOCK
129468



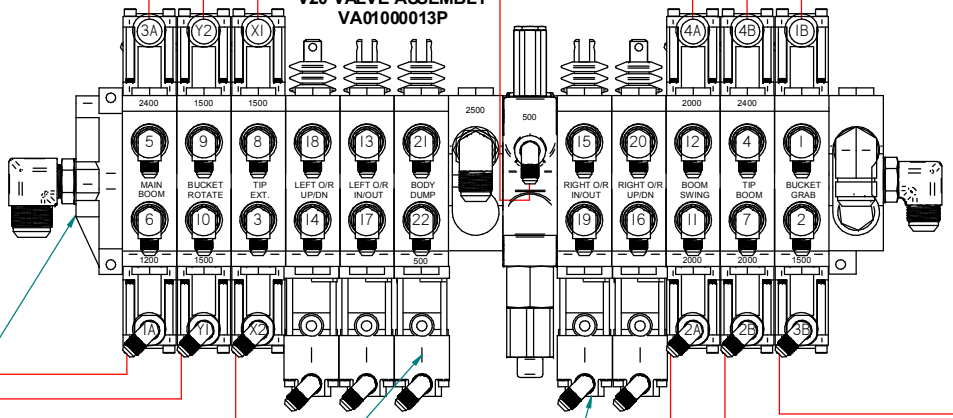
PLUGGED

PLUGGED

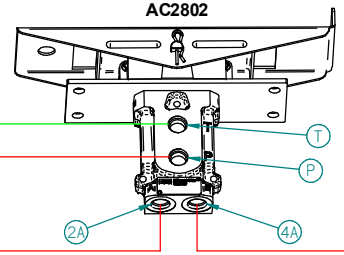


FLOW PATH FOR PILOT CONTROL BLOCK

V20 VALVE ASSEMBLY
VA01000013P



PILOT FOOT CONTROLLER
AC2802



TO ADD ADDITIONAL VALVES BEYOND SWAP END CAP WITH VA10006 POWER BEYOND END CAP AND VA10002 POWER BEYOND SLEEVE

IF HOIST IS POWER UP, GRAVITY DOWN, SPOOL TO BE SWAPPED WITH A VA03121160R

IF REMOTE CONTROL OF OUTRIGGERS AND BODY DUMP IS REQUIRED INSTALL VA02000009

CONTINUED ON PAGE 4

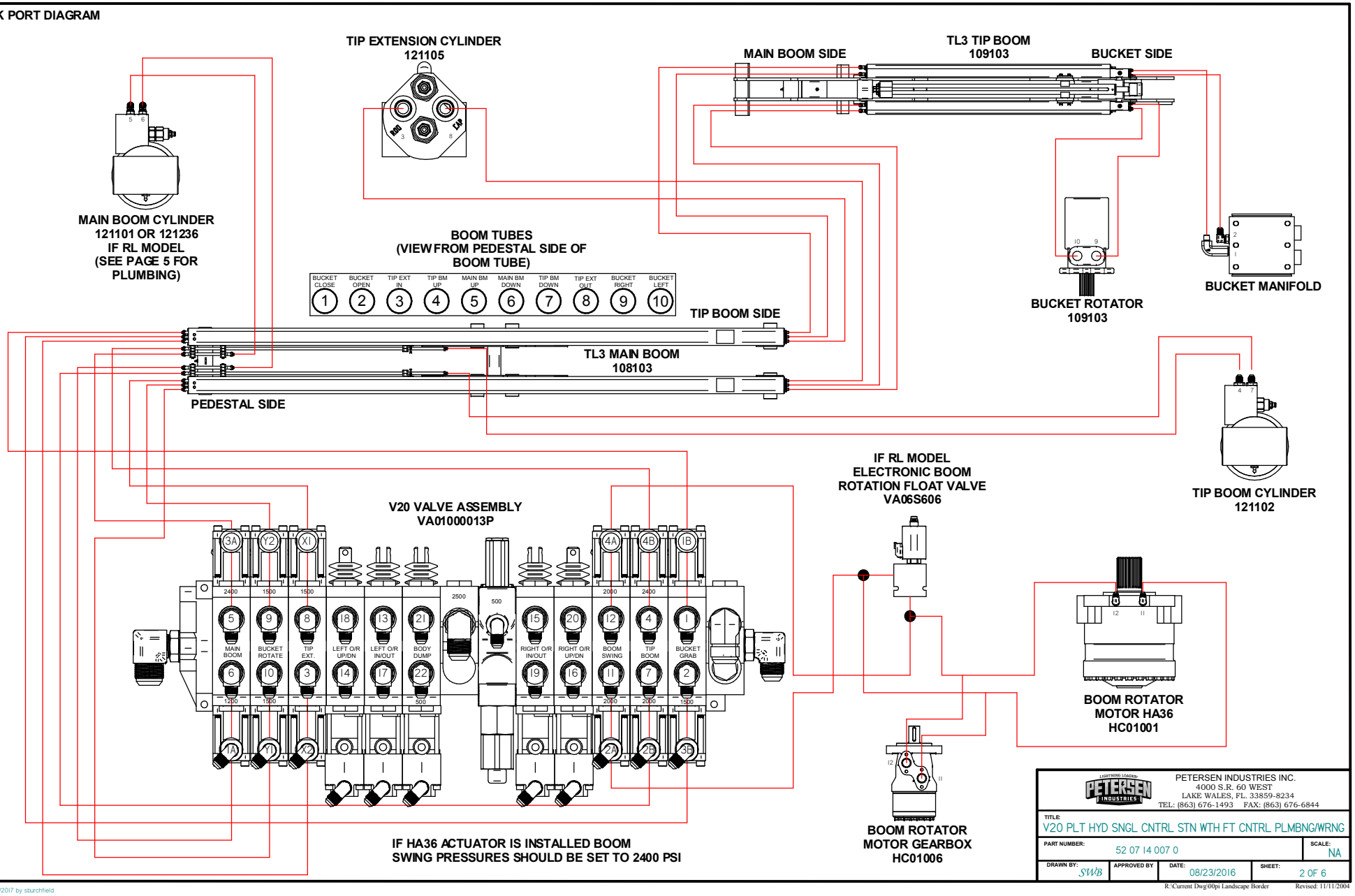
NOTE: USE HOSE KIT HS7TOP/MOUNT/PILOT

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: V20 PLT HYD SNGL CNTRL STN WTH FT CNTRL PLMBNG/WRNG			
PART NUMBER: 52 07 14 007 0			SCALE: NA
DRAWN BY: SWB	APPROVED BY	DATE: 08/23/2016	SHEET: 1 OF 6

Last Printed 7/31/2017 by sburchfield
R:\Current Dwg\00psi Landscape Border
Revised: 11/11/2004

WORK PORT DIAGRAM



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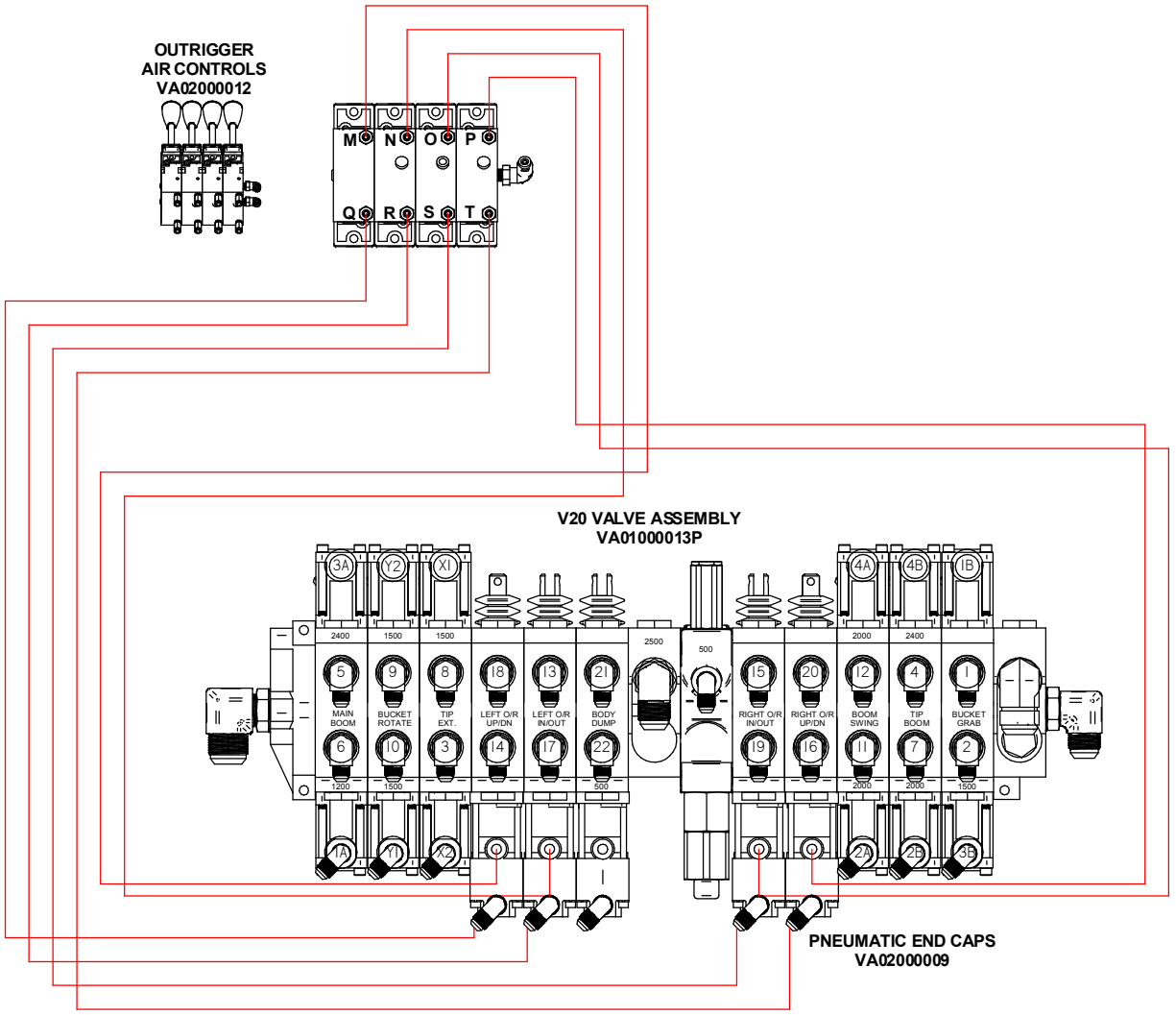
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: V20 PLT HYD SNGL CNTRL STN WTH FT CNTRL PLMBNG/WRNG			
PART NUMBER: 52 07 14 007 0			SCALE: NA
DRAWN BY: SWB	APPROVED BY	DATE: 08/23/2016	SHEET: 2 OF 6

PLUMBING DIAGRAM



PETERSEN INDUSTRIES INC. 4000 S.R. 60 WEST LAKE WALES, FL. 33859-8234 TEL: (863) 676-1493 FAX: (863) 676-6844			
TITLE: V20 PLT HYD SNGL CNTRL STN WTH FT CNTRL PLMBNG/WRNG			
PART NUMBER: 52 07 I4 007 0			SCALE:
DRAWN BY:	APPROVED BY	DATE:	SHEET: 3 OF 6

PLUMBING DIAGRAM

CONTINUED
FROM PAGE 1

TANDEM PUMP
HC02013

PUMP PIPE
TU04011

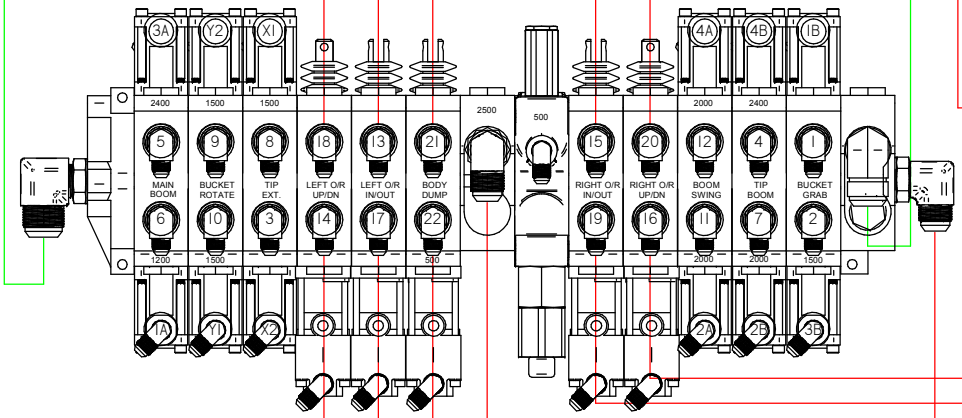
TANK 45 GAL
130104

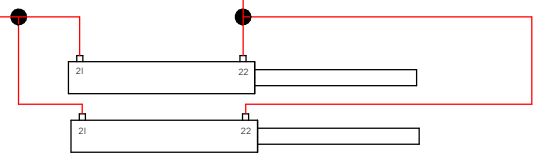
OUTRIGGERS

LEFT O/R

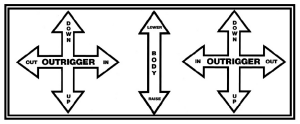
RIGHT O/R

V20 VALVE ASSEMBLY
VA01000013P





BODY HOIST CYLINDERS



Left Outrigger Dump Body Right Outrigger

PETERSEN INDUSTRIES INC.
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TITLE: V20 PLT HYD SNGL CNTRL STN WTH FT CNTRL PLMBNG/WRNG

PART NUMBER: 52 07 14 007 0

SCALE: NA

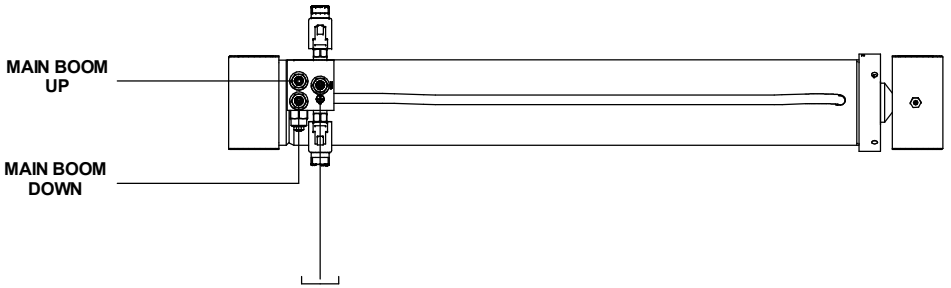
DRAWN BY: SWB

APPROVED BY:

DATE: 08/23/2016

SHEET: 4 OF 6

MAIN BOOM CYLINDER
121236



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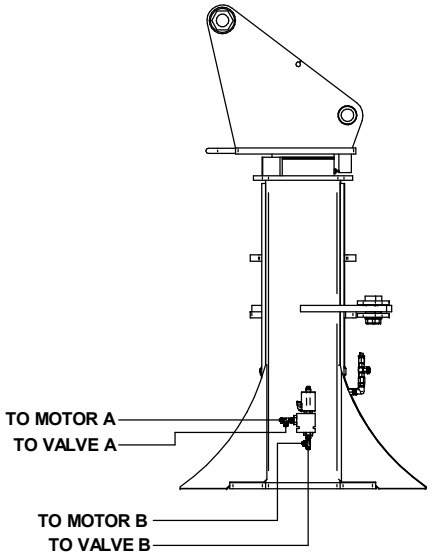

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TITLE: V20 PLT HYD SNGL CNTRL STN WTH FT CNTRL PLMBNG/WRNG

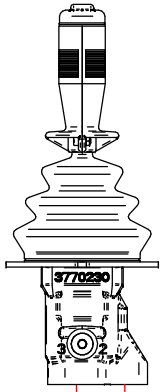
PART NUMBER:	SCALE:
52 07 14 007 0	NA

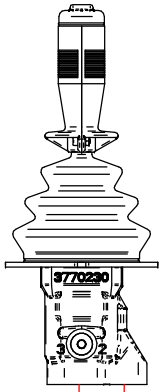
DRAWN BY:	APPROVED BY	DATE:	SHEET:
SWB		08/23/2016	5 OF 6

ELECTRICAL DIAGRAM

LEFT
JOYSTICK
VA02000004

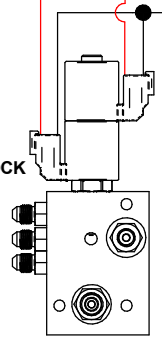
RIGHT
JOYSTICK
VA02000004





12 VOLT
10 AMP FUSE

PILOT CONTROL BLOCK
129468

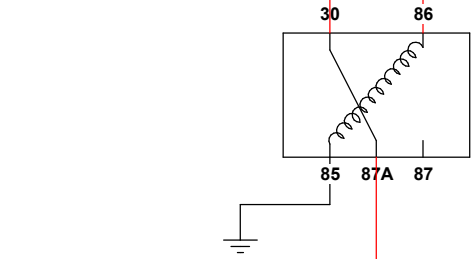


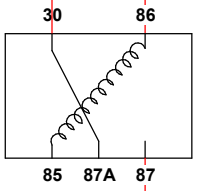
OPEN = ENGAGED
CLOSED = FLOAT

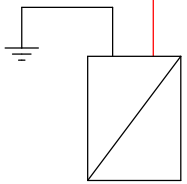
12 VOLT
20 AMP FUSE

FLOAT SWITCH
IN REAR CAB

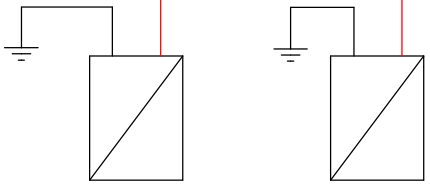
12 VOLT
5 AMP FUSE







SWING
FLOAT



BOOM
FLOAT

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: V20 PLT HYD SNGL CNTRL STN WTH FT CNTRL PLMBNG/WRNG

PART NUMBER: 52 07 14 007 0

SCALE: NA

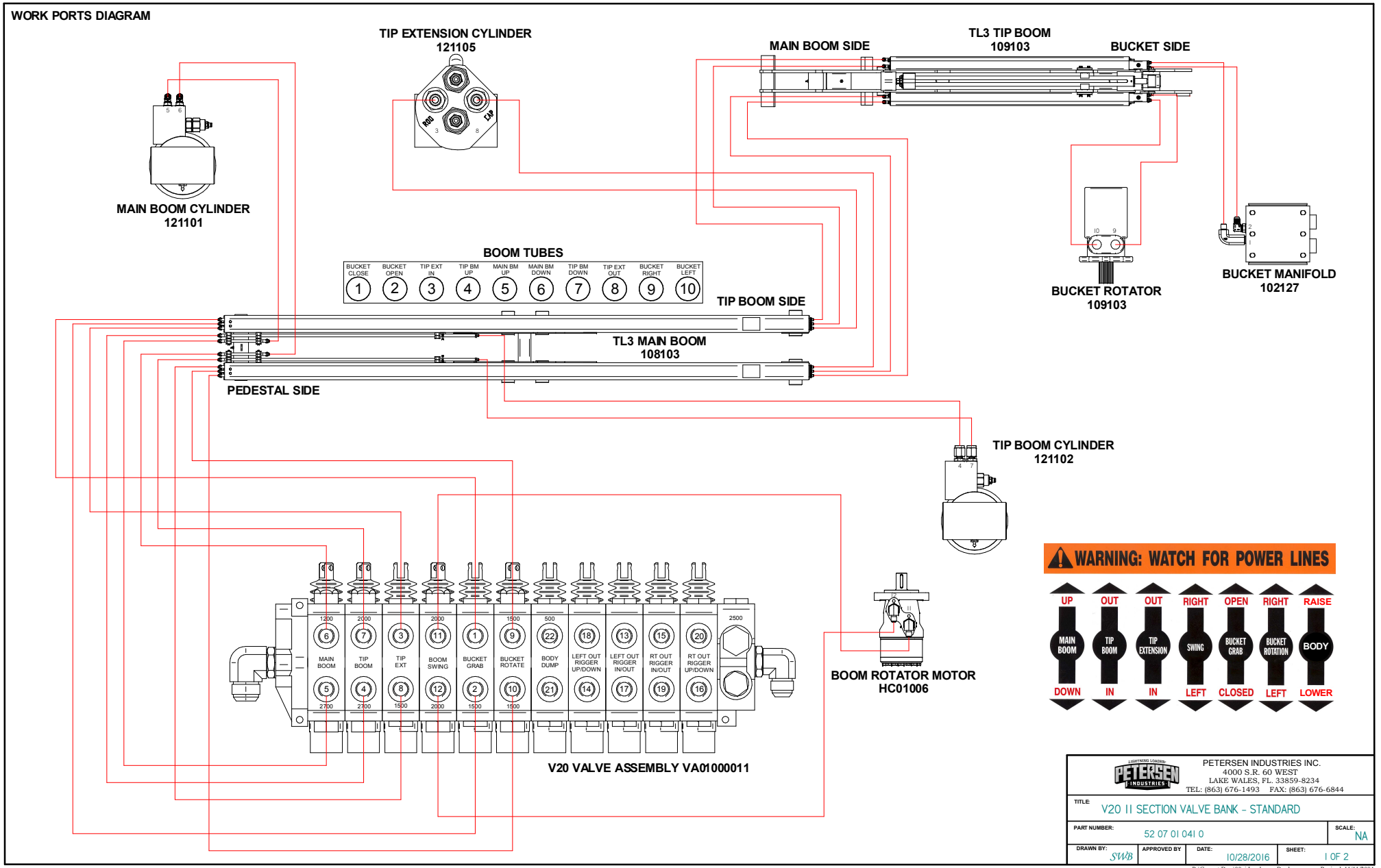
DRAWN BY: SWB

APPROVED BY:

DATE: 08/23/2016

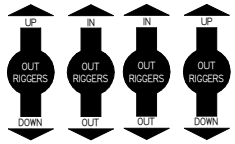
SHEET: 6 OF 6

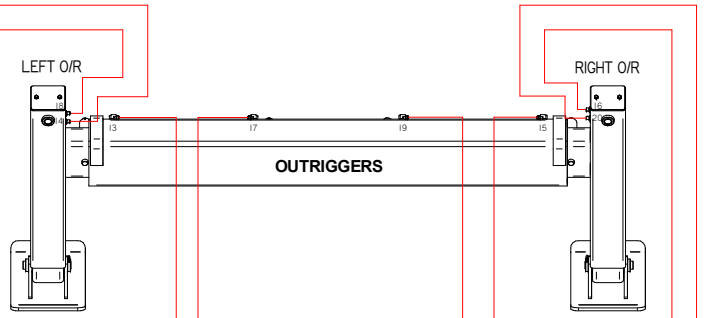
WORK PORTS DIAGRAM



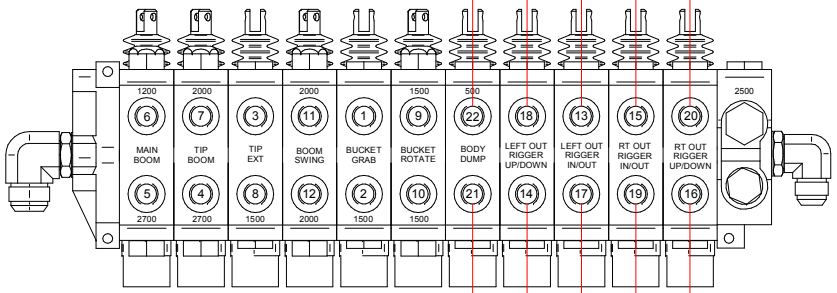
PETERSEN INDUSTRIES INC.	4000 S.R. 60 WEST, LAKE WALES, FL. 33859-8234, TEL: (863) 676-1493 FAX: (863) 676-6844
TITLE:	V20 11 SECTION VALVE BANK - STANDARD
PART NUMBER:	52 07 01 041 0
SCALE:	NA
DRAWN BY:	SWB
APPROVED BY	
DATE:	10/28/2016
SHEET:	1 OF 2

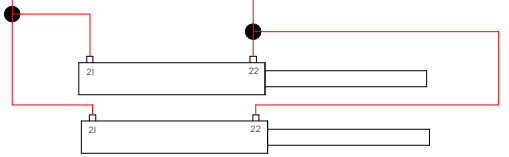
WORK PORTS DIAGRAM
(CONTINUED)





V20 VALVE ASSEMBLY VA01000011





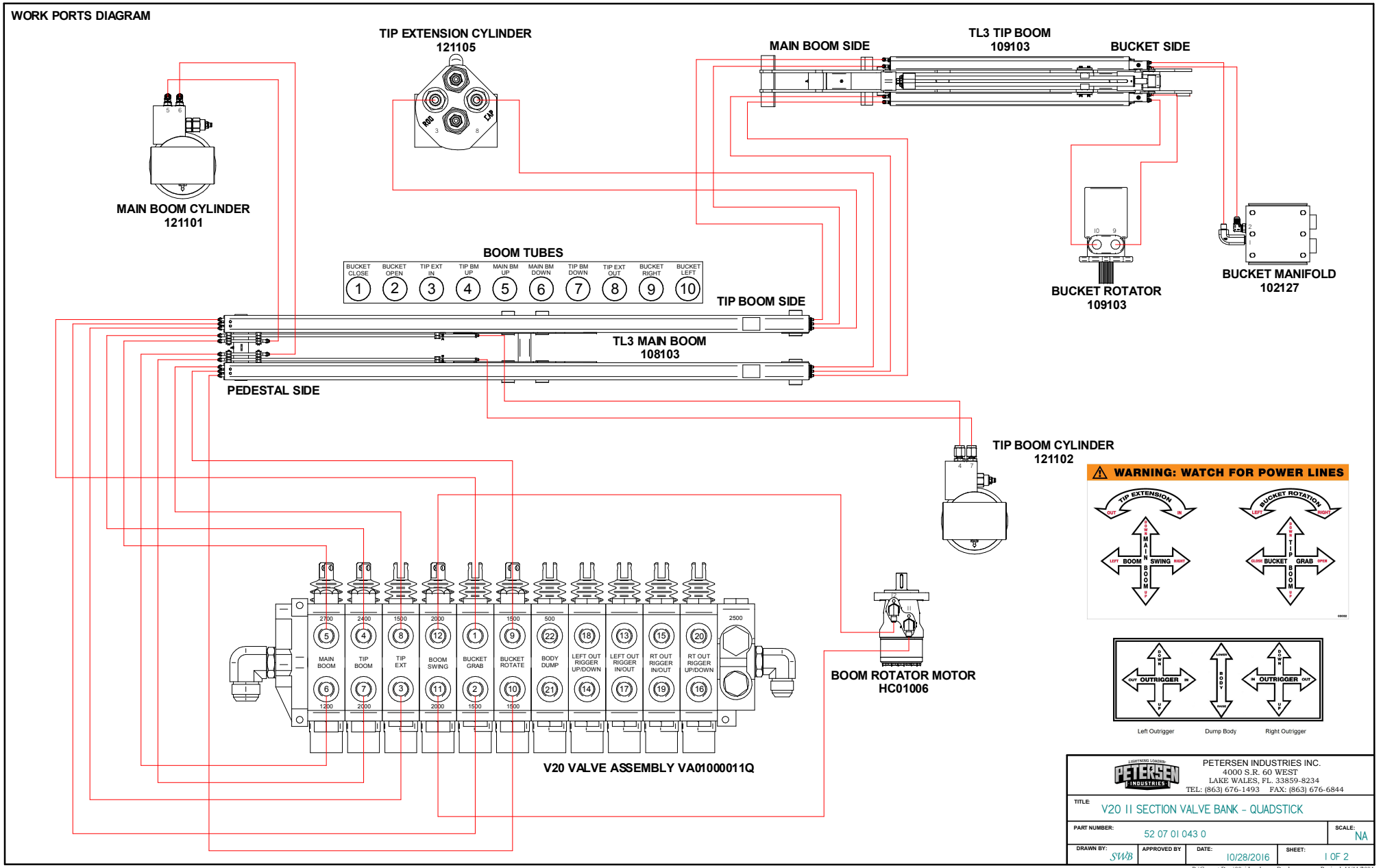
BODY HOIST CYLINDERS

NOTE: ON 22' BODIES AND LARGER HOIST IS POWER UP & GRAVITY DOWN. UP PORT RELIEF IS THEN SET TO 3100 PSI AND MAIN RELIEF IS SET TO 3000 PSI. DEPENDING ON CONTROL OPTION BODY HOIST VALVE MAYBE SEPERATE VALVE BANK.

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: V20 II SECTION VALVE BANK - STANDARD			
PART NUMBER: 52 07 01 041 0			SCALE: NA
DRAWN BY: SWB	APPROVED BY	DATE: 10/28/2016	SHEET: 2 OF 2

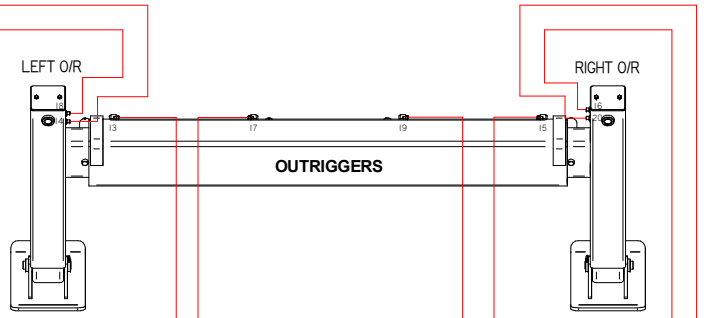
WORK PORTS DIAGRAM



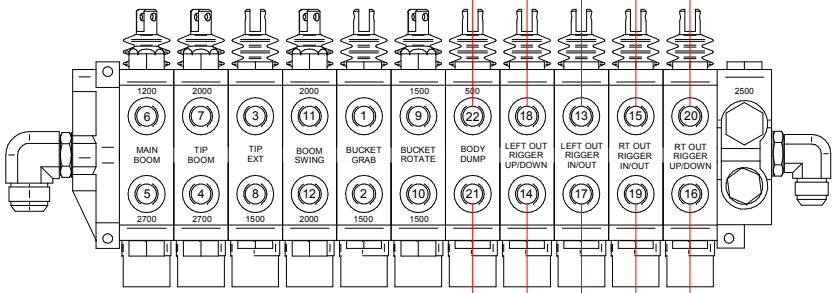
PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

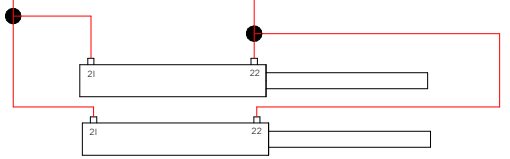
TITLE: V20 11 SECTION VALVE BANK - QUADSTICK			
PART NUMBER: 52 07 01 043 0			SCALE: NA
DRAWN BY: SWB	APPROVED BY	DATE: 10/28/2016	SHEET: 1 OF 2

WORK PORTS DIAGRAM
(CONTINUED)



V20 VALVE ASSEMBLY VA01000011Q





BODY HOIST CYLINDERS

NOTE: ON 22' BODIES AND LARGER HOIST IS POWER UP & GRAVITY DOWN. UP PORT RELIEF IS THEN SET TO 3100 PSI AND MAIN RELIEF IS SET TO 3000 PSI. DEPENDING ON CONTROL OPTION BODY HOIST VALVE MAYBE SEPERATE VALVE BANK.

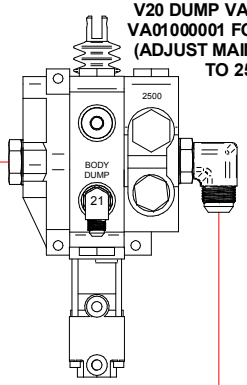
PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: V20 11 SECTION VALVE BANK - QUADSTICK			
PART NUMBER: 52 07 01 043 0			SCALE: NA
DRAWN BY: SWB	APPROVED BY	DATE: 10/28/2016	SHEET: 2 OF 2

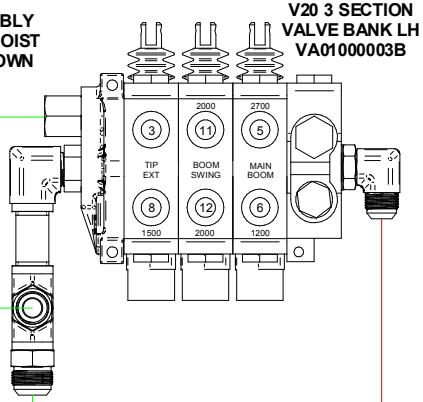
PLUMBING DIAGRAM

REV.	DESCRIPTION	DATE	BY
-	-	-	-

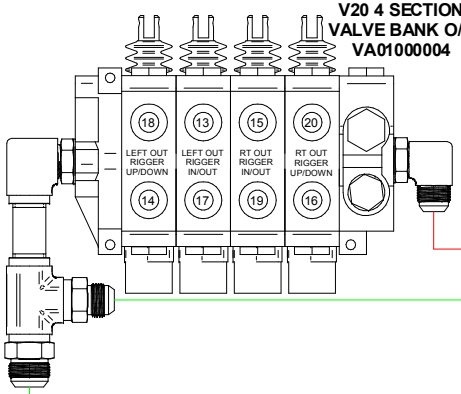
32 07 14 004 0
V20 DUMP VALVE ASSEMBLY
VA01000001 FOR SCOTT HOIST
(ADJUST MAIN RELIEF DOWN TO 2500 PSI)



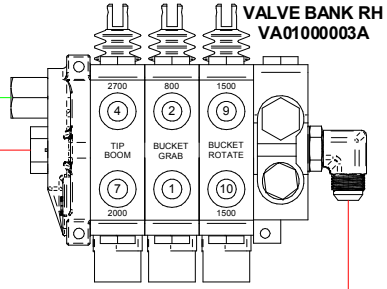
32 07 14 002 0
V20 3 SECTION
VALVE BANK LH
VA01000003B

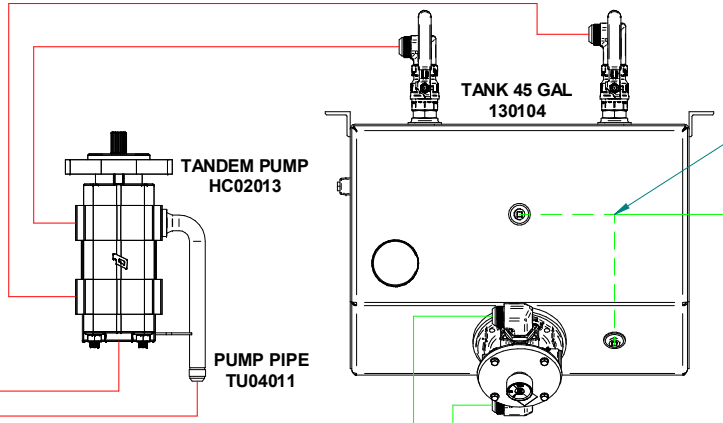


32 07 14 003 0
V20 4 SECTION
VALVE BANK O/R
VA01000004



32 07 14 001 0
V20 3 SECTION
VALVE BANK RH
VA01000003A





TANDEM PUMP
HC02013

PUMP PIPE
TU04011

DASHED LINE SHOWS WHICH CASE DRAIN PORTS THAT CAN BE USED

TO CASE DRAIN
ON GEARBOX MOTOR

TOLERANCES

1 DEC.	± 0.100
2 DEC.	± 0.050
3 DEC.	± 0.010
ANGLE:	± 1.000°
FRACTION:	± 1/32"
DIM. UNITS:	INCHES
SURFACE FINISH:	125

UNLESS OTHERWISE SPECIFIED

DEC = DECIMAL PLACES

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: RL WITH RS CAB PLUMBING DIAGRAM

PART NUMBER: 52 07 14 009 0

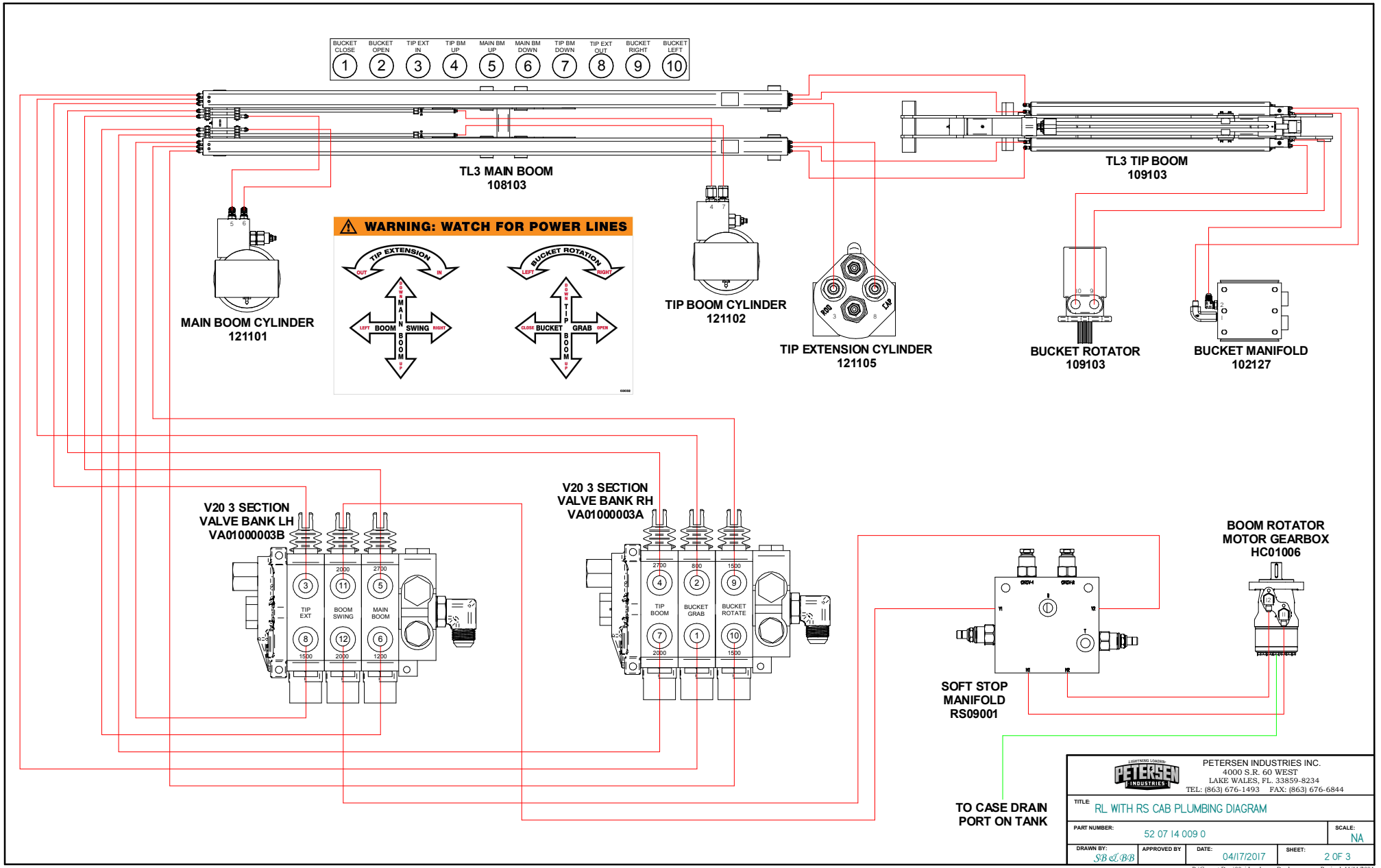
SCALE: NA

DRAWN BY: SB & BB

APPROVED BY:

DATE: 04/17/2017

SHEET: 1 OF 3



PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: RL WITH RS CAB PLUMBING DIAGRAM

PART NUMBER: 52 07 14 009 0

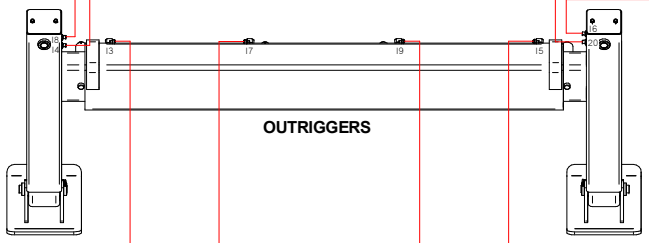
SCALE: NA

DRAWN BY: SB & BB

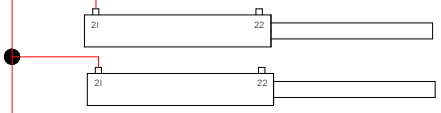
APPROVED BY:

DATE: 04/17/2017

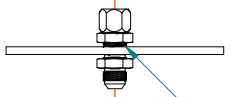
SHEET: 2 OF 3



OUTRIGGERS

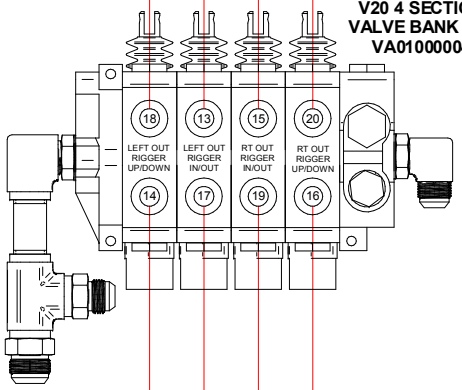


TRAILER HOIST CYLINDERS

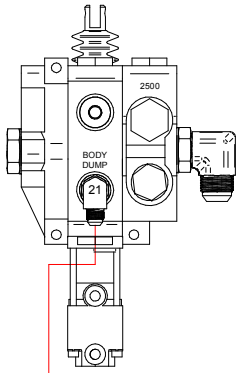


NPT NIPPLE WELDED IN PLACE AT THE REAR OF TRUCK

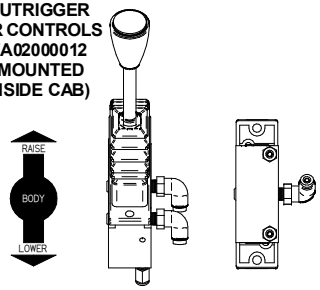
V20 4 SECTION VALVE BANK O/R VA01000004



V20 DUMP VALVE ASSEMBLY VA01000001 FOR SCOTT HOIST



OUTRIGGER AIR CONTROLS VA02000012 (MOUNTED INSIDE CAB)



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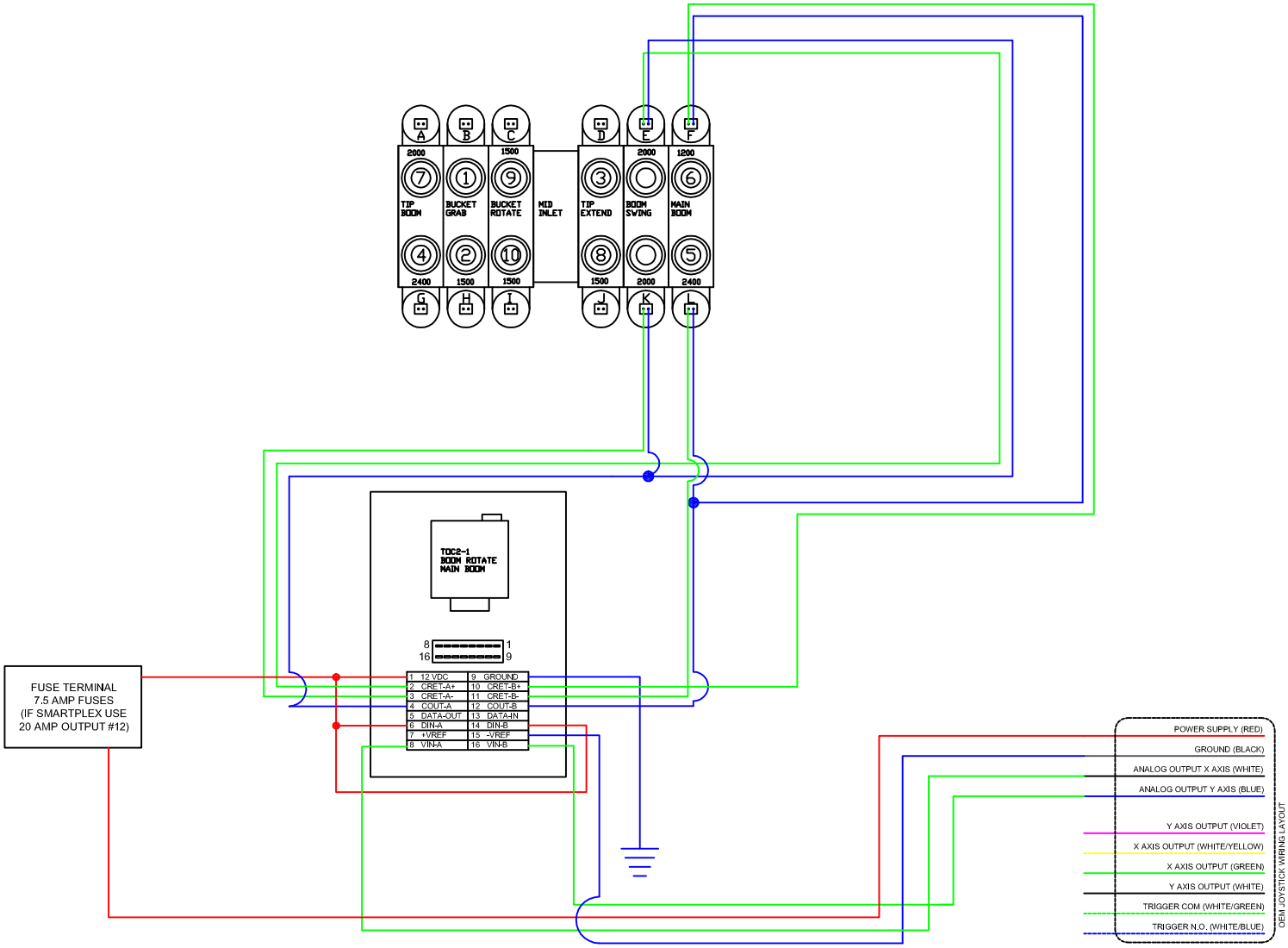
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: RL WITH RS CAB PLUMBING DIAGRAM

PART NUMBER:		SCALE:
52 07 14 009 0		NA
DRAWN BY: SWB	APPROVED BY	DATE: 04/17/2017
SHEET: 3 OF 3		

REV.	DESCRIPTION	DATE	BY



PETERSEN INDUSTRIES INC.
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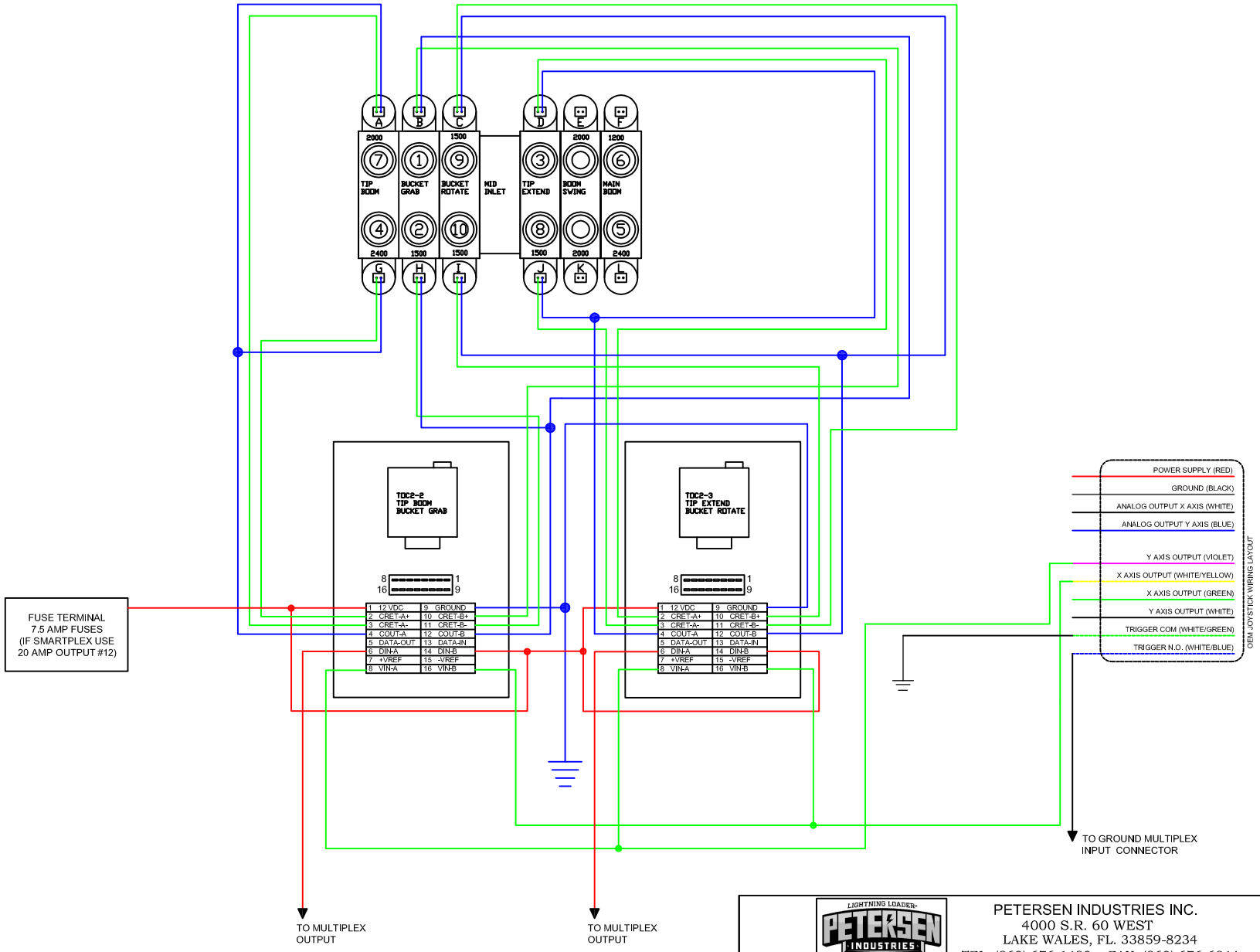
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: ELECTRONIC JOYSTICK
SCHEMATIC TOC2 #1

PART NUMBER:			SCALE:
62 07 14 007 0			NA
DRAWN BY: JAC	APPROVED BY:	DATE: 4/19/2013	SHEET: 1 OF 1

REV.	DESCRIPTION	DATE	BY



PETERSEN INDUSTRIES INC.
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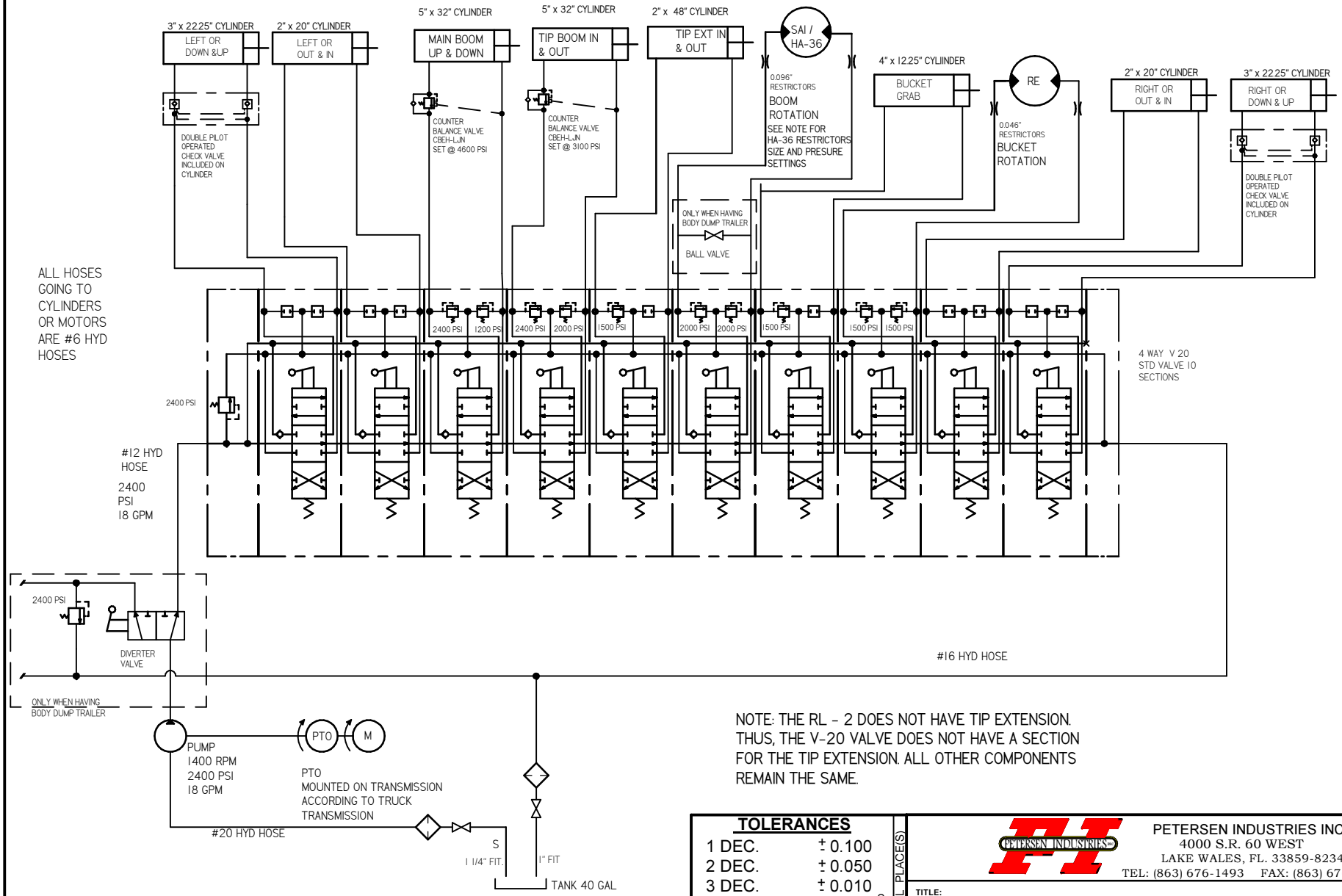
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: ELECTRONIC JOYSTICK
SCHEMATIC TOC2 #2 &3

PART NUMBER:	SCALE:
62 07 14 008 0	NA

DRAWN BY:	APPROVED BY:	DATE:	SHEET:
JAC		4/19/2013	1 OF 1



NOTE: THE RL - 2 DOES NOT HAVE TIP EXTENSION. THUS, THE V-20 VALVE DOES NOT HAVE A SECTION FOR THE TIP EXTENSION. ALL OTHER COMPONENTS REMAIN THE SAME.

NOTE: WHEN USING HA - 36 OR SS 40 INSTEAD OF SAI, USE .056" RESTRICTORS AND USE 2400 PSI PORT RELIEF VALVES ON THE P 20 VALVES. WORKING PRESSURE FOR HA 36 IS 2400 PSI

TOLERANCES

1 DEC.	± 0.100
2 DEC.	± 0.050
3 DEC.	± 0.010
ANGLE:	± 1.000 °
FRACTION:	± 1/32"
DIM. UNITS:	INCHES
SURFACE FINISH:	125/32

UNLESS OTHERWISE SPECIFIED

DEC. = DECIMAL PLACE(S)

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

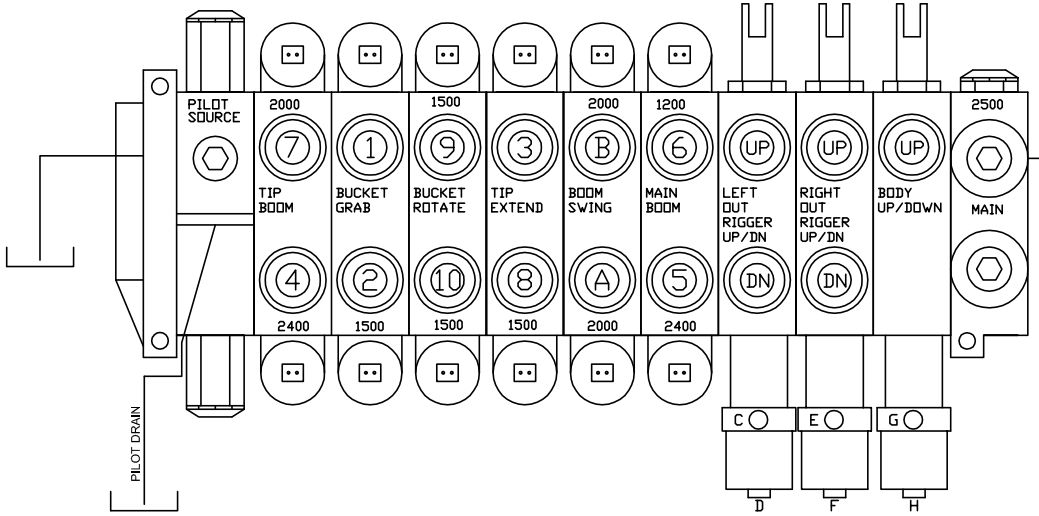
TITLE: HYDRAULIC CIRCUIT FOR RL - 3 / RL - 2 SIDE MOUNT

PART NUMBER: 52 07 04 001 3			SCALE: N/A
DRAWN BY:	APPROVED BY:	DATE: 6/24/99	SHEET: 1 OF 1

REV.	DESCRIPTION	DATE	BY

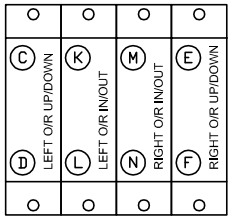
BOOM TUBES

1	2	3	4	5	6	7	8	9	10
BUCKET CLOSE	BUCKET OPEN	TIP EXT OUT	TIP BM UP	MAIN BM UP	MAIN BM DOWN	TIP BM DOWN	TIP EXT IN	BUCKET RIGHT	BUCKET LEFT

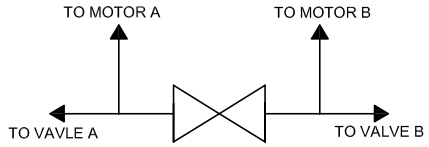


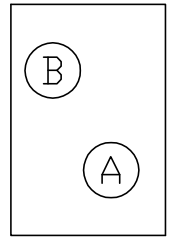
18 GPM @ 1400 RPM
PUMP SECTION 1

AIR CONTROLLERS MOUNTED INSIDE SIDE MOUNT OPERATOR'S CAB



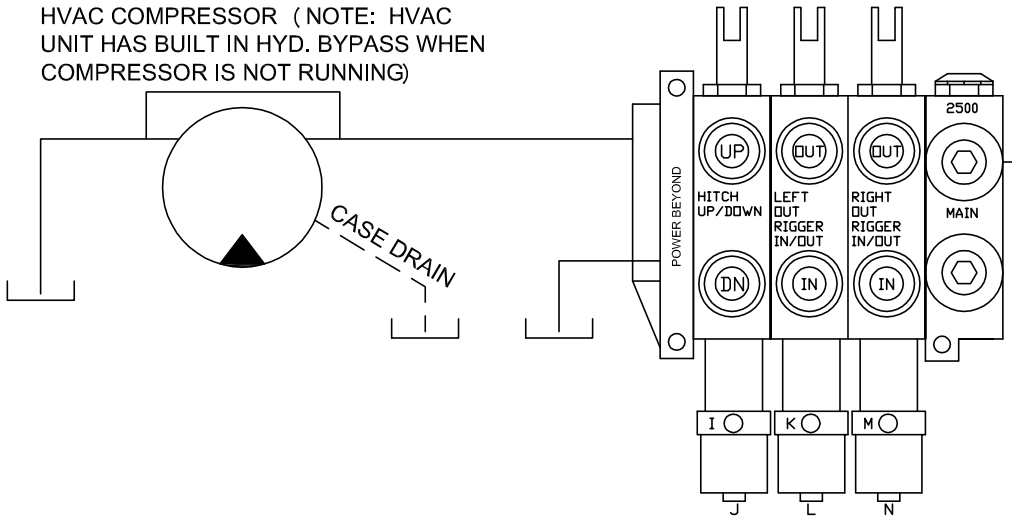
BOOM ROTATION FLOAT VALVE MOUNTED NEAR REAR AIR CONTROLS (1/4 TURN BALL VALVE)



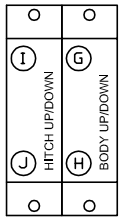


ROTATOR MOTOR AS VIEWED FROM REAR OF TRUCK

HVAC COMPRESSOR (NOTE: HVAC UNIT HAS BUILT IN HYD. BYPASS WHEN COMPRESSOR IS NOT RUNNING)



9 GPM @ 1400 RPM
PUMP SECTION 2



AIR CONTROLLERS MOUNTED AT REAR OF TRUCK

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

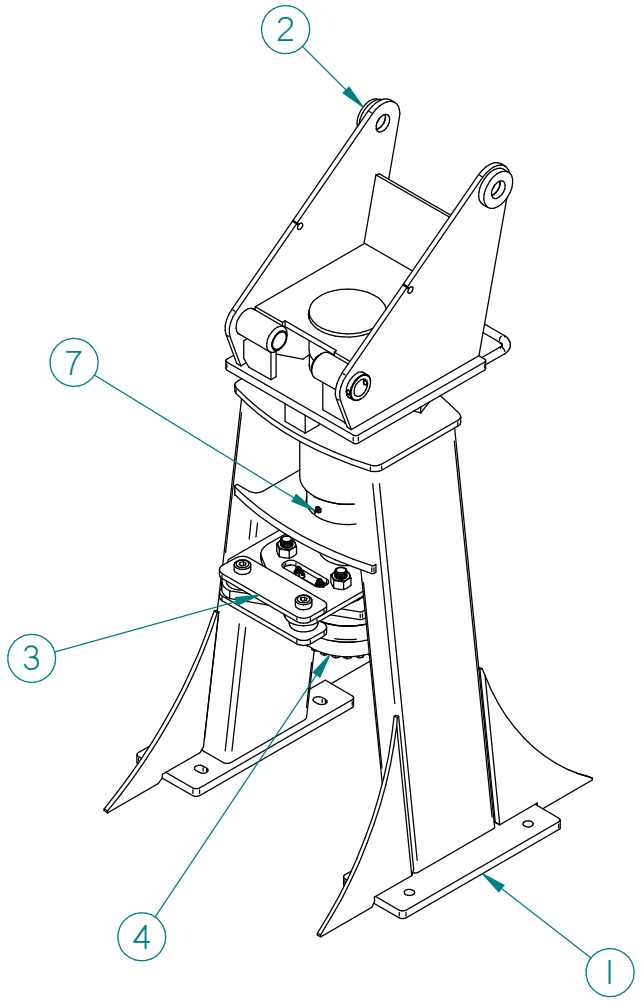
TITLE: RL3 PLUMBING WITH ELECTRONIC & PNEUMATIC CONTROLS

PART NUMBER:			SCALE: NA
DRAWN BY: JAC	APPROVED BY:	DATE: 6/2/2014	SHEET: 1 OF 1

010 ASSEMBLY

TORQUE SPECIFICATIONS:

*ROTARY ACTUATOR NUTS
TORQUE TO 500 FT-LB



Item #	Title	Document #	MACOLA	Quantity
1	PEDESTAL, REAR LOADER HA36 WELDMENT	31 02 06 005 0	106129	1
2	HEAD WELDMENT FOR HA36	31 01 06 002 4	107104	1
3	HA-36 TORQUE ARM ASSEMBLY	22 02 10 003 1	114103	1
4	HYDRAULIC, ACTUATOR HA36	HC01001	HC01001	1
5	SCREW, SOCKET HEAD CAP 1-1/4 - 7 X 3-1/2	SCA2056C	SCA2056C	4
6	NUT HEX 1-1/4 - 7 UNC CENTERLOCK	NUC20U	NUC20U	4
7	1/8" STRAIGHT GREASE FITTING	HF2002S	HF2002S	1
8	TRASH HEAD-PEDESTAL SPACER	41 02 15 001 2	106210	1
9	TRASH HEAD PEDESTAL NYLATRON SPACER	41 02 15 027 0	BU510002	1
10	TRASH HEAD LOCK - COLLAR	41 01 06 004 0	117103	2
11	BOLT HEX 1/2-13 X 3.00 USS G5	BL308048U513	BL308048U513	2
12	HEX NUT 1/2-13 STOVERLOCK	NUS08U	NUS08U	2

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4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: PEDESTAL, REAR LOADER HA36 ASSEMBLY

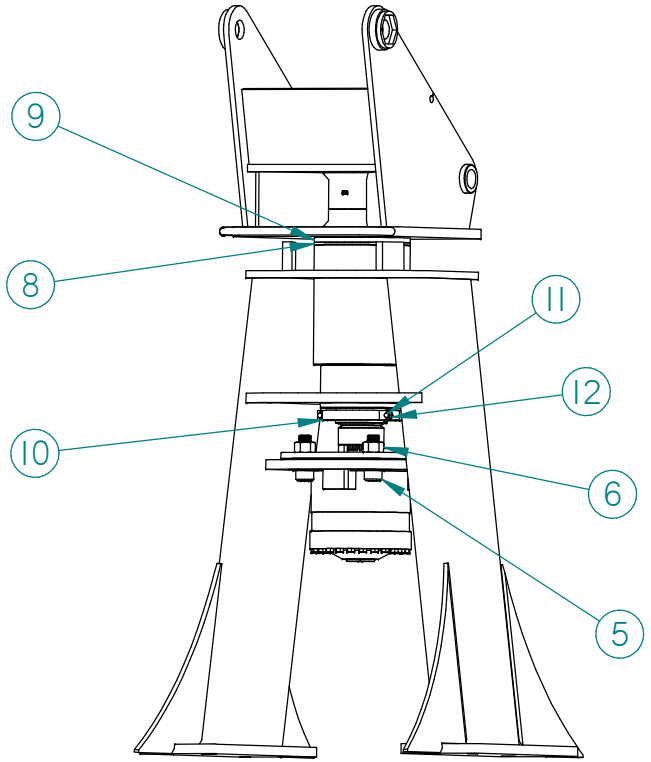
PART NUMBER:	SCALE:
31 02 06 006 0 / 106130	1:20

DRAWN BY:	APPROVED BY:	DATE:	SHEET:
BRB		06/15/2017	1 OF 2

010 ASSEMBLY

TORQUE SPECIFICATIONS:

*ROTARY ACTUATOR NUTS
TORQUE TO 500 FT-LB



Item #	Title	Document #	MACOLA	Quantity
1	PEDESTAL, REAR LOADER HA36 WELDMENT	31 02 06 005 0	106129	1
2	HEAD WELDMENT FOR HA36	31 01 06 002 4	107104	1
3	HA-36 TORQUE ARM ASSEMBLY	22 02 10 003 1	114103	1
4	HYDRAULIC, ACTUATOR HA36	HC01001	HC01001	1
5	SCREW, SOCKET HEAD CAP 1-1/4 - 7 X 3-1/2	SCA2056C	SCA2056C	4
6	NUT HEX 1-1/4 - 7 UNC CENTERLOCK	NUC20U	NUC20U	4
7	1/8" STRAIGHT GREASE FITTING	HF2002S	HF2002S	1
8	TRASH HEAD-PEDESTAL SPACER	41 02 15 001 2	106210	1
9	TRASH HEAD PEDESTAL NYLATRON SPACER	41 02 15 027 0	BU510002	1
10	TRASH HEAD LOCK - COLLAR	41 01 06 004 0	117103	2
11	BOLT HEX 1/2-13 X 3.00 USS G5	BL308048U513	BL308048U513	2
12	HEX NUT 1/2-13 STOVERLOCK	NUS08U	NUS08U	2

PETERSEN INDUSTRIES INC.
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TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: PEDESTAL, REAR LOADER HA36 ASSEMBLY

PART NUMBER:	SCALE:
31 02 06 006 0 / 106130	

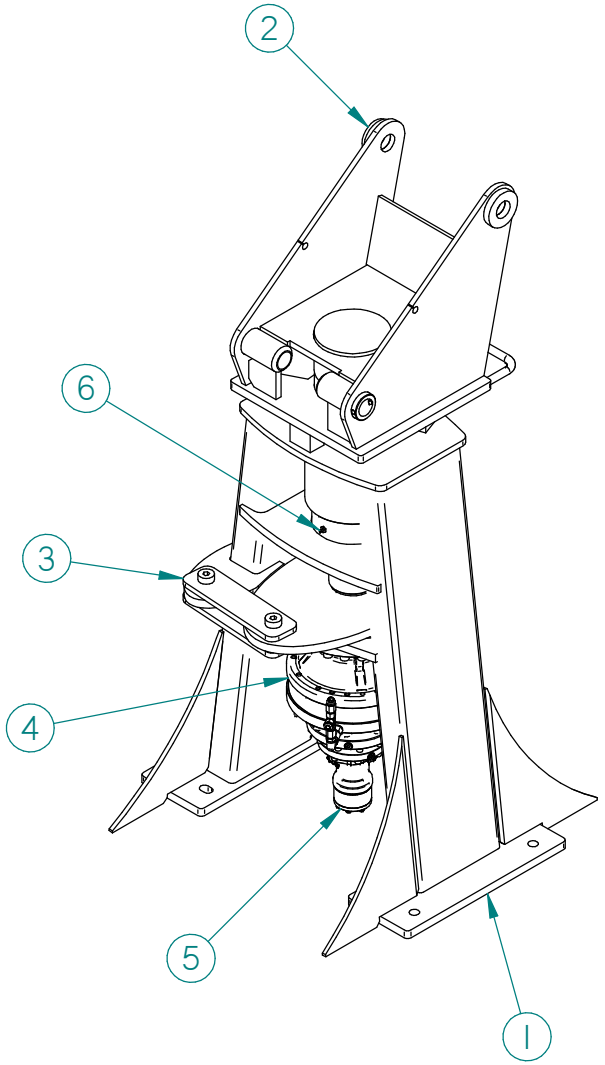
DRAWN BY:	APPROVED BY:	DATE:	SHEET:
BRB		06/15/2017	2 OF 2

010 ASSEMBLY

TORQUE SPECIFICATIONS:

- GEARBOX BOLTS SCA1032C
  BOLTS SHOULD BE OIL FREE
  & HAVE RED LOCK TIGHT APPLIED.
  TORQUE TO 160 FT-LB.

- MOTOR BOLT FA1112MM28
  TORQUE TO 60 FT-LB & INSTALL
  LOCK CLIPS & SNAP RINGS.



Item #	Title	Document #	MACOLA	Quantity
1	PEDESTAL, REAR LOADER GEARBOX WELDMENT	31 02 06 003 0	106127	1
2	HEAD WELDMENT FOR GEARBOX	31 01 06 005 1	107105	1
3	GEARBOX TORQUE ARM ASSEMBLY - INLINE	31 02 07 002 3	114101	1
4	DINAMIC OIL SLEWING GEARBOX	HC01005	HC01005	1
5	HYDRAULIC MOTOR	HC01006	HC01006	1
6	1/8" STRAIGHT GREASE FITTING	HF2002S	HF2002S	1
7	TRASH HEAD-PEDESTAL SPACER	41 02 15 001 2	106210	1
8	TRASH HEAD PEDESTAL NYLATRON SPACER	41 02 15 027 0	BU510002	1
9	TRASH HEAD LOCK - COLLAR	41 01 06 004 0	117103	2
10	BOLT HEX 1/2-13 X 3.00 USS G5	BL308048U513	BL308048U513	2
11	HEX NUT 1/2-13 STOVERLOCK	NUS08U	NUS08U	2
12	GEARBOX MOUNTING BOLT	SCA1032C	SCA1032C	20
13	MOTOR LOCKING BOLT	FAA1112MM28	FA1112MM28	2
14	HYDRAULIC, #6 JIC X #10 M OR 90	HF10610JM9	HF10610JM9	2

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: REAR LOADER GB ASSEMBLY

PART NUMBER: 31 02 06 004 0 / 106128

SCALE: 1:20

DRAWN BY: BRB

APPROVED BY:

DATE: 06/14/2017

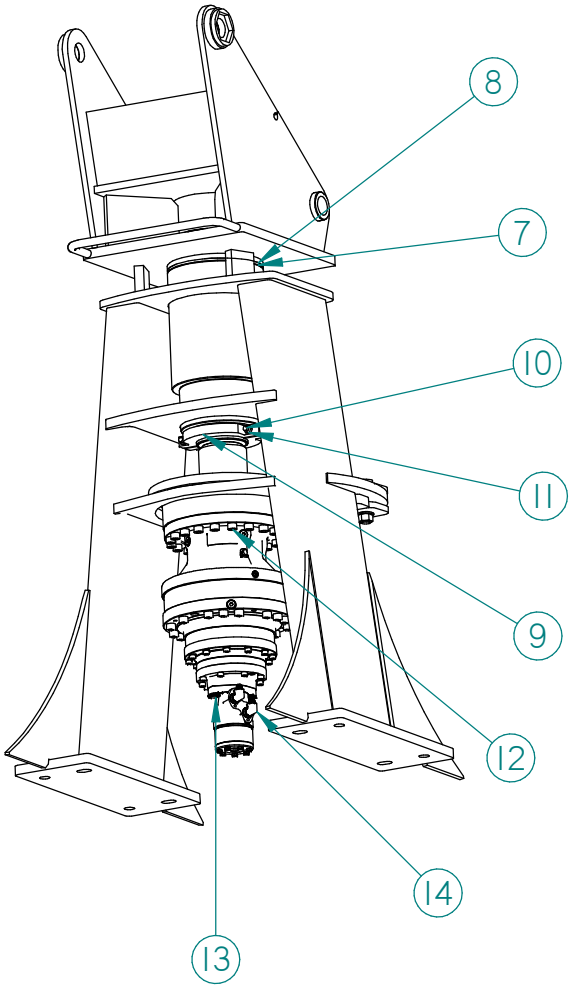
SHEET: 1 OF 2

010 ASSEMBLY

TORQUE SPECIFICATIONS:

- GEARBOX BOLTS SCA1032C
  BOLTS SHOULD BE OIL FREE
  & HAVE RED LOCK TIGHT APPLIED.
  TORQUE TO 160 FT-LB.

- MOTOR BOLT FA1112MM28
  TORQUE TO 60 FT-LB & INSTALL
  LOCK CLIPS & SNAP RINGS.



Item #	Title	Document #	MACOLA	Quantity
1	PEDESTAL, REAR LOADER GEARBOX WELDMENT	31 02 06 003 0	106127	1
2	HEAD WELDMENT FOR GEARBOX	31 01 06 005 1	107105	1
3	GEARBOX TORQUE ARM ASSEMBLY - INLINE	31 02 07 002 3	114101	1
4	DINAMIC OIL SLEWING GEARBOX	HC01005	HC01005	1
5	HYDRAULIC MOTOR	HC01006	HC01006	1
6	1/8" STRAIGHT GREASE FITTING	HF2002S	HF2002S	1
7	TRASH HEAD-PEDESTAL SPACER	41 02 15 001 2	106210	1
8	TRASH HEAD PEDESTAL NYLATRON SPACER	41 02 15 027 0	BU510002	1
9	TRASH HEAD LOCK - COLLAR	41 01 06 004 0	117103	2
10	BOLT HEX 1/2-13 X 3.00 USS G5	BL308048U513	BL308048U513	2
11	HEX NUT 1/2-13 STOVERLOCK	NUS08U	NUS08U	2
12	GEARBOX MOUNTING BOLT	SCA1032C	SCA1032C	20
13	MOTOR LOCKING BOLT	FAA1112MM28	FA1112MM28	2
14	HYDRAULIC, #6 JIC X #10 M OR 90	HF10610JM9	HF10610JM9	2

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: REAR LOADER GB ASSEMBLY

PART NUMBER: 31 02 06 004 0 / 106128

SCALE:

DRAWN BY: BRB

APPROVED BY:

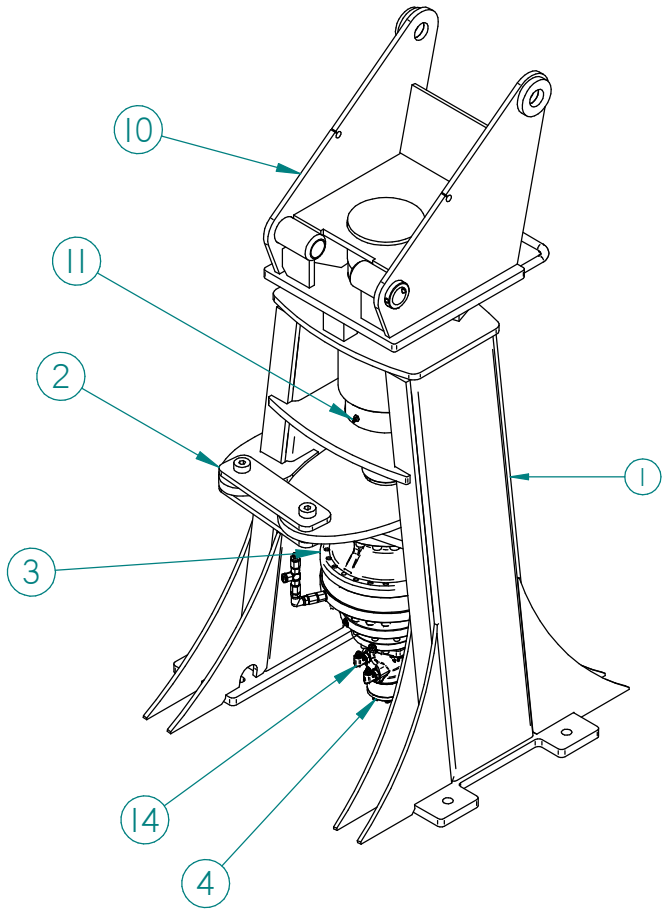
DATE: 06/14/2017

SHEET: 2 OF 2

TORQUE SPECIFICATIONS:

- GEARBOX BOLTS SCAI032C
  BOLTS SHOULD BE OIL FREE
  & HAVE RED LOCK TIGHT APPLIED.
  TORQUE TO 160 FT-LB.

- MOTOR BOLT FAI112MM28
  TORQUE TO 60 FT-LB & INSTALL
  LOCK CLIPS & SNAP RINGS.



Item #	Title	Document #	MACOLA	Qty
1	PEDESTAL, REAR STEER WELDMENT	31 02 07 001 3	106109	1
2	GEARBOX TORQUE ARM ASSEMBLY - INLINE	31 02 07 002 3	114101	1
3	DINAMIC OIL SLEWING GEARBOX	HC01005	HC01005	1
4	HYDRAULIC MOTOR	HC01006	HC01006	1
5"	MOTOR LOCKING BOLT	FAAI112MM28	FAI112MM28	2
6"	GEARBOX MOUNTING BOLT	SCAI032C	SCAI032C	20
7"	TRASH HEAD LOCK - COLLAR	41 01 06 004 0	117103	2
8"	TRASH HEAD-PEDESTAL SPACER	41 02 15 001 2	106210	1
9"	TRASH HEAD PEDESTAL NYLATRON SPACER	41 02 15 027 0	BU510002	1
10	HEAD WELDMENT FOR GEARBOX	31 01 06 005 1	107105	1
11	1/8" STRAIGHT GREASE FITTING	HF2002S	HF2002S	2
12"	BOLT HEX 1/2-13 X 3.00 USS G5	BL308048U513	BL308048U513	2
13"	HEX NUT 1/2-13 USS	NUA08U	NUA08U	2
14	HYDRAULIC, #6 JIC X #10 M OR 90	HF10610JM9	HF10610JM9	2

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: PEDESTAL, REAR STEER ASSEMBLY

PART NUMBER: 31 02 07 005 0 / 106120

SCALE: 1:20

DRAWN BY: SWB

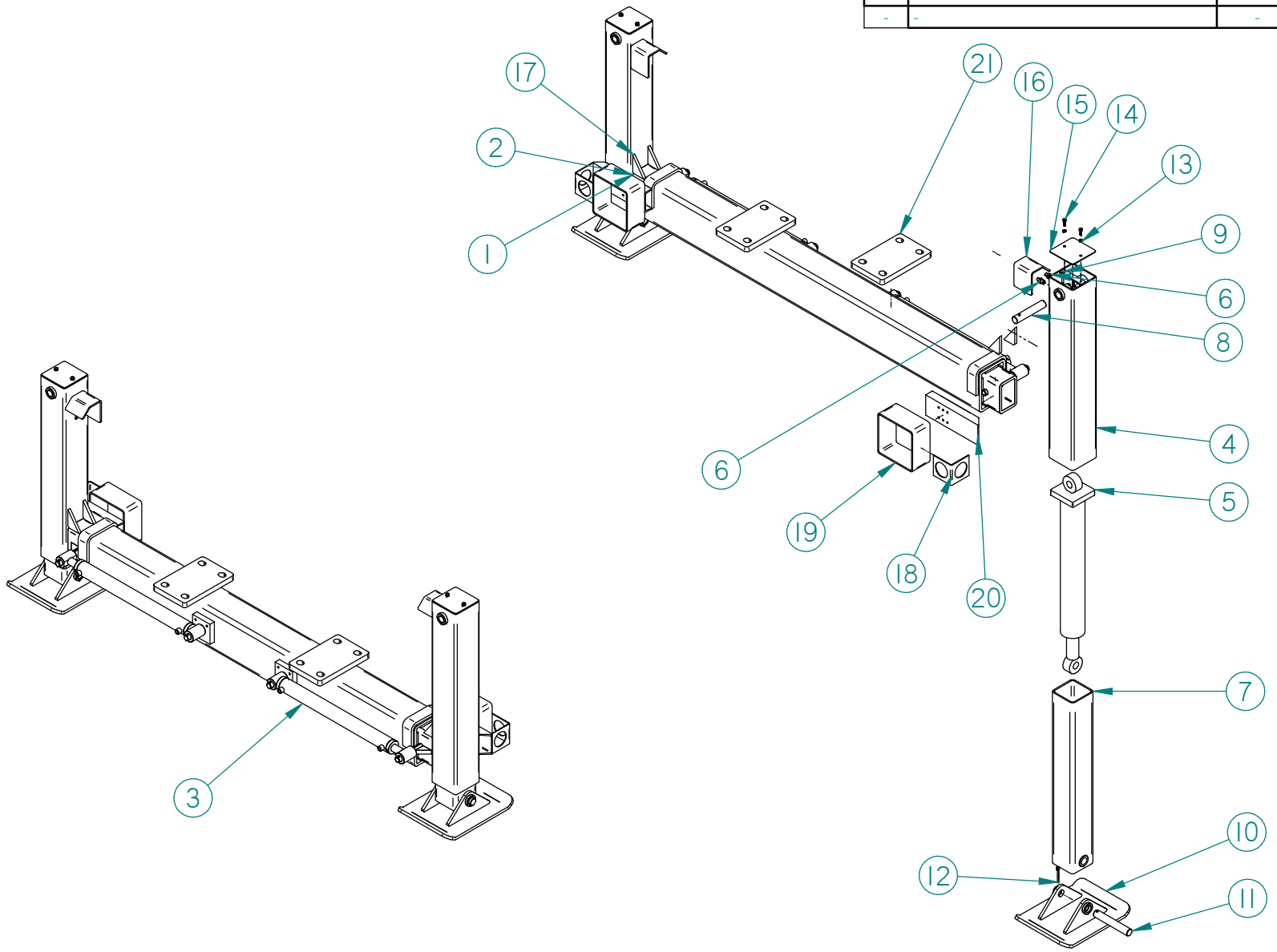
APPROVED BY:

DATE: 02/08/2016

SHEET: 1 OF 1

010 ASSEMBLY

REV.	DESCRIPTION	DATE	BY
-	-	-	-



TOLERANCES

1 DEC.	± 0.100
2 DEC.	± 0.050
3 DEC.	± 0.010
ANGLE:	± 1.000°
FRACTION:	± 1/32"
DIM. UNITS:	INCHES
SURFACE FINISH:	125/32

UNLESS OTHERWISE SPECIFIED

DEC. = DECIMAL PLACE(S)

LIGHTNING LOADER PETERSEN INDUSTRIES

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: RL AND RS OUTRIGGERS ASSEMBLY

PART NUMBER:	SCALE:
22 06 04 014 0	1:25

DRAWN BY:	APPROVED BY:	DATE:	SHEET:
SWB		06/27/2017	1 OF 2

Item #	Title	Document #	MACOLA	Qty
1	OUTRIGGER, #3A HORIZONTAL LEG ASSEMBLY	22 06 04 001 1	113102	1
2	OUTRIGGER, #3A INNER HORIZONTAL LEG WELDMENT	22 06 04 005 0	113114	2
3	OUTRIGGER IN/OUT CYLINDER	CY05001	CY05001	2
4	OUTRIGGER LEG OUTER TUB	22 06 04 007 1	113104	2
5	CYLINDER, OUTRIGGER, VERTICAL LEG EXTENSION RL AND RS	CY05006	CY05006	2
6	HYDRAULIC, FITTING #6-6 MALE CONNECTOR	HF060606	HF060606	4
7	OUTRIGGER, LEG INNER TUB	22 06 04 006 1	113105	2
8	PIN, VERTICAL CYLINDER, BASE END	42 06 04 021 1	PI18106F1	2
9	ROLL PIN, .3125 X 2	FA040532	FA040532	2
10	OUTRIGGER FOOT ASSEMBLY	22 06 04 008 1	113106	2
11	PIN - OUTRIGGER LEG CYLINDER LOWER	42 06 04 010 2	PI18122F	2
12	COTTER PIN, 5/16 X 3	FA020548	FA020548	2
13	WASHER LOCK 5/16 SPLIT	WAS055	WAS055	4
14	HEX BOLT 5/16-18 X 1 USS G5	BL305016U518	BL305016U518	4
15	OUTRIGGER VERTICAL LEG COVER PLATE	42 06 04 023 0	113107	2
16	RL, OUTRIGGER, HOSE GUARD	42 06 04 018 0	113178	2
17	OUTRIGGER, #3 TUBE GUSSET, VERTICAL TO HORIZONTAL	42 06 04 028 0	113124	4
18	RS, REAR RED MARKER LIGHT BRACKET	42 05 19 010 0	119337	2
19	TAIL LIGHT PROTECTOR	41 08 04 051 0	125379	2
20	BODY, RS REAR LIGHT SUPPORT	42 05 19 009 0	119264	2
21	RL, OUTRIGGER 3 MOUNTING PLATE	42 06 04 020 3	113179	2

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

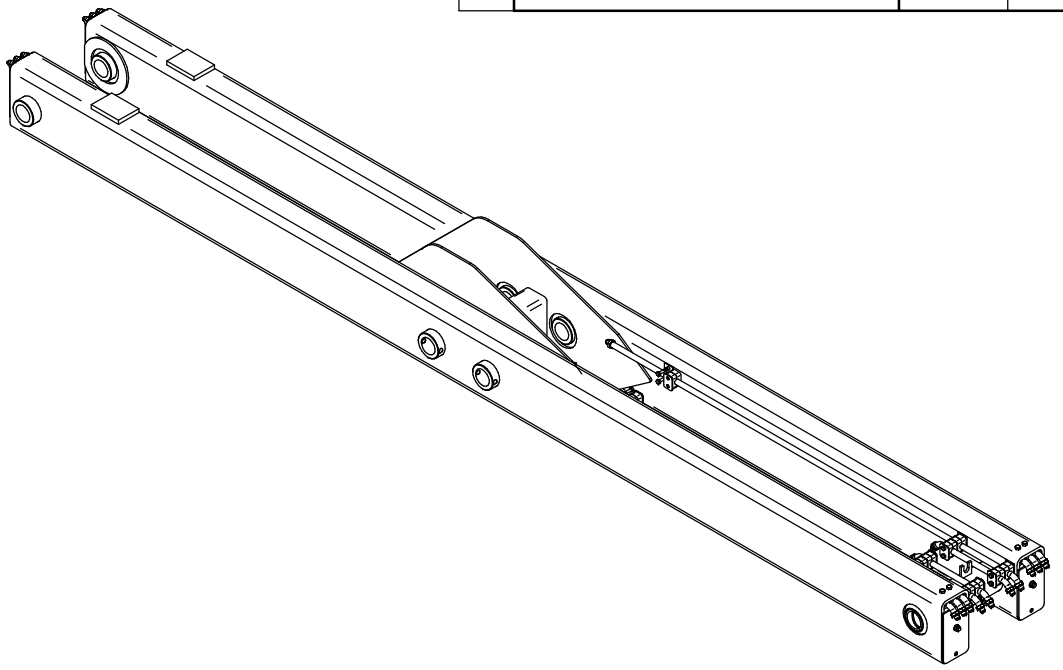
TITLE: RL AND RS OUTRIGGERS ASSEMBLY

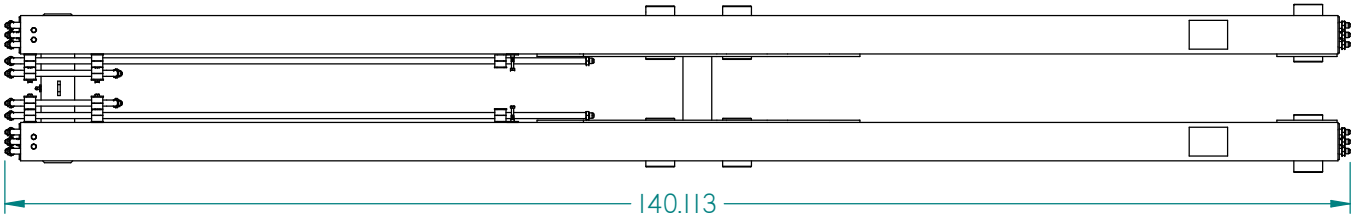
PART NUMBER:	SCALE:
22 06 04 014 0	NA

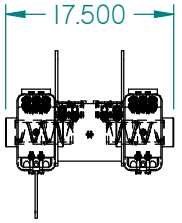
DRAWN BY:	APPROVED BY:	DATE:	SHEET:
SWB		06/27/2017	2 OF 2

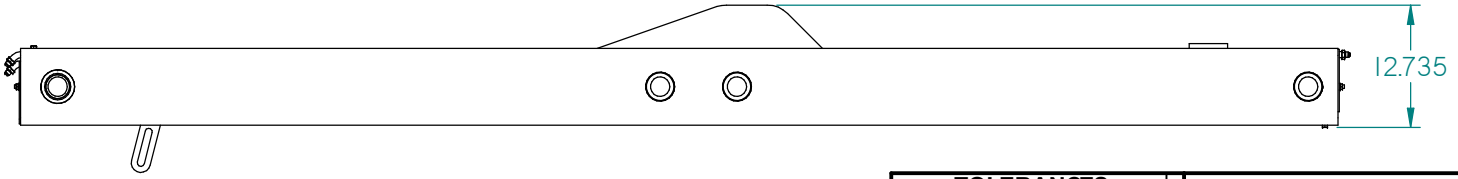
REV.	DESCRIPTION	DATE	BY
-	-	-	-

010 ASSEMBLY









TOLERANCES

1 DEC.	± 0.100
2 DEC.	± 0.050
3 DEC.	± 0.010
ANGLE:	± 1.000°
FRACTION:	± 1/32"
DIM. UNITS:	INCHES
SURFACE FINISH:	125/32

UNLESS OTHERWISE SPECIFIED

DEC. = DECIMAL PLACE(S)

LIGHTNING LOADER PETERSEN INDUSTRIES

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

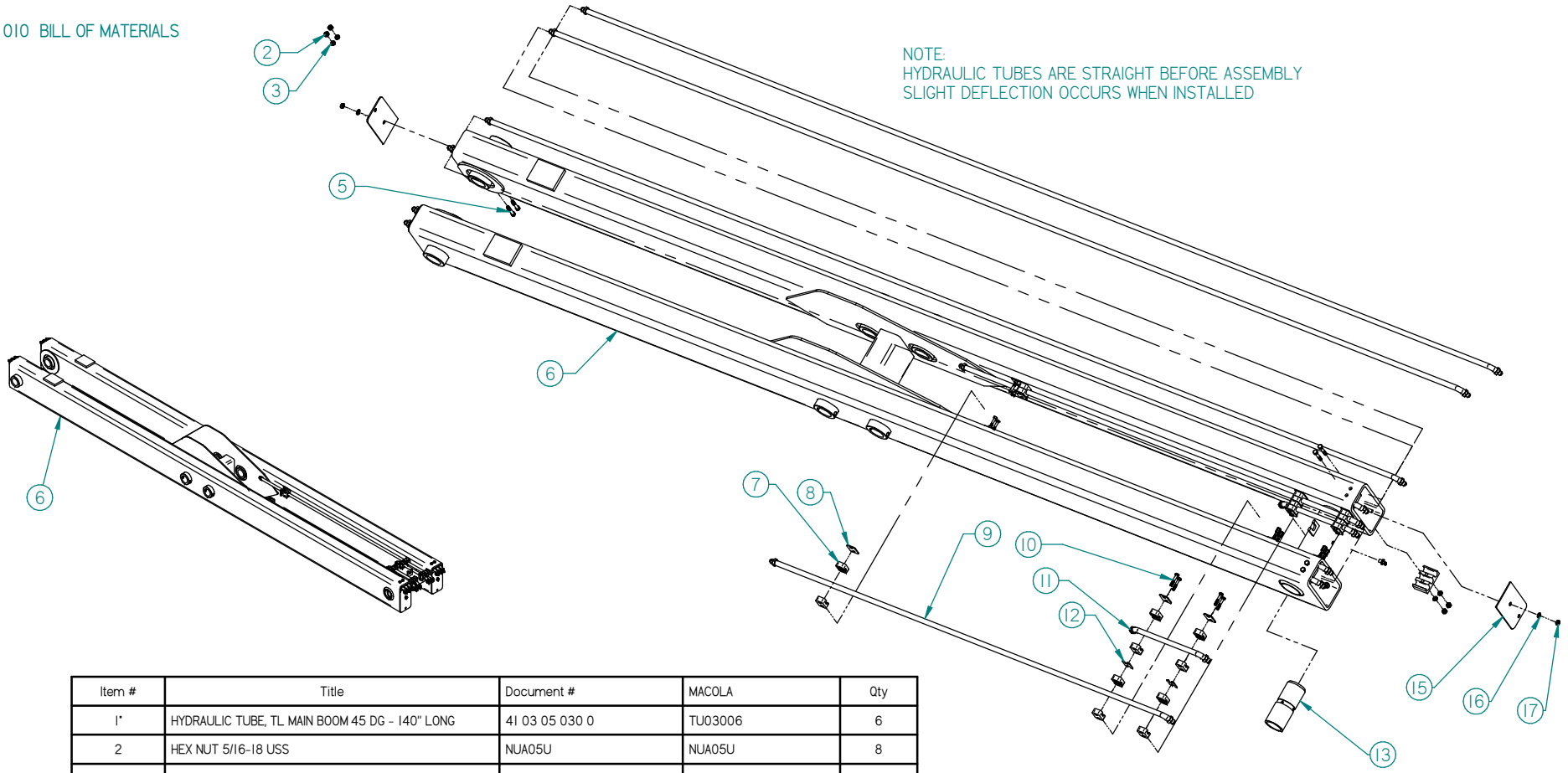
TITLE: MAIN BOOM TL3 ASSEMBLY

PART NUMBER:	SCALE:
12 03 04 001 0 / 108103	1:20

DRAWN BY:	APPROVED BY:	DATE:	SHEET:
OJ		08/04/2006	1 OF 2

010 BILL OF MATERIALS

NOTE:
HYDRAULIC TUBES ARE STRAIGHT BEFORE ASSEMBLY
SLIGHT DEFLECTION OCCURS WHEN INSTALLED



Item #	Title	Document #	MACOLA	Qty
1*	HYDRAULIC TUBE, TL MAIN BOOM 45 DG - 140" LONG	41 03 05 030 0	TU03006	6
2	HEX NUT 5/16-18 USS	NUA05U	NUA05U	8
3	WASHER LOCK 5/16 SPLIT	WAS055	WAS055	8
4*	3 HOLE CLAMP NYLATRON	40 00 00 066 0	CLT3N	4
5	HEX BOLT 5/16-18 X 2 UNC G5	BL305032U518	BL305032U518	8
6	TL MAIN BOOM WELDMENT	21 03 05 002 2	108152	1
7	CLAMP, PLASTIC (1-HOLE) (1 SET)	CLP210	CLP210	10
8	CLAMP, TOP PLATE ONLY (1-HOLE)	CL5G215	CL5G215	6
9	HYDRAULIC TUBE, TL MAIN BOOM 45 DG - 62" LONG	41 03 05 029 0	TU02002	2
10	BOLT HEX 1/4-20 X 1-1/2 UNC G5	BL304024U520	BL304024U520	8
11	HYDRAULIC TUBE, TL MAIN BOOM45 DG - 12" LONG	41 03 05 020 0	TU03002	2
12	CLAMP SAFETY PLATE	CL5G211	CL5G211	4
13	BUSHING, 2-1/2" X 2" X 6" NYLATRON	41 03 05 028 2	BU503004	2
14*	1/8" STRAIGHT GREASE FITTING	HF2002S	HF2002S	1
15	TL MAIN BOOM END CAP	41 03 05 007 2	108225	4
16	WASHER LOCK 3/8 SPLIT	WAS065	WAS065	4
17	HEX NUT 3/8 -16 USS	NUA06U	NUA06U	4

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

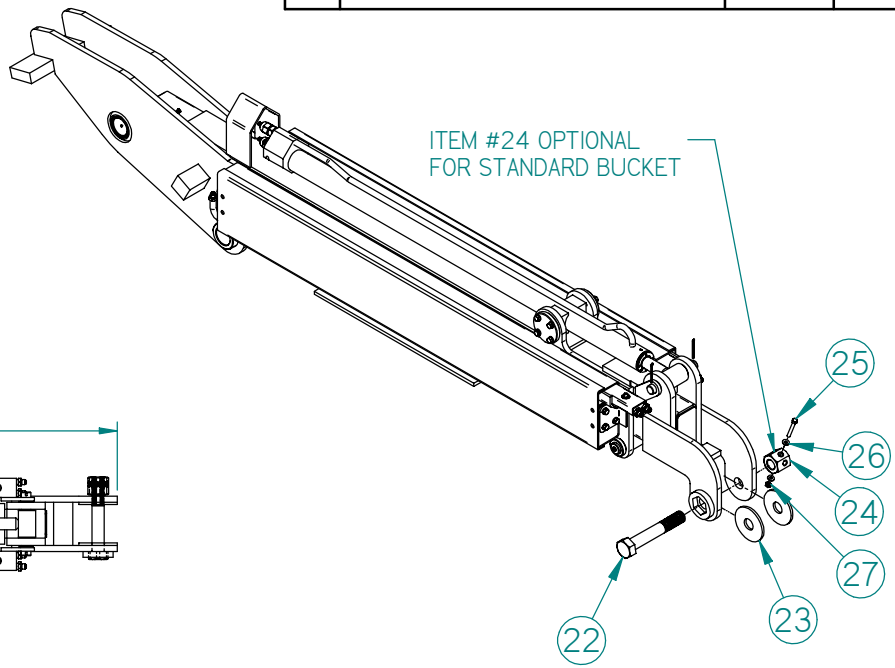
TITLE: MAIN BOOM TL3 ASSEMBLY

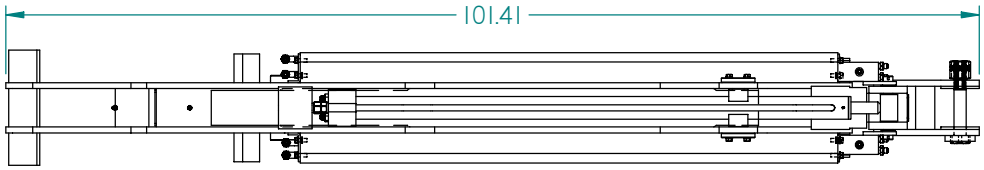
PART NUMBER:	SCALE:
12 03 04 001 0 / 108103	1:20

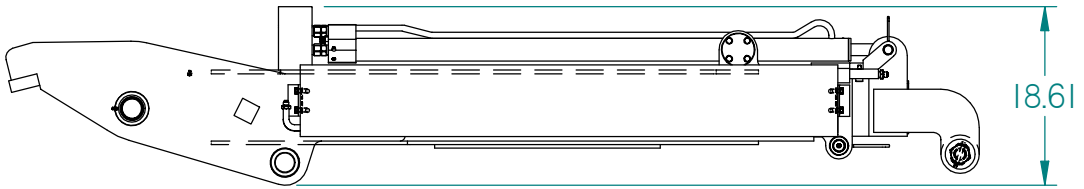
DRAWN BY:	APPROVED BY:	DATE:	SHEET:
OJ		08/04/2006	2 OF 2

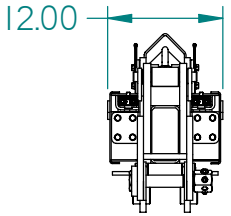
010 ASSEMBLY

REV.	DESCRIPTION	DATE	BY
-	-	-	-









TOLERANCES

1 DEC.	± 0.100
2 DEC.	± 0.050
3 DEC.	± 0.010
ANGLE:	± 1.000°
FRACTION:	± 1/32"
DIM. UNITS:	INCHES
SURFACE FINISH:	125/32

UNLESS OTHERWISE SPECIFIED

DEC. = DECIMAL PLACE(S)

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: TL3 TIP BOOM ASSEMBLY

PART NUMBER: 12 04 04 002 1 / 109103

SCALE: 1:20

DRAWN BY: BRB

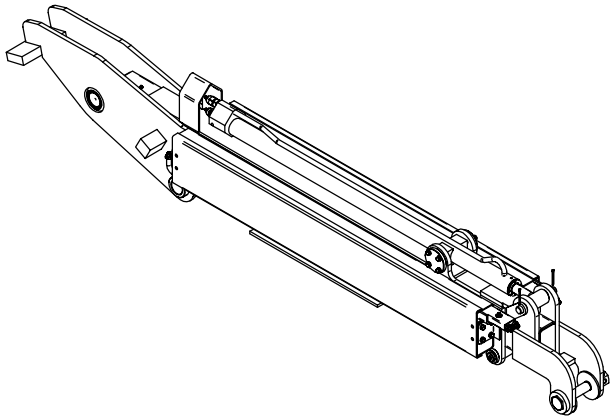
APPROVED BY:

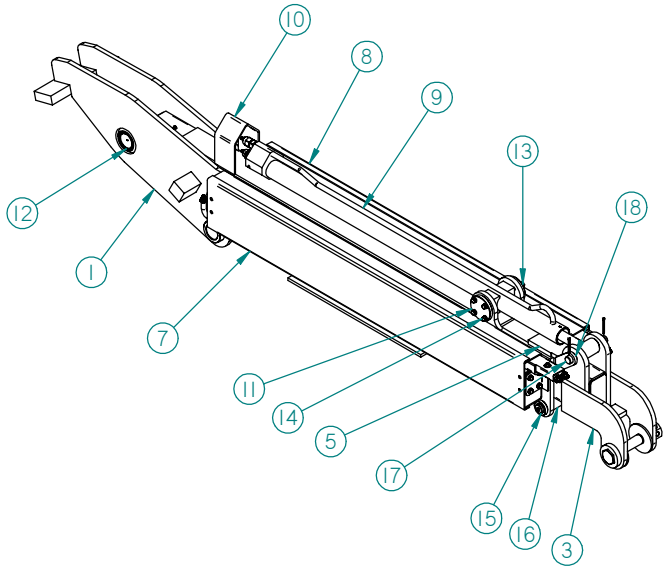
DATE: 10/26/2016

SHEET: 1 OF 2

010 BILL OF MATERIALS

Item #	Title	Document #	MACOLA	QTY
1	TL3 TIP BOOM OUTER WELDMENT	21 04 04 011 1	109152	1
2*	TL3 TIP BOOM SIDE WEAR PAD 2-7/8 X 5	41 04 04 041 0	BU303003	2
3	TL3 TIP EXTENSION INNER TUBE WELDMENT	21 04 04 010 3	109153	1
4*	TIP EXTENSION SQUARE WEAR PUCK	41 04 04 028 1	109210	10
5	TIP EXTENSION WEAR PLT RTNR / RTRCT STOP PLT ASSEMBLY	21 04 04 009 0	109154	1
6*	TL3 TIP BOOM TOP WEAR PAD 2-7/8 X 4	41 04 04 040 0	BU303002	1
7	HOSE RECOIL BOX ASSEMBLY - RIGHT	21 04 04 012 1	123122	1
8	HOSE RECOIL BOX ASSEMBLY - LEFT	21 04 04 013 1	123121	1
9	TIP EXTENSION CYLINDER SHAFT ASSEMBLY	22 14 01 010 2	121105	1
10	TIP BOOM TIP EXTENSION GUARD	41 04 04 027 1	109238	1
11	TRUNION TIP EXTENSION CYLINDER MOUNT	41 04 04 004 1	109205	2
12	BUSHING, 2 1/2 X 2 X 2 NYLATRON	41 11 09 022 5	BU502008	2
13	WASHER LOCK 3/8 SPLIT	WAS065	WAS065	8
14	HEX BOLT 3/8-16 X 1.00 USS G5	BL306016U516	BL306016U516	8
15	PIN, CONNECT	41 04 04 018 0	PI18105F	1
16	TIP BOOM, SUPPORT ROLLER WITH BUSHINGS	31 04 04 008 0	109235	1
17	PIN, CONNECT	41 04 04 012 0	PI16112F	1
18	WASHER, BUSHING 1.00 X 1.50	WAB1624	WAB1624	2
19*	PIN, COTTER .187 X 2	FA020332	FA020332	2
20*	COTTER PIN 5/16 X 3	FA020548	FA020548	1
21*	HYDRAULIC, .125 STRAIGHT GREASE FITTING	HF2002S	HF2002S	3
22	HEX BOLT 1-1/4-7 X 7-3/4 GR8	BL120124U87	BL120124U87	1
23	BUCKET BRAKE WASHER 4 X 1-5/16 X 1/4	WAF642004	WAF642004	2
24	BUCKET BOLT NUT	40 00 00 053 1	102454	1
25	HEX BOLT 5/16-18 X 2.50 USS G5	BL305040U518	BL305040U518	1
26	WASHER FLAT 5/16 USS	WAF05U5	WAF05U5	2
27	HEX NUT 5/16-24 SAE STOVERLOCK	NUS05S	NUS05S	1





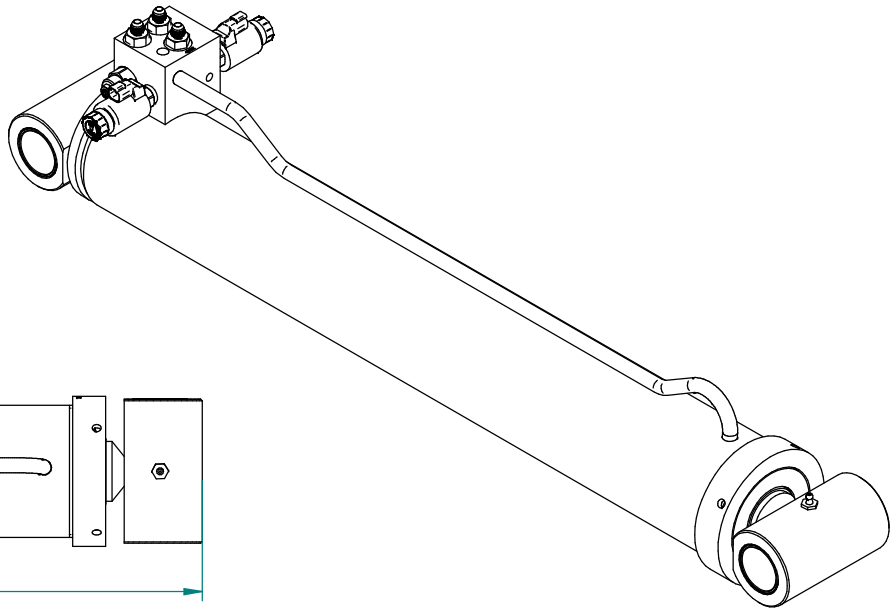
PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

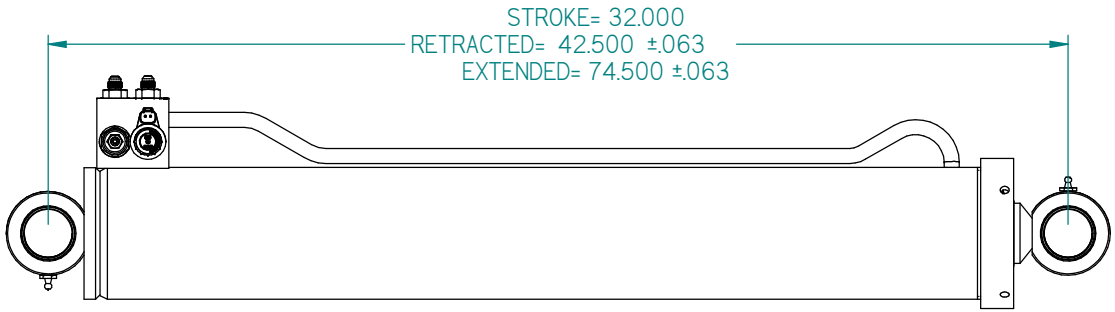
TITLE: TL3 TIP BOOM ASSEMBLY

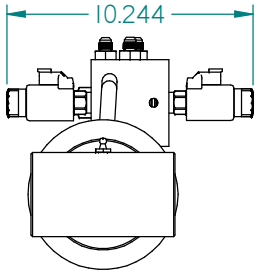
PART NUMBER:	SCALE:
12 04 04 002 1 / 109103	1:24

DRAWN BY:	APPROVED BY:	DATE:	SHEET:
BRB		10/26/2016	2 OF 2

010 ASSEMBLY
020 COUNTER BALANCE VALVE SET TO 3100 PSI
030 5" BORE X 32" STROKE X 2.5" ROD





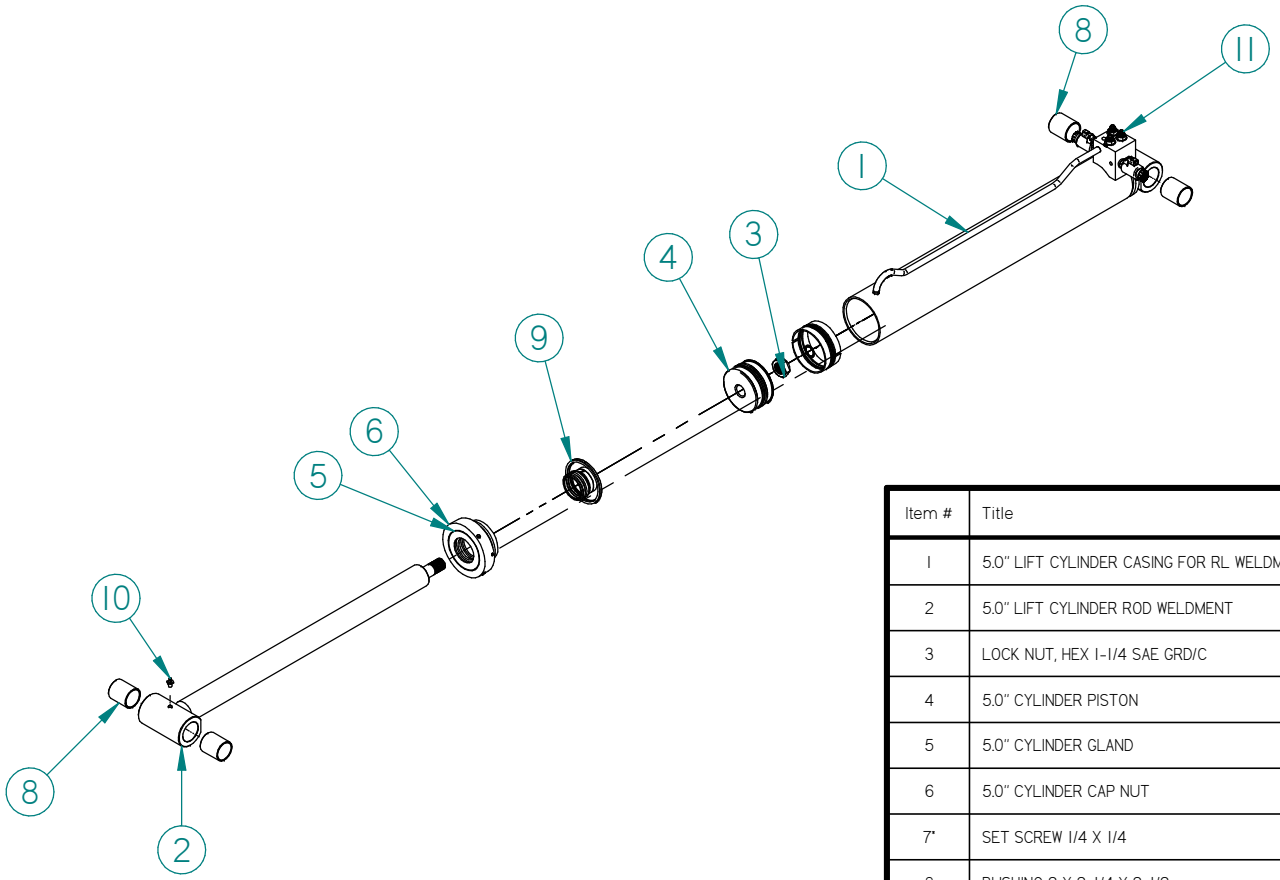


USED FOR RL3 MAIN LIFT CYLINDER TO ALLOW MAIN BOOM UP/DOWN FLOAT WHILE IN TRANSIT

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: 5.0" LIFT CYLINDER FOR RL			
PART NUMBER: 21 14 05 019 0 / 121236			SCALE: 1:8
DRAWN BY: SWB	APPROVED BY:	DATE: 04/06/2017	SHEET: 1 OF 3

010 BILL OF MATERIALS
020 INSTALL BUSHING (ITEM 8) INTO ROD SPOOL. THEN
DRILL THRU HOLE FOR GREASE FITTING (ITEM 10)



Item #	Title	Document #	MACOLA	Qty
1	5.0" LIFT CYLINDER CASING FOR RL WELDMENT	21 14 05 018 0	121235	1
2	5.0" LIFT CYLINDER ROD WELDMENT	21 14 05 002 0	121174	1
3	LOCK NUT, HEX 1-1/4 SAE GRD/C	NUL20S	NUL20S	1
4	5.0" CYLINDER PISTON	41 14 05 009 7	121157	1
5	5.0" CYLINDER GLAND	41 14 05 008 2	121158	1
6	5.0" CYLINDER CAP NUT	42 14 05 001 0	121156	1
7*	SET SCREW 1/4 X 1/4	SCB0404	SCB0404	1
8	BUSHING 2 X 2-1/4 X 2-1/2	BU402024	BU402024	4
9	SEAL KIT 2-1/2 X 5 TH10329A	52 14 05 001 0	HPKTH10329A	1
10	1/8" STRAIGHT GREASE FITTING	HF2002S	HF2002S	2
11	HYDRAULIC, #6 JIC X #8 M OR	HF10608JM	HF10608JM	3

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: 5.0" LIFT CYLINDER FOR RL

PART NUMBER: 21 14 05 019 0 / 121236

SCALE: 1:20

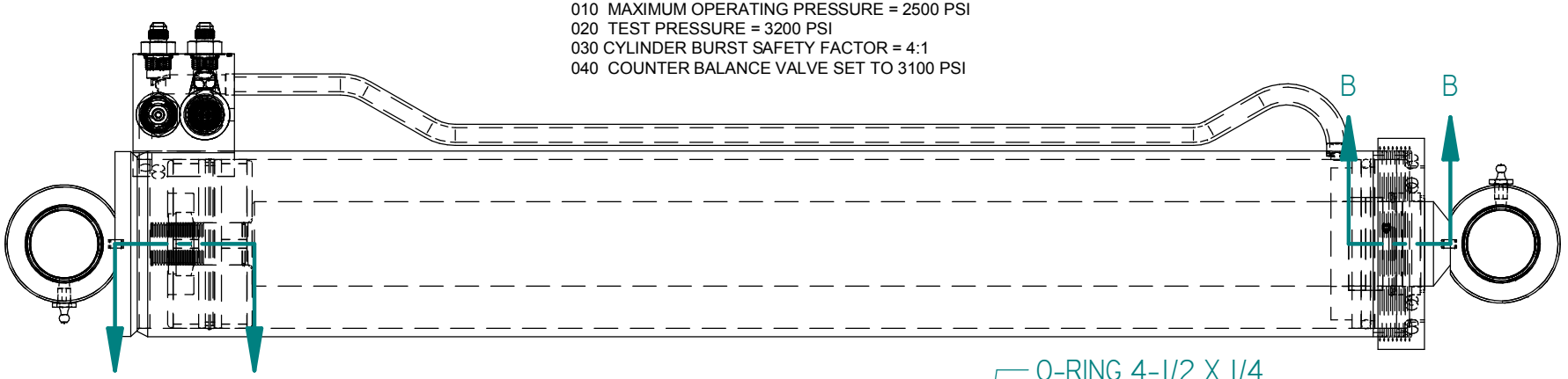
DRAWN BY: SWB

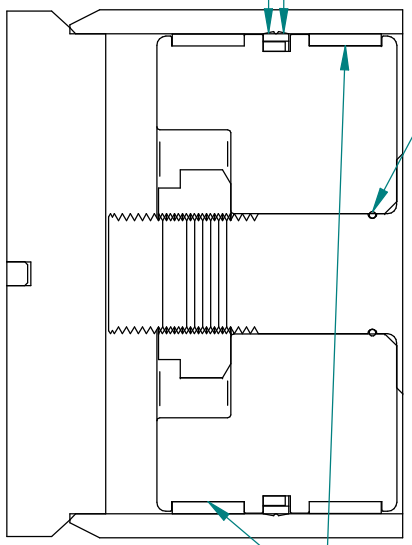
APPROVED BY:

DATE: 04/06/2017

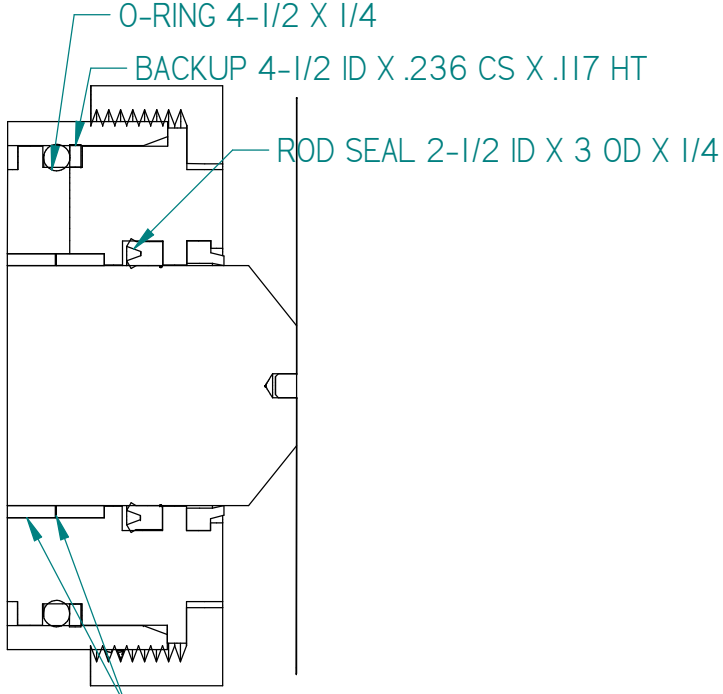
SHEET: 2 OF 3

010 MAXIMUM OPERATING PRESSURE = 2500 PSI
020 TEST PRESSURE = 3200 PSI
030 CYLINDER BURST SAFETY FACTOR = 4:1
040 COUNTER BALANCE VALVE SET TO 3100 PSI





SECTION A-A

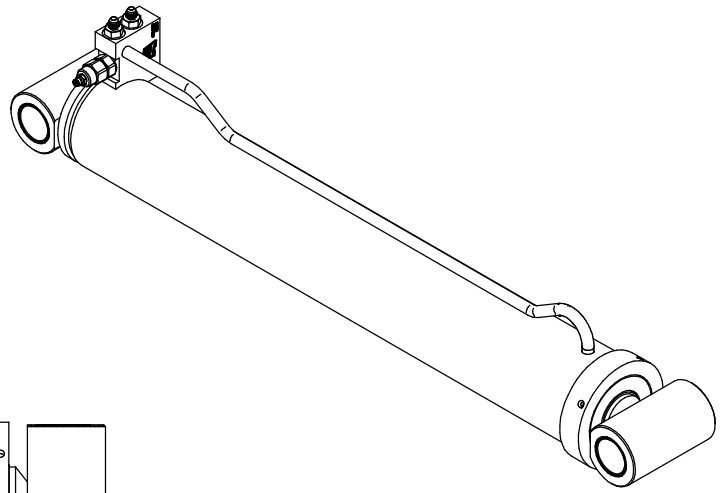


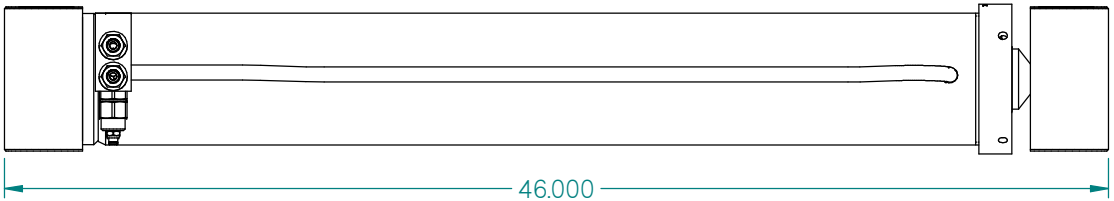
SECTION B-B

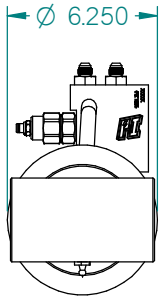
PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

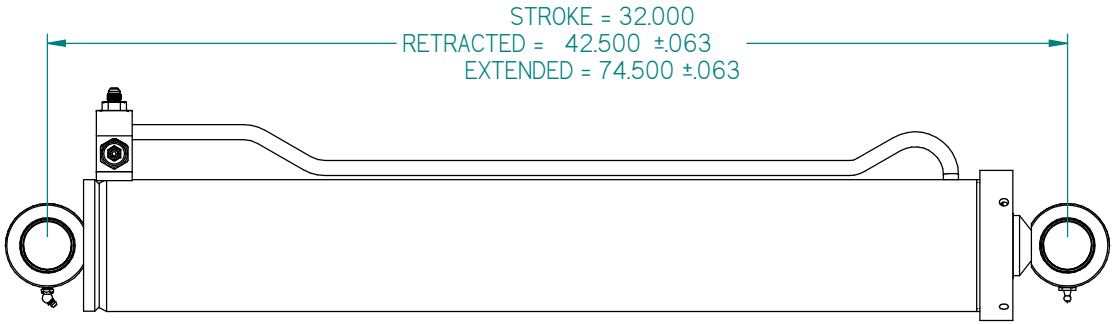
TITLE: 5.0" LIFT CYLINDER FOR RL			
PART NUMBER: 21 14 05 019 0 / 121236			SCALE: NA
DRAWN BY: SWB	APPROVED BY:	DATE: 04/06/2017	SHEET: 3 OF 3

010 ASSEMBLY
020 COUNTER BALANCE VALVE SET TO 3100 PSI
030 5" BORE X 32" STROKE X 2.5" ROD





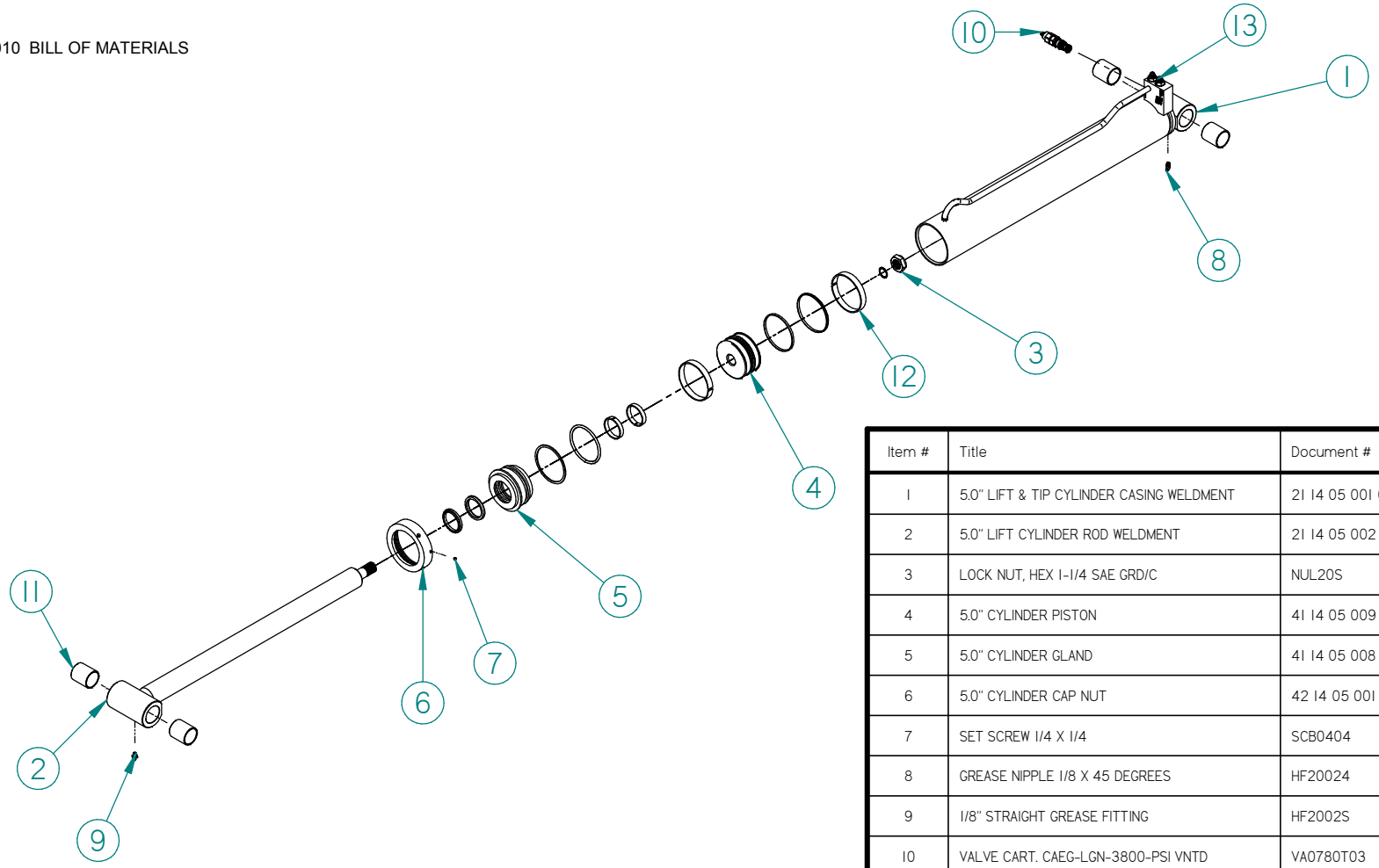




PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: 5.0" LIFT CYLINDER			
PART NUMBER: 21 14 05 003 0 / 121101			SCALE: 1:8
DRAWN BY: Olvera J.	APPROVED BY:	DATE: 11/23/2005	SHEET: 1 OF 3

010 BILL OF MATERIALS



Item #	Title	Document #	MACOLA	Qty
1	5.0" LIFT & TIP CYLINDER CASING WELDMENT	21 14 05 001 0	121126	1
2	5.0" LIFT CYLINDER ROD WELDMENT	21 14 05 002 0	121174	1
3	LOCK NUT, HEX 1-1/4 SAE GRD/C	NUL20S	NUL20S	1
4	5.0" CYLINDER PISTON	41 14 05 009 7	121157	1
5	5.0" CYLINDER GLAND	41 14 05 008 2	121158	1
6	5.0" CYLINDER CAP NUT	42 14 05 001 0	121156	1
7	SET SCREW 1/4 X 1/4	SCB0404	SCB0404	1
8	GREASE NIPPLE 1/8 X 45 DEGREES	HF20024	HF20024	1
9	1/8" STRAIGHT GREASE FITTING	HF2002S	HF2002S	1
10	VALVE CART. CAEG-LGN-3800-PSI VNTD	VA0780T03	VA0780T03	1
11	BUSHING 2 X 2-1/4 X 2-1/2	121166	121166	4
12	SEAL KIT 2-1/2 X 5 TH10329A	52 14 05 001 0	HPKTH10329A	1
13	HYDRAULIC, #6 JIC X #8 M OR	HF10608JM	HF10608JM	2

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: 5.0" LIFT CYLINDER

PART NUMBER: 21 14 05 003 0 / 121101

SCALE: 1:20

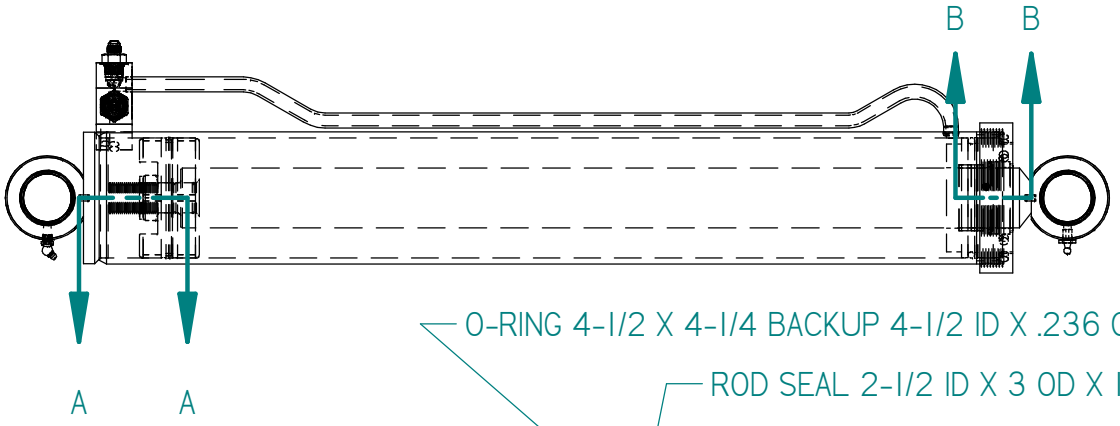
DRAWN BY: Olvera J.

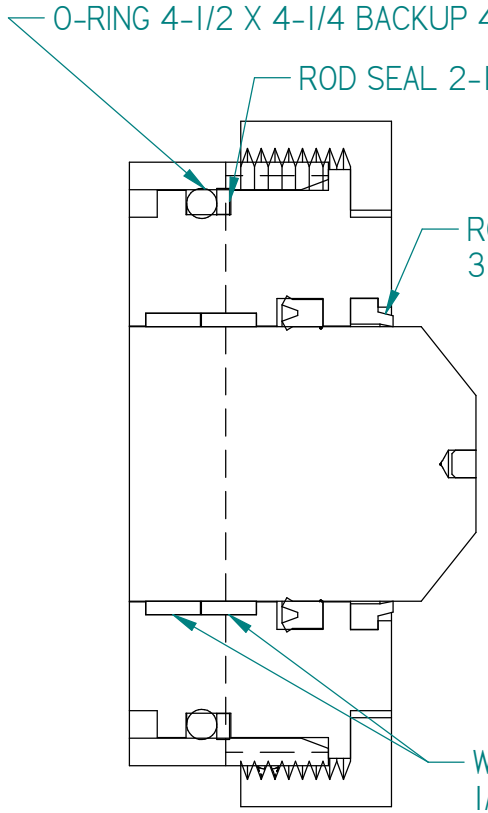
APPROVED BY:

DATE: 11/23/2005

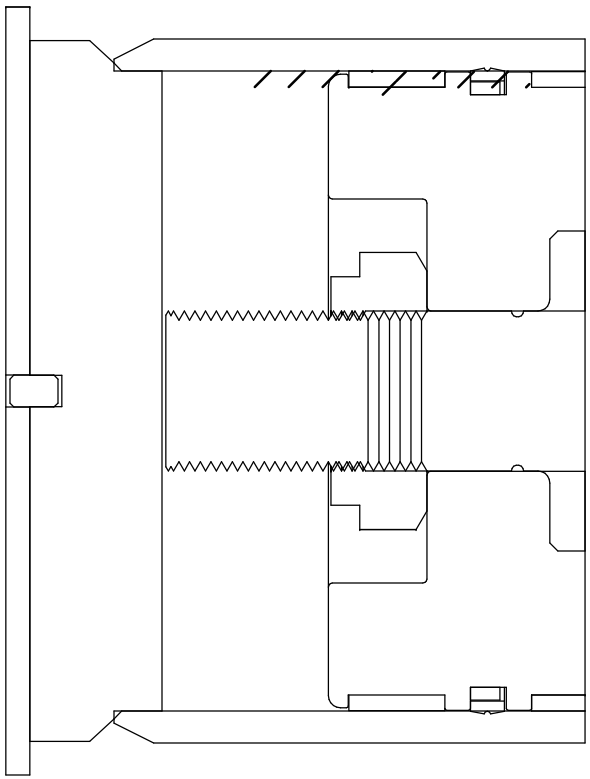
SHEET: 2 OF 3

010 MAXIMUM OPERATING PRESSURE = 2500 PSI
020 TEST PRESSURE = 3200 PSI
030 CYLINDER BURST SAFETY FACTOR = 4:1
040 COUNTER BALANCE VALVE SET TO 3100 PSI





SECTION B-B

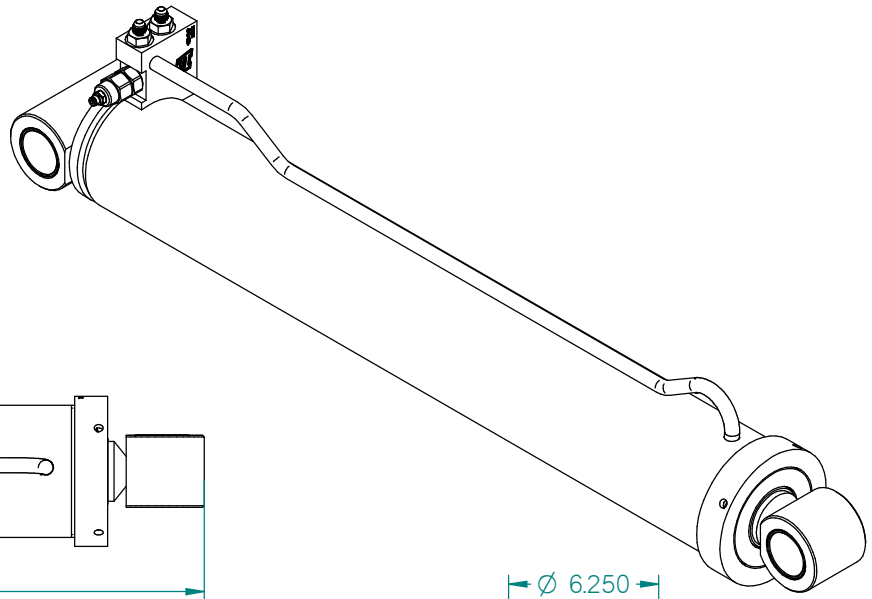


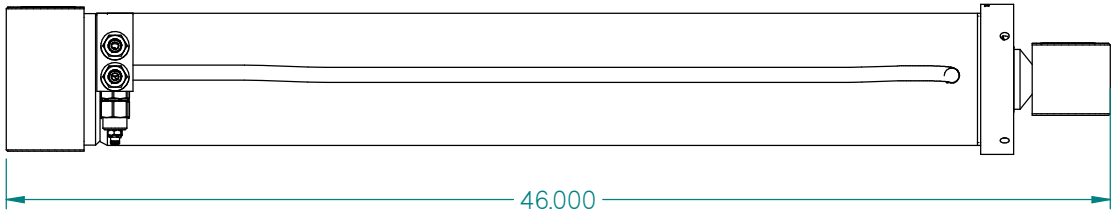
SECTION A-A

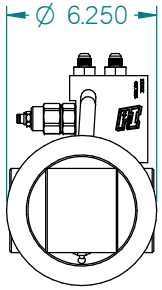
PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

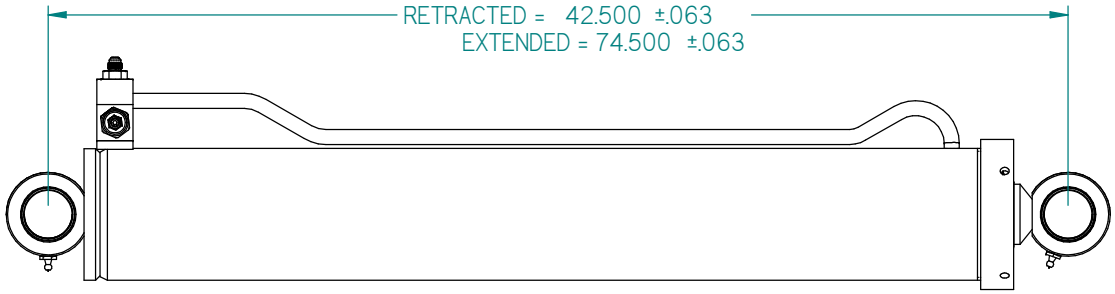
TITLE:			
5.0" LIFT CYLINDER			
PART NUMBER: 21 14 05 003 0 / 121101			SCALE: NA
DRAWN BY: Olvera J.	APPROVED BY:	DATE: 11/23/2005	SHEET: 3 OF 3

010 ASSEMBLY
020 COUNTER BALANCE VALVE SET TO 3100 PSI
030 5" BORE X 32" STROKE X 2.5" ROD





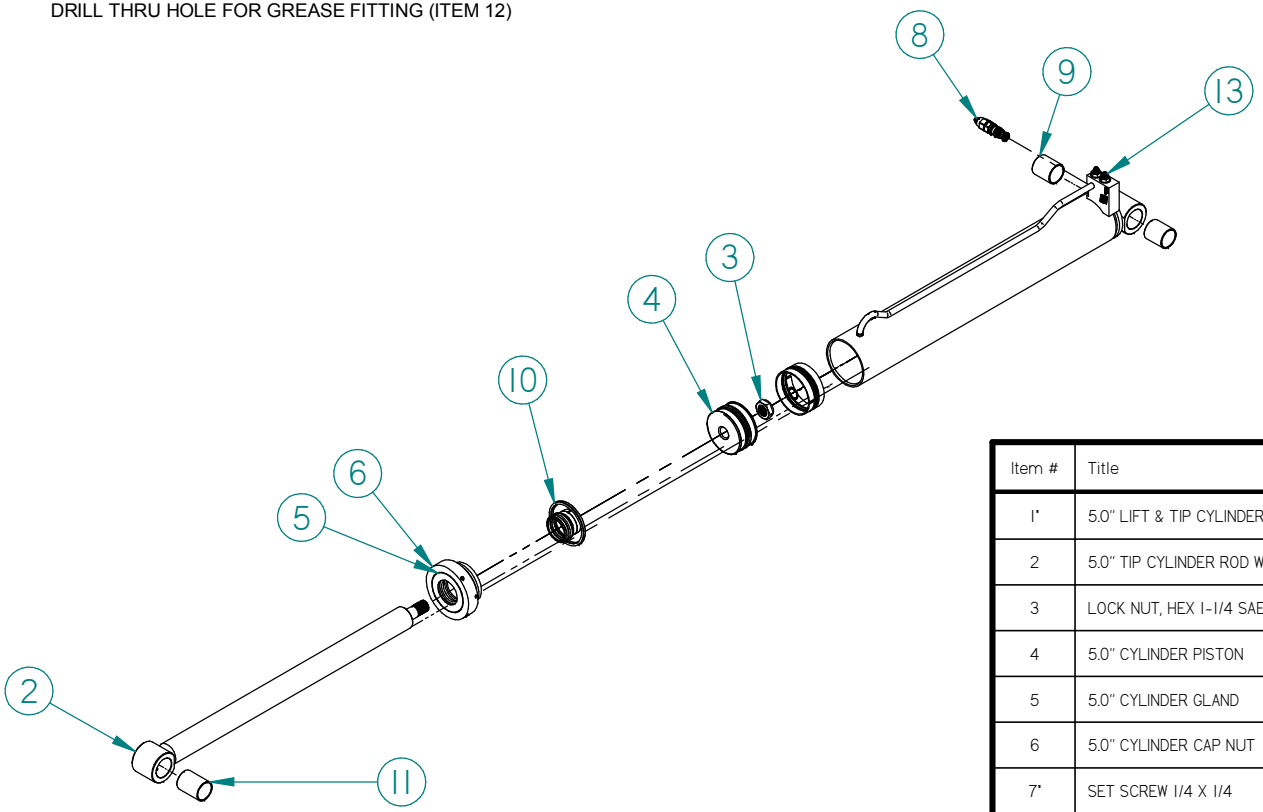




PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: 5.0" TIP CYLINDER			
PART NUMBER: 21 14 05 005 0 / 121102			SCALE: 1:8
DRAWN BY: Olvera J.	APPROVED BY:	DATE: 11/23/2005	SHEET: 1 OF 3

010 BILL OF MATERIALS
020 INSTALL BUSHING (ITEM 11) INTO ROD SPOOL. THEN DRILL THRU HOLE FOR GREASE FITTING (ITEM 12)



Item #	Title	Document #	MACOLA	Qty
1*	5.0" LIFT & TIP CYLINDER CASING WELDMENT	21 14 05 001 0	121126	1
2	5.0" TIP CYLINDER ROD WELDMENT	21 14 05 004 0	121175	1
3	LOCK NUT, HEX 1-1/4 SAE GRD/C	NUL20S	NUL20S	1
4	5.0" CYLINDER PISTON	41 14 05 009 7	121157	1
5	5.0" CYLINDER GLAND	41 14 05 008 2	121158	1
6	5.0" CYLINDER CAP NUT	42 14 05 001 0	121156	1
7*	SET SCREW 1/4 X 1/4	SCB0404	SCB0404	1
8	VALVE CART. CAEG-LGN-3100-PSI	VA0780T03	VA0780T02	1
9	BUSHING 2 X 2-1/4 X 2-1/2	121166	121166	2
10	SEAL KIT 2-1/2 X 5 THI0329A	52 14 05 001 0	HPKTHI0329A	1
11	BUSHING 2 X 2-1/4 X 3	121167	121167	1
12*	1/8" STRAIGHT GREASE FITTING	HF2002S	HF2002S	2
13	HYDRAULIC, #6 JIC X #8 M OR	HFI0608JM	HFI0608JM	2

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: 5.0" TIP CYLINDER

PART NUMBER: 21 14 05 005 0 / 121102

SCALE: 1:20

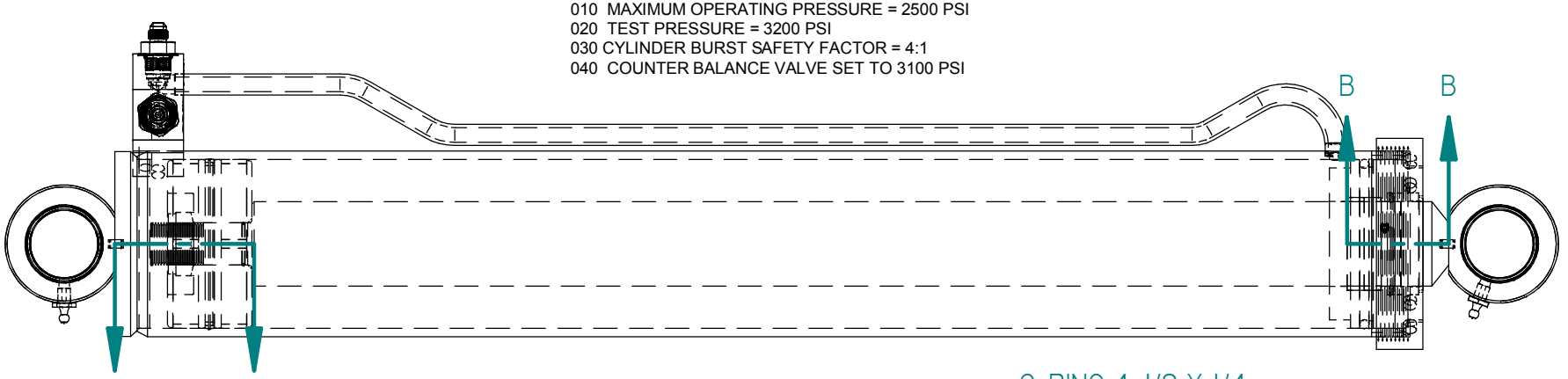
DRAWN BY: Olvera J.

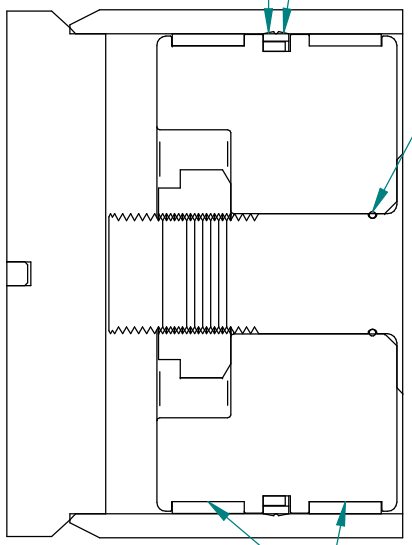
APPROVED BY:

DATE: 11/23/2005

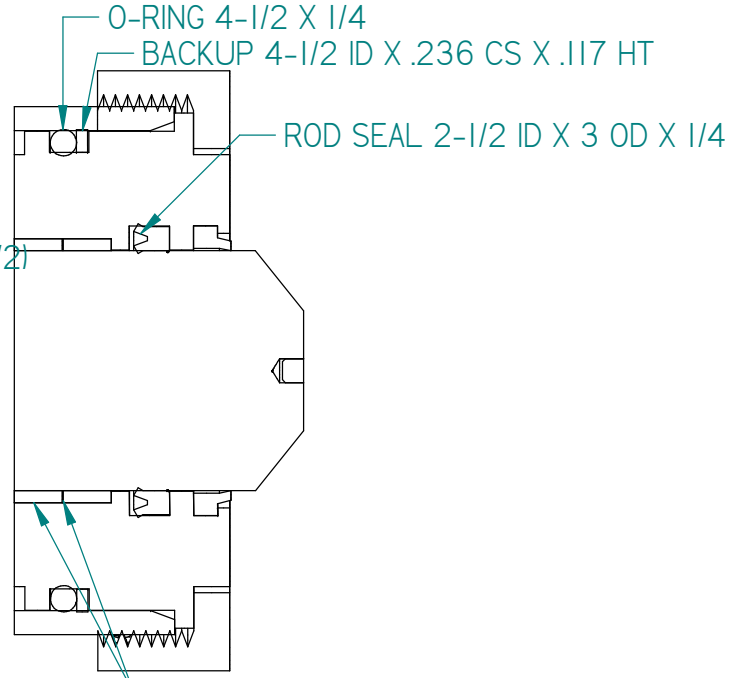
SHEET: 2 OF 3

010 MAXIMUM OPERATING PRESSURE = 2500 PSI
020 TEST PRESSURE = 3200 PSI
030 CYLINDER BURST SAFETY FACTOR = 4:1
040 COUNTER BALANCE VALVE SET TO 3100 PSI





SECTION A-A



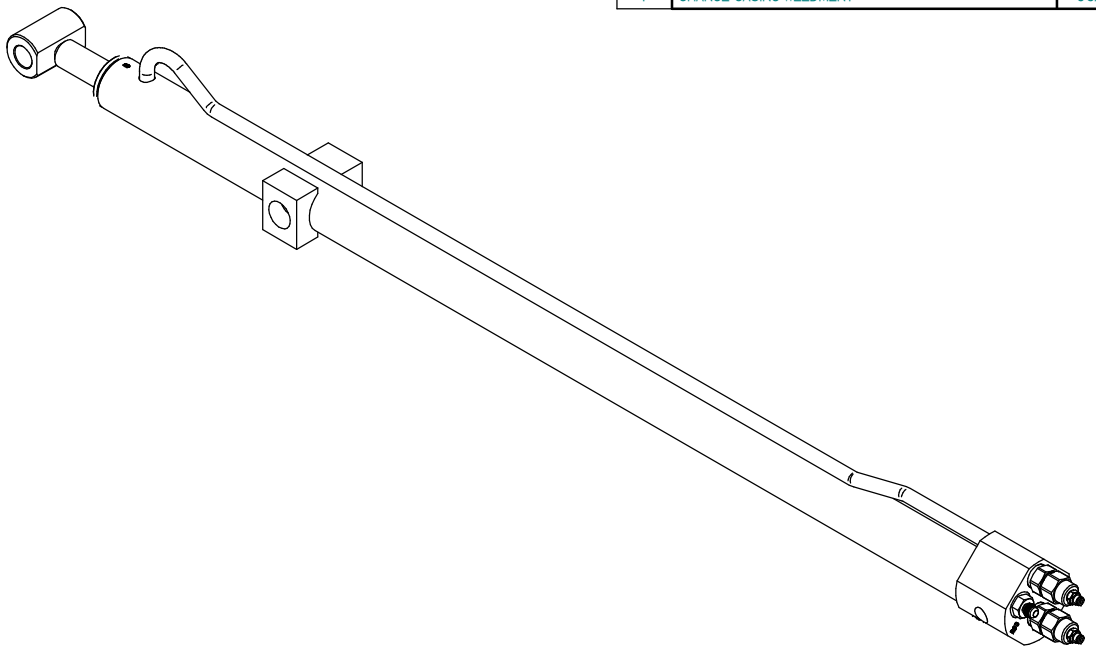
SECTION B-B

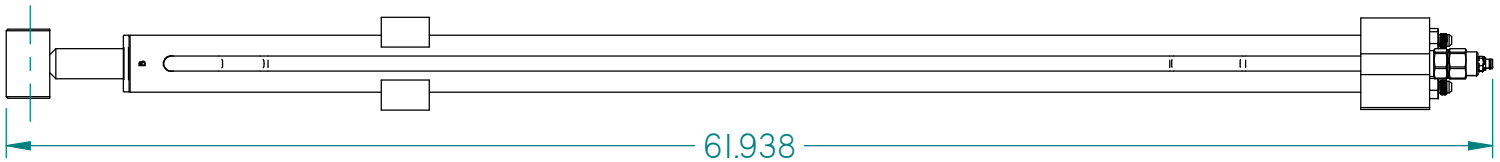
PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

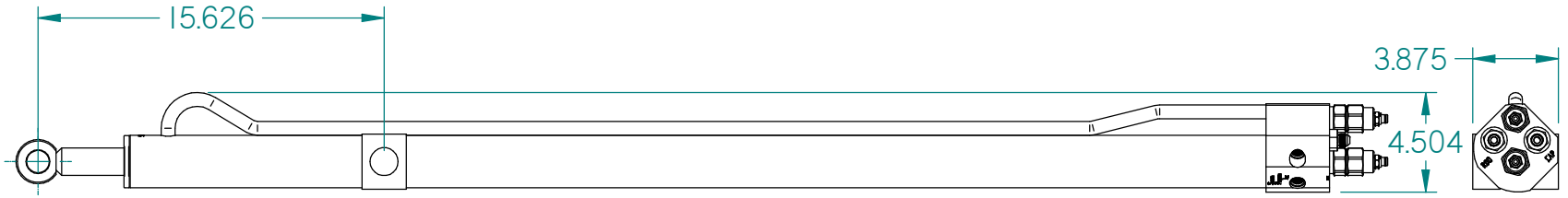
TITLE:			
5.0" TIP CYLINDER			
PART NUMBER: 21 14 05 005 0 / 121102			SCALE: NA
DRAWN BY: Olvera J.	APPROVED BY:	DATE: 11/23/2005	SHEET: 3 OF 3

REV.	DESCRIPTION	DATE	BY
1	CHANGE CASING WELDMENT	06/05/06	OJ

010 ASSEMBLY







TOLERANCES

1 DEC.	± 0.100
2 DEC.	± 0.050
3 DEC.	± 0.010
ANGLE:	± 1.000°
FRACTION:	± 1/32"
DIM. UNITS:	INCHES
SURFACE FINISH:	125/32

UNLESS OTHERWISE SPECIFIED

DEC. = DECIMAL PLACE(S)

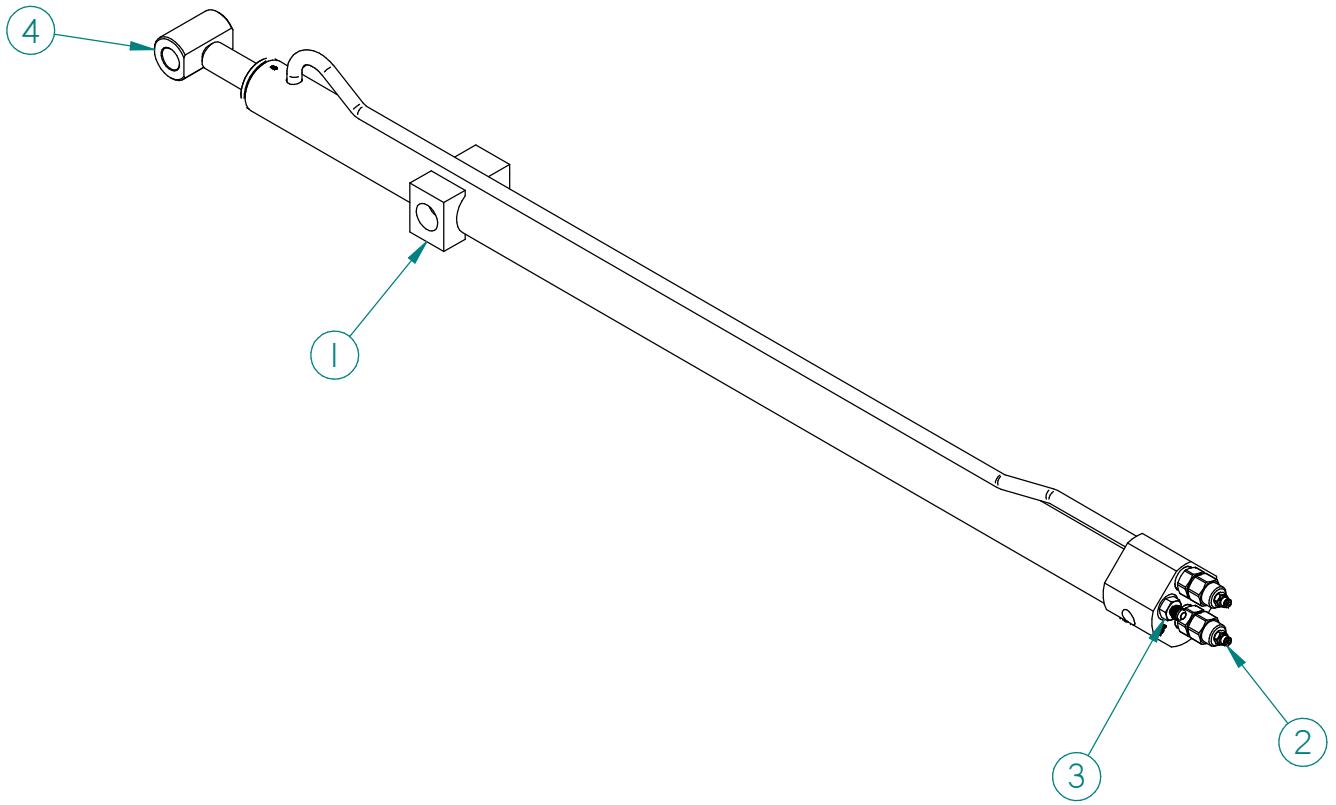
PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: 2.0" TIP EXTENSION CYLINDER

PART NUMBER:	SCALE:
22 14 01 010 1 / 121105	1:8

DRAWN BY:	APPROVED BY:	DATE:	SHEET:
LW		12/16/2004	1 OF 3

010 BILL OF MATERIALS
020 ASSEMBLE AS SHOWN



Item #	Title	Document #	MACOLA	Qty
1	CYLINDER 2.0", TIP EXTENSION CASING WELDMENT	22 14 01 002 3	121127	1
2	VALVE CART. CAEG-LGN-3800-PSI VNTD	VA0780T03	VA0780T03	2
3	HYDRAULIC, #6 JIC X #8 M OR	HF10608JM	HF10608JM	2
4	2.0"TIP EXTENSION CYLINDER ROD ASSEMBLY	22 14 01 008 1	121177	1

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: 2.0" TIP EXTENSION CYLINDER

PART NUMBER:	SCALE:
22 14 01 010 1 / 121105	1:8

DRAWN BY:	APPROVED BY:	DATE:	SHEET:
LW		12/16/2004	2 OF 3

Item #	Title	Document #	MACOLA	Qty
1"	DUAL COUNTER BALANCE VALVE, TIP EXTENSION CYLINDER	42 14 01 009 1	CP071005	1
2"	2.0" TIP EXTENSION CYLINDER CASING	42 14 01 002 4	121176	1
3"	CYLINDER, TRUNION MOUNT BLOCK	42 14 01 008 1	CP071003	2
4"	HYDRAULIC TUBE, TIP EXTENSION CYLINDER	41 04 04 036 1	TU04006	1
5"	HYDRAULIC, #6 JIC X #8 M OR	HF10608JM	HF10608JM	2
6"	VALVE CART. CAEG-LGN-3800-PSI VNTD	VA0780T03	VA0780T03	2
7"	2.0" TIP EXTENSION CYLINDER SHAFT	42 14 01 005 2		1
8"	TIP EXTENSION CYLINDER ROD END SPOOL	42 14 01 006 1	115155	1
9"	NUT HEX 3/4 STOVERLOCK SAE	NUS12S	NUS12S	1
10"	5/8 X 1/16 O-RING	HPKTH12570		1
11"	2.0" TIP EXTENSION CYLINDER GLAND NUT	42 14 01 003 4	121163	1
12"	1 1/2 OD X 1/2 W X 1/8 CS WEAR BAND	HPKTH12570		2
13"	1 1/4 ID X 1 5/8 OD X 3/16 WIPER	HPKTH12570		1
14"	11/2 ID X 2 OD X 0.050 BACK UP RING	HPKTH12570		1
15"	1 3/4 X 1/8 O-RING	HPKTH12570		1
16"	1 1/4 ID X 1 5/8 OD X 5/16 ROD	HPKTH12570		1
17"	2.0" CYLINDER PISTON	42 14 01 004 2	121160	1
18"	1 1/2 ID X 2 OD X 3/8 PISTON	HPKTH12570		2

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: 2.0" TIP EXTENSION CYLINDER

PART NUMBER: 22 14 01 010 1 / 121105

SCALE: NA

DRAWN BY: LW

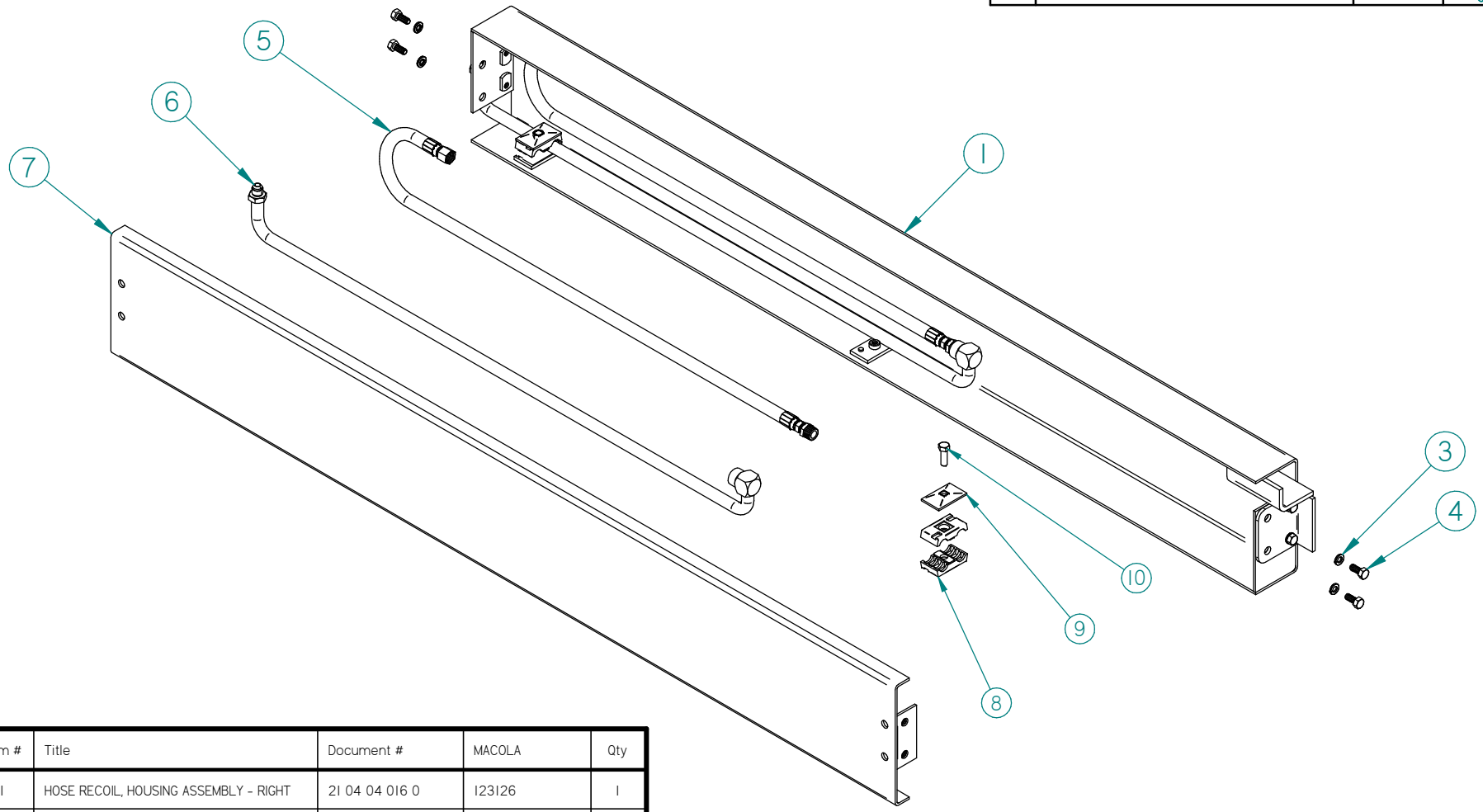
APPROVED BY:

DATE: 12/16/2004

SHEET: 3 OF 3

010 ASSEMBLY

REV.	DESCRIPTION	DATE	BY
1	CHANGED RECOIL SLIDE TO TUBING FROM CHANNEL	07/30/2008	RB



Item #	Title	Document #	MACOLA	Qty
1	HOSE RECOIL, HOUSING ASSEMBLY - RIGHT	21 04 04 016 0	123126	1
2*	TIP BOOM, HOSE RECOIL SLIDE ASSY RH	21 04 04 014 1	123124	1
3	WASHER LOCK 5/16 SPLIT	WAS055	WAS055	4
4	HEX BOLT 5/16-18 X 3/4 USS G5	BL305012U518	BL305012U518	4
5	HOSE CUT 36" #6-S RECOIL BOX	HSI0576FS	HSI0576FS	2
6	TUBE, TL3 HOSE RECOIL BOX - CURVED	41 04 04 043 0	TU04004	2
7	HOSE RECOIL, COVER ASSEMBLY	21 04 04 018 0	123127	1
8	CLAMP, PLASTIC ONLY (2-HOLE) (1 SET)	CLP220	CLP220	2
9	CLAMP, TOP PLATE ONLY (2-HOLE)	CL5G225	CL5G225	2
10	BOLT, HEX HD, 5/16 - 18 UNC 1.250 LG	BL305012U518	BL305012U518	2

TOLERANCES

1 DEC.	± 0.100
2 DEC.	± 0.050
3 DEC.	± 0.010
ANGLE:	± 1.000°
FRACTION:	± 1/32"
DIM. UNITS:	INCHES
SURFACE FINISH:	125/32

UNLESS OTHERWISE SPECIFIED

DEC = DECIMAL PLACE(S)

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: HOSE RECOIL BOX ASSEMBLY - RIGHT

PART NUMBER: 21 04 04 012 1 / 123122

SCALE: 1:8

DRAWN BY: RB

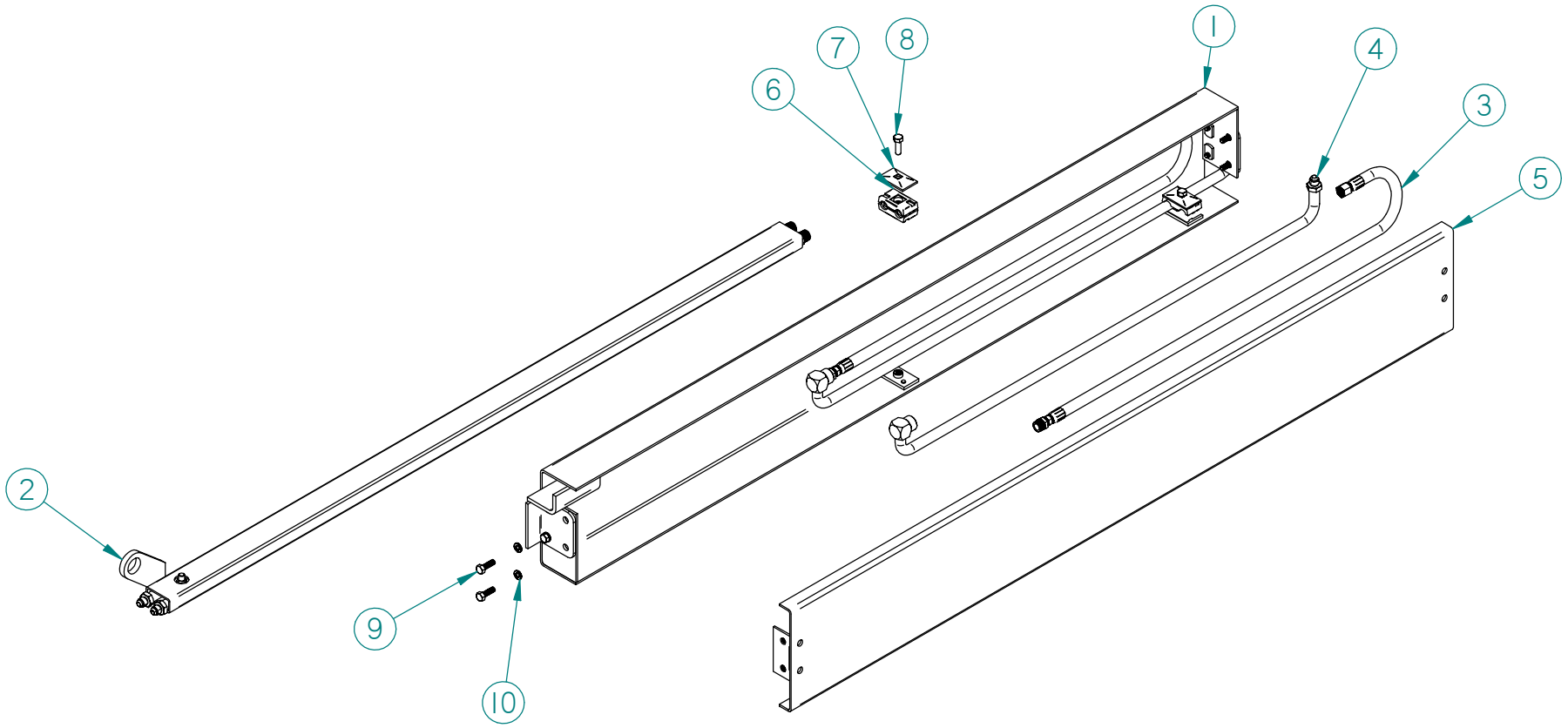
APPROVED BY:

DATE: 07/30/2008

SHEET: 1 OF 1

010 ASSEMBLY

REV.	DESCRIPTION	DATE	BY
1	CHANGED RECOIL SLIDE TO TUBING FROM CHANNEL	07/30/2008	RB



Item #	Title	Document #	MACOLA	Qty
1	HOSE RECOIL, HOUSING ASSEMBLY - LEFT	21 04 04 017 0	123125	1
2	TIP BOOM, HOSE RECOIL SLIDE ASSY LH	21 04 04 015 1	123123	1
3	HOSE CUT 36" #6-S RECOIL BOX	HS10576FS	HS10576FS	2
4	TUBE, TL3 HOSE RECOIL BOX - CURVED	41 04 04 043 0	TU04004	2
5	HOSE RECOIL, COVER ASSEMBLY	21 04 04 018 0	123127	1
6	CLAMP, PLASTIC ONLY (2-HOLE) (1 SET)	CLP220	CLP220	2
7	CLAMP, TOP PLATE ONLY (2-HOLE)	CL5G225	CL5G225	2
8	BOLT, HEX HD, 5/16 - 18 UNC 1.250 LG	BL305012U518	BL305012U518	2
9	HEX BOLT 5/16-18 X 1 USS G5	BL305016U518	BL305016U518	4
10	WASHER LOCK 5/16 SPLIT	WAS055	WAS055	4

TOLERANCES

1 DEC.	± 0.100
2 DEC.	± 0.050
3 DEC.	± 0.010
ANGLE:	± 1.000°
FRACTION:	± 1/32"
DIM. UNITS:	INCHES
SURFACE FINISH:	125/32

UNLESS OTHERWISE SPECIFIED

DEC. = DECIMAL PLACE(S)

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: HOSE RECOIL BOX ASSEMBLY - LEFT

PART NUMBER: 21 04 04 013 1 / 123121

SCALE: 1:10

DRAWN BY: RB

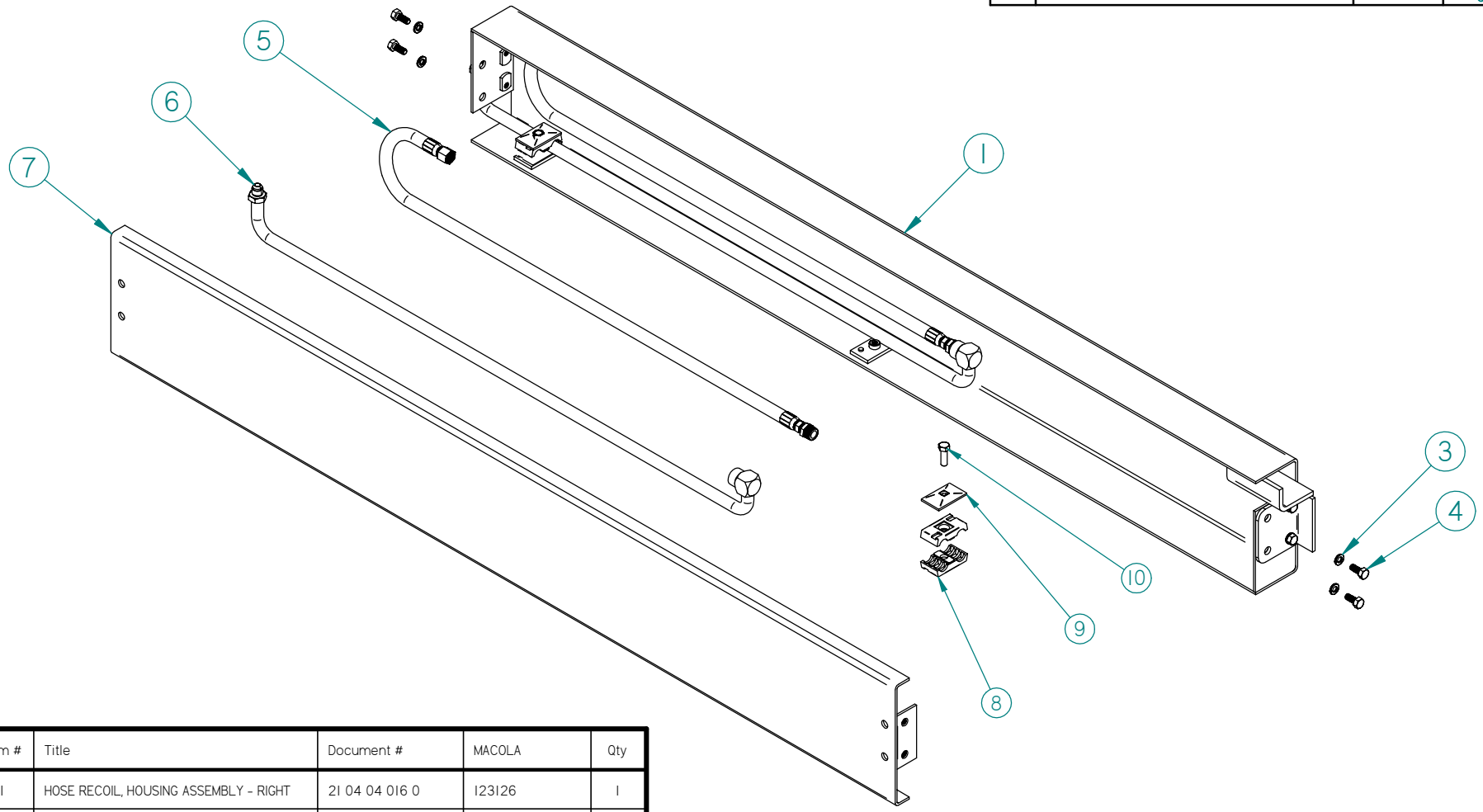
APPROVED BY:

DATE: 07/30/2008

SHEET: 1 OF 1

010 ASSEMBLY

REV.	DESCRIPTION	DATE	BY
1	CHANGED RECOIL SLIDE TO TUBING FROM CHANNEL	07/30/2008	RB



Item #	Title	Document #	MACOLA	Qty
1	HOSE RECOIL, HOUSING ASSEMBLY - RIGHT	21 04 04 016 0	123126	1
2*	TIP BOOM, HOSE RECOIL SLIDE ASSY RH	21 04 04 014 1	123124	1
3	WASHER LOCK 5/16 SPLIT	WAS055	WAS055	4
4	HEX BOLT 5/16-18 X 3/4 USS G5	BL305012U518	BL305012U518	4
5	HOSE CUT 36" #6-S RECOIL BOX	HSI0576FS	HSI0576FS	2
6	TUBE, TL3 HOSE RECOIL BOX - CURVED	41 04 04 043 0	TU04004	2
7	HOSE RECOIL, COVER ASSEMBLY	21 04 04 018 0	123127	1
8	CLAMP, PLASTIC ONLY (2-HOLE) (1 SET)	CLP220	CLP220	2
9	CLAMP, TOP PLATE ONLY (2-HOLE)	CL5G225	CL5G225	2
10	BOLT, HEX HD, 5/16 - 18 UNC 1.250 LG	BL305012U518	BL305012U518	2

TOLERANCES

1 DEC.	± 0.100
2 DEC.	± 0.050
3 DEC.	± 0.010
ANGLE:	± 1.000°
FRACTION:	± 1/32"
DIM. UNITS:	INCHES
SURFACE FINISH:	125/32

UNLESS OTHERWISE SPECIFIED

DEC. = DECIMAL PLACE(S)

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: HOSE RECOIL BOX ASSEMBLY - RIGHT

PART NUMBER: 21 04 04 012 1 / 123122

SCALE: 1:8

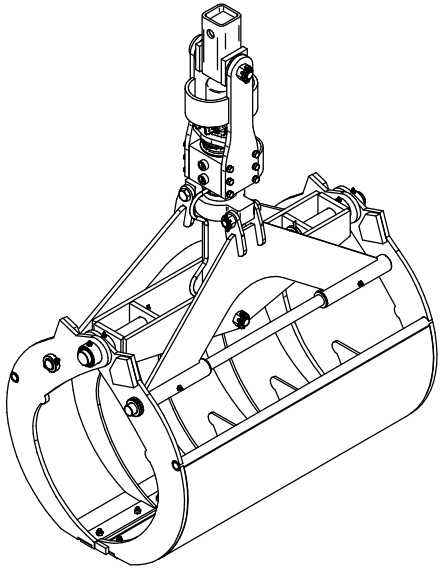
DRAWN BY: RB

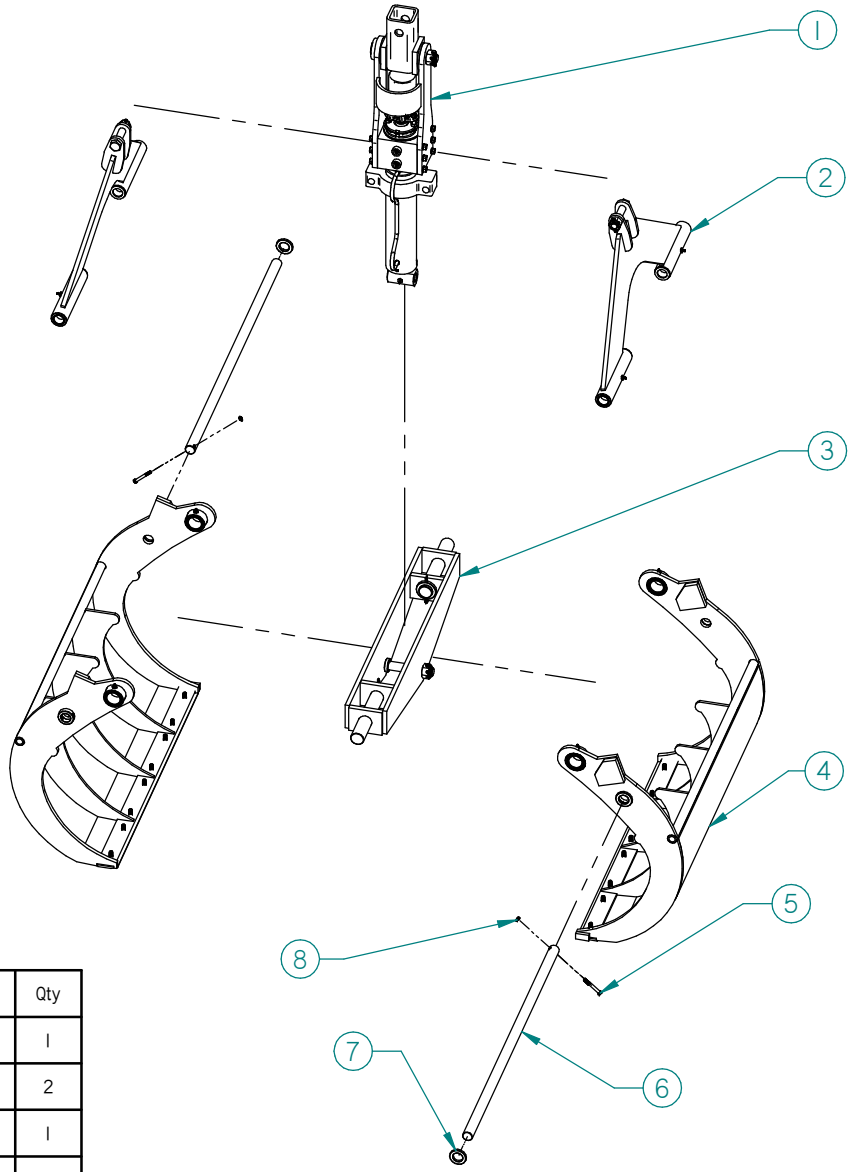
APPROVED BY:

DATE: 07/30/2008

SHEET: 1 OF 1

010 BILL OF MATERIALS





Item #	Title	Document #	MACOLA	Qty
1	BUCKET CYLINDER ROTATOR ASSEMBLY (RE MOTOR)	22 11 01 010 0	102124	1
2	STANDARD BUCKET A FRAME ASSEMBLY	22 11 01 001 2	102130	2
3	BUCKET SADDLE ASSEMBLY	22 11 01 003 0	102129	1
4	TRASH BUCKET JAW ASSEMBLY	22 11 01 002 5	102132	2
5	BOLT HEX 3/8-16 UNC X 3 G8	BL108048U816	BL108048U816	2
6	STD BUCKET A FRAME SHAFT	42 11 01 011 1	102173	2
7	STD BUCKET A FRAME COLLAR	41 11 09 019 1	116106	2
8	NUT HEX 3/8 -16 UNC STOVERLOCK	NUS06U	NUS06U	2

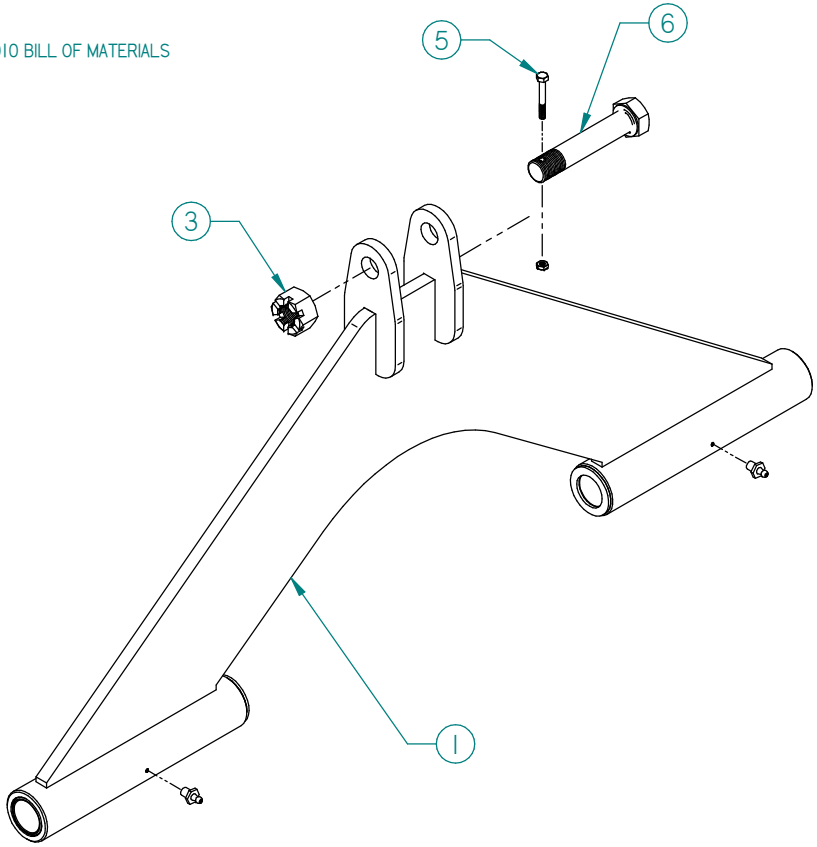
PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

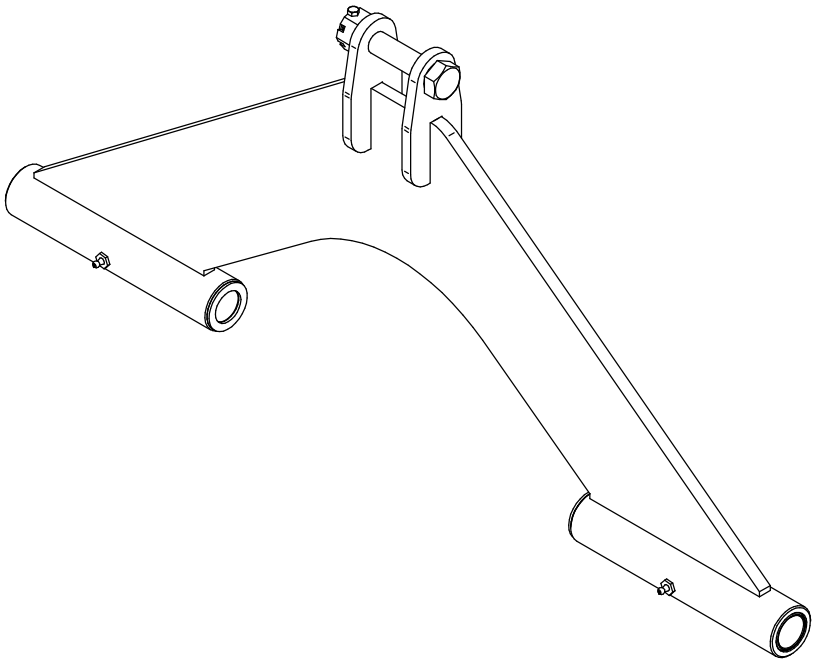
TITLE: STANDARD TRASH BUCKET ASSEMBLY

PART NUMBER:	SCALE:
11 11 01 001 1 / 102101	1:28

DRAWN BY:	APPROVED BY:	DATE:	SHEET:
EB		12/20/2000	2 OF 3

010 BILL OF MATERIALS





Item #	Title	Document #	Macola	Qty
1	STANDARD BUCKET A FRAME WELDMENT	22 11 01 009 0	102172	1
2*	1/8" STRAIGHT GREASE FITTING	HF2002S	HF2002S	2
3	NUT SLOTTED 1-14 SAE GR5	NUB16S5	NUB16S5	1
4*	HEX NUT 1/4-20 STOVERLOCK USS	NUS04U	NUS04U	1
5	BOLT HEX 1/4-20 X 2 USS G5	BL304032U520	BL304032U520	1
6	BOLT HEX 1-14 X 5 1/4 SAE HOLE	BL116084S8H1400	BL116084S8H1400	1

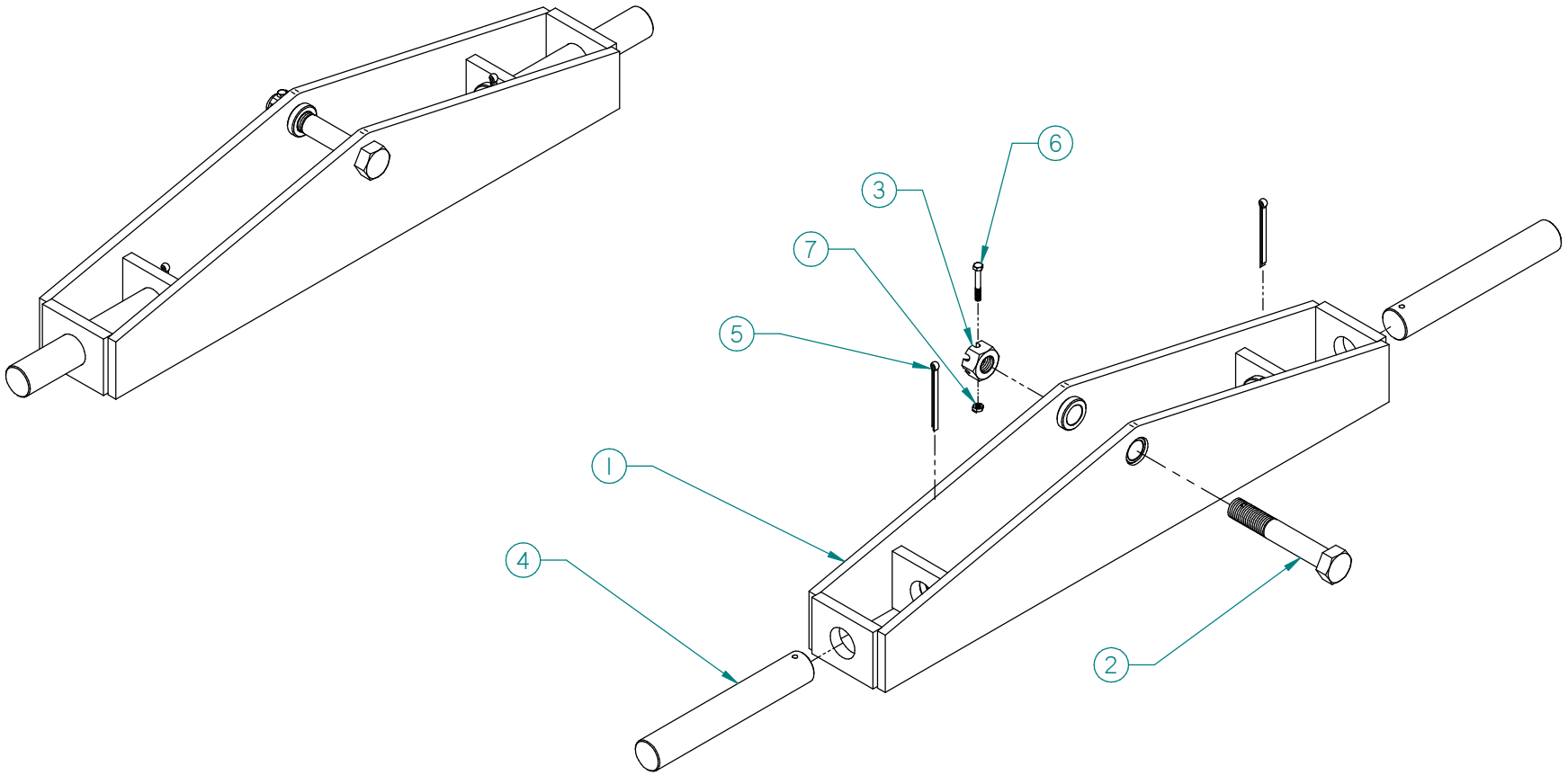
PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: STANDARD BUCKET A FRAME ASSEMBLY

PART NUMBER:	SCALE:
22 11 01 001 2 / 102130	1:8

DRAWN BY:	APPROVED BY:	DATE:	SHEET:
EB		02/23/1999	2 OF 2

010 BILL OF MATERIALS



Item #	Title	Document #	MACOLA	Qty
1	BUCKET SADDLE WELDMENT	22 11 01 004 1	102178	1
2	HEX BOLT 1-1/4-7 X 7-3/4 GR8	BL120124U87	BL120124U87	1
3	SLOTTED NUT 1-1/4 UNC GR5	NUB20U	NUB20U	1
4	BUCKET SADDLE PIVOT PIN	41 11 09 005 0	PI30204F	2
5	COTTER PIN 5/16 X 4	FA020564	FA020564	2
6	HEX BOLT 5/16-18 X 2-1/4 USS G5	BL305036U518	BL305036U518	1
7	HEX NUT 5/16-24 SAE STOVERLOCK	NUS05S	NUS05S	1

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: BUCKET SADDLE ASSEMBLY

PART NUMBER: 22 11 01 003 0 / 102129

SCALE: 1:10

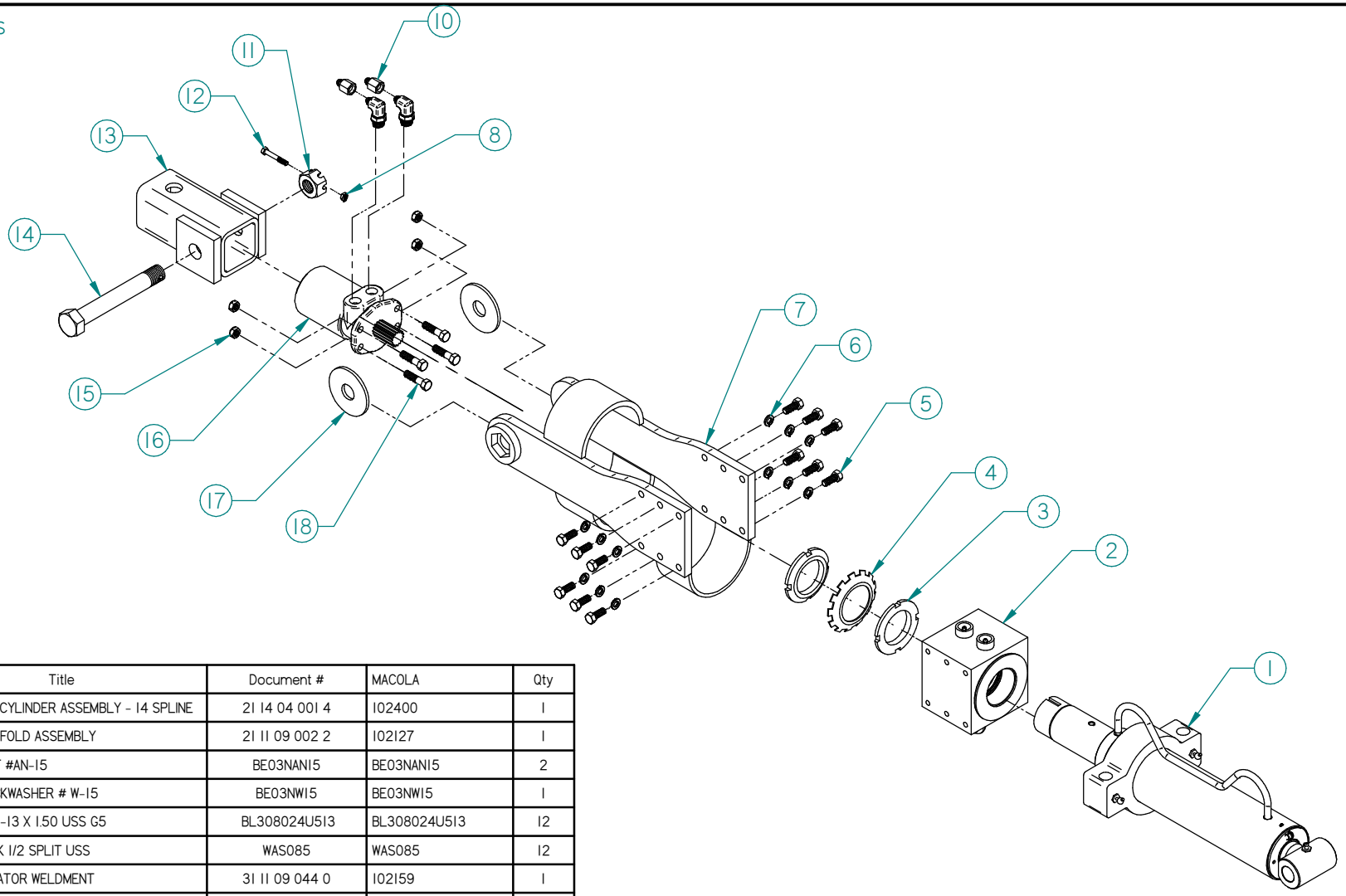
DRAWN BY: EB

APPROVED BY:

DATE: 11/13/2000

SHEET: 2 OF 2

010 BILL OF MATERIALS



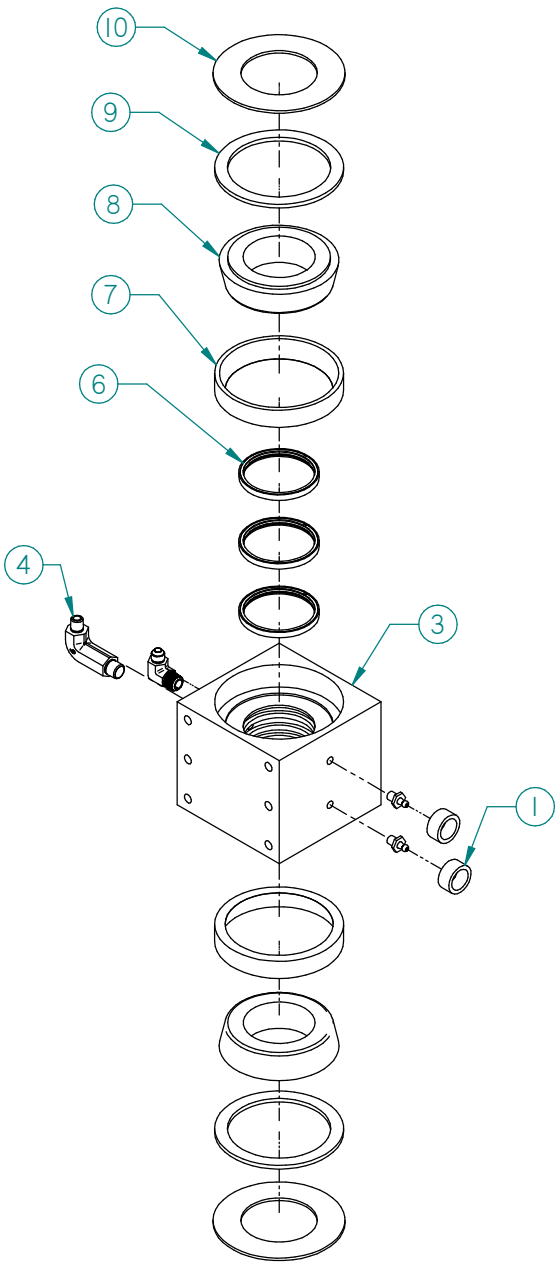
Item #	Title	Document #	MACOLA	Qty
1	4.0" BUCKET CYLINDER ASSEMBLY - 14 SPLINE	21 14 04 001 4	102400	1
2	BUCKET MANIFOLD ASSEMBLY	21 11 09 002 2	102127	1
3	BEARING, NUT #AN-15	BE03NAN15	BE03NAN15	2
4	BEARING, LOCKWASHER # W-15	BE03NW15	BE03NW15	1
5	BOLT HEX 1/2-13 X 1.50 USS G5	BL308024U513	BL308024U513	12
6	WASHER LOCK 1/2 SPLIT USS	WAS085	WAS085	12
7	BUCKET ROTATOR WELDMENT	31 11 09 044 0	102159	1
8	HEX NUT 5/16-24 SAE STOVERLOCK	NUS05S	NUS05S	1
9*	HYDRAULIC, #6 JIC X #10 M OR 90	HF10610JM9	HF10610JM9	2
10	FITTING, RESTRICTOR 06M JIC 06F JIC	HF906063046FM	HF906063046FM	2
11	SLOTTED NUT 1-1/4 UNC GR5	NUB20U	NUB20U	1
12	HEX BOLT 5/16-18 X 2-1/4 USS G5	BL305036U518	BL305036U518	1
13	GIMBAL WELDMENT 4 X 5-1/2	31 11 09 042 1	102119	1
14	BOLT - ROTATOR GIMBAL, TRASH	41 11 09 040 0	102158	1
15	HEX NUT 1/2-13 STOVERLOCK	NUS08U	NUS08U	4
16	HYD MOTOR RE-32-08-05-0 (14 SPLINE)	HC03004	HC03004	1
17	BUCKET BRAKE WASHER 4 X 1-5/16 X 1/4	WAF642004	WAF642004	2
18	BOLT HEX 1/2-13 X 2 UNC GR8	BL108032U813	BL108032U813	4

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: BUCKET CYLINDER ROTATOR ASSEMBLY (RE MOTOR)

PART NUMBER:			SCALE:
22 11 01 010 0 / 102124			1:12
DRAWN BY:	APPROVED BY:	DATE:	SHEET:
OJ		11/09/2005	2 OF 2

010 BILL OF MATERIALS



Item #	Title	Document #	MACOLA	Qty
1	BUCKET MANIFOLD GREASE FITTING COVER	41 11 09 025 0	102151	2
2*	1/8" STRAIGHT GREASE FITTING	HF2002S	HF2002S	2
3	BUCKET MANIFOLD HOUSING	41 11 09 024 2	102443	1
4	ELBOW 90 06M-JIC 06M-JIC LONG	HF806069ML	HF806069ML	1
5*	HYDRAULIC, #6-6 90 DEG ELBOW	HF806069M	HF806069M	1
6	SEAL KIT TR-035	HPKTR035	HPKTR035S09	3
7	BEARING RACE #493	BE03N493	BE03N493	2
8	TIMKEN ROLLER BEARING #495-A	BE03N495A	BE03N495A	2
9	BEARING GREASE RETAINER FOR CONTINUOUS ROTATOR	41 11 09 013 2	WAL866902	2
10	CONTINUOUS ROTATOR THRUST WASHER	41 11 09 015 1	WAF885002	2

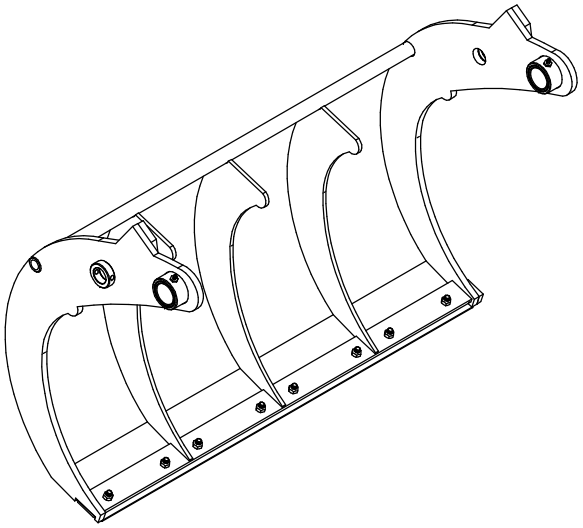
PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

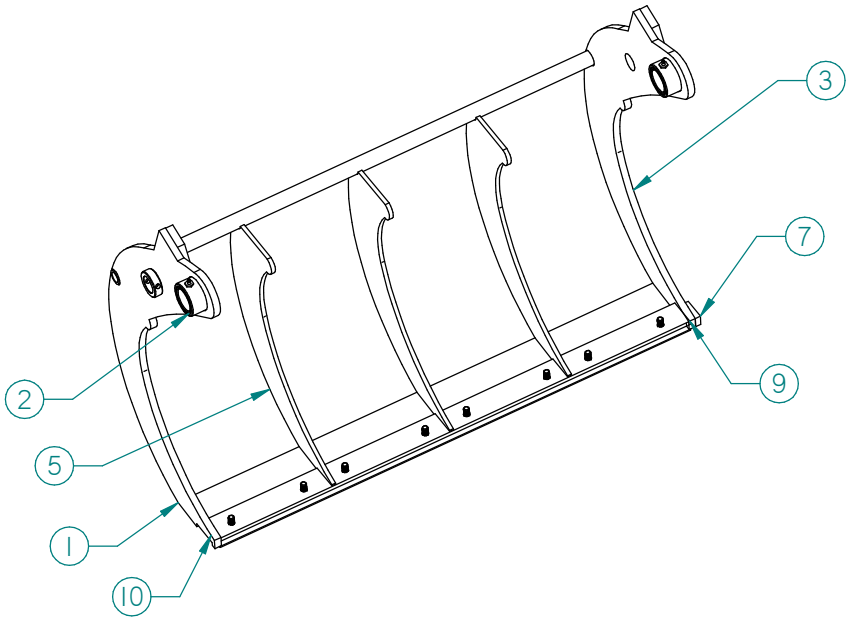
TITLE: BUCKET MANIFOLD ASSEMBLY

PART NUMBER:	SCALE:
21 11 09 002 2 / 102127	1:8

DRAWN BY:	APPROVED BY:	DATE:	SHEET:
EB		12/14/2000	3 OF 3

010 BILL OF MATERIALS
020 ASSEMBLE AS SHOWN





Item #	Title	Document #	MACOLA	Qty
1	BUCKET, TL JAW RIGHT SIDE WELDMENT	22 11 01 007 1	102435	1
2	BUSHING, 2 1/2 X 2 X 2 NYLATRON	41 11 09 022 4	BU502008	2
3	BUCKET, TL JAW LEFT SIDE WELDMENT	22 11 01 008 1	102442	1
4*	BUCKET, TL JAW RIB TUBE	42 11 01 019 1	102169	1
5	STD BUCKET JAWS RIB	41 11 09 021 2	102165	3
6*	BUCKET, TL JAW SKIN 3/16"	42 11 01 015 4	102166	1
7	BUCKET, ALLIGNMENT BLOCK	42 11 01 040 0	102199	1
8*	1/8" STRAIGHT GREASE FITTING	HF2002S	HF2002S	2
9	BUCKET, TL JAW BOLT-ON BAR 3/8 X 2-1/2 X 46	42 11 01 042 1	102161	1
10	BUCKET, TL JAW BLADE	42 11 01 041 0	102171	1
11*	HEX NUT 1/2-13 STOVERLOCK	NUS08U	NUS08U	8

PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: TRASH BUCKET JAW ASSEMBLY

PART NUMBER: 22 11 01 002 5 / 102132

SCALE: 1:16

DRAWN BY: EB

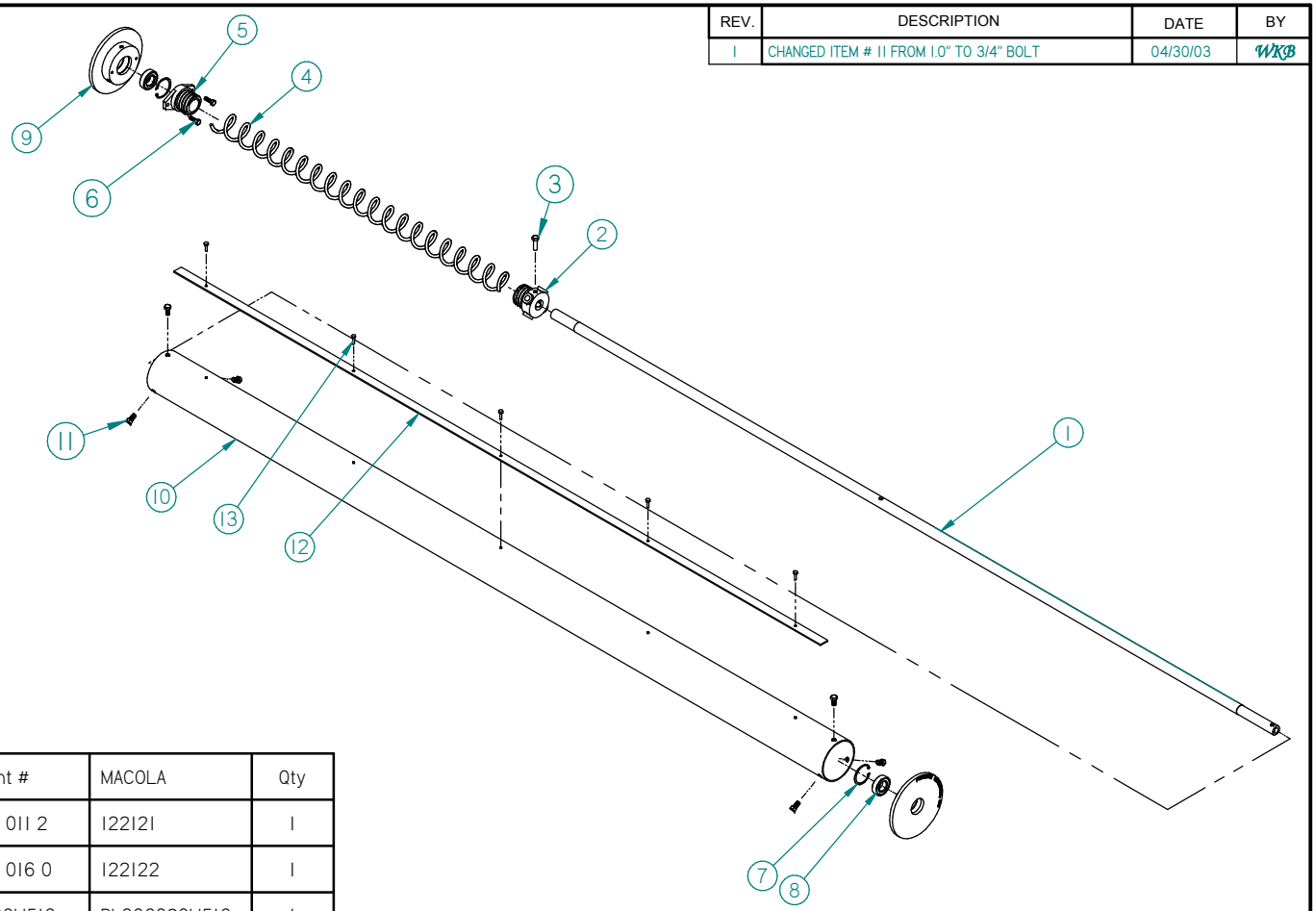
APPROVED BY:

DATE: 08/28/2000

SHEET: 2 OF 3

010 ASSEMBLY

REV.	DESCRIPTION	DATE	BY
1	CHANGED ITEM # 11 FROM 1.0" TO 3/4" BOLT	04/30/03	WKB



Item #	Title	Document #	MACOLA	Qty
1	LOAD COVER SHAFT	42 09 01 011 2	122121	1
2	LOAD COVER SPRING CONE, SHAFT SIDE	42 09 01 016 0	122122	1
3	HEX BOLT 3/8-16 X 1.25 USS G5	BL306020U516	BL306020U516	1
4	LOAD COVER SPRING	42 09 01 017 0	SP01001	1
5	LOAD COVER SPRING CONE, PLATE SIDE	42 09 01 015 0	122123	1
6	HEX BOLT 5/16-18 X 1 USS G5	BL305016U518	BL305016U518	2
7	2.1875" RETAINER RING, 1/16" THICK	FA093200	FA093200	2
8	BEARING 1.0" ID, 2.0" OD, .56" THICK	BE04N1641DC	BE04N1641DC	2
9	LOAD COVER END PLATE	42 09 01 010 2	CA3002	2
10	LOAD COVER TUBING	42 09 01 013 2	122126	1
11	HEX BOLT 3/8-16 X .750 USS G5	BL306012U516	BL306012U516	6
12	LOAD COVER STRAP	42 09 01 012 0	122127	1
13	# 14 SCREW, 3/4" LONG	BL306020U516	BL306020U516	5

TOLERANCES

1 DEC.	± 0.100
2 DEC.	± 0.050
3 DEC.	± 0.010
ANGLE:	± 1.000°
FRACTION:	± 1/32"
DIM. UNITS:	INCHES
SURFACE FINISH:	125/32

UNLESS OTHERWISE SPECIFIED

DEC. = DECIMAL PLACE(S)

LIGHTNING LOADER PETERSEN INDUSTRIES

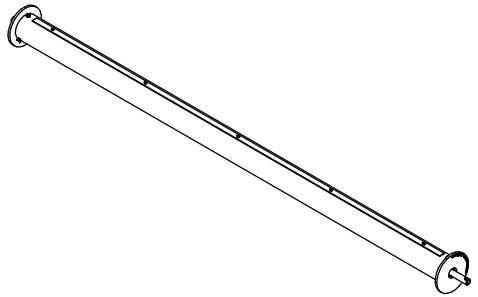
PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

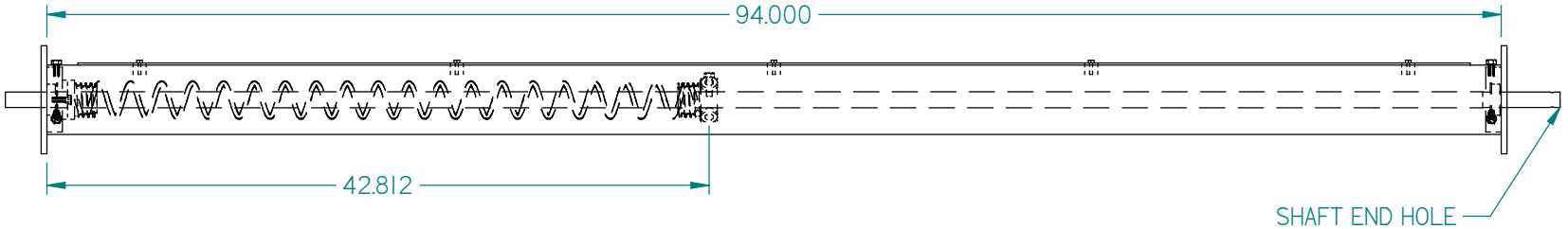
TITLE: LOAD COVER ROLLER ASSEMBLY

PART NUMBER:	SCALE:
22 09 01 001 1 / 122101	1:18

DRAWN BY:	APPROVED BY:	DATE:	SHEET:
EB		10/29/2001	1 OF 2

010 ASSEMBLE END PLATE, BEARING AND RETAINING RING WITH SPRING CONE.
020 ATTACH SPRING AND SHAFT CONE TO CONE ASSEMBLED END PLATE.
030 SLIDE SHAFT THROUGH SUB ASSEMBLY. SPRING MUST BE ON OPPOSITE SIDE OF SHAFT END HOLE. PULL SHAFT CONE AND SECURE IT TO THE SHAFT WITH BOLT.
040 INSERT SUB ASSEMBLY INTO TUBING. ATTACH TUBING TO END PLATE SUB ASSEMBLY WITH BOLTS
050 ASSEMBLE END PLATE, BEARING AND RETAINING RING.
060 INSERT END PLATE SUB ASSEMBLY AT ASSEMBLY OPEN END AND ATTACH IT WITH BOLTS.
070 INSTALL COVER AND SECURE IT TO TUBING WITH STRAP AND SCREWS





PETERSEN INDUSTRIES INC.
4000 S.R. 60 WEST
LAKE WALES, FL. 33859-8234
TEL: (863) 676-1493 FAX: (863) 676-6844

TITLE: LOAD COVER ROLLER ASSEMBLY

PART NUMBER:	SCALE:
22 09 01 001 1 / 122101	1:12

DRAWN BY:	APPROVED BY:	DATE:	SHEET:
EB		10/29/2001	2 OF 2

Dia. No.		Part Name	Order By This Part No.
MISCELLANEOUS PARTS:			
		Seal Kit - HA36 Hydraulic Actuator	HPKAS395
		Seal Kit - SS40 Hydraulic Actuator	HPK430308SI
		Pump, Standard Spline	HC02002
	*	3-Way Valve, 3/4" Port	VA0312160R
	*	4-Way Valve, 3/4" Port	VA0412160R
	*	Seal Kit, 5" Lift Cylinder	HPKTH10329B
	*	Seal Kit, 5" Tip Cylinder	HPKTH10329B
		Seal Kit, 3" Vertical Outrigger Cylinder, Round	HPK12044X
		Seal Kit, 3" Vertical Outrigger Cylinder, Square	HPKTH16195
		Seal Kit, 2" Horizontal Outrigger Cylinder	HPKTH10154
		Seal Kit, 4" Bucket Cylinder	HPKTH10140
		Suction Filter Assembly	OT01002
		Suction Filter Element	OT02003
		Return Filter Assembly	OT03004
		Return Filter Element	OT03005
		Seal Kit, 2" Tip Extension Cylinder	HPKTH12570
	*	NOTE: Item numbers with an asterisk (*) may have part numbers and	
		prices different than what is shown on this price list. Please consult with	
		the Petersen Parts Department to help correctly identify these parts for	
		your loader. You may reach our Parts Department at 800/930-5623,	
		ext. 229.	

NOTIFICATION OF TRANSFER OF OWNERSHIP

TO: Petersen Industries, Inc.
4000 SR 60 West
Lake Wales, FL 33859
Telephone: 800/930-5623, Ext. 256

FROM: _____

_____

_____

This is to advise you that our organization is no longer the owner of the Petersen loader listed below. We have listed the name and address of the subsequent owner. Would you please change your records accordingly.

Petersen Loader Serial Number: _____

VIN: _____

Name and Address of New Owner:

_____

_____

_____

Phone:_____

Contact: _____

BY: _____
(Name)

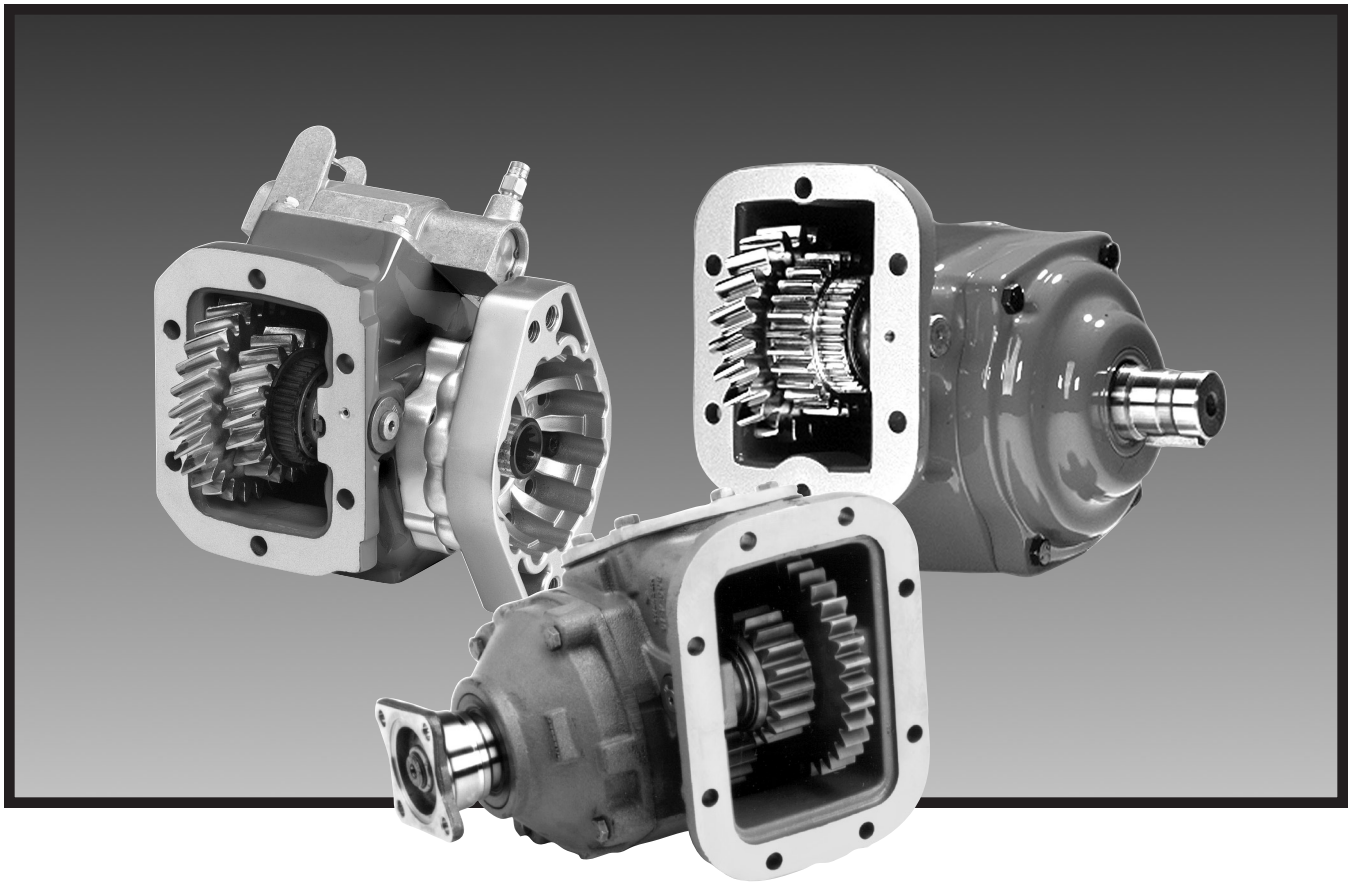
Date: _____

CHELSEA®

Bulletin HY25-1380-M1/US

Owner's Manual
Power Take-Offs

Effective: April 2008
Supersedes: HY25-1380-M1/US March 2008



267 Series
269 Series
277 Series
278 Series
859 Series
867 Series

Parker

⚠ WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

Offer of Sale

The items described in this document are hereby offered for sale by Parker Hannifin Corporation, its subsidiaries or its authorized distributors. This offer and its acceptance are governed by the provisions stated in the "Offer of Sale".

Patent Information

The Chelsea® Power Take-Off or its components shipped with this owner's manual may be manufactured under one or more of the following U.S. patents:
4610175 5228355 4597301 5645363 6151975 6142274 6260682 7159701 B2
Other patents pending.

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

Continued on Next Page

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

Safety Information

These instructions are for your safety and the safety of the end user. Read them carefully until you understand them.

General Safety Information

To prevent injury to yourself and/or damage to the equipment:

- Read carefully all owner's manuals, service manuals, and/or other instructions.
- Always follow proper procedures, and use proper tools and safety equipment.
- Be sure to receive proper training.
- Never work alone while under a vehicle or while repairing or maintaining equipment.
- Always use proper components in applications for which they are approved.
- Be sure to assemble components properly.
- Never use wornout or damaged components.
- Always block any raised or moving device that may injure a person working on or under a vehicle.
- Never operate the controls of the Power Take-Off or other driven equipment from any position that could result in getting caught in the moving machinery.

Proper Matching of P.T.O.

WARNING: A Power Take-Off must be properly matched to the vehicle transmission and to the auxiliary equipment being powered. An improperly matched Power Take-Off could cause severe damage to the vehicle transmission, the auxiliary driveshaft, and/or to the auxiliary equipment being powered. **Damaged components or equipment could malfunction causing serious personal injury to the vehicle operator or to others nearby.**

To avoid personal injury and/or equipment damage:

- Always refer to Chelsea catalogs, literature, and owner's manuals. Follow Chelsea recommendations when selecting, installing, repairing, or operating a Power Take-Off.
- Never attempt to use a Power Take-Off not specifically recommended by Chelsea for the vehicle transmission.
- Always match the Power Take-Off's specified output capabilities to the requirements of the equipment to be powered.
- Never use a Power Take-Off whose range of speed could exceed the maximum.

Cold Weather Operation of Powershift P.T.O.

WARNING: During extreme cold weather operation [32°F (0°C) and lower], a disengaged Powershift Power Take-Off can momentarily transmit high torque that will cause unexpected output shaft rotation. This is caused by the high viscosity of the transmission oil when it is extremely cold. As slippage occurs between the Power Take-Off clutch plates, the oil will rapidly heat up and the viscous drag will quickly decrease.

The Power Take-Off output shaft rotation could cause unexpected movement of the driven equipment resulting in serious personal injury, death, or equipment damage.

To avoid personal injury or equipment damage:

- Driven equipment must have separate controls.
- The driven equipment must be left in the disengaged position when not in operation.
- Do not operate the driven equipment until the vehicle is allowed to warm up.

This symbol warns of possible personal injury.

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

Safety Information (Continued)

Rotating Auxiliary Driveshafts

WARNING:

- Rotating auxiliary driveshafts are dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death.
- Do not go under the vehicle when the engine is running.
- Do not work on or near an exposed shaft when the engine is running.
- Shut off the engine before working on the Power Take-Off or driven equipment.
- Exposed rotating driveshafts must be guarded.

Guarding Auxiliary Driveshafts

WARNING: We strongly recommend that a Power Take-Off and a directly mounted pump be used to eliminate the auxiliary driveshaft whenever possible. If an auxiliary driveshaft is used and remains exposed after installation, it is the responsibility of the vehicle designer and P.T.O. installer to install a guard.

Using Set Screws

WARNING: Auxiliary driveshafts may be installed with either recessed or protruding set screws. If you choose a square head set screw, you should be aware that it will protrude above the hub of the yoke and may be a point where clothes, skin, hair, hands, etc. could be snagged. A socket head set screw, which may not protrude above the hub of the yoke, does not permit the same amount of torquing as does a square head set screw. Also, a square head set screw, if used with a lock wire, will prevent loosening of the screw caused by vibration. Regardless of the choice made with respect to a set screw, an exposed rotating auxiliary driveshaft must be guarded.

Important: Safety Information and Owner's Manual

Chelsea Power Take-Offs are packaged with safety information decals, instructions, and an owner's manual. These items are located in the envelope with the P.T.O. mounting gaskets. Also, safety information and installation instructions are packaged with some individual parts and kits. **Be sure to read the owner's manual before installing or operating the P.T.O.** Always install the safety information decals according to the instructions provided. Place the owner's manual in the vehicle glove compartment.

WARNING: Operating the P.T.O. with the Vehicle in Motion

Some Power Take-Offs may be operated when the vehicle is in motion. To do so, the P.T.O. must have been properly selected to operate at highway speeds and correctly matched to the vehicle transmission and the requirements of the driven equipment.

If in doubt about the P.T.O. specifications and capabilities, avoid operating the P.T.O. when the vehicle is in motion. Improper application and/or operation can cause serious personal injury or premature failure of the vehicle, the driven equipment, and/or the P.T.O.

Always remember to disengage the P.T.O. when the driven equipment is not in operation.

Pump Installation Precautions

Use a bracket to support the pump to the transmission if:

- The pump weighs **40 pounds [18.4 kg]** or more.
- The combined length of the P.T.O. and pump is **18 inches [45.72 cm]** or more from the P.T.O. centerline to the end of the pump.

This symbol warns of possible personal injury.

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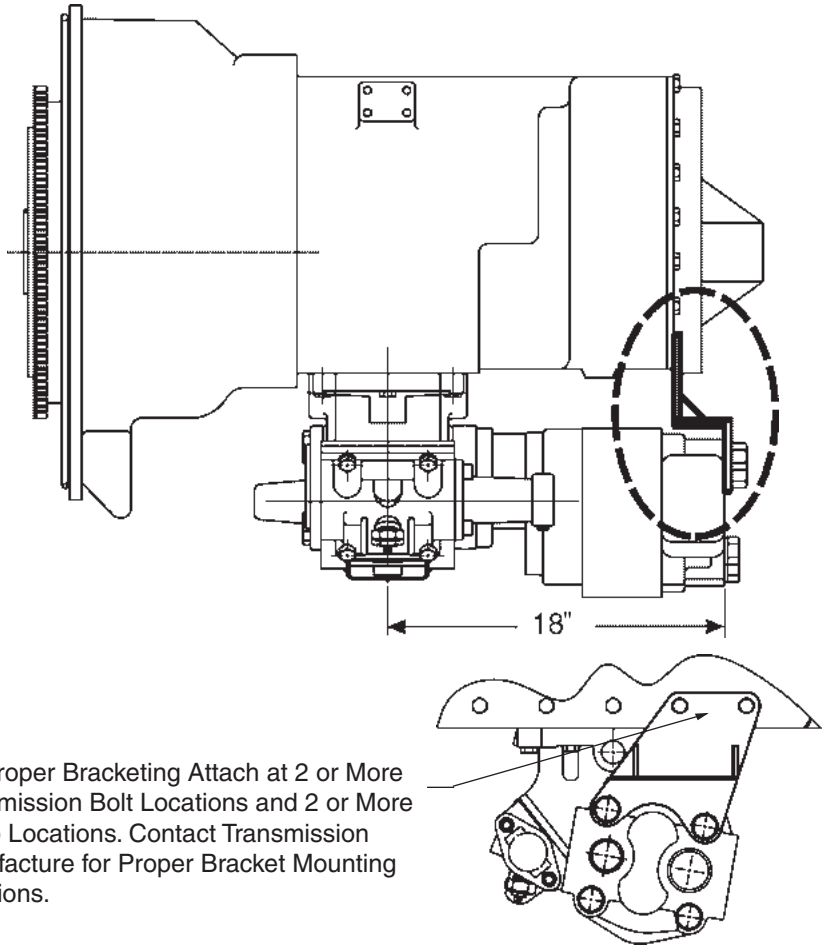
Direct Mount Pump Support Recommendations



NOTE: For Proper Bracketing Attach at 2 or More Transmission Bolt Locations and 2 or More Pump Locations. Contact Transmission Manufacture for Proper Bracket Mounting Locations.

Use caution to ensure that bracket does not pre-load pump/P.T.O. mounting

Chelsea strongly recommends the use of pump supports (Support Brackets) in all applications. P.T.O. warranty will be void if a pump bracket is not used when:

1) The combined weight of pump, fittings and hose exceed **40 pounds [18.14 kg]**.
2) The combined length of the P.T.O. and pump is **18 inches [45.72 cm]** or more from the P.T.O. centerline to the end of the pump.

ALSO: Remember to pack the female pilot of the P.T.O. pump shaft with grease before installing the pump on the P.T.O. (reference Chelsea grease pack 379688)

This symbol warns of possible personal injury.

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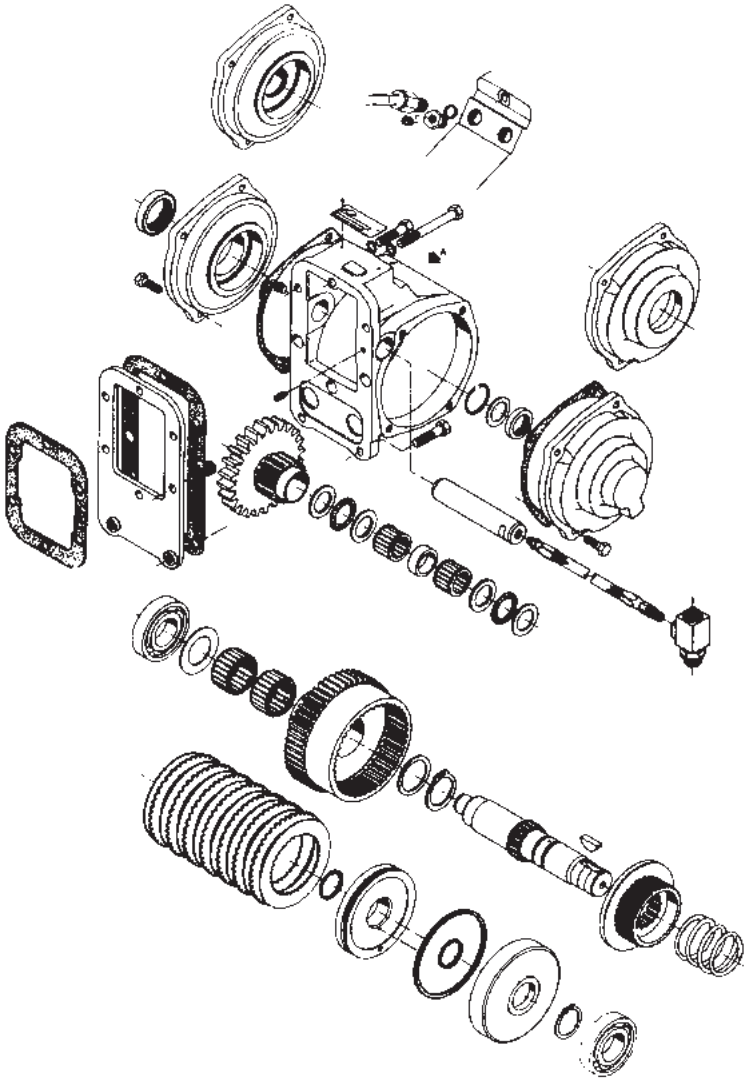
Foreword

Since our major objective is to show you how to get additional and more profitable miles from truck, tractor and trailer components, we want to provide you with information on the installation of Chelsea Power Take-Offs.

We all realize that an inadequate transmission will overwork any Power Take-Off in a very short period of time. In addition, a mismatched transmission/P.T.O. combination can result in unsatisfactory performance of the equipment right from the start.

Before you order new trucks, be sure you're getting the right transmission/P.T.O. combination. It is of vital importance for efficient performance to have adequate power. To help you select the proper type, size and design of P.T.O. it is advisable to discuss your specific requirements with Chelsea P.T.O. specialists. They know their products and have easy access to manufacturers of equipment, transmissions and Power Take-Offs. They can inform you about everything you need to know about power, at the right time, before you specify components.

Exploded View of a Typical Powershift P.T.O.



Chelsea P.T.O. Safety Label Instructions

1. The two black and orange on white 5" x 7" pressure sensitive vinyl labels, part number 379274; must be placed on the vehicle frame rails (one (1) on each side), in a position that would be **HIGHLY** visible to anyone that would go under the truck near the P.T.O. rotating shaft. If the vehicle is to be painted after these labels are installed, cover them with two (2) blank masking covers. Remove the masking covers after painting.

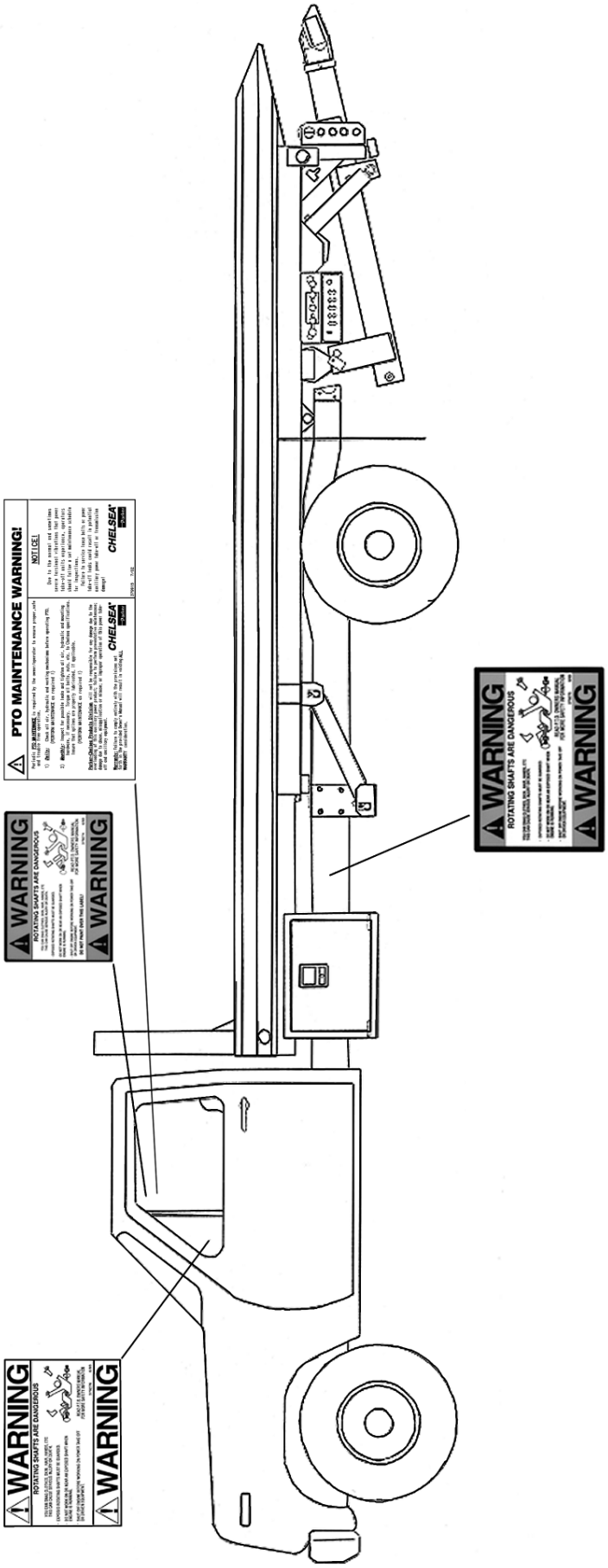
2. Place the one (1) black and orange on white 3.5" x 5" pressure sensitive vinyl label, part number 379275, on the visor nearest the operator of the vehicle, this must be placed near the P.T.O. visor label.

3. Place the one (1) red and white with black lettering 3.5" x 7.5" pressure sensitive vinyl label, part number 379915, on the opposite side of the visor from the above label # 379275.

4. Place the one (1) white and black heavy duty card, part number 379276, in the vehicle glove box. Again in a position highly visible to the operator, for example: try to place this card on top of whatever may be in the glove box.

If you require labels, please order part number 328946X at no charge from your local Chelsea Warehouse or send request direct to:

Parker Hannifin Corporation
Chelsea Products Division
8225 Hacks Cross Road
Olive Branch, MS 38654
Customer Service: (662) 895-1011



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Function of Auxiliary Power Shafts

An auxiliary power shaft transmits torque from the power source to the driven accessory. The shaft must be capable of transmitting the maximum torque and R.P.M. required of the accessory, plus any shock loads that develop.

An auxiliary power shaft operates through constantly relative angles between the power source and the driven accessory, therefore, the length of the auxiliary power shaft must be capable of changing while transmitting torque. This length change, commonly called "slip movement", is caused by movement of the power train due to torque reactions and chassis deflections.

Joint operating angles are very important in an auxiliary power joint application. In many cases, the longevity of a joint is dependent on the operating angles. (See chart below)

This information is limited to 1000 through 1310 series applications. For applications requiring a series larger than 1310, contact your local Chelsea distributor**.**

Determining Shaft Type

1) Solid or tubular?
   a) In applications requiring more than 1000 R.P.M. or where the application necessitates a highly balanced auxiliary power shaft, a tubular shaft should be used.
   b) Spicer's solid shafting auxiliary power joints are designed for 1000 or less R.P.M. intermittent service such as:

      Driving small hydraulic pumps

      Driving winches

      Driving low speed product pumps
2) Joint Series should be determined using the chart on the following page.

Spicer® Universal Joint Operating Angles			
Prop. Shaft R.P.M.	**Max. Normal Operating Angle**	**Prop. Shaft R.P.M.**	**Max. Normal Operating Angle**
3000	5° 50'	1500	11° 30'
2500	7° 00'	1000	11° 30'
2000	8° 40'	500	11° 30'

Above based on angular acceleration of 100 RAD/SEC^2

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Spicer® Universal Joint Engineering Data

Joint Series	1000	1100	1280	1310
Torque Rating				
Automotive (Gas or Diesel Engine) Lbs. ft.				
Continuous	50	54	95	130
Tubing				
Diameter	1.750	1.250	2.500	3.00
Wall Thickness	.065	.095	.083	.083
W = Welded S = Seamless	W	S	W	W
Flange Diameter (Swing Diameter)				
Rectangular Type	3.500	3.500	3.875	3.875
Bolt Holes - Flange Yoke				
Circle	2.750	2.750	3.125	3.125
Diameter	.312	.312	.375	.375
Number	4	4	4	4
Male Pilot Dia.	2.250	2.250	2.375	2.375
Distance Across Lugs				
Snap Ring	2.188	2.656	3.469	3.469
Construction				
Bearing Diameter	.938	.938	1.062	1.062

Maximum Operating Speed * By Tube Size, Solid Shaft Size, and Length
***(For speed below 500 R.P.M. or over 2500 R.P.M., contact your Chelsea Distributor)**

Tubing Dia. & Wall Thickness Joint & Shaft (W=Welded S=Seamless)	Max. Installed Length in Inches for Given R.P.M. Centerline to Centerline of Joints for a Two Joint Assembly or Centerline of Joint to Centerline of Center Bearing for a Joint & Shaft R.P.M. - Revolutions per Minute				
	500	**1000**	**1500**	**2000**	**2500**
1.750" X .065" W	117"	82"	67"	58"	52"
1.250" X .095" S	91"	64"	52"	45"	40"
2.500" X .083" W	122"	87"	70"	62"	55"
3.000" X .083" W	-	-	-	85"	76"
Solid Shaft Diameter					
.750"	60"	42"	35"	30"	27"
.812"	62"	44"	36"	31"	28"
.875"	65"	46"	37"	32"	29"
1.000"	69"	49"	40"	35"	31"
1.250"	77"	55"	45"	39"	35"

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Mounting the P.T.O. on the Transmission

When installing a P.T.O., always wear protective clothing and safety glasses.

1. Begin by draining the oil from the transmission. Use caution, since the oil may be hot (**Fig. 1**).

Fig. 1

2. Remove the P.T.O. aperture plate with a 15mm socket (**Fig. 2**).

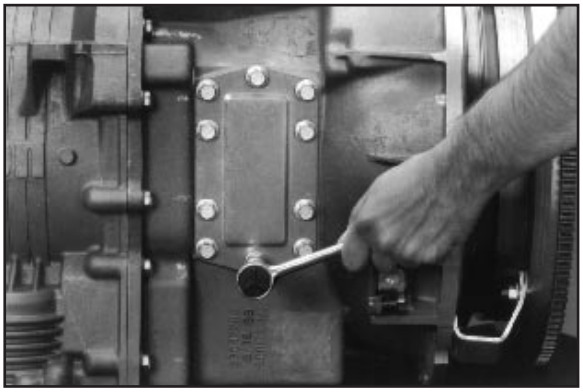
Fig. 2

3. Remove the gasket and clean the aperture surface (**Fig. 3**).

NOTE: Do not reuse the gasket that comes with the transmission.

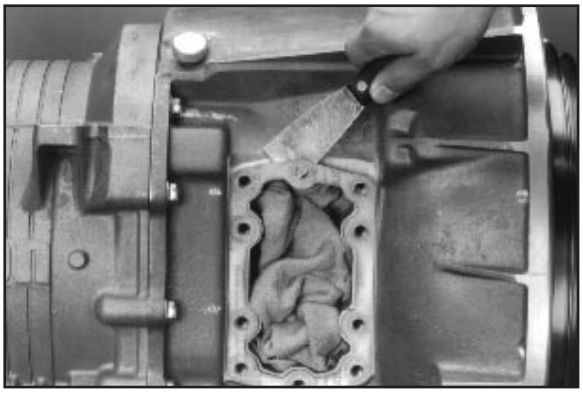
Fig. 3

4. Using a screwdriver, install the guide pins until they bottom out (**Fig. 4**) (Refer to Page 34 for 269 & 278 Series).

NOTE: Do not use sealing compounds because they are generally incompatible with automatic transmission fluid.

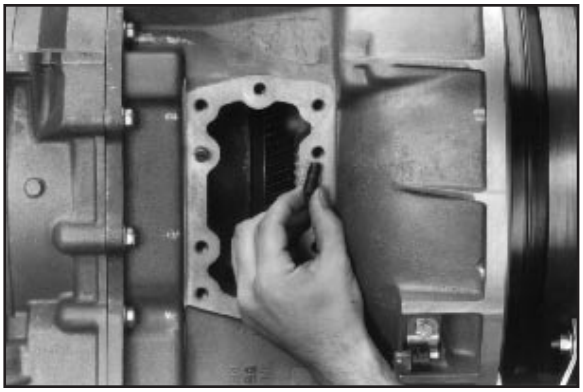
Fig. 4

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Mounting the P.T.O. on the Transmission (Continued)

5. Install the special gasket over the guide pins. The ribbed surface should face outward, toward the installer (**Fig. 5**).

NOTE: To insure proper backlash and sealing of P.T.O. to transmission only use gasket furnished with the P.T.O.

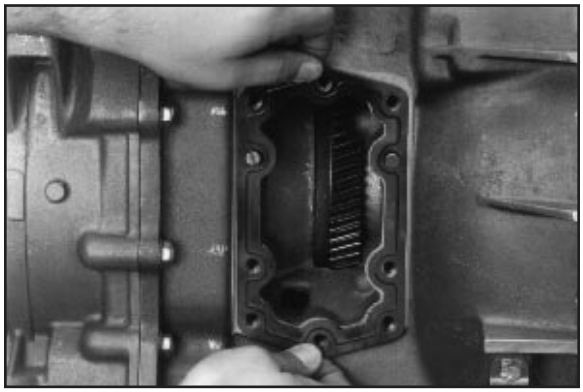

Fig. 5

6. Position the P.T.O. and secure it with the top capscrew (**Fig. 6**).

NOTE: Refer to page 34 for proper capscrew installation for the 269 & 278 Series

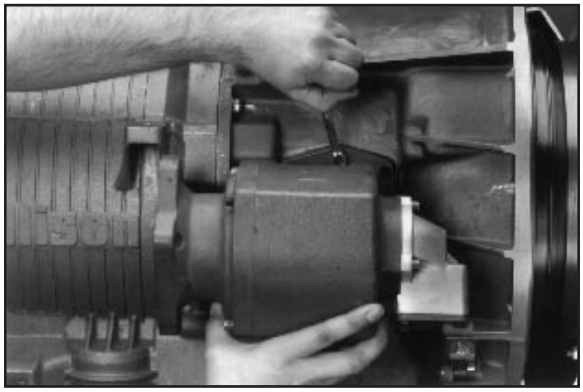

Fig. 6

7. Install the remaining capscrews. Torque all to 40 - 50 Lbs. ft. (54 - 68 N.m. or 5.5 - 6.9 Kg.m) (**Fig. 7**).

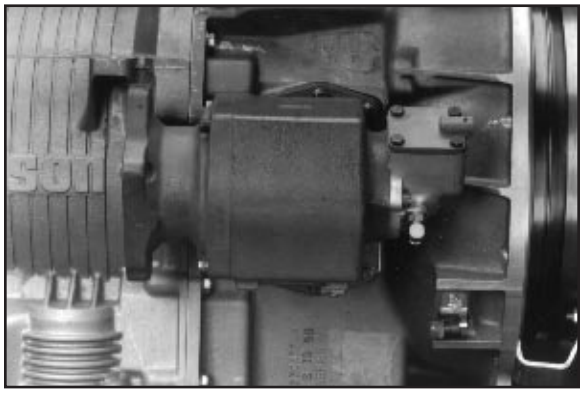

Fig. 7

8. Rotate the valve cap to one of two positions to provide maximum clearance (**Fig. 8**).

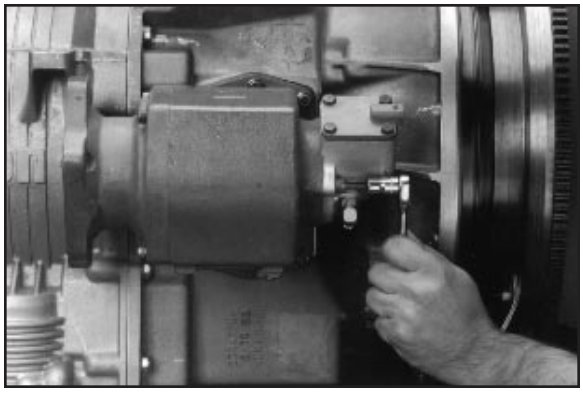

Fig. 8

Mounting the P.T.O. on the Transmission (Continued)

9. After selecting the best position for the application, torque the valve cap bolts to 16 - 20 Lbs. ft. (22 - 27 N.m. or 2.2 - 2.8 kg) (**Fig. 9**).

NOTE: If using a rotatable flange see page 34 for bolt torque specifications.

Fig. 9

10. Securely attach the high pressure line to the valve (**Fig. 10**).

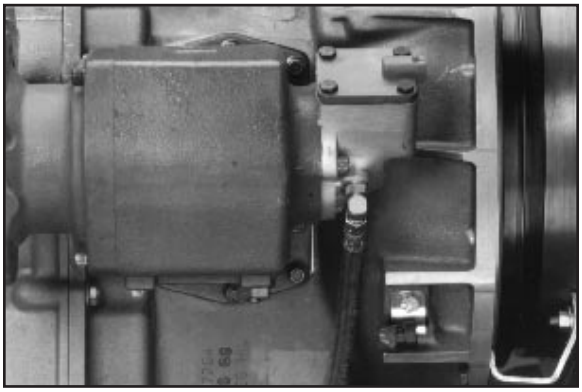

Fig. 10

11. Use the special fitting to securely attach the high pressure line to the transmission. This fitting is included with the P.T.O. (**Fig. 11**). See the chart on page 12 for the correct hose specifications. With the hose and P.T.O. securely connected, refill the transmission to the manufacturer's suggested specifications.

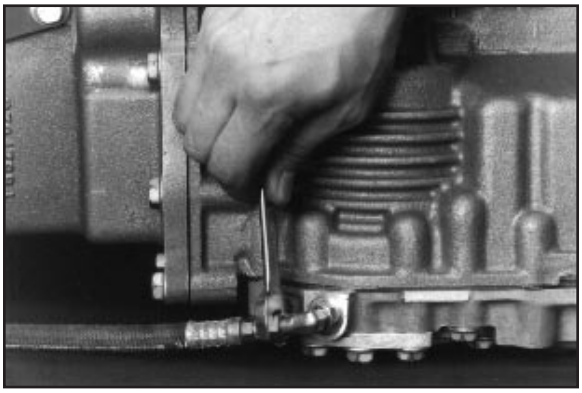

Fig. 11 (Left side)

12. Complete the assembly by installing the electrical connection (**Fig. 12**).

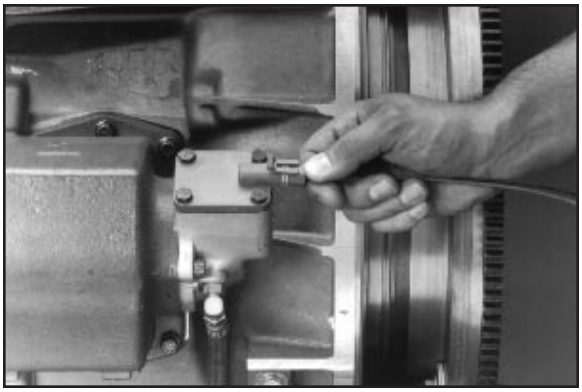

Fig. 12

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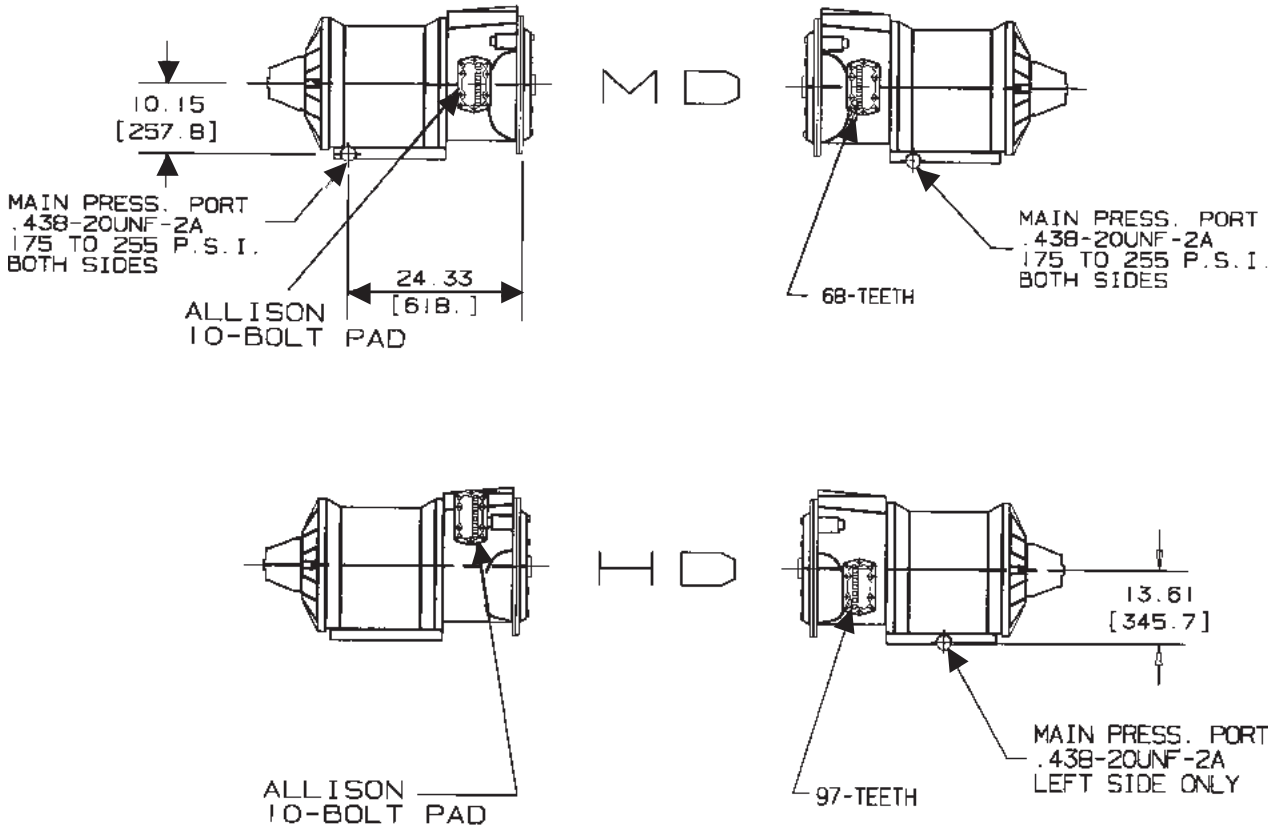
Pressure Port and Aperture Opening Identification

1. These drawings represent left and right views of the MD and HD pressure ports on the transmission.



Hose Specifications by Transmission

TRANS.	LOCATION	267 Series	277 Series	278 Series	859 Series
MD	L.H. Side (Left Press. Port)	329130-1X	329130-5X	329130-5X	329130-5X
MD	R.H. Side (Right Press. Port)	329130-4X	329075-1X	329075-1X	329075-1X
HD	Top Right (Left Press. Port)	329130-6X	329075-2X	329075-2X	329075-2X
HD	L.H. Side (Left Press. Port)	329130-1X	329130-4X	329075-4X	329130-4X
HD[1,2]	L.H. Side (Left Press. Port)	—	329130-5X	329130-5X	329130-5X
HD[1,2]	Top Right (Right Press. Port)	—	329130-4X	329075-4X	329130-4X
MD[1,2]	L.H. Side (Left Press. Port)	—	329130-5X	329130-5X	329130-5X
MD[1,2]	R.H. Side (Right Press. Port)	—	329075-1X	329075-1X	329075-1X

An HD with 2 P.T.O.'s requires a 379556 "T" fitting and a 379703 swivel nut 90 degree elbow to attach 2 hoses to the single port on the left side.

1 Lubrication Option "R", shifter Options "G" and "H" for 277 and 859 Series

2 Lubrication Option "R" for 278 Series

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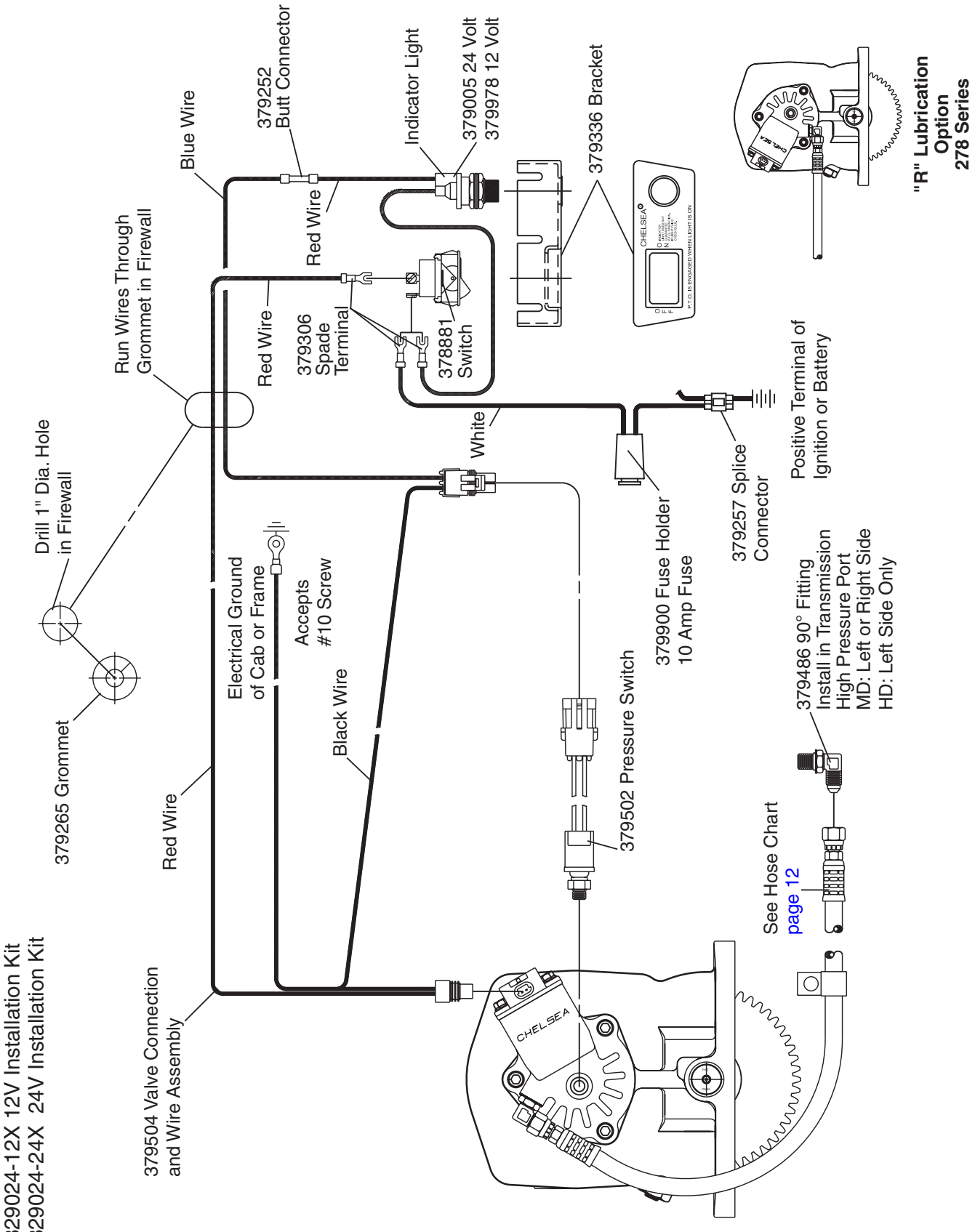
Shift Installation Kit 277, 278 & 859 Series without Electronic Overspeed Control (SK-347 Rev C) (Old Style)



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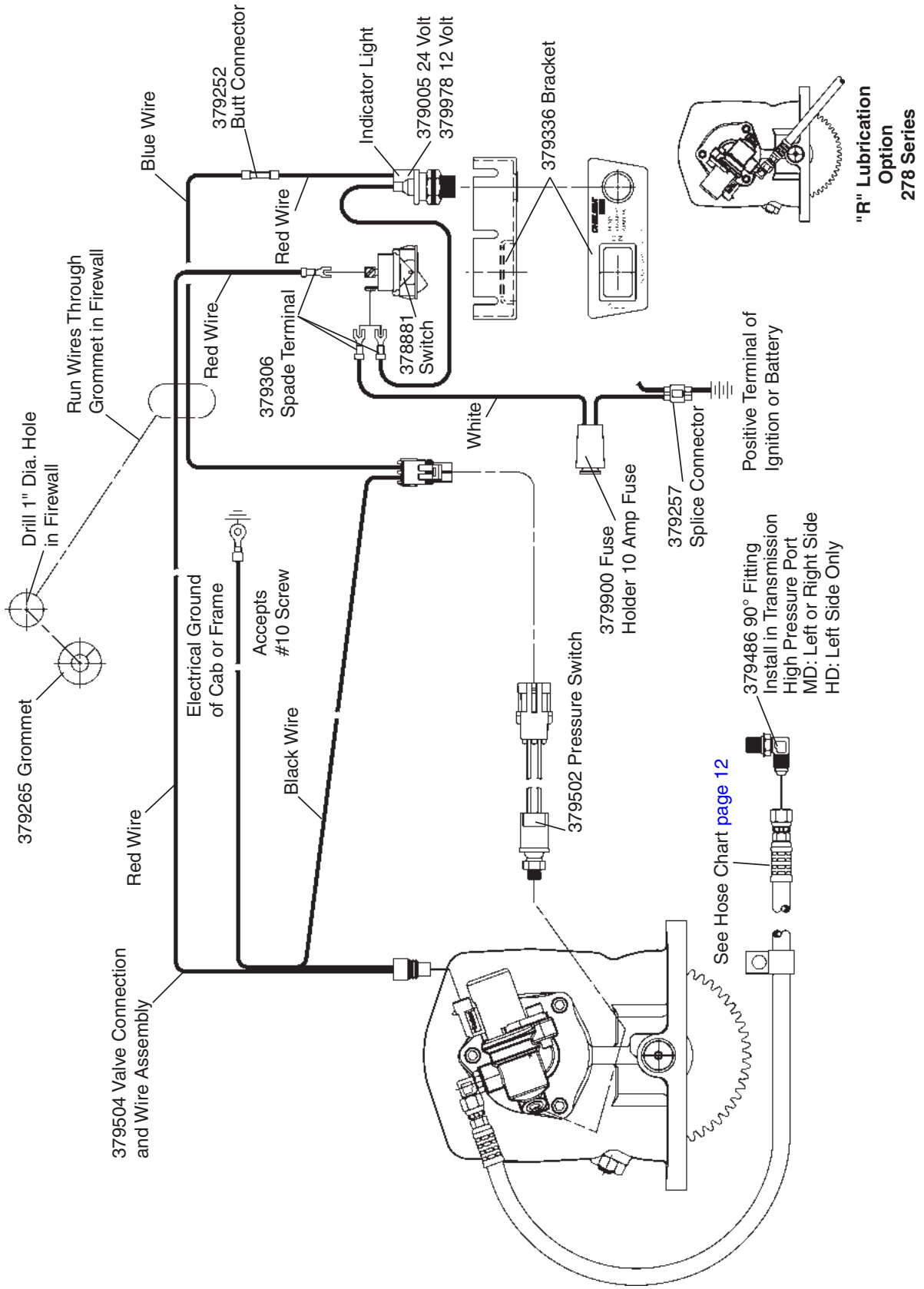
Shift Installation Kit 277, 278 & 859 Series without Electronic Overspeed Control (SK-347 Rev D) (New Style)



329024-12X 12V Installation Kit
329024-24X 24V Installation Kit

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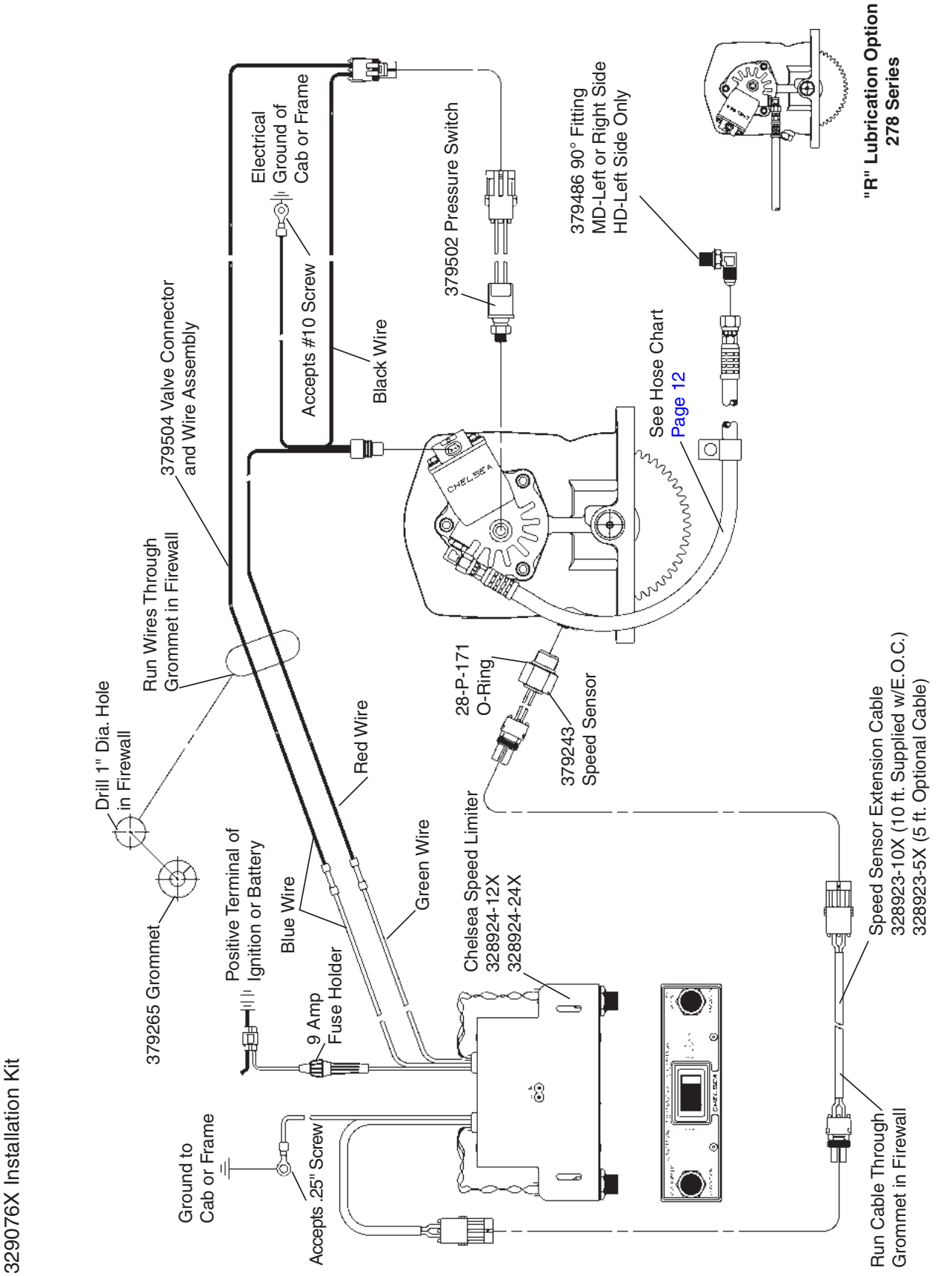
Shift Installation Kit 277, 278 & 859 Series with Electronic Overspeed Control (SK-348 Rev B) (Old Style)



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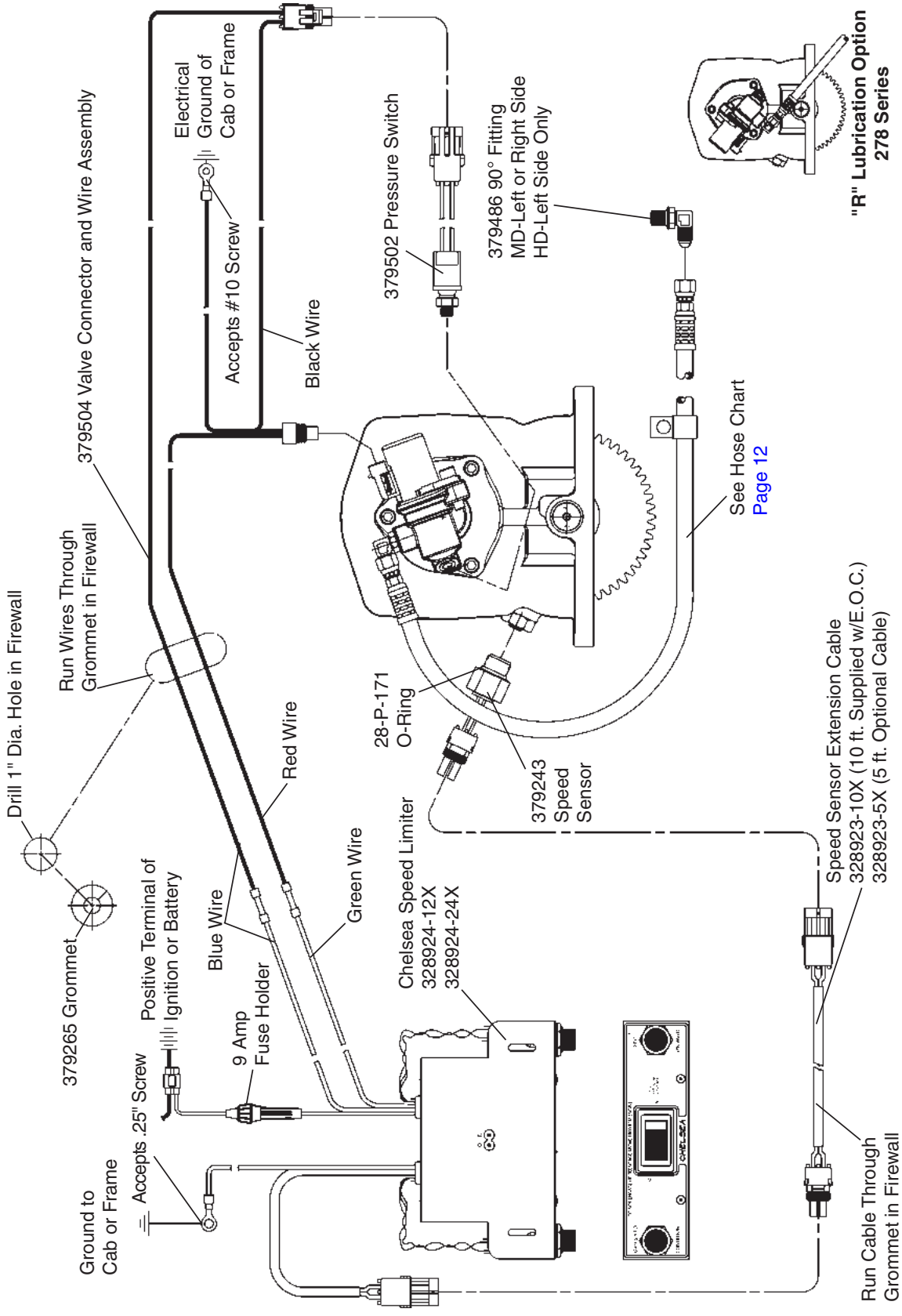
Shift Installation Kit 277, 278 & 859 Series with Electronic Overspeed Control (SK-348 Rev C) (New Style)



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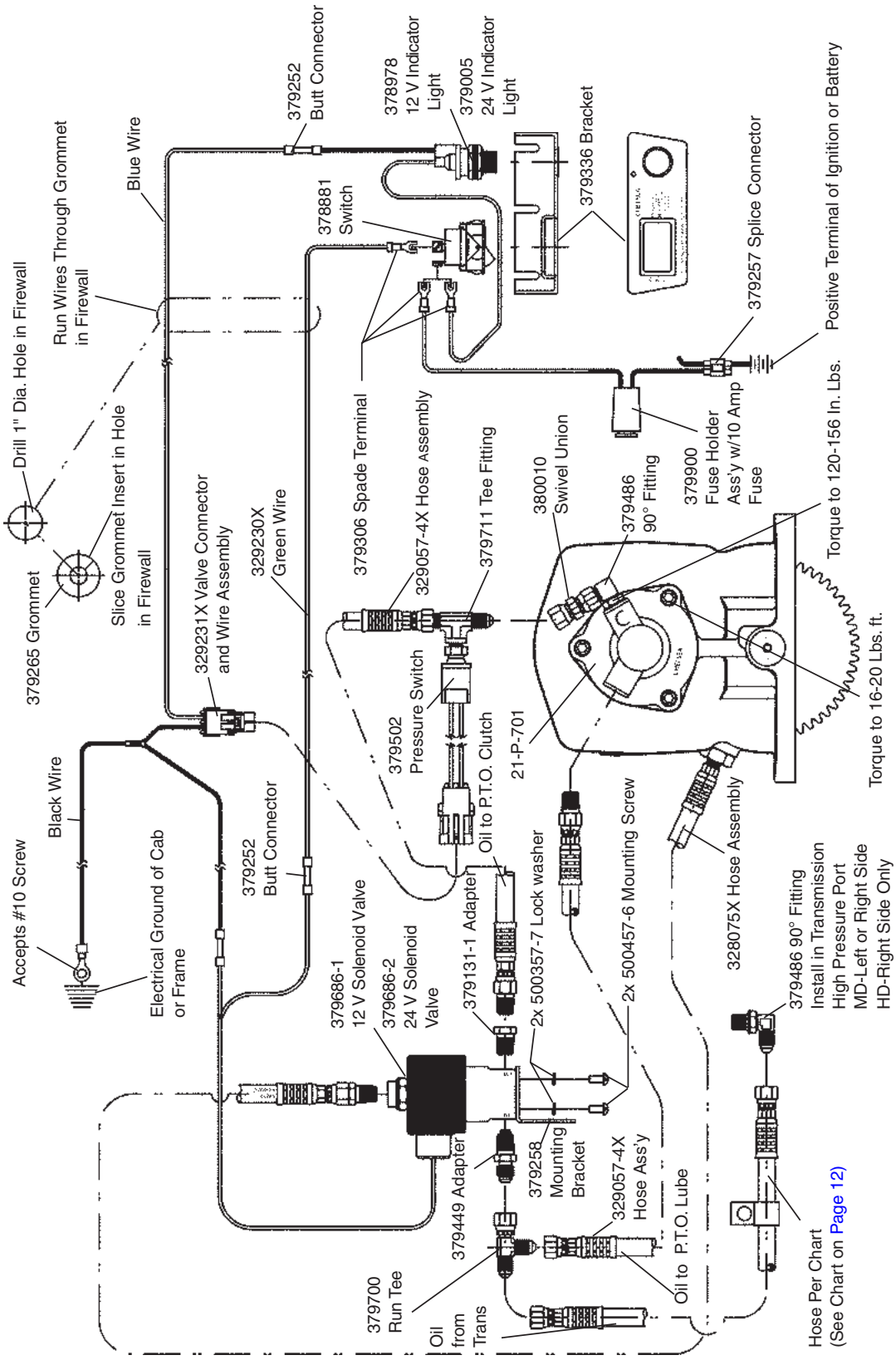
Shift Installation Kit 277, 278, & 859 Series with Remote Mount Solenoid (SK-432 Rev B)



329237-12X 12V Installation Kit
329237-24X 24V Installation Kit

NOTE: This option is not available with nor can it be used on E.O.C. applications.

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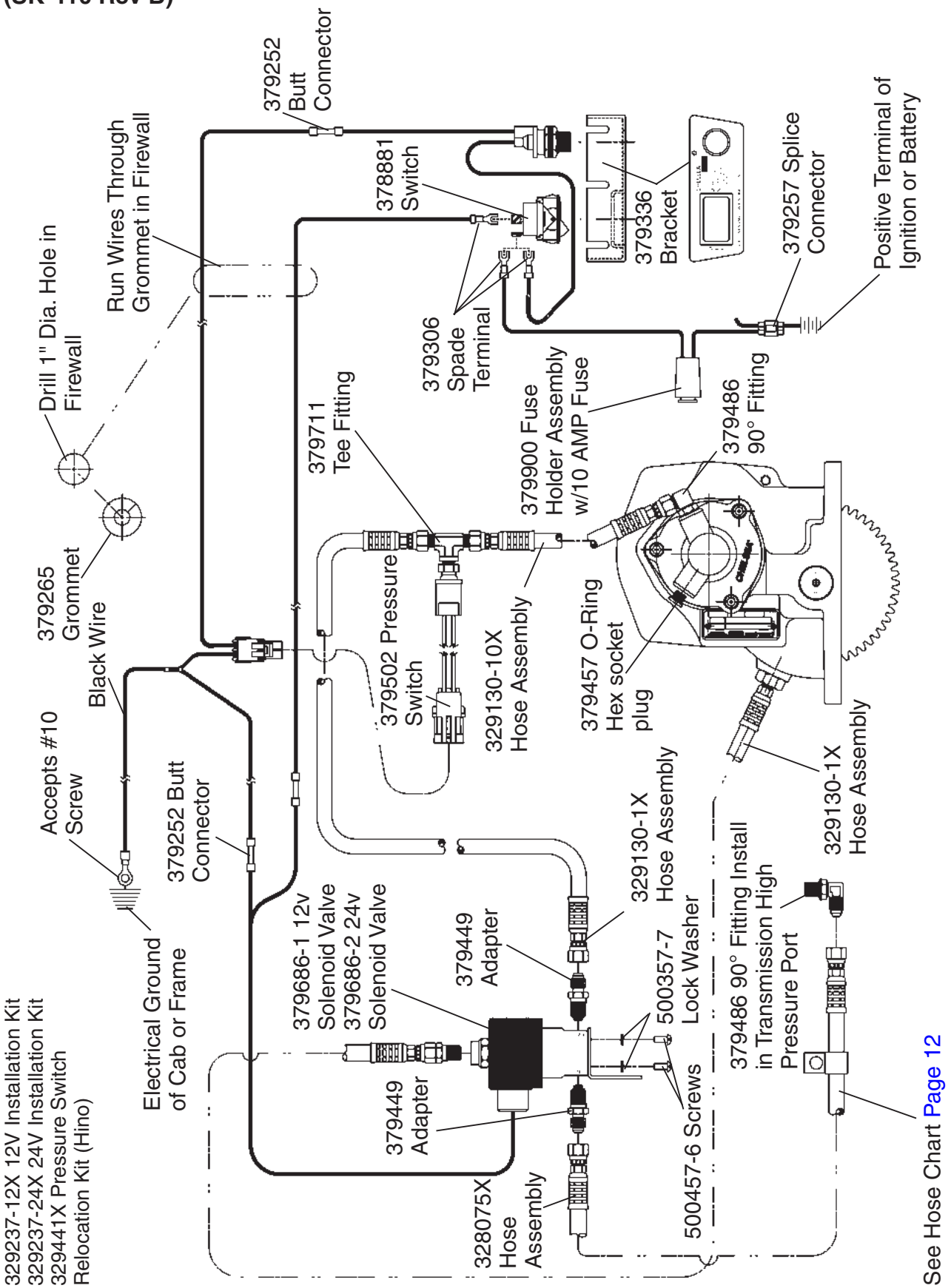
Shift Installation Kit 277 Series with Remote Mount Solenoid for Hino Model 338 (SK-410 Rev B)



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GMT C Series Trucks

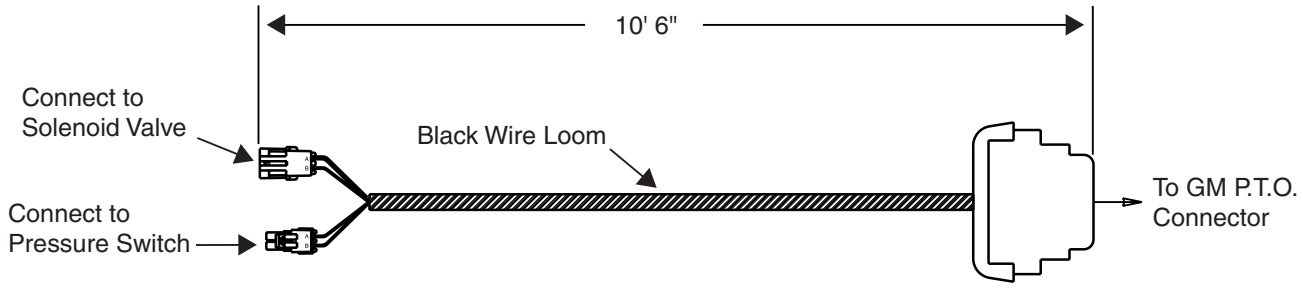
For model year 2003 GM C Series 4500, 5500, 6500, 7500 and 8500 trucks may be equipped with the Allison World (MD) transmission. In these vehicles GM Truck has integrated a P.T.O. connector, located in the right hand engine compartment area. A Power Take-Off switch has also been incorporated into the GM dash panel to control P.T.O. operation. With the P.T.O. option ordered on the truck, the P.T.O. connector and in-dash switch simplify the interface for the body builder.

In order for the customer to utilize the full capability of the P.T.O./transmission, Chelsea has design a wiring harness that must be used between the GM P.T.O. connector and the Chelsea Power Take-Off. These are for P.T.O. Non E.O.C. applications only.

On the Allison World (MD) transmission the P.T.O. drive gear is engine driven. The wiring harness is not "required" for the Power Take-Offs listed on the chart, but must be used if the GM supplied in-dash P.T.O. switch is to be utilized.

See wiring harness part number 379926 for the 277, 278 and 859 Series Power Take-Offs.

2003 GM "C" Series Wiring Harness for 277, 278 and 859 Series
Part Number 379926



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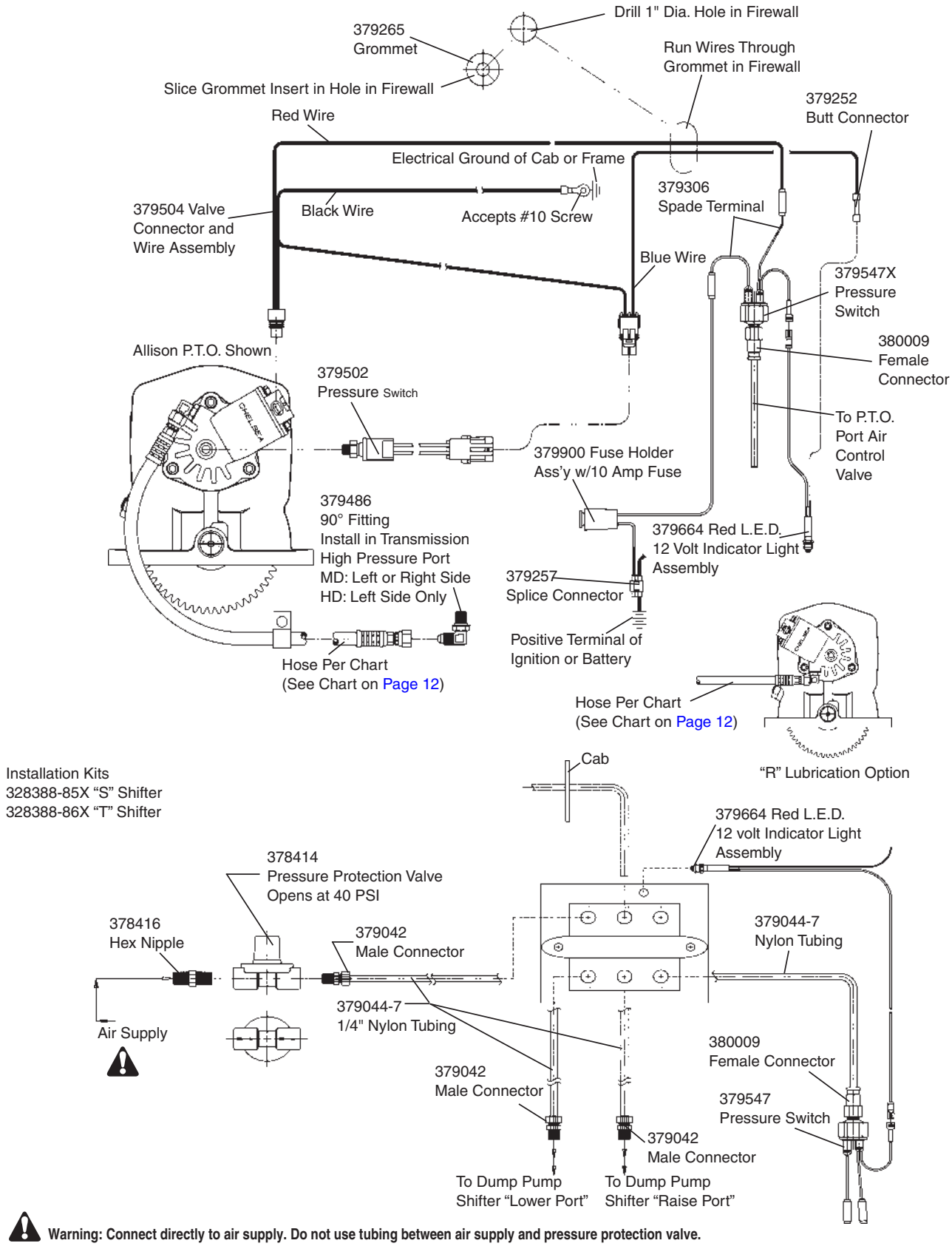
P.T.O. Combo Valve Installation Sketch, 277/278 Series (SK-427 Rev B) (Old Style)



Warning: Connect directly to air supply. Do not use tubing between air supply and pressure protection valve.

Caution: When installing nylon tubing avoid sharp angles, exhaust and manifold systems.

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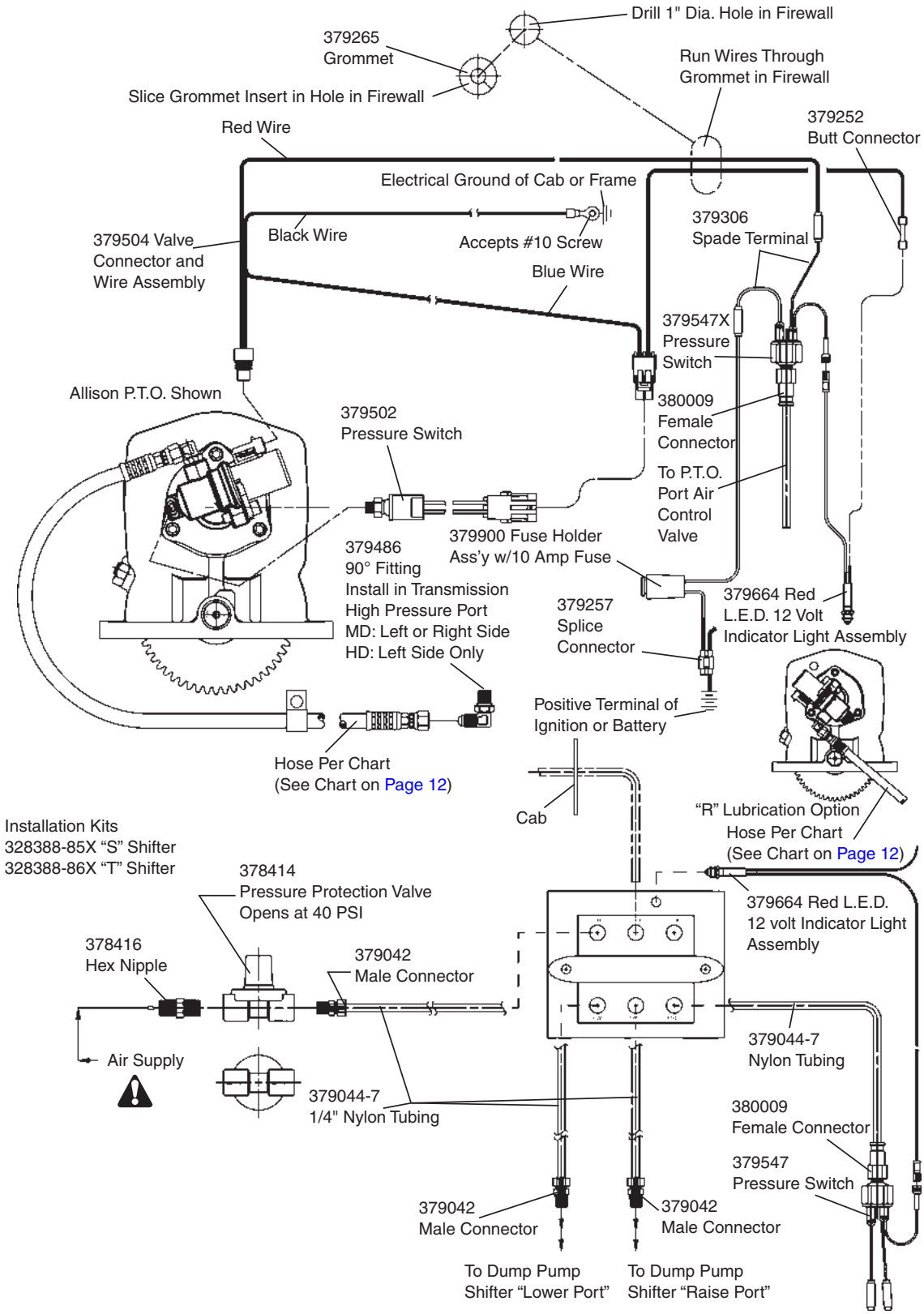
Olive Branch, MS 38654 USA

P.T.O. Combo Valve Installation Sketch, 277/278 Series (SK-427 Rev C) (New Style)



Warning: Connect directly to air supply. Do not use tubing between air supply and pressure protection valve.

Caution: When installing nylon tubing avoid sharp angles, exhaust and manifold systems.

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Mounting the P.T.O. on the Transmission

When installing a P.T.O., always wear protective clothing and safety glasses.

1. Remove the P.T.O. aperture plate with a 16mm socket (**Fig. 1**).

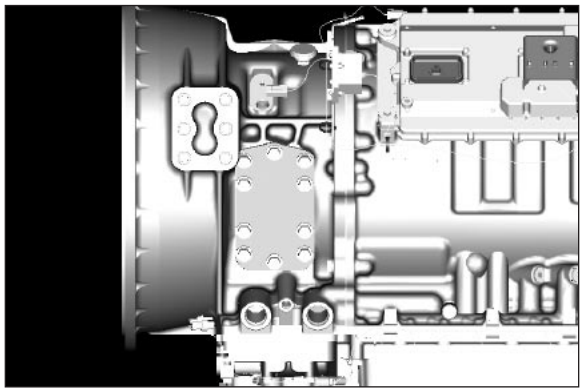
Fig. 1

2. Remove the gasket and clean the aperture surface (**Fig. 2**).

NOTE: Do not reuse the gasket that comes with the transmission.

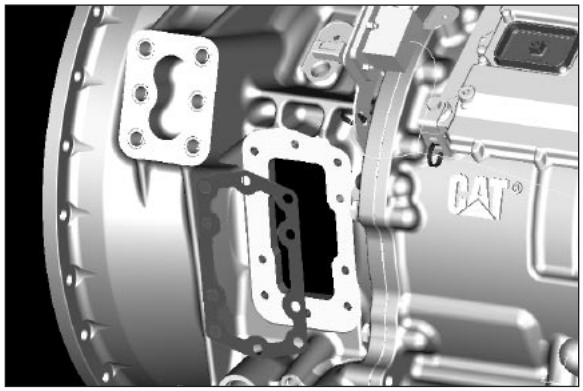
Fig. 2

3. Using a screwdriver, install the guide pins until they bottom out (**Fig. 3**) (see page 34).

NOTE: Do not use sealing compounds because they are generally incompatible with automatic transmission fluid.

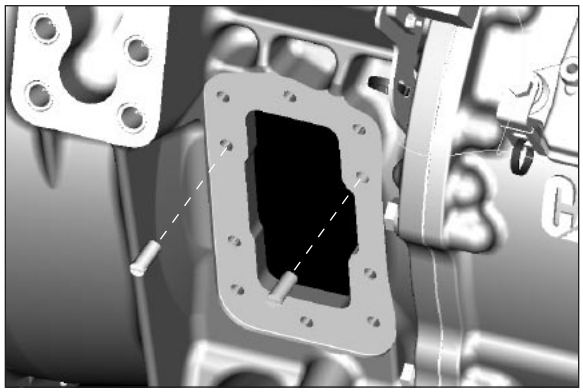
Fig. 3

4. Install the special gasket over the guide pins. The ribbed surface should face outward, toward the installer (**Fig. 4**).

NOTE: To insure proper backlash and sealing of the P.T.O. to the transmission, only use Gasket furnished with the P.T.O.

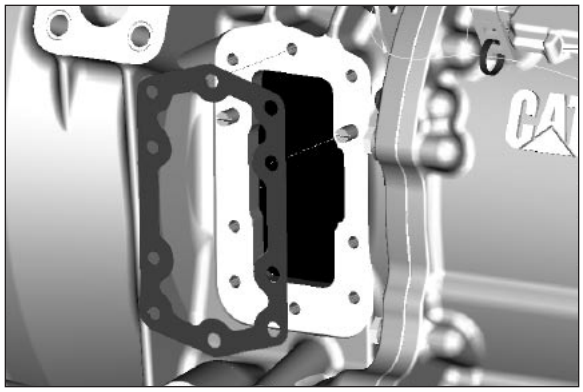
Fig. 4

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Mounting the P.T.O. on the Transmission (Continued)

5. Position the P.T.O. and secure it with the top capscrew provided. (**Fig. 5**)

NOTE: Refer to page 34 for proper capscrew installation for the 269 & 278 Series

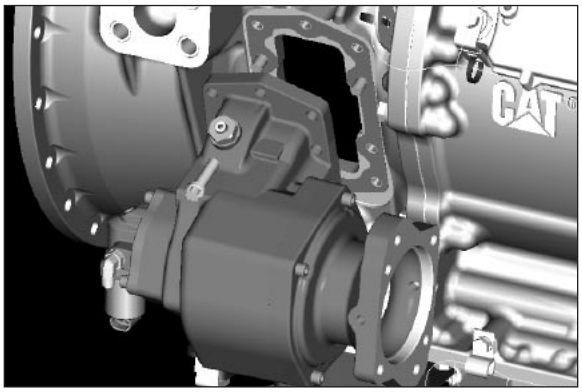


Fig. 5

6. Install the remaining capscrews. Torque them to 37-44 Lbs. ft. [50-60 N.m.] (**Fig. 6**).

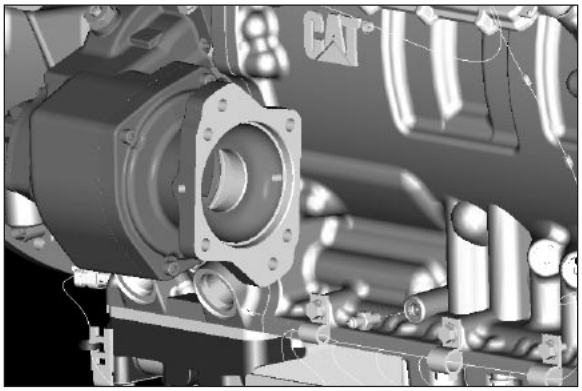


Fig. 6

NOTE: There are two (2) high pressure ports available. Use the port located on the driver's side of the transmission unless there is an interference issue with a pump or driven object (**Fig. 7**).

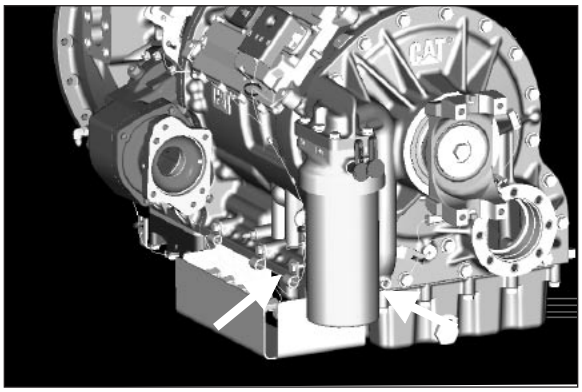


Fig. 7

7. Using the special fitting (379812) to securely attach the high pressure line to the transmission. This fitting is included with the P.T.O. Tighten to 8 - 10 Lbs. ft. [11.0 - 13.5 N.m.] (**Fig. 8**).

   See the hose chart on page 28 for the correct hose specifications. Tighten hose end fitting 2 flats from finger tight

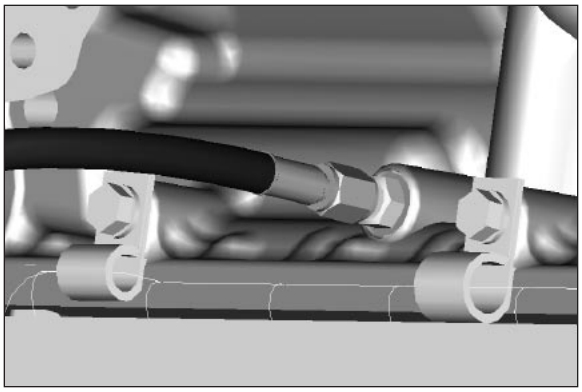


Fig. 8

Mounting the P.T.O. on the Transmission (Continued)

8. Securely attach the high pressure line to the valve. Tighten hose end fitting 2 flats from finger tight (**Fig. 9**).

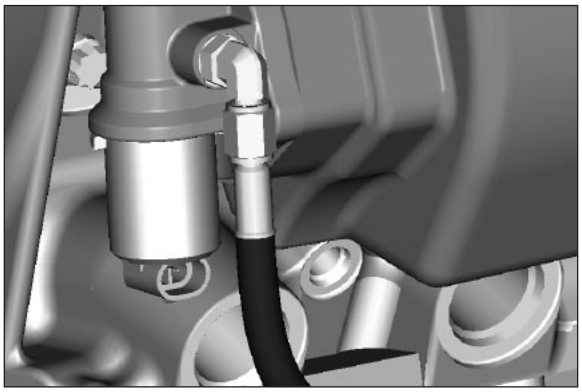


Fig. 9

9. Complete the assembly by installing the electrical connection (**Fig. 10**).

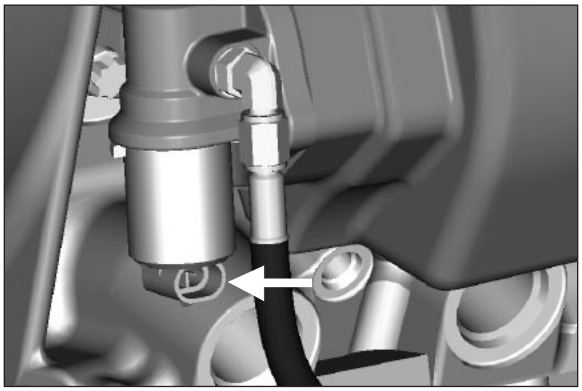
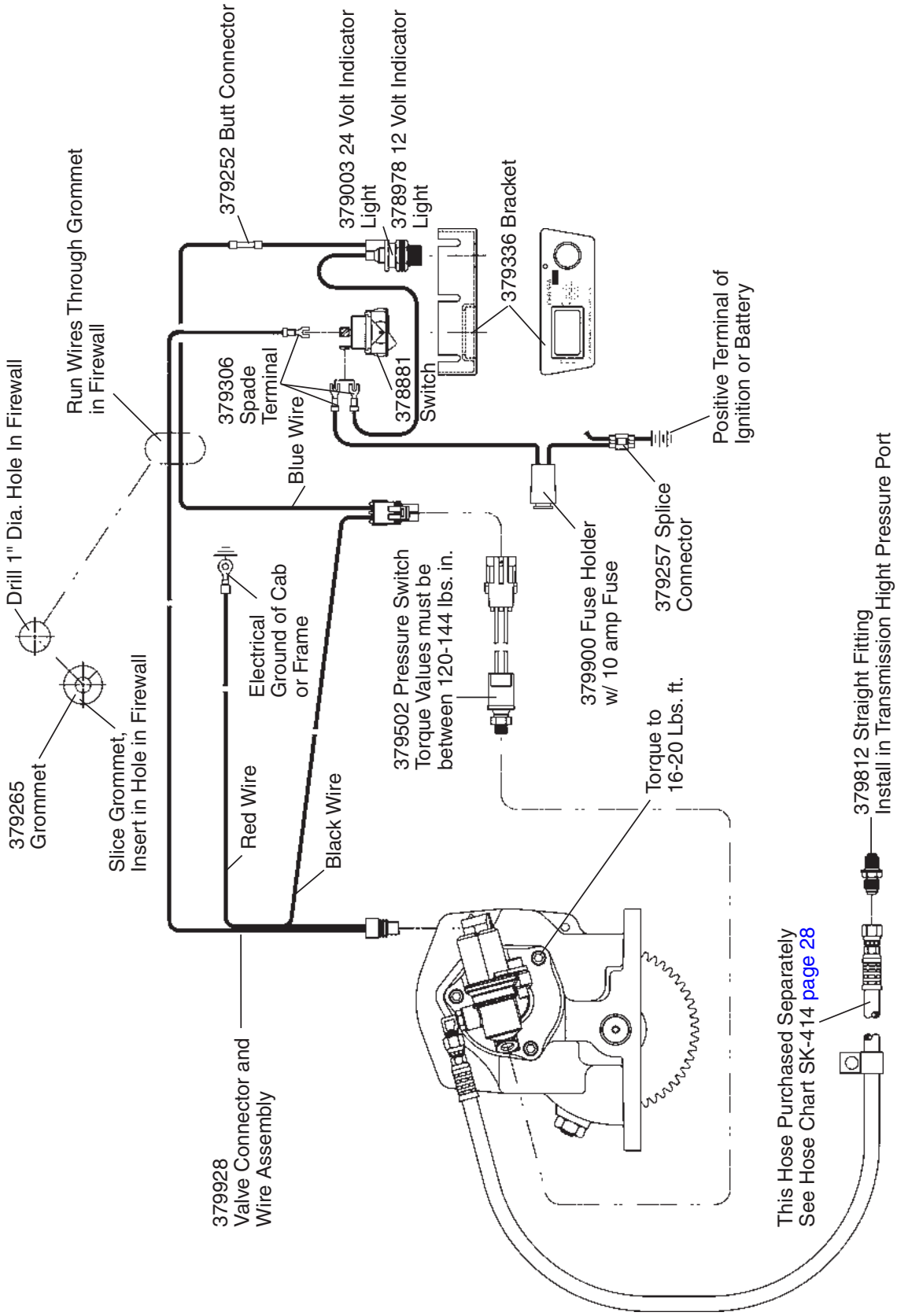


Fig. 10

NOTE: See page 25-27 for electrical connection drawings.

NOTE: If using a rotatable flange, see page 34 for bolt torque.

Shift Installation Kit 277, 278 and 859 Series Without Electronic Overspeed Control (SK-411 Rev A)



329443-12X - For 12V Installation Kit
329443-24X - For 24V Installation Kit

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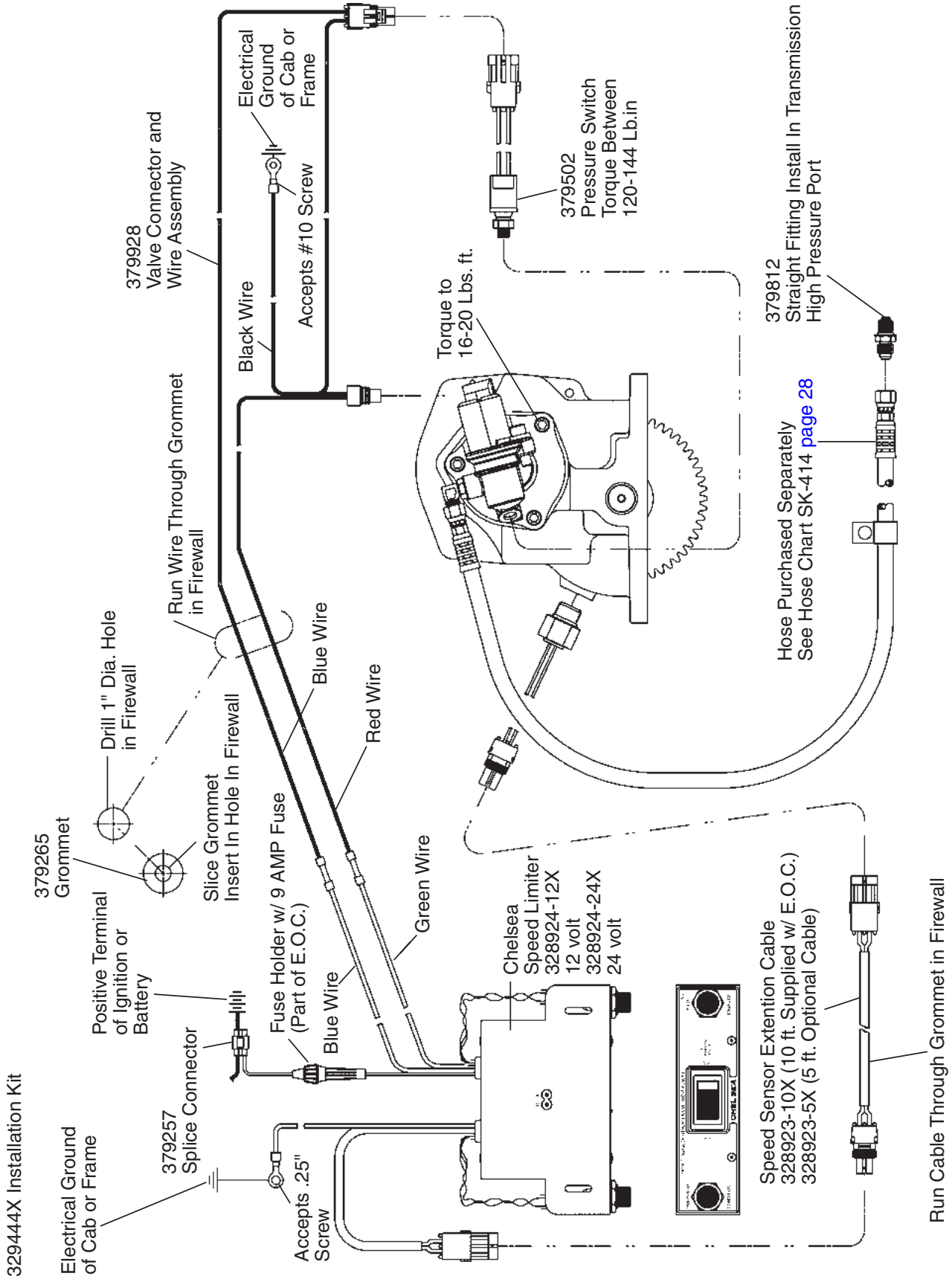
Olive Branch, MS 38654 USA

Electronic Overspeed Control Installation Sketch for 277, 278 and 859 Series (SK-412 Rev A)



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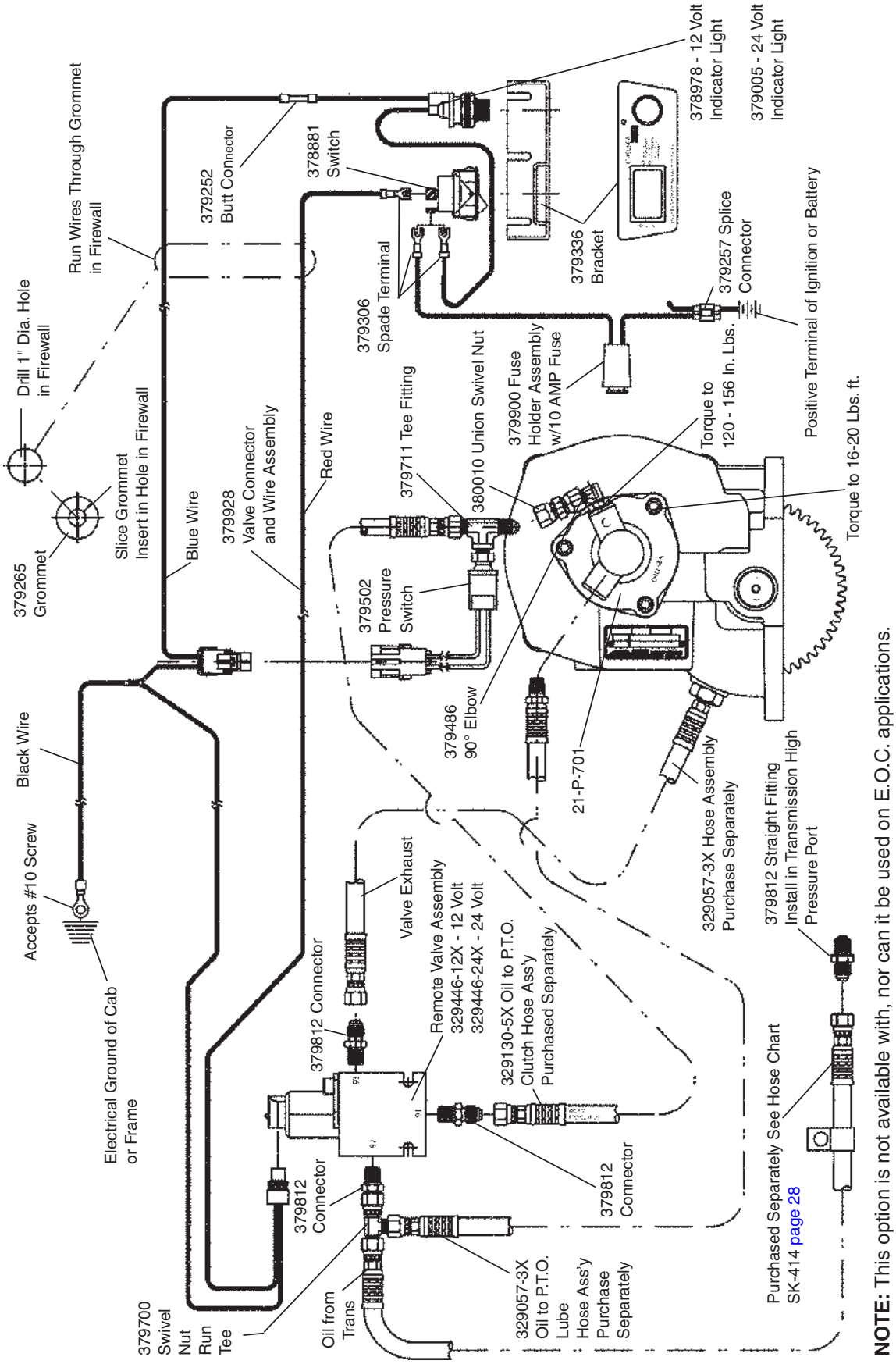
Olive Branch, MS 38654 USA

Remote Mount Installation Sketch for 277, 278 and 859 (SK-413 Rev C)



NOTE: This option is not available with, nor can it be used on E.O.C. applications.

329445-12X 12V Installation Kit
329445-24X 24V Installation Kit

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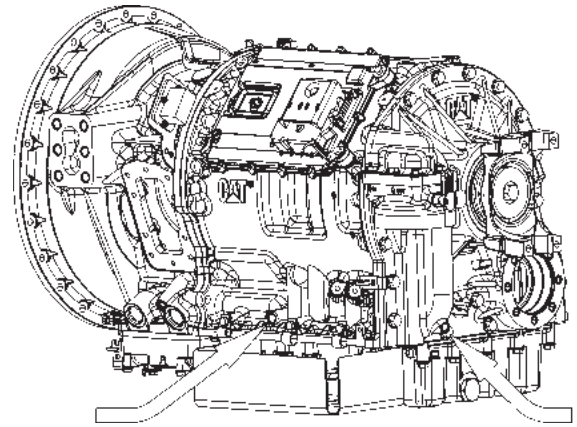
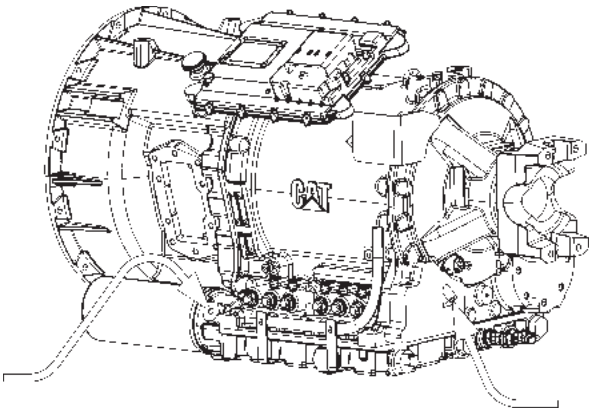
Pressure Port Locations & Hose Chart (SK-414 Rev B)



Left Side Port Rear Port

CX31
(Filter Removed for Clarity)



Left Side Port Rear Port

CX28

Both High Pressure Connections are -4 O-Ring Boss

HOSE CHART							
Trans.	**P.T.O.**	**P.T.O. Location**	**High Oil Pressure Location**	**P.T.O. Valve Location**	**P.T.O. Fitting**	**Trans. Fitting**	**Trans.-P.T.O. Valve Hose #**
CX31 CX28	277, 278 859	Driver (LHS)	LHS	Attached	379486	379812	329075-1X
		Driver (LHS)	Rear				329075-5X
		Pass. (RHS)	LHS				329075-2X
		Pass. (RHS)	Rear			379486	329075-5X
		Driver (LHS)	LHS	Remote	379486	379812	329130-6X
		Driver (LHS)	Rear				329130-6X
		Pass. (RHS)	LHS				329130-6X
		Pass. (RHS)	Rear				329130-6X
	267	Driver (LHS)	LHS	N/A	379486	379812	329130-3X
		Driver (LHS)	Rear			379486	329075-5X
		Pass. (RHS)	LHS			379812	329075-2X
		Pass. (RHS)	Rear			379812	329075-5X
	867	Driver (LHS)	LHS	N/A	379486	379812	329130-3X
		Driver (LHS)	Rear				329075-5X
		Pass. (RHS)	LHS				329075-2X
		Pass. (RHS)	Rear			379486	329075-5X

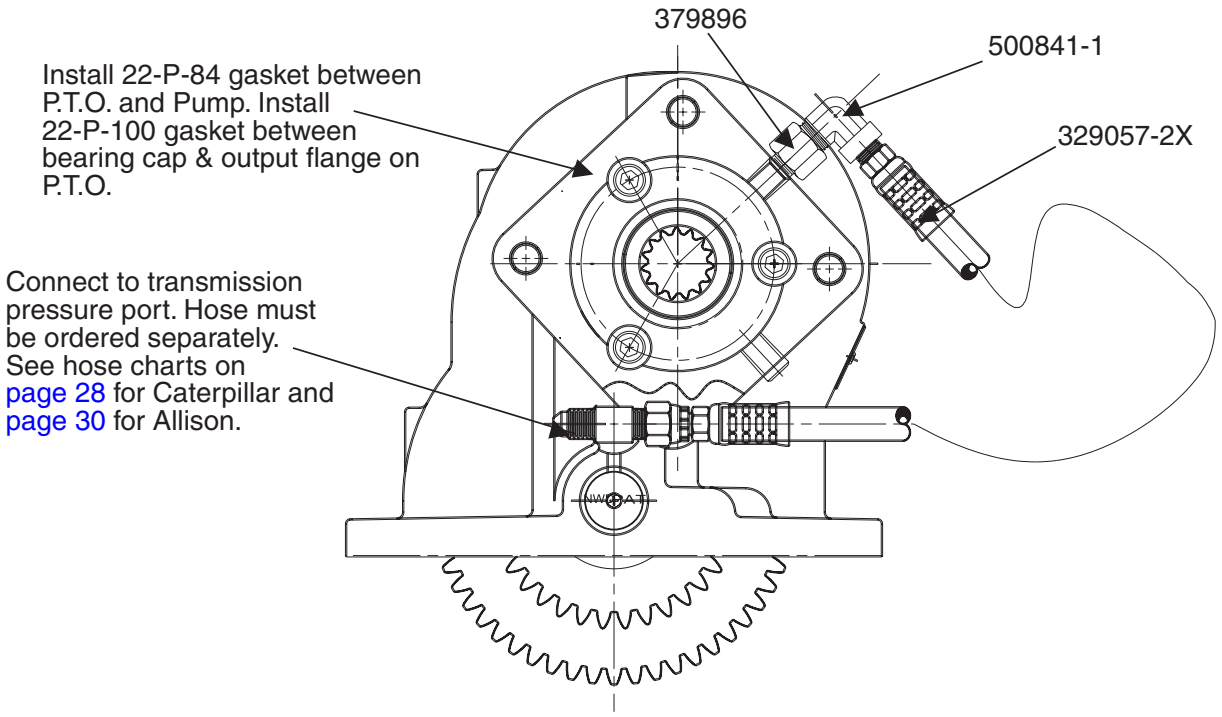
LHS = Left Side of Transmission, 8 o'clock position
RHS = Right Side of Transmission, 1 o'clock position

NOTES:

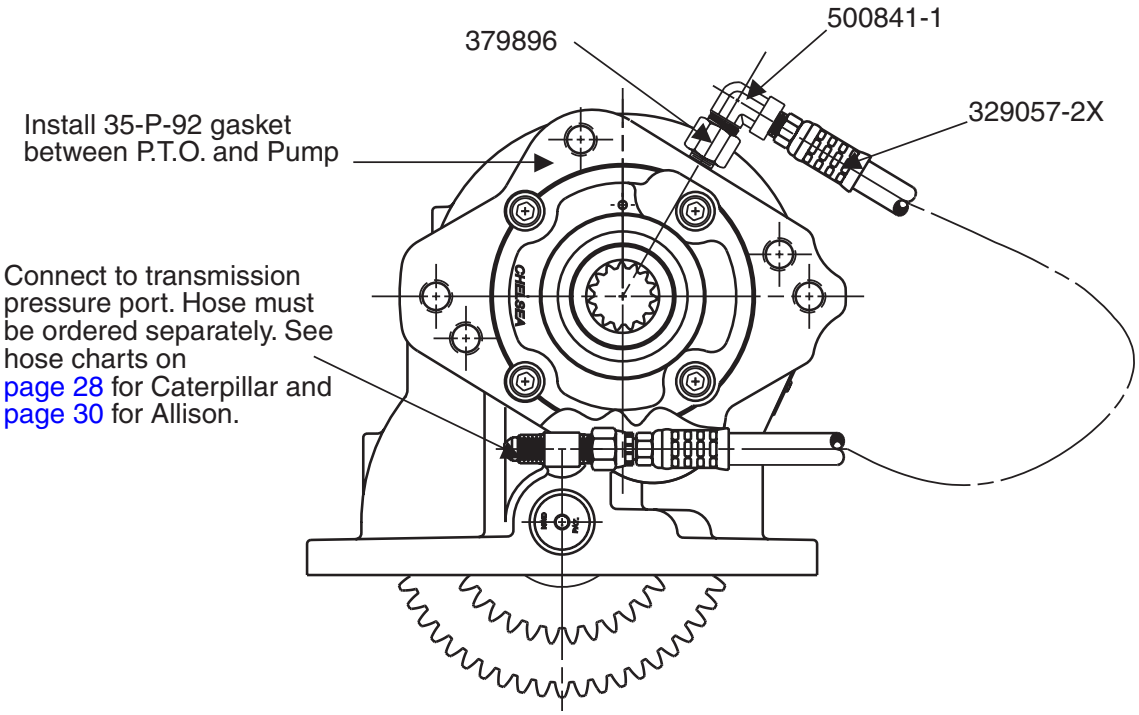
1. P.T.O. Fitting 379486 and Transmission Fitting 379812 included with the P.T.O. Unit. If Using 379486 in Transmission it Must be Purchased Separately
2. Hoses to be Purchased Separately
3. 379486 Elbow Will Not Install on Left Hand (Driver) Side Oil Port Due to Transmission Interference
4. If 379486 is Listed as Transmission Fitting for Rear Location, Route Hose Along Right Hand (passenger) Side of Transmission and Under Transmission Output Yoke

CAUTION: Wet Spline Options Must be used with a Pump that has a Contiguous Sealing surface to Ensure a proper seal between Pump and P.T.O.

Installation "RY" Wet 267 Series (SK-351 Rev C)



Installation "AF" Wet Spline 267 Series (SK-350 Rev C)



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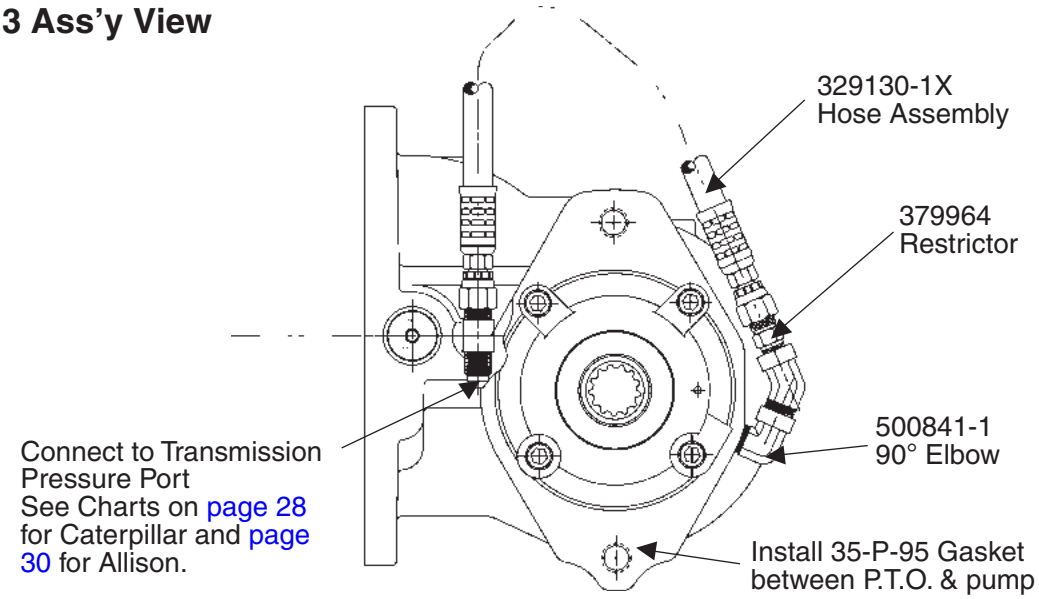
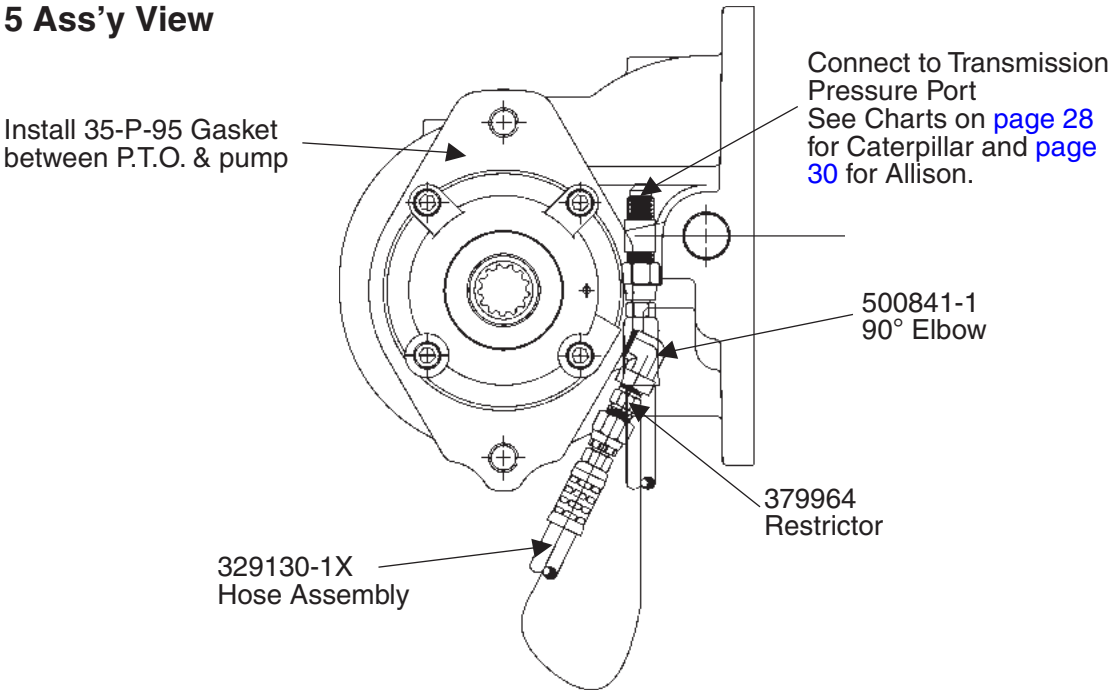
Installation "AK" Wet Spline 267 Series (SK-378 Rev A)

3 Ass'y View



Kit #329406X for Wet Spline
Installation Components

5 Ass'y View



Pressure Hose Chart (Transmission to P.T.O.)		
Trans	**Location**	**Hose**
MD	Left	329130-5X
MD	Right	329130-4X
HD	Left	329130-5X
HD	Top Right	329130-8X

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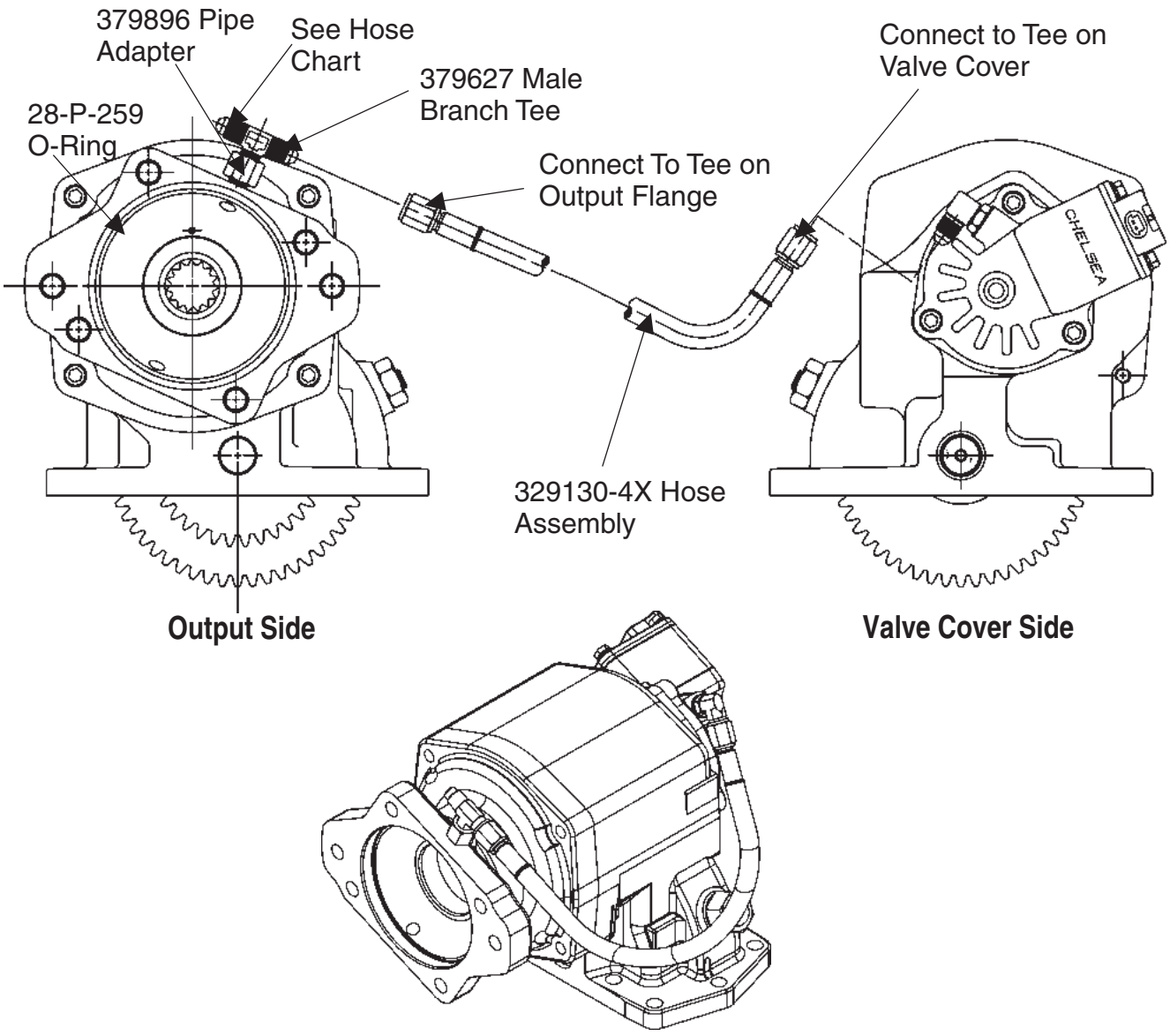
Installation "AF" Wet Spline 277 & 278 Series (SK-383 Rev B) (Old Style)



Pressure Hose Chart (Transmission to P.T.O.)		
Trans	**Location**	**Hose**
MD	Left	329130-1X
MD	Right	329075-1X
HD	Left	329130-1X
HD	Right	329075-2X

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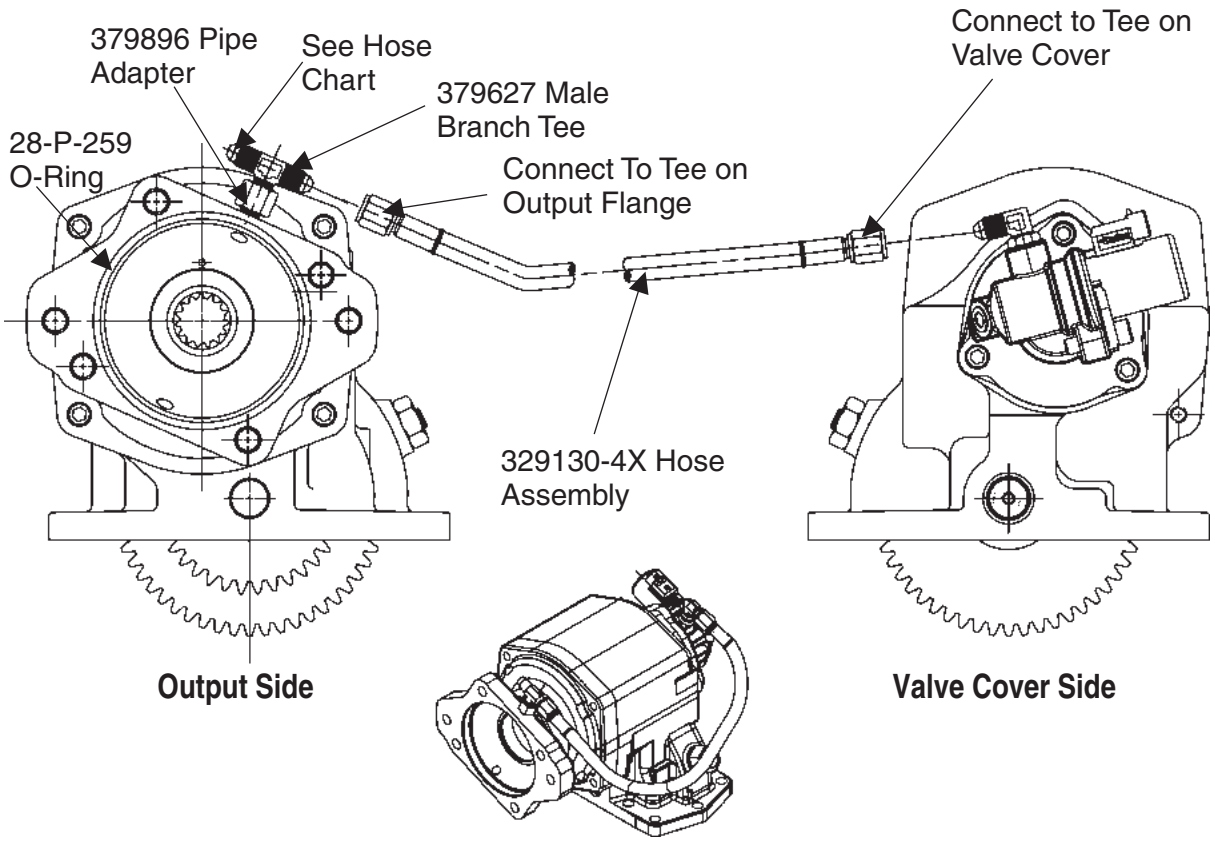
Installation "AF" Wet Spline 277 & 278 Series (SK-383 Rev C) (New Style)



Pressure Hose Chart (Transmission to P.T.O.)		
Trans	**Location**	**Hose**
MD	Left	329130-1X
MD	Right	329075-1X
HD	Left	329130-1X
HD	Right	329075-2X

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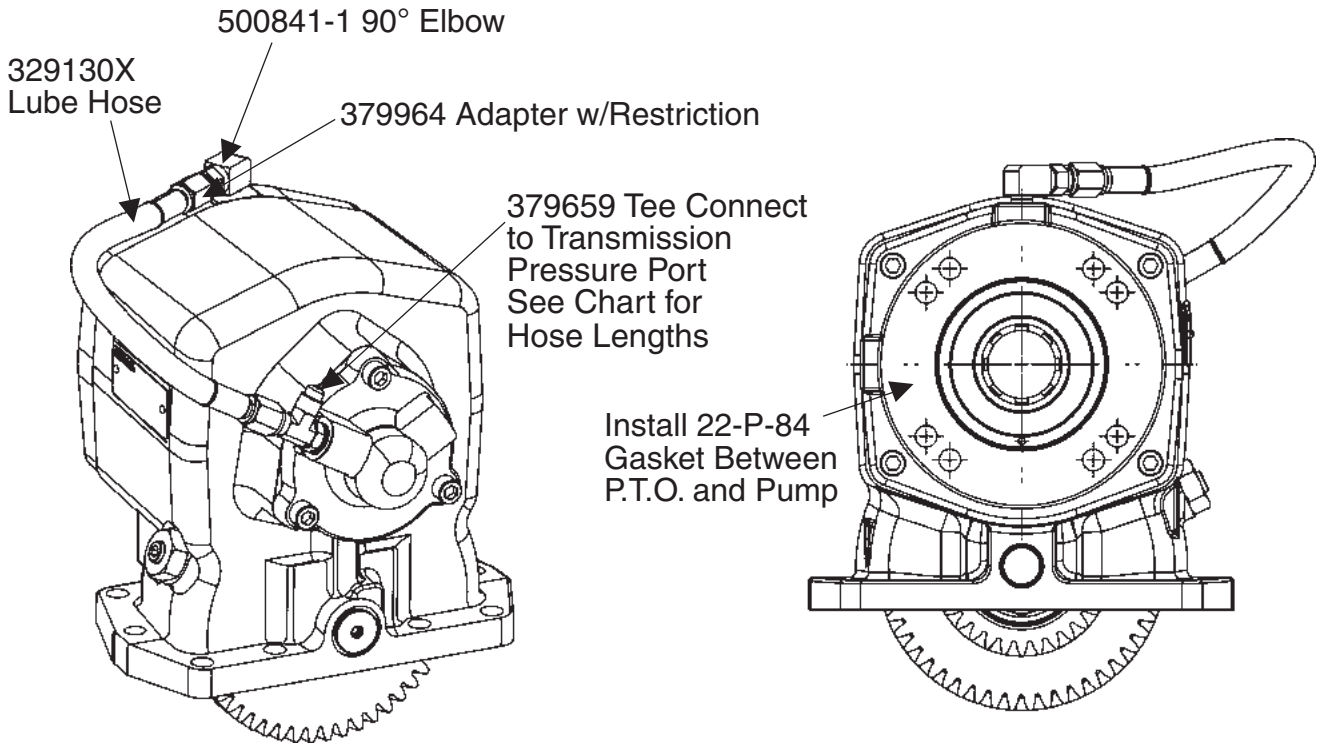
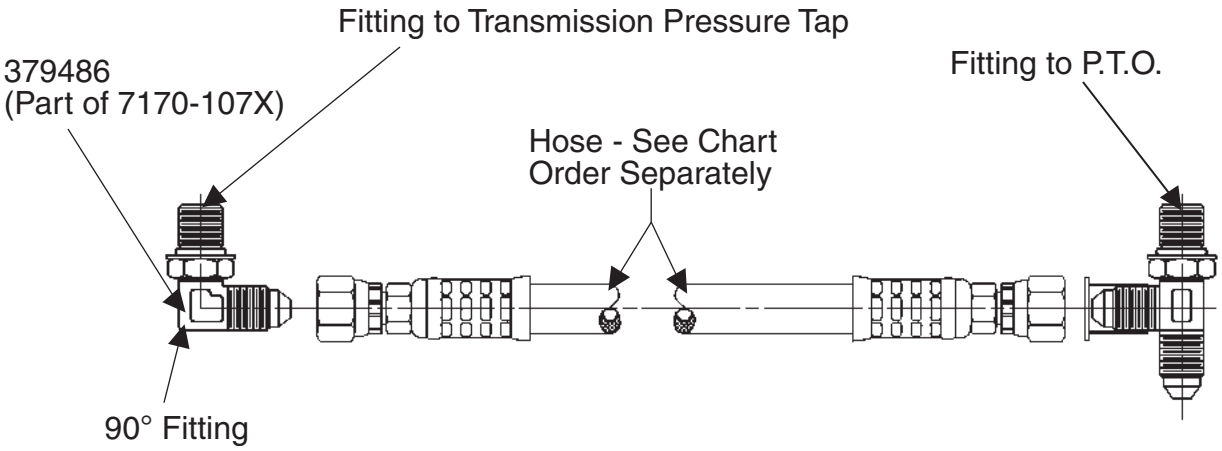
Installation "XY" Wet Spline 269 Series (SK-416 Rev B)





Pressure Hose Chart (Transmission to P.T.O.)		
Trans	**Location**	**Hose**
MD	Left	329130-5X
MD	Right	329075-1X
HD	Left	329075-4X
HD	Top Right	329075-2X

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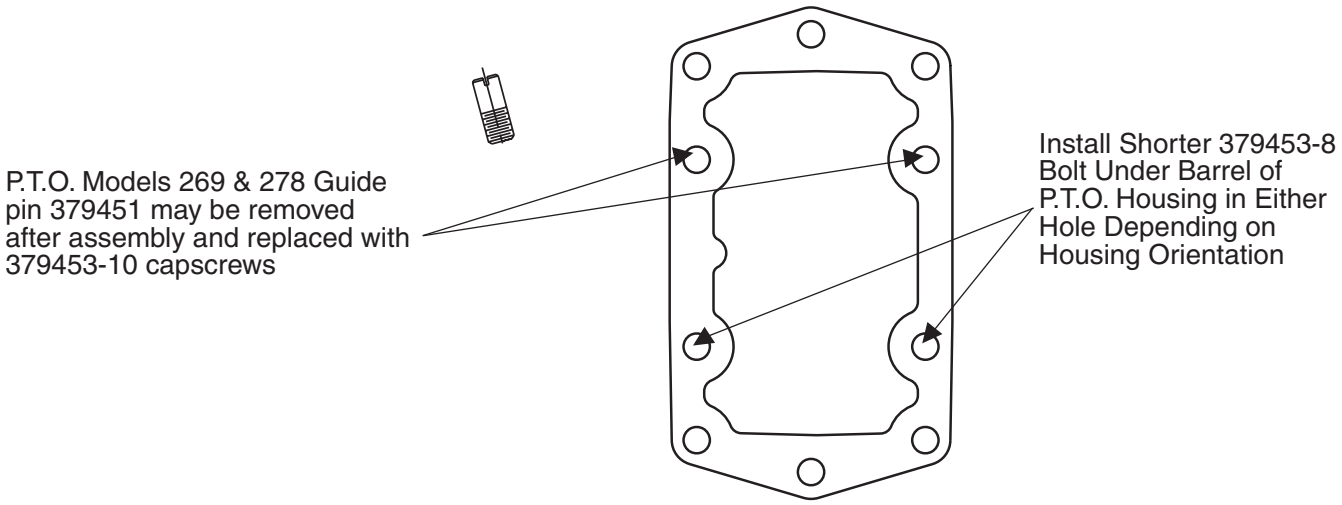
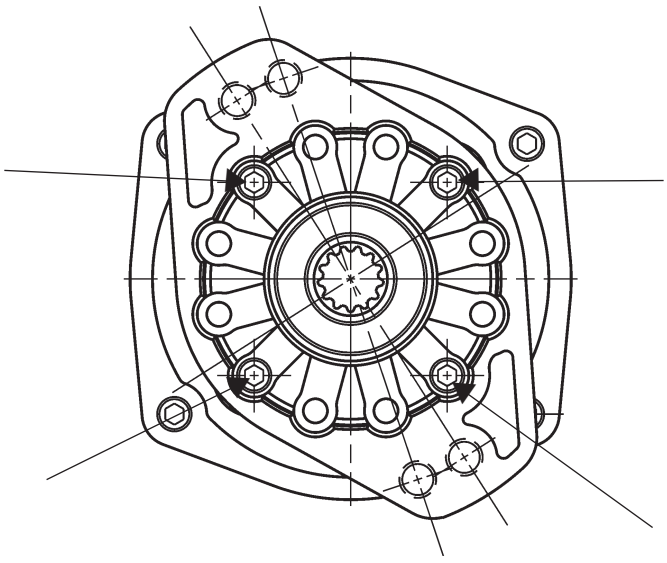
269 & 278 Series Installation Mounting Kit Instructions (SK-355 Rev A)



Installing Rotatable Flanges

The rotatable flange is shipped loose with the P.T.O. units for ease of installation. After determining the flange position, attach the flange to the P.T.O. bearing cap using the capscrews provided in the bag kit. Bag kit number 328170-207X (6-bolt family) will contain (3) capscrews (378447-6) and 328170-208X (277 Series) will contain (4) capscrews for attaching the flange to the P.T.O. bearing cap.
After installing the capscrews make sure to torque the screws to 16-20 Lbs. ft.
Consideration should be taken on the size and weight of the pump being installed. (see pages 3 and 4)



RA Flange Shown

NOTE: Reinstalling or tightening of a rotatable flange after it has become loose is not recommended. If a P.T.O. has run for a length of time after the flange has become loose, the flange and / or bearing cap may not be to manufacturing tolerance.

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P.T.O. Shifting Procedure & Precautions

CAUTION: This vehicle is equipped with a Power Take-Off. Shut engine off before working on the Power Take-Off or getting below the vehicle. Consult the operating instructions before using the P.T.O. (See sun visor.)

POWER TAKE-OFF OPERATION — VEHICLE STATIONARY

Automatic Transmission with Powershift P.T.O.s

Engage the P.T.O. with the engine at idle speed.

NOTE: Powershift P.T.O.s: The engine must be at idle or below 1000 R.P.M. when the P.T.O. is engaged. See the transmission manufacturer's instructions for special procedures.

IMPORTANT:

Failure to follow the proper shifting or operating sequences will result in premature P.T.O. failure with possible damage to other equipment.

Warning: Cold Weather Operation of Powershift P.T.O.s

During extreme cold weather operation [32° F (0° C) and lower], a disengaged Powershift Power Take-Off can momentarily transmit high torque that will cause unexpected output shaft rotation. This is caused by the high viscosity of the transmission oil when it is extremely cold. As slippage occurs between the Power Take-Off clutch plates, the oil will rapidly heat up and the viscous drag quickly decreases.

The Power Take-Off output shaft rotation could cause unexpected movement of the driven equipment, resulting in serious personal injury, death, or equipment damage.

To avoid personal injury or equipment damage:

- Driven equipment must have separate controls.
- Driven equipment must be left in the disengaged position when not in operation.
- Driven equipment must not be operated until the vehicle is allowed to warm up.

This symbol warns of possible personal injury.

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Notes

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Notes

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Power Take-Off Maintenance

Due to the normal and sometime severe torsional vibrations that Power Take-Off units experience, operators should follow a set maintenance schedule for inspections. Failure to service loose bolts or Power Take-Off leaks could result in potential auxiliary Power Take-Off or transmission damage.

Periodic P.T.O. MAINTENANCE is required by the owner/operator to ensure proper, safe and trouble free operation.

Daily: Check all air, hydraulic and working mechanisms before operating P.T.O. Perform maintenance as required.

Monthly: Inspect for possible leaks and tighten all air, hydraulic and mounting hardware, if necessary. Torque all bolts, nuts, etc. to Chelsea specifications. Insure that splines are properly lubricated, if applicable. Perform maintenance as required.

With regards to the direct mounted pump splines, the P.T.O. requires the application of a specially formulated anti-fretting, high pressure, high temperature grease. The addition of the grease has been proven to reduce the effects of the torsional vibrations, which result in fretting corrosion on the P.T.O. internal splines as well as the pump external splines. Fretting corrosion appears as a "rusting and wearing" of the pump shaft splines. Severe duty applications, which require long P.T.O. running times and high torque may require more frequent regreasing. Applications such as Utility Trucks that run continuously and are lightly loaded also require frequent regreasing due to the sheer hours of running time. It is important to note that service intervals will vary for each and every application and is the responsibility of the end user of the product. Chelsea also recommends that you consult your pump owners manuals and technical services for their maintenance guidelines. Fretting corrosion is caused by many factors and without proper maintenance; the anti-fretting grease can only reduce its effects on components.

Chelsea offers the grease to our customers in two packages. The first is a 5/8 fluid ounce tube (379688), which is included with every applicable P.T.O., and the second is a 14-ounce grease cartridge (379831). Chelsea also offers greaseable shafts for most all output designators.

Warranty: Failure to comply entirely with the provisions set forth in the appropriate Owner's Manual will result in voiding of ALL Warranty consideration.

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Chelsea Products Division
Olive Branch, MS 38654 USA

Offer of Sale

The items described in this document and other documents or descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors are hereby offered for sale at prices to be established by Parker Hannifin Corporation, its subsidiaries and its authorized distributors. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any such items, when communicated to Parker Hannifin Corporation, its subsidiary or an authorized distributor ("Seller") verbally or in writing, shall constitute acceptance of this offer.

1. Terms and Conditions of Sale: All descriptions, quotations, proposals, offers, acknowledgments, acceptances and sales of Seller's products are subject to and shall be governed exclusively by the terms and conditions stated herein. Buyer's acceptance of any offer to sell is limited to these terms and conditions. Any terms or conditions in addition to, or inconsistent with those stated herein, proposed by Buyer in any acceptance of an offer by Seller, are hereby objected to. No such additional, different or inconsistent terms and conditions shall become part of the contract between Buyer and Seller unless expressly accepted in writing by Seller. Seller's acceptance of any offer to purchase by Buyer is expressly conditional upon Buyer's assent to all the terms and conditions stated herein, including any terms in addition to, or inconsistent with those contained in Buyer's offer, Acceptance of Seller's products shall in all events constitute such assent.

2. Payment: Payment shall be made by Buyer net 30 days from the date of delivery of the items purchased hereunder. Amounts not timely paid shall bear interest at the maximum rate permitted by law for each month or portion thereof that the Buyer is late in making payment. Any claims by Buyer for omissions or shortages in a shipment shall be waived unless Seller receives notice thereof within 30 days after Buyer's receipt of the shipment.

3. Delivery: Unless otherwise provided on the face hereof, delivery shall be made F.O.B. Seller's plant. Regardless of the method of delivery, however, risk of loss shall pass to Buyer upon Seller's delivery to a carrier. Any delivery dates shown are approximate only and Seller shall have no liability for any delays in delivery.

4. Warranty: Seller warrants that the items sold hereunder shall be free from defects in material or workmanship for a period of:

(A) All Power Take-Off units one (1) year from date of installation.

(B) Except 267, 277, 278, 242, 244, 246, 250, 251 and 859 series two (2) years from date of installation. **THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO ITEMS PROVIDED HEREUNDER. SELLER MAKES NO OTHER WARRANTY, GUARANTEE, OR REPRESENTATION OF ANY KIND WHATSOEVER. ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO, MERCHANTABILITY AND FITNESS FOR PURPOSE, WHETHER EXPRESS, IMPLIED, OR ARISING BY OPERATION OF LAW, TRADE USAGE, OR COURSE OF DEALING ARE HEREBY DISCLAIMED. NOTWITHSTANDING THE FOREGOING, THERE ARE NO WARRANTIES WHATSOEVER ON ITEMS BUILT OR ACQUIRED WHOLLY OR PARTIALLY, TO BUYER'S DESIGNS OR SPECIFICATIONS.**

5. Limitation Of Remedy: SELLER'S LIABILITY ARISING FROM OR IN ANY WAY CONNECTED WITH THE ITEMS SOLD OR THIS CONTRACT SHALL BE LIMITED EXCLUSIVELY TO REPAIR OR REPLACEMENT OF THE ITEMS SOLD OR REFUND OF THE PURCHASE PRICE PAID BY BUYER, AT SELLER'S SOLE OPTION. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES OF ANY KIND OR NATURE WHATSOEVER, INCLUDING BUT NOT LIMITED TO LOST PROFITS ARISING FROM OR IN ANY WAY CONNECTED WITH THIS AGREEMENT OR ITEMS SOLD HEREUNDER, WHETHER ALLEGED TO ARISE FROM BREACH OF CONTRACT, EXPRESS OR IMPLIED WARRANTY, OR IN TORT, INCLUDING WITHOUT LIMITATION, NEGLIGENCE, FAILURE TO WARN OR STRICT LIABILITY.

6. Changes, Reschedules and Cancellations: Buyer may request to modify the designs or specifications for the items sold hereunder as well as the quantities and delivery dates thereof, or may request to cancel all or part of this order, however, no such requested modification or cancellation shall become part of the contract between Buyer and Seller unless accepted by Seller in a written amendment to this Agreement. Acceptance of any such requested modification or cancellation shall be at Seller's discretion, and shall be upon such terms and conditions as Seller may require.

7. Special Tooling: A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the items sold hereunder, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

8. Buyer's Property: Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property, Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Taxes: Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

10. Indemnity For Infringement of Intellectual Property Rights: Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. Patents, U.S. Trademarks, copyrights, trade dress and trade secrets (hereinafter 'Intellectual Property Rights'). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If an item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it noninfringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgments resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right.

11. Force Majeure: Seller does not assume the risk of and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter 'Events of Force Majeure'). Events of Force Majeure shall include without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials and any other cause beyond Seller's control.

12. Entire Agreement/Governing Law: The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain there/to. This Agreement shall be governed in all respects by the law of the State of Ohio. No actions arising out of the sale of the items sold hereunder or this Agreement may be brought by either party more than two (2) years after the cause of action accrues.

1/06-P

Parker Chelsea

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FP 06/08 12M

Bulletin HY14-2705-M3/US
Service and Parts Bulletin

Model V20

Effective: August 1, 2002
Supersedes: Cat. No. GSD-1102 dated 2/92

Sectional Body Directional Control Valve

⚠ WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

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bul2705-m3.p65, bl

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Contents

List of Illustrations

SECTION I
INTRODUCTION

This manual contains pertinent step-by-step maintenance instructions plus parts ordering information and a complete part and service kit listing for the Model V20 Directional Control Valve.

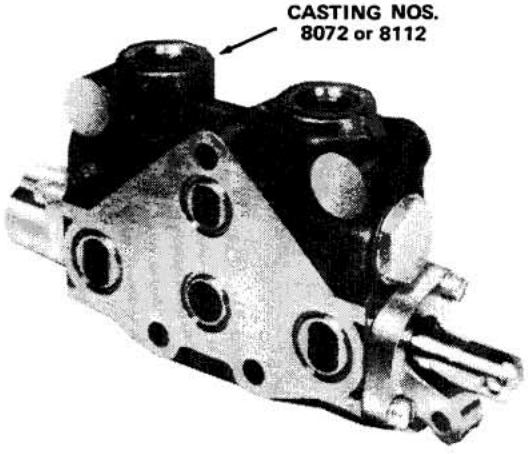
If further assistance is required, contact:

Your Gresen Distributor or Representative.

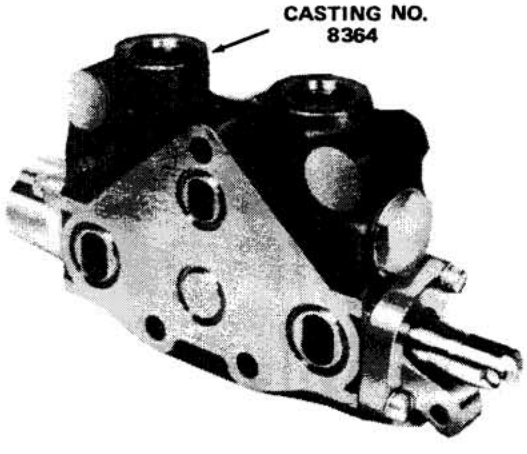
WARNING

There is a visual similarity between Gresen's Model V20 Directional Control Valve covered in this manual and Gresen's V20C Closed Center Directional Control Valve.

Work sections for these two valve assemblies should *NEVER* be *intermixed* or *interchanged* without prior consultation with the factory. Intermixing a V20C closed center work section with a V20P or V20T work section will convert the complete valve bank to closed center operation and in some cases, could render the valve assembly inoperable and cause damage to components in the hydraulic circuit.



Model V20P or V20T
Work Section.



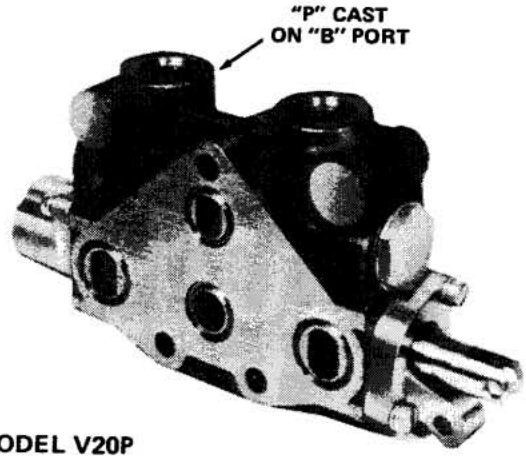
Model V20C
Work Section.

SECTION II
DESCRIPTION

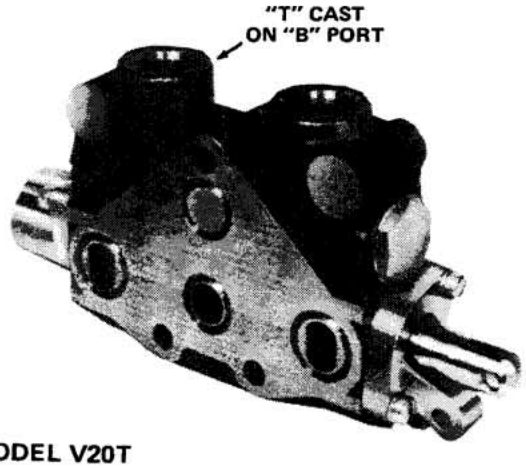
Gresen Model V20 Directional Control Valves may be purchased with five different valve sections, plus various options, to meet the desired job specification.

The following paragraphs describe the five sections and any options with reference to the parts illustrations in Section IV in this manual.

Gresen's Models CP, CT, V20P and V20T work sections are interchangeable and may be intermixed within a complete directional control valve assembly. When Models CP or CT work sections are used, maximum pressure is limited to 2500 PSI.



MODEL V20P



MODEL V20T

Figure 2-1. Model V20P (Parallel Circuit) and Model V20T (Tandem Circuit) Work Sections.

Table 2-1. Casting Part Numbers

Description	Model CP/CT	Model V20
Parallel Center Section	7697-	8072-
Tandem Center Section	7698-	8112-
Series Center Section	—	11483-
V20R Center Section	—	10954-
V20R Tandem Center Section	—	10762-
LO Center Section	6732-	11571-
Mid-Inlet Section	6825-	6825-
Inlet Cover (Standard)	1815-	8398-
Inlet Cover (Top Ports)	1862-	8398-
Inlet Cover w/Flow Control	7736-	7736-
Outlet Cover (End Outlet)	6770-	6770-
Outlet Cover (Top Outlet)	8644-	8644-

Numbers shown for sections and covers are base casting numbers, not ordering numbers. Refer to Parts Ordering Information, Section III, for ordering information.

MODEL V20P

4-WAY, 3-POSITION VALVE SECTION

This section provides control of double-acting cylinders without the floating action plus hydraulic motor start, stop and reverse control where free-wheeling is NOT required. Cylinder ports are blocked in neutral position.

MODEL V20P

3-WAY, 3-POSITION VALVE SECTION

This section provides control of single acting cylinders or start and stop of non-reversable hydraulic motors where free-wheeling of motor is not required. The cylinder port is blocked in neutral position.

MODEL V20P

4-WAY, 3-POSITION VALVE SECTION WITH PRESSURE DETENT RELEASE

This section provides automatic return to neutral position as soon as work cycle is completed.

The spool is held in either power position by a detent assembly until released. When pressure in the power circuit reaches a predetermined setting, the detent assembly releases and the centering spring returns the spool to neutral.

MODEL V20P

4-WAY, 4-POSITION, FLOAT VALVE SECTION

This section provides control of double-acting cylinders requiring a floating action such as: loaders, dozers, snow plows, etc.

Incorporated into the valve section is a 4-position float positioner. Three positions are standard double-acting with spring return to neutral. The fourth position is detented to hold control in float (both cylinder ports open to tank).

MODEL V20-T

TANDEM (PRIORITY) SECTION, 3-WAY, 4-WAY, OR 4-WAY FLOAT

This section allows any upstream valve sections to have priority. Only when the upstream sections are in neutral or metering position will oil be available to this section.

SPOOL ACTION OPTIONS:

A. SPRING RETURN TO NEUTRAL, (Standard).

Spool will return to neutral position from A or B power position when handle is released.

B. "R" OPTION, Detent with Spring Return to Neutral

Can be used on either 3-way, 4-way or free flow spool. Has detent position for either spool "in", spool "out" or 2-position detent for both spool "in" and spool "out" positions, with spring return to neutral position.

Recommended for hydraulic motors where the motor operates continuously in one direction (detent position) with only intermittent operation in the opposite direction.

C. "D" Option, 3-Position Detent

Used when manual placement (NO spring return to neutral) is desired in any of three positions—spool in, spool out, and neutral. An optional detent stop (part no. 1889-001) may be used to convert spool action to "neutral" and "spool out" positions only or for "neutral" and "spool in" position only, thus giving a two-position spool action.

D. "A" OPTION, Spring Extended Spool

This feature eliminates spring return to neutral. The spring returns to the spool "out" position only, usually used for cam operation of spool.

Customer must supply cam follower mechanism.

HANDLE ASSEMBLIES

Provides choice of either horizontal or vertical handle assemblies.

INLET and OUTLET COVERS (Refer to Section III, Parts Ordering Information

CYLINDER PORT CHECK and RELIEF VALVE OPTION (Refer to Figures 4-30 through 4-42)

SECTION III
MAINTENANCE

REPLACING, ADDING OR REMOVING SECTION ASSEMBLIES

NOTE

For clarification, we shall call the inlet cover containing the main relief the left side of the valve assembly. Refer to Figure 3-1.

1. Before disassembly, it is suggested that each valve section be marked numerically to avoid incorrect reassembly.
2. Remove three assembly stud nuts (Item 32, Figure 4-1) from the left end section using a 9/16" thin wall socket.
3. Remove valve sections by sliding from assembly studs (Item 1, Figure 4-1).
4. If valve sections are to be added or removed, use the proper length assembly studs from the chart below.

No. of Sections	Assembly Stud Kit No.*
1	K-6104-D
2	K-6105-D
3	K-6106-D
4	K-6107-D
5	K-6108-C
6	K-6109-C
7	K-6110-C
8	K-6111-C
9	K-6112-C

*Each Kit contains 3 assembly studs and 3 9310-006 hex nuts.

NOTE: When using 8644 Right End Cover, add one section to assure proper stud length.

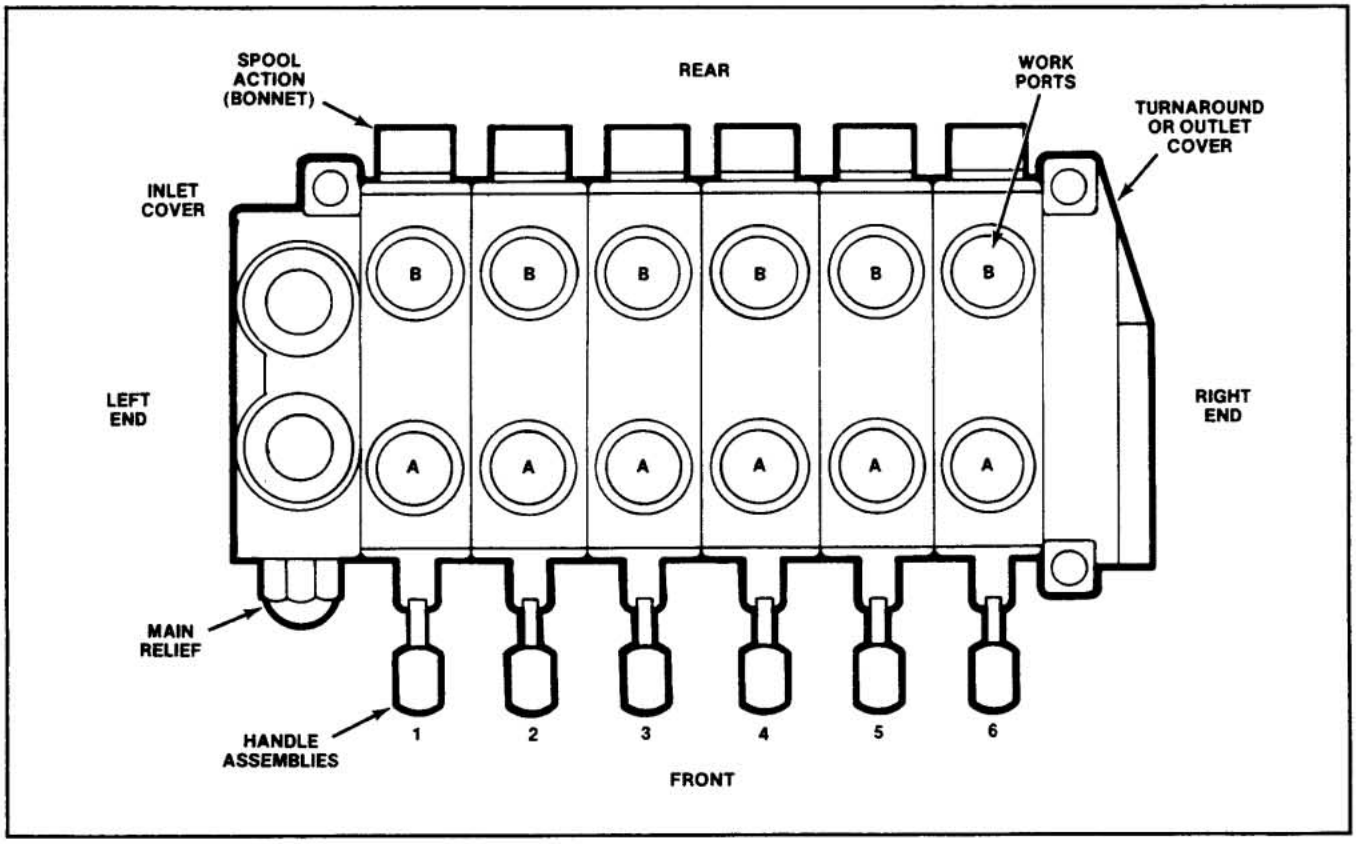


Figure 3-1. Schematic-View of Typical Control Valve Assembly.

NOTE

Use assembly nuts (part no.9310-006), 3 required, with all assembly studs. NO LOCK WASHERS! All studs are stress-proof material and should be replaced only with original equipment replacement parts.

5. Thoroughly clean O-ring counterbores and ground surfaces of each section.

6. Replace the four O-rings. For closed center sections use two 21733-001 (new) and two 21857-001 seals per section. For open center, use three 21733-001 and one 21857-001. For closed center, load sensing, sections use two 21857-001, two 21733-001 and one 21866-001. Buna-N seals are standard. For optional viton seals, see cross-reference chart on pg. 4-37. See chart on pg. 3-2 for old seal numbers.

7. Replace valve sections on assembly studs in the same order in which they were removed. O-ring counterbores should be to the left when facing "A" port-end of valve.

NOTE

Use care in replacing valve sections to avoid dislodging O-rings from counterbores.

8. When all valve sections are positioned on assembly studs, replace stud nuts and tighten evenly to 32 ft. lbs. [43 Nm] torque.

CAUTION

If stud nuts are not tightened to the proper torque, valve spools may bind or stick, or cause section seals to extrude.

REPLACING SPOOL SEALS

Valve sections and covers are identified by numbers cast into the body. Refer to Table 2-1, page 2-0.

Figure 3-2 shows spool assembly—less the complete handle assembly. When handle bracket is furnished, retainer plates and screws (items 1 and 4, Figure 3-2) are omitted. Seal assembly is retained by the handle bracket which will also retain the optional wiper seal.

1. Remove bonnet assembly parts from back of valves and keep in order of disassembly.

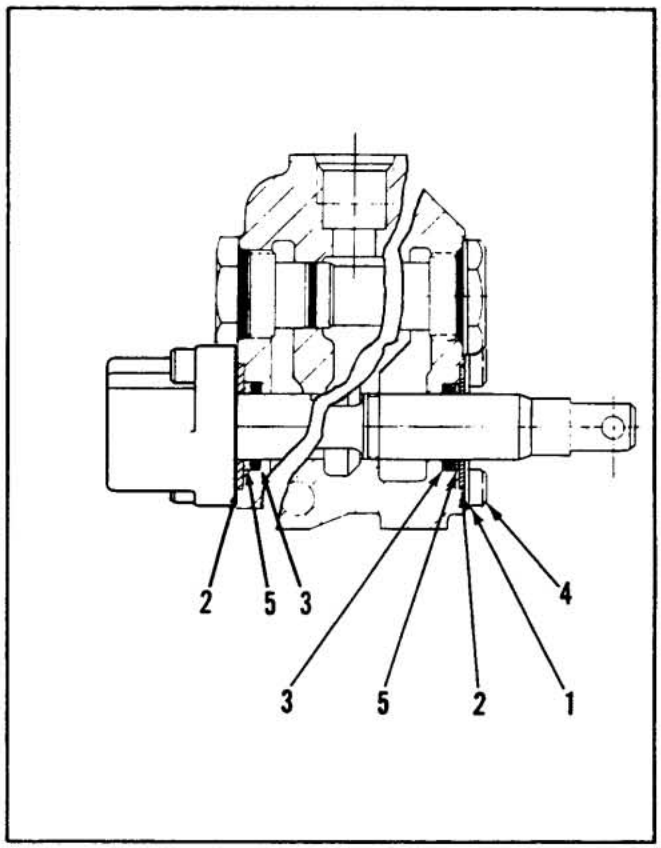


Figure 3-2. Spool Seal Assembly

2. Remove all parts connected to the spool on the front of the valve, either the complete handle bracket assembly, or the seal retainer assembly if a handle bracket is not furnished.

NOTE

DO NOT REMOVE the spool as the seals can be replaced externally. Prevent spool from turning or moving by inserting a screw driver through clevis slot, or running a rod through the pin hole and using as a handle. DO NOT hold the spool with a wrench. This will destroy the finish.

3. Remove retainer plate (Item 1, Figure 3-2), retainer plate washers (Item 2), back-up washers (Item 5), and spool seals (Item 3).

4. Thoroughly clean counterbore.

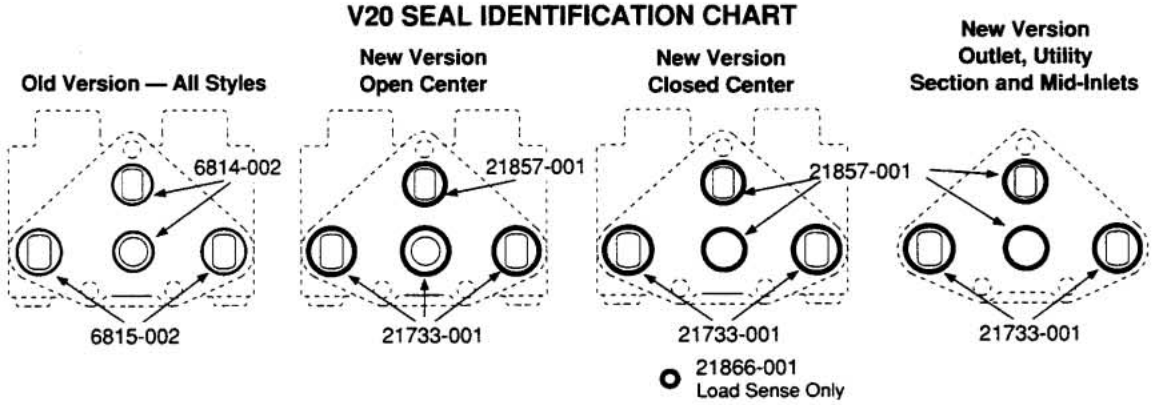
5. Lightly oil new seals. Slide over valve spool and insert in seal counterbore.

PARTS ORDERING INFORMATION

As of April 1, 1991, the section seals for the V20 changed. The new versions have larger cross section (old was .070, new is .103) and different configurations for open center and closed center sections. The old design utilized the same seals for all versions (two .801 I.D. and two .926 I.D.). The new design uses one configuration for open center (three .924 I.D. and one .799I.D.) and another configuration for closed center, load sensing and all outlet covers (two .924 I.D. and two .799 I.D., with one .237 I.D. for load sensing).

The following chart is provided to aid in selection of the proper seals. It is important to note that the seal kits include all O-rings (new and old), therefore there will be some left unused.

V20 SEAL IDENTIFICATION CHART



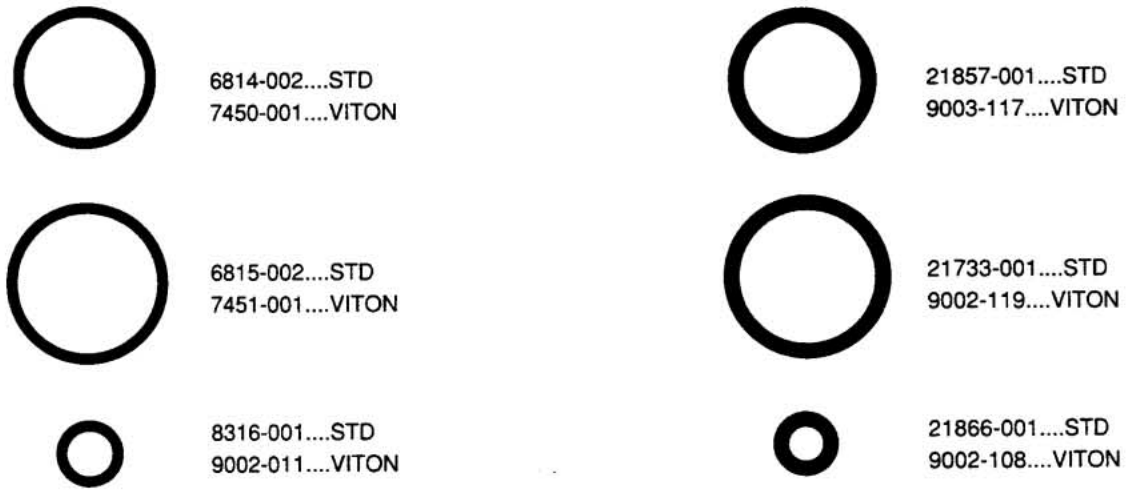
The following section seals are included in the Kits:

Standard Kits		Viton Kits	
Old	New	Old	New
(2)6814-002	(2)21857-001	(2)7450-001	(2)9003-117
(2)6815-002	(3)21733-001	(2)7451-001	(3)9002-119
Load sensing kits (additional seals)			
(1)8316-001	(1)21866-001	(1)9002-011	(1)9002-108

Seal kit changes.

K-6121 Section Seal Kit, One Section
K-6027 Complete Seal Kit, 3 or 4 Way Section
K-6028 Complete Seal Kit, 4 Way Float Section
K-6209 Complete Seal Kit, Series 3 or 4 Way Section
K-6210 Complete Seal Kit, Series 4 Way Float Section
K-6154 Complete Seal Kit, Load Sensing 4 Way Float
K-6155 Complete Seal Kit, Load Sensing 3 or 4 Way Section
K-6156 Section Seal Kit, Load Sensing-One Section
K-6160 Viton Section Seal Kit, One Section

* Complete Seal Kits include spool seals and O-rings for check plugs.



THESE SEALS ARE NOT INTERCHANGEABLE. OLD AND NEW STYLE SECTIONS MAY BE USED IN THE SAME ASSEMBLY PROVIDED THE CORRECT SEALS ARE USED FOR EACH SECTION.

INLET COVERS — Two Inlet Covers are available. All inlet covers are machined to accept the Model WH differential poppet relief cartridge or Model RP51 pilot-operated relief cartridge. If an outlet port is not used in the inlet cover, the outlet port in the right end cover of the valve must be used for tank return line. The inlet cover may be machined with several different combinations of port sizes and locations. NPT and SAE threads cannot be intermixed in the same casting.

Use the following porting charts to arrive at the desired machining modification number.

Inlet Cover, Part No. 8398

Port Location	NPT*						SAE					
End Inlet	1/2	3/4	1/2	—	3/4	—	12	12	—	10	10	—
Top Inlet**	1/2	3/4	1/2	1/2	3/4	3/4	12	12	12	10	10	10
Top Outlet**	1/2	3/4	1/2	1/2	3/4	3/4	12	12	12	10	10	10
End Outlet	1/2	3/4	—	—	—	—	12	—	—	10	—	—
SAE 4 Gage Port	—	—	—	—	—	—	No	Yes	Yes	No	Yes	No
1/4" Gage Port	No	No	No	Yes	Yes	No	—	—	—	—	—	—
Machining Modification Number	018	014	019	012	023	016	008	025	013	024	021	002

* Pipe ports not recommended for pressures over 2000 PSI [138 bar].

** Top ports are cored and will be plugged if end inlet and outlet are specified.

Inlet Cover, Part No. 7736 With Flow Control

Inlet cover, part number 7736, is equipped with an adjustable flow control assembly. Refer to Figure 4-42 for complete parts breakdown.

A Power Beyond option in this cover will allow excess flow to be used downstream only when upstream valve is activated and controlled flow is being used. When upstream valve is in neutral position, all flow is directed through the open center.

Port Location		NPT*	SAE		
End In		3/4	10	12	10
Top In		3/4	10	12	10
End Out		3/4	10	12	12
Machining Modification Number	Without Power Beyond	011	016	009	—
	With Power Beyond	013	—	012	017

* Pipe ports not recommended for pressures over 2000 PSI [138 bar].

ORDERING EXAMPLE FOR INLET COVERS WITH FLOW CONTROL

7736 **003** **RP51 2000PSI CRACK** **13 to 21 GPM**

BASIC CASTING PART NO.

COVER MACHINING MODIFICATION NO.

RELIEF VALVE DETAILS*

FLOW CONTROL RANGE (Flow control only)

Flow Control Ranges

(For inlet cover with flow control only)

3 to 16 GPM [11 to 60 litres/min]
8 to 25 GPM [30 to 95 litres/min]
13 to 21 GPM [49 to 79 litres/min]

*Specify model number of relief valve to be installed; either WH or RP51.

Specify relief setting required **OR**
Specify "NR" (no relief) plug installed **OR**
Specify plastic shipping plug, installed in relief cavity.

Example: If a left inlet cover with a SAE 10 inlet, a SAE 12 outlet, with RP51 relief set at 2000 PSI [138 bar] crack and flow control range of 13-21 GPM [49-79 litres/min] is required, order 7736-003-RP51 2000 PSI [138 bar] crack — 13-21 GPM [49-79 litres/min].

OUTLET COVERS — Two Outlet Covers are available. Outlet covers may be machined with several different combinations of port sizes and locations. NPT and SAE threads cannot be intermixed in the same casting. If an outlet port is not used in the outlet cover, the outlet port in the left end cover must be used for tank return line.

Use the following porting charts to arrive at the desired machining modification number.

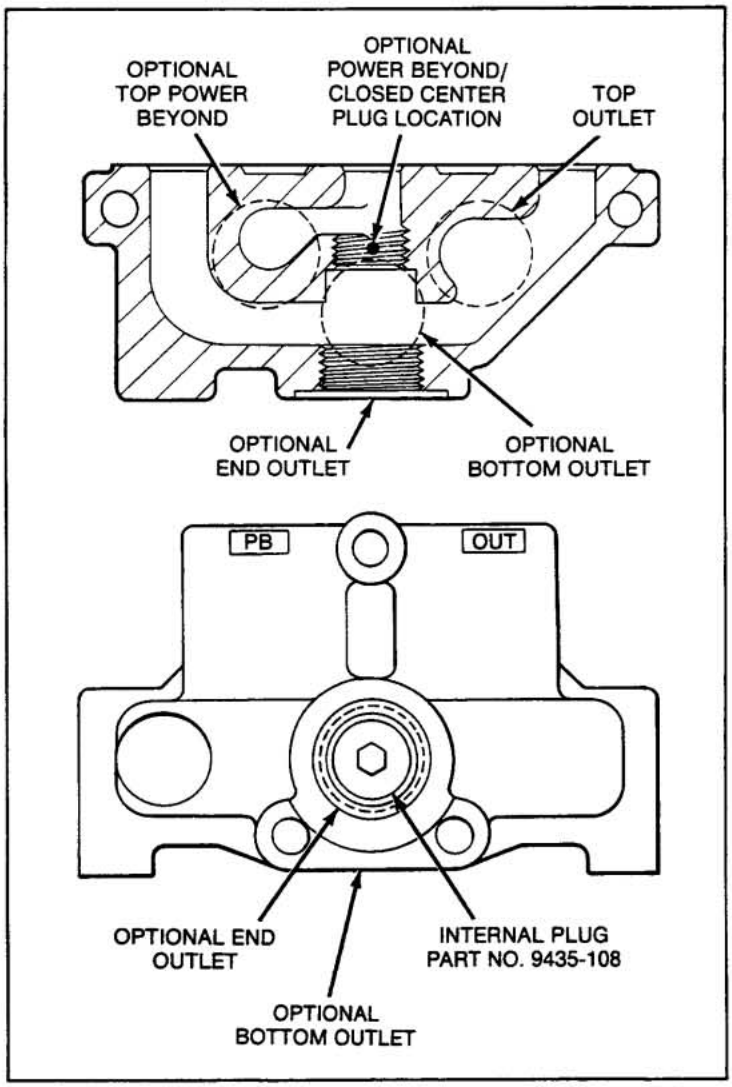


Figure 3-3. Outlet Cover Part No. 8644

Outlet Cover, Part No. 8644

Standard machining provides an outlet port (top, end or bottom) for open center applications. Closed center or top power beyond options are available. For power beyond, the top power beyond port is machined, and the core between the open center and exhaust passages is tapped and plugged. Plugging the power beyond port (and the internal core) converts the cover to closed center.

Port Location	NPT			SAE				
Top Outlet*	3/4	3/4	3/4	12	12	12	12	12
End Outlet	—	—	3/4	—	—	12	12	12
Bottom Outlet	—	3/4	—	—	12	—	—	12
Top Power Beyond	—	—	3/4	—	—	10	12	12
Machining Modification Number	008	005	006	007	010	012	004	013

*Top outlet is cored and will be plugged if end or bottom outlet is specified.

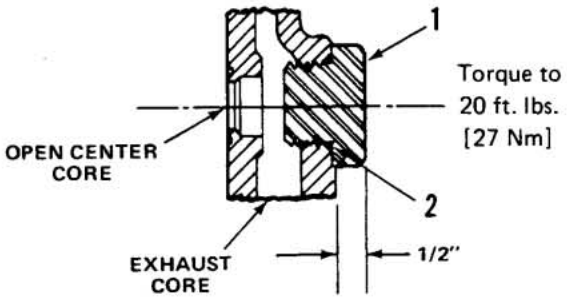
Outlet Cover, Part No. 6770.

Port Size Available	End Outlet Port Only	Machined for Power Beyond Sleeve, Closed Center Plug or Conversion Plug.	
		With End Outlet	No End Outlet
1/2-14 NPT	6770-004	6770-009	6770-007
3/4-14 NPT	6770-001	6770-005	
SAE 10 (7/8-14 UNF)	6770-002	6770-006	
SAE 12 (1-1/16 12 UNF)	6770-003	6770-013	

6770 OUTLET COVER OPTIONS

No. 1727 Conversion Plug

Provides for conversion from "Power Beyond" or "Closed-Center" usage to "Open-Center" or vice-versa.



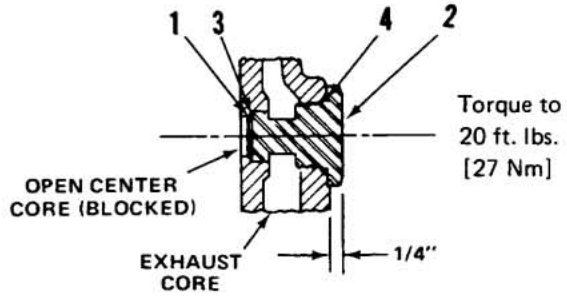
SERVICE KIT K-6016

(Contains 1 Each of Items 1 and 2)

Item No.	Part No.	Description	No. Required
1	1727-001	Conversion Plug	1
2	2709-001*	O-Ring Seal	1

No. 1830 Closed-Center Plug Option.

Provides a "Closed-Center" System by plugging the open-center flow passage. It is normally used with a variable displacement pump.



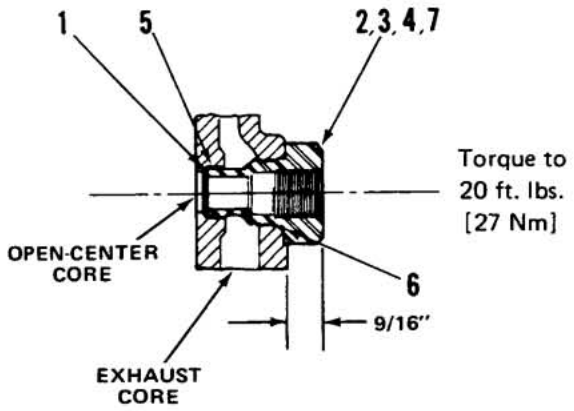
SERVICE KIT K-6015

(Contains 1 Each of Items 1, 2, 3 and 4)

Item No.	Part No.	Description	No. Required
1	1721-001*	Seal	1
2	1830-001	Closed-Center Plug	1
3	9020-017	Back-Up Washer	1
4	2709-001*	O-Ring Seal	1

No. 1833, 1835 or 1836 Power Beyond Sleeve Options.

Provides for proper hook-up of an additional valve "down-stream". The Power Beyond Sleeve prevents subjecting the exhaust core of the valve to back pressure.



SERVICE KITS

K-6017-B* (1/2 NPT – Contains 1 Each of Items 1, 2, 5, 6)
K-6018-B* (SAE 8 – Contans 1 Each of Items 1, 3, 5, 6)
K-6019-B* (SAE 10 – Contans 1 Each of Items 1, 4, 5, 6)
K-6060-B(SAE 16 – Contains 1 Each of Items 1, 5, 6, 7)

Item No.	Part No.	Description	No. Required
1	1721-001*	Seal	1
2	1833-001	P.B. Sleeve (1/2-14 NPT)	1
3	1835-001	P.B. Sleeve SAE 8 (3/4-16 UNF)	1
4	1836-001	P.B. Sleeve SAE 10 (7/8-14 UNF)	1
5	9020-017	Back-Up Washer	1
6	2709-001*	O-Ring Seal	1
7	7706-001	P.B. Sleeve SAE 16 (1" Tube) Male Fitting	1

NOTE

To convert from Power Beyond usage to "Open-Center" usage, NEVER ATTEMPT TO PLUG THE POWER BEYOND SLEEVE, as this would convert to "Closed-Center" Valve.

ORDERING EXAMPLE FOR RIGHT COVER PLATE: **6770** **006** **Cover with SAE 8 Power Beyond Sleeve Installed**

BASIC CASTING

COVER MACHINING MODIFICATION

OPTION DETAILS

Example: If a right cover with a SAE 10 outlet and a SAE 8 power beyond sleeve was required, then order: per the above description.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on Page 4-37.

V20P, V20T and V20S VALVE CENTER SECTIONS

The following information is necessary for proper specification for each V20P, V20T or V20S Valve Center Section:

1. Function of Section
2. Options
3. Work port sizes
4. Work port "A" Options
5. Work port "B" Options
6. Handle end Options

The chart shown below will help in identifying the Options available and the information needed for proper ordering. Refer to product catalog No. PC-1106 for complete information on options available.

CIRCUIT	PARALLEL – V20P ☐ Casting No. 8072 (See Page 2-0) TANDEM – V20T ☐ Casting No. 8112 (See Page 2-0) SERIES – V20S ☐ Casting No. 11483 (See Page 2-0)
FUNCTION OF SECTION	FUNCTION OF SECTION (Check one for each section) • 3-Way (Work port on handle end will be plugged) ☐ • 4-Way ☐ • 4-Way Float (K) ☐ • _____ ☐
OPTIONAL FEATURES	ADDITIONAL OPTIONS • Free Flow (F) ☐ • 3-Position Detent (D) ☐ • _____ ☐ • _____ _____
WORK PORT SIZES	"A" and "B" WORK PORT SIZES 3/8, 1/2 NPT; SAE 8, 10
WORK PORT "A" OPTIONS	OPTIONS AVAILABLE (Specify) • Relief (RC or RCA*) _____ • Anti-Cavitation (A-C) _____ • Combination Relief and Anti-Cavitation (CRA) _____ Specify Relief Setting, Crack or Full Flow *RCA cannot be used with valve handle or bracket.
WORK PORT "B" OPTIONS	OPTIONS AVAILABLE (Specify) • Relief (RC or RCA*) _____ • Anti-Cavitation (A-C) _____ • Combination Relief and Anti-Cavitation (CRA) _____ Specify Relief Setting, Crack or Full Flow *RCA cannot be used with valve handle or bracket.
HANDLE-END OPTIONS	Location: "A" Work Port End ☐ "B" Work Port End ☐ Handle Type: No. 1802, Vert. ☐ No. 3249, Horiz. ☐ Less Complete Handle Assy (LCHA) ☐ Less Handle Only (LHO) ☐ Handle Bracket Only (HBO) ☐ Bracket: No. 1801 ☐ No. 7355 ☐ Rotate 180° From Standard ☐ Float Section: Pull Handle to Float ☐ Push Handle to Float ☐ Heavy Duty Retainer ☐ Spool Protector Boot ☐ Spool Wiper ☐

SECTION IV
PARTS LISTING

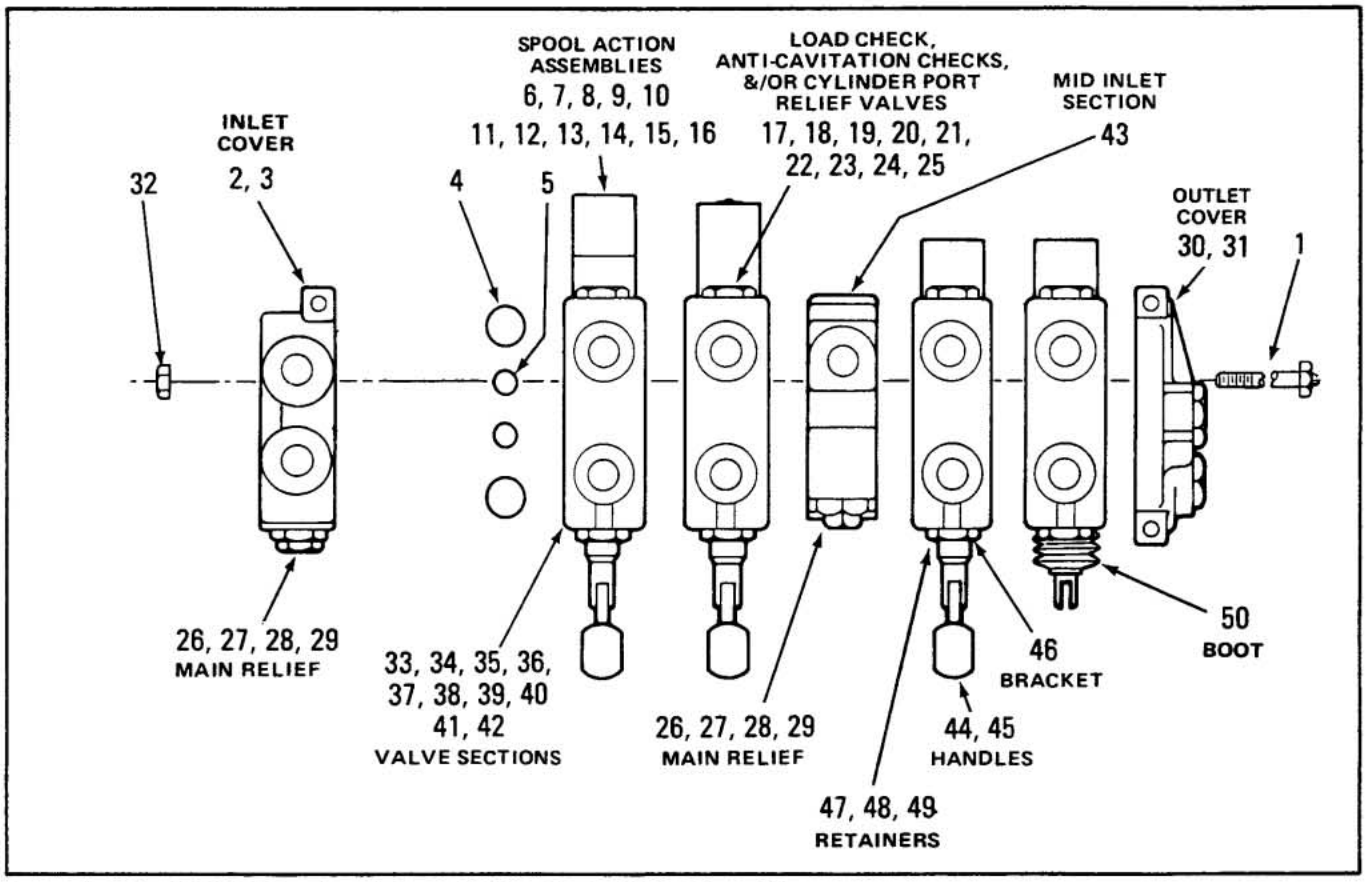


Figure 4-1. Model V20 Directional Control Valve, Typical Main Assembly.

MODEL V20 DIRECTIONAL CONTROL VALVE, TYPICAL MAIN ASSEMBLY

Item No.	Part No.	Description			Quantity Per Assembly
1	K-6104-D	STUD KIT, 1-Section	Each Stud Kit Contains 3 Assembly Studs and 3 Stud Nuts	Note: Torque Stud Nuts to 32 ft. lbs. [43.5 Nm]	1
	K-6105-D	STUD KIT, 2-Section			1
	K-6106-D	STUD KIT, 3-Section			1
	K-6107-D	STUD KIT, 4-Section			1
	K-6108-C	STUD KIT, 5-Section			1
	K-6109-C	STUD KIT, 6-Section			1
	K-6110-C	STUD KIT, 7-Section			1
	K-6111-C	STUD KIT, 8-Section			1
	K-6112-C	STUD KIT, 9-Section			1
2	8398-	COVER, Left (Refer to Page 3-3)			1
3	7736-	COVER, Left, with flow control (Refer to Page 3-3 and Figure 4-43)			1
4	21733-001*	O-RING, Exhaust, Large (new)			**
	6815-002*	O-RING, Exhaust, Large (old)			**

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

**All old versions include two exhaust and two small O-rings. All new open center versions include three large and one small O-ring. Other new versions including outlet, utility section and mid-inlets contain two of each.

MODEL V20 DIRECTIONAL CONTROL VALVE, TYPICAL MAIN ASSEMBLY (Continued)

Item No.	Part No.	Description	Quantity Per Assembly
5	21857-001*	O-RING, Pressure, Small (new)	**
	6814-002*	O-RING, Pressure, Small (old)	**
	21866-001*	O-RING, Load Sensing (new)	**
	8316-001*	O-RING, Load Sensing (old)	**
6		POSITIONER, Standard Spool (See Figure 4-12)	A/R
7		POSITIONER, Manual Spool (See Figure 4-13)	A/R
8		POSITIONER, Float Detent, 4-Way, 4-Position (See Figure 4-14)	A/R
9		DETENT, Option "R", With Spring Return To Neutral (See Figure 4-15)	A/R
10		DETENT, Option "D", 3-Position (See Figure 4-16)	A/R
11		SPRING EXTENDED SPOOL, Option "A" (See Figure 4-17)	A/R
12		ELECTRO-MAGNETIC SPOOL RELEASE (See Figure 4-18)	A/R
13		POSITIONER, Pressure Detent Release (See Figure 4-19)	A/R
14		POSITIONER, Rotary, Option "W" (See Figure 4-20).	A/R
15		POSITIONER, Standard Spool, V20S or V20R (See Figure 4-21)	A/R
16		POSITIONER, Float Detent, 4-Way, 4-Position, V20S (See Figure 4-22)	A/R
17		CHECK, Lockout (See Figure 4-29)	A/R
18		CHECK, Anti-Cavitation (See Figure 4-30)	A/R
19		CHECK, Anti-Cavitation, V20S (See Figure 4-31)	A/R
20		PLUG, Load Check, (See Figure 4-32)	A/R
21		PLUG, Load Check, V20S (See Figure 4-33)	A/R
22		RELIEF, Work Port, Model RC (See Figure 4-34)	A/R
23		RELIEF, Work Port, Model RCA (See Figure 4-35)	A/R
24		RELIEF/ANTI-CAVITATION CHECK, Work Port, Model CRA (See Figure 4-37)	A/R
25		RELIEF, Work Port, Model RCS (See Figure 4-38)	A/R
26		RELIEF, Main, Model WH (See Figure 4-39)	A/R
27		RELIEF, Main, Model WHA (See Figure 4-40)	A/R
28		RELIEF, Main, Model RP51 (See Figure 4-41	A/R
29		PLUG, No Main Relief (NR) (See Figure 4-43)	A/R
30	6770-	COVER, Right (See pages 3-3 & 3-4)	1
31	8644-	COVER, Right (See page 3-3)	1
32	9310-006	NUT, Stud (Not sold separately. See Item No. 1)	
33	8072-	VALVE SECTION, 4-Way, 4-Position, Float (See Figure 4-2)	A/R
34	8072-	VALVE SECTION, 4-Way, 3-Position (See Figure 4-3)	A/R
35	8072-	VALVE SECTION, 3-Way, 3-Position (See Figure 4-4)	A/R
36	8072-	VALVE SECTION, 4-Way, 3-Position, With Pressure Detent Release (See Figure 4-5)	A/R
37	11571-	VALVE SECTION, 4-Way, 3-Position, With Pilot Operated Checks (See Figure 4-6)	A/R
38	8112-	VALVE SECTION, Tandem (See Figure 4-7)	A/R
39	10954-	VALVE SECTION, Low Pressure Drop (See Figure 4-8)	A/R
40	10762-	VALVE SECTION, Tandem, Low Pressure Drop (See Figure 4-9)	A/R
41	11483-	VALVE SECTION, Series (See Figure 4-10)	A/R
42	11483-	VALVE SECTION, Series, 4-Way, 4-Position, Float (See Figure 4-11)	A/R
43	6825-001	MID-INLET SECTION, Split Flow, Top Inlet 3/4—14 NPT	A/R
	6825-004	MID-INLET SECTION, Split Flow, Top Inlet 1/2—14 NPT	A/R
	6825-007	MID-INLET SECTION, Split Flow, Top Inlet SAE 12 (1-1/16—12 UNF)	A/R
	6825-011	MID-INLET SECTION, Split Flow, Top Inlet SAE 10 (7/8—14 UNF)	A/R
	6825-005	MID-INLET SECTION, Combined Flow, Top Inlet 3/4—14 NPT	A/R
	6825-008	MID-INLET SECTION, Combined Flow, Top Inlet 1/2—14 NPT	A/R
	6825-013	MID-INLET SECTION, Combined Flow, Top Inlet SAE 10 (7/8—14 UNF)	A/R
	6825-016	MID-INLET SECTION, Combined Flow, Top Inlet SAE 12 (1-1/16—12 UNF)	A/R
	6825-002	MID-INLET SECTION, Top Cored Hole Plugged with 3/8—18 NPT Plug	A/R
44		HANDLE ASSEMBLY, Vertical (See Figure 4-26)	A/R
45		HANDLE ASSEMBLY, Horizontal (See Figure 4-27)	A/R
46		BRACKET, Standard Handle (See Figure 4-25)	A/R
47	K-6033-B	RETAINER, Seal, Standard (See Figure 4-23)	A/R
48	K-6029-B	RETAINER, Seal, Heavy Duty (See Figure 4-24)	A/R
50	K-6056-B	BOOT ASSEMBLY, Spool Protective (See Figure 4-28)	A/R

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

**All old versions include two exhaust and two small O-rings. All new open center versions include three large and one small O-ring. Other new versions including outlet, utility section and mid-inlets contain two of each.

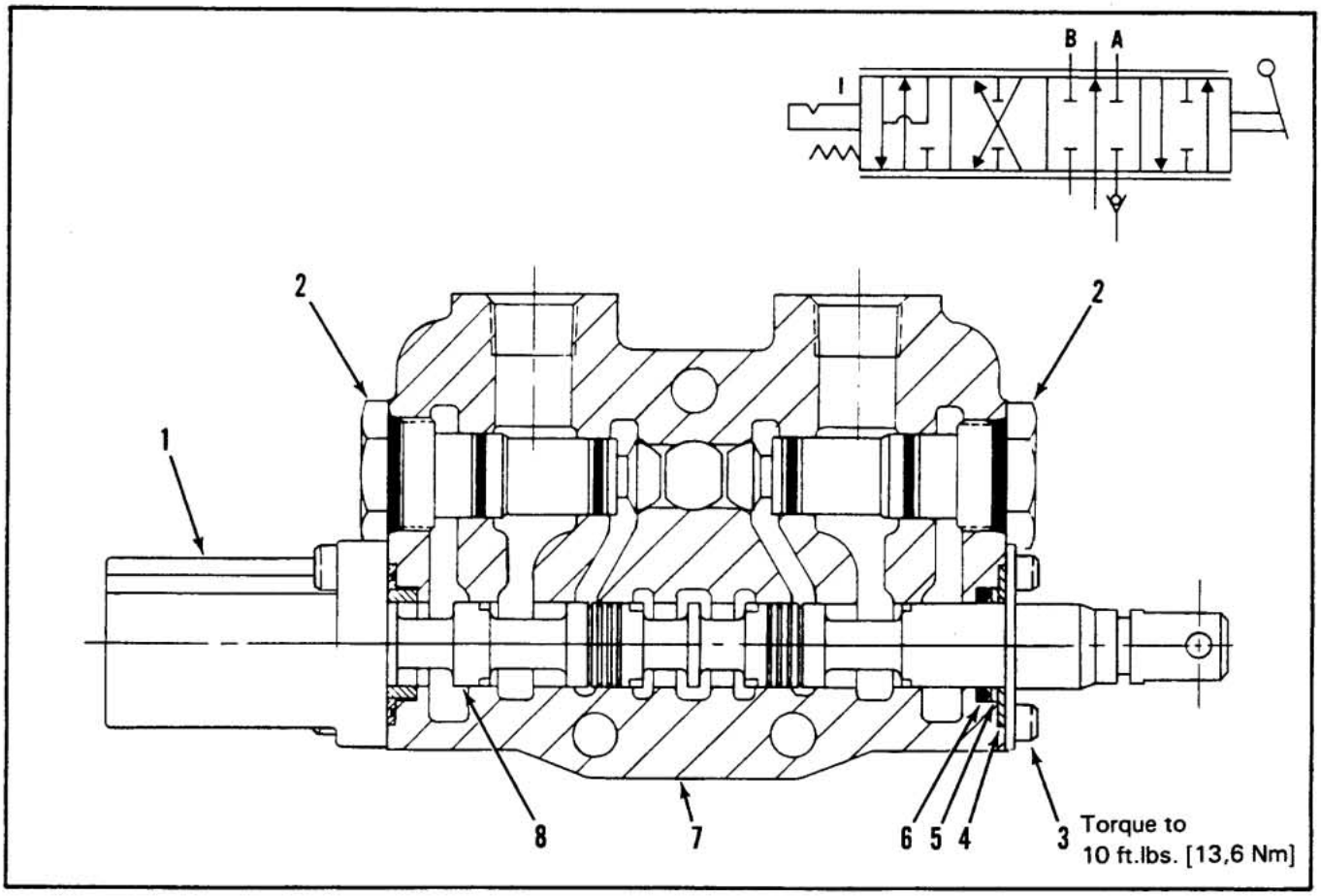


Figure 4-2. 4-Way, 4-Position Float Valve Section.

4-WAY, 4-POSITION FLOAT VALVE SECTION

Item No.	Part No.	Description		Quantity Per Section
1	K-6127-A	POSITIONER, Float (See Figure 4-14)		1
2	K-6030-C	CHECK, Load (See Figure 4-32)		2
3	K-6033-B	RETAINER ASSEMBLY, Standard, Includes Screws (See Figure 4-23. See Figures 4-24 through 4-28 for optional assemblies.)		1
4	6752-001	RETAINER, Plate Washer		1
5	3265-001	WASHER, Back-Up	See Note 1	1
6	7700-001*	SEAL, O-Ring	See Note 1	1
7	8072-	HOUSING, V20 Valve	See Note 2	1
8	8085-001	SPOOL, Float	See Note 2	1

Notes:

1. Seal and washer not sold separately. Order Seal Kit No. K-6035-A.

2. These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-6 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

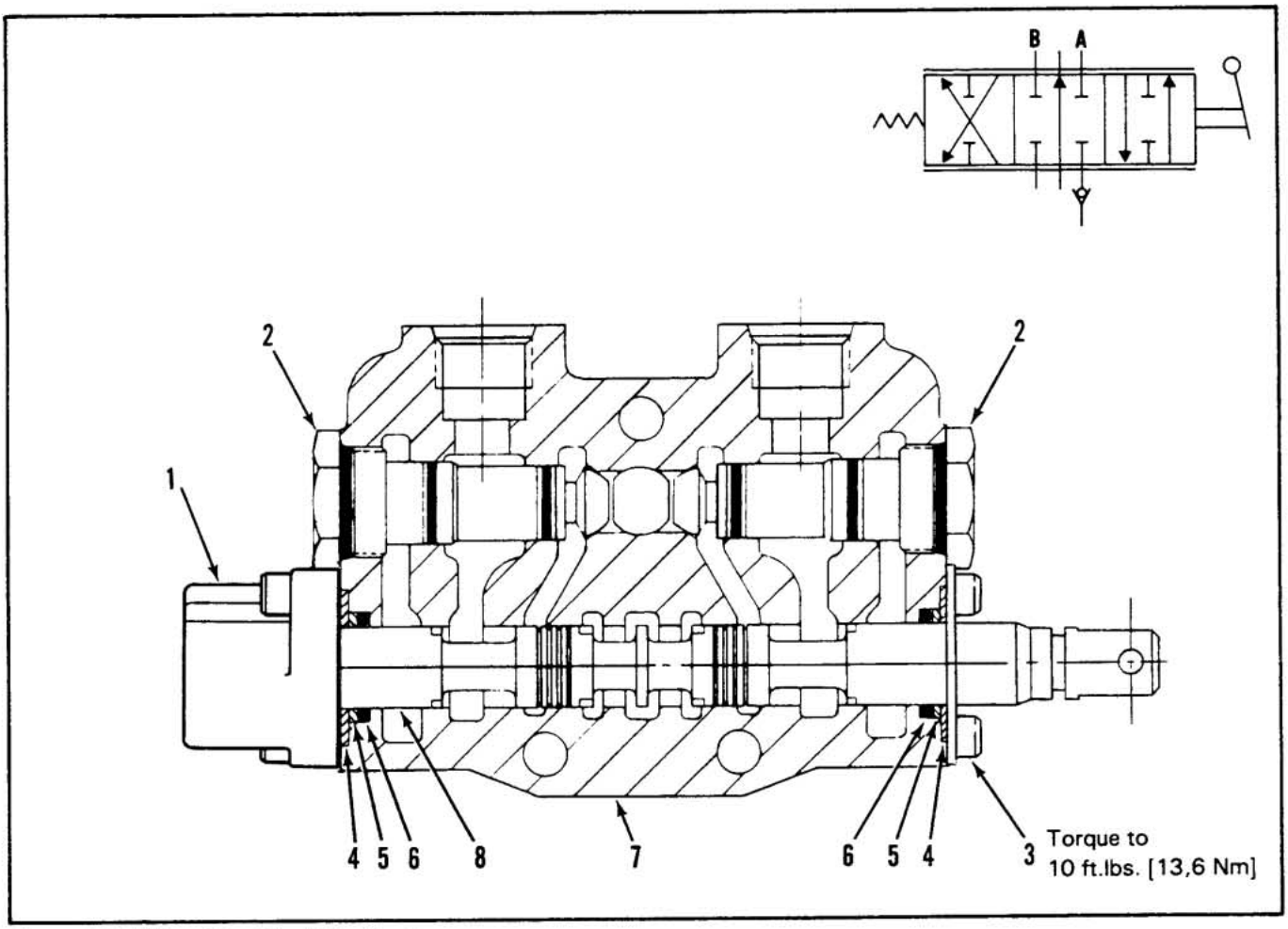


Figure 4-3. 4-Way, 3-Position Valve Section.

4-WAY, 3-POSITION VALVE SECTION

Item No.	Part No.	Description	Quantity Per Section
1	K-6125-B	POSITIONER, Spool, Standard (See Figure 4-12)	1
2	K-6030-C	CHECK, Load (See Figure 4-32)	2
3	K-6033-B	RETAINER ASSEMBLY, Standard, Includes Screws (See Figure 4-23. See Figure 4-24 thru 4-28 for optional assemblies.)	1
4	6752-001	RETAINER, Plate Washer	2
5	3265-001	WASHER, Back-Up } See Note 1	2
6	7700-001*	SEAL, O-Ring } See Note 1	2
7	8072-	HOUSING, Standard } See Note 2	1
8	8084-001	SPOOL, 4-Way } See Note 2	1

Notes:

1. Seal and washer not sold separately. Order Seal Kit No. K-6035-A.

2. These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-6 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

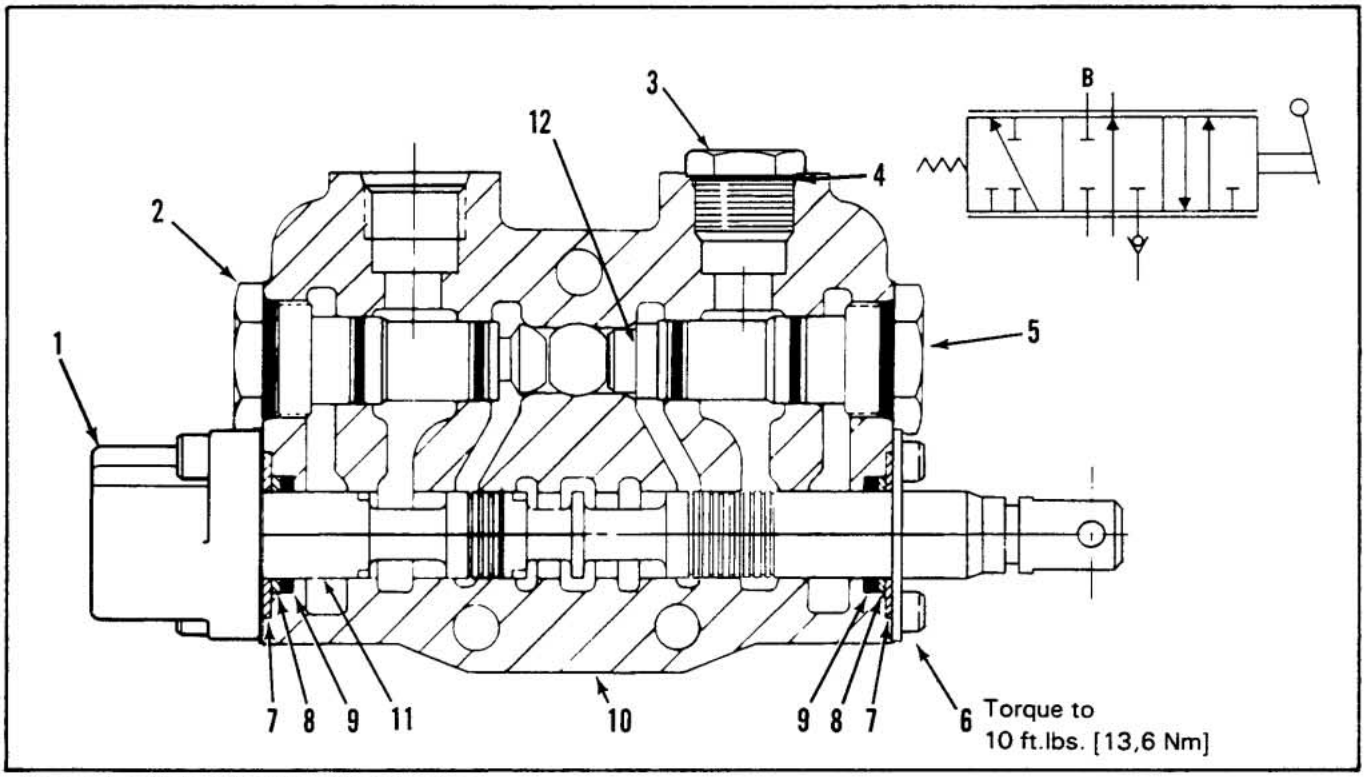


Figure 4-4. 3-Way, 3-Position Valve Section.

3-WAY, 3-POSITION VALVE SECTION

Item No.	Part No.	Description	Quantity Per Assembly
1	K-6125-B	POSITIONER, Spool, Standard (See Figure 4-12)	1
2	K-6030-C	CHECK, Load (See Figure 4-32)	1
3	2684-001	PLUG, 3-Way Conversion, SAE 8 (3/4"–16 UNF)	A/R
	1458-001	PLUG, 3-Way Conversion, SAE 10(7/8"–14 UNF)	A/R
	0073-001	PLUG, 3-Way Conversion, 3/8"–18 NPT	A/R
	0947-001	PLUG, 3-Way Conversion, 1/2"–14 NPT	A/R
4	2706-001	SEAL, O-Ring, SAE 8 Plug	A/R
	2707-001	SEAL, O-Ring, SAE 10 Plug	A/R
5	K-6030-C	PLUG, Check (Load Check and Spring are not used)	1
6	K-6033-B	RETAINER ASSEMBLY, Standard, Includes Screws (See Figure 4-23. See Figures 24 thru 4-28 for optional assemblies)	1
7	6752-001	RETAINER, Plate Washer	2
8	3265-001	WASHER, Back-Up } See Note 1	2
9	7700-001*	SEAL, O-Ring } See Note 1	2
10	8072-	HOUSING } See Note 2	1
11	8083-001	SPOOL, 3-Way } See Note 2	1
12	6754-001	PLUG, 3-Way	1

Notes:

1. Seal and washer not sold separately. Order Seal Kit No. K-6035-A.

2. These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-6 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

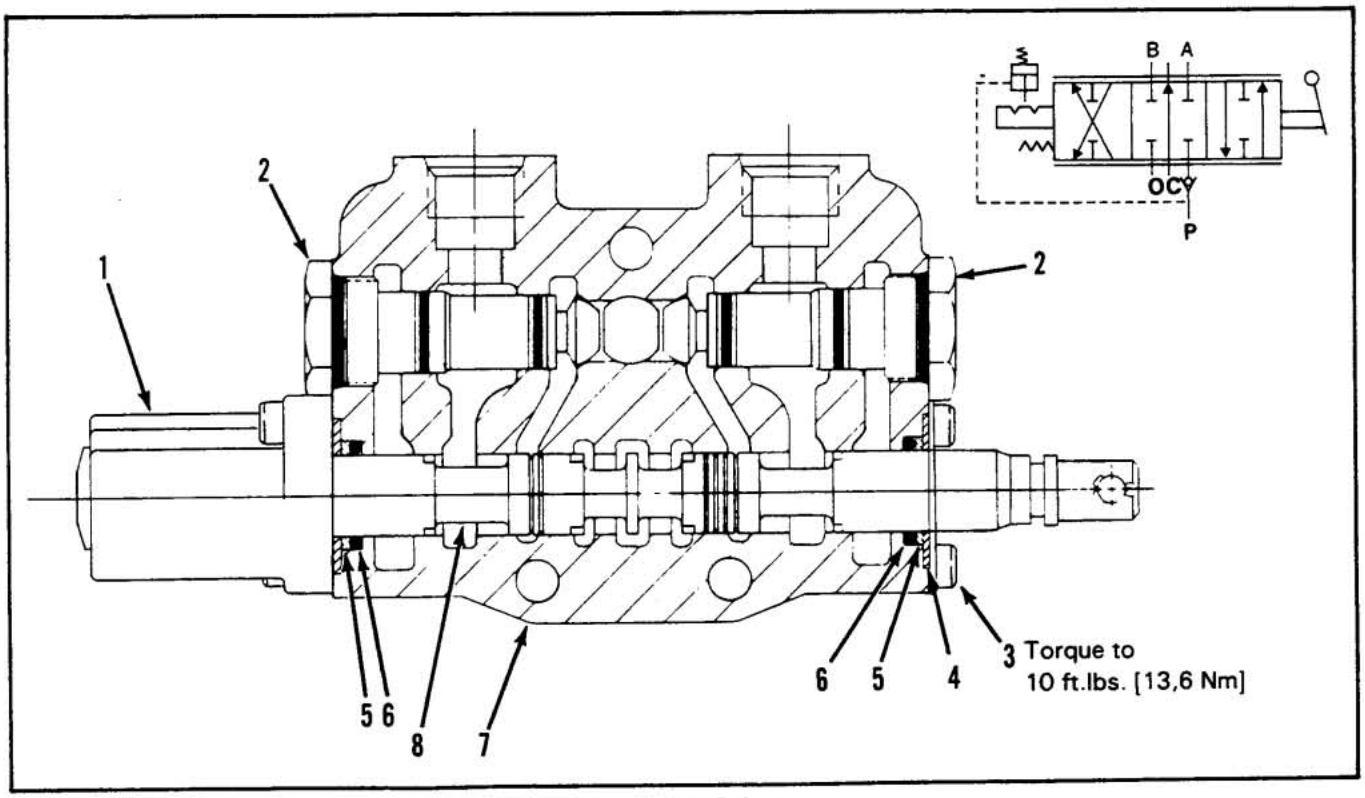


Figure 4-5. 4-Way, 3-Position Valve Section with Pressure Detent Release.

4-WAY, 3-POSITION VALVE SECTION WITH PRESSURE DETENT RELEASE (KO)

Item No.	Part No.	Description	Quantity Per Section
1		POSITIONER, Pressure Detent Release (See Figure 4-19)	1
2	K-6030-A	CHECK, Load (See Figure 4-32)	2
3	K-6033-B	RETAINER ASSEMBLY, Standard, Includes Screws, (See Figure 4-23. See Figures 4-24 thru 4-28 for optional assemblies.)	1
4	6752-001	RETAINER, Plate Washer	1
5	3765-001	WASHER, Back-Up } See Note 1	2
6	7700-001*	SEAL, O-Ring } See Note 1	2
7	8072-	HOUSING } See Note 2	1
8	8534-001	SPOOL, 4-Way } See Note 2	1

Notes:

1. Seal and washer not sold separately. Order Seal Kit No. K-6035-A.

2. These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-6 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

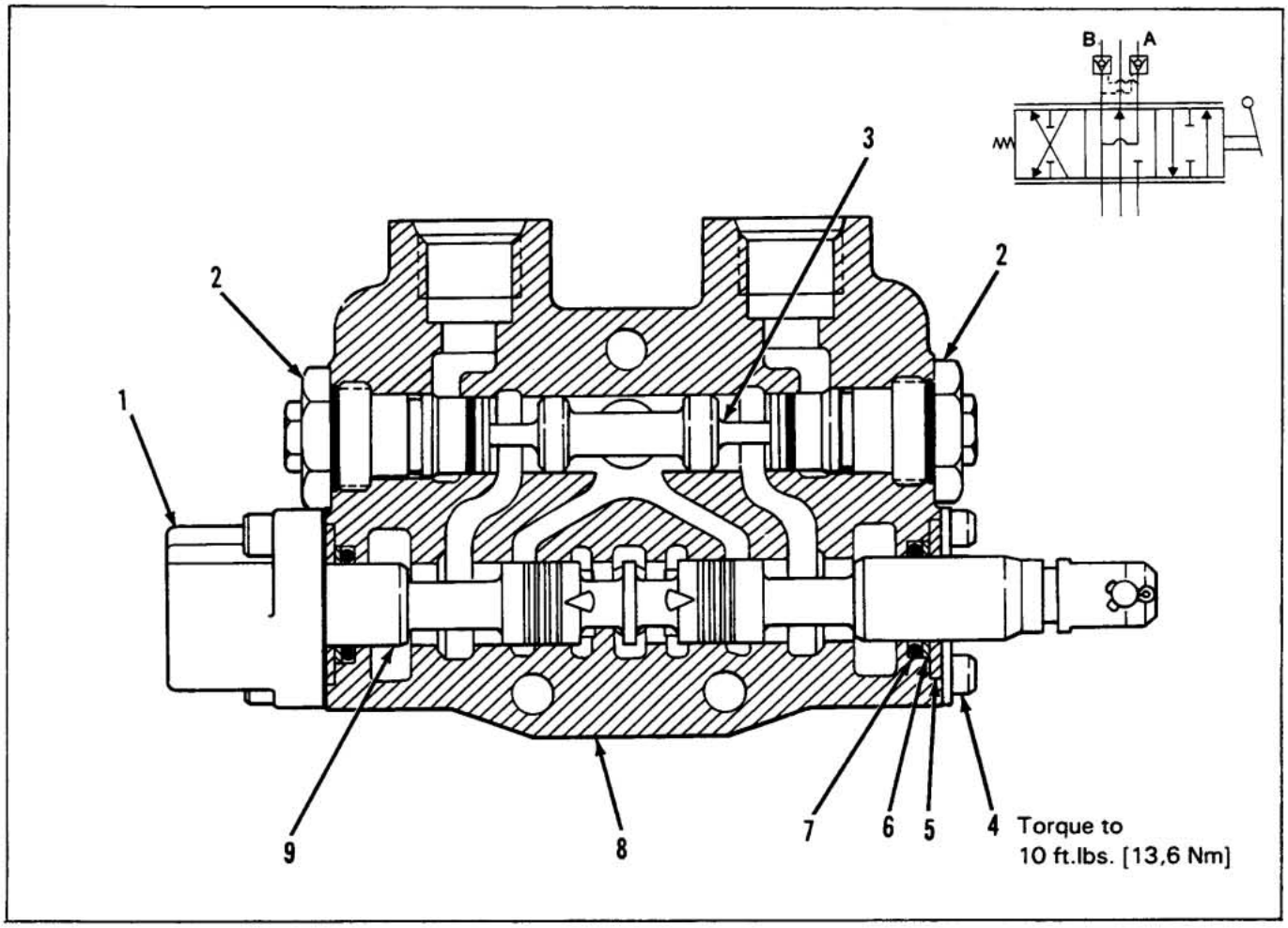


Figure 4-6. 4-Way, 3-Position Lockout Valve Section.

4-WAY, 3-POSITION LOCKOUT VALVE SECTION

Item No.	Part No.	Description	Quantity Per Section
1	K-6125-B	POSITIONER, Spool, Standard (See Figure 4-12)	1
2	K-6024-D	CHECK, Lockout (See Figure 4-29)	2
3	8648-001	PISTON, Unlocking	1
4	K-6033-B	RETAINER ASSEMBLY, Standard, Includes screws (See Figure 4-23. See Figure 4-24 thru 4-28 for optional assemblies.)	1
5	6752-001	RETAINER, Plate Washer	2
6	3265-001	WASHER, Back-Up } Not sold separately. Order K-6035-A	2
7	7700-001*	SEAL, O-Ring }	2
8	11571-	HOUSING, V20 Lockout } See Note	1
9	8397-001	SPOOL, Modified 4-Way Free Flow }	1

Note: These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-6 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

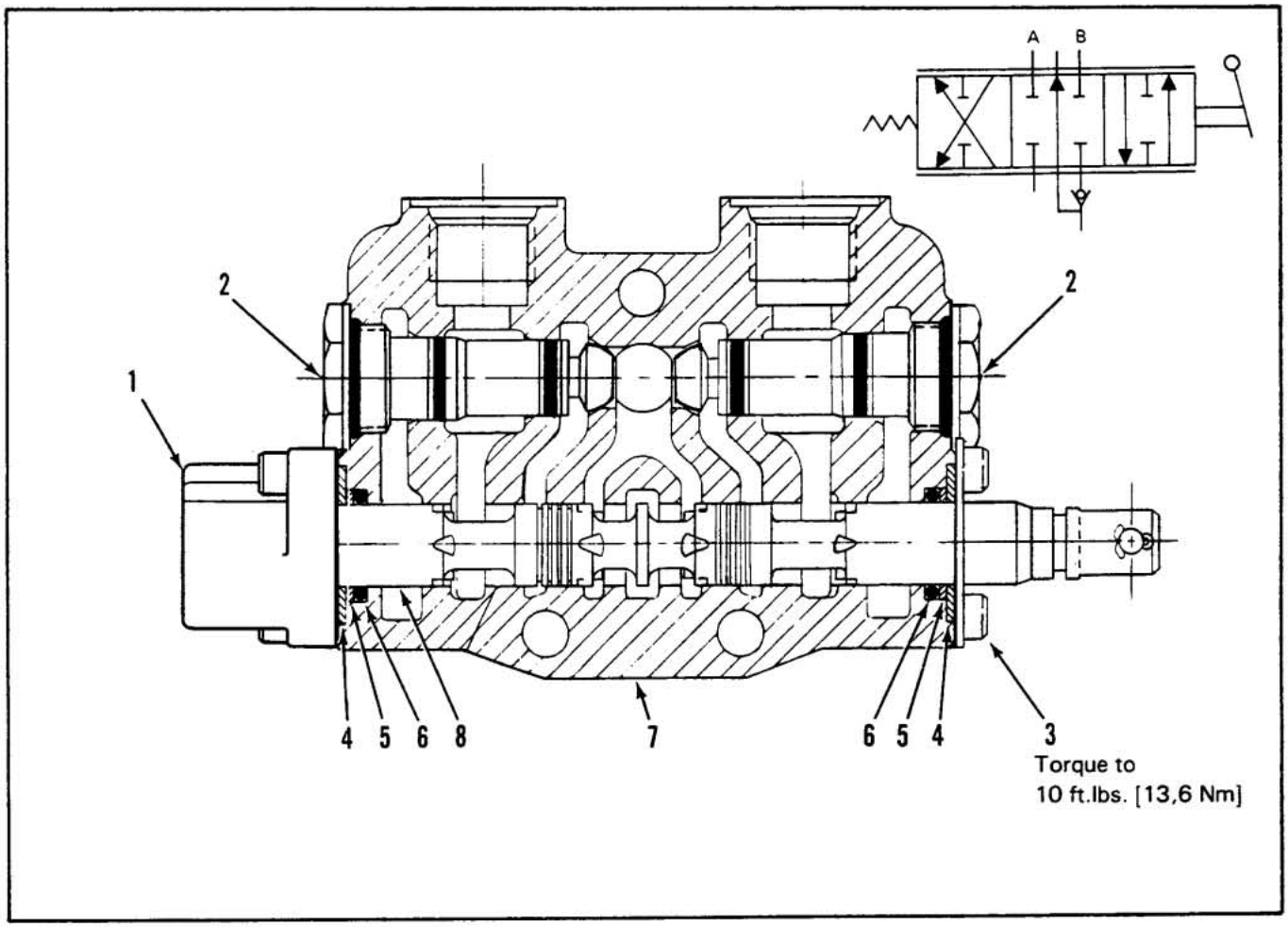


Figure 4-7. 4-Way, 3-Position Tandem Valve Section (shown with 4-way spool).

4-WAY, 3-POSITION TANDEM VALVE SECTION

Item No.	Part No.	Description		Quantity Per Section
1	K-6125-B	POSITIONER, Spool, Standard (See Figure 4-12)		1
2	K-6030-C	CHECK, Load (See Figure 4-32)		2
3	K-6033-B	RETAINER ASSEMBLY, Standard, Includes Screws (See Figure 4-23. See Figures 4-24 thru 4-28 for optional assemblies.)		1
4	6752-001	RETAINER, Plate Washer		2
5	3265-001	WASHER, Back-Up	See Note 1	2
6	7700-001*	SEAL, O-Ring	See Note 1	2
7	8112-	HOUSING	See Note 2	1
8	8084-001	SPOOL, 4-Way	See Note 2	1

Notes:

1. Seal and washer not sold separately. Order Seal Kit No. K-6035-A.

2. These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-6 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

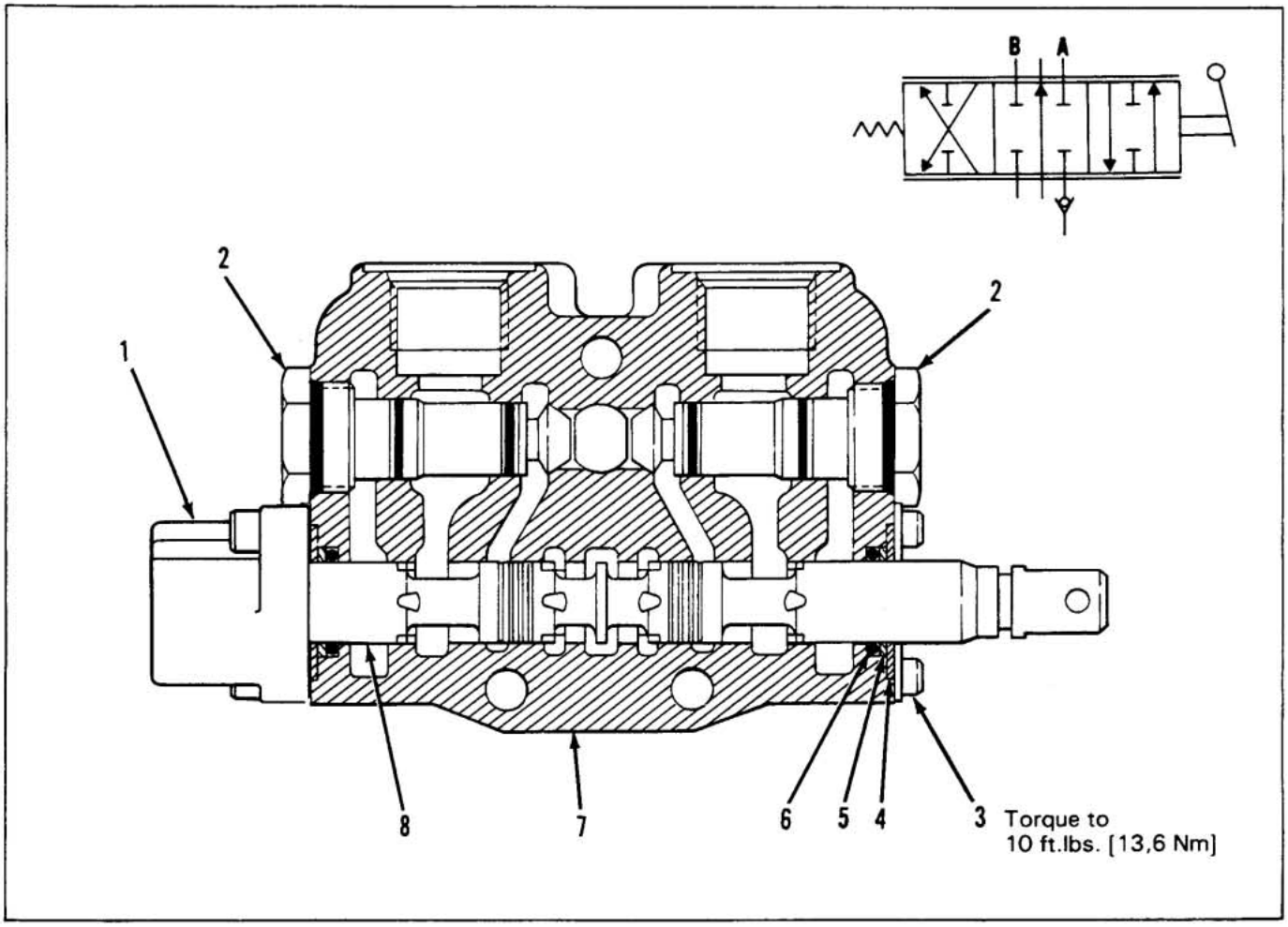


Figure 4-8. 4-Way, 3-Position, Low Pressure Drop Valve Section.

4-WAY, 3-POSITION, LOW PRESSURE DROP VALVE SECTION

Item No.	Part No.	Description	Quantity Per Section
1	K-6207-A	POSITIONER, Spool, Standard (See Figure 4-21)	1
2	K-6030-C	CHECK, Load (See Figure 4-32)	2
3	K-6033-B	RETAINER ASSEMBLY, Standard, Includes screws (See Figure 4-23. See Figure 4-24 thru 4-28 for optional assemblies.)	1
4	6752-001	RETAINER, Plate Washer	2
5	3265-001	WASHER, Back Up } Not Sold separately. Order K-6035-A	2
6	7700-001*	SEAL, O-Ring }	2
7	10954-	HOUSING, V20 Low Pressure Drop } See Note	1
8	8084-001	SPOOL, 4-Way }	1

Note: These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-6 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

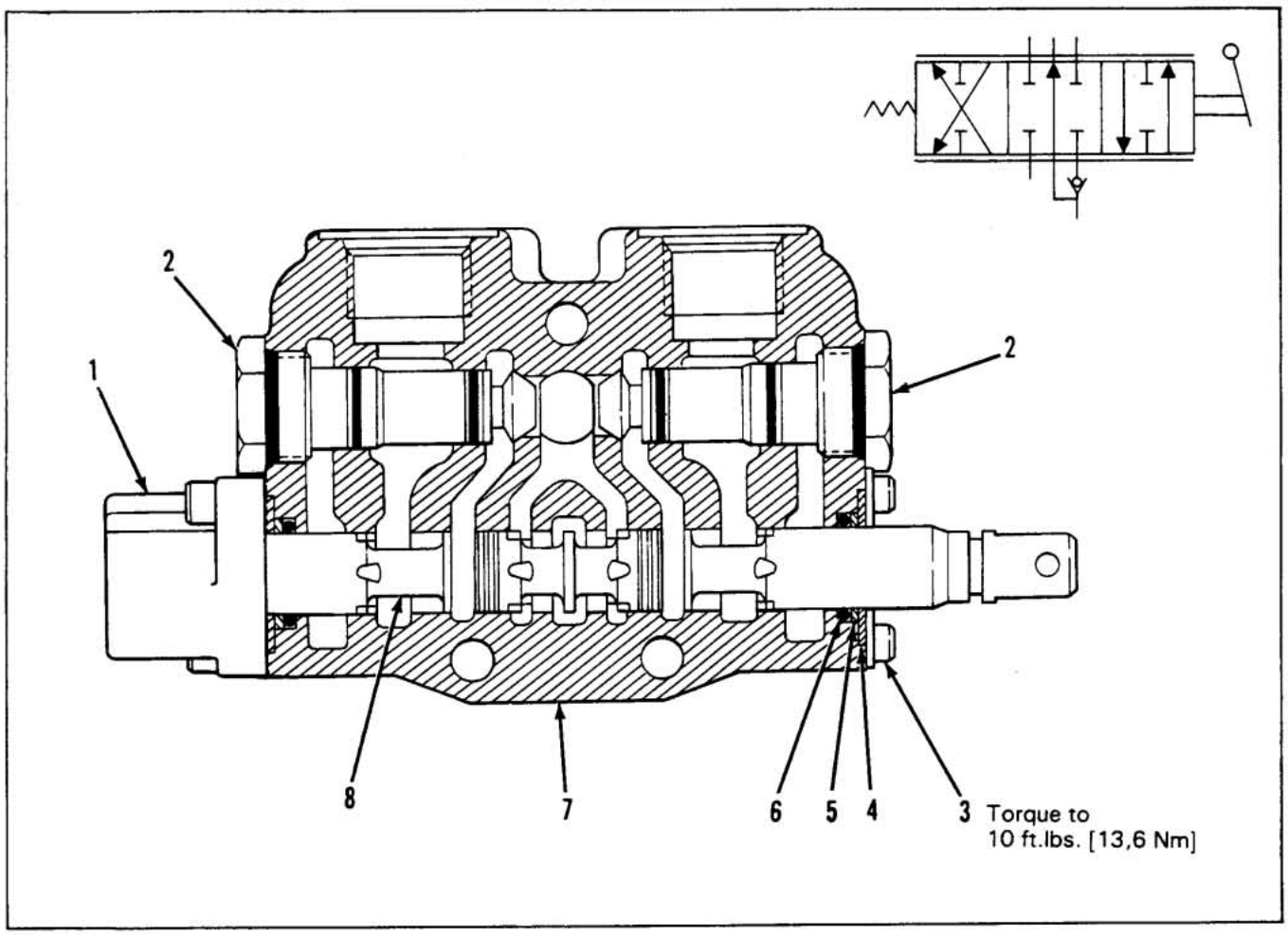


Figure 4-9. 4-Way, 3-Position, Tandem, Low Pressure Drop Valve Section.

4-WAY, 3-POSITION, TANDEM, LOW PRESSURE DROP VALVE SECTION

Item No.	Part No.	Description	Quantity Per Section
1	K-6207-A	POSITIONER, Spool, Standard (See Figure 4-21)	1
2	K-6030-C	CHECK, Load (See Figure 4-32)	2
3	K-6033-B	RETAINER ASSEMBLY, Standard, Includes screws (See Figure 4-23. See Figure 4-24 thru 4-28 for optional assemblies.)	1
4	6752-001	RETAINER, Plate Washer	2
5	3265-001	WASHER, Back-Up } Not Sold separately. Order K-6035-A	2
6	7700-001*	SEAL, O-Ring } Not Sold separately. Order K-6035-A	2
7	10762-	HOUSING, Tandem, Low Pressure Drop } See Note	1
8	8084-001	SPOOL, 4-Way } See Note	1

Note: These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-6 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

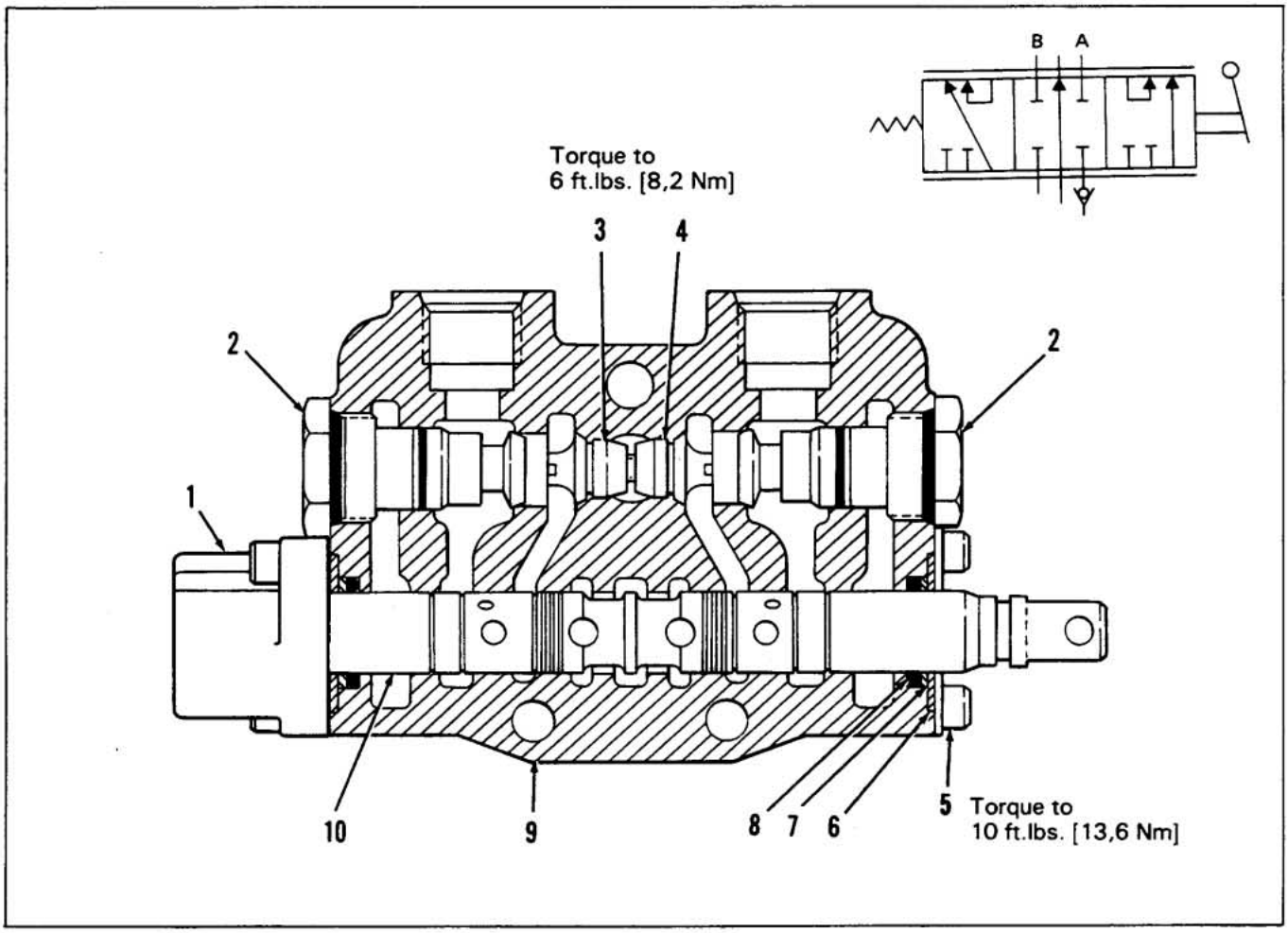


Figure 4-10. 4-Way, 3-Position, Series Valve Section.

4-WAY, 3-POSITION, SERIES VALVE SECTION

Item No.	Part No.	Description	Quantity Per Section
1	K-6207-A	POSITIONER, Spool, Standard (See Figure 4-21)	1
2	K-6203	CHECK, Load (See Figure 4-33)	2
3	11246-001	PLUG, Power Core } See Note 1	1
4	11716-001	PLUG, Power Core }	1
5	K-6033-B	RETAINER ASSEMBLY, Standard, Includes screws (See Figure 4-23. See Figure 4-24 thru 4-28 for optional assemblies.)	1
6	6752-001	RETAINER, Plate Washer	2
7	3265-001	WASHER, Back-Up } Not Sold separately. Order K-6035-A	2
8	7700-001*	Seal, O-Ring }	2
9	11483-	HOUSING, V20 Series } See Note 2	1
10	11245-001	SPOOL, Series, 4-Way }	1

Notes:

1. Parts not sold separately. Order K-6200-A. Power core plug assembly is only used in Series housings manufactured prior to May 1, 1985 (Series housing #8072).
2. These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-6 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

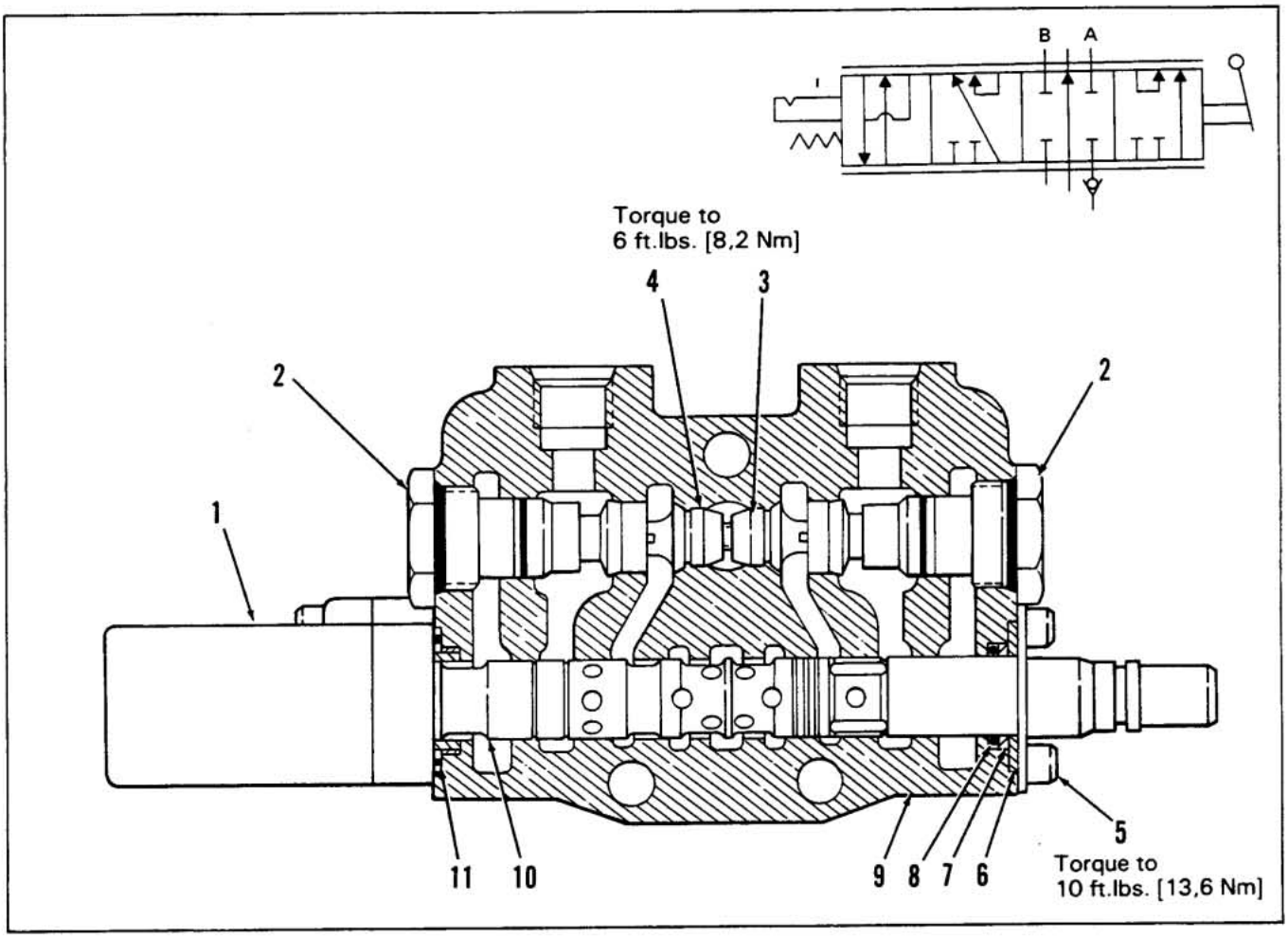


Figure 4-11. 4-Way, 4-Position Float, Series Valve Section.

4-WAY, 4-POSITION FLOAT, SERIES VALVE SECTION

Item No.	Part No.	Description	Quantity Per Section
1	K-6208	POSITIONER, Float Out (See Figure 4-22)	1
2	K-6203	CHECK, Load (See Figure 4-33)	2
3	11246-001	PLUG, Power Core } See Note 1	1
4	11716-001	PLUG, Power Core }	1
5	K-6033-B	RETAINER ASSEMBLY, Standard, Includes screws (See Figure 4-23. See Figure 4-24 thru 4-28 for optional assemblies.)	1
6	6752-001	RETAINER, Plate Washer	1
7	3265-001	WASHER, Back-Up } Not sold separately. Order K-6035-A	1
8	7700-001*	SEAL, O-Ring }	1
9	11483-	HOUSING, V20 Series } See Note 2	1
10	11377-001	SPOOL, Series, Float }	1
11		SPOOL SEAL ASSEMBLY (See Figure 4-22)	1

Notes:

1. Parts not sold separately. Order K-6200-A. Power core plug assembly is only used in Series housings manufactured prior to May 1, 1985 (series housing #8072).
2. These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-2 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

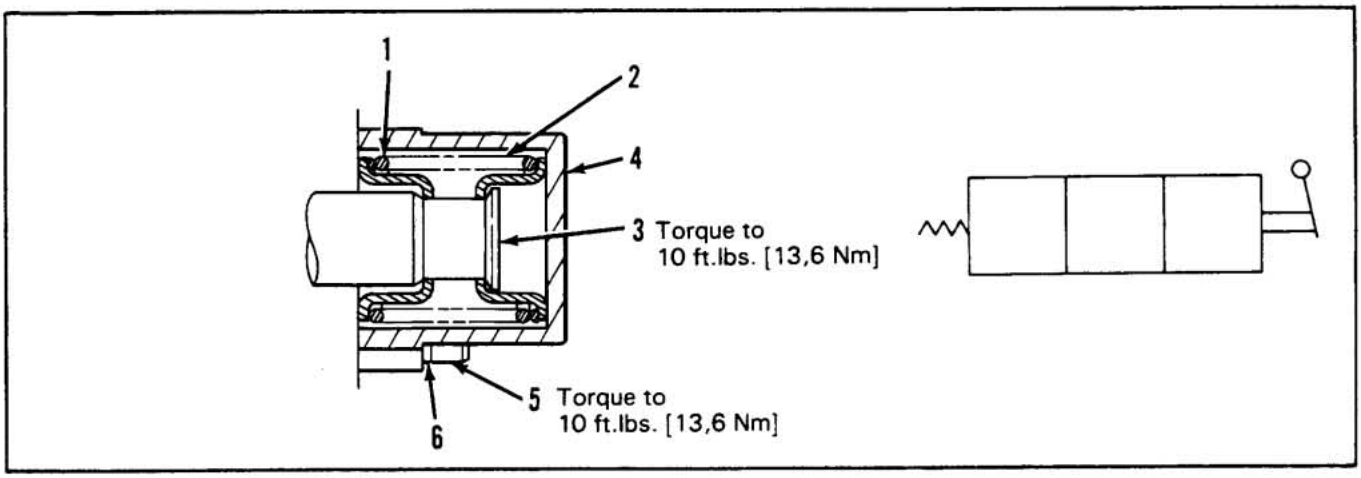


Figure 4-12. Standard Spool Positioner.

STANDARD SPOOL POSITIONER

Item No.	Part No.	Description	Quantity
	K-6125-B	REPLACEMENT KIT (Contains all items listed below)	
1	7433-001	Spring, Return	1
2	1809-001	COLLAR, Spring	2
3	10892-001	COLLAR, Spool	1
4	1811-001	BONNET	1
5	3731-101	SCREW, HSHC, 1/4-20 x 7/8 inch long	2
6	0563-001	WASHER, Lock	2

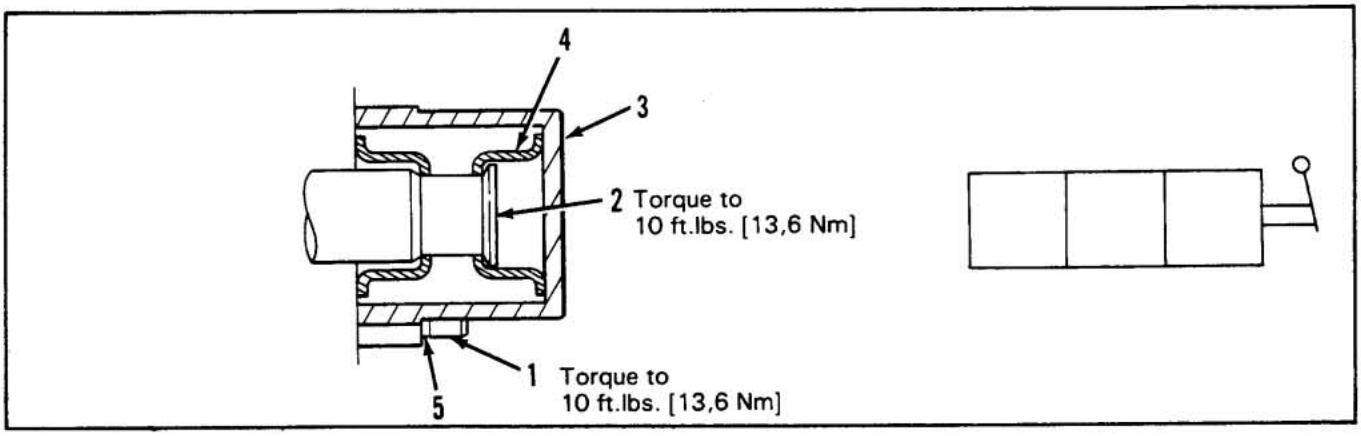


Figure 4-13. Manual Spool Positioner.

MANUAL SPOOL POSITIONER

Item No.	Part No.	Description	Quantity
1	3731-101	SCREW, HSHC, 1/4-20 x 7/8 inch long	2
2	10892-001	COLLAR, Spool	1
3	1811-001	BONNET	1
4	1809-001	COLLAR, Stop	2
5	0563-001	WASHER, Lock	2

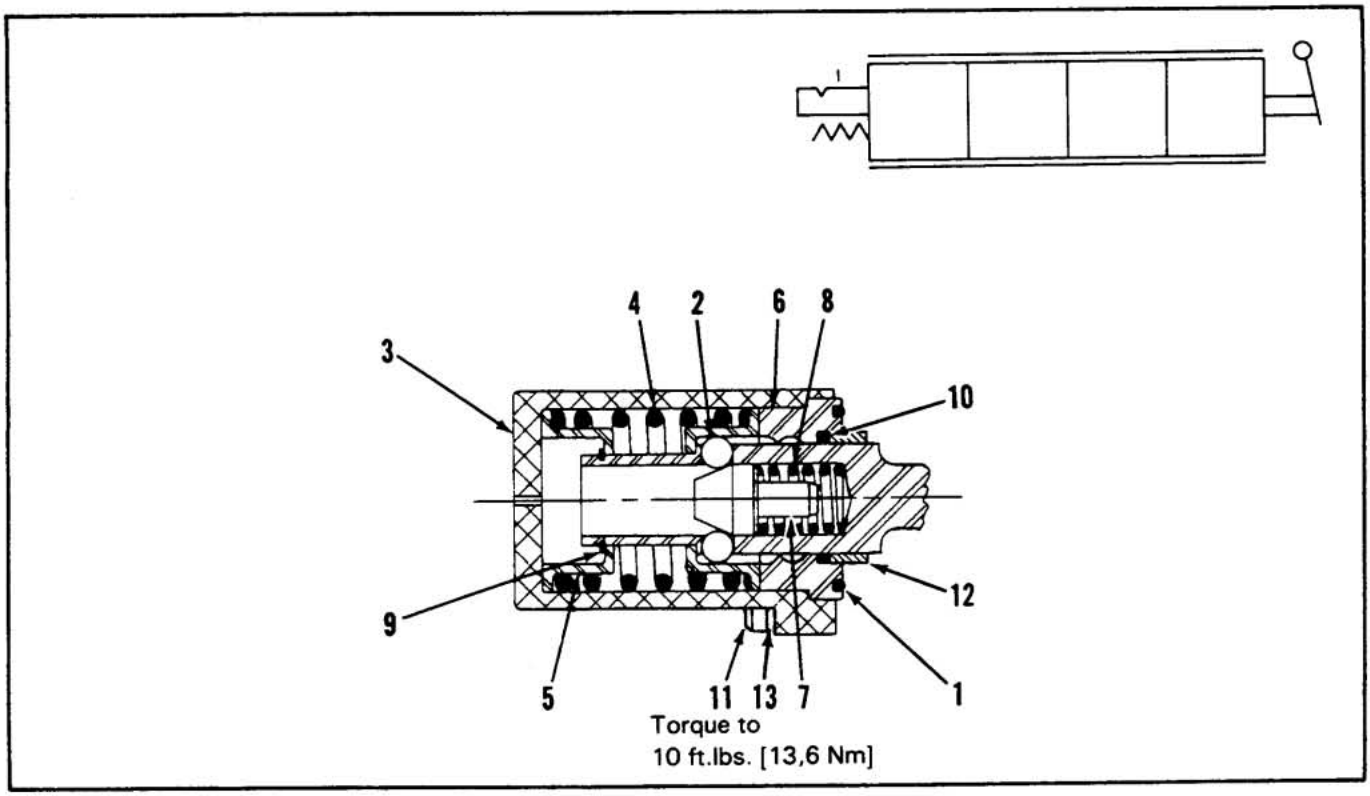


Figure 4-14. 4-Way, 4-Position Float Detent Positioner.

4-WAY, 4-POSITION FLOAT DETENT POSITIONER

Item No.	Part No.	Description	Quantity
	K-6127-B	REPLACEMENT KIT (Contains all items listed below)	
1	21047-001*	O-RING, Seal	1
2	1700-001	BALL, Detent	4
3	8082-001	BONNET, Float	1
4	8099-001	SPRING, Centering (See Note)	1
5	1826-001	COLLAR, Stop	2
6	8077-001	SLEEVE, Detent	1
7	1828-001	FOLLOWER, Detent Ball	1
8	8098-001	SPRING, Detent (See Note)	1
9	1852-001	RING, Retaining	1
10	1853-001*	SEAL, Spool	1
11	3731-101	SCREW, HSHC, 1/4-20 x 7/8 inch long	2
12	8079-001	SLEEVE, Retainer	1
13	0563-001	WASHER, Lock	2

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

Note:

Springs shown are standard. Heavy duty springs are available:

Order No. 3091-001 Heavy Duty Centering Spring.

Order No. 1829-001 Heavy Duty Detent Spring.

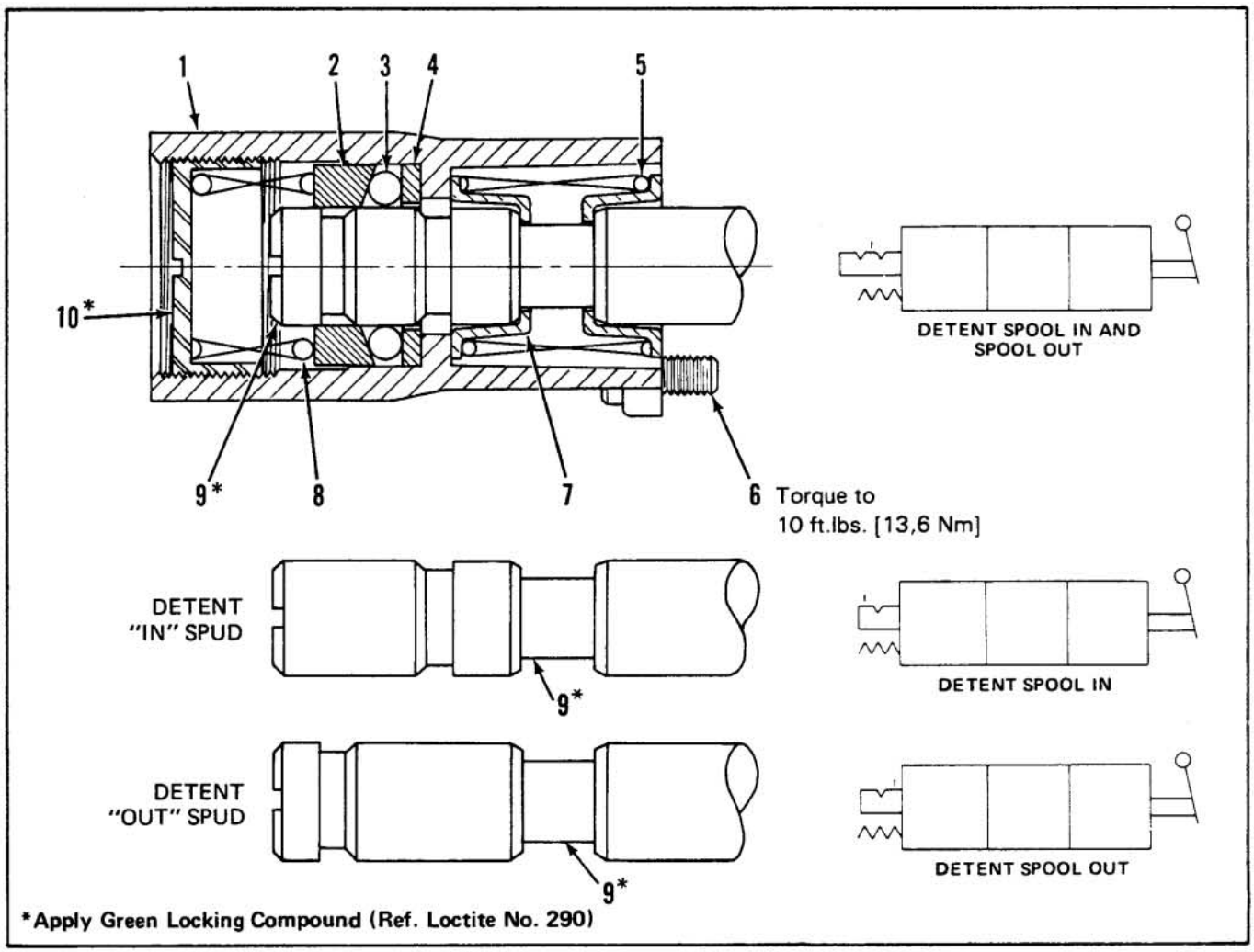


Figure 4-15. Option "R" Detent with Spring Return to Neutral.

OPTION "R" DETENT with SPRING RETURN TO NEUTRAL

Item No.	Part No.	Description	Quantity
	K-6152-A	REPLACEMENT KIT, Detent Spool "IN" position only	
	K-6151-A	REPLACEMENT KIT, Detent Spool "OUT" position only	
	K-6153-A	REPLACEMENT KIT, Detent Spool "IN" and "OUT" positions (Replacement Kits contain all of the items listed below with the correct spud (item 9) for each kit)	
1	8325-001	BONNET, R Detent	1
2	8571-001	RACE, Ball	1
3	1700-001	BALL, Steel	12
4	7994-001	PLATE, Thrust	1
5	3250-001	SPRING, Centering	1
6	3731-099	SCREW, HSHC, 1/4-20 by 5/8 inch long	2
7	1809-001	COLLAR, Spring	2
8	3252-001	SPRING	1
9	8573-001	SPUD, R Detent "IN"	1
	8572-001	SPUD, R Detent "OUT"	1
	8574-001	SPUD, R Detent "IN" and "OUT"	1
10	20443-001	CAP, Adjusting	1

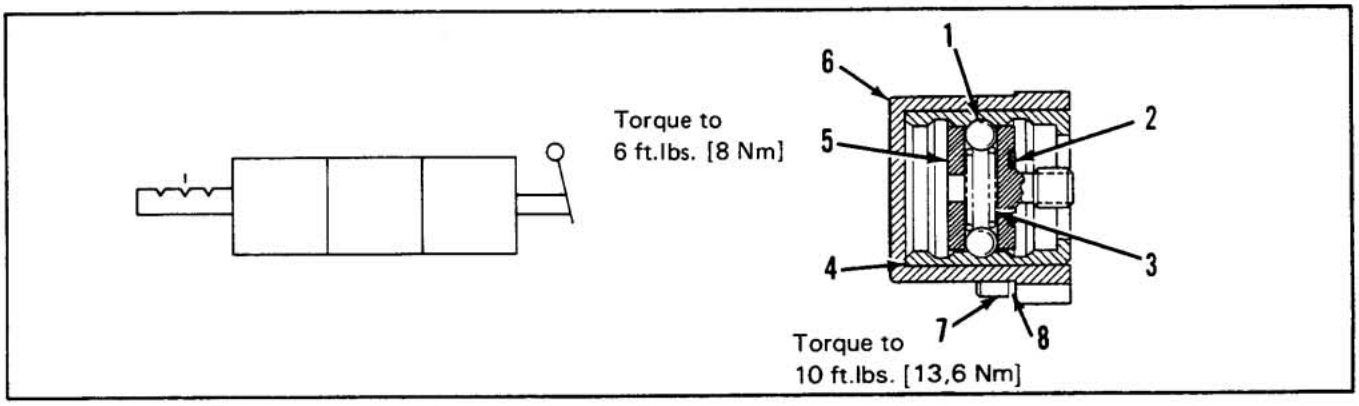


Figure 4-16. Option "D" 3-Position Detent Spool.

OPTION "D" 3-POSITION DETENT SPOOL

Item No.	Part No.	Description	Quantity
	K-6012-E	REPLACEMENT KIT (Contains all items listed below except item 8)	
1	0023-001	BALL, Detent	2
2	1837-001	WASHER, Lock	1
3	1838-001	SPRING, Detent	1
4	6812-001	SLEEVE, Detent, 3-position	1
5	1840-001	HOLDER, Detent	1
6	1811-001	BONNET	1
7	3731-101	SCREW, HSHC, 1/4-20 x 7/8 inch long	2
8	0563-001	WASHER, Lock	2
9	1889-001	STOP, Detent, optional (not shown)	1

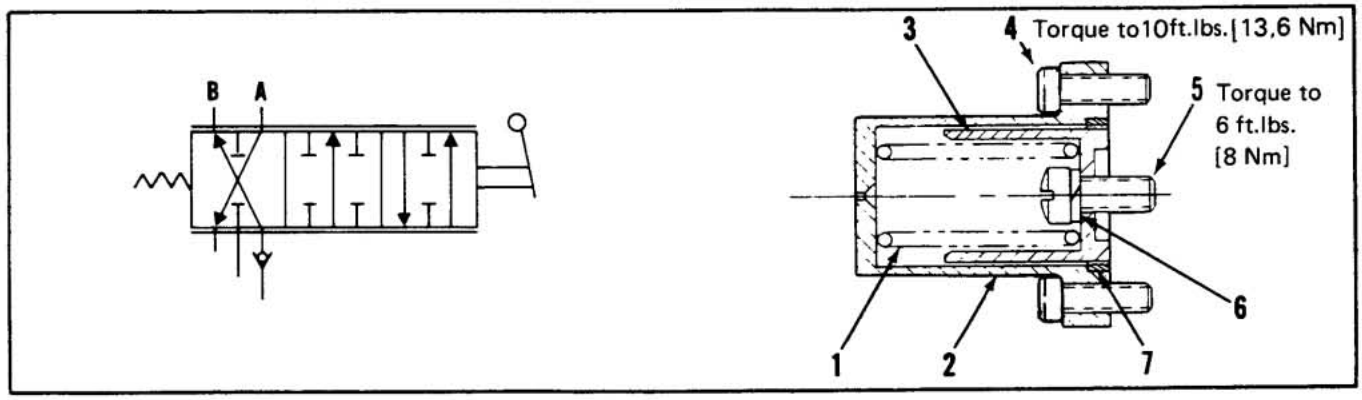


Figure 4-17. Option "A" Spring, Extended Spool.

OPTION "A" SPRING, EXTENDED SPOOL

Item No.	Part No.	Description	Quantity
	K-6150-A	REPLACEMENT KIT (Contains all items listed below)	
1	8666-001	SPRING, Return	1
2	1824-001	BONNET	1
3	1860-001	COLLAR, Stop	1
4	9161-407	SCREW, HSHC, 1/4-20 by 7/8 inch long	2
5	1812-001	SCREW, Cap	1
6	1813-001	WASHER, Lock	1
7	6756-001	SLEEVE, Bonnet	1

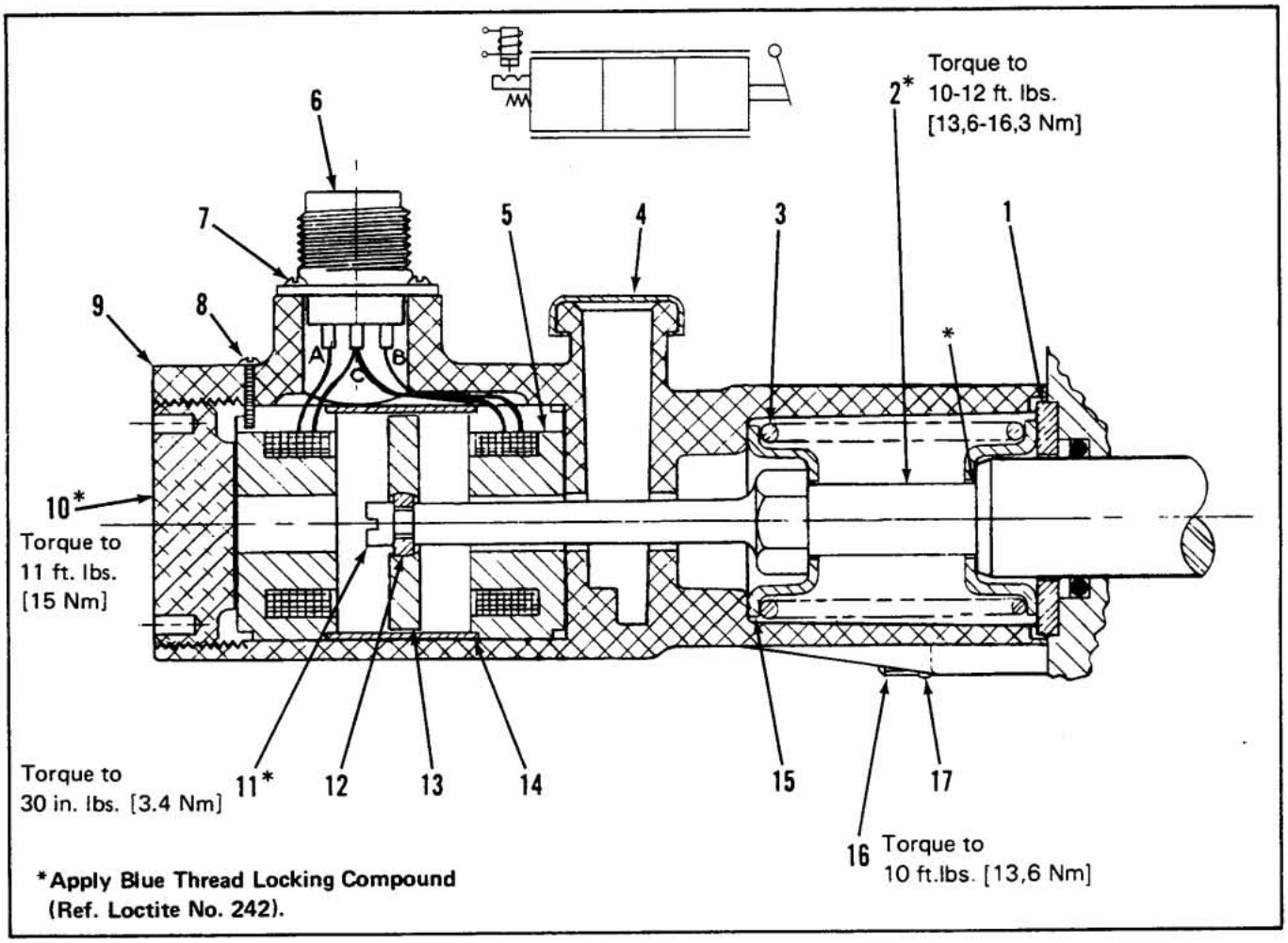


Figure 4-18. Electro-Magnetic Spool Release Positioner.

ELECTRO-MAGNETIC SPOOL RELEASE POSITIONER

Item No.	Part No.	Description	Quantity
	K-6064-A	REPLACEMENT KIT (Contains Items 2, 5, 11, 12, 13)	
1	7572-001	RETAINER, Spool Seal	1
2	7954-001	SPUD, Positioner	1
3	3250-001	SPRING, 1.114 OD x 0.095 WD	1
4	7589-001	CAP, Seal	1
5	7752-001	ELECTRO-MAGNET	2
6	7955-001	CONNECTOR, Electrical	1
7	7593-001	SCREW, Thread-Cutting	4
8	7956-001	SCREW, Thread-Cutting	1
9	7583-004	BONNET, Electric Detent	1
10	7957-001	PLUG, Bonnet	1
11	7756-001	SCREW, Shoulder, .188 x 0.156 inch long	1
12	7755-001	WASHER, Alignment	1
13	8555-001	ARMATURE	1
14	7958-001	SPACER	1
15	7573-001	COLLAR, Spring	2
16	3731-103	SCREW, Housing, .250 x 1.25 inches long	2
17	0563-001	WASHER, Lock, 0.250 ID	2

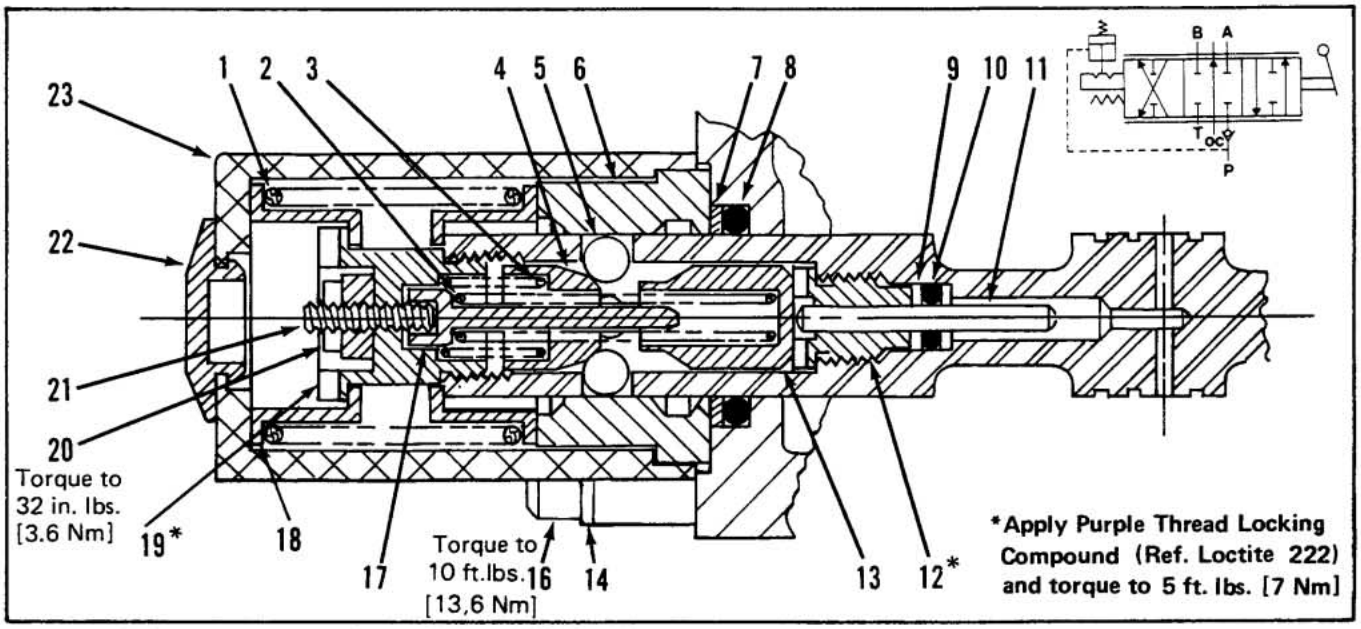


Figure 4-19. Optional Pressure Detent Release (KO) Positioner.

OPTIONAL PRESSURE DETENT RELEASE (KO) POSITIONER

Item No.	Part No.	Description	Quantity
	K-6061-B	SEAL KIT (Contains items 7, 8, 9 and 10 listed below)	
1	7433-001	SPRING, Centering	1
2	8047-001	SPRING, Standard (500-1600 PSI [35-110 bar] Crack)	1
	8010-001	SPRING, Optional (1601-2400 PSI [111-165 bar] Crack)	1
	8538-001	SPRING, Optional (2401-3000 PSI [166-207 bar] Crack)	1
	8537-001	SPRING, Optional (3001-3500 PSI [166-207 bar] Crack)	1
3	7898-001	SPRING, 0.385 O.D.x.054 W.D.	1
4	7897-001	FOLLOWER, Ball	1
5	1700-001	BALL, Steel	4
6	8007-001	SLEEVE, Detent	1
7	3265-001	RING, Back-Up } Not Sold	1
8	7700-001*	SEAL, O-Ring } Separately	1
9	7907-001	RING, Back-Up } Order K-6061-B	2
10	3328-001	SEAL, O-Ring }	1
11	7908-001	ROLLER, Needle	1
12	7906-001	GUIDE, Piston	1
13	7896-001	PLUNGER, Knockout	1
14	7904-001	PLATE, Bearing	2
16	9161-407	SCREW, HSHC, 1/4-20 by 7/8 inch long	2
17	7899-001	GUIDE, Spring	1
18	8536-001	COLLAR, Spring	2
19	8535-001	COLLAR, Spool	1
20	6229-001	LOCKNUT	1
21	8014-001	SCREW, Hex Set, No. 10-24x0.62	1
22	7902-001	PLUG, Button, Flush Head	1
23	1824-002	BONNET	1

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

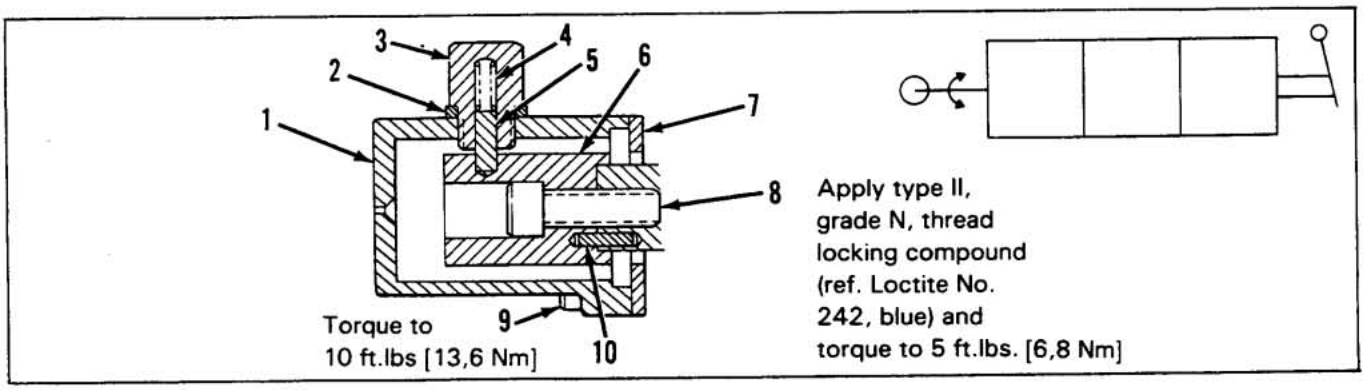


Figure 4-20. Option "W" Rotary Spool Positioner.

OPTION "W" ROTARY SPOOL POSITIONER

Item No.	Part No.	Description	Quantity
	K-6141-C	REPLACEMENT KIT (Contains all items listed below)	
1	1824-006	BONNET, Rotary	1
2	8743-001	WASHER, Detent Cap	1
3	8744-001	CAP, Rotary Detent	1
4	8808-001	SPRING, Detent	1
5	2676-001	PIN, Detent	1
6	8746-001	BODY, Rotary Cam	1
7	6552-001	PLATE, Seal Retainer	1
8	3731-150	SCREW, HSHC, 5/16-18 by 1 inch long	1
9	9161-407	SCREW, HSHC, 1/4-20 by 7/8 inch long	2
10	0888-001	PIN, Dowel	1

NOTE: Apply heavy duty, general purpose grease to the helical groove of Cam Body (Item 6) and Pin (Item 5). For standard assembly, hole in spool clevis must be horizontal with valve spool in neutral.

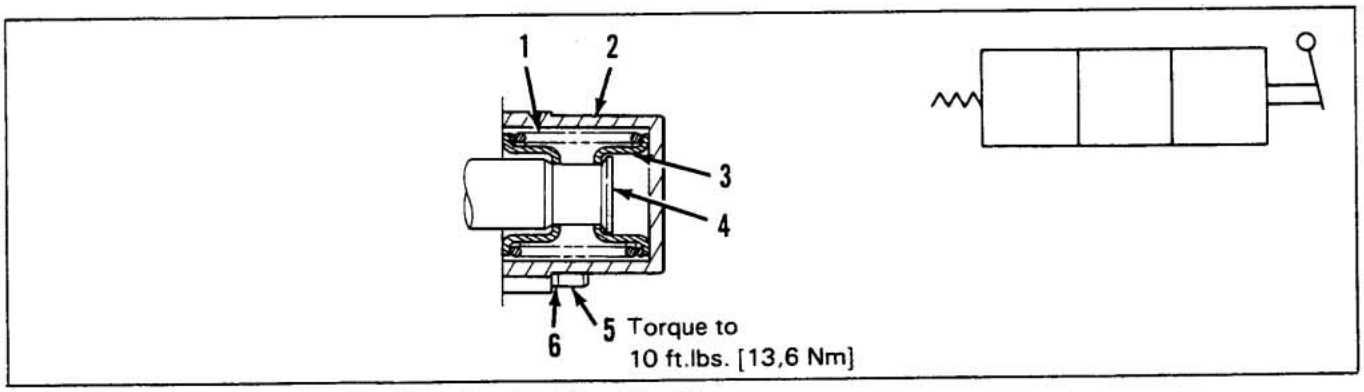


Figure 4-21. Series or Low Pressure Drop, Standard Spool Positioner.

SERIES OR LOW PRESSURE DROP, STANDARD SPOOL POSITIONER

Item No.	Part No.	Description	Quantity
	K-6207-A	REPLACEMENT KIT (Contains all items listed below)	
1	10956-001	SPRING, Return	1
2	1811-001	BONNET	1
3	1809-001	COLLAR, Spring	2
4	10892-001	COLLAR, Spool	1
5	3731-101	SCREW, HSHC, 1/4-20 x 7/8 inch long	2
6	0563-001	WASHER, Lock	2

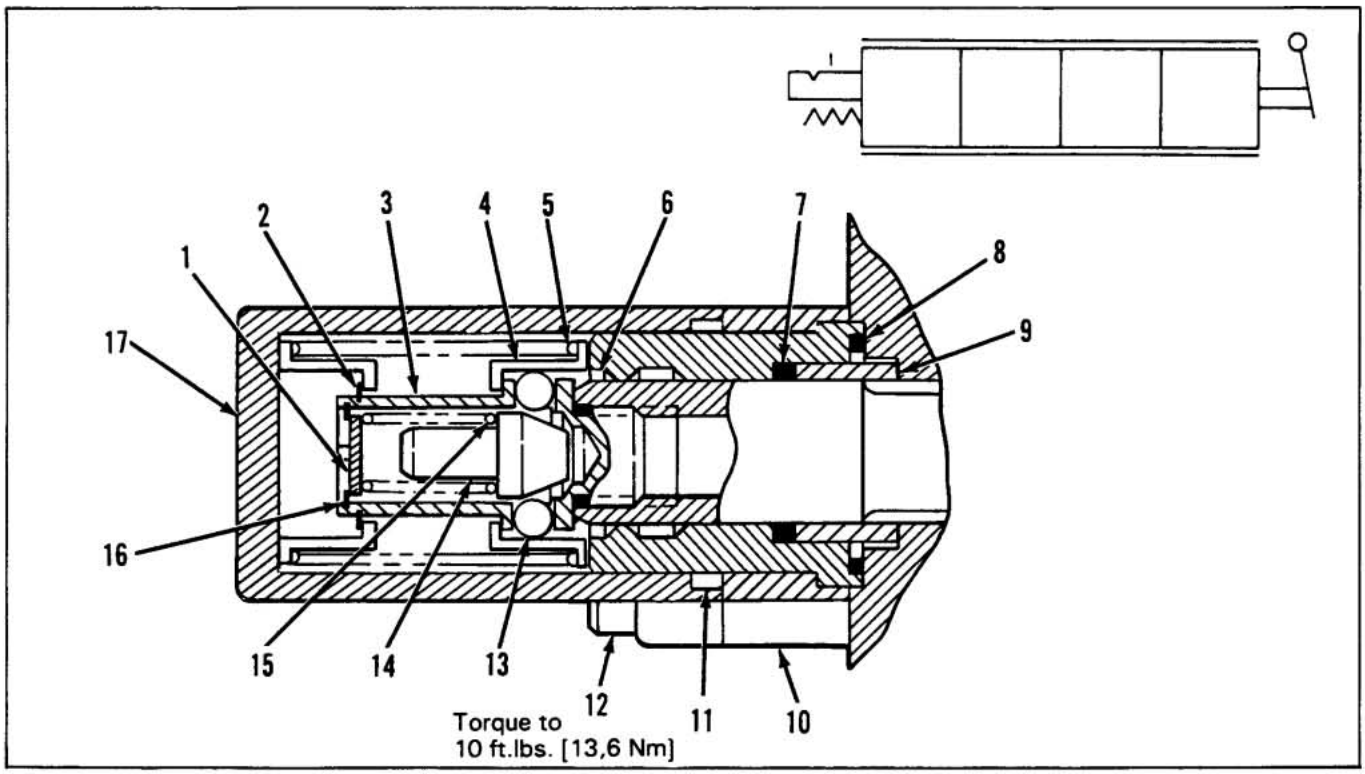


Figure 4-22. V20S 4-Way, 4-Position Float (out) Detent Positioner.

V20S 4-WAY, 4-POSITION FLOAT (OUT) DETENT POSITIONER

Item No.	Part No.	Description	Quantity
	K-6208	REPLACEMENT KIT (Contains all items listed below)	
1	11371-001	SHIM	1
2	1852-001	RING, Retaining	1
3	11373-001	COLLAR, Spool	1
4	1826-001	COLLAR, Spring	2
5	1807-001	SPRING, Centering	1
6	0449-001*	SEAL, O-Ring	1
7	1853-001*	SEAL, Four Lobed	1
8	21047-001*	SEAL, O-Ring	1
9	8079-001	SLEEVE, Retainer	1
10	7905-001	SPACER, Bonnet	1
11	11372-001	SLEEVE, Detent	1
12	9161-412	SCREW, HSHC, 1/4-20 by 1½ inch long	2
13	1700-001	BALL, Detent	4
14	1828-001	FOLLOWER, Ball	1
15	1829-001	SPRING, Detent	1
16	9320-016	RING, Retaining	1
17	8082-001	BONNET	1

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

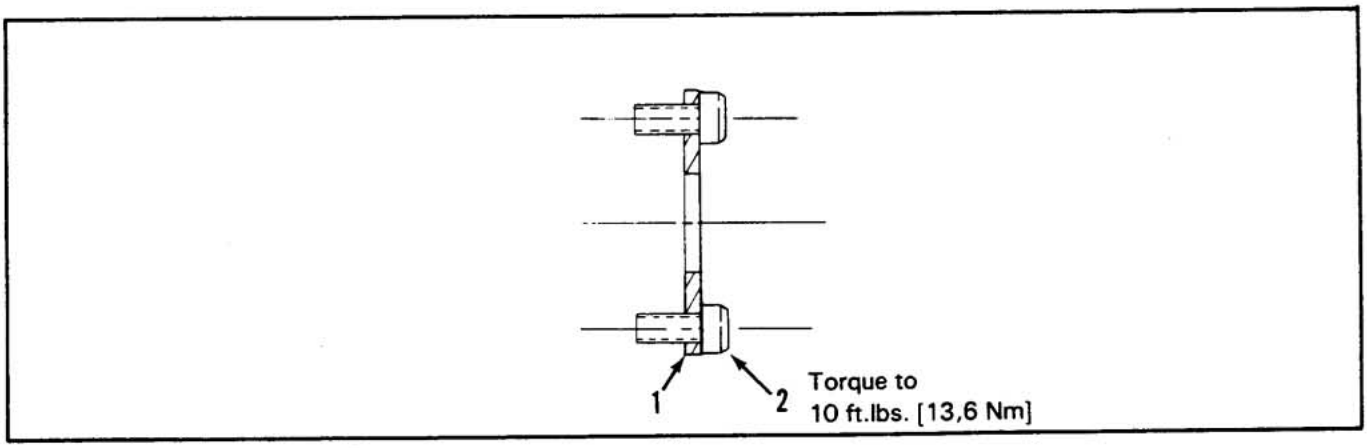


Figure 4-23. Standard Seal Retainer.

STANDARD SEAL RETAINER

Used when handle bracket is not furnished and tank line pressures are below 200 PSI [14 bar].

Item No.	Part No.	Description	Quantity
	K-6033-B	REPLACEMENT KIT (Contains items 1 and 2)	
1	6552-001	PLATE	1
2	3731-098	SCREW, HSHC, 1/4-20 by 1/2 inch long	2

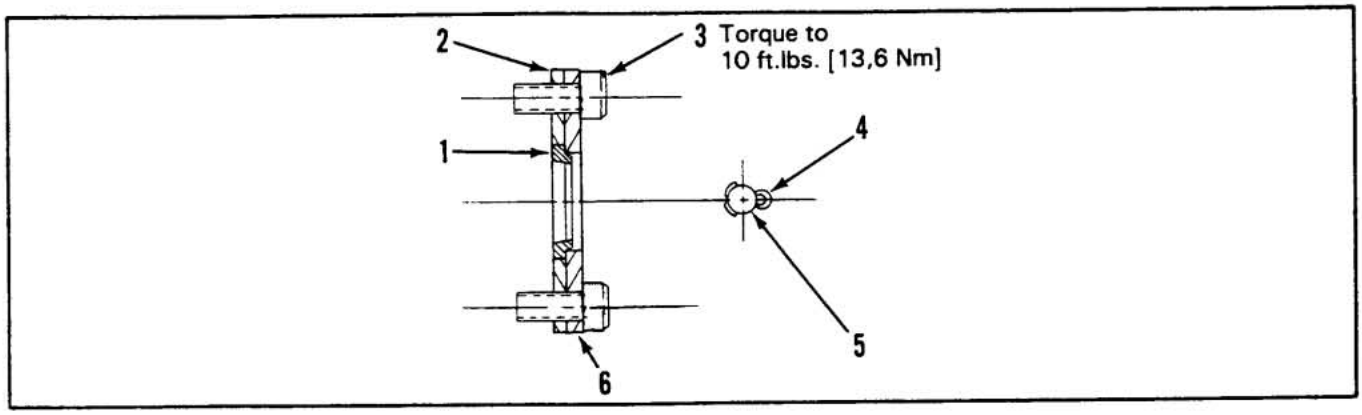


Figure 4-24. Optional Heavy Duty Seal Retainer.

OPTIONAL HEAVY DUTY SEAL RETAINER WITH OPTIONAL SPOOL WIPER

Used when handle bracket is not furnished and tank line pressure is below 1000 PSI, [69 bar], and when wiper seal is desired.

Item No.	Part No.	Description	Quantity
	K-6029-B	REPLACEMENT KIT (Contains all items listed below)	
1	1800-001	WIPER, Spool (Optional)	1
2	6802-001	PLATE, Seal	1
3	3731-098	SCREW, HSHC, 1/4-20 by 1/2 inch long	2
4	0086-001	PIN, Cotter	1
5	1857-001	PIN	1
6	6552-001	PLATE	1

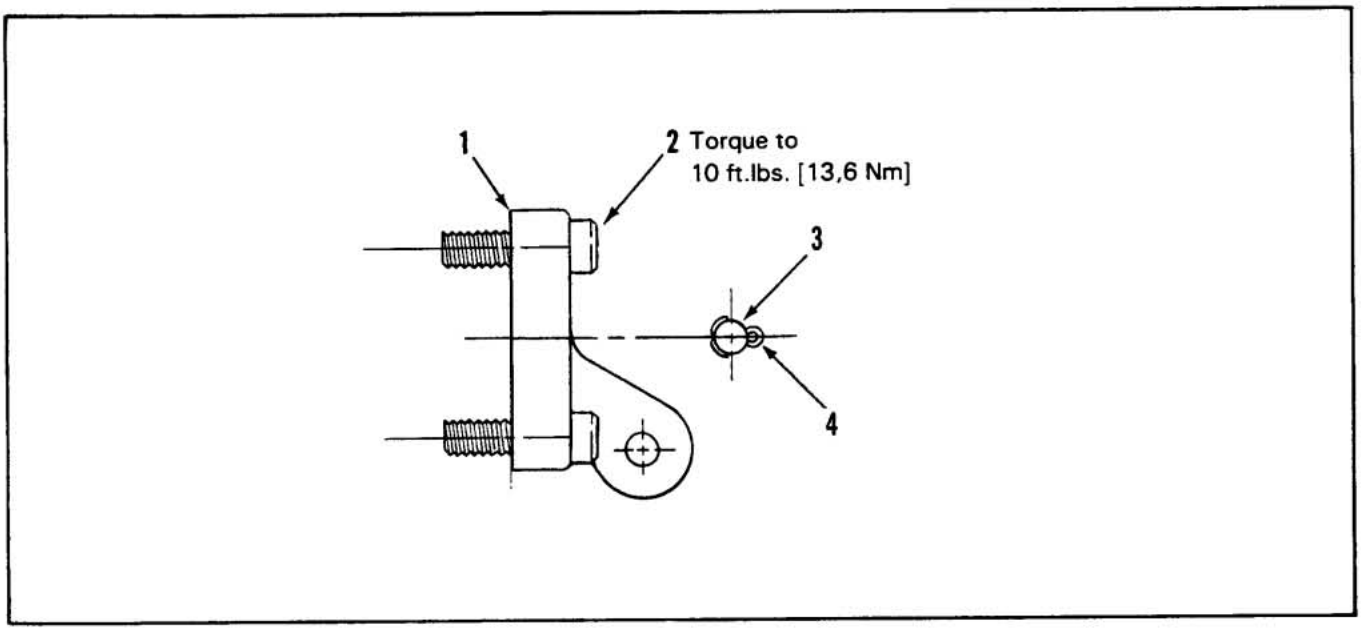


Figure 4-25. Handle Bracket Assembly.

HANDLE BRACKET ASSEMBLY

Item No.	Part No.	Description	Quantity
	K-6031-A	REPLACEMENT KIT, Standard, (Contains items 1, 2, 3 and 4)	
	K-6037-A	SERVICE KIT, Heavy Duty, (Contains items 1 and 2)	
1	1801-001	BRACKET, Die Cast (Standard)	1
	1801-002	BRACKET, Die Cast (Optional, for use with CRA Relief)	1
	7355-001	BRACKET, Cast Iron (Optional, Heavy Duty)	1
2	9161-407	SCREW, HSHC, 1/4-20 by 7/8 inch long	2
3	1857-001	PIN	1
4	0086-001	PIN, Cotter	1
5	1800-001	SEAL, Wiper, optional (not shown)	1

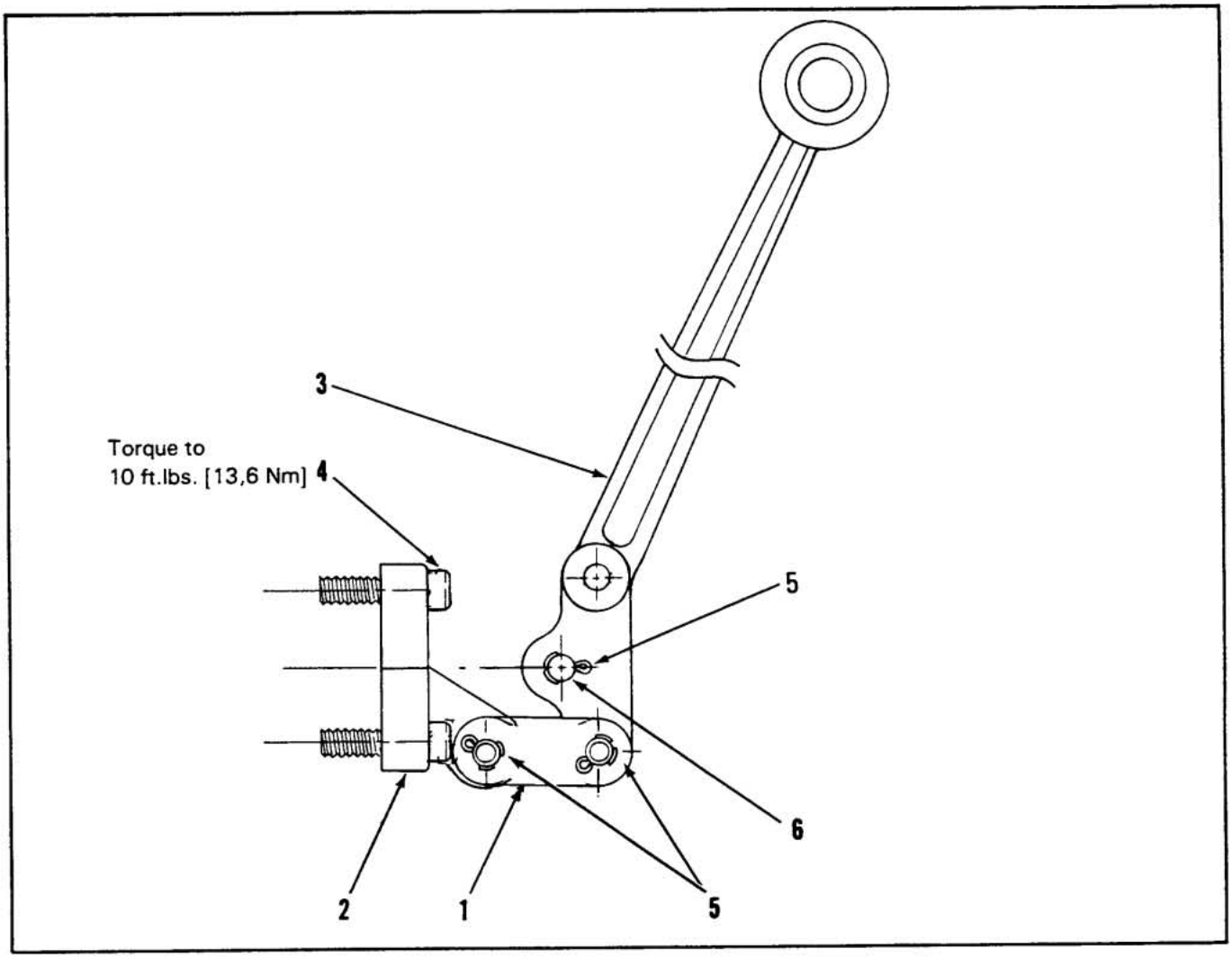


Figure 4-26. Optional Vertical Handle and Bracket Assembly.

OPTIONAL VERTICAL HANDLE and BRACKET ASSEMBLY

Item No.	Part No.	Description	Quantity
	K-6004-B	REPLACEMENT KIT, Standard (Black plastic coated handle)	
	K-6137-A	REPLACEMENT KIT, Optional (Plain handle)	
		All Replacement Kits contain all items listed below except No. 7355-001, Bracket	
1	11393-001	LINK	1
	11392-001	PLATE, Link	1
2	1801-001	BRACKET, Die Cast (Standard)	1
	7355-001	BRACKET, Cast Iron (Optional, Heavy Duty)	1
3	1802-001	HANDLE, Standard Vertical, Black plastic coated	1
	1802-003	HANDLE, Optional Vertical, Plain	1
4	9161-407	SCREW, HSHC, 1/4-20 by 7/8 inch long	2
5	0086-001	PIN, Cotter	3
6	1857-001	PIN	1
7	1800-001	SEAL, Wiper, optional (not shown)	1

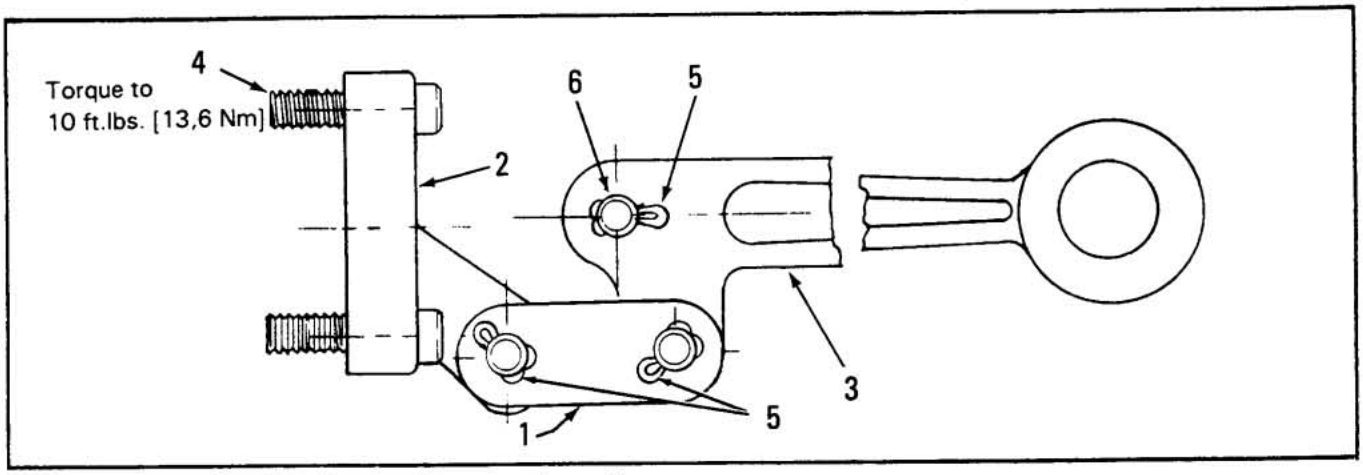


Figure 4-27. Optional Horizontal Handle and Bracket Assembly.

OPTIONAL HORIZONTAL HANDLE and BRACKET ASSEMBLY

Item No.	Part No.	Description	Quantity
	K-6007-B	REPLACEMENT KIT, Standard (Black plastic coated handle)	
	K-6139-A	REPLACEMENT KIT, Optional (Plain handle)	
		All Replacement Kits contain all items listed below except No. 7355-001, Bracket	
1	11393-001	LINK	1
	11392-001	PLATE, Link	1
2	1801-001	BRACKET, Die Cast (Standard)	1
	7355-001	BRACKET, Cast Iron (Optional Heavy Duty)	1
3	3249-001	HANDLE, Standard Horizontal, Black plastic coated	1
	3249-003	HANDLE, Optional Horizontal, Plain	1
4	9161-407	SCREW, HSHC, 1/4-20 by 7/8 inch long	2
5	086-001	PIN, Cotter	3
6	1857-001	PIN	1
7	1800-001	SEAL, Wiper, optional (not shown)	1

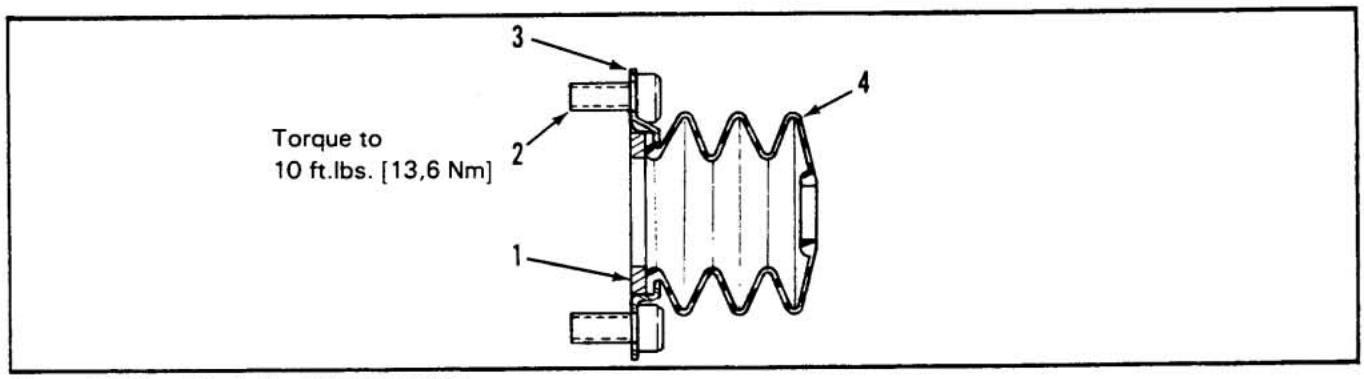


Figure 4-28. Spool Protective Boot Assembly.

SPOOL PROTECTIVE BOOT ASSEMBLY

Item No.	Part No.	Description	Quantity
	K-6056-B	REPLACEMENT KIT (Contains all items listed below)	
1	7624-001	WASHER, Breather	1
2	3731-098	SCREW, HSHC, 1/4-20 by 1/2 inch long	2
3	7623-001	RETAINER, Boot	1
4	7622-001	BOOT	1

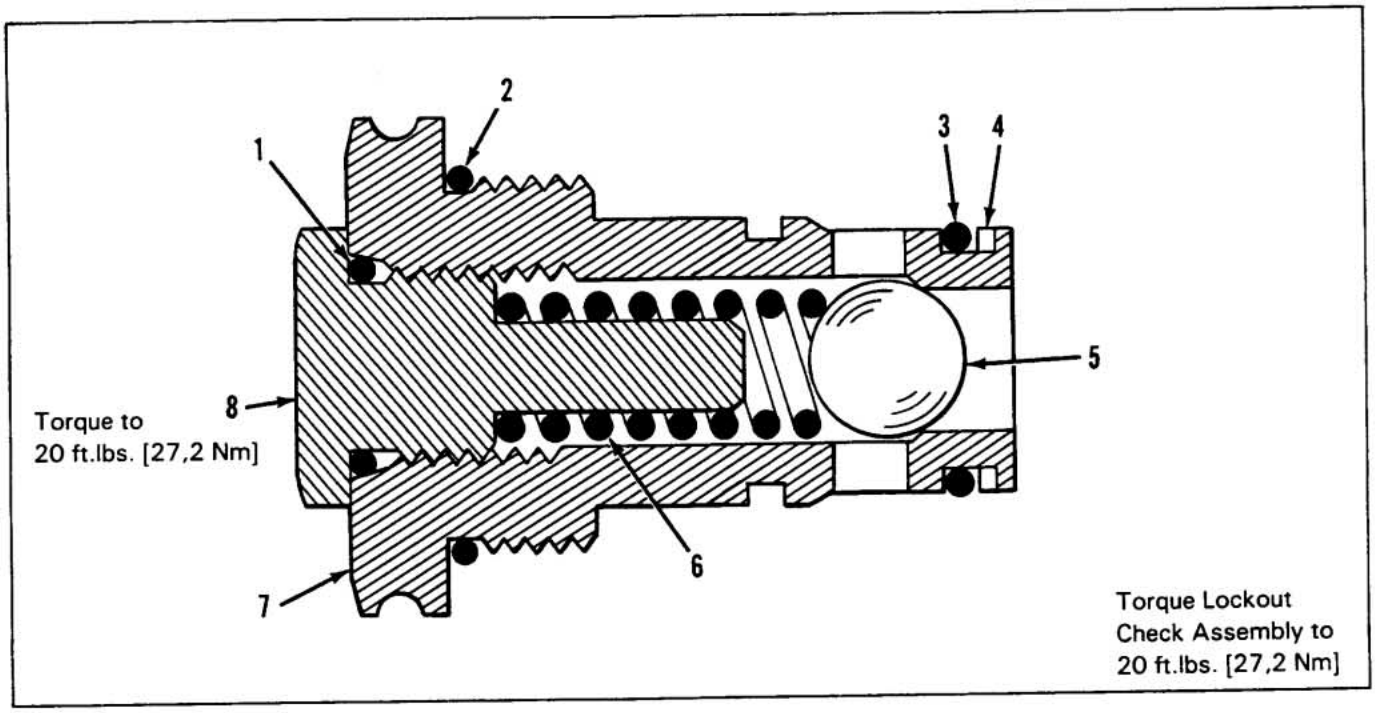


Figure 4-29. Lockout Check Assembly.

LOCKOUT CHECK ASSEMBLY

Item No.	Part No.	Description	Quantity Per Check
	K-6024-D*	REPLACEMENT KIT (Contains all items listed below)	
	K-6039*	SEAL KIT (Contains items 1 thru 4)	
1	0449-001*	SEAL, O-Ring	1
2	2707-001*	SEAL, O-Ring	1
3	1818-001*	SEAL, O-Ring	1
4	3092-001	RING, Back-Up, Cut	1
5	0071-001	BALL, Steel	1
6	1571-001	SPRING	1
7	11466-001	BODY, Check	1
8	0216-001	CAP, Check	1

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

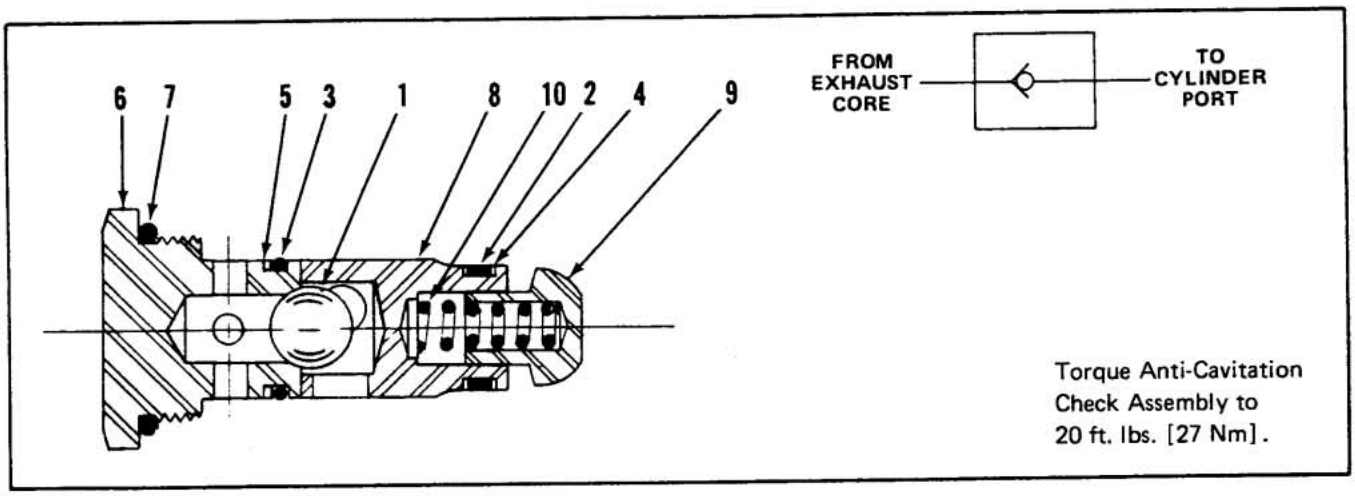


Figure 4-30. Optional Anti-Cavitation Check Assembly.

OPTIONAL ANTI-CAVITATION CHECK ASSEMBLY

Item No.	Part No.	Description		Quantity Per Check
	K-6021-A*	REPLACEMENT ANTI-CAVITATION ASSEMBLY (Contains all items listed below)		
	K-6032*	SEAL KIT (Contains items 2, 3, 4, 5 and 7 listed below)		
1	0071-001	BALL, Steel, 7/16 inch	Not Sold Separately Order K-6032	1
2	1818-001*	SEAL, O-Ring		1
3	1819-001*	SEAL, O-Ring		1
4	1820-001	WASHER, Back-Up, inner, Check Plug		2
5	1821-001	WASHER, Back-Up, Outer, Check Plug		1
6	1822-001	BODY, Check, Anti-Cavitation		1
7	2707-001*	SEAL, O-Ring		1
8	1823-001	RETAINER, Ball, Check		1
9	2781-001	CHECK, Steel		1
10	1868-001	SPRING, Check		1

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

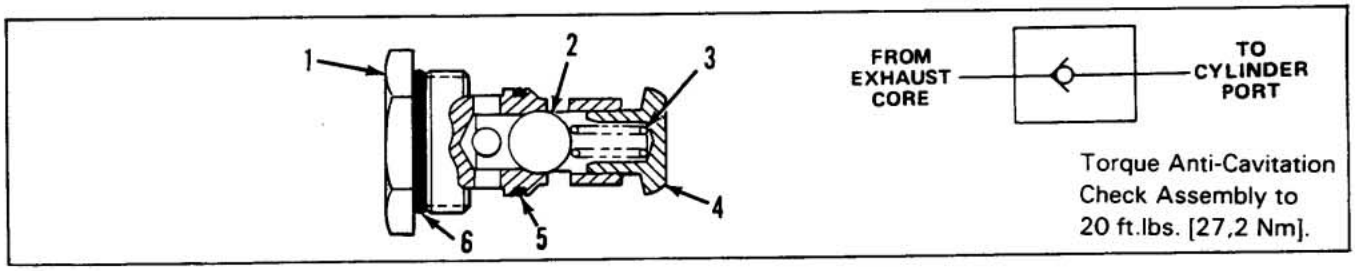


Figure 4-31. Optional, V20S Anti-Cavitation Check Assembly.

OPTIONAL, V20S ANTI-CAVITATION CHECK ASSEMBLY

Item No.	Part No.	Description		Quantity Per Check
	K-6205*	REPLACEMENT KIT (Contains all items listed below)		
	K-6206*	SEAL KIT (Contains items 5 and 6)		
1	11340-001	BODY, Check		1
2	0071-001	BALL, Steel, 7/16 inch		1
3	11343-001	SPRING, Check		1
4	7791-002	POPPET, Check		1
5	1819-001*	SEAL, O-Ring	Not sold separately. Order K-6206	1
6	2707-001*	SEAL, O-Ring		1

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

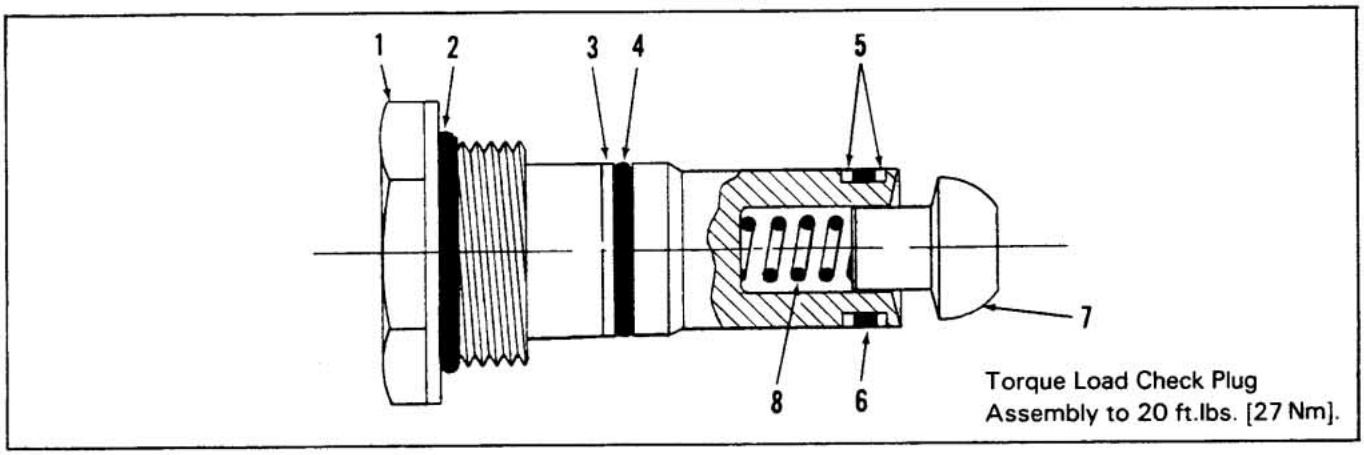


Figure 4-32. Load Check Plug Assembly.

LOAD CHECK PLUG ASSEMBLY

Item No.	Part No.	Description		Quantity Per Plug Assembly
	K-6030-A*	REPLACEMENT LOAD CHECK PLUG ASSEMBLY.		
	K-6032*	SEAL KIT, (Contains items 2, 3, 4, 5 and 6)		
1	3411-001	Plug, Lift Check, Steel (Heavy Duty)		1
2	2707-001*	SEAL, O-Ring	Not Sold Separately Order K-6032	1
3	1821-001	WASHER, Back-Up, Outer		1
4	1819-001*	SEAL, O-Ring, Outer		1
5	1820-001	WASHER, Back-Up, Inner		2
6	1818-001*	SEAL, O-Ring		1
7	2781-001	POPPET, Lift Check		1
8	1868-001	SPRING, Lift Check		1

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

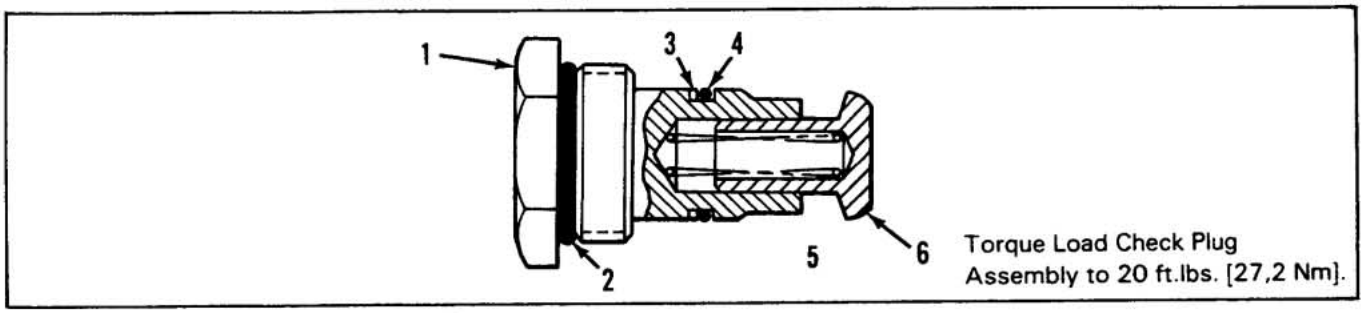


Figure 4-33. V20S Load Check Plug Assembly.

V20S LOAD CHECK PLUG ASSEMBLY

Item No.	Part No.	Description		Quantity Per Plug Assembly
	K-6203*	REPLACEMENT KIT (Contains all items listed below)		
	K-6204*	SEAL KIT (Contains items 2, 3 and 4)		
1	11241-001	PLUG, Load Check		1
2	2707-001*	SEAL, O-Ring	Not sold separately. Order K-6204	1
3	1821-001	RING, Back-Up		1
4	1819-001*	SEAL, O-Ring		1
5	1868-001	SPRING, Load Check		1
6	7791-001	POPPET, Load Check		1

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

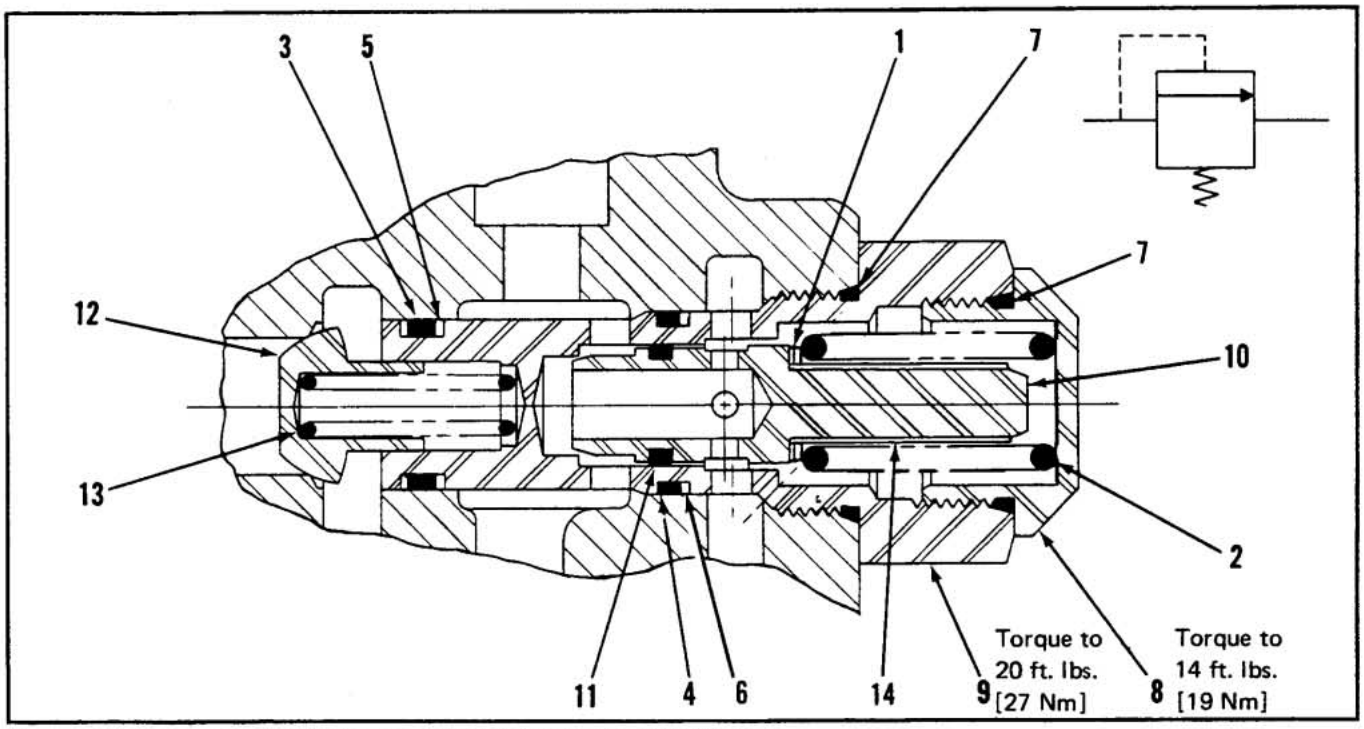


Figure 4-34. Optional Model RC Cylinder Port Relief (non-adjustable type).

OPTIONAL MODEL RC CYLINDER PORT RELIEF (Non-Adjustable Type)

For replacement Model RC Relief Cartridge, specify pressure setting required.

Item No.	Part No.	Description	Quantity Per Relief
	K-19002	SERVICE KIT (Contains items 10 and 11)	
	K-6005A*	SEAL KIT (Contains all seals - items 3, 4, 5, 6 and 7)	
1	0458-001	SHIM (.040 inch [1,0 mm] thick)	A/R
	0459-001	SHIM (.020 inch [0,5 mm] thick)	A/R
	0462-001	SHIM (.010 inch [0,25 mm] thick)	A/R
2	1450-001	SPRING (500-1350 PSI [35-93 bar] Crack)	1
	1869-001	SPRING (500-1249 PSI [34-86 bar] Crack)	1
	7638-001	SPRING (1250-1749 PSI [86-121 bar] Crack)	1
	7078-001	SPRING (1750-1999 PSI [121-138 bar] Crack)	1
	1870-001	SPRING (2000-2599 PSI [138-179 bar] Crack)	1
3	1818-001*	SEAL, O-Ring — Not Sold Separately Order K-6005A	1
4	1819-001*	SEAL, O-Ring — Not Sold Separately Order K-6005A	1
5	1820-001	WASHER, Back-Up, Inner, Check Plug — Not Sold Separately Order K-6005A	2
6	1821-001	WASHER, Back-Up, Outer, Check Plug — Not Sold Separately Order K-6005A	1
7	2707-001*	SEAL, O-Ring — Not Sold Separately Order K-6005A	2
8	1880-001	CAP, Relief	1
9	1884-001	BODY, Relief	1
10	1881-001	POPPET, Relief — Not Sold Separately Order K-19002	1
11	1883-001	RING, Piston — Not Sold Separately Order K-19002	1
12	2781-001	CHECK, Steel	1
13	1868-001	SPRING, Check	1
14	7874-001	SLEEVE, Dampening (Not to be used with 1450-001 and 1451-001 Springs)	1

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

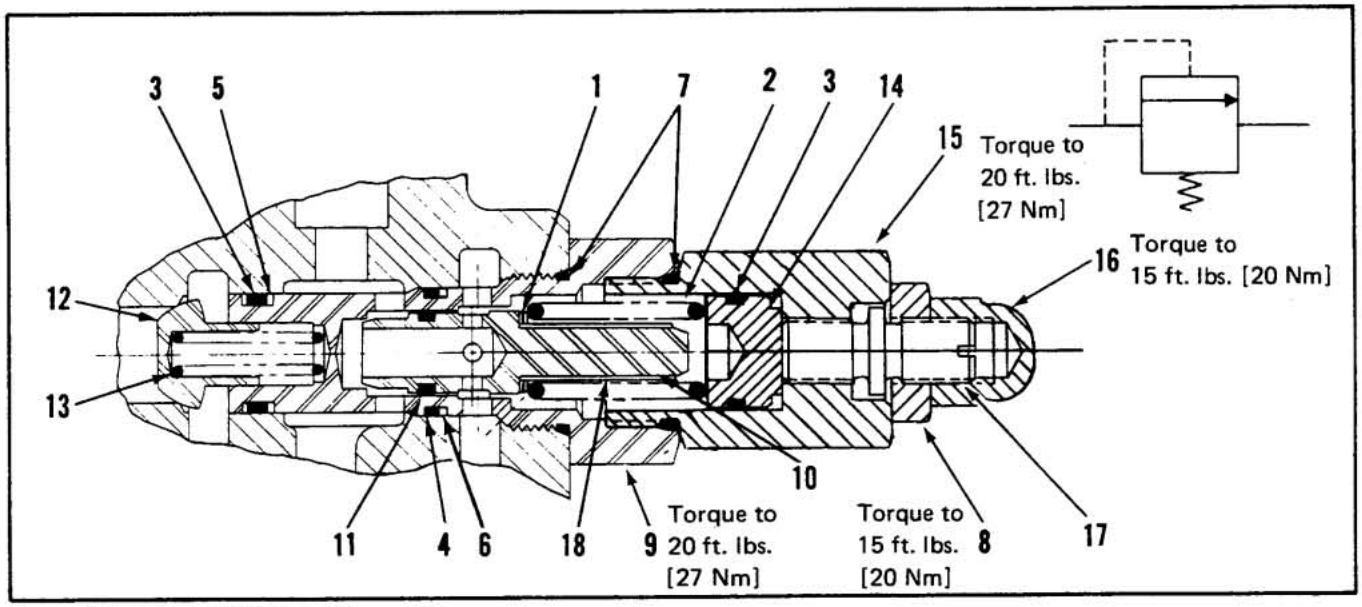


Figure 4-35. Optional RCA Relief Assembly.

OPTIONAL RCA RELIEF ASSEMBLY

All V20 Valves are machined to accept this assembly without modification. Simply remove load check assembly and install RCA combination.

Model RCA cannot be used on handle end of valve section with No. 1802-001 Vertical Handle due to interference.

Item No.	Part No.	Description	Quantity Per Relief
	K-19002	SERVICE KIT (Contains items 10 and 11)	
	K-6005A*	SEAL KIT (Contains all seals, items 3, 4, 5, 6 and 7)	
1	0458-001	SHIM (.040 inch [1,0 mm] thick)	A/R
	0459-001	SHIM (.020 inch [0,5 mm] thick)	A/R
	0462-001	SHIM (.010 inch [0,25 mm] thick)	A/R
2	7638-001	SPRING, S.S., 750-1500 PSI [52-103 bar]	1
	7078-001	SPRING, S.S., 1250-2000 PSI [86-138 bar]	1
	1870-001	SPRING, S.S., 1500-2500 PSI [103-172 bar]	1
	7497-001	SPRING, S.S., 2000-3000 PSI [138-207 bar]	1
3	1818-001*	SEAL, O-Ring	2
4	1819-001*	SEAL, O-Ring	1
5	1820-001	WASHER, Back-Up, Inner	2
6	1821-001	WASHER, Back-Up, Outer	1
7	2707-001*	SEAL, O-Ring	2
8	3500-001	NUT, Jam	1
9	1884-001	BODY, Relief	1
10	1881-001	POPPET, Relief	1
11	1883-001	RING, Piston	1
12	2781-001	CHECK, Steel	1
13	1868-001	SPRING, Check	1
14	11481-001	PISTON	1
15	3498-001	CAP, Adjustable Relief	1
16	3497-001	NUT, Acorn	1
17	3496-001	STEM, Adjustable	1
18	7874-001	SLEEVE, Dampening (Not to be used with 1450-001 or 1451-001 Springs)	1

Items 3, 4, 5, 6, 7: Not Sold Separately Order K-6005A

Items 10, 11: Not Sold Separately Order K-19002

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

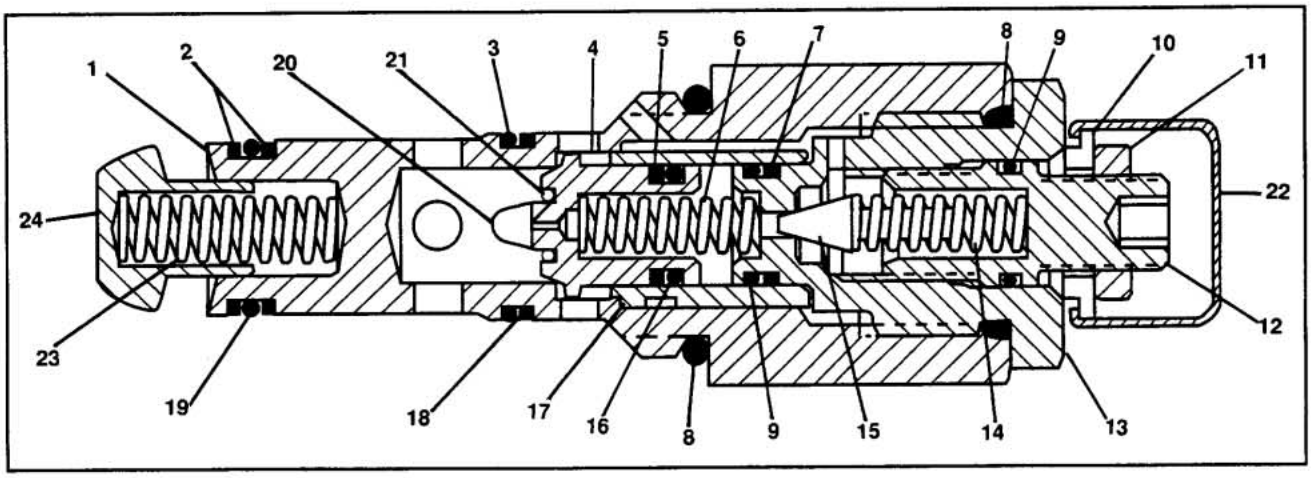


Figure 4-36. Optional RP 20-N Relief Assembly.

OPTIONAL RP 20-N CYLINDER PART RELIEF

All V20 valves are machined to accept this assembly without modification. Simply remove load check assembly and install RCA combination.

Item No.	Part No.	Description	Quantity Per Relief
	K-6192	SEAL KIT (Contains items 2, 3, 5, 7, 8, 9, 16, 18 and 19)	
1	20497-001	BODY, Relief	1
2	1820-001	RING, Back-Up	2
3	01819-001*	SEAL, O-Ring	1
4	20499-001	POPPET, Main	1
5	21581-001	RING, Back-Up	1
6	20503-001	SPRING	1
7	21582-001	RING, Back-Up	1
8	02707-001*	SEAL, O-Ring	2
9	09001-012*	SEAL, O-Ring	2
10	10035-001	WASHER	1
11	09302-006	NUT, Hex Jam	1
12	08956-001	SCREW, Adjustment	1
13	20500-001	BODY, Pilot	1
14	10059-001	SPRING	1
15	08475-001	POPPET, Relief	1
16	07830-001*	SEAL, O-Ring	1
17	20125-001	SLEEVE, Relief	1
18	01821-001	RING, Back-Up	1
19	01818-001*	SEAL, O-Ring	1
20	11839-001	SCREEN, Filter	1
21	11840-001	RING, Retaining	1
22	10034-001	COVER, Tamper Proof	1
23	01868-001	SPRING	1
24	02781-001	POPPET	1

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

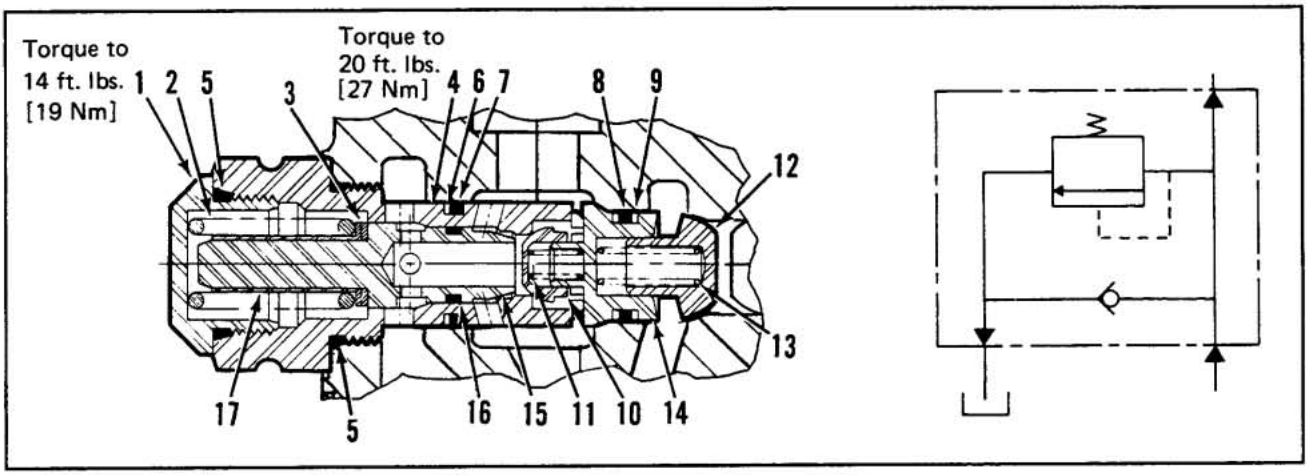


Figure 4-37. Optional Combination Relief and Anti-Cavitation Check Assembly (CRA)

OPTIONAL COMBINATION RELIEF and ANTI-CAVITATION CHECK ASSEMBLY (CRA)

All V20 Valves are machined to accept this assembly without modification. Simply remove load check assembly and install RCA combination.

Item No.	Part No.	Description	Quantity Per Relief
	K-19002	SERVICE KIT (Contains items 15 and 16)	
	K-6005A*	SEAL KIT (Contains items 5, 6, 7, 8 and 9)	
1	1880-001	CAP, Relief	1
2	1869-001	SPRING (500-1249 PSI [34-86 bar] Crack)	1
	7638-001	SPRING (1250-1749 PSI [86-121 bar] Crack)	1
	7078-001	SPRING (1750-1999 PSI [121-138 bar] Crack)	1
	1870-001	SPRING (2000-2599 PSI [138-179 bar] Crack)	1
3	0458-001	SHIM (.040 inch [1,0 mm] thick)	A/R
	0459-001	SHIM (.020 inch [0,5 mm] thick)	A/R
	0462-001	SHIM (.010 inch [0,25 mm] thick)	A/R
4	7741-001	BODY, Combination	1
5	2707-001*	SEAL, O-Ring (Not Sold Separately Order K-6005A)	2
6	1821-001	WASHER, Back-Up Outer (Not Sold Separately Order K-6005A)	1
7	1819-001*	SEAL, O-Ring (Not Sold Separately Order K-6005A)	1
8	1818-001*	SEAL, O-Ring (Not Sold Separately Order K-6005A)	1
9	1820-001	WASHER, Back-Up Inner (Not Sold Separately Order K-6005A)	2
10	7743-001	POPPET, Anti-Cavitation	1
11	7744-001	SPRING, Anti-Cavitation	1
12	6015-001	POPPET (See Note)	1
13	6016-001	SPRING, Check (See Note)	1
14	7742-001	RETAINER, Poppet	1
15	1881-001	POPPET, Relief (Not Sold Separately Order K-19002)	1
16	1883-001	RING, Piston (Not Sold Separately Order K-19002)	1
17	7874-001	SLEEVE, Dampening (not to be used with 1450-001 or 1451-001 Springs)	1

Notes:

1. Replacement Model CRA Cartridge includes items 12 and 13. Specify pressure setting.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

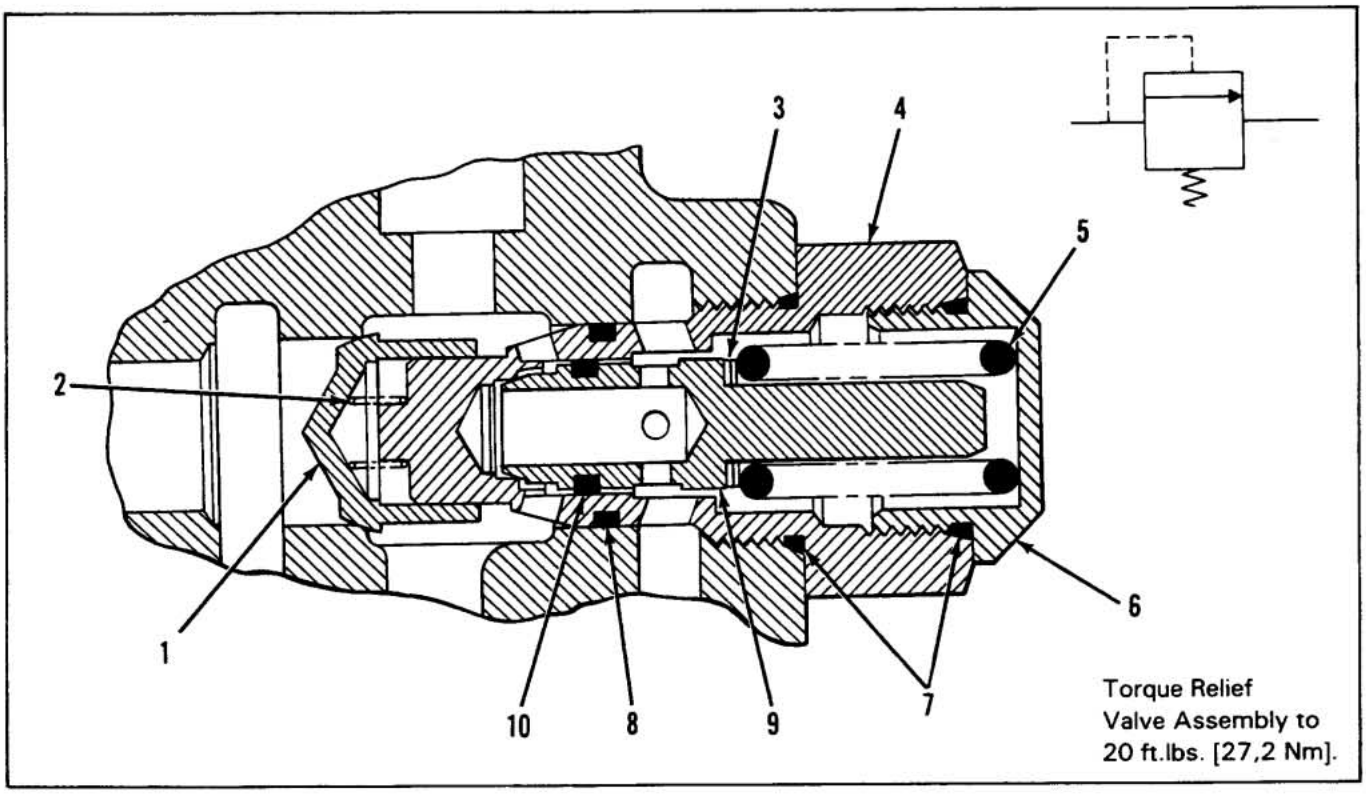


Figure 4-38. Optional V20S Work Port Relief. Model RCS (Non-Adjustable).

OPTIONAL V20S WORK PORT RELIEF, MODEL RCS (Non-Adjustable)

Item No.	Part No.	Description	Quantity Per Relief
	K-19002	SERVICE KIT (Contains items 9 and 10)	
	K-6206*	SEAL KIT (Contains items 7 and 8)	
1	11469-001	POPPET, Check	1
2	11470-001	SPRING, Check	1
3	0458-001	SHIM (.040 inch [1,0 mm] thick)	A/R
	0459-001	SHIM (.020 inch [0,5 mm] thick)	A/R
	0462-001	SHIM (.010 inch [0,25 mm] thick)	A/R
4	11471-001	BODY, RCS Relief	1
5	1869-001	SPRING (500-1249 PSI [35-86 bar] Crack)	1
	7638-001	SPRING (1250-1749 PSI [86-121 bar] Crack)	1
	7078-001	SPRING (1750-1999 PSI [121-138 bar] Crack)	1
	1870-001	SPRING (2000-2599 PSI [138-179 bar] Crack)	1
6	1880-001	CAP, Relief	1
7	2707-001*	SEAL, O-Ring } Not sold separately.	1
8	1819-001*	SEAL, O-Ring } Order K-6206	1
9	1881-001	POPPET, Relief } Not sold separately.	1
10	1883-001	RING, Piston } Order K-19002	1

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

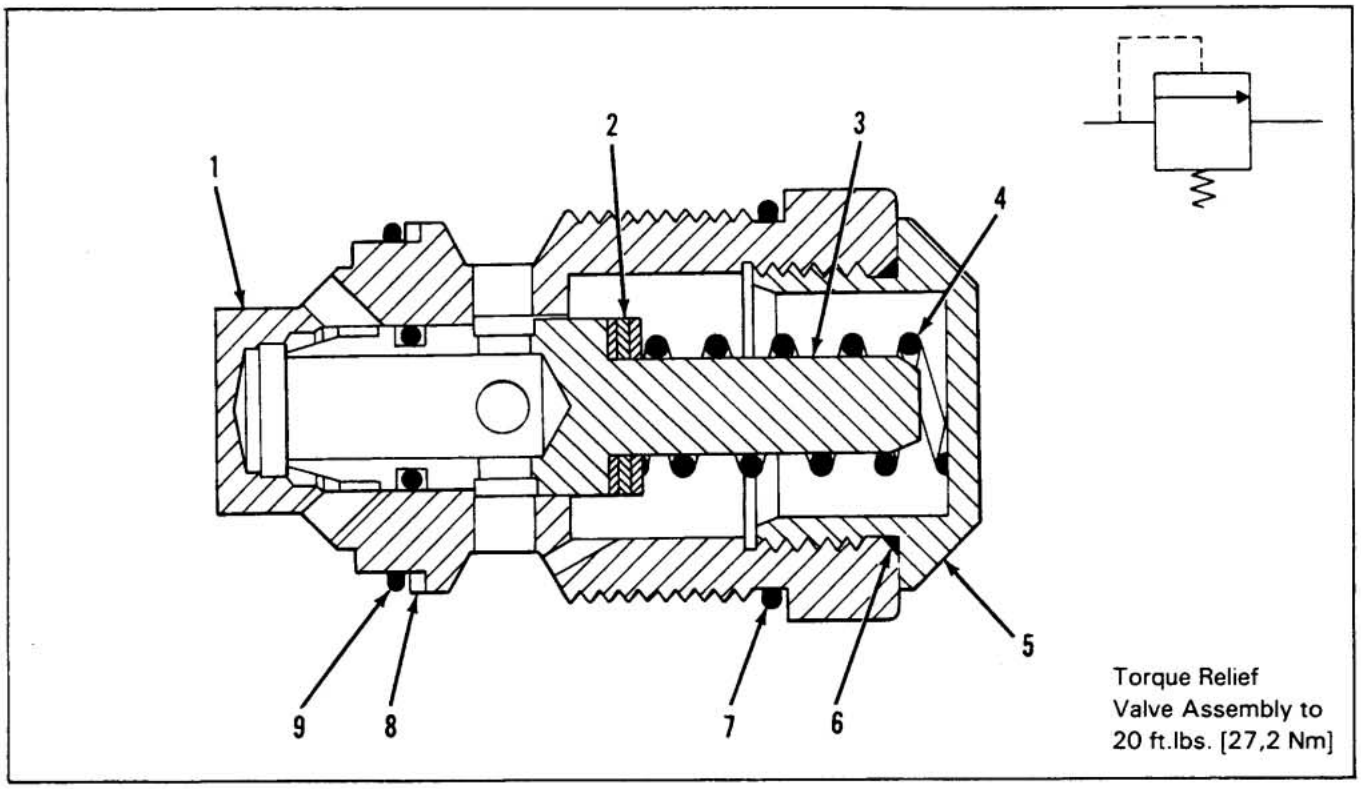


Figure 4-39. Model WH Differential Popper Main Relief Valve (Non-Adjustable).

MODEL WH DIFFERENTIAL POPPET MAIN RELIEF VALVE (Non-Adjustable)

Item No.	Part No.	Description	Quantity Per Relief
	K-19003-A*	SEAL KIT (Contains items 6 thru 9)	
1	6533-001	BODY, WH Relief	1
2	0458-001	SHIM (.040 inch [1,0 mm] thick)	A/R
	0459-001	SHIM (.020 inch [0,5 mm] thick)	A/R
	0462-001	SHIM (.010 inch [0,25 mm] thick)	A/R
3	3936-001	POPPET	1
4	1869-001	SPRING (500-1249 PSI [35-86 bar] Crack)	1
	7638-001	SPRING (1250-1749 PSI [86-121 bar] Crack)	1
	7078-001	SPRING (1750-1999 PSI [121-138 bar] Crack)	1
	1870-001	SPRING (2000-2599 PSI [138-179 bar] Crack)	1
5	1880-001	CAP, Relief	1
6	2707-001*	SEAL, O-Ring	1
7	1615-001*	SEAL, O-Ring	1
8	9020-022	RING, Back-Up	1
9	1718-001*	SEAL, O-Ring	1

Not sold separately. Order K-19003-A

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

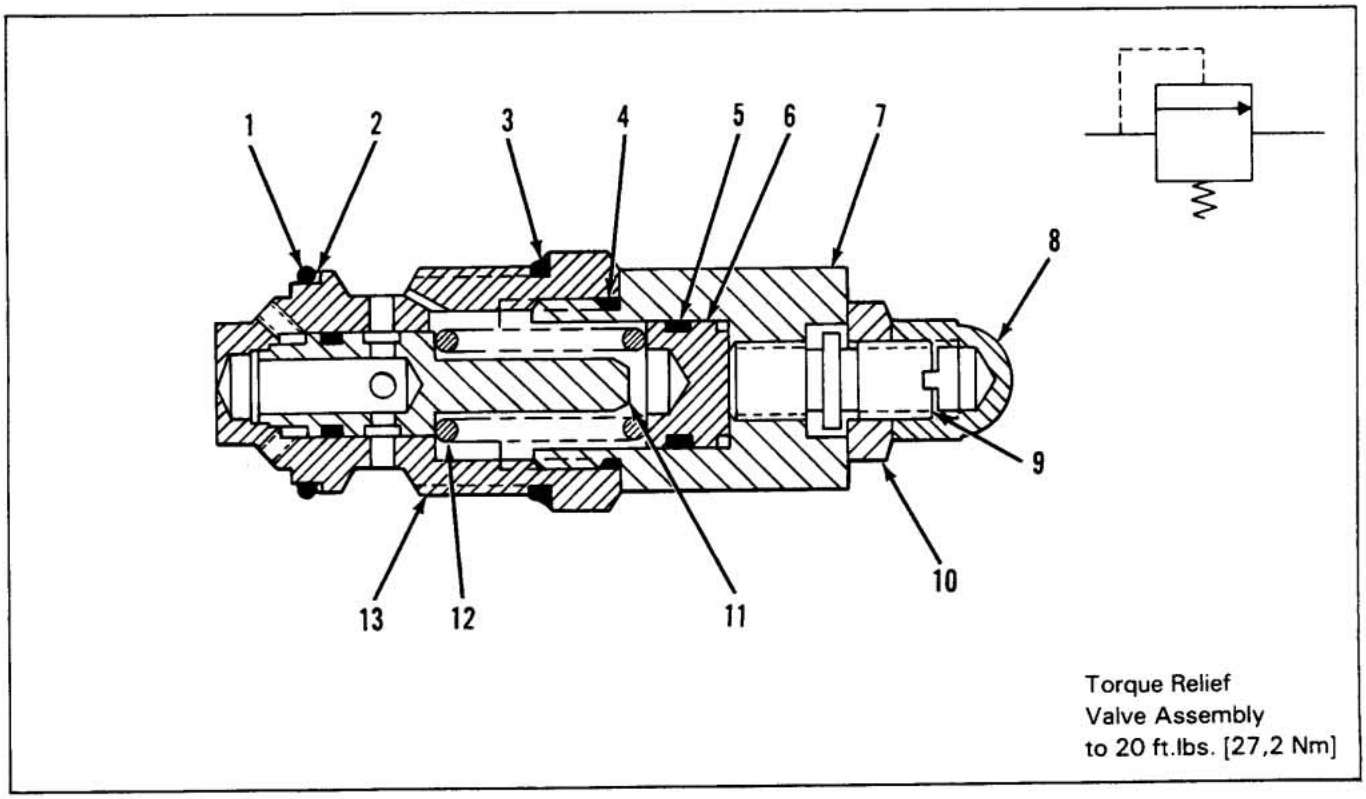


Figure 4-40. Model WHA Differential Poppet Main Relief Valve (Adjustable within the spring range).

MODEL WHA DIFFERENTIAL POPPET MAIN RELIEF VALVE (Adjustable within the spring range)

Item No.	Part No.	Description	Quantity Per Relief
	K-19012*	SEAL KIT (Contains items 1 thru 5)	
1	1718-001*	SEAL, O-Ring } Not sold separately. Order K-19012	1
2	9020-022	RING, Back-Up }	1
3	1615-001*	SEAL, O-Ring }	1
4	2707-001*	SEAL, O-Ring }	1
5	1818-001*	SEAL, O-Ring }	1
6	3495-001	PISTON	1
7	3498-001	CAP	1
8	3497-001	NUT, Acorn	1
9	3496-001	STEM, Adjusting	1
10	3500-001	NUT, Hex Jam	1
11	3936-001	POPPET	1
12	7638-001	SPRING, S.S., 750-1500 PSI [52-103 bar] Crack	1
	7078-001	SPRING, S.S., 1250-2000 PSI [86-138 bar] Crack	1
	1870-001	SPRING, S.S., 1500-2500 PSI [103-172 bar] Crack	1
	7497-001	SPRING, S.S., 2000-3000 PSI [138-207 bar] Crack	1
13	6533-001	BODY, WH Relief	1

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

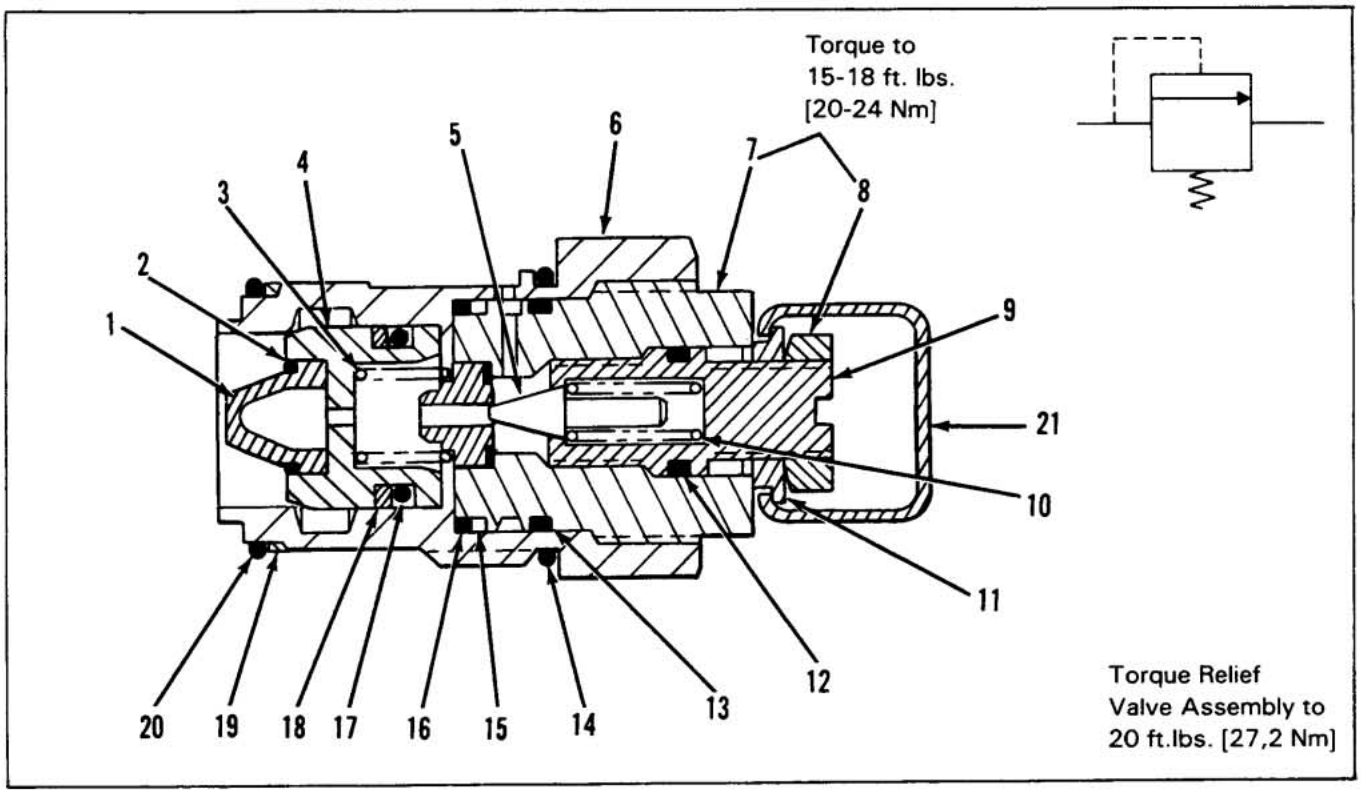


Figure 4-41. Model RP51 Pilot Operated Main Relief Valve.

MODEL RP51 PILOT OPERATED MAIN RELIEF VALVE

Item No.	Part No.	Description	Quantity
	K-19005*	SEAL KIT (Contains items 12-20)	
1	12675-001	FILTER	1
2	10298-001	RING, Retaining	1
3	20254-001	SPRING	1
4	20209-001	POPPET, Main	1
5	8475-001	POPPET, Relief	1
6	8954-001	BODY, Relief Valve	1
7	11059-001	BODY, Pilot Assembly	1
8	9302-006	NUT, Hex Jam	1
9	8956-001	SCREW, Adjustment	1
10	10059-001	SPRING, Pilot	1
11	10035-001	WASHER, RP51-N (Shown)	1
	10852-001	WASHER, ID, RP51-A (Not Shown)	1
12	6884-001*	SEAL, O-Ring	1
13	6814-002*	SEAL, O-Ring	1
14	1615-001*	SEAL, O-Ring	1
15	9020-019	RING, Back-Up	1
16	1660-001*	SEAL, O-Ring	1
17	9000-113*	SEAL, O-Ring	1
18	20903-001	RING, Back-Up	1
19	9020-022	RING, Back-Up	1
20	1718-001*	SEAL, O-Ring	1
21	10034-001	COVER, Tamperproof (RP51-N only)	1

Not sold separately. Order K-19005

NOTE

Due to close tolerances on working parts, Model RP51 is not field serviceable. If service other than seal replacement is required, contact the factory.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

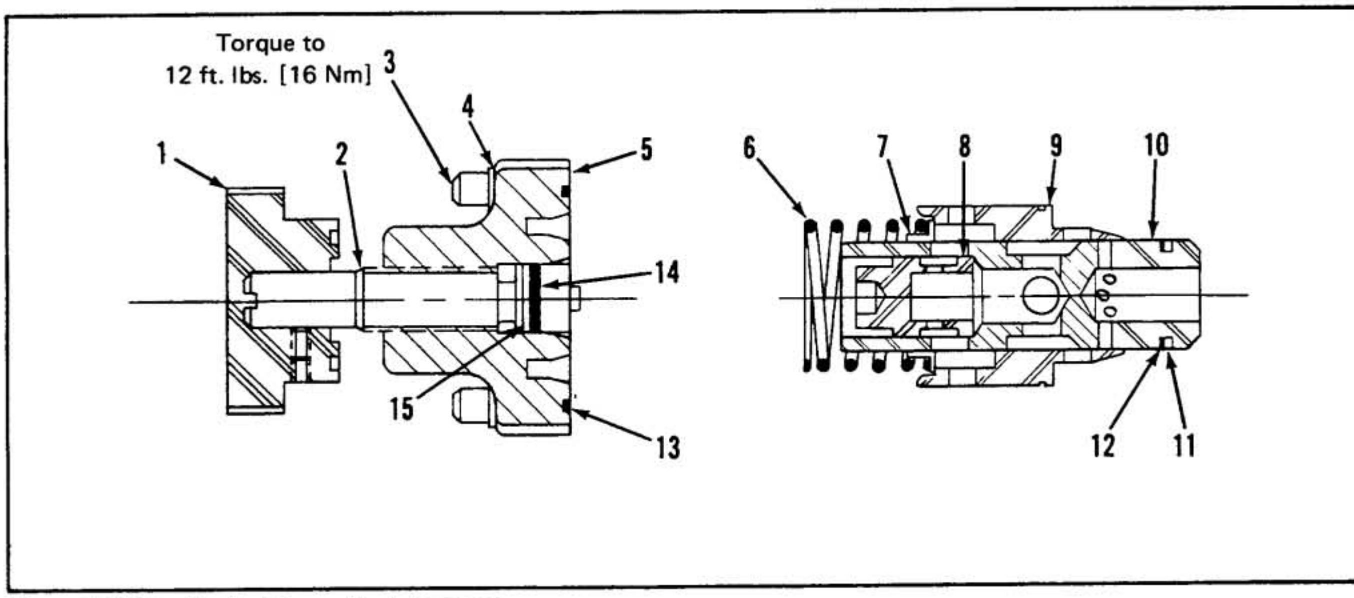


Figure 4-42. Flow Control Assembly, Inlet Cover.

FLOW CONTROL ASSEMBLY, INLET COVER

Item No.	Part No.	Description		Quantity
	K-6066-C	REPLACEMENT KIT, Actuator (Contains items 1 thru 5 and 13 thru 15)		
	K-6067-A	REPLACEMENT KIT, Flow Control, 3-16 GPM [11-60 litres/min]		
	K-6068-A	REPLACEMENT KIT, Flow Control, 8-25 GPM [30-95 litres/min]		
	K-6069-A	REPLACEMENT KIT, Flow Control, 13-21 GPM [49-79 litres/min] (Flow Control Replacement Kits contain items 6 thru 12)		
	K-6065	SEAL KIT (Contains items 11 thru 15)		
1	3236-001	KNOB		1
2	6309-001	ADJUSTER, Flow (Standard)		1
	3902-001	ADJUSTER, Flow (Optional, 3-inch [76 mm] stem)		1
3	3731-101	SCREW, Hex Head		4
4	0563-001	WASHER, Lock		4
5	3906-001	CAP, Control		1
	3906-002	CAP, Control (For use with optional dust boot)		1
6	3882-001	SPRING, Control		1
7	6665-001	COLLAR		
8	3897-001	PISTON, Control 3-16 GPM [11-60 litres/min]	See Note	1
	7740-001	PISTON, Control, 8-25 GPM [30-95 litres/min]	See Note	1
	7483-001	PISTON, Control, 13-21 GPM [49-79 litres/min]	See Note	1
9	3891-001	SLEEVE, Metering, 3-16 GPM [11-60 litres/min]	See Note	1
	7484-001	SLEEVE, Metering, 8-25 and 13-21 GPM [30-95 and 49-79 litres/min]	See Note	1
10	3888-001	GUIDE, Sleeve, 3-16 GPM [11-60 litres/min]	See Note	1
	7485-001	GUIDE, Sleeve, 8-25 and 13-21 GPM [30-95 and 49-79 litres/min]	See Note	1
11	1821-001	WASHER, Back-Up	Not sold separately. Order K-6065	1
12	1819-001*	SEAL, O-Ring	Not sold separately. Order K-6065	1
13	3911-001	SEAL, O-Ring	Not sold separately. Order K-6065	1
14	9001-012	SEAL, O-Ring	Not sold separately. Order K-6065	1
15	3908-001	WASHER, Back-Up	Not sold separately. Order K-6065	1
16	10957-001	BOOT (Not shown, cannot be used with knob)		1

Note:

These are matched parts and are not sold separately. Order appropriate Replacement Kit for required GPM flow control.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

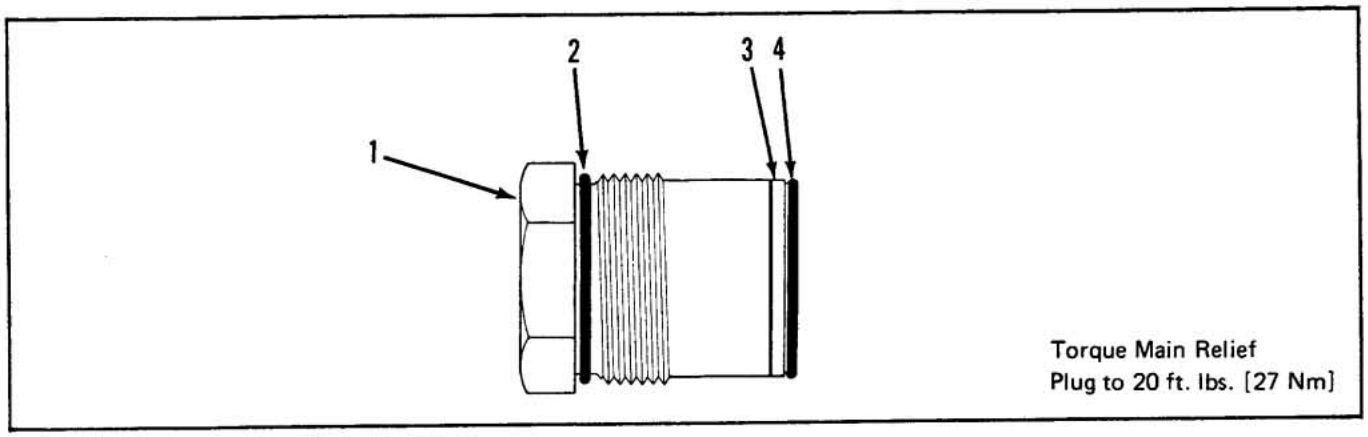


Figure 4-43. Main Relief Plug.

"NR" MAIN RELIEF PLUG

Item No.	Part No.	Description	Quantity
	K-6132-A	REPLACEMENT PLUG ASSEMBLY (Contains all items listed below)	
	K-28062-A	SEAL KIT (Contains items 2, 3 and 4)	
1	6760-001	PLUG, Relief	1
2	1615-001*	SEAL, O-Ring } Not Sold	1
3	9020-022	WASHER, Back-Up } Separately	1
4	1718-001	SEAL, O-Ring } Order K-28062	1

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

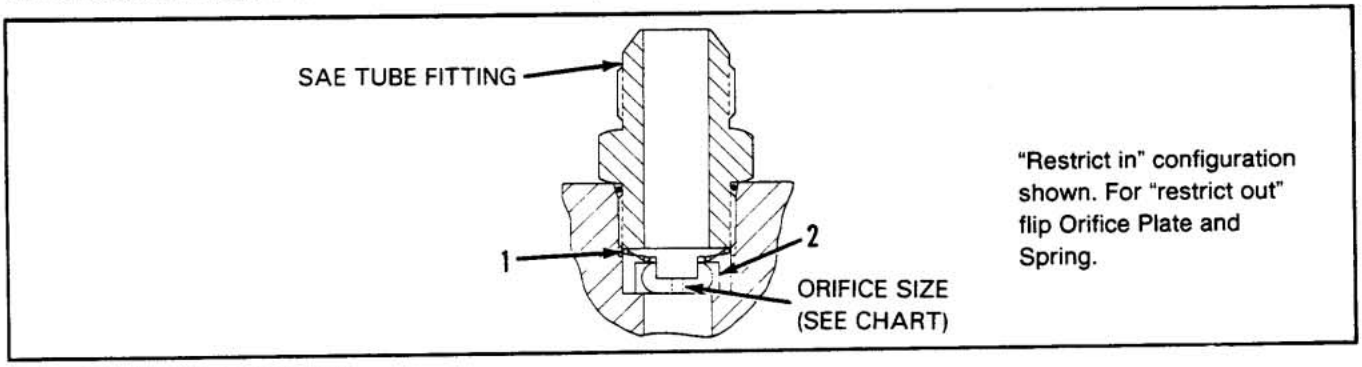


Figure 4-44. Work Port Restrictors.

WORK PORT RESTRICTORS

Item No.	Port No.	Description	Quantity
	11031-xxx*	RESTRICTOR ASSEMBLY, SAE 8 Port (Contains items 1 and 2)	
	10098-xxx*	RESTRICTOR ASSEMBLY, SAE 10 Port (Contains items 1 and 2)	
1	10821-001	SPRING, Conical (SAE 8 Port)	1
	10064-001	SPRING, Conical (SAE 10 Port)	1
2	10817-xxx*	PLATE, Orifice (SAE 8 Port)	1
	10063-xxx*	PLATE, Orifice (SAE 10 Port)	1

*The last three digits of the Restrictor Assembly and Orifice Plate part numbers are the same as the orifice hole size. Example: .062 hole is part number XXXXX-062.

ORIFICE HOLE SIZES AVAILABLE

SAE 8 PORT	SAE 10 PORT
015, 028, 032, 046, 055, 062, 074, 082, 095, 109, 125, 141, 156, 172, 189, 220	015, 032, 037, 047, 053, 062, 070, 076, 082, 086, 095, 109, 125, 141, 156, 189, 203, 220, 281

Standard Buna-N Seals and O-Rings

All standard Gresen products utilize Buna-N seals which are compatible with petroleum base, water-in-oil emulsions, and water-glycol fluids. Phosphate ester type fire-resistant fluids will cause Buna-N seals to swell. This swelling is not normally detrimental to static seals, but will be a problem for dynamic seals such as valve spool seals. Swelling of these seals can result in binding. The temperature range of Buna-N seals is −40°F to +200°F [−40°C to +93°C].

Table 4-1. Cross Reference For Seals and O-Rings, Buna-N to Viton

Buna-N Part No.	Viton Part No.	Application
1129-001	None	
1615-001	7447-001	Section Seal, Exhaust
1718-001	7446-001	WC Relief, NR Plug
1721-001	7612-001	Power Beyond Sleeve, Inner
1800-001	None	
1818-001	7444-001	Inner Check Plug Seal
1819-001	7445-001	Outer Check Plug Seal
1853-001	7613-001	Quad Seal, Float
2706-001	None	
2707-001	7448-001	Check Plug Seal
2709-001	6277-001	Power Beyond Sleeve, Outer
6806-001	None	
21857-001	9003-117	Section Seal, Pressure (new)
6814-002	7450-001	Section Seal, Pressure (old)
21733-001	9002-119	Section Seal, Exhaust (new)
6815-002	7451-001	Section Seal, Exhaust (old)
21866-001	9002-108	Section Seal, Load Sensing (new)
8316-001	9002-011	Section Seal, Load Sensing (old)

Optional Viton Seals and O-Rings

Viton seals are recommended for most applications that use phosphate-ester type fluids. Viton seals are also recommended for applications that have a continuous operating temperature of +200°F [+93°C] or more.

Table 4-2. Cross Reference For Seal Kits, Buna-N to Viton

Buna-N Kit No.	Viton Kit No.	Application
K-6001-A	None	
K-6002-A	None	
K-6005-A	K-6041	RC Relief
K-6017-B	K-6053-A	Power Beyond (1/2 NPTF)
K-6018-B	K-6054-A	Power Beyond (SAE 8)
K-6019-B	K-6055-A	Power Beyond (SAE 10)
K-6021-A	K-6043	Anti-Cavitation Check
K-6027-A	K-6046	Section Seal, 3-Way, 4-Way
K-6028-C	K-6049-A	Section Seal, Float
K-6030-C	K-6047	Check Plug
K-6032	K-6041	Load Check, Anti-Cav. Check, RC Relief
K-6034-D	None	
K-6035-A	K-6048	Spool Seal
K-6039	None	
K-6040-C	None	

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www.parker.com/hydraulicvalve

Bulletin HY14-2705-M3/US,
3C, 8/02, PHD

White Hydraulics, Inc.
P.O. Box 1127
Hopkinsville, KY 42241
Phone- (270) 885-1110
Fax- (270) 886-8462

WHITE HYDRAULICS

PI444002
9/01

Service Instructions For The
RE (500/501) Series

For Use With
Seal Kit 500444002

*****USE EXPLODED VIEW ON BACK FOR REFERENCE*****

A) Remove all shaft related components from shaft (27) (i.e. keys, wire rings, nuts). To aid in reassembly of the motor, make a "V" shaped set of lines from the endcover (24) to the housing using either paint or a marker. With shaft facing down, secure motor in vise by clamping on to housing (15).

B) Loosen and remove seven bolts (26) holding motor assembly together. Remove endcover (24) and endcover seal (10). Discard seal. Remove balance plate (22) taking care not to drop the three steel balls (23) located in the three holes in the balance plate (22). Remove rotor assembly (21), manifold (19), drive link spacer (20) (NOTE: Some motors do not use spacer), drive link (18) and thrust bearing (17). Remove body seals (9) from rotor assembly (21) and housing seal (8) from housing (15) and discard seals. (NOTE: Compare old housing seal (8) to the two housing seals included in kit to determine which one to use.)

C) Gently tap shaft (27) upward from housing (15) and remove through rear of housing and lay aside. Remove housing (15) from vise and turn over. Pry dust seal (1) from housing. Push the seal carrier (11), thrust washer (12) and thrust bearing (13) down until they make contact with the roller bearing (14) located in the housing bore.

D) Remove wire ring (2), steel backup shim (3) and high pressure seal (4) from inner bore groove with a small screwdriver Lift our seal carrier (11), thrust washer (12) and thrust bearing (13) from the housing bore. Using a small screwdriver, carefully pry shaft seal (7), backup seal (6), and metal backup shim (5) from seal carrier (11) and discard. Lay seal carrier (11), thrust washer (12) and thrust bearing (13) aside. (NOTE: If a new thrust washer (12) and seal carrier (11) is included in kit, old items may be discarded).

E) At this point, all parts should be cleaned in an oil-base solvent and dried using compressed air (For safety, observe all OSHA safety guidelines). All new seals should be lightly coated in clean oil prior to installation.

F) Place shaft (27) on a clean flat surface with output end facing up. Place thrust bearing (13) (NOTE: If thrust bearing has integral washer, make sure washer surface faces down.) Then thrust washer (12) on shaft (See Technical Bulletin PI444004 to determine correct thrust washer to use). Lightly coat seal area of shaft with clean oil and place plactic installation sleeve with shaft seal (7) down onto shaft covering all splines, keyways and wire ring grooves. Slide shaft seal (7) down onto shaft (27) making sure that lip on seal faces down (See Figure 1 for correct seal orientation) until it contacts thrust washer (12). Remove plastic installation sleeve. Carefully install the backup seal (6) onto the shaft (27) with the flat side up and the seal lip facing the shaft seal (7). Place the metal backup shim (5) onto the shaft and against the backup seal (6). Place the seal carrier (11) onto the shaft (large end down) and carefully press the seal carrier (11) down onto the seal assembly using an arbor press and sleeve to compress the seal into the carrier.

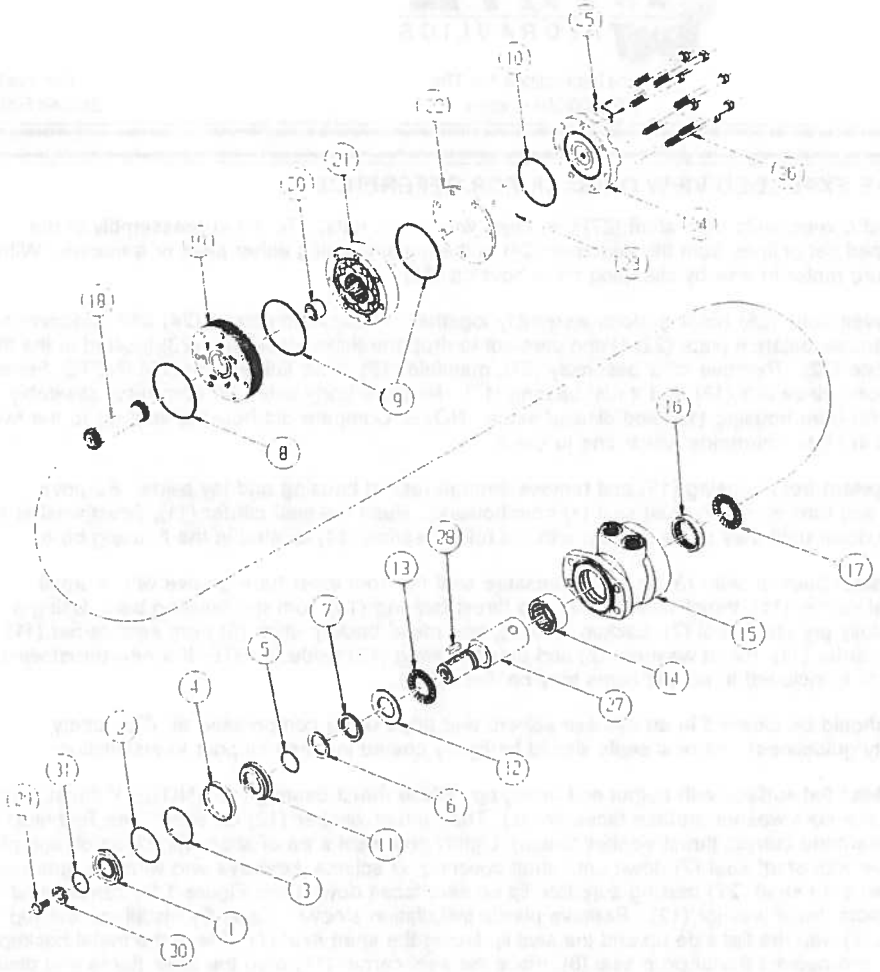
G) With pilot side facing up, place housing (15) on spacers to raise housing approximately .250 above work surface (NOTE: Spacers should allow shaft to contact work surface). Place shaft/seal carrier assembly into housing (15). Install high pressure seal (4) into groove in housing. Install metal backup shim (3) against high pressure seal (4) in groove in housing bore by squeezing the shim (3) between thumb and forefinger to bow shim. While maintaining bow in shim, start the shim into the groove and use a small screwdriver to push the shim into groove. Install wire ring (2) into the groove making sure that the ends are butted.

H) While holding shaft into housing, place housing/shaft assembly in vise with shaft end down. Making sure that end of drive link (18) with crowned splines goes into shaft end, install drive link (18) into shaft and tap lightly to seat the seal carrier against the wire ring (2). Place thrust bearing (17) over drive link (18). If seal carrier (11) is properly seated against wire ring (2), thrust bearing (17) will be flush with rear surface of housing.

I) Install housing seal (8) into groove in housing (15). Place manifold (19) onto housing, (15) side with only seven holes facing housing (15). Place body seals (9) in grooves in both sides of rotor (21). Place rotor (21) onto manifold (19) with side of rotor with chamfer in splines facing manifold (19).

J) Install balance plate (22) onto rotor (21) making sure holes for steel balls (23) faces up. Install three steel balls (23) in holes in balance plate (22). Install endcover seal (10) into groove in endcover (24) and place endcover onto balance plate (22). Install seven assembly bolts (26) and pre-torque to 10 ft. lbs. Using the bolt torque sequence shown in Figure 2, final torque all bolts to 50 ft. lbs.

K) Remove motor from vise and place on work surface with shaft (27) facing up. Making sure that lip on seal (1) faces up, place dust seal (1) over shaft (27). Using a sleeve and a hammer, carefully drive dust seal (1) into place.



RE (500/501) Series Motor Components

1. Dust Seal
2. Split Wire Ring
3. Metal Backup Shim
4. High Pressure Seal
5. Metal Backup Shim
6. Backup Seal
7. Shaft Seal
8. Housing Seal
9. Body Seals (2)
10. Endcover Seal
11. Seal Carrier
12. Thrust Washer
13. Front Thrust Bearing
14. Front Housing Bearing
15. Housing
16. Rear Housing Bearing
17. Rear Thrust Bearing
18. Drive Link
19. Manifold
20. Drive Link Spacer
21. Rotor Assembly
22. Balance Plate
23. Steel Balls (3)
24. Endcover
25. I.D. Tag Assembly
26. Assembly Bolts (7)
27. Shaft
28. Shaft Key
29. Shaft Bolt
30. Lock Washer
31. Wire Ring

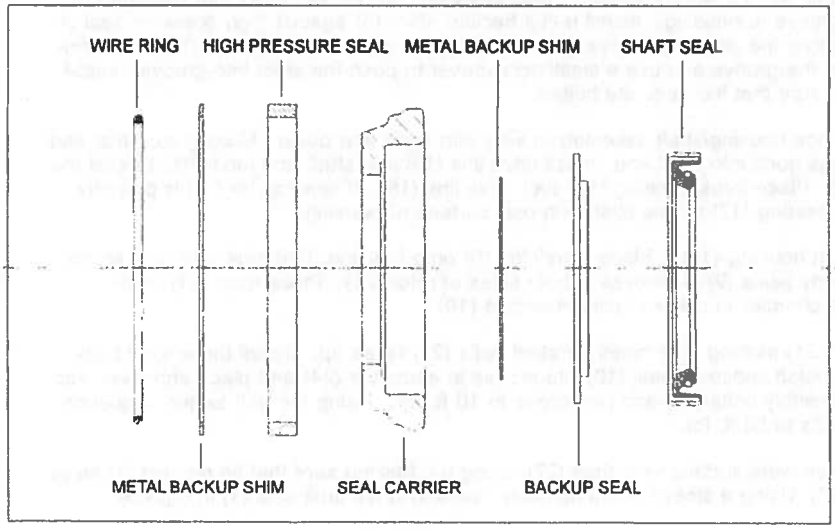


FIGURE 1

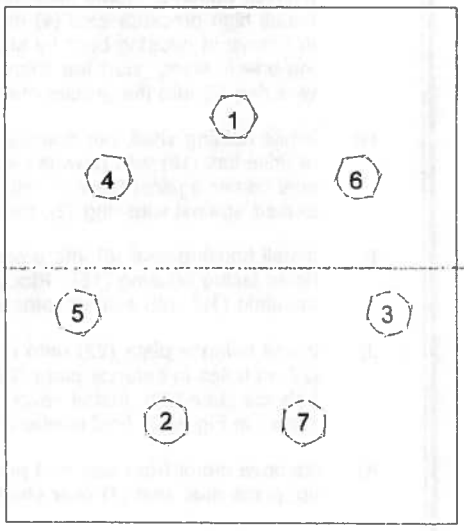
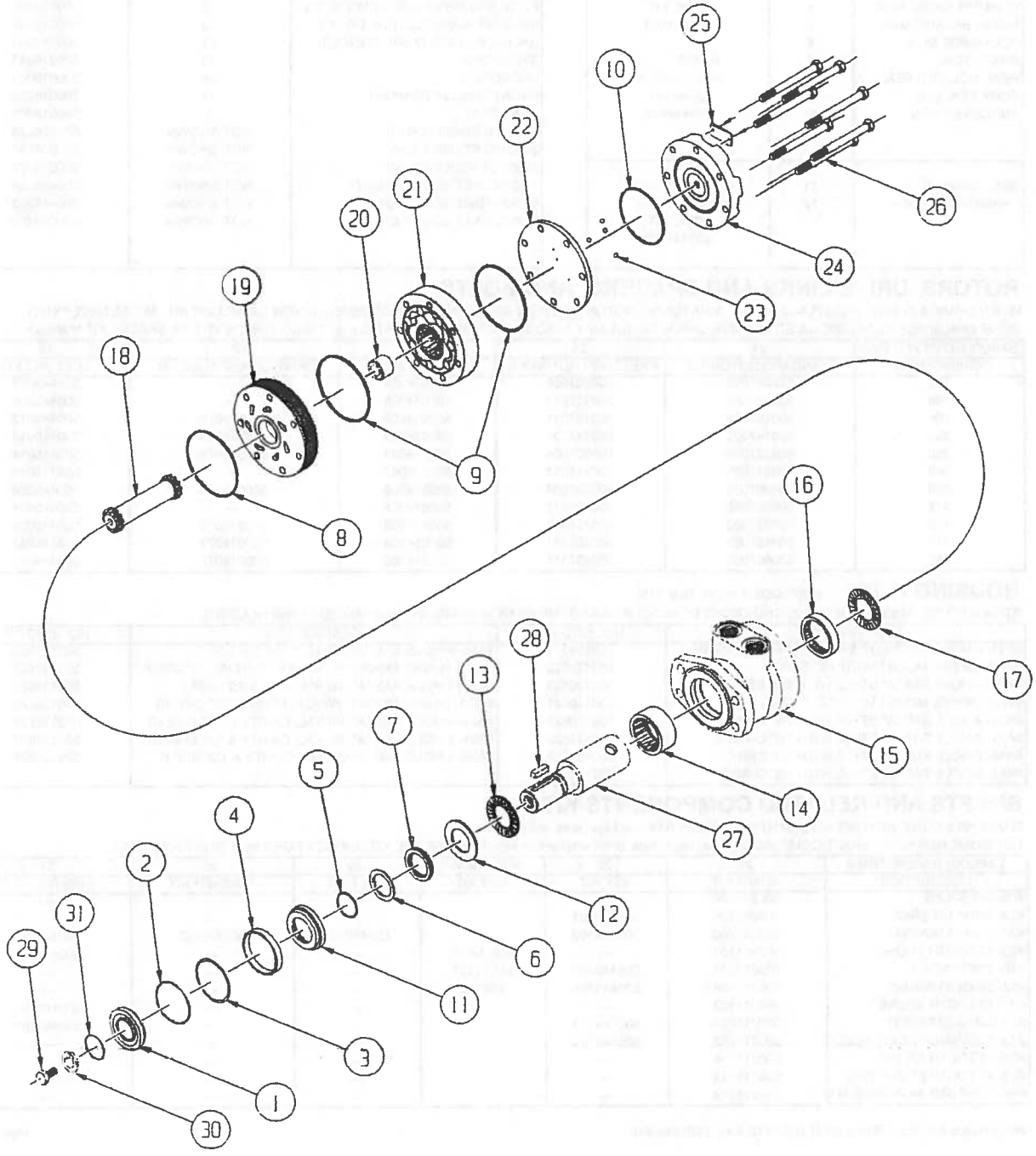


FIGURE 2

RE (500) Series



RE (500) SERIES MOTOR COMPONENTS

SEAL KIT 500444001

DESCRIPTION	EXP VIEW ITEM #	KIT #
DUST SEAL	1	
HOUSING SEAL	2	ITEMS # 1-12
METAL BACKUP SHIM	3	INCLUDED IN
HIGH PRESSURE SEAL	4	SEAL KIT
METAL BACKUP SHIM	5	500444001
POLYAMIDE SEAL	6	
SHAFT SEAL	7	ITEMS # 1-10
REAR HOUSING SEAL	8	INCLUDED IN
BODY SEALS (2)	9	SEAL KIT
ENDCOVER SEAL	10	500444002
SEAL CARRIER	11	ITEMS #11-12
THRUST WASHER	12	INCLUDED IN SEAL KIT 500444003

MISCELLANEOUS KITS

DESCRIPTION	EXPLODED VIEW ITEM #	KIT
REAR THRUST BEARING	17	500018059
FRONT HOUSING BEARING (1" WIDE)	14	500018003
REAR HOUSING BEARING (.5" WIDE)	16	500018002
FORWARD MANIFOLD (CCW OR "0")	19	500015006
REVERSE MANIFOLD (CW OR "1")	19	500015007
BALANCE PLATE (3 BALLS INCLD)	22	500012001
STEEL BALL	23	500018048
ENDCOVER	24	500016001
FRONT THRUST BEARING	13	500018252
DUST SEAL	1	500018006
1000 PSI RELIEF VALVE	NOT SHOWN	500018228
2000 PSI RELIEF VALVE	NOT SHOWN	500018231
3000 PSI RELIEF VALVE	NOT SHOWN	500018221
1.00-20 UNEF SLOTTED NUT	NOT SHOWN	500449304
1.00-20 UNEF SOLID NUT	NOT SHOWN	500449303
1.00-20 UNEF LOCK NUT	NOT SHOWN	300339303P

ROTORS, DRIVE LINKS AND SPACERS, AND BOLTS

WHEN CHANGING MOTOR DISPLACEMENTS, A MATCHING ROTOR AND BOLT SET KIT MUST BE ORDERED. A NEW DRIVE LINK KIT MAY BE NECESSARY. DRIVE LINK SPACERS ARE INCLUDED IN DRIVE LINK KITS, BUT MAY ALSO BE ORDERED SEPERATELY BY USING THE DRIVE LINK SPACER KIT NUMBER.

EXPLODED VIEW ITEM #	21	21	18	20	26
DISPLACEMENT	STANDARD ROTOR KIT	FREETURN ROTOR KIT	DRIVE LINK KIT	DRIVE LINK SPACER KIT	BOLT SET KIT
120	500087005	500087008	500014009	—	500445006
160	500137005	500137011	500014009	—	500445006
200	500167004	500167011	500014009	500018075	500445012
230	500147002	500147004	500014009	500018185	500445014
260	500227000	500227004	500014009	500018076	500445014
300	500247005	500247011	500014007	—	500445018
350	500207000	500207004	500014008	500018076	500445026
375	500307005	500307011	500014008	—	500445024
470	500357003	500357005	500014008	500018076	500445026
540	500407005	500407011	500014008	500018077	500445032
750	500607005	500607011	500014008	500018078	500445045

HOUSING KITS (EXPLODED VIEW ITEM #15)

STANDARD HOUSING KITS INCLUDE THE FRONT BEARING (#14) AND THE REAR BEARING (#16) INSTALLED IN THE HOUSING.

DESCRIPTION	HOUSING KIT	DESCRIPTION	HOUSING KIT
#F31- 4-HOLE W/O PILOT & RS 4-HOLE BOLT PTRN.	500130223	#A58- 6-HOLE SAE "A" STYLE WITH 1/2" BSP.F	500131923
#W38- WHEEL MOUNT WITH 1/2" BSP.F	500130523	#W38- WHEEL MOUNT W/ RELIEF PORT W/ 1/2" BSP.F	500133523
#A38- 4-HOLE SAE "A" STYLE WITH 1/2" BSP.F	500130623	#A38- 4-HOLE SAE "A" W/ RLF. PRT & 1/2" BSP.F	500133623
#W31- WHEEL MOUNT WITH 7/8" O-RING	500130723	#W31- WHEEL MOUNT W/ RLF. PORT & 7/8" O-RING	500133723
#A31- 4-HOLE SAE "A" STYLE WITH 7/8" O-RING	500130823	#A31- 4-HOLE SAE "A" W/ VAL. CAVITY & 7/8" O-RING	500133823
#A11- 2-HOLE SAE "A" STYLE WITH 7/8" O-RING	500131623	#A51- 6-HOLE SAE "A" W/ VAL. CAVITY & 7/8" O-RING	500134823
#A18- 2-HOLE SAE "A" STYLE WITH 1/2" BSP.F	500131723	#A58- 6-HOLE SAE "A" W/ VAL. CAVITY & 1/2" BSP.F	500134923
#A51- 6-HOLE SAE "A" STYLE WITH 7/8" O-RING	500131823		

SHAFTS AND RELATED COMPONENTS KITS

SHAFT KITS COME WITH RELATED SHAFT COMPONENTS (i.e. keys, nuts, etc.)
TO ORDER INDIVIDUAL SHAFT COMPONENTS (i.e. keys, nuts, bolts, washers or wire rings) USE THE KIT NUMBER FOR EACH INDIVIDUAL PART.

EXPLODED VIEW ITEM #	27	28	NOT SHOWN	29	30	31
DESCRIPTION	SHAFT KIT	KEY KIT	NUT KIT	BOLT KIT	WASHER KIT	WIRE RING KIT
#02- 6-B SPLINE	500011600	—		—	—	—
#22- 1-1/4" TAPERED	500011300	500449101		—	—	—
#20- 1-1/4" STRAIGHT	500011200	500449102		500449301	500449302	500449201
#23- 14 TOOTH SPLINE	500011101	—	SEE MISC.	—	—	500449201
#10- 1" STRAIGHT	500011201	500449100	KITS LIST	—	—	—
#12- 25MM STRAIGHT	500011109	500449104	ABOVE	—	—	—
#24- 19 TOOTH SPLINE	500011102	—		—	—	500449201
#21- 32MM STRAIGHT	500011203	500449103		—	—	500449201
#19- 1" STRAIGHT EXTENDED	500011202	500449100		—	—	—
#01- 13 TOOTH SPLINE	500011114	—		—	—	—
#29- 12 TOOTH SPLINE (BK)	500011116	—		—	—	—
#26- 1-1/4" STR. NON-ANNEALE	500011214	—		—	—	—