EXPERT 2000

Cool-Hand

Maintenance Manual

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LABRIE LEACH WITTKE

CAPSCREW MARKING AND TORQUE VALUES

Usage	**Much Used**	**Used at Times**	**Used at Times**
Capscrew Diameter & Minimum Tensile Strength PSI	To 3/4 - 120,000 To 1 - 115,000	To 5/8 - 140,000 To 3/4 - 133,000	150,000
Quality of Material	Min. Commercial	Med. Commercial	Best Commercial
SAE Grade Number	5	6 or 7	8
CAPSCREW HEAD MARKINGS Manufacturers marks may vary. These are all SAE Grade 5 (3-line.)			
Capscrew Body Size (Inches) - (Thread)	Torque Ft-Lb (kg m)	Torque Ft-Lb (kg m)	Torque Ft-Lb (kg m)
1/4 - 20	8 (1.11)	10 (1.38)	12 (1.66)
- 28	10 (1.38)		14 (1.94)
5/16 - 18	17 (2.35)	19 (2.63)	24 (3.32)
- 24	19 (2.63)		27 (3.73)
3/8 - 16	31 (4.29)	34 (4.70)	44 (6.09)
- 24	35 (4.84)		49 (6.78)
7/16 - 14	49 (6.78)	55 (7.61)	70 (9.68)
- 20	55 (7.61)		78 (10.79)
1/2 - 13	75 (10.37)	85 (11.76)	105 (14.52)
- 20	85 (11.76)		120 (16.60)
9/16 - 12	110 (15.21)	120 (16.60)	155 (21.44)
- 18	120 (16.60)		170 (23.51)
5/8 - 11	150 (20.75)	167 (23.10)	210 (29.04)
- 18	170 (23.51)		240 (33.19)
3/4 - 10	270 (37.34)	280 (38.72)	375 (51.86)
- 16	295 (40.80)		420 (58.09)
7/8 - 9	395 (54.63)	440 (60.85)	605 (83.67)
- 14	435 (60.16)		675 (93.35)
1 - 8	590 (81.60)	660 (91.28)	910 (125.85)
- 14	660 (91.28)		990 (136.92)

NOTES:

1. *Always use the torque values listed above when specific torque values are not available.*
2. *The above is based on use of clean, dry threads.*
3. *Reduce torque by 10% when engine oil is used as a lubricant.*
4. *Reduce torque by 20% if new plated capscrews are used.*
5. *General Formula for calculating Torques is as follows: Torque in Inch Lbs. = .2 x Nominal Diameter of Screw x Loads in Lbs., where Load = 80% of Yield Strength, expressed in Lbs., not pounds per square inch.*

COOL HAND AUTOMATED ARM

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13.0 *COOL HAND* AUTOMATED ARM MAINTENANCE

13.1 HYDRAULIC SYSTEM

13.1.1 GENERAL DESCRIPTION

Automated arm units use an extra valve stack to control the arm (figure 13.2). This valve is a proportional type, meaning that amount of flow coming out of it will be according to the position of the spool. This feature allows infinite control of the speed and the movement of the arm. The arm is powered by a piston pump (see section 13.1.2 "Tandem Pump"). For more information on hydraulic system and the control valve of the body (figure 13.1), refer to both the General Maintenance and the Hydraulic sections. You will find detailed schematics and procedures to service the valve and/or to identify pipes and hoses.

This section will show how to adjust the hydraulic pressure of the arm and to calibrate cushioning system. At the end of the section, you will find a troubleshooting section, which if combined to the Expert 2000 Troubleshooting section, will help resolve most of the commonly seen problems on that type of unit.

Note:
Before servicing an automated arm unit, make sure to have the proper skills and training. Refer to section 1.5 "Lockout/Tagout procedure".

BODY FUNCTIONS VALVE

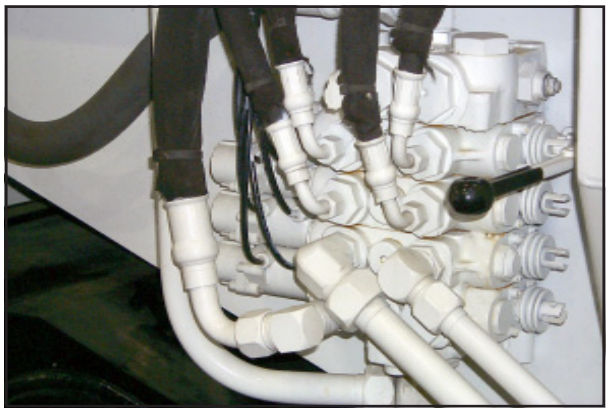


FIGURE 13.1

PROPORTIONAL VALVE

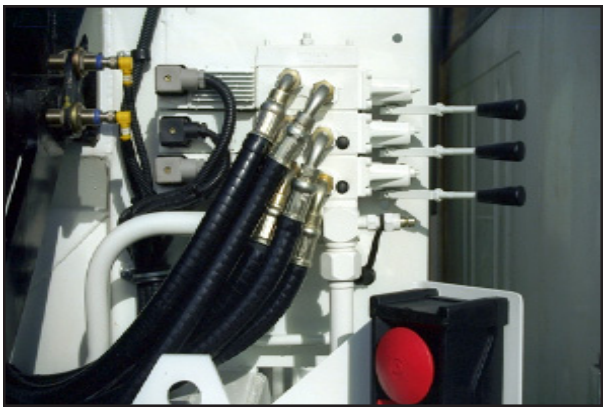


FIGURE 13.2

DANGER

SECURE THE AREA AROUND THE PATH OF THE ARM PRIOR TO PERFORMING ANY REPAIRS OR MAINTENANCE.

DANGER

APPLY THE "LOCKOUT/TAGOUT" PROCEDURE AT ALL TIMES.

13.1.2 TANDEM PUMP

The automated version of the Expert 2000 is equipped with a tandem pump (figure 13.3). The tandem pump is made of two separate sections: The vane pump and the piston pump with variable flow.

The vane pump section powers all the body functions such as the tailgate, the body hoist, the packer and the crusher panel. All these functions are controlled through a directional control valve.

The piston pump, however, powers the automated arm functions such as the grabber, the inner and the outer boom for the retraction and extension movement. All these functions are controlled through a proportional valve.

Finally, the tandem pump is connected to the engine crankshaft and therefore is always turning when the truck engine is running.

Tandem pump

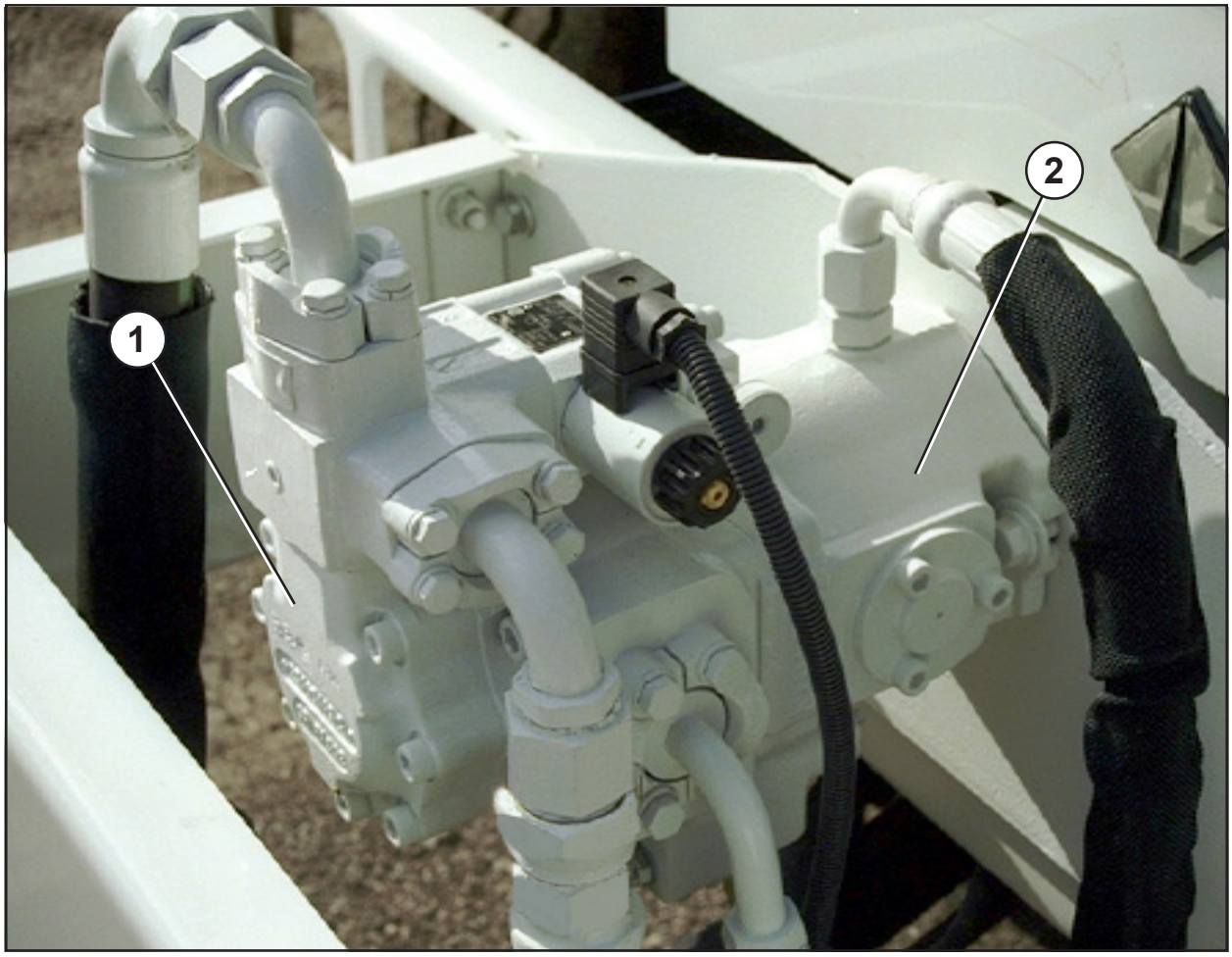


FIGURE 13.3

1: VANE PUMP
2: PISTON PUMP

13.1.3 VANE PUMP

Since the pump is connected directly to the engine, it is constantly turning and pumping hydraulic oil. In order to control the hydraulic flow, a dump valve mounted on the pump (figure 13.4) is either used to send the fluid to the body hydraulic system or sent back to the tank.

When the pump switch (figure 13.5) is turned "ON", an electric signal is sent to the dump valve solenoid. Then, the flow of the vane pump is sent to the body directional valve. Otherwise, when the pump switch is turned "OFF , the hydraulic flow returns back to the tank.

When the switch is turned "ON", the transmission electronic control unit (ECU), monitors the vehicle speed and the engine RPM and then allows (or not) the dump valve to engage. If the vehicle is exceeding 15Mph (25Km/h), or if the engine speed exceeds 900RPM, the dump valve will not engage.

Pump switch

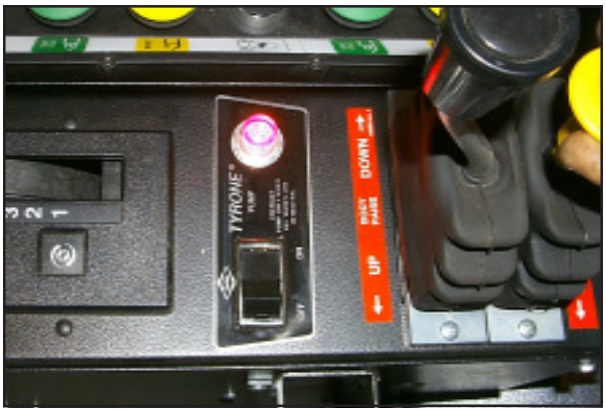


FIGURE 13.5

Dump valve

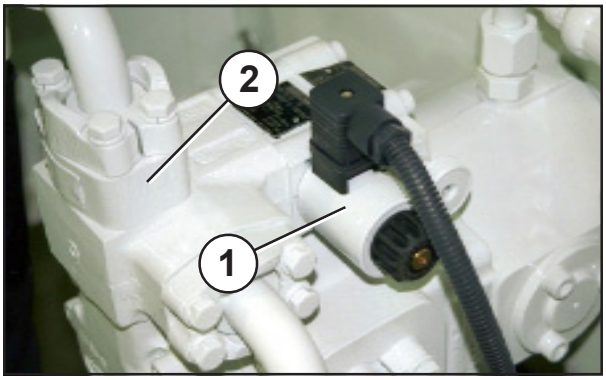


FIGURE 13.4

1: VANE PUMP SOLENOID VALVE
2: FLOW REGULATOR

A minimum of 90 PSI of air pressure is also required for the dump valve to operate. This minimum pressure ensures that the hydraulic tank will be pressurized before using the pump.

After the dump valve is engaged, it will stay engaged at any engine speed under 2300 RPM. Refer to section 13.3.3 "Allison Transmission Programming Parameters".

The vane pump is capable of delivering a flow of 40 gallons per minute when the engine is running at 1200 RPM.

A flow regulator at the pump outlet (figure 13.4) limits the flow to the directional valve. Any excess flow above 50GPM is sent back directly to the hydraulic tank. When the dump valve is not engaged the flow returns to the tank.

WARNING

THE VANE PUMP SHALL NOT TURN ANY FASTER THAN 2300 RPM.

13.1.4 PISTON PUMP

This section of the tandem pump is equipped with a load sensing system. This means that the pump will deliver its flow according to demand.

When moving the joystick, an electric signal from the joystick is sent to the coils on the proportional valve (figure 13.6), allowing the spools inside the valve to move accordingly and proportionally to the movement of the joystick. The demand or "load" is then created.

At that point, the piston pump starts to deliver its flow to the proportional valve making the arm to move.

The pump will deliver its flow proportionally to the demand (or movement of the joystick). When there is no "load", (Joystick to center position) the pump turns without sending oil in the system (Refer to section 13.2.2 "Piston pump adjustment".

In order to operate the arm and send a signal to the proportional valve, the pump switch must be turned "ON" and the joystick moved out from its center position.

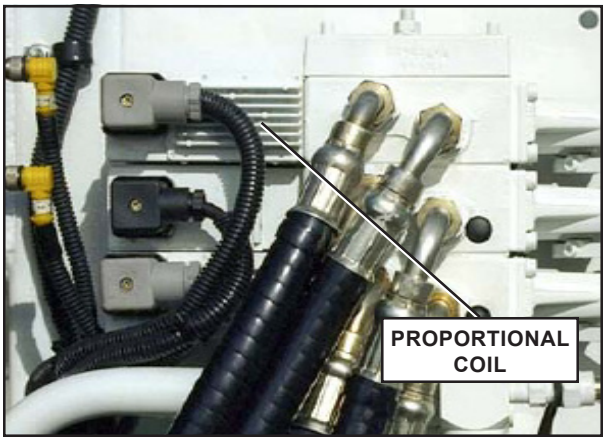


FIGURE 13.6

Note:
Only the coils used to control the inner boom and the outer boom are proportional. The grabber coil is an "ON and OFF" type.

WARNING

DO NOT KEEP THE MANUAL CONTROL LEVERS ON THE PROPORTIONAL VALVE. THESE CONTROL LEVERS SHOULD BE USED FOR MAINTENANCE PURPOSES ONLY.

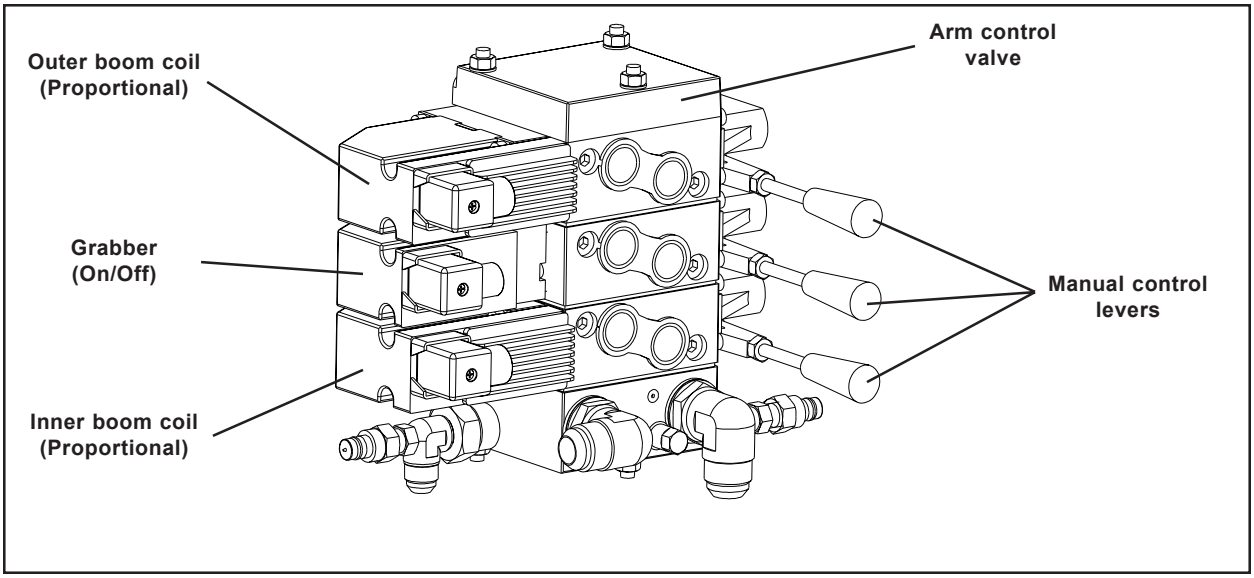


FIGURE 13.7

13.1.5 PRESSURIZED TANK

To ensure proper fluid supply to the pump and to prevent cavitation in the hydraulic system, air pressure of 3 to 3.5 PSI is applied to the hydraulic tank. The cavitation is defined as the formation of air pockets in a moving fluid. The presence of air in the hydraulic oil produces cavitation inside the pump, generating excessive noise. Cavitation is forming most of the time after replacing hydraulic components or after flushing the hydraulic system.

A gage and a pressure regulator are installed to adjust the air pressure inside the tank. This gage is located inside the frame rail on the curbside of the chassis (figure 13.8). This gage can be accessed only when body is raised.

The hydraulic tank is also mounted with a 5-PSI relief valve (figure 13.9) and a 5-PSI pressurized filler cap.

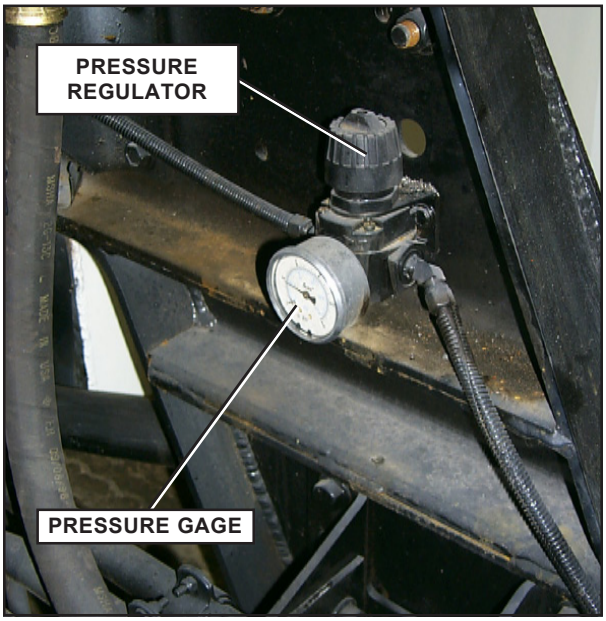


FIGURE 13.8

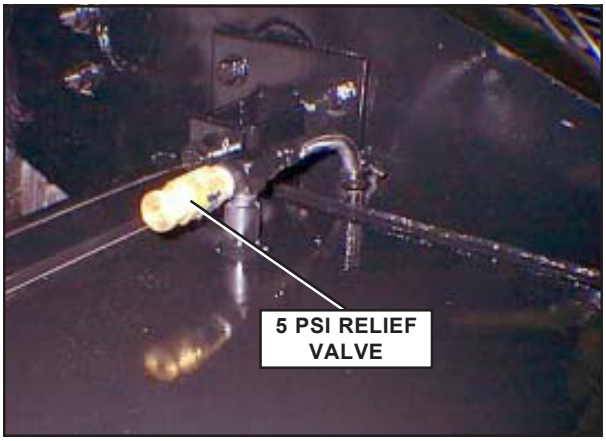


FIGURE 13.9

FIGURE 13.10

DANGER

INSTALL THE BODY SAFETY PROP BEFORE PERFORMING ANY WORK UNDER BODY.

WARNING

DO NOT EXCEED 5 PSI OF AIR PRESSURE INSIDE THE TANK.

13.1.6 PUMP INSPECTION

The pump should be visually inspected on a daily basis. Follow this procedure.

PUMP INSPECTION PROCEDURE

1. **Ensure that the parking brake is applied and the vehicle is tagged out for maintenance purposes (refer to section 1.5 "Lockout/Tagout procedure").**
2. **Start the engine, engage the hydraulic pump.**
3. **The pump should turn freely without any excessive noise or vibrations.**
4. **Inspect the pump (under) and connections for any oil leak.**
5. **For any other problem with the pump, refer to section 3.3 "Troubleshooting guide.**

TANDEM PUMP

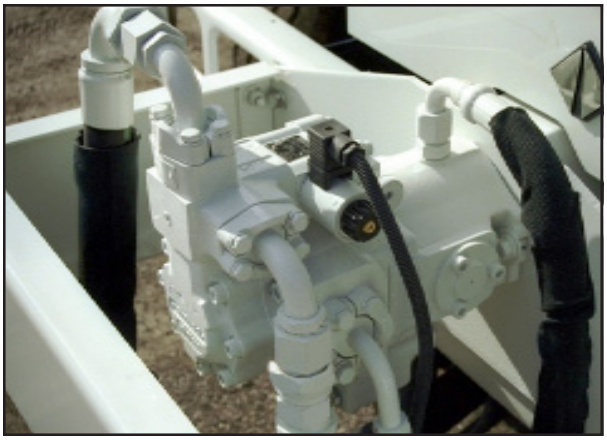


FIGURE 13.11

WARNING

STOP THE TRUCK ENGINE AS SOON AS A HYDRAULIC PROBLEM IS FOUND. IF THE UNIT HAS TO BE DRIVEN AWAY FOR REPAIRS ON THE HYDRAULIC SYSTEM, REMOVE THE DRIVE SHAFT BETWEEN THE ENGINE AND THE PUMP BEFORE RESTARTING THE ENGINE.

13.1.7 PUMP EMERGENCY SHUTDOWN

If a major problem occurs with the arm or the hydraulic system, or in the case of hydraulic hose failure, apply the following procedure:

PUMP EMERGENCY SHUTDOWN PROCEDURE

1. **Press on the nearest Emergency Stop Button (figure 13.13).**
2. **Turn the pump switch "OFF" and stop the truck engine.**
3. **Close the main hydraulic valve on the suction line near the tank (figure 13.12).**
4. **Call the maintenance facility and report the problem to the maintenance personnel.**
5. **Before restarting the engine, make sure that the pump is being properly primed and the main valve on the hydraulic tank is open.**
6. **If not possible, remove the drive shaft between the engine and the pump.**

CURBSIDE VIEW, UNDER THE HOPPER

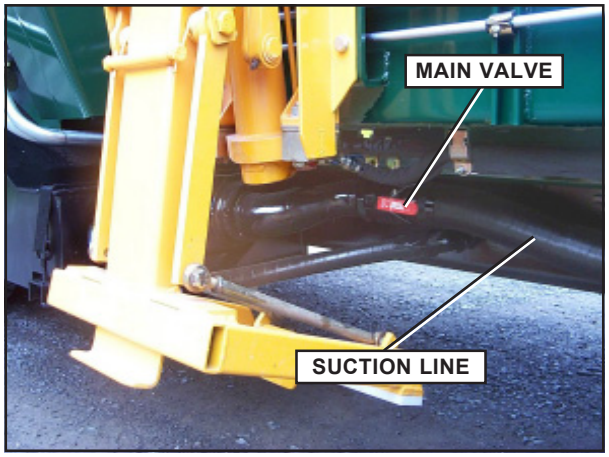


FIGURE 13.12

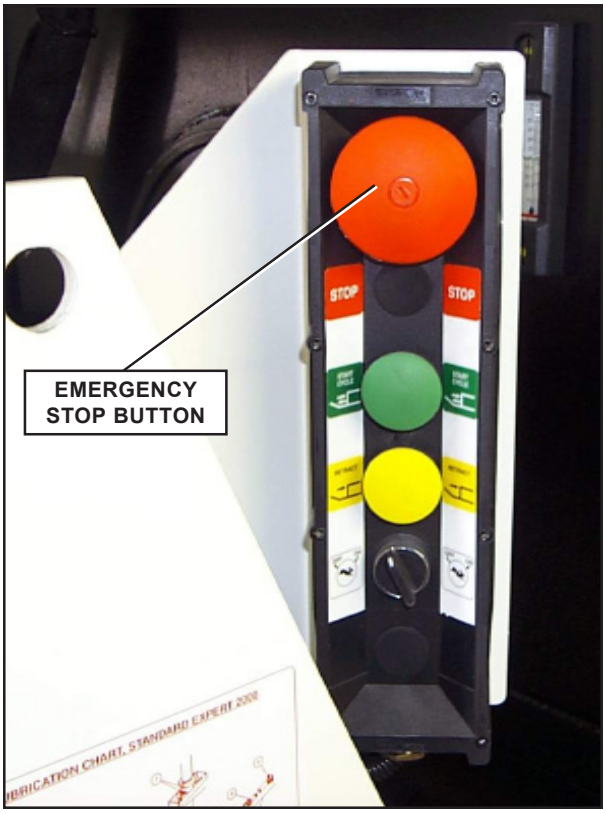


FIGURE 13.13

WARNING

STOP THE TRUCK ENGINE AS SOON AS A HYDRAULIC PROBLEM IS FOUND. IF THE UNIT HAS TO BE DRIVEN AWAY FOR REPAIRS ON THE HYDRAULIC SYSTEM, REMOVE THE DRIVE SHAFT BETWEEN THE ENGINE AND THE PUMP BEFORE RESTARTING THE ENGINE.

13.1.8 PUMP PRIMING PROCEDURE

To prevent cavitation or air in the hydraulic system after installing a new pump or after replacing the oil in the hydraulic system, make sure to prime the pump before starting the engine. Apply the following procedure to prime the pump.

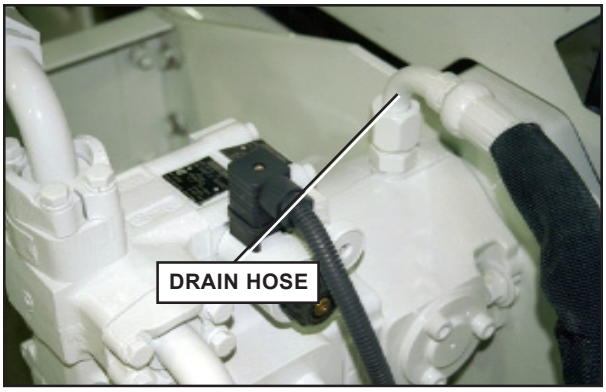


FIGURE 13.14

DANGER

APPLY THE "LOCKOUT/TAGOUT" PROCEDURE AT ALL TIMES.

HYDRAULIC PUMP PRIMING PROCEDURE

1. **Apply the lockout/tagout procedure.**
2. **Secure the area around the path of the arm at all times.**
3. **To avoid any oil spill when working on the pump or prior to any service job, slowly remove the oil filler cap of the hydraulic tank to release the pressure inside the tank.**
4. **Make sure that the main valve on the suction line is closed.**
5. **Remove the drain hose from on pump housing (figure 13.14).**
6. **Fill the pump housing with the proper hydraulic oil.**
7. **Open the main valve on the tank suction line (figure 13.12).**
8. **Reinstall the drain hose on the pump housing.**
9. **Reinstall the filler cap and allow the pressure to rise inside the tank.**
10. **Check that the air pressure on the regulator gage found inside the chassis frame rail (figure 13.8).**
11. **Crank the engine without letting it start repeatedly about five times in order to fill the suction hose and the pump with hydraulic oil and to push the air back into the tank.**
12. **Before putting the vehicle back in service, recalibrate the system pressure according to section 13.2 "Hydraulic pressure adjustment".**

13.2 HYDRAULIC PRESSURE ADJUSTMENT

13.2.1 VANE PUMP RELIEF VALVE ADJUSTMENT

The tandem pump has its own relief valve (figure 13.16). The pressure chart below gives the proper adjustment pressure of both 22 and 29/34 cubic yard bodies. Use this chart to adjust the relief of the pump and the body function valve. A 0-4000 pressure gage (figure 13.15) as well as a set of ball-end Hex key (figure 13.17) is required to perform this pressure adjustment procedure.

Note:
The relief valve of the vane pump has to set before the main relief valve on the directional control valve.

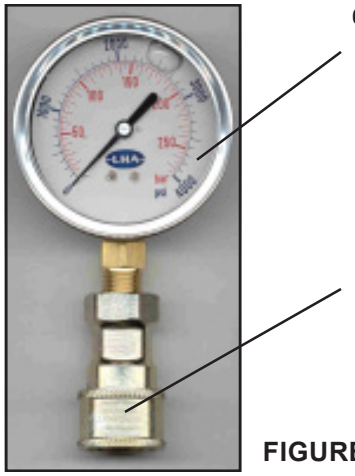


FIGURE 13.15

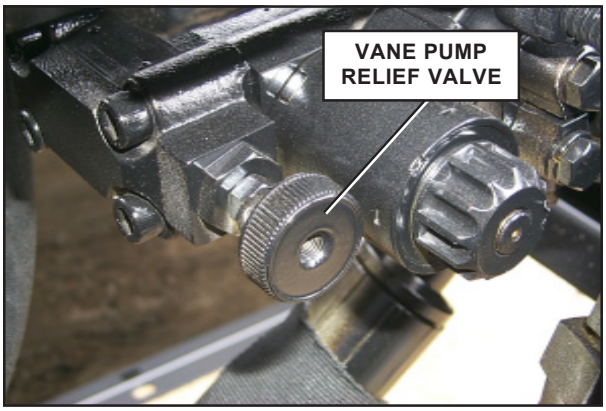


FIGURE 13.16

Ball-end Hex Key (Metric & SAE)

FIGURE 13.17

PRESSURE CHART FOR 22 CU.YD BODY or 4-inch dia. packer cylinders	PRESSURE CHART FOR 29/34 CU.YD BODY or 4-inch dia. packer cylinders
1. Vane pump relief valve is set at *2200* PSI at 1500 RPM. 2. The main relief valve is set at *2000* PSI at 1500 RPM.	1. Vane pump relief valve is set at *3200* PSI at 1500 RPM. 2. The main relief valve is set at *3000* PSI at 1500 RPM.

13.2.1 VANE PUMP RELIEF VALVE (cont'd)

Apply the following procedure in order to adjust the relief valve of the vane pump.

VANE PUMP RELIEF VALVE ADJUSTMENT PROCEDURE

1. **Apply the lockout/tagout procedure.**
2. **Ensure safety around the vehicle at all times.**
3. **Install the 0-4000 PSI pressure gage on the quick connect fitting located on the body functions valve (figure 13.18).**
4. **Start the engine and engage the hydraulic system (Pump switch "ON").**
5. **Engage the speed-up system. The engine must be running at 1500 RPM.**
6. **Tighten the main relief valve adjustment screw (figure 13.19) to be able to adjust the vane pump.**
7. **Activate the crusher panel until the cylinder reaches the end of its stroke (Going up).**
8. **Adjust the relief valve of the vane pump (figure 13.20) according to the pressure chart.**
9. **When the vane pump is adjusted to the proper pressure, calibrate the relief of the body function valve according to the pressure chart.**

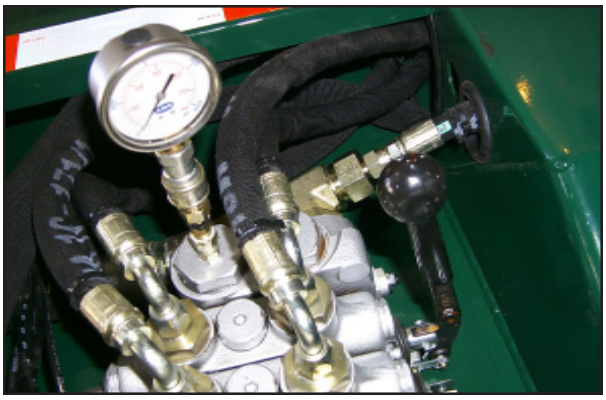


FIGURE 13.18

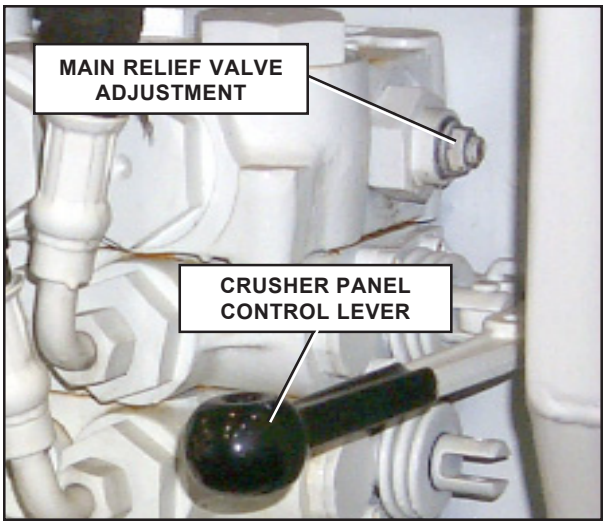


FIGURE 13.19

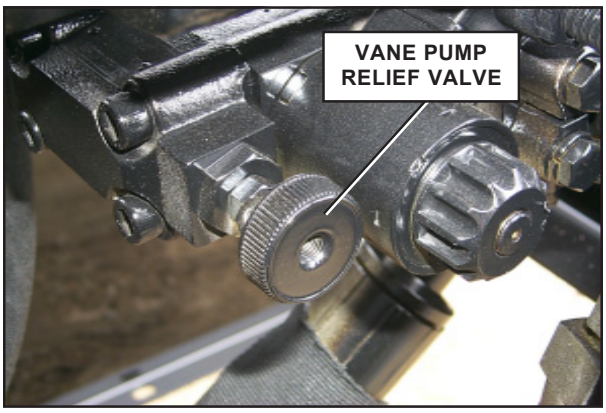


FIGURE 13.20

13.2.2 PISTON PUMP ADJUSTMENT

As described in section 13.1.3, the piston pump delivers its flow only on demand (when the joystick is moved). The compensator, located on the pump (figure 13.22), controls both the pressure output and the load sensing system of the piston pump.

How it works:

The load sense port on the proportional valve or LS port (figure 13.21), allows pressure from the valve to return to the compensator, creating a margin pressure of **450** PSI between the PP port and the LS port. When moving the joystick, the pressure on the LS port will build up, creating the demand to the piston pump.

At that point, the compensator will increase the pump flow, keeping the pressure **450** PSI above the pressure of the load sense port.

If a pressure of 2000 PSI is required to lift a cart, the pressure at the PP port will be 2450 PSI. A differential pressure of **450** PSI. When there is no demand, the pressure at the port LS will drop to 0 PSI.

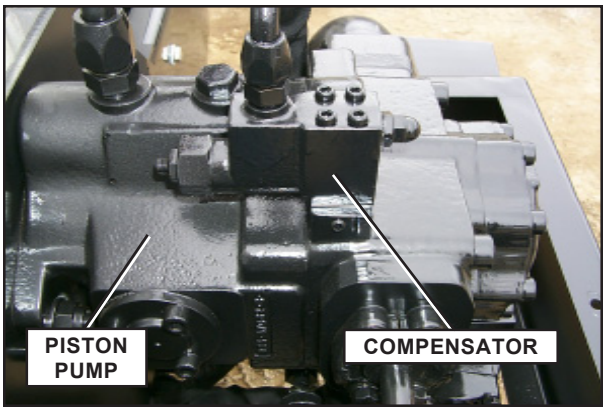


FIGURE 13.22

Note:
The port PP should always indicate **450** PSI.

The pressure adjustments of the pump compensator and the proportional valve have to be made, following the right sequence.

Two pressure gages (0-4000) are necessary to perform this adjustment. One connected to the pressure port (PP) and the other on the load sense port (LS). See figure 13.23.

The procedure on the next page will show how to adjust the load sense and the pump maximum output pressure.

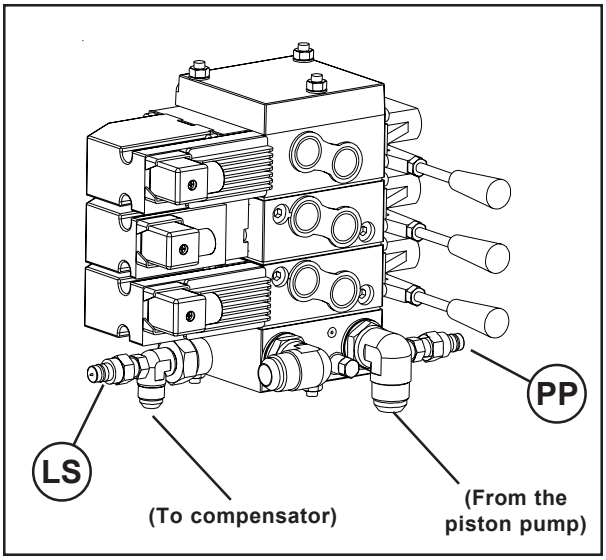


FIGURE 13.21

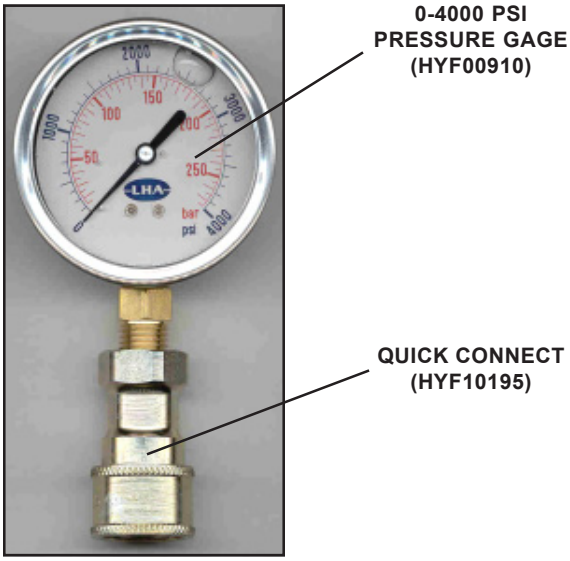


FIGURE 13.23

13.2.3 LOAD SENSE PRESSURE ADJUSTMENT

LOAD SENSE ADJUSTMENT

1. **Apply the lockout / tagout procedure.**
2. **Before making any adjustments, secure the area around the path of the arm.**
3. **Remove all residual hydraulic pressure in the system by moving the manual levers back and forth.**
4. **Make sure that all hoses are tight and not leaking.**
5. **Connect one gage to the load sense port (LS) and the second one to the pressure port (PP).**
6. **Put the transmission in Neutral.**
7. **Start the engine, and engage the hydraulic pump.**
8. **The pressure port gage (PP) should indicate 450 PSI and the load sense (LS) 0 PSI. If the pressure does not correspond, loosen the lock nut (figure 13.24) and turn the adjustment screw to adjust the pressure to 450 PSI.**
9. **To adjust the load sensing pressure, the load sense screw on the compensator may need to be turned in or out according to the reading on the pressure gage.**
10. **Recheck the pressure and tighten the lock nut in place while holding the adjustment screw.**
11. **Verify that the arm is working properly with the manual levers on the valve.**

COMPENSATOR

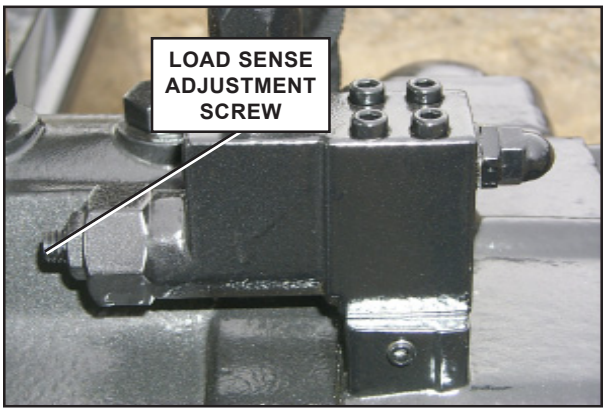


FIGURE 13.24

Note:
In the case where a new pump is installed on the vehicle, the compensator screw must be loosened completely to prevent any damage to the hydraulic system and its component.

DANGER

APPLY THE "LOCKOUT/TAGOUT" PROCEDURE AT ALL TIMES.

DANGER

DO NOT STAND DIRECTLY IN THE PATH OF THE ARM WHILE CARRYING OUT THESE ADJUSTMENTS.

Note:
If the arm is moving erratically or intermittently, the presence of air in the system may be the cause.

13.2.4 PISTON PUMP PRESSURE ADJUSTMENT

Apply the following procedure to calibrate the piston pump pressure.

COMPENSATOR ADJUSTMENT PROCEDURE

1. **Apply the lockout / tagout procedure.**
2. **Secure the area around the path of the arm.**
3. **Remove all residual hydraulic pressure by moving the levers back and forth.**
4. **Make sure that all hoses are tight and not leaking.**
5. **Connect one gage to the load sense port (LS) and the second one to the pressure port (PP).**
6. **Put transmission in Neutral;**
7. **Start the engine, and engage the hydraulic pump.**
8. **The pressure port gage (PP) should indicate 450 PSI and the load sense (LS) 0 PSI. If the pressure does not correspond, adjust the load sense pressure first (section 13.2.3).**
9. **Using the lever on the proportional valve, retract the outer boom.**
10. **Raise the inner boom and hold the lever in order to read the pressure on the PP gage.**
11. **Loosen or tighten the compensator screw to adjust the pressure on the gage on PP port to 2800 PSI (See table on next page).**

COMPENSATOR

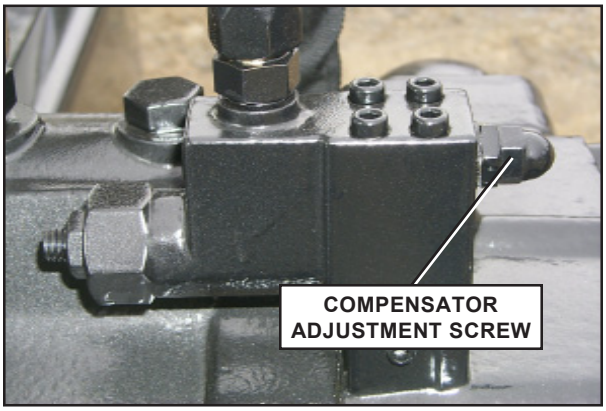


FIGURE 13.25

DANGER

APPLY THE "LOCKOUT/TAGOUT" PROCEDURE AT ALL TIMES.

13.2.5 INNER BOOM RELIEF VALVE

INNER BOOM RELIEF VALVE ADJUSTMENT PROCEDURE

1. **Using the lever on the proportional valve, retract the outer boom.**
2. **Raise the inner boom and hold the lever in order to read the "inner boom up" pressure on PP gage.**
3. **Adjust the work port at 3000 PSI, and then add 1/4 of a turn to the screw (figure 13.26).**
4. **Lower the inner boom and hold the lever in order to read the "inner boom down" pressure on PP gage.**
5. **Adjust the inner boom work port at 2100 PSI (figure 13.26).**

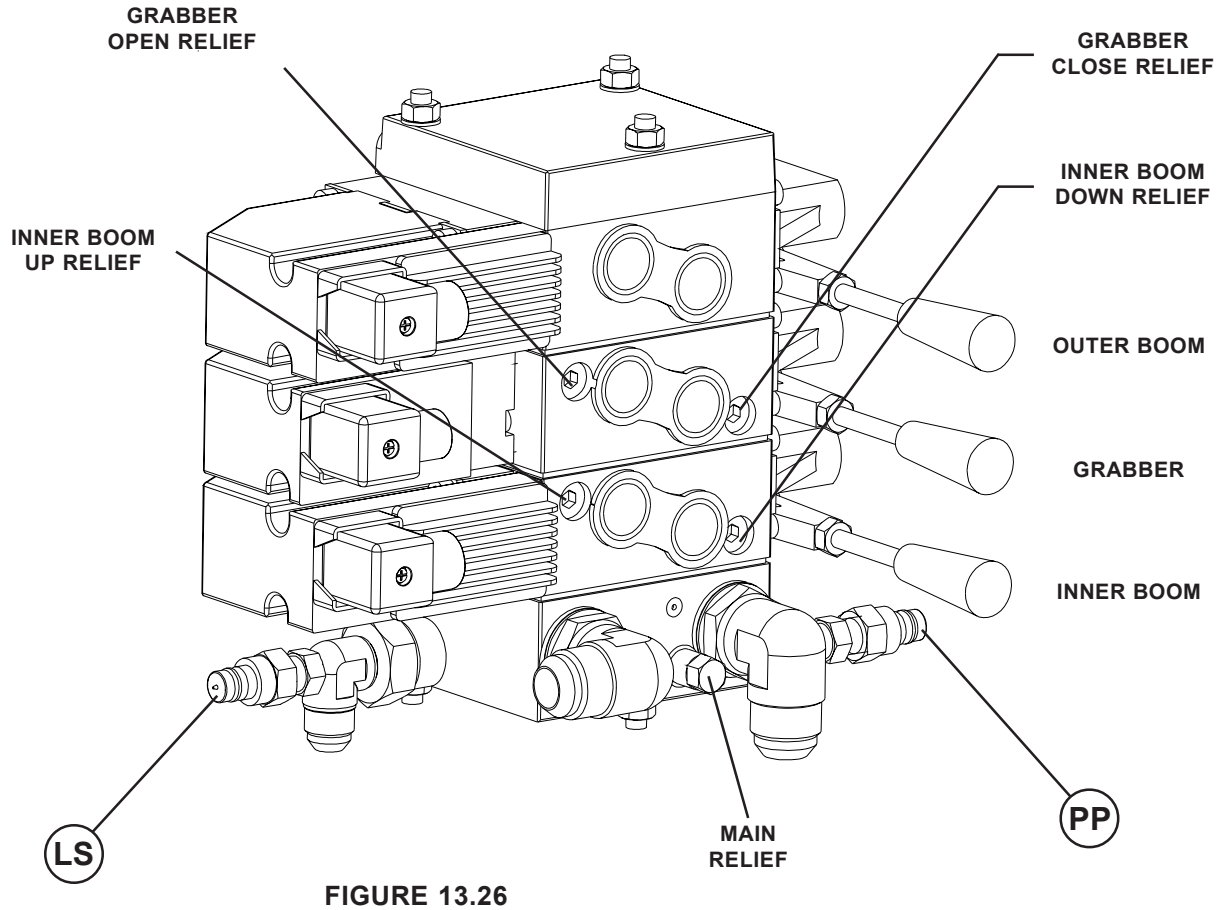


FIGURE 13.26

AUTOMATED ARM PRESSURE CHART (*For PV25/PV29* pump at Idle speed)

1. **PROPORTIONAL VALVE MAIN RELIEF (Cracking): ..... 3300 PSI* (Factory adjusted)**
2. **PISTON PUMP COMPENSATOR: ..... 2800 PSI (Gage PP)**
3. **LOAD SENSE PRESSURE ADJUSTMENT: ..... 450 PSI (Gage PP) and 0 PSI (Gage LS)**
4. **GRABBER RELIEF VALVE (OPENED/CLOSED): ..... 1800 PSI (Gage PP)**
5. **INNER BOOM RELIEF VALVE (ARM UP): ..... 3000 PSI (Gage PP)****
6. **INNER BOOM RELIEF VALVE (ARM DOWN) ..... 2100 PSI (Gage PP)**

* The calibration of the main relief valve requires a flow meter. It is not recommended to adjust it since the calibration was done by the manufacturer of the valve.

** Add 1/4 of turn to the adjustment screw

13.2.6 GRABBER PRESSURE ADJUSTMENT

GRABBER RELIEF VALVE ADJUSTMENT PROCEDURE

1. **Fully extend the arm.**
2. **Using the lever on the proportional valve, close the grabber and hold the lever in place in order to keep and read the pressure on the PP gage.**
3. **Adjust the "close grabber" work port at** 1800 **PSI.**
4. **Open the grabber and adjust the pressure of the "open grabber" work port also at** 1800 **PSI.**

DANGER

DO NOT STAND DIRECTLY IN THE PATH OF THE ARM WHILE CARRYING OUT THESE ADJUSTMENTS.

13.2.7 CYLINDER CUSHION ADJUSTMENT

The inner and outer boom cylinders are both cushioned on their extension and retraction strokes. The cushioning system slows down the speed of the cylinder at the end of the stroke to allow smooth movements when handling carts.

Note:
For vehicle equipped with the Auto-dump feature, this section does not apply. Refer to Easy Supervisor User Guide.

The cushioning system is factory adjusted. However, the cushioning effect may be modified at two levels: the range and the speed.

By moving the proximity switches in their mounting brackets (figure 13.27), cushions will be active at a different position and for a longer (or shorter) distance in the cylinders strokes.

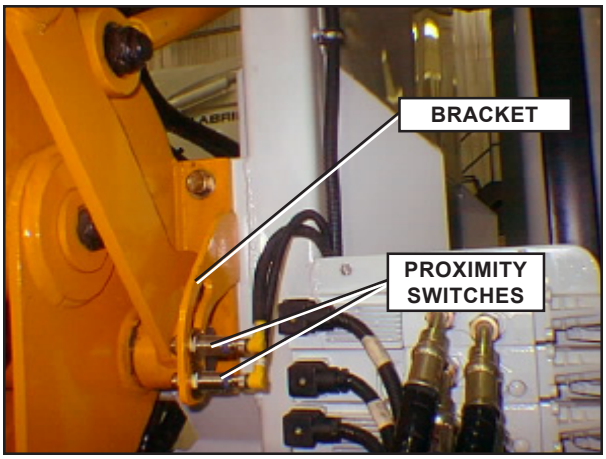


FIGURE 13.27

Continued on next page. . .

13.2.7 CYLINDER CUSHION ADJUSTMENT (cont'd)

Proximity switches detect the presence of metal. When metal is detected, the red pilot light on the proximity switches turns "OFF" and the arm starts to slow down.

The first red light that shuts off marks the beginning of a cushion. (A red light on each proximity switches corresponds to "no cushion signal"). Therefore, the arm is moving faster when the red lights are "ON".

The position of each proximity switch on the mounting brackets will determine where the cushioning will start. Two pairs of proximity switches are required to control the cushioning system of the arm. Each pair controls either the retract or the extend cushion of a cylinder.

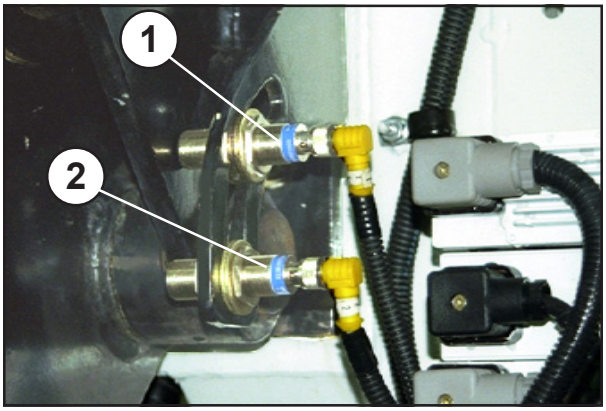


FIGURE 13.28

1: INNER BOOM RETRACT* ..... (Dx1)
2: INNER BOOM EXTEND* ..... (Dx2)

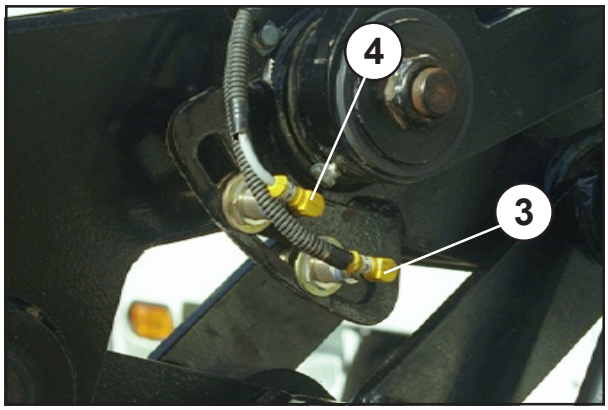


FIGURE 13.29

3: OUTER BOOM EXTEND* ..... (Dx3)
4: OUTER BOOM RETRACT* ..... (Dx4)

To adjust the proximity switches we recommend to use the following procedure:

PROXIMITY SWITCHES ADJUSMENT PROCEDURE

1. **For each of the proximity switches (1 to 4), place the cylinder rod at distance Dx (see figure 13.30 to 13.33).**
2. **Loosen and move the proximity switch in its bracket until the red light shuts off at this specific position. This will mark the beginning of the cushion.**
3. **Tighten the proximity switch in place and repeat for every proximity switch.**

DANGER

APPLY THE "LOCKOUT/TAGOUT" PROCEDURE AT ALL TIMES.

DANGER

DO NOT STAND DIRECTLY IN THE PATH OF THE ARM WHILE CARRYING OUT THESE ADJUSTMENTS.

* The word "extension" and "retraction" refer only to the cylinder movement and not the movement of the arm itself.

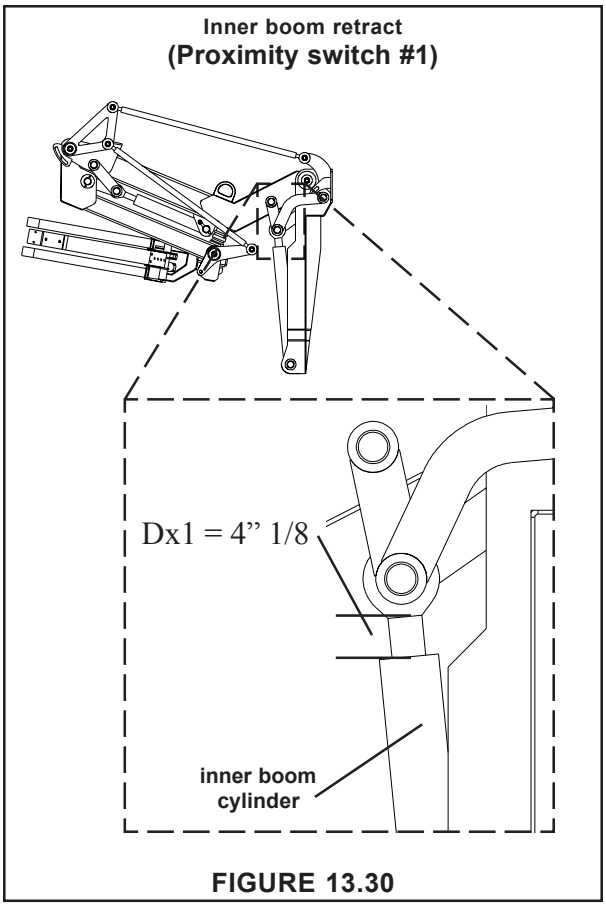


FIGURE 13.30

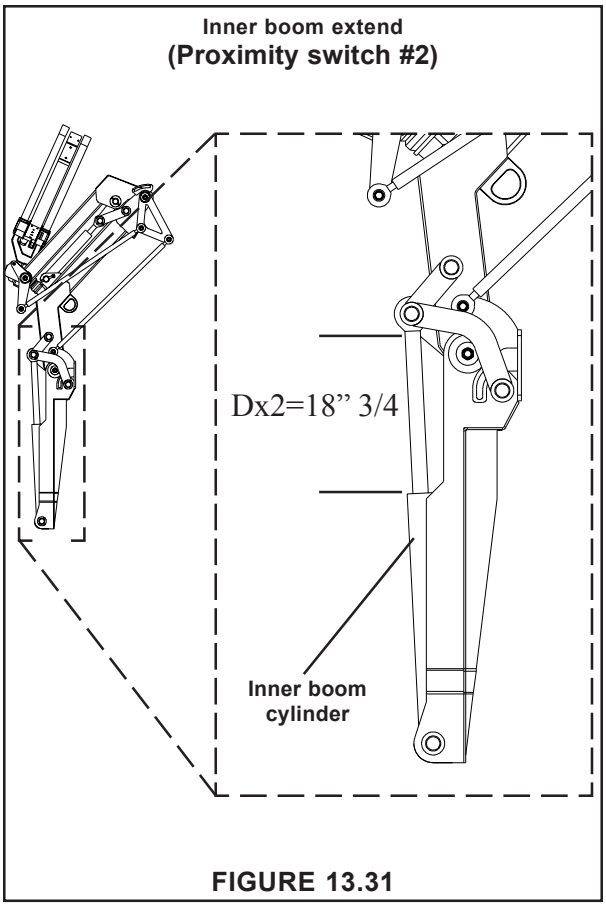


FIGURE 13.31

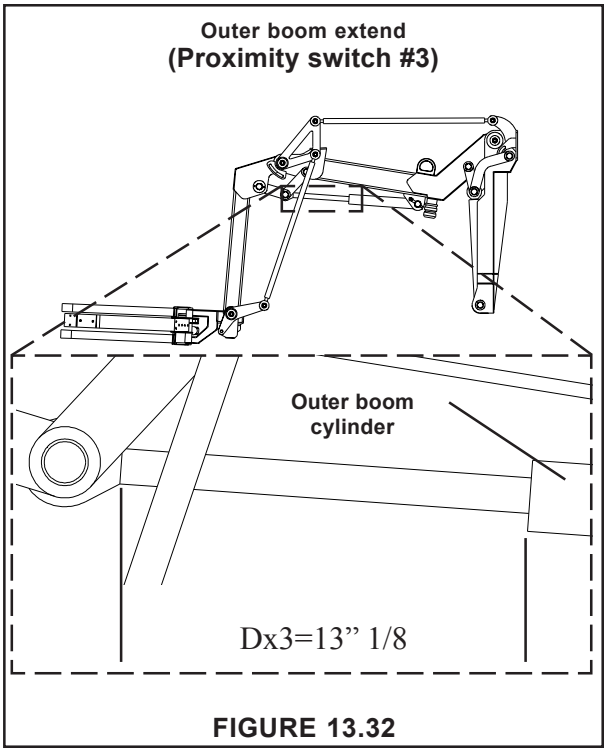


FIGURE 13.32

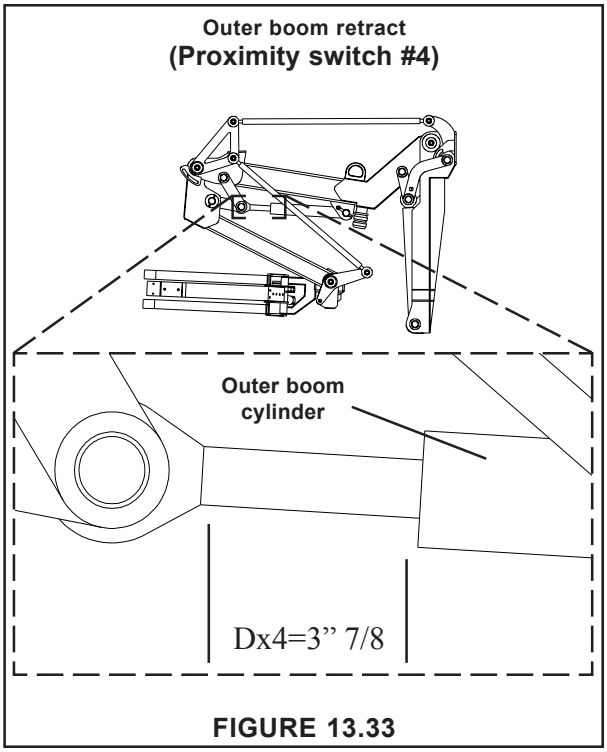


FIGURE 13.33

13.2.7 CYLINDER CUSHION ADJUSTMENT (cont'd)

Located inside the console, two electronic modules control the speed or amount of cushion for the outer and the inner boom cylinders. On each module, there are screws for cushion speed adjustment (figure 13.34). **It is not recommended to change the adjustment of the cushions since they were adjusted at the factory.**

However, if the arm does not reach or hits the rubber bumper too hard, it is possible to reduce (or increase) the speed of the cylinder cushion. Perform the following procedure for cushion adjustment:

DANGER

APPLY THE "LOCKOUT/TAGOUT" PROCEDURE AT ALL TIMES.

NOTE:
The word "extension" and "retraction" refer only to the cylinder movement and not the movement of the arm itself.

DANGER

DO NOT STAND DIRECTLY IN THE PATH OF THE ARM WHILE CARRYING OUT THESE ADJUSTMENTS.

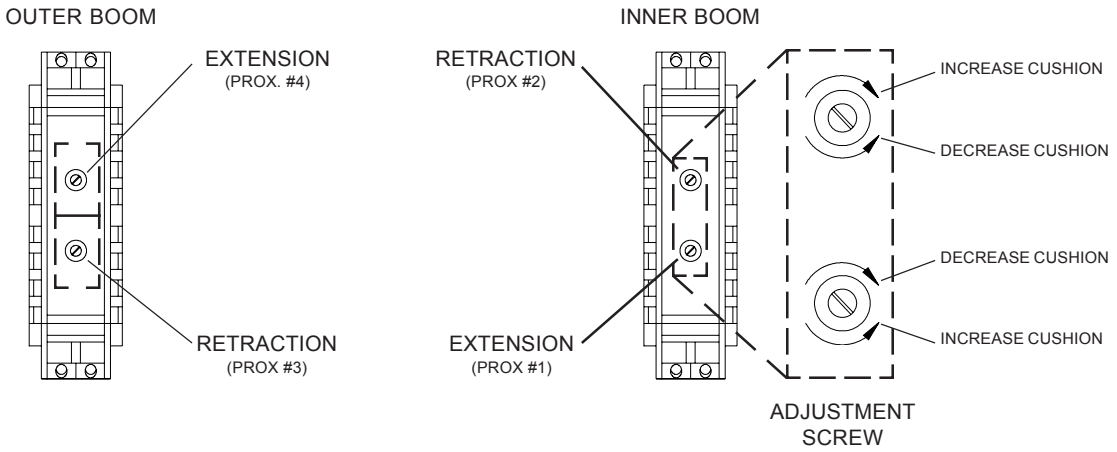
CUSHION SPEED ADJUSTMENT PROCEDURE

1. **Secure the area around the path of the arm.**
2. **Start the engine and engage the hydraulic system.**
3. **Clearly identify the cylinder cushion that needs to be adjusted and the corresponding module.**
4. **Move the joystick slowly to the desired position in order to bring the cylinder at the beginning of the cushion range (distance Dx), At that point, the red pilot light shall turn "OFF".**
5. **Release the joystick and make sure that the proximity switch light is "OFF".**
6. **Move the joystick again in the same direction to evaluate the speed of the arm. The arm cylinder should reach the end of its stroke without knocking. If not, increase the amount of cushion (reduce the speed).**

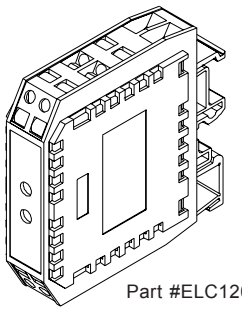
The screw on the cushion module may be turned clockwise or counterclockwise depending on what result is required.

The cushion's speed adjustment is made by step of one quarter (1/4) of a turn at a time. See figure 13.34 for proper way to increase or decrease the amount of cushion as it is not the same way for each screw).

Increasing the amount of cushion will result in reducing the speed of the arm in the cushion range. Decreasing the amount of cushion will result in faster arm speed in the cushion range.

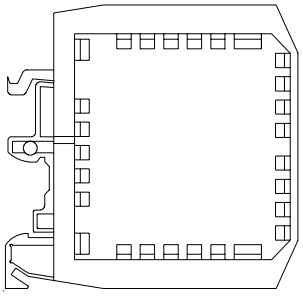


CUSHIONING MODULE



Part #ELC12000

SIDE VIEW



FRONT VIEW

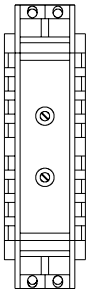


FIGURE 13.34

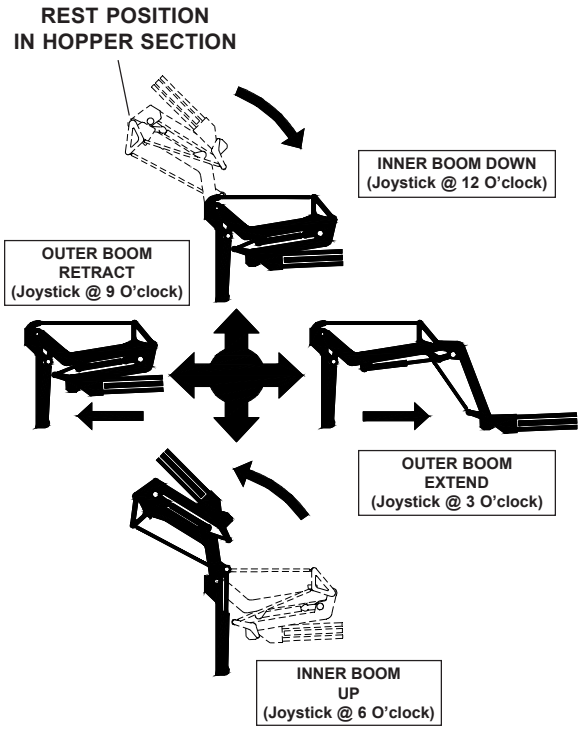


FIGURE 13.35

13.2.8 ARM SPEED ADJUSTMENT

The arm speed is controlled by the amount of hydraulic fluid that is being sent to the arm's cylinder. The arm control valve spools can let through 6 to 10 gallons per minute of hydraulic oil, depending on the section of the valve*. The flow is limited by a mechanical movement restrictor or stopper (figure 13.36).

Note:
No arm speed adjustment is required unless replacing the valve or a section of it.

ARM CONTROL VALVE

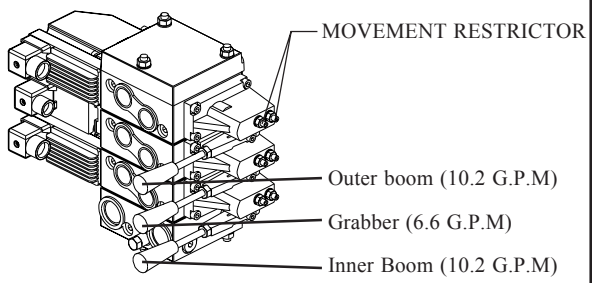


FIGURE 13.36

DANGER

APPLY THE "LOCKOUT/TAGOUT" PROCEDURE AT ALL TIMES.

DANGER

DO NOT STAND DIRECTLY IN THE PATH OF THE ARM WHILE CARRYING OUT THESE ADJUSTMENTS.

ARM SPEED ADJUSTMENT PROCEDURE

1. **Secure the area around the path of the arm.**
2. **Start the engine and engage the hydraulic system.**
3. **Clearly identify the stopper screw on the valve that corresponds to the proper function (boom extension/ retraction, grabber open/close). Move the lever to evaluate the speed of the arm then release the lever.**
4. **Loosen the lock nut.**
5. **Screw in the restrictor adjustment only one eighth (1/8th) of a turn at a time to see a significant change of the arm's speed.**
6. **Move the lever again to evaluate the arm's speed. Repeat until satisfactory.**
7. **Tighten the lock nut.**

NOTE:
The cushioning system is not functioning when using manual control levers.

*** Limiting the stroke of the spools is limiting the amount of oil (flow) going through them. Controlling the flow of oil means controlling the speed of the arm.**

13.2.9 OUTER BOOM RESTRICTOR ADJUSTMENT

The outer boom cylinder is equipped with an adjustable restrictor on the rod side (extension). The restrictor (figure 13.37) prevents the weight of the arm to pull the cylinder faster than the oil pressure.

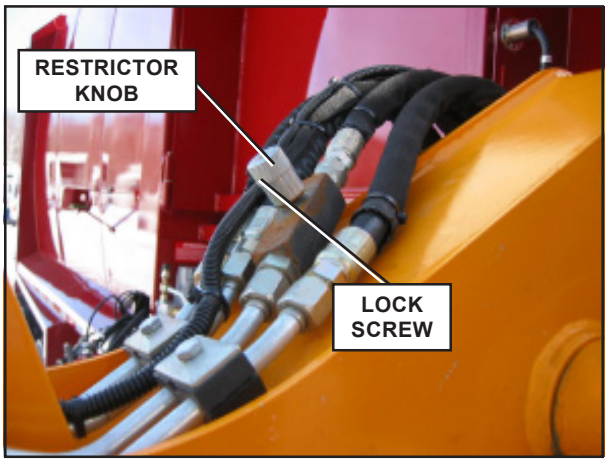


FIGURE 13.37

FIGURE 13.38

RESTRICTOR ADJUSTMENT PROCEDURE

1. **Secure the area around the path of the arm.**
2. **Engine at idle speed: 750-800 RPM.**
3. **Maintain the crusher panel up to warm up the hydraulic oil (10-15 minutes). Release the crusher panel then activate the packer blade so the oil goes through the whole system. Repeat this operation until the oil temperature reaches 150 ^{0}F.**
4. **Position the arm as shown in figure 13.38.**
5. **Unlock the restrictor knob by loosening the hex key lock screw.**
6. **Screw-out the restrictor knob.**
7. **Extend and retract the outer boom several times. At one point, while extending the outer boom, the weight of the outer pulls faster on the cylinder than the flow coming from the pump. The arm slows down and goes again when the flow reaches the cylinder.**
8. **Screw-in the restrictor until the pump alone forces the extension of the cylinder and you obtain a steady pendulum motion.**
9. **Do not over screw the restrictor, since the restriction has to be at the minimum, so the arm speed and the oil temperature are not affected.**
10. **Once properly adjusted, lock the restrictor knob in place using the hex key lock screw.**

13.2.10 INNER BOOM LOCK VALVE ADJUSTMENT

IMPORTANT:
Throughout this procedure: the inner boom cylinder must not bottom out. Use only hydraulic power to raise the inner boom.

INNER BOOM LOCK VALVE ADJUSTMENT PROCEDURE

1. **Secure the area around the path of the arm.**
2. **Start the engine and engage the hydraulic system.**
3. **Operate the inner boom to ensure no air is in the hydraulic system.**
4. **Retract the inner boom cylinder to one-third of its stroke (Inner boom down), then extend the outer boom cylinder to full reach.**
5. **Loosen the locknut on the cartridge of the lock valve (figure 13.39).**
6. **With the pump switch turned off, tighten the adjustment screw until the inner boom starts to fall under it's own weight (The inner boom may start to shake when loosening too much).**
7. **Then return the screw back in until the inner boom just stops falling. Pick up a weight of 450 lbs to the grabber and check if the inner boom goes further down. If the inner boom falls, loosen the adjustment screw until it stops.**
8. **Once properly adjusted tighten the locknut of the adjustment screw.**

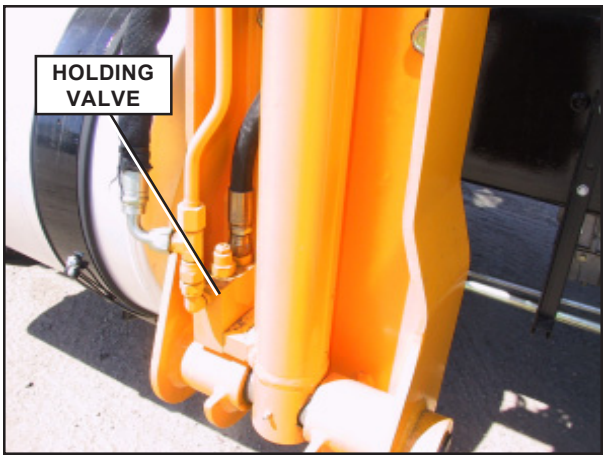


FIGURE 13.39

DANGER

APPLY THE "LOCKOUT/TAGOUT" PROCEDURE AT ALL TIMES.

DANGER

DO NOT STAND DIRECTLY IN THE PATH OF THE ARM WHILE CARRYING OUT THESE ADJUSTMENTS.

13.2.11 GRABBER LOCK VALVE ADJUSTMENT

The purpose of this lock valve is to lock the oil inside the cylinder so no oil can come out on either side of it. This situation will remain until enough flow or pressure is sent in again to move the cylinder.

This feature ensures that once the grabber is closed on a roller cart, it will remain that way and will not close any further or open until another hydraulic signal (like open or close the grabber) is sent. No maintenance or adjustment is required on the lock valve.

In case the grabber fails to hold onto carts, remove and clean the valve or replace it

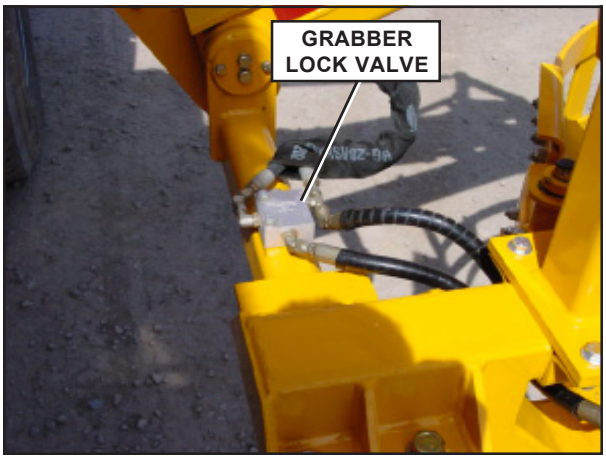


FIGURE 13.40

DANGER

APPLY THE "LOCKOUT/TAGOUT" PROCEDURE AT ALL TIMES.

DANGER

DO NOT STAND DIRECTLY IN THE PATH OF THE ARM WHILE CARRYING OUT THESE ADJUSTMENTS.

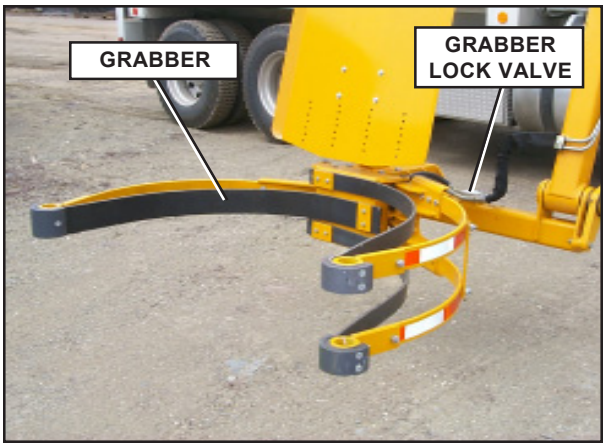


FIGURE 13.41

13.2.12 PRESSURIZED HYDRAULIC TANK

To make sure the pump is properly fed with oil and to prevent any cavitation, the hydraulic tank is pressurized with air.

The air from the brake system of the truck is being used for this purpose. The pressure has to be brought down around 3 to 3.5 PSI with the use of an air pressure regulator (figure13.44).

Then the air pressure enters the hydraulic tank from the top and presses down on the hydraulic oil to feed the pump. To prevent any pressure built up, a safety relief valve set to PSI is being used. The filler cap will also vent any air pressure higher than 5 PSI.

DANGER

DO NOT EXCEED A PRESSURE OF 5 PSI WHEN ADJUSTING THE AIR REGULATOR. KEEP THE SAFETY VALVE AND THE FILLER CAP CLEAN AND TAKE EXTREME PRECAUTION WHEN OPENING THE FILLER CAP.

FIGURE 13.42

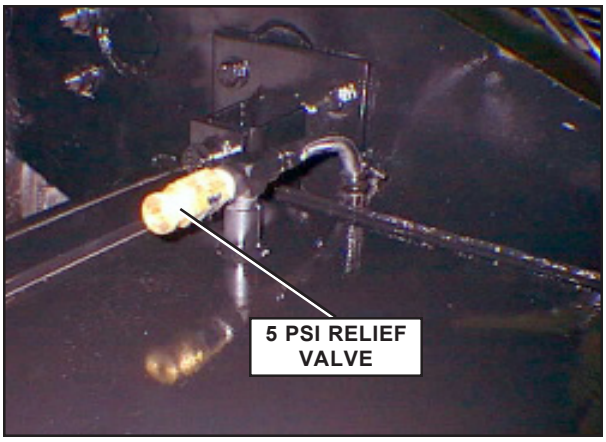


FIGURE 13.43

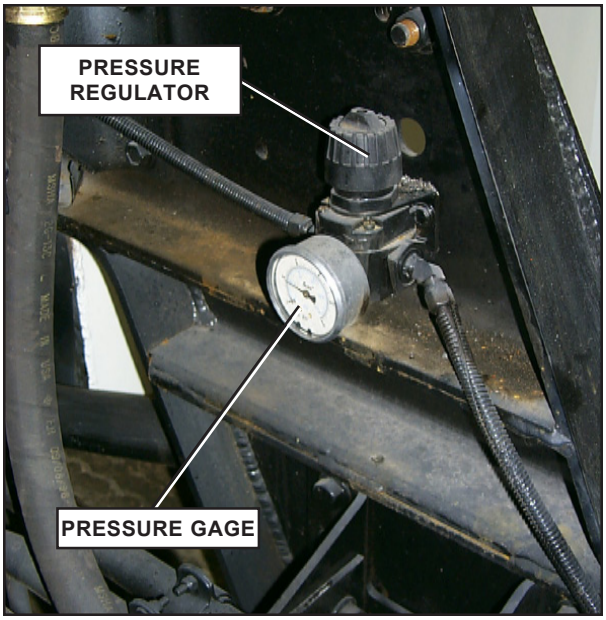


FIGURE 13.44

13.3 ELECTRICAL SYSTEMS

13.3.1 ELECTRICAL SYSTEM GENERAL DESCRIPTION

The automated side loader units use the same electrical system for the body and cab controls as the standard Expert 2000 unit, except the wiring of the auto-neutral system (See section 13.3.4).

Also, the automated arm has a separate wiring system. A combination of different color-coded wiring harnesses, ensure the proper electrical communication between the joystick, the arm computer (cushioning module) and the hydraulic control valve.

Most of the electrical components are located in the console. A sealed packer control module located at the front of the body and can be accessed through a removable access door (figure 13.45).

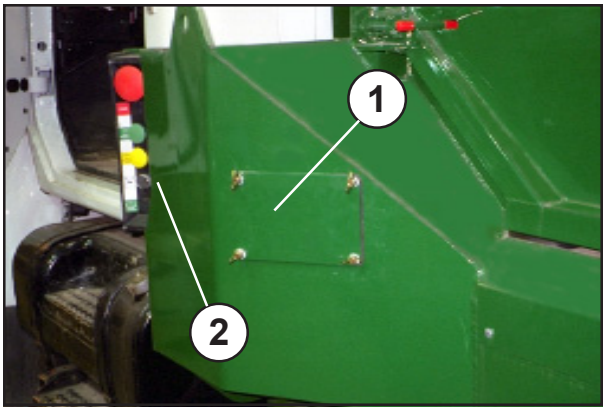


FIGURE 13.45

PACKER ELECTRONIC MODULE

1: ACCESS DOOR FOR PACKER MODULE

2: PACKER CONTROLS (optional on left-hand side)

13.3.2 ELECTRICAL SCHEMATICS

Refer to the main electrical schematic found a little plastic bag inside the console (figure 13.46).

For every truck configuration, a different schematic is being used. Therefore, the electrical schematics found the special pocket of this manual and in the console are specific to the truck. Those schematics are numbered in the bottom right corner. To help trace back the proper schematic going with a specific truck, a sticker with schematic number is applied on the inside wall of the console.

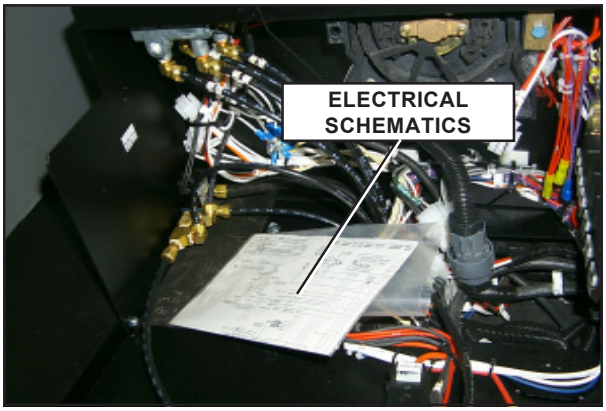


FIGURE 13.46

13.3.3 ALLISON TRANSMISSION PROGRAMMING PARAMETERS

The Allison transmission electronic control unit (ECU) controls several systems of the automated unit; it prevents pump from over speeding (2300 RPM maximum). The ECU also prevents the pump engagement if the engine speed is any higher than 900 RPM. It will also shut off the pump and the joystick (of the arm) if the vehicle is moving faster than 15 MPH (25Km/h). The transmission ECU also controls the auto-neutral system.

If the vehicle requires having the ECU repaired or replaced, or a specific programming parameters, refer to section 3.17 "Allison Transmission Programming Parameters".

A "Pro-link" keypad interface (figure 13.47) may be used to program the Allison ECU and verify if the signals are properly reaching the computer and verify the fault code. To tap onto the ECU, Labrie uses the following wires on the Allison connector:

FIGURE 13.47

INPUT:

#117: PUMP PACK ENABLE: Active when the brakes are used, and when the PTO and auto-neutral switch is "ON"(ground signal).

#118: PTO ENABLE: Active when the PTO switch is "ON"(+12V. signal).

#153: AUTO-NEUTRAL PACK INPUT: Active when the brakes are used, and when the PTO and auto-neutral switches are "ON" (ground signal).

OUTPUT:

#112: PTO ENABLE OUTPUT: Active when the PTO switch is "ON" and when all engine and vehicle speed criteria are respected (+12V. signal). Refer to the programming parameter chart, section 3.17 "Allison Transmission Programming Parameters" in the Troubleshooting section of the Parts and Service manual.

#114: NEUTRAL SIGNAL OUTPUT: Active when the transmission is in neutral. This signal (ground signal) is used to allow the fast idle engagement (1500 RPM). For more details, refer to the electrical schematic.

13.3.4 AUTO-NEUTRAL SYSTEM

The Auto-neutral switch allows the transmission to shift from "**DRIVE**" to "**NEUTRAL**" automatically without using the shifter lever or shifter keypad.

When the operator stops the vehicle and applies the temporary handbrake, a signal is sent to transmission computer (ECU) to automatically shift the transmission to "**NEUTRAL**". However, the transmission will not shift back to "**DRIVE**" automatically when releasing the temporary handbrake; the operator must press the footbrake pedal to shift back to "**DRIVE**"

Also, when the Auto-neutral switch is set to "ON", the transmission will automatically shift to **NEUTRAL** as soon as the operator presses the footbrake pedal (without activating the temporary handbrake).

30 PSI of air is required at the brake pedal to activate the Auto-neutral. This means that a medium pressure of the foot on the brake pedal is sufficient to activate the Auto-neutral and shift the transmission to "**NEUTRAL**". When releasing the brake pedal, the transmission will shift back to "**DRIVE**" automatically.

Pressure switch

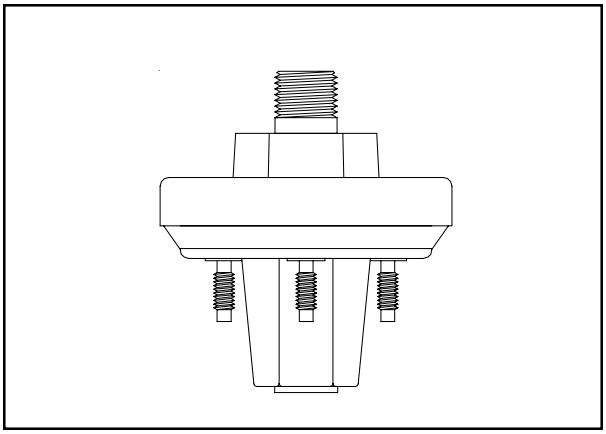


FIGURE 13.48

Pressure switches (figure 13.48) are installed on the footbrake pedals. The one installed on the right-hand side, is found in the cab behind the pedal (figure 13.49). The one on the left-hand side is accessible from the engine compartment mounted on the firewall (figure 13.50). A third pressure switch is located behind the temporary handbrake toggle switch (figure 13.51).

Pressure switch on the right-hand side driving position

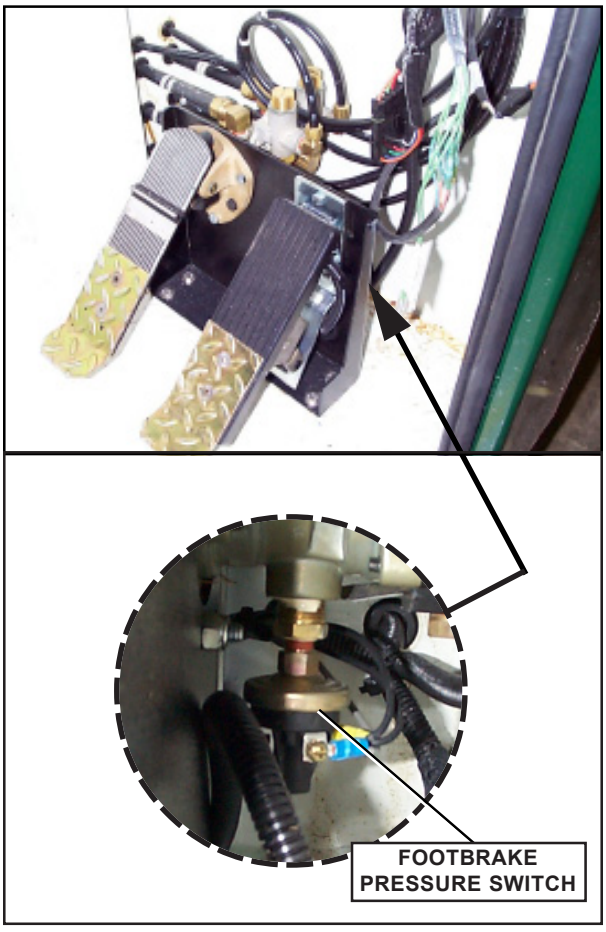


FIGURE 13.49

Continued on next page . . .

13.3.4 AUTO-NEUTRAL SYSTEM (Cont'd)

The pressure switches found on the footbrake (PNI00605) are adjustable but were calibrated at 30 PSI from the factory and do not required further adjustment. The pressure switch for the temporary handbrake (PNI00600) is fixed and it is set to operate at 55PSI.

Pressure switch on the engine compartment

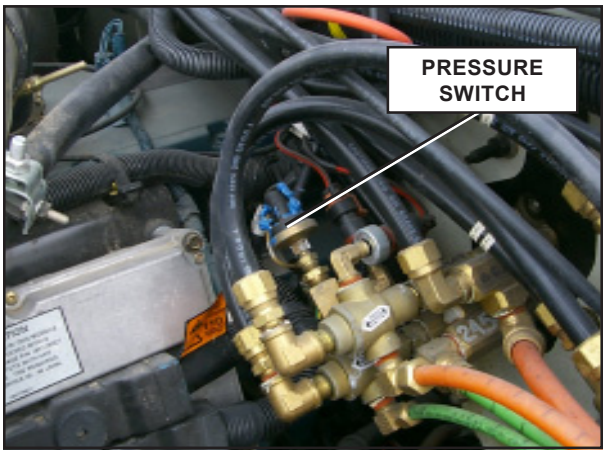


FIGURE 13.50

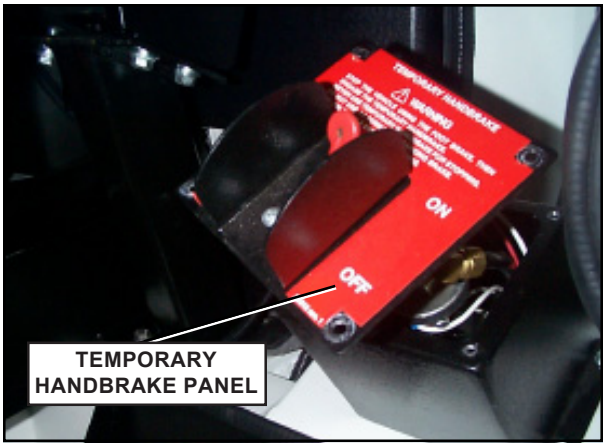


FIGURE 13.51

Pressure switch behind temporary handbrake

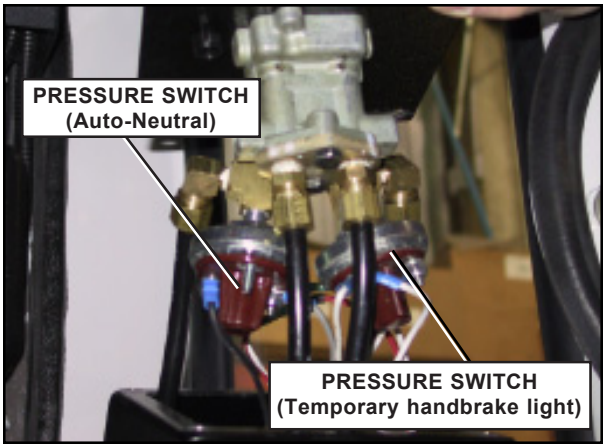
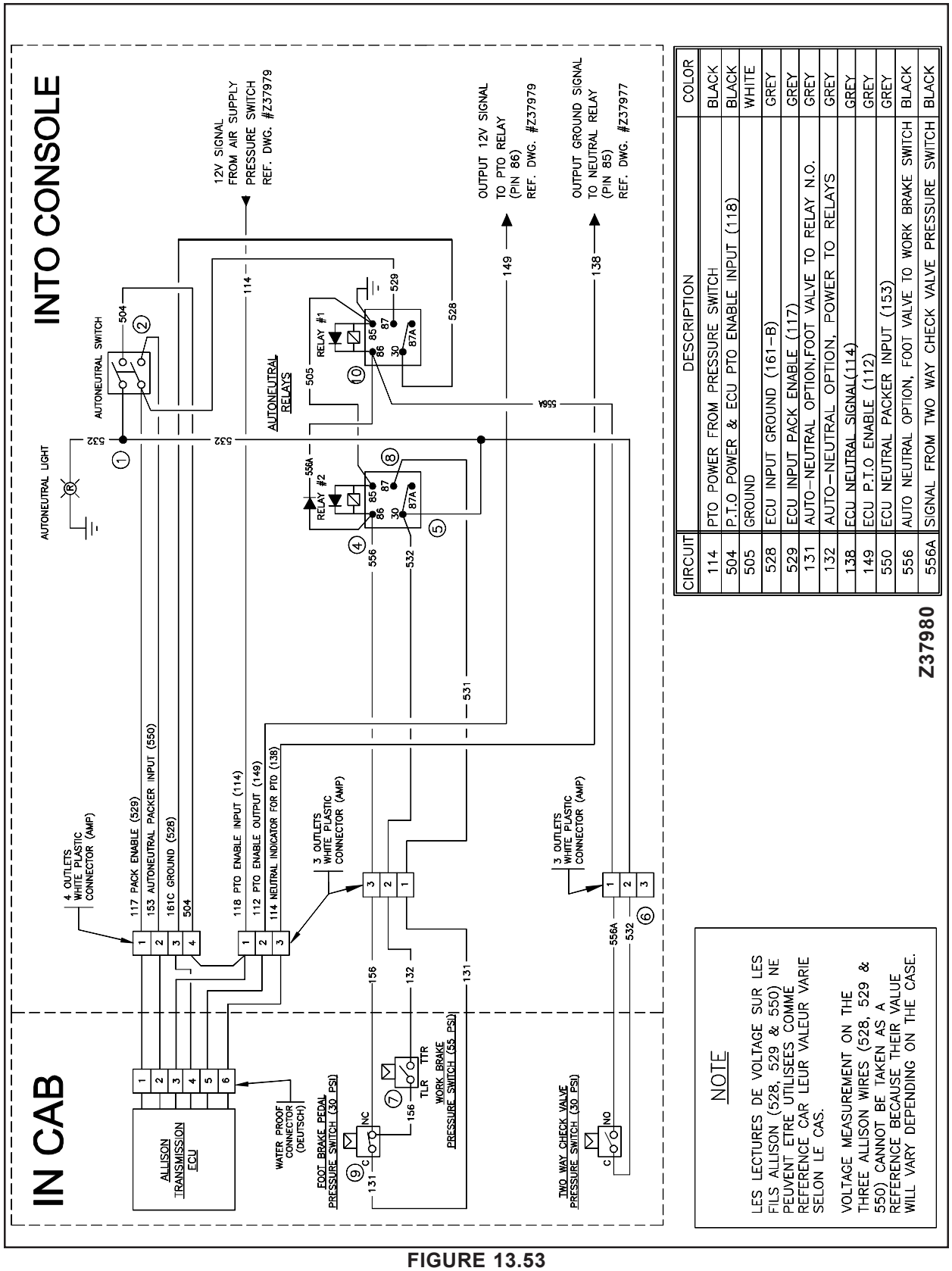


FIGURE 13.52

AUTO NEUTRAL TROUBLESHOOTING SCHEMATICS



CIRCUIT	DESCRIPTION	COLOR
114	PTO POWER FROM PRESSURE SWITCH	BLACK
504	P.T.O POWER & ECU PTO ENABLE INPUT (118)	BLACK
505	GROUND	WHITE
528	ECU INPUT GROUND (161-B)	GREY
529	ECU INPUT PACK ENABLE (117)	GREY
131	AUTO-NEUTRAL OPTION,FOOT VALVE TO RELAY N.O.	GREY
132	AUTO-NEUTRAL OPTION, POWER TO RELAYS	GREY
138	ECU NEUTRAL SIGNAL(114)	GREY
149	ECU P.T.O ENABLE (112)	GREY
550	ECU NEUTRAL PACKER INPUT (153)	GREY
556	AUTO NEUTRAL OPTION, FOOT VALVE TO WORK BRAKE SWITCH	BLACK
556A	SIGNAL FROM TWO WAY CHECK VALVE PRESSURE SWITCH	BLACK

NOTE

LES LECTURES DE VOLTAGE SUR LES FILS ALLISON (528, 529 & 550) NE PEUVENT ETRE UTILISEES COMME REFERENCE CAR LEUR VALEUR VARIE SELON LE CAS.

VOLTAGE MEASUREMENT ON THE THREE ALLISON WIRES (528, 529 & 550) CANNOT BE TAKEN AS A REFERENCE BECAUSE THEIR VALUE WILL VARY DEPENDING ON THE CASE.

FIGURE 13.53

13.4 TROUBLESHOOTING GUIDE

13.4.1 COOL HAND TROUBLESHOOTING

This troubleshooting guide will help identify the most commonly seen problems on the Cool hand Automated Arm. It will also provide the possible cause of a problem and give possible solutions to resolve the problem. This guide applies only to the Cool Hand section of the unit. For further information regarding the body or other problems that might occur, refer to the body troubleshooting guide found in section 3 of this manual or contact the Labrie Technical Support service.

PROBLEMS	POSSIBLE CAUSES	SOLUTION
• The cushion's distance is insufficient or too long. (Without Smart-Hand feature)	1. The proximity switches are faulty or misplaced on bracket mount;	1. Position the proximity switch on bracket mount (See section 13.2.7 "Cylinder cushion adjustment");
	2. Power cables are cut off or defective;	2. Change faulty proximity switches and/or cables;

PROBLEMS	POSSIBLE CAUSES	SOLUTION
• The arm is too fast.	1. Wrong pressure setting;	1. Re-calibrate the pressure setting (see section 13.2 "Hydraulic pressure adjustment");
	2. Restrictors on the DANFOSS valve hold too tight;	2. Re-calibrate cylinder's speed (see section 13.2.8 "Arm speed adjustment");

PROBLEMS	POSSIBLE CAUSES	SOLUTION
• The arm is too slow.	1. Wrong hydraulic pressure setting;	1. Re-calibrate the pressure setting (see section 13.2 "Hydraulic pressure adjustment");
	2. Restrictors on the DANFOSS valve hold too tight;	2. Re-calibrate cylinder's speed (see section 13.2.8 "Arm speed adjustment");
	3. No signals from the proximity switches;	3. Check for incoming signals from the proximity switches (See section 13.4.2 "Proximity switch signal checking procedure");
	4. Faulty proximity switches;	4. Change faulty proximity switches and or cables;

13.4.1 COOL HAND TROUBLESHOOTING (cont'd)

PROBLEMS	POSSIBLE CAUSES	SOLUTION
• Flashing lights on dashboard are always blinking. (Without Smart-Hand feature)	1. The proximity switch in the hopper section is misplaced;	1. Position the proximity switch on bracket mount, aligned with the metal rod, inner boom up in the hopper section;
	2. Power cables are cut off or defective;	2. Perform a continuity test on the cable or change faulty cables;
	3. The proximity switch is faulty.	3. Change faulty proximity switches;

PROBLEMS	POSSIBLE CAUSES	SOLUTION
• The arm does not respond to joystick (Assuming that PTO switch and light are On). (Without Smart-Hand feature).	1. Burned fuses.	1. Check fuses in the console (6 port fuse holder)
	2. Power cables are cut off or defective.	2. Check red wires (#158) on each cushioning modules for 12 volts supply (Move joystick to get signals).
	3. Faulty joystick.	3. Contact customer's services at Labrie.

13.4.2 PROXIMITY SWITCH SIGNAL CHECKING PROCEDURE

SIGNALS CHECKING PROCEDURE

1. **Secure the area around the path of the arm.**
2. **Start the engine and engage the hydraulic system.**
3. **With the levers installed on the arm control valve, bring the arm cylinders to the middle of their stroke (Inner and outer boom half extension).**
4. **Make sure that all the proximity switches light are "ON" (Red pilot lights).**
5. **Identify, in the console, the corresponding cushioning module for each proximity switches.**
6. **Check each wires (figure 13.54) for proper ground signals.**

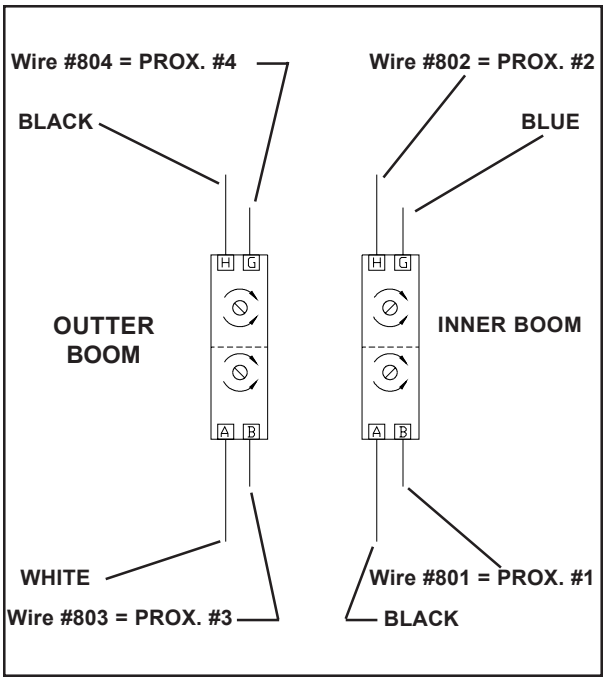


FIGURE 13.54

NOTE:
For more details on the cushioning modules, refer to section 13.2.7 "Cylinder cushion adjustment".

13.5 HYDRAULIC SCHEMATICS (Arm section)

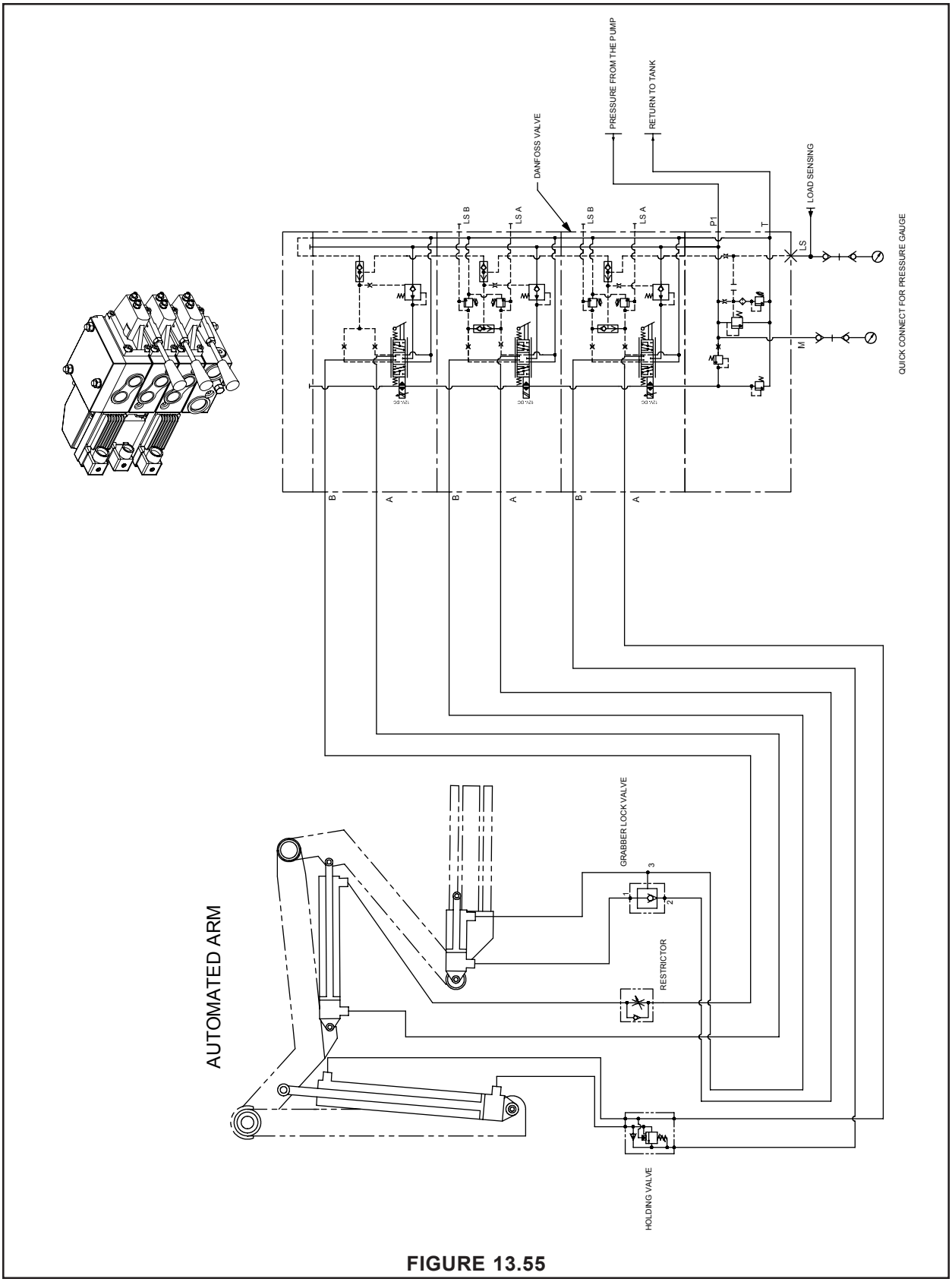


FIGURE 13.55

13.6 HYDRAULIC SCHEMATIC (Body section)

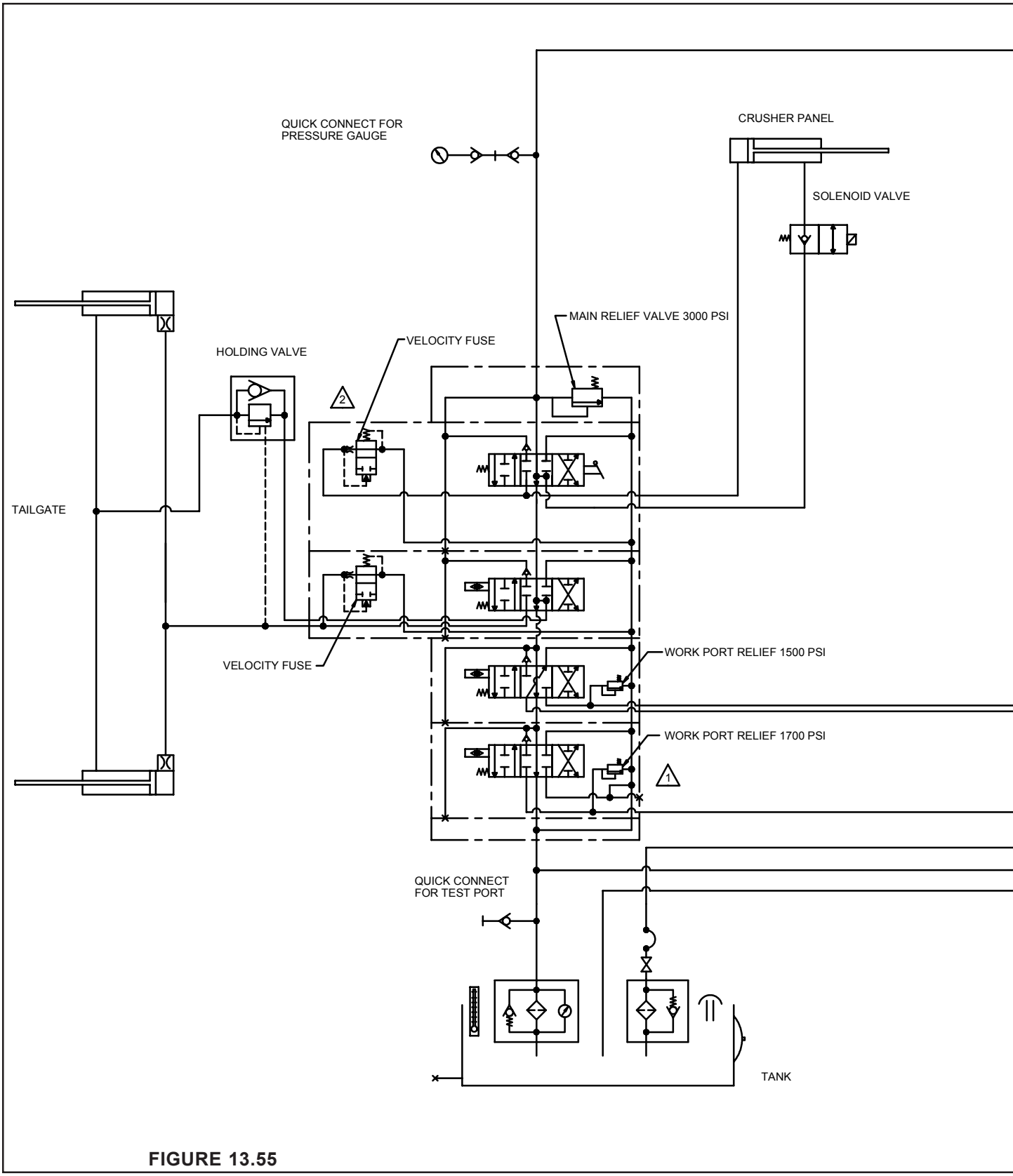
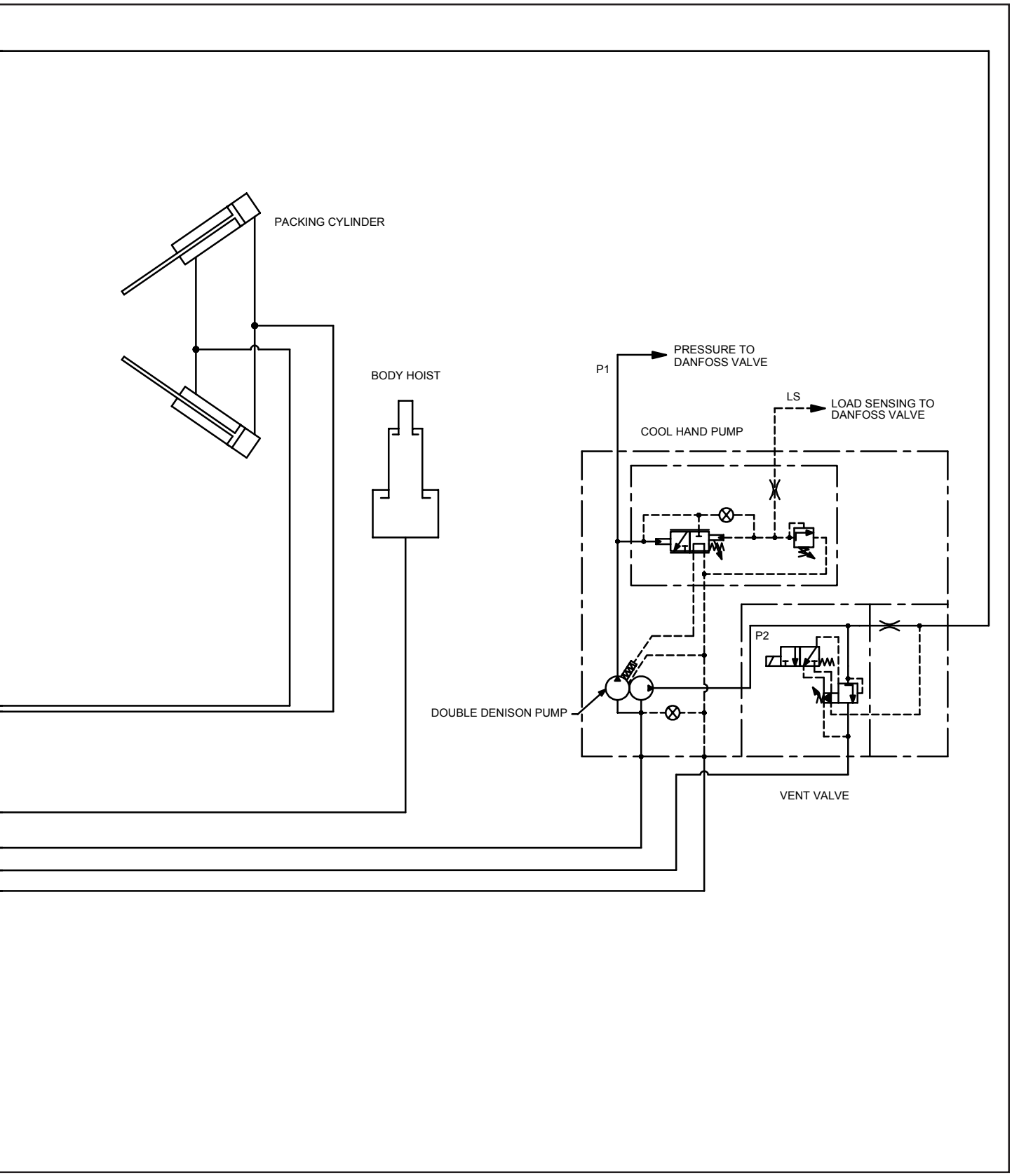


FIGURE 13.55


PACKING CYLINDER
BODY HOIST
P1
PRESSURE TO
DANFOSS VALVE
LS
LOAD SENSING TO
DANFOSS VALVE
COOL HAND PUMP
P2
DOUBLE DENISON PUMP
VENT VALVE

13.7 22, 29, 34 CU.YD BODY HYDARULIC DIAGRAM FOR COOL HAND

13.7.1 EXPERT 2000HYDRAULIC DIAGRAM, 3000psi system, with Cool-Hand Automated arm

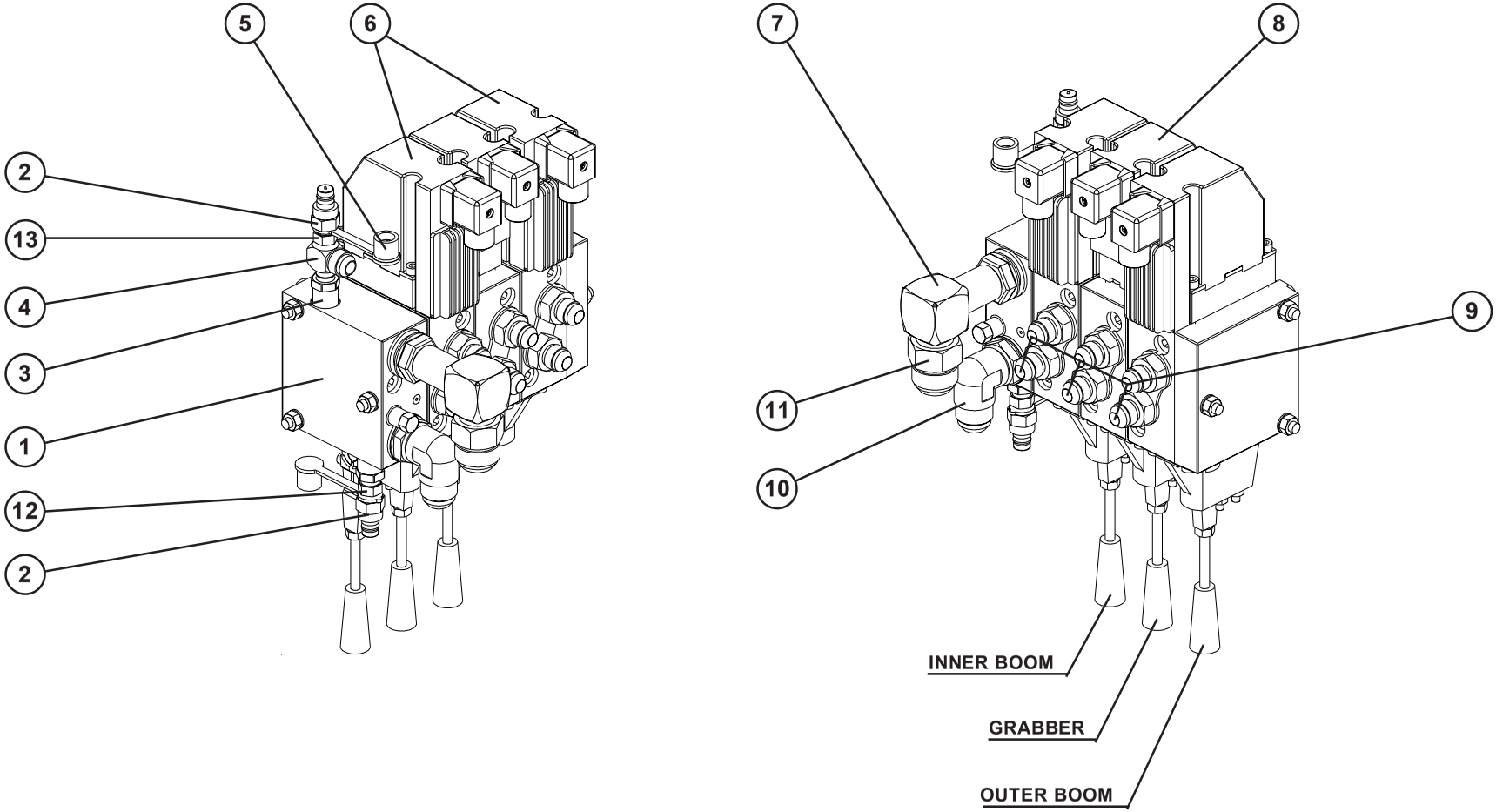
13.7 22,29, 34 CU.YD BODY HYDRAULIC DIAGRAM FOR COOL HAND

13.7.1 EXPERT 2000HYDRAULIC DIAGRAM, 3000psi system, with Cool-Hand Automated arm

No.	Part #	Description	Qty.
1	HYF06700	Fitting / all	2
2	25000	Pipe / 25 and 29 cu. yd.	1
	25000	Pipe / 34 cu.yd with tag axle	1
	25463	Pipe / 34 cu.yd without tag axle	1
3	25252	Pipe / All	1
4	HYF05400	Fitting / All	1
5	27333	Pipe / 22 cu. yd.	1
	20632	Pipe / 29 cu. yd.	1
	44546	Pipe / 34 cu. yd.	1
6	20911	Hose / All	1
7	27321	Pipe / All	1
8	25179	Pipe / 22 and 29 cu. yd.	1
	25179	Pipe / 34 cu.yd with tag axle	1
	25466	Pipe / 34 cu.yd without tag axle	1
9	HYF08110	Fitting / All	1
10	HYF06600	Fitting / All	1
11	25191	Pipe / All	1
12	HYF05114	Fitting / All	1
13	31225	Pipe / 22 cu. yd.	1
	20625	Pipe / 29 cu. yd.	1
	44547	Pipe / 34 cu. yd	1
14	30272	Hose / All	1
15	27326	Pipe / All	1
16	HYF06900	Fitting / All	1
17	29598	Pipe	1
18	25055	Pipe / 25 and 29 cu. yd.	1
	25055	Pipe / 34 cu.yd with tag axle	1
	25465	Pipe / 34 cu.yd without tag axle	1
19	HYF06800	Fitting / All	2
20	25192	Pipe / All	1
21	HYF05300	Fitting / All	1
22	31224	Pipe / 22 cu. yd.	1
	10395	Pipe / 29 cu. yd.	1
	10974	Pipe / 34 cu. yd.	1
23	30282	Hose / All	1
24	20635	Pipe / All	1
25	24387	Pipe / All	1
26	5007	Bracket / All	2
27	HYS0200	Support / All	5
28	HYS0300	Support / All	5
28	HYS0400	Support / All	5

13.7 22, 29, 34 CU.YD BODY HYDARULIC DIAGRAM FOR COOL HAND

13.7.2 PROPORTIONNAL VALVE



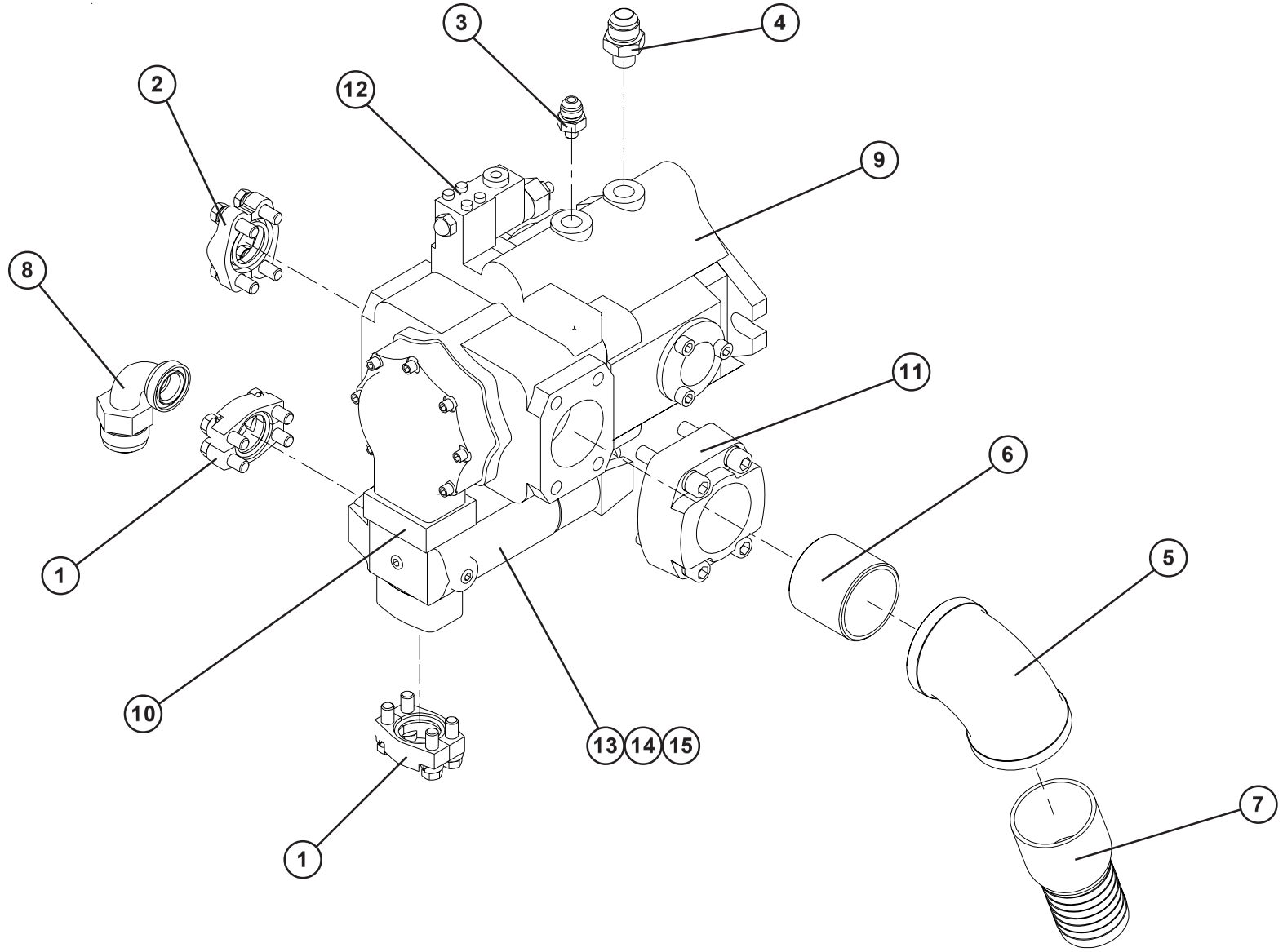
13.7 22,29, 34 CU.YD BODY HYDRAULIC DIAGRAM FOR COOL HAND

13.7.2 PROPORTIONNAL VALVE

No.	Part #	Description	Qty.
1.	HYV04300-01	Proportional valve assy.	1
2.	HYF10200	Quick connect	2
3.	HYF04690	Adaptor union	2
4.	27324	Adaptor 90°	1
5.	HYF10050	Protector cap	2
6.	HYV04321-01	Electric actuator	2
7.	HYF05155	90° adaptor	1
8.	HYV04320	Electric actuator	1
9.	HYF04900	Adaptor, union	6
10.	HYF07500	90° adaptor	1
11.	HYF09625	Adaptor, union	1
12.	HYF09000	Adaptor, union	1
13.	HYF08950	Adaptor, union	1

13.7 22, 29, 34 CU.YD BODY HYDARULIC DIAGRAM FOR COOL HAND

13.7.3 HYDRAULIC PUMP



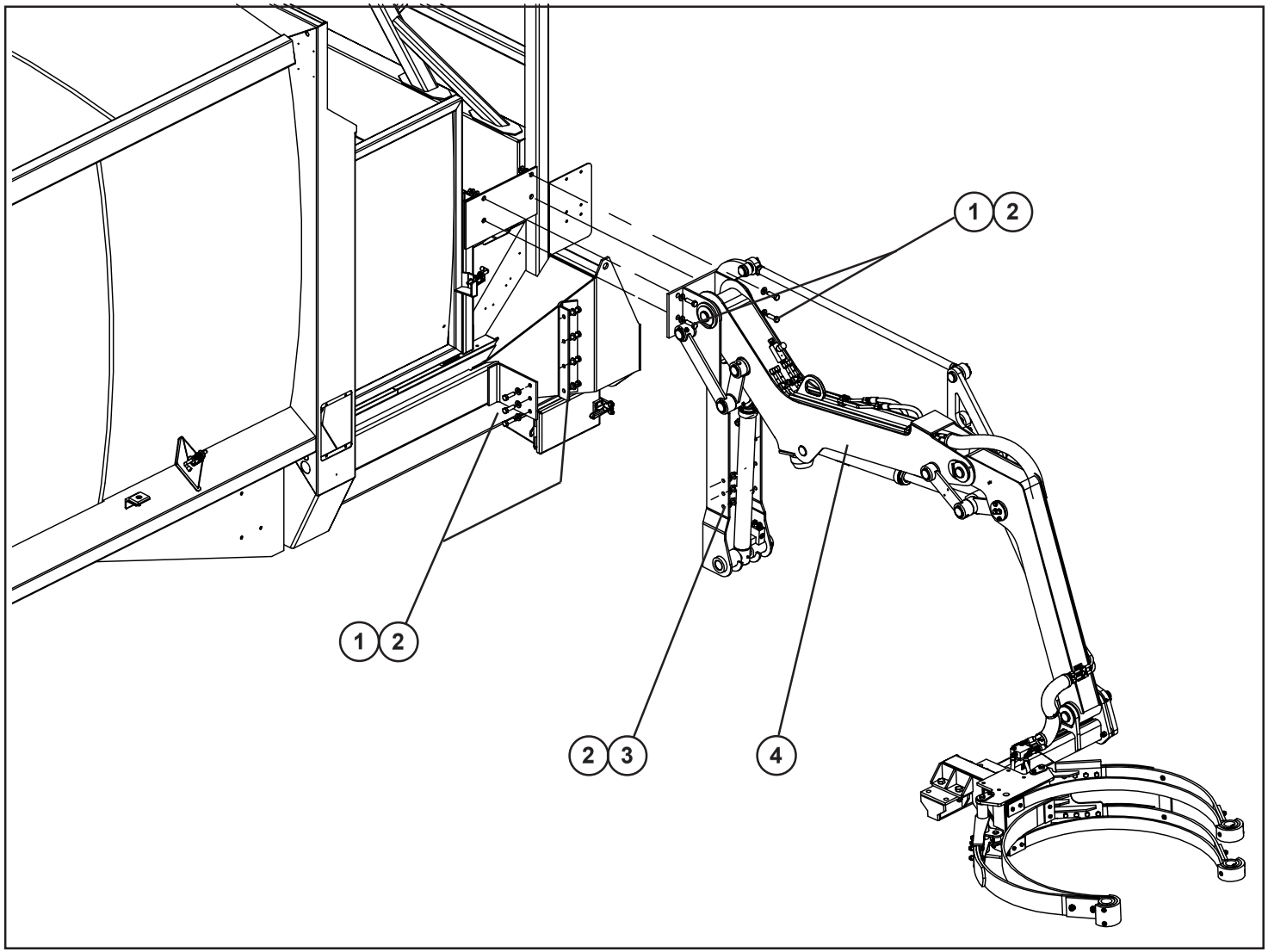
13.7 22,29, 34 CU.YD BODY HYDRAULIC DIAGRAM FOR COOL HAND

13.7.3 HYDRAULIC PUMP

No.	Part #	Description / Body Capacity	Qty.
1.	HYF00080	Adaptor flange	2
2.	HYF00095	Adaptor flange	1
3.	HYF04850	Adaptor, union	1
4.	HYF04955	Adaptor, union	1
5.	HYF13150	90^{O} Pipe adaptor	1
6.	HYF13185	Adaptor	1
7.	HYF14050	Pipe king nipple	1
8.	HYF25005	90^{O} Adaptor	1
9.	HYP01500	Tandem pump (PV29)	1
10.	HYP01550	Spacer	1
11.	HYS02550	Pipe flange	1
12.	HYP01555	Compensator	1
13.	HYP01565	Dump valve	1
14.	HYP01570	Plunger	1
15.	HYP01560	Solenoid	1

13.8 AUTOMATED ARM PARTS

13.8.1 ARM INSTALLATION ON BODY



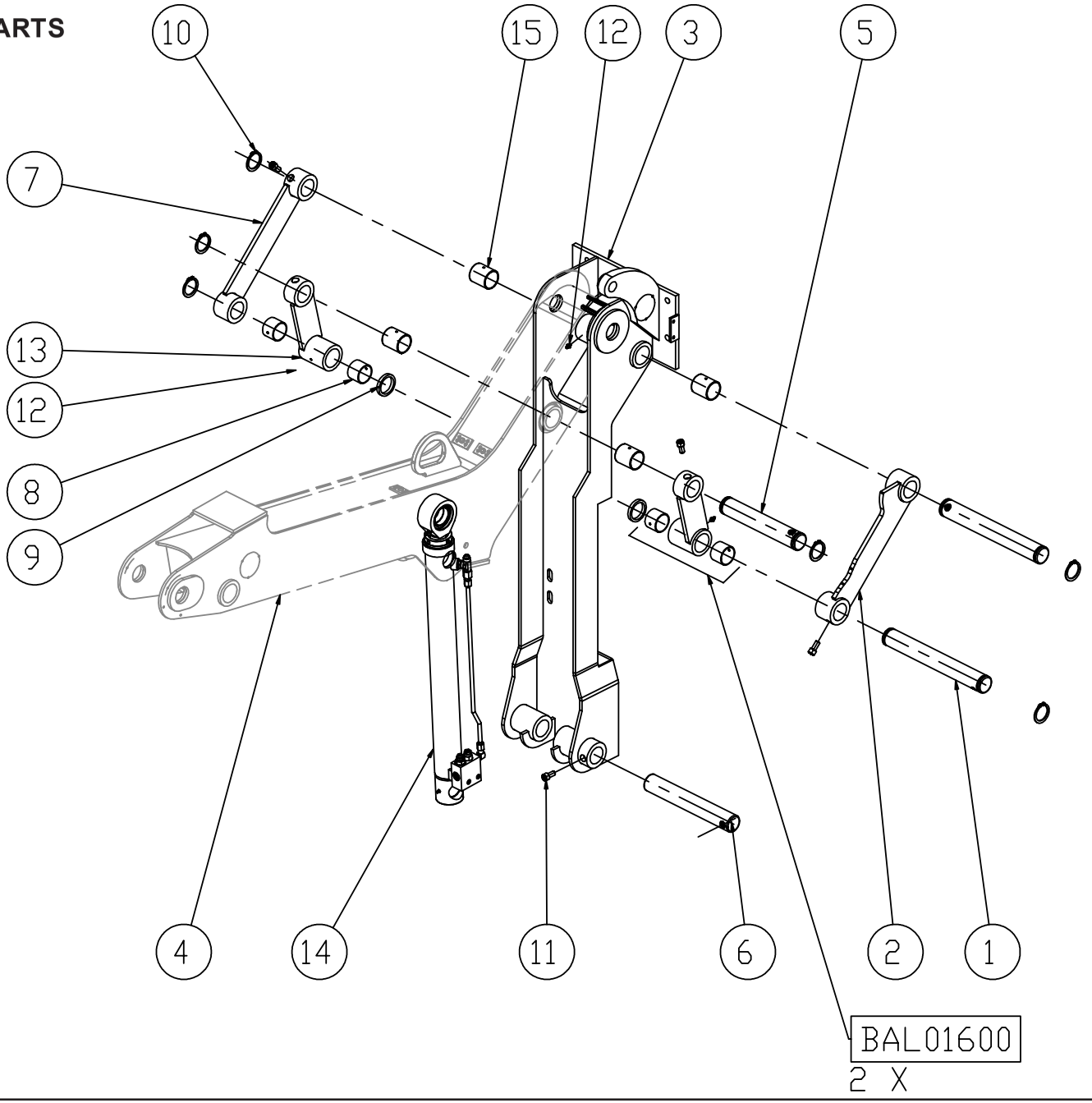
13.8 AUTOMATED ARM PARTS

13.8.1 ARM INSTALLATION ON BODY

No.	Part #	Description	Qty.
1.	QUB13150	Bolt	11
2.	QUR02130	Washer	22
3.	QUE02400	Nut	11
4.	BCB00211-01	Automated arm	1

13.8 AUTOMATED ARM PARTS

13.8.2 ARM BASE ASSEMBLY



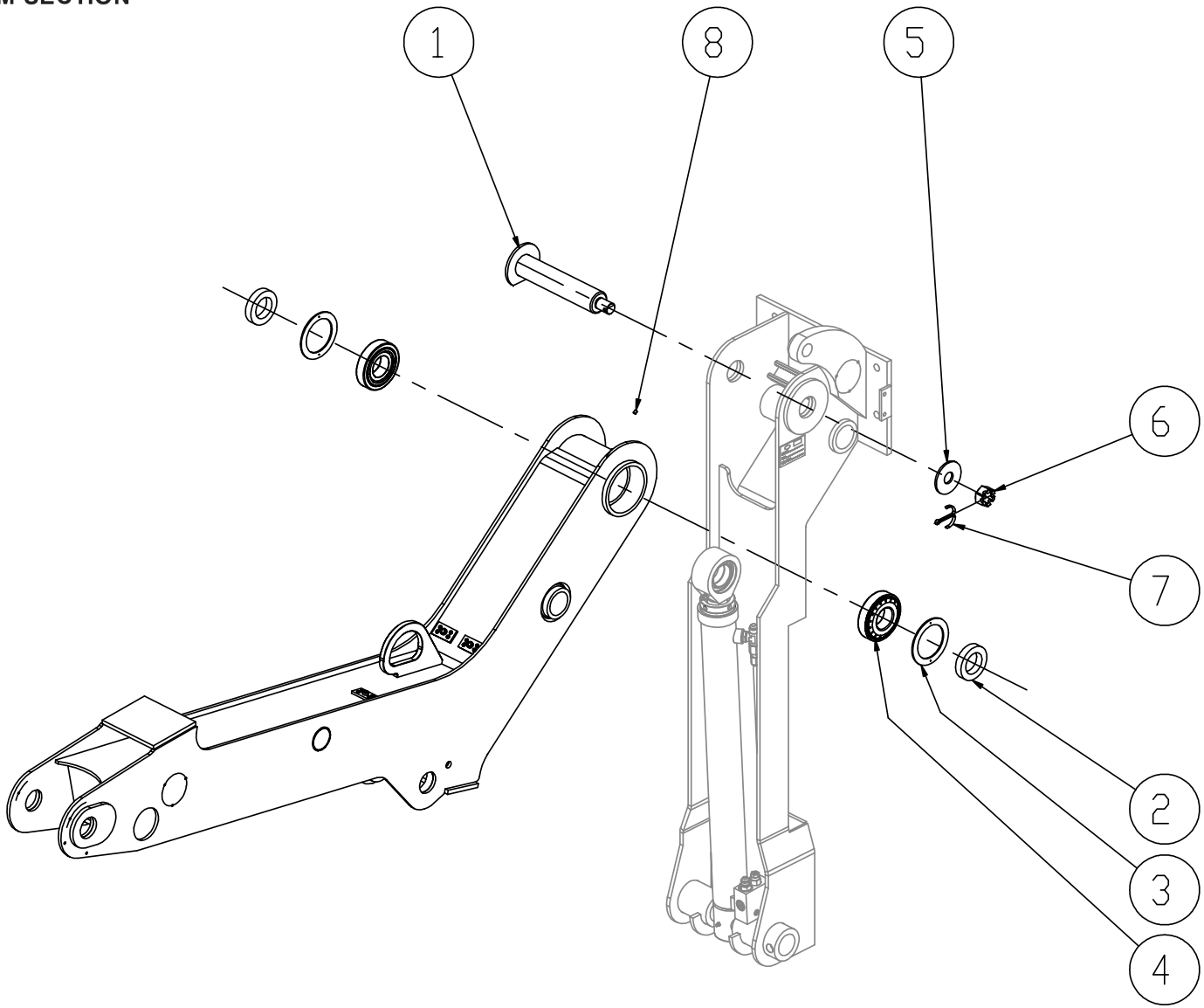
13.8 AUTOMATED ARM PARTS

13.8.2 ARM BASE ASSEMBLY

No.	Part #	Description	Qty.
1.	51513	PIVOT	2
2.	51514	LINKAGE RH EXTERIOR	1
3.	51518	BASE ASSY.	1
4.	51656	INNER BOOM ASSY.	1
5.	BAA01500	PIVOT	1
6.	BAA01600	PIVOT	1
7.	BAL01200	LINKAGE LH EXTERIOR	1
8.	BCH00100	PLAIN BUSHING	8
9.	BCH01600	RING	2
10.	BCH01700	SNAP RING	6
11.	BCH01800	BOLT	4
12.	BCH05125	GREASE FITTING	3
13.	BCH12500	LINKAGE INTERIOR	2
14.	HYC00216	LOWER BOOM CYLINDER	1
15.	QUB45000	PLAIN BUSHING	4

13.8 AUTOMATED ARM PARTS

13.8.3 INNER BOOM SECTION



13.8 AUTOMATED ARM PARTS

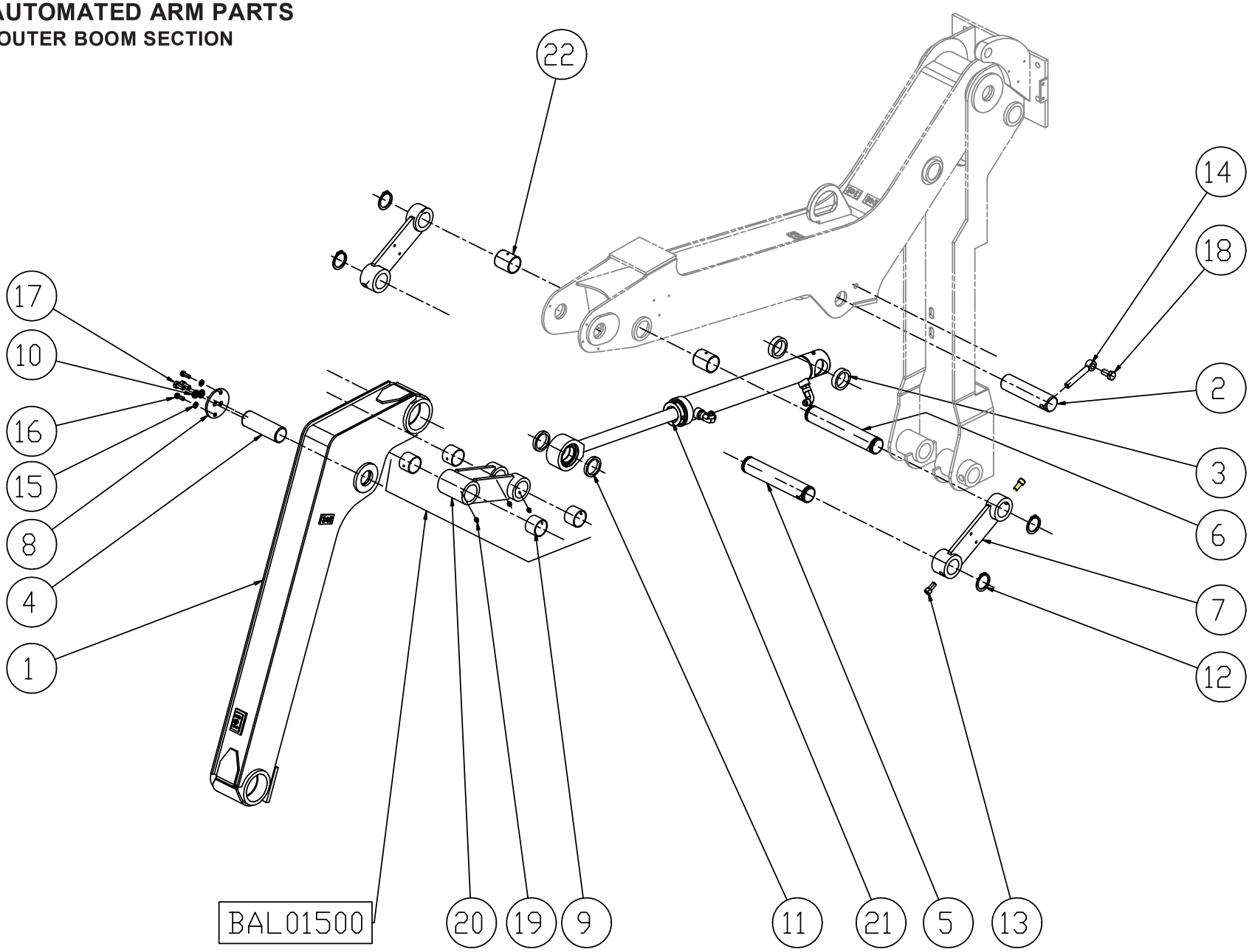
13.8.3 INNER BOOM SECTION

No.	Part #	Description	Qty.
1.	51517	PIVOT	1
2.	59858	KIT SPACER*	1
	BCH01100	*SPACER 0.649"*	*2*
	BCH01105	*SPACER 0.669"*	*2*
	BCH01110	*SPACER 0.688"*	*2*
	BCH01115	*SPACER 0.708"*	*2*
3.	BAJ00200	SEAL	2
4.	BAR00200	BEARING	2
5.	BCH01000	WASHER	1
6.	QUE03975	CASTLE NUT	1
7.	QUP03710	COTTER PIN	1
8.	QUV02799	SCREW	1

* The spacer kit provides several spacer thicknesses to fill gaps between bushings and bearing. The gap may vary from one side to another; make sure to install the proper spacer to fill the gap. Note that the kit is design for this pivot only and may not fit on other pivots.

13.8 AUTOMATED ARM PARTS

13.8.4 OUTER BOOM SECTION



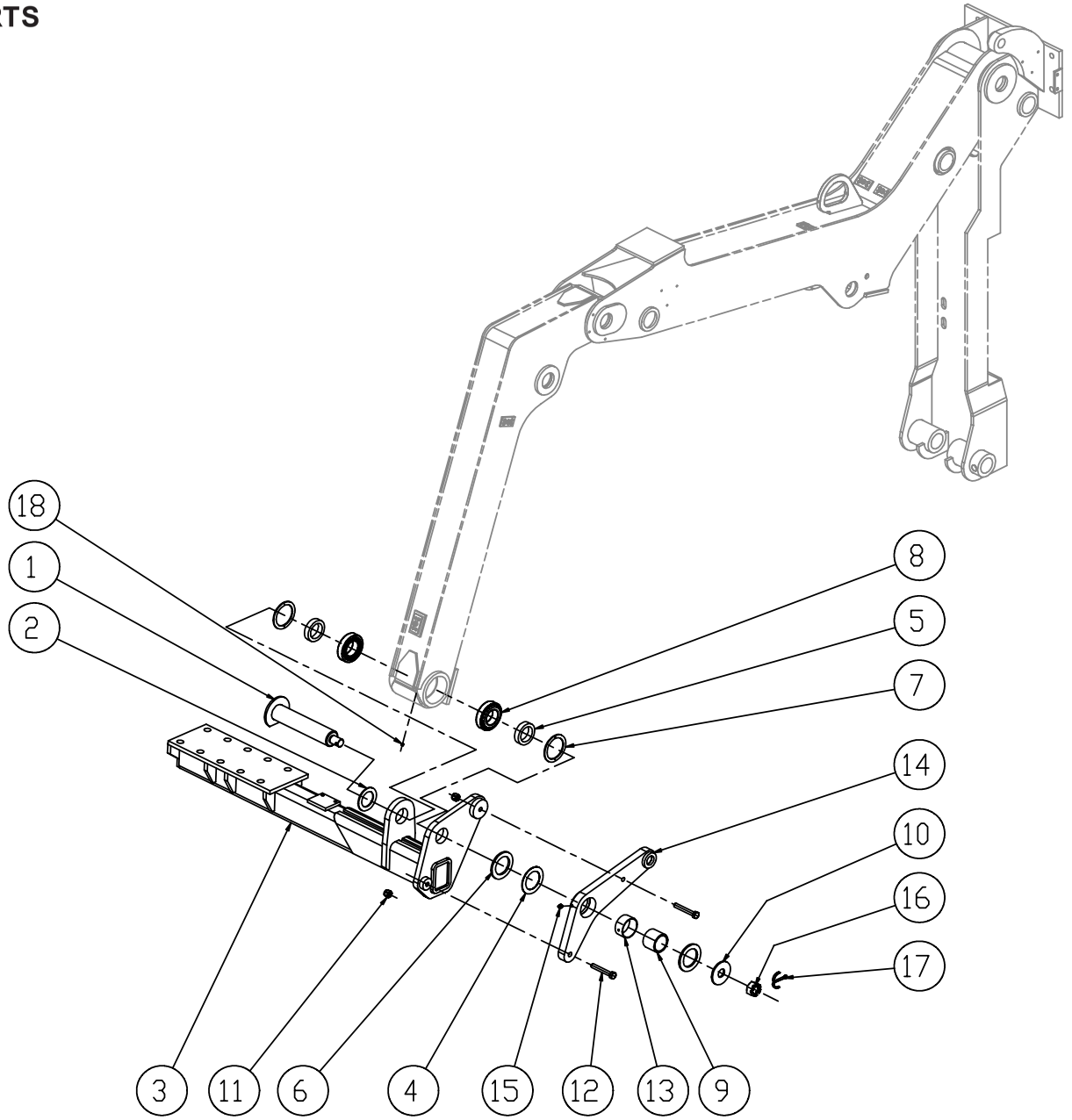
13.8 AUTOMATED ARM PARTS

13.8.4 OUTER BOOM SECTION

No.	Part #	Description	Qty.
1.	46900	OUTER BOOM ASSY	1
2.	51734	PIVOT	1
3.	51735	SPACER	2
4.	BAA01100	PIVOT	1
5.	BAA01400	PIVOT	1
6.	BAA01500	PIVOT	1
7.	BAL01100	OUTER ARM CONNECTING LINK	2
8.	BAP02000	COVER	1
9.	BCH00100	PLAIN BUSHING	4
10.	BCH01200	LOCK WASHER	2
11.	BCH01600	RING	2
12.	BCH01700	SNAP RING	4
13.	BCH01800	BOLT	2
14.	BCH02000	EYE BOLT	1
15.	BCH02100	LOCK WASHER	2
16.	BCH04305	BOLT	2
17.	BCH04310	BOLT	2
18.	BCH04315	BOLT	1
19.	BCH05125	GREASE FITTING	3
20.	BCH12750	INNER ARM CONNECTING LINK	1
21.	HYC00204	OUTER BOOM CYLINDER	1
22.	QUB45000	PLAIN BUSHING	2

13.8 AUTOMATED ARM PARTS

13.8.5 HORIZONTAL BOOM



13.8 AUTOMATED ARM PARTS

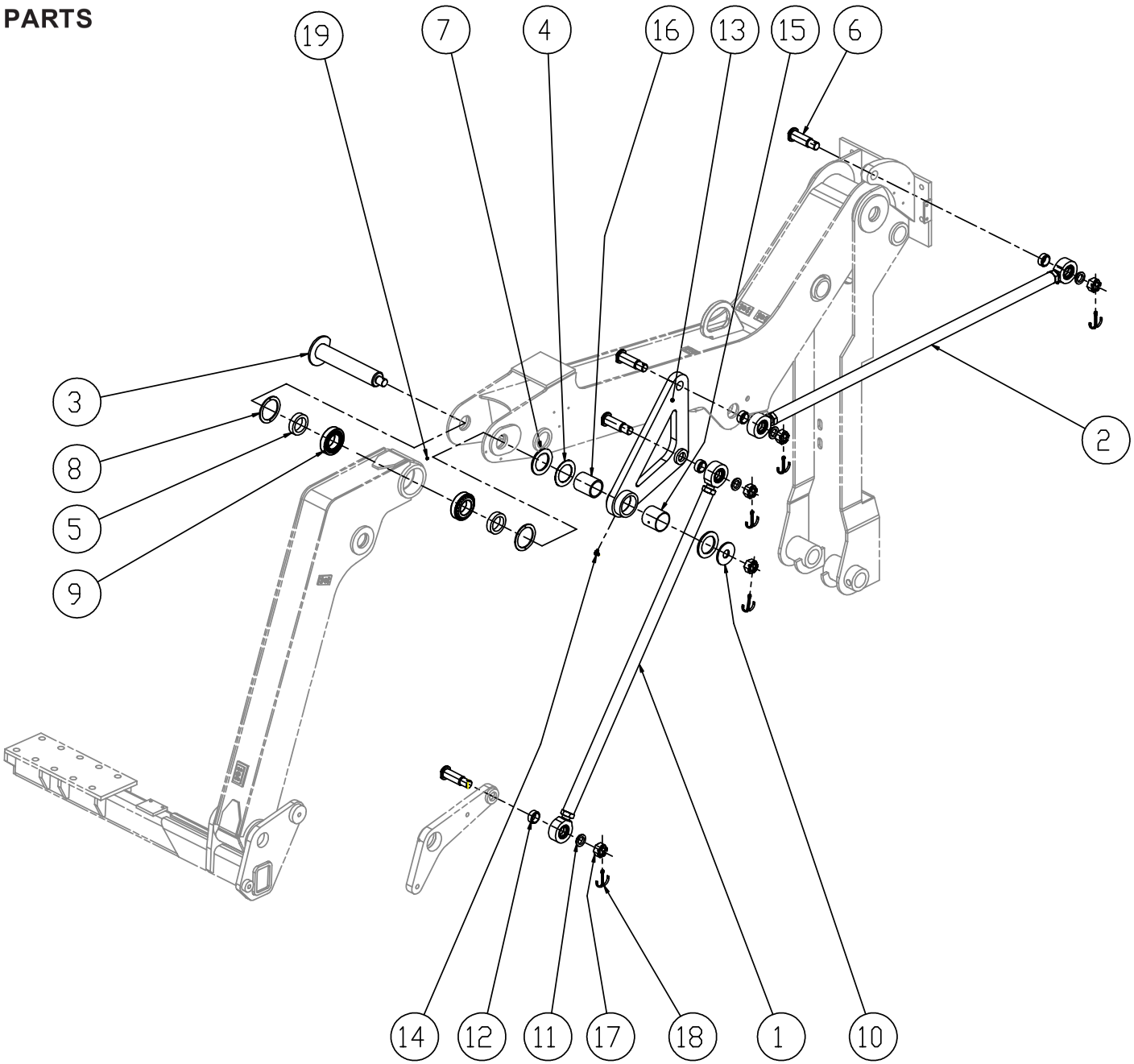
13.8.5 HORIZONTAL BOOM

No.	Part #	Description	Qty.
1.	51517	PIVOT	1
2.	51543	SPACER	1
3.	59798	HORIZONTAL BOOM ASSY	1
4.	59856	KIT SPACER BRASS	1
	BCH04005	*SPACER 0.039”*	*1*
	BCH04010	*SPACER 0.078”*	*1*
5.	59857	KIT SPACER	1
	BAC01100	*SPACER 0.649”*	*2*
	BAC01105	*SPACER 0.669”*	*2*
	BAC01110	*SPACER 0.688”*	*2*
	BAC01115	*SPACER 0.708”*	*2*
	BAC01120	*SPACER 0.748”*	*2*
6.	BAC01200	SPACER	2
7.	BAJ00100	SEAL	2
8.	BAR00100	BEARING	2
9.	BCH00900	SPACER	1
10.	BCH01000	WASHER	1
11.	BCH03600	NUT	2
12.	BCH04330	BOLT	2
13.	BCH04900	PLAIN BUSHING	1
14.	BCH05000	PIVOT LINK ASSY.	1
15.	BCH05125	GREASE FITTING	1
16.	QUE03975	CASTLE NUT	1
17.	QUP03710	COTTER PIN	1
18.	QUV02799	SCREW	1

* The spacer kit provides several spacer thicknesses to fill gaps between bushings and bearing. The gap may vary from one side to another; make sure to install the proper spacer to fill the gap. Note that the kit is design for this pivot only and may not fit on other pivots.

13.8 AUTOMATED ARM PARTS

13.8.6 ARM LINKAGE



13.8 AUTOMATED ARM PARTS

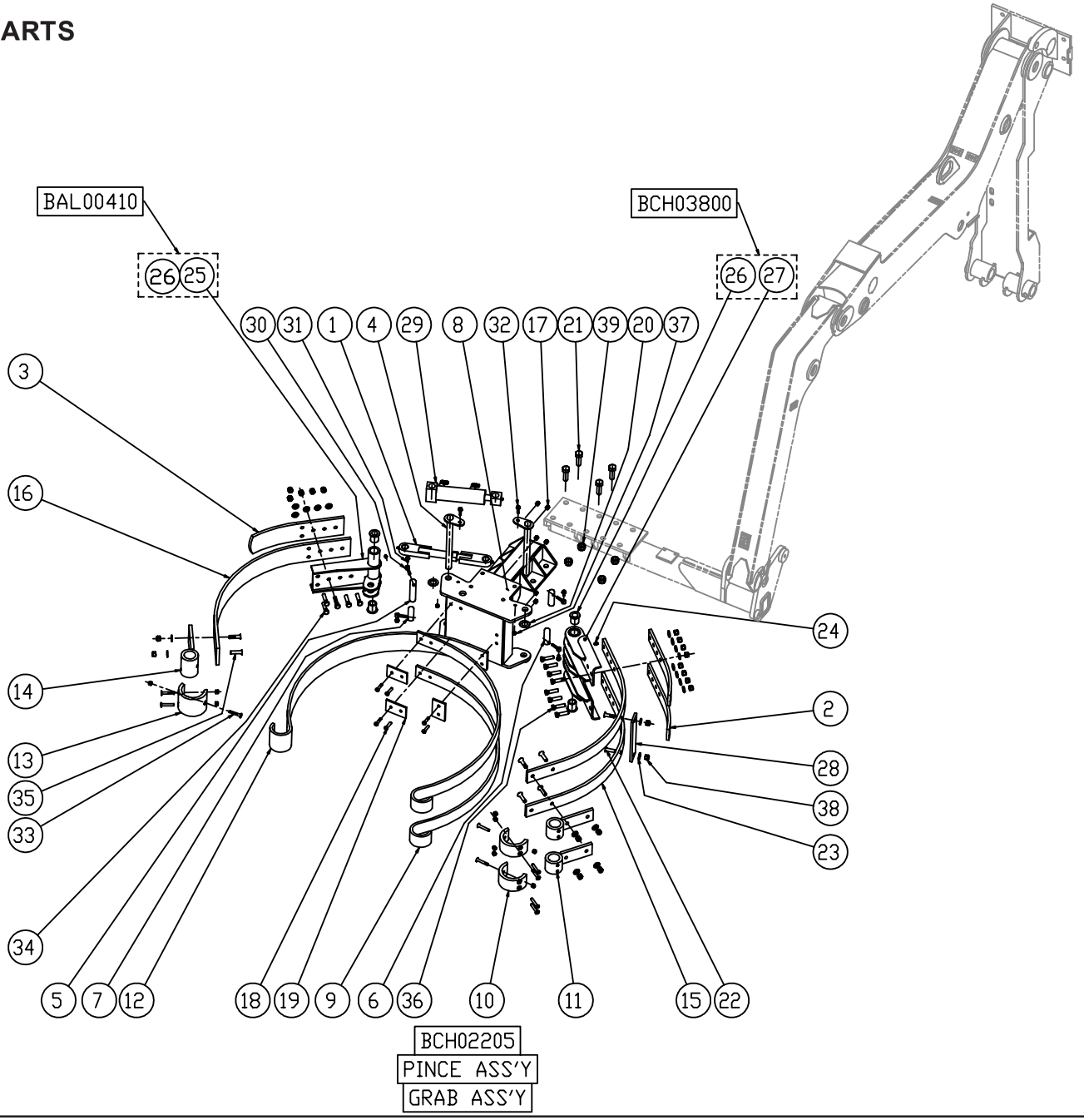
13.8.6 ARM LINKAGE

No.	Part #	Description	Qty.
1.	46802	TURNBUCKLE ASSY SHORT	1
2.	46803	TURNBUCKLE ASSY LONG	1
3.	51736	PIVOT	1
4.	59856	KIT SPACER BRASS	1
	BCH04005	*SPACER 0.039"*	*1*
	BCH04010	*SPACER 0.078"*	*1*
5.	59857	KIT SPACER	1
	BAC01100	*SPACER 0.649"*	*2*
	BAC01105	*SPACER 0.669"*	*2*
	BAC01110	*SPACER 0.688"*	*2*
	BAC01115	*SPACER 0.708"*	*2*
	BAC01120	*SPACER 0.748"*	*2*
6.	BAA03000	PIVOT	4
7.	BAC01200	SPACER	2
8.	BAJ00100	SEAL	2
9.	BAR00100	BEARING	2
10.	BCH01000	WASHER	1
11.	BCH04000	SPACER	4
12.	BCH04100	SPACER	4
13.	BCH04705	PIVOT LINK ASSY	1
14.	BCH05130	GREASE FITTING.	1
15.	BCH13500	PLAIN BUSHING	1
16.	BCH13600	PLAIN BUSHING	1
17.	QUE03975	CASTLE NUT	5
18.	QUP03710	COTTER PIN	5
19.	QUV02799	SCREW	1

* The spacer kit provides several spacer thicknesses to fill gaps between bushings and bearing. The gap may vary from one side to another; make sure to install the proper spacer to fill the gap. Note that the kit is design for this pivot only and may not fit on other pivots.

13.8 AUTOMATED ARM PARTS

13.8.7 GRABBER



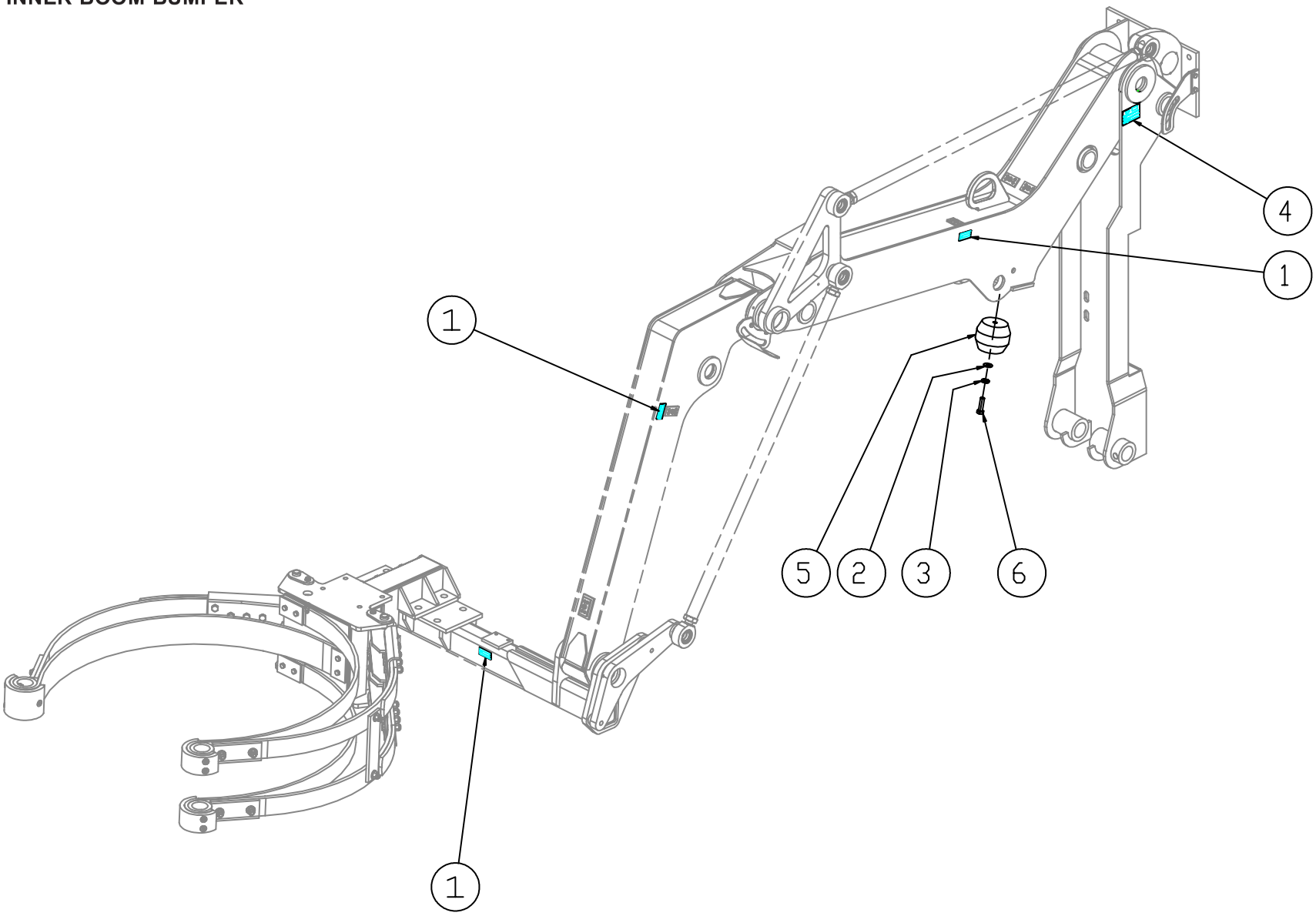
13.8 AUTOMATED ARM PARTS

13.8.7 GRABBER

No.	Part #	Description	Qty.
	BCH02205	GRABBER ASSY	1
1.	33637	ROD ASSY.	1
2.	46816	SPRING BLADE LINING	2
3.	46817	SPRING BLADE LINING	1
4.	51510	PIVOT	2
5.	BAA00500	PIVOT	1
6.	BAA00510	PIVOT	2
7.	BAA00520	PIVOT	1
8.	BAA04010	GRAB SUPPORT ASSY.	1
9.	BAC00250	STRAP	2
10.	BAC00255	STRAP PROTECTOR	2
11.	BAC00260	STRAP SUPPORT	2
12.	BAC00400	STRAP	1
13.	BAC00405	STRAP PROTECTOR	1
14.	BAC00410	STRAP SUPPORT	1
15.	BAL00250	SPRING BLADE	2
16.	BAL00400	SPRING BLADE	1
17.	BCH02300	NUT 15	
18.	BCH02400	BOLT	6
19.	BCH02500	CLAMPING PLATE	3
20.	BCH03000	SPACER	2
21.	BCH03200	BOLT	4
22.	BCH03400	FLAT HEAD BOLT	2
23.	BCH04200	WASHER FLAT	21
24.	BCH05125	GREASE FITTING	2
25.	BCH12800	SPRING SUPPORT SINGLE ASSY.	1
26.	BCH12900	BUSHING	4
27.	BCH13000	SPRING SUPPORT DOUBLE ASSY.	1
28.	BCH13400	BOND PLATE	1
29.	HYC00170	GRABBER CYLINDER ASSY.	1
30.	QUB00890	EYE BOLT	4
31.	QUB02750	BOLT	4
32.	QUB02915	BOLT	2
33.	QUB03902	FLAT HEAD BOLT	9
34.	QUB04775	BOLT	5
35.	QUB05811	FLAT HEAD BOLT	6
36.	QUB06251	BOLT	8
37.	QUE01200	NUT	2
38.	QUE01500	LOCK NUT	21
39.	QUE01800	NUT	4

13.8 AUTOMATED ARM PARTS

13.8.8 INNER BOOM BUMPER

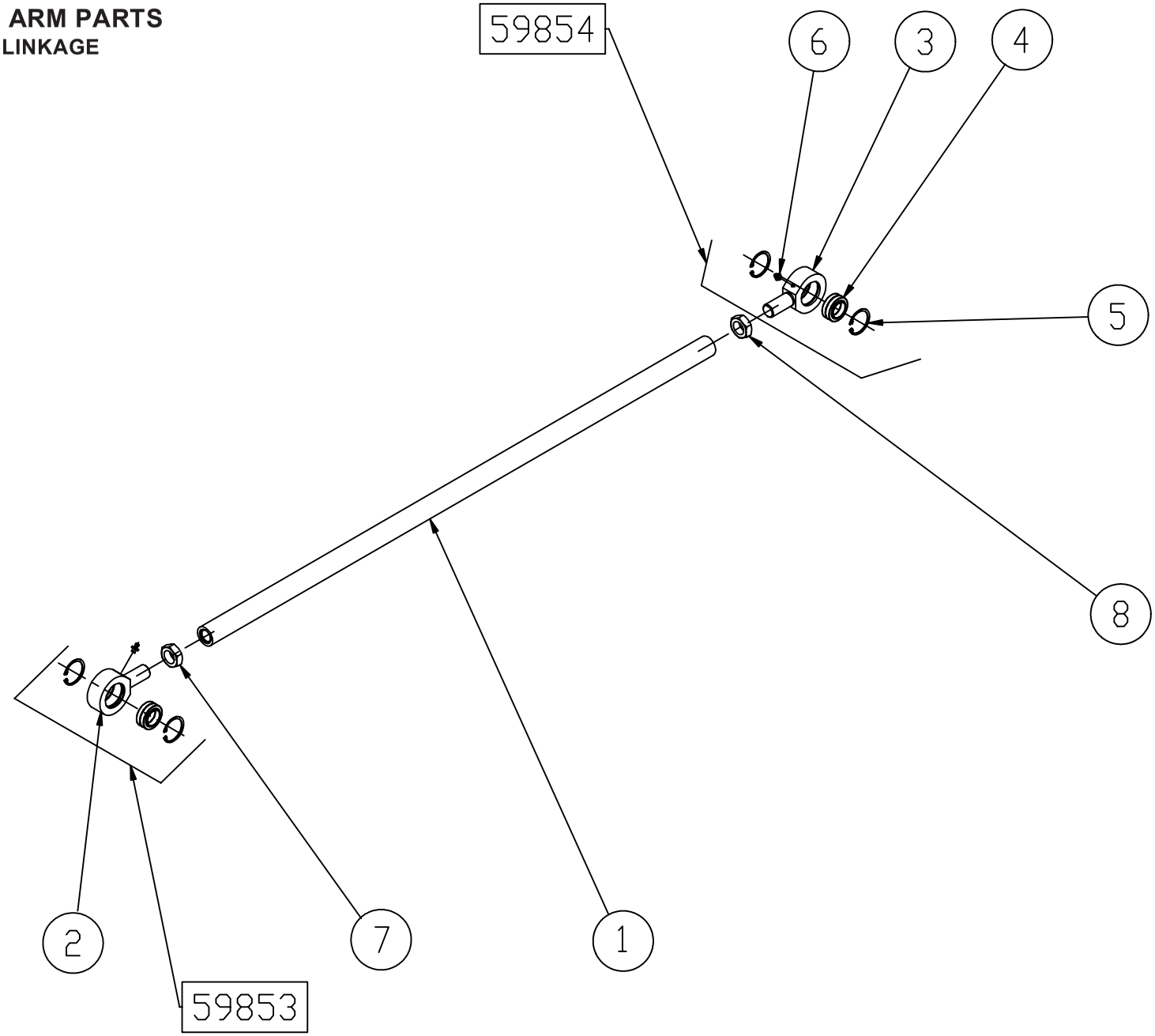


13.8 AUTOMATED ARM PARTS

13.8.8 INNER BOOM BUMPER

No.	Part #	Description	Qty.
1.	59850	IDENTIFICATION STICKER	3
2.	BCH00300	WASHER	1
3.	BCH01200	LOCK WASHER	1
4.	BCH14200	IDENTIFICATION STICKER	1
5.	QUB00120	BUMPER	1
6.	QUB04840	BOLT	1

13.8 AUTOMATED ARM PARTS
13.8.9 OUTER BOOM LINKAGE



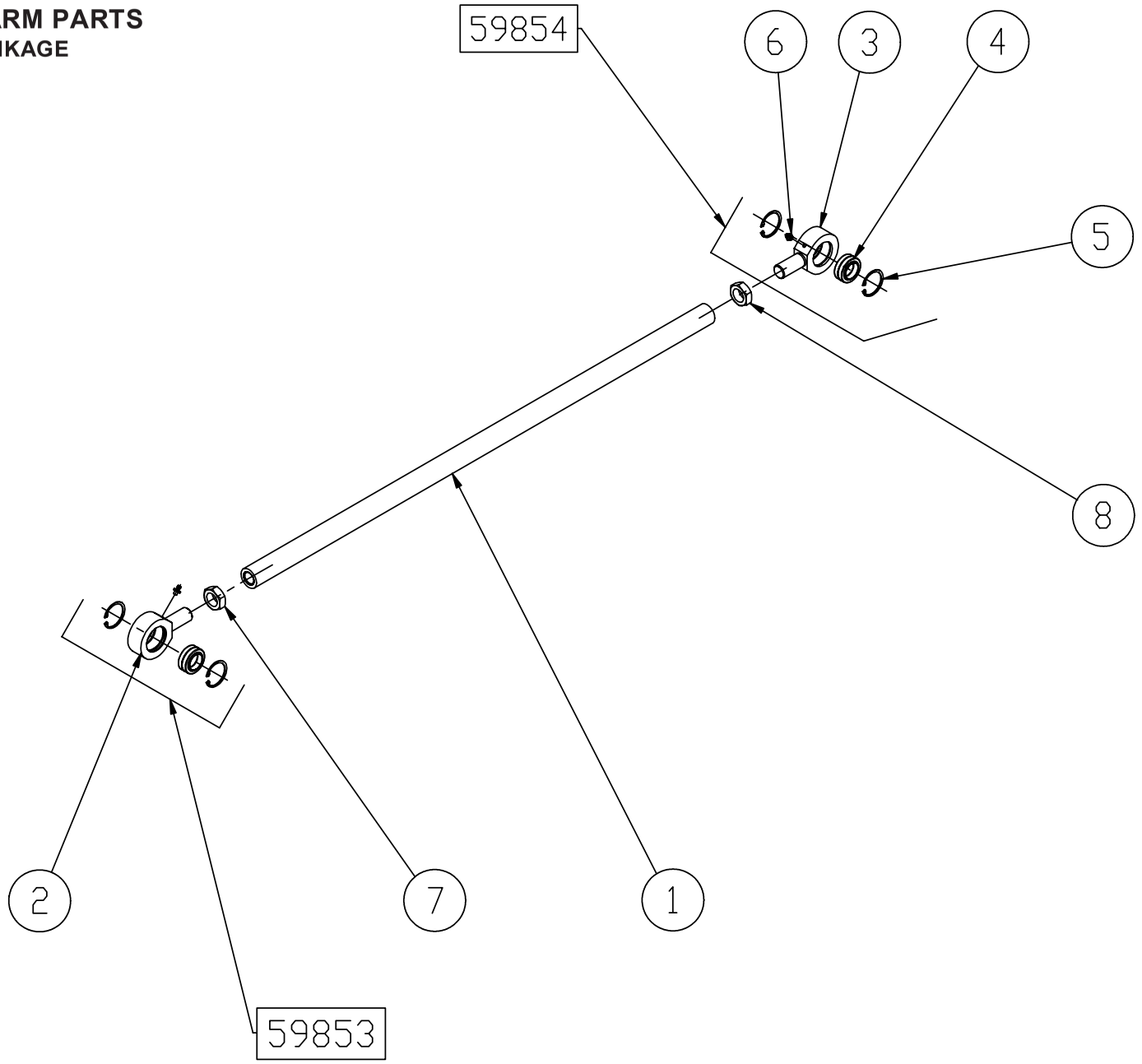
13.8 AUTOMATED ARM PARTS

13.8.9 OUTER BOOM LINKAGE

No.	Part #	Description	Qty.
	46803	*TURNBUCKLE ASSY. LONG*	*1*
1.	46804	TURNBUCKLE	1
2.	46806	ROD END (right-hand thread)	1
3.	46807	ROD END (left-hand thread)	1
4.	BAR00500	SPHERICAL PLAIN BEARING	2
5.	BCH04600	SNAP RING	4
6.	BCH05125	GREASE FITTING	2
7.	QUE01950	JAM NUT (right-hand thread)	1
8.	QUE01951	JAM NUT (left-hand thread)	1

13.8 AUTOMATED ARM PARTS

13.8.10 INNER BOOM LINKAGE



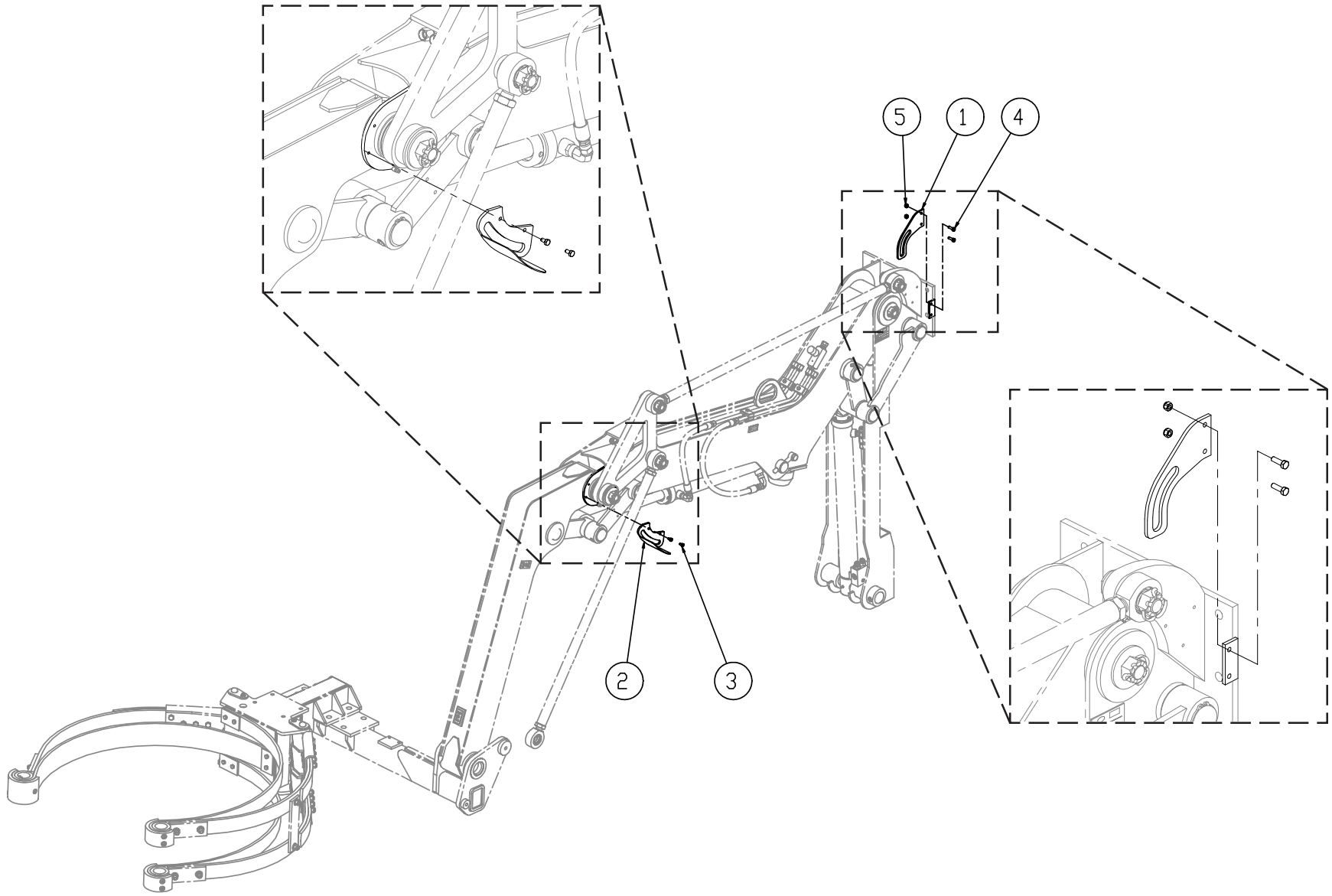
13.8 AUTOMATED ARM PARTS

13.8.10 INNER BOOM LINKAGE

No.	Part #	Description	Qty.
	46802	*TURNBUCKLE ASSY. SHORT*	*1*
1.	46805	TURNBUCKLE	1
2.	46806	ROD END (right-hand thread)	1
3.	46807	ROD END (left-hand thread)	1
4.	BAR00500	SPHERICAL PLAIN BEARING	2
5.	BCH04600	SNAP RING	4
6.	BCH05125	GREASE FITTING	2
7.	QUE01950	JAM NUT (right-hand thread)	1
8.	QUE01951	JAM NUT (left-hand thread)	1

13.8 AUTOMATED ARM PARTS

13.8.11 PROXIMITY SWITCH BRACKET



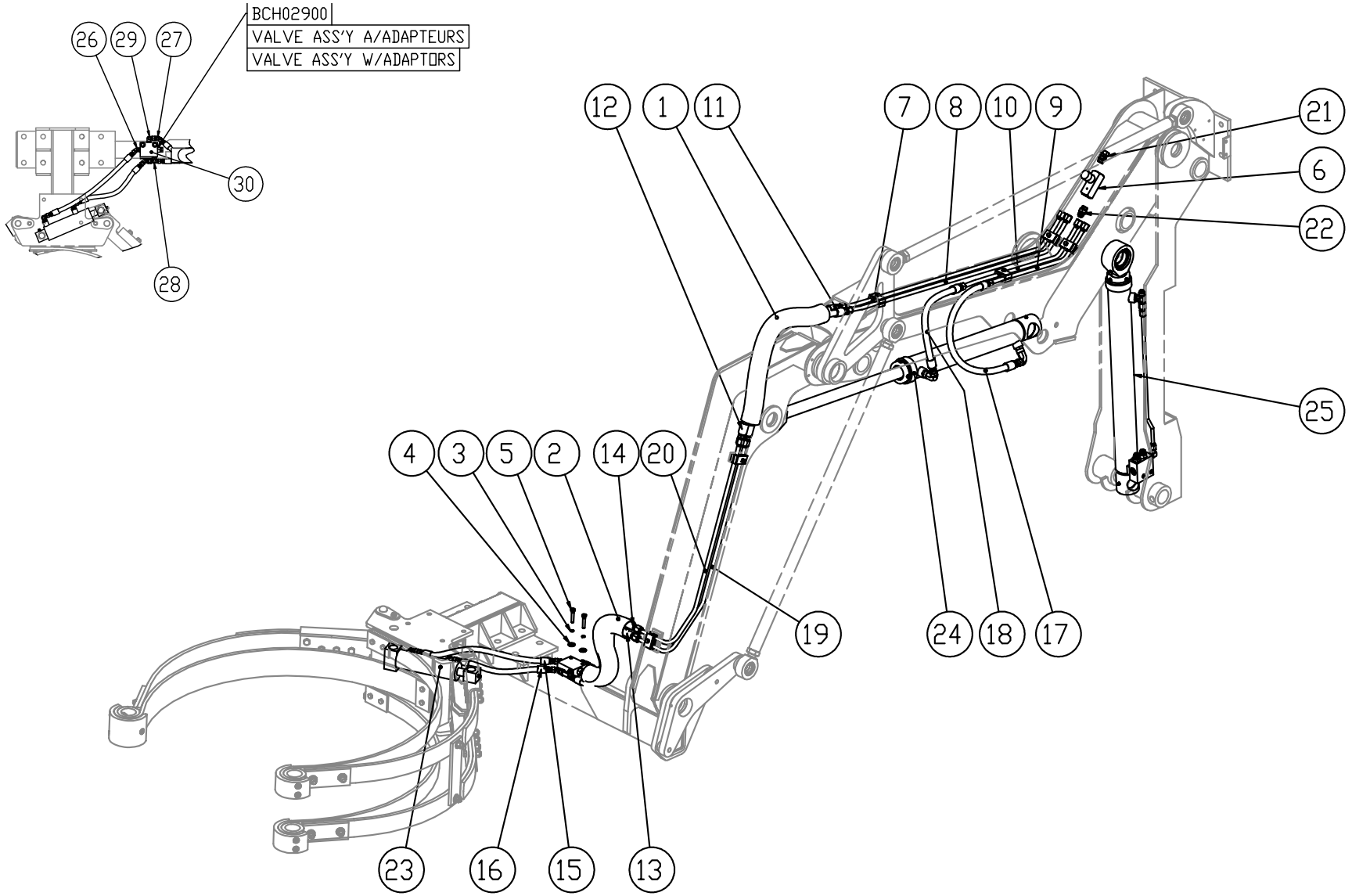
13.8 AUTOMATED ARM PARTS

13.8.11 INNER BOOM LINKAGE

No.	Part #	Description	Qty.
1.	38569	BRACKET, PROXIMITY SWITCH	1
2.	51667	BRACKET, PROXIMITY SWITCH	1
3.	QUB01901	BOLT	2
4.	QUE01200	NUT	2
5.	QUB02801	BOLT	2

13.8 AUTOMATED ARM PARTS

13.8.12 ARM HYDRAULIC



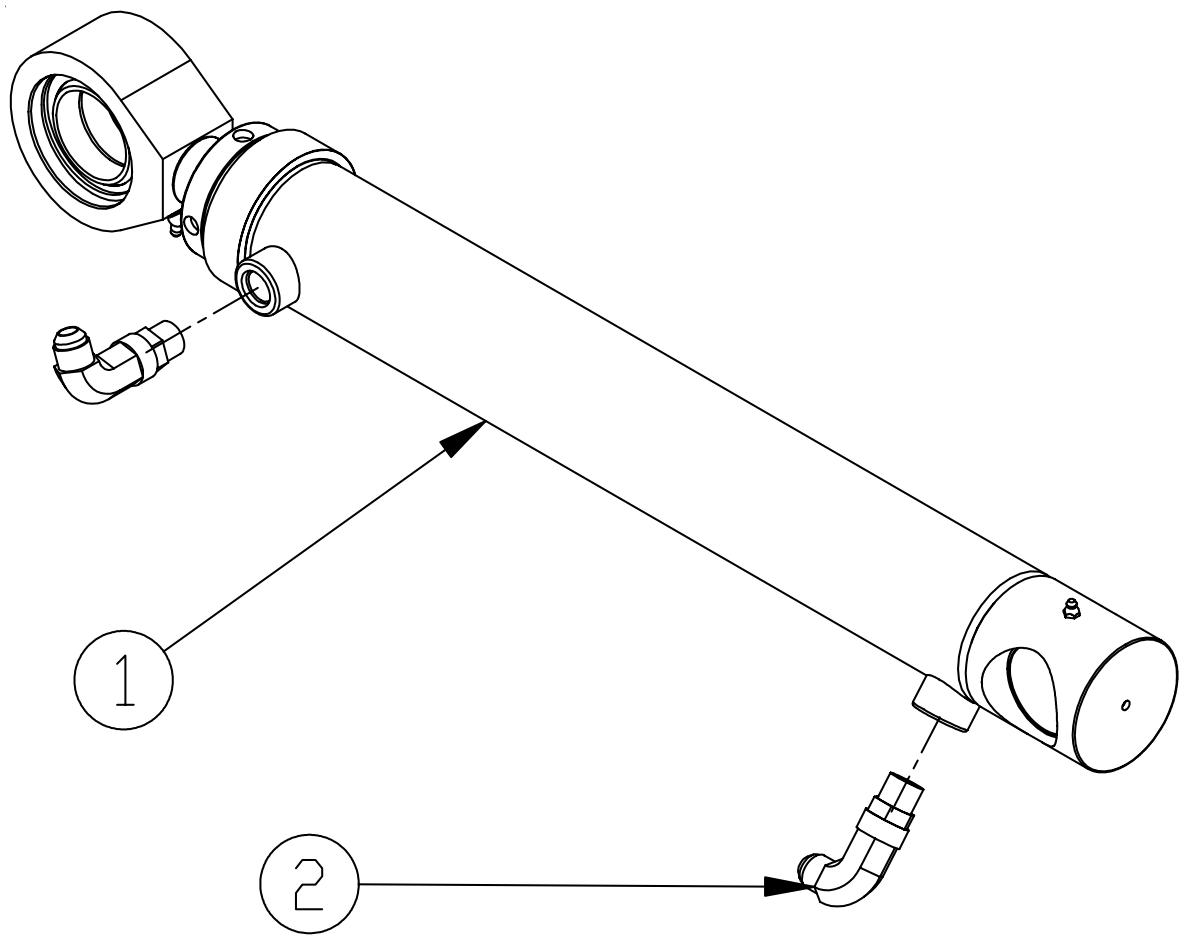
13.8 AUTOMATED ARM PARTS

13.8.12 ARM HYDRAULIC

No.	Part #	Description	Qty.
1.	BCH00500	SLEEVE NYLON	1
2.	BCH00650	SLEEVE NYLON	1
3.	BCH02600	WASHER LOCK	2
4.	BCH02700	WASHER	2
5.	BCH02800	BOLT	2
6.	BCH11000	VALVE, FLOW CONTROL	1
7.	HYS00602	SUPPORT, HYDRAULIC	6
8.	BCH11200	TUBING	2
9.	BCH11500	TUBING	1
10.	BCH11600	TUBING	1
11.	BCH11700	HOSE	1
12.	BCH11800	HOSE	1
13.	BCH11900	HOSE	1
14.	BCH12000	HOSE	1
15.	BCH12100	HOSE	1
16.	BCH12200	HOSE	1
17.	BCH12300	HOSE	1
18.	BCH12400	HOSE	1
19.	BCH13700	TUBING	1
20.	BCH13800	TUBING	1
21.	BCH14100	STRAIGHT FITTING	1
22.	BCH14105	STRAIGHT FITTING	1
23.	HYC00170	GRABBER CYLINDER ASSY.	1
24.	HYC00204	OUTER BOOM CYLINDER	1
25.	HYC00216	LOWER BOOM CYLINDER	1
26.	HYF02775	FITTING ELBOW	1
27.	HYF02785	FITTING ELBOW	2
28.	HYF05662	FITTING TEE	1
29.	HYF07400	FITTING ELBOW	1
30.	HYV07508	VALVE ASSY.	1

13.8 AUTOMATED ARM PARTS

13.8.13 OUTER BOOM CYLINDER



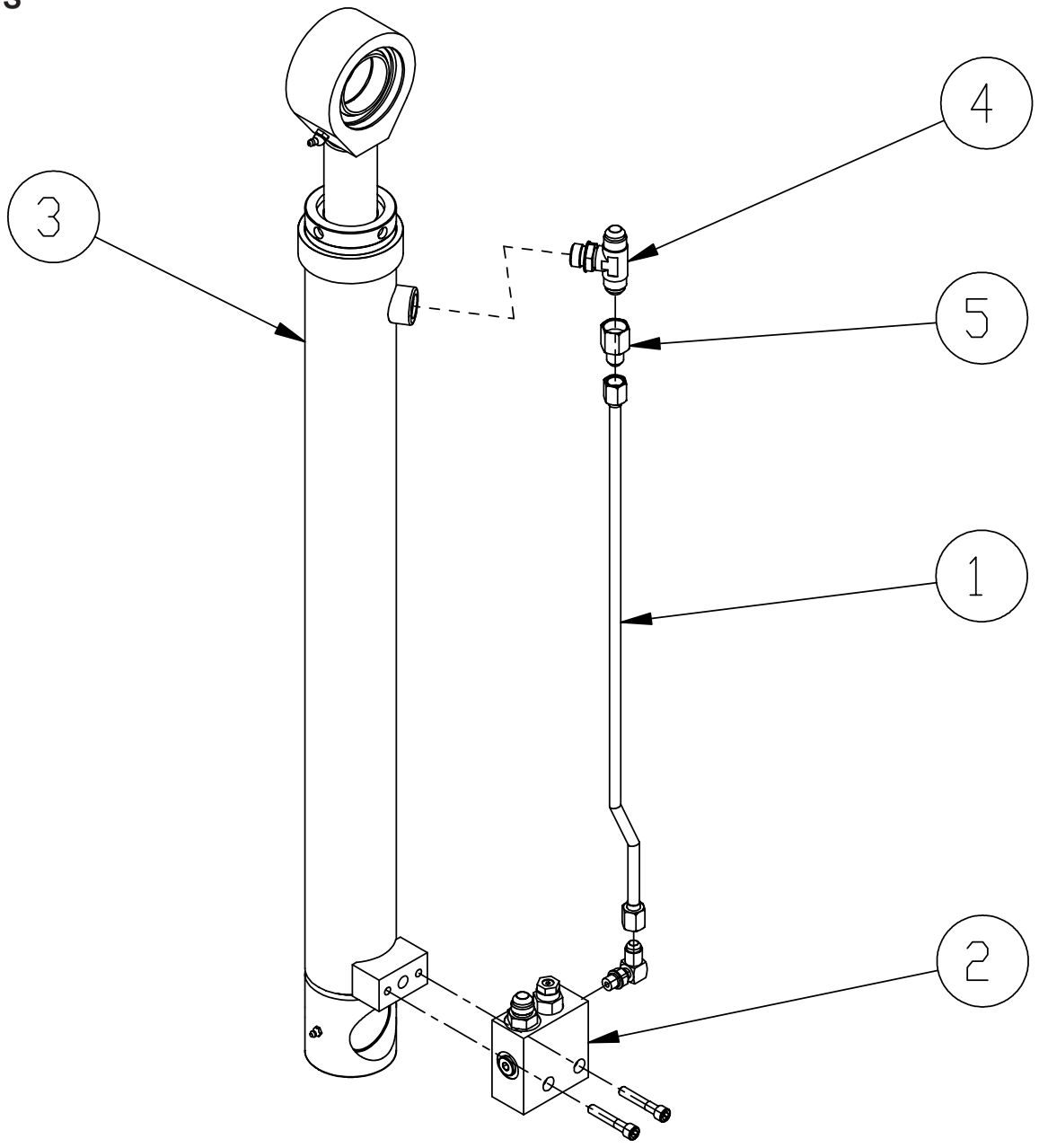
13.8 AUTOMATED ARM PARTS

13.8.13 OUTER BOOM CYLINDER

No.	Part #	Description	Qty.
	HYC00204	*OUTER BOOM CYLINDER*	*1*
1.	HYJ03097	CYLINDER SEAL KIT	1
2.	HYF05125	ELBOW UNION	2

13.8 AUTOMATED ARM PARTS

13.8.14 INNER BOOM CYLINDER



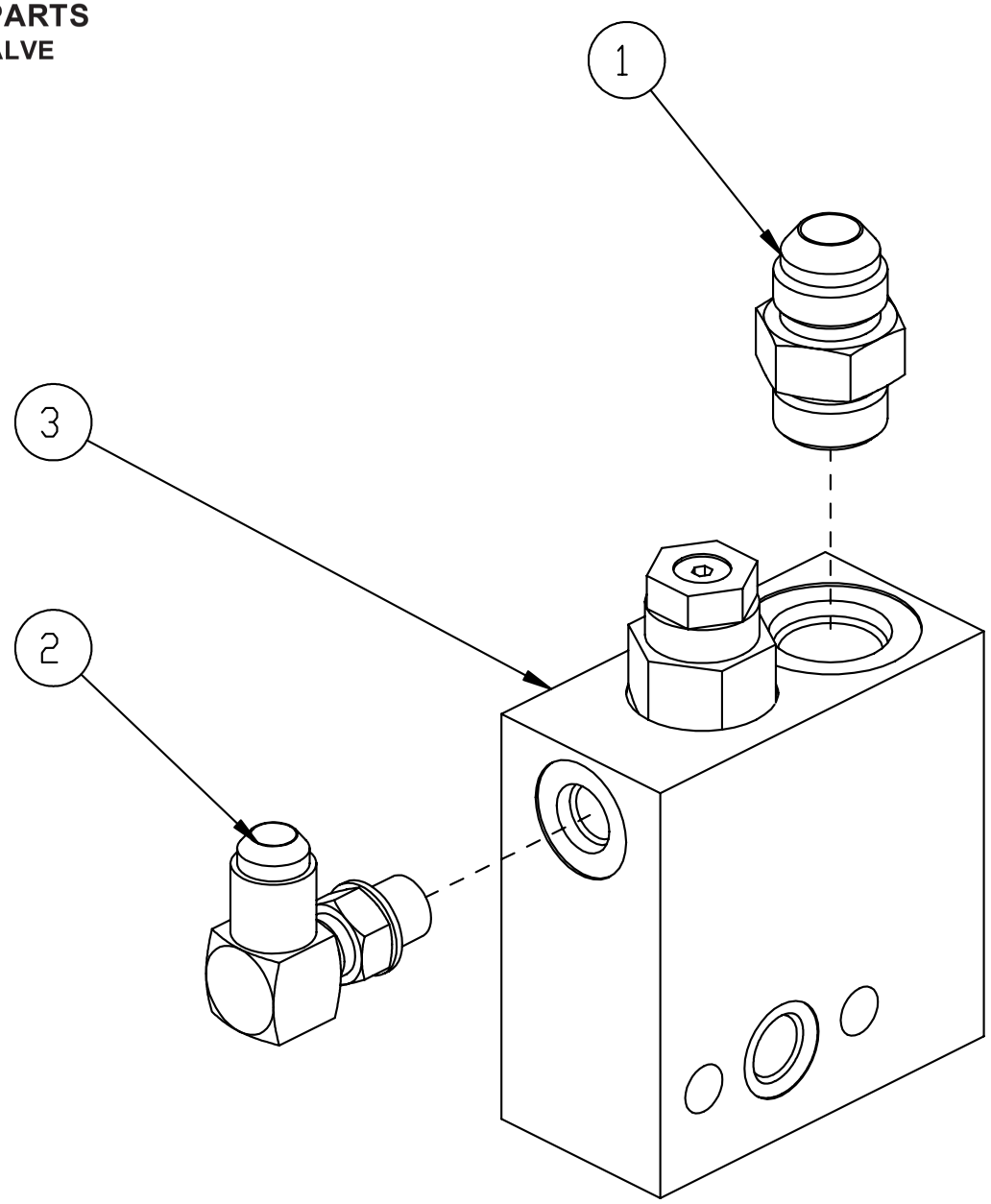
13.8 AUTOMATED ARM PARTS

13.8.14 INNER BOOM CYLINDER

No.	Part #	Description	Qty.
	HYC00216	*INNER BOOM CYLINDER ASSY.*	*1*
1.	49802	HYDRAULIC PIPE	1
2.	BAM00100	BLOCK VALVE ASS'Y	1
3.	HYJ03105	CYLINDER SEAL KIT	1
4.	HYF05140	TEE UNION	1
5.	HYF08270	ADAPTOR UNION	1

13.8 AUTOMATED ARM PARTS

13.8.15 INNER BOOM LOCK VALVE



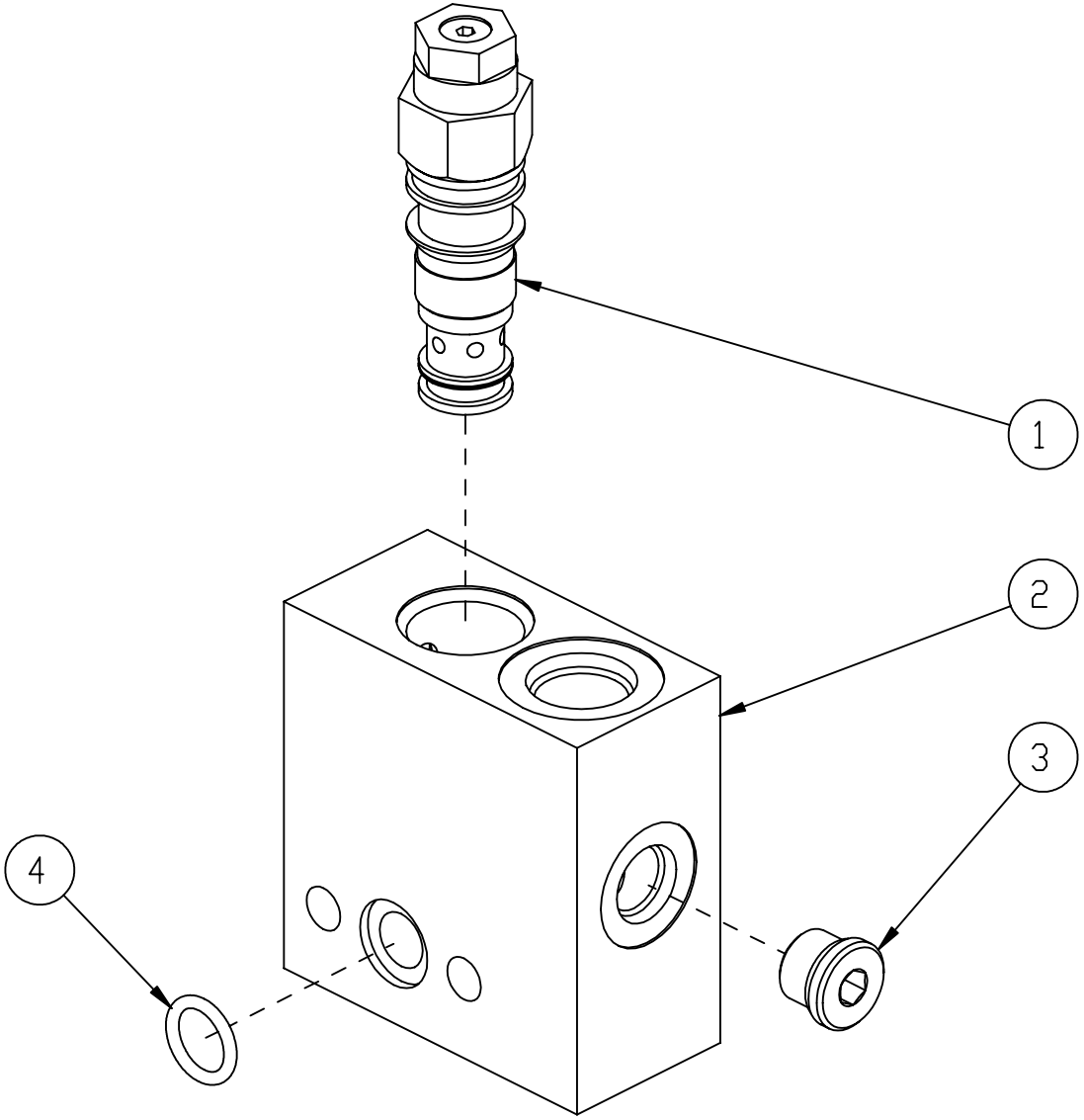
13.8 AUTOMATED ARM PARTS

13.8.15 INNER BOOM LOCK VALVE

No.	Part #	Description	Qty.
	BAM00100	*VALVE BLOCK ASSY.*	*1*
1.	HYF05110	ADAPTOR	1
2.	HYF07300	ELBOW UNION	1
3.	HYV07507	VALVE BLOCK ASSY.	1

13.8 AUTOMATED ARM PARTS

13.8.16 INNER BOOM LOCK VALVE BLOCK



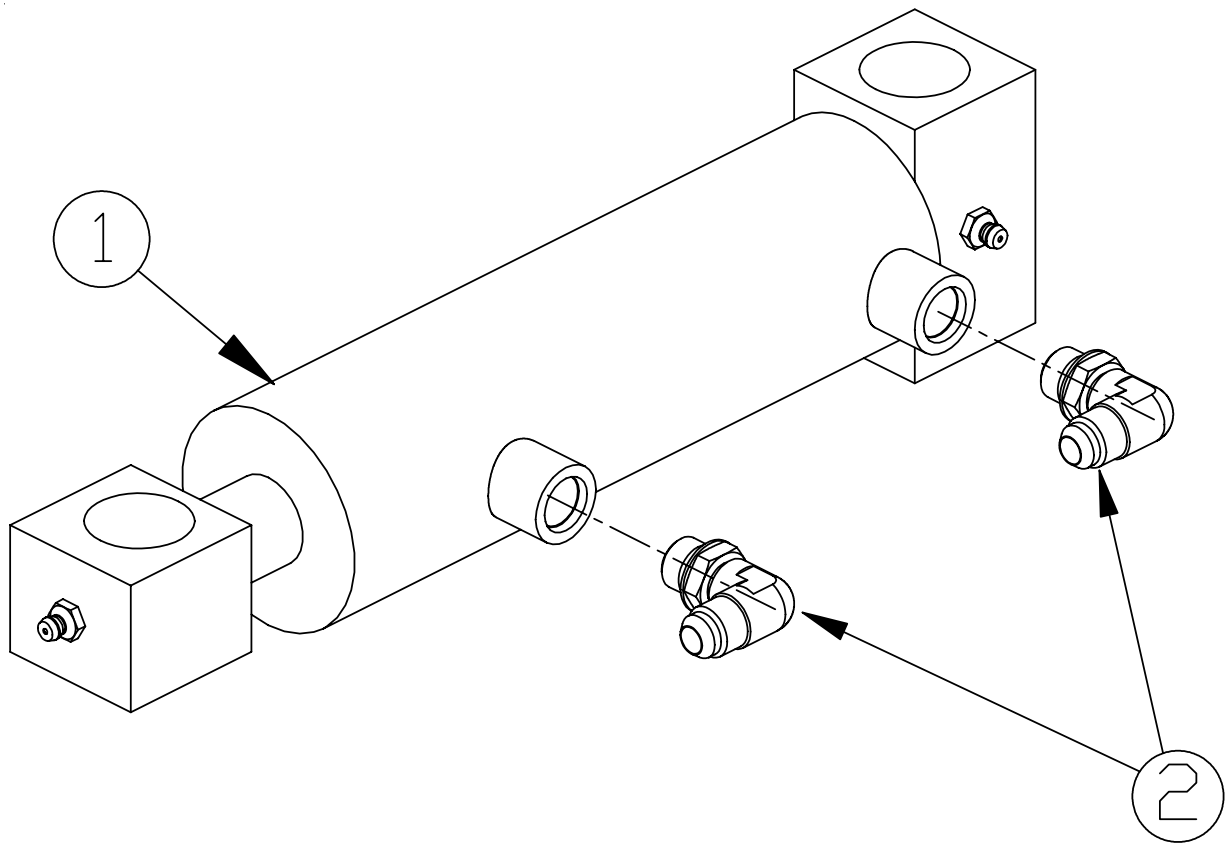
13.8 AUTOMATED ARM PARTS

13.8.16 INNER BOOM LOCK VALVE BLOCK

No.	Part #	Description	Qty.
	HYV07507	*VALVE BLOCK ASSY.*	*1*
1.	BAC02000	CARTRIDGE	1
2.	BAM00150	MANIFOLD	1
3.	HYF11350	PLUG	1
4.	HYJ01340	O-RING	1

13.8 AUTOMATED ARM PARTS

13.8.17 GRABBER CYLINDER



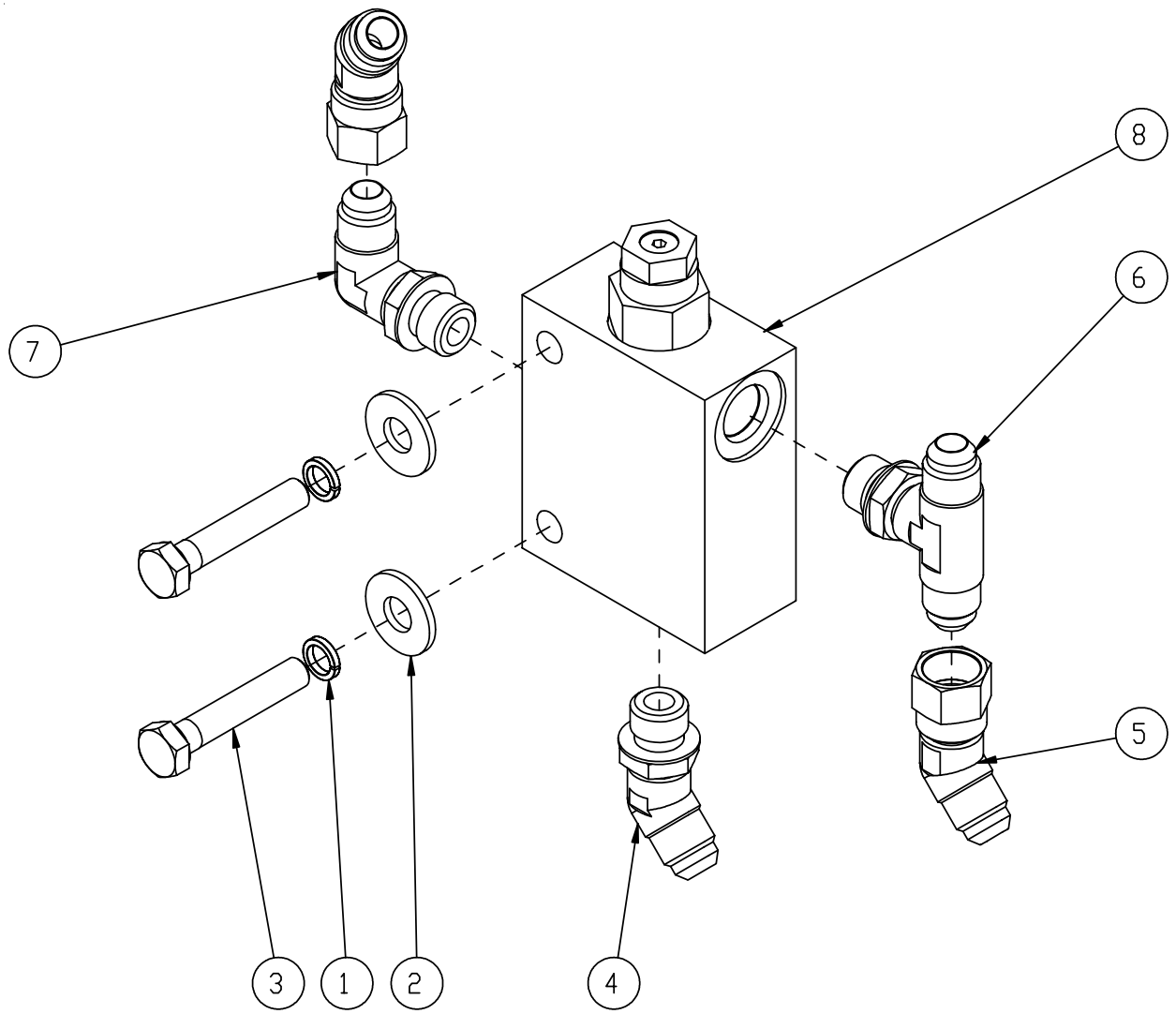
13.8 AUTOMATED ARM PARTS

13.8.17 GRABBER CYLINDER

No.	Part #	Description	Qty.
	HYC00170	*GRABBER CYLINDER*	*1*
1.	HYJ03003	CYLINDER SEAL SEAL	1
2.	HYF07400	ELBOW UNION	1

13.8 AUTOMATED ARM PARTS

13.8.18 GRABBER LOCK VALVE



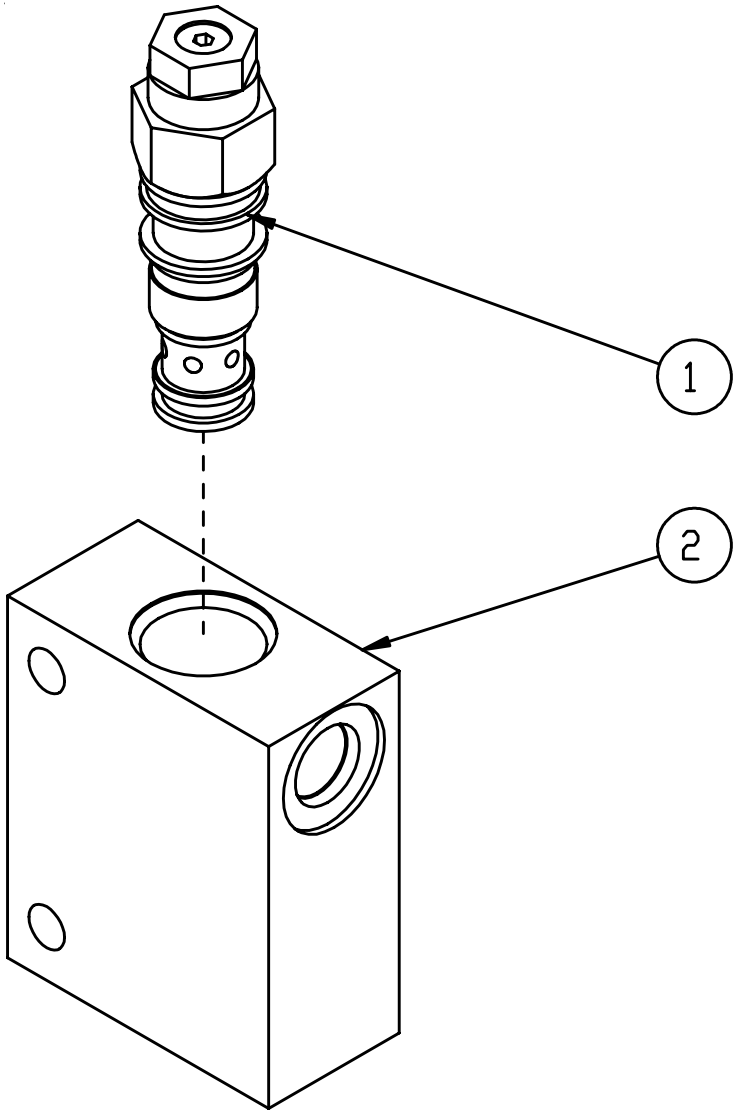
13.8 AUTOMATED ARM PARTS

13.8.18 GRABBER LOCK VALVE

No.	Part #	Description	Qty.
	BCH02900	*GRABBER LOCK VALVE ASSY.*	*1*
1.	BCH02600	WASHER LOCK	2
2.	BCH02700	WASHER	2
3.	BCH02800	BOLT	2
4.	HYF02775	FITTING ELBOW	1
5.	HYF02785	FITTING ELBOW	2
6.	HYF05662	FITTING TEE	1
7.	HYF07400	FITTING ELBOW	1
8.	HYV07508	VALVE ASSY.	1

13.8 AUTOMATED ARM PARTS

13.8.19 GRABBER LOCK VALVE CARTRIDGE



13.8 AUTOMATED ARM PARTS

13.8.19 GRABBER LOCK VALVE CARTRIDGE

No.	Part #	Description	Qty.
	HYV07508	*VALVE ASSY.*	*1*
1.	BAC02100	CARTRIDGE	1
2.	HYM01250	MANIFOLD	1

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