Gehl V400
Mustang 4000V

Form No.
50950064
Revision B
11/13

SKID-STEER LOADERS

Service Manual

General Information

The above safety alert symbol means: ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED! It stresses an attitude of "safety awareness" and can be found throughout this service manual and on decals on the machine.

Before operating or working on this machine, read and study the following safety information. In addition, be sure that everyone who operates or works on this equipment is familiar with these safety precautions. It is essential to have competent and careful operators, who are not physically or mentally impaired, and who are thoroughly trained in the safe operation of the machine and the handling of loads. It is recommended that the operator be capable of obtaining a valid motor vehicle operator's license.

The use of skid-steer loaders is subject to certain hazards that cannot be eliminated by mechanical means, but only by exercising intelligence, care and common sense. Such hazards include, but are not limited to, hillside operation, overloading, instability of the load, poor maintenance and using the equipment for a purpose for which it is not intended or designed.

Manitou Americas ALWAYS consider the operator's safety when designing machinery and guards exposed moving parts for the operator's protection. However, some areas cannot be guarded or shielded in order to assure proper operation. The Operator's Manual and the decals on the machine warn of additional hazards and should be read and observed closely.

These topics in the *Safety* chapter of the service manual include procedures, which, when followed, will allow for safe performance of service procedures: Mandatory Safety Shutdown Procedure, Lift Arm Support Device, Roll-Over Protective Structure (ROPS/FOPS)/Falling Object Protective Structure (FOPS) Lock Mechanism, Loader Raising and Lowering Procedures, and Relieving Hydraulic Pressure.

Signal Words

DANGER

"DANGER" indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury.

WARNING

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

CAUTION

"CAUTION" indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury. May also alert against unsafe practices.

Additional Safety Reminders

Read and understand the Service Manual and all decals before maintaining, adjusting or servicing this equipment.

Doors, Guards and Shields - Some photographs in this manual may show doors, guards and shields open or removed for illustrative purposes only. BE SURE all doors, guards and shields are in their proper operating positions before starting engine to operate unit.

Damaged or Worn-out Parts - For safe operation, replace damaged or worn-out parts with genuine Gehl/ Mustang service parts, before operating this equipment.

Attachments - Gehl and Mustang loaders are designed and intended to be used only with Manitou Americas attachments or approved referral attachments. Manitou Americas cannot be responsible for safety if the loader is used with a non-approved attachment.

Battery Safety - To avoid injury from a spark or short circuit, turn the electrical disconnect switch to the OFF position before servicing any part of the electrical system. Do not tip the battery more than 45º.

Cooling System Drain Procedure

Gehl V400 and Mustang 4000V model skid-steer loaders use a hydraulic oil cooler/radiator design to help keep the hydraulic oil and engine coolant from overheating. Many procedures in this Service Manual require partially or fully draining the radiator/cooler to perform the procedures.

WARNING

BEFORE beginning this service procedure, perform the following SAFETY procedure:

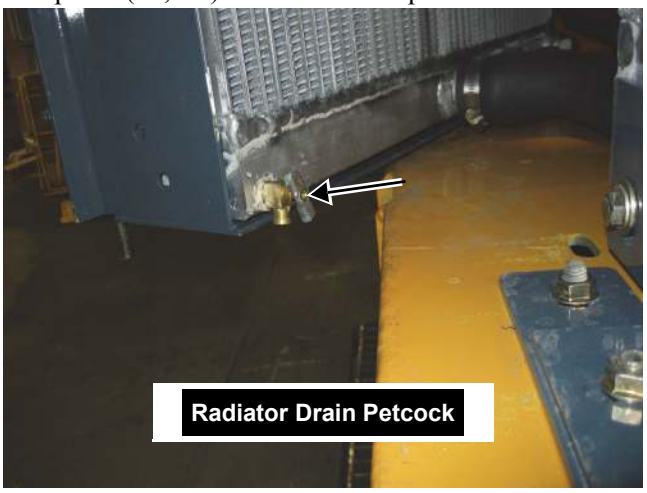
- **Lower the lift arm.**
- **Shut off the engine and allow it to cool.**

(For detailed instructions, refer to the *Safety* chapter of this manual.)

Radiator Drain Procedure

1. Raise the engine cover and lock open the rear grille.
2. Pull up on the oil cooler/radiator lock pin and put it in its placeholder, then swing the oil cooler/radiator out.

3. Place a catch pan with a capacity of at least 16.0 quarts (15,1 L) underneath the petcock.



4. Crack open the pressurized cap on the recovery tank.

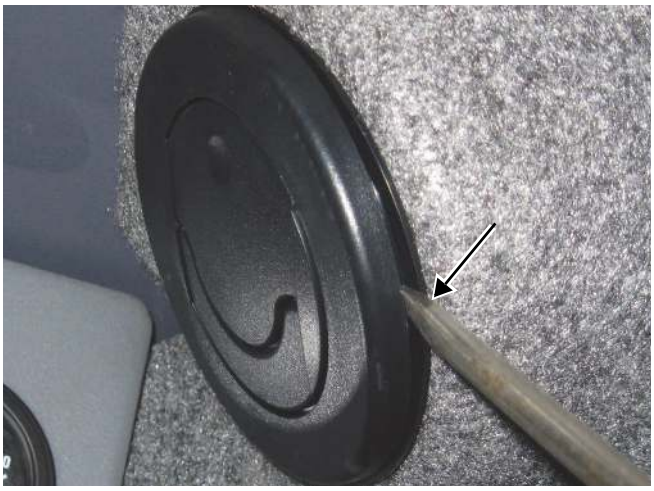
5. Fully open the petcock to drain the anti-freeze.
6. Close the petcock on the radiator when it is finished draining.
7. Add 16.0 quarts (15,1 L) of a mixture of 50% water and 50% ethylene glycol to the recover tank. Coolant level should be visible in the sight glass - midway on the glass.
8. Retighten the pressurized cap onto the recovery tank.

Air Duct Louver Replacement

The headliner and forward side consoles with air ducts in the ROPS/FOPS are optional and used when heating and heating/air-conditioning options are installed.

Replacement Procedure

1. Using a thin flat-tipped screwdriver, insert the screwdriver between the face of the louver and the louver's bezel.



2. Rotate the screwdriver to lift the face and pop it off the bezel to release the louver.

3. Pop new louver into existing bezel until a "click" sound indicates it is seated.

ROPS/FOPS Rear Window Removal and Installation

WARNING

BEFORE beginning this service procedure, perform the following SAFETY procedure:

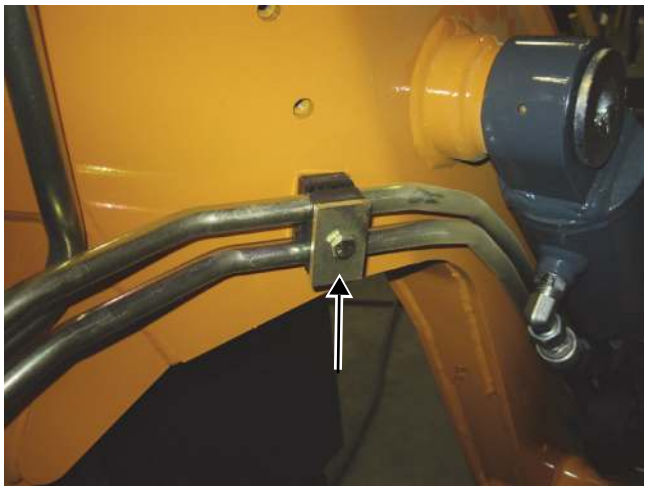
• Shut off the engine.

(For detailed instructions, refer to the *Safety* chapter of this manual.)

Removal Procedure

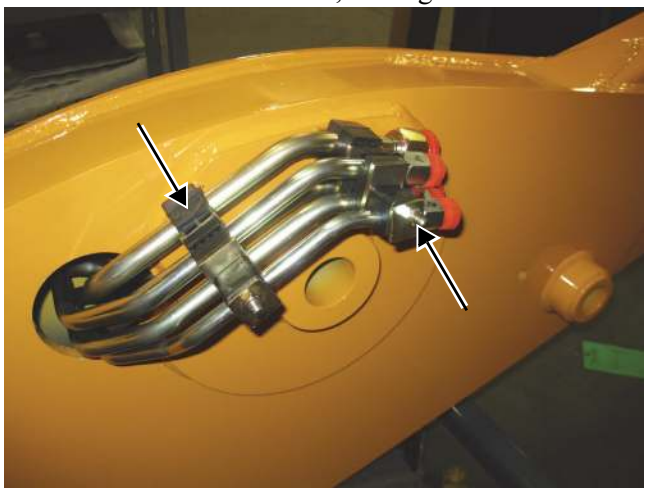
1. Grab and pull emergency exit tag until the ripcord pulls free of rubber seal.

2. With an assistant outside the ROPS/FOPS to catch the window, push window outward.

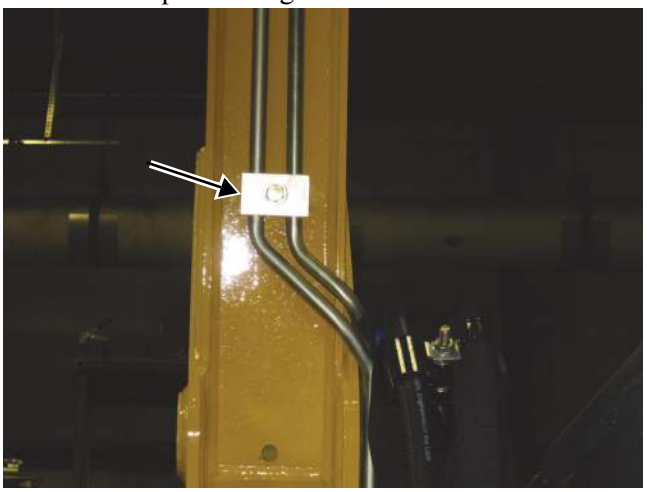


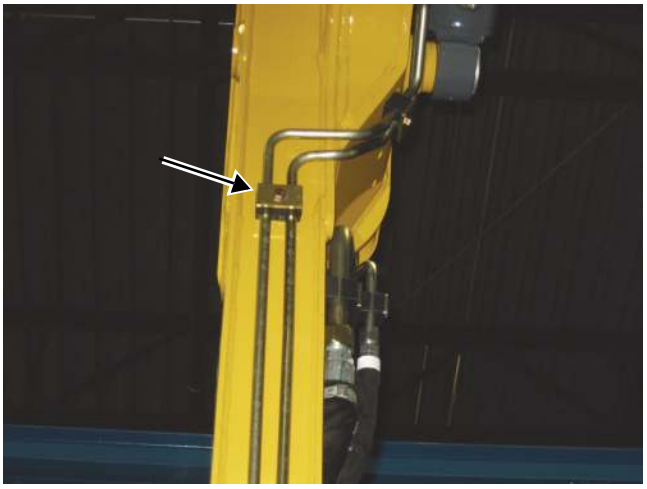
19. Disconnect the couplers from their tubes.
20. Remove the cover plate on the couplers at the front of the lift arm on both sides of the lift arm.

21. After marking all the hydraulic hoses and tubes, disconnect the hoses from their hydraulic tubes and cap or plug them on both sides of the lift arm.
22. At the rear of the lift arm, remove capscrews, locknuts, cover plates, plastic ties and tube clamps on both sides of the lift arm, if a high-flow model.



23. At the rear of the lift arm, pull the interior hoses out of the lift arm on both sides of the lift arm, if a high-flow model.
24. Power-A-Tach hitch machines: Underneath the lift arm, remove capscrews, locknuts, cover plate and tube clamps securing tubes located there.





25. Remove the many hydraulic line clips and plates that secure the hydraulic tubes to the lift arm, if necessary.

Installation Procedure - Reverse the removal steps.

NOTE: After removing/replacing any components of the lift and tilt system, ALWAYS prime hydraulic system by operating the lift arm and attachment (NO LOAD) slowly up and down for several cycles. Check system for hydraulic oil leaks. Fill the hydraulic reservoir until fluid becomes visible on the hydraulic oil dipstick.

NOTE: Refer to the lift arm bushing installation procedure in this chapter if bushings require replacement.

Crossmember Removal and Installation

The crossmember, or apron, can be removed as a complete unit with the control handles to facilitate work on the gear pump/load-sensing pump beneath it, or to perform work on the control handles.

Removal Procedure - Dual Joystick and Hand/Foot Controls

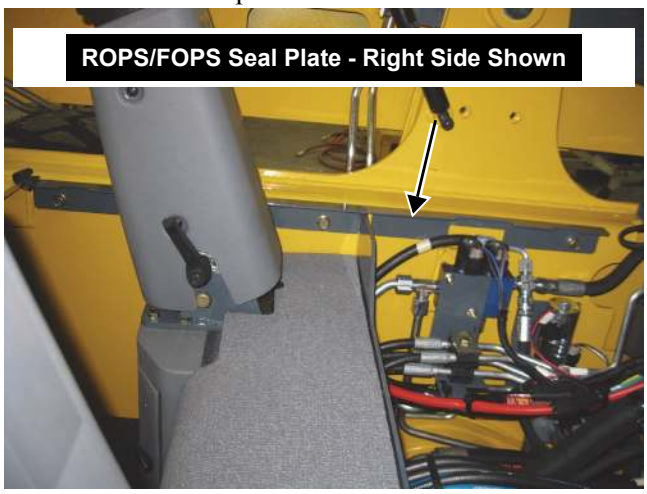
WARNING

BEFORE beginning this service procedure, perform the following SAFETY procedures:

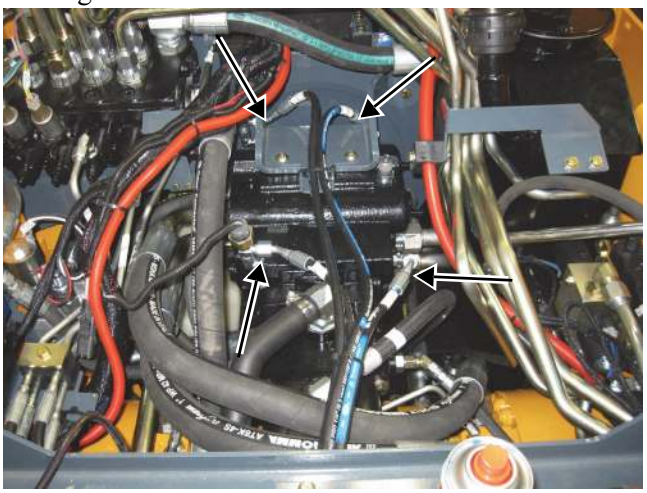
- **Remove attachment from lift arm.**
- **Raise lift arm; engage lift arm support device.**
- **Shut off the engine.**
- **Tilt back ROPS/FOPS until lock engages.**

(For detailed instructions, refer to the *Safety* chapter of this manual.)

1. Remove the control consoles per the procedure in this chapter.
2. Remove the foot plate and battery access cover per the procedure in this chapter.
3. Remove three locking capscrews securing the left and right ROPS/FOPS seal plates inside the chassis and remove the plates.


ROPS/FOPS Seal Plate - Right Side Shown

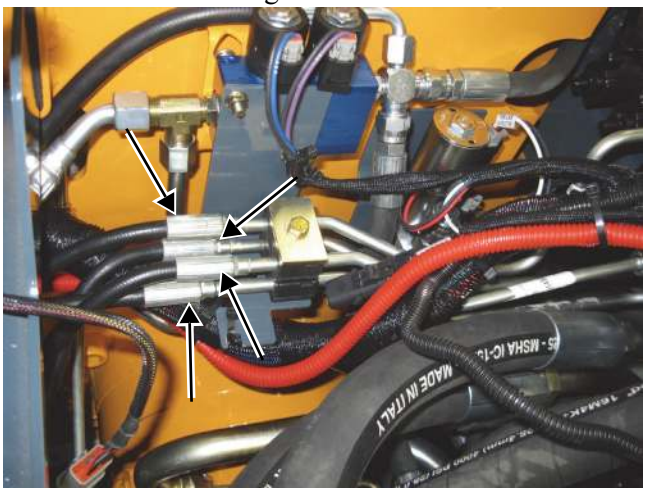
4. Disconnect the four wheel drive control handle hoses on top of the hydrostatic pump at their fittings.



NOTE: To aid in re-assembly of hydraulic hoses and tubes, mark hoses and tubes to be removed before disassembly.

NOTE: Cap or plug the hydraulic hoses and fittings after disconnecting them to prevent fluid loss and contamination of the hydraulic system.

5. Disconnect the four lift and tilt control handle hoses where they connect to main control valve tubes behind the right control handle.



Axle Housing Assembly Removal and Installation

Removal Procedure

WARNING

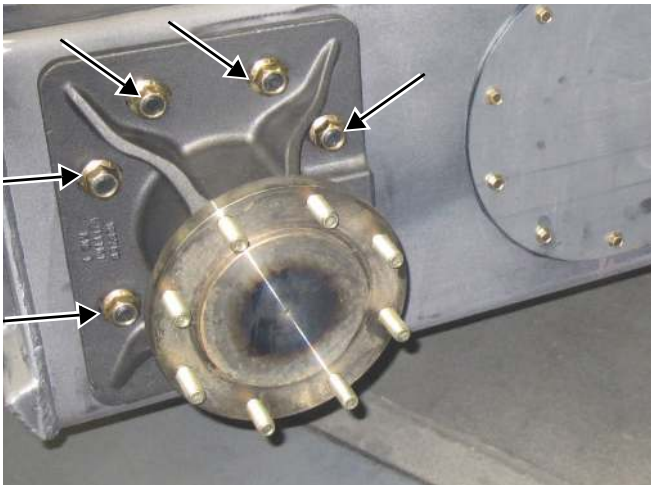
BEFORE beginning this service procedure, perform the following SAFETY procedures:

• Shut off the engine.

• Raise and securely block the loader so all four tires are off the ground.

(For detailed instructions, refer to the *Safety* chapter of this manual.)

1. Remove the wheels and tires on the side of loader being serviced.
2. Drain the oil from the chaincase. See the procedure in the *Lubrication* chapter.
3. Remove 18 machine screws on the chaincase access cover (between tires) to access the drive chain.
4. Attach a suitable hoist to the axle assembly to support the weight of the assembly. Remove the eight locknuts and washers attaching the axle housing to the chassis.



5. Pull axle housing away from the chassis, allowing the axle housing sprocket to drop inside the chaincase.

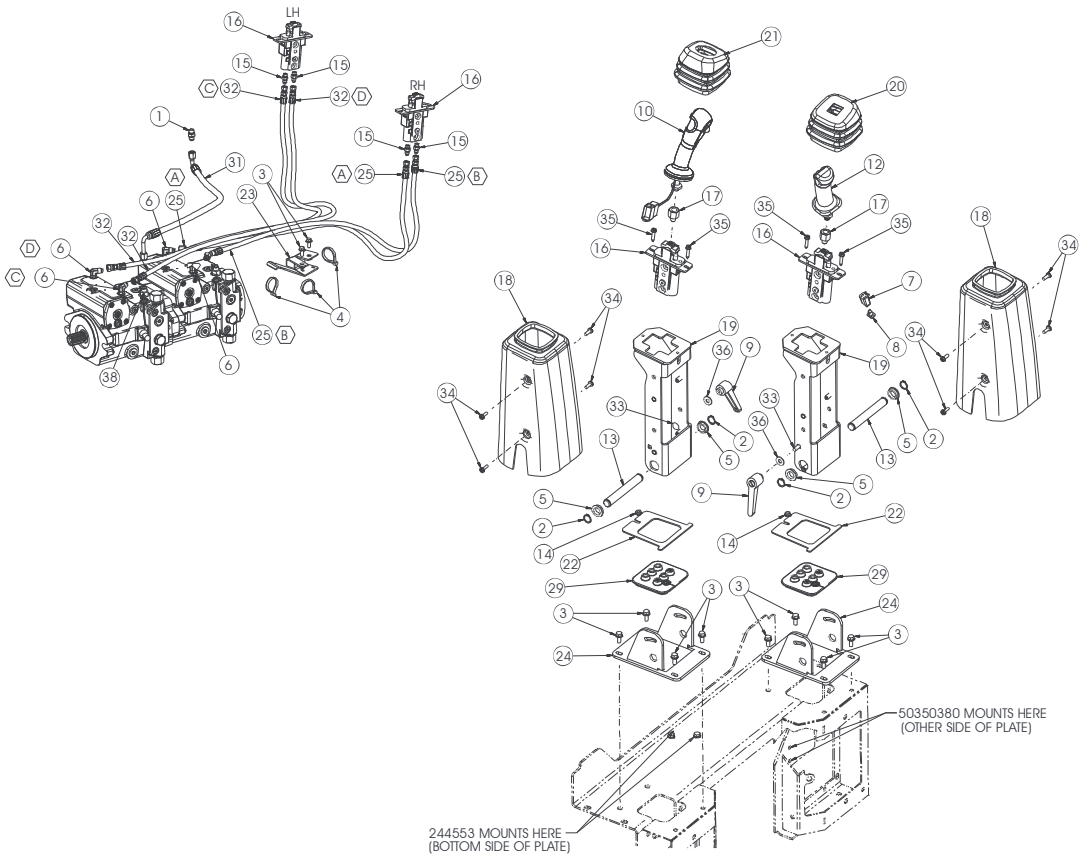
NOTE: It may be necessary to carefully insert a pry bar or chisel between the chassis and axle housing to loosen the axles.

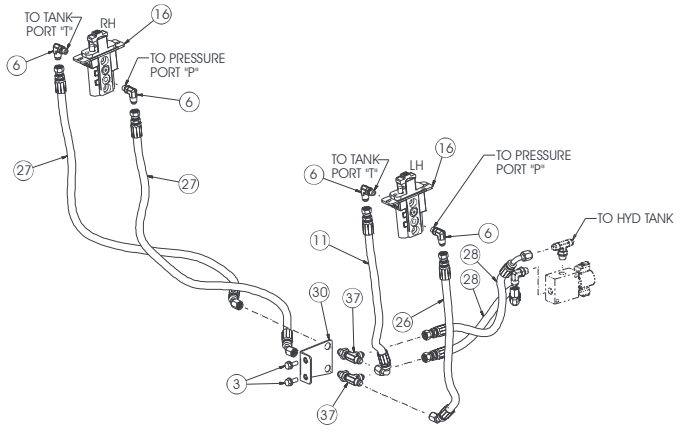
Installation Procedure

1. Support the axle housing assembly with a suitable hoist.
2. Clean the side of the chassis where installing.
3. Install a new o-ring on the axle housing assembly and secure it with grease.

4. Align the holes in the axle housing with studs in the chassis and push it in place.
5. Install the eight washers and locknuts securing axle housing to chassis (hand tighten at this point).
6. Install and adjust the drive chains per the procedure in this chapter. Axle nut torque is 280 lbf. (380 N•m).
7. Reinstall the chaincase access cover using oil-resistant RTV sealant between cover and chaincase.
8. Refill the oil in the chaincase. See the procedure in the *Lubrication* chapter.
9. Reinstall the wheels and tires. Wheel nut torque is: 240 lbf. (325 N•m).

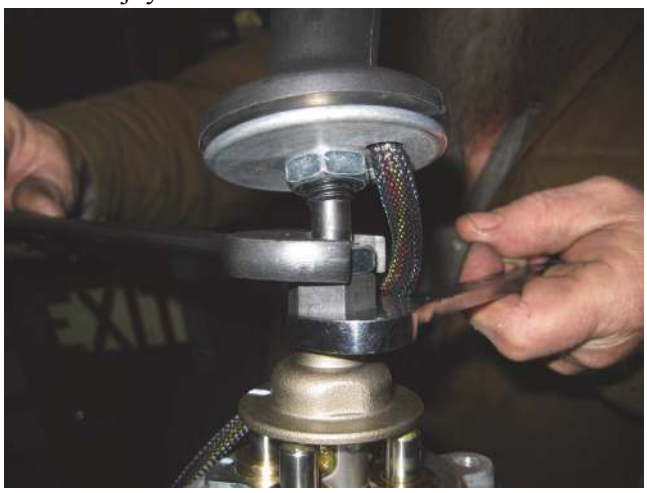
Wheel Drive Components - Hand/Foot Controls



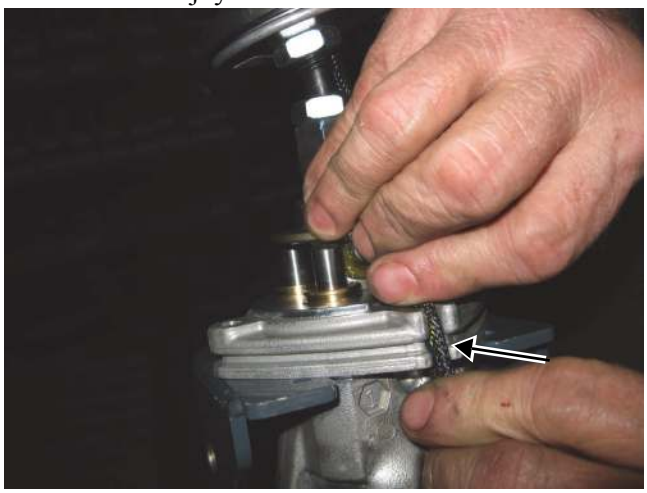


1	FITTING/STRAIGHT	14	NUT/LOCK	27	ASSY/HOSE
2	RING/RETAINING	15	FITTING/STRAIGHT	28	ASSY/HOSE
3	SCREW/CAP LOCKING	16	VALVE/CONTROL	29	GROMMET/PILOT HOSES
4	TIE/CABLE	17	ADAPTER	30	SUPPORT/FITTING
5	BEARING/BRONZE	18	COVER/TOWER	31	ASSY/HOSE
6	FITTING/90°	19	TOWER/H-F	32	ASSY/HOSE
7	PLUG/DEUTSCH	20	BOOT/CONTROL VALVE	33	BOLT/CARRIAGE
8	WEDGE/DEUTSCH	21	BOOT/CONTROL VALVE	34	SCREW/MACHINE
9	HANDLE/RATCHET	22	BRACKET/GROMMET RETAINER	35	SCREW/TAPPING
10	GRIP/AUXILIARY/ELECTRIC	23	BRACKET/HOSE	36	WASHER/FLAT
11	HOSE/PRESSURE	24	MOUNT/PIVOT	37	FITTING/TEE
12	KAWASAKI GRIP	25	ASSY/HOSE		
13	PIN/TILT CONSOLE	26	ASSY/HOSE		

5. Screw down and attach the control grip to the top of the joystick.



6. Route the electrical wire in the control grip through a slot in the joystick.



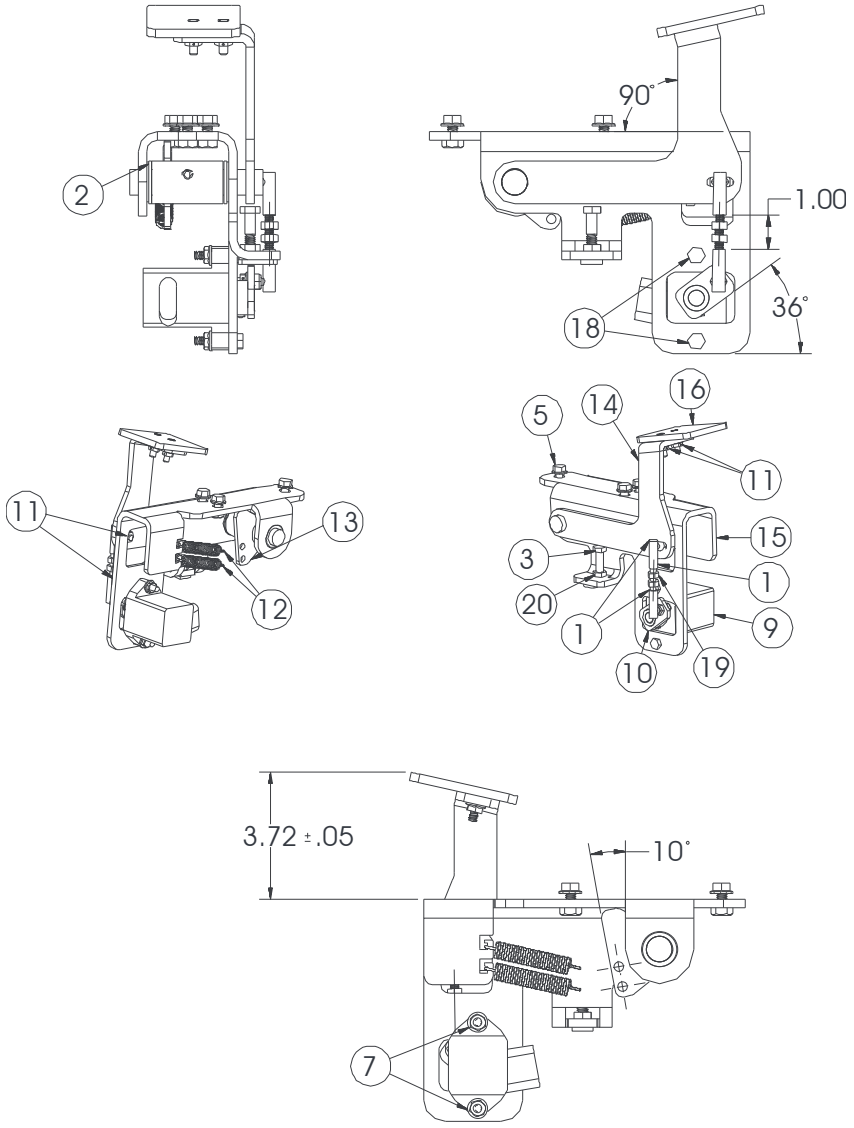
7. Slip the entire assembly into the joystick stand.
8. Bolt the joystick onto the joystick stand.

9. View of joystick secured onto the joystick stand.

10. Connect the tower cover to the joystick stand with four machine screw.
11. Pull the boot down over the control grip and top of the joystick stand.

12. View of correctly orientated control handles.

Electrical Foot Throttle Components - Dual Joystick and T-Bar Controls



1	JOINT/BALL	8	ROD/THREADED	15	ASSY/THROTTLE
2	WASHER/FLAT	9	SENSOR/THROTTLE	16	ASSY/PEDAL/TOP
3	SCREW/CAP	10	LINK/THROTTLE	17	SCREW/CAP
4	PIN/ROLL	11	NUT/HEX LOCK	18	SCREW/CAP
5	SCREW/CAP LOCKING	12	SPRING	19	NUT/HEX
6	BEARING/BRONZE	13	STOP/TRAVEL	20	NUT/HEX JAM
7	NUT/SPIRALOCK™	14	PEDAL/THROTTLE		

Drive Motor Removal and Installation

WARNING

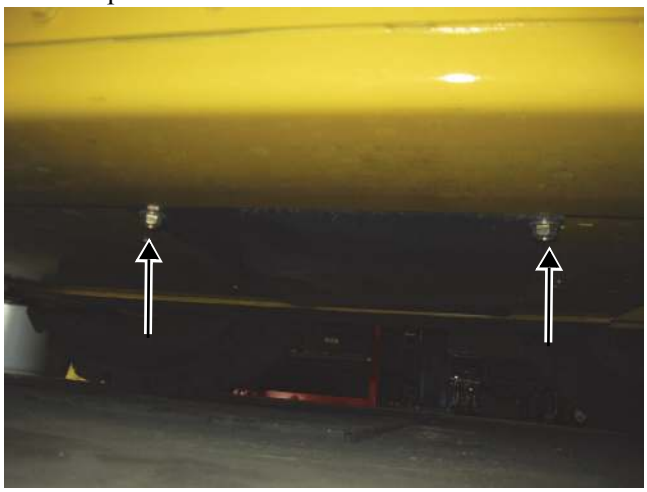
BEFORE beginning this service procedure, perform the following SAFETY procedures:

- **Remove attachment from lift arm.**
- **Raise and securely block the loader so all four tires are off the ground.**
- **Raise lift arm; engage lift arm support device.**
- **Shut off the engine.**
- **Tilt back ROPS/FOPS until lock engages.**

(For detailed instructions, refer to the *Safety* chapter of this manual.)

Removal Procedure

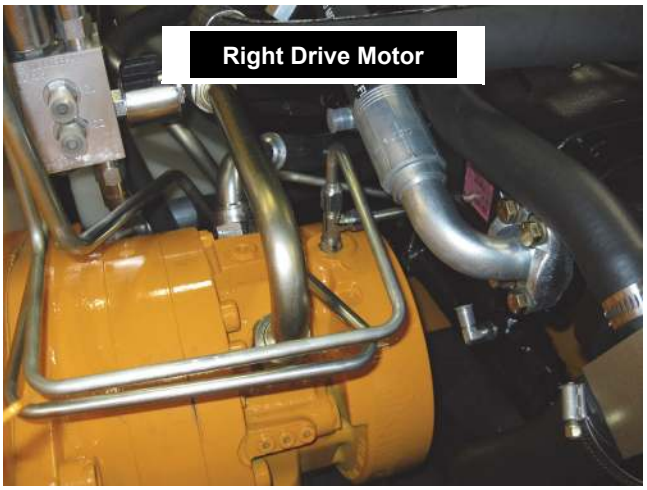
1. Underneath the skid-steer loader, remove two capscrews securing the belly pans and then remove both pans from the chassis.

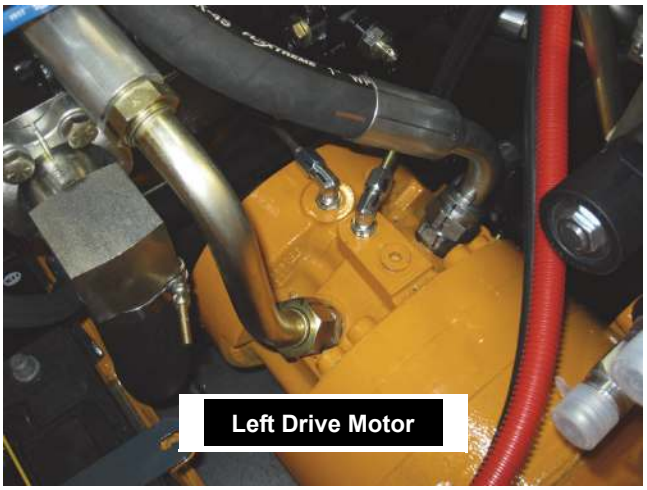


2. Remove the drive chains per the procedure in the *Wheel Drives* chapter.
3. If necessary, drain oil from the hydraulic reservoir and chaincases per their procedures in the *Lubrication* chapter.

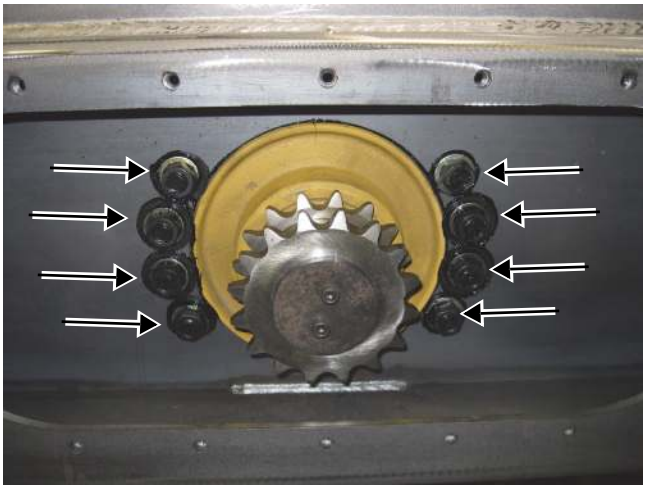
NOTE: If the hydraulic hoses and tubes are plugged after removal to prevent oil leakage, it should not be necessary to drain the hydraulic reservoir. Hydraulic hoses and tubes, along with the auxiliary suction hose and other components should be plugged to prevent contaminants from entering the hydraulic system.

4. BEFORE disconnecting hydraulic hoses and tubes from the drive motor, mark each hose/tube and the port where it attaches to the drive motor (so that hoses/tubes can be correctly reattached during installation).
5. Disconnect all hydraulic hoses and tubes on each drive motor.

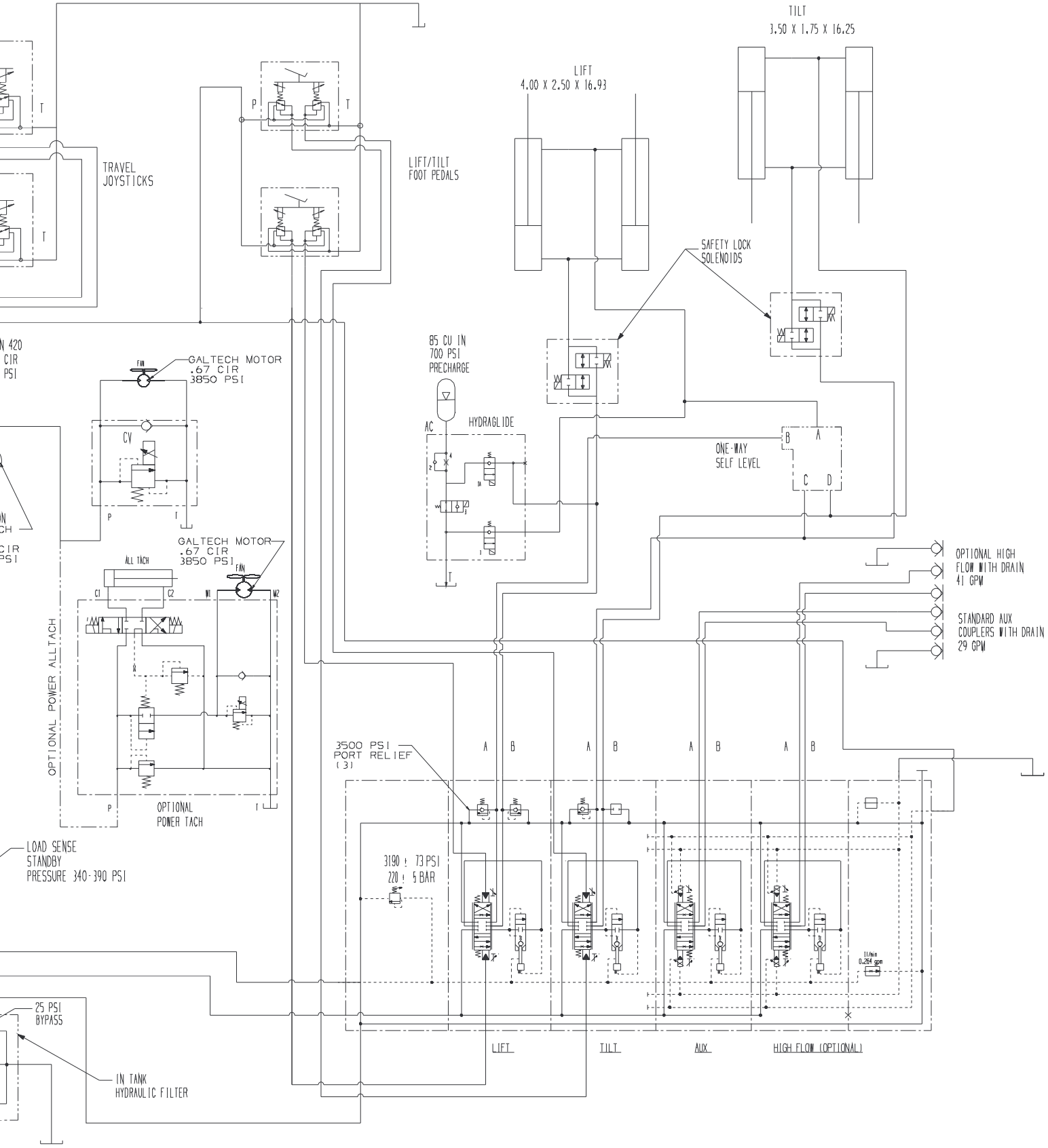




6. Support the drive motor with a suitable hoist and remove eight socket-head capscrews (200 lbf.) (271 N•m) and washers attaching the drive motor to the chaincase.



Hydrostatic/Hydraulic Schematic - Hand/Foot Controls



Hydraulics - Standard Chassis Components - Dual Joystick and Hand/Foot

Parts Listing For Previous Drawing

1	FITTING/STRAIGHT
2	FITTING/STRAIGHT
3	FITTING/STRAIGHT
4	CLAMP/HOSE
5	FITTING/STRAIGHT
6	FITTING/90°
7	FITTING/STRAIGHT
8	FITTING/STRAIGHT
9	FITTING/STRAIGHT
10	FITTING/90°
11	FITTING/STRAIGHT
12	FITTING/TEE RUN
13	FITTING/45°
14	CLAMP/TUBE
15	PLATE/TOP
16	CLAMP/TUBE
17	FITTING/TEE
18	FITTING/90°
19	CLAMP/TUBE
20	FITTING/90°
21	CAP/RESERVOIR
22	PLUG
23	NUT/SPIRALOCK™
24	SWITCH/TEMP
25	FITTING/STRAIGHT
26	NUT/SPIRALOCK™
27	VALVE/SELF-LEVEL
28	CLAMP/HOSE
29	FITTING/90°
30	CLAMP/T-BOLT
31	KIT/SPLIT FLANGE
32	KIT/SPLIT FLANGE
33	PLATE/MOUNTING
34	FITTING/90°
35	FILTER/VENT
36	HOSE/SUCTION
37	ASSEMBLY/HOSE & TUBE
38	TEE/RUN
39	MANIFOLD/VALVE
40	VALVE/SOLENOID
41	FITTING/TEE RUN
42	CLAMP/T-BOLT
43	HOSE/PRESSURE
44	NUT/HEX
45	FITTING/STRAIGHT
46	FITTING/STRAIGHT
47	FITTING/90°
48	PUMP/LOAD SENSING
49	PUMP/GEAR
50	HOSE/PRESSURE
51	FILTER/HYDRAULIC
52	ADAPTER/90°
53	TUBE/LIFT ROD END
54	TUBE/TILT
55	TUBE/TILT
56	HOSE/SUCTION
57	HOSE/SUCTION
58	MANIFOLD
59	FITTING/CROSS
60	VALVE
61	BRACKET/MANIFOLD/FAN
62	TUBE/AUXILIARY
63	TUBE/AUXILIARY
64	TUBE/TILT CROSSOVER
65	TUBE/LIFT
66	TUBE/LIFT BASE END
67	TUBE/LIFT BASE END
68	DIPSTICK/HYD OIL
69	TUBE/HOSE/FANDRIVE
70	TUBE/HOSE/FANDRIVE
71	TUBE/RETURN
72	MOUNTING/VALVE
73	BRACKET/TUBE
74	HOSE/LOWER
75	HOSE/UPPER
76	HOSE/HYDRAULIC
77	HOSE/ASSY
78	HOSE/ASSY
79	TUBE/DRAIN
80	TUBE/SELF-LEVEL
81	HOSE/DRAIN
82	TANK/RESERVOIR
83	O-RING
84	CLAMP/HOSE
85	O-RING
86	CLAMP/T-BOLT
87	CAP
88	TUBE/AUX DRAIN
89	HOSE/ASSY
90	BRACKET/HOSE
91	MANIFOLD/FANDRIVE
92	BRACKET/HOSE
93	TUBE/FILL
94	TUBE/TILT
95	TIE/CABLE
96	TUBE/DRAIN/FAN
97	TUBE/DRAIN/BRAKE
98	TUBE/TILT CROSSOVER
99	TUBE/LIFT CROSSOVER
100	HOSE/HYDRAULIC
101	CLAMP/TUBE SINGLE
102	PLATE/COVER
103	BRACKET/WIRE
104	FITTING/STRAIGHT
105	SCREW/CAP
106	SCREW/CAP
107	SCREW/CAP
108	SCREW/CAP
109	SCREW/CAP
110	SCREW/CAP
111	SCREW/CAP
112	SCREW/CAP
113	BOLT/CARRIAGE
114	SCREW/CAP
115	SCREW/CAP
116	SCREW/CAP
117	BOLT/CARRIAGE
118	SCREW/CAP
119	WASHER/FLAT
120	SCREW/CAP
121	BOLT/CARRIAGE
122	BOLT/CARRIAGE
123	NUT/HEX
124	WASHER/FLAT
125	SCREW/CAP
126	FITTING/TEE
127	FITTING/90°
128	WASHER/HARD

Pressure and Load-Sense Check, Test and Adjustment

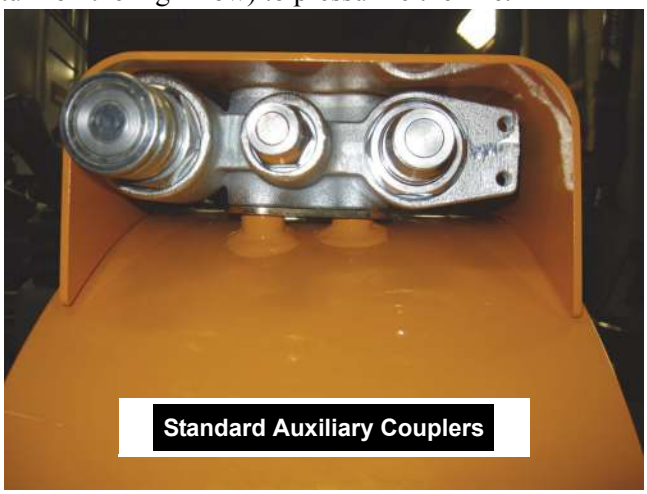
The control valve on the skid-steer loader controls lift and tilt functions of the lift arm and standard and high-flow auxiliary hydraulics. It is located on the right side of the chassis. There is also an inlet relief in the control valve for the load-sense signal.

There are two adjustable pressure compensators on the axial piston load-sensing pump. One is used to set maximum system pressure, the other, to set load-sense standby pressure.

System Pressure and Load-Sense Check Procedure

The hydraulic oil must be at normal operating temperature, around 140° F (60° C).

It is possible to perform a system pressure reading check at the auxiliary hydraulic couplers located on the left lift arm. Install a pressure gauge in the end of the male coupler and activate the auxiliary hydraulics (or turn on the high-flow) to pressurize the line.



1. At the Hydraulics Couplers: Climb into the operator's seat, lower the restraint bar and start the engine.
2. Activate the standard control function of the standard auxiliary, or high-flow auxiliary if checking that.
3. Slowly increase the engine speed to high idle.
4. Have assistant observe the pressure reading on the gauge. The pressure reading on the loader should be:
   a. for standard flow, at least 3450 PSI ± 25 PSI (238 bar ± 1,7 bar), and
   b. for high-flow, at least 3450 PSI ± 25 PSI (238 bar ± 1,7 bar).

System Pressure and Load-Sense Test Procedure and Adjustment

The hydraulic oil must be at normal operating temperature, around 140° F (60° C).

WARNING

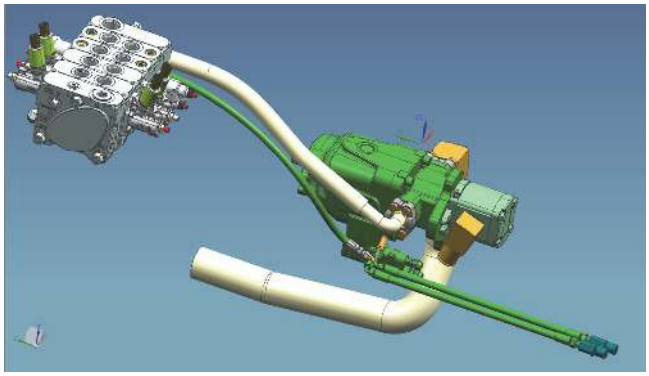
BEFORE beginning this service procedure, perform the following SAFETY procedures:

- **Remove attachment from lift arm.**
- **Raise lift arm; engage lift arm support device.**
- **Shut off the engine.**
- **Relieve hydraulic system pressure.**
- **Tilt back ROPS/FOPS until lock engages.**

(For detailed instructions, refer to the *Safety* chapter of this manual.)

NOTE: To prevent contamination, ALWAYS clean the area around hydraulic fittings before disconnecting any hydraulic plug, hose or tube.

1. What you'll need: an assistant, a minimum 5000 PSI (345 bar) pressure gauge, a lower pressure gauge 600 or 1000 PSI (41,3 or 69 bar), hoses and Allen wrench. You may purchase a kit, PN 50353020, that includes the hoses, caps, fittings and test ports. Gauges are not included.
2. Put the lower pressure gauge in the pump output pressure port straight fitting with the loader idling to check the low pressure standby. DO NOT OPERATE ANY VALVE FUNCTIONS.



Tilt Cylinder Removal and Installation

Removal Procedure

NOTE: Refer to the "Lift Arm Removal/Disassembly" procedure in the *Mainframe* chapter for instructions on removing the complete lift arm assembly, including the tilt cylinders.

1. Remove the bucket or attachment.
2. With the engine running, lower the lift arm until it is in contact (or near contact) with the lift arm stops (on front of chassis).

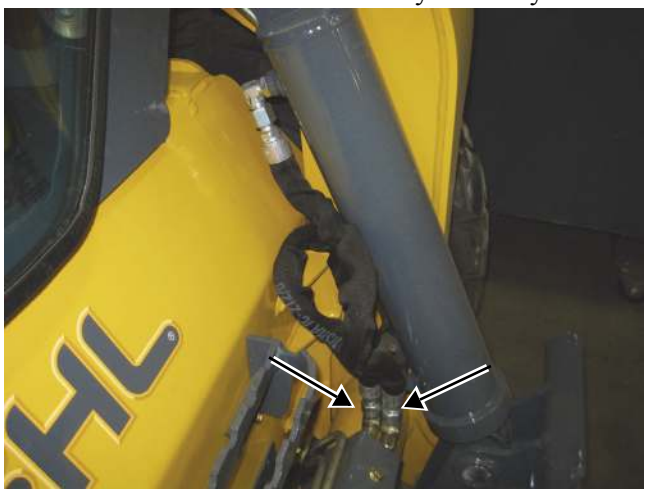
WARNING

BEFORE continuing this service procedure, perform the following SAFETY procedures:

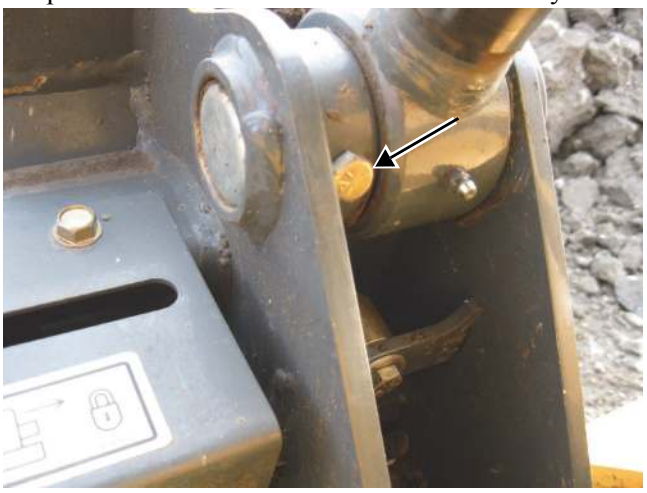
- **Shut off the engine.**
- **Relieve hydraulic system pressure.**

(For detailed instructions, refer to the *Safety* chapter in this manual.)

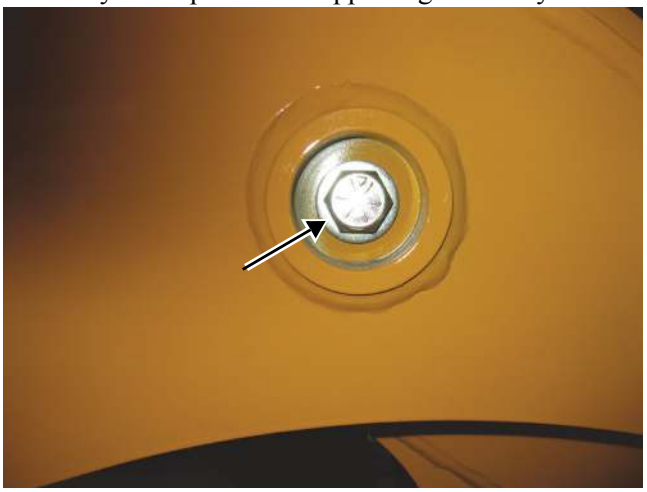
3. Disconnect the upper and lower tilt cylinder hoses from the tubes on the crossmember. BE SURE to plug the hoses and cap the fittings to prevent fluid loss and contamination of the hydraulic system.



4. While supporting the weight of the tilt cylinder, remove the capscrew and locknut securing the lower tilt cylinder pivot pin. Then drive the pivot pin out to release the lower end of the tilt cylinder.



5. Loosen the capscrew on the end of the upper tilt cylinder pin by two to three counterclockwise turns. Strike the bolt head to drive the pin into the lift arm and break the pin free of the taper. Remove the capscrew and flat washer. Remove the upper tilt cylinder pin while supporting the tilt cylinder.



6. Remove upper and lower hoses from the cylinder.

Installation Procedure

1. Connect the upper and lower hoses to the tilt cylinder.
2. Install the base end of the tilt cylinder in position on the lift arm and insert the pivot pin. Use Loctite® 242 (or equivalent) on the capscrew before reinstalling and torque to 80 ft.-lbs. (108 N•m).
3. Position the rod end of the tilt cylinder and insert the pivot pin through the cylinder and attachment mount. Secure the pivot pin with a capscrew and locknut.

Brake/Two-Speed and Safety Lock Solenoid Valves - Removal and Installation

Gehl V400 and Mustang 4000V model skid-steer loaders have separate electric solenoids for lift, tilt and brake functions of the hydraulic system. The tilt safety lock valve is located on the left side of the chassis at the self-leveling valve. The lift safety lock valve is located on the right side of the chassis above and behind the main control valve. The brake/two-speed solenoid valve is located forward and below the main control valve.

Removal Procedure

WARNING

BEFORE beginning this service procedure, perform the following SAFETY procedures:

- **Remove attachment from lift arm.**
- **Raise lift arm; engage lift arm support device.**
- **Shut off the engine.**
- **Relieve hydraulic system pressure.**
- **Tilt back ROPS/FOPS until lock engages.**

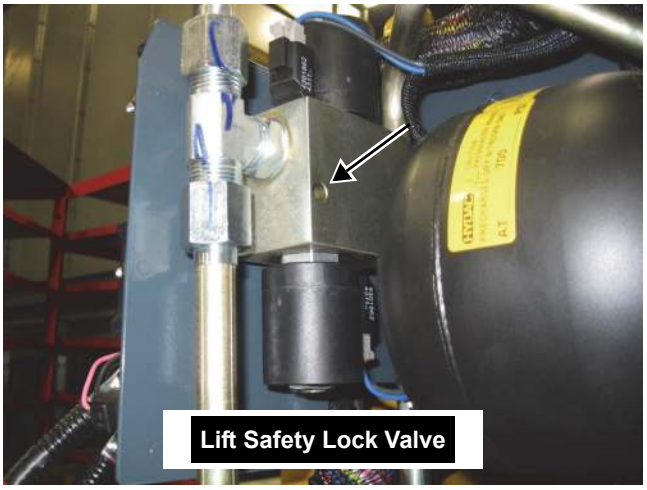
(For detailed instructions, refer to the *Safety* chapter in this manual.)

IMPORTANT: Cap or plug the hydraulic hoses, tubes and fittings after disconnecting them to prevent fluid loss and contamination of the hydraulic system.

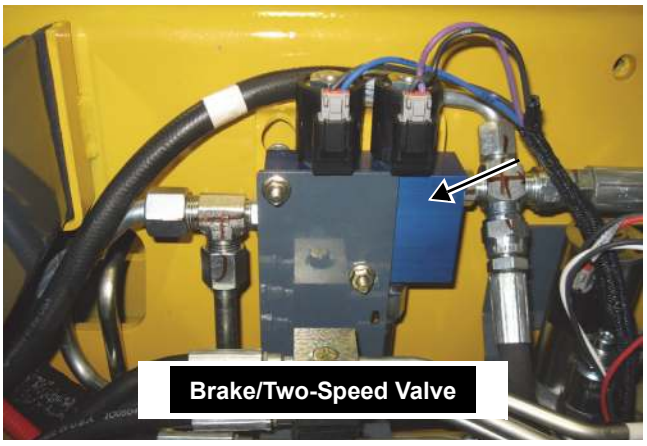
NOTE: To remove the hydraulic tubes from their fittings, it may be necessary to loosen hydraulic tubes at the other end to provide some free-play.

1. **Tilt Safety Lock Valve Removal**: Disconnect two electrical connectors on the solenoid coils. Remove two hydraulic tubes from their fittings. Remove two locknuts securing the valve to the valve mounting plate. Disconnect two forward hydraulic tubes from the front of the self-leveling valve and move out of the way. Remove the valve.

2. **Lift Safety Lock Valve Removal**: Disconnect two electrical connectors on the solenoid coils. Remove two hydraulic tubes from their fittings. Remove the valve.



3. **Brake/Two-Speed Valve Removal**: Disconnect two electrical connectors on the solenoid coils. Remove four hydraulic hoses on the lock valve. Remove two locknuts securing the valve to the chassis. Remove the valve.



Installation Procedure - Follow all warnings first, then reverse the removal steps.

Hydraulic Oil Reservoir Removal and Installation

The hydraulic oil reservoir is a self-contained, welded steel reservoir secured to the floor of the chassis located in front and left of the engine.

Removal Procedure

WARNING

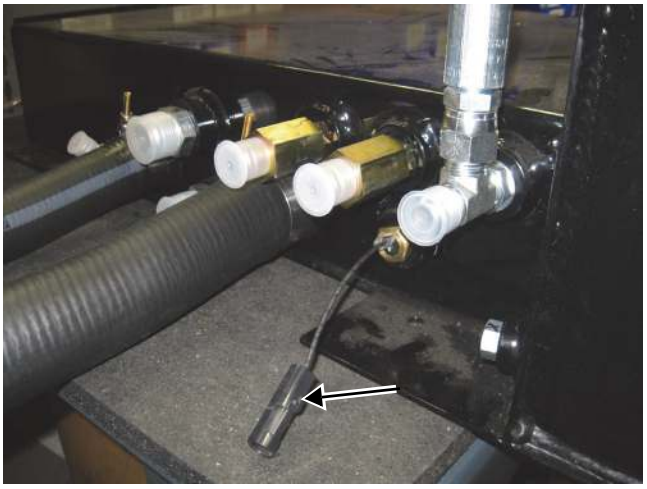
BEFORE beginning this service procedure, perform the following SAFETY procedures:

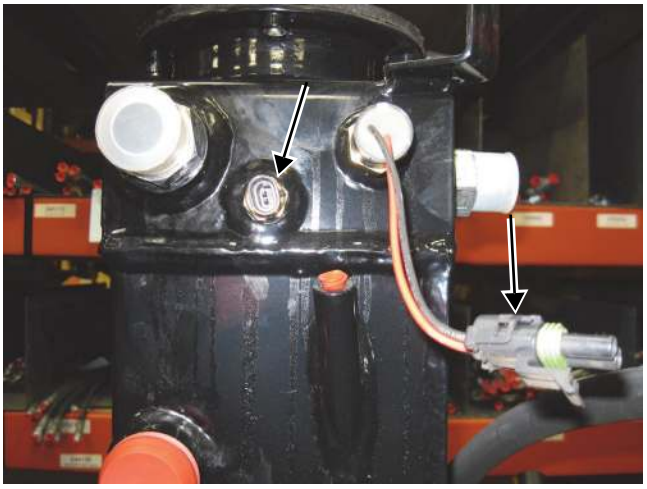
- **Remove attachment from lift arm.**
- **Raise lift arm; engage lift arm support device.**
- **Shut off the engine.**
- **Relieve hydraulic system pressure.**
- **Tilt back ROPS/FOPS until lock engages.**

(For detailed instructions, refer to the *Safety* chapter of this manual.)

IMPORTANT: Cap or plug ALL hydraulic hoses, tubes, fittings and control valve ports immediately after being disconnected to prevent fluid loss and contamination of the hydraulic system.

1. Drain all the oil from the hydraulic reservoir into a suitable container capable of holding at least 25 gallons (94,7 L). For this procedure refer to "Cooling System Drain Procedure" on page 13 in the *Lubrication* chapter.
2. Remove the engine cover, ROPS/FOPS and fuel tank per their procedures in the *Mainframe* chapter.
3. Remove all side engine covers.
4. Remove the hydrostatic pump per the procedure in the *Hydrostatic System* chapter.
5. Remove the engine with the hydraulic oil remote tank attached per the procedure in the *Engine* chapter.
6. Disconnect three electrical connectors on the reservoir.





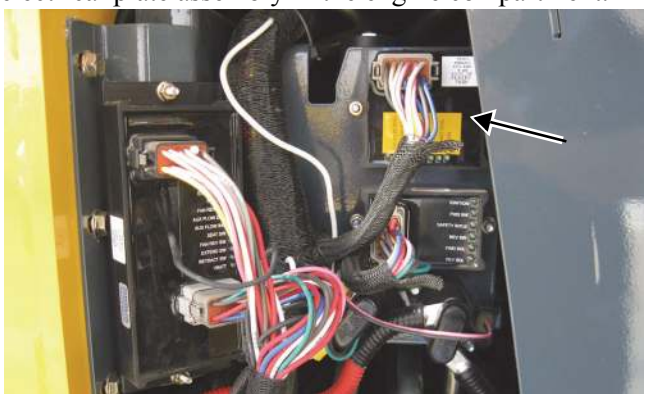
7. Remove four carriage bolts and hex nuts securing the hydraulic tank to the floor of the chassis.

Troubleshooting Guide

Problem	Possible Cause	Remedy
Starter will not engage when keyswitch is turned to “START”.	Seat or restraint bar switch malfunctioning or not activated	Operator is in the seat with the restraint bar down. Replace switches as needed.
	Faulty starter relay in panel	Test starter relay. Replace as needed.
	Battery terminals or cables loose or corroded	Clean battery terminals and cables and tighten them.
	Battery discharged or defective	Recharge or replace battery.
	Starter solenoid in chassis malfunctioning	Troubleshoot circuit per wiring diagram, located trouble. Replace starter solenoid.
	Ignition wiring, seat switch, restraint bar switch, etc. loose or disconnected	Check wiring for poor connections, broken leads; repair wiring or connection.
	Starter or pinion faulty	Remove starter; repair or replace as needed.
	Engine fault code: ECU will not allow crank if certain faults are present	Contact your dealer.
	Engine starter solenoid malfunctions	Replace engine starter solenoid.
	Engine solenoid wire disconnected	Repair or replace as needed.
Work lights not functioning properly.	Single light doesn’t work; light bulb is burned out or faulty wiring	Check and replace light bulb. **IMPORTANT**: When changing the halogen bulb, DO NOT directly touch the light bulb. Use a clean rag to handle the bulb. Check wiring connection to light.
	No lights at all; 10 A or 15 A light fuse blown	Consult wiring diagram, check circuit and find trouble before resetting breaker.
	Faulty light switch or poor ground or bad connection	Replace light switch. Check ground wire connections.
	Loose ROPS/FOPS connector	Verify wiring connections.
Lift/Tilt and/or Drive Solenoids do not work.	Wiring to solenoids disconnected or faulty	Refer to wiring diagram, locate trouble and repair as needed.
	Faulty seat or restraint bar switch	Replace seat or restraint bar switches as needed.
	Faulty solenoid valve coil	Test and replace solenoid valve coil(s) as needed.
	Faulty hydraulic solenoid relay in the panel	Test relay, replace as needed.
	Faulty interlock module	Test module; replace as needed.

Two-Speed, Ride Control and Float Module Test

The following procedure can be used to test the two-speed, ride control and float module mounted on an electrical plate assembly in the engine compartment.



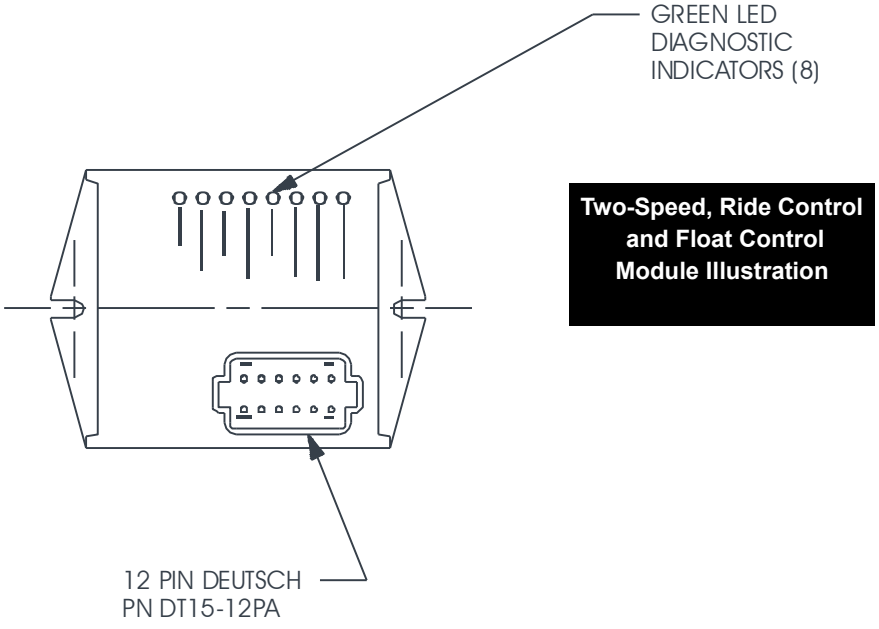
WARNING

BEFORE beginning this service procedure, perform the following SAFETY procedure:

- **Remove attachment from lift arm.**
- **Raise lift arm; engage lift arm support device.**
- **Shut off the engine.**

(For detailed instructions, refer to the *Safety* chapter of this manual.)

1. Remove the right side ROPS/FOPS access panel.
2. Put an operator in the seat with the restraint bar down.
3. Most troubleshooting of the two-speed, ride control and float module can be done by observing the green diagnostic LED indicators on the module.
   - Disconnect the 12-pin connector and inspect the terminals. Be sure no pins are bent on the module and no sockets are damaged on the harness. Replace any damaged components and reconnect the harness to the control module.
4. Refer to truth table (page 174) to analyze functionality of module.
   - With the keyswitch "ON," press the #1 button on the left control handle. The "High/Low Toggle" LED should be lit while the button is depressed. The "High Gear Sol" LED should toggle ON (light) and OFF with alternate pushes of the button.
   - With the keyswitch "ON," press the #2 button on the right control handle. The "Ride Ctrl Toggle" LED should be lit while the button is depressed. The "Ride Ctrl Sol" LED should toggle ON (light) and OFF with alternate pushes of the button.
   - With the keyswitch "ON," press the #1 button on the right control handle. The "Float Toggle" LED should blink while the button is depressed. The "Float Sol" LED should blink ON (light) and OFF with alternate pushes of the button. Press and hold the #1 button for five seconds to lock the "Float" into a continuous "ON" state.



Two-Speed, Ride Control and Float Control Module Illustration

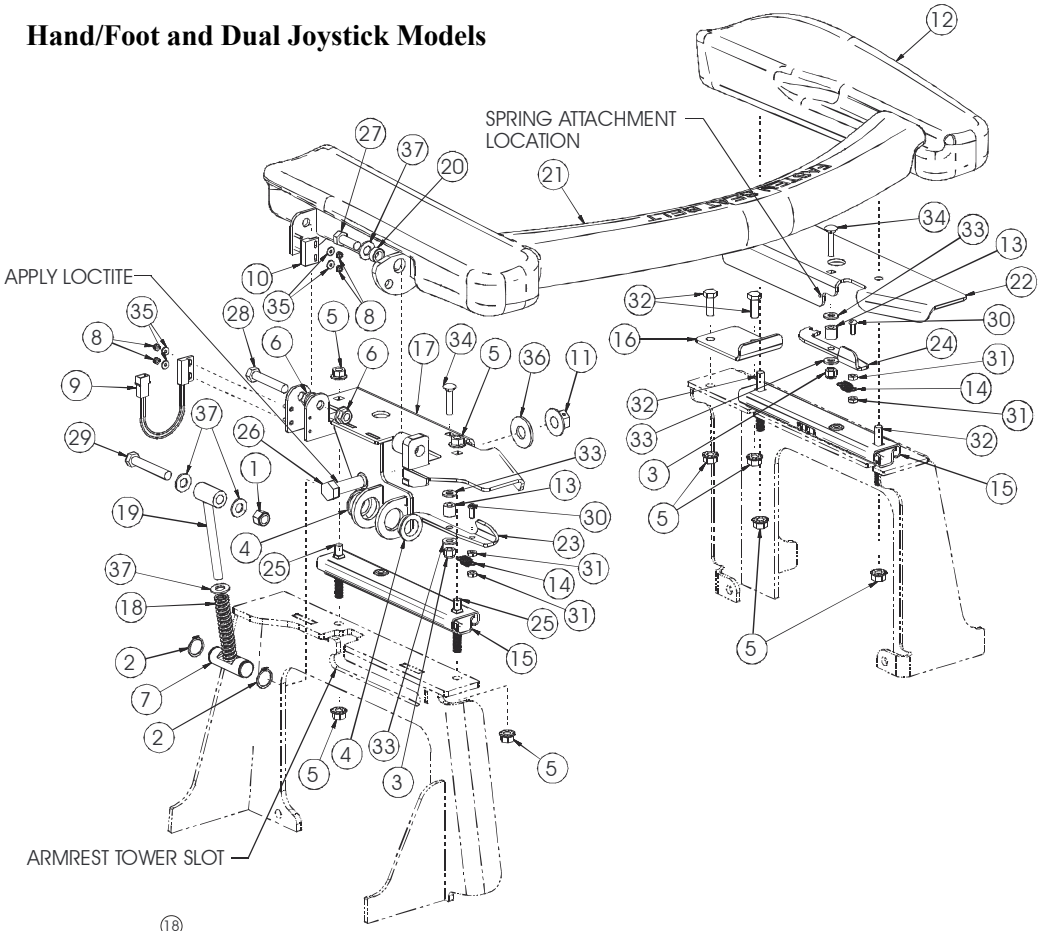
PIN DESCRIPTIONS:

1. BLK GROUND
2. TAN FLOAT LAMP
3. GRY RIDE CONTROL TOGGLE
4. PNK FLOAT SWITCH
5. RED +12VDC
6. WHT LOW/HIGH GEAR TOGGLE
7. BLU RIDE CONTROL LAMP
8. BRN RIDE CONTROL SOLENOID (5 AMP OUTPUT)
9. YEL FLOAT/RIDE SOLENOID (10 AMP OUTPUT)
10. OPERATOR PRESENCE INPUT
11. ORG HIGH GEAR LAMP
12. PUR HIGH GEAR SOLENOID (5 AMP OUTPUT)

MATING CONNECTOR:
DEUTSCH PNB DT06-12S

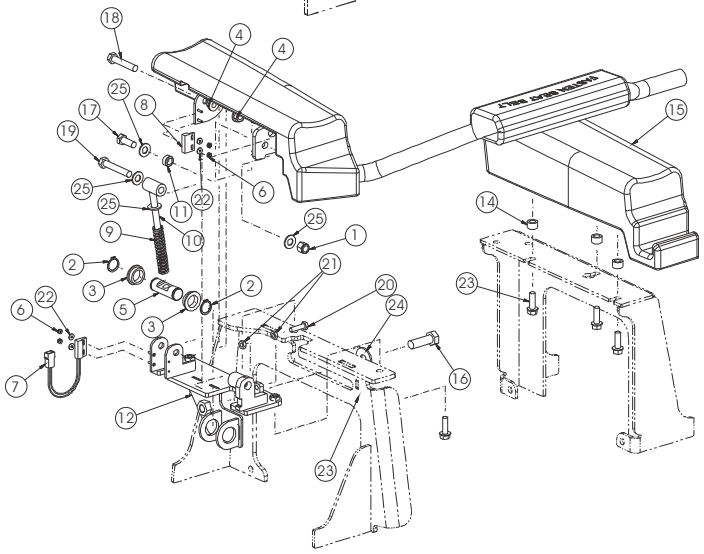
Restraint Bar Components

Hand/Foot and Dual Joystick Models

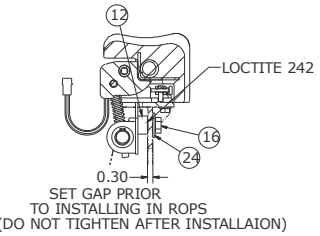


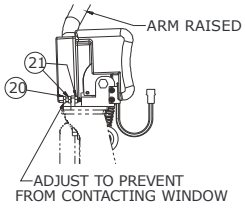
1	NUT/LOCK
2	RING/RETAINING
3	HLN INST
4	BEARING
5	NUT/LOCK
6	NUT/SPIRALOCK
7	PIN/PIVOT
8	NUT/NYLON INSERT
9	SWITCH/PROXIMITY
10	MAGNET/SWITCH
11	NUT/LOCK
12	ARMREST
13	TUBE
14	SPRING/EXTEN
15	RAIL/ARMREST
16	STOP/TRAVEL
17	BAR/PIVOT
18	SPRING/COMP
19	ARM/PIVOT
20	SPACER/PIVOT
21	BAR/RESTRAINT
22	PLATE/SLIDER
23	LEVER/ADJUSTER
24	LEVER/ADJUSTER
25	BOLT/CARRIAGE
26	SCREW/CAP
27	SCREW/CAP
28	SCREW/CAP
29	SCREW/CAP
30	SCREW/MACHINE
31	NUT/HEX MACHINE
32	SCREW/CAP
33	WASHER/FLAT
34	BOLT/CARRIAGE
35	WASHER/FLAT
36	WASHER/FLAT
37	WASHER/FLAT

T-Bar Models

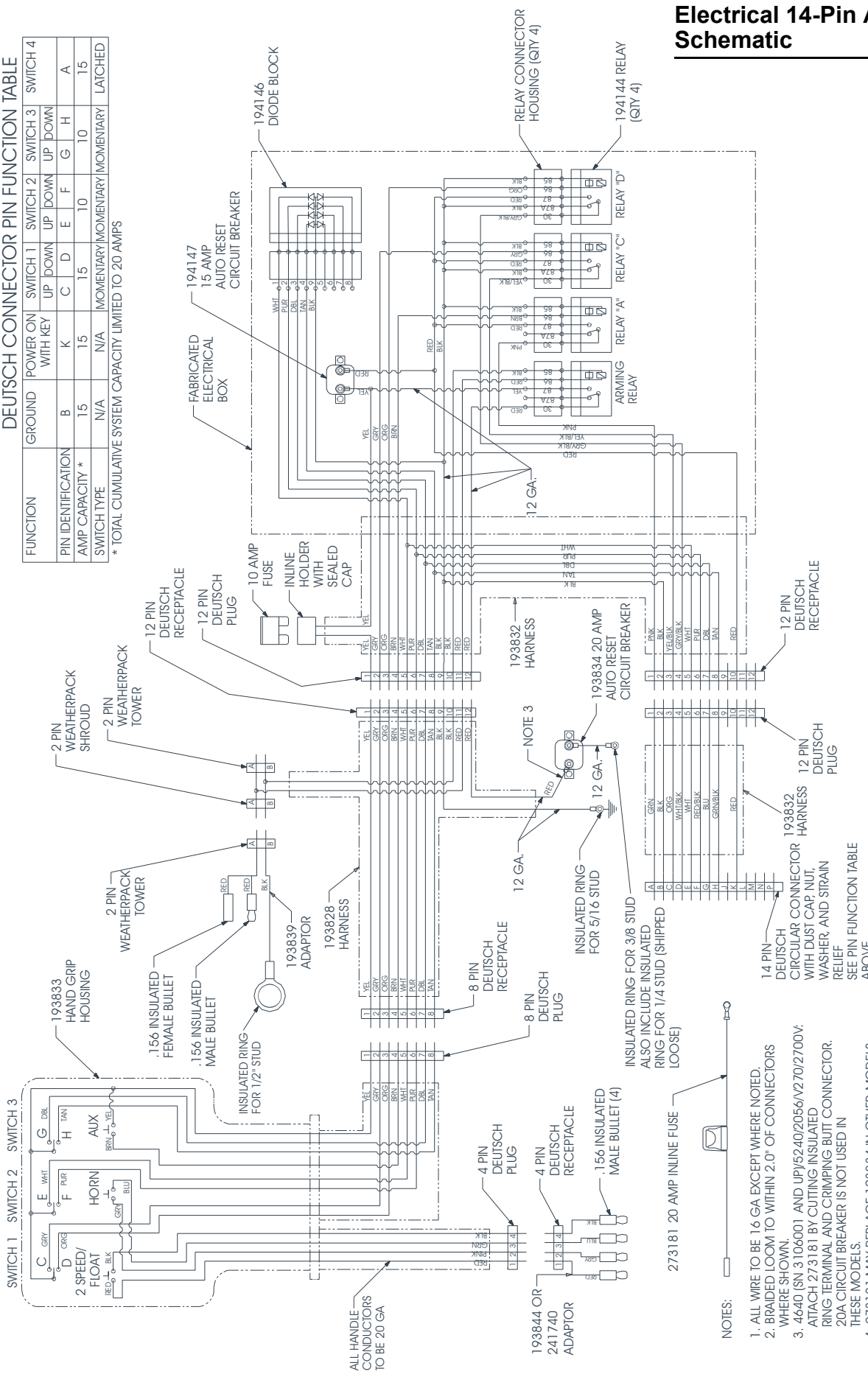


1	NUT/HEX LOCK
2	RING/EXT. RETAINING
3	BEARING/BRONZE
4	NUT/SPIRALOCK™
5	PIN/PIVOT GROOVED
6	NUT/HEX NYLON INSERT
7	SWITCH/PROXIMITY
8	MAGNET/SWITCH ACTUATOR
9	SPRING/COMPRESSION
10	PIVOT ARM/RESTRAINT BAR
11	SPACER/PIVOT
12	PIVOT/BAR
13	BAR/RESTRAINT
14	STANDOFF
15	ARMREST
16	SCREW/CAP
17	SCREW/CAP
18	SCREW/CAP
19	SCREW/CAP
20	SCREW/CAP
21	NUT/HEX JAM
22	WASHER/FLAT
23	SCREW/CAP
24	WASHER/FLAT
25	WASHER/FLAT

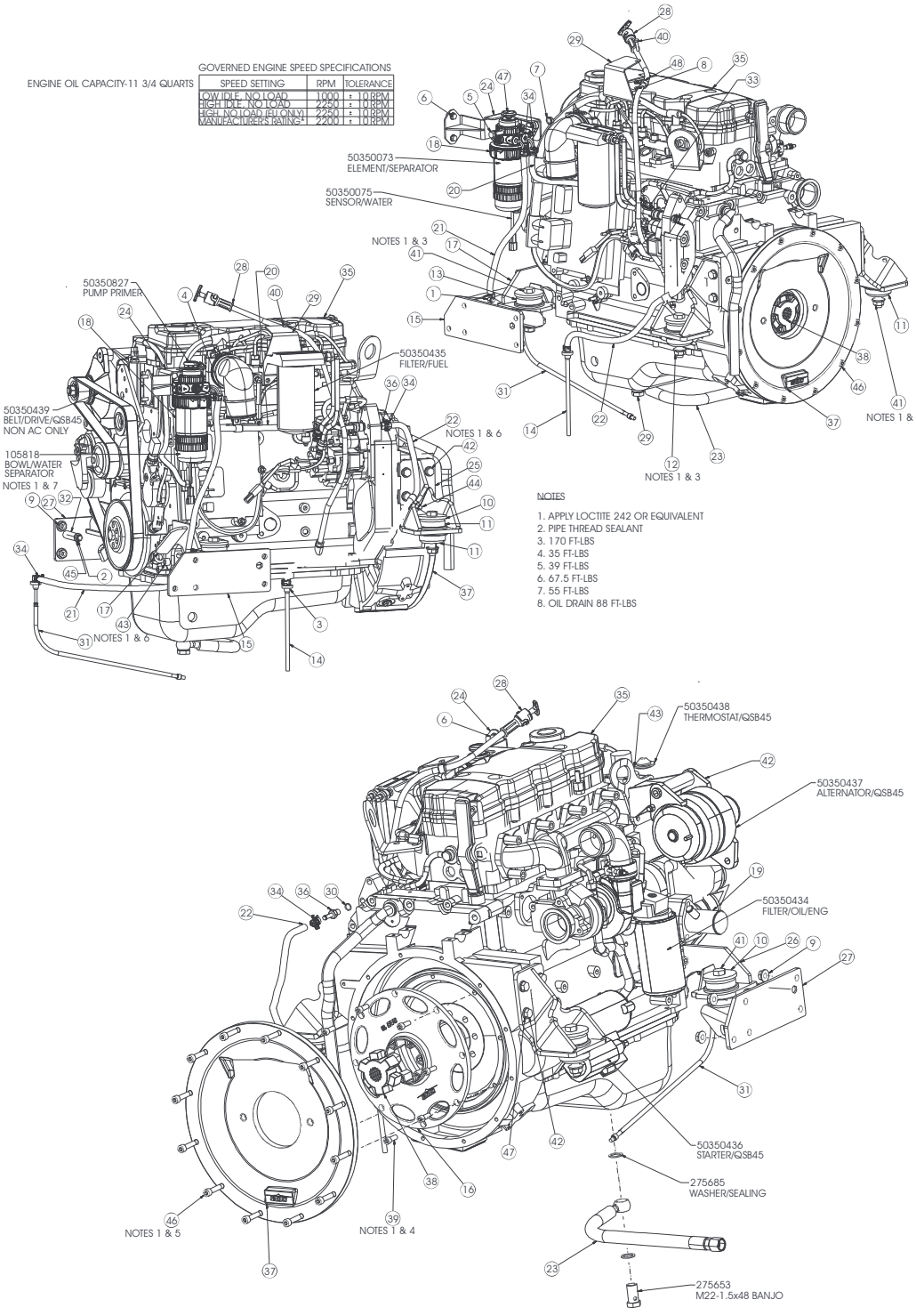




Electrical 14-Pin Auxiliary Schematic



Engine Components



1 NUT/LOCK
2 NUT/LOCK
3 BUSHING/TANK
4 CLAMP/HOSE
5 SCREW/CAP
6 SCREW/CAP
7 NUT/LOCK
8 NUT/SPIRALOCK™
9 NUT/SPIRALOCK™
10 WASHER/FLAT
11 ISOLATOR
12 NUT/SPIRALOCK™
13 ISOLATOR
14 TUBE/FUEL
15 MOUNT/MOTOR
16 PLATE/COUPLER
17 MOUNT/MOTOR
18 SEPARATOR/FUEL
19 INLET/WATER
20 HOSE/FUEL
21 HOSE/FUEL
22 HOSE/FUEL
23 HOSE/DRAIN
24 BRACKEt
25 MOUNT/ENGINE
26 MOUNT/ENGINE
27 MOUNT/ENGINE
28 DIPSTICK
29 BKT/DIPSTICK
30 WASHER/SEALING
31 ASSY/PICKUP/FUEL
32 ROLLER
33 CONNECTOR/FUEL
34 CLAMP/HOSE
35 ENGINE
36 FITTING/FUEL
37 MOUNTING/PUMP
38 COUPLER/SPLINED
39 SCREW/CAP
40 SCREW/CAP
41 SCREW/CAP
42 SCREW/CAP
43 SCREW/CAP
44 SCREW/CAP
45 WASHER/FLAT
46 SCREW/CAP
47 WASHER/FLAT
48 CLAMP/HOSE

Exhaust Assembly Removal and Installation

Removal Procedure

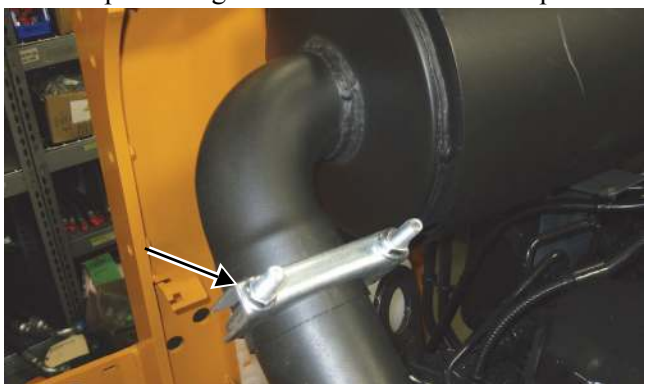
WARNING

BEFORE beginning this service procedure, perform the following SAFETY procedures:

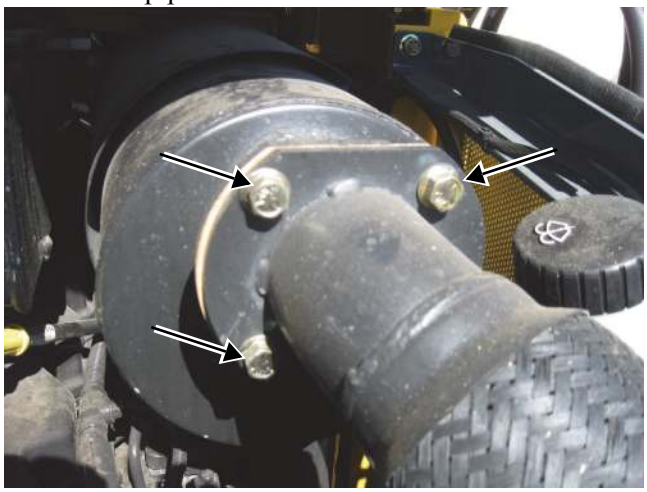
- **Remove attachment from lift arm.**
- **Raise lift arm; engage lift arm support device.**
- **Shut off the engine and allow to cool.**

(For detailed instructions, refer to the *Safety* chapter of this manual.)

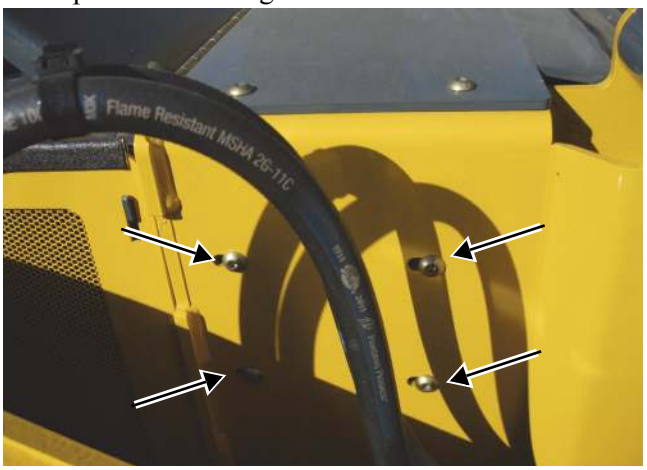
1. Open the engine access cover and lock open the rear grille.
2. Remove the engine access cover per the procedure found in the *Mainframe* chapter.
3. At the front of the muffler, loosen the muffler clamp securing the muffler to the flex coupler.



4. Remove four capscrews securing the muffler to the exhaust pipe.

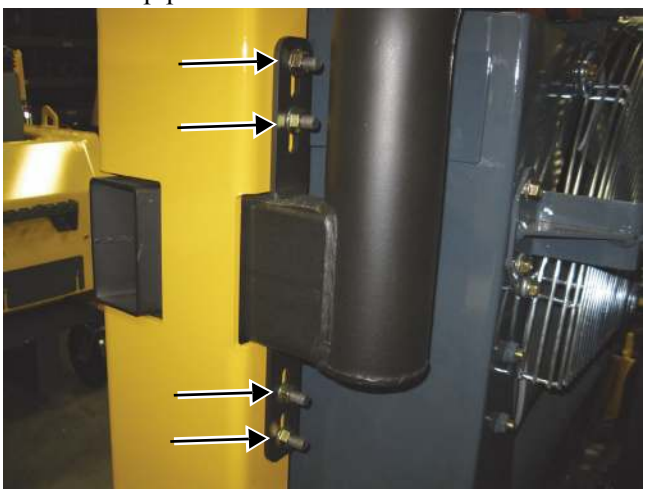


5. Outside the right riser, remove four button-head capscrews securing the muffler to the chassis.



6. Lift the muffler up to pull the capscrews out of the larger hole openings and remove the muffler.
7. To remove the exhaust pipe: Unbolt the metal right rear panel and remove it.

8. Remove four nuts on exhaust bracket securing exhaust pipe to the chassis.



9. Carefully pull the exhaust pipe forward and out of the chassis.

Installation Procedure - Follow all warnings first, then reverse the removal steps.

Cummins QSB4.5 Engine Diagnostic Fault Codes

FMI=8 Abnormal frequency or pulse width or period—(applies to J1939)
To be considered in cases of FMIs 4 and 5. Any frequency or PWM signal that is outside the predefined limits which bound the signal range for frequency or duty cycle (outside Region **"b"** or the signal definition). Also, if the signal is an ECM output, any signal whose frequency or duty cycle is Not consistent with the signal which is emitted.

- *For J1939, broadcast of data value is substituted with "error indicator" value*

FMI=9 Abnormal update rate—(applies to J1939)
Any failure that is detected when receipt of data via the datalink bus, or as input from a smart actuator or smart sensor, is not at the update rate expected or required by the ECM (outside Region **"c"** of the signal range definition). Any error that causes the controller to Not send information at the rate as required by the system. This type of fault may or may not be directly associated with the value of general broadcast information.

FMI=10 Abnormal rate of change—(applies to J1939)
Any data, exclusive of the abnormalities covered by FMI 2, that is considered valid but whose data is changing at a rate that is outside the predefined limits that bound the rate of change for a properly functioning system (outside Region **"c"** of the signal range definition). Broadcast of data values continued as normal.

FMI=11 Root cause not known—(applies to J1939)
It has been detected that a failure has occurred in a particular subsystem but the exact nature of the fault is not known.

- *For J1939, broadcast of data value is substituted with "error indicator" value*

FMI=12 Bad intelligent device or component—(applies to J1939)
Inconsistency of data indicates that a device with some internal intelligence, such as a controller, ECM, smart sensor or smart actuator, is not properly functioning. This data may be internal to a module or external from a datalink message or from various system responses. For J1939, broadcast of data value is substituted with "error indicator" value

FMI=13 Out of calibration—(applies to J1939)
A failure that can be identified to be the result of, not being properly calibrated. This may be the case for a subsystem that can identify that the calibration attempting to be used by the controller is out of date. Or it may be the case that the mechanical subsystem is determined to be out of calibration.
This failure mode does not relate to the signal range definition, as do many of the FMIs.

FMI=14 Special instructions—(applies to J1939)
SPNs 611 to 615 (for J1939) are defined as "System Diagnostics Codes" and are used to identify failures that cannot be tied to a specific field replaceable component. Specific subsystem fault isolation is the goal of any diagnostic system, but for various reasons this cannot always be accomplished. These SPNs or SIDs allow the manufacturer some flexibility to communicate non-"specific component" diagnostic information. Since for J1939 SPNs 611-615 use the standard SPN/FMI format, it allows the use of standard diagnostics tools, electronic dashboards, satellite systems and other advanced devices that scan Parameter Groups containing the SPN/FMI formats (for J1939) and devices that scan for PID 194. Because manufacturer-defined codes are not desirable in terms of standardization, the use of these codes should only occur when diagnostic information cannot be communicated as a specific component and failure mode.
Possible reasons for using a System Diagnostic Code include:
1. Cost of specific component fault isolation is not justified, *or*
2. New concepts in total vehicle diagnostics are being developed, *or*
3. New diagnostic strategies that are not component specific are being developed.

Due to the fact that the SPNs 611-615 (for J1939) are manufacturer defined and not component specific, FMIs 0-13, and 15-31 have little meaning for J1939. Additionally, only FMIs 0-15 are not available for J1939. Therefore, FMI 14, "Special Instructions," is usually used. The goal is to refer the service personnel to the manufacturer's troubleshooting manual for more information on the particular diagnostic code. This failure mode does not relate to the signal range definition as do many of the FMIs. This type of fault may or may not be directly associated with the value of the general broadcast information.

FMI=15 Data valid but above normal operating range - least severe level— (applies only to J1939)
The signal communicating information is within a defined acceptable and valid range, but the real world condition is above what would be considered normal as determined by the predefined least severe level limits for that