# SERVICE MANUAL

## Guardian™ SP.300F / Guardian™ SP.345F / Guardian™ SP.400F
## Tier 4B (final)
## Sprayer

*Guardian™ SP.300F - PIN YGYM01022 and above; Guardian™ SP.345F - PIN YGYM01022 and above; Guardian™ SP.400F - From PIN YFYM00909 to YGYM01021; PIN YGYM01022 and above*

**Part number 48001084**
1st edition English
July 2016
*Replaces part number 47834791*

NEW HOLLAND AGRICULTURE

Before leaving the machine:

1. Park machine on a firm level surface.
2. Put all controls in neutral or park lock position.
3. Engage park brake. Use wheel chocks if required.
4. Lower all hydraulic equipment — Implements, header, etc.
5. Turn off engine and remove key.

When, due to exceptional circumstances, you would decide to keep the engine running after leaving the operator's station, then the following precautions must be followed:

1. Bring the engine to low idle speed.
2. Disengage all drive systems.
3. **⚠ WARNING**

   **Some components may continue to run down after you disengage drive systems.**
   **Make sure all drive systems are fully disengaged.**
   **Failure to comply could result in death or serious injury.**

   **W0113A**

   Shift the transmission into neutral.
4. Apply the parking brake.

## ⚠ General maintenance safety ⚠

Keep area used for servicing the machine clean and dry. Clean up spilled fluids.

Service machine on a firm level surface.

Install guards and shields after servicing the machine.

Close all access doors and install all panels after servicing the machine.

Do not attempt to clean, lubricate, clear obstructions or make adjustments to the machine while it is in motion or while the engine is running.

Always make sure working area is clear of tools, parts, other persons and pets before you start operating the machine.

Unsupported hydraulic cylinders can lose pressure and drop the equipment causing a crushing hazard. Do not leave equipment in a raised position while parked or during service, unless securely supported.

Incorrect towing procedures can cause accidents. Contact your dealer if towing is required.

Stop the engine, remove key and relieve pressure before disconnecting or connecting fluid lines.

Stop the engine and remove key before disconnecting or connecting electrical connections.

Scalding can result from incorrect removal of coolant caps. Cooling system operates under pressure. Hot coolant can spray out if a cap is removed while the system is hot. Allow system to cool before removing cap. When removing a cap turn it slowly to allow pressure to escape before completely removing the cap.

Replace damaged or worn tubes, hoses, electrical wiring, etc.

Engine, transmission, exhaust components, and hydraulic lines may become hot during operation. Take care when servicing such components. Allow surfaces to cool before handling or disconnecting hot components. Wear protective equipment when appropriate.

When welding, remove all electrical monitors from unit to prevent damage. Always disconnect the battery before welding on the machine. Always wash your hands after handling battery components.

## Protecting the electronic and/or electrical systems during charging and welding

To avoid damage to the electronic and/or electrical systems, always observe the following practices:

1. Never make or break any of the charging circuit connections when the engine is running, including the battery connections.
2. Never short any of the charging components to ground.
3. Always disconnect the ground cable from the battery before arc welding on the machine or on any machine attachment.
   - Position the welder ground clamp as close to the welding area as possible.
   - If you weld in close proximity to a computer module, then you should remove the module from the machine.
   - Never allow welding cables to lie on, near, or across any electrical wiring or electronic component while you weld.
4. Always disconnect the negative cable from the battery when charging the battery in the machine with a battery charger.

   ***NOTICE:*** *If you must weld on the unit, you must disconnect the battery ground cable from the machine battery. The electronic monitoring system and charging system will be damaged if this is not done.*
5. Remove the battery ground cable. Reconnect the cable when you complete welding.

**⚠ WARNING**

**Battery acid causes burns. Batteries contain sulfuric acid.**
**Avoid contact with skin, eyes or clothing. Antidote (external): Flush with water. Antidote (eyes): flush with water for 15 minutes and seek medical attention immediately. Antidote (internal): Drink large quantities of water or milk. Do not induce vomiting. Seek medical attention immediately.**
**Failure to comply could result in death or serious injury.**

W0111A

## Special tools

The special tools that NEW HOLLAND suggests and illustrate in this manual have been specifically researched and designed for use with NEW HOLLAND machines. The special tools are essential for reliable repair operations. The special tools are accurately built and rigorously tested to offer efficient and long-lasting operation.

By using these tools, repair personnel will benefit from:

- Operating in optimal technical conditions
- Obtaining the best results
- Saving time and effort
- Working in safe conditions

# General specification - SP.300F

| | |
|---|---|
| SP.300F 2 wheel steer [YGYM01022 - ] | |
| SP.300F 4 wheel steer [YGYM01022 - ] | |

| Model SP.300F | |
|---|---|
| Engine | Cummins QSB Tier 4 Final **300 Hp** — power bulge to **310 Hp** |
| Fuel capacity and type | **568 l** (**150 US gal**) Ultra low sulfur diesel |
| Diesel Exhaust Fluid (DEF) Capacity | **56.8 L** (**15.0 US gal**) |
| Cooling package | Stacked side by side single pass design, hydraulically driven fan |
| Engine/transmission | Located in rear - ISO mounted |
| Transmission | Torq-Trac® hydrostatic drive system with Twin Sauer-Danfoss heavy duty pumps |
| Hydro pump displacement | 100 cc each |
| Final drives | Planetary drives |
| Parking brake | 4 wheel |
| Service brake | 4 wheel internal wet disc |
| Steering | |
| Standard front wheel | Hydrostatic with two steering cylinders, no tie rods, **4.6 m** (**15.0 ft**) turning radius |
| Optional 4 wheel steer | **4.6 m** (**15.0 ft**) turn radius in 4 wheel steer, **6.4 m** (**21.0 ft**) turn radius in 2 wheel steer |
| HYDRALINK™ Suspension | Full suspension travel of **51 cm** (**20 in**) . 4-wheel independent with integrated hydraulic leveling/shock absorbers, auto leveling for each wheel leg. |
| Crop clearance | **183 cm** (**72 in**) |
| Wheel width adjustment | **305 - 406 cm** (**120 - 160 in**), hydraulic adjust, wheels move in/out equally on both sides. Operator remains centered. |
| Air system | Direct engine driven, water cooled air compressor and air storage tank. |
| Auxiliary hydraulic circuit | **117 l/min** (**31 US gpm**) - Optional **193 l/min** (**51 US gpm**) closed center |
| Product tank options | |
| Stainless steel | **4542 L** (**1200 US gal**) |
| Stainless steel | **5300 L** (**1400 US gal**) |
| Stainless steel | **6057 L** (**1600 US gal**) |
| | |
| Product pump standard | Hypro 9306C - **795 l/min @ 5.5 bar** ( **210 US gpm @ 80 psi**) |
| Product pump optional | Hypro 9307C high capacity - **1173 l/min @ 5.5 bar** ( **310 US gpm @ 80 psi**) |
| Rinse tank standard | **568 l** (**150 US gal**), Poly |
| Boom options | **60 ft**, **75 ft/60 ft**, **80 ft/60 ft**, **90 ft/60 ft**, **100 ft/60 ft**, **120 ft/ 70 ft**, **27 m/ 18 m**, **30 m/ 18 m**, **32 m/ 18 m**, **36 m/ 22 m** |
| Boom lines | Standard **2.54 cm** (**1 in**) stainless steel — Optional **3.81 cm** (**1.5 in**) stainless steel |
| Cab | SprayView Cab or Premium SprayView Cab |
| Height | **401 cm** (**158 in**) |
| Width (transport) | **368 cm** (**145 in**) |
| Length (boom unfolded) | **922 cm** (**363 in**) |
| Wheel base | **450 cm** (**177 in**) |
| Boom travel | Lowered **56 cm** (**22 in**) — Raised **300 cm** (**118 in**) |
| Weight (approximate) | **14016 kg** (**30900 lb**) |

# Contents

# Engine - 10

## Engine and crankcase - 001

SERVICE



(*) See content for specific models

# Contents

## Engine - 10

### Fuel tanks - 216

SERVICE



(*) See content for specific models

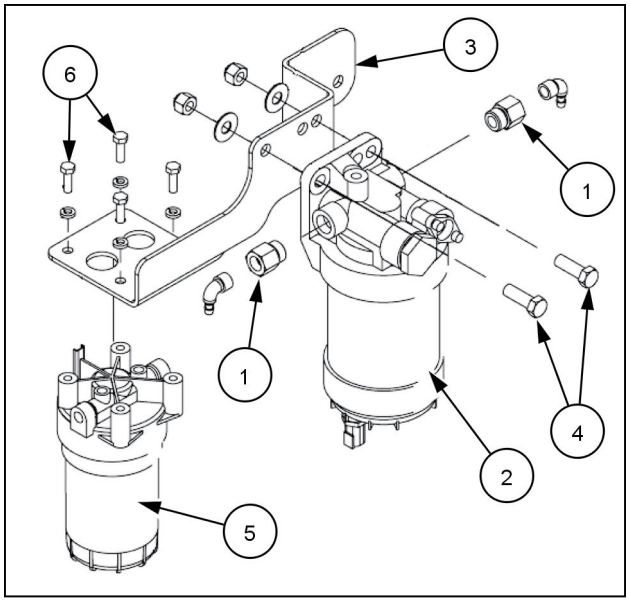
# Fuel-water separator filter - Install - Primary and secondary fuel filters

| | |
|---|---|
| SP.300F | |
| SP.345F | |
| SP.400F | |

1. Install the primary and the secondary filters by inserting the filters into the filter heads. Turn the filters clockwise to tighten the filters into place.

***NOTE:*** *Use the following steps to install the filter heads, fuel lines, and mounting plate.*

2. Attach the fittings **(1)** to the primary fuel filter/water separator **(2)**.
3. Attach the primary fuel filter/water separator to the mounting bracket **(3)** using the bolts, washers, and nuts **(4)** . Tighten securely.
4. Attach the secondary fuel filter **(5)** to the mounting bracket using the bolts and washers **(6)** . tighten securely.

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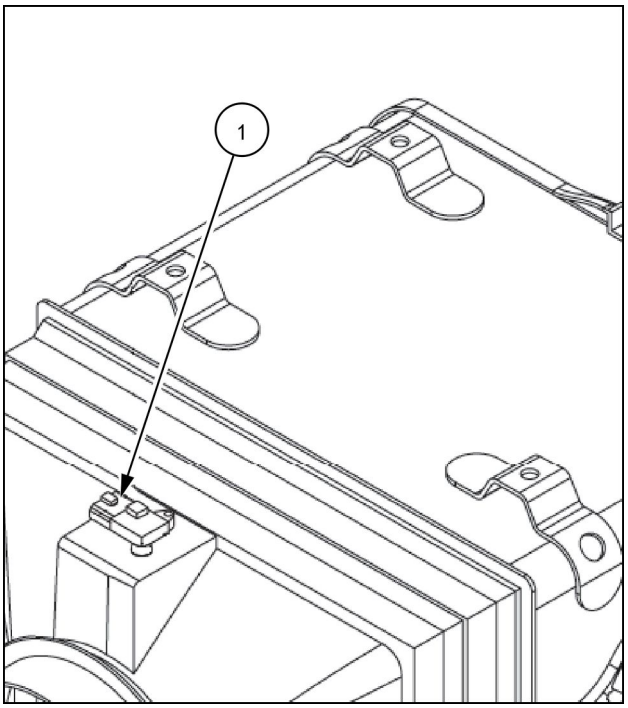
5. Attach the fuel line from the fuel tank to the inlet of the primary fuel filter/water separator.
   Attach the fuel line from the primary fuel filter/water separator to the fuel pump.
   Attach the fuel line to the secondary fuel filter inlet.
   Attach the fuel line from the secondary fuel filter inlet to the fuel pump.
   Attach the fuel line from the engine to the secondary fuel filter outlet.
6. Connect the wire harness connection to the primary fuel filter/water separator.
7. Remove tags marking the lines.

6. Connect the wire connection to the Temperature Barometric Air Pressure (TBAP) sensor **(1)**.

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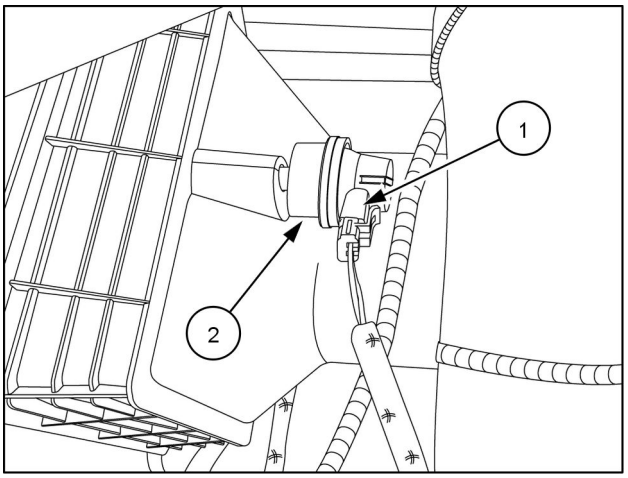
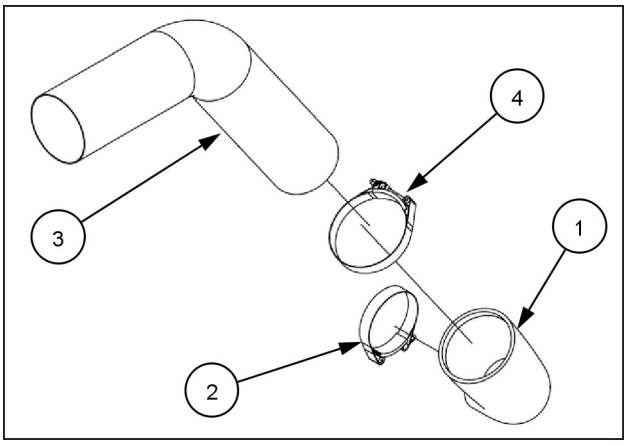
7. Connect the wire connection **(1)** to the restriction indicator sensor **(2)**.




RAIL13SP03874AA 5

8. Connect the reducer elbow **(1)** to the engine intake using the hose clamp **(2)**.
9. Connect the intake elbow **(3)** to the reducer elbow **(1)** using the hose clamp **(4)**.

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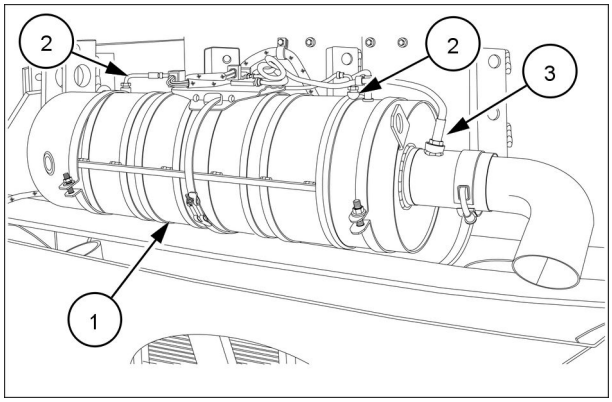
## Selective Catalytic Reduction (SCR)

The SCR **(1)** is connected to the DRT. The function of the SCR is to further reduce the NOx content in the exhaust gasses to nitrogen by allowing the exhaust gasses to pass through the catalyst within the SCR.
The SCR is mounted to the DRT at one end, and has the tail pipe extension attached to the other end. The SCR is mounted to the SCR enclosure with metal straps.
Attached to the SCR are two temperature sensors **(2)** . One sensor is attached to the inlet side of the SCR chamber, and the other temperature sensor is attached to the outlet side. Also attached to the SCR is a NOx sensor **(3)** at the outlet.

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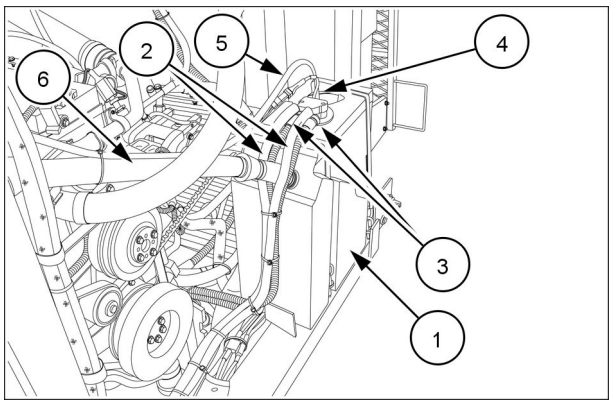
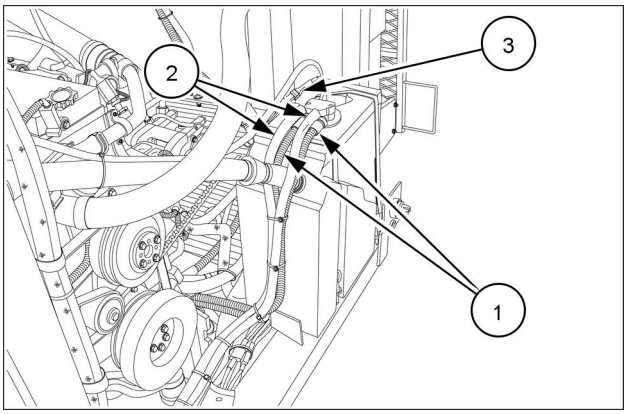
## Diesel Exhaust Fluid (DEF) tank

The DEF tank **(1)** is mounted in the engine enclosure at the left hand side of the vehicle. The function of the DEF tank is to hold the supply of DEF for the vehicle as well as send feedback signals to the engine control regarding DEF level, quality, and temperature. The DEF tank is removable from the machine and is held in place with two straps.
Connected to the DEF tank are the coolant circulation feed and return lines **(2)** , the DEF feed and return lines **(3)**, a 12 volt power/ground to sensor CAN high/low wire **(4)** , and a vent tube **(5)** . Also connected to the tank is the tank fill tube **(6)** which can be accessed through the sliding doors at the front of the engine enclosure.



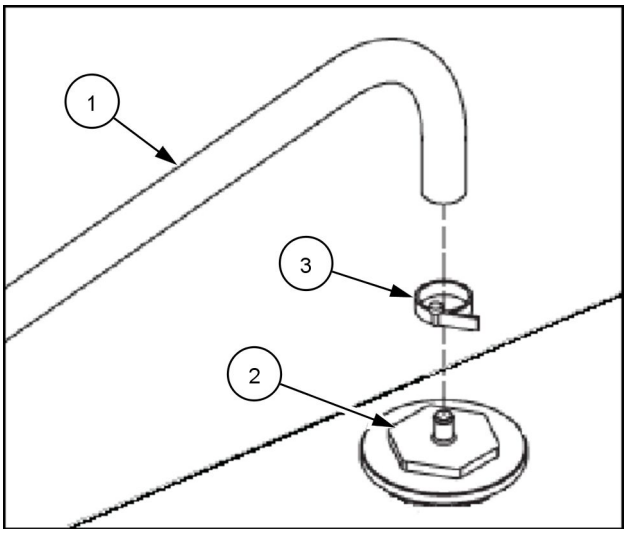

RAIL14SP01688FA 7

6. Disconnect the lines connected to the DEF Header attached to the top of the DEF tank. Disconnect the DEF suction and return lines **(1)**. Disconnect the Tank heater coolant inlet and return lines **(2)**. Disconnect the wire harness connection **(3)**. Cap and plug all lines and fittings.



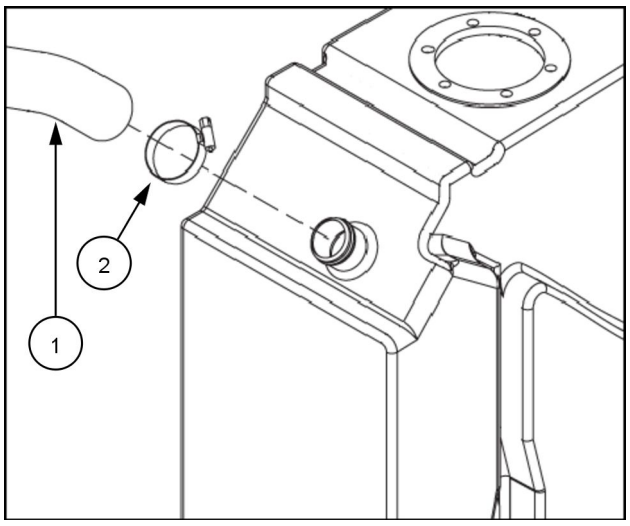

RAIL14SP01688FA 3

7. Remove the vent line **(1)** from the tank vent assembly **(2)** by removing the hose clamp **(3)** attaching the hose to the vent assembly.




RAIL14SP01697BA 4

8. Disconnect the filler tube hose **(1)** from the tank by removing the hose clamp **(2)** attaching the hose to the tank.




RAIL14SP01694BA 5

# Contents

# Engine - 10

## Engine cooling system - 400

SERVICE



(*) See content for specific models

# Contents

# Engine - 10

## Fan and drive - 414

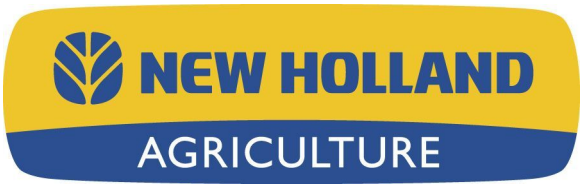
SERVICE



(*) See content for specific models

**CNH Industrial America - Main 700 State Street Racine, Wisconsin United States 53404**

SERVICE - Technical Publications & Tools

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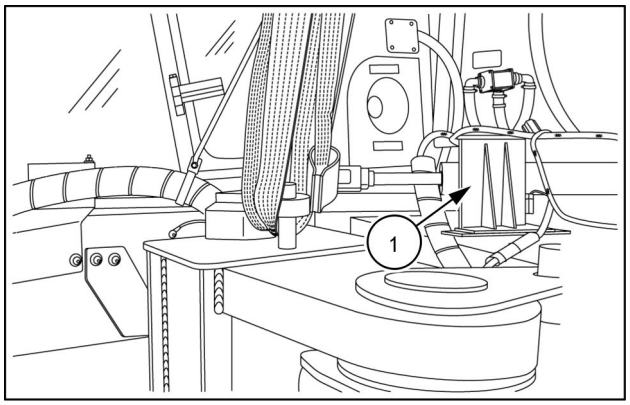
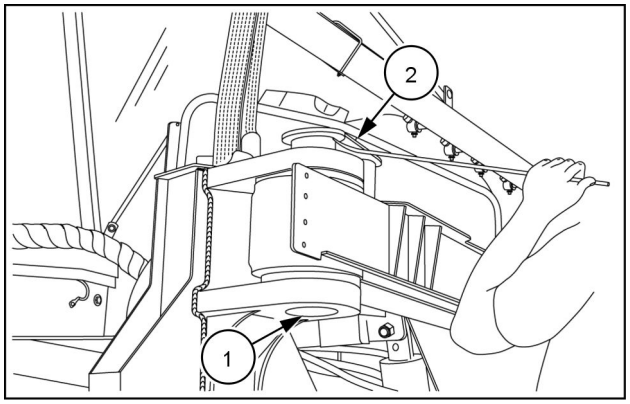
All data given in this publication is subject to production variations. Dimensions and weight are approximate only and the illustrations do not necessarily show products in standard condition. For exact information about any particular product, please consult your NEW HOLLAND Dealer.

31. Support the leg with an appropriate lifting device.
32. Fold the steering cylinder, bracket, wire harness, and hoses **(1)** onto the deck next to the operator's cab.



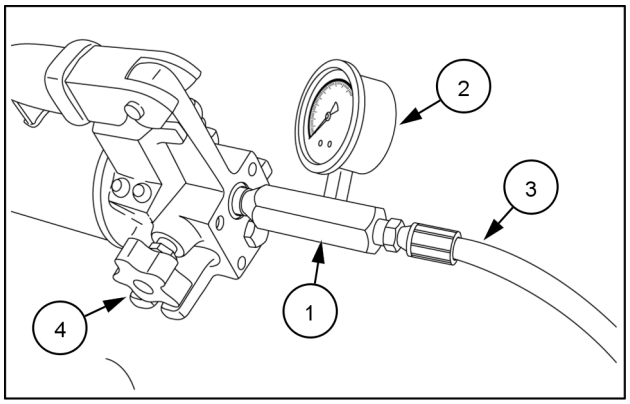

RAIL13SP01022AA 20

33. Drive the steering kingpin upward with a rubber hammer from the bottom to start removing the pin **(1)**. Continue to pull the pin out by prying with a pry bar from the top **(2)**. If the steering kingpin will not come up, a puller will be required.



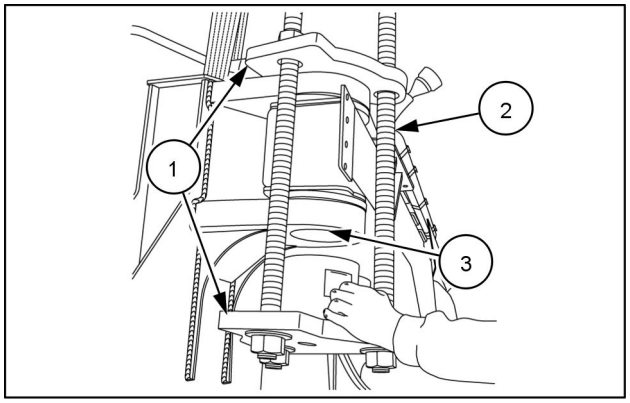

RAIL13SP01018AA 21

34. Plumb the adapter **(1)**, the pressure gauge **(2)**, and the port-a-power hose **(3)** to the port-a-power **(4)**.



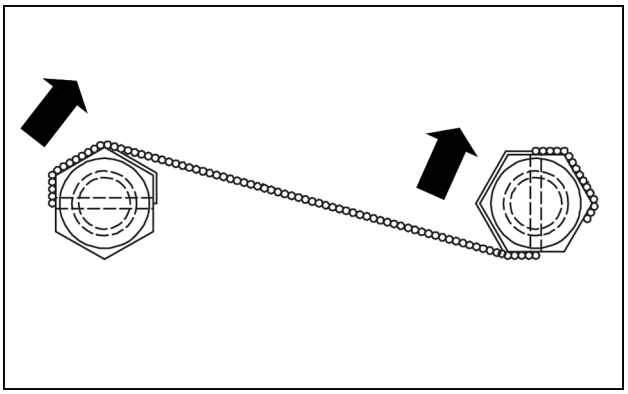

RAIL13SP01025AA 22

35. Assemble the two lifting plates **(1)** and three threaded rods **(2)** from the kit to the leg. Assemble the lifting plates with the flat edge of the plates forward.
36. Attach the plug **(3)** from the kit to the bottom of the steering kingpin using two **.375 in** socket head screws from the kit.



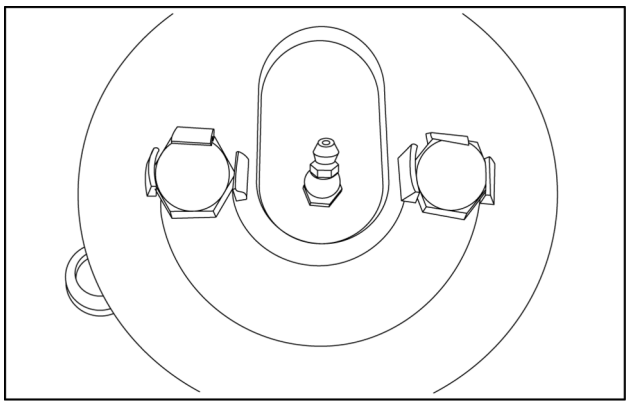

RAIL13SP01023AA 23

30. Acceptable technique includes securing the two bolts against each other. The safety wire is run through the head of the first bolt (creating tension in the direction of tightness for that bolt), twisted five to seven twists per inch, and then run through the second bolt to create tension, through the safety wire, in the direction of tightening for each bolt. After routing one of the wires through the second bolt, twist the two wires together an additional five to seven twists.



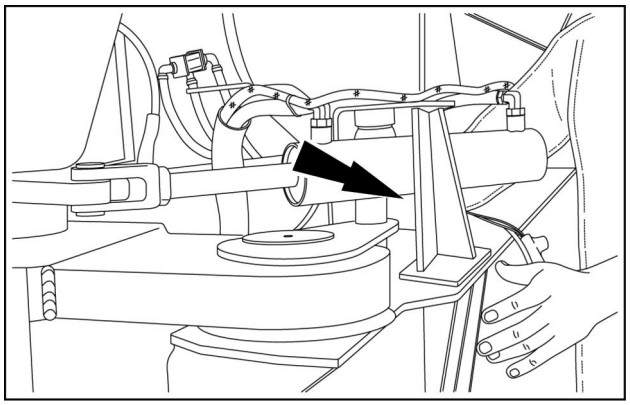
RAIL13SP00957AA 21

31. The lockwire locking device configuration shown in step **29** and **30** is used on units produced prior to Serial Number YAYM00145. The locking device configuration now used, starting with the previously mentioned Serial Numbered units. The two locking device configurations are not interchangeable.



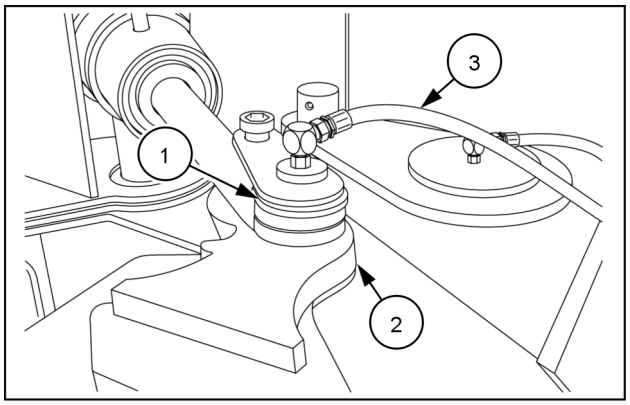
RAIL13SP01054AA 22

32. Move the steering cylinder and bracket into position and mount the bracket to the swing arm.



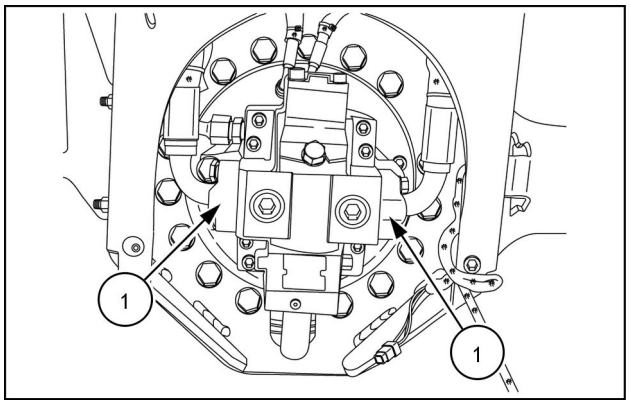
RAIL13SP01052AA 23

33. Install the pin **(1)** into the rod end of the steering cylinder.
34. Install the roll pin **(2)** into the steering cylinder rod end pin.
35. Install the grease hose **(3)** into the steering cylinder rod end pin.
36. Install the grease hose **(3)** into the end of the steering kingpin.



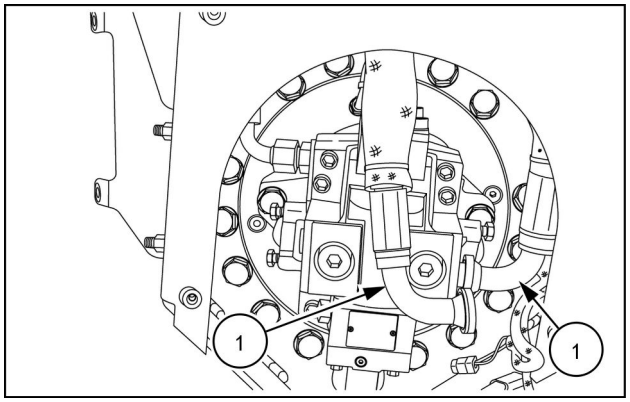

RAIL13SP01065AA 24

7. Loosen the bolts of the split clamps **(1)** attaching the hydraulic hoses to the wheel motor. Remove nearest one half of each split clamp.



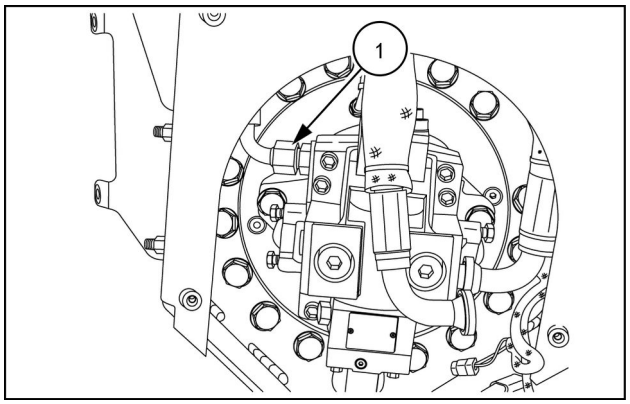

RAIL15SP00809AA_1 4

8. Disconnect the hydraulic hoses **(1)** attached to the wheel motor. Cap or plug the hoses to prevent hydraulic oil from draining out.



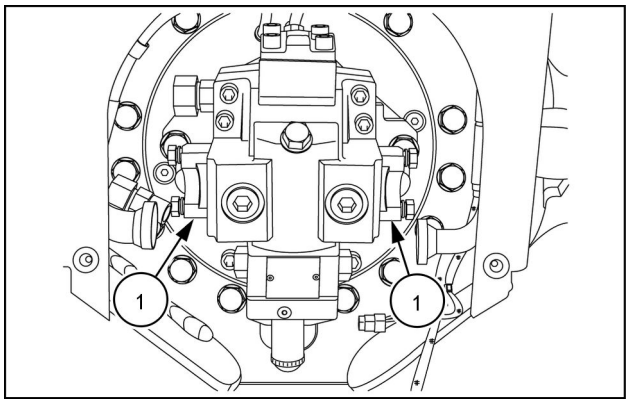

RAIL15SP00810AA_1 5

9. Disconnect the third hydraulic hose **(1)** attached to the upper half of the wheel motor. Cap or plug the hoses to prevent hydraulic oil from draining out.



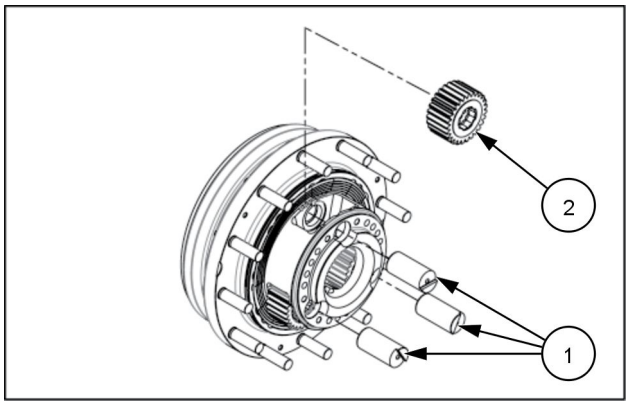

RAIL15SP00810AA_1 6

10. Remove the second half of each split clamp **(1)**.



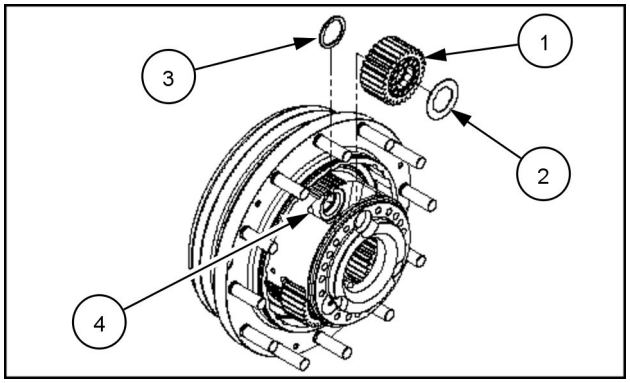

RAIL15SP00811AA_1 7

17. Install an eye-bolt in the threaded hole of the planet shaft **(1)**. Pull the planet shaft from the spindle/carrier while holding onto the planet gear **(2)** with the planet gear still installed into the spindle/carrier.



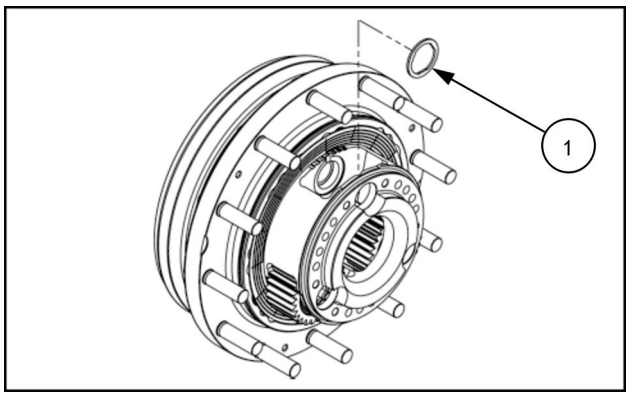

RAIL15SP01331AA 9

18. Rotate the housing so that the studs straddle the planet gear. Lift the planet gear **(1)** from the carrier window until the gear contacts the studs. The washers may come with the planet gear. Remove the washer **(2)** from the top of the planet gear. Reach into the planet window opening with a pick and remove the washer **(3)** from the counter-bore in the carrier window **(4)**. The planet gear can now be tilted and removed past the studs.



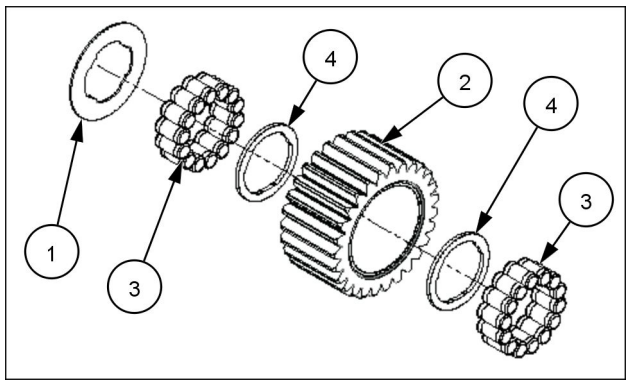

RAIL15SP01334AA 10

19. Remove thrust washer **(1)** from the top side of the carrier window.




RAIL15SP01333AA 11

20. Slide the washers **(1)** from the planet gear **(2)**. Slide the needle rollers **(3)** and spacer rings **(4)** from the bore of the planet gear.
21. Repeat step **17** through step **20** for the remaining planet gears.




RAIL15SP01335AA 12

5. Increase pressure until the park brake begins to slip. The brake slip pressure should be between **903 - 1110 kPa** (**131 - 161 psi**).
6. Increase the pressure to **1227 kPa** (**178 psi**). The handle should turn freely.
7. Increase the pressure to **10342 kPa** (**1500 psi**) and hold for **1 min**.
8. Observe that the unit does not lose pressure indicating that the unit has passed brake testing. If the unit does not hold the pressure the brake must be repaired. Refer to **Planetary drive and hub - Disassemble (25.108)** for repair procedure.

# Contents

# Hydrostatic drive - 29

6. Remove the hose connected at the X1 port and connect it to one of the tee fittings. Insert a plug into the valve connection point from which the hose was removed.
7. Remove the hose connected at the X2 port and connect it to one of the tee fittings. Insert a plug into the valve connection point from which the hose was removed.
8. Locate the four multifunction cartridges located on the back side of the hydrostat. Rotate the second hex coupling nut counterclockwise three full turns.

***NOTE:*** *To prevent external leakage do not exceed three full turns of the second hex coupling nut.*

9. In the cab move the hydro lever to the forward position. Pump the Port-A-Power to a minimum of **180 psi** to release the brakes.

***NOTE:*** *You must keep pressure at a minimum of **180 psi** to keep the brakes released. Monitor the pressure gauge when the machine is moving.*

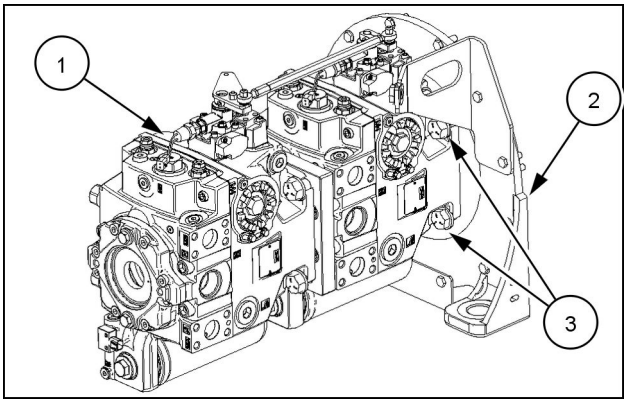
10. Tow the machine at a slow speed **1.6 - 4.8 km/h** (**1.0 - 3.0 mph**) only far enough to remove the machine from the roadway or to load onto a trailer.

***NOTICE:*** *Severe damage to the machine will result from towing an extended distance.*

# Pump - Install - 130cc H1 hydrostatic pump

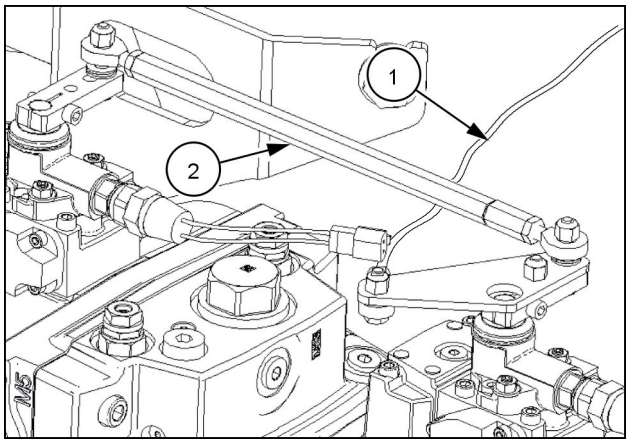
| | |
|---|---|
| SP.345F | |
| SP.400F | |

1. Attach suitable lifting device to tandem pump assembly **(1)**.
2. Using lifting device, position tandem pump assembly on flywheel housing mount **(2)** making sure shaft on tandem pump assembly is properly aligned with splines of hydrostat coupling.
3. Install tandem pump assembly to flywheel housing mount using four, flat washers and hex bolts **(3)**. Tighten the bolts securely.




RAIL15SP00201AA 1

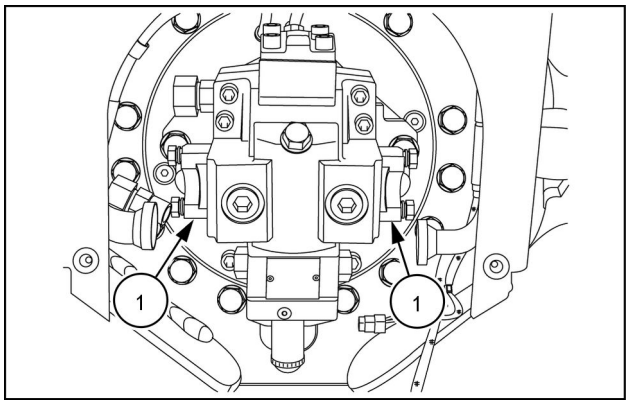
4. Connect the cable **(1)** to the dual linkage connection **(2)** using the nut. Tighten securely.




RAIL15SP00103AA 2

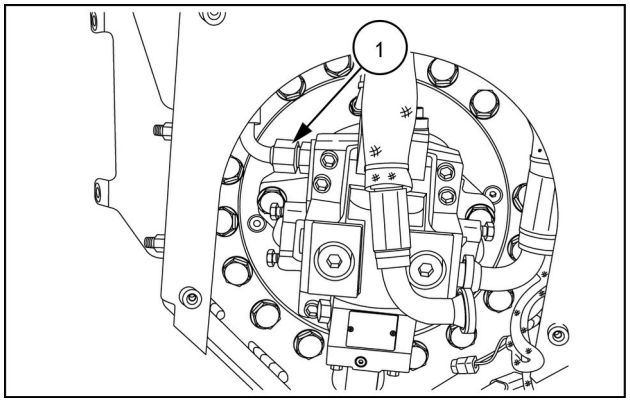
5. Connect two electrical connections located on the top of each pump.
6. Connect the hydraulic lines and fittings to the tandem pump assembly.
7. If the auxiliary hydraulic pump was removed, install auxiliary hydraulic pump. **Auxiliary hydraulic pump - Install (35.220)**
8. Check and fill the hydraulic reservoir to the proper level.
9. Perform hydraulic fluid level checks and pressure tests. Start engine and check for leaks.

5. Install one half of each split clamp **(1)** onto the wheel motor using the bolts and washers. Do not tighten the clamp halves completely.



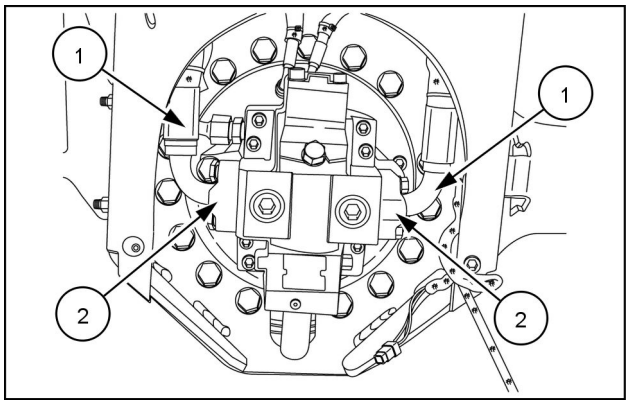

RAIL15SP00811AA_1 4

6. Attach the third hydraulic hose **(1)** to the wheel motor. Tighten the hose connection securely.



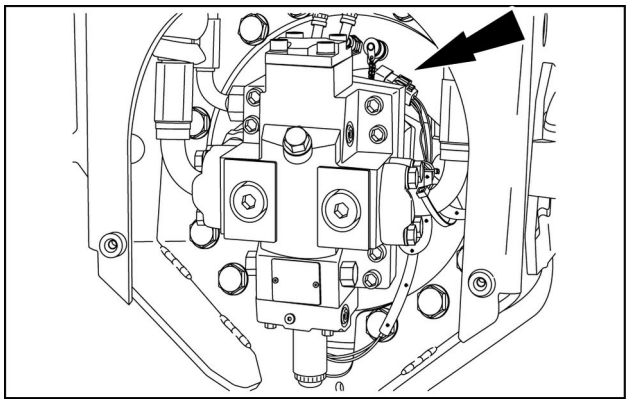

RAIL15SP00810AA_1 5

7. Slide the hydraulic hoses **(1)** into place on the wheel motor. Attach the second half of each split clamp **(2)** to the wheel motor and secure the hoses to the wheel motor. Tighten all the split clamp bolts completely.



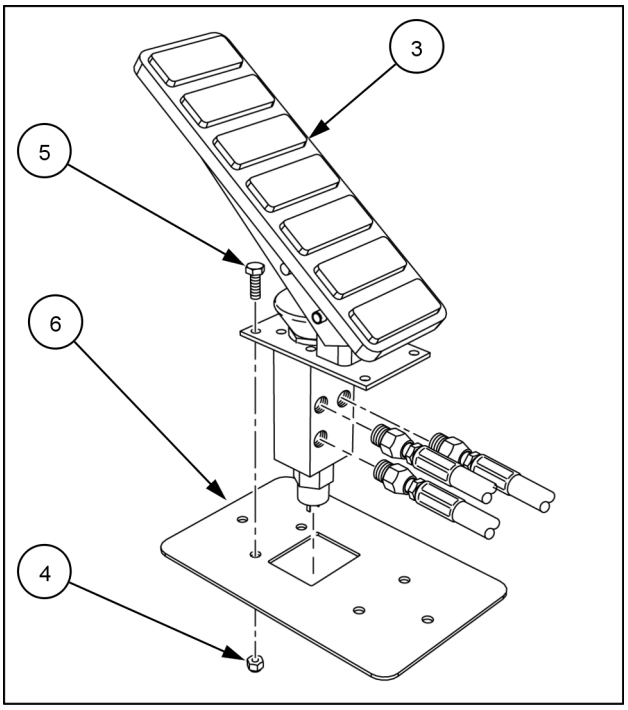

RAIL15SP00809AA_1 6

8. Connect the wire harness connections to the wheel motor.



RAIL15SP00808AA_1 7

6. Remove four locknuts **(4)** from hex bolts **(5)** protruding through floor mounting plate **(6)** to exterior of vehicle.
7. Remove four hex bolts **(5)** from brake pedal/valve assembly **(3)**, and pull assembly up through opening in floor mounting plate **(6)**.




RAIL13SP01119AA 2

# Contents

# Hydraulic systems - 35

## Hydraulic systems - 000

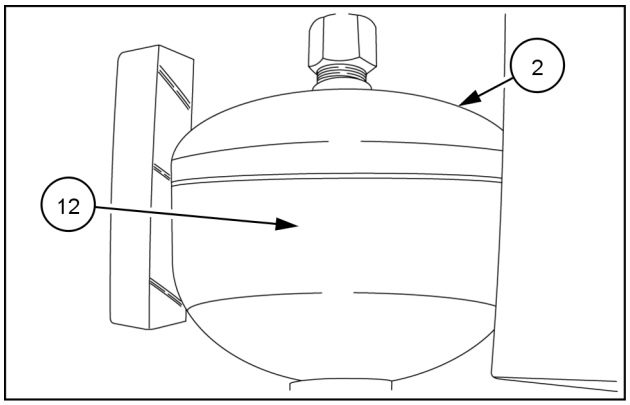


(*) See content for specific models

# Hydraulic systems - Hydraulic schematic frame 02 - Propel hydraulic schematic, SP.300F and SP.345F T4B with planetary drive

| | |
|---|---|
| SP.300F 2 wheel steer [YGYM01022 - ] | |
| SP.300F 4 wheel steer [YGYM01022 - ] | |
| SP.345F 2 wheel steer [YGYM01022 - ] | |
| SP.345F 4 wheel steer [YGYM01022 - ] | |
| SP.400F 2 wheel steer [YGYM01022 - ] | |
| SP.400F 4 wheel steer [YGYM01022 - ] | |

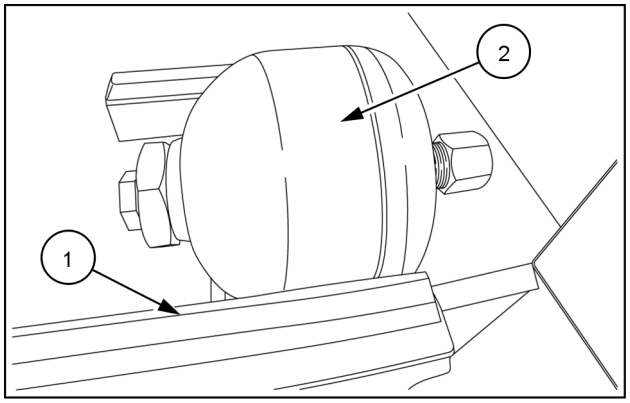
13. Add a label **(12)** to accumulator **(2)** with wording to alert others that accumulator is filled and to what applicable psi pressure it is charged.




RAIL13SP03457AA 12

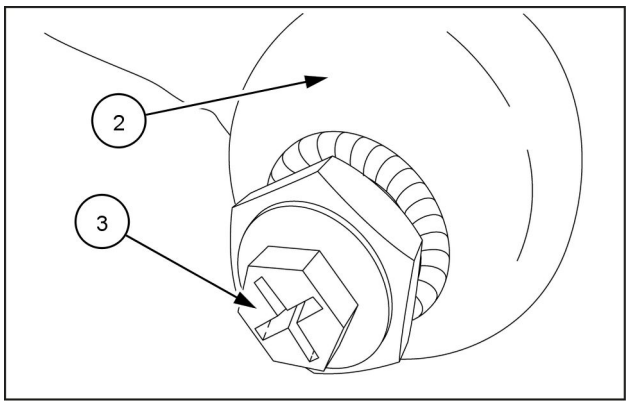
## Boom tilt accumulator

1. Using padded vice **(1)**, securely clamp down accumulator **(2)**.



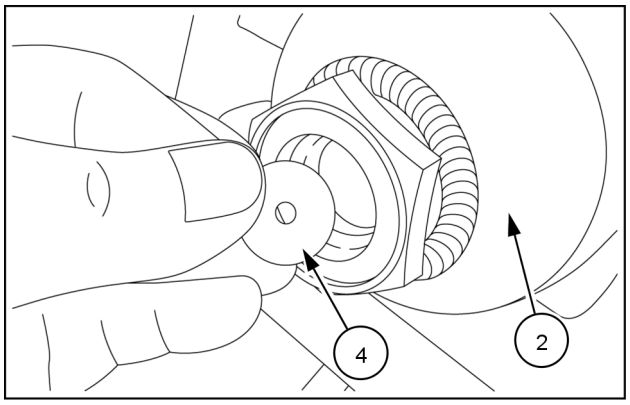

RAIL13SP03458AA 13

2. Remove red cap **(3)** on base of accumulator **(2)** and discard.



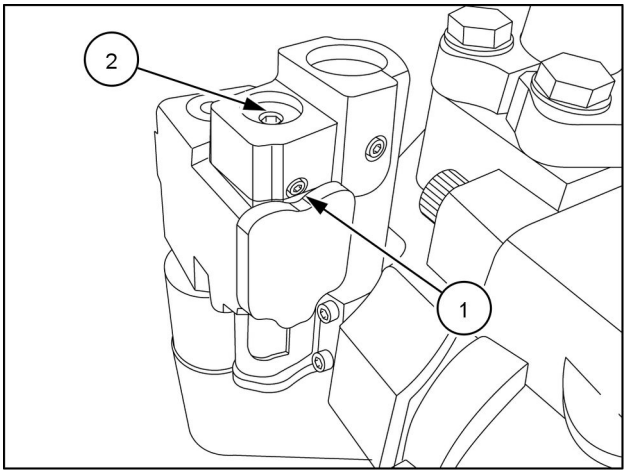

RAIL13SP03451AA 14

3. Insert **5.156 mm** (**0.203 in**) orifice disk **(4)** into opening on base of accumulator **(2)**.



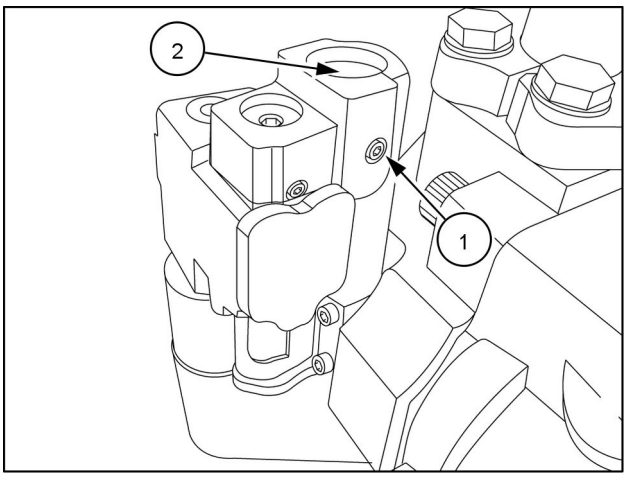

RAIL13SP03454AA 15

2. Install a **34474 kPa** (**5000 psi**) gauge on the Auxiliary Pump test port.
3. Ensure the cold cranking solenoid is getting power.
4. Start the engine. Ensure the oil is warm.
5. Read the gauge. The compensator pressure should be **1207 - 1551 kPa** (**175 - 225 psi**).
6. Adjust the pressure value. Turn the adjustment screw on the compensator clockwise to increase the pressure value. Turn the adjustment screw counter clockwise to decrease the pressure value.




RAIL14SP00233AA 3

7. Set the high pressure (normal cranking) by attaching an external **12 V** power supply to the cold cranking solenoid.
8. Install a **34474 kPa** (**5000 psi**) gauge on the Auxiliary Pump test port.
9. Start the engine. Ensure the oil is warm.
10. Read the gauge. The pressure reading should be **16892 - 17237 kPa** (**2450 - 2500 psi**) .
11. Adjust as needed by loosening the set screw **(1)** of the cold cranking solenoid valve. Turn the high pressure adjuster **(2)** clockwise to increase pressure and counter clockwise decrease pressure. Tighten set screw.

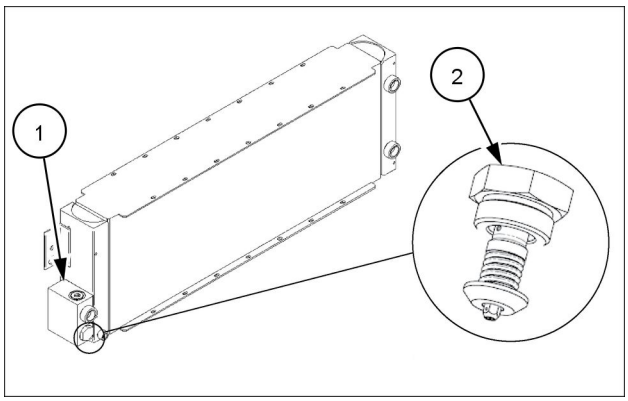



RAIL14SP00233AA 4

# Thermal bypass valve - Overview

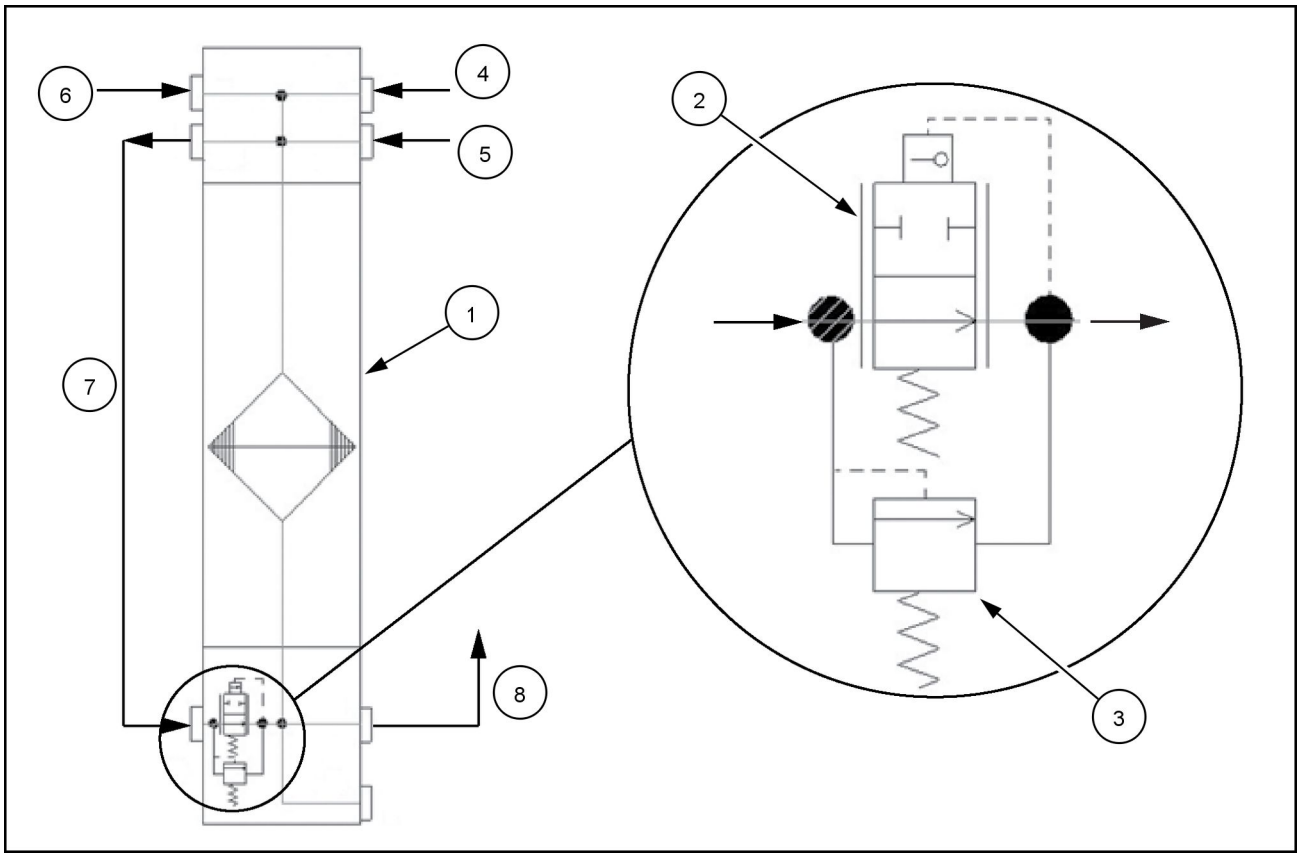
| | |
|---|---|
| SP.300F | |
| SP.345F | |
| SP.400F | |

A thermal bypass valve **(1)** is attached to the hydraulic oil cooler of the vehicle. The bypass valve handles input hydraulic oil from the cooling fan motor, the cooling fan relief hydraulic oil, and the shuttle valve. The bypass valve body is not removable, but the internal cartridge **(2)** can be removed for replacement or repair. The thermal bypass valve is a dual purpose valve containing both the thermal bypass and the relief valve functions in one.




RAIL15SP00135FA 1

The thermal bypass valve is normally open. The normally open valve function allows the hydraulic oil of the hydraulic system to circulate through, and past the hydraulic oil cooler by way of the hydraulic oil cooler bypass hose, when the hydraulic oil temperature is below **54 °C** (**130 °F**). This function allows cool hydraulic oil to operate the within the system to provide hydraulic pressure for the initial demand of the system.



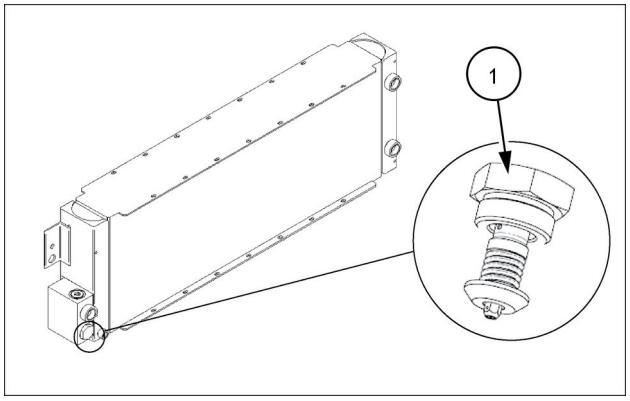

RAIL15SP00140FA 2

| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Hydraulic oil cooler | 5 | Input — Shuttle valve |
| 2 | Thermal bypass valve | 6 | Input — Fan motor |

# Thermal bypass valve - Install

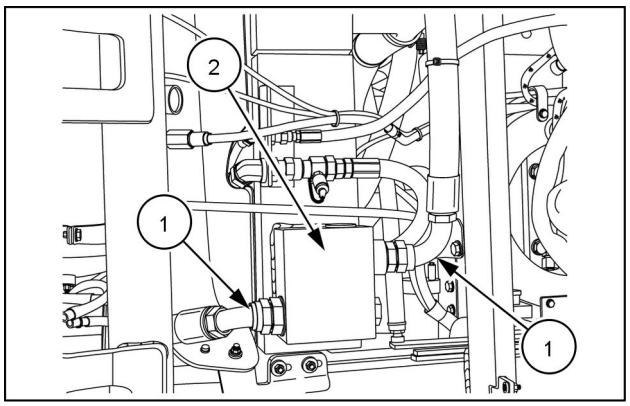
| | |
|---|---|
| SP.300F | |
| SP.345F | |
| SP.400F | |

1. Inspect the interior of the thermal bypass valve for debris. Clean as required.
2. Install the thermal bypass valve cartridge **(1)** into the thermal bypass valve body. Tighten the cartridge securely.



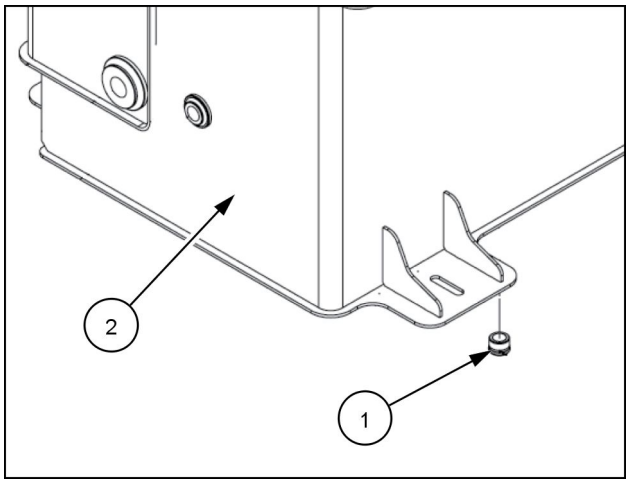

RAIL15SP00135FA 1

3. Attach the hydraulic oil lines **(1)** to the bypass valve **(2)**. Tighten the connections securely.




RAIL14SP01769AA 2

4. Install the drain plug **(1)** into the hydraulic reservoir **(2)**. Fill the hydraulic reservoir with specified hydraulic oil.




RAIL14SP01765AA 3

5. Start the engine of the vehicle. Check the hydraulic oil level. Bring the level up to the proper capacity if needed. Verify operation of the hydraulic component of the system.

# Contents

## Hydraulic systems - 35

### Hydraulic fan drive cooling system - 752

SERVICE



(*) See content for specific models

# Contents

## Hydraulic systems - 35

### Machine leveling control system - 610



(*) See content for specific models

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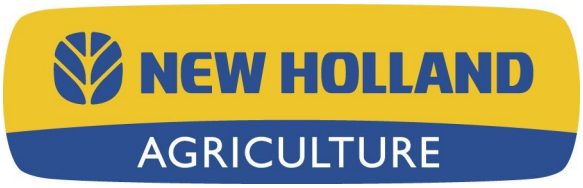
SERVICE - Technical Publications & Tools

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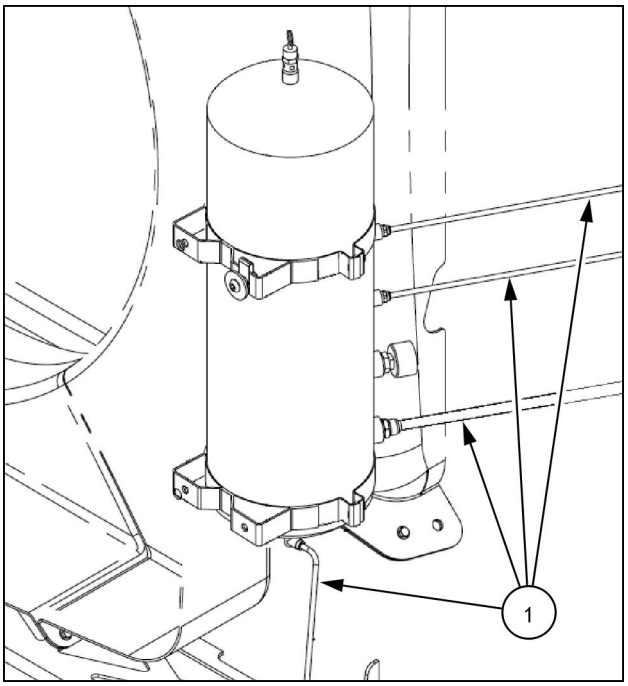
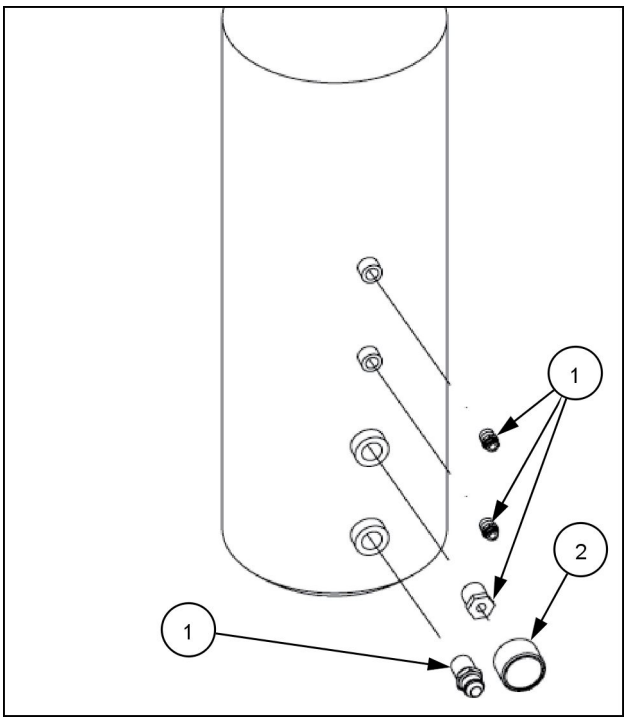
6. Disconnect the lines **(1)** attached to the air tank.




RAIL15SP00097AA 4

7. Remove the air line fittings **(1)** and pressure gauge **(2)** from the air tank.




RAIL15SP00098AA 5

# Index

## Pneumatic system - 36

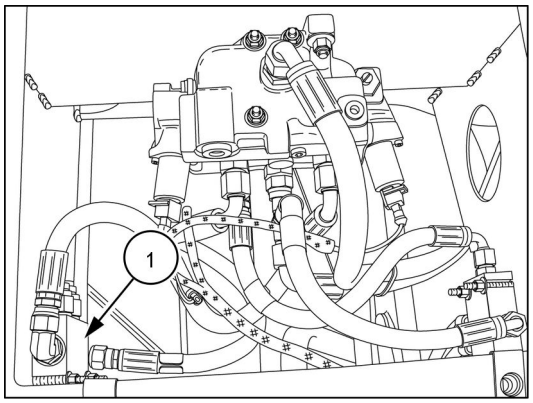
### Pneumatic suspension - 908



(*) See content for specific models

## Counterbalance valve

The counterbalance valve **(1)** checks oil in the rear steering cylinders. The rear steering cylinders are plumbed in series, and the hydraulic oil is trapped in the cylinders by the counterbalance valve. These rear cylinders will require phasing occasionally. Refer to **Steering cylinder - Service instruction - Four wheel steer, cylinder phasing (41.216)** for cylinder phasing procedure.

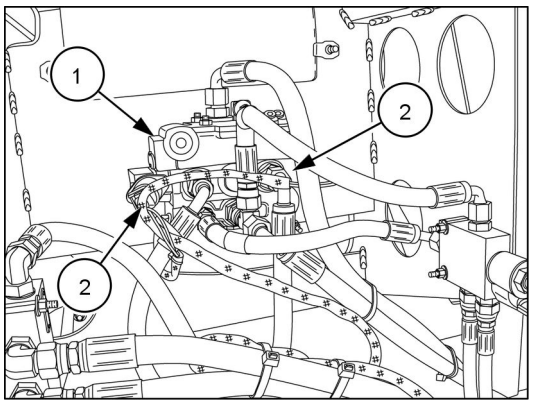



RAIL13SP05043AA 6

## Directional control valve

The directional valve **(1)** controls the direction of hydraulic fluid flow to the counterbalance valve and to the lock valve. The valve is located in the recessed opening of the raised walkway.

The valve is operated electrically by a pulse width modulation (PWM) signal sent from the MC2 master control to the PWM coils **(2)** of the directional control valve.




RAIL13SP05046AA 7

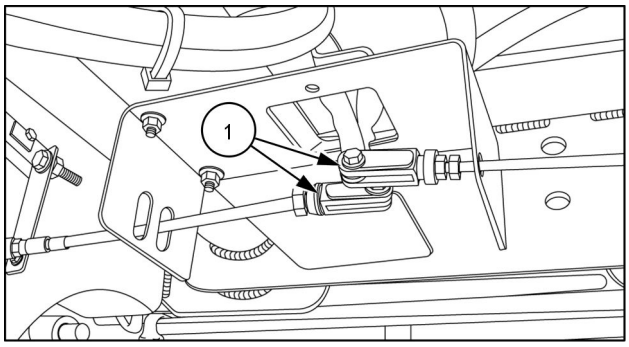
# Steering control - Electrical schema - Four wheel steer

| | |
|---|---|
| SP.300F | |
| SP.345F | |
| SP.400F | |

# Steering cylinder - Service instruction - Steering cylinder toe in

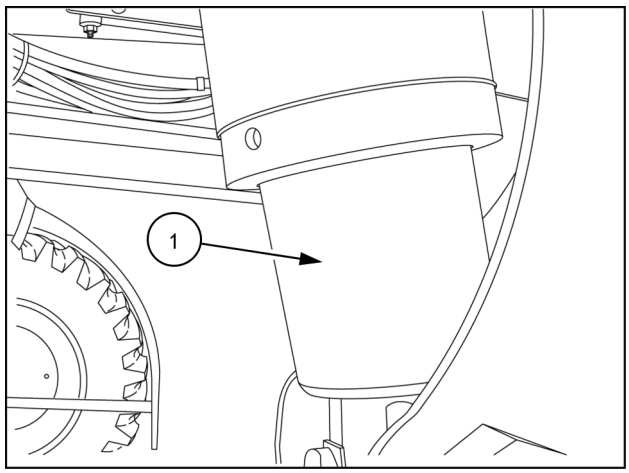
| | |
|---|---|
| SP.300F | |
| SP.345F | |
| SP.400F | |

1. Perform the steering cylinder phasing procedure **Steering cylinder - Service instruction - Four wheel steer, cylinder phasing (41.216)**.
2. Start the vehicle engine. Ensure that the vehicle is on level ground and that the tires are facing forward. Reduce vehicle engine speed to low idle. Have someone at ground level check that the tread width cylinders are fully retracted.
3. Detach the two right and two left side suspension valve linkages **(1)**.

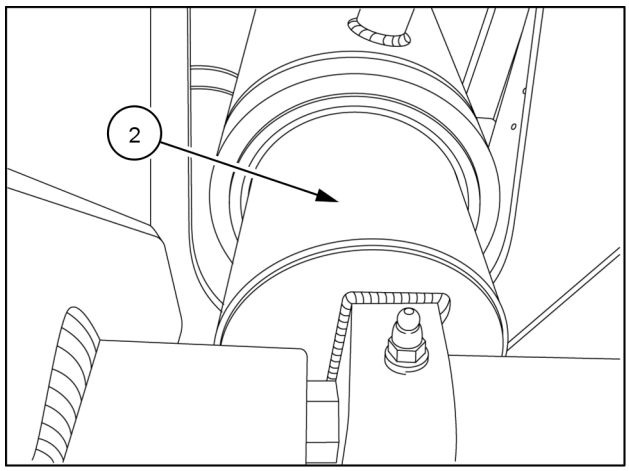



RAIL13SP03381AA 1

4. Actuate each linkage fore or aft until there is **102 mm** (**4 in**) of unpainted suspension cylinder rod exposed on each of the four suspension cylinders **(1) (2)**.
5. After setting all four cylinders to the **102 mm** (**4 in**) value, recheck all the cylinders again.
6. Repeat Step **4** as required until the exposed rod on all four cylinders is at **102 mm** (**4 in**).
7. Reconnect the suspension valve linkages.



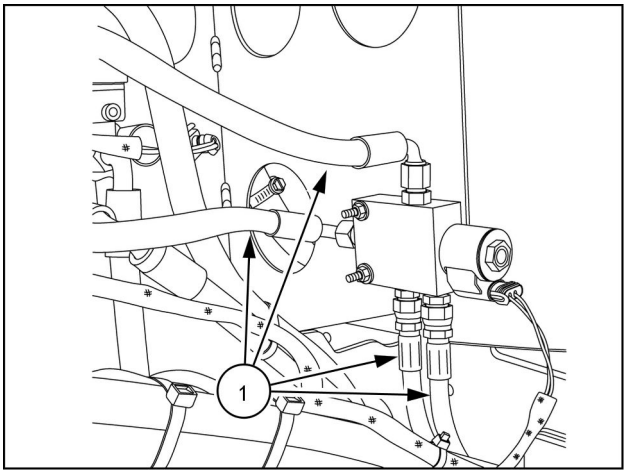

RAIL13SP03391AA 2




RAIL13SP03383AA 3

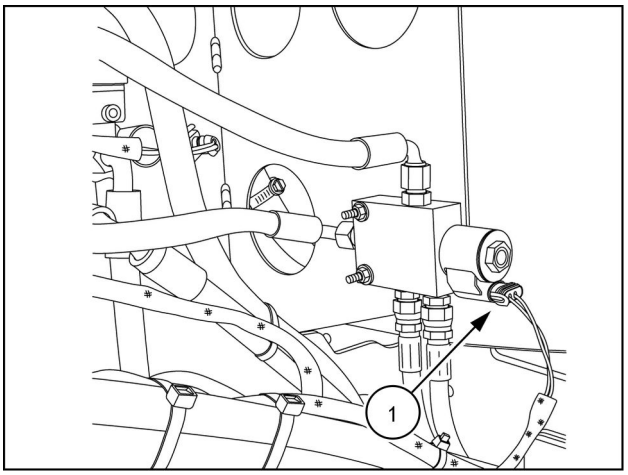
## Lock valve

1. Tag and mark the four hydraulic lines attached to the lock valve.
2. Place a clean drain pan underneath the hydraulic fittings on the lock valve where the lines are to be removed.
3. Slowly open and remove the hydraulic lines attached to the lock valve being sure to catch any residual fluid in the remaining in the lines being sure to collect all of the residual fluid in the lines and fittings.



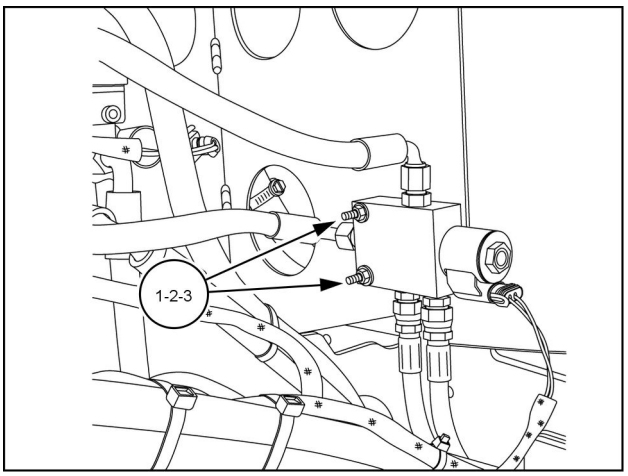

RAIL13SP05057AA 10

4. Unhook the electrical connection **(1)** attached to the solenoid on the lock valve.




RAIL13SP05057AA 11

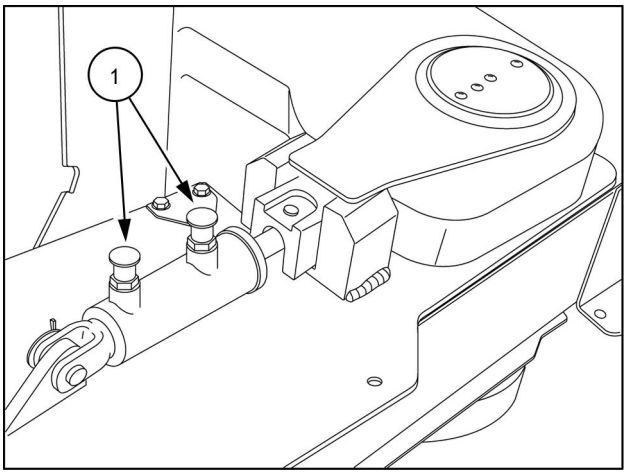
5. Remove the bolts **(1)**, nuts **(2)** and washers **(3)** securing the lock valve and remove the valve from the machine.




RAIL13SP05057AA 12

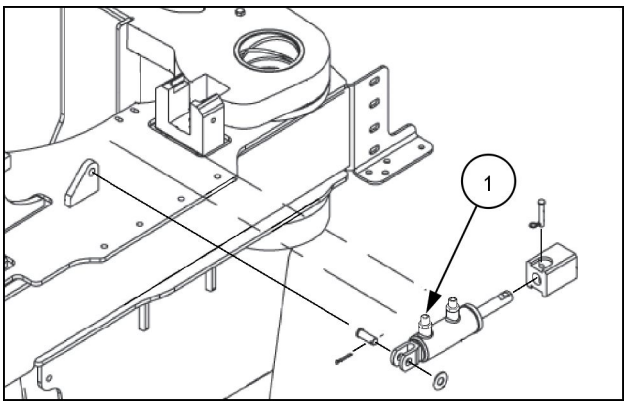
## Stop cylinder

1. Mark and tag the hydraulic lines **(1)** on both ends of the stop cylinder to ensure proper placement during installation.



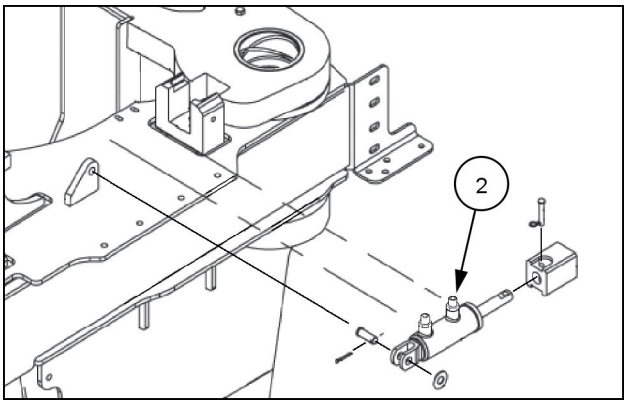

RAIL13SP05059AA 13

2. Slowly open and remove the hydraulic line from the fitting **(1)** on the base end of the stop cylinder.



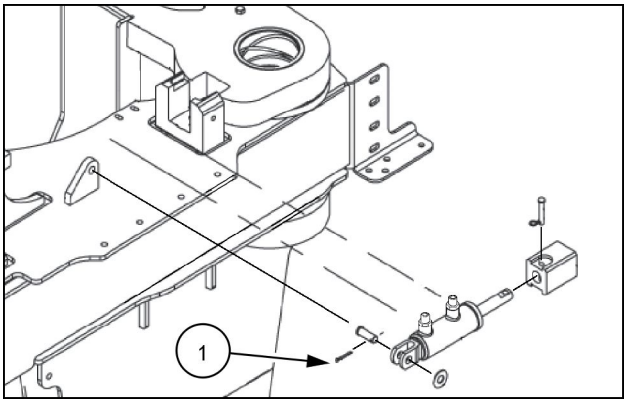

RAIL13SP04984AA 14

3. Slowly open and remove the hydraulic line from the fitting **(2)** on the rod end of the stop cylinder.




RAIL13SP04984AA 15

4. Remove and discard the cotter pin **(1)** securing the clevis pin into the base end of the stop cylinder.




RAIL13SP04984AA 16

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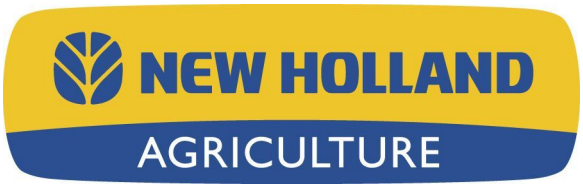


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# Index

## Wheels - 44

### Front wheels - 511

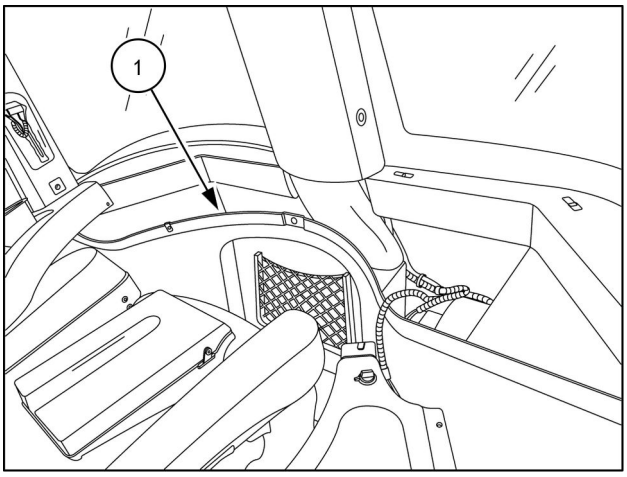


(*) See content for specific models

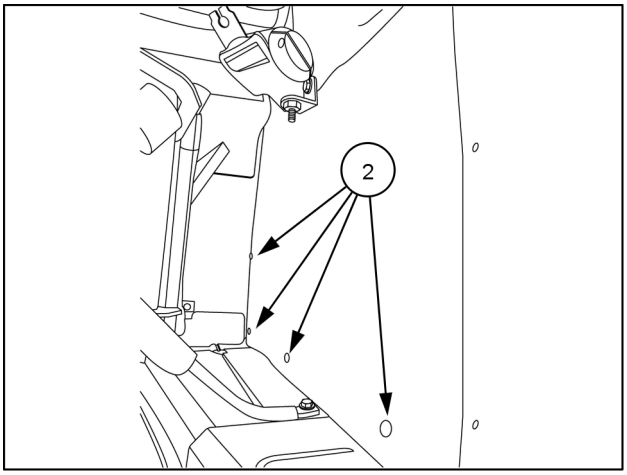
# Contents

# Cab climate control - 50

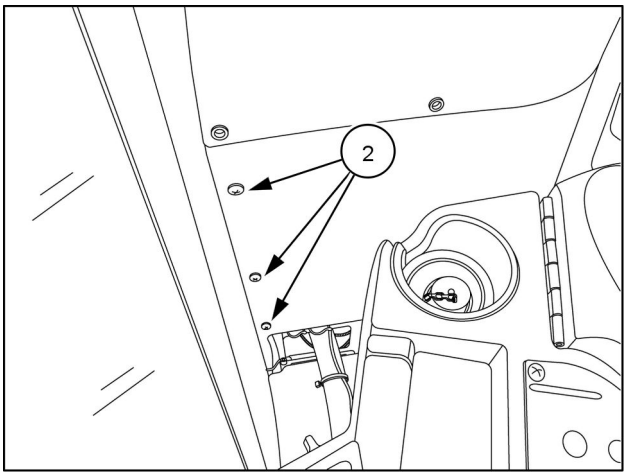
9. Install the back panel **(1)** into the proper position and secure with the back panel mounting screws **(2)**.




RAIL13SP04731AA 8




RAIL13SP04732AA 9




RAIL13SP04734AA 10

10. Install the floor mat.

# Contents

# Cab climate control - 50

## Air conditioning - 200



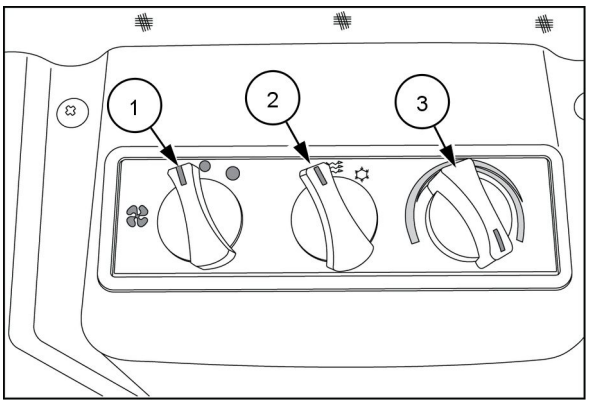
(*) See content for specific models

## Air conditioning control

Two styles of control are available for operator control of the air conditioning system: manual control and Automatic Temperature Control (ATC). The two style of controls also control the heating function of the HVAC system.

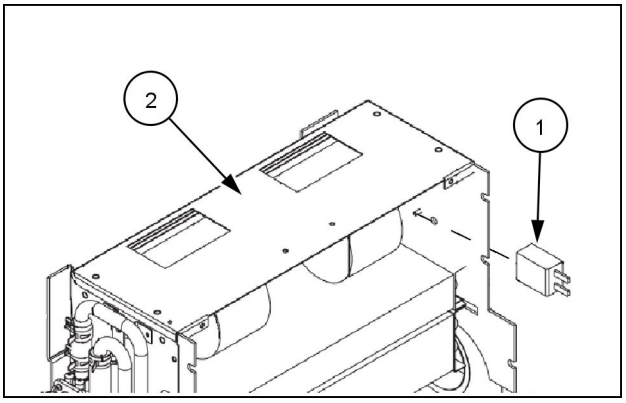
## Manual control

The manual control use a simple three switch control panel to direct control of the air conditioning and heating system. The three switches control, fan speed **(1)** , AC/Heat selection **(2)** , and temperature control **(3)**.Turning the fan speed control switch increases the fan speed of the blower motors. The AC/Heat selector switch allows for either heating or cooling functioning. The temperature control switch allows temperature setting for the cab interior.




RAIL12SP01140AA 8

When air conditioning is selected using the manual control, the system is activated. A thermostat **(1)** , mounted in the evaporator housing **(2)** , receives a signal from the temperature control switch in order to regulate the AC system for the desired cab temperature. The temperature control switch also controls the operation of the water valve for cab heating.




RAIL13SP04976AA 9

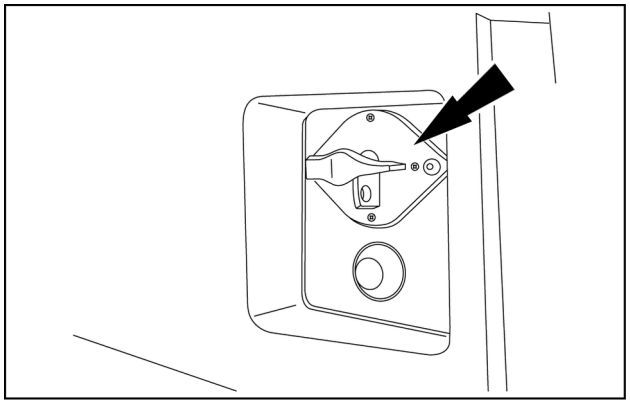
**Thermostat**

15. Open red (high side) valve on manifold gauge set and add the factory recommended charge amount **3.40 kg** (**7.50 lb**). Close red valve on manifold gauge set. Charging is complete. Verify proper AC operation. Document total refrigerant added to system and apply appropriate label near compressor stating refrigerant charge amount.
16. If the proper refrigerant charge amount is not known, add one to two pounds of liquid refrigerant to the system through the high side port (red). The amount of refrigerant added depends on the estimated full charge amount. It is typically 1/2 to 3/4 of the estimated full charge. Close red valve on manifold gauge set. This type of refrigerant charging should be done at an ambient temperature of 32°C (90°F) or greater with machine doors open to provide a load on the evaporator.
17. Turn refrigerant tank right side up on charging scale (vapor charge position).
18. Start machine engine and turn on AC system.
19. Record ambient temperature, evaporator inlet temperature, evaporator air outlet temperature, suction pressure, and discharge pressure.
20. If suction pressure is **0.3 bar** (**5.0 psi**) or less, keep engine speed at idle until additional refrigerant has been added and suction pressure exceeds **0.34 bar** (**5.00 psi**).
21. Slowly open blue valve on manifold gauge set and bleed vapor refrigerant into low side of system in small increments of **0.05 - 0.09 kg** (**0.10 - 0.20 lb**). Suction pressure should not exceed **3.4 bar** (**50.0 psi**) while charging vapor into the low side of the system or the compressor can be damaged.
22. Continue to add refrigerant in this manner in small increments until optimum AC performance is achieved.
23. Document total amount of refrigerant added to system and apply appropriate label near compressor stating refrigerant charge amount.

## Alternate charging technique

1. Perform Step **1** through Step **20** of the AC field charging procedure.
2. With an infrared thermometer, measure condenser tube temperatures from refrigerant inlet to refrigerant outlet (typically from top to bottom).
3. The temperature will be highest at the refrigerant inlet (superheated region). Then the temperature will decrease to the saturation temperature of the refrigerant at the operating discharge pressure (saturation or condensing temperature). Near the outlet of the condenser, the temperature should once again decrease by roughly **6 - 8 °C** ( **10 - 14 °F**) below the saturation temperature (sub-cooled region).

4. Close the engine access doors and lock the doors into place using the door locking straps.
5. Turn the power to the batteries on by turning the switch attached to the engine panel to the “ON” position.

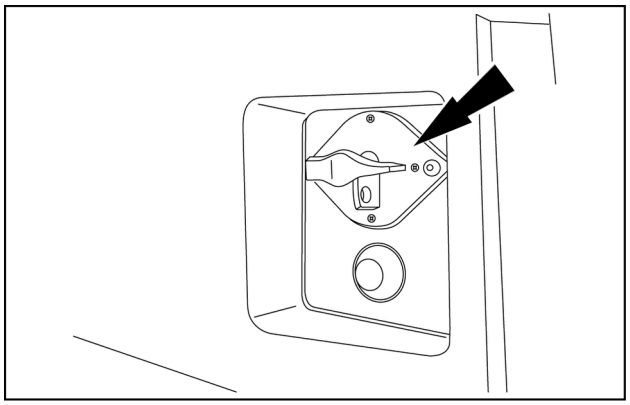


RAIL14SP00818AA 4

6. Start the machine and check for the proper functionality of the compressor drive belt.

***NOTE:*** *The belt should be rotating smoothly and quietly within the pulleys.*

7. Turn the power to the batteries on by turning the switch attached to the engine panel to the “ON” position.

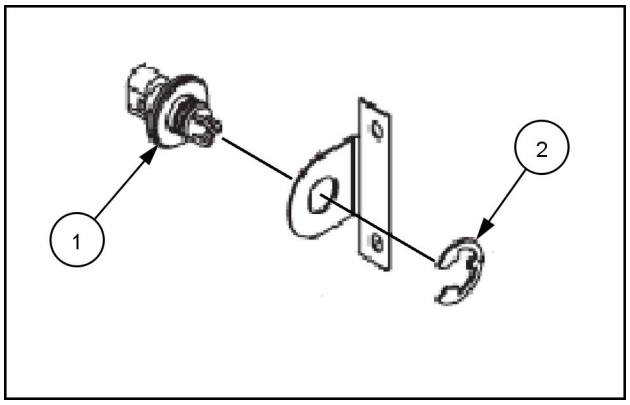


RAIL14SP00818AA 4

8. Cycle the air conditioning system multiple times to ensure the proper component functionality.

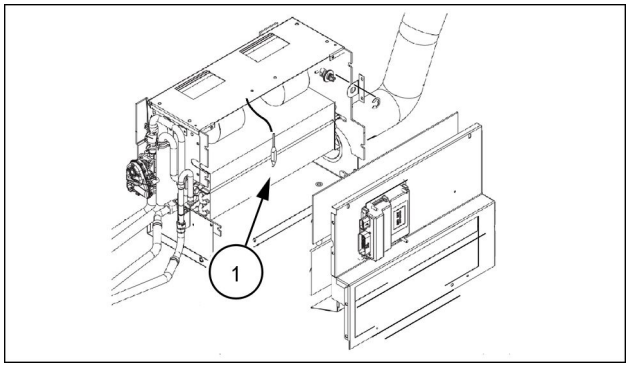
## HVAC components — Premium SprayView Cab

1. Install the air temperature probe **(1)** into the mounting bracket and secure into position using the mounting clip **(2)**.
2. Connect the electrical connection to the air temperature probe.



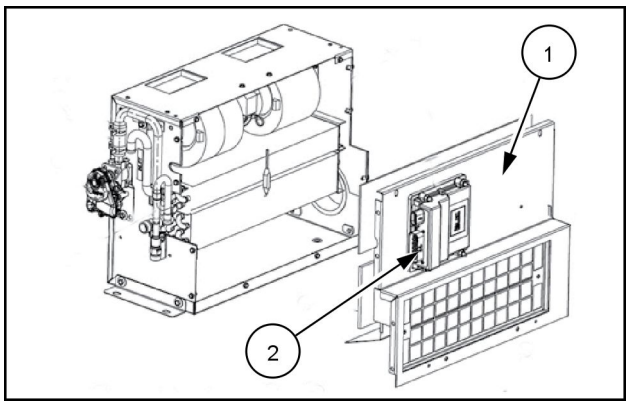

RAIL13SP04980AA 8

3. Install the evaporator probe **(1)** into the evaporator housing by connecting the probe to the electrical connector.




RAIL13SP04979AA 9

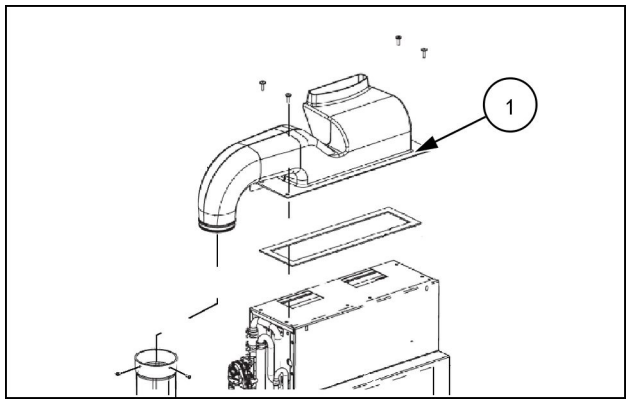
3. Attach the front cover **(1)** onto the evaporator housing using the screws.
4. Connect the electrical harness to the AC ECU **(2)** mounted on the front of the front panel.




RAIL13SP04968AA 10

## Evaporator install — SprayView and Premium and cabs

1. Attach the plenum duct **(1)** to the top of the evaporator housing and to the inner duct using the screws.



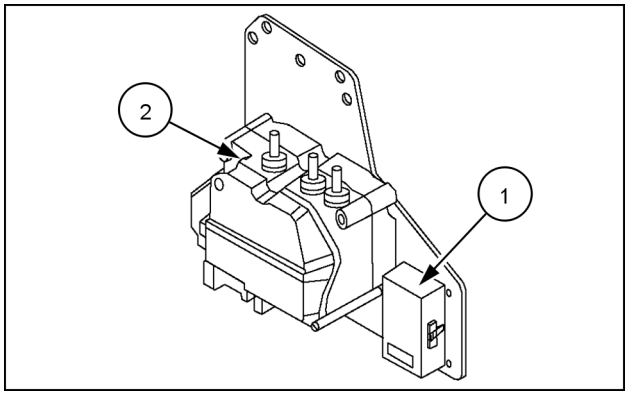

RAIL13SP04975AA 11

# Contents

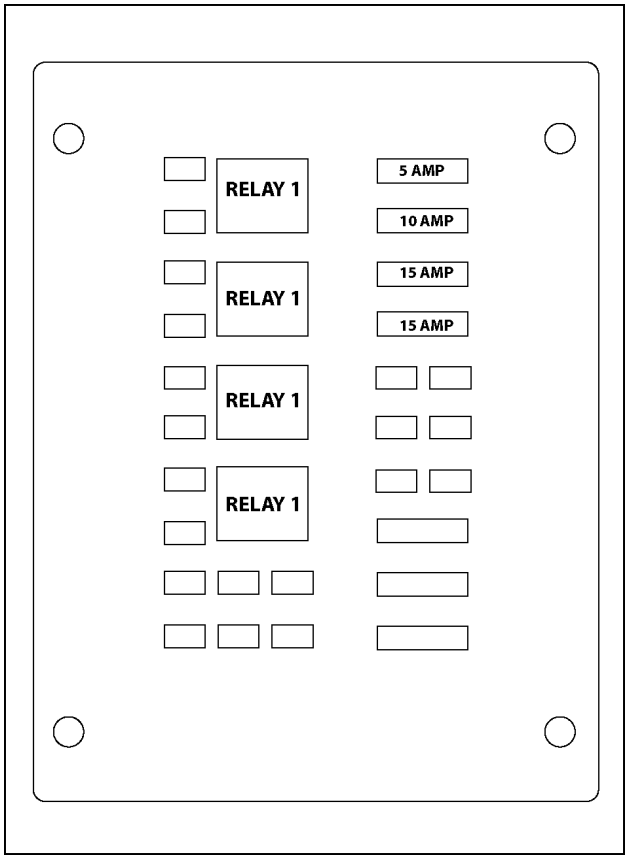
# Electrical systems - 55

## Engine fuse and relay panel

There is a fuse and relay panel associated with the Def system and engine starting. A fuses / relay panel **(1)** is mounted adjacent to the DEF pump module **(2)** . The panel includes four relays and four fuses. The function of the DEF relays and fuses is to provide control and power for the DEF pump and heated lines as related to engine starting.




RAIL15SP00356AA 15



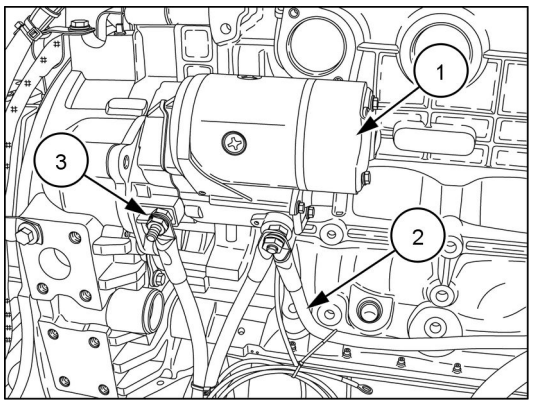

RAIL15SP00355BA 16

**DEF Fuse/Relay Panel**

| Item | Description |
|---|---|
| Relay 1 | Ignition and exhaust senders |
| Relay 2 | DEF supply module |
| Relay 3 | DEF heaters |
| Relay 4 | Starter lock out, Neutral start switch |
| Fuse 1 | 5 AMP, Ignition key |
| Fuse 2 | 10 AMP, Exhaust sensors |
| Fuse 3 | 15 Amp, DEF Supply module |
| Fuse 4 | 15 AMP, DEF Line heaters |

## STARTING CIRCUIT

The start system begins with a 12 volt feed into the ignition switch. When the key is turned, the 12 volt signal runs from the cab harness to the neutral start switch and the neutral start relay. From the relay the 12 volt signal runs to the auxiliary fuse panel. From the fuse panel the 12 volts runs to the battery combiner switch and to the starter relay to initiate engine cranking.

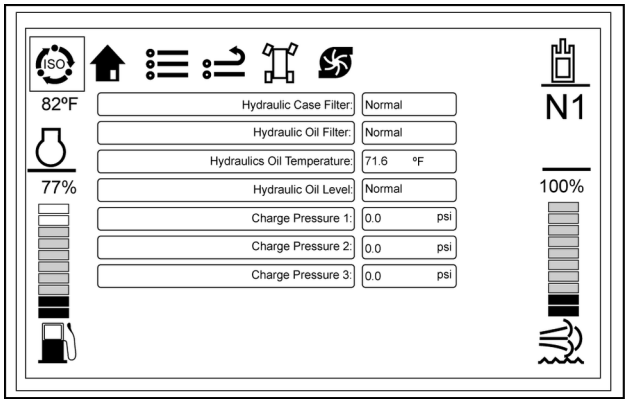



RAIL14SP00107AA 35

| Item | Description |
|---|---|
| 1 | Starter Motor |
| 2 | Power cable from 100 Amp Relay |
| 3 | Ground Cable |

Refer to the following illustration for circuit path of the starting system.

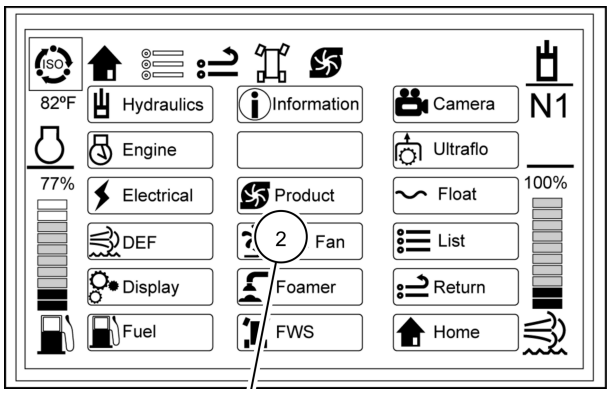
The hydraulic system operating conditions are displayed. The Hydraulics screen is a monitoring screen only and has no selectable features.




RAIL14SP00813AA 4

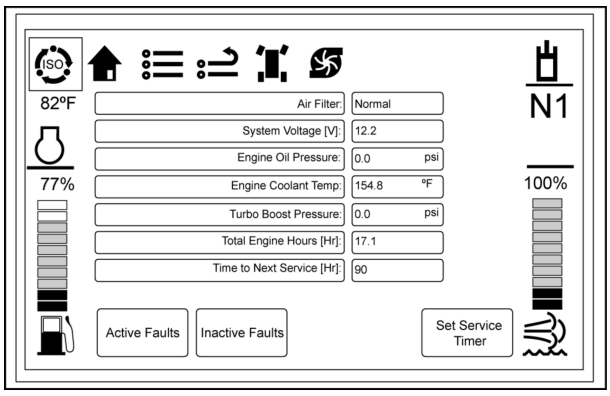
## Engine screen

From the home screen touch the navigation icon.
From the list screen touch the “Engine” button **(1)**, or touch the engine icon **(2)** on the left side of the screen.
The engine screen displays.



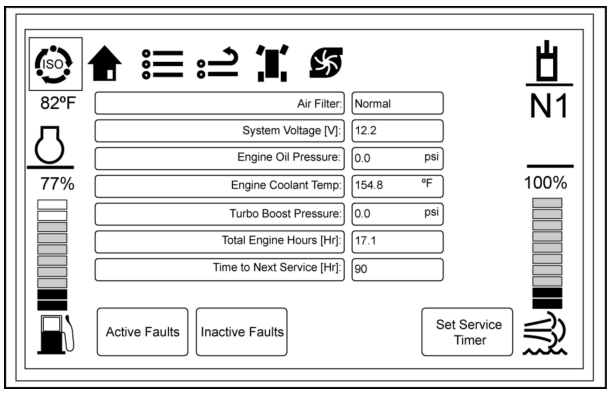

RAIL14SP00802AA 5

The engine screen will display the operating conditions of the engine. Additionally, the engine screen contains the Active Faults **(1)** button, Inactive Faults **(2)** button, and the Set Service Timer **(3)** button.




RAIL14SP00797AA 6

If a engine fault has been detected, the engine icon will flash **(1)**.
Touch the flashing icon, or touch the Active Fault button **(2)** to display the engine fault codes.
The Service Fault Number screen displays.




RAIL14SP00797AA 7

# Harnesses and connectors - Electrical schematic sheet 04 - Egress lighting harness

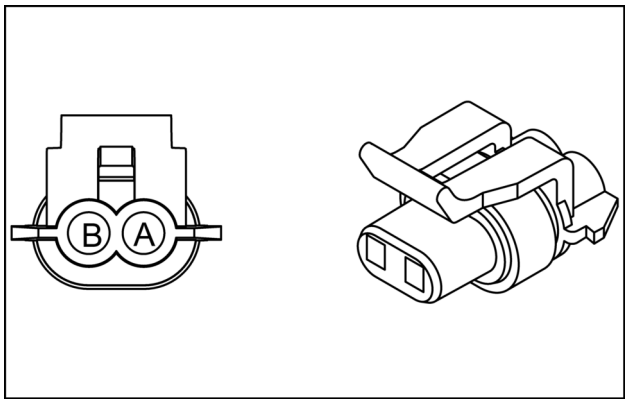
# Harnesses and connectors - Electrical schematic sheet 09 - Planetary harness, cab and chassis

# Harnesses and connectors - Electrical schematic sheet 14 - Indicator lights harness

## Harnesses and connectors - Electrical schematic sheet 19 - 5 section center boom harness

***CONNECTOR BH028 Boom hydraulic harness***

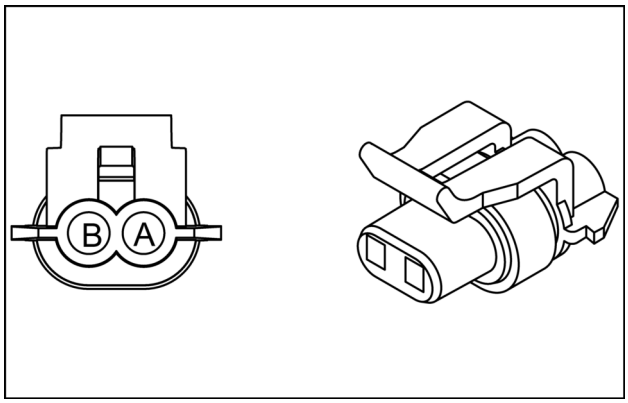
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| A | 18/GREEN | GND 1 | **SHEET 23** |
| B | 18/WHITE | L PRI IN | |




87693821 3

***CONNECTOR BH029 Boom hydraulic harness***

| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| A | 18/GREEN | GND 1 | **SHEET 23** |
| B | 18/BROWN | L PRI OUT | |




87693821 4

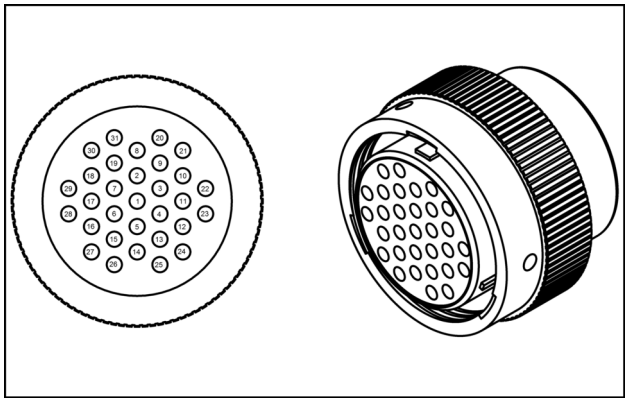
# Wire connectors - Component diagram 04 - Connectors 40 through 49

***CONNECTOR AR049 Armrest harness to Main chassis harness***

| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | SHIELD J1939 | CAN SHIELD | **SHEET 10** |
| 2 | 18 J1939/GREEN | J1939 CAN LO | |
| 3 | 18 J1939/YELLOW | J1939 CAN HI | |
| 4 | 18/GREEN | DPY GND12VDC(-) | |
| 5 | 18/ORANGE | DPY SWT 12VDC(+) | |
| 6 | 18 /RED | DPY CON 12VDC(+) | |
| 7 | 18/PINK | SECTION 1 | |
| 8 | SHIELD J1939 | RAV IN CAN SH | |
| 9 | 18 J1939/GREEN | RAV IN CAN LO | |
| 10 | 18 J1939/YELLOW | RAV IN CAN HI | |
| 11 | 18/PINK | SECTION 2 | |
| 12 | 18/GREEN | SHIELD DRAIN | |
| 13 | SHIELD J1939 | RAV OUT CAN SH | |
| 14 | 18 J1939/GREEN | RAV OUT CAN LO | |
| 15 | 18 J1939/YELLOW | RAV OUT CAN HI | |
| 16 | 18/ORANGE | NODE PWR OUT(+) | |
| 17 | 18/GREEN | GND(-) | |
| 18 | 18/ORANGE | SWT PWR(+) | |
| 19 | 14/RED | CONSTANT PWR(+) | |
| 20 | — | USB VCC | |
| 21 | BLACK 1R5 | USB GND | |
| 22 | WHITE 1-R6 | USB DATA - | |
| 23 | GREEN 1-R7 | USB DATA + | |
| 24 | 18/GREEN | GPS RCVR SWT(-) | |
| 25 | 18/ORANGE | GPS RCVR SWT(+) | |
| 26 | SH | GRIP SH | |
| 27 | 18 TWISTED/BLACK | RS485B | |
| 28 | 18 TWISTED/CLEAR | RS485A | |
| 29 | 18/GREEN | GRIP GRD(-) | |
| 30 | 18/ORANGE | GRIP SWT PWR(+) | |
| 31 | 18/PINK | SECTION 3 | |
| 32 | 18/PURPLE | NL GATE SWT N/0 | |
| 33 | 18/PINK | SECTION 4 | |
| 34 | 18/TAN | RV GATE SWT N/O | |
| 35 | 18/PINK | SECTION 5 | |
| 36 | 18/ORANGE | THOTTLE INC | |
| 37 | 18/ORANGE | THOTTLE DEC | |
| 38 | 18/BLACK | COORDINATED STR | |
| 39 | 18/BLACK | UNLOCK REAR STR | |
| 40 | 18/GRAY | REV FAN ON | |
| 41 | 18/PURPLE | FLOAT CIRCUIT | |
| 42 | 18/TAN | POWER BEYOND ON | |
| 43 | 18/PINK | FOAM MARKER ON | |
| 44 | 18/PINK | RINSE SMP OPEN | |
| 45 | 18/PINK | SPARE OUTLET | |
| 46 | 18/PURPLE | PROD SUMP OPEN | |
| 47 | 18/PINK | AUTO STEER SIG | |
| 48 | 18/PURPLE | PROD PUMP ON | |
| 49 | 18/PINK | MASTER | |
| 50 | 18/PINK | RINSE NZZL ON | |

***CONNECTOR CM050 Main Chassis harness to Raven harness***

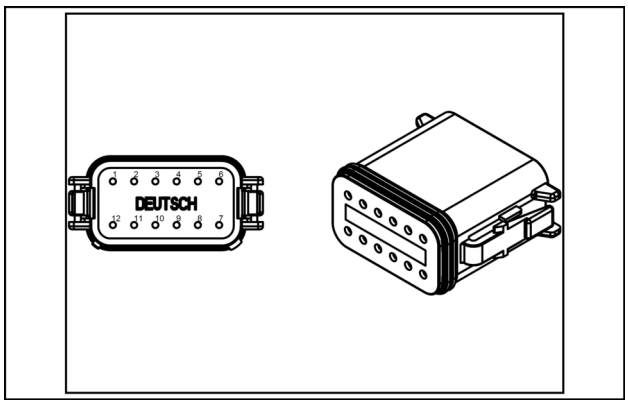
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | 18/BLACK | ULTRA FLO (-) | **SHEET 01** |
| 2 | 18/BROWN | ULTRA FLO (+) | |
| 3 | 18/PURPLE | ULTRA FLO SIG | |
| 4 | 18/WHITE | FREQ SPEED | |
| 5 | — | — | |
| 6 | 18/BROWN | SPARGE INC | |
| 7 | 18/BROWN | SPARGE DEC | |
| 8 | 18/WHITE | TELE EXTEND | |
| 9 | 18/BROWN | TELE RETRACT | |
| 10 | 18/BROWN | TREAD IN | |
| 11 | 18/WHITE | TREAD OUT | |
| 12 | 18/GRAY | PARK BRAKE | |
| 13 | 16/PINK | REMOTE 1 | |
| 14 | 16/PINK | REMOTE 2 | |
| 15 | 18/BLUE | REG INHIBIT RTN | |
| 16 | 18/ORANGE | REGEN INHIBIT | |
| 17 | 18/GREEN | MNL REGEN | |
| 18 | 18/ORANGE | MNL REG SWT RTN | |
| 19 | 14/GREEN | CNTRL GND | |
| 20 | 14/ORANGE | CNTRL PWR | |
| 21 | | | |
| 22 | | | |
| 23 | | | |
| 24 | | | |
| 25 | 20 J1939/YELLOW | GUIDANCE HI | |
| 26 | 20 J1939/GREEN | GUIDANCE LO | |
| 27 | SH J1939 | GUIDANCE SH | |
| 28 | | | |
| 29 | | | |
| 30 | | | |
| 31 | | | |



87700172 2

***CONNECTOR AR067 Armrest harness to cab antenna harness***

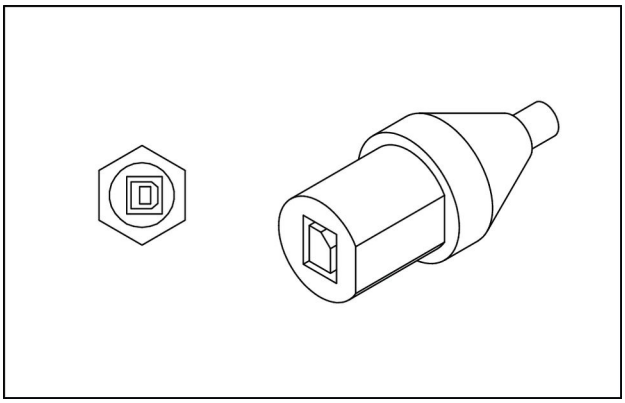
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | 18/RED | CONSTANT PWR(+) | **SHEET 10** |
| 2 | 18 J1939/YELLOW | RAV CAN HI | |
| 3 | 18 GREEN | GND(-) | |
| 4 | 18 J1939/GREEN | RAV CAN LO | |
| 5 | — | — | |
| 6 | — | — | |
| 7 | 18/WHITE | FREQ SPEED | |
| 8 | SH J1939 | RS232 SH OUT | |
| 9 | 18 J1939/GREEN | RS232 RX DS OUT | |
| 10 | 18 J1939/YELLOW | RS232 TX DS OUT | |
| 11 | 18/ORANGE | GPS RCVR SWT(+) | |
| 12 | 18/GREEN | GPS RCVR SWT(-) | |




87710838 5

***CONNECTOR AR068 Armrest harness to USB plug***

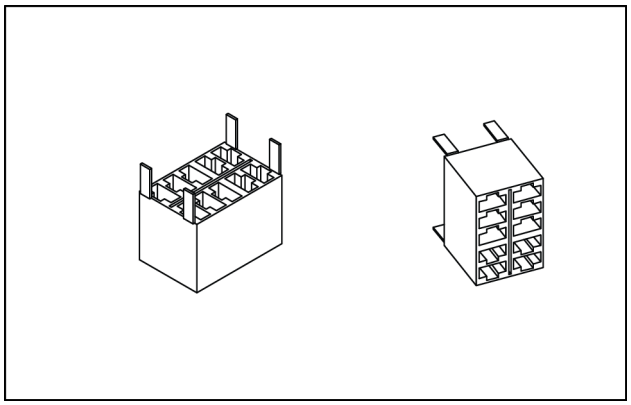
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | RED | USB VCC | **SHEET 10** |
| 2 | WHITE 1-R6 | USB DATA - | |
| 3 | GREEN 1-R7 | USB DATA + | |
| 4 | BLACK 1R5 | USB GND (REF) | |



21-48377 6

***CONNECTOR AR083 Armrest harness to right side secondary fold switch***

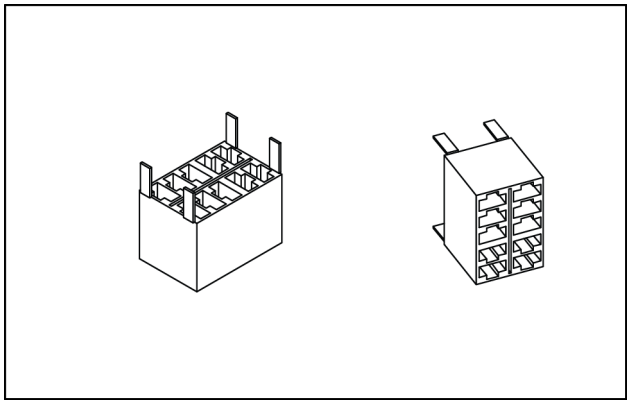
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | — | — | **SHEET 10** |
| 2 | 18/RED | SWT PWR COM 12V | |
| 3 | 18/BROWN | R SEC UP | |
| 4 | — | — | |
| 5 | — | — | |
| 6 | — | — | |
| 7 | 18/GREEN | BACKLGT PWR(-) | |
| 8 | 18/RED1 | BACKLGT PWR(+) | |
| 9 | 18/GREEN | BACKLGT PWR(-) | |
| 10 | 18/RED | BACKLGT PWR(+) | |



21-48378 4

***CONNECTOR AR084 Armrest harness to left side secondary fold switch***

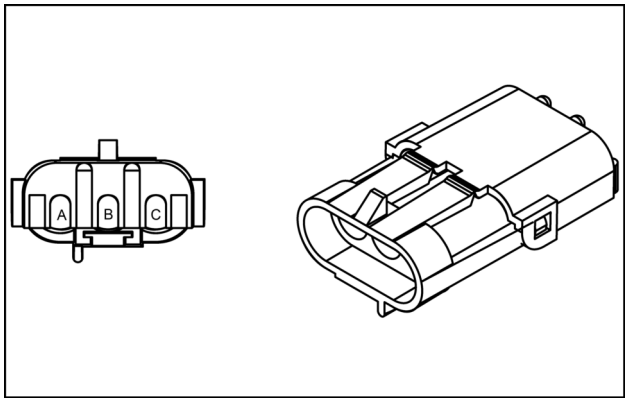
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | 18/WHITE | L SEC DOWN | **SHEET 10** |
| 2 | 18/RED | SWT PWR COM 12V | |
| 3 | 18/BROWN | L SEC UP | |
| 4 | — | — | |
| 5 | — | — | |
| 6 | — | — | |
| 7 | 18/GREEN | BACKLGT PWR(-) | |
| 8 | 18/RED1 | BACKLGT PWR(+) | |
| 9 | 18/GREEN | BACKLGT PWR(-) | |
| 10 | 18/RED | BACKLGT PWR(+) | |



21-48378 5

***CONNECTOR CM102 Main chassis harness to rinse nozzle valve***

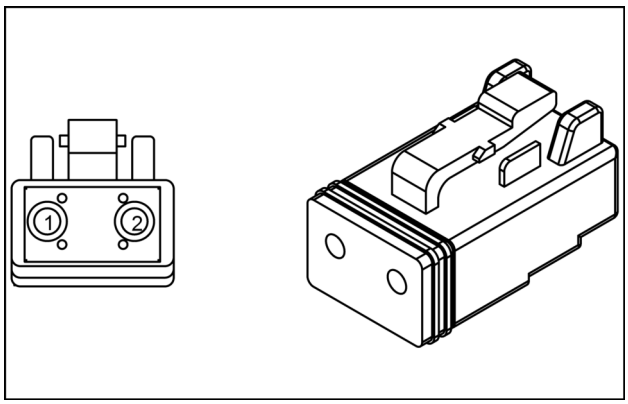
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| A | 18/PINK | RINSE NZZL OPEN | **SHEET 01** |
| B | 18/ORANGE | PROD VLV 12V | |
| C | 18/GREEN | GRD 2 | |




87692858 3

***CONNECTOR CM103 Main chassis harness to eductor***

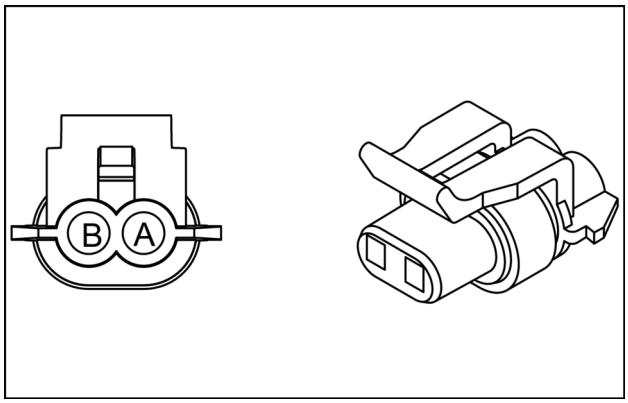
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| A | 18/ORANGE | 12V SWT PWR CB2 | **SHEET 01** |
| B | 18/PURPLE | PROD SUMP OPEN | |




87711966 4

***CONNECTOR CM115 Main chassis harness to integrated valve SV1***

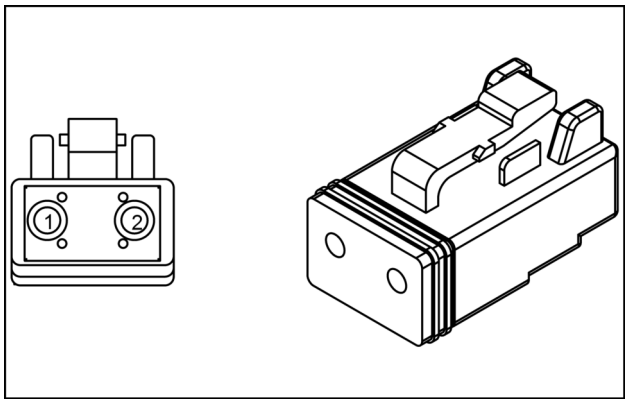
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| A | 18/GREEN | GND 2 | **SHEET 01** |
| B | 18/BROWN | BOOM DOWN | |




87693821 5

***CONNECTOR CM116 Main chassis harness to headlight relay harness***

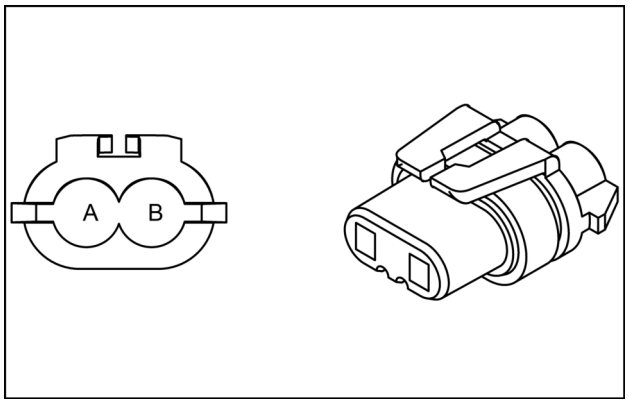
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | 16/WHITE | LO BEAM | **SHEET 01** |
| 2 | 16/BLUE | HI BEAM | |
| 3 | 14/GREEN | GND 1 | |
| 4 | 18/BLUE | HI BEAM SIG | |
| 5 | 18/WHITE | LO BEAM SIG | |
| 6 | 14/RED | HEAD LGT 12V | |




87711966 6

***CONNECTOR CM156 Main chassis harness to standard side oval lamp***

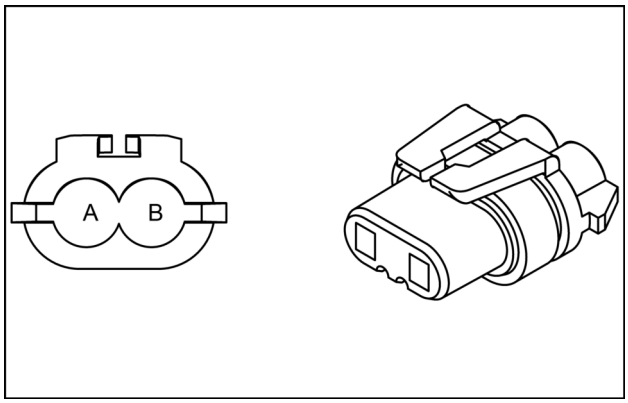
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| A | 16/BLUE | SIDE CVR LGT | **SHEET 01** |
| B | 16/GREEN | GND 1 | |




87686685 6

***CONNECTOR CM157 Main chassis harness to standard side oval lamp***

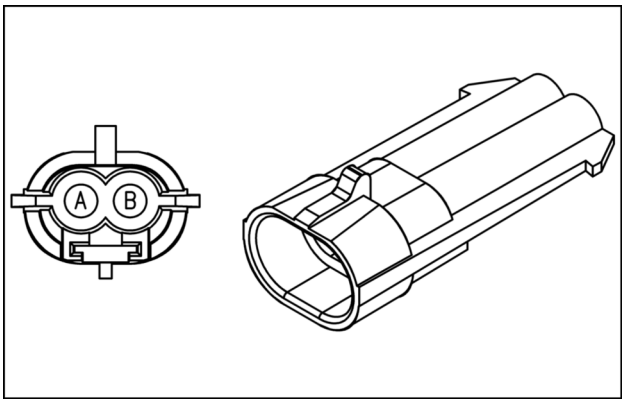
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| A | 16/BLUE | SIDE CVR LGT | **SHEET 01** |
| B | 16/GREEN | GND 1 | |




87686685 7

***CONNECTOR UF228 Ultra flow boom harness***

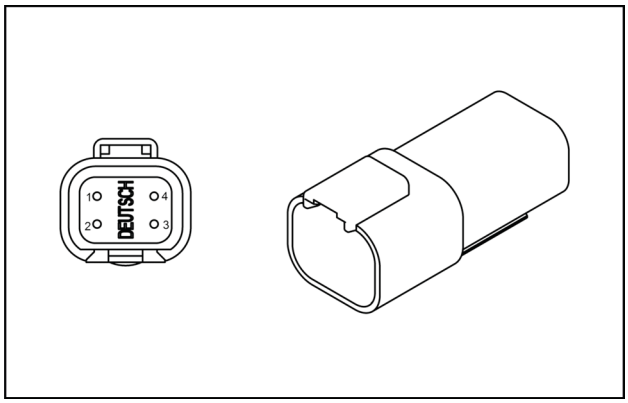
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| A | 18/GREEN | GND 2 | **SHEET 03** |
| B | 18/BROWN | PWR BEYOND | |




87693431 11

***CONNECTOR UF236 Ultra flow boom harness***

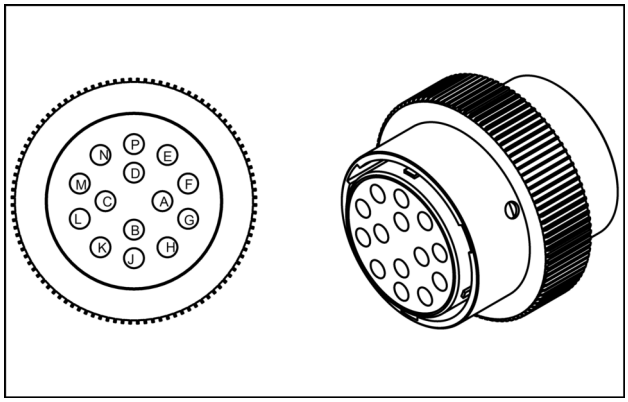
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| A | 18/BLACK | ULTRA FLO (-) | **SHEET 03** |
| B | 18/BROWN | ULTRA FLO (+) | |
| | 18/PURPLE | ULTRA FLO SIG | |
| | — | — | |




87694102 12

***CONNECTOR CM202 Main chassis harness to cab harness***

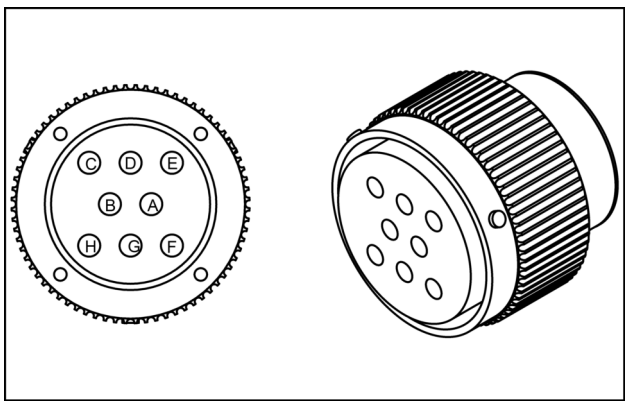
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| A | — | — | **SHEET 01** |
| B | — | — | |
| C | 16/ORANGE | AUX OUTLET 2D | |
| D | 14/ORANGE | POS PRES MTR FD | |
| E | 16/BLACK | MIRROR LGT FD | |
| F | — | — | |
| G | 18/BLACK | L RR CAB LGT PWR | |
| H | — | — | |
| J | 18/BLACK | R RR CAB LGT PWR | |
| K | 18/BLACK | RR CAB BEACONS FD | |
| L | 18/BLACK | 1 & 6 STDM LGT FD | |
| M | 18/BLACK | 2 & 5 STDM LGT FD | |
| N | 18/BLACK | 3 & 4 STDM LGT FD | |
| P | 16/ORANGE | WIPER MTR FD | |




87703934 3

***CONNECTOR CM203 Main chassis harness to cab harness***

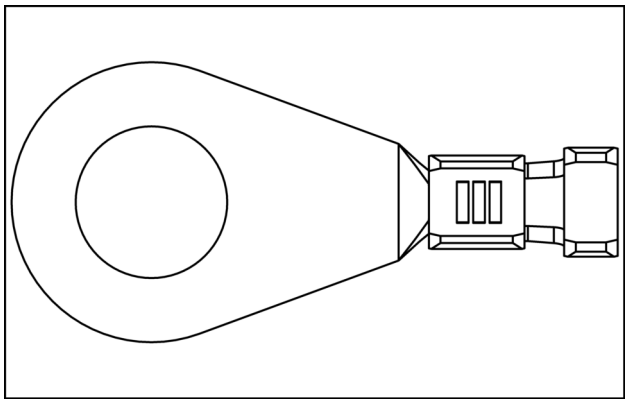
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| A | 12/RED | OUTLET 1 CON PWR | **SHEET 01** |
| B | 12/ORANGE | OUTLET 1 SWT PWR | |
| C | 12/ORANGE | OUTLET 2 SWT PWR | |
| D | 12/ORANGE | OUTLET 3 SWT PWR | |
| E | 12/ORANGE | OUTLET 4 SWT PWR | |
| F | 12/RED | OUTLET 2 CON PWR | |
| G | 12/RED | OUTLET 3 CON PWR | |
| H | 12/RED | OUTLET 4 CON PWR | |




84177898 4

***CONNECTOR EN221 Engine harness to ground***

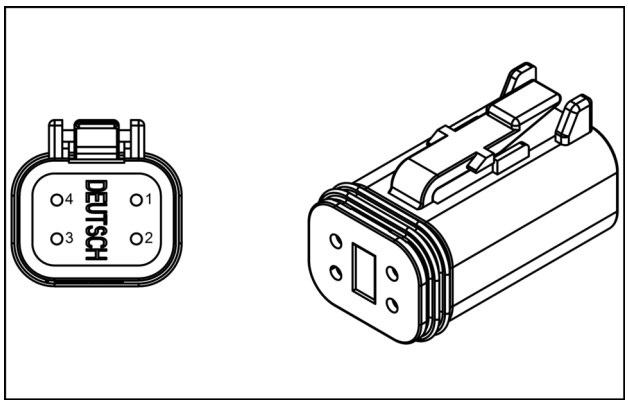
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| A | 16/PURPLE | NTL SWT/RELAY | **SHEET 05** |



47365222 9

***CONNECTOR EN222 Engine harness to 200 amp relay jumper harness***

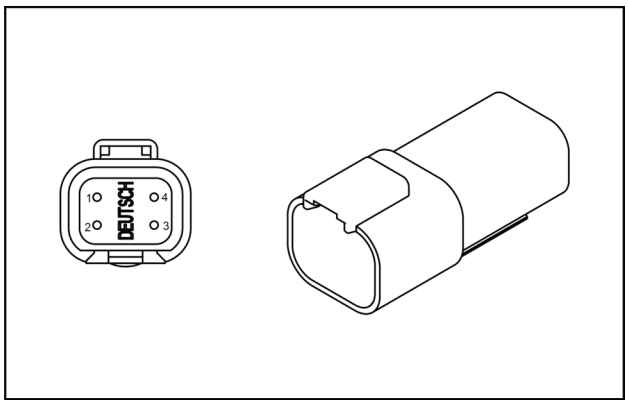
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | 18/GREEN | HEATER SIG RET | **SHEET 05** |
| 2 | 18/PURPLE | HEATER SIG OUT | |




87694101 10

***CONNECTOR UF236 Ultra flow harness 21.53939***

| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | 18/GREEN | GND | **SHEET 01** |
| 2 | 18/BROWN | 5 VOLT DC | |
| 3 | 18/PURPLE | ULTRA FLO SIG | |
| 4 | — | — | |

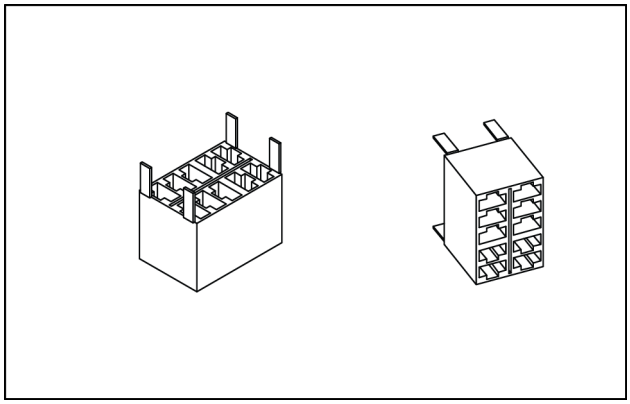



87694102 7

# Wire connectors - Component diagram 34 - Connectors 340 through 349

***CONNECTOR AR335 Armrest harness to auxiliary back light***

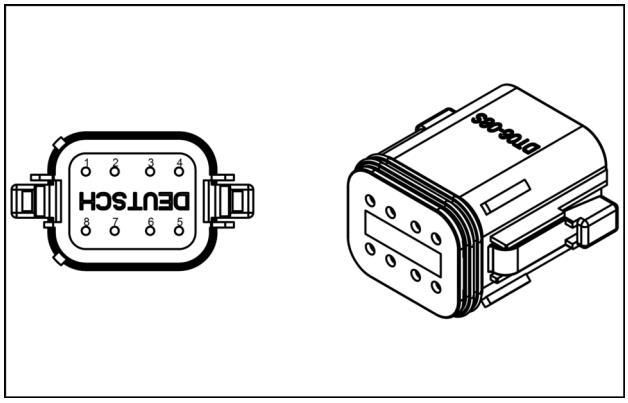
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | — | — | **SHEET 10** |
| 2 | 18/BLUE | REG INHIBIT RTN | |
| 3 | 18/ORANGE | REGEN INHIBIT | |
| 4 | 18/ORANGE | MNL REG SWT RTN | |
| 5 | 18/GREEN | MNL REGEN | |
| 6 | - | — | |
| 7 | 18/GREEN | BACKLGT PWR(-) | |
| 8 | 18/RED | BACKLGT PWR(+) | |
| 9 | 18/GREEN | BACKLGT PWR(-) | |
| 10 | 18/RED | BACKLGT PWR(+) | |



21-48378 1

***CONNECTOR CM347 Main chassis harness to Engine harness***

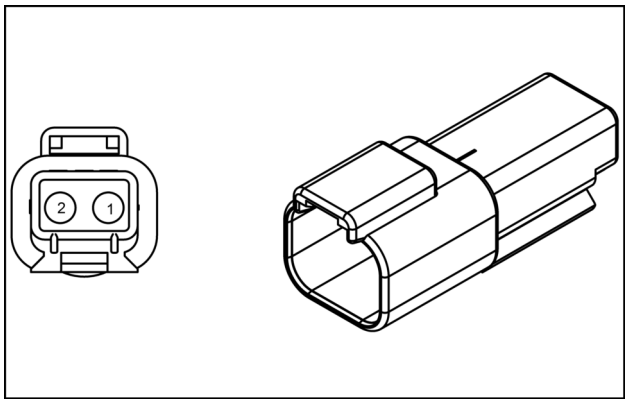
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | 18/BLUE | REG INHIBIT RTN | **SHEET 01** |
| 2 | 16/ORANGE | REGEN INHIBIT | |
| 3 | 18/GGREEN | MNL REGEN | |
| 4 | 18/ORANGE | MNL REG SWT RTN | |
| 5 | 18/PINK | DPF REGEN LAMP | |
| 6 | 18/PURPLE | HI EXH TEMP LMP | |
| 7 | 18/BROWN | REG DISABLE LMP | |
| 8 | 18/BLACK | DEF LOW LAMP | |




87695894 2

***CONNECTOR EL366 Egress lighting harness to cab harness***

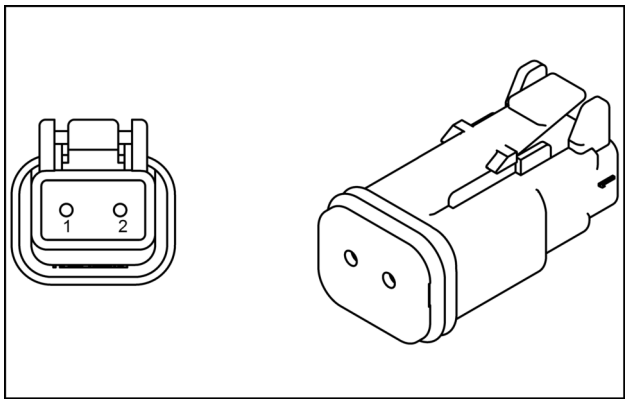
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | — | — | **SHEET 04** |
| 2 | 18/PURPLE | LGT SIGNAL | |




87696073 7

***CONNECTOR EL367 Egress lighting harness to work light***

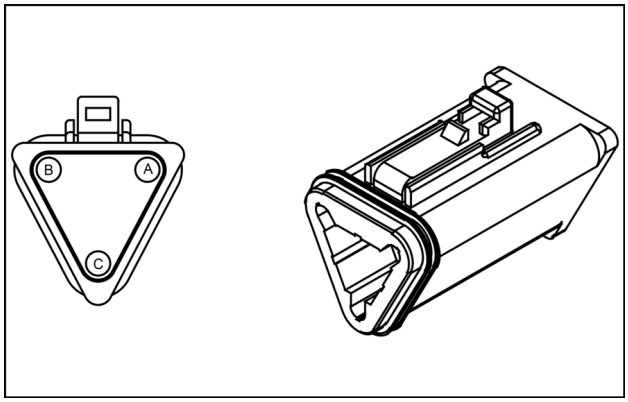
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | 18/BLUE | LGT OUTPUT | **SHEET 04** |
| 2 | 18/GREEN | GND | |




87695582 8

***CONNECTOR AR418 Armrest harness to Raven CAN HI/LO***

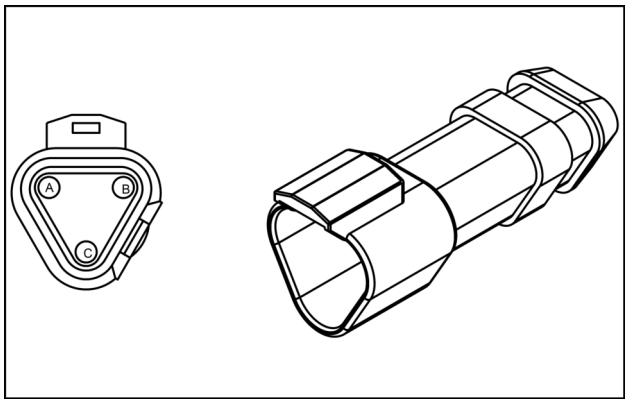
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| A | YELLOW | 20 J1939 | **SHEET 10** |
| B | GREEN | 20 J1939 | |
| C | GREEN | SHIELD J1939 | |




84580328 3

***CONNECTOR AR419 Armrest harness to ISO CAN HI/LO***

| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| A | 20 J1939/YELLOW | ISO CAN HI | **SHEET 10** |
| B | 20 J1939/GREEN | ISO CAN LO | |
| C | SHIELD J1939/GREEN | ISO SHIELD | |




87700816 4

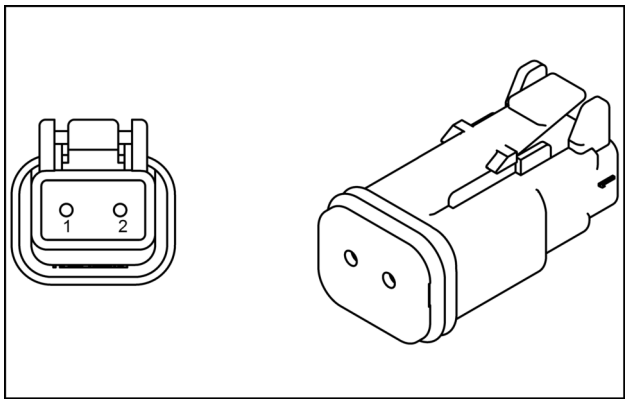
# Wire connectors - Component diagram 50 - Connectors 500 through 509

***CONNECTOR CD501 Planetary cab harness***

| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | 16/GREEN | CNTRL GND | **SHEET 09** |
| 2 | 16/GREEN | CNTRL PWR | |
| 3 | 20 J1939/YELLOW | PLUS 1 DIAG HI | |
| 4 | 20 J1939/GREEN | PLUS 1 DIAG LO | |
| 5 | 18/GRAY | PARK BRAKE | |
| 6 | 18/PURPLE | TEMP L FRT MTR | |
| 7 | 18/GRAY | TEMP R FRT MTR | |
| 8 | 18/ORANGE | 5 VOLT PWR | |
| 9 | 18/GREEN | 5 VOLT GND | |
| 10 | 18/BROWN | BRAKE PEDAL C | |
| 11 | 18/BROWN | BRAKE PEDAL F | |
| 12 | 18/BROWN | BRAKE PEDAL K | |
| 13 | 18/YELLOW | JOYSTK OUTPUT 1 | |
| 14 | 18/WHITE | JOYSTK OUTPUT 2 | |
| 15 | 18/CLEAR | ANGLE SENSOR | |
| 16 | 18/CLEAR | FRT PUMP FWD | |
| 17 | 18/CLEAR | FRT PUMP REV | |
| 18 | 18/BLACK | REAR PUMP FWD | |
| 19 | 18/BLACK | REAR PUMP REV | |
| 20 | 20 J1939/YELLOW | ENGINE/IQCAN HI | |
| 21 | 20 J1939/GREEN | ENGINE/IQCAN LO | |
| 22 | — | — | |
| 23 | 18/GRAY | TEMP L REAR MTR | |
| 24 | 18/TAN | TEMP R REAR MTR | |
| 25 | 18/CLEAR | SPEED L FRT MTR | |
| 26 | 18/CLEAR | SPEED R FRT MTR | |
| 27 | 18/CLEAR | SPEED L REAR MTR | |
| 28 | 18/CLEAR | SPEED R REAR MTR | |
| 29 | 18/BLACK | DIR L REAR MTR | |
| 30 | 18/BLACK | DIR SIG R REAR MTR | |
| 31 | 18/BLACK | DIR R FRT MTR | |
| 32 | 18/BLACK | DIR L FRT MTR | |
| 33 | 18/BLACK | NL START OUTPUT | |
| 34 | 18/BLACK | CCO #1 | |
| 35 | 18/BLACK | CCO #2 | |
| 36 | 18/BLACK | — | |
| 37 | 18/BLACK | — | |
| 38 | 18/GRAY | PARK BRAKE REL | |
| 39 | 18/PURPLE | HI FRT FOWARD | |
| 40 | 18GRAY | HI FRT REVERSE | |
| 41 | 18/ORANGE | HI REAR FORWARD | |
| 42 | 18/GRAY | HI REAR REVERSE | |
| 43 | 18/GRAY | L FRT HI MTR | |
| 44 | 18/GRAY | R FRT HI MTR | |
| 45 | 18/PINK | L REAR HI MTR | |
| 46 | 18/PURPLE | R REAR HI MTR | |
| 47 | 16/ORANGE | CNTRL PWR | |
| 48 | 16/ORANGE | CNTRL PWR | |
| 49 | 16/ORANGE | CNTRL PWR | |
| 50 | 16/ORANGE | CNTRL PWR | |

***CONNECTOR DC525 Planetary chassis harness***

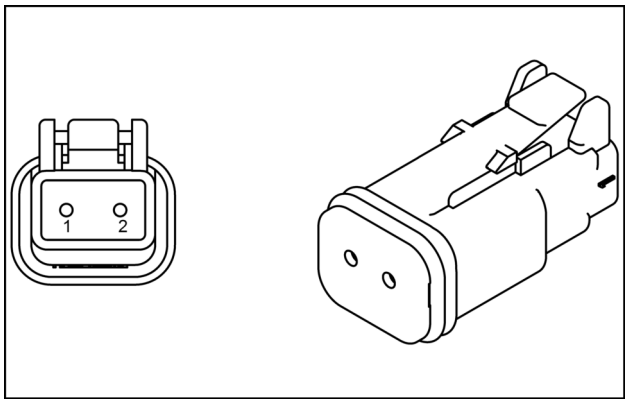
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | 18/GRAY | HI FRT REVERSE | **SHEET 09** |
| 2 | 16/GREEN | CNTRL GND | |




87695582 5

***CONNECTOR DC526 Planetary chassis harness***

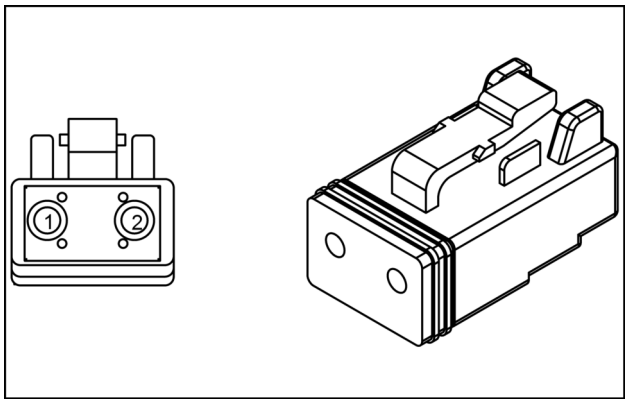
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | 18/ORANGE | HI REAR FORWARD | **SHEET 09** |
| 2 | 16/GREEN | CNTRL GND | |




87695582 6

***CONNECTOR EN716 Engine harness to DEF line***

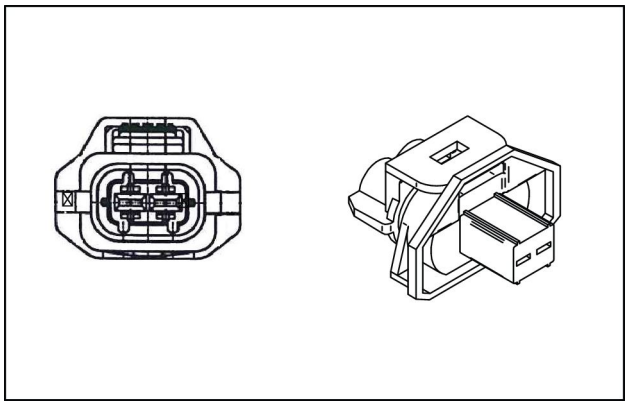
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | 18/YELLOW | DEF HTR SCTN 3 | |
| 2 | 18/BLACK | DEF HTR MON | |




87711966 6

***CONNECTOR EN717 Engine harness to DRT***

| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | 18/ORANGE | DEF DOSE VLV HI | |
| 2 | 18/PURPLE | DEF DOSE VLV LO | |

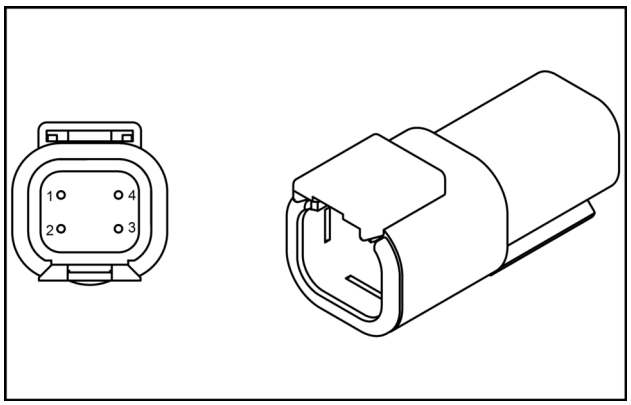


21-61861 7

# Wire connectors - Component diagram 90 - Connectors 900 through 909

***CONNECTOR UF900 Ultra flow harness 21.53939***

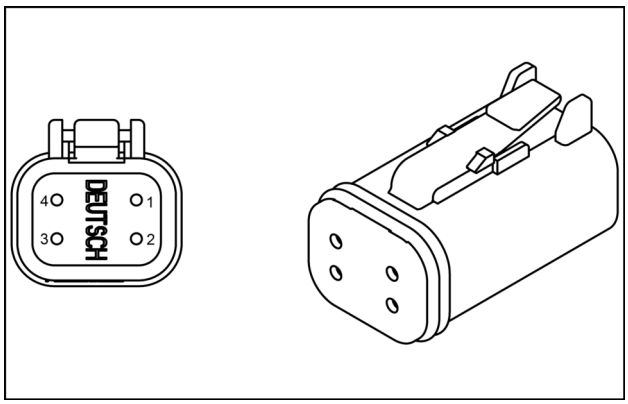
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | 18/RED | 12 VOLT | **SHEET 03** |
| 2 | 18/GREEN | GND | |
| 3 | 18BROWN | 5 VOLT DC | |
| 4 | — | — | |




87700105 1

***CONNECTOR UF901 Ultra flow harness 21.53939***

| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | – | — | **SHEET 03** |
| 2 | 18/GREEN | GND | |
| 3 | 18/RED | 12 VOLT | |
| 4 | 18/PURPLE | ULTRA FLO SIG | |

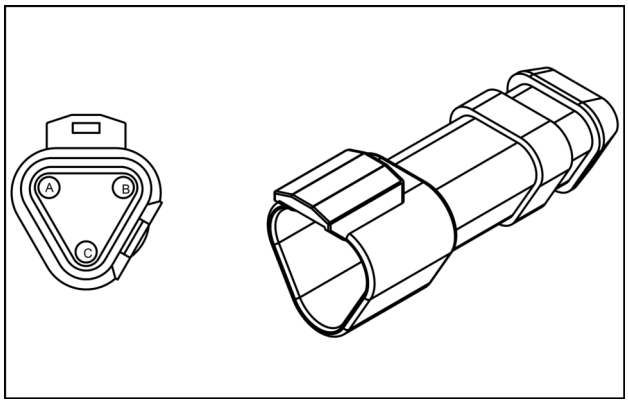



87694153 2

# Wire connectors - Component diagram 92 - Connectors 920 through 929

***CONNECTOR AT922 Antenna harness***

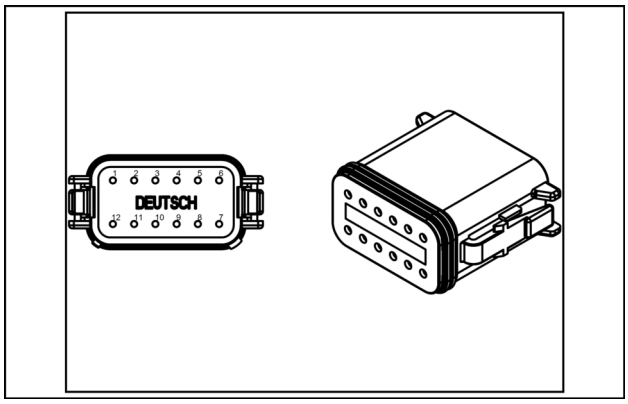
| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| A | 18 TWISTED/ YELLOW | CAN HI VEH BUS2 | **SHEET 16** |
| B | 18 TWISTED/ GREEN | CAN LO VEH BUS2 | |
| C | — | — | |




87700816 1

***CONNECTOR AT923 Antenna harness***

| PIN Number | Wire gauge/color | Circuit reference | Electrical schematic frame |
|---|---|---|---|
| 1 | 18 TWISTED/ GREEN | CAN HI VEH BUS2 | **SHEET 16** |
| 2 | 18/BLUE | RS232 RX | |
| 3 | 18/GRAY | RS232 TX | |
| 4 | 18/PINK | PPS IN (EVENT) | |
| 5 | 18/BLACK | RS232 GND | |
| 6 | | — | |
| 7 | | — | |
| 8 | | — | |
| 9 | | — | |
| 10 | 18/ORANGE | KEY SW B+ | |
| 11 | 18/BLACK | CLEAN GND | |
| 12 | 18 TWISTED/ GREEN | CAN LO VEH BUS2 | |




87710838 2

| Code | SPN# | FMI# | Lamp color | Reason for fault | Effect (only when code is active) | Action |
|---|---|---|---|---|---|---|
| 584 | 677 | 3 | AMBER | Open circuit or high voltage detected at starter lockout circuit | Either the engine will not start or the engine will not have starter lockout protection | Check engine wiring harness. If problem persists call Cummins service |
| 585 | 677 | 4 | AMBER | Low voltage detected at the starter lockout circuit | Either the engine will not start or the engine will not have starter lockout protection | Check engine wiring harness. If problem persists call Cummins service |
| 595 | 103 | 16 | AMBER | High turbocharger speed has been detected by the ECM | Possible reduced engine performance | Call Cummins Service |
| 649 | 1378 | 31 | AMBER | Change engine oil and filter | None on performance | Change engine oil and filter |
| 687 | 103 | 18 | AMBER | Low turbocharger speed detected by the ECM | Possible reduced engine performance | Call Cummins Service |
| 689 | 190 | 2 | AMBER | The ECM has detected an error in the engine speed signal | Possible reduced engine performance | Call Cummins Service |
| 691 | 1172 | 3 | AMBER | High signal voltage detected at the turbocharger compressor intake air temperature circuit | Possible reduced engine performance | Call Cummins Service |
| 692 | 1172 | 4 | AMBER | Low signal voltage detected at the turbocharger compressor intake air temperature circuit | Possible reduced engine performance | Call Cummins Service |
| 731 | 723 | 7 | AMBER | Engine position signal form the crankshaft position sensor and camshaft position sensor do not match | Possible reduced engine performance | Call Cummins Service |
| 741 | 1176 | 3 | AMBER | High signal voltage detected at the turbocharger compressor intake pressure sensor circuit | Possible reduced engine performance | Call Cummins Service |
| 742 | 1176 | 4 | AMBER | Low signal voltage detected at the turbocharger compressor intake pressure sensor circuit | Possible reduced engine performance | Call Cummins Service |
| 743 | 1176 | 2 | AMBER | | Possible reduced engine performance | Call Cummins Service |
| 778 | 723 | 2 | AMBER | The ECM has detected a loss of signal from the camshaft position sensor | Possible reduced engine performance | Call Cummins Service |
| 1117 | 3597 | 2 | NONE | Supply voltage to the ECM fell below a calibrated limit momentarily, or the ECM was not allowed to power down correctly | Possible reduced engine performance | Allow 30 seconds after shutting key off before turning key back on or before turning battery disconnect switch off |

| Code | SPN# | FMI# | Lamp color | Reason for fault | Effect (only when code is active) | Action |
|---|---|---|---|---|---|---|
| 3578 | 4376 | 4 | AMBER | Low signal voltage detected at the **DEF/ADBLUE®** return valve | Possible reduced engine performance | Check for damaged or plugged heated **DEF/ADBLUE®** lines, check engine wire harness |
| 3582 | 4364 | 18 | AMBER | NOx conversion across the SCR catalyst is too low | Possible reduced engine performance | Check for degraded, diluted or incorrect **DEF/ADBLUE®**, check for exhaust system leaks |
| 3583 | 5031 | 10 | AMBER | The aftertreatment outlet NOx sensor heater is unable to maintain its normal operating temperature | None on performance | Check engine wiring harness |
| 3596 | 4334 | 2 | AMBER | The **DEF/ADBLUE®** pressure sensor has reported a reading too high or too low for the operating conditions | Possible reduced engine performance | Check for plugged **DEF/ADBLUE®** filters, check for damaged or plugged heated **DEF/ADBLUE®** lines, check engine wire harness |
| 3649 | 5024 | 10 | AMBER | The aftertreatment outlet NOx sensor heater is unable to maintain its normal operating temperature | None on performance | Check engine wiring harness |
| 3681 | 3228 | 2 | AMBER | The aftertreatment outlet NOx sensor indicates that the power supply to the sensor is incorrect | None on performance | Check engine wiring harness |
| 3682 | 3218 | 2 | AMBER | The Aftertreatment outlet NOx sensor indicates that the power supply to the sensor is incorrect | None on performance | Check engine wiring harness |
| 3697 | 630 | 12 | RED | Error internal to the ECM related to engine software failures | Engine may not start or may be difficult to start | Call Cummins Service |
| 3712 | 5246 | 0 | RED | Critical SCR related fault codes have been active for an extended period of time and require immediate attention | Engine power derate | Call Cummins Service |
| 3714 | 1569 | 31 | AMBER | Critical fault codes related to engine operation are active | Possible reduced engine performance | Call Cummins Service |
| 3717 | 3226 | 13 | AMBER | A nominal system voltage mismatch has been detected by the aftertreatment outlet NOx sensor | None on performance | Check engine wiring harness |

# Contents

## Electrical systems - 55

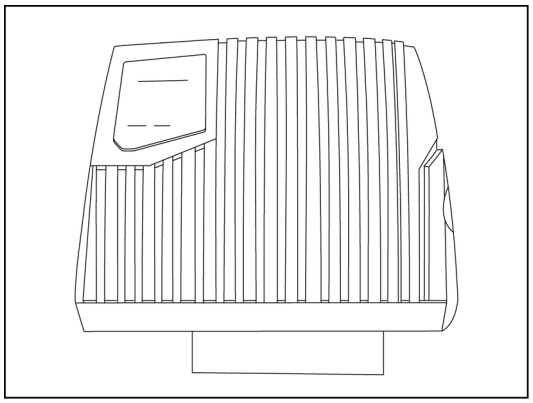
### Engine starting system - 201

FUNCTIONAL DATA



(*) See content for specific models

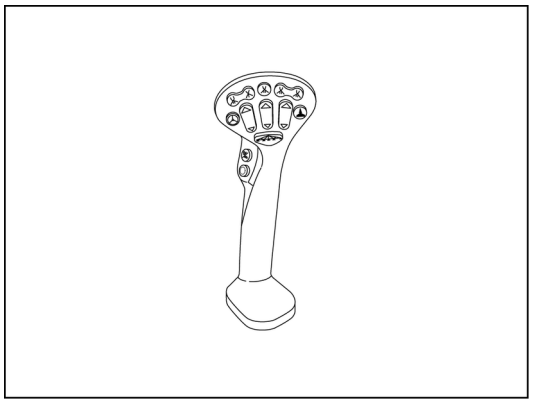
with sealed connectors. The controller is mounted under the cab next to the MC2 controller and is accessible from the bottom side of the vehicle. The XS2 controller is not unique to each machine and can be switched out with another controller.



RAIL14SP00090AA 3

## Joystick control handle

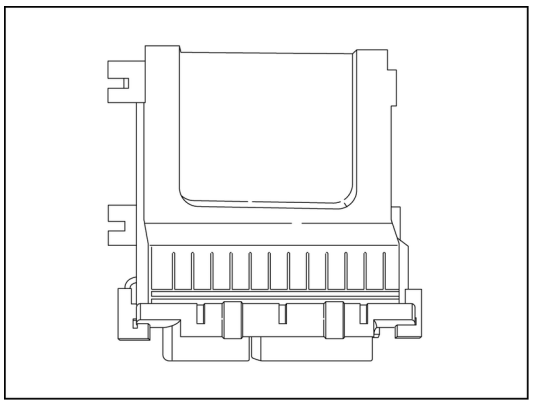
The joystick control handle (grip) is the main control component for operator input for the vehicle. The grip feature push buttons for the control of the boom and product delivery functions, and engine speed and shifting. The grip also acts as the throttle for the vehicle. The grip is mounted to the armrest console.



RAIL14SP00086AA 4

## Input/Output Module

The input/output module (XIO2) handles the inputs and outputs for the cab controls such as the grip, the warning light panel, and the brake pedal. The XIO2 module features analog inputs, digital inputs and outputs, RS-485 interface (grip), status indicators in the form of blinking lights on the module housing. The controller is a sealed enclosure with sealed connectors. The module is mounted in the engine compartment.



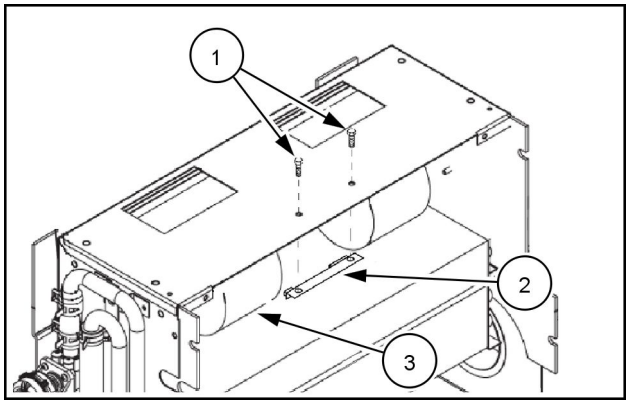
RAIL14SP00092AA 5

There is an optional XIO2 module used on the vehicle which is used to replace the Raven super node when third party control of the spraying system is required. The module, know as XIO2 hourglass style, is mounted in the armrest

# Blower - Install - Pressurize blower motor

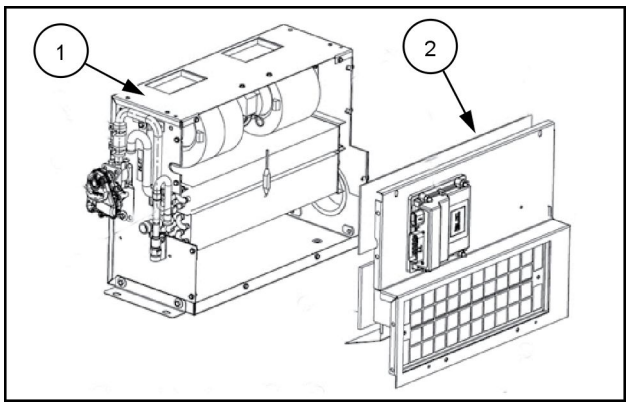
| | |
|---|---|
| SP.300F | |
| SP.345F | |
| SP.400F | |

1. Install the pressurize blower motor **(3)** in the proper position inside of the blower/evaporator housing.
2. Install the blower motor bracket **(2)** and the mounting bolts **(1)** securing the pressurize blower motor in the blower/evaporator housing.
3. Connect the electrical connector on the pressurize blower motor.



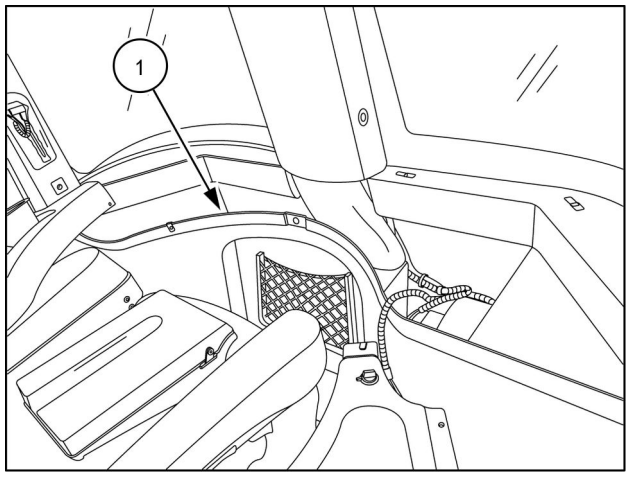

RAIL13SP04969AA 1

4. Install the blower/evaporator housing front panel **(2)** into the proper position on the blower/evaporator housing **(1)**.
5. Install the front panel mounting bolts and tighten.



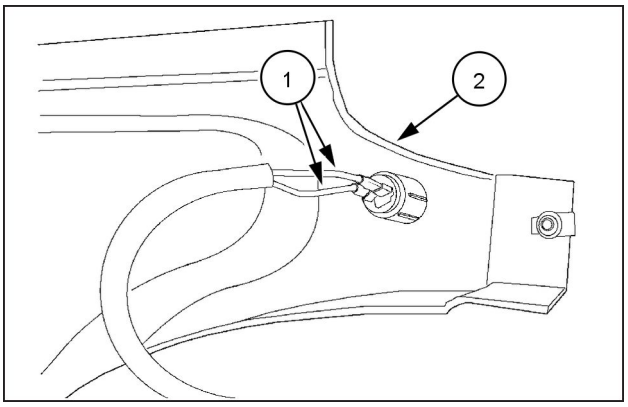

RAIL13SP04968AA 2

6. Install the back panel into the proper position in the cab of the sprayer.



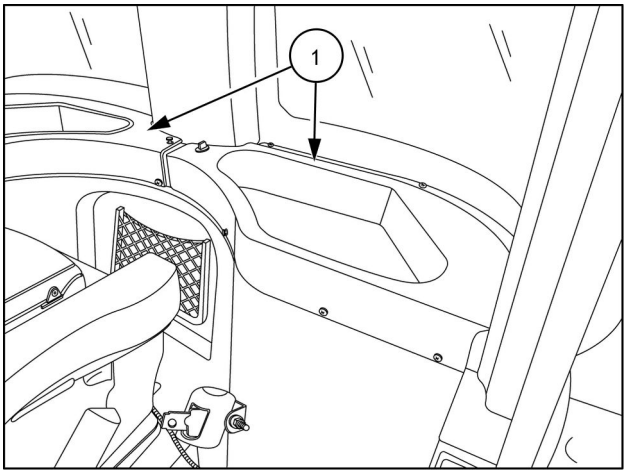

RAIL13SP04731AA 3

10. Install the electrical connections **(1)** on the back of the right rear panel **(2)**.



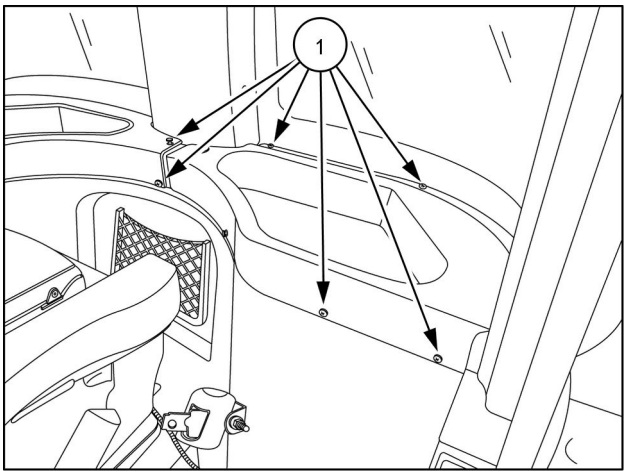

RAIL13SP04971AA 7

11. Install the two upper rear panels **(1)** into the proper positions.




RAIL13SP04736AA 8

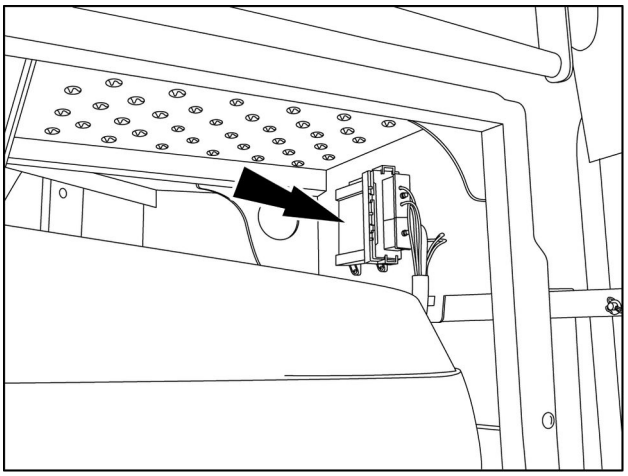
12. Install all of the upper rear panel mounting bolts **(1)** and tighten.




RAIL13SP04736AA 9

## XI 02 controller

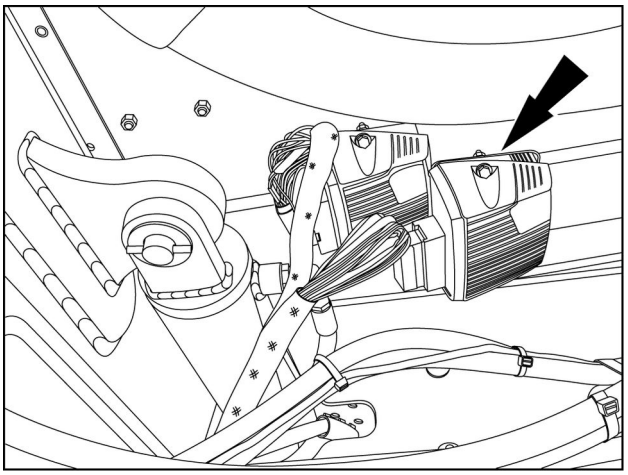
1. Attach the XI 02 control to the underside of the raised deck using screws, washers, and nuts. Tighten securely.
2. Connect the electrical connector to the control.



RAIL13SP05044AA 7

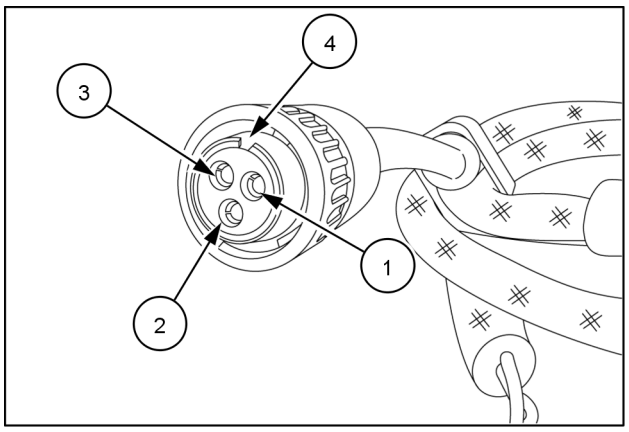
## MC2 master controller

1. Attach the MC2 master controller to the underside of the cab using the mounting bolts. Tighten securely.
2. Connect the electrical connector to the MC2 master controller.



RAIL13SP05045AA 8

7. With a voltmeter, test the plug as shown above from 2 a clock **(1)** to the 6 a 'clock **(2)** positions, and from the 2 a clock **(1)** to the 10 a clock **(3)** positions for **5 V**. Positions are relative from the keyway of the connector **(4)**. Next, use the following instructions to manually determine if the cable is transmitting a signal from the flow meter to the console. The opposite end of the cable attaches to the lower right hand corner of the cab and a voltage and continuity test can be conducted to confirm a break in the cable to the meter.



RAIL13SP03392AA 8

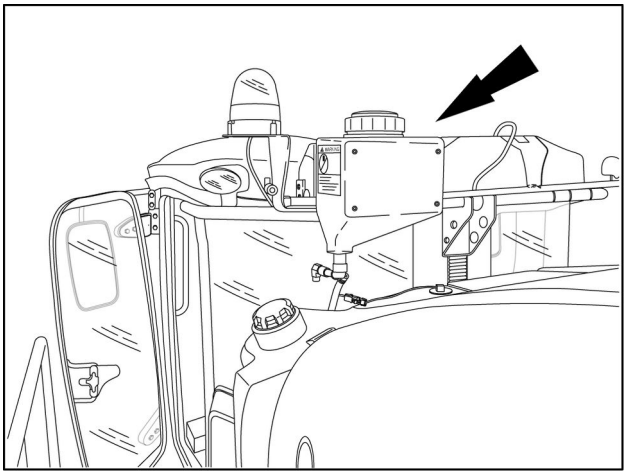
- Enter a METER CAL number of "1" in the console key labeled “Meter Cal 5”.
- Depress the key on the console labeled “Tank Volume 9”. Clear and enter "0".
- Place BOOM switch ON, master and power ON.
- With a small jumper wire (or paper clip), short between 2 a clock **(1)** and 6 a clock **(2)** sockets with a “short / no short” motion.
- Each time a contact is made, the TOTAL VOLUME should increment up 1 or more counts.
- If TOTAL VOLUME does not count up, remove the section of cable and repeat the test at the connector next closest to the console. Replace defective cable as required.
- Perform all voltage checks.
- If all cables test good, replace the flow meter.
- After testing is complete, re-enter correct METER CAL numbers before application.

8. Before removing the flow meter for inspection, if available, plug in a replacement meter and blowthrough with the cable attached. Using the previously outlined procedure, attempt to count up and confirm operation.

# Rinse tank - Remove - Hand rinse tank

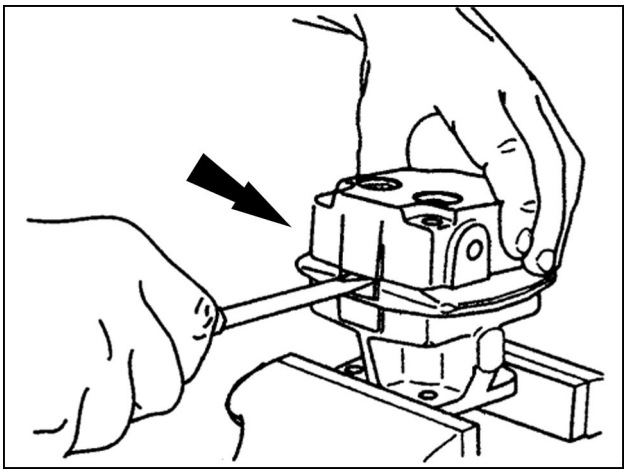
| | |
|---|---|
| SP.300F | |
| SP.345F | |
| SP.400F | |

1. Drain the fluid form the hand rinse tank. The hand wash tank is located at the upper left hand rear side of the cab.
2. Remove the hose and clamp from the tank outlet.
3. Remove the bolts securing the tank to the mounting bracket. Remove the tank from the vehicle.



RAIL12SP01102AA 1

14. Use a small screwdriver to carefully pry apart the end plate and gerotor housing, at the boss area of the housing, if motor end plate will not lift off easily. If gerotor housing will not lift off easily, carefully pry apart boss area between the gerotor housing and the motor body. It may be necessary to alternate sides when prying apart motor sections.



RAIL13SP01132AA 4

15. Remove both parts of gerotor.
16. Remove key from shaft.
17. Remove O-ring from motor end plate and body with a flat instrument such as a knife blade.
18. Inspect motor end plate, body, and gerotor housing for wear and/or gouging.

***NOTE:*** *If gouging has occurred in both motor end plate and body, motor is not repairable. If gouging has occurred in the motor end plate, body, or gerotor housing, the part that is worn must be replaced. If gerotor housing is damaged, gerotor parts must also be replaced.*

## Motor shaft removal and disassembly

19. Remove the slinger ring from the motor shaft.
20. **⚠ CAUTION**

    **Eye injury hazard!**
    **Always wear eye or full face protection when performing this procedure.**
    **Failure to comply could result in minor or moderate injury.**

    **C0081A**

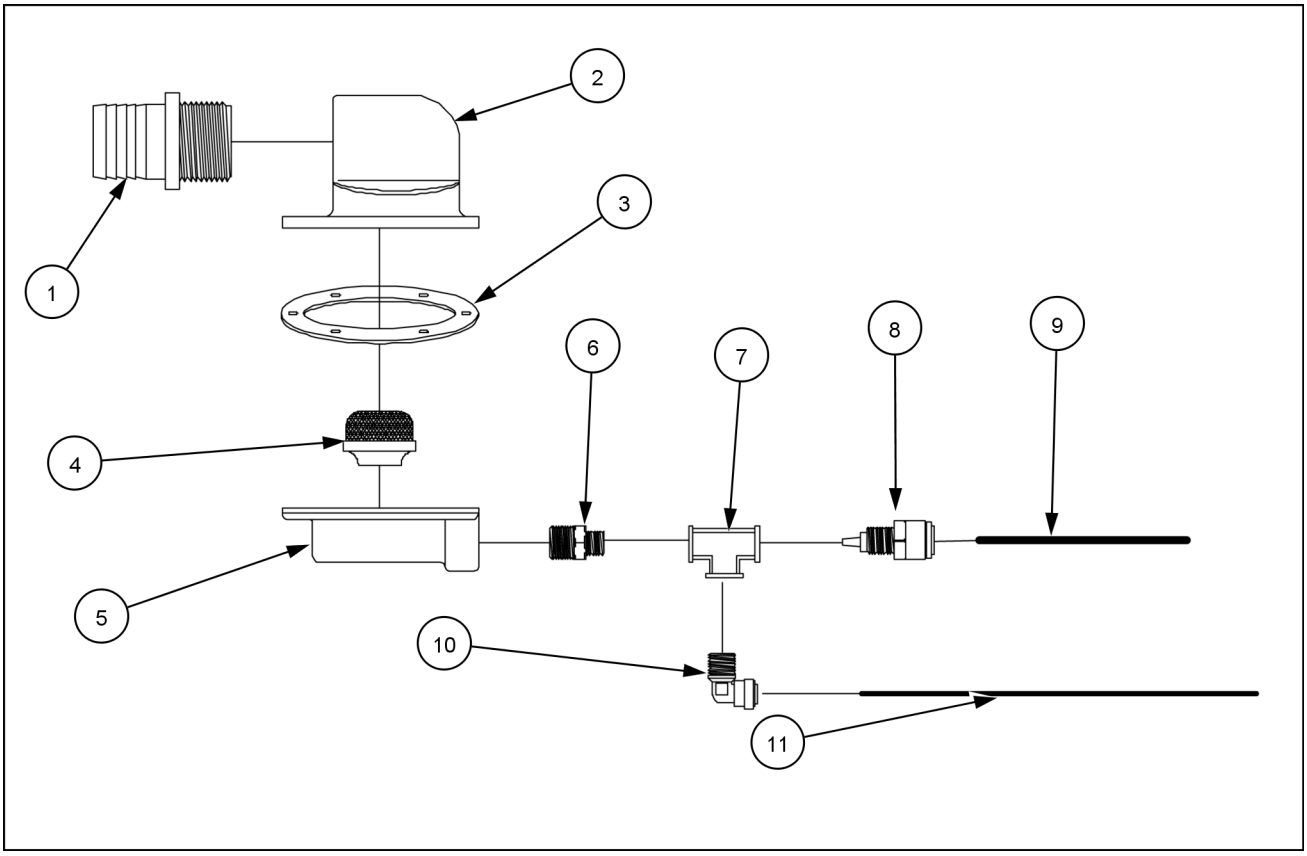
    Using large retaining ring pliers, remove retaining ring next to ball bearing in motor body.

# Foam marking system - Service instruction - Maintenance

| | |
|---|---|
| SP.300F | |
| SP.345F | |
| SP.400F | |

## Foam heads and In-Line Filter

1. The screens inside the foam heads should be washed periodically with hot water.
2. The in-line filter element should be cleaned occasionally to ensure sufficient liquid flow to the foam head assemblies.




RAIL13SP01144FA 1

| Foamhead Assembly | |
|---|---|
| Item | Description |
| 1 | Hose Barb Nipple |
| 2 | Top Housing |
| 3 | Gasket |
| 4 | Screen |
| 5 | Base Housing |
| 6 | Reducer (Brass) |
| 7 | Tee (Brass) |
| 8 | Straight Quick Connect with Venturi |
| 9 | Black Poly Tubing |
| 10 | Reducer (Brass) |
| 11 | Black Poly Tubing |

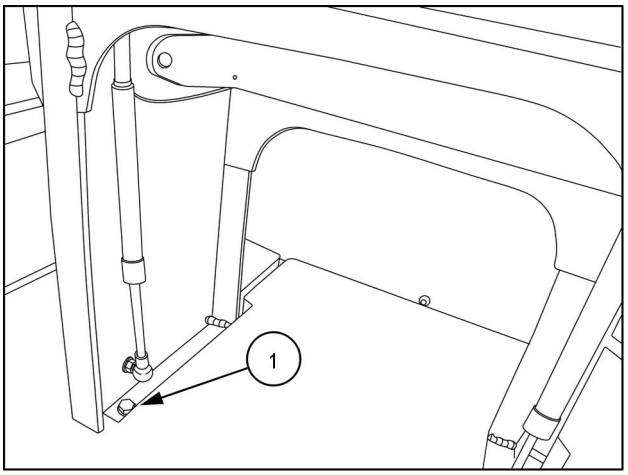
## Control module

1. The unit should have hot water run through each side periodically to ensure proper flow.

# Instructional seat - Install

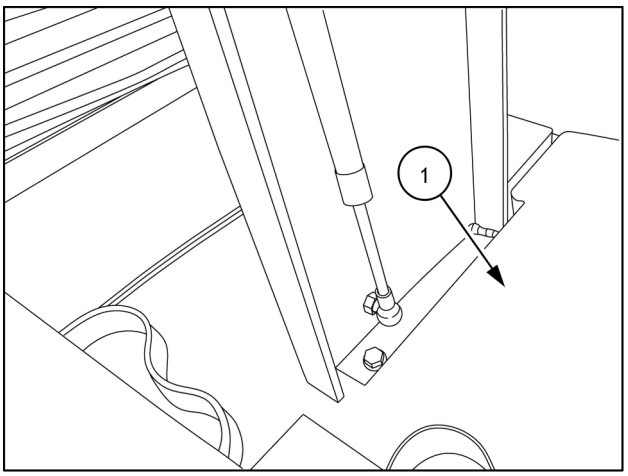
| | |
|---|---|
| SP.300F | |
| SP.345F | |
| SP.400F | |

1. Install the instructional seat into the proper position in the interior of the cab.
2. Install the two instructional seat mounting bolts and tighten to the proper specifications.




RAIL13SP05152AA 1

3. Place the floor mat into the proper position around the instructional seat.



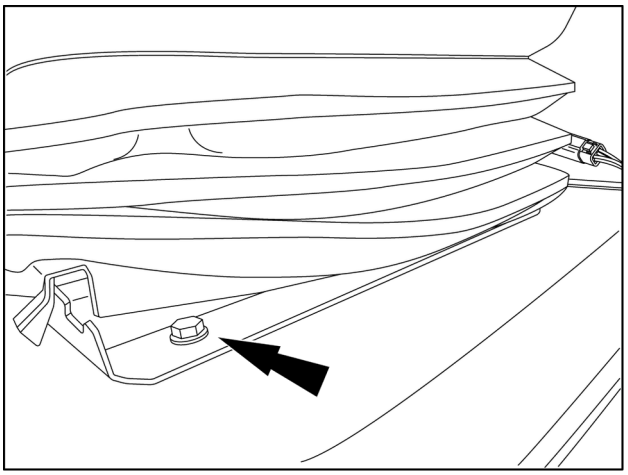

RAIL13SP05154AA 2

4. Place the base of the instructional seat into the proper position.
5. Cycle the seat up and down multiple times to ensure the proper component functionality.

# Seat suspension unit - Install

| | |
|---|---|
| SP.300F | |
| SP.345F | |
| SP.400F | |

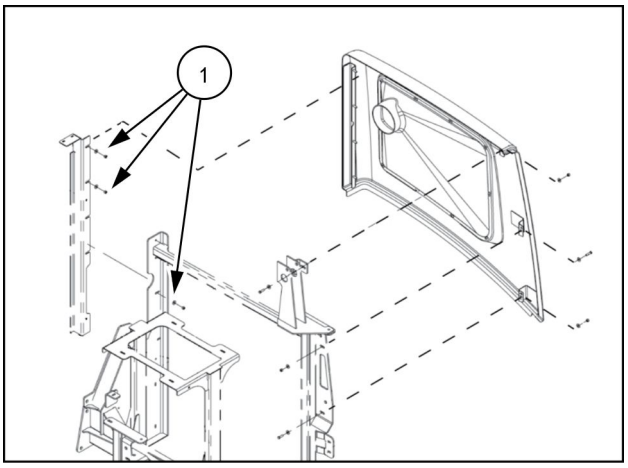
1. Place the seat suspension unit into position in the interior of the cab.
2. Secure the seat suspension to the floor of the cab using the four mounting bolts.
3. Place the seat cowling around the mounting bolt area.



RAIL13SP05153AA 1

**Next operation:**
Install the operators seat onto the seat suspension **Operator seat - Install (90.120)**.

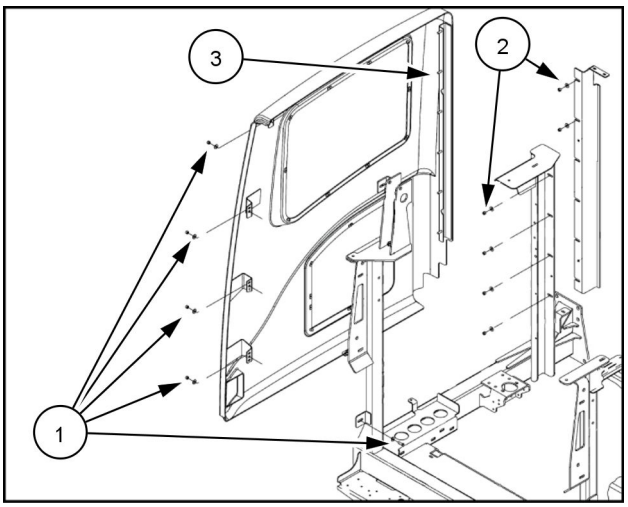
24. Remove the nuts and washers **(1)** from the upper right hand panel mounting studs, located at the front end of the panel. The studs are part of the panel.
25. Slide the upper right hand panel forward in order for the mounting studs of the panel to be removed from the mounting holes located in the vehicle frame posts. Remove the panel from the vehicle.




RAIL14SP01503AA 15

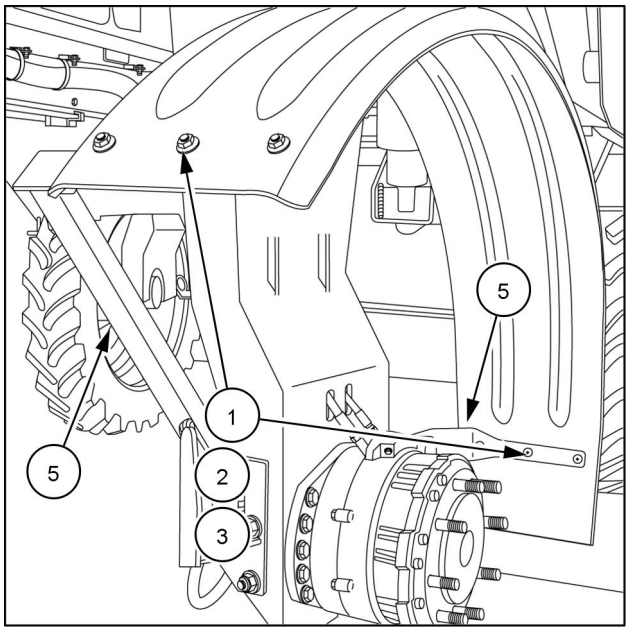
## Engine enclosure left hand panel removal

26. Attach an appropriate lifting device to the left hand panel. Ensure the panel is fully secured before removal of the panel hardware.
27. Remove the bolts, washers, and nuts **(1)** securing the rear end of the left hand panel to the vehicle frame post.
28. Remove the nuts and washers **(2)** from the left hand panel mounting studs, located at the front end of the panel. The studs are part of the panel.
29. Slide the left hand panel forward in order for the mounting studs **(3)** of the panel to be removed from the mounting holes located in the vehicle frame posts. Remove the panel from the vehicle.



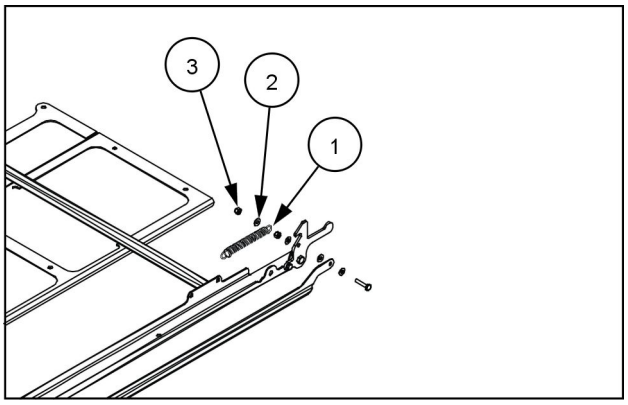

RAIL14SP01504AA 16

7. Install six locknuts **(1)**, washers **(2)**, and carriage bolts **(3)** securing fender **(4)** to fender bracket weldments **(5)**.



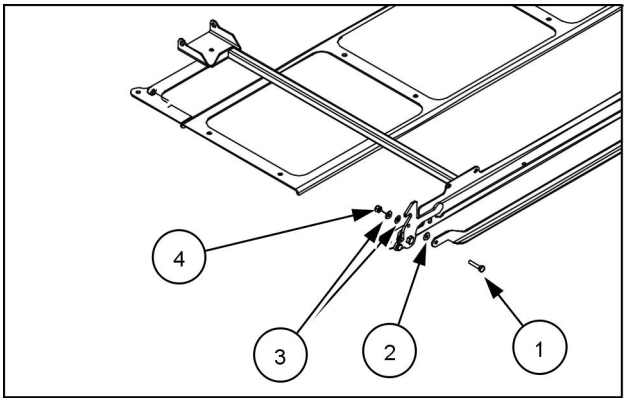

RAIL13SP03396AA 7

37. Place the open end of the spring **(1)** on to the bolt followed by a ¼ Stainless Steel Flat Washer **(2)** and a ¼-20 Stainless Steel Nylock Nut **(3)**. Tighten securely.




RAIL14SP01179AA 30

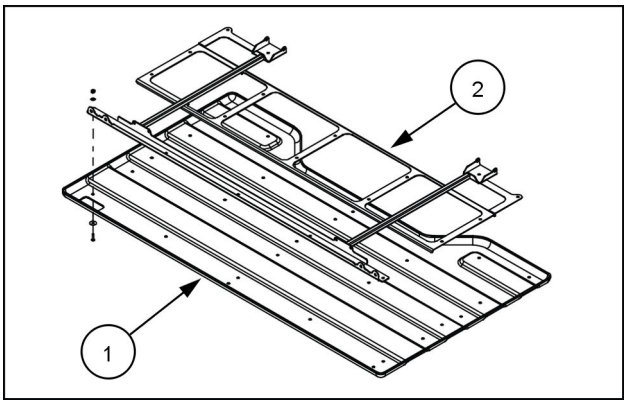
38. Assemble the front edge of the latch rod to the front hook. Insert a ¼-20 x 1-1/4 Stainless Steel Bolt **(1)** through the latch rod, place a ¼ Stainless Steel Flat Washer **(2)** on to the bolt. Insert the bolt through the unused hole in the hook. On to the bolt assemble two ¼ Stainless Steel Flat Washers **(3)** followed by a ¼-20 Stainless Steel Nylock Nut **(4)**. Tighten securely.




RAIL14SP01180AA 31

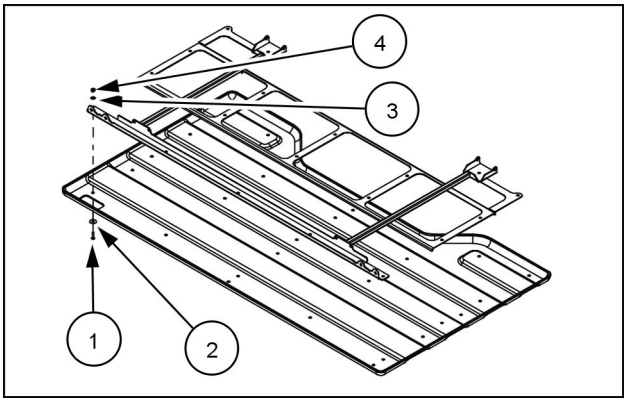
39. Place the right hand front panel near the front right side of the vehicle with the latch rod toward the center.

40. Position a Long Frame Mid Belly Pan Panel **(1)** on a work bench with the large indentation away from you and the panel lip up. On top of the panel, position the Belly Pan Option Weldment **(2)**. Align the right hand corner mounting hole with the second mounting hole in the panel on the right hand corner. The latch mounting tabs should be pointing upward.



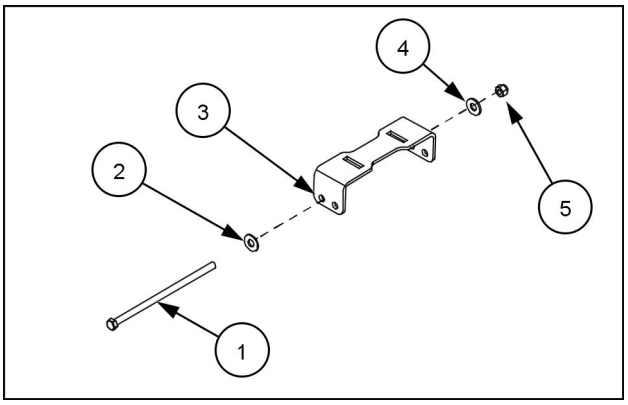

RAIL14SP01181AA 32

41. From the panel side, insert a ¼-20 x ¾ Stainless Steel Button Head Bolt **(1)** with a ¼ x 1 x .05 Stainless Steel Flat Washer **(2)** up through the panel and the weldment. Assemble a ¼ Stainless Steel Flat Washer **(3)** and a ¼-20 Stainless Steel Nylock Nut **(4)**. Do not fully tighten until all the bolts are assembled. Line up the remaining holes in the weldment with the corresponding holes in the panel. Insert a ¼-20 x ¾ Stainless Steel Button Head Bolt with a ¼ x 1 x .05 Stainless Steel Flat Washer up through the remaining holes. Assemble a ¼ Stainless Steel Flat Washer and a ¼-20 Stainless Steel Nylock Nut onto each bolt. After all the bolts are assembled, tighten all bolts securely.



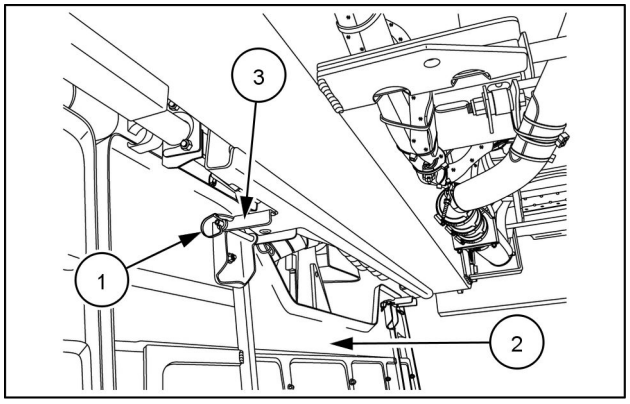

RAIL14SP01181AA 33

78. Insert a 3/8-16 x 8 Stainless Steel Bolt **(1)** with a 3/8 Wide Stainless Steel Flat Washer **(2)** through the rear hole of the door hitch bracket **(3)** . Secure in place with another 3/8 Wide Stainless Steel Flat Washer **(4)** and a 3/8-16 Stainless Steel Nylock Nut **(5)** . Tighten securely.




RAIL14SP01146AA 69

79. Using the Hitch Pins **(1)** hang the mid belly pan panels **(2)** on to the pivot bracket **(3)**. Insert the hitch pin through the pivot brackets and through the pivots on each panel on the rear and mid belly pan brackets. Secure the hitch pins in place with the clip pins.

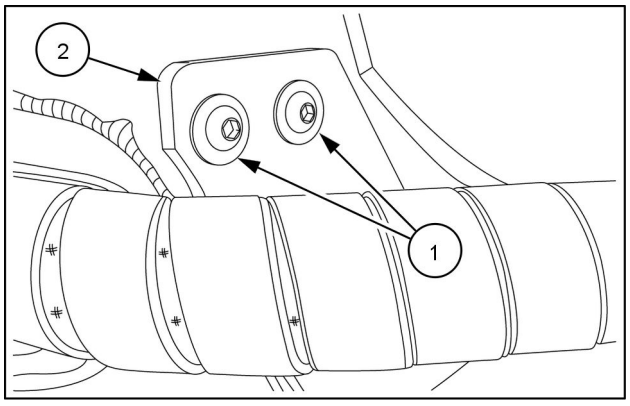



RAIL14SP01127AA 70

80. After the panels are assembled at the pivot points, adjust all brackets and door hitch assemblies to allow smooth latching of the panels. Tighten all hardware when proper adjustment is complete.

## Install front belly pan panel brackets

81. Remove the two bolts **(1)** securing the hose scuff guard **(2)** at the left front outside of the vehicle frame. Discard the hardware.




RAIL14SP01128AA 71