APACHE™

AS1025

2012 Owner's Manual

DO NOT OPERATE THIS EQUIPMENT UNTIL THIS MANUAL HAS BEEN READ AND UNDERSTOOD. ONLY PROPERLY TRAINED PERSONS SHOULD OPERATE THIS MACHINE.

EQUIPMENT TECHNOLOGIES ET

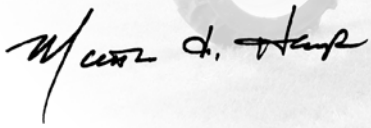
FORM # 580000086

Dear Valued Customer,

Congratulations on the purchase of your new Apache Sprayer and welcome to the Apache family of owners. We hope that your new sprayer exceeds your expectations and gives you years of satisfaction. We invite you to visit us at www.apachesprayer.com or in person at our plant in Mooresville, Indiana if you are in the area.

On behalf of all of our employees we thank you for your business.

Yours Faithfully,



Matthew F. Hays

Chief Executive Officer

NOTICE

Before applying chemicals or fertilizers with your Apache Sprayer, please check and calibrate the following precision agricultural equipment depending on the machine's configuration:

1. Check all settings and calibrations in your SCS 5000, Envisio Pro II or Viper Pro consoles:
    - Swath Width
    - Boom Section Calibration
    - Receiver Fore/Aft Settings
    - Valve Calibration
    - Flow Meter Calibration
    - Speed Calibration
    - Rate Calibration
    - Low Limit Setting
    - Valve Advance and Delay
2. Please review your Autoboom and Accuboom settings, if equipped.
3. Calibrate the SmarTrax™ autosteer, if equipped. SmarTrax calibration must be performed on a large, flat, open area. Make sure all settings are entered properly and that you perform the calibration in its entirety. This includes driving on an A-B line for roughly 20 minutes after automatic calibration is complete to allow the yaw sensor to learn how to acquire the line properly.

Chapter 5: Lubrication and Maintenance

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CHAPTER 1

GENERAL INFORMATION

The graphics and text in this manual generally describe the AS1025 Apache Sprayers. Apache Sprayers differ by model and by optionally installed equipment. Your Apache Sprayer may not exactly match the graphics and/or text descriptions in this manual. Please contact your dealer or Equipment Technologies with any questions regarding this manual or the instructions within.

2012 AS1025 Specifications

	AS1025
Tank Capacity	1000 gallons [3785.4 liters]
Engine	173 Cummins Interim Tier IV
Transmission	Standard: ZF Powershift 6-speed with lock-up torque converter
Speeds	1st 0 to 5 mph [8.04 km/h] 2nd 0 to 7 mph [11.27 km/h] 3rd 0 to 11 mph [17.7 km/h] 4th 0 to 17 mph [27.36 km/h] 5th 0 to 27 mph [43.45 km/h] 6th 0 to 35 mph [56.3 km/h]
Brakes	Internal, wet disc self-adjusting
Suspension	Front Axle: Center oscillation with independent hydraulic accumulated struts. Rear Axle: Patented hydraulic load suspension with compensating anti-sway control, self-adjusting for diminishing/increasing load.
Crop Clearance	42 in. [106.6] or 50 in. [127 cm]
Axles	120 in. [304.8 cm] Fixed Width Axle (Standard) 120 to 160 in. [304.8 to 406.4 cm] Adjustable Axle Width with Optional Hydraulic Adjust
Final Drive	ITL/JCB planetary gearset (42 in. [106.6 cm] CC); Fairfield all gear drop box (50 in. [127 cm] CC)
Cab	ET custom pressurized cab
Weight	18,500 lbs [8391.4 kg] dry weight
Width	12 ft [3.65 m]

	AS1025
Height	143 in. [3.63 m]
Length	24 ft. [7.3 m]
Booms	80 ft [24.3 m], 90 ft [27.4 m], 100 ft [30.4 m], 60/80 ft [18.2/24.3 m], 60/90 ft [18.2/27.4 m]
Boom Height	14 to 74 in. [35.5 to 187.9 cm] (42 in. [106.6 cm] CC); 22 to 82 in. [55.9 to 208.3 cm] (50 in. [127 cm] CC)
Wheel Base	15 ft [4.6 m]
Tires	Standard Front: 380/80R38 Standard Rear: 380/90R46
Turning Radius	17 ft [5.1 m]
Fuel Capacity	100 gallons [378.5 liters]
Product Pump	Hypro 9306C HM1C, hydraulically driven centrifugal pump

Apache AS1025 Fluids, Filters and Capacities

Component	Lubrication	Capacity Quarts [Liters]	Filter Part Number
Engine Oil	Lucas 15W-40 Magnum Motor Oil	16 [15]	201450305
Engine Coolant	KostGuard Universal Antifreeze 50/50	24 [22.7]	----
Engine Primary Air Filter	----	----	201300140
Engine Safety Air Filter	----	----	201300141
Transmission	Lucas 15W-40 Magnum Motor Oil	27 [25.5]	310100001
Differential (Rear Axle)	Lucas Universal Hydraulic Fluid	11.9 [11.2]	----
Planetary	Lucas 80/90 Gear Oil	2.2 [2]	----
Rear Drop Box	Lucas 80/90 Gear Oil	21 [20]	----
Engine Fuel	Diesel	100 Gallons [379 Liters]	Filter: 201450304 Separator: 201450303
Hydraulic System	Lucas Universal Hydraulic Fluid	40 Gallons [151.2 Liters]	Filter: 880000026 Strainer: 840000010 Hydraulic Filter Kit: K65000209 Hydraulic Filter Kit with Oil: K65000210
Front Suspension	Lucas Universal Hydraulic Fluid	as required	----
A/C System	R134a	2.6 lbs	----
Cab Filters	----	----	Cab Filter Kit: K65000190 Charcoal Filter: 490003651* Recirculating Filter: 490006661*
Crankcase Ventilation Filter	----	----	201450305
* - Included in kit K65000190 NOTE: Any oil and fluid substitutions must meet or exceed recommended fluid specifications.			

Tire Pressure (Cold)

- 320/85R38 . . . . . 41 psi [2.82 bar]
- 320/90R50 . . . . . 78 psi [5.37 bar]
- 380/80R38 . . . . . 35 psi [2.41 bar]
- 380/90R46 . . . . . 60 psi [4.31 bar]
- 480/70R34 . . . . . 46 psi [3.17 bar]
- 520/85R46 . . . . . 23 psi [1.58 bar]
- 30.5x32R-3 . . . . . 26 psi [1.79 Bar]

Lug Nut Torque

- All Wheels . . . . . 420 lb-ft [570 N•m]

Wet System Capacities

- Product Tank . . . . . 1000 gallons [3785 Liters]
- Rinse Tank . . . . . 100 gallons [379 Liters]

Hydraulic Pump Output . . . . . 2400 psi [168.9 bar]

AS1025 Optional Equipment

The following chart lists optional kits available for the AS1025 Apache Sprayer. The kits include all parts, brackets and mounting hardware needed for installation.

Part Number	Description
K65000171	Fence row nozzle 1 side 60/80 and 80 ft. booms. Order 2 kits for both sides.
K65000172	Fence row nozzle 1 side 90 and 100 ft. booms. Order 2 kits for both sides.
K65000197	Foam marker for straight booms.
K65000198	Foam marker for combo booms.
K65000205	3” quick fill for poly tank.
K65000238	3” quick fill for stainless tank.
K65000212	Flowmax fill station flow meter.
K65000191	Sprayer survival kit.
K65000209	Hydraulic filter kit (without oil)
K65000210	Hydraulic filter kit (with oil)
K65000244	Yearly service filter kit (AS1025)
K65000196	Hypro chemical eductor kit for poly product tank.
K65000240	Hypro chemical eductor kit for stainless steel product tank.
K65000223	SCS 5000 monitor. Includes hardware and adapter.
K65000224	Envizio Pro II console. Includes hardware and MBA 6 antenna.
K65000225	Viper Pro console. Must choose Phoenix 200 or 300 antenna kit.
K65000226	Precision wiring, includes harnesses, switchbox, boom speed/sense node and product node.
K65000231	PowerGlide Plus auto boom kit
K65000232	UltraGlide with 3 sensors (ultrasonic eye autoboom)
K65000236	UltraGlide with 5 sensors (ultrasonic eye autoboom)
K65000239	Add UltraGlide to existing PowerGlide
K65000213	Add PowerGlide to existing UltraGlide
K65000227	Antenna kit with Phoenix 200. (Viper Only)
K65000228	Antenna kit with Phoenix 300. (Viper Only)
K65000229	SmarTrax autosteer kit. Must have Envisio Pro II or Viper Pro.
K65000230	Accuboom kit. Must have Envisio Pro II or Viper Pro.
K65000222	Hydraulic Adjust On the Go 2012
K65000202	Fender kit: front tires 42 and 50 in. CC (cannot be used with semi- or full-float tires)
K65000203	Fender kit: rear axle 42 in. CC (cannot be used with semi- or full-float tires)

Part Number	Description
K65000204	Fender kit: rear axle 50 in. CC (cannot be used with semi- or full-float tires)
K65000222	Hydraulic adjust on the go (120-160 adjustable axles only)
K65000079	Rear semi-float tires and rims for 42 in. CC; tire size 520/85R46
K65000081	Rear semi-float tires and rims for 50 in. CC; tire size 520/85R46
K65000080	Front semi-float tires and rims; tire size 480/70R34
K65000083	Rear full-float tires and rims for rear of 50 in. CC only; tire size 30.5x32R-3 (no full-float front tire option)
K65000106	Dual rear tire kit for 50 in. CC; tire size 380/90R46 (standard tires)
K65000218	Dual rear tire kit for 50 in. CC; tire size 320/90R50 (narrow tires)

NOTES

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CHAPTER 2

SAFETY

Apache is committed to the safe design and operation of its products. This Apache Sprayer has been designed and manufactured with your personal safety while operating this Apache Sprayer as a primary concern.

Safety Symbols, Signal Words and Statements

Safety symbols, signal words and statements, and symbols are used in this manual and on the Apache Sprayer to identify and alert you of potential hazards where personal safety precautions are required.

The safety alert symbol is used to alert you of potential personal injury hazards. Carefully read the safety message associated with safety symbol and follow any instructions provided to ensure your safety.

Safety signal words are used to alert you of potential personal injury hazards. Carefully read the safety message associated with safety signal word and follow any instructions provided to ensure your safety.

Safety statements are used to explain and inform you of potential personal injury hazards and provide precautionary instructions. Read, understand and follow all safety messages and information contained in this manual and on the Apache Sprayer to prevent personal injury and ensure safe reliable Apache Sprayer operation.

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE:Indicates a potentially hazardous situation which, if not avoided, may result in improper Apache Sprayer operation and/or damage to equipment, property and the environment.

Safety Precautions

There is no substitute for common sense and following careful operation and service practices. Improper practices and carelessness can cause personal injury or even death.

The following safety precautions and guidelines must be followed in addition to the specific safety precautions listed throughout this manual and on the Apache Sprayer to reduce the risk of personal injury.

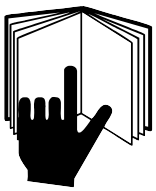
Keep this manual and all included literature in a safe and convenient location. Contact your Apache dealer or Apache at (800) 861-2142 to obtain replacement owner's manuals and safety decals.

To ensure your safety, the safety of others, and the safe operation of the sprayer, read, follow and practice the following:

⚠ WARNING

The safety messages that follow have WARNING level hazards.

Pre-Operation Hazards



Read and understand this Owner's Manual before operating or servicing the Apache Sprayer to ensure that safe operating practices and maintenance procedures are followed. If you do not understand any part of this manual and need assistance, see your Apache dealer for assistance.

- ***NEVER permit anyone to operate the Apache Sprayer without proper training. Obtain proper knowledge and training before attempting to perform any operation or service procedure in this manual.***
- ***This Apache Sprayer and its attachments are designed to spray liquid product. Use of this Apache Sprayer in any other manner other than its intended use is prohibited.***

- ***Remove or clean contaminated clothing before entering the cab.***
- ***Some components and systems of Apache Sprayers are manufactured by companies other than Apache and have specific safety, inspection, adjustment and maintenance procedures outlined by their manufacturer. Carefully read and understand all non-Apache Sprayer and sprayer manufacturer instructions and manuals supplied with the Apache Sprayer. These include, but are not limited to the Engine Owner's Manual, Sprayer Monitor System Manual, Radio Manual, Chemical Eductor Manual, Product Pump Instructions and other optional equipment.***

Fire and Explosion Hazards

Diesel fuel is flammable and explosive under certain conditions. Store any containers containing fuel in a well-ventilated area, away from any combustibles or sources of ignition.

- ***NEVER use a shop rag to catch spilling fuel.***
- ***Wipe up all fuel spills immediately.***
- ***NEVER refuel with the engine running.***

- ***ALWAYS have appropriate safety equipment available. Have all fire extinguishers checked periodically for proper certification, operation and/or charge capacity.***
- ***ALWAYS read and follow safety-related precautions found on containers of hazardous substances like parts cleaners, primers, sealants and sealant removers.***

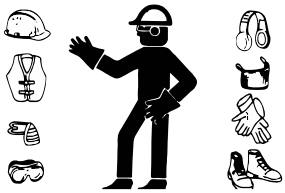
Burn Hazards

Some of the engine surfaces become very hot during operation and shortly after shutdown. Keep hands and other body parts away from hot engine surfaces.

Lifting Hazards

- ***ALWAYS use lifting equipment with sufficient capacity to lift the Apache Sprayer or equipment.***
- ***If transport is needed for repair, acquire assistance when using a hoist and when loading and unloading.***

Exposure Hazard



ALWAYS wear the appropriate personal protective equipment as required by the task at hand, including but not limited to:

- ***Relatively tight and belted clothing***
- ***Safety gloves***
- ***Safety shoes/boots***
- ***Safety eye glasses/goggles/shields***
- ***Hearing protection, ear plugs***
- ***Head protection, hard hats***
- ***ALWAYS wear a respirator, goggles and gloves in addition to wearing long shirt sleeves and long pants when handling chemicals. Read the chemical safety label or instructions before usage.***

Entanglement / Sever Hazard

NEVER wear jewelry, watches, unbuttoned cuffs, ties or loose-fitting clothing and ALWAYS tie long hair back when working near moving/rotating parts.

- ***ALWAYS Keep hands, feet, hair and clothing away from all moving/rotating parts.***
- ***NEVER operate the engine without the guards in place.***

Alcohol and Drug Hazard

- ***DO NOT operate or service the Apache Sprayer while under the influence of alcohol, awareness-altering drugs or medications that would affect your ability to operate or maintain the sprayer safely.***

Exhaust Emissions Safety

Carefully read all safety information and observe any exhaust or pollution safety instructions. Be aware of and follow all regulations and policies as outlined by the engine OEM to maintain exhaust emission compliance with the Environmental Protection Agency (EPA), California Air Resources Board (CARB) and Environment Canada where applicable.

It is the owner's responsibility to keep the Apache Sprayer maintained and within compliance.

The state of California, U.S., has special regulations that may exceed the EPA regulations. If the Apache Sprayer is operated or serviced in the state of California, observe all exhaust and pollution regulations.

WARNING! Exhaust Gas Exposure Hazards

- ***All internal combustion engines create carbon monoxide gas during operation and special precautions are required to avoid carbon monoxide poisoning. Prolonged exposure to carbon monoxide will cause brain damage or death.***
- ***ALWAYS operate the engine outside in a well-ventilated area.***
- ***NEVER block windows, vents or other means of ventilation if the engine is operating in an enclosed area.***
- ***ALWAYS ensure that all connections are tightened to specifications after repair is made to the exhaust system.***

Environmental Precautions

The safety messages that follow have NOTICE level hazards.

- *Thoroughly clean any spilled fluids from the equipment and/or ground after service is completed. Dispose of used fluids and filters as required by law.*
- *ALWAYS be environmentally responsible. Follow the guidelines of the EPA or other governmental agencies for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.*
- *NEVER dispose of hazardous materials by dumping them into a sewer, on the ground, or into ground water or waterways.*

Safety Belt

WARNING! Impact Hazards.

- ***ALWAYS fasten your seat belt when operating the Apache Sprayer. The safety belt must be worn properly by the driver anytime the Apache Sprayer is in motion.***
- ***NEVER alter or tamper with any safety belt system components.***

Safety belt systems are designed to limit occupant motion by restraining occupants' bodies within the cab and prevent, or reduce the severity of, injuries during most types of collisions. When safety belts are used properly, they are effective in reducing the risk of injury.

Inspect the safety belt system regularly for cuts, frays, wear, discoloration or abrasion. The hardware, mounts, retractor and belt should work freely. The belt and/or components must not show signs of deterioration. If you suspect any part of the system is in need of repair, have the system repaired or replaced immediately and use only parts designed for the safety system.

WARNING! Impact Hazard. DO NOT operate the Apache Sprayer if any part of the seat belt system is damaged. The system must be repaired or replaced before operating the Apache Sprayer.

NOTICE:DO NOT use harsh cleaners, bleach or any products which could cause the safety belt material to deteriorate.

Safety Decals

CAUTION! ALWAYS read and follow the safety decals on the Apache Sprayer. Safety decals are additional reminders for safe operating and maintenance techniques.

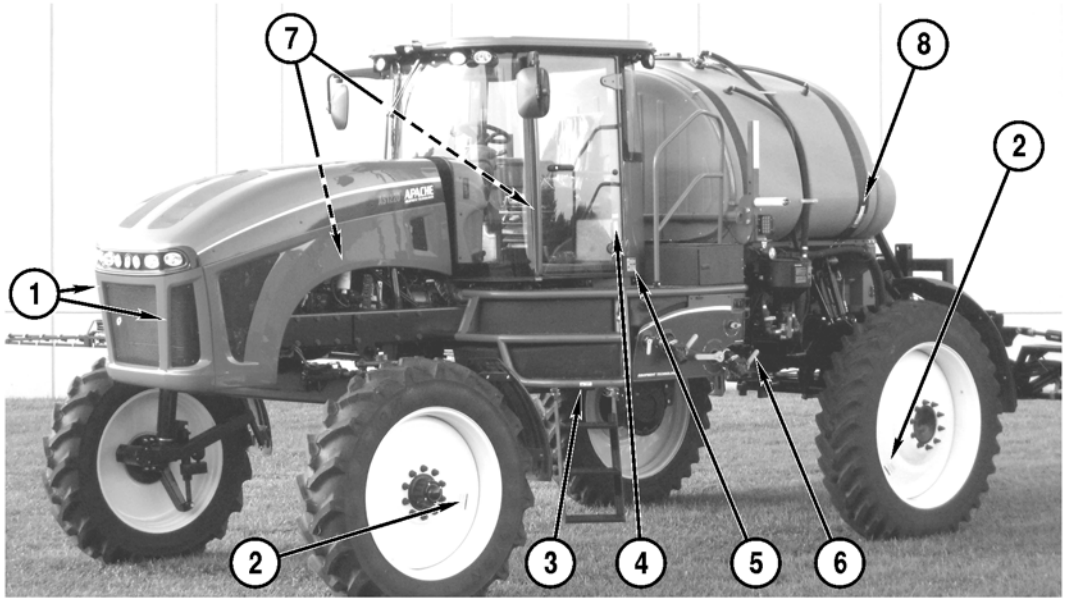
Safety decals are used to explain and inform you of potential personal injury hazards and provide precautionary instructions. Read, understand and follow all safety decals on the Apache Sprayer to prevent personal injury and ensure safe reliable Apache Sprayer operation.

NOTICE:Prevent safety decals from becoming dirty or damaged and replace them immediately should they become damaged or are missing. Should an Apache Sprayer part that has a decal attached to it need replacement, obtain a new decal with the new part.

Contact your Apache dealer or Apache at (800) 861-2142 to obtain replacement safety decals.

To ensure your safety, the safety of others and the safe operation of the sprayer, read, follow and observe the following safety decals.

Exterior Decal Locations



1.

⚠ WARNING

BURN / SEVER HAZARD

Keep fingers clear of hot surfaces and rotating parts while engine cover is open and engine is running.

420306036

2.

⚠ WARNING

TIRE HAZARD

- Torque wheel bolts to 420 ft-lb (570 N•m). Check torque daily for first week of operation and weekly thereafter.
- Replacement tire must meet or exceed original tire specifications. Failure to comply may cause tire failure resulting in serious injury or death.

420306033

3.

⚠ WARNING

STRIKING BYSTANDER HAZARD

Keep bystanders away from automatic ladder; it may move unexpectedly.

420306059

4.

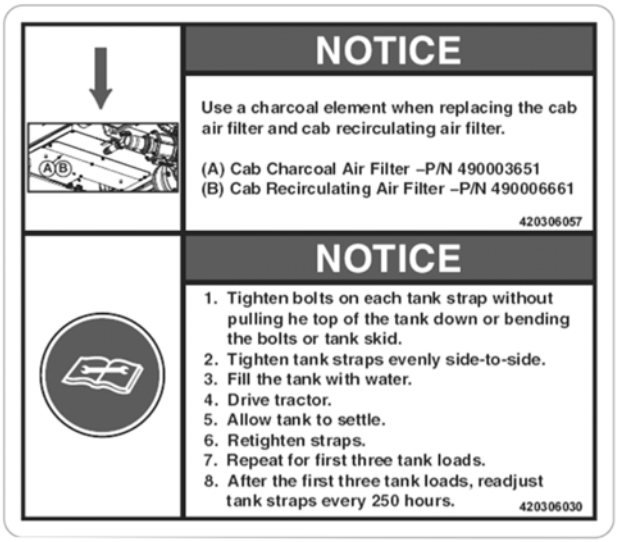
⚠ WARNING

FALLING HAZARD

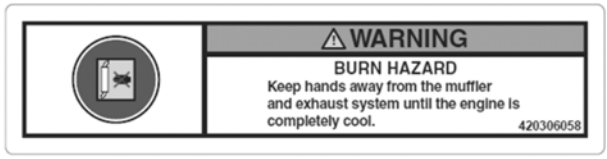
Never allow riders on the machine.

420305530

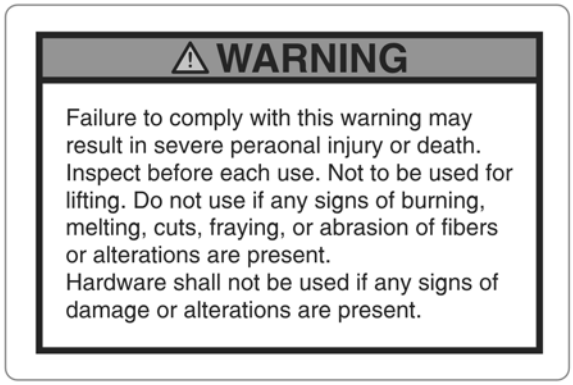
5.


NOTICE
Use a charcoal element when replacing the cab air filter and cab recirculating air filter.
(A) Cab Charcoal Air Filter –P/N 490003651
(B) Cab Recirculating Air Filter –P/N 490006661
420306057
NOTICE
1. Tighten bolts on each tank strap without pulling he top of the tank down or bending the bolts or tank skid.
2. Tighten tank straps evenly side-to-side.
3. Fill the tank with water.
4. Drive tractor.
5. Allow tank to settle.
6. Retighten straps.
7. Repeat for first three tank loads.
8. After the first three tank loads, readjust tank straps every 250 hours.
420306030

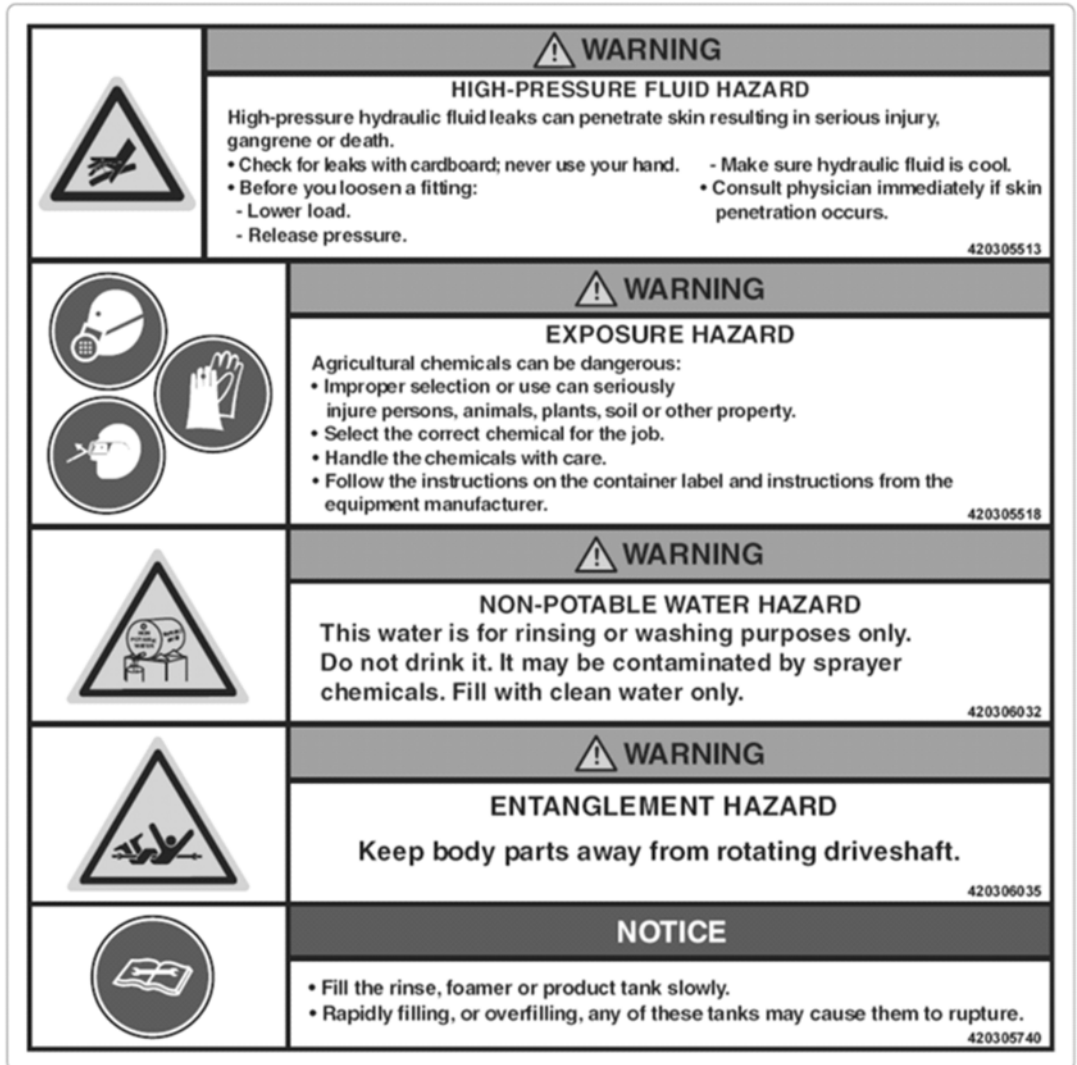
7.


WARNING
BURN HAZARD
Keep hands away from the muffler and exhaust system until the engine is completely cool.
420306058

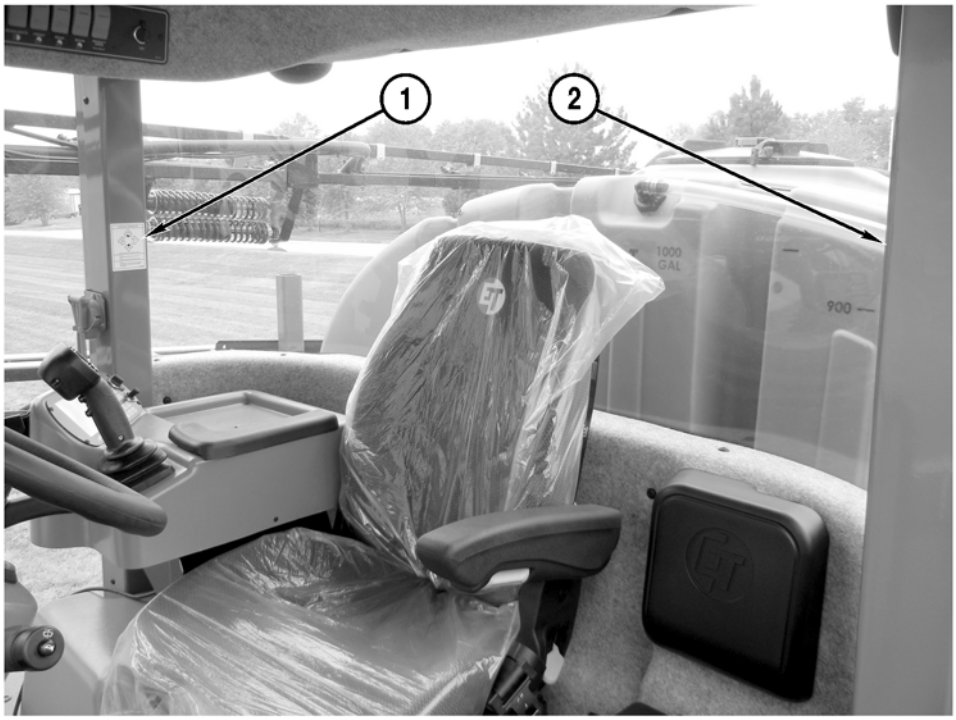
8.


WARNING
Failure to comply with this warning may result in severe peraonal injury or death. Inspect before each use. Not to be used for lifting. Do not use if any signs of burning, melting, cuts, fraying, or abrasion of fibers or alterations are present.
Hardware shall not be used if any signs of damage or alterations are present.

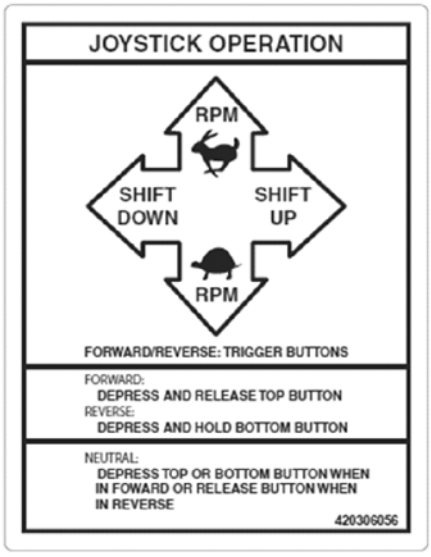
6.


WARNING
HIGH-PRESSURE FLUID HAZARD
High-pressure hydraulic fluid leaks can penetrate skin resulting in serious injury, gangrene or death.
• Check for leaks with cardboard; never use your hand.
• Before you loosen a fitting:
- Lower load.
- Release pressure.
- Make sure hydraulic fluid is cool.
• Consult physician immediately if skin penetration occurs.
420305513
WARNING
EXPOSURE HAZARD
Agricultural chemicals can be dangerous:
• Improper selection or use can seriously injure persons, animals, plants, soil or other property.
• Select the correct chemical for the job.
• Handle the chemicals with care.
• Follow the instructions on the container label and instructions from the equipment manufacturer.
420305518
WARNING
NON-POTABLE WATER HAZARD
This water is for rinsing or washing purposes only. Do not drink it. It may be contaminated by sprayer chemicals. Fill with clean water only.
420306032
WARNING
ENTANGLEMENT HAZARD
Keep body parts away from rotating driveshaft.
420306035
NOTICE
• Fill the rinse, foamer or product tank slowly.
• Rapidly filling, or overfilling, any of these tanks may cause them to rupture.
420305740

Interior Decal Locations



1.



2.

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CHAPTER 3

OPERATION

Before performing any operation procedures, read the following safety messages and read the Safety Section.

WARNING! Control Hazard. DO NOT operate the Apache Sprayer while wearing a headset to listen to music or radio because it will be difficult to hear the warning signals.

WARNING! Impact Hazard. Secure any loose items in cab. Items that are unsecured may cause injury in case of a roll-over.

WARNING! Roll-Over Hazards

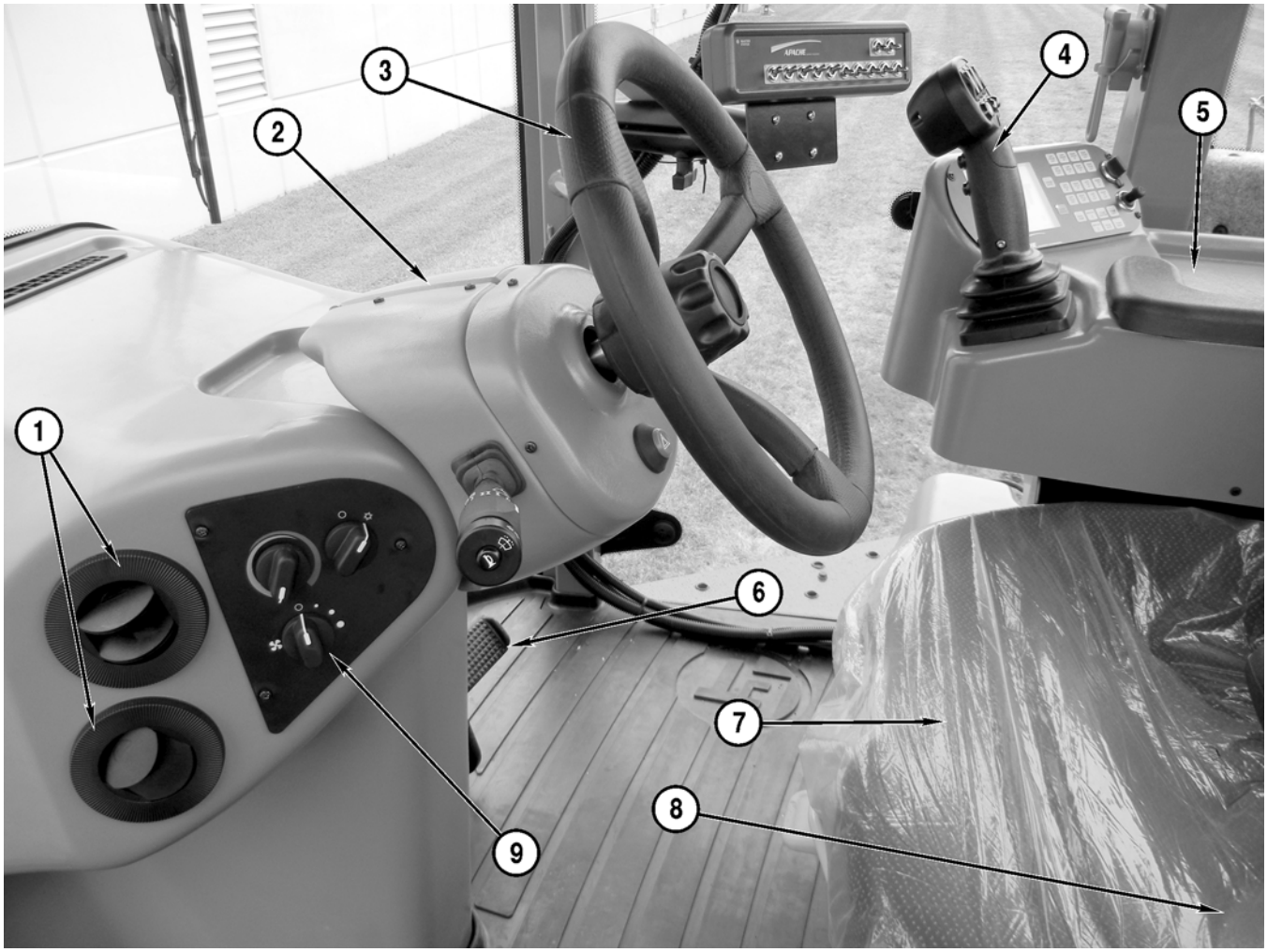
- ***DO NOT operate on steep slopes.***
- ***DO NOT drive across a slope. Drive up and down slopes.***
- ***DO NOT turn down a slope.***
- ***Slow down when turning.***
- ***Keep booms as close to the ground as possible.***
- ***Drive slowly across rough ground.***
- ***DO NOT operate on public roads or highways with product in the product tank.***
- ***ALWAYS come to a complete stop before reversing directions.***

Pre-Operation Checks

Before operating the Apache Sprayer, perform the following safety and equipment checks.

- Read and understand this manual before operating the Apache Sprayer.
- Read and follow all safety messages and safety decal instructions in this section. See ”Safety” on page 2-1.
- Check the condition of all safety decals. Replace if damaged.
- Check that all shields and guards are properly installed and in good working condition. Replace if damaged.
- Check all hardware for proper installation and torque. See ”Torque Value Charts” on page 7-1.
- Check the operating area for bystanders and obstruction before operating.
- Check that all hydraulic hoses and fittings are in good condition and not leaking. Make sure the hoses are routed to prevent damage, not twisted, sharply bent, kinked, frayed, or pulled tight or rubbing, before starting the Apache Sprayer. Replace any damaged hoses or fittings immediately.
- Check the operation and condition of the seat belt. Immediately repair or replace the seat belt if damaged or if it does not operate properly.
- Check tires for proper inflation pressure according to tire manufacturer’s recommendations. Specifications are also provided on the back cover of this manual. See ”Check Tire Pressure” on page 5-12.
- Check engine oil level and add oil as needed. See ”Check Engine Oil Level” on page 5-12.
- Check transmission fluid level and add fluid as needed. See ”Check Transmission Oil Level” on page 5-14.
- Check differential, gearboxes and/or planetaries fluid levels and add fluid as needed. See ”Check Differential Fluid Level” on page 5-18.
- Check coolant level and add coolant as needed. See the engine manufacturer’s manual for details.
- Check hydraulic reservoir fluid level and add fluid as needed. See ”Check Hydraulic Fluid Level” on page 5-14.

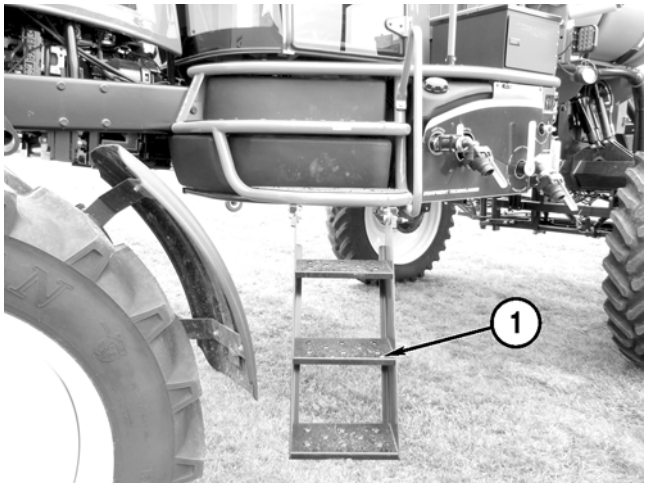
Cab Overview



1. **Air vents**
2. **Steering Column**
3. **Steering Wheel**
4. **Joystick**
5. **Side Console**
6. **Brake Pedal(s)**
7. **Air Seat**
8. **Fire Extinguisher (behind seat)**
9. **Climate Controls**

Cab Access Ladder

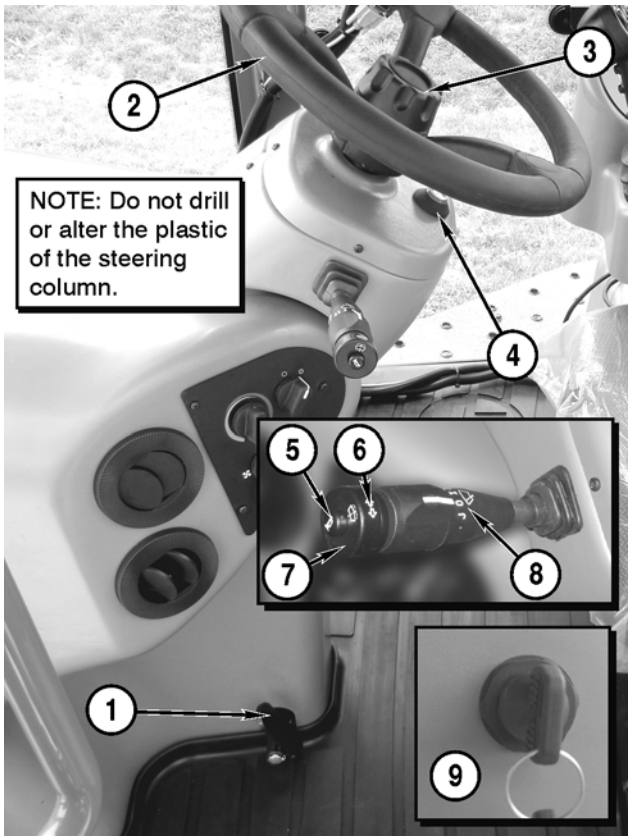
1. **Access Ladder**
   The cab access ladder is automatically actuated by the parking brake switch.
   - When the parking brake is applied, the ladder folds down.
   - When the parking brake is released, the ladder folds up.



Steering Column

NOTE: DO NOT drill or alter in any way, the plastic of the steering column.

1. **Steering Column Tilt Adjustment Lever**
   - Step forward on the foot lever.
   - Adjust the tilt to the desired position.
   - Release the foot lever to lock the column.
2. **Steering Wheel**
3. **Steering Wheel Telescope Adjustment Knob**
   - Turn center knob counterclockwise to unlock.
   - Position steering wheel to desired height.
   - Turn center knob clockwise to lock.
4. **Hazard Flasher Button**
5. **Horn Button**
   Push to sound horn.
6. **Turn Signal Lever**
   - Push lever up for right turn signal.
   - Push lever down for left turn signal.
7. **Windshield Washer**
   - Push ring to operate washer.
8. **Windshield Wiper Switch**
   - Turn lever to the “I” position for low speed wiper.
   - Turn lever to the “II” position for high-speed wiper.
9. **Key Switch**
   Shown in the “OFF” position. See ”Starting and Stopping the Engine” on page 3-12.



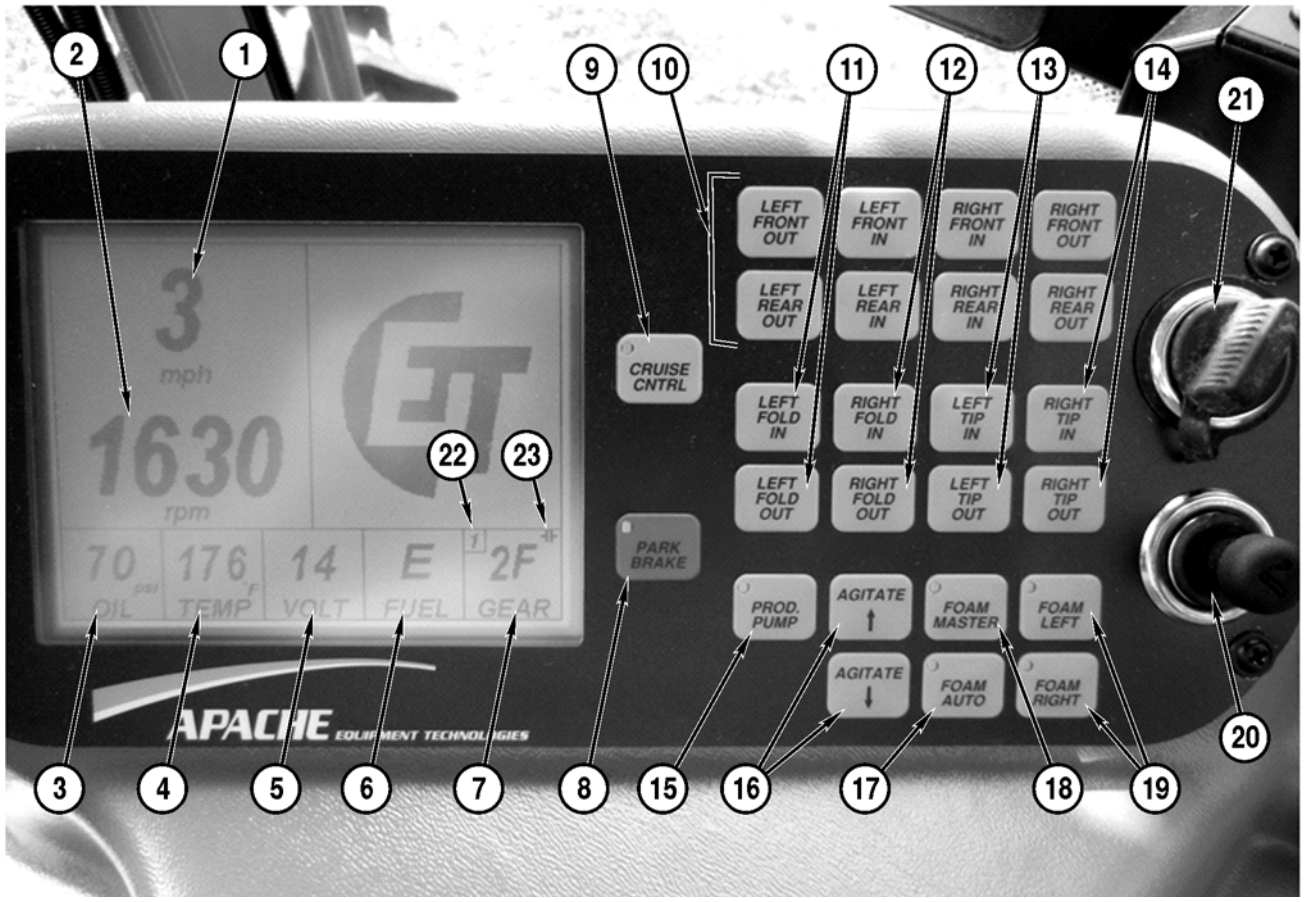
Fault Code Indicator:

1. **Fault Code Indicator on Console**
   When a fault code is logged, the ET logo will disappear on the right side of the console display and one or more of the following fault codes will appear:
   - Stop Engine
   - Check Engine
   - Water In Fuel
   - Wait To Start
   - Water Temperature
   - Failed Fuse F11
   - Low Oil Pressure
   - Change Air Filter
   - High Hydraulic Temp
   - High Trans Temp
   - Low Coolant
   - ECU Failure
   - Trans Fault
   - SPN 00000 FMI 00

Refer to Cummins Engine Fault Codes on page 6-1.

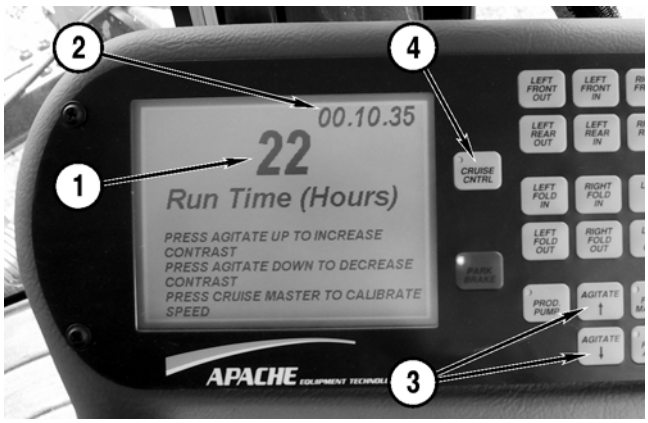
Contact you local dealer for trans fault codes.

Apache Sprayer Console



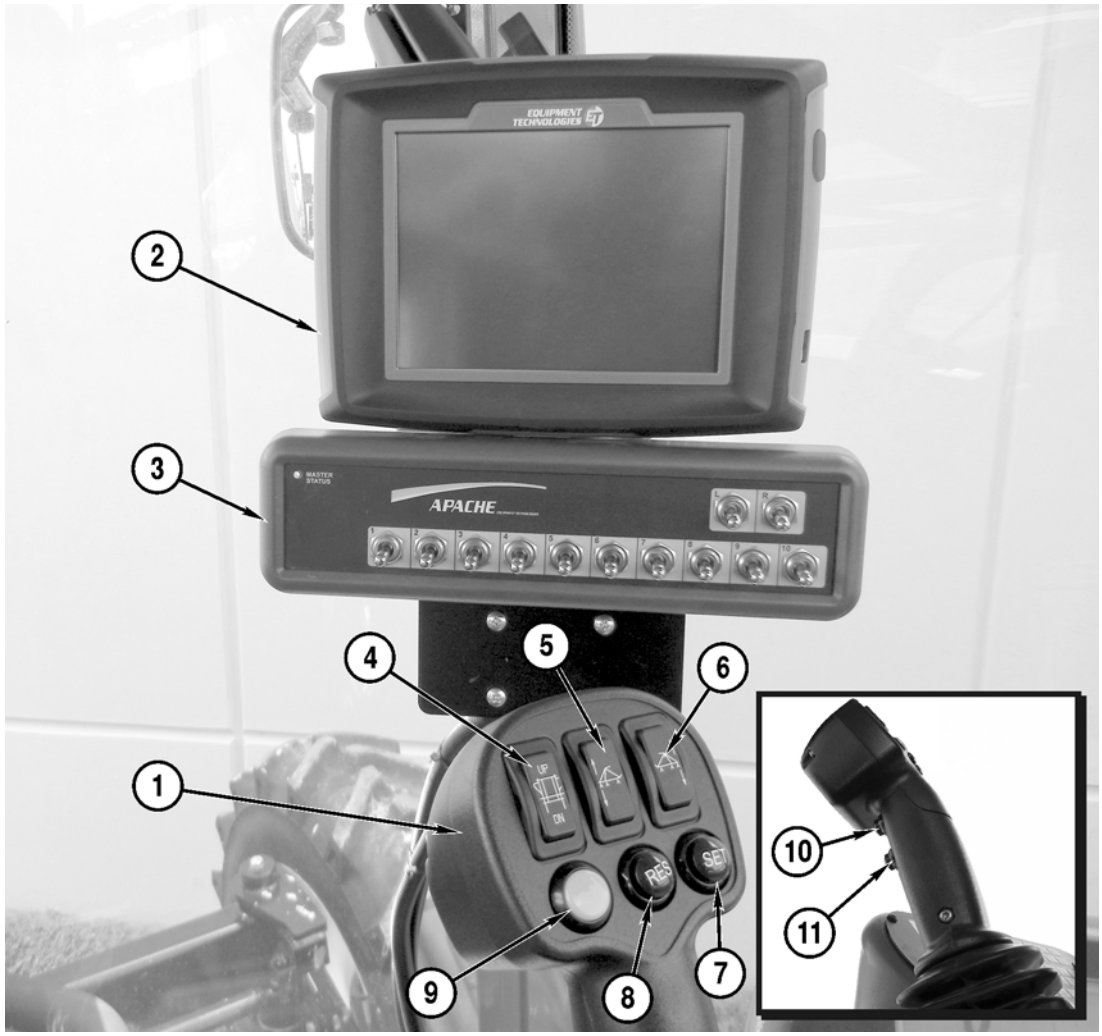
1. MPH Readout
2. Engine RPM
3. Engine Oil Pressure
4. Engine Water Temperature
5. Voltage Level
6. Fuel Level
7. Direction and Gear Indicator (Indicates current, actual transmission gear)
8. Park Brake Switch
9. Cruise Control Master Switch
10. Axle Hydraulic Adjust Switches In and Out (Optional)
11. Left Boom Fold In and Fold Out
12. Right Boom Fold In and Fold Out
13. Left Boom Tip Fold In and Fold Out
14. Right Boom Tip Fold In and Fold Out
15. Product Pump On/Off Switch
16. Agitation Pressure Increase and Decrease
17. Foam Auto On/Off
18. Foam Master On/Off Switch
19. Turn Foam Drop On for Right Side and Left Side
20. Cigarette Lighter
21. Auxiliary Power Outlet
22. High Limit Gear Selected by Operator (appears in auto mode only)
23. Torque Converter Lock Up Indicator (appears only when converter is locked)

The console displays the machine hours, software version, and instructions for screen contrast adjustment and speed calibration for the first 5 seconds of the key being turned from the off position to the run position.



1. **Number of Hours On Machine**
2. **Software Version Number**
3. **Console Display Contrast Adjust**
   To adjust the contrast of the console display:
   - Press the agitate increase button and hold to increase the contrast of display.
   - Press the agitate decrease button to decrease the contrast of display.
     Both must be done before start up of the Apache Sprayer while the display is in this mode.
4. **Speed Calibration**
   To calibrate the speed of the Apache Sprayer:
   - Press the cruise master button (while the board is in this state).
   - Press the cruise master a second time.
   - Drive a measured mile, 5,280 feet [1.6km].
   - Drive through the mark at end of measure mile, pushing the cruise master when the front wheels are crossing the mile mark. This will automatically reset the speed reading on the Apache Sprayer.

Joystick and Envisio Pro II Console



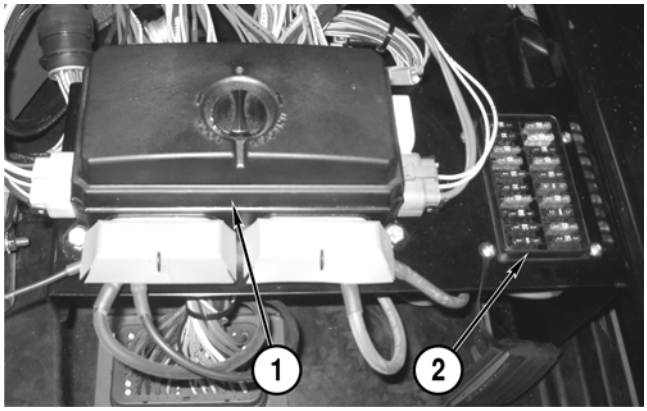
1. **Joystick**
   See ”Apache Sprayer Direction and Speed” on page 3-14. for complete operations.
2. **Envisio Pro II Console**
3. **Boom Switch Box**
4. **Boom Rack**
   Press to move the boom rack up or down.
5. **Left Boom Tilt**
   Press to tilt the left boom up or down.
6. **Right Boom Tilt**
   Press to tilt the right boom up or down.
7. **Set Button for Cruise**
   Press to set cruise control.
8. **Resume Button for Cruise**
   Press to resume cruise control.
9. **Master Spray Switch**
   Press to turn all five spray sections on or off.
10. **Transmission Forward Direction Trigger Button**
11. **Transmission Reverse Direction Trigger Button**
    The reverse button must be held in to move in reverse.

Fuse Blocks

The fuse blocks are located under a service cover inside the right, rear, of the cab. The cover is shown removed for clarity.

The main fuse block (1) contains both mini spade fuses and relays, as well as a fuse removal tool. The small fuse block (2) contains only regular spade fuses.

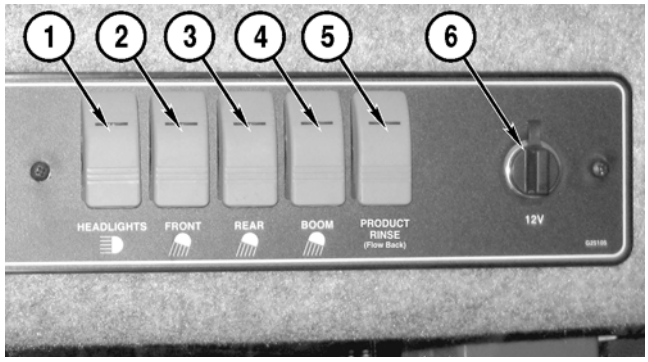
To access the main fuse block fuses, remove the cover by rotating the knob on top 1/4 turn to the UNLOCK position. To access the fuses in the small fuse block, flip up the snap-on lid.

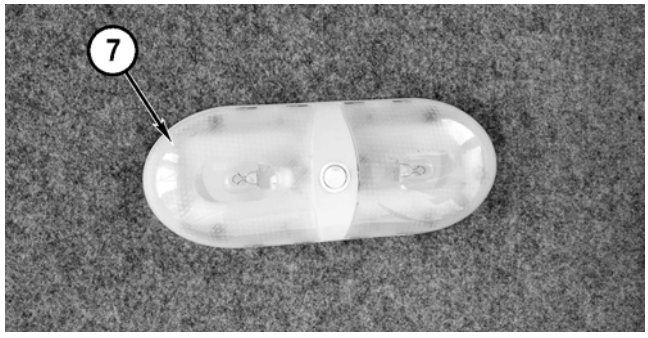


Light Switches

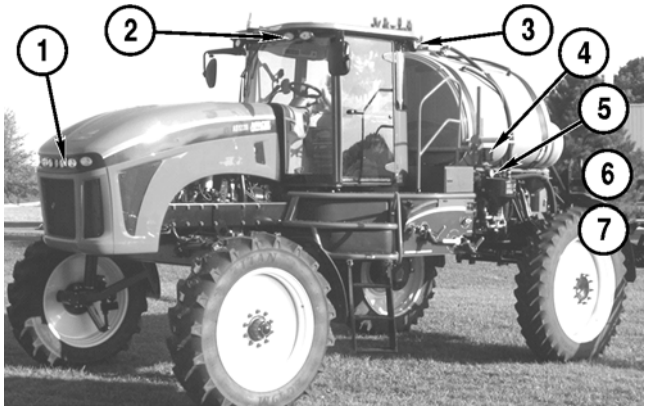
1. **Headlights**
   - Press the switch down to turn on the hood-mounted headlights, marker lights and tail lights.
   - Press the switch up to turn off the lights.
2. **Cab Front Lights**
   - Press the switch down to turn on the cab-mounted, front-facing work lights.
   - Press the switch up to turn off the lights.
3. **Cab Rear Lights**
   - Press the switch down to turn on the cab-mounted, rear-facing work lights.
   - Press the switch up to turn off the lights.
4. **Boom Lights**
   - Press the switch down to turn on the dual beam boom lights.
   - Press the switch up to turn off the lights.
5. **Product Rinse (Flow Back)**
   See ”Flushing Booms” on page 4-25.
6. **Auxiliary Power Outlet**
7. **Dome Light**
   - Press the switch to turn the light on and off.

NOTICE: The dome light can drain the battery if left on without the engine running.





Apache Sprayer Lighting



1. **Headlights**
2. **Cab Front Work Lights**
3. **Cab Rear Work Lights**
4. **Side Hazard and Turn Signal Lights**
5. **Dual Beam Boom Work Lights**
6. **Rear Hazard and Turn Signal Lights**
   (Mounted to back rack - not shown)
7. **Brake Lights**
   (Mounted to back of chassis - not shown)

Turn Signal and Hazard Light Function:

- When the hazard lights are turned on, light sets #4, #6 and #7 will all flash.

Turn Signal Function:

- When the left turn signal is turned on, the left side of light sets #4, #6 and #7 will all flash.
- When the right turn signal is turned on, the right side of light sets #4, #6 and #7 will all flash.

If the hazard lights are already flashing when the turn signal is activated, the lights opposite the turn indicator will glow steady while the lights on the side of the turn will flash.

AM/FM Radio with Weather Band and CD Player

1. **AM/FM, Satellite Radio with Weather Band, NOAA / SAME Severe Weather Alert Programmable, USB Ready, and CD Player**
   See manufacturer instructions for operation, and local NOAA / SAME alert settings.
2. **Equipment Technologies is pleased to provide you with 6-months of free Sirius Satellite Radio!**
   See Activation Information on the next page or find the instructions at the bottom of page 2 of the quick reference guide of your Apache's Jensen radio set.

Sirius Satellite Radio Activation Information

Activation is easy and does not start until you are ready. This way, you are able to enjoy 120+ channels of crystal clear satellite radio throughout the majority of your application season.

Activating your Sirius® Subscription
Before you can listen to SIRIUS Satellite Radio, you must subscribe to the service.

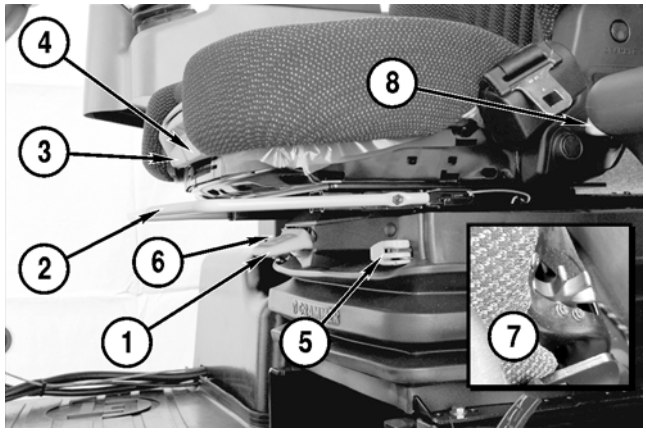
1. 1. With the power ON, press the Mode button to enter Sirius Ready mode. After displaying the SIRIUS logo, the Receiver will update all the SIRIUS channels. NOTE: Don't push any buttons or perform any operations until updating has been completed
2. Once updated and the SIRIUS channels are received, the display will change to "Call 1-888-539-SIRIUS to Subscribe" and will place you in SIRIUS Satellite Radio's Preview Channel. Channel 184 is the SIRIUS preview channel. You will not be able to tune any other Sirius Radio channels until you activate your subscription.
3. You will need to access your SIRIUS ID, which is displayed on channel 000. Press and hold the INFO/ENTER button on the radio to enter to enter Direct Tuning mode. Press << or >> to select digits 000. Press ENTER to make your selection. This display your unit's unique 12-digit SIRIUS ID Number.
4. Write the SIRIUS ID number down.
5. Contact SIRIUS on the internet: https://activate.siriusradio.com/ Follow the prompts to activate your subscription. You can also call SIRIUS toll free at: 1-888-539-SIRIUS (1-888-539-7474.

Renewal information
There is absolutely no obligation to renew. At the end of your 6-months of free service, you will be contacted by a Sirius representative or you may contact your Apache dealer ahead of time to have the billing transferred to you directly. It is entirely up to you, but again, there is no obligation to renew.

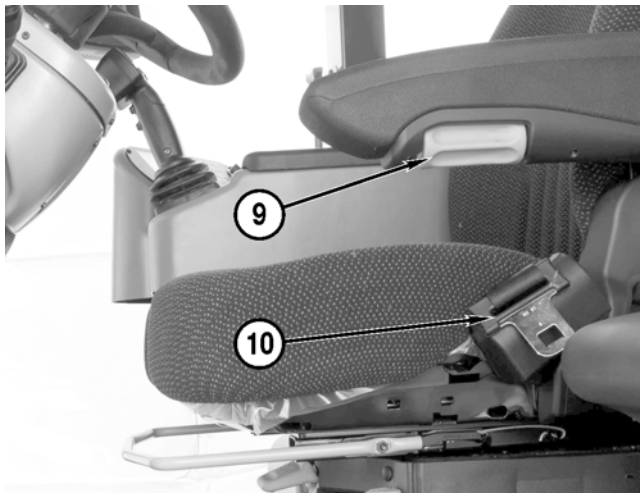
Channel Information
Visit http://www.siriusxm.com/channellineup for an up-to-date listing of channels.

Enjoy!

Seat Adjustment



1. **Height**
   - Lift lever to raise the seat.
   - Push the lever down to lower the seat.
2. **Fore-Aft Position of Whole Seat**
   - Pull lever up to adjust seat forward or backward.
3. **Fore-Aft Position of Seat Cushion Only**
   - Pull lever up to adjust seat cushion forward or backward.
4. **Seat Cushion Tilt**
   - Pull lever up to tilt seat cushion up or down.
5. **Fore-Aft Isolator**
   - Turn the lever to the left to allow front-to-back movement of the seat.
   - Return the lever to the right to lock-out movement.
6. **Ride Firmness**
   - Turn the knob counter-clockwise for firm ride.
   - Turn the knob clockwise for soft ride.
7. **Lumbar Support**
   - Turn the knob counter-clockwise for more lumbar support.
   - Turn the knob clockwise for less lumbar support.
8. **Backrest**
   - Lift the lever.
   - Position the backrest.
   - Release the lever.
9. **Armrest**
   Turn knob to adjust armrest angle.
10. **Seat Belt**



Starting and Stopping the Engine

Starting

WARNING! Impact Hazard. ALWAYS fasten your seat belt when operating the Apache Sprayer. The safety belt must be worn properly by the driver anytime the Apache Sprayer is in motion. Refer to Safety Belt on page 3-11.

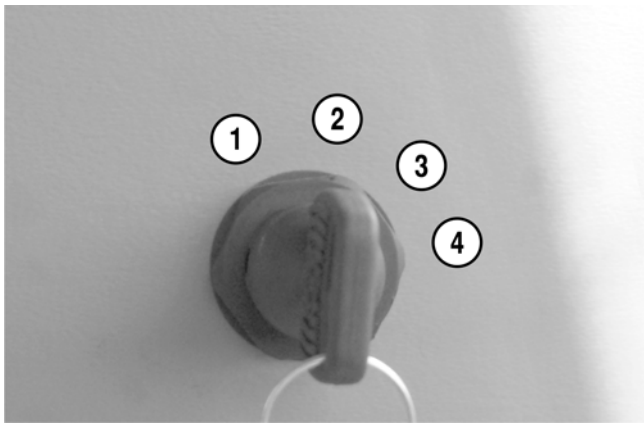
WARNING! Sudden Movement Hazards

- ***ALWAYS start the engine from the operator's seat.***
- ***ALWAYS set the parking brake (1) before starting the engine.***
- ***ALWAYS fasten your seat belt before starting the engine.***

WARNING! Fire Hazard. NEVER start the engine by shorting across the starter terminals.

The key switch has 4 positions:

1. **Position 1 - Accessory**
2. **Position 2 - OFF position**
3. **Position 3 - RUN position**
4. **Position 4 - START position**



- Turn the key switch to the RUN position (3) and wait for the "Wait-To-Start" lamp on the console display to go out.
- Turn the key to the START position (4) and crank the engine.
- When the engine starts, release the key.

NOTICE: NEVER continuously crank the starter more than 30 seconds. Stop cranking and allow the starter to cool for 2 minutes between cranking to avoid damaging the starter.

NOTICE: If the engine stalls under load, immediately stop the Apache Sprayer and shift the transmission into NEUTRAL. Restart the engine immediately to avoid damaging the turbocharger.

- If the engine does not start after four attempts, see the Troubleshooting section in the engine manufacturer's service manual or contact your dealer.
- After the engine is started, check all gauges for normal engine operation. If the gauges indicate a problem, stop the engine and determine the cause.

Warm-up

Check the engine oil pressure gauge (1) as soon as the engine starts.

- If the oil pressure gauge does not reach the minimum pressure of 15 psi [1.03 bar], stop the engine and determine the cause.
- Normal engine oil pressure is 50 psi [3.45 bar] when the engine oil is 240°F [116°C].

NOTE: Engine oil pressure can vary depending on conditions. See the engine manufacturer's service manual, supplied with the Apache Sprayer.

Check the engine coolant gauge (2).

- Normal operating temperature is 180°F [82°C].
- If the engine coolant rises above 234°F [112°C], reduce the load on the engine.
- If the coolant temperature does not drop, stop the engine and determine the cause.

Stopping

NOTICE: After operating the engine under load, allow the engine to idle for 2 minutes before stopping to avoid damaging the turbocharger.

To stop the Apache Sprayer:

- Lower the engine rpm.
- Shift the transmission to NEUTRAL by squeezing the trigger button on the joystick (1).
- Apply the parking brake (2).
- Turn the key to the OFF position and remove the key.

Apache Sprayer Direction and Speed

WARNING! Sudden Movement Hazards

- ***NEVER leave the operator's seat or cab when the Apache Sprayer is in gear. ALWAYS stop the Apache Sprayer, shift the transmission into NEUTRAL and then apply the parking brake before exiting the cab.***
- ***ALWAYS stop the Apache Sprayer and apply the parking brake before changing direction. The Apache Sprayer must be at a complete stop before shifting the transmission into or from FORWARD, REVERSE OR NEUTRAL.***

NOTICE: NEVER shift the transmission into NEUTRAL when the Apache Sprayer is moving. The transmission is only lubricated when in gear. Coasting will damage the transmission.

Automatic Transmission Mode

NOTICE: Transmission must be in manual mode during calibration.

The ZF transmission can be operated as a manual or automatic transmission. All joystick functions remain the same in either setting (forward, neutral, reverse, and throttle). Setting the transmission in automatic mode allows you to optimize the best torque and rpm performance in each gear. This option could be considered as "Semi"-Automatic mode; allowing the operator complete flexibility in shifting.

NOTE: Upon startup of the machine we default the transmission to 2nd gear in both manual and automatic modes.

In automatic mode you must set the highest gear that you want the transmission to operate in. That gear will be the highest gear that the transmission will shift to until you shift up or down. If you shift up or down, the new gear chosen becomes the highest gear the transmission will operate in. Shifting up or down while in automatic mode does not change the transmission mode from automatic to manual it simply changes the high gear you have selected. It is important to remember that even while in automatic mode you still have complete control over the transmission because at any time, you may manually shift the transmission as if it were in manual mode.

Example 1: If you choose the spraying gear to be 4th gear and want that to be the highest gear you reach in the field then, shift to 4th. The transmission will now only reach 4th gear. When you slow down the transmission will automatically downshift until it reaches 2nd gear. The gears utilized in this example would be between 2nd, 3rd, and 4th gears.

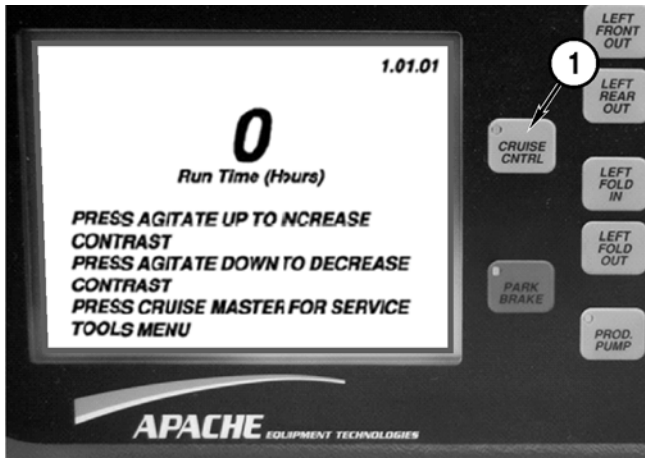
Field conditions can have an effect on the machine if it is manual mode or automatic mode. Here is an example of operating in automatic mode navigating through various field conditions while spraying.

Example 2: You have received several days of rain and have allowed the ground to dry slightly but need to spray. Some areas of the field are dry but there are a few wet spots. You select 4th gear as your high gear to spray in. You reach an area of the field that you know is wet and know the machine will navigate through best in 2nd gear, so before entering the wet area shift down to 2nd gear once you have passed through the wet area shift back up to 4th gear. Downshifting before entering the wet area will allow you to avoid any loss of traction that could occur due to a momentary loss in torque when the transmission automatically shifts to 3rd gear followed by a surge in torque when the converter locks up.

Example 3: You have just finished spraying and will be driving the machine on the road. You can set 6th gear as your high gear or when you pull onto the road shift through the gears like you were in manual mode until you reach 6th gear. Remember that when you pull into the next field to spray that your high gear is still set at 6th gear and you need to downshift to the gear you would like to spray in.

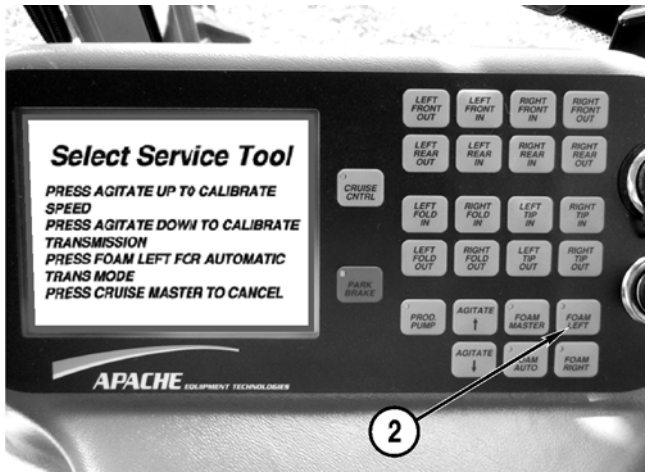
Changing ZF Transmission Between Automatic and Manual Modes

The ZF transmission can be switched between manual and automatic modes at initial key power up by pressing the cruise master switch just to the right of the display (1).



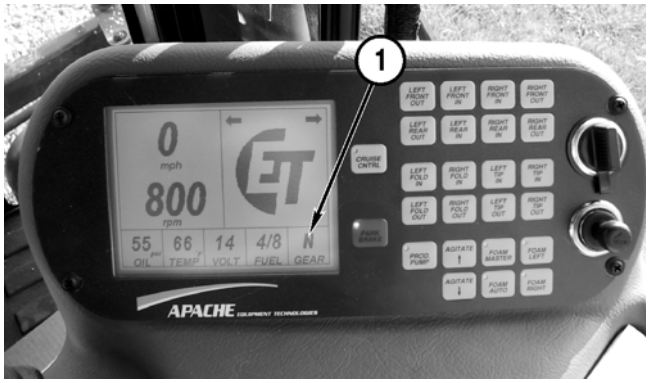
Doing this will take you to the next screen where you will press the foam left button to the right of the screen (2) to select automatic transmission mode. It can be put back in manual mode by repeating this procedure.

NOTE: Anytime the transmission mode is changed, you must turn the key back to the OFF position before starting.

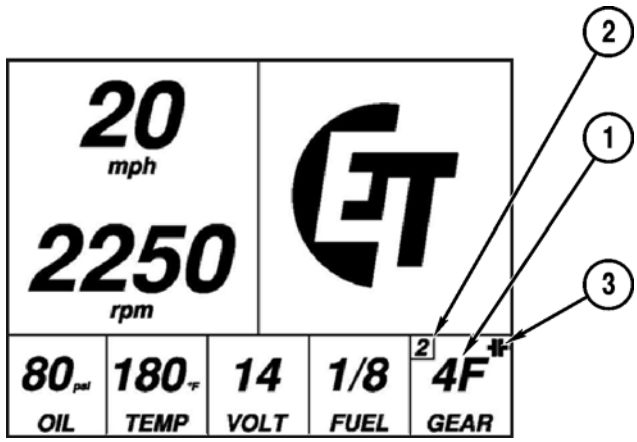


Neutral

At start-up, the Apache Sprayer transmission is reset to NEUTRAL and an indicator lamp on the console will indicate “N” (1).



Squeeze and hold either one of the trigger buttons to put into gear.



- Use the top button for FORWARD and the bottom button for REVERSE.
- Once the transmission is in gear, the gear indicator will show the current gear.
- The small number indicator (2) in the top left corner of gear selection box will only appear while in automatic mode (explained later in this manual). The small indicator (2) displays the highest gear you have preselected for the transmission to use. While in automatic mode, the large indicator (1) is displaying the current gear the transmission is using.
- The symbol in the top right corner of the gear indicator (3) shows when the ZF transmission's lock-up torque converter is locked. The indicator will only display when the converter is locked.

Return to NEUTRAL by squeezing either of the trigger buttons.

- The transmission will immediately shift to NEUTRAL.

NOTE: The joystick will not shift the transmission into NEUTRAL. The trigger buttons must be used.

- To obtain NEUTRAL from a forward gear, squeeze either trigger button on the joystick.
- To obtain NEUTRAL from a reverse gear, release the bottom trigger button on the joystick.

Forward

To move the Apache Sprayer forward:
Apply the foot brakes and release the parking brake.

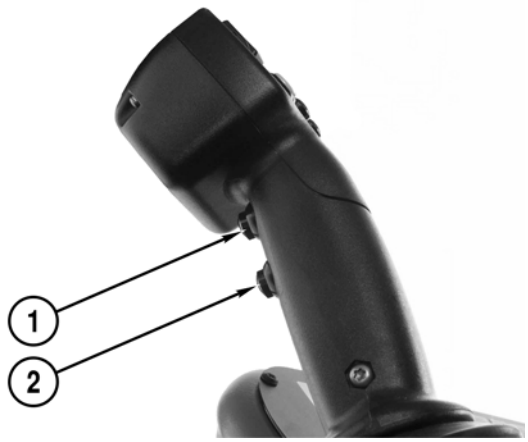
NOTE: The transmission will not shift if the parking brake is applied.

To move forward:

Release the park brake.

Apply the Apache Sprayer brakes.

Squeeze and hold the top trigger button (1) on the joystick until the transmission shifts into first gear FORWARD. The Apache Sprayer will begin rolling forward at this time.



Once the Apache Sprayer is in first gear FORWARD, release the button.

- Push the joystick forward to increase the engine rpm and ground speed.
- Pull the joystick back to decrease the engine rpm.

NOTE: The joystick will not shift the transmission into NEUTRAL. To obtain NEUTRAL from a FORWARD gear, squeeze either trigger button (1 or 2) on the joystick.

NOTE: If the Apache Sprayer is moving forward and either trigger button on the joystick is squeezed, the machine will shift to NEUTRAL. Once the Apache Sprayer is below 1400 rpm and 4 mph [6.4 km/h], squeezing and holding the top trigger button on the joystick shifts the Apache Sprayer into the gear the transmission was in before NEUTRAL.

Shifting Forward Gears

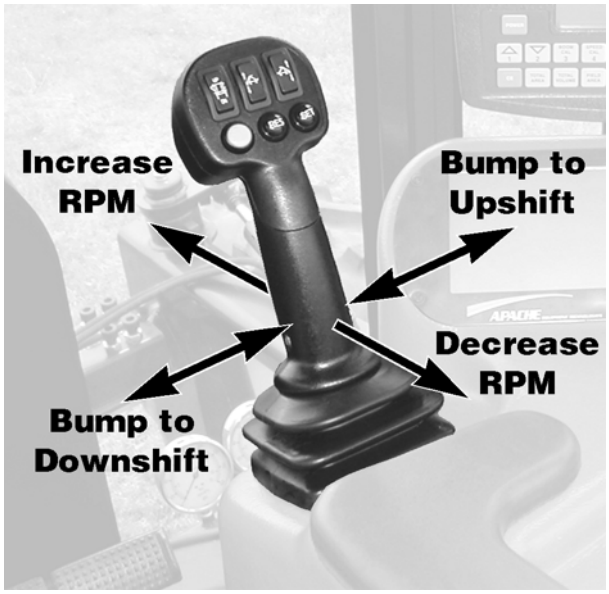
The Apache Sprayer is equipped with a torque converter. This allows the Apache Sprayer to take off in any gear. Once the Apache Sprayer is moving, you may up shift or down shift without returning the transmission to the neutral position. The Apache Sprayer is equipped with six forward gears and three reverse gears. Be aware of speed ranges for each gear. Use the Gear Speed Ranges chart for reference.

Gear Speed Ranges	
Gear	**Speed**
1st	0 to 5 mph [8.04 km/h]
2nd	0 to 7 mph [11.27 km/h]
3rd	0 to 11 mph [17.7 km/h]
4th	0 to 17 mph [27.36 km/h]
5th	0 to 27 mph [43.45 km/h]
6th	0 to 35 mph [56.3 km/h]

The torque converter is a lock-up style converter, so you may notice that the transmission feels as if it is shifting gears on its own, even in manual mode. This feeling is actually the converter locking or unlocking.

The lock up feature will not engage until the engine controller and transmission controller get to operating temperature and power usage range, therefore you may notice slower top speeds (especially in colder climates) until the oil reaches operating temperature.

Upshifting and downshifting are achieved with a sideways rock and release movement or bump of the joystick. The joystick should return to the center (side-to-side) position between shifts and some time must be allowed for the transmission to respond.



Upshifting:

- While the Apache Sprayer is in either the FORWARD or REVERSE direction, bump the joystick to the right one time to shift up to the next higher gear. Repeat this motion to upshift the transmission one gear at a time.

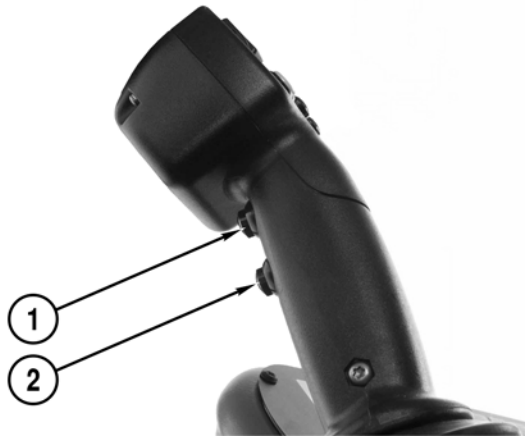
Downshifting:

- Pull back on the joystick slightly to decrease engine rpm, lightly apply the Apache Sprayer brakes, then bump the joystick to the left one time to downshift to the next lower gear. Repeat this motion to downshift the transmission one gear at a time.

NOTE: The transmission is equipped with shift protect; the transmission will not downshift, even if the display readout changes on the console, until the engine rpms drop down to the appropriate speed range.

NOTICE: NEVER shift the transmission into NEUTRAL while the Apache Sprayer is in motion. The transmission is only lubricated while in gear. Coasting will cause damage to the transmission.

Reverse



To move the Apache Sprayer in REVERSE:
NOTE: The transmission will not shift if the parking brake is applied.

Apply the foot brakes.

Release the parking brake.

To shift into REVERSE from NEUTRAL, squeeze and hold the bottom trigger button (2) on the joystick.

- Push the joystick forward to increase the engine rpm and ground speed.
- Pull the joystick back to decrease the engine rpm.

The reverse button (2) must be held in at all times to move in REVERSE.

NOTE: The joystick will not shift the transmission into NEUTRAL. To obtain NEUTRAL from a REVERSE gear, release the bottom trigger button (2) on the joystick.

NOTE: If the Apache Sprayer is moving in REVERSE and the reverse button (2) is released, the transmission will shift to NEUTRAL. Once the Apache Sprayer is below 1200 rpm and 4 mph [6.4 km/h], squeezing and holding the bottom trigger button (2) shifts the transmission into the gear the transmission was in before NEUTRAL.

Cruise Control

To use the cruise control function:

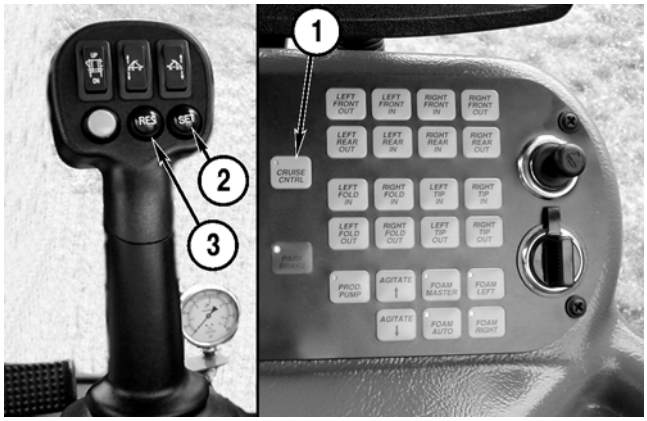
Turn the master cruise button (1) located on the console on.

Once the desired speed is reached, push and release the SET button (2) on the joystick.

If the engine rpms are increased or decreased using the joystick, the cruise control will disengage; to resume cruise speed, press the RES button (3) on the joystick to return to the previously set cruise control speed.

If the transmission is up- or down-shifted, the cruise control will disengage.

The cruise control will operate between 6 and 20 mph [9.7 and 32.2 km/h]. If the SET button (2) is pressed while the speed is out of range, the command will be ignored.



NOTICE: Use of the brakes WILL NOT disengage the cruise control.

Towing

ALWAYS use towing safety equipment and proper emergency warning lighting when towing the Apache Sprayer.

If the Apache Sprayer's transmission should become disabled, it may be towed for approximately 1 mile [1.6 km] at speeds less than 3 mph [4.8 km/h]. While towing the Apache Sprayer, the engine should be running at idle and the parking brake released.

If the Apache Sprayer should become disabled and the engine will not start, remove the driveshaft between the differential and transmission. The Apache Sprayer may be towed up to 1 mile [1.6 km] at speeds less than 3 mph [4.8 km/h].

NOTICE: The brakes depend on supply oil from the hydraulic system. If the engine is not running, you will have no brakes.

NOTICE: The brakes are located in the rear differential housing. If the driveshafts from the rear differential to the planetaries or drop boxes are removed, you will have no park or foot brakes. If the driveshaft between differential and park brake is removed, you will have no park brake.

NOTICE: DO NOT tow the Apache Sprayer if the:

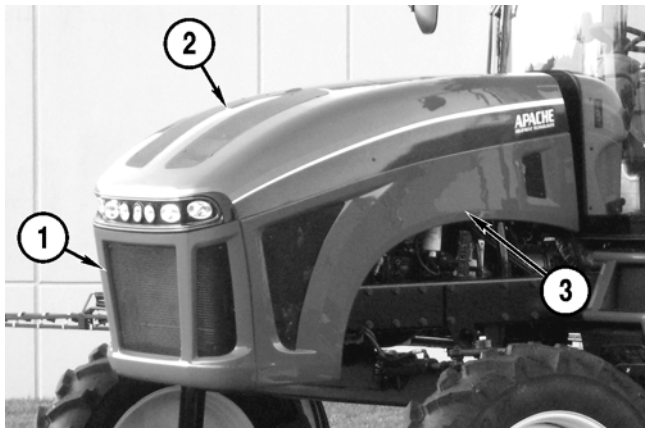
- Driveshaft is connected and it has no hydraulic supply to release parking brake.
- Rear differential is damaged (contact dealer for repair).

NOTICE: DO NOT use the Apache Sprayer as a tow vehicle.

NOTICE: DO NOT use any part of the Apache Sprayer as a tow bar which is not designed for use as a tow bar or tow hook-up.

Hood Panel Removal

The hood assembly is comprised of four panels; the front (1), top (2) and two sides (3).



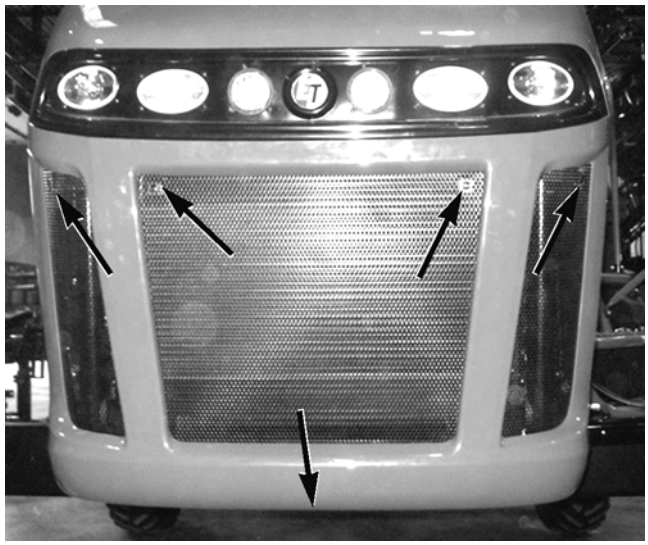
Side

To remove the side panel, remove the 2 screws in the front of the side panel, 2 screws on the underside of the panel, and 2 screws at the back of the side panel.

Front

Remove the 5 screws on the front of the grill.

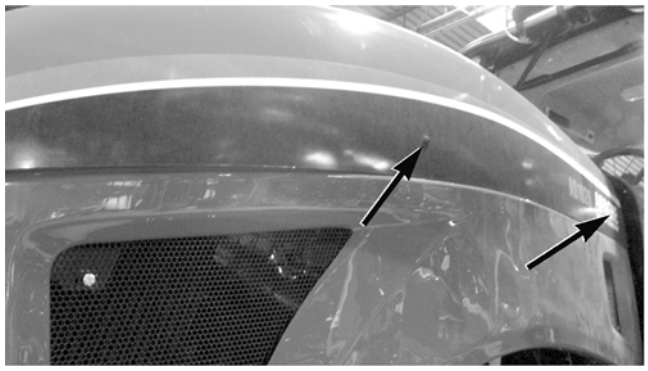
Once the screws are removed, the front panel can be removed to access the radiator.



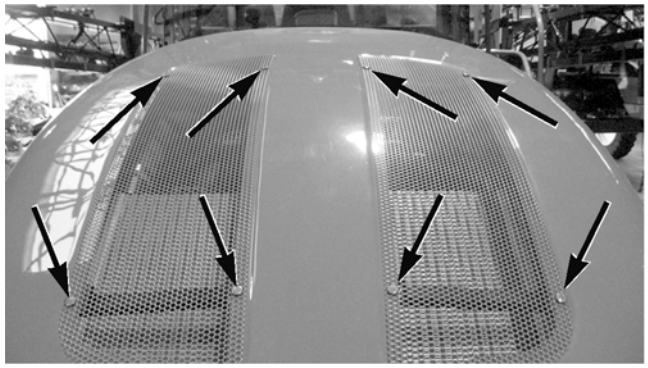
Top

The front panel must be removed before the top panel can be removed.

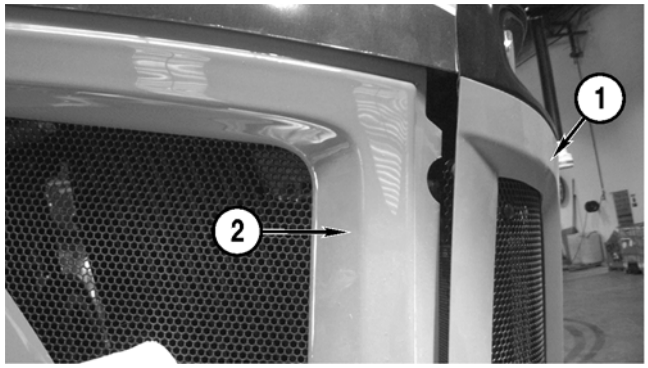
Remove the 2 screws along each side of the hood.



Remove the 8 screws holding the front of the hood. Then remove 3 more screws on the bottom front of the top panel, just below the headlights.



TIP: When installing panels, put the front panel (1) on first, then slide the side panel (2) into front panel.



Battery

The batteries are located under the hood, between the engine and the cab.

A side panel must be removed to access the batteries. See ”Hood Panel Removal” on page 3-19.

The Apache Sprayer features a battery disconnect switch, located on the left hand, rear of the engine compartment.

Turn the battery disconnect switch to the OFF position when the machine is not in use.

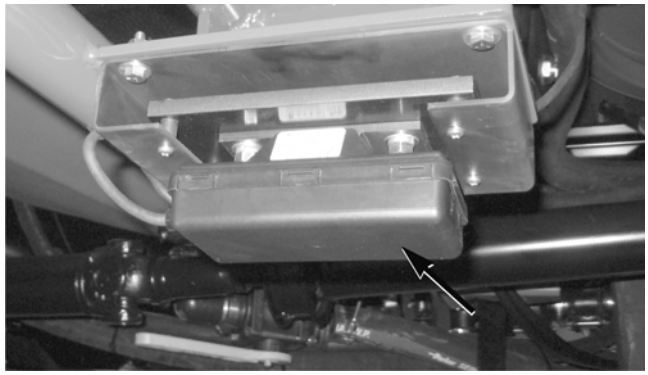
NOTE: The negative battery cable must still be disconnected when servicing the machine.

Antenna Mounting Plate

On machines equipped with GPS, a steel plate is mounted at the roof-line at the front, center of the cab for magnetic base GPS antennas.

Raven Radar Gun

The Raven radar gun is located on the right side of the Apache Sprayer, mounted under the muffler.



Axle Adjustment (Manual)

The front and rear axles on the Apache Sprayer are adjustable from 120 to 160 in. [304.8 to 406.4 cm] (measured from center of left tire to center of right tire).

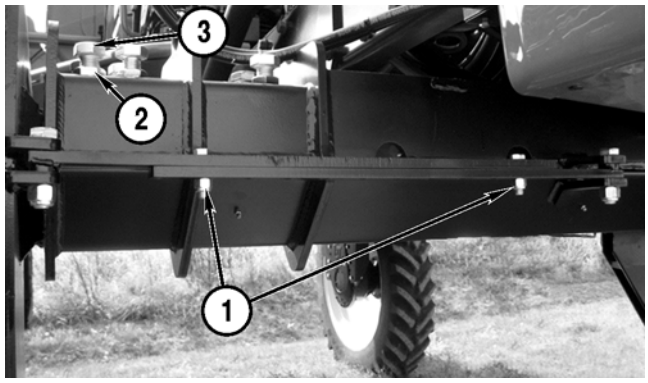
Front

Safely lift the front of the Apache Sprayer so the front tires are slightly off of the ground.

Remove the two inner bolts (1) from the locking bar.

Loosen the six jam nuts (2) and six bolts (3) on the axle brace. The right front axle is shown.

NOTICE: DO NOT extend the axle beyond 160 in. [406.4 cm] (measured from center of left tire to center of right tire).



Manually slide the wheel to the desired width, making sure the locking bar holes are aligned.

Tighten the six bolts (3) to 80 lb-ft [108 N•m] to secure the axle in place.

Tighten the jam nuts (2).

Install the two locking bar bolts (1) and tighten.

Repeat the steps to adjust the other front axle.

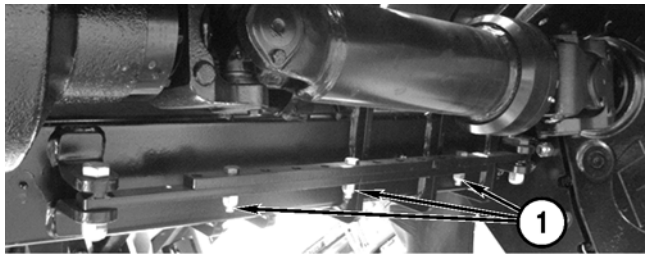
Rear

Safely lift the rear of the Apache Sprayer so the rear tires are slightly off of the ground.

Remove the three inner bolts (1) from the locking bar.

Loosen the twelve jam nuts (2) and twelve bolts (3) on the two axle braces. The left rear axle is shown.

NOTICE: DO NOT extend the axle beyond 160 in. [406.4 cm] (measured from center of left tire to center of right tire).



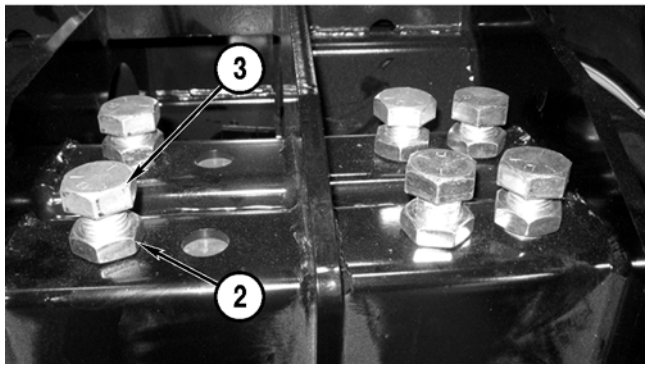
Manually slide the wheel to the desired width, making sure the locking bar holes are aligned.

Tighten the twelve bolts (3) to 80 lb-ft [108 N•m] to secure the axle in place.

Tighten the twelve jam nuts (2).

Install the three locking bar bolts (1) and tighten.

Repeat the steps to adjust the other rear axle.



Axle Adjustment (Optional) (Adjust On The Go)

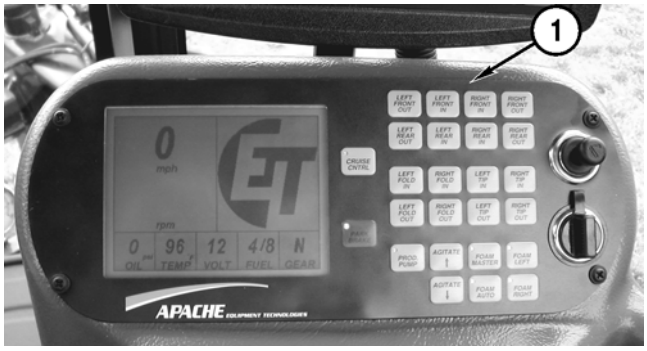
The front and rear axles on the Apache Sprayer are adjustable from 120 to 160 in. [304.8 to 406.4 cm] (measured from center of left tire to center of right tire).

NOTE: The Adjust On The Go system will not allow the axle to be adjusted beyond 160 in. [406.4 cm].

To adjust the axles:
While the engine is idling, operate the Apache Sprayer in the forward direction at approximately 3 mph [4.8 km/h].

Press the desired switch(es) (1) on the console to move the wheels in or out.

The axles can be adjusted individually, in combination or all together.

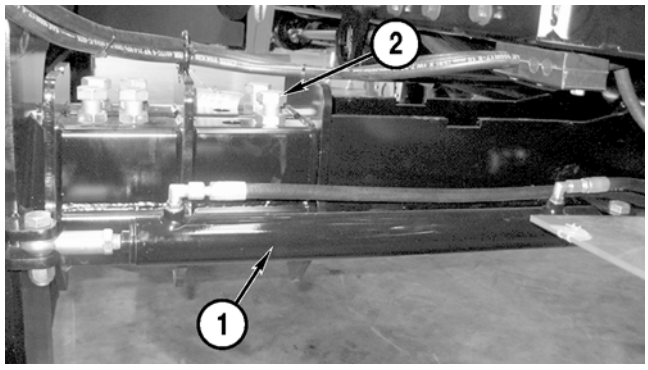


Front

When activated, the Adjust On The Go cylinder (1) adjusts the axle inward or outward as desired. The front wheels/axles are actuated by one cylinder per wheel. The left front Adjust On The Go axle is shown.

NOTICE: The bolts (2) should be torqued to 15 lb-ft [20 N•m] at all times. Check and adjust the torque weekly. See "Adjust On The Go Axles" on page 5-20.

NOTE: Grease the axles daily when using the Adjust On The Go feature. See "Grease Axle Components" on page 5-17.

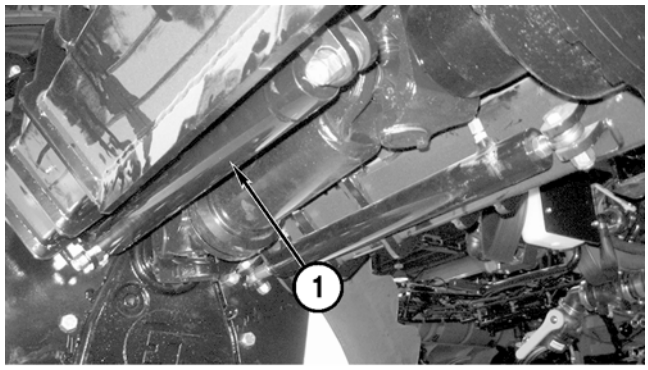


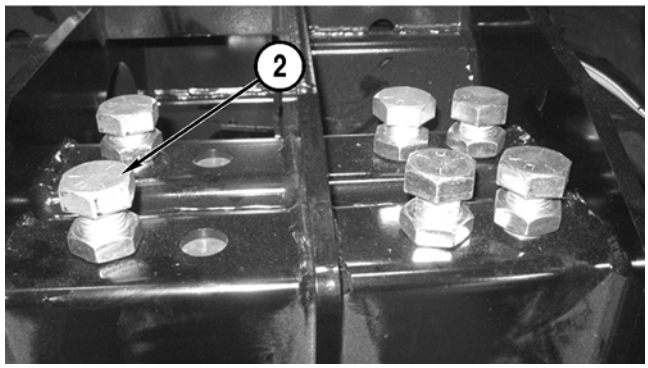
Rear

When activated the Adjust On The Go cylinder (1) adjusts the axle inward or outward as desired. The rear wheels/axles are actuated by two cylinders per wheel. The left rear Adjust On The Go axle is shown.

NOTICE: The bolts (2) should be torqued to 15 lb-ft [20 N•m] at all times. Check and adjust the torque weekly. See "Adjust On The Go Axles" on page 5-20.

NOTE: Grease the axles daily when using the Adjust On The Go feature. See "Grease Axle Components" on page 5-17.





Precision Equipment

The following are factory installed precision sprayer control options.

- SCS 5000 (console controller)
- Envisio Pro II (console controller)
- Viper Pro (console controller)
- SmarTrax (integrated autosteer)
- AccuBoom (sectional spray control)
- AutoBoom (boom height control)

Refer to the respective operators manual included with the machine before use.

NOTE: Raven-based precision equipment is designed in a joint effort with Equipment Technologies and Raven and contains items that are specific to Apache Sprayers. Please note this with your service provider when seeking service.

If your Apache Sprayer is equipped with anything other than factory installed precision equipment, please contact your dealer for assistance.

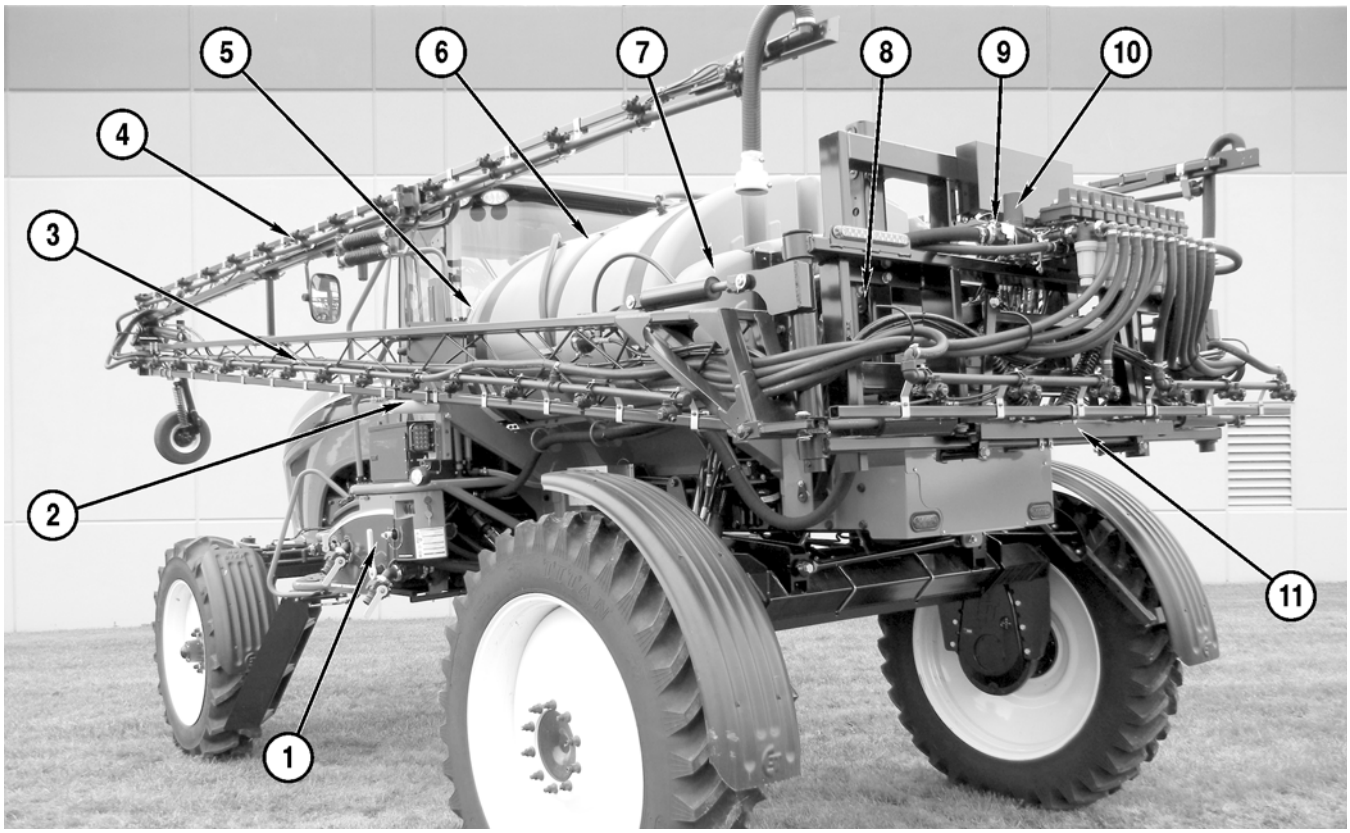
APACHE™

CHAPTER 4

WET SYSTEM OPERATION

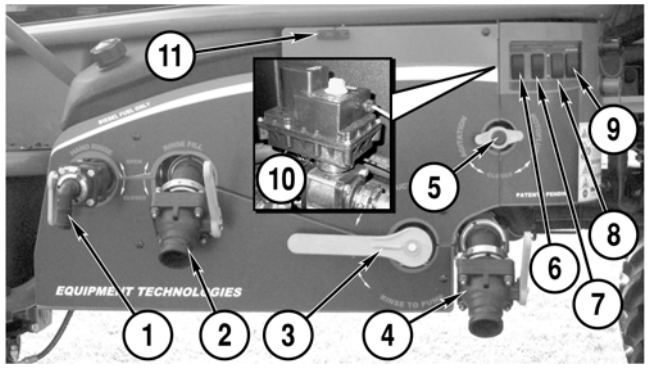
NOTICE: Before performing any wet system operation procedures, read the Safety Section on page 2-1.

Wet System Overview



1. **Fill Station**
2. **Boom Cradle**
3. **Left Boom**
4. **Left Boom Tip**
5. **Tank Level Sight Tube**
6. **Product Tank**
7. **Rinse Tank**
8. **Rinse Tank Sight Tube (on rinse tank)**
9. **Flow Meter**
10. **Standard Flow Control Valve (servo valve)**
11. **Boom Rack**

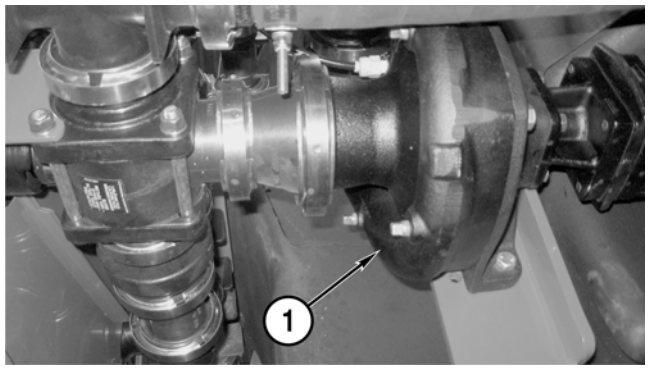
Fill Station



1. **Hand Rinse Valve**
   This valve allows water from the rinse tank on the right side to be used for hand rinsing.
2. **Rinse Tank Quick Fill**
3. **Product Valve (shown in CLOSED position)**
   This valve directs flow from the product tank to the pump or from the rinse tank to the pump.
4. **Product Tank Quick Fill**
5. **Roto-Flush/Agitate Valve**
   Directs flow between the roto-flush and agitation.
6. **Fill Station Light Switch**
7. **Remote Product Pump Switch**
   This switch turns the product pump while outside of the cab.
8. **Increase/Decrease Agitation Switch**
   Used to increase or decrease agitation from the fill station. Activation switch must be held down while adjusting.
9. **Activate Agitation Switch**
   Used to activate the fill station agitation adjust switch. Must hold down while increasing or decreasing agitation from the fill station.
10. **Agitation Valve**
    During normal spraying operation, this valve is electronically actuated and controlled by a switch on the side console in the cab.
11. **Fill Station Light**

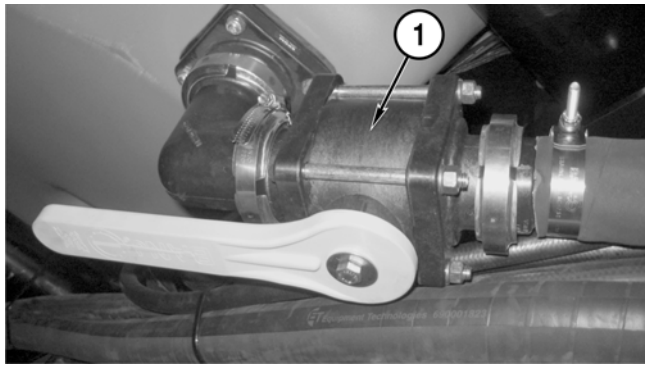
Product Pump and Valves

1. **Product Pump**



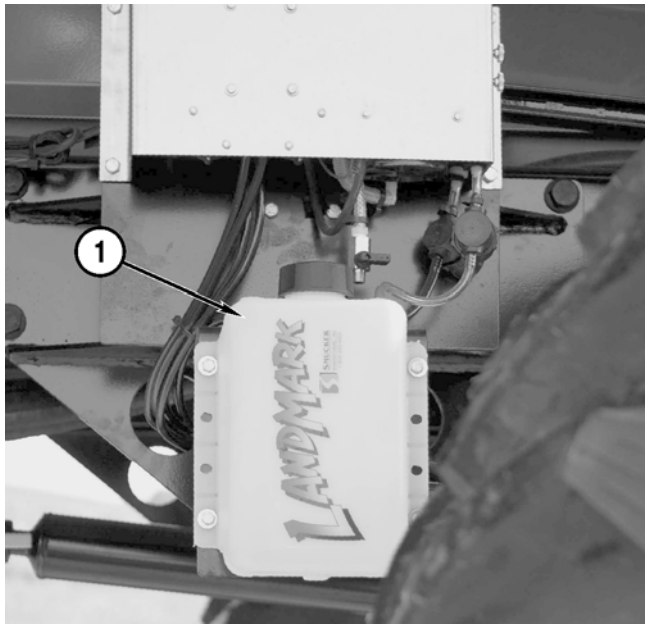
Sump Valve

1. **Product Tank Sump Valve**
   Shown in the OPEN position.



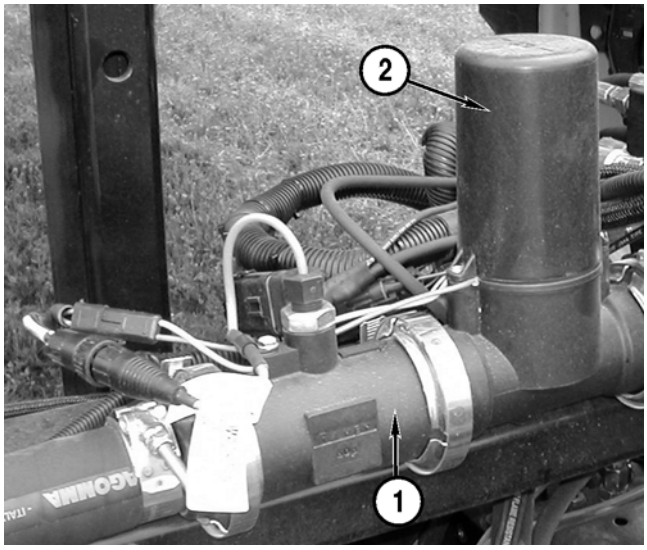
Foam Tank

1. **Foam Concentrate Bottle**



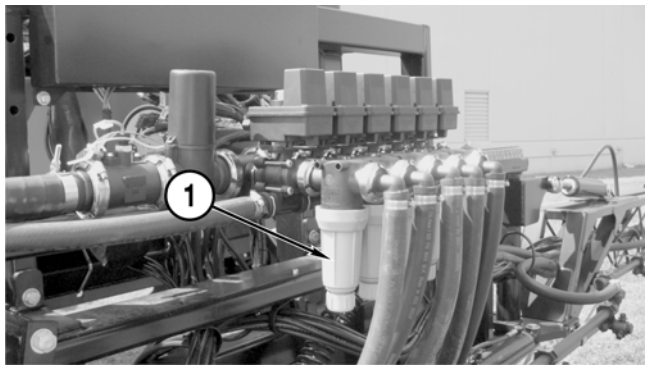
Flow Control

1. **Raven Flowmeter**
2. **Raven Standard Flow Control Valve (Servo Valve)**



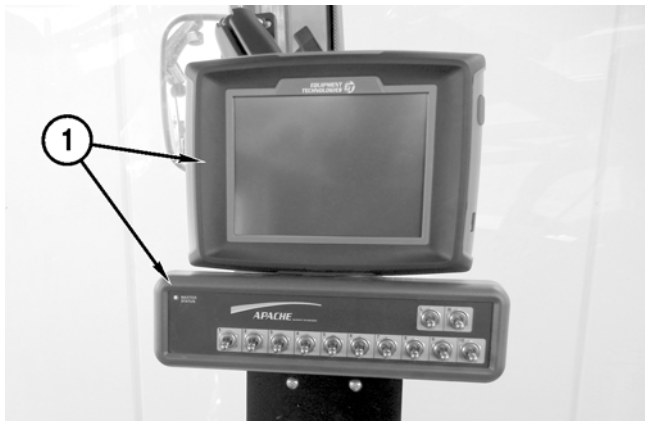
Electronic Boom Valves

The strainers (1) on the electronic boom valves (five-section boom valve shown) have 50 mesh screens, that must be cleaned periodically.



Envizio Pro II Monitor

1. **Envizio Pro II Monitor and Apache Switchbox**
   This monitor is built for Equipment Technologies by Raven. On equipped Apache Sprayer models, the monitor and switchbox are located in the right side of the cab.
   See the manufacturer's instructions, provided with the Apache Sprayer, for complete operating, calibration, and service information.



Monitor Calibration Information
(for all Raven built monitors)

Valve cal 2123

Speed cal (radar gun equipped).....565

Speed cal (GPS for speed) 785

Meter cal.....See tag on the flowmeter, located on the rear boom rack.

Boom cal .....The boom cal numbers are specific for each sprayer and are dependent on the boom width, number of sections and nozzle spacing.

NOTE: All console calibration numbers should be recorded in the Apache owner's manual for future reference.

NOTE: These are factory presets. All controls must be calibrated before applying chemicals.

NOTE: The radar gun is not factory-calibrated. See the manufacturer's instructions, provided with the Apache Sprayer, for proper calibration.

NOTE: The SCS 5000 Monitor, Envisio Pro II and Viper Pro are the only three console controller options. If your Apache Sprayer has a different console, please contact your Apache dealer for information.

SCS 5000 Monitor

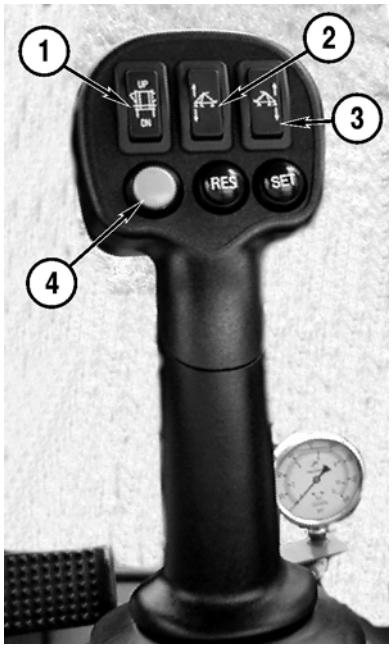
Envisio Pro II Monitor

Viper Pro Monitor

Side Console

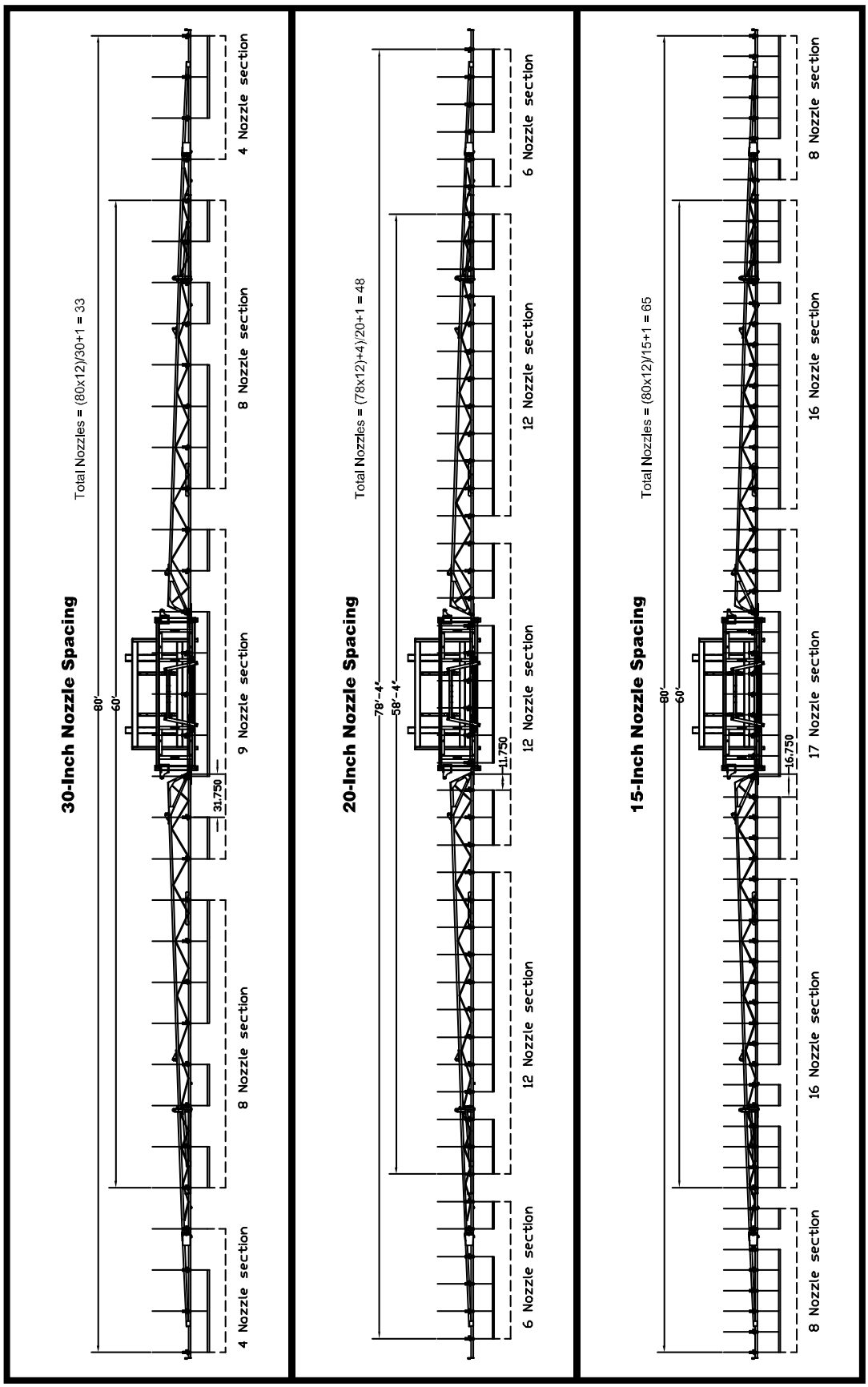
1. **Envisio Pro II Controller**
2. **Switchbox**
3. **Cruise Control Master Switch**
4. **Left Boom Fold In and Out**
5. **Right Boom Fold In and Out**
6. **Left Boom Tip In and Out**
7. **Right Boom Tip In and Out**
8. **Axle Width Adjustment Switches (Optional Adjust on the Go)**
9. **Auxiliary Power Point**
10. **Cigarette Lighter**
11. **Foam Switch for Left and Right Side**
12. **Foam Master Switch**
13. **Foam Auto**
    When switched on, foam can be switched from left to right using the yellow Master Switch on the joystick.
14. **Agitate Increase and Decrease**
15. **Product Pump Switch**
16. **Parking Brake Switch**
    A red light indicates when the parking brake is applied.

Joystick

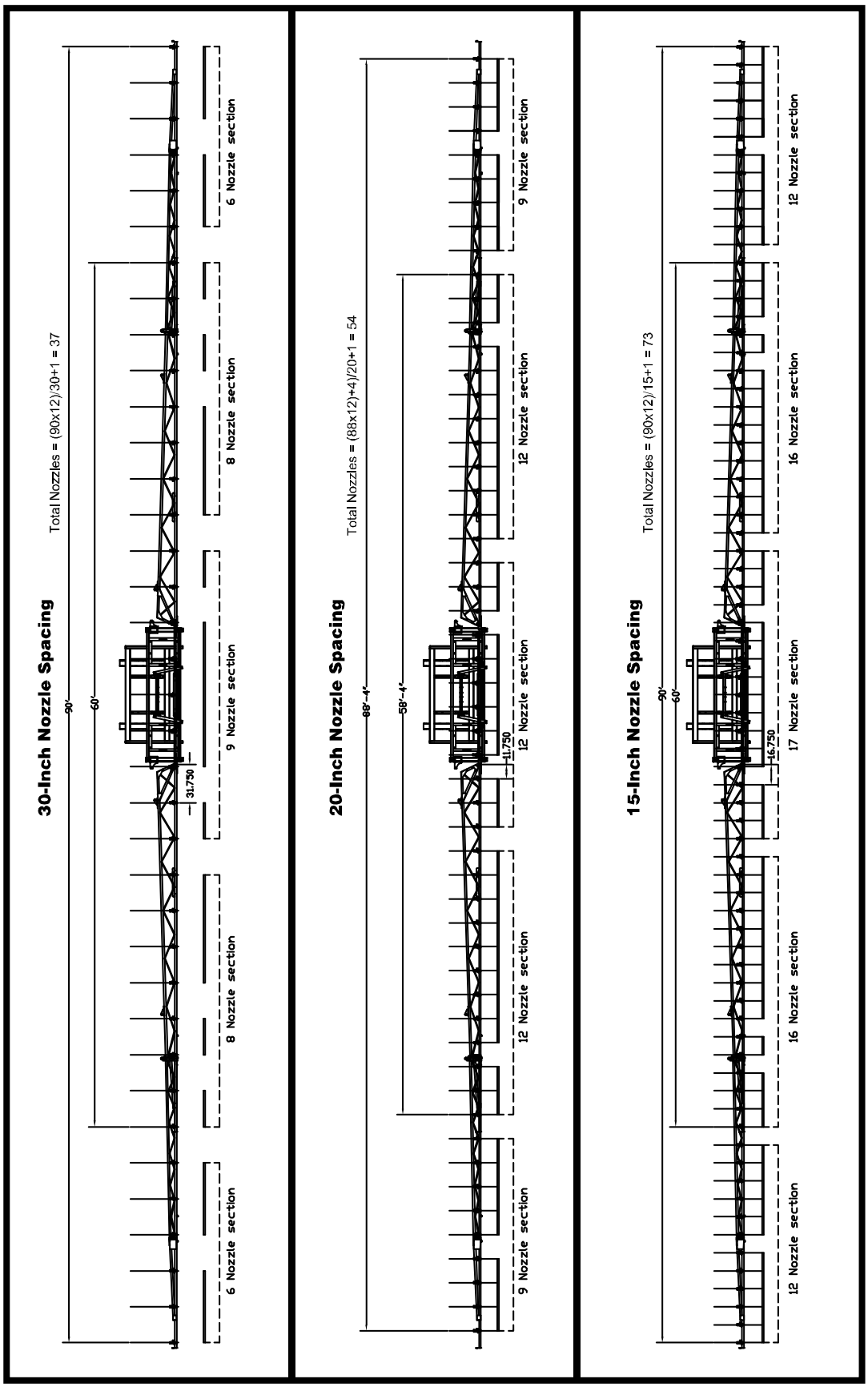


1. **Boom Center Rack Up/Down**
   Press to raise or lower the boom mast. Press the top of the switch to raise and press the bottom of the switch to lower.
2. **Left Boom Tilt**
   Press to tilt the left boom up or down. Press the top of the switch to raise and press the bottom of the switch to lower.
3. **Right Boom Tilt**
   Press to tilt the right boom up or down. Press the top of the switch to raise and press the bottom of the switch to lower.
4. **Master Spray Switch**
   Press to turn on or off all boom sections that are in the on position on the switchbox.

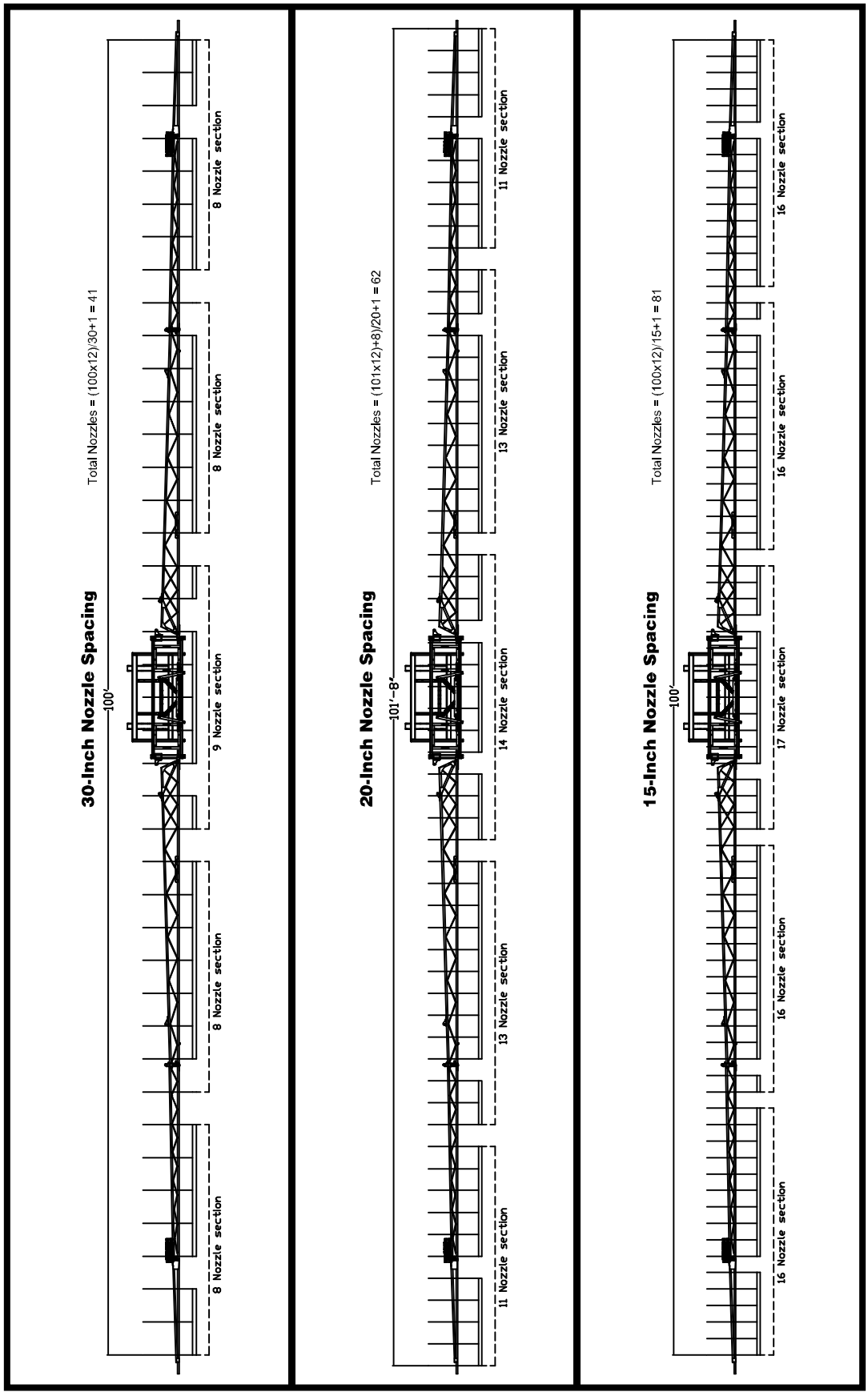
60’/80’ Nozzle Layout



60’/90’ Nozzle Layout

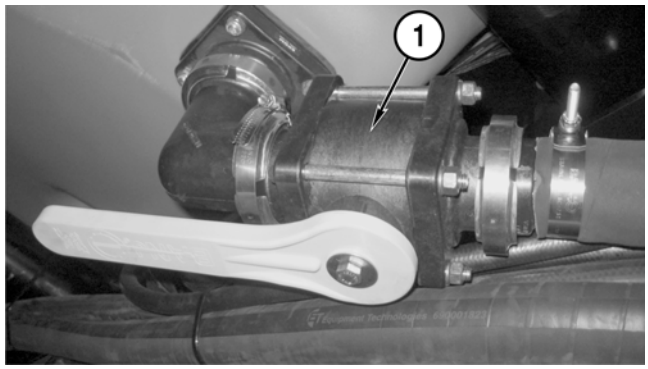


100’ Straight Nozzle Layout



Filling Product Tank

Open the sump valve (1) on the underside of the product tank.

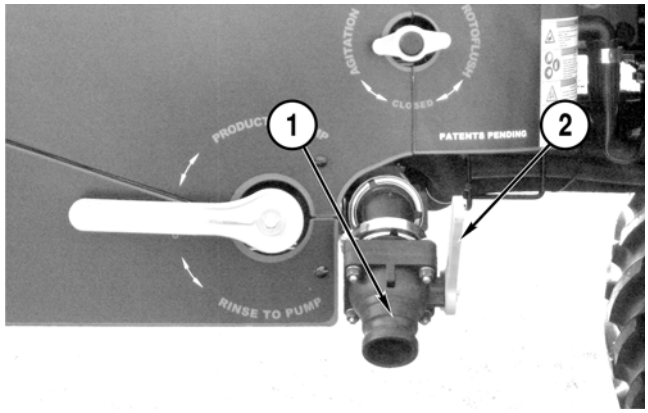


Remove the cap from the product quick fill inlet (1) and connect the hose from the nurse tank to the inlet.

Open the product fill valve (2), shown in the CLOSED position, and fill tank to desired level. There is a tank level indicator tube on the front left corner of the tank, just behind the cab entrance door.

When filling is complete, close the valve on the nurse tank, then close the product fill valve.

Disconnect the hose from the inlet and install the quick fill inlet cap.



Filling Rinse Tank

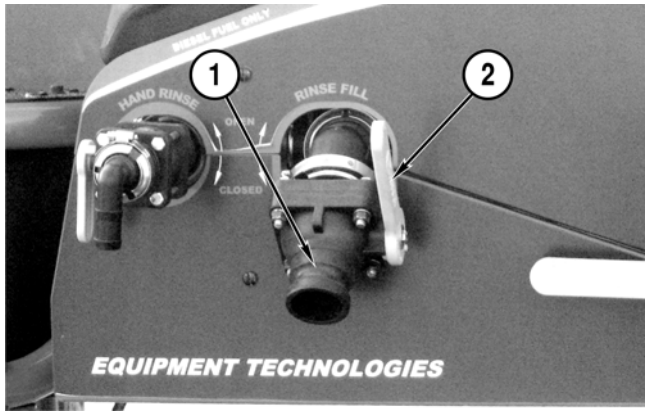
Remove the cap from the foam/rinse quick fill inlet (1) and connect the hose from the nurse tank to the inlet.

Open the rinse valve (2), shown in the CLOSED position and fill to the desired level. There is a tank level indicator tube on the back side of the tank.

IMPORTANT: Fill the tank slowly. Rapid filling or overfilling may rupture the tank.

When filling is complete, close the valve on the nurse tank, then close the rinse fill valve.

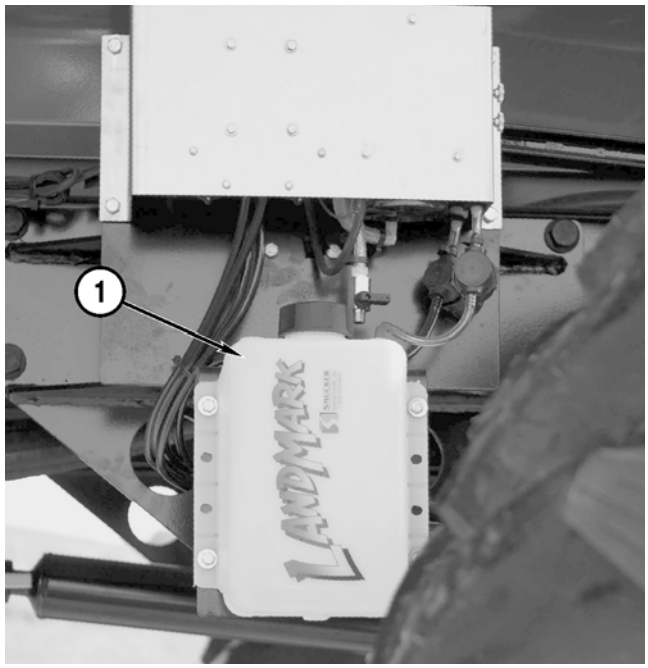
Disconnect the hose from the inlet and install the quick fill inlet cap.



Filling Foam Marker Tank

Remove the lid on the top of the foam tank (1), add the appropriate amount of foam concentrate, and install the lid.

Water for the foam marker is supplied by the rinse tank. Therefore, it must have water in it for the foam marker to operate. the rinse tank has a level indicator on the rear of the tank.



Operating Booms

Before performing any boom operations, read all the following safety messages and take all necessary precautions to avoid personal injury and equipment damage.

WARNING! Electrocution Hazard. DO NOT fold or unfold the booms near power lines.

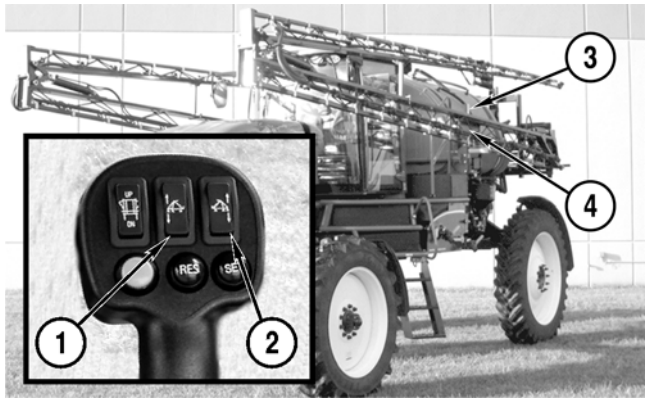
WARNING! Control Hazard. NEVER fold or unfold the booms while the Apache Sprayer is moving over 5 mph [8.04 km/h] or with the optional Auto Boom height control turned ON.

NOTICE: The boom tips must be folded before the booms can be retracted. The cab can be damaged if the boom tips are not folded properly.

Tilt to Remove Boom from Cradle

All Boom Sizes

On the joystick, press the top of the left (1) and right (2) boom tilt raise/lower switches to raise the booms and boom hangers (3) off of the boom cradles (4).



Unfold Booms

IMPORTANT: DO NOT fold or unfold the booms near power lines.

NOTICE: The boom hangers must be tilted off of the boom cradles before they can be unfolded.

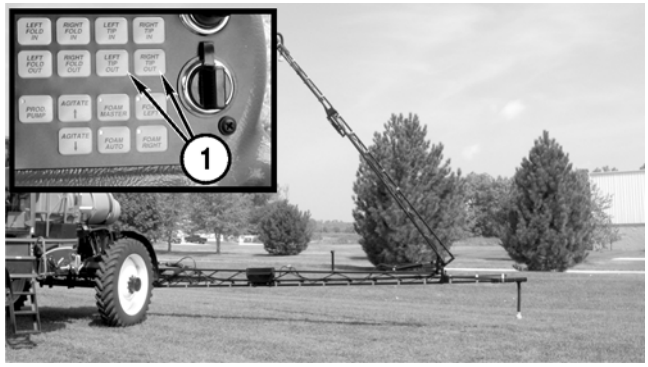
On the side console, press the Left Fold Out and Right Fold Out switches (1) until the booms are fully extended. After the booms are fully extended, the boom tips can be unfolded.

Unfold Boom Tips

All Boom Sizes

NOTICE: The booms must be unfolded before the boom tips can be extended. The machine can be damaged if the booms are not unfolded properly.

On the side console, press the Left Tip Out and Right Tip Out switches (1) until the boom tips are fully extended.

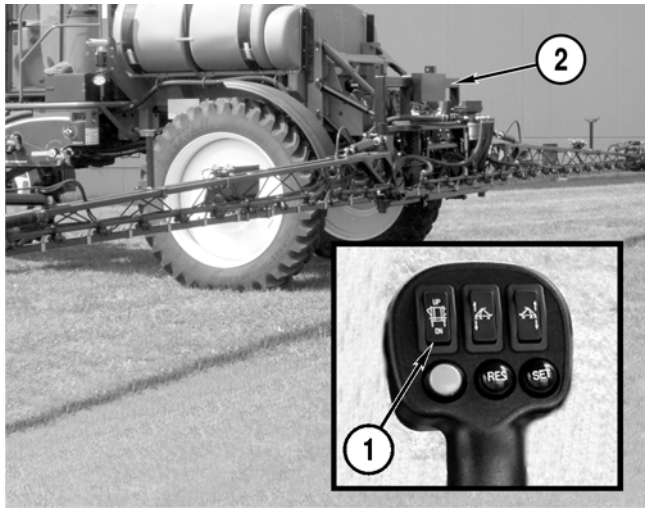


Height Adjustment

All Boom Sizes

On the joystick, press the bottom of the boom rack raise/lower switch (1) to lower the boom rack (2) to the desired height.

Press the top of the switch to raise the boom rack.

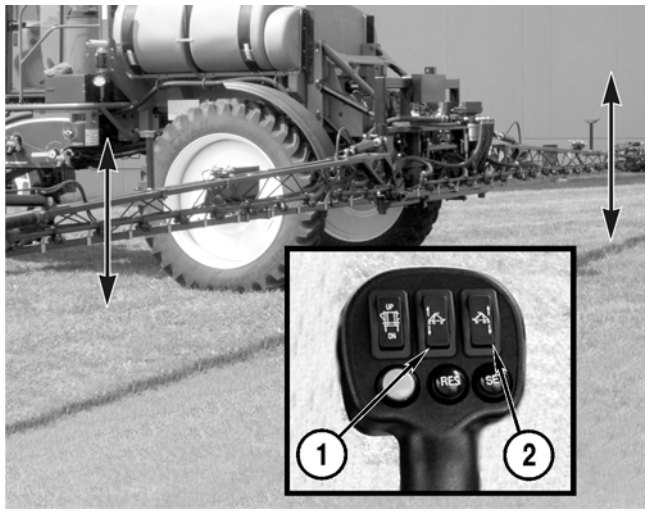


Tilt to Level Boom

All Boom Sizes

On the joystick, use the left (1) and/or right (2) boom tilt raise/lower switches to adjust the booms to level.

Press the top of the switches to tilt the boom up and the bottom of the switches to tilt the boom down.

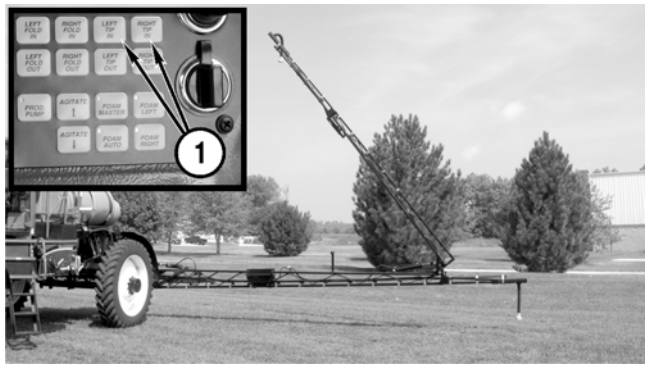


Fold Boom Tips

All Boom Sizes

On the side console, press the Left Tip In and Right Tip In switches (1) until the boom tips are fully folded.

After the boom tips are fully folded, the booms can be folded.

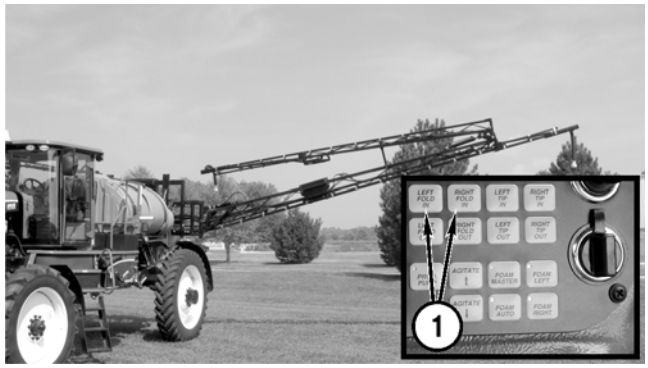


Fold Booms

NOTICE: Fold the booms slowly to reduce the possibility of the booms hitting the cab.

NOTICE: ALWAYS raise the rack and the left and right boom tips completely before folding the booms.

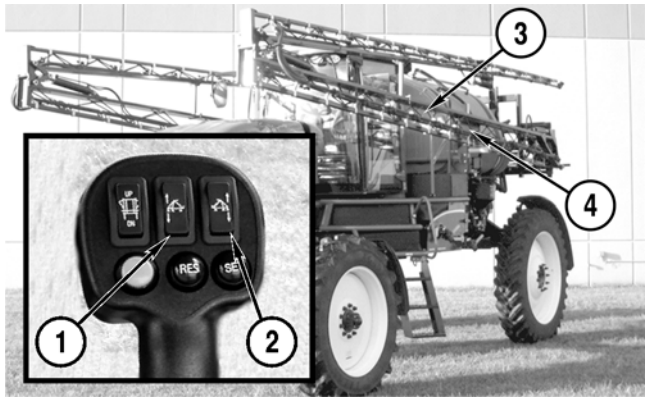
All Boom Sizes
On the side console, press the Left Fold In and Right Fold In switches (1) until the booms are fully folded.



Tilt to Return Boom to Cradle

All Boom Sizes
On the joystick, press the bottom of the left (1) and right (2) boom tilt raise/lower switches to tilt the booms (3) onto the boom cradle (4).

With the booms properly stored, the Apache Sprayer is ready for transport.



Spraying

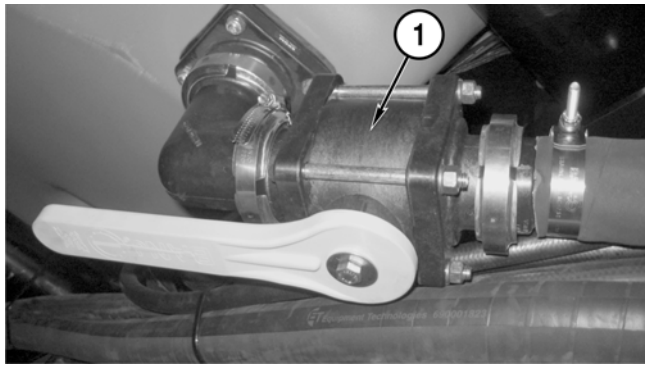
Make sure the product, rinse, and foam marker tanks are filled. See “Filling Rinse Tank” on page 4-11. See “Filling Product Tank” on page 4-11. See “Filling Foam Marker Tank” on page 4-12.

Level the booms and boom tips using the tilt and unfold switches. See “Operating Booms” on page 4-13

Set the boom height using the boom rack switch. See “Height Adjustment” on page 4-14.

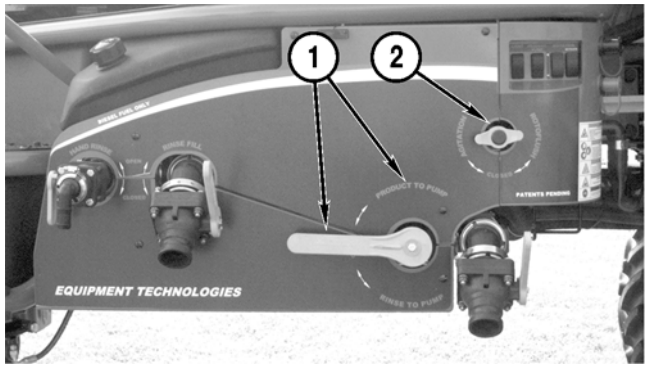
Open the sump valve (1) on the underside of the product tank.

NOTICE: ALWAYS read and follow all chemical labels and follow all federal and state laws when applying chemicals.



Set the product valve (1) to PRODUCT TO PUMP.

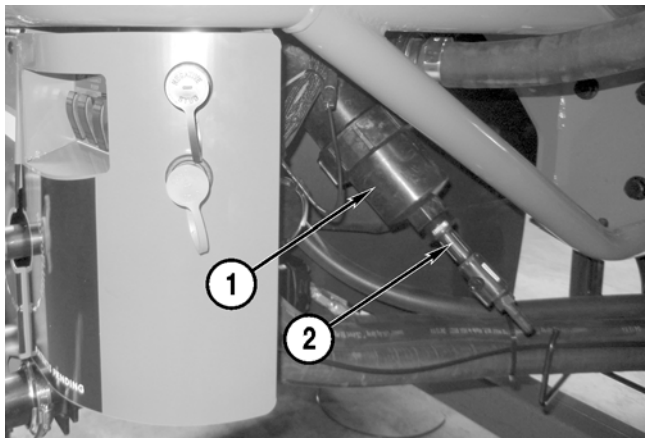
Set the flush/agitation knob (2) to AGITATION.



The product strainer (1) features 50 mesh screens, which should be checked and cleaned after every 50 hours of operation or as needed.

The stainer also features a drain valve (2). This valve can be used to ease the draining of the strainer housing before removal for cleaning, or while flushing, or winterizing.

NOTE: Depending on the chemicals being applied, it may be necessary to substitute the 50 mesh screen with a more coarse strainer. See the chemical manufacturer's instructions for complete details.



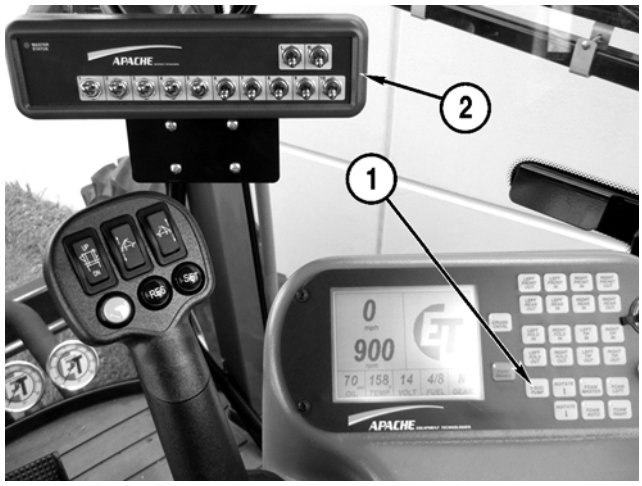
Power up the SCS 5000, Envisio Pro II or Viper Pro controller (SCS 5000 shown) and check the settings.

Select a saved flow rate or enter the desired rate. See the respective controller's manual supplied with the Apache Sprayer for complete operating instructions.

Set the product pump switch (1) to the ON position.

Set the desired boom section switches (2) to the ON position.

IMPORTANT: DO NOT run the product pump dry. Damage to the pump seals will result. DO NOT intentionally dead-head the pump with high pressures. Damage to the pump seals will result. Product pump dead-head pressure with agitation closed should be 120 psi.

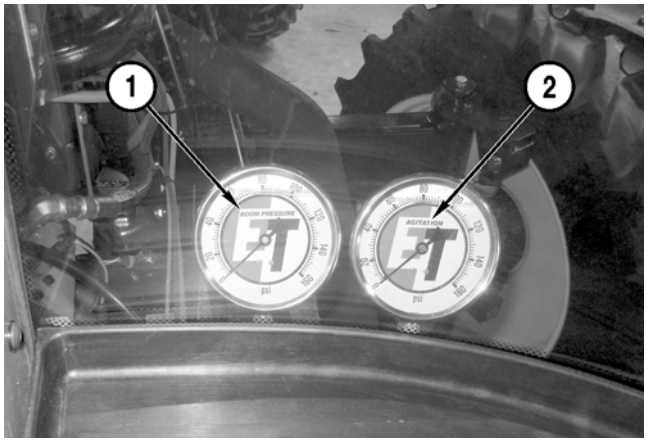


The boom pressure (1) and agitation (2) gauges are mounted outside at the lower right of the cab.

- The boom pressure gauge reads pressure at the right side of the boom valve manifold.
- The agitation gauge reads pressure at the agitation valve.

NOTE: When the agitation valve is fully open, the agitation pressure gauge and the boom pressure gauge should show approximately the same pressure.

IMPORTANT: Selecting the correct spray tip is critical to obtain proper application. See the spray tip manufacturer's instructions for proper selection.



Select an appropriate gear for the desired Apache Sprayer speed during spraying. See "Shifting Forward Gears" on page 3-17. Under typical operating conditions, second or third gear is recommended.

Use the master product on/off switch (1) on the joystick to start and stop spraying.

Use the Raven Sprayer Control boom switches on the switchbox (2) to start and stop product flow to individual boom sections if necessary. The Raven Sprayer Control will automatically adjust the product flow for the remaining sections.

Use the Apache boom control switchbox for individual, manual control of up to ten boom sections (2) and two optional fence row sections (3).

Valve Advance and Valve Delay

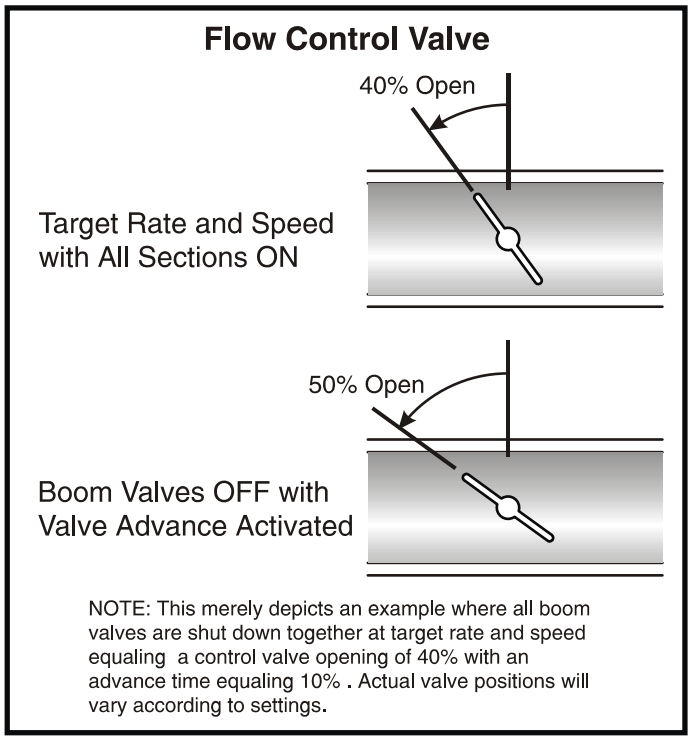
Apache Sprayers use TeeJet Flow Back boom valves. These valves are designed with an extra by-pass port in the shut-off balls to allow a small amount of pressure from the boom pipe to be relieved back to the product tank when the valve is switched off. The rapid pressure relief helps eliminate the unwanted waste of liquid out of the spray tips after the valve is shutoff that is typically seen with standard boom valves. Only a small amount of liquid from each valve must be diverted back to the product tank to eliminate pressure so the boom pipe remains full of liquid.

The use of the Flow Back valves will provide benefits such as improving application accuracy, allows you to spray all the way to the end of rows, reduce overlaps, and reduce chemical expense due to waste.

Because the Flow Back valves relieve a small amount of pressure back to the product tank there have been a few questions about what to do to improve the boom pressure after the valves have been turned back on while using lower rate applications. There are two settings that are available in the Raven controllers that will help in this area. The settings are called and Valve Advance and Valve Delay. These settings are in both the SCS controllers (4000/5000) and Field Computers (Envizio Pro, Envizio Pro II, and Viper Pro).

Valve Advance

The Valve Advance feature allows the user, while in automatic mode, to set the amount of time (in seconds) in which the flow control valve will open over and above the position it is at when the last remaining boom section that is on, is turned off by AccuBoom, or by simply turning them all off using the master switch. A value of 1-9 means the flow control valve is allowed to move further open 1-9 seconds respectively. Think of it as a percentage that the valve is open. For example, you are spraying X rate at X MPH. Say that rate requires the control valve to be 40% open at target rate and speed with all sections on. You now approach your headland at target speed, and your boom sections all shut off at the same time either by AccuBoom, or you simply shut them all off using the master switch, your control valve will now be allowed to open the amount that it is able to open in X amount of seconds (your advance setting). So, if in X amount of seconds, the valve is able to open 10 more percent, your valve will now be open a total of 50%. This example (depicted on next page) would be in a perfect condition where the valves all shut off at the same time at target rate and speed.



NOTE: This merely depicts an example where all boom valves are shut down together at target rate and speed equaling a control valve opening of 40% with an advance time equaling 10% . Actual valve positions will vary according to settings.

If you came into an angled headland, or into the headland at a lower speed, the flow control valve would compensate for that and shut down to maintain target rate as sections shut off, or your speed slows. Therefore, the control valve would opened for X seconds (or 10% in this example) further than the position is at when either the AccuBoom shuts down the last section remaining on, or you manually shut them down using the master switch. So if the valve is 20% open at this time, it will open a total of 30% after the advance. This will result in quicker section turn on when returning to spray

The Valve Advance setting basically does just what it says. It “advances” the amount that the control valve is open at boom shut down to increase the amount of flow available when you re-enter the headland to recover the pressure dropped off by the flowback valves, insuring a more responsive return to spray. Rate, speed, driving habits and field condition are all factors in the valve advance setting.

NOTE: The Advance button is only displayed if a Standard, Fast, or Fast Close valve is selected and if the product control node has a software version 1.50 or higher.

- To set the Valve Advance in an SCS (4000/5000) controller start by pushing the “Data Menu” button until “Product” is highlighted. Then use the up or down arrows to scroll over to “Valve Advance” then push “Enter”. Input the number “2” and push “Enter” again.

- To set the Valve Advance in a Field Computer (Envizio Pro, Envizio Pro II, and Viper Pro) start by selecting the “Product Control” menu, then chose the “Valve” box. Inside the “Valve Calibration” menu chose “Advance” and enter a number of “2”.

- Valve Advance is preset from Equipment Technologies at 2.

Valve Delay
The Valve Delay feature allows the user to set a delay between the time the booms start turning back on and when the console begins to control the flow rate. A value of 1-9 means a delay of 1-9 seconds respectively. For example, you have a valve delay setting of X and you have entered your headland to turn around. As previously explained, your valve advance setting will now advance the control valve whatever amount you have it set at. As you re-enter the unapplied area and the first boom valve turns back on whether it be by the AccuBoom or master switch, the valve delay will take over and continue hold the flow control valve at your advance setting position for X second before the console controller starts to control the flow rate. A value of 0 would mean there is no delay and the console will begin to control rate as soon as the first boom valve turns back on. It is best that you have some sort of delay set that will compliment your field conditions and driving style so that the console can start to control the flow valve out in the open unapplied area with all boom sections charged so that it does not get confused and try to hunt for a rate as your speed is picking up and sections are turning on, especially in uneven headlands and no spray zones.

NOTE: The valve delay feature is active if the time between turning OFF and turning ON the booms is less than 30 seconds. For example when turning around on headlands this will leave the control valve at a fixed setting for 30 seconds

- Setting the Valve Delay in an SCS (4000/5000) controller start by pushing the “Data Menu” button until “Product” is highlighted. Then use the up or down arrow to scroll over to “Valve Delay” then push “Enter”. Input a value of “1” then push “Enter” again.

- Setting the Valve Delay in a Field Computer (Envizio Pro, Envizio Pro II, and Viper Pro) start by selecting the “Product Control” menu, then chose the “Calibration Settings” box. Inside the Calibration Settings menu chose the “Valve Delay” box and enter a number of “1”. • Valve Delay is preset from Equipment Technologies at 1.

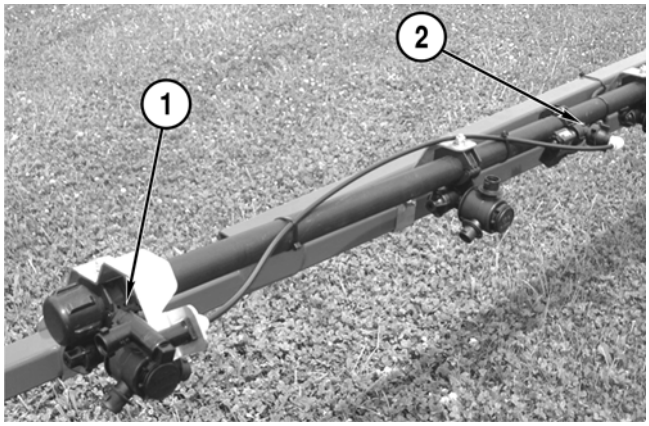
NOTE: The numbers suggested above of 1 for Valve Delay and 2 for Valve Advance are only good starting points and may need to be adjusted. These settings will need to be tailored to each individual user because they are based on application rates, speed, and pressure. For best results, approach the headlands at consistent speeds while turning all boom sections OFF.

Optional Fence Row Nozzle

If equipped, the fence row nozzles (1) and actuator solenoids (2) are plumbed into the first boom section on the left (shown) and the last boom section on the right. Therefore, the respective section must be on for the fence row nozzle to operate.

To operate the left fence row nozzle, boom section 1 and boom section L must both be switched on.

To operate the right fence row nozzle, the highest configured boom section and boom section R must both be switched on.

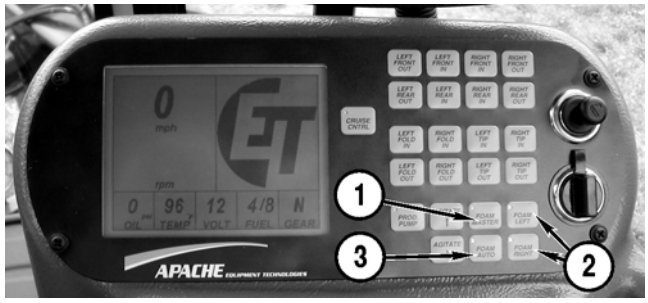


Operating Foam Marker

To turn on the foam marker, push the Foam Master button (1) on the console.

- Push the Foam Left button (2) to drop foam on the left.
- Push the Foam Right button (2) to drop foam on the right.

If the Apache Sprayer has the optional combo boom, open the foam valves on each of the booms to drop foam at 60'. The valves are located at the midpoint of each boom.



Auto Foam

To use the Auto Foam feature, turn on the Foam Master switch (1), then turn on the Auto Foam button (3). Foam will drop from whichever side was used last.

When you turn the boom section switches on or off with the yellow master spray switch on the joystick, the foam will switch from left to right.

NOTE: The yellow master spray switch on the joystick must be turned on before the Auto Foam feature is activated.

NOTE: The LandMark injection foam marker is the only factory-installed foam marker. If your Apache Sprayer is equipped with a different foam marker, contact your dealer.

NOTE: After filling the foam tank, the foam marker may need to run for 1 to 2 minutes before the foam begins.

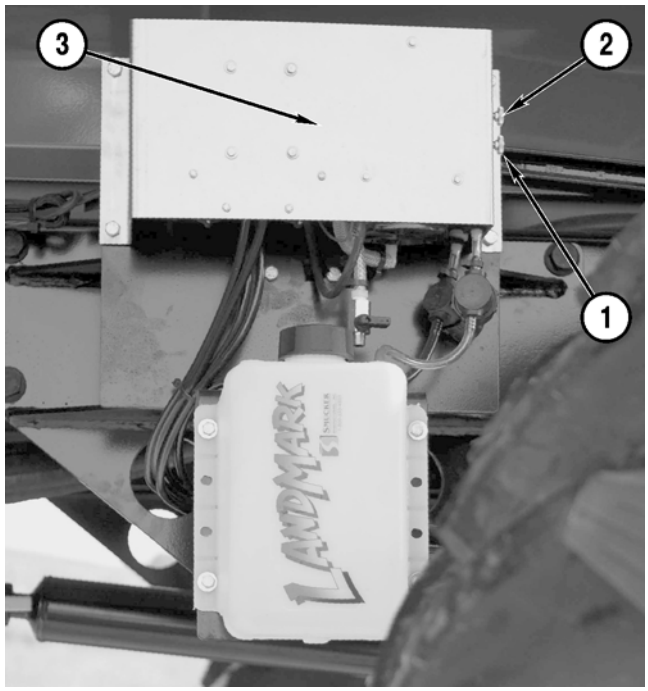
LandMark Injection Foam Marker

Your new foam marker is designed to produce the longest lasting foam, and provide you with the convenience of not having to mix your foam concentrate and fill the foam marker tank as often. Accuracy in spraying is critical to your operation.

NOTICE: The LandMark injection marker draws fresh water in one line and soap concentrate in the other before it reaches the liquid pump. It is very important that when you first begin, or if you change brands of foam concentrate, that you properly set the "soap injection valve" and the "output valve". This will produce the best results in foam quality and ensure the proper amount of soap concentrate is used.

Injection Marker Operation Instructions

See page page 4-23 for injection marker feature location.



Turn on the injection marker and allow the liquid pump to prime. If the liquid pump does not prime, open the priming valve until liquid begins to flow, then close the priming valve.

To adjust the foam quality, open the soap injection valve (1) by turning the knob counterclockwise. Adjust the foam quality until foam is rich and thick.

To adjust the total foam output, open the output valve (2) by turning the knob counterclockwise. Adjust as needed.

- Opening the valve too far will flood the chambers and produce soupy foam.
- Closing the valve too far will not produce enough foam.

The water pump and air compressor are located behind the panel (3).

When the foam marker is set properly, quality foam will be produced at 60 drops per minute. See the following table.

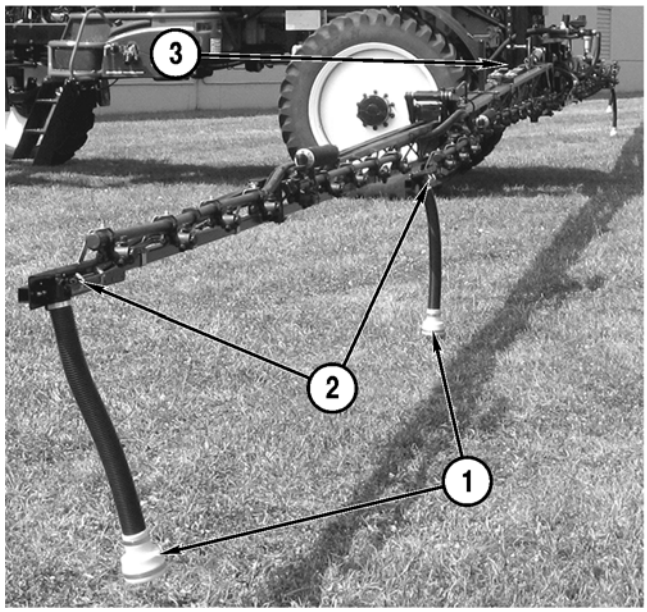
NOTE: This foam should stick to your hand when turned upside down.

NOTE: The foam marker pulls water from the rinse tank to create foam.

Output	Drops per Minute (based on 3 in. [7.6 cm] boot)	Foam Spacing @ 5 mph [8.04 km/h]	Foam Spacing @ 10 mph [16 km/h]	Foam Spacing @ 15 mph [24.1 km/h]
5 gpm [18.9 lpm]	62	7.1 [2.16 m]	14.2 [4.32 m]	21.3 [6.9 m]

Optional Combo Boom Drops

1. **Optional Foam Marker Boot and Drop**
   If your Apache Sprayer is equipped with the Land-Mark injection foam marker, then the boot is located near the end of each boom.
2. **Foam Marker Mixing Chamber**
   The foam marker mixing chamber is located near the end of each boom.
3. **Combo Boom Diverter Valves**
   On machines equipped with combo booms, these valves are used to switch which side the foam is dropped. Both valves, one for air supply and one for foam mix supply, must be activated for proper operation.



Maintenance

Clean and replace the air pump and in-line solution filters regularly to extend the lift of the pump. The air pump has one sponge and one felt filter.

Freezing

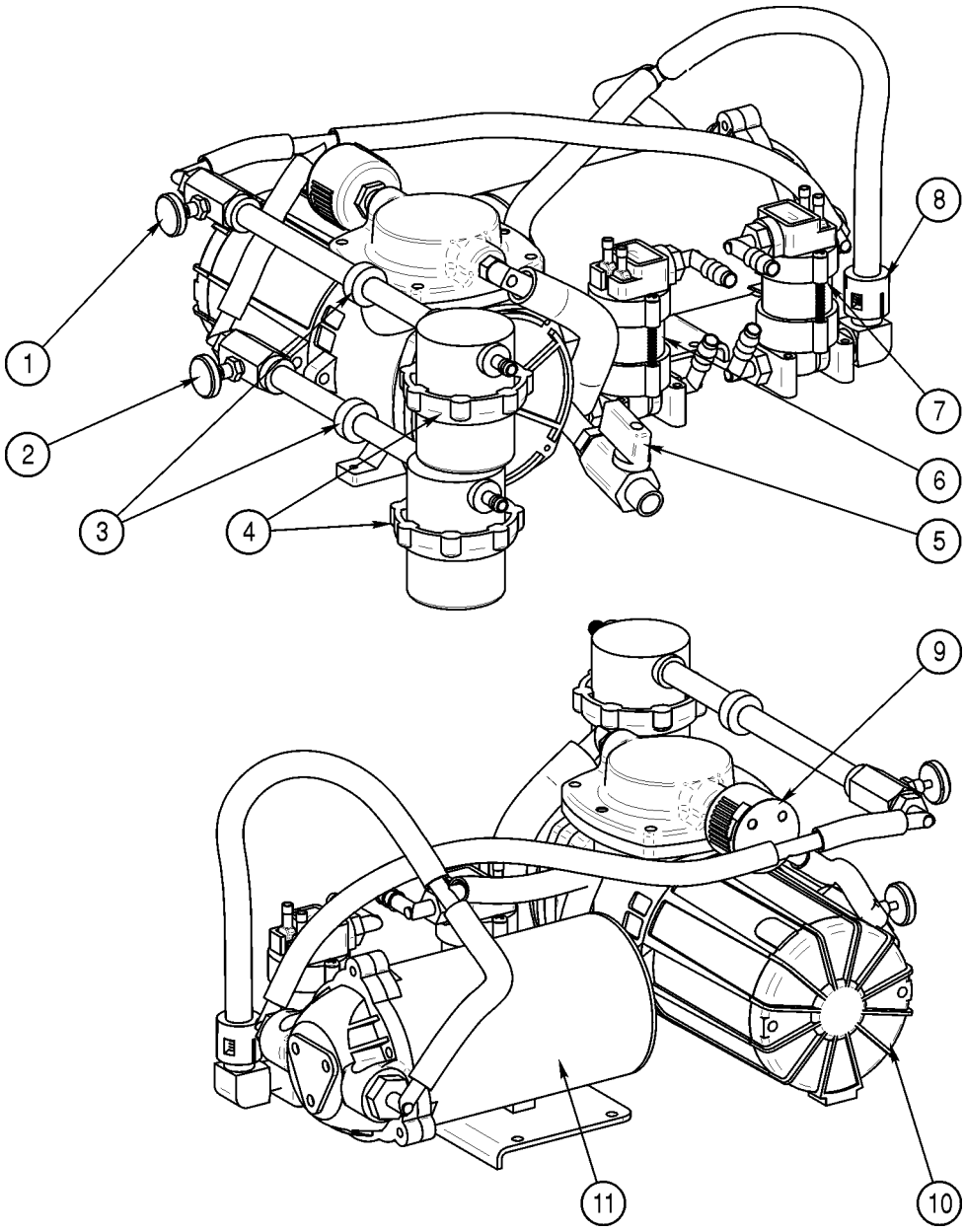
When operating in temperatures at or below freezing, ethylene-glycol-based antifreeze may be added to the water and soap tanks.

If the system will be exposed to freezing temperatures overnight:

1. Pull the suction tube out of the tank and expose it to the air.
2. Close the soap valve and run the system for 10 to 15 seconds to clear the foam solution from the pump and solenoids.

For long-term storage:

1. Drain the tank of the foam solution and run fresh water through the entire system.
2. While the unit is running, blow air through the suction tube until the system is dry.
3. Flip the power switch to dry the other side.



1. **Output Valve**
   Labeled “More Foam Less Foam”
2. **Soap Injection Valve**
3. **Check Valve**
4. **Strainer**
5. **Priming Valve**
6. **Air Solenoid**
7. **Soap Solenoid**
8. **Check Valve**
9. **Compressor Breather**
10. **Thomas Air Compressor**
11. **Liquid Pump**

Flushing Product Tank

NOTICE: Read and follow chemical labels for flushing, disposal, and protective clothing requirement instructions.

NOTICE: DO NOT run the product pump dry. Damage to the pump seals will result. DO NOT intentionally dead-head the pump with high pressures. Damage to the pump seals will result.

Fill the rinse tank with clean, fresh, water. See “Filling Rinse Tank” on page 4-11.

Turn the product valve to RINSE TO PUMP (1).

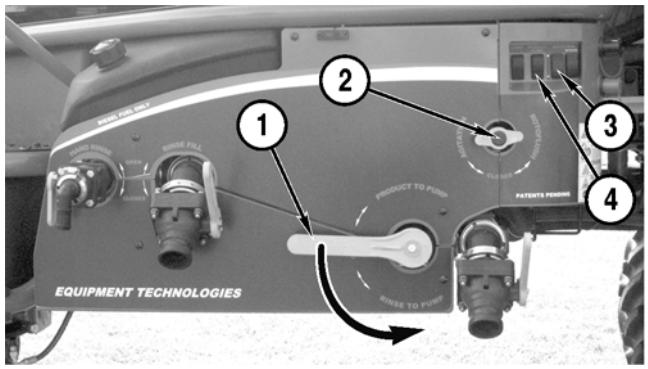
Turn the Agitate/Roto-Flush knob to ROTO-FLUSH (2).

Start the engine.

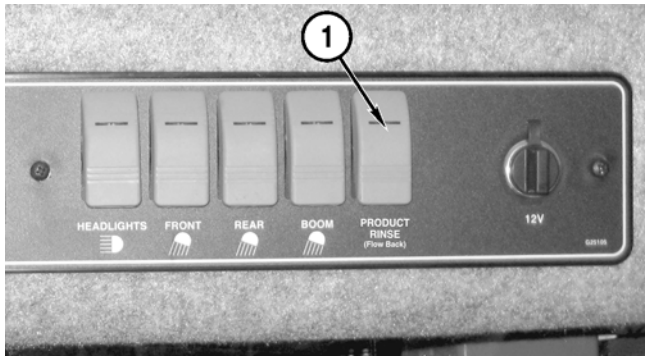
Use the Agitation switch (3) to increase agitation to its highest level.

Set the product pump switch (4) to the ON position and increase the engine speed to approximately 1500 rpm.

NOTICE: The rinse tank will empty quickly. Monitor the process closely to reduce the possibility of running the product pump dry.

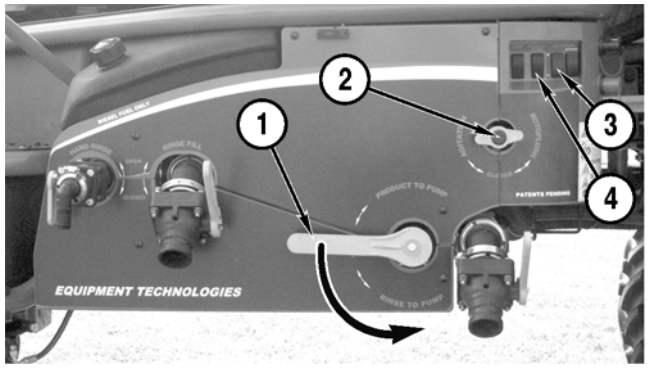


While rinsing the tank, press the Flow Back Rinse switch (1) in the cab and hold it about 10 seconds to rinse the flow back line.



After the tank is rinsed:

- Return the engine to IDLE.
- Set the product pump switch (4) to OFF.
- Turn the product lever (1) to PRODUCT TO PUMP.
- Turn the Agitate/Roto-Flush knob (2) to OFF.



Flushing Booms

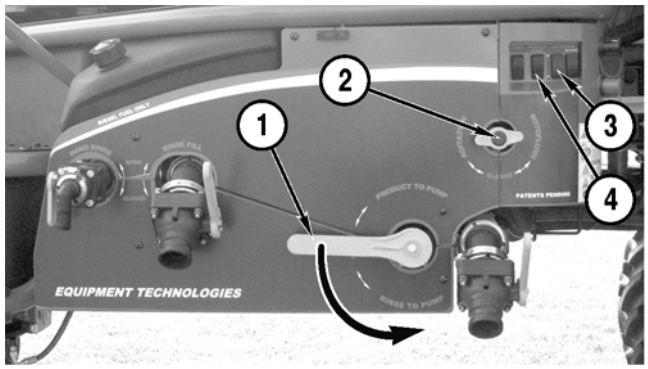
NOTICE: Read and follow chemical labels for proper usage, flushing, disposal and protective clothing requirement instructions. ALWAYS dispose of chemicals and contaminated rinse water in a safe location in accordance with chemical label recommendations and local laws.

NOTICE: Some chemicals may require multiple tank flushings.

NOTICE: DO NOT run the product pump dry. Damage to the pump seals will result. DO NOT intentionally deadhead the pump with high pressures. Damage to the pump seals will result.

To flush the booms:

- Unfold the booms.
- Set the product valve (1) to RINSE TO PUMP.
- Set the product pump switch (4) to the ON position.
- Increase engine speed to 1800 rpm.
- Turn the agitate/roto-flush knob (2) to ROTO-FLUSH.
- Set the boom section switches to the ON position.



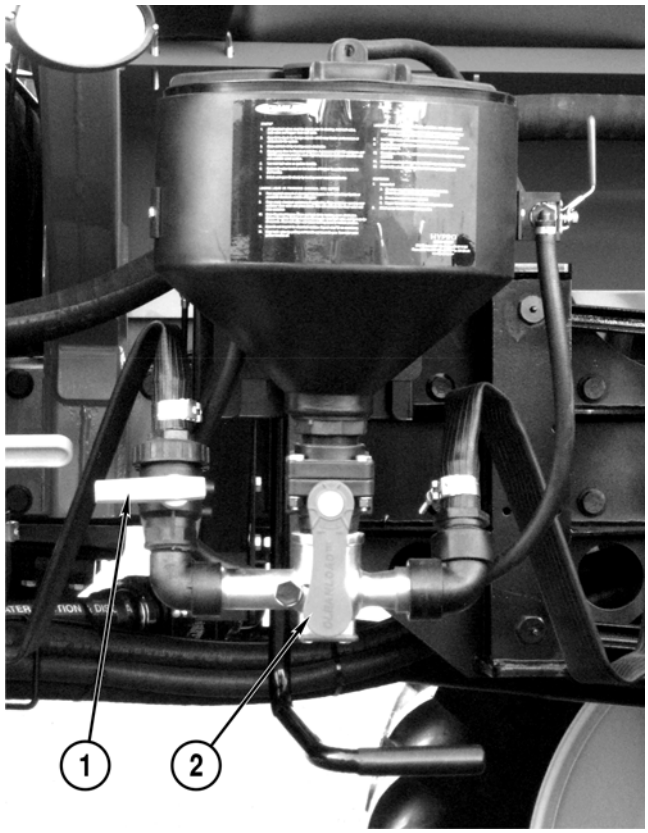
NOTE: If the Apache Sprayer is equipped with an optional chemical eductor, flush the eductor at the same time as the booms.

After the booms and flowback valve are flushed:

- Return the engine speed to IDLE.
- Set the boom section switches to OFF.
- Set the product pump switch (4) to OFF.
- Set the product valve (1) to PRODUCT TO PUMP.
- Set agitate/roto-flush knob (2) to AGITATE.
- Return agitate switch (3) to original setting.
- Fold the booms, and turn off the engine.

Cleanload Chemical Eductor

Startup



1. All eductor valves must be closed prior to starting. Close the inlet ball valve (1) and the hopper ball valve (2).
2. Open the lid to check for foreign objects which may hinder performance or contaminate the system.
3. Close and lock the lid by turning the cover clockwise.
4. Divert pump flow to the eductor inlet line.

NOTICE: A pressure of 30 psi [2.06 bar] minimum and 150 psi [10.3 bar] maximum must be used. Higher pressures increase eduction rate and available wand suction.

5. Turn the yellow handle of the inlet ball valve (1) to the open position.
6. Open the hopper ball valve (2), located on the bottom of hopper, by rotating the handle into a vertical position.
7. Unlock and open the lid slowly by turning the cover counterclockwise.
8. Load the eductor. Loading instructions differ for eductors equipped with an optional suction lance. Use the procedure that is appropriate for your application.

Loading Liquid or Powdered Chemical into Hopper

NOTICE: DO NOT at any point put your face directly over the hopper.

NOTICE: Avoid splashing liquids or powdered chemicals outside of the hopper.

1. Pour required amount of chemical into the hopper.
2. Rinse empty chemical containers if applicable. Place container opening over the container rinse valve and press down. This will activate the rinse valve and rinse the container.
3. Rinse the Cleanload hopper.
4. Close and lock the lid by turning the cover clockwise.
5. Release the safety locking band on the hopper rinse ball valve and open the valve for 20 seconds.
6. Close the ball valve and return the locking band to the locked position.
7. Open the lid and inspect for chemical residue. Repeat steps 3 to 6 as necessary.
8. Close the hopper ball valve (2) by rotating the handle into a horizontal position (shown). Turn the inlet valve (1) (yellow handle) off.

NOTE: The eductor hoses are flexible and may be kinked while in the up position. This is normal and will not cause any damage to the hoses or equipment.

Loading Liquid and/or Powdered Chemical with Suction Lance

NOTE: The suction lance must be purchased separately. It is not included with the chemical eductor.

NOTE: Lance suction is dependent on eductor pressure and flow. For best results, use highest pressure available (up to 150 psi [10.3 bar] maximum).

1. Insert lance body with o-ring into eductor until the o-ring is sealed.
2. Use the free end of the lance to vacuum powdered or liquid chemical.
3. Rinse lance. Place lance end into a clean container of water to rinse lance assembly.
4. Remove lance body from eductor and drain any remaining fluid into hopper.
5. Close hopper ball valve. Turn inlet valve (yellow handle) off.

Shutdown

1. Before shutdown, make sure:
   - All valves are closed. Be sure to close the hopper ball valve first. (Close by moving handle into a horizontal position.)
   - Chemical residue has been cleaned.
   - Hopper lid is closed and locked by turning cover clockwise.
2. Divert pump flow back to normal operation.
3. Raise eductor to up positions and insert latch pin.

NOTICE: DO NOT store a contaminated lance in the Apache Sprayer cab.

NOTES

APACHE™

CHAPTER 5

LUBRICATION AND MAINTENANCE

Before performing any maintenance procedures, read the Safety Section on page 2-1.

Maintenance Precautions

- Any part which is found defective as a result of inspection or any part whose specifications are not adequate must be replaced.
- ALWAYS tighten components to the specified torque. Loose parts can cause equipment damage or cause it to operate improperly.
- Only use Apache-approved replacement parts. Other replacement parts may affect warranty coverage.
- NEVER attempt to modify the Apache Sprayer design or safety features.
- If a warning alarm or indicator activates during engine operation, stop the Apache Sprayer and engine immediately and contact your Apache dealer. Determine the cause and repair the problem before continuing operation. To ensure your safety, the safety of others, and the safe operation and maintenance of the sprayer, read, follow and practice the following:

WARNING! Exposure Hazards

- ***ALWAYS wear appropriate eye protection to prevent the risk of eye injury. Wear safety glasses to prevent eye contact with debris, chemicals and fluids.***
- ***ALWAYS wear ear plugs when working around loud noises to prevent hearing loss.***
- ***ALWAYS wear the appropriate gloves to protect your hands, especially when handling extremely hot or cold equipment and fluids.***

WARNING! Entanglement Hazards

- ***NEVER leave the key in the key switch when servicing the Apache Sprayer. Attach a "Person working on vehicle. DO NOT Start or Operate" tag near the key switch while performing maintenance on the equipment.***
- ***ALWAYS stop the engine before beginning service.***
- ***NEVER operate the engine without the guards in place.***
- ***ALWAYS remove any tools or shop rags used during maintenance from the area before operation.***
- ***NEVER engage the transmission or driven equipment by hand from underneath the Apache Sprayer when the engine is running.***

WARNING! Piercing Hazards

- ***Avoid skin contact with high-pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High-pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high-pressure fuel spray, obtain prompt medical treatment.***
- ***NEVER check for a hydraulic leak with your hands. ALWAYS use a piece of wood or cardboard.***

WARNING! Flying Object Hazard.

- ***ALWAYS wear eye protection when servicing the engine or when using compressed air or high-pressure water. Dust, flying debris, compressed air, pressurized water or steam may injure your eyes.***

WARNING! Crush Hazards

- ***ALWAYS make sure the Apache Sprayer is on flat, solid ground before getting under the Apache Sprayer.***
- ***ALWAYS block front and rear axle wheels before getting under the Apache Sprayer.***
- ***If using a hydraulic jack or jack stands, ensure they are of the proper capacity and used in a proper manner under the frame of the Apache Sprayer.***
- ***Use a hoist or use assistance when lifting components that weigh 50 lb [23 kg] or more. Make sure all lifting devices such as chains, hooks or slings are in good condition, of the correct capacity, positioned correctly and have current, valid inspection labels.***
- ***ALWAYS use lifting equipment with sufficient capacity to lift the Apache Sprayer or equipment.***
- ***If transport is needed for repair, acquire assistance when using a hoist and when loading and unloading.***

WARNING! Fire/Explosion Hazards

- ***While the engine is running or the battery is charging, hydrogen gas is being produced and can be easily ignited. Keep the area around the battery well-ventilated and keep sparks, open flame and any other form of ignition out of the area.***
- ***ALWAYS turn off the battery switch or disconnect the negative (-) battery cable before servicing the equipment***

WARNING! Explosion Hazard.

- ***Batteries contain sulfuric acid. NEVER allow battery fluid to come in contact with clothing, skin or eyes. Severe burns could result. If battery fluid contacts the eyes and/ or skin, immediately flush the affected areas with a large amount of clean water and obtain prompt medical treatment.***

WARNING! Exposure Hazard.

- ***ALWAYS wear safety goggles and protective clothing when servicing the battery.***

WARNING! High-Pressure Compressed Air - Exposure and Impact Hazards

- ***Pneumatic components store compressed air and can separate violently during disassembly or removal. Before servicing any part of the pneumatic (air) system, slowly release all compressed air from the system.***
- ***NEVER exceed the recommended working air pressure.***
- ***NEVER connect or disconnect a hose or line containing air pressure.***
- ***ALWAYS wear safety glasses when working with compressed air systems. NEVER look into the area of escaping air when draining air tanks or disconnecting lines. Dirt or moisture may be expelled, causing eye injury.***

WARNING! Shop Equipment Hazards

- ***ALWAYS check before starting the engine that any tools or shop rags used during maintenance have been removed from the area.***
- ***ALWAYS use tools appropriate for the task at hand and use the correct size tool for loosening or tightening machine parts.***
- ***ALWAYS use the proper tools and equipment for servicing the Apache Sprayer. Ensure the tools are rated and approved for use with this Apache Sprayer.***

- ***If an Apache Sprayer is to be operated with test equipment connected, precautions must be taken to ensure that all equipment and related components are securely attached to prevent movement and interference.***
- ***Before performing any maintenance procedure, have all the correct tools you need to perform the required tasks.***
- ***Ensure that the work area is adequately illuminated. ALWAYS install wire cages on portable safety lamps.***

Environmental Precautions

The safety messages that follow have NOTICE level hazards.

- Thoroughly clean any spilled fluids from the equipment and/or ground after service is completed. Dispose of used fluids and filters as required by law.
- ALWAYS be environmentally responsible. Follow the guidelines of the EPA or other governmental agencies for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.
- NEVER dispose of hazardous materials by dumping them into a sewer, on the ground, or into ground water or waterways.

Non-Apache Equipment Maintenance

Some components and systems of Apache Sprayers are manufactured by companies other than Apache and have specific safety, inspection, adjustment and maintenance procedures outlined by their manufacturer.

NOTICE: ALWAYS perform maintenance procedures for all OEM equipment in addition to procedures for the Apache Sprayer.

Some non-Apache equipment operator's and maintenance manuals are included with the Apache Sprayer. These include, but are not limited to, the Engine Owner's Manual, Sprayer Monitor System Manual, Chemical Eductor Manual, Product Pump Instructions and other optional equipment manuals.

NOTICE: ALWAYS perform and reference the original equipment manufacturers' service information when performing service or maintenance procedures on equipment manufactured by companies other than Apache. Before servicing original equipment manufacturer (OEM) systems or components, properly identify the OEM model and serial number to ensure correct service and replacement part information is referenced.

Cleaning Guidelines

The following guidelines are recommended when cleaning mechanical and electrical parts of the cab.

WARNING! Fire Hazard

- ***Cleaning solvents can cause death or serious injury.***
- ***Cleaning solvents are extremely flammable and toxic if inhaled.***
- ***DO NOT use near sparks or flame and avoid inhaling.***
- ***Use in a well-ventilated area and follow the manufacturers' warnings on use and handling.***

WARNING! Exposure Hazard.

- ***Wear safety glasses, gloves, and other proper protective clothing or gear when handling part cleaners or other hazardous cleaning agents.***

The safety messages that follow have NOTICE level hazards.

- Use caution when using power washers to avoid damaging rubber, plastic or electrical components.

Mechanical Parts

- Clean mechanical parts with a noncombustible cleaning agent.
- Clean mating surfaces thoroughly after removing a part to which an o-ring or gasket is attached. If you replace a part, ALWAYS use a new o-ring or gasket.

Electrical Parts

- NEVER spray water or cleaners directly on electrical parts.
- Electrical parts are susceptible to water damage and insulations leaks. Current leakage can develop if electrical parts become wet or the insulation is damaged.

Body and Cab Exterior

- The use of a low-pressure water supply system and mild automotive-type soap is recommended to wash and rinse the Apache Sprayer.
- DO NOT use abrasive cleaning materials on the Apache Sprayer, as brushes, chemicals and cleaners may damage the finish or components.
- DO NOT remove ice or snow from painted surfaces with a scraper or blade.
- DO NOT allow diesel fuel, oils, lubricants or antifreeze to come in contact with painted surfaces.
- When cleaning chrome, stainless-steel or aluminum parts, use clean water and a soft cloth.
- Avoid scratching or damaging polished metal finishes; DO NOT use abrasive cleaners.
- NEVER use pressurized water or cleaners to clean the cab interior.
- NEVER use corrosive cleaning solutions or any type of abrasives. Part or equipment damage caused by use of corrosive cleaners or abrasives is not covered under Apache warranty.
- Periodically clean the interior dash, gauge panels, floor and seat with a mild cleanser or water-dampened cloth.
- Periodically clean all interior glass with a water-dampened cloth or approved glass cleaning materials.

Apache Sprayer Service Interval Chart

Perform and repeat the prescribed maintenance at each interval ❍ = Conditional Service ● = Regular Service NOTE: Do not overlook the "After First 100 Hours" interval.	Before Initial Use	After First 10 Hours	As Required	Daily	Every 40 Hours	**After First 100 Hours**	Every 100 Hours	Every 250 Hours	Every 500 Hours or Yearly	Every Year	Every 1000 Hours or Yearly	Every 2500 Hours or Yearly
Grease Entire Boom	❍			●								
Torque Lug Nuts	❍	❍			●							
Torque Boom Lead Bolts	❍	❍			●							
Grease Steering Components	❍				●							
Grease Axle Components	❍		❍		●							
Grease Driveline Components	❍						●					
Adjust Poly Tank Straps	❍	❍				❍	●					
Adjust Boom	❍	❍	❍									
Torque Axle Extension Bolts	❍		❍				●					
Adjust Toe-In			❍							●		
Change Engine Safety Air Filter			❍							●		
Winterize Wet System			❍							●		
Change Cab Filters			❍							●		
Flush Wet System (including product pump)			❍	●								
Check Tire Pressure				●								
Check Oil Engine Level				●								
Drain Water from Fuel/Water Separator				●								
Check Coolant Level, Cooling Package, and Hoses				●								
Check Transmission Oil Level				●								
Check Hydraulic Fluid Level				●								
Grease Rear Suspension					●							
Check Differential Fluid Level					●							
Check Differential for Leaks					●							
Re-Phase Steering Cylinders					●							
Change Fuel Primary Filter							●					
Change Fuel Separator Filter							●					
Clean Fuel Tank Strainer			❍				●					
Clean/Change Primary Engine Air Filter			❍					●				
Change Differential Fluid						❍		●				
Change Hydraulic Fluid Filter (Immediately if indicator is red)						❍		●				
Clean Hydraulic Fluid Strainer								●				
Change Primary Engine Air Filter								●				
Change Engine Oil and Filter						❍			●			
Change Transmission Oil and Filter						❍			●			
Inspect Rear Suspension Cylinder, Accumulator and Charge									●			
Inspect Front Accumulator and Suspension Cylinder									●			
Check Front Suspension Cylinder Fluid Level									●			
Check Charge in Front Accumulators									●	●		
Change Final Drive Fluid									●			
Recalibrate Raven Radar Gun									●			
Inspect and Repack Wheel Hub and Flex Bearings									●			
Change Hydraulic Fluid											●	
Change Crankcase Ventilation Filter												●

Before Initial Use

The following services must be performed before initial use of the Apache Sprayer and repeated at the interval prescribed in the Apache Sprayer Service Interval Chart. See “Apache Sprayer Service Interval Chart” on page 5-5.

- Grease Boom. See “Grease Boom” on page 5-10.
- Torque Lug Nuts. See “Torque Lug Nuts” on page 5-15.
- Grease Steering Components. See “Grease Steering Components” on page 5-16.
- Grease Axle Components. See “Grease Axle Components” on page 5-17.
- Grease Driveline. See “Grease Driveline Components” on page 5-19.
- Check Axle Extension Bolt Torque. See “Torque Axle Extension Brace Bolts” on page 5-20.
- Adjust Poly Tank Straps. See “Adjust Poly Tank Straps” on page 5-21.
- Adjust Boom. See “Adjust Boom” on page 5-6.

After First 10 Hours

The following services must be performed after the first 10 hours of operation and repeated at the interval prescribed in the Apache Sprayer Service Interval Chart. See “Apache Sprayer Service Interval Chart” on page 5-5.

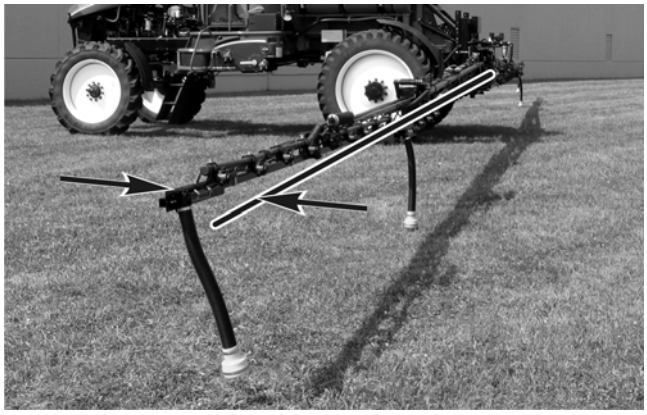
- Torque Lug Nuts. See “Torque Lug Nuts” on page 5-15.
- Adjust Poly Tank Straps. See “Adjust Poly Tank Straps” on page 5-21.

Adjust Boom

NOTICE: All boom adjustments should be performed with the boom fully unfolded and lowered.

Boom Lead

The outermost tip of the booms should lead the boom rack by 3 to 4 inches [76.2 to 101.6 mm].



To adjust the boom lead:

Loosen the boom lead bolts (1) near the bottom of the boom rack.

- Turn the jam nuts (2) toward the end of the boom to increase boom lead.
- Turn the jam nuts (2) toward the center of the boom rack to reduce boom lead.

Tighten the jam nuts and lead bolts after correct lead is set.

Torque the boom lead bolts to 420 lb-ft [569 N•m]

Repeat the steps for the remaining boom, as required.

Boom Breakaway

Each left and right boom is equipped with one or two boom breakaways depending on boom configuration. A right, boom tip breakaway is shown.

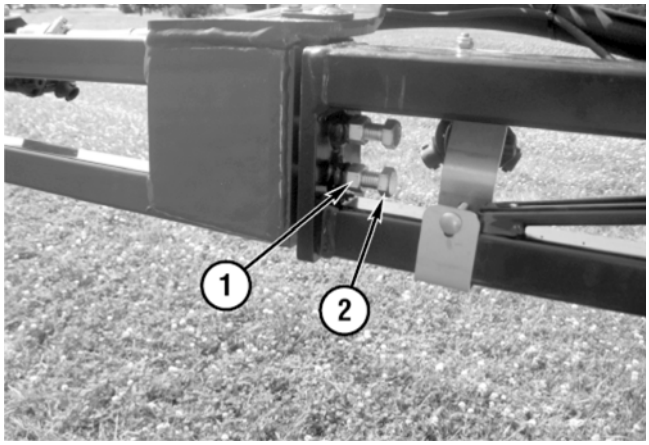
The breakaways should be adjusted so the boom sections on both sides of the breakaways are straight and aligned as they extend from the boom rack.

To adjust the breakaway:

Loosen the jam nut (1) and turn the adjusting screw (2) to align the booms.

Tighten the jam nut.

Repeat the steps for the remaining breakaways, as required.



Boom Stabilizer

There are four boom stabilizers mounted on the boom rack. The upper and lower right-side stabilizers (1) are shown.

The gap between the nylon wear pads and the steel frame should be 0.093 to 0.125 in. [2.4 to 3.2 mm] with the booms unfolded.

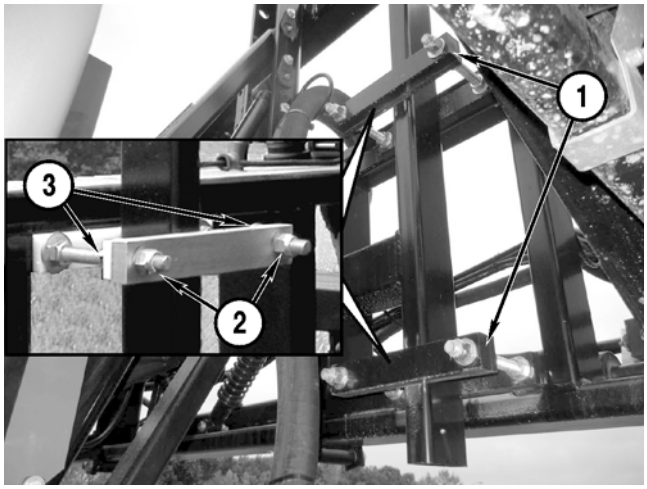
To adjust the gap:

Loosen both lock nuts (2) on the stabilizer and equally adjust the jam nuts (3) until the gap is correct.

Tighten the lock nuts (2).

Repeat the steps for the other stabilizers, as required.

NOTE: For best performance, the jam nuts must be adjusted so the stabilizer halves are parallel and provide the 0.093 to 0.125 in. [2.4 to 3.2 mm] gap.



Boom Tip
(80 ft, 90 ft, and 100 ft Booms)
The boom tips should be level with the main boom.

The left boom tip is shown.

To adjust the boom tip level:

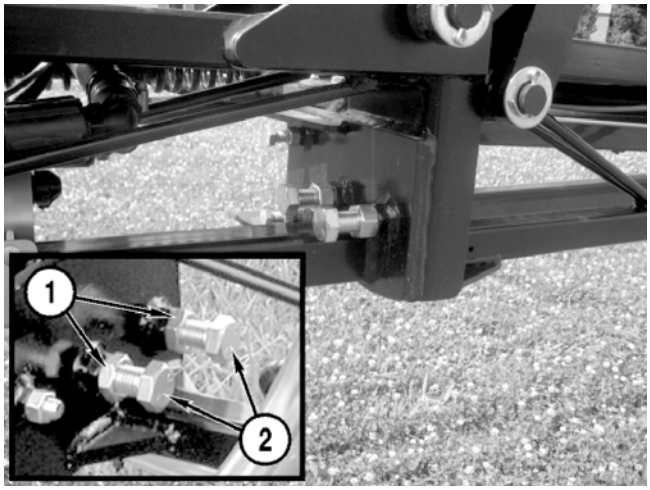
Loosen the jam nuts (1) on the leveling bracket.

Turn the leveling bolts (2) clockwise to raise the boom tip or counter-clockwise to lower the boom tip.

NOTE: When the boom tip is adjusted properly, there will be some side-to-side movement in the cylinder and in the linkage bars.

NOTE: Adjust the bolts equally for best performance.

Repeat the steps for the other boom tip, as required.



As Required

The following services will be required at various intervals depending on Apache Sprayer use and environmental conditions. Repeat these services as prescribed by the Apache Sprayer Service Interval Chart. See “Apache Sprayer Service Interval Chart” on page 5-5.

- Grease Axle Components. See “Grease Axle Components” on page 5-17.
- Adjust poly Tank Straps. See “Adjust Poly Tank Straps” on page 5-21.
- Adjust Boom. See “Adjust Boom” on page 5-6.
- Check Axle Extension Bolt Torque. See “Torque Axle Extension Brace Bolts” on page 5-20.
- Adjust Toe-In. See “Adjust Toe-In (Standard 120” Axles)” on page 5-35.
- Clean or Change the Primary Engine Air Filter. See “Clean or Change Engine Primary Air Filter” on page 5-23.
- Change Engine Safety Air Filter. See “Change Engine Safety Air Filter” on page 5-37.
- Winterize Wet System. See “Winterize Wet System” on page 5-38.
- Change Cab Air Filters. See “Change Cab Recirculating Air and Charcoal Filter” on page 5-40.
- Flush Wet System. See “Flushing Booms” on page 4-25.
- Inspect Front Accumulator. See “Inspect Front Accumulator and Suspension Cylinder” on page 5-25.
- Clean the Fuel Tank Strainer. See “Clean Fuel Tank Strainer” on page 5-22.

Clean or Change Engine Primary Air Filter

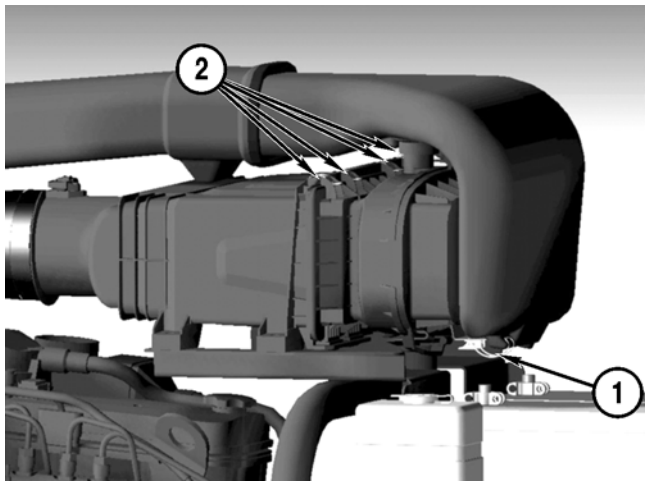
NOTICE: When operating in severe conditions, the primary air filter should be cleaned after every 40 hours of use or if indicated by the console display.

NOTICE: If a “Change Air Filter” fault is indicated on the console display, stop immediately and remove and clean or change the primary air filter as needed.

The primary air filter is mounted in the engine compartment, above the engine and toward the cab.

Clean the outside of the air cleaner and surrounding area to keep dust from entering the cleaner assembly.

Unlatch the snap latch (1) and remove the snorkel by lifting and pulling towards cab. Swing the snorkel to the left side of the machine to provide room to remove air cleaner cover.



Unlatch the four snap latches (2) on the top side of the air cleaner cover. Remove the cover and position it out of the way so the primary air filter can be removed.

Remove primary air filter. The air filter can be removed by sliding it out on the left side of the engine.

NOTICE: NEVER clean the inner engine air filter (engine safety air filter). When it is dirty, ALWAYS replace it with a new one.

Clean the filter using compressed air. Blow the filter from the inside-out.

If installing a new primary engine air filter:

- Primary Engine Air Filter Part Number: 201300140.

Install the filter, the air cleaner cover, and engage the cover latches.

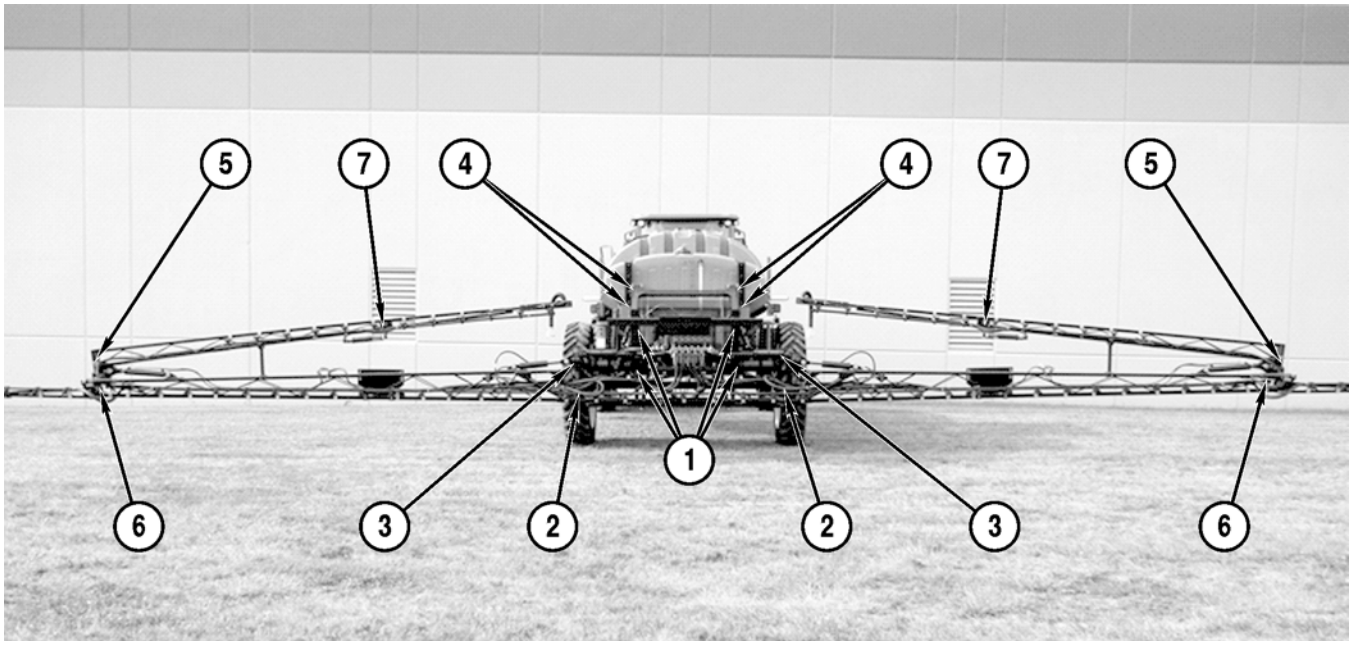
Daily

The following services must be performed daily, before operation of the Apache Sprayer.

- Clean or Change Primary Engine Air Filter as needed. See “Clean or Change Engine Primary Air Filter” on page 5-23.

NOTICE: NEVER clean the inner engine air filter (engine safety air filter). When it is dirty, ALWAYS replace it with a new one.

Grease Boom

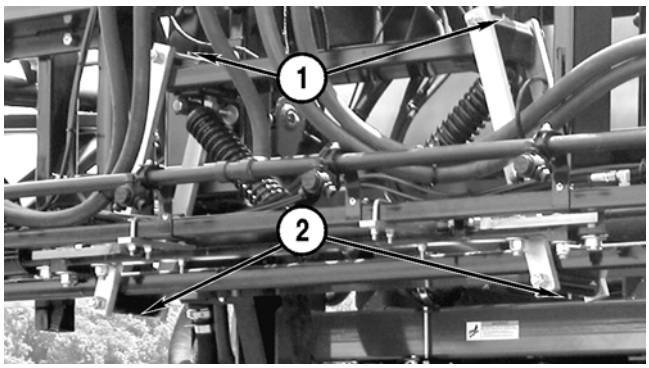


The boom is equipped with seven sets of grease fittings. Apply an ample amount of lithium grease through each of the grease fittings.

1. **Boom Stabilizer**
2. **Boom Tilt**
3. **Boom Fold**
4. **Boom Rack**
5. **Boom Tip**
6. **Boom Inner Breakaway (if equipped)**
7. **Boom Outer Breakaway**

Boom Stabilizer

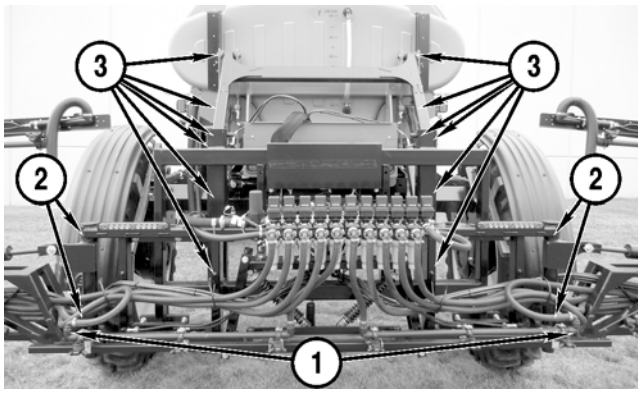
There are two upper (1) and two lower (2) boom stabilizer grease fittings.



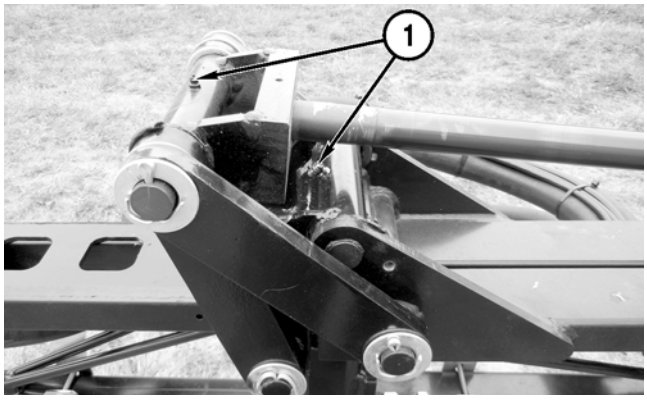
Boom Tilt
There are two boom tilt grease fittings (1).

Boom Fold
There are four boom fold grease fittings (2).

Boom Rack
There are 12 boom rack, flag-pin style, grease fittings (3).

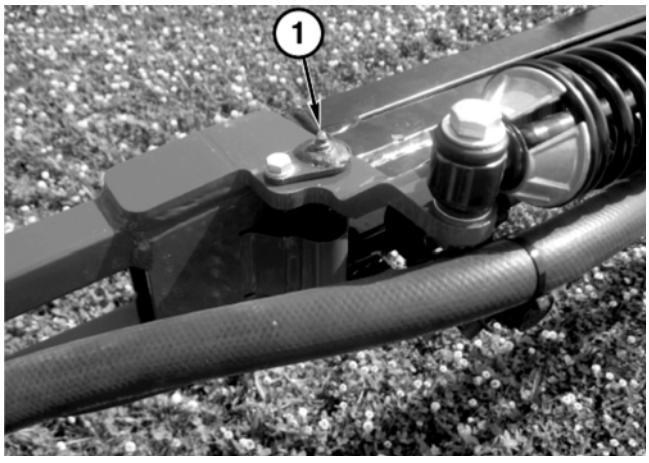


Boom Tip
There are four boom tip grease fittings (1), two on each boom tip. The left side is shown.



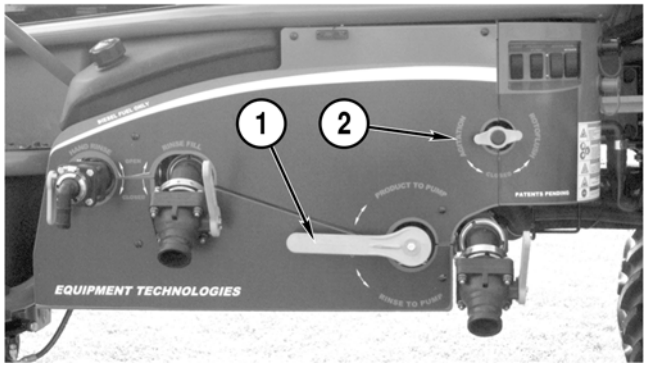
Boom Inner Breakaway (if equipped)
There is one boom inner breakaway grease fitting (1) on each boom. The left side is shown.

Boom Outer Breakaway
There is one boom outer breakaway grease fitting (1), on each boom tip. The left side is shown.



Flush Wet System

Drain and flush the product tank and wet system after use and when changing chemicals. See “Flushing Product Tank” on page 4-24. See “Flushing Booms” on page 4-25. See “After the booms and flowback valve are flushed:” on page 4-25.



Check Tire Pressure

Perform the following:

- Check the tires for damage. Replace tires that have cuts or bubbles.
- Check the tires for proper inflation pressure. Inflate tires according to the tire manufacturer’s recommendations. Tire pressures are listed on the back cover of this manual.
- Check the rims for cracks and other damage. Replace damaged rims.

Check Engine Oil Level

NOTICE: If the engine has been running, shut off and wait 10 minutes before checking oil level.

The dipstick is located in the engine compartment, on the left side of the engine.

While parked on level ground, remove the dipstick and check the oil level.

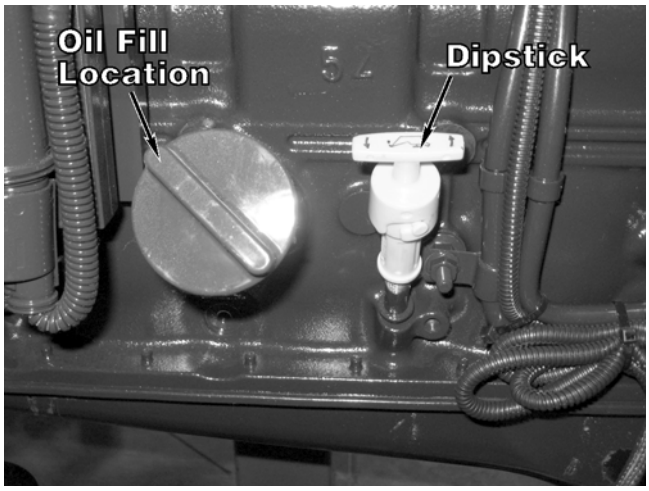
The oil level should be within the hatched area on the dipstick.

If the oil level is below the ADD mark, add high quality Lucas 15W-40 Magnum motor oil at the oil fill location on top of the engine.

Add oil as needed to bring the level to the hatched area on the dipstick.

Replace the dipstick.

Additional lubricating oil system information is available in the engine manufacturer’s manual provided with the Apache Sprayer.



Check Cooling System

WARNING! Fire Hazard. Coolant may be flammable under certain conditions. NEVER allow coolant to come into contact with hot surfaces.

WARNING! Exposure Hazard. Wear eye protection and rubber gloves when handling engine coolant. Avoid skin contact with coolant. If contact with the eyes or skin should occur, flush eyes and wash immediately with clean water.

WARNING! Burn Hazard. NEVER remove the radiator cap if the engine is hot. Steam and hot engine coolant will spray out and seriously burn you. Allow the engine to cool down before you attempt to remove the cap.

Remove the small grille on the top, left of the hood assembly to gain access to the radiator fill cap.

Remove the radiator cap and check the coolant level. Remove the radiator cap slowly to relieve internal pressure. The coolant should be level with the bottom of the fill neck.

Add coolant as necessary. DO NOT overfill the cooling system, as this may cause the coolant to spray from the system during operation.

NOTICE: See the engine manufacturer's manual for coolant requirements and additional cooling system information. Coolant specifications must meet or exceed ASTM D3306 / D6210 or RP-329.

Install the radiator cap.

WARNING! Burn Hazard.

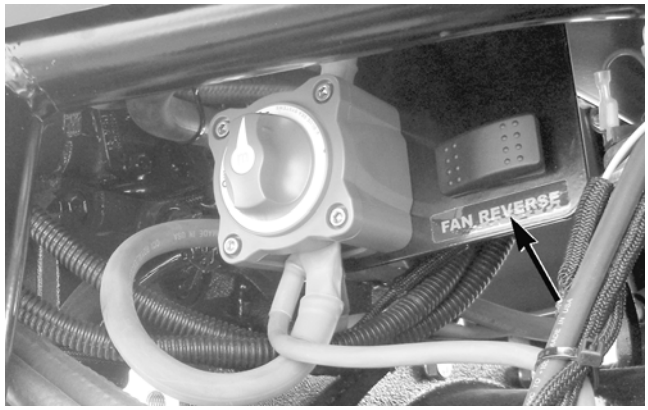
ALWAYS tighten the radiator cap securely after checking the coolant. Steam can spray out during engine operation if the cap is loose.

Inspect the cooling system components for damage and debris.

- Check tubes, hoses and other components for damage and leaks.
- Replace damaged components as necessary.
- Clean debris from around or between cooling package components.

Cycle Fan Reverser

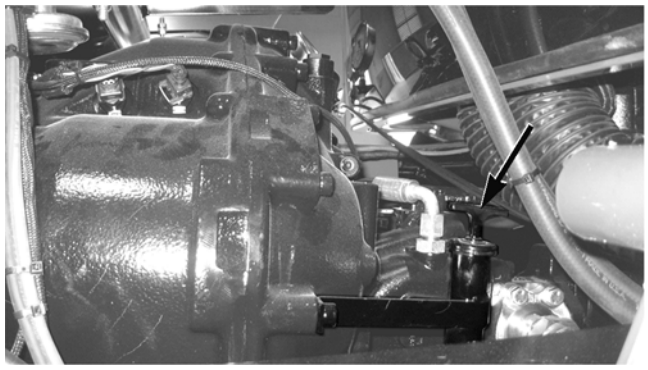
The Apache Sprayer is equipped with a fan reverser. This function be used to reverse the air flow through the radiator and coolers in order to remove dust and debris.



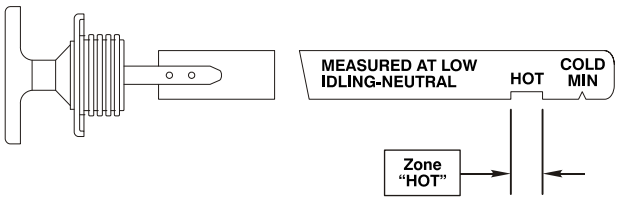
While the engine is running, push the fan reverser button located at the left rear of the engine, next to the battery kill switch. Operate this function until the radiator and coolers are free of dust and debris.

Check Transmission Oil Level

The transmission oil dipstick is located in the engine compartment, on the left side of the engine, and toward the cab.



NOTE: All measurements must be taken with the engine running at low idle.



The transmission oil level check must be carried out as follows:

- Check transmission oil level weekly
- Machine on level ground
- Transmission in Neutral position
- In the cold start phase, the engine must be running approximately 2 to 3 minutes at idle speed. The transmission oil level must be above the cold start mark “COLD MIN”.

Turn the dipstick handle counter-clockwise to loosen.

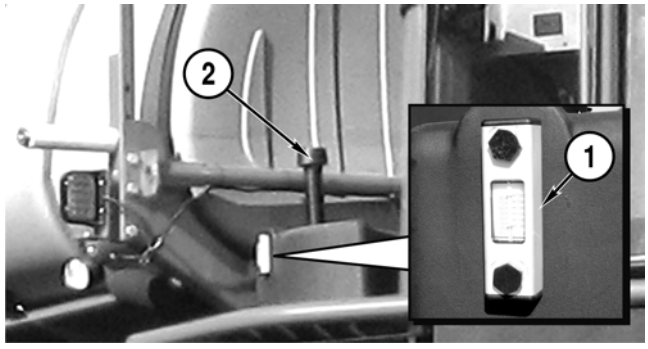
Remove the dipstick and check the transmission oil level.

NOTICE: DO NOT overfill the transmission oil. Overfilling can damage the transmission or cause the transmission to malfunction or overheat.

NOTICE: Use only Lucas 15W-40 Magnum motor oil.

Check Hydraulic Fluid Level

NOTICE: The machine must be on level ground with the booms folded and in the transport position for an accurate hydraulic fluid level reading.



The hydraulic fluid reservoir is located on the right side of the Apache Sprayer and a sight glass (1) indicates the hydraulic fluid level and temperature.

NOTICE: Use only Lucas Universal Hydraulic Fluid, or equivalent, for the Apache Sprayer hydraulic system.

If no fluid is visible in the sight glass, remove the fill cap (2) and add Lucas Universal Hydraulic Fluid, or equivalent, until fluid is visible in the bottom of the sight glass.

NOTICE: DO NOT fill more than 3/4 up on the sight glass.

Every 40 Hours

The following services must be performed after every 40 hours of operation of the Apache Sprayer.

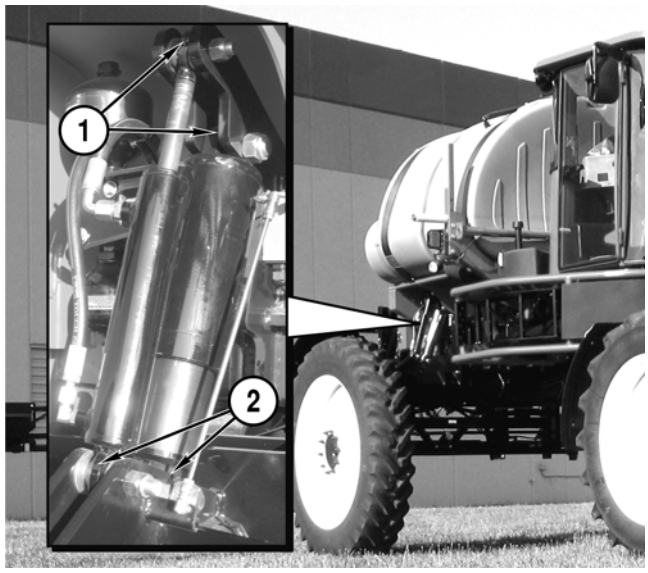
Torque Lug Nuts

Torque wheel lug nuts to:

- 420 lb-ft [569 N•m]

Grease Rear Suspension

Apply Lucas lithium grease or equivalent to the upper (1) and lower (2) grease fittings at each end of the suspension cylinder.



Grease Steering Components

NOTICE: Do not over-grease the ball joints. Damage to the dust cover will result.

Each steering cylinder has two king-pin grease fittings (1), two ball joint grease fittings (2), one inter-flex bearing grease fitting (3), and one hub grease fitting (4). The right wheel is shown.

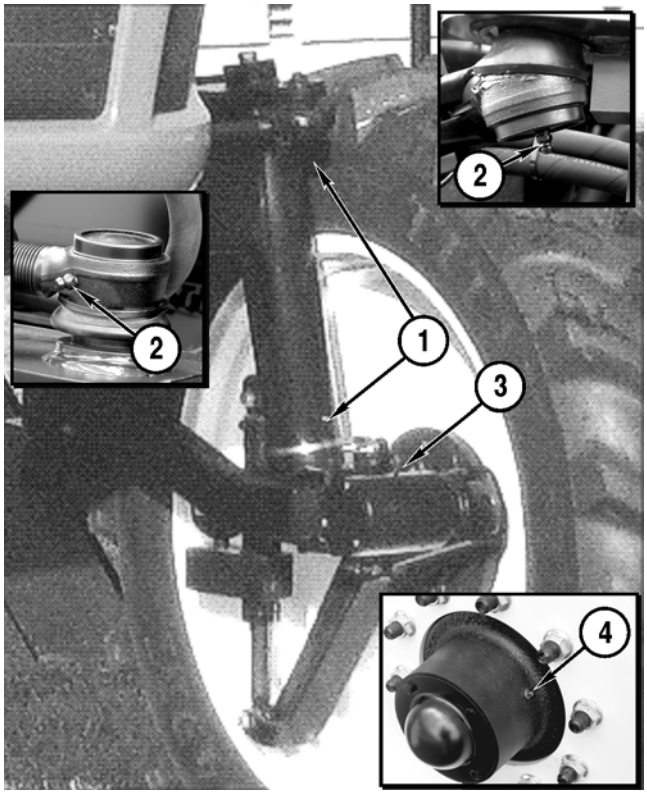
Apply lithium grease through the two king-pin grease fittings (1).

Apply lithium grease through the two ball-joint grease fittings (2) on the tie rod ends.

NOTE: The inter-flex (3) and hub (4) bearings are sealed chambers and once greased require very little grease to maintain.

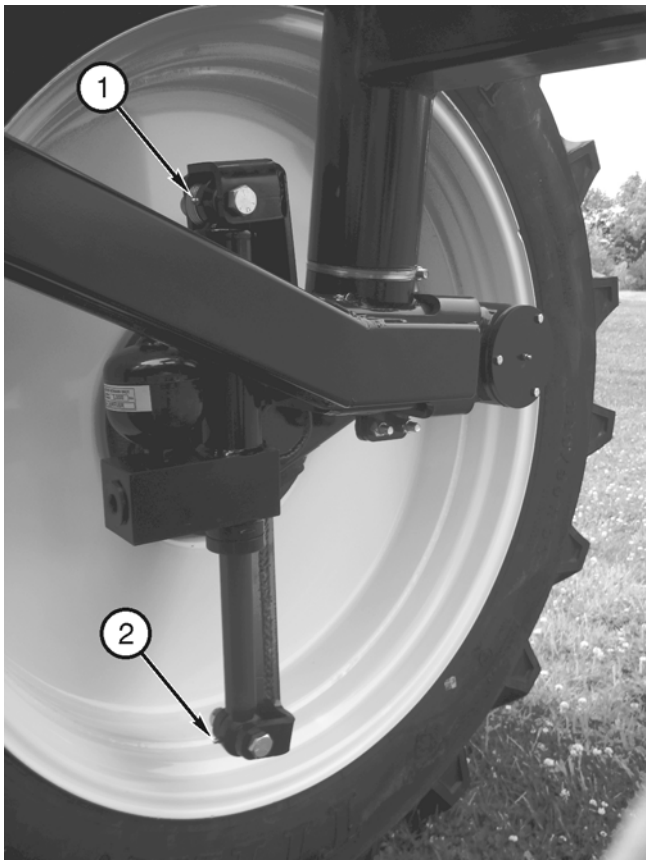
Apply lithium grease through the inter-flex bearing grease fitting (3).

Apply lithium grease through the hub bearing grease fitting (4).



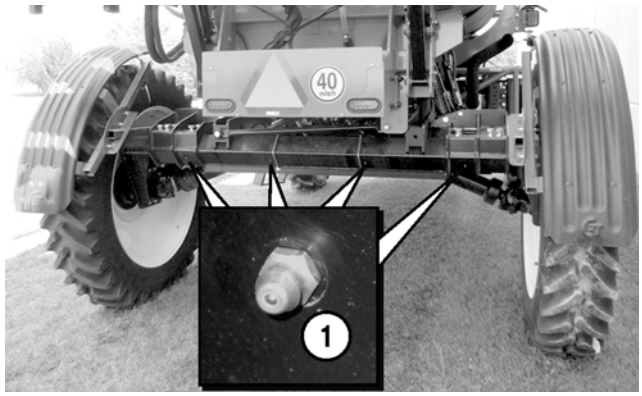
The front strut is equipped with one upper (1) and one lower (2) grease fitting per side.

Apply Lucas lithium grease or equivalent through each grease fitting.



Grease Axle Components

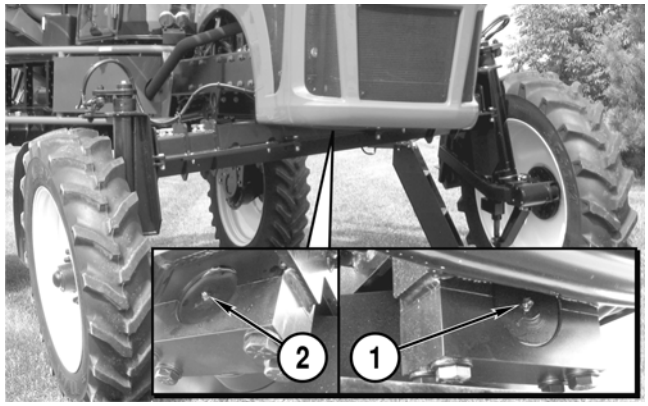
The rear axle is equipped with 16 grease fittings, installed in two square-tube axle extension assemblies. Eight fittings point downward from the bottom faces of each square tube. Shown are the four rear-most fittings (1).



The front axle is equipped with eight grease fittings.

Apply an ample amount of Lucas lithium grease or equivalent through each of the fittings.

An axle pivot is located under the vehicle on the front axle. The pivot is equipped with a grease fitting on front (1) and rear (2) of the front axle.



Apply an ample amount of Lucas lithium grease or equivalent through each of the fittings.

Torque Boom Lead Bolts

Torque the boom lead bolts (1) on the boom rack to 420 lb-ft [569 N•m]. Torque the bolts on both the right hand side and left hand side of the boom rack.

Check Differential Fluid Level

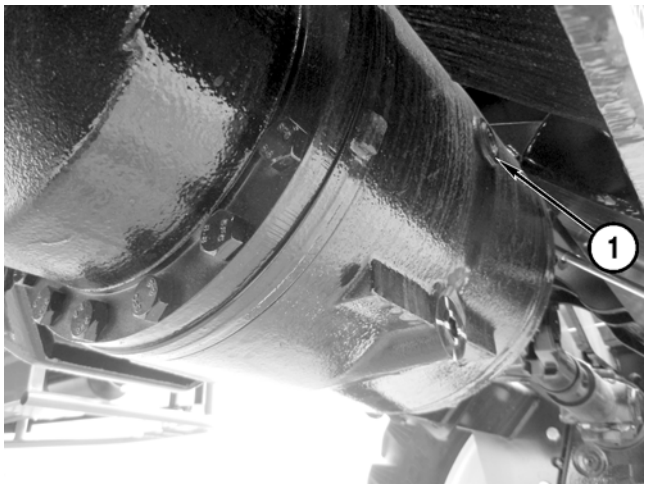
The differential is located under the Apache Sprayer, on the rear axle. The fill/level plug is directly above the drain plug on the rear of the differential.

With the machine parked on level ground, remove the differential fill/level plug (1) and check the fluid level. The fluid should be level with the bottom of the fill/level hole.

NOTICE: Use only Lucas Universal Hydraulic Fluid, or equivalent, for the differential fluid.

If required, add Lucas Universal Hydraulic Fluid, or equivalent, to fill the differential to the bottom of the fill/level hole.

Install the plug and tighten.



Check Differential for Leaks

Inspect the differential for leaks at the U-joint, near the drop boxes, and between inner and outer housings. Repair the leaks before operating the Apache Sprayer.

Re-Phase Steering Cylinders

With the engine operating at 1000 rpm and the hydraulic fluid at operating temperature, turn the steering wheel to the extreme left and continue to turn the wheel 100 revolutions. Repeat this process turning the steering wheel to the extreme right.

After First 100 Hours

The following services must be performed after the first 100 hours of operation and repeated as prescribed by the Apache Sprayer Service Interval Chart.

- Adjust Poly Tank Straps. See “Adjust Poly Tank Straps” on page 5-21.
- Change Differential Fluid. See “Change Differential Fluid” on page 5-23.
- Change Hydraulic Fluid Filter. See “Change Hydraulic Fluid Filter” on page 5-24.
- Change Engine Oil and Filter. See “Change Engine Oil and Filter” on page 5-28.
- Change Transmission Oil and Filter. See “Change Transmission Oil and Filter” on page 5-29.

Every 100 Hours

The following services must be performed after every 100 hours of operation of the Apache Sprayer.

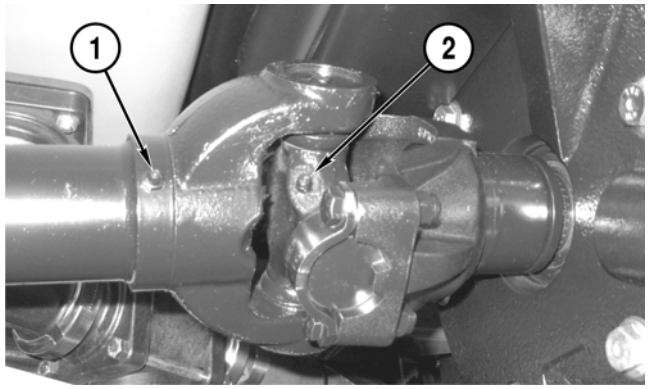
Grease Driveline Components

The Apache Sprayer has a total of ten driveline grease fittings. Three of these fittings are slip joint fittings and seven are U-joint fittings.

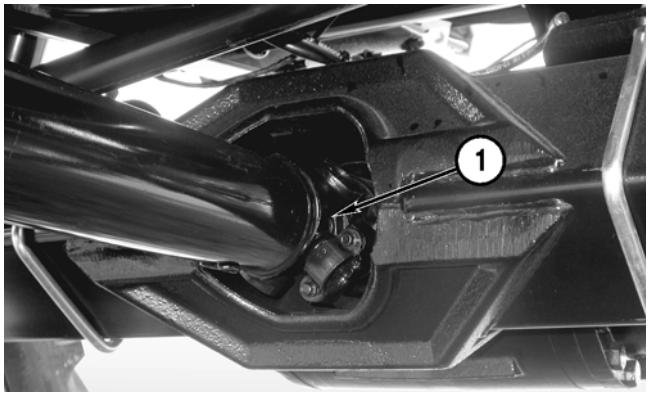
Apply an ample amount of Lucas lithium grease or equivalent through each of the fittings.

One slip joint grease fitting (1) is located under the Apache Sprayer, between the transmission and the rear axle.

A U-joint fitting is located at the transmission output U-joint (not shown) and another fitting (2) is located on the U-joint connected to the slip joint.



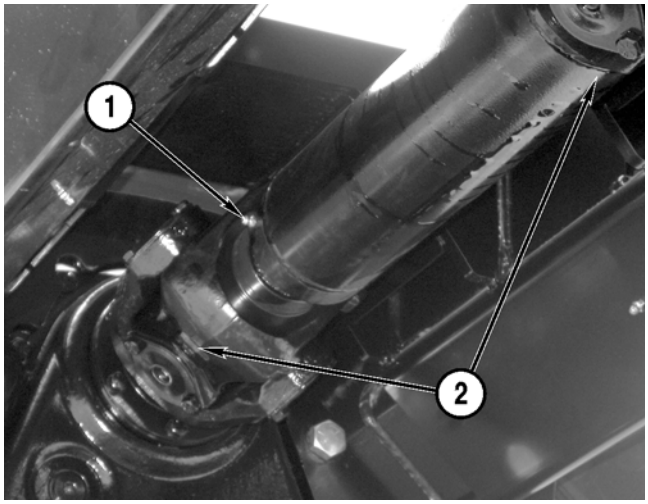
A U-joint fitting (1) is located at the differential input.



The other two slip joint grease fittings (1) are located under the Apache Sprayer, between the differential and each drop box U-joint.

The remaining U-joint fittings (2) are located on the U-joints at each end of the left and right axles.

The left axle is shown.



Torque Axle Extension Brace Bolts

NOTICE: There are different axle brace bolt torque values for manual and Adjust On The Go axles. Follow the instructions for your application.

Manual Adjust Axles

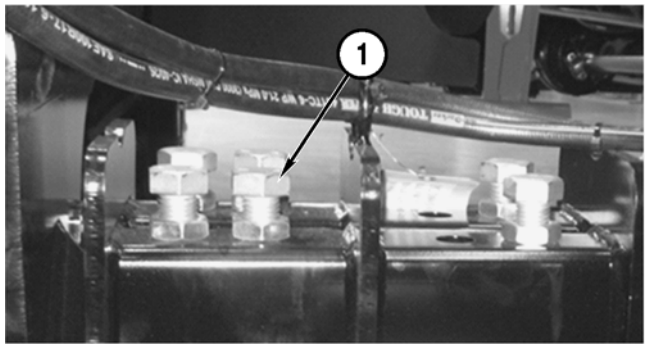
There are six axle brace bolts (1) on each front brace.

Loosen all the jam nuts.

Tighten the axle brace bolts (1) to 80 lb-ft [108 N•m].

Tighten the jam nuts.

Repeat the process for the other front axle brace.



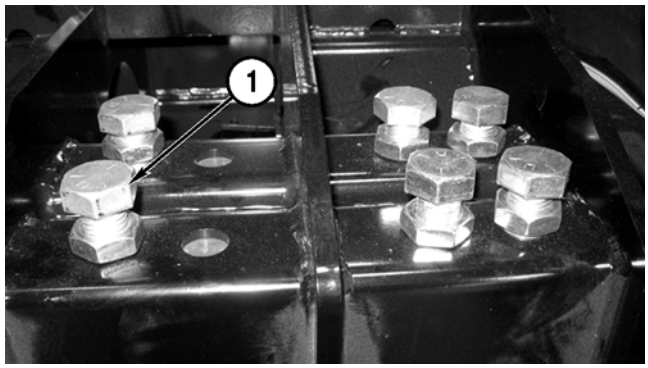
There are twelve axle brace bolts (1) on each rear brace.

Loosen all the jam nuts.

Tighten the bolts (1) to 80 lb-ft [108 N•m].

Tighten the jam nuts.

Repeat the process for the other rear axle brace.



Adjust On The Go Axles

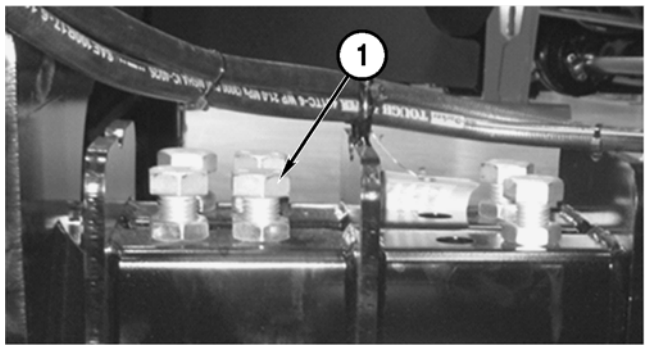
There are six axle brace bolts (1) on each front brace.

Loosen all the jam nuts.

Tighten the axle brace bolts (1) to 15 lb-ft [20 N•m].

Tighten the jam nuts.

Repeat the process for the other front axle brace.



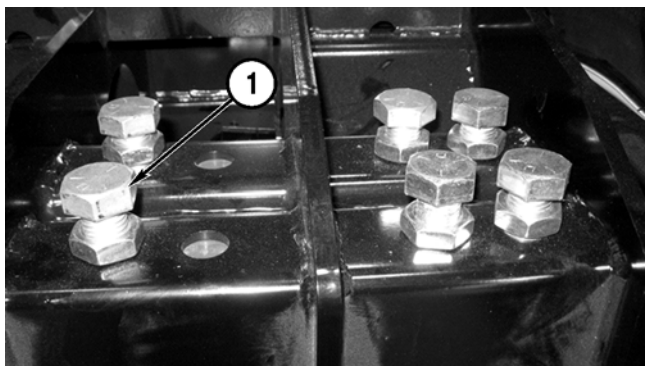
There are twelve axle brace bolts (1) on each rear brace.

Loosen all the jam nuts.

Tighten the bolts (1) to 15 lb-ft [20 N•m].

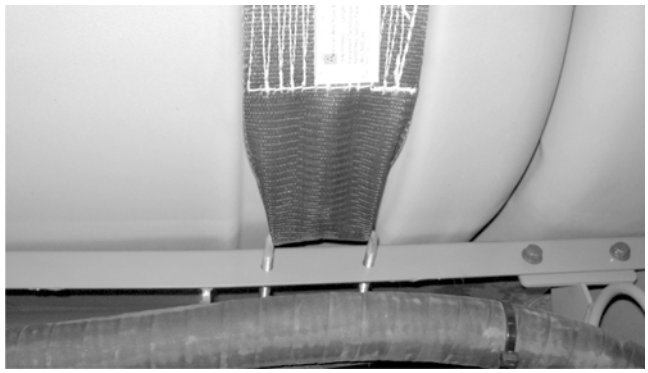
Tighten the jam nuts.

Repeat the process for the other rear axle brace.



Adjust Poly Tank Straps

Tighten the bolts on each tank strap without deforming the tank, bolts or tank skid. Tighten the bolts evenly from side to side.



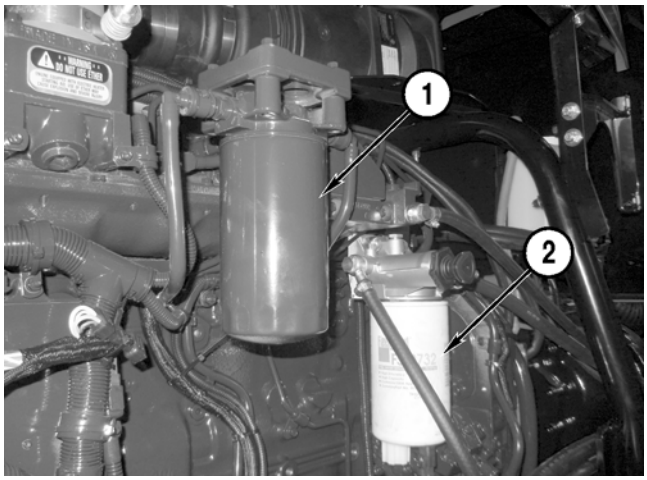
Fill the product tank with water and drive the Apache Sprayer to allow the tank to settle.

Stop the Apache Sprayer and check the straps.

Adjust the straps as needed.

Change Fuel Filter

The fuel filter (1) is located in the engine compartment on the left side of the engine.



WARNING! Fire Hazard. Wipe up fuel spills immediately. Fuel will spill from the filter and fuel lines when loosened or removed. Use a suitable container to collect the fuel and dispose of properly.

Turn the filter counter-clockwise to remove. Dispose of the filter properly.

NOTICE: ALWAYS replace the fuel filter with a new fuel filter.

- Fuel Filter Part Number: 201450304

Fill the new filter with diesel fuel before installing.

Tighten the filter, by hand, 3/4 to 1-1/4 turns after the seal contacts the filter housing.

NOTE: It is not necessary to bleed the fuel system after replacing fuel filters.

Additional fuel system information is available in the engine manufacturer's manual provided with the Apache Sprayer.

Change Fuel Separator Filter

The fuel separator filter (2) is located in the engine compartment on the left side of the engine.

Turn the filter counter-clockwise to remove.

Dispose of the filter properly.

NOTICE: ALWAYS replace the fuel separator filter with a new separator filter.

- Fuel Separator Filter Part Number: 201450303.

Fill the new filter with diesel fuel before installing.

NOTICE: DO NOT overtighten the filter. Damage to the seal can result.

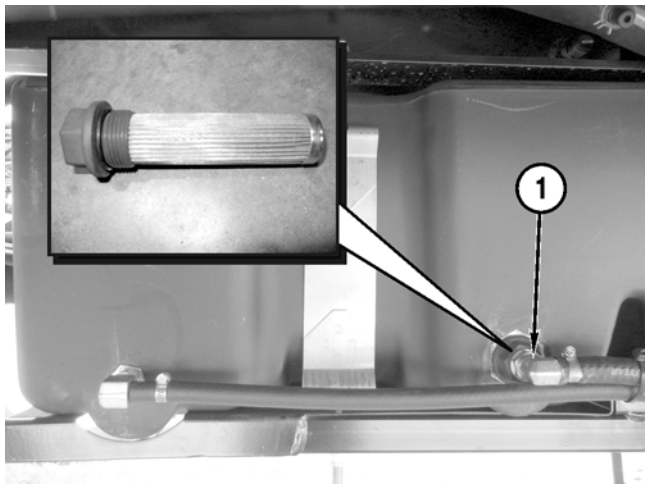
Tighten the filter, by hand, 3/4 to 1-1/4 turns after the seal contacts the filter housing.

NOTE: It is not necessary to bleed the fuel system after replacing fuel filters.

Additional fuel system information is available in the engine manufacturer's manual provided with the Apache Sprayer.

Clean Fuel Tank Strainer

The fuel tank strainer is located in the fuel tank, behind the fuel supply line fitting (1).



An opportune time to clean the fuel tank strainer is when the fuel level is low.

Drain the fuel tank and remove the 1/2” supply line fitting (1) from the tank strainer.

Unscrew the strainer from the tank and clean any debris from inside or outside of the screen. The strainer has a bypass built into the end that can potentially let debris into the inside of the strainer if it becomes completely clogged.

NOTICE: Replace the strainer if it has a hole or is damaged in any way.

- Fuel Strainer Part Number: 201450001.

Every 250 Hours

The following services must be performed after every 250 hours of operation of the Apache Sprayer.

Clean or Change Engine Primary Air Filter

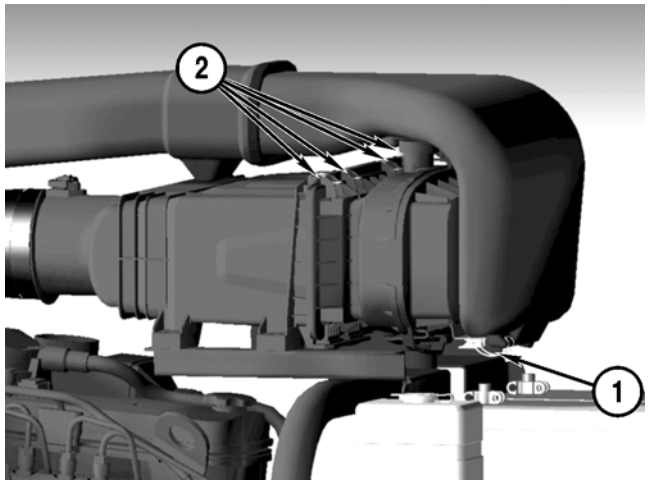
NOTICE: When operating in severe conditions, the primary air filter should be cleaned after every 40 hours of use or if indicated by the console display.

NOTICE: If a "Change Air Filter" fault is indicated on the console display, stop immediately and remove and clean or change the primary air filter as needed.

The primary air filter is mounted in the engine compartment, above the engine and toward the cab.

Clean the outside of the air cleaner and surrounding area to keep dust from entering the cleaner assembly.

Unlatch the snap latch (1) and remove the snorkel by lifting and pulling towards cab. Swing the snorkel to the left side of the machine to provide room to remove air cleaner cover.



Unlatch the four snap latches (2) on the top side of the air cleaner cover. Remove the cover and position it out of the way so the primary air filter can be removed.

Remove primary air filter. The air filter can be removed by sliding it out on the left side of the engine.

NOTICE: NEVER clean the inner engine air filter (engine safety air filter). When it is dirty, ALWAYS replace it with a new one.

Clean the filter using compressed air. Blow the filter from the inside-out.

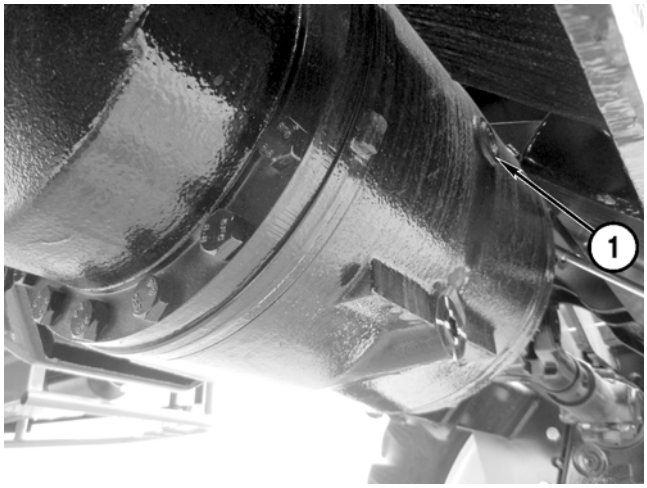
If installing a new primary engine air filter:

- Primary Engine Air Filter Part Number: 201300140.

Install the filter, the air cleaner cover, and engage the cover latches.

Change Differential Fluid

The differential is located under the Apache Sprayer, on the rear axle. The fill/level plug (1) is directly above the drain plug on the rear of the differential.



Remove the differential drain plug and drain the fluid into a suitable container. Dispose of the fluid properly.

Install the drain plug and tighten.

NOTICE: Use only Lucas Universal Hydraulic Fluid, or equivalent, for the differential fluid.

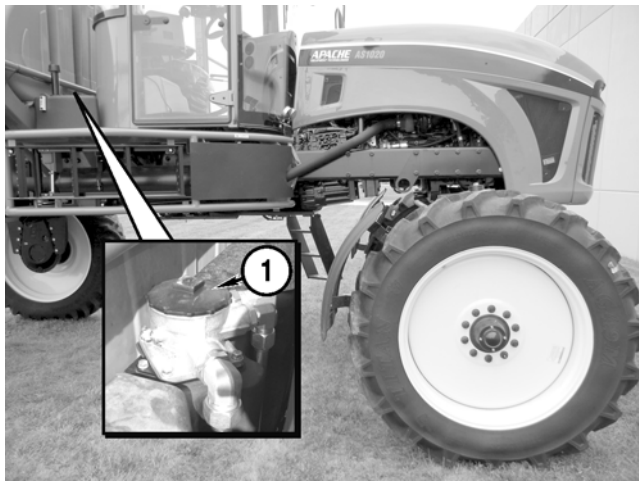
Remove the differential fill/level plug (1). Add fluid until it is level with the bottom of the fill/level hole.

- Differential Fluid Capacity: Approximately 11.9 quarts [11.26 liters].

Install the fill/level plug (1) and tighten.

Change Hydraulic Fluid Filter

The hydraulic fluid filter is located between the cab and product tank on the right side of the Apache Sprayer.



Remove the cover (1) from the filter housing.

Remove the filter from the assembly.

Discard the filter into an appropriate container.

Install an o-ring on the filter housing and lubricate it with clean Lucas Universal Hydraulic Fluid or equivalent.

Install the filter into the filter housing.

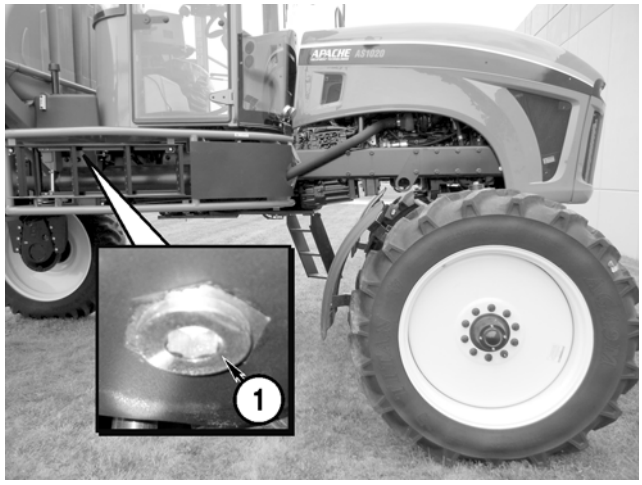
Install and tighten the filter housing cover.

Use the sight glass to check the fluid level. See “Check Hydraulic Fluid Level” on page 5-14.

Clean Hydraulic Fluid Strainer

The hydraulic fluid strainer is located under the Apache Sprayer, on the side of the hydraulic fluid reservoir. The strainer is in line with the hydraulic fluid line.

Remove the hydraulic fluid drain plug (1) from the bottom of the reservoir and drain the fluid into a suitable container with a capacity of approximately 40 gallons [151.42 liters].



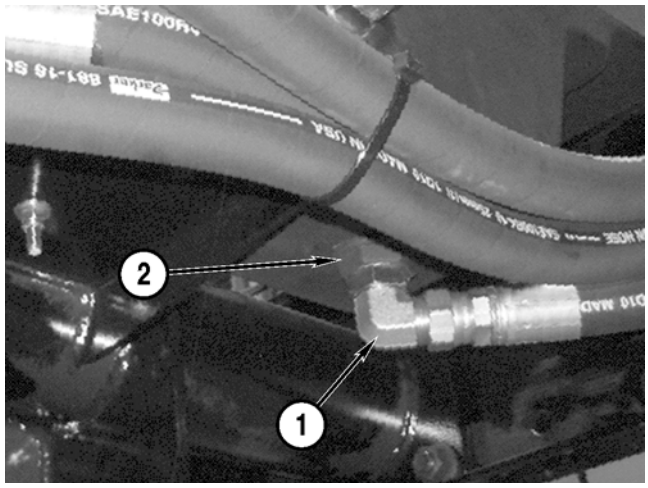
Install the drain plug.

Remove the hydraulic fluid line (1).

Remove the strainer (2).

Clean the strainer with diesel fuel and allow to air dry. Dispose of the fuel properly.

NOTICE: If the strainer cannot be cleaned or has holes in the screen, replace with new a strainer.



Install the hydraulic fluid strainer (2).

- Hydraulic Fluid Strainer
  Part Number: 840000010.

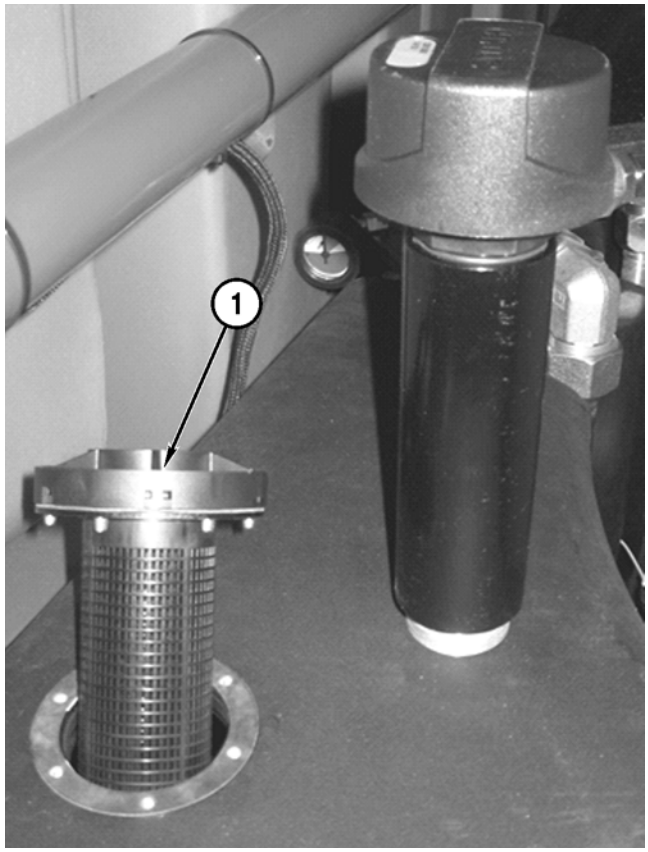
Install the hydraulic line (1).

NOTICE: Use only Lucas Universal Hydraulic Fluid, or equivalent, for the Apache Sprayer hydraulic system.

NOTE: The hydraulic fluid fill location has a screen (1) in the fill neck. FIll the reservoir slowly to reduce the possibility of spilling.

Fill the hydraulic fluid reservoir with Lucas Universal Hydraulic Fluid or equivalent. The reservoir capacity is approximately 40 gallons [151.42 liters].

Use the sight glass to check the fluid level. See “Check Hydraulic Fluid Level” on page 5-14.



Every 500 Hours or Yearly (whichever comes first)

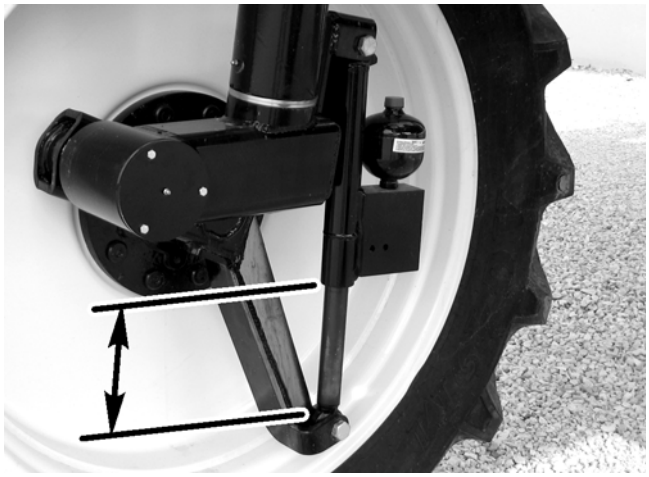
NOTE: Some services at this interval were performed at the “After First 100 Hours” interval. If the service was performed as prescribed, measurement of 500 hours should begin at the 100 hour mark.

The following services must be performed after every 500 hours of operation or yearly.

Inspect Front Accumulator and Suspension Cylinder

Inspect the front accumulators and suspension cylinders for hydraulic leaks and correct operation. Typically, the cylinder should have 4 to 6 in. [101.6 to 152.4 mm] of the cylinder ram showing while the Apache Sprayer is on level ground.

NOTE: Additional cylinder ram may be exposed when the Apache Sprayer is new. Several hours of operation will break in the seals.



Check Front Suspension Cylinder Fluid Level

Safely raise the front of the Apache Sprayer so the front tires are just off of the ground.

Remove the plug (1) from the front of each front suspension cylinder and check the fluid level. The fluid should be level with the bottom of the fill hole.

NOTICE: If the fluid is foamy, the cylinder has failed. Contact your dealer for repair.

NOTICE: Use only Lucas Universal Hydraulic Fluid, or equivalent, for the suspension cylinder fluid.

If required, add Lucas Universal Hydraulic Fluid, or equivalent, to fill the suspension cylinder to the bottom of the fill hole.

Install the plug (1) and tighten.

Check Front Suspension Accumulator Charge

Safely raise the front of the Apache Sprayer so the front tires are just off of the ground.

Remove the cap (2) and install a nitrogen valve and gauge on the accumulator.

Open the valve and check the nitrogen pressure.

- AS1025 Accumulator Nitrogen Pressure: 900 psi [62 bar]

NOTE: It may be necessary to top off the nitrogen level yearly.

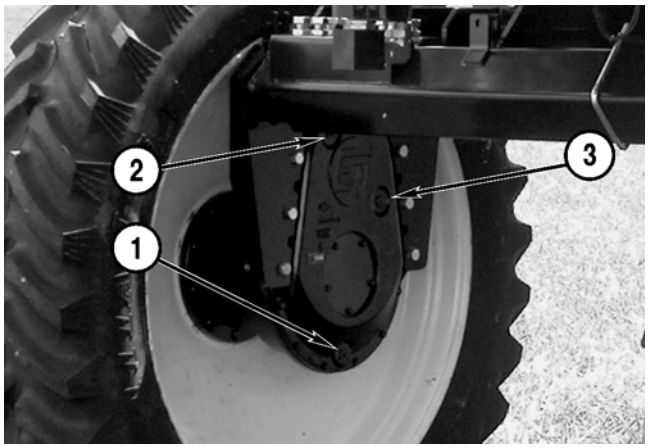
NOTICE: If oil comes out of the accumulator charge port, the accumulator has failed. Contact your dealer for a replacement accumulator.

Change Final Drive Fluid

Depending on the machine's crop clearance, the Apache sprayer is equipped with either a drop box or planetary final drive.

Drop Box

The drop box drain, level and fill plugs are located on the drop box at each rear wheel. The left drop box is shown.



Remove the drain plug (1) and drain the fluid into a suitable container. Dispose of the fluid properly.

Install the drain plug (1).

NOTICE: Use only Lucas 80/90 Gear Oil or equivalent for the drop box fluid.

Remove the drop box fill plug (2) and level plug (3).

Add fluid until it is level with the bottom of the level hole (3).

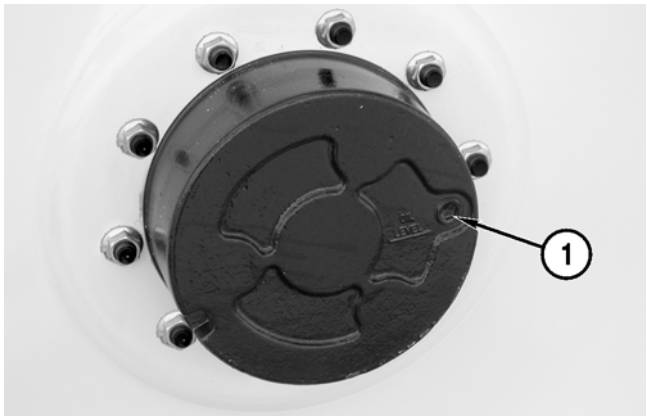
- Drop Box Fluid Capacity:
  Approximately 21 quarts [20 liters]

Install and tighten the fill plug (2) and the level plug (3).

Repeat the steps for the other drop box.

Planetary

The planetaries are located on each rear wheel. The plug (1) on the planetary serves as the drain and fill location.



To drain the planetary fluid, position the wheel so the plug on the planetary is in the 6 o'clock position.

Remove the plug in the planetary, drain the fluid into a suitable container and dispose of the fluid properly.

To fill the planetary fluid, position the wheel so the plug on the planetary is in the 3 o'clock position.

NOTICE: Use only Lucas 80/90 Gear Oil or equivalent for the planetary fluid.

Fill each planetary with Lucas 80/90 Gear Oil or equivalent to the bottom of the fill hole.

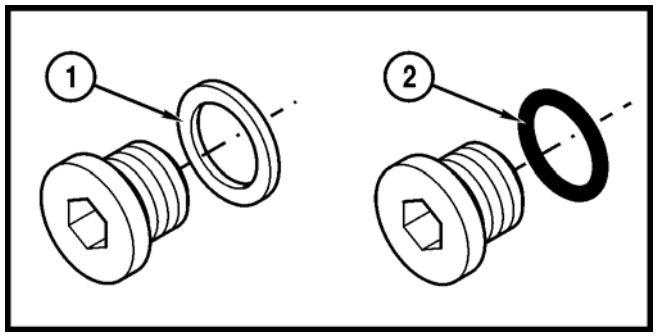
- Planetary Fluid Capacity:
  Approximately 2.2 quarts [2.0 liters].

Install the plug (1) and tighten.

Change Engine Oil and Filter

WARNING! Burn Hazard. If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being burned. ALWAYS wear eye protection.

Operate the engine for approximately five minutes to warm the engine oil. Shut off the engine.

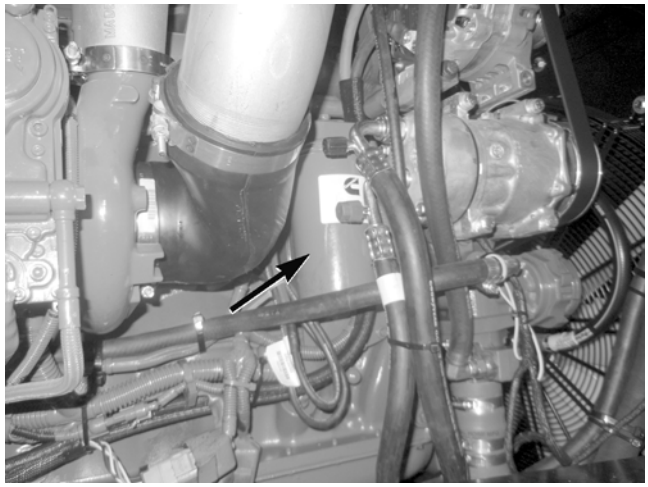


The engine oil drain plug is located on the right side of the oil pan. Remove the engine oil drain plug and drain the oil into a suitable container. Properly dispose of the used engine oil.

Install the drain plug and tighten to the torque value below:

1. Plug with Copper Washer:
   52 lb-ft [71 N•m]
2. Plug with O-ring:
   37 lb-ft [50 N•m]

The engine oil filter is located on the right side of the engine.



Turn the engine oil filter counter-clockwise to remove. Dispose of the filter properly.

NOTICE: DO NOT overtighten the filter. Damage to the seal can result.

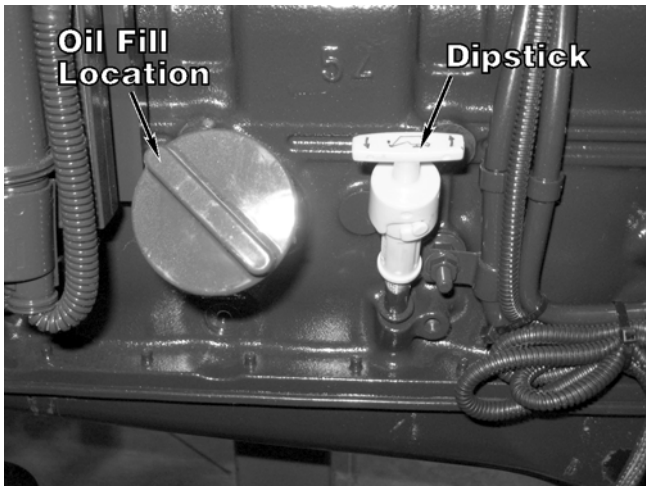
Lubricate the seal on the engine oil filter.

- Engine Oil Filter Part Number: 201450305.

Install and tighten the filter, by hand, 3/4 to 1-1/4 turns after the seal contacts the filter housing.

NOTICE: DO NOT overfill the engine oil. Crankcase oil capacity can vary. ALWAYS use the dipstick to determine if the engine oil is to the appropriate level.

Fill the engine with high quality Lucas 15W-40 Magnum motor oil or equivalent at the oil fill location on the left side of the engine.



- Engine Oil Capacity:
  Approximately 16 quarts [15 liters].

Add oil as needed to bring the level to the hatched area on the dipstick.

Install the dipstick.

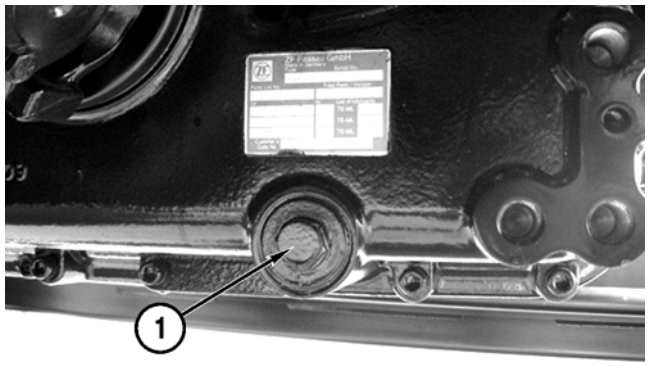
Operate the engine and check for leaks.

Shut off the engine and wait 10 minutes. Check the engine oil level and add oil as needed to bring the level to the hatched area on the dipstick.

Additional lubricating oil system information is available in the engine manufacturer's manual provided with the Apache Sprayer.

Change Transmission Oil and Filter

The transmission drain plug is located under the machine on the back side of the transmission.



Park the machine on firm, level ground and apply the parking brake. Switch OFF the engine and remove the starter key. Disconnect the battery.

NOTE: The transmission should be at operating temperature and the Apache Sprayer on level ground.

Drain the oil as follows:

- Place a used oil container of suitable size under the transmission.
- Remove the transmission oil drain plug (1) and drain the used oil.
- The drain plug contains a magnetic insert. Be sure to clean any debris clinging to the plug. Clean the sealing surface on the housing.
- Install the plug with new o-ring.

Unscrew and remove the filter.

Do not allow any dirt or oil sludge to enter the transmission oil system.

NOTICE: Do not install damaged filters.

NOTICE: Due to high system pressure, only use filters approved by ZF or Equipment Technologies.

The filter differential pressure valve (bypass valve) is equipped with a filter contamination switch which informs the driver of ZF-Fine filter contamination. When the warning lamp is illuminated, the ZF-Fine filter must be changed.

NOTICE: The transmission oil filter must be changed at every transmission oil change.

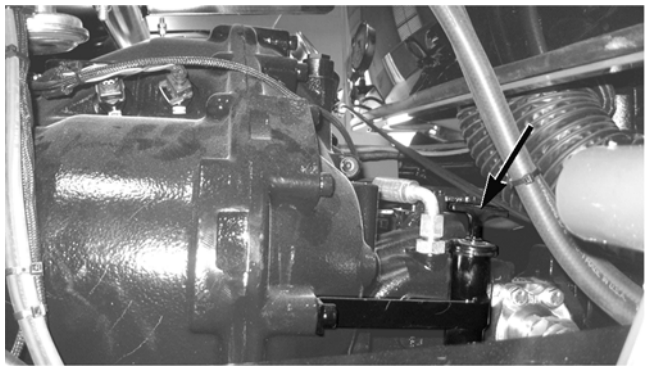
Lubricate the seal on the transmission oil filter.

- Transmission Oil Filter
  Part Number: 310100001

Install and tighten the filter, by hand, 1/3 to 1/2 turns after the seal contacts the filter housing.

NOTICE: Do not overtighten the filter. Damage to the seal can result.

Fill the system with new transmission oil through the dipstick tube.

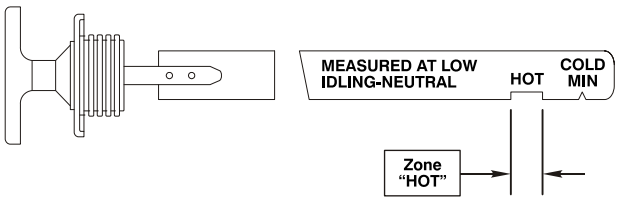


- Transmission oil capacity:
  27 quarts [25.6 liters]

NOTICE: DO NOT overfill the transmission oil. Overfilling can damage the transmission or cause the transmission to malfunction.

NOTICE: Use only Lucas 15W-40 Magnum engine oil or equivalent.

NOTE: All measurements must be taken with the engine running at low idle.



The transmission oil level check must be carried out as follows:

- Check transmission oil level weekly
- Machine on level ground
- Transmission in Neutral position
- In the cold start phase, the engine must be running approximately 2 to 3 minutes at idle speed. The transmission oil level must be above the cold start mark “COLD MIN”.

Turn the dipstick handle counter-clockwise to loosen and remove the dipstick.

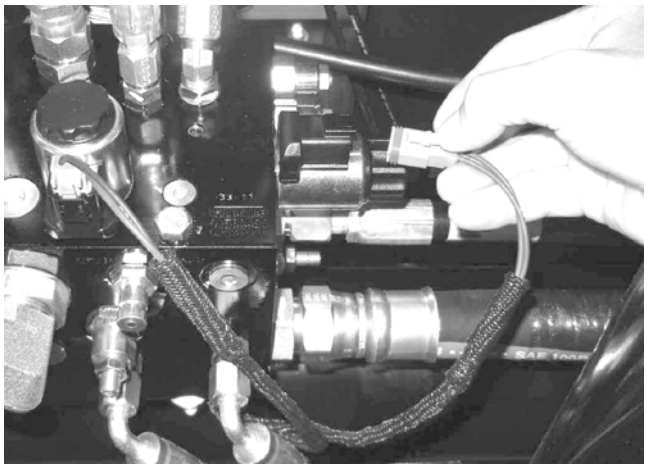
Check the transmission oil level. Add oil as needed.

Install the dipstick and turn the handle clockwise to tighten.

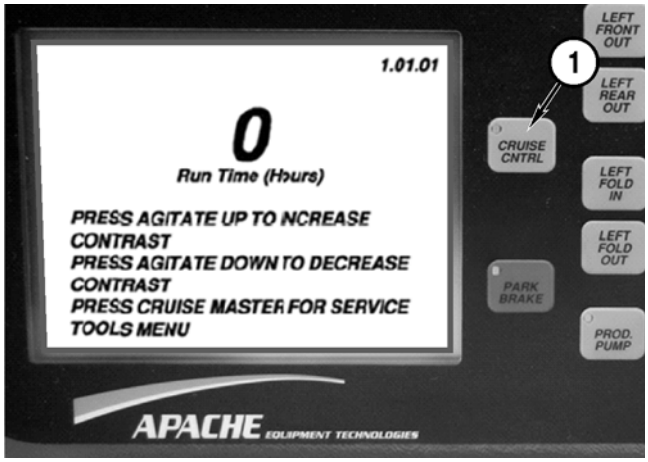
NOTE: The transmission must be calibrated after every oil and filter change.

Transmission Calibration Procedure

1. Start the machine and operate until the engine reaches normal operating temperature.
2. Move the machine to a safe, level area.
3. Shut the machine OFF.
4. Disconnect the parking brake coil (2-pin Deutsch plug on the junction block, under the cab).
5. Start the machine.



6. Press the CRUISE MASTER button (1) while at the startup screen to enter the SERVICE TOOLS MENU.



7. Select Service Tool

   A. Check to make sure the transmission is in MANUAL MODE. The screen should read PRESS FOAM LEFT FOR AUTOMATIC TRANS MODE. If it does not, press FOAM LEFT (2) and go back to step 4.

   B. Press AGITATE DOWN (3) to enter CALIBRATE TRANS mode.

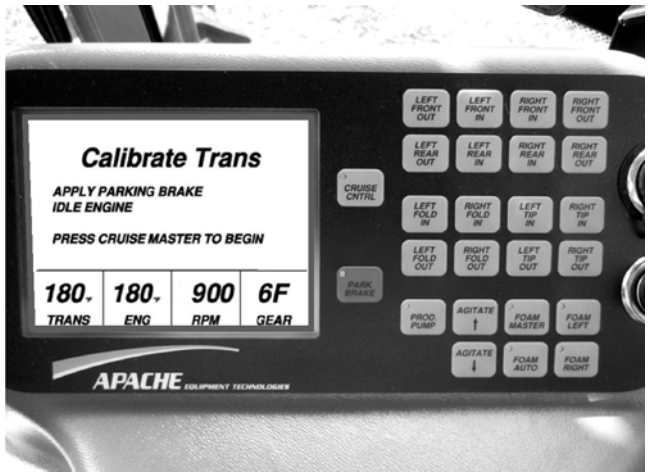
8. Warm the transmission oil to 180°F [82°C].

   A. Depress the brakes and shift the transmission into 6th gear.

   B. While still holding the brakes rev the engine to full throttle and hold for a maximum of 30 seconds (parking brake still unplugged).

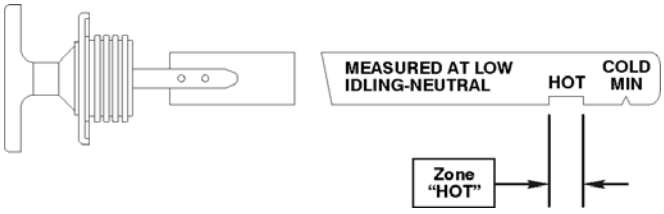
   C. Idle down and shift into neutral. Wait at least 15 seconds to allow the hot oil in the torque converter to properly distribute.

   D. Repeat steps A through C until the TRANS temperature is 180°F [82°C]. Do not extend step B beyond 30 seconds. Damage to the transmission could occur.



9. With the parking brake applied, engine idling and transmission in neutral, check the transmission oil level. It should be within the hot zone. Fill or drain as required.

10. Warm the transmission oil to 185°F [85°C].



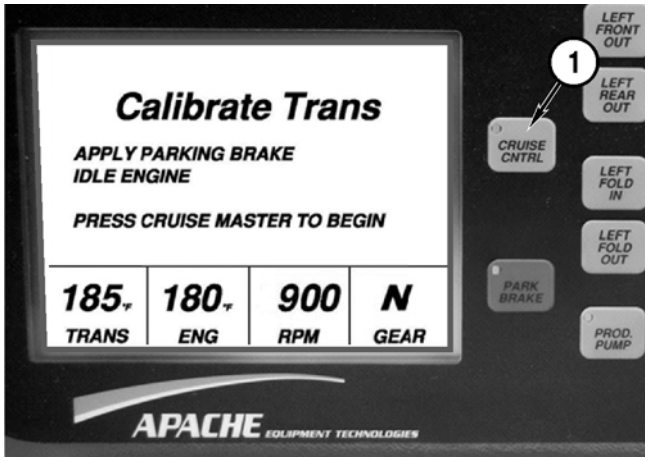
A. Depress the brakes and shift the transmission into 6th gear.

B. While still holding the brakes rev the engine to full throttle and hold for a maximum of 30 seconds (parking brake still unplugged).

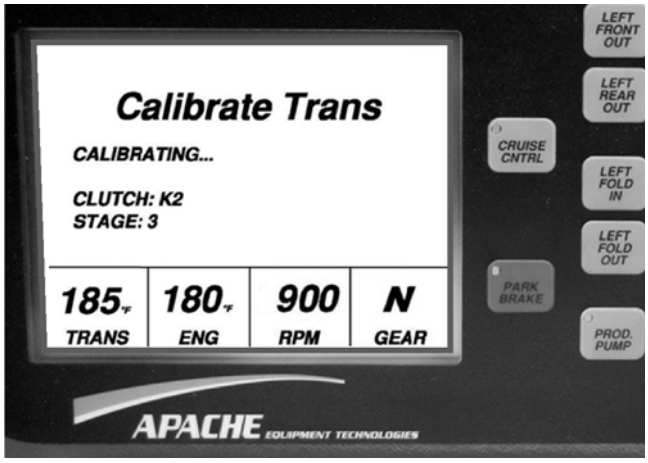
C. Idle down and shift into neutral. Wait at least 15 seconds to allow the hot oil in the torque converter to properly distribute.

D. Repeat steps A through C until the TRANS temperature is in 185°F [85°C]. Do not extend step B beyond 30 seconds. Damage to the transmission could occur.

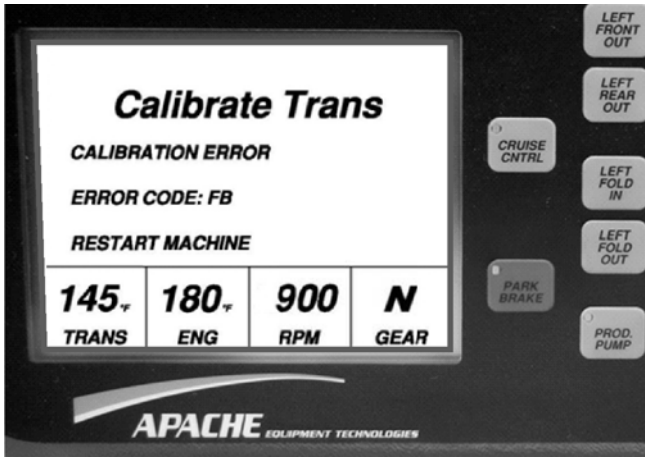
11. Calibrate the transmission. With the TRANS temperature at 185°F [85°C], parking brake applied engine idling and transmission in neutral, press CRUISE MASTER (1) to begin transmission calibration.



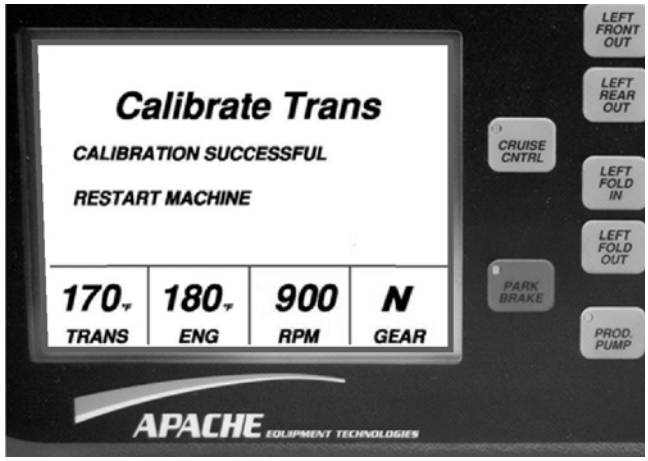
12. The cal sequence will take a few minutes as it runs through 7 clutches; K1, K2, K3, K4, KV, KR and WK (Figure 6). The current clutch and stage are displayed on screen.
The TRANS temperature will decrease during calibration.



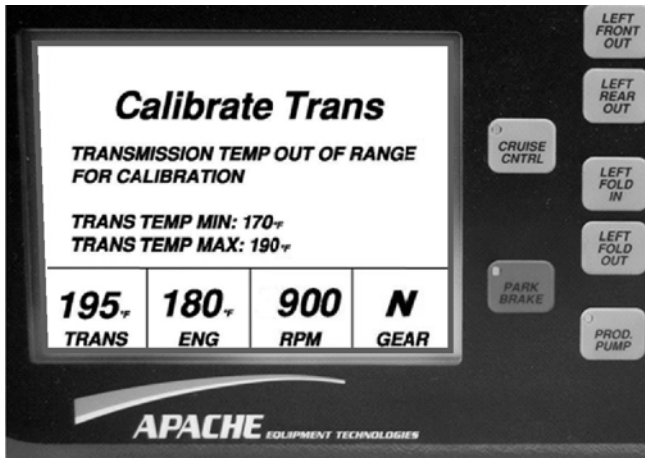
13. f there is an error during the calibration, the calibration will stop and an error code will be displayed on the screen. Refer to the ZF Fault Code List to determine the error code.
Resolve the error, restart the machine and return to step 10 to rerun the calibration.



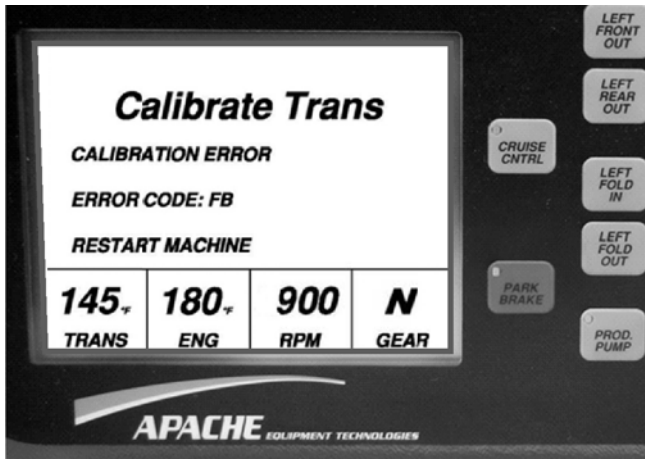
14. CALIBRATION SUCCESSFUL will be displayed once the calibration is complete.
15. Turn the key to the OFF position and WAIT at least 30 seconds. Do not turn the key to the ON position within turning the key OFF.
16. Reconnect the parking brake 2-pin Deutsch plug on the junction block under the cab.
17. Start the machine and verify the functionality of the transmission



NOTE: If the TRANS temperature is out of the 170°F to 190°F [76.6°C to 87.7°C] range, the calibration will not be allowed to initiate or a bad calibration could occur.

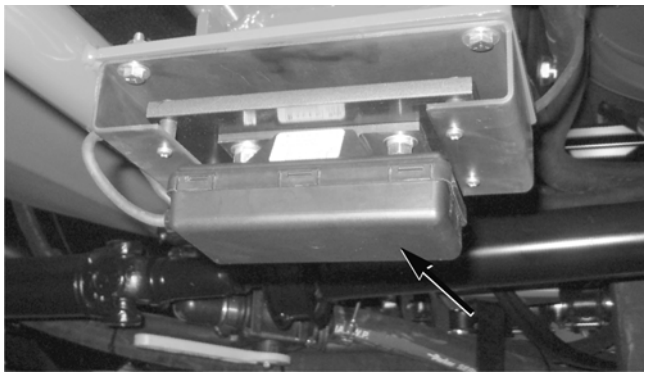


If the TRANS temperature falls below 145°F [62°C] during calibration, an error is likely to occur. Return to step 10 to restart the calibration.



Recalibrate Raven Radar Gun

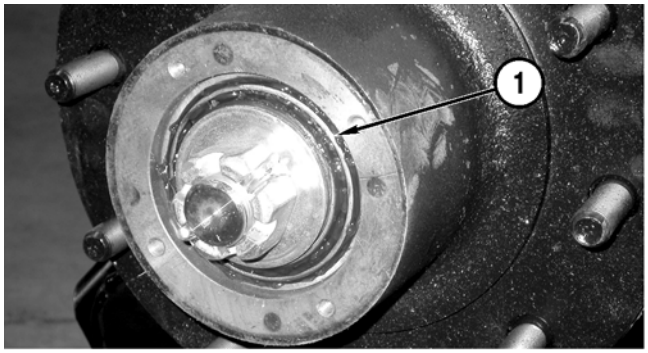
The Raven radar gun should be calibrated every year. See the Raven manufacturer's instructions, provided with the Apache Sprayer.

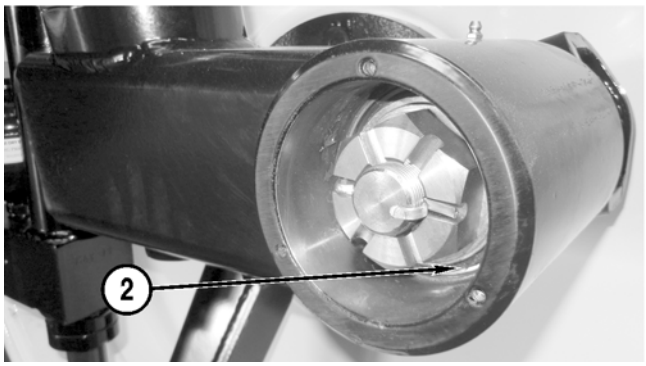


Inspect and Repack Wheel and Inter-Flex Bearings

With the weight of the machine off of the bearings, inspect the wheel (1) and inter-flex (2) bearings for sufficient grease and free movement, while making sure that there is no side-to-side play in the hub or joint.

Contact your dealer immediately if you have any concerns.





Every Year

The following services must be performed every year.

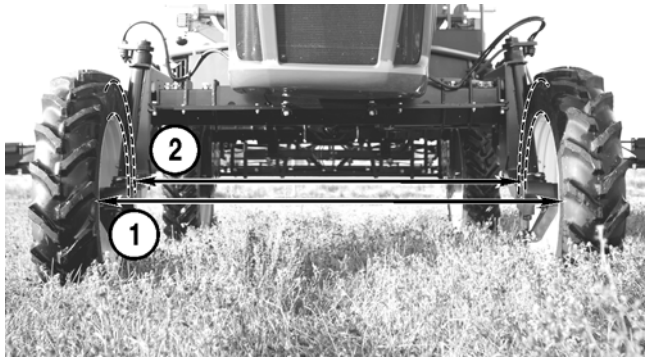
Adjust Toe-In (Standard 120” Axles)

Measure Toe-In

Safely lift the front of the Apache Sprayer so the front tires are slightly off of the ground.

Turn the steering wheel so the front wheels are pointing straight.

Measure and note the distance between the left and right tires at the front (1) of the tires and at the rear (2) of the tires.

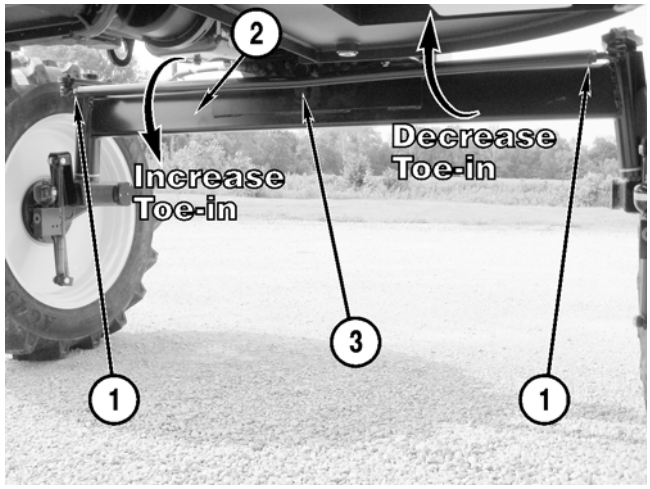


The distance at the front (1) of the tires should be 0.25 in. [6.35 mm] less than at the rear (2) of the tires.

If the toe-in is not approximately 0.25 in. [6.35 mm], the toe-in must be adjusted.

Adjust Toe-in

Loosen the jam nut (1) at each end of the tie rod (2).



Turn the tie rod clockwise (as viewed from the left side) to increase toe-in.

Turn the tie rod counterclockwise (as viewed from the left side) to decrease toe-in.

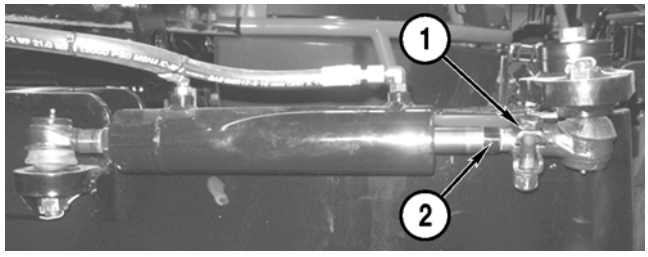
Position the tie rod so the bend (3) is pointing downward and tighten the jam nuts.

Once the toe-in is set, turn the wheels all the way to the left and measure the distance between the left strut tower (1) and the axle tube (2).

Turn the wheels all the way to the right and measure the distance between the right strut tower and axle tube.

The distance should be equal on both sides. If the distance is not equal, the steering cylinder rod must be adjusted.

To adjust the steering cylinder rod:



Loosen the nut and bolt on the steering cylinder clamp (1).

Use a wrench on the ball joint end (2) to adjust the spacing.

- If distance between the strut tower and axle tube is greater on the left wheel, turn the ram counterclockwise (as viewed from the ram end of the cylinder).
- If distance between the strut tower and axle tube is greater on the right wheel, turn the ram clockwise (as viewed from the ram end of the cylinder).

Adjust Toe-In (120” to 160” Adjustable Axles)

NOTICE: On adjustable axle machines, the steering must be re-phased before measuring or adjusting the toe-in. With the engine operating at 1000 rpm and the hydraulic fluid at operating temperature, turn the steering wheel to the extreme left and continue to turn 100 complete revolutions. Repeat this procedure turning the steering wheel to the extreme right. This process will be easier with warm oil.

Rephase the Steering

NOTE: This process will be easier with warm oil.

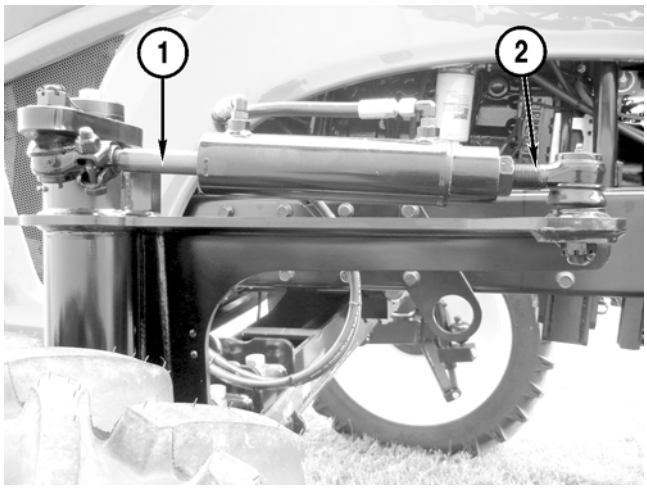
Operate the engine at 1000 rpm and make sure the hydraulic fluid is at operating temperature.

Turn the steering wheel to the extreme left and continue to turn 100 complete revolutions.

Turn the steering wheel to the extreme right and continue to turn 100 complete revolutions.

Measure Tie Rods

Measure the rear tie rod ends (2) on the left and right steering cylinder. The measurements must be equal and between 4.125 in. [104.7 mm] and 4.5 in. [114.3 mm]. Adjust the tie rods if necessary.



Safely lift the front of the Apache Sprayer so the front tires are slightly off of the ground and turn the steering wheel so the front wheels appear to be pointing straight.

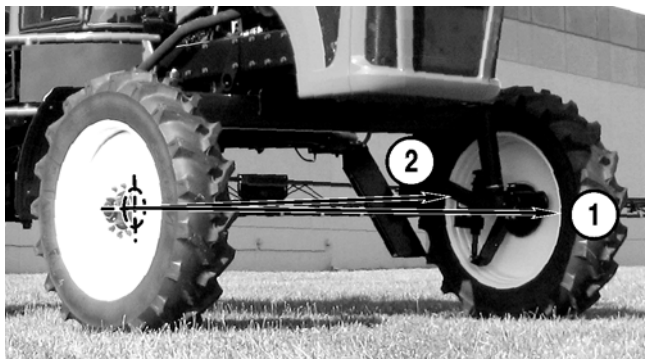
Make sure the tie rod end’s ball joints are fully seated in the taper.

Measure the distance that the steering cylinder ram is extended on the left and right wheel. The measurements must be equal and between 3.87 in. [98.4 mm] and 4.125 in. [104.7 mm].

Adjust the steering cylinder rams by turning the wheel to the left or to the right until they have an equal amount of ram protruding.

Measure Toe-in

Safely lift the front of the Apache Sprayer so the front tires are slightly off of the ground.



Turn the steering wheel so the front wheels are pointing straight.

Measure and note the distance (1) from the center of the right hub to the front of the left rim.

Measure and note the distance (2) from the center of the right hub to the rear of the left rim.

If distance (1) is 0.25 in. [6.35 mm] less than distance (2), the toe-in is correct for the right wheel. If the toe-in is not correct, it must be adjusted.

Repeat the steps, measuring from the left hub to the right rim, to measure toe-in for the right wheel.

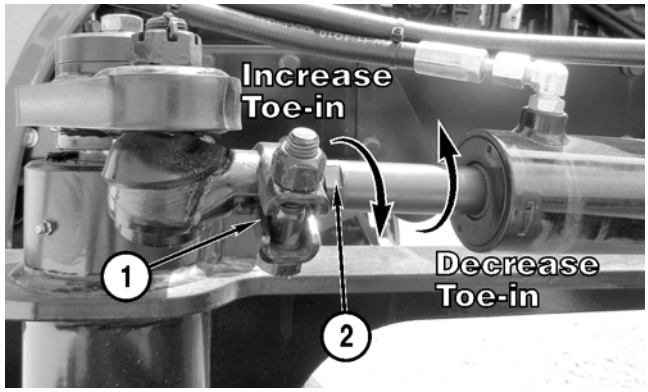
Adjust the toe-in on each wheel until it meets specification.

Adjust Toe-in

Toe-in adjustments should be made at the ram end of the steering cylinder.

Loosen the nut and bolt on the tie rod clamp (1).

Use a wrench on the end of the ram (2) to increase or decrease toe-in.



Change Engine Safety Air Filter

NOTICE: DO NOT attempt to clean the engine safety air filter. ALWAYS replace with a new filter.

The engine safety air filter is mounted in the engine compartment, above the engine and toward the cab. It is in the same housing as the primary engine air filter.

Unlatch the snap latch (1) and remove the snorkel by lifting and pulling towards cab. Swing the snorkel to the left side of the machine to provide room to remove air cleaner cover.

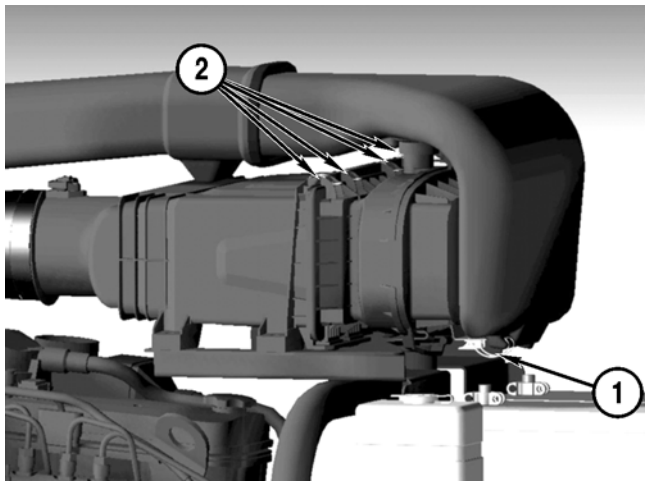
Unlatch the four snap latches (2) on the top side of the air cleaner cover. Remove the cover and position it out of the way so the primary air filter can be removed.

Remove primary air filter. The air filter can be removed by sliding it out on the left side of the engine.

Remove secondary air filter located behind primary.

Discard the filter and install a new one.

NOTICE: DO NOT leave the intake opening uncovered. If not replacing the filter immediately, cover the opening to prevent dirt and debris entering the intake system.



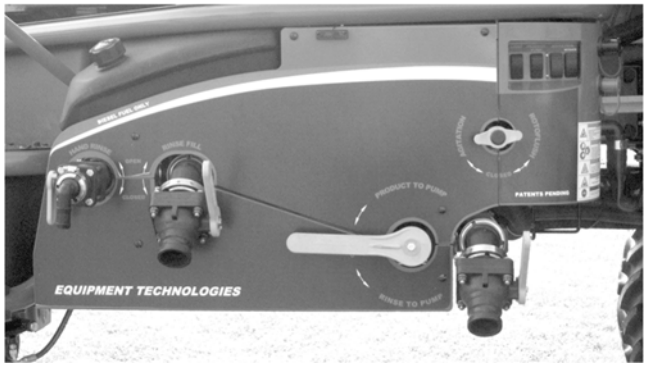
Install the new engine safety air filter.

- Engine Safety Air Filter Part Number: 201300141.

Install the primary filter, air cleaner cover, and engage the latches.

Winterize Wet System

The product tank and wet system must be flushed before winterizing. See “Flushing Product Tank” on page 4-24. See “Flushing Booms” on page 4-25. See “After the booms and flowback valve are flushed:” on page 4-25.



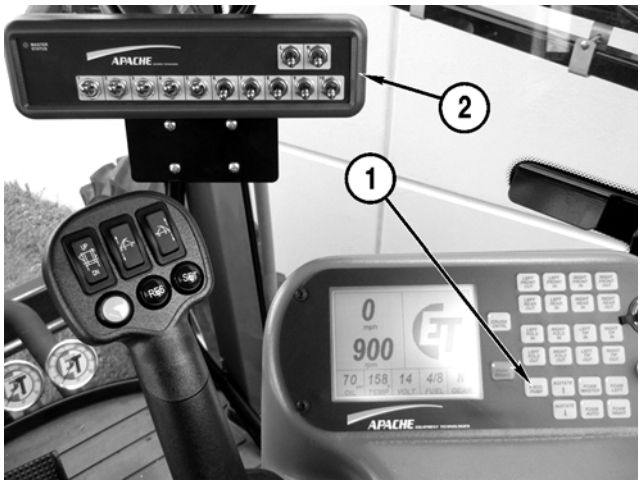
Open the product tank fill valve, foam marker fill valve, rinse tank valve, and roto-flush valve to drain any remaining water in the tanks and roto-flush line.

Close the rinse tank valve, foam marker valve, and sump valve.

Set all boom section switches to the ON position and press the agitation decrease button to turn agitation off.

Connect a compressed air line to the main fill valve (1). Apply compressed air at 40 psi [2.7 bar] to blow out the wet system and booms.

Cycle the boom section switches (2) off and on several times to purge water from around the valves.



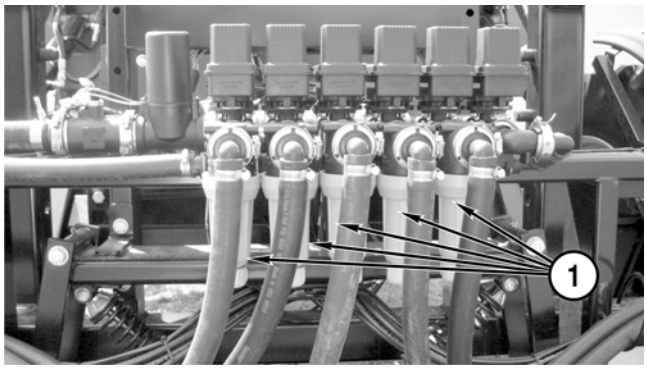
Disconnect the air line and close the product fill valve.

NOTICE: Drain the rinse tank and foam tank to prevent damage during storage.

Remove all boom section strainers (1) and the product strainer.

Reinstall the strainer bowls.

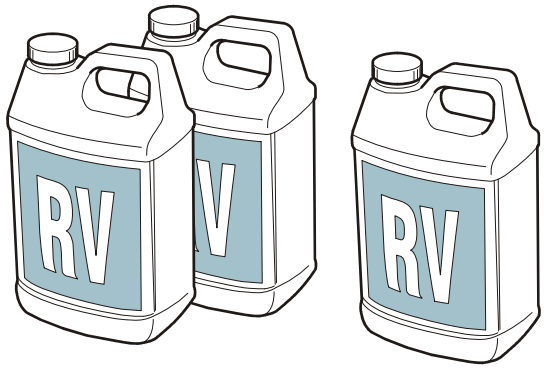
Store the strainers in a warm, dry location.



Pour approximately 20 gallons [76 liters] of RV anti-freeze into the product tank.

NOTICE: Boom lengths over 60 ft will require more than 20 gallons [76 liters] of antifreeze.

Pour 1 gallon [4 liters] of RV antifreeze into the rinse tank.

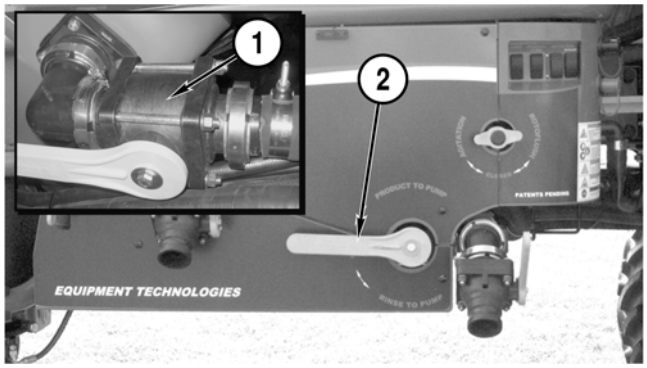


Repeatedly open and close the sump valve (1) and rinse tank /product valve (2), to allow the antifreeze to surround the ball valves.

Close the rinse tank valve (2) and open the sump valve (1).

Except for one nozzle at the end of each boom section, turn off all the nozzle bodies.

Open all manual valves halfway and then close to allow any trapped water to escape.



NOTICE: DO NOT run the product pump dry. Damage to the pump seals will result. DO NOT intentionally dead-head the pump with high pressures. Damage to the pump seals will result.

Start the engine.

Unfold and lower the booms as far as possible.

Set all boom section switches (2) to the OFF position and press the agitation increase button (3).

Set the product pump switch (1) to the ON position.

Press the agitation decrease button (3) to turn agitation off.

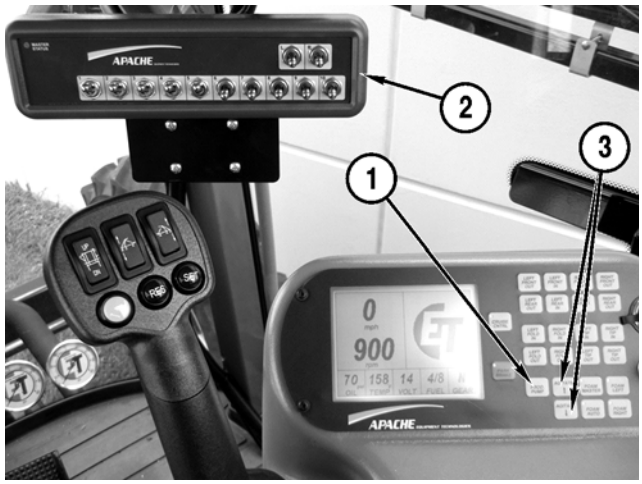
One at a time, set the boom section switches (2) to the ON position until antifreeze flows from the open nozzle in each boom section.

Turn the boom section switches (2) to OFF.

Set the product pump switch (1) to the OFF position.

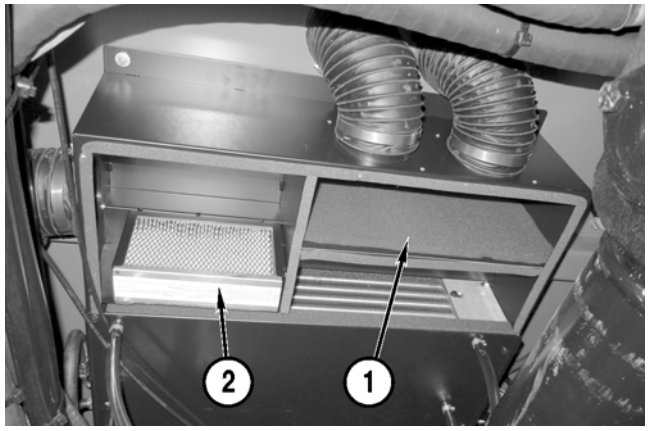
NOTE: Excess antifreeze may be left in the sprayer.

Winterize the foamer. See “Freezing” on page 4-20.



Change Cab Recirculating Air and Charcoal Filter

NOTICE: DO NOT attempt to clean the old cab air filters. ALWAYS replace with a new filter.



The recirculating air filter (1) and charcoal air filter (2) are located under the cab, inside the A/C box.

Use a 10 mm socket to remove the 5 bolts securing the back half of the A/C box bottom cover. Remove the cover slowly because the charcoal filter (2) is held in place by this cover. The recirculating filter (1) is held in place with Velcro.

Remove and discard the old filters.

Insert new filters into the frame with the air-flow arrow pointing toward the front of the Apache Sprayer.

- Cab Recirculating Air FIlter (1)
  Part Number: 490006661
- Charcoal Air Filter (2)
  Part Number: 490003651
- Cab Filter Kit (includes both filters)
  Part Number: K65000190

Close the cover and install the five bolts.

Check Front Suspension Accumulator Charge

Contact your Apache dealer for service.

The charge in the front suspension accumulators must be checked yearly.

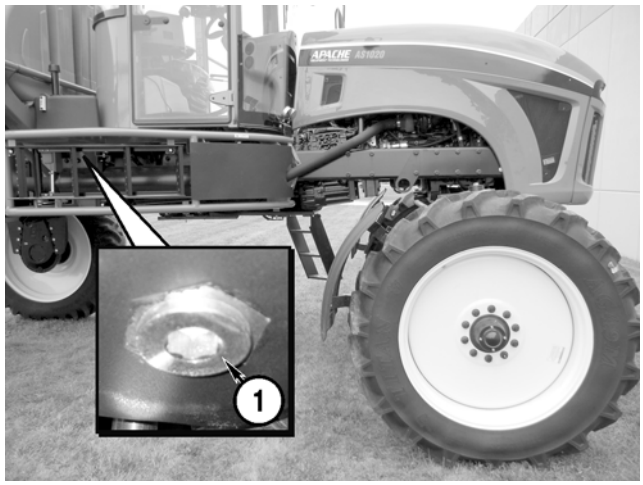
- AS1025 Accumulator Nitrogen Pressure:
  900 psi [62 bar]

Every 1000 Hours or Yearly

The following services must be performed after every 1000 hours of operation or yearly.

Change Hydraulic Fluid

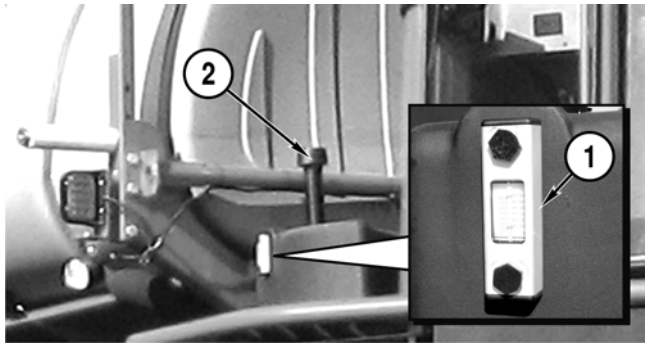
The hydraulic fluid drain plug (1) is located on the hydraulic fluid reservoir, between the cab and the product tank.



Remove the hydraulic fluid drain plug (1) from the bottom of the reservoir and drain the fluid into a suitable container with a capacity of more than 40 gallons [151.42 liters]. Dispose of the fluid properly.

Install the drain plug (1).

NOTICE: Use only Lucas Universal Hydraulic Fluid or equivalent for the Apache Sprayer hydraulic system.



Remove the hydraulic fluid reservoir cap (2) and fill with Lucas Universal Hydraulic Fluid or equivalent.

- Hydraulic Fluid Reservoir Capacity: Approximately 40 gallons [151.42 liters]

Use the sight glass (1) to check the fluid level. See “Check Hydraulic Fluid Level” on page 5-14.

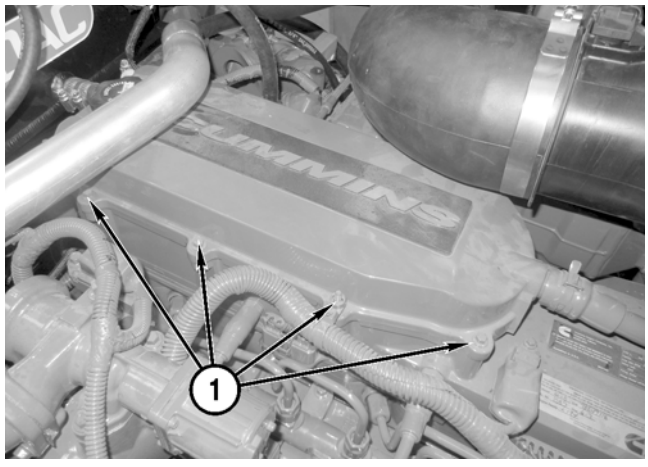
NOTE: The sight glass also shows hydraulic fluid temperature.

Every 2500 Hours

The following services must be performed after every 2500 hours of operation of the Apache Sprayer.

Change Crankcase Ventilation Filter

Remove the perimeter capscrews (1) on the crankcase ventilation filter cover.



Remove the cover and change the filter.

- AS1025 Crankcase Ventilation Filter Part Number: 201450305.

NOTES

APACHE™

CHAPTER 6

CUMMINS ENGINE FAULT CODES

Cummins Fault Code	These codes will display on the console		Cummins Description
	J1939 SPN	J1939 FMI	
719	22	3	Extended Crankcase Blow-by Pressure Circuit - Voltage Above Normal, or Shorted to High Source
729	22	4	Extended Crankcase Blow-by Pressure Circuit - Voltage Below Normal, or Shorted to Low Source
2111	52	3	Coolant Temperature 2 Sensor Circuit - Voltage Above Normal, or Shorted to High Source
2112	52	4	Coolant Temperature 2 Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
2113	52	16	Coolant Temperature 2 - Data Valid but Above Normal Operational Range - Moderately Severe Level
2114	52	0	Coolant Temperature 2 - Data Valid but Above Normal Operational Range - Most Severe Level
241	84	2	Vehicle Speed Sensor Circuit - Data Erratic, Intermittent, or Incorrect
242	84	10	Vehicle Speed Sensor Circuit tampering has been detected ñ Abnormal Rate of Change
131	91	3	Accelerator Pedal or Lever Position Sensor Circuit - Voltage Above Normal, or Shorted to High Source
132	91	4	Accelerator Pedal or Lever Position Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
147	91	1	Accelerator Pedal or Lever Position Sensor Circuit ñ Abnormal Frequency, Pulse Width, or Period
148	91	0	Accelerator Pedal or Lever Position Sensor Circuit ñ Abnormal Frequency, Pulse Width, or Period
287	91	19	SAE J1939 Multiplexing Accelerator Pedal or Lever Sensor System Error - Received Network Data In Error SAE J1939 Multiplexing
1242	91	2	Accelerator Pedal or Lever Position Sensor 1 and 2 - Data Erratic, Intermittent, or Incorrect
528	93	2	Auxiliary Alternate Torque Validation Switch - Data Erratic, Intermittent, or Incorrect
268	94	2	Fuel Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect

Cummins Fault Code	These codes will display on the console		Cummins Description
	J1939 SPN	J1939 FMI	
546	94	3	Fuel Delivery Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
547	94	4	Fuel Delivery Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
2215	94	18	Fuel Pump Delivery Pressure - Data Valid but Below Normal Operational Range - Moderately Severe Level
2216	94	1	Fuel Pump Delivery Pressure - Data Valid but Above Normal Operational Range ñ Moderately Severe Level
2261	94	15	Fuel Pump Delivery Pressure - Data Valid but Above Normal Operational Range - Least Severe Level
2262	94	17	Fuel Pump Delivery Pressure - Data Valid but Below Normal Operational Range - Least Severe Level
2372	95	16	Fuel Filter Differential Pressure - Data Valid but Above Normal Operational Range - Moderately Severe Level
418	97	15	Water in Fuel Indicator High - Data Valid but Above Normal Operational Range ñ Least Severe Level
428	97	3	Water in Fuel Sensor Circuit - Voltage Above Normal, or Shorted to High Source
429	97	4	Water in Fuel Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
1852	97	16	Water in Fuel Indicator - Data Valid but Above Normal Operational Range - Moderately Severe Level
135	100	3	Oil Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
141	100	4	Oil Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
143	100	18	Oil Pressure Low ñ Data Valid but Below Normal Operational Range - Moderately Severe Level
415	100	1	Oil Pressure Low ñ Data Valid but Below Normal Operational Range - Most Severe Level
435	100	2	Oil Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect
122	102	3	Intake Manifold Pressure Sensor Circuit ñ Voltage Above Normal, or Shorted to High Source
123	102	4	Intake Manifold Pressure Sensor Circuit ñ Voltage Below Normal, or Shorted to Low Source
124	102	16	Intake Manifold 1 Pressure - Data Valid but Above Normal Operational Range - Moderately Severe Level
2973	102	2	Intake Manifold Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect
595	103	16	Turbocharger #1 Speed High - Data Valid but Above Normal Operational Range ñ Moderately Severe Level
687	103	18	Turbocharger #1 Speed Low - Data Valid but Below Normal Operational Range ñ Moderately Severe Level

Cummins Fault Code	These codes will display on the console		Cummins Description
	J1939 SPN	J1939 FMI	
2345	103	10	Turbocharger speed invalid rate of change detected - Abnormal Rate of Change
153	105	3	Intake Manifold Air Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source
154	105	4	Intake Manifold Air Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
155	105	0	Intake Manifold Air Temperature High ñ Data Valid but Above Normal Operational Range - Most Severe Level
488	105	16	Intake Manifold 1 Temperature - Data Valid but Above Normal Operational Range - Moderately Severe Level
221	108	3	Barometric Pressure Sensor Circuit ñ Voltage Above Normal, or Shorted to High Source
222	108	4	Barometric Pressure Sensor Circuit ñ Voltage Below Normal, or Shorted to Low Source
295	108	2	Barometric Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect
231	109	3	Coolant Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
232	109	4	Coolant Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
233	109	18	Coolant Pressure - Data Valid but Below Normal Operational Range - Moderately Severe Level
144	110	3	Coolant Temperature Sensor Circuit ñ Voltage Above Normal, or Shorted to High Source
145	110	4	Coolant Temperature Sensor Circuit ñ Voltage Below Normal, or Shorted to Low Source
146	110	16	Coolant Temperature High - Data Valid but Above Normal Operational Range - Moderately Severe Level
151	110	0	Coolant Temperature Low - Data Valid but Above Normal Operational Range - Most Severe Level
334	110	2	Coolant Temperature Sensor Circuit ñ Data Erratic, Intermittent, or Incorrect
2963	110	15	Engine Coolant Temperature High - Data Valid but Above Normal Operational Range - Least Severe Level
195	111	3	Coolant Level Sensor Circuit - Voltage Above Normal, or Shorted to High Source
196	111	4	Coolant Level Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
197	111	18	Coolant Level - Data Valid but Below Normal Operational Range - Moderately Severe Level
235	111	1	Coolant Level Low - Data Valid but Below Normal Operational Range - Most Severe Level
422	111	2	Coolant Level - Data Erratic, Intermittent, or Incorrect
449	157	0	Fuel Pressure High - Data Valid but Above Normal Operational Range ñ Moderately Severe Level

Cummins Fault Code	These codes will display on the console		Cummins Description
	J1939 SPN	J1939 FMI	
451	157	3	Injector Metering Rail #1 Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
452	157	4	Injector Metering Rail #1 Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
553	157	16	Injector Metering Rail #1 Pressure High ñ Data Valid but Above Normal Operational Range - Moderately Severe Level
554	157	2	Fuel Pressure Sensor Error - Data Erratic, Intermittent, or Incorrect
559	157	18	Injector Metering Rail #1 Pressure Low ñ Data Valid but Below Normal Operational Range - Moderately Severe Level
1911	157	0	Injector Metering Rail 1 Pressure - Data Valid but Above Normal Operational Range - Most Severe Level
2249	157	1	Injector Metering Rail 1 Pressure - Data Valid but Below Normal Operational Range - Most Severe Level
951	166	2	Cylinder Power Imbalance Between Cylinders ǀData Erratic, Intermittent, or Incorrect
596	167	16	Electrical Charging System Voltage High ñ Data Valid but Above Normal Operational Range - Moderately Severe Level
597	167	18	Electrical Charging System Voltage Low ñ Data Valid but Below Normal Operational Range - Moderately Severe Level
598	167	1	Electrical Charging System Voltage Low ñ Data Valid but Below Normal Operational Range - Most Severe Level
441	168	18	Battery #1 Voltage Low - Data Valid but Below Normal Operational Range ñ Moderately Severe Level
442	168	16	Battery #1 Voltage High - Data Valid but Above Normal Operational Range ñ Moderately Severe Level
249	171	3	Ambient Air Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source
256	171	4	Ambient Air Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
261	174	16	Engine Fuel Temperature - Data Valid but Above Normal Operational Range - Moderately Severe Level
263	174	3	Engine Fuel Temperature Sensor 1 Circuit - Voltage Above Normal, or Shorted to High Source
265	174	4	Engine Fuel Temperature Sensor 1 Circuit - Voltage Below Normal, or Shorted to Low Source
212	175	3	Engine Oil Temperature Sensor 1 Circuit - Voltage Above Normal, or Shorted to High Source
213	175	4	Engine Oil Temperature Sensor 1 Circuit - Voltage Below Normal, or Shorted to Low Source
214	175	0	Engine Oil Temperature - Data Valid but Above Normal Operational Range - Most Severe Level
425	175	2	Engine Oil Temperature - Data Erratic, Intermittent, or Incorrect
234	190	0	Engine Speed High - Data Valid but Above Normal Operational Range - Most Severe Level

Cummins Fault Code	These codes will display on the console		Cummins Description
	J1939 SPN	J1939 FMI	
689	190	2	Primary Engine Speed Sensor Error ñ Data Erratic, Intermittent, or Incorrect
2321	190	2	Engine Speed / Position Sensor #1 - Data Erratic, Intermittent, or Incorrect
349	191	16	Transmission Output Shaft Speed - Data Valid but Above Normal Operational Range - Moderately Severe Level
489	191	18	Transmission Output Shaft Speed - Data Valid but Below Normal Operational Range - Moderately Severe Level
319	251	2	Real Time Clock Power Interrupt - Data Erratic, Intermittent, or Incorrect
2375	412	3	Exhaust Gas Recirculation Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source
2376	412	4	Exhaust Gas Recirculation Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
292	441	14	Auxiliary Temperature Sensor Input 1 - Special Instructions
293	441	3	Auxiliary Temperature Sensor Input # 1 Circuit ǀVoltage Above Normal, or Shorted to High Source
294	441	4	Auxiliary Temperature Sensor Input # 1 Circuit ǀVoltage Below Normal, or Shorted to Low Source
431	558	2	Accelerator Pedal or Lever Idle Validation Circuit - Data Erratic, Intermittent, or Incorrect
432	558	13	Accelerator Pedal or Lever Idle Validation Circuit - Out of Calibration
551	558	4	Accelerator Pedal or Lever Idle Validation Circuit - Voltage Below Normal, or Shorted to Low Source
523	611	2	OEM Intermediate (PTO) Speed switch Validation ǀData Erratic, Intermittent, or Incorrect
2292	611	16	Fuel Inlet Meter Device - Data Valid but Above Normal Operational Range - Moderately Severe Level
2293	611	18	Fuel Inlet Meter Device flow demand lower than expected - Data Valid but Below Normal Operational Range - Moderately Severe Level
115	612	2	Engine Speed/Position Sensor Circuit lost both of two signals from the magnetic pickup sensor - Data Erratic, Intermittent, or incorrect
244	623	4	Red Stop Lamp Driver Circuit - Voltage Below Normal, or Shorted to Low Source
351	627	12	Injector Power Supply - Bad Intelligent Device or Component
1117	627	2	Power Lost With Ignition On - Data Erratic, Intermittent, or Incorrect
111	629	12	Engine Control Module Critical internal failure - Bad intelligent Device or Component
343	629	12	Engine Control Module Warning internal hardware failure - Bad Intelligent Device or Component
341	630	2	Engine Control Module data lost - Data Erratic, Intermittent, or Incorrect
342	630	13	Electronic Calibration Code Incompatibility - Out of Calibration
2217	630	31	ECM Program Memory (RAM) Corruption - Condition Exists
2311	633	31	Fueling Actuator #1 Circuit Error ñ Condition Exists
285	639	9	SAE J1939 Multiplexing PGN Timeout Error - Abnormal Update Rate
286	639	13	SAE J1939 Multiplexing Configuration Error ñ Out of Calibration

Cummins Fault Code	These codes will display on the console		Cummins Description
	J1939 SPN	J1939 FMI	
599	640	14	Auxiliary Commanded Dual Output Shutdown - Special Instructions
237	644	2	External Speed Input (Multiple Unit Synchronization) - Data Erratic, Intermittent, or Incorrect
245	647	4	Fan Control Circuit - Voltage Below Normal, or Shorted to Low Source
2377	647	3	Fan Control Circuit - Voltage Above Normal, or Shorted to High Source
322	651	5	Injector Solenoid Cylinder #1 Circuit ñ Current Below Normal, or Open Circuit
1139	651	7	Injector Cylinder #1 - Mechanical System Not Responding Properly or Out of Adjustment
331	652	5	Injector Solenoid Cylinder #2 Circuit ñ Current Below Normal, or Open Circuit
1141	652	7	Injector Cylinder #2 - Mechanical System Not Responding Properly or Out of Adjustment
324	653	5	Injector Solenoid Cylinder #3 Circuit ñ Current Below Normal, or Open Circuit
1142	653	7	Injector Cylinder #3 - Mechanical System Not Responding Properly or Out of Adjustment
332	654	5	Injector Solenoid Cylinder #4 Circuit ñ Current Below Normal, or Open Circuit
1143	654	7	Injector Cylinder #4 - Mechanical System Not Responding Properly or Out of Adjustment
323	655	5	Injector Solenoid Cylinder #5 Circuit ñ Current Below Normal, or Open Circuit
1144	655	7	Injector Cylinder #5 - Mechanical System Not Responding Properly or Out of Adjustment
325	656	5	Injector Solenoid Cylinder #6 Circuit ñ Current Below Normal, or Open Circuit
1145	656	7	Injector Cylinder #6 - Mechanical System Not Responding Properly or Out of Adjustment
584	677	3	Starter Relay Circuit - Voltage Above Normal, or Shorted to High Source
585	677	4	Starter Relay Circuit - Voltage Below Normal, or Shorted to Low Source
2557	697	3	Auxiliary PWM Driver #1 - Voltage Above Normal, or Shorted to High Source
2558	697	4	Auxiliary PWM Driver #1 - Voltage Below Normal, or Shorted to Low Source
527	702	3	Auxiliary Input/Output 2 Circuit - Voltage Above Normal, or Shorted to High Source
529	703	3	Auxiliary Input/Output 3 Circuit - Voltage Above Normal, or Shorted to High Source
779	703	11	Warning Auxiliary Equipment Sensor Input # 3 (OEM Switch) - Root Cause Not Known
2195	703	14	Auxiliary Equipment Sensor Input 3 Engine Protection Critical - Special Instructions

Cummins Fault Code	These codes will display on the console		Cummins Description
	J1939 SPN	J1939 FMI	
731	723	7	Engine Speed/Position #2 mechanical misalignment between camshaft and crankshaft sensors - Mechanical System Not Responding Properly or Out of Adjustment
778	723	2	Engine Speed Sensor (Camshaft) Error ñ Data Erratic, Intermittent, or Incorrect
2322	723	2	Engine Speed / Position Sensor #2 - Data Erratic, Intermittent, or Incorrect
2555	729	3	Intake Air Heater #1 Circuit - Voltage Above Normal, or Shorted to High Source
2556	729	4	Intake Air Heater #1 Circuit - Voltage Below Normal, or Shorted to Low Source
2425	730	4	Intake Air Heater 2 Circuit - Voltage Below Normal, or Shorted to Low Source
2426	730	3	Intake Air Heater 2 Circuit - Voltage Above Normal, or Shorted to High Source
133	974	3	Remote Accelerator Pedal or Lever Position Sensor Circuit ñ Voltage Above Normal, or Shorted to High Source
134	974	4	Remote Accelerator Pedal or Lever Position Sensor Circuit ñ Voltage Below Normal, or Shorted to Low Source
288	974	19	Remote Accelerator Pedal or Lever Data Error - Received Network Data In Error
284	1043	4	Engine Speed/Position Sensor (Crankshaft) Supply Voltage Circuit - Voltage Below Normal, or Shorted to Low Source
2182	1072	3	Engine Brake Actuator Driver 1 Circuit - Voltage Above Normal, or Shorted to High Source
2183	1072	4	Engine Brake Actuator Driver 1 Circuit - Voltage Below Normal, or Shorted to Low Source
2363	1073	4	Engine Brake Actuator Circuit #2 ñ Voltage Below Normal, or Shorted to Low Source
2367	1073	3	Engine Brake Actuator Circuit #2 ñ Voltage Above Normal, or Shorted to High Source
2265	1075	3	Fuel Priming Pump Control Signal Circuit ñ Voltage Above Normal, or Shorted to High Source
2266	1075	4	Fuel Priming Pump Control Signal Circuit ñ Voltage Below Normal, or Shorted to Low Source
2365	1112	4	Engine Brake Actuator Driver Output 3 Circuit - Voltage Below Normal, or Shorted to Low Source
2368	1112	3	Engine Brake Actuator Driver 3 Circuit - Voltage Above Normal, or Shorted to High Source
697	1136	3	ECM Internal Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source
698	1136	4	ECM Internal Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
691	1172	3	Turbocharger #1 Compressor Inlet Temperature Sensor Circuit ñ Voltage Above Normal, or Shorted to High Source

Cummins Fault Code	These codes will display on the console		Cummins Description
	J1939 SPN	J1939 FMI	
692	1172	4	Turbocharger #1 Compressor Inlet Temperature Sensor Circuit ñ Voltage Below Normal, or Shorted to Low Source
2373	1209	3	Exhaust Gas Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
2374	1209	4	Exhaust Gas Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
338	1267	3	Idle Shutdown Vehicle Accessories Relay Driver Circuit - Voltage Above Normal, or Shorted to High Source
339	1267	4	Idle Shutdown Vehicle Accessories Relay Driver Circuit - Voltage Below Normal, or Shorted to Low Source
271	1347	4	High Fuel Pressure Solenoid Valve Circuit ñ Voltage Below Normal, or Shorted to Low Source
272	1347	3	High Fuel Pressure Solenoid Valve Circuit ñ Voltage Above Normal, or Shorted to High Source
281	1347	7	High Fuel Pressure Solenoid Valve #1 ñ Mechanical System Not Responding Properly or Out of Adjustment
497	1377	2	Multiple Unit Synchronization Switch Circuit - Data Erratic, Intermittent, or Incorrect
649	1378	31	Change Lubricating Oil and Filter ñ Condition Exists
296	1388	14	Auxiliary Pressure Sensor Input 1 - Special Instructions
297	1388	3	Auxiliary Pressure Sensor Input # 2 Circuit - Voltage Above Normal, or Shorted to High Source
298	1388	4	Auxiliary Pressure Sensor Input # 2 Circuit -Voltage Below Normal, or Shorted to Low Source
211	1484	31	Additional Auxiliary Diagnostic Codes logged - Condition Exists
1256	1563	2	Control Module Identification Input State Error - Data Erratic, Intermittent, or Incorrect
1257	1563	2	Control Module Identification Input State Error - Data Erratic, Intermittent, or Incorrect
199	1661	4	Engine Automatic Start Lamp Driver Circuit - Voltage Above Normal, or Shorted to High Source
2263	1800	16	Battery Temperature - Data Valid but Above Normal Operational Range - Moderately Severe Level
2264	1800	18	Battery Temperature - Data Valid but Below Normal Operational Range - Moderately Severe Level
1239	2623	3	Accelerator Pedal or Lever Position Sensor 2 Circuit - Voltage Above Normal, or Shorted to High Source
1241	2623	4	Accelerator Pedal or Lever Position Sensor 2 Circuit - Voltage Below Normal, or Shorted to Low Source
2346	2789	15	Turbocharger Turbine Inlet Temperature (Calculated) - Data Valid but Above Normal Operational Range ñ Least Severe Level
2347	2790	15	Turbocharger Compressor Outlet Temperature (Calculated) - Data Valid but Above Normal Operational Range ñ Least Severe Level
757	2802	31	Electronic Control Module data lost - Condition Exists

Cummins Fault Code	These codes will display on the console		Cummins Description
	J1939 SPN	J1939 FMI	
2115	2981	3	Coolant Pressure 2 Circuit - Voltage Above Normal, or Shorted to High Source
2116	2981	4	Coolant Pressure 2 Circuit - Voltage Below Normal, or Shorted to Low Source
2117	2981	18	Coolant Pressure 2 - Data Valid but Below Normal Operational Range - Moderately Severe Level
352	3509	4	Sensor Supply Voltage #1 Circuit ñ Voltage Below Normal, or Shorted to Low Source
386	3509	3	Sensor Supply Voltage #1 Circuit ñ Voltage Above Normal, or Shorted to High Source
187	3510	4	Sensor Supply Voltage #2 Circuit ñ Voltage Below Normal, or Shorted to Low Source
227	3510	3	Sensor Supply Voltage #2 Circuit ñ Voltage Above Normal, or Shorted to High Source
238	3511	4	Sensor Supply Voltage #3 Circuit ñ Voltage Below Normal, or Shorted to Low Source
239	3511	3	Sensor Supply Voltage #3 Circuit - Voltage Above Normal, or Shorted to High Source
2185	3512	3	Sensor Supply Voltage #4 Circuit ñ Voltage Above Normal, or Shorted to High Source
2186	3512	4	Sensor Supply Voltage #4 Circuit ñ Voltage Below Normal, or Shorted to Low Source
193	520199	3	Cruise Control (Resistive) Signal Circuit - Voltage Above Normal, or Shorted to High Source
194	520199	4	Cruise Control (Resistive) Signal Circuit - Voltage Below Normal, or Shorted to Low Source
125	102	18	Intake Manifold 1 Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level
426	639	2	J1939 Network #1 - Data erratic, intermittent or incorrect
515	3514	3	Sensor Supply 6 Circuit - Voltage above normal, or shorted to high source
516	3514	4	Sensor Supply 6 Circuit - Voltage below normal, or shorted to low source
555	101	16	Crankcase Pressure ÍData Valid But Above Normal Operating Range - Moderately Severe Level
556	101	0	Crankcase Pressure ÍData Valid But Above Normal Operating Range - Moderately Severe Level
769	597	3	Brake Switch Circuit - Voltage Above Normal, or Shorted to High Source
771	597	4	Brake Switch Circuit - Voltage Below Normal, or Shorted to Low Source
952	524286	31	Reserved for temporary use -Condition Exists
953	524286	31	Reserved for temporary use -Condition Exists
1381	441	14	Auxiliary Temperature Sensor Input 1 - Special Instructions
1663	3241	13	Aftertreatment Exhaust Gas Temperature 1 Swapped - Out of Calibration
1664	4796	31	Aftertreatment Diesel Oxidation Catalyst Missing - Condition Exists
1665	3241	4	Aftertreatment Exhaust Gas Temperature 1 Circuit - Voltage Below Normal, or Shorted to Low Source

Cummins Fault Code	These codes will display on the console		Cummins Description
	J1939 SPN	J1939 FMI	
1666	3241	3	Aftertreatment Exhaust Gas Temperature 1 Circuit - Voltage Below Normal, or Shorted to Low Source
1667	3241	2	Aftertreatment Exhaust Gas Temperature 1 - Data Erratic, Intermittent or Incorrect
1674	3249	4	Aftertreatment Exhaust Gas Temperature 2 Circuit - Voltage Below Normal, or Shorted to Low Source
1675	3249	3	Aftertreatment Exhaust Gas Temperature 2 Circuit - Voltage Below Normal, or Shorted to Low Source
1676	3249	2	Aftertreatment Exhaust Gas Temperature 2 - Data erratic, intermittent or incorrect
1691	3050	18	Aftertreatment Diesel Oxidation Catalyst System - Data Valid But Below Normal Operating Range - Moderately Severe Level
1695	3513	3	Sensor Supply 5 - Voltage Above Normal, or Shorted to High Source
1696	3513	4	Sensor Supply 5 - Voltage Below Normal, or Shorted to Low Source
1843	101	3	Crankcase Pressure Circuit - Voltage Above Normal, or Shorted to High Source
1844	101	4	Crankcase Pressure Circuit - Below Normal, or Shorted to Low Source
1847	110	14	Engine Coolant Temperature - Special Instructions
1866	411	2	Exhaust Gas Recirculation (EGR) Valve Delta Pressure - Data Erratic, Intermittent or Incorrect
1876	3245	3	Aftertreatment Exhaust Gas Temperature 3 Circuit - Voltage Above Normal, or Shorted to High Source
1877	3245	4	Aftertreatment Exhaust Gas Temperature 3 Circuit - Voltage Below Normal, or Shorted to Low Source
1878	3245	2	Aftertreatment Exhaust Gas Temperature 3 - Data Erratic, Intermittent or Incorrect
1879	3251	3	Aftertreatment Particulate Filter Differential Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
1881	3251	4	Aftertreatment Particulate Filter Differential Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
1883	3251	2	Aftertreatment Particulate Filter Differential Pressure Sensor - Data Erratic, Intermittent or Incorrect
1896	2791	13	EGR Valve Controller - Out of Calibration
1921	3251	16	Aftertreatment Particulate Filter Differential Pressure -Data Valid But Above Normal Operating Range - Moderately Severe Level
1922	3251	0	Aftertreatment Particulate Filter Differential Pressure -Data Valid But Above Normal Operational Range - Most Severe Level
1938	3597	18	ECU Power Output Supply Voltage 1 -Data Valid But Below Normal Operating Range - Moderately Severe Level
1939	3597	3	ECU Power Output Supply Voltage 1 -Voltage Above Normal, or Shorted to High Source
1941	3597	4	ECU Power Output Supply Voltage 1 -Voltage Below Normal, or Shorted to Low Source
1942	101	2	Crankcase Pressure |Data Erratic, Intermittent or Incorrect

Cummins Fault Code	These codes will display on the console		Cummins Description
	J1939 SPN	J1939 FMI	
1943	3555	17	Ambient Air Density - Data Valid But Below Normal Operating Range - Least Severe Level
1962	641	15	VGT/VFT Actuator Driver Over Temperature (Calculated) - Data Valid But Above Normal Operating Range - Least Severe Level
1968	3249	16	Aftertreatment Exhaust Gas Temperature 2 - Data Valid But Above Normal Operating Range - Moderately Severe Level
1972	3245	16	Aftertreatment Exhaust Gas Temperature 3 - Data Valid But Above Normal Operating Range - Moderately Severe Level
1974	101	15	Crankcase Pressure |Data Valid But Above Normal Operating Range - Least Severe Level
1981	3936	15	Aftertreatment Diesel Particulate Filter System - Data Valid But Above Normal Operating Range - Least Severe Level
1993	4795	31	Aftertreatment Diesel Particulate Filter Missing - Condition Exists
2272	27	4	EGR Valve Position Circuit - Voltage Below Normal, or Shorted to Low Source
2273	411	3	Exhaust Gas Recirculation (EGR) Valve Delta Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
2274	411	4	Exhaust Gas Recirculation (EGR) Valve Delta Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
2288	103	15	Turbocharger 1 Speed - Data Valid But Above Normal Operating Range - Least Severe Level
2349	2791	5	EGR Valve Control Circuit - Current below normal or open circuit
2351	2791	4	EGR Valve Control Circuit - Voltage below normal, or shorted to low source
2353	2791	6	EGR Valve Control Circuit - Current above normal or grounded circuit
2357	2791	7	EGR Valve Control Circuit - Mechanical system not responding or out of adjustment
2387	641	7	VGT Actuator Driver Circuit (Motor) - Mechanical System Not Responding or Out of Adjustment
2448	111	17	Coolant Level - Data Valid But Below Normal Operating Range - Least Severe Level
2449	641	13	VGT Actuator Controller - Out of Calibration
2468	190	0	Engine Crankshaft Speed/Position - Data Valid But Above Normal Operating Range - Moderately Severe Level
2554	1209	2	Exhaust Gas Pressure - Data Erratic, Intermittent or Incorrect
2571	2630	3	Engine Charge Air Cooler Outlet Temperature - Voltage Above Normal, or Shorted to High Source
2572	2630	4	Engine Charge Air Cooler Outlet Temperature - Voltage Below Normal, or Shorted to Low Source
2634	641	12	VGT Actuator Controller - Bad intelligent Device or Component
2635	641	31	VGT Actuator Driver Circuit - Condition Exists
2636	641	9	VGT Actuator Driver Circuit - Abnormal Update Rate
2637	3050	11	Aftertreatment Diesel Oxidation Catalyst Face Plugged - Root Cause Not Known

Cummins Fault Code	These codes will display on the console		Cummins Description
	J1939 SPN	J1939 FMI	
2638	3050	17	Aftertreatment Diesel Oxidation Catalyst System - Data Valid But Below Normal Operating Range - Least Severe Level
2639	3251	15	Aftertreatment Particulate Filter Differential Pressure -Data Valid But Above Normal Operating Range - Least Severe Level
2646	110	31	Engine Coolant Temperature ICondition Exists
2659	110	31	Engine Coolant Temperature ICondition Exists
2699	520320	7	Crankcase Depression Valve - Mechanical System Not Responding or Out of Adjustment
2728	3556	16	Aftertreatment Fuel Injector 1 - Data Valid But Above Normal Operating Range - Moderately Severe Level
2742	3249	17	Aftertreatment Exhaust Gas Temperature 2 - Data Valid But Below Normal Operating Range - Least Severe Level
2743	3249	18	Aftertreatment Exhaust Gas Temperature 2 - Data Valid But Below Normal Operating Range - Moderately Severe Level
2754	81	16	Engine Particulate Trap Inlet Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level
2764	1209	16	Exhaust Gas Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level
2765	2797	13	Engine Injector Bank 1 Barcodes - Out of Calibration
2774	3058	31	Engine Exhaust Gas Recirculation (EGR) System - Condition Exists
2777	3703	31	Particulate Trap Active Regeneration Inhibited Due to Inhibit Switch - Condition Exists
2778	3481	16	Aftertreatment Fuel Rate - Data Valid But Above Normal Operating Range - Moderately Severe Level
2789	110	18	Engine Coolant Temperature -Data Valid But Below Normal Operating Range - Moderately Severe Level
2961	412	15	Exhaust Gas Recirculation (EGR) Temperature -Data Valid But Above Normal Operating Range - Least Severe Level
2962	412	16	Exhaust Gas Recirculation (EGR) Temperature -Data Valid But Above Normal Operating Range - Moderately Severe Level
2998	1632	14	Engine Torque Limit Feature - Special Instructions
3133	3610	3	Aftertreatment Diesel Particulate Filter Outlet Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
3134	3610	4	Aftertreatment Diesel Particulate Filter Outlet Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
3135	3610	2	Aftertreatment Diesel Particulate Filter Outlet Pressure - Data Erratic, Intermittent or Incorrect
3136	520441	3	Engine Exhaust Gas Recirculation (EGR) Outlet Pressure Sensor Circuit - Above Normal, or Shorted to High Source
3137	520441	4	Engine Exhaust Gas Recirculation (EGR) Outlet Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
3139	3667	3	Engine Air Shutoff Circuit - Voltage above normal, or shorted to high source
3141	3667	4	Engine Air Shutoff Circuit - Voltage below normal, or shorted to low source

Cummins Fault Code	These codes will display on the console		Cummins Description
	J1939 SPN	J1939 FMI	
3168	3936	16	Aftertreatment Diesel Particulate Filter System - Data Valid But Above Normal Operating Range - Moderately Severe Level
3186	1623	9	Tachograph Output Shaft Speed -Abnormal update rate
3213	1623	2	Tachograph Output Shaft Speed -Received Network Data In Error
3222	520435	12	Glow Plug Module - Bad intelligent device or component
3251	4765	0	Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
3253	3242	16	Aftertreatment 1 Diesel Particulate Filter Intake Temperature -Data Valid But Above Normal Operating Range - Moderately Severe Level
3254	3242	15	Aftertreatment 1 Diesel Particulate Filter Intake Temperature -Data Valid But Above Normal Operating Range - Least Severe Level
3295	520442	3	Engine Exhaust Gas Recirculation (EGR) Mixer Inlet Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source
3296	520442	4	Engine Exhaust Gas Recirculation (EGR) Mixer Inlet Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
3311	3242	0	Aftertreatment Diesel Particulate Filter Intake Gas Temperature ñ Data valid but above normal operational range ñ Most Severe Level
3312	3246	0	Aftertreatment Diesel Particulate Filter Outlet Gas Temperature ñ Data valid but above normal operational range ñ Most Severe Level
3313	4765	4	Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature Sensor Circuit - Voltage below normal, or shorted to low source
3314	4765	3	Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature Sensor Circuit - Voltage above normal, or shorted to high source
3315	4765	2	Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature - Data erratic, intermittent or incorrect
3316	3242	4	Aftertreatment 1 Diesel Particulate Filter Intake Temperature Sensor Circuit - Voltage below normal, or shorted to low source
3317	3242	3	Aftertreatment 1 Diesel Particulate Filter Intake Temperature Sensor Circuit - Voltage above normal, or shorted to high source
3318	3242	2	Aftertreatment 1 Diesel Particulate Filter Intake Temperature -Data erratic, intermittent or incorrect
3325	4765	13	Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature Swapped - Out of Calibration
3326	91	9	SAE J1939 Multiplexed Accelerator Pedal or Lever Sensor System - Abnormal update rate
3328	191	9	Transmission Output Shaft Speed -Abnormal update rate
3329	1231	2	J1939 Network #2 - Data Erratic, Intermittent or Incorrect
3331	1235	2	J1939 Network #3 - Data Erratic, Intermittent or Incorrect
3369	171	9	Turbocharger 1 Compressor Inlet Temperature Sensor - Abnormal Update Rate
3371	171	19	Turbocharger 1 Compressor Inlet Temperature Sensor - Received Network Data In Error
3372	108	9	Turbocharger 1 Compressor Inlet Pressure - Abnormal Update Rate

Cummins Fault Code	These codes will display on the console		Cummins Description
	J1939 SPN	J1939 FMI	
3373	108	19	Turbocharger 1 Compressor Inlet Pressure - Received Network Data In Error
3377	520448	31	Engine Crankcase Ventilation Hose Disconnected - Condition Exists
3712	5246	0	Aftertreatment SCR Operator Inducement - Data valid but above normal operational range - Most Severe Level
3727	5571	7	High Pressure Common Rail Fuel Pressure Relief Valve - Mechanical system not responding or out of adjustment

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CHAPTER 7

TORQUE VALUE CHARTS

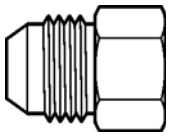
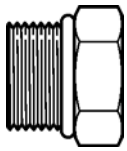
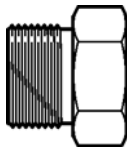
Fittings

ALWAYS tighten fittings to the values below unless a different torque value is specified.

Make sure fitting threads are clean and threads are engaged properly.

All torque values are adopted from SAE J514 and SAE J1453.

Size Chart

SAE Dash Size			
	SAE (JIC) 37° Flare Thread	O-ring Style Straight Thread	Face Seal
	Size	Size	Size
2	5/16-24	5/16-24	----
3	3/8-24	3/8-24	----
4	7/16-20	7/16-20	9/16-18
5	1/2-20	1/2-20	----
6	9/16-18	9/16-18	11/16-16
8	3/4-16	3/4-16	13/16-16
10	7/8-14	7/8-14	1-14
12	1 1/16-12	1 1/16-12	1 3/16-12
14	1 3/16-12	1 3/16-12	----
16	1 5/16-12	1 5/16-12	1 7/16-12
20	1 5/8-12	1 5/8-12	1 11/16-12
24	1 7/8-12	1 7/8-12	2-12
32	2 1/2-12	2 1/2-12	----

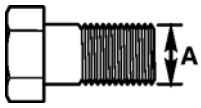
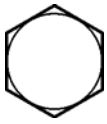
Torque Value Chart

SAE Dash Size	TORQUE					
	SAE 37° Flare		O-ring Straight Thread		Face Seal	
	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m
2	4	5	4	5	----	----
3	8	11	9	12	----	----
4	12	16	16	22	18	25
5	15	20	22	30	---	---
6	18	25	35	48	27	37
8	37	50	60	82	40	54
10	48	65	105	143	63	86
12	74	100	140	190	92	125
14	88	120	184	250	----	----
16	100	135	221	300	122	165
20	133	180	258	350	147	200
24	166	225	317	430	166	225
32	236	320	----	----	----	----

Bolts

ALWAYS tighten fittings to the values below unless a different torque value is specified. Fasteners must ALWAYS be replaced with the same grade. Make sure fitting threads are clean and threads are engaged properly. All torque values are adopted from SAE J1701 and SAE J1701M.

SAE Series Torque Value Chart

 **A** = Bolt Diameter		 SAE Grade 2 (No Markings)		 SAE Grade 5 (3 Radial Dashes)		 SAE Grade 8 (6 Radial Dashes)	
A Diameter (Inches)	Wrench Size	GRADE					
		SAE 2		SAE 5		SAE 8	
		lb-ft	N•m	lb-ft	N•m	lb-ft	N•m
1/4”	7/16”	6	8	10	13	14	18
5/16”	1/2”	12	17	19	26	27	37
3/8”	9/16”	23	31	35	47	49	67
7/16”	5/8”	36	48	55	75	78	106
1/2”	3/4”	55	75	85	115	120	163
9/16”	13/16”	78	106	121	164	171	232
5/8”	15/16”	110	149	170	230	240	325
3/4”	1 1/8”	192	261	297	403	420	569
7/8”	1 5/16”	306	416	474	642	669	907
1”	1 1/2”	467	634	722	979	1020	1383

Metric Series Torque Value Chart

 Diameter and Thread Pitch (Millimeters)	Wrench Size	 Metric Grade 8.8		 Metric Grade 10.9		 Metric Grade 8.8		 Metric Grade 10.9		 Diameter and Thread Pitch (Millimeters)
		Course Thread				Fine Thread				
		Metric 8.8		Metric 10.9		Metric 8.8		Metric 10.9		
		N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	
6 x 1.0	10	8	6	11	8	8	6	11	8	6 x 1.0
8 x 1.25	13	20	15	27	20	21	16	29	22	8 x 1.0
10 x 1.5	16	39	29	54	40	41	30	57	42	10 x 1.25
12 x 1.75	18	68	50	94	70	75	55	103	76	12 x 1.25
14 x 2.0	21	109	80	151	111	118	87	163	120	14 x 1.5
16 x 2.0	24	169	125	234	173	181	133	250	184	16 x 1.5
18 x 2.5	27	234	172	323	239	263	194	363	268	18 x 1.5
20 x 2.5	30	330	244	457	337	367	270	507	374	20 x 1.5
22 x 2.5	34	451	332	623	460	495	365	684	505	22 x 1.5
24 x 3.0	36	571	421	790	583	623	459	861	635	24 x 2.0
30 x 3.0	46	1175	867	1626	1199	1258	928	1740	1283	30 x 2.0

NOTES

APACHE™

CHAPTER 8

TROUBLESHOOTING

Apache Sprayer Troubleshooting Symptoms and Solutions

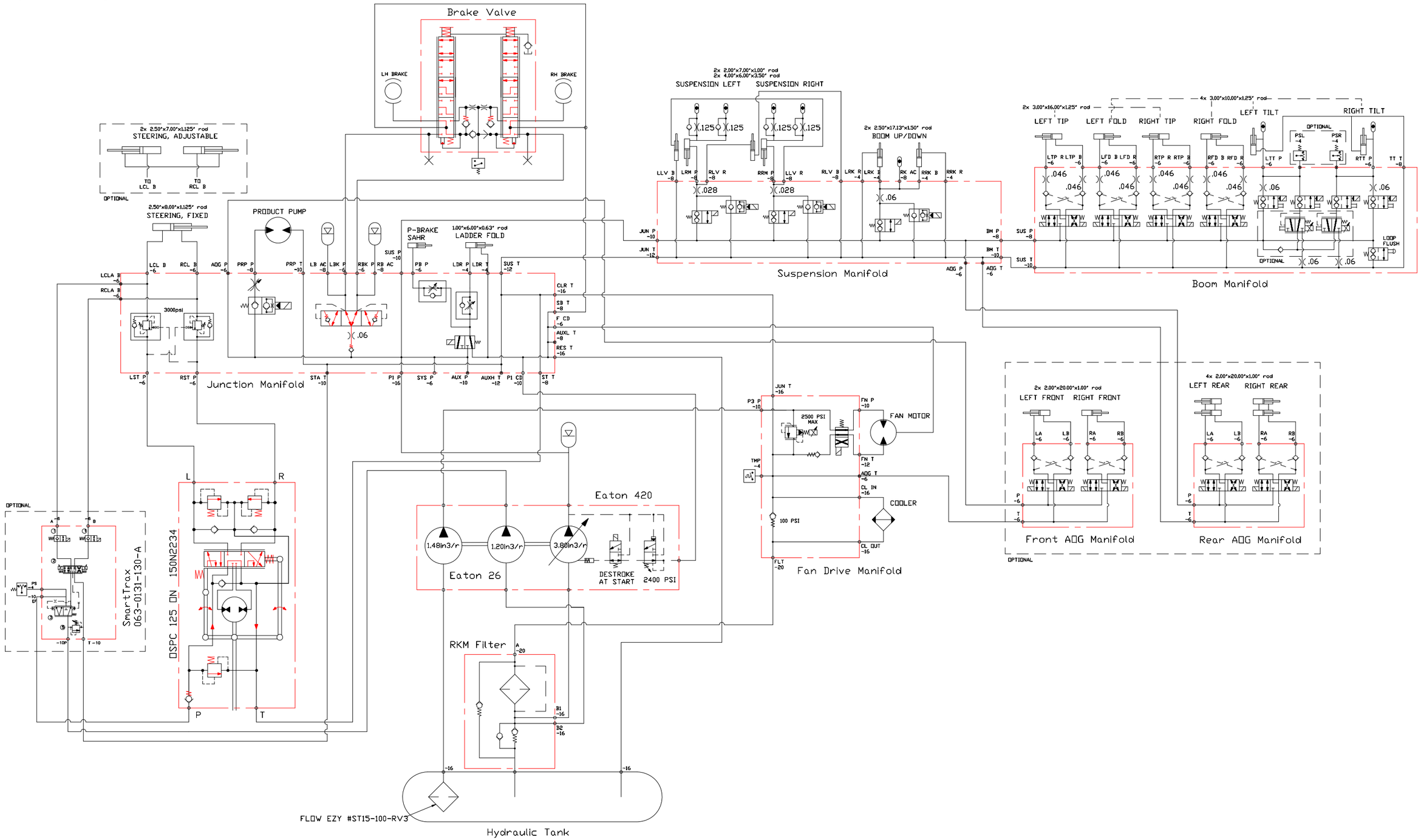
SYMPTOM	SOLUTION
Parking brake will not engage.	Check electrical coil on hydraulic junction block, under cab, for power. Check hose connections to brake canister on transmission.
Apache Sprayer will not move forward or backward.	Parking brake is engaged. Check electrical connections on parking brake and transmission. Contact your dealer.
Constant alarm sounds when Apache Sprayer moves forward or backward.	Check transmission fluid level. Check wire connection at sending unit. Check transmission temperature sensor. Contact your dealer.
Apache Sprayer will not move forward.	Check driveshaft. Check transmission fluid level. Check electrical connections on transmission. Contact your dealer.
Apache Sprayer will not move backward.	Check driveshaft. Check transmission fluid level. Check electrical connections on transmission. Contact your dealer.
Engine will not start.	Check diesel fuel level. Check neutral safety relay. Check electrical connections in side console, at mother board.

SYMPTOM	SOLUTION
Apache Sprayer steering does not work.	Check hydraulic fluid level. Check for hydraulic fluid leaks. Check steering column coupling on steering motor.
Transmission will not shift gears.	Check transmission fluid level. Contact your dealer.
Apache Sprayer brakes do not work.	Check brake hoses for leaks. Check push rods on master cylinder. Contact your dealer.
No power to console in cab.	Check electrical connections in right rear corner of cab, near fuse box.
Road and service lights do not work.	Confirm light switches in “ON” position. Check electrical connections to switches. Check for power at light housings. Contact your dealer.
Turn signals and/or flashers do not work.	Confirm lever/switch in “ON” position. Check electrical connections at light housings. Check for power at light housings.
Booms will not fold or unfold.	Confirm engine is running. Check hydraulic fluid level. Confirm booms are greased properly. Check for hydraulic fluid leaks. Check electrical connections in cab and at boom manifold.
Booms will not tilt up or down.	Confirm engine is running. Check hydraulic fluid level. Check for hydraulic fluid leaks. Check electrical connections in cab and at boom manifold.

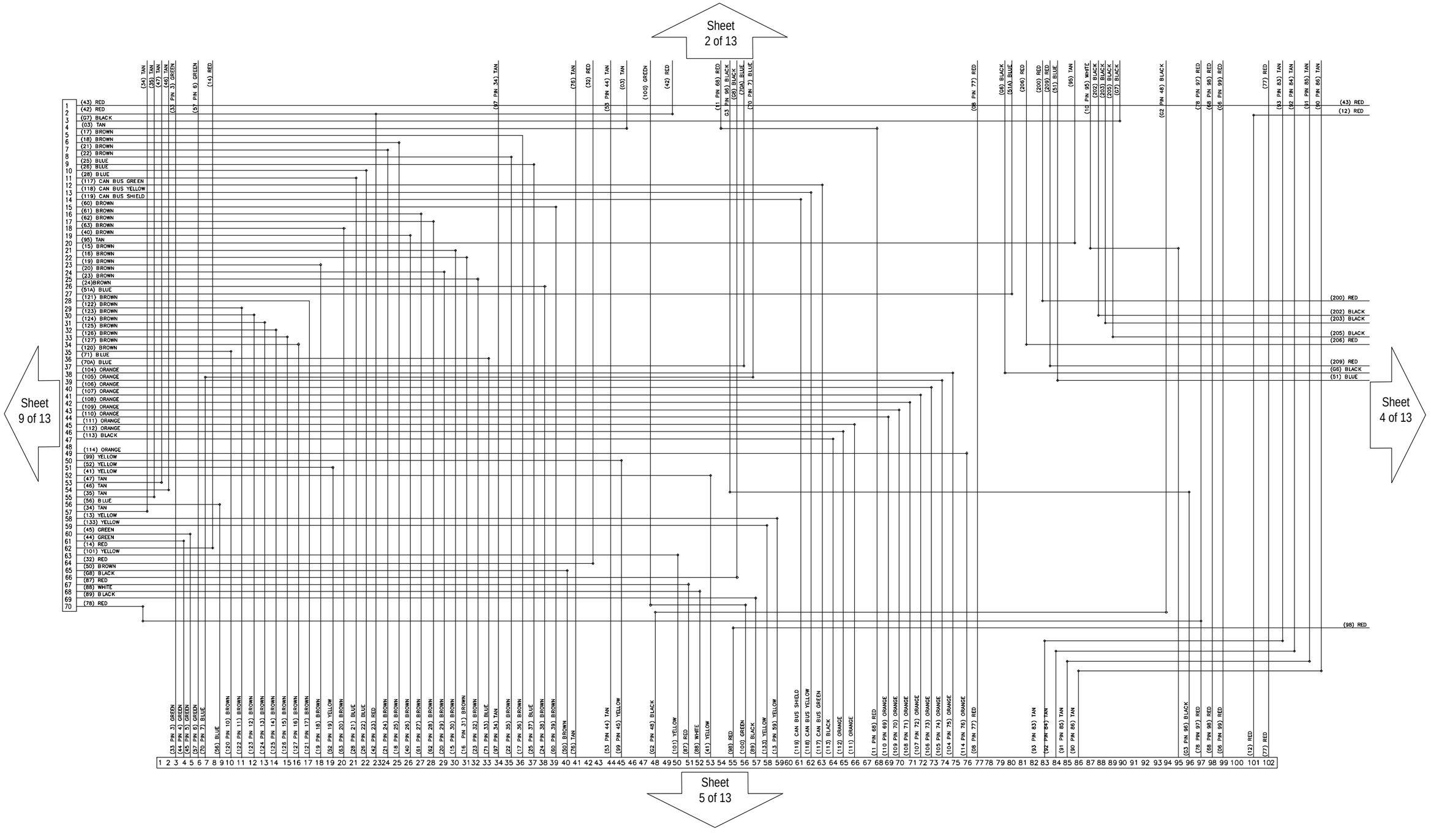
SYMPTOM	SOLUTION
Apache Sprayer will not spray.	Confirm engine is running. Confirm product in product tank. Confirm ball valves from tank to product pump are open. Confirm product pump is turned on. Check ground speed on Raven display. Confirm boom valves are opening.
Product boom valves will not turn on.	Unplug electric connection at valve for 20 seconds. Check electrical connections in cab. Check fuse panel in cab.
Product boom valves will not turn off.	Check boom valves for operation. Check electrical connections at boom valves. Check electrical connections in cab.
Seat will not raise or lower.	Check wire connections at right side of seat. Check for air leaks.
Raven monitor does not turn on.	Check fuse in fuse block to right of seat. Check electrical connections at console.
Front suspension cylinder is flat.	Lift tire off ground and check suspension cylinder fluid level. If fluid is foaming, the accumulator has failed. If fluid is low, fill to top of plug. Check operation. Contact your dealer.
Rear suspension will not rise.	Check hydraulic fluid level. Check electrical connections at suspension block and switches.
Product pump will not turn on.	Confirm product pump button is on and indicator is lit. Check electrical connections at hydraulic valve block. Check electrical connections in cab.
A/C does not cool.	Confirm A/C switch in “ON” position. Confirm fan in “ON” position. Check belt to compressor. Contact your dealer.

NOTES

Hydraulic System



Electrical System (Sheet 1 of 13)



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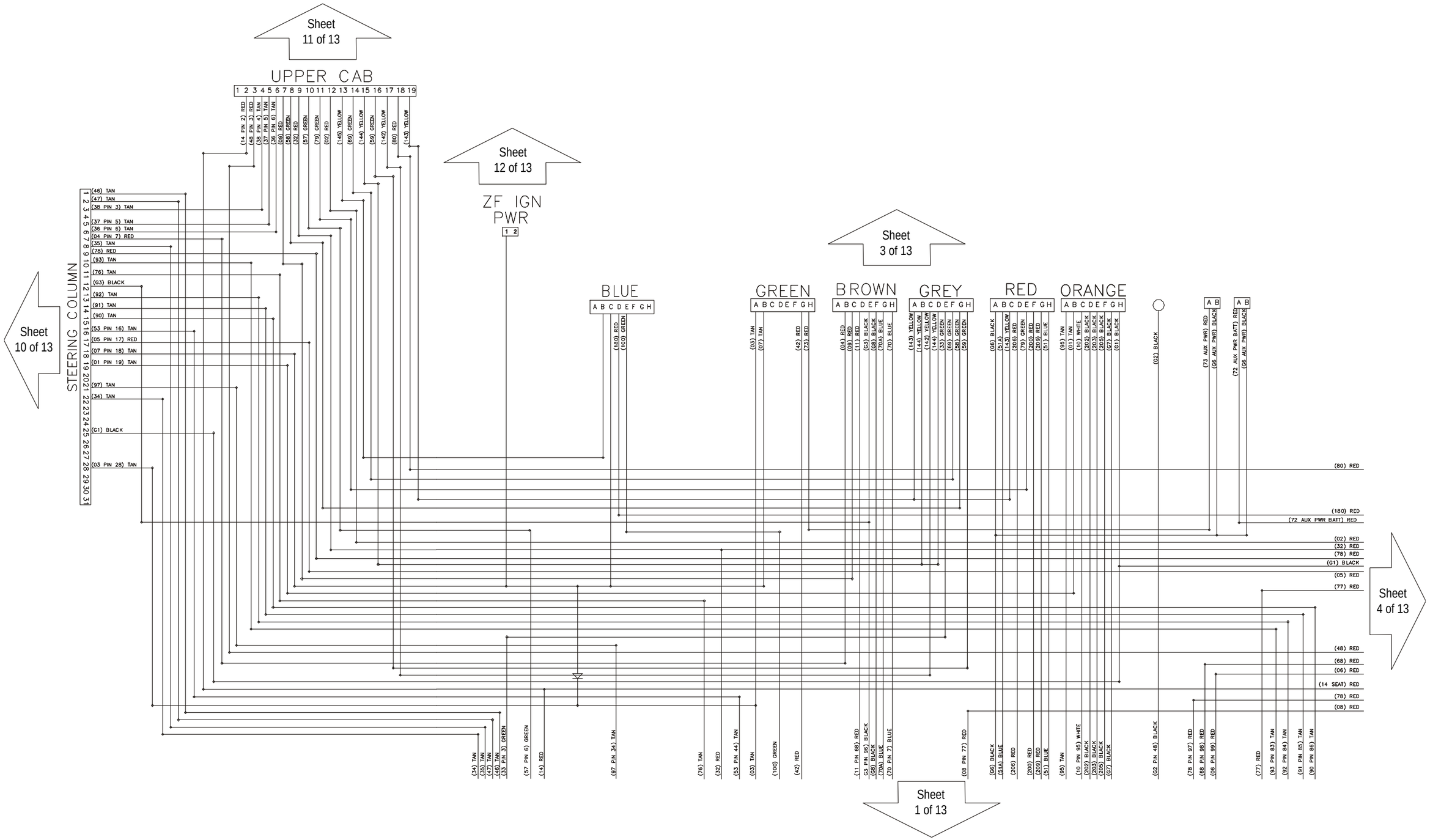

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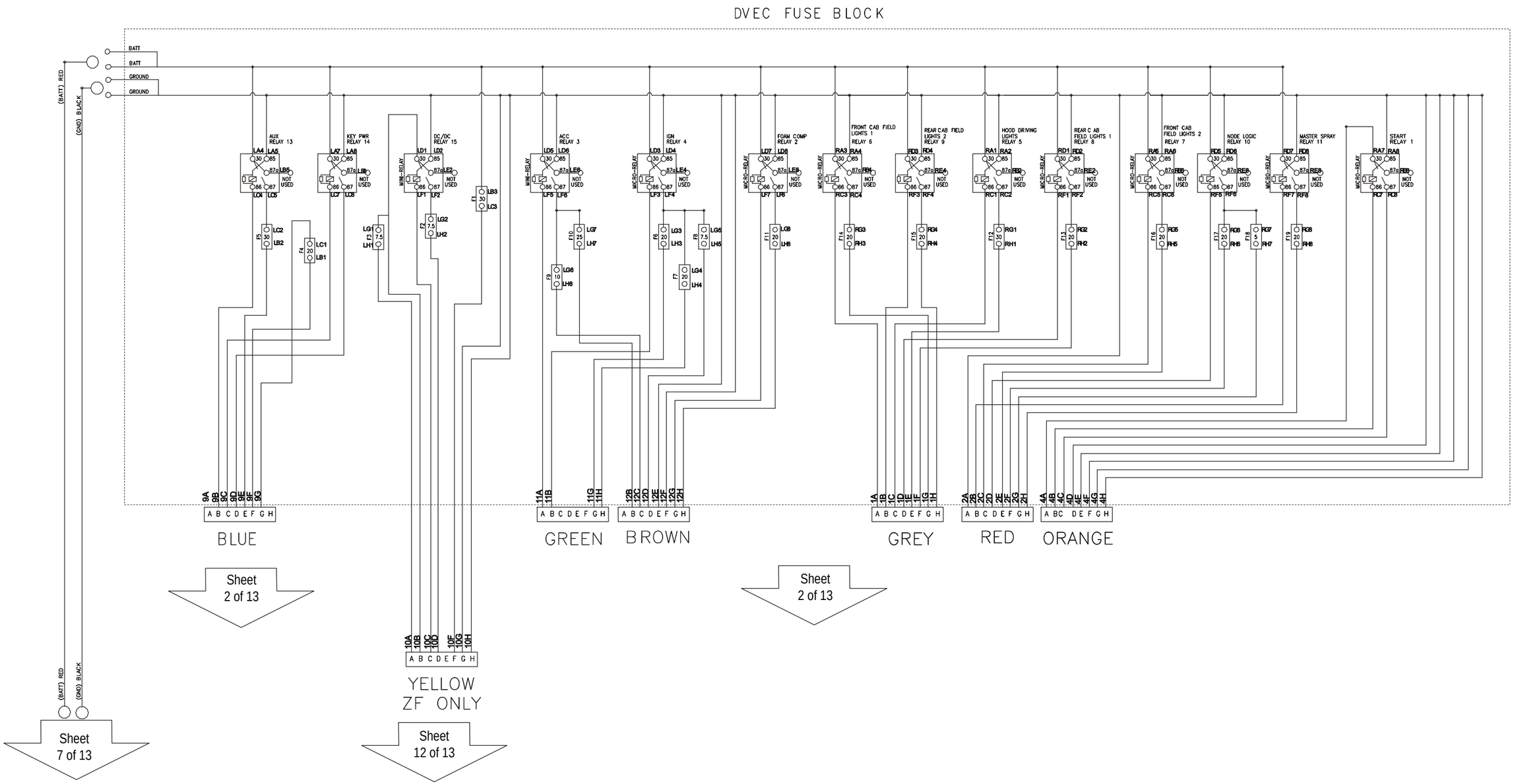

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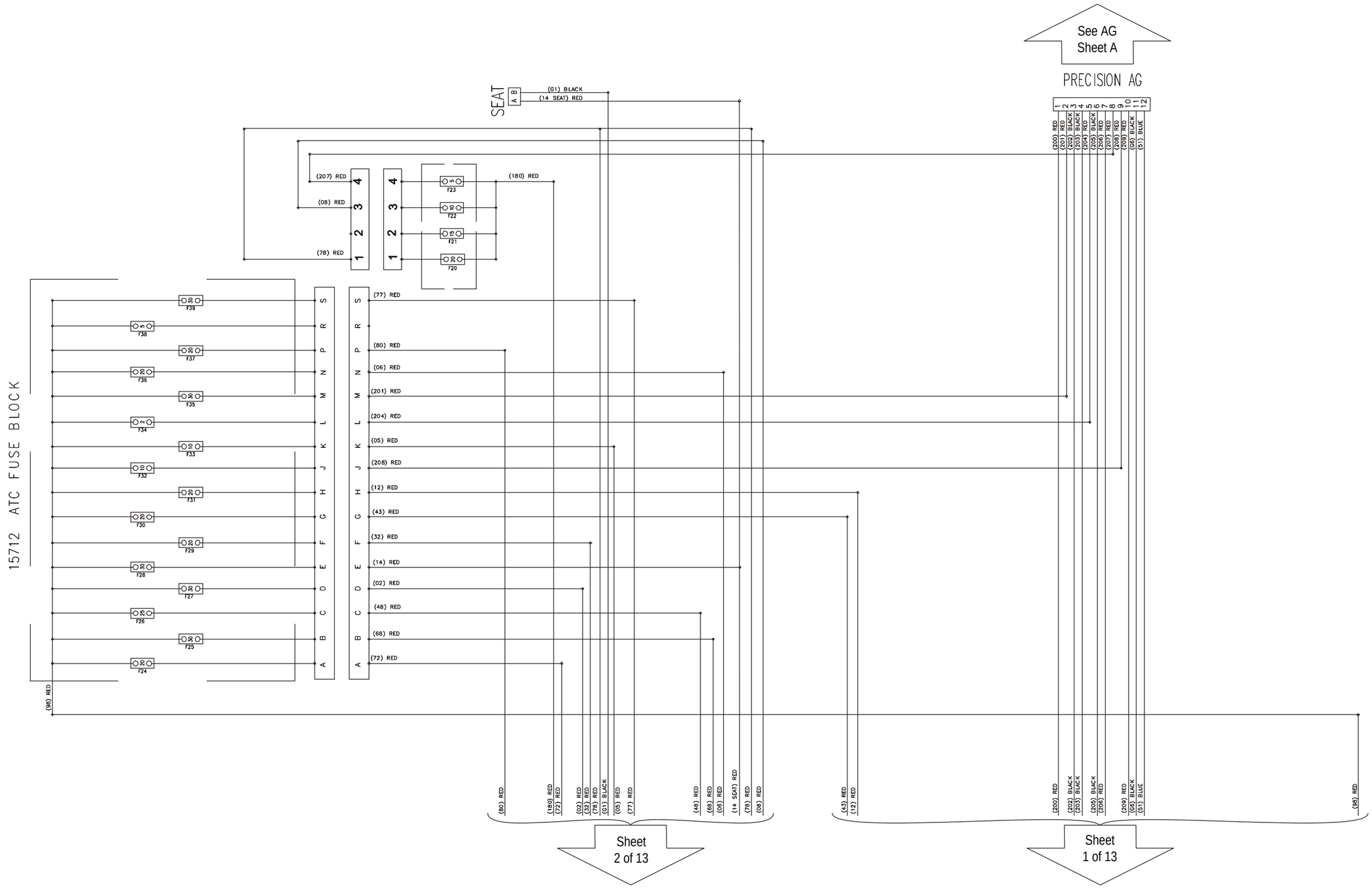

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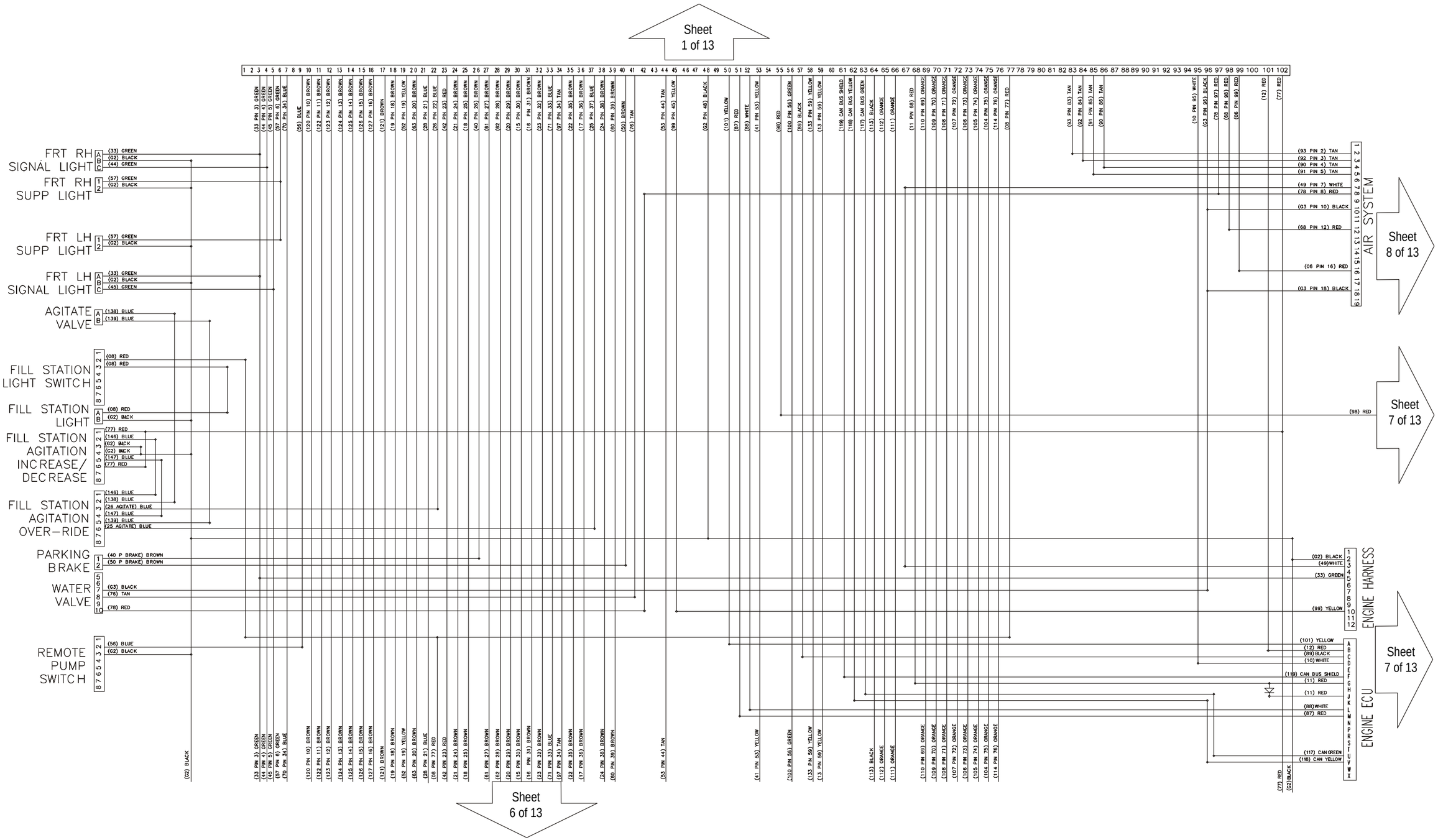

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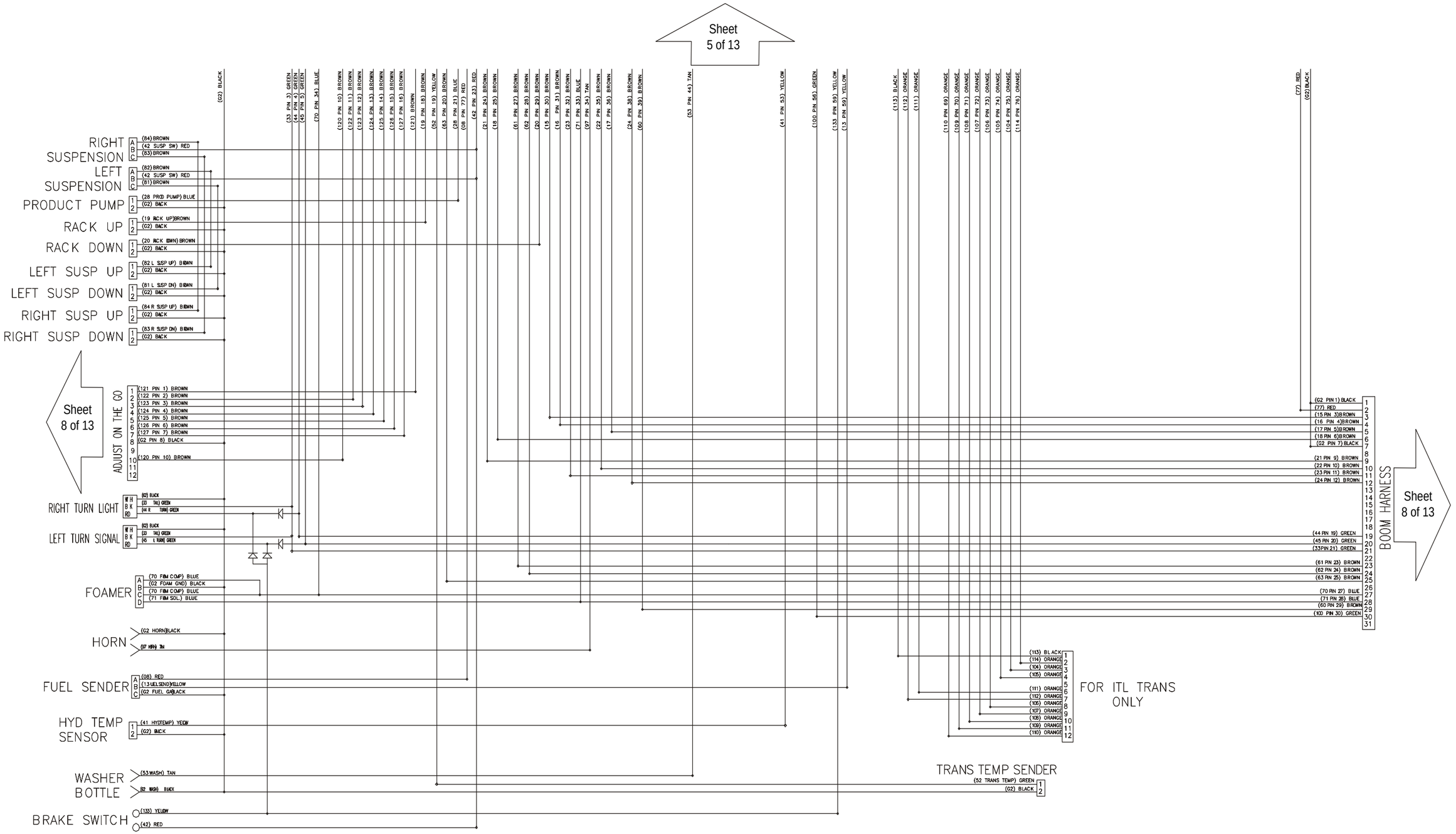

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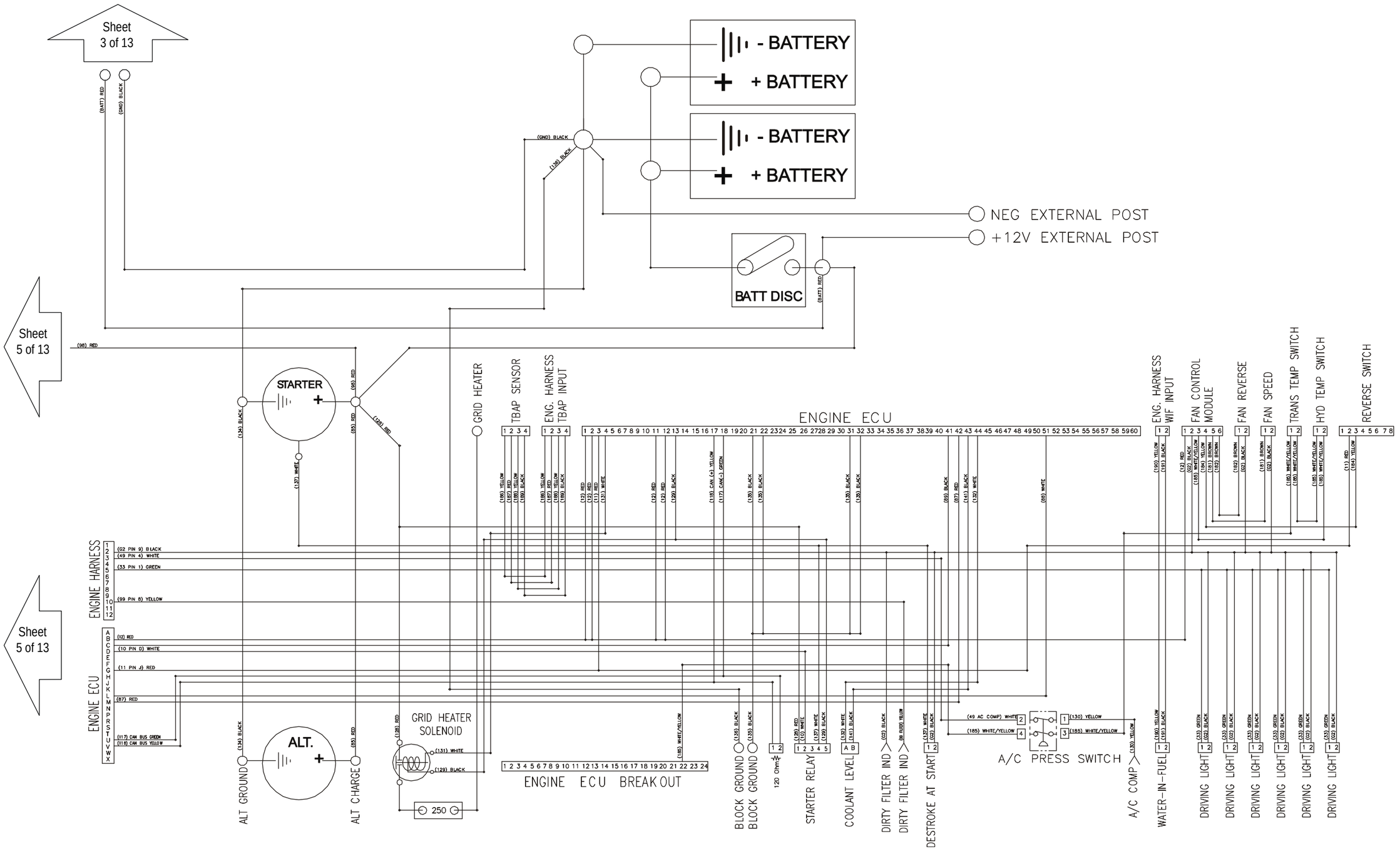

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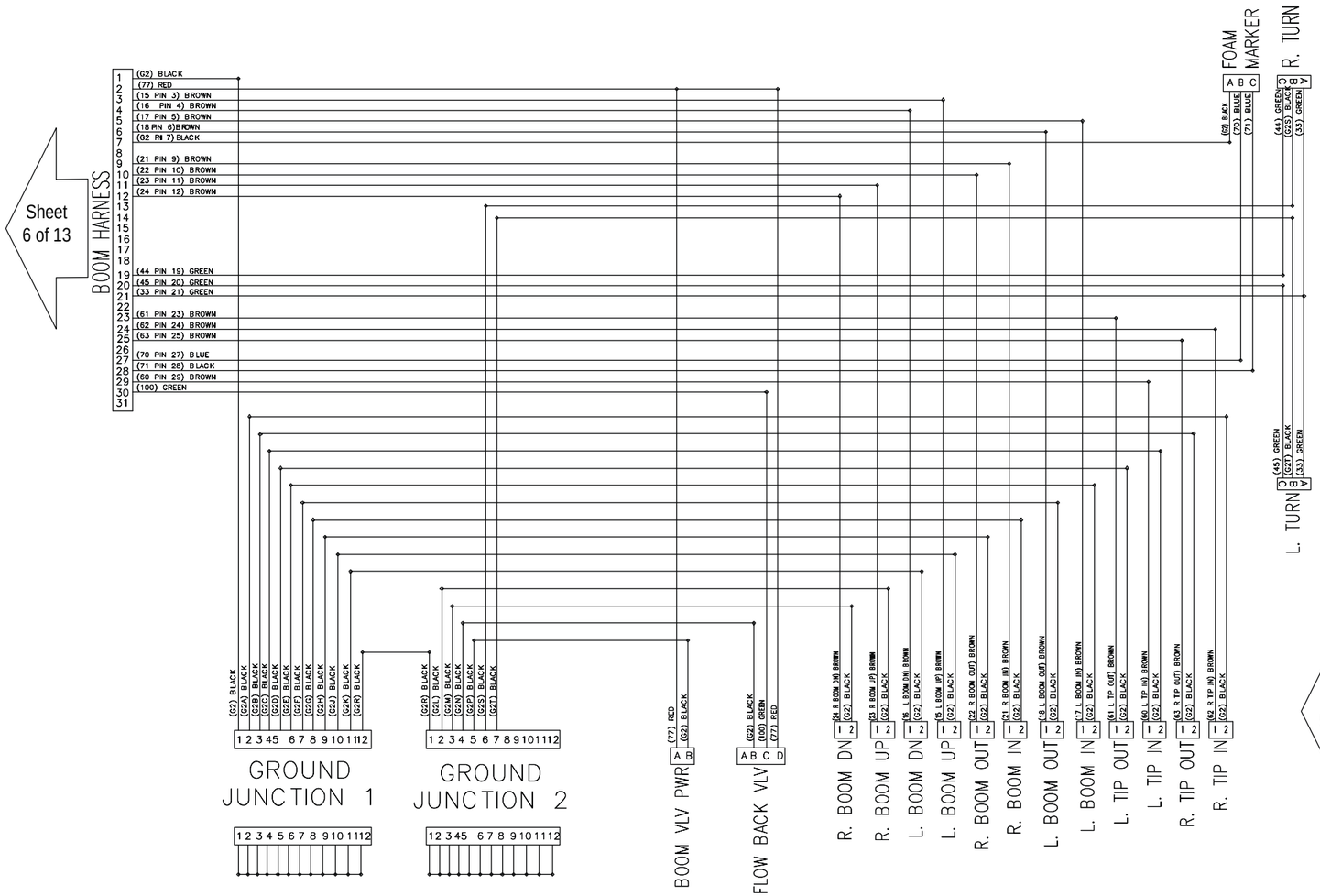

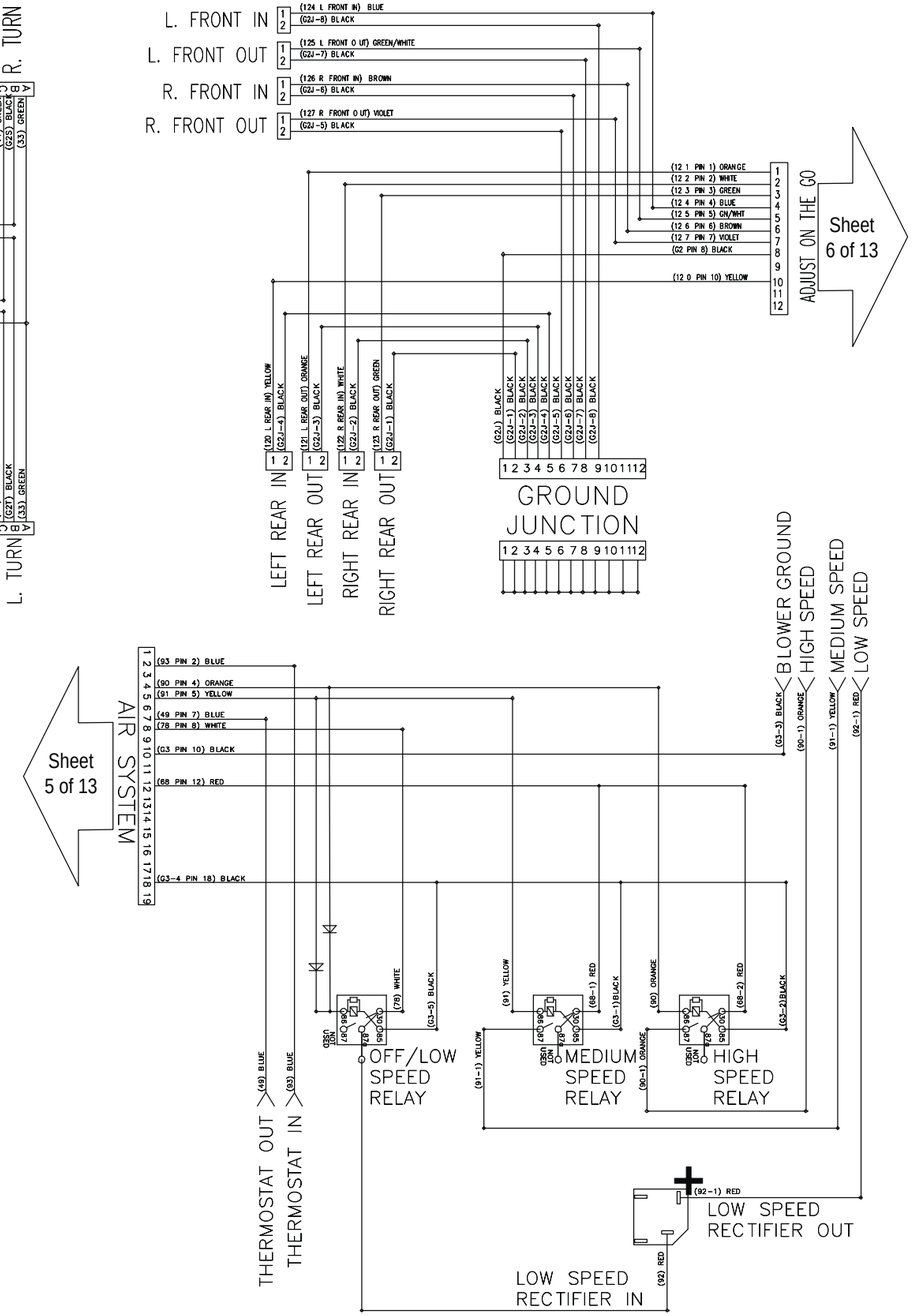

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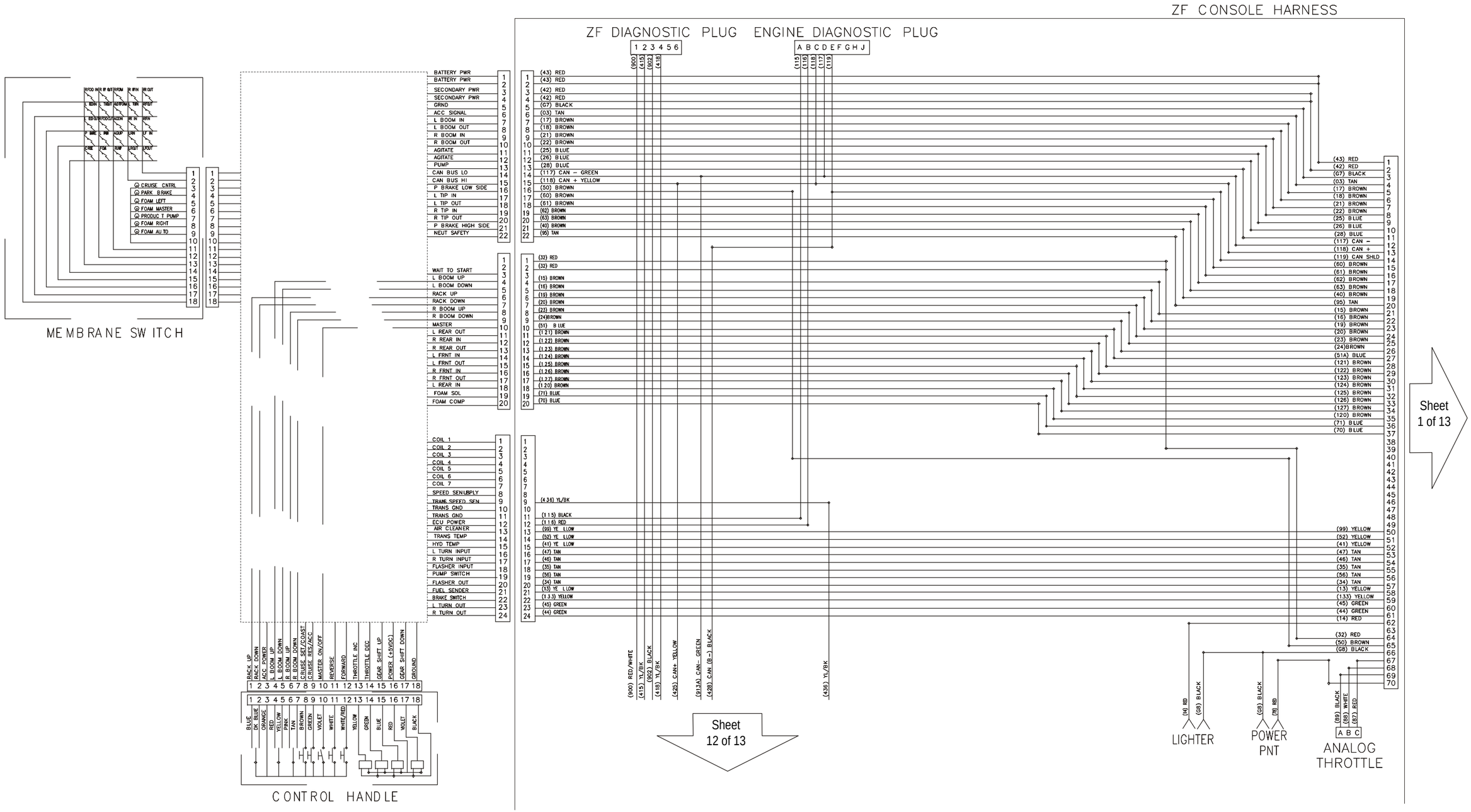

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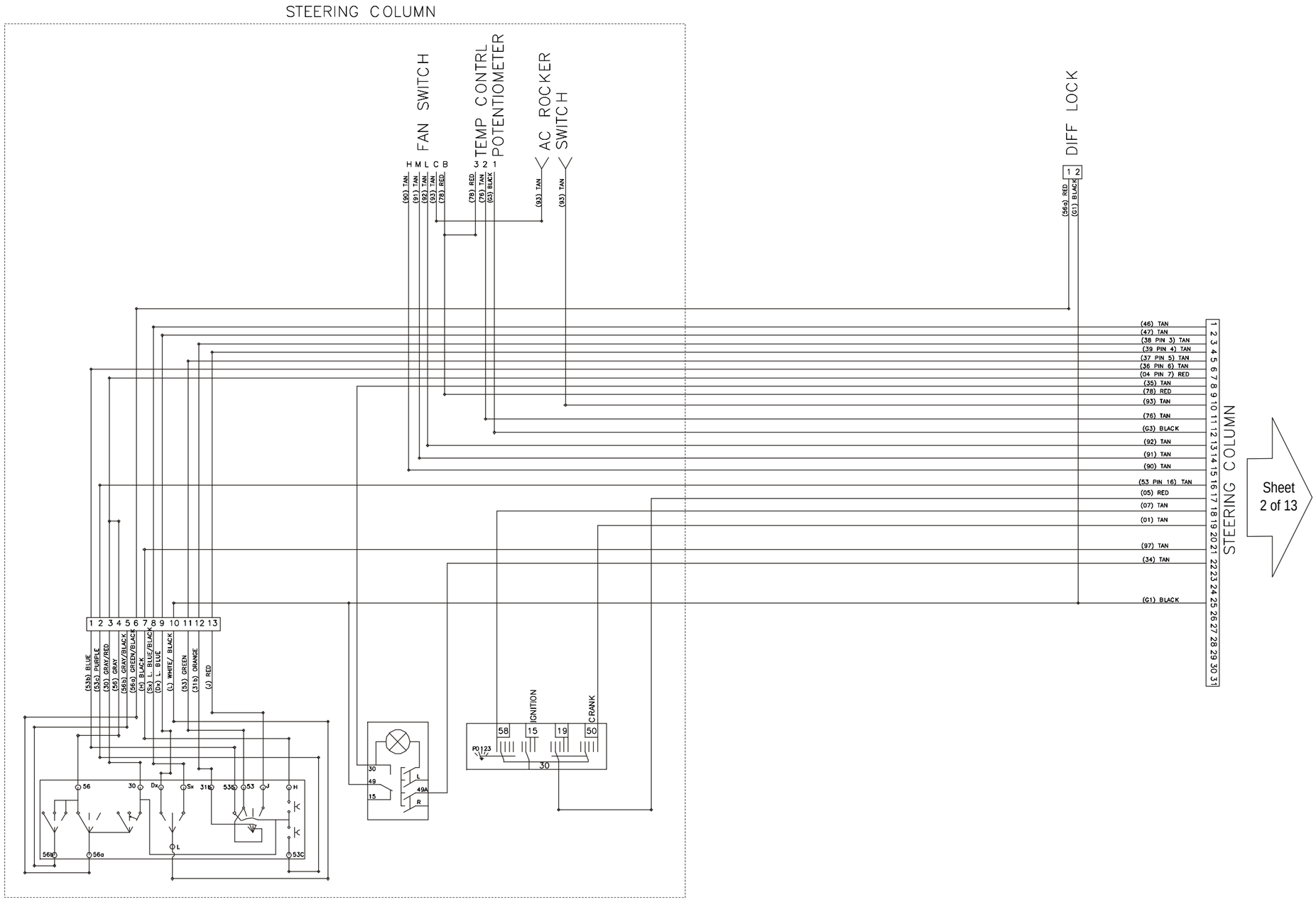

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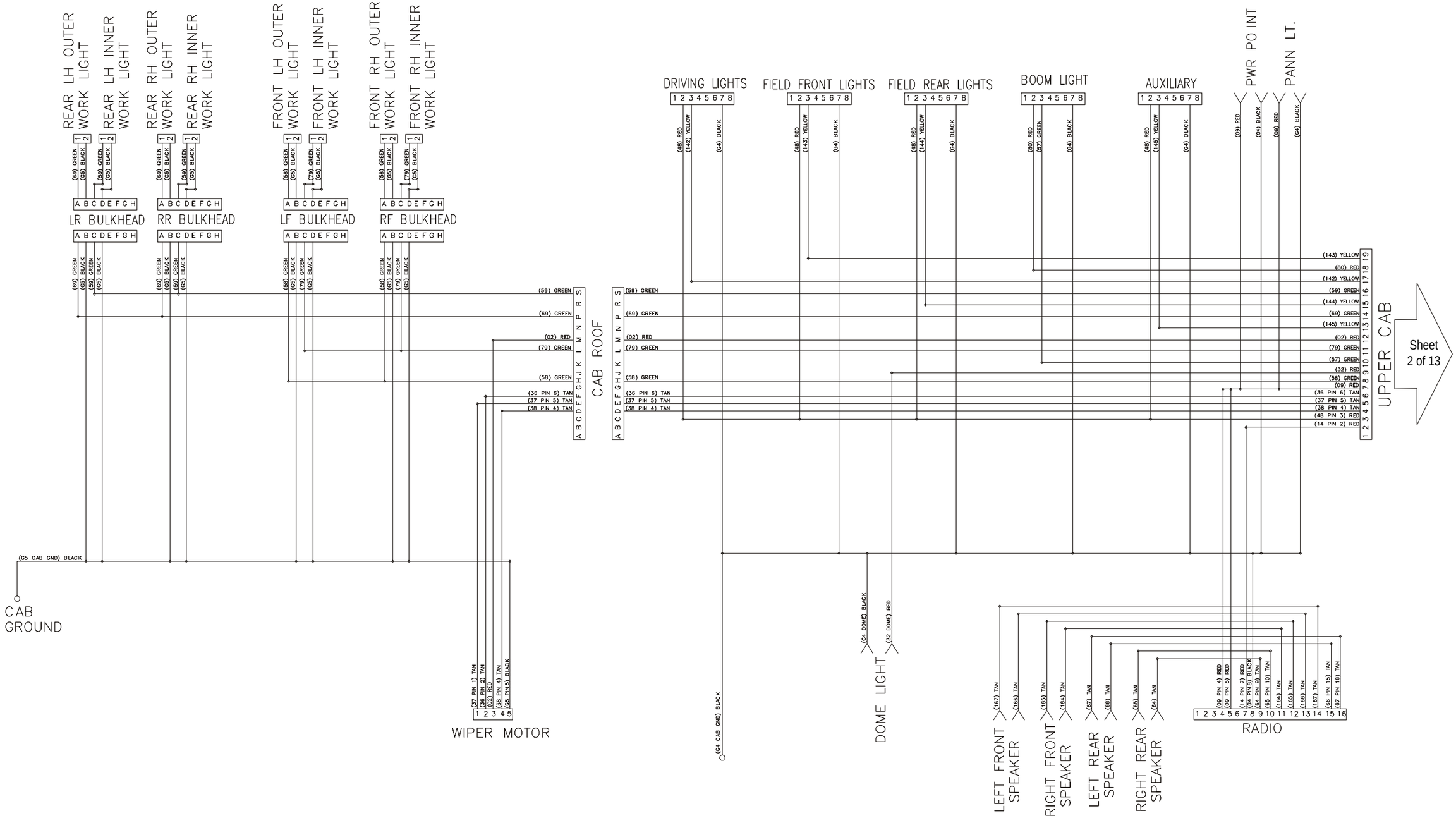

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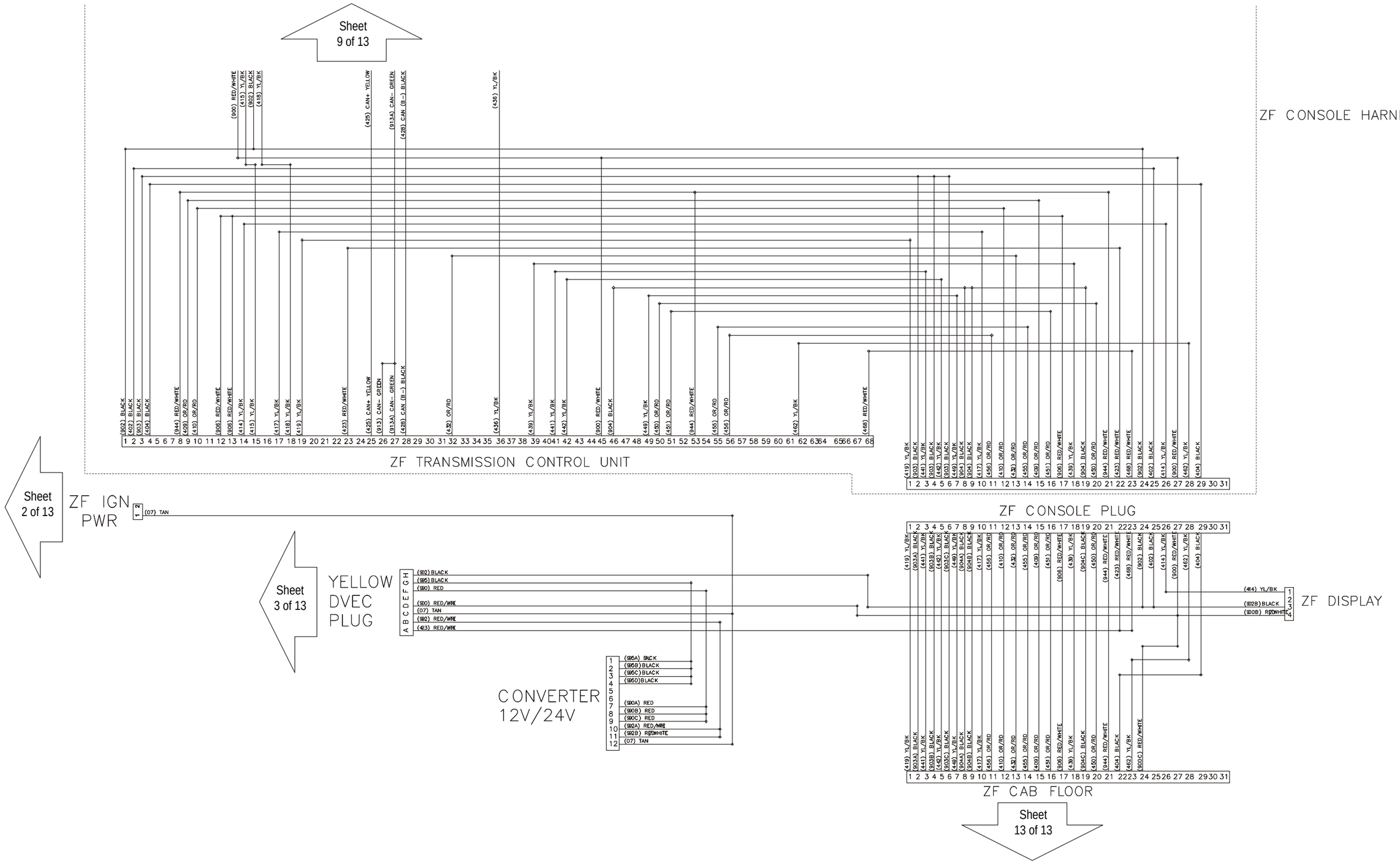

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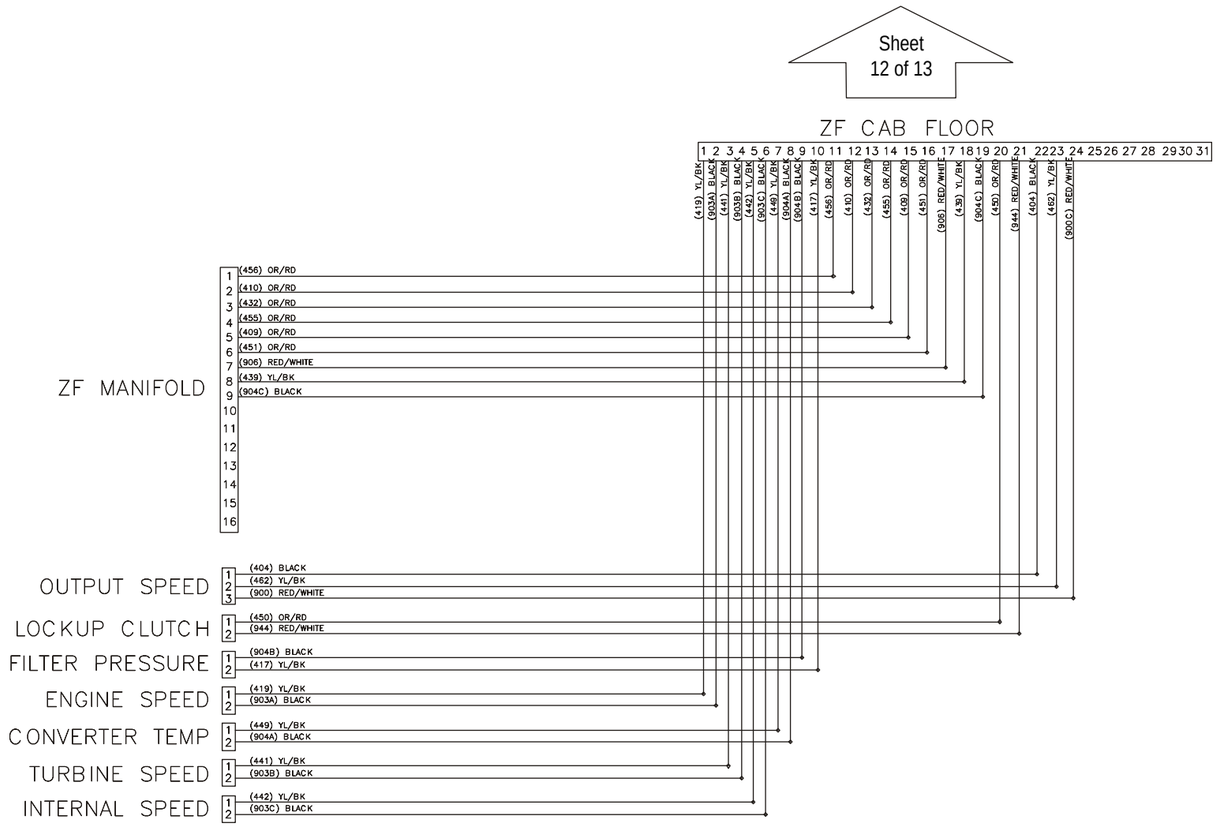

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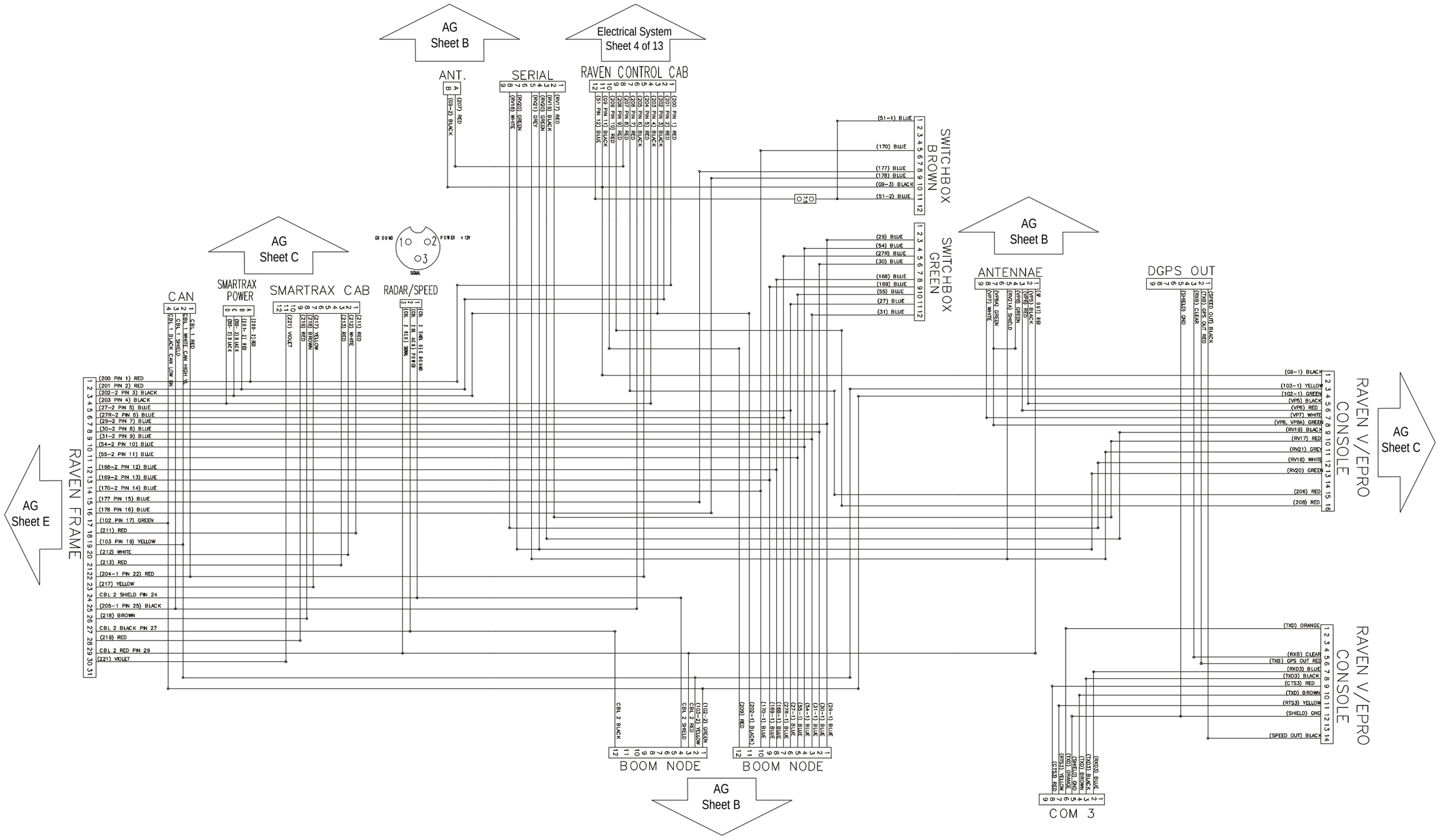

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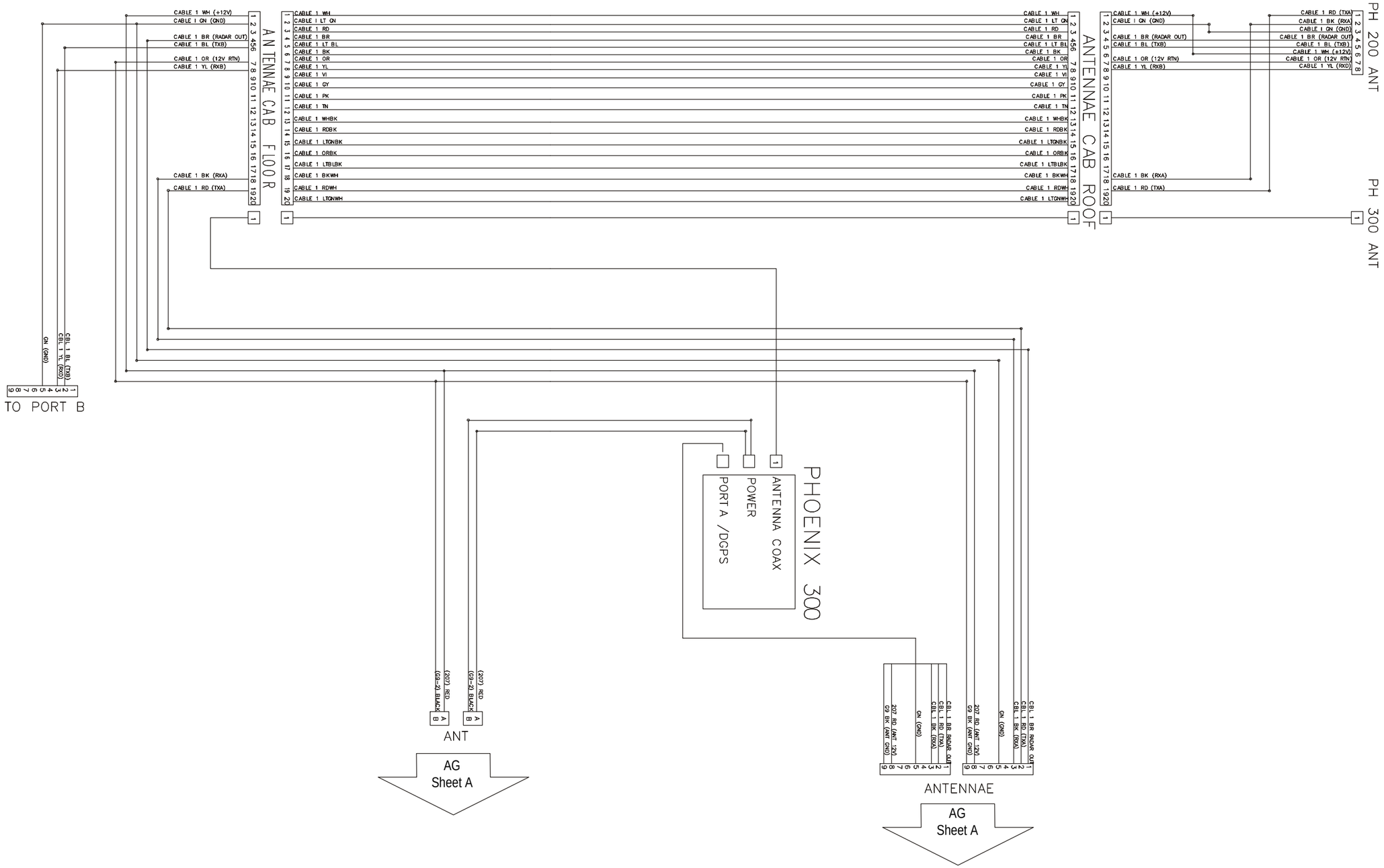

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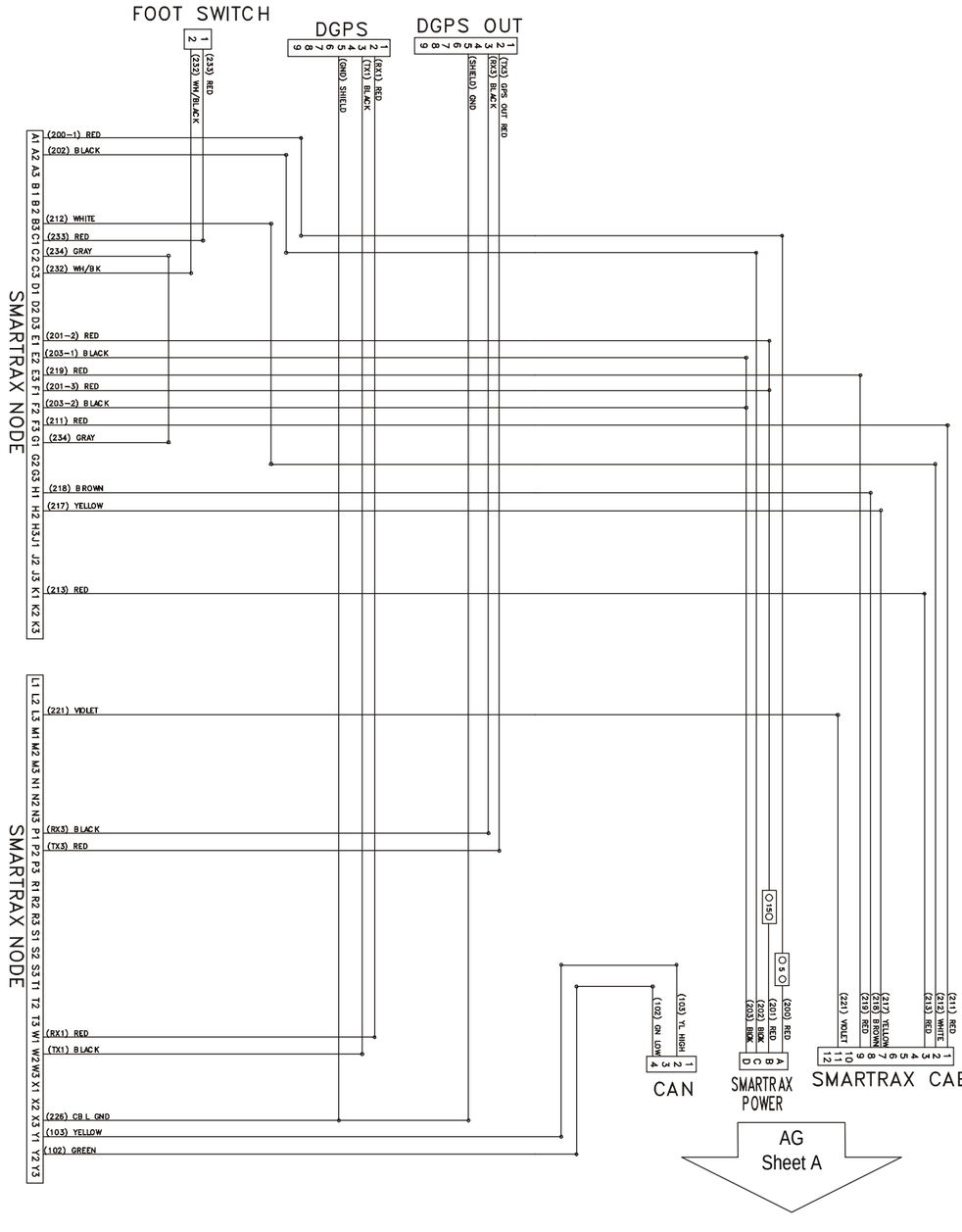

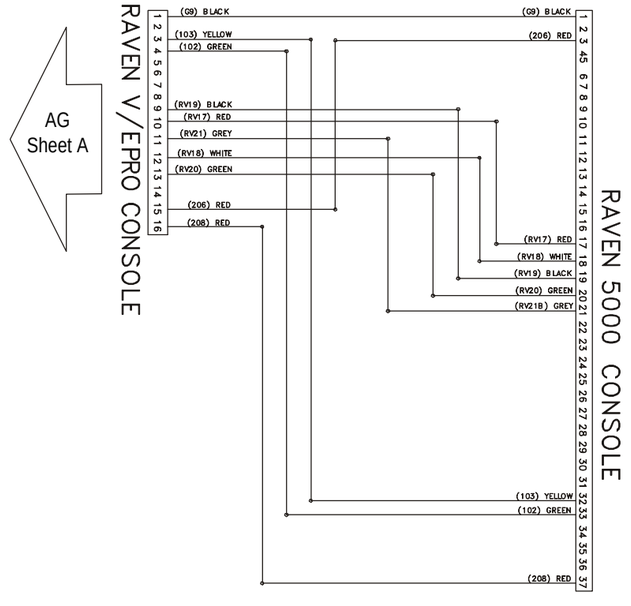

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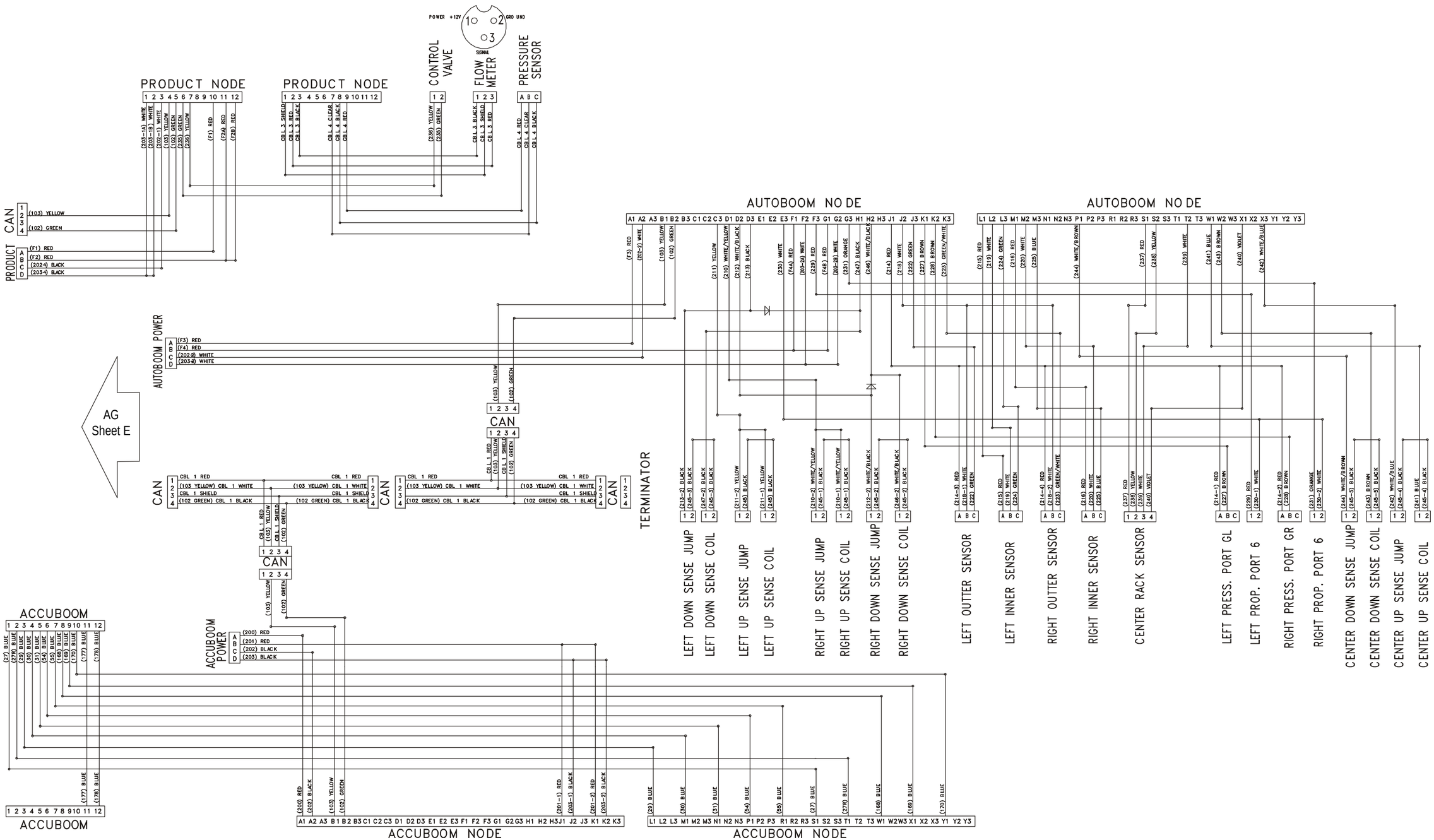
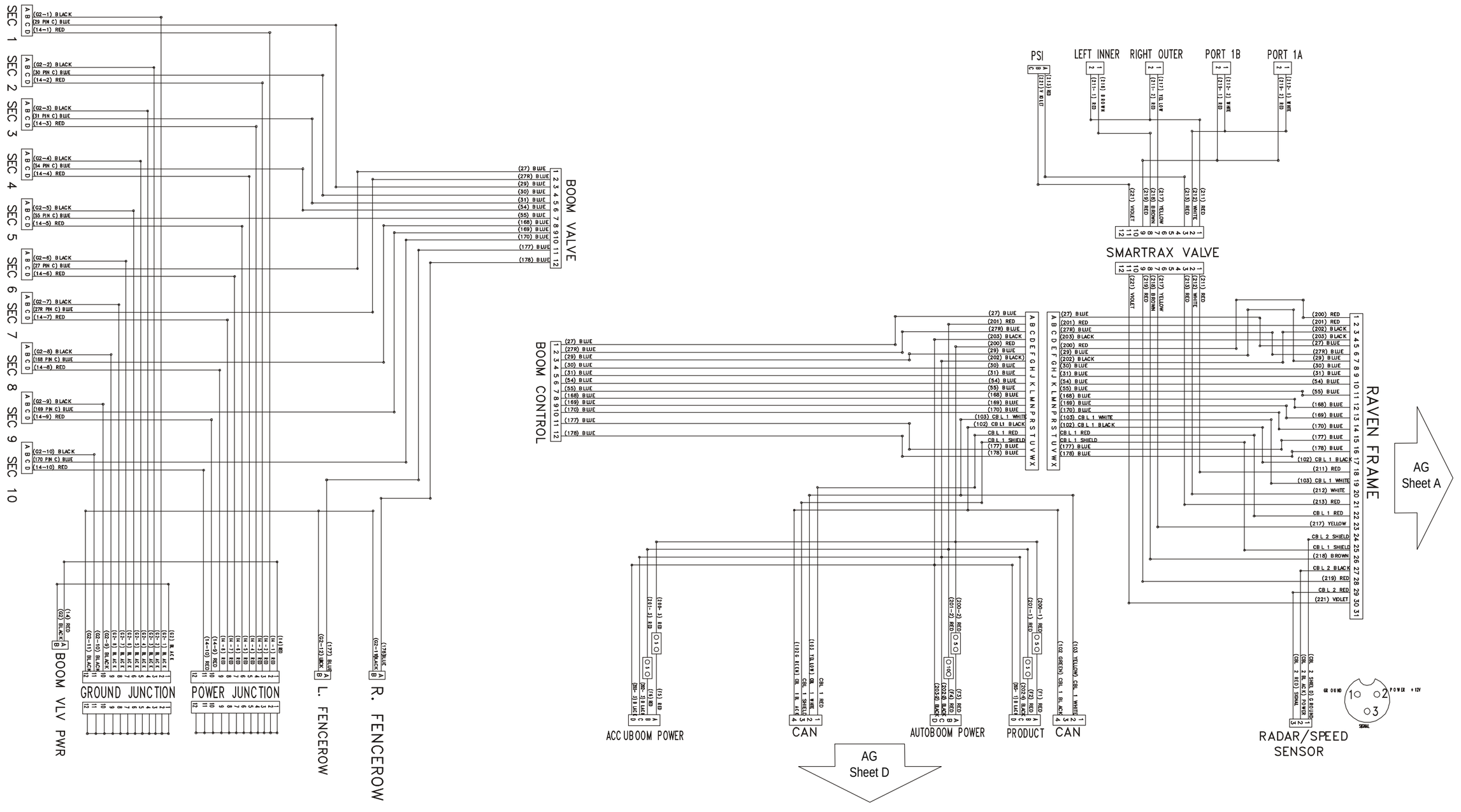


Precision AG Electrical (Sheet E)



Fuse Block Layout

DVEC Block 2012				
Source	**Function**	**Circuit**		
		Pwr Source	**To**	**Cir #**
F1 (30A)	DC-DC Converter 12V Pwr In	Batt	Converter	990
F2 (7.5A)	24 Volt Ignition Pwr	Converter	TCU	900
F3 (7.5A)	24 Volt Permanent Pwr	Converter	TCU/Trans	423/468
F4 (20A)	**Not Used**	**Boom Support Light Relay 12**	**Support Lt Plg**	***
F5 (30A)	Aux Boom Pwr	Aux Relay 13	Aux Boom Pwr Plg	100 GN
F6 (20A)	Console Backup, Chassis	Ign Relay 4	Console Backup, Rt Sus, Lt Sus, Brake Sw	42 RD
F7 (20A)	Aux Acc Pwr	Ign Relay 4	Aux Acc Plg	73 RD
F8 (7.5A)	Engine Ign Pwr	Ign Relay 4	Engine ECU	11 RD
F9 (10A)	Radio, Overhead Pwr Pnt, Pann Lt	Acc Relay 3	Radio, Pwr Pnt	09 RD
F10 (25A)	Horn, Washer, Wiper Batt Pwr	Acc Relay 3	Turn Signal Lever	04 RD
F11 (20A)	Foamer	Foam Relay 2	Foamer Plgs	70 BL
F12 (30A)	Front Hood Lights	Driving Lights Relay 5	Driving Lt Plugs	33 GN
F13 (20A)	Rear Outer Cab Lights	Rear Field Lt Relay 8	Rear Outer Lt Plgs	69 GN
F14 (20A)	Front Outer Cab Lights	Frt Field Lt Relay 6	Front Outer Lt Plgs	58 GN
F15 (20A)	Rear Inner Cab Lights	Rear Field Lt Relay 9	Rear Inner Lt Plgs	59 GN
F16 (20A)	Front Inner Cab Lights	Frt Field Lt Relay 7	Front Inner Lt Plugs	79 GN
F17 (20A)	Node Logic	Node Logic Relay 10	Node Pwr	200 RD
F18 (5A)	Boom Node	Node Logic Relay 10	Node Pwr	209 RD
F19 (20A)	Master Spray Control	Mast Spry Relay 11	Switch Box	51 BL
Relay 1	Start Relay	Ignition Switch Crank	Start Relay	01 TN/10 WH
Relay 2	Foam Comp Relay	Foam Switch Board	F11	70 BL
Relay 3	Acc Relay	Acc Pwr Board out	F9/F10	03 TN/04,09 RD
Relay 4	Ign Relay	Ignition Switch Ign	F6/F7/F8	07 TN/42,73,11 RD
Relay 5	Front Hood Lights	Driving Switch	F12	142 YL / 33 GN
Relay 6	Front Cab Field 1 Outer	Field Front Switch	F14	143 YL / 58 GN
Relay 7	Front Cab Field 2 Inner	Field Front Switch	F16	143 YL / 79 GN
Relay 8	Rear Cab Field 1 Outer	Field Rear Switch	F13	144 YL / 69 GN
Relay 9	Rear Cab Field 2 Inner	Field Rear Switch	F15	144 YL / 59 GN
Relay 10	Node Logic Relay	Raven Console	F17/F18	206 RD/200,209 RD
Relay 11	Master Spray Relay	Master Switch	F19	51 BL
Relay 12	**Not used**	**Field Rear Switch**	**F4**	***
Relay 13	Aux Boom Power Relay	Auxiliary Switch	F5	145 YL / 100 GN
Relay 14	Key Pwr Relay	Ignition Switch Ign	F20/F21/F22/F23	180 RD
Relay 15	DC-DC Converter	Converter	F2	
Ground	**Function**			
Gnd G1	Seat, Steering Column			
Gnd G2	Chassis			
Gnd G3	Air System			
Gnd G4	Upper Cab			
Gnd G5	Cab Roof			
Gnd G6	Aux Pwr Batt, Aux Pwr Key, Raven Console, Switch Box, Antenna			
Gnd G7	Console			
Gnd G8	Power Point and Lighter			
Gnd 202	Node Logic			
Gnd 203	Node High Current			
Gnd 205	Raven CAN			
Gnd 902,3 & 4	TCU			
Gnd 995	DC-DC Converter			

15712 Block 2012				
Source	**Function**	**Circuit**		
		Pwr Source	**To**	**Cir #**
F20 (20A)	Console Pwr Pnt, Fan Switch, Booste	Relay 14	Pwr Pnt, Fan Sw	78 RD
F21 (15A)	Key Power Open	Relay 14	Open	***
F22 (10A)	Fuel Sending Unit, Fill Station Light	Relay 14	Sending Unit, Fill Station Light	08 RD
F23 (5A)	Antenna	Relay 14	Antenna Pwr	207 RD
F24 (20A)	Aux Batt Power	Batt	Aux Batt Plg	72 RD
F25 (30A)	HVAC High Med Relay Batt Pwr	Batt	HVAC Plg	68 RD
F26 (25A)	Overhead Light Switch	Batt	Light Switches	48 RD
F27 (30A)	Wiper Batt Power	Batt	Wiper Motor Plg	02 RD
F28 (30A)	Seat, Radio Batt Pwr, Lighter	Batt	Seat, Radio Batt Pwr, Lighter	14 RD
F29 (20A)	Dome Light, Hazard Batt Pwr	Batt	Dome Light, Hazard/Console	32 RD
F30 (20A)	Console Batt Pwr	Batt	Console	43 RD
F31 (20A)	Engine Batt Pwr	Batt	Engine ECU	12 RD
F32 (10A)	Raven Console	Batt	Rav Con Pwr	208 RD
F33 (10A)	Key Switch Batt Pwr	Batt	Key Switch	05 RD
F34 (2A)	Raven CAN	Batt	Can Pwr	204 RD
F35 (30A)	Node High Current	Batt	Node Pwr	201 RD
F36 (20A)	Booster Blower Relay	Batt	Blower Relay	06 RD
F37 (20A)	Boom Support Light Switch	Batt	Boom Switch	80RD/57GN
F38 (5A)	Batt Pwr Open	Batt	Open	***
F39 (30A)	Boom Valve Power	Batt	Boom Valves	77 RD

APACHE™

CHAPTER 10

WARRANTY

Equipment Technologies Warranty Policy For all 2012 Model Year

NEW APACHE LIMITED WARRANTY POLICY

Equipment Technologies (hereinafter called ET) warrants each new Apache to be free from defects in materials and workmanship for a period of five (5) years or two thousand (2000) hours, whichever occurs first, from the date of delivery to the original purchaser, with the exclusions listed herein. Under no circumstances does this limited warranty cover any merchandise or component parts, which, in the sole opinion of ET, have been subject to negligent, misuse, improper storage, alteration, accident, or if repairs have been made with parts other than those manufactured, supplied, and/or authorized by ET. Under no circumstances are component parts warranted against normal wear and tear. There is no warranty on glass, parking brake pads, brake linings, filters, oils, product pump seals, product pump bearings, rubber product hoses, or pressure gauges.

First Year - Limited warranty covers the total machine for the first year from the date of delivery to the original purchaser or one thousand (1000) hours whichever occurs first, for both parts and labor. Under no circumstances does this limited warranty cover any merchandise or component parts, which, in the opinion of ET, have been subject to negligent, misuse, improper storage, alteration, accident, or if repairs have been made with parts other than those manufactured, supplied, and/or authorized by ET. For engine, tire, and battery warranty please see below.

Second Year - Limited warranty covers the driveline and chassis components for both parts and labor from the date of delivery to the original purchaser or one thousand (1000) hours which ever comes first. The following components are covered under the second year of warranty. Transmission and its internal components, rear differential and its internal components, front axle assembly (excludes seals, bearings, wear pads, suspension cylinder, accumulator, and steering cylinders), frame rails, engine bolster, rear axle assembly (excludes wear pads, drive shafts, and rear suspension components), planetaries and their internal components (excludes bearings, seals, and o rings), drop boxes and their internal components, and frame cross members and any bracket that bolts directly to the frame rails. This portion of coverage is subject to all listed conditions but further excludes oil, seals, gaskets and leakage.

Years Three through Five - Limited warranty covers the driveline and chassis components for parts only from the date of delivery to the original purchaser or two thousand (2000) hours which ever comes first. The following components are covered under years three through five of warranty. Transmission and its internal components, rear differential and its internal components, front axle assembly (excludes seals, bearings, wear pads, suspension cylinder, accumulator, and steering cylinders), frame rails, engine bolster, rear axle assembly (excludes wear pads, drive shafts, and rear suspension components), planetaries and their internal components (excludes bearings, seals, and o rings), drop boxes and their internal components, and frame cross members and any bracket that bolts directly to the frame rails. This portion of coverage is subject to all listed conditions but further excludes oil, seals, gaskets and leakage.

Engine Warranty - The limited engine warranty is covered by engine manufacturer for two (2) years or two thousand (2000) hours from the date of delivery to the original purchaser, whichever comes first. ET does warranty the

a/c compressor, a/c belt, alternator, and engine belt for the first year only. The engine manufacturer warrants all other bolt on and engine components. See engine warranty for complete details.

Tires - The tire manufacturer (Titan) covers the tire warranty. Contact your local authorized Titan dealer for complete warranty details.

Batteries - Batteries are warranted for thirty (30) months. Batteries are warranted through NAPA auto part stores. If you have no authorized NAPA auto part stores, then contact ET for warranty replacement information.

Replacement Parts - Replacement parts are warranted for six (6) months. Contact ET for warranty replacement information.

ET's obligation under this limited warranty is limited to repairing or replacing free of charge to the original purchaser, at a location designated by ET, any part that in ET's sole judgment, shows evidence of defect or improper workmanship, provided that the part is returned to ET within thirty (30) days of repair date. Parts must be returned through the authorized selling dealer, transportation charges prepaid. All returned parts must be clean from all chemicals and/or oils.

ET's obligation under this limited warranty is in lieu of all other warranties or representations, expressed or implied, and specifically excludes any obligations or liability for loss of crops, losses caused by harvest delays or any expense or loss of labor, supplies, rental equipment, and all incidental or consequential damages. The replacement of parts and/or repair is the exclusive remedy under this limited warranty. ET reserves the right to repair or replace any defective part or parts. No person is authorized to give any other warranties or to assume any other liability on ET's behalf. This limited warranty is void if ET's limited warranty policy maintenance standards are violated.

ET makes NO warranty of merchantability or fitness for a particular purpose.

This machine must be registered to both ET and engine manufacture within ten (10) working days from the date of delivery to the original purchaser.

All inquires about this warranty policy should be addressed to:

Warranty Department • 2201 Hancel Parkway • Mooresville, IN • 46158

Telephone: 317-834-4500

Apache Machine Warranty Registration

In the cab of each new Apache is a warranty registration sheet that is in triplicate. When the Apache is delivered to the end user this registration sheet must be completed, signed, and dated by both the dealer representative and the end user. This completed form starts the warranty period for this machine. The completed registration sheet one copy is for the end user, one copy for the dealer, and the white copy is to be faxed, emailed, or mailed to (ET) within ten (10) business days of it being signed. These forms are also on our web site www.apachesprayer.com under the dealer login. On the web site you can either download the registration form in PDF print it or complete or you may enter the information under warranty registration and submit it through our web site. If you submit through the web site, then we will still need the signed form by the customer fax or mailed to us at ET.

Engine Warranty Registration

There are two ways to register the engine warranty for Cummins. The first is a mail-in warranty registration card. In the cab of each new Apache with the engine book is a warranty registration card. This card needs to be completed and mailed or fax to the engine manufacture as directed on the card. The second registration method is to go online and register the engine for warranty.

To register the Cummins engine for warranty online: go to www.cummins.com, click on "product registration" and read the terms and conditions, if you agree with the terms and conditions, then click on "I accept", and follow the instructions to register.

APACHE™

CHAPTER 11

MAINTENANCE LOG

_____ Season

Check and inspect each of the following items on your Apache Sprayer. Put the date on the line next to each item as it is completed.

	Check front suspension cylinders for leaks around the seal and oil level in cylinder.
	Grease the front axle assembly including all king-pins, ball joints and center pivot pin. Check all front axle bolts for proper torque.
	Check adjustment of all hood panels and make sure all screws are present and tightened. Clean radiator and cooling package of all debris, check all radiator and cooling package hoses to make sure they are tight and not leaking.
	Change engine oil and replace filter.
	Service fuel system and replace filters.
	Service transmission; change oil and replace filter, remove suction screen, clean and inspect for damage.
	Replace cab filters with new.
	Remove and replace engine air filters, check intake clamps to make sure they are tight.
	Grease the U-joints on all driveshafts and inspect each U-joint for wear and missing caps. Inspect carrier bearing on the front driveshaft for wear and damaged rubber.
	Service rear differential and bleed brake system.
	Grease the rear axle assembly and check all rear axle bolts for proper torque.
	Service the hydraulic system oil, replace return filters, remove suction screens, clean and inspect for damage.

	Remove all product screens from strainers, clean and inspect for damage. Replace as needed. Flush the wet system with clean water, remove inspection plug from product pump and inspect impeller for damage. Turn on pump and dead-head the pressure and check at gauge outside of cab, increase and decrease agitation and check gauge for operation. Fold booms out and adjust and grease.
	Inspect booms for cracks, breaks and worn hinge points.
	Inspect boom plumbing for worn hoses and bad nozzles.
	Inspect all hydraulic hoses for rubs, worn spots and leaks.
	Inspect all hydraulic cylinders for leaks and proper operation.
	Inspect wiring harnesses for rub points.
	Inspect foam marker components for leaks and operation (if equipped).
	Verify Raven Controller calibrations:
	Flow meter
	Boom sections
	Control valve
	Speed cal
	Check A/C operation.
	Inspect frame for cracks and loose bolts.
	Inspect Tee Jet valves for operation and wear.
List any major repair work this season and date it was performed:	

_____ Season

Check and inspect each of the following items on your Apache Sprayer. Put the date on the line next to each item as it is completed.

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List any major repair work this season and date it was performed:		

EQUIPMENT TECHNOLOGIES ET

Your Apache Dealer: