



RT175/RT175 Gen:3

Tier 4i Engines – Serial Numbers 10951 - 811000

Tier 4 Engines – Serial Numbers 811051 and Up

RT210/RT210 Gen:3

Tier 4i Engines – Serial Numbers 21201 - 921000

Tier 4 Engines – Serial Numbers 921651 and Up

RT250 Gen:3

Tier 4 Engines – Serial Numbers 70501 and Up

Compact Track Loader Operator's Manual

50940411 Rev. G 02/19

 **WARNING**

This product can expose you to lead which is known to the State of California to cause cancer and birth defects or other reproductive harm.

For more information go to www.P65Warnings.ca.gov

 **WARNING**

Breathing diesel engine exhaust exposes you to chemicals known to the state of California to cause cancer and birth defects or other reproductive harm.

- **Always start and operate the engine in a well-ventilated area.**
- **If in an enclosed area, vent the exhaust to the outside.**
- **Do not modify or tamper with the exhaust system.**
- **Do not idle the engine except as necessary.**

For more information go to www.P65warnings.ca.gov/diesel.

MANITOU EQUIPMENT AMERICA, LLC

WARRANTY

Manitou Equipment America, LLC under the Gehl brand (“Gehl”) warrants new Gehl equipment to the Original Retail Purchaser to be free from defects in material and workmanship for a period of twelve (12) months from the Warranty Start Date.

GEHL WARRANTY SERVICE INCLUDES:

Genuine XPRT parts and labor costs required to repair or replace equipment at the selling dealer’s business location.

GEHL MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED (INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE), EXCEPT AS EXPRESSLY STATED IN THIS WARRANTY STATEMENT.

ANY OF THESE LIMITATIONS EXCLUDED BY LOCAL LAW SHALL BE DEEMED DELETED FROM THIS WARRANTY; ALL OTHER TERMS WILL CONTINUE TO APPLY.

SOME STATES DO NOT PERMIT THE EXCLUSION OR LIMITATION OF THESE WARRANTIES AND YOU MAY HAVE GREATER RIGHTS UNDER YOUR STATE LAW.

GEHL WARRANTY DOES NOT INCLUDE:

1. Transportation to selling dealer’s business location or, at the option of the Original Retail Purchaser, the cost of a service call.
2. Used equipment.
3. Components covered by their own non-Gehl warranties, such as tires, batteries, trade accessories and engines.
4. Normal maintenance service and expendable, high-wear items.
5. Repairs or adjustments caused by: improper use; failure to follow recommended maintenance procedures; use of unauthorized attachments; accident or other casualty.
6. Liability for incidental or consequential damages of any type, including, but not limited to lost profits or expenses of acquiring replacement equipment.

No agent, employee or representative of Gehl has any authority to bind Gehl to any warranty except as specifically set forth herein.

This agreement has been prepared in multiple languages, including but not limited to, English, Spanish, and French (Canada). In the event of any inconsistency, the English version shall apply and be binding upon the parties.

50940453/BP0218



WARNING



**THIS OPERATOR'S MANUAL IS
PROVIDED FOR OPERATOR USE**

**DO NOT REMOVE
FROM THIS MACHINE**

Do not start, operate or work on the machine until you carefully read and thoroughly understand the contents of this Operator's Manual.

Failure to follow safety, operating and maintenance instructions can result in serious injury to the operator or bystanders, poor operation, and costly breakdowns.

If you have any questions on proper operation, adjustment or maintenance of the machine, contact your dealer or the Manitou Group Service Department before starting or continuing operation.

Delivery Checklists

The following checklist is an important reminder of valuable information and inspections that **MUST** be made before the machine is delivered to the customer. Check off each item after the prescribed action is taken.

✓PRE-DELIVERY CHECK:

- Machine has not been damaged in shipment. Check for such things as dents and loose or missing parts. Correct or replace components as required.
- Battery is securely mounted and not cracked. Be sure cable connections are tight.
- Cylinders, hoses and fittings are not damaged, leaking or loosely connected.
- Cooler/radiator hoses and fittings are not damaged, leaking or loosely connected. Radiator is filled to proper level and has the proper anti-freeze protection.
- Filters are not damaged, leaking or loosely secured.
- Machine is properly lubricated and no grease fittings are missing or damaged.
- Hydraulic system reservoir, engine crankcase and drive gearcases are filled to their proper levels.
- Engine radiator is filled to proper level and has proper anti-freeze protection.
- All adjustments are made to comply with settings provided in the *Maintenance* chapter of this manual.
- All guards, shields and decals are in place and secured.
- Model and serial numbers for the machine are recorded in the spaces provided on this page.

IMPORTANT

Start the engine and test run the machine while checking that all controls operate properly.

- All drive and hydraulic controls operate properly and are not damaged or binding.
- Drive controls are properly adjusted for correct neutral position.
- The parking brake, along with the lock-out devices, are activated with the unit stationary (no pilot control pressure).
- All instrument panel gauges, indicator lights, etc. function properly.
- All installed lights, such as work lights, function properly.
- All hydraulic functions are **NOT** operational with the arm rests/safety bars in the raised, lock-out position.
- Hydraloc™ system functions properly as described in the Operator's Manual.

I acknowledge the pre-delivery procedures were performed on the machine as outlined on this page.

Dealership's Name

Dealer Representative's Name

Date Checklist Filled Out

Model & Serial Number

Engine Serial Number

✓AT-DELIVERY CHECK:

The following checklist is an important reminder of valuable information that **MUST** be passed on to the customer at the time of delivery. Check off each item as you explain it to the customer. Review with the customer the contents of this Operator's Manual, especially:

- The *Index* for quickly locating topics.
- The *Safety* and *Operation* chapters, for information regarding safe operation of the machine.
- The *Maintenance* and *Troubleshooting* chapters, for information regarding proper maintenance of the machine. Explain that regular lubrication and maintenance are required for continued safe operation and long machine life.
- A copy of the product warranty is included on the inside front cover of this Operator's Manual.
- Give this Operator's Manual and the AEM Safety Manual to the customer, and instruct the customer to read and completely understand the content of each manual before operating the machine.
- Explain that the customer **MUST** consult the engine manual (if provided) for related specifications, operating adjustments and maintenance instructions.
- Completely fill out the Owner's Registration, including customer's signature, and return it to the company.

Customer's Signature

Date Delivered

RETAIN FOR CUSTOMER'S RECORDS

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Customer's Signature

Date Delivered

RETAIN FOR DEALER'S RECORDS

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NOTES

Introduction

Safety Symbol

Manitou Group, in cooperation with the Society of Automotive Engineers, has adopted this:



Safety Alert Symbol

This symbol identifies potential safety hazards, which, if not properly avoided, could result in injury. When you see this symbol in this manual or on the machine, you are reminded to BE ALERT! Your personal safety is involved!

Contents and Use of this Manual

This Operator's Manual provides information about the safe and proper operation and maintenance for the machine. Major points of safe operation and maintenance are detailed in the *Safety* chapter of this manual.

This manual also includes general troubleshooting and specification information about the machine.

Follow the instructions in the Operator's Manual Safety, Operation and Maintenance chapters, concerning accident prevention regulations, safety and occupational regulations, and machine and traffic regulations. Manitou Group is not liable for damage resulting from the failure to follow these regulations.



Improper operation, inspection and maintenance of the machine can cause injury or death. Read and understand the contents of this manual COMPLETELY and become familiar with the machine before operating it.

It is the owner's or employer's responsibility to fully instruct each operator in the proper and safe operation and maintenance of the machine.

A storage container is provided behind the operator's seat for storing the Operator's Manual. After using the manual, return it to the storage container.

This manual is considered a permanent part of the machine and should be with the machine at all times. If the machine is resold, include this operator's manual as part of the sale.

Replace this manual promptly if it becomes damaged, lost or stolen.

Some illustrations in this manual may show doors, guards and shields open or removed for illustrative purposes only. BE SURE all doors, guards and shields are in their proper operating positions BEFORE starting the engine to operate the machine.

Because of ongoing product improvements, information included in this manual may not exactly match the machine. Manitou Group reserves the right to modify and improve products at any time without notice or obligation.

Introduction

Safety Symbol and Signal Words

This manual and decals on the machine warn of safety hazards and should be read and observed closely.

Manitou Group, in cooperation with the Society of Automotive Engineers, has adopted this:



Safety Alert Symbol

This symbol is used throughout this operator's manual and on the decals on the machine. It identifies potential safety hazards, which, if not properly avoided, could result in injury. When you see this symbol in this manual or on the machine, you are reminded to BE ALERT! Personal safety is involved!

Signal Words



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



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



The word "CAUTION" indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury.

IMPORTANT: The word "IMPORTANT" indicates situations that can result in possible damage to the machine.

NOTE: The word "NOTE" indicates special or particularly useful information.

Machine Orientation

"Right" and "left", as described in this manual, are determined from a position sitting in the operator's seat and facing forward.

Proper Machine Use



Improper use of the machine can result in property damage, injury or death.

The machine is designed only for moving earth, coarse gravel or ballast and rubble. Use with approved attachments is also allowed (See "Fields of Application" on page 14). Use in any other way is considered as contrary to the intended use. Compliance with, and strict adherence to, the conditions of operation, service and repair as specified by the manufacturer, also constitute essential elements of the intended use.

The machine was designed and built according to the best available technology and approved safety regulations in the countries where it is sold. However, it is impossible to completely safeguard against abusive, improper use. The operator must always consider potential safety risks and hazards during operation. Accident prevention regulations, all other generally recognized regulations on safety and occupational medicine, and all road traffic regulations must be observed at all times.

The machine must be maintained in proper operating condition. Any damaged or malfunctioning parts must be repaired or replaced immediately.

Any arbitrary modification carried out to the machine may relieve the manufacturer of liability for any resulting damage or injury.

Service and Registration

The wide Gehl dealership network stands ready to provide any assistance that may be required, including genuine service parts. All parts should be obtained from or ordered through your dealer.

When ordering service parts, provide complete information about the part and the quantity required. Also provide the model and serial numbers of the machine. For your safety and continued proper operation, use only genuine service parts. Record the model and serial numbers in the spaces below for quick reference.

NOTE: The machine model number is stamped on the right front axle attachment plate, and is also found on the type label located on the front right side of the machine.

Machine Model and Serial Numbers

Machine Model Number: _____

Machine Serial Number: _____



Model/Serial Number Placard

Compact Track Loader		West Bend WI 53095 USA		
Product Identification Number: GHLR175XXXXXXXXXX				
Model	Power	Rated Capacity	Operating Mass	

Model Number

Serial Number

Component Serial Numbers

Engine Serial Number: _____

Model
RT250



Models
RT175/
RT210



Hydraulic Motor
Serial Number: _____



Introduction

Hydraulic Pump
Serial Number: _____

Model
RT250



Models
RT175/
RT210



ROPS/FOPS Certification Label

The ROPS/FOPS certification label is located in the right front corner of the ROPS/FOPS ceiling



Fig. 1 – ROPS/FOPS Certification Label

Component Identification

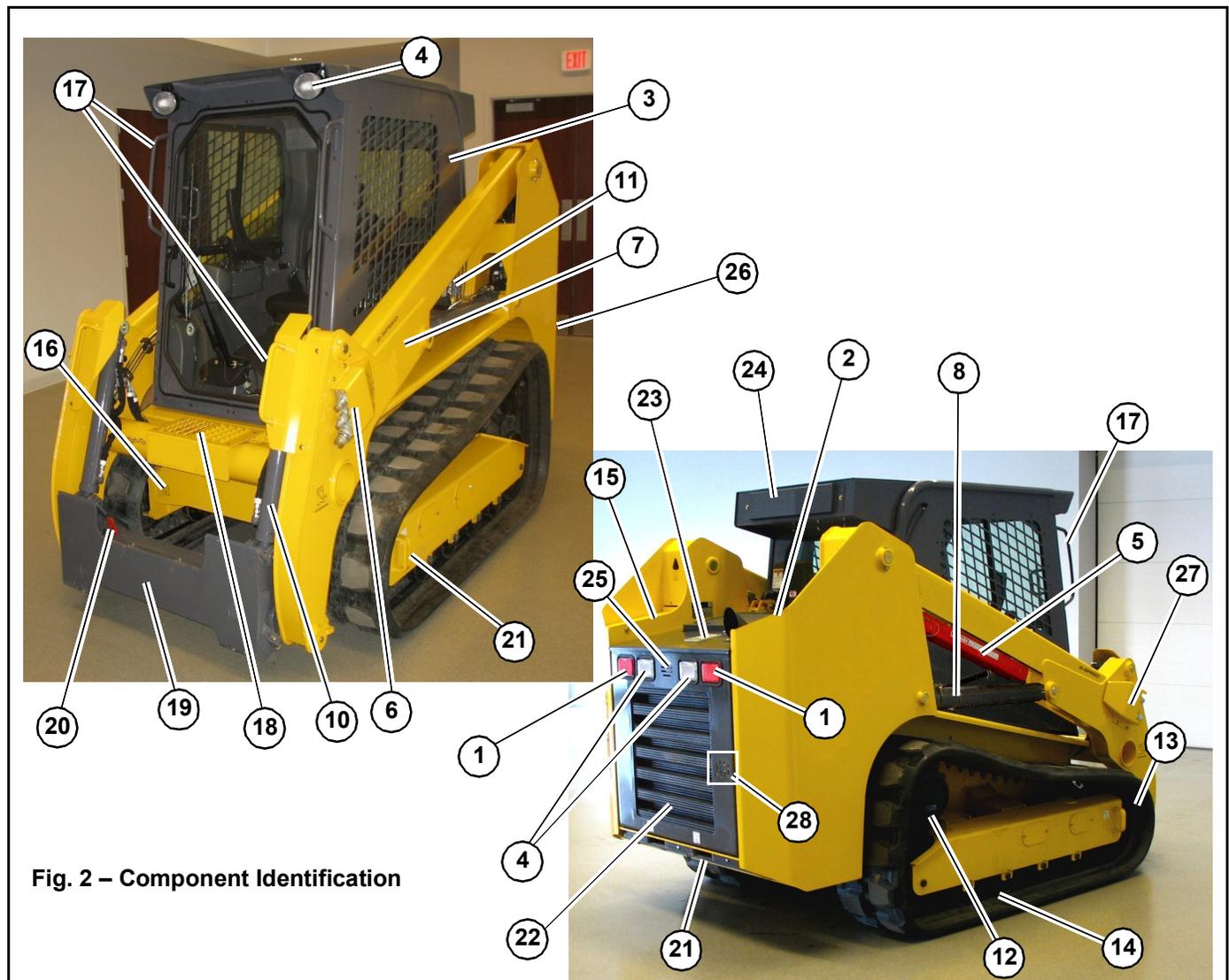


Fig. 2 – Component Identification

Item	Description
1	Tail light
2	Hydraulic tank filler cover
3	ROPS/FOPS
4	Work lights
5	Lift arm support
6	Standard auxiliary hydraulics lines
7	Lift arm
8	Lift arm cylinder
10	Tilt cylinder
11	Fuel filler cap
12	Travel motor
13	Rubber track
14	Track roller
15	Battery compartment cover

Item	Description
16	Lift points
17	Exit/entry hand-holds
18	Exit/entry step
19	Attachment hitch
20	Optional Power-A-Tach® quick attach system locking flag
21	Tie-down point
22	Back cover
23	Engine compartment cover
24	Optional Air conditioning intake cover
25	Backup alarm location (early machines)
26	Storage compartment
27	Optional high-flow auxiliary hydraulics lines
28	Backup alarm location (later machines)

Introduction

Fields of Application

Table 1: Fields of Application

Attachments	Model	Width	Height	Depth	Capacity ¹
Dirt / Construction Bucket	RT175	1676 mm (66 in.)	508 mm (20 in.)	937 mm (36.9 in.)	0.40 m ³ (14.3 ft. ³)
Light Material Bucket		1778 mm (70 in.)	571 mm (22.5 in.)	1029 mm (40.5 in.)	0.57 m ³ (20.3 ft. ³)
HD Dirt / Construction Bucket	RT210	1880 mm (74 in.)	571 mm (22.5 in.)	1037 mm (40.8 in.)	0.57 m ³ (20.3 ft. ³)
Light Material Bucket		1880 mm (74 in.)	669 mm (26.3 in.)	1074 mm (42.3 in.)	0.77 m ³ (27.2 ft. ³)
Dirt / Construction Bucket	RT250	2134 mm (84 in.)	618 mm (24.3 in.)	1146 mm (45.1 in.)	0.76 m ³ (27.0 ft. ³)
HD Dirt / Construction Bucket		1880 mm (74 in.)	571 mm (22.5 in.)	1037 mm (40.8 in.)	0.57 m ³ (20.3 ft. ³)
		2134 mm (84 in.)	618 mm (24.3 in.)	1146 mm (45.1 in.)	0.76 m ³ (27.0 ft. ³)
Light Material Bucket		2286 mm (90 in.)	707 mm (27.8 in.)	1232 mm (48.5 in.)	1.0 m ³ (37 ft. ³)
Pallet Forks	All	N/A	N/A	1067 mm (42 in.)	N/A
				1219 mm (48 in.)	

1. To determine load weights, multiply maximum material density by bucket capacity. Refer to “Common Materials and Densities” on page 46.

The attachments determine how the machine is used.



WARNING

Contact Edge Attachments (<http://www.edgeattach.com/>) for information about available attachments approved for use with the machine.

Use of unapproved attachments could result in serious injury or property damage.

Using Attachments

Read all documentation provided with attachments to learn how to safely operate and maintain them.

Do not use the machine for any applications or purposes other than those described in this manual or manuals supplied with attachments. Refer to the above table for information about approved attachments and their uses. Contact your dealer before using attachments or equipment not approved by Manitou Group. Use of non-approved attachments or unauthorized modifications is prohibited.

Vibration Information

Compact construction equipment is generally used in harsh environments. This type of usage can expose an operator to uncomfortable levels of vibration. It is useful to understand exposure to vibration levels when operating compact equipment and what can be done to reduce vibration exposure. As a result, equipment operation can be more efficient, productive and safe.

An operator's exposure to vibration occurs in two ways:

- Whole-Body Vibration (WBV)
- Hand-Arm Vibration (HAV)

WBV issues are primarily addressed in this manual, because evaluations have shown that operation of mobile compact construction equipment on work sites typically results in HAV levels less than the allowed exposure limit of 2.5 m/s². Member States of the European Union must comply with the Physical Agents (vibration) Directive, 2002/44/EC.

Effective control of vibration exposure for an operator involves more than just vibration levels on the machine. The work site, how the machine is used, and proper training all play important roles in reducing vibration exposure.

Vibration exposure results from:

- Work site conditions.
- How the machine is operated.
- The machine characteristics.

Common causes of high WBV levels:

- Using a machine that is improper for the task.
- Work site with potholes, ruts and debris.
- Improper operating techniques, such as driving too fast.
- Incorrect adjustment of the seat and controls.
- Other physical activities while using the machine.

Vibration Measurement and Actions

The vibration directive places the responsibility for compliance on employers. Actions that should be followed by employers include:

- Assess the levels of vibration exposure.
- Determine from this assessment if operators will be exposed to vibration levels above the limits stated in the directive.
- Take appropriate actions to reduce operator's exposure to vibration.
- Provide operators with information and training to reduce their exposure to vibration.
- Keep good records and update operations and training on a regular basis.

If the assessment concludes that vibration level exposure is too high, one or more of the following actions may be necessary:

1. Train operators:
 - Perform operations (accelerating, steering, braking, etc.) in a smooth manner.
 - Adjust the controls, mirrors and seat suspension for comfortable operation. Do not make adjustments when the machine is in use.
 - Travel across the smoothest parts of the work site and avoid ruts and potholes.
2. Choose proper equipment for the job:
 - Use machines with the proper power and capacity.
 - Select machines with good suspension seats.
 - Look for controls that are easy to use.
 - Ensure good visibility from the operator's position.
3. Maintain the work site:
 - Smooth ruts and fill potholes in traffic areas whenever possible.
 - Clean up debris frequently.

Introduction

- Vary traffic patterns to avoid exposure to rough terrain.
4. Maintain equipment. Check that seat suspension and all controls work smoothly and properly.

Vibration Levels

See “Vibration Levels” on page 44 for a table listing typical whole-body vibration levels for the machine.

Fire Extinguisher

An installation location for a fire extinguisher is on the shelf between the rear window and the operator's seat (Z, Fig. 3).

IMPORTANT: *Installation of a fire extinguisher according to DIN-EN 3 must be performed by an authorized dealer.*

NOTE: *A fire extinguisher is neither included as standard equipment nor available as an option from Manitou Group.*

IMPORTANT: *Inspect the fire extinguisher at regular intervals as recommended by the fire extinguisher equipment manufacturer(s).*

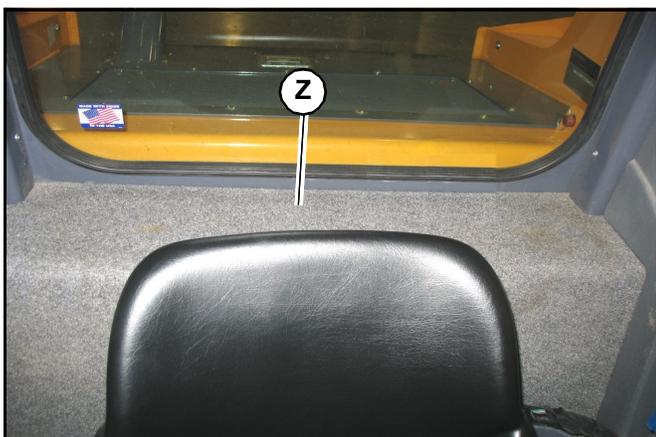


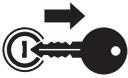
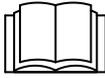
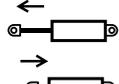
Fig. 3 – Location for Fire Extinguisher

Manufacturer Information

Products described in this manual are manufactured by Manitou Group.

NOTE: *Not all models and options described in this manual are available in all areas.*

Indicator and Operation Symbols

						
Safety Hazard	Lift Point	Hydraulic Oil Filter	Fast Speed	Slow Speed	Hydraulic Oil	Hydraglide™
						
Engine Start	Engine Stop	Engine Run	Wear Seat Belt	Back Door Latch	Service Hours	Engine Oil Pressure
						
Remove Key	Crush Hazard	Service Required	Crush Hazard	Hot Surface Hazard	Rotating Fan — Keep Away	Safety Lock
						
Read Operator's Manual	Parking Brake	Windshield Wiper/Washer	Diesel Fuel	HVAC Fan	Auxiliary Hydraulics Flow	Work Lights
						
Lift Arm Float	Drive System Error	Pre-Heat	Engine Coolant Temp	Engine Air Filter	Horn	Tie-Down Point
						
Module Communication Error	Straight Tracking Adjust	Elevated EGT Temp	DPF Regen Accept	DPF Regen Cancel/Inhibit	DPF Service	DPF Regen
						
Aftertreatment Error Code	Engine Error Code	Rear Window Wiper/Washer	Air Conditioning	Air Conditioning OFF	Engine Error Code	

NOTES

Safety

Safety Symbol and Signal Words

This manual and decals on the machine warn of safety hazards and should be read and observed closely.

Manitou Group, in cooperation with the Society of Automotive Engineers, has adopted this:



Safety Alert Symbol

This symbol is used throughout this operator's manual and on the decals on the machine. It identifies potential safety hazards, which, if not properly avoided, could result in injury. When you see this symbol in this manual or on the machine, you are reminded to **BE ALERT!** Personal safety is involved!

Signal Words



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



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



The word "CAUTION" indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury.

- Before operating the machine, first read and study the safety information in this manual. Be sure that anyone who operates or works on the machine is familiar with the safety precautions. This includes providing translations of the warnings and instructions for operators who are not fluent in reading English.
- It is essential that operators be thoroughly trained in the safe operation of the machine and load handling. Operators must not be physically or mentally impaired. Do not allow minors or unqualified personnel to operate the machine, or to be near the machine unless they are properly supervised. It is recommended that the operator be capable of obtaining a valid motor vehicle operator's license.
- Do not use the machine for any application or purpose other than those described in this manual, or in manuals supplied with any attachments used with the machine.
- Use of the machine is subject to certain hazards that cannot be eliminated by mechanical means, but only by exercising intelligence, care and common sense. Such hazards include: hillside operation, overloading, load instability, poor maintenance, and using the machine for a purpose for which it was not intended or designed.
- Manitou Group always takes operator's safety into consideration during the design process. Guards and shields are provided, which protect the operator and bystanders from moving parts and other hazards. Operators must be alert, however, because some areas cannot be guarded or shielded without preventing or interfering with proper operation.
- Different applications may require optional safety equipment. Users must evaluate the work-site hazards and equip the machine and the operator as necessary. The information in this manual does not replace any applicable safety rules and laws. Before operating the machine, learn the rules and laws for the local area. Make sure the machine is equipped as required according to these rules/laws.

Safety

- Remember that some risks to your health may not be immediately apparent. Exhaust gases and noise pollution may not be visible, but these hazards can cause permanent injuries.
- Some photographs in this manual may show doors, guards and shields open or removed for the purposes of illustration only. Be sure all doors, guards, shields and panels are secured in the proper operating positions before starting the engine to operate the machine.

Mandatory Safety Shutdown Procedure

BEFORE cleaning, adjusting, lubricating, fueling, or servicing the machine, or leaving it unattended:

1. Bring the machine to a complete stop on a level surface. If the machine must be parked on a slope, park across the slope.
2. Empty the attachment and lower the lift arm and attachment to the ground. If the lift arm must be left in the raised position, DO NOT leave the operator's position unless the lift arm support is properly applied. See "Lift Arm Support" on page 102.
3. Move the throttle to the low-idle position and allow the engine to cool for approximately 2 minutes.
4. Shut off the engine. Listen for evidence that parts have stopped moving before continuing.
5. Unfasten the seat belt, remove the ignition key and take it with you. Exit the machine using the hand-holds.
6. On machines equipped with the optional battery disconnect switch, always turn the switch to the "OFF" position when parking the machine inside an enclosure.

ONLY when these precautions have been taken can you be sure it is safe to proceed. Failure to follow this procedure could result in death or serious injury.

Before Starting

- Do not modify the Roll-Over Protective Structure/Falling Object Protective Structure (ROPS/FOPS) unless instructed to do so in Manitou Group-approved installation instructions. Modifications, such as welding, drilling or cutting, can weaken the structure and reduce the protection it provides. A damaged ROPS/FOPS cannot be repaired – it must be replaced.
- Unauthorized modifications to the machine can cause injury or death. Never make unauthorized modifications to any part of the machine. Any machine modification made without authorization from Manitou Group could create a safety hazard, for which the machine owner would be responsible.
- For safety reasons, use only genuine service parts. For example, using incorrect fasteners could lead to a condition in which the safety of critical assemblies is dangerously compromised.
- Manitou Group equipment is designed and intended to be used only with Manitou attachments or Manitou-approved attachments. To avoid possible personal injury, equipment damage and performance problems, use only attachments that are approved for use on and within the rated operating capacity of the machine (see "Payloads/Capacities" on page 38). Contact your dealer or Manitou Group for information about attachment approval and compatibility with specific machine models. Manitou Group cannot be responsible if the machine is used with non-approved attachments.
- Optional kits are available through your dealer. Because Manitou cannot anticipate, identify and test all of the attachments owners may want to install on their machines, please contact Manitou Group for information on approval of attachments, and their compatibility with optional kits.
- Remove all trash and debris from the machine every day, especially in the engine compartment, to minimize the risk of fire.

- Never use ether starting aids. Engine pre-heating is used for cold weather starting. Engine pre-heating can cause ether or other starting fluid to detonate, causing injury or damage.
- Walk around the machine and inspect it before using it. Look for damage, loose or missing parts, leaks, etc. Repair as required before using the machine.
- Warn all nearby personnel before starting the machine.
- Contact the proper local authorities for utility line locations BEFORE starting to dig. In North America, contact the North American One-Call Referral System at 8-1-1 in the U.S., or 1-888-258-0808 in the U.S. and Canada.
- Below-ground hazards also include water mains, tunnels and buried foundations. Know what is underneath the work site before starting to dig.
- Before working near power lines (either above-ground or buried cable-type), always contact the power utility and establish a safety plan with them.
- If temperatures are changing, be cautious of dark and wet patches when working or traveling over frozen ground.
- Stay away from ditches, overhangs and other weak support surfaces. Be sure the surrounding ground has adequate strength to support the weight of the machine and the load.
- The operator's area, steps and hand holds must be kept free of oil, dirt, ice and unsecured objects.
- If a lighting system is installed, check its operation before working in darkness.
- Always keep windows, lights and mirrors clean. Poor visibility can cause accidents.
- Use warning tag/control lockout procedures during service. Alert others that service or maintenance is being performed by tagging the operator's controls — and other machine areas if required — with a warning notice.
- NEVER start the engine if there is any indication that maintenance or service work is in progress, or if a warning tag is attached to the controls.
- Replace damaged safety decals and a lost or damaged operator's manual. Always store this operator's manual in the storage compartment provided for it inside the cab.
- Work crew members should observe and monitor terrain and soil conditions at the work site, along with traffic, weather-related hazards and any above- or below-ground obstacles and hazards.
- Read the operator's manual provided with each attachment before using it.
- Adjust the seat to allow full actuation of the throttle pedal. Never adjust the seat during machine operation.
- Before working on or with the machine, remove jewelry, tie back long hair, and do not wear loose-fitting garments, such as, scarves, ties, unzipped jackets, etc., which could become caught in the moving parts of the machine and cause injury.

During Operation

- ALWAYS fasten the seat belt securely and properly. Never operate the machine without the seat belt fastened around the operator.
- Only start the engine and only operate the controls while seated in the operator's seat.
- Check indicators and displays for normal conditions after starting the engine. Check the operation of the controls. Listen for unusual sounds and remain alert for other potentially hazardous conditions.
- If the engine should stall for any reason during operation, always turn the ignition key all the way counter-clockwise to the "OFF" position before re-starting the engine.

Safety

- Operator visibility is limited in certain areas; ROPS/FOPS posts, attachments, the lift arm, items in the cab, etc., can obstruct the operator's view and could mask hazards or people in the area around the machine. It is very important the operator is aware of these masked visibility areas before operating the machine, especially on busy work sites.

To reduce the hazards posed by masked visibility areas:

- Use caution when raising or lowering attachments; masked visibility areas can change dramatically when attachments and/or the lift arm is moved.
- Look around the machine before operating. Objects near the machine and close to the ground can be difficult to see from the cab.
- Always look in the direction of travel, including reverse. A back-up alarm is not a substitute for looking behind you when operating the machine in reverse.
- Keep bystanders out of and away from the work area.
- Keep the lift arm low while traveling.
- Control the machine cautiously and gradually until fully familiar with all the controls and handling.
- New operators must learn to operate the machine in an open area away from bystanders. Practice with the controls until the machine can be operated safely and efficiently.
- Do not overload the machine. See “Payloads/Capacities” on page 38 for the load limits.
- Do not raise or drop a loaded bucket or attachment suddenly. Abrupt movements under load can cause serious instability.
- Do not use the machine to lift or transport people.
- Never leave the operator's seat without lowering the lift arm / attachment flat on the ground or engaging the lift arm support device(s), and then stopping the engine and removing the ignition key.
- Stop the engine and place the controls in the lock-out position before mounting attachments. Check that attachments are securely fastened to the lift arm before working.
- Be aware that attachments affect the handling and balance of the machine. Adjust the operation of the machine as necessary when using attachments.
- Before coupling or uncoupling the hydraulic lines for the attachment, stop the engine and release the pressure in the hydraulic system by moving the control joystick in all directions a couple of times.
- Make sure the bucket is lowered to the ground before activating the lift arm float. Never activate the float function with the bucket or attachment raised, because this will cause the lift arm and bucket or attachment to drop suddenly.
- Be aware of overhead obstacles. Any object near the lift arm could represent a potential hazard, or cause the operator to react suddenly and cause an accident. Use a spotter or signal person when working near bridges, phone lines, work-site scaffolds, or other obstructions.
- Use extra care on loose ground. Working heavy loads over loose, soft ground or uneven terrain can cause dangerous side-load conditions and possible tip-over and injury. Traveling with a suspended load or an unbalanced load can also be hazardous.
- Stay away from the edges of loading docks, ramps, ditches, excavations, retaining walls and trenches.
- Do not place limbs near moving parts. Severing of body parts can result.
- Never carry riders. Do not allow others to ride on the machine or attachments, because they could fall or cause an accident.
- Always keep hands and feet inside the operator's compartment while operating the machine.
- Wear safety goggles, ear and head protection, and any other protective clothing or equipment as needed while operating the machine.

- Exhaust fumes can kill. Do not operate the machine in an enclosed area without adequate ventilation. Internal combustion engines deplete the oxygen supply within enclosed spaces and may create a serious hazard.
 - Operators should also be aware of any open windows, doors or duct work into which exhaust gases may be carried, exposing others to danger.
 - Never allow anyone under a raised lift arm. Lowering the lift arm or a falling load can result in death or serious personal injury.
 - Avoid slowing suddenly while carrying a load. Sudden slowing can cause the load to fall off the attachment, or cause the machine to tip over.
 - Slow down the work cycle and use slower travel speeds in congested or populated areas. Use commonly understood signals so other members of the work crew can warn the operator to slow or halt work in a potentially hazardous situation.
 - Use a signal person if you cannot see the entire work area clearly, in high traffic areas and whenever the operator's view is not clear.
 - Stay alert for people moving through the work area. When loading a truck, the operator should always know where the driver is.
 - To cross railroad tracks, ditches, curbs or similar surfaces, cross perpendicularly and drive slowly.
 - Exposed hydraulic hoses could react with explosive force if struck by falling or overhead items. NEVER allow hoses to be hit, bent or interfered with during operation. Extra guards may be required. Replace any damaged hoses.
 - Do not move the lift arm or attachment during transport. Lock out the lift arm controls during transport.
 - Do not use the machine in an environment where the hot muffler could present a fire hazard, such as hay or straw storage facilities.
 - Machine stability is affected by:
 - Load being carried
 - Height of the load
 - Machine speed
 - Abrupt control movements
 - Driving over uneven terrain
- DISREGARDING ANY OF THESE FACTORS CAN CAUSE THE MACHINE TO TIP OR CAN THROW THE OPERATOR OUT OF THE SEAT OR MACHINE, WHICH COULD RESULT IN DEATH OR SERIOUS INJURY. Therefore, ALWAYS operate the machine only with the seat belt fastened. Do not exceed the machine's rated operating capacity (see "Payloads/Capacities" on page 38). Carry the load low. Move the controls smoothly and gradually, and operate at speeds appropriate for the conditions.
- If the machine becomes unstable and starts to tip, keep the seat belt fastened, hold on firmly and brace yourself. Lean away from the point of impact and stay with the machine. If tipping occurs, DO NOT jump from the machine. The machine is equipped with rollover protection, which can only protect the operator while in the operator's seat. Trying to escape from a tipping machine can result in death or serious personal injury.
 - Do not drive into materials at high speeds to avoid being thrown forward and injured.
 - To avoid tipping, travel with the bucket or attachment as low as possible: 200–300 mm (8–12 in.) from the ground.
 - Never travel over obstacles or slopes that will cause the machine to tilt severely. Travel around any slope or obstacle that would cause a tilt greater than 10°.
 - Avoid steep slopes. Do not make sharp turns on slopes. Drive up and down slopes, not across them. Drive slowly on slopes. Keep the heavy end of the machine pointed uphill.

Safety

- Avoid sharp turns and high speeds while carrying loads, especially on slopes. The stability of the machine is reduced during sharp turns, and the load may shift, greatly increasing the possibility of an overturn.
- Do not turn the machine when lifting loads. As loads are lifted, stability decreases, which can increase the possibility of a rollover.
- Do not raise the safety bars/arm rests while traveling. Raising the safety bars/arm rests abruptly applies the parking brake, which can cause the machine to tip forward.
- Do not turn off the ignition switch while traveling. Turning off the ignition will cause sudden braking, which may cause the machine to tip.
- Reduce speed before shifting from high to low travel speed. Down-shifting from high- to low-speed drive while traveling at high speed may cause the machine to tip and can cause injury, loss of control and damage to the machine.
- Be sure no one enters the work area of the machine. Anyone near the machine is at risk of being injured.
- Unless necessary for servicing the machine, the engine hood must not be opened while the engine is running.
- In cold weather, avoid sudden travel movements and stay away from even slight slopes. The machine can slide sideways on icy slopes.
- Snow accumulation can hide potential hazards. Use care while operating and while using the machine to clear snow.
- If the machine becomes damaged or malfunctions, stop the machine immediately and lock and tag it. Repair the damage or malfunction before using the machine again.
- Never jump off the machine. Always leave the machine using the steps and hand-holds. Never get on or off a moving machine.
- If unable to exit out the front of the cab, remove the rear window by pulling the emergency rear window release triangle until the window seal is pulled out of the window frame, then push the window out of the frame.



Applications with Load-Handling Devices

- Specific procedures are required when using load-handling devices (e.g., slings, chains) for transporting and placing loads. For example, assistance from other people is needed when lifting and lowering pipes, culverts, or containers:
 - The machine may only be used with load-handling devices if the necessary safety devices are in place and functional.
 - The load must be secured to prevent it from falling or slipping.
 - Persons guiding the load must stay in visual contact with the operator.
 - The operator must guide the load to the ground as soon as possible and avoid any rotating or swinging movements.
 - The machine may be moved with a raised load only if the path of the machine is level.
 - Persons attaching or securing loads may only approach the machine from the side, after the operator has given permission. The operator may only give permission after the machine and the attachment are stationary.
 - Do NOT use any lifting attachments (slings, chains) that are damaged or of inadequate rated capacity.

Parking the Machine

- When shutting down the machine for the day, plan ahead so the machine will be on a firm, level surface away from traffic and away from high-walls, cliff edges and any area of potential water accumulation or runoff. Lower the attachment and lift arm to the ground. There should be no possibility of unintended or accidental machine movement.
- If the machine must be parked on a slope, park across the slope and chock the tracks to prevent movement.
- To avoid collisions when parking on streets, use barriers, caution signs, lights, etc., so that the machine can be easily seen at night.
- After the machine has been parked properly, shut down the machine according to the “Mandatory Safety Shutdown Procedure” on page 20.

Electrical Energy

- Stay away from high-voltage lines. Electrocutation can result from contact or proximity to high-voltage electric lines. The machine does not have to make physical contact with power lines for current to be transmitted. Use a spotter and hand signals to keep away from power lines not clearly visible to the operator.
- If the machine comes into contact with a live wire:
 - Do not leave the machine.
 - If possible, drive the machine out of the danger area.
 - Warn others not to approach or touch the machine.
 - Have the live wire de-energized.
 - Do not leave the machine until the wire has been safely de-energized.

- Depending upon the voltage in the power line and atmospheric conditions, strong electric shocks can occur if the bucket is closer than 3 m (10 ft.) from the power line. Higher voltages and rainy weather can further increase the safe operating distance.
- Work on the machine’s electrical system must be performed only by trained technicians.
- Inspect and check the machine’s electrical equipment at regular intervals. Problems found, such as loose connections or scorched cables, must be repaired before using the machine.
- Only use proper, original equipment fuses/circuit breakers with the specified current rating. Turn off the machine immediately if there is any indication of a problem with the electrical system.

Maintenance and Service Safety Practices

- Only trained and authorized personnel, with a full awareness of safe procedures, should be allowed to operate or perform maintenance or service on the machine.
- Use solid support blocking. Never rely on jacks or other inadequate supports when maintenance work is being done. Never work under any equipment supported only by jacks.
- Do not use the lift or tilt hydraulics to lift or support the machine for maintenance or service.
- Always secure the ROPS/FOPS to the chassis with anchor bolts and washers before driving or using the machine.
- Always close the cab door before tilting the ROPS/FOPS.
- Stay clear from underneath the ROPS/FOPS as it is tilted.
- Always secure the ROPS/FOPS in the tilted position with the tilt support. Never allow anyone under the ROPS/FOPS if the securing pin is not in place.

Safety

- Check ROPS/FOPS tilt component condition at regular intervals. Replace damaged or worn parts immediately.
- Allow no one under the raised lift arm and do not exit the machine if the lift arm is raised unless the lift arm support is properly applied. See “Lift Arm Support” on page 102. Disconnecting or loosening any hydraulic line, hose, fitting or component, parts failure, and venting hydraulic pressure all can cause the lift arm to drop.
- Keep fuel and other fluid reservoir caps tight. Do not start the engine until caps have been secured.
- Never attempt to bypass the keyswitch to start the engine. Use only the proper jump-starting procedure according to “Jump-Starting” on page 86.
- Never use hands to search for hydraulic fluid leaks. Instead, use a piece of paper or cardboard. Escaping fluid under pressure can be invisible and can penetrate the skin and cause serious injury. If any fluid is injected into your skin, see a doctor at once. Injected fluid must be surgically removed by a doctor or gangrene may result.
- Always wear safety glasses with side shields when striking metal against metal. In addition, it is recommended that a softer (chip-resistant) material be used to cushion the blow, otherwise, serious injury to the eyes or other parts of the body could result.
- Use care when seating retainer pins — retainer pins can fly out or splinter when struck and could cause injury.
- Do not smoke or have any spark- or flame-producing equipment or materials in the area while filling the fuel tank or working on the fuel or hydraulic systems.
- Do not attempt to loosen or disconnect any hydraulic lines, hoses, fittings, covers or caps without first relieving hydraulic circuit pressure. Relieve hydraulic pressure by performing the “Mandatory Safety Shutdown Procedure” on page 20 and slowly loosening the hydraulic reservoir filler cap. Be careful not to touch any hydraulic components that have been in recent operation. Failure to heed this warning could result in severe burns.
- Do not attempt to remove the radiator cap after the engine has reached operating temperature or if it is overheated. At operating temperatures, engine coolant is extremely hot and under pressure. Always wait for the engine to cool before attempting to relieve pressure and remove the radiator cap. Failure to heed this warning could result in severe burns.
- Refer to the parts manual for information about assembly of components. Always use the correct parts and the proper torques — incorrect fastener connections can dangerously weaken assemblies.
- Exhaust fumes can kill. Do not operate the machine in an enclosed area unless there is adequate ventilation.
- Operators should also be aware of any open windows, doors or duct work into which exhaust gases may be carried, exposing others to danger.
- Do not run the engine if repairs are being performed alone. There should always be at least 2 people present if the engine must be run during service. Both persons must maintain visual contact with each other. Keep a safe distance away from all rotating and moving parts.
- Always use the proper tools while working on the machine. Inappropriate tools could break or slip, causing injury, or they may not adequately perform intended functions.
- Unless necessary for servicing the machine, do not open the engine cover while the engine is running.
- Do not use the machine when maintenance is scheduled to be performed. Postponing maintenance can result in a serious reduction of the service life of the machine, more serious and costly equipment failures, and contribute to unsafe operating conditions.

- Do not work on hot engines, cooling systems or hydraulic systems. Wait for the engine to cool. When engine lube oil, gearbox lubricant or other fluids require changing, wait for fluid temperatures to decrease to a moderate level before removing drain plugs.

NOTE: *Temperatures below 49°C (120°F) will reduce the chances of scalding exposed skin while allowing the fluid to drain quickly and completely. Do not let the fluid fully cool, because drain time will be substantially increased.*

- Dispose of all oils and fluids properly. Used oils/fluids are environmental contaminants and may only be disposed of at approved collection facilities. Never drain any oils/fluids onto the ground, dispose of in municipal waste collection containers, or in metropolitan sewer systems or landfills. Check state and local regulations for other requirements.
- All safety equipment must be maintained so it is always in good condition.
- Safety-critical parts must be periodically replaced. Replace the following potentially fire-related components as soon as they begin to show signs of deterioration:
 - Fuel system flexible hoses, fuel tank overflow drain hose and the fuel filler cap.
 - Hydraulic system hoses, especially the pump outlet lines. Replace hydraulic hoses every 6 years from the date of manufacture, even if they do not appear damaged. The date of manufacture (month or quarter and year) is indicated on the hydraulic hoses.
- Keep mounting brackets and hose and cable routing straps tight. Hose routing should have gradual bends.
- After cleaning the machine, examine all fuel, lubricant and hydraulic oil lines for leaks, chafe marks and damage. Tighten any loose connections and repair or replace parts as necessary.
- Hydraulic line and hoses must be routed and fitted properly. Make sure no connections are interchanged.
- When handling oil, grease and other chemical substances, follow the product-related safety requirements Material Safety Data Sheet (MSDS) carefully to prevent burning or scalding.

Battery Hazards

- Use the battery disconnect switch, or disconnect the negative battery cable from the negative battery terminal, before performing electrical service or electrical welding on the machine.
- Do not use a battery when the fluid level is below the minimum level. Doing so will hasten the deterioration of the battery and shortens battery life, and can also cause rupturing or explosion.
- Turn off all electrical equipment before connecting leads to the battery, including electrical switches on the battery charger or jump-starting equipment.
- When disconnecting at the battery terminals, remove the cable connected to the negative terminal first. When installing a battery, connect the positive terminal cable first.
- Connect positive cable first when installing jumper cables. The final cable connection, at the metal frame of the machine being charged or jump-started, should be as far away from the battery as possible. Disconnect the negative cable first when removing jumper cables.
- Sparks and open flames can set off explosive battery gas from incidental contact or static discharge. Turn off all switches and the engine when working on batteries. Keep battery terminals tight. Contact between a loose cable clamp and a terminal post can create an explosive spark.
- When jump-starting from another machine, do not allow the machines to touch. Wear safety glasses or goggles while battery connections are made.
- Never jump-start the machine if it has a frozen battery. The battery could explode. Thaw a frozen battery before charging it or attaching jumper cables.

Safety

- Flush eyes with water for 10-15 minutes if battery acid is splashed in the face. Anyone swallowing battery acid must have immediate medical aid. Call the Poison Control Center at 1-800-222-1222 in the United States.

Fire Hazards

- The machine must be cleaned on a regular basis to avoid the buildup of flammable debris, such as leaves, straw, etc. Accumulated debris, particularly in the engine compartment, creates a fire hazard.
- The machine has several components that operate at high temperature under normal operation conditions, primarily the engine and exhaust systems. Also, the electrical system, if not properly maintained or if damaged, can arc or produce sparks. These conditions make it extremely important to avoid circumstances where explosive dust or gases can be ignited by arcs, sparks or heat.
- It is recommended that a 2.27 kg (5 lb.) or larger, multi-purpose “A/B/C” fire extinguisher be mounted in the cab. Check the fire extinguisher periodically and be sure that work crew members are trained in its use.
- Add fuel, oil, antifreeze and hydraulic fluid to the machine only in a well ventilated area. The machine must be parked with controls, lights and switches turned off. The engine must be turned off before refueling or performing service checks.
- Do not smoke while filling the fuel tank, while working on the fuel or hydraulic systems, or while working around the battery.
- Always immediately replace the fuel filler cap after refueling.
- Take care to avoid spilling combustible fluids, such as oil or fuel, on a hot engine.

- Static electricity can produce dangerous sparks at the fuel-filling nozzle. Do not wear polyester, or polyester-blend clothing while fueling. Before fueling, touch the metal surface of the machine away from the fuel fill to dissipate any built-up static electricity. Do not re-enter the machine but stay near the fuel filling point during refueling to minimize the build-up of static electricity. Do not use cell phones while fueling. Make sure the static line is connected from the machine to the fuel truck before fueling begins.
- Ultra-Low Sulfur Diesel (ULSD) poses a greater static ignition hazard than earlier diesel formulations. Avoid death or serious injury from fire or explosion; consult with your fuel or fuel system supplier to ensure the entire fuel delivery system is in compliance with fueling standards for proper grounding and bonding practices.
- Oil from leaks can ignite on hot components. Repair any damaged or leaking components before using the machine.

Additional Safety Equipment

- Certain operations require use of additional safety equipment. Install additional safety equipment if conditions require. For example, when using a hydraulic breaker, a polycarbonate front window may be required.
- Never attempt to alter or modify the protective structure, by drilling holes, welding or re-locating fasteners. Any serious impact or damage to the system requires a complete integrity re-evaluation, and the replacement of the system may be necessary.
- Laminated glass or polycarbonate protection for the front, side or rear windows may also be required depending upon particular work conditions.
- Contact your dealer for available safety guards if there is any risk of objects striking the operator’s cab.

Crystalline Silica Exposure

Exposure to crystalline silica (found in sand, soil and rocks) has been associated with silicosis, a debilitating and often fatal lung disease. A Hazard Review (Pub. No. 2002-129) by the U.S. National Institute for Occupational Safety and Health (NIOSH) indicates a significant risk of chronic silicosis for workers exposed to inhaled crystalline silica over a working lifetime. NIOSH recommends an exposure limit of 0.05 mg/m^3 as a time-weighted average for up to a 10-hr workday during a 40-hr work week. NIOSH also recommends substituting less hazardous materials when feasible, using respiratory protection and regular medical examinations for exposed workers.

Transporting the Machine

Obey federal, state and local over-the-road regulations. Check restrictions regarding weight, height, width and length of a load. The hauling vehicle, trailer and load must all be in compliance with applicable regulations. See “Loading and Transporting the Machine on a Transport Vehicle” on page 117.

Lifting the Machine with a Crane

Only lift the machine according to the following guidelines:

- The crane and rigging equipment must have sufficient capacity. See “Weights” on page 39.
- Secure the machine against unintentional movement. Use taglines as needed.
- Do not lift the machine with persons on or in the machine.
- Any person guiding the crane operator must be within sight or sound of the crane operator.
- Lift the machine only with the standard bucket installed, with the bucket empty and in the transport position.
- Persons must stay clear of, and not under, the machine when it is lifted.

- Fasten the rigging equipment so the machine is horizontal when it is lifted.
- Do not lift the machine by the cab. Attach the rigging equipment only at the lift points identified by this symbol:



- Lift the machine according to “Lifting the Machine using a Crane” on page 116.

Loading and Transporting the Machine

- Load and transport the machine according to “Loading and Transporting the Machine on a Transport Vehicle” on page 117.
- The transport vehicle must support the height, width, length and weight of the machine. See “Dimensions” on page 36 and “Weights” on page 39.
- Remove any dirt, snow or ice from the tracks on the machine, and from the loading ramps and transport platform, to prevent slipping.
- Secure the machine to the transport vehicle according to “Loading and Transporting the Machine on a Transport Vehicle” on page 117 to prevent unintentional movement.

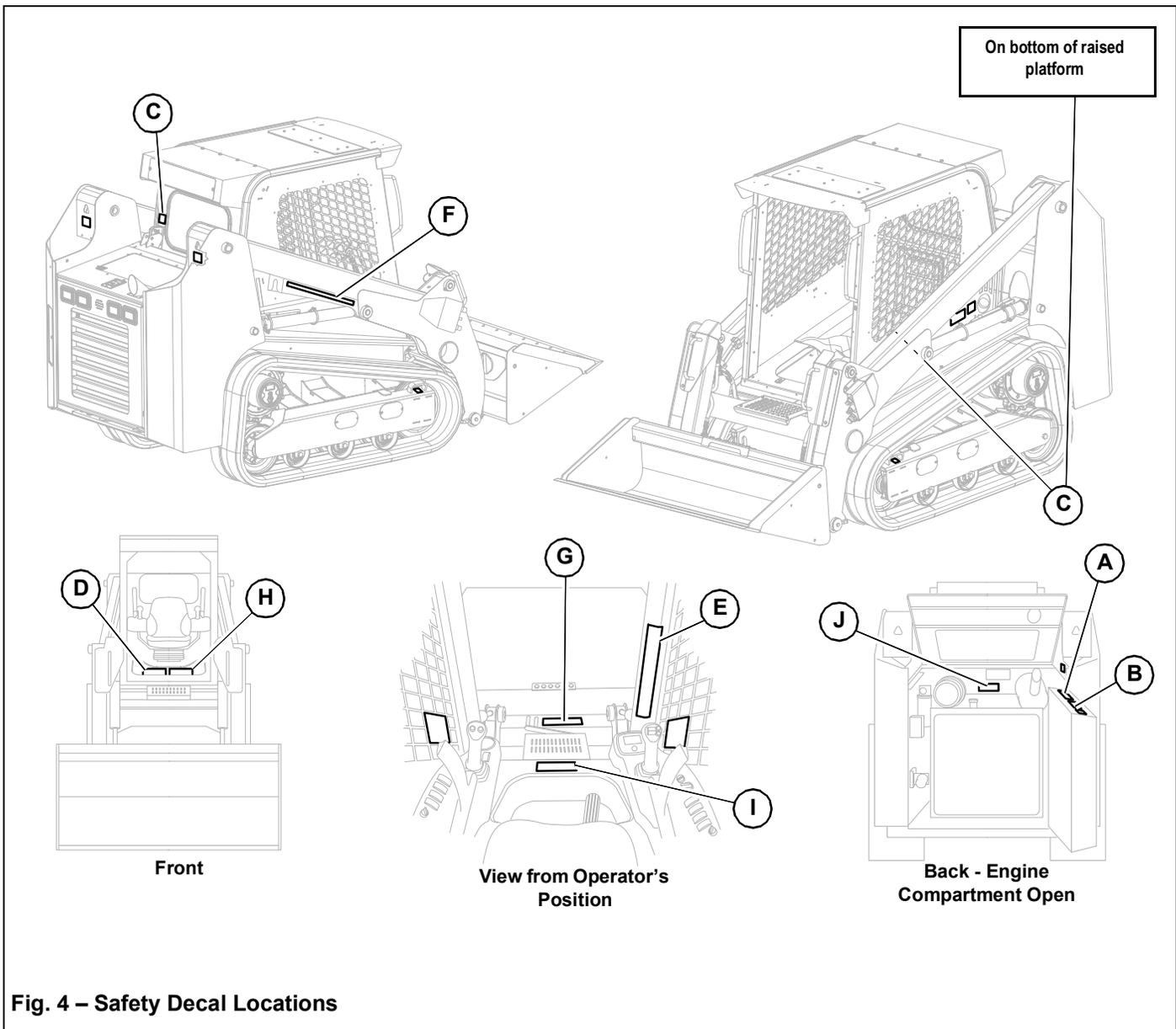
Safety

Safety Decals

- The machine has decals that provide safety information and precautions. These decals must be kept legible. If missing or illegible, they must be replaced promptly. Replacements can be obtained from your dealer.
- Refer to the Parts Manual for decal part numbers and ordering information.

New Decal Application

- Surfaces must be free of dirt, dust, grease and foreign material before applying the decal. Remove the smaller portion of the decal backing paper and apply the exposed adhesive to the clean surface, maintaining proper position and alignment. Peel the rest of the backing paper and apply hand pressure to smooth out the decal surface. Refer to the following pages for proper decal locations.
- If replacing a part that has a decal on it, ensure that the replacement part has the same decal.



ANSI-Style Safety Decals

A



(Located inside the engine compartment)

Warning Decal

WARNING: ROTATING FAN / HOT SURFACES

- Keep hands out or stop engine.
- Do not touch hot engine or hydraulic system parts.

B



(Located inside the engine compartment)

Warning Decal

WARNING: AVOID INJURY OR DEATH

- Keep safety devices working.
- Jump start per Operator's Manual procedure.
- Keep guards, screens and windows in place.
- Do not smoke while fueling or servicing machine.
- Clean debris from engine compartment daily to avoid fire. Keep fire extinguisher nearby.
- Do not use hand to find hydraulic leaks. Escaping oil under pressure can be invisible and penetrate skin.
- Allow radiator to cool before removing cap. Loosen cap slowly to avoid burns.

C



(Located on the bottom of the ROPS / operator's platform and to the left of the rear cab window just above the ROPS tilt lock.)

Read Operator's Manual Decal

WARNING

- Be sure lock mechanism is securely engaged before working under ROPS.
- Read instructions for use in Operator's Manual.

D



(Located by the floor pan inside the cab, and on the manual box cover behind the operator's seat)

Read Operator's Manual Decal

WARNING: AVOID INJURY OR DEATH

- Read Operator's Manual and all safety signs before using machine.
- The owner is responsible to ensure all users are instructed on safe use and maintenance.
- Check machine before operating. Service per Operator's Manual.
- Contact dealer (or manufacturer) for information and service parts.

E



(Located on the inside of the right door pillar inside the cab)

Avoid Injury/Death/Overturn Decal

DANGER: AVOID INJURY OR DEATH

- ALWAYS wear seatbelt.
- Keep out from under lift arm unless lift arm is supported.
- Operate only from operator's seat.
- Look in direction of travel. Keep children and bystanders away.

WARNING

AVOID INJURY OR DEATH

Always follow "Mandatory Safety Shutdown Procedure".

1. Lower equipment to the ground.
2. Reduce throttle, stop engine.
3. Apply park brake; remove key.
4. Check safety interlocks.

WARNING

AVOID OVERTURN

- Carry load low.
- Do not exceed Rated Operating Capacity.
- Avoid steep slopes and high speed turns.
- Travel up and down slopes with heavy end uphill.

WARNING: AVOID INJURY OR DEATH

1. Lower equipment to the ground.
2. Reduce throttle, stop engine.
3. Apply park brake; remove key.
4. Check safety interlocks.

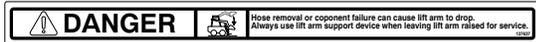
WARNING: AVOID OVERTURN

- Carry load low.
- Do not exceed Rated Operating Capacity.
- Avoid steep slopes and high speed turns.
- Travel up and down slopes with heavy end uphill.

Safety

ANSI-Style Safety Decals (Cont.)

F



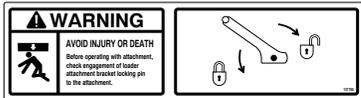
(Located on the lift arm lift support device)

Keep Out From Under Lift Arm Decal

DANGER

- Hose removal or component failure can cause lift arm to drop.
- Always use lift arm support device when leaving lift arm raised for service. See “Lift Arm Support” on page 102.

G



Manual Attachment Lock



Power-A-Tach® Quick Attach System Attachment Lock

(Located on the top of the attachment mounting plate)

Attachment Lock Warning Decal

WARNING: AVOID INJURY OR DEATH

Before operating with attachment, check engagement of loader attachment bracket locking pin to the attachment.

H



(Located by the floor pan inside the cab)

Avoid Injury or Death Decal

WARNING: AVOID INJURY OR DEATH

- Inspect work area; avoid all hazards.
- Operate only in well ventilated area.
- Wear any needed Personal Protective Equipment.
- Keep away from electric power lines; avoid contact.
- Do not wear loose clothing while operating or servicing machine.

I



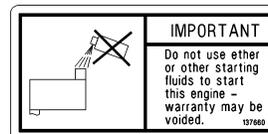
(Located by the floor pan inside the cab)

No Riders Keep Out From Under Work Tool Decal

DANGER: AVOID INJURY OR DEATH

- Keep out from under work tool, unless lift arm is supported. See “Lift Arm Support” on page 102
- No riders! Never use work tools as work platform.

J



(Located inside the engine compartment)

IMPORTANT Decal

Do not use ether or other starting fluids to start this engine – warranty may be voided.

ISO-Style Safety Decals

A



(Located inside the engine compartment)

Warning Decal

WARNING: ROTATING FAN / HOT SURFACES

- Keep hands out or stop engine.
- Do not touch hot engine or hydraulic system parts.

B



(Located inside the engine compartment)

Warning Decal

WARNING: AVOID INJURY OR DEATH

- Read the Operator's Manual before performing any maintenance on the machine.
- Do not smoke while fueling or servicing machine. Keep sparks and open flames away from the engine compartment to avoid fire. Keep fire extinguisher nearby.
- Never attempt to bypass the keyswitch to start the engine. Use only the proper jump-starting procedure according to the Operator's Manual.
- Do not use hand to find hydraulic leaks. Escaping oil under pressure can be invisible and penetrate skin.
- Allow radiator to cool before removing cap. Loosen cap slowly to avoid burns.
- Exhaust fumes can kill. Do not operate the machine in an enclosed area without adequate ventilation.

C



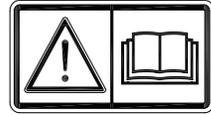
(Located on the bottom of the ROPS / operator's platform and to the left of the rear cab window just above the ROPS tilt lock.)

Crush Hazard / Read Operator's Manual Decal

WARNING

- Be sure lock mechanism is securely engaged before working under ROPS.
- Read instructions for use in Operator's Manual.

D



(Located by the floor pan inside the cab, and on the manual box cover behind the operator's seat)

Read Operator's Manual Decal

WARNING: AVOID INJURY OR DEATH

- Read Operator's Manual and all safety signs before using, maintaining or servicing the machine.
- The owner is responsible to ensure all users are instructed on safe use and maintenance.
- Contact dealer (or manufacturer) for information and service parts.

E



(Located on the inside of the right door pillar inside the cab)

Avoid Injury/Death/Overturn Decal

DANGER: AVOID INJURY OR DEATH

- Keep out from under lift arm unless lift arm is supported. See "Lift Arm Support" on page 102
- ALWAYS wear seatbelt.
- Operate only from operator's seat.
- Look in direction of travel. Keep children and bystanders away.

WARNING: AVOID INJURY OR DEATH

1. Lower equipment to the ground.
2. Reduce throttle, stop engine.
3. Apply park brake; remove key.
4. Check safety interlocks.

WARNING: AVOID OVERTURN

- Read Operator's Manual and all safety signs before using, maintaining or servicing the machine.
- Carry load low.
- Do not exceed Rated Operating Capacity.
- Avoid steep slopes and high speed turns.
- Travel up and down slopes with heavy end uphill.

Safety

ISO-Style Safety Decals (Cont.)

F



(Located on the lift arm lift support device)

Keep Out From Under Lift Arm Decal

DANGER

- Keep out from under lift arm unless lift arm is supported.
- Always use lift arm support device when leaving lift arm raised for service. See “Lift Arm Support” on page 102.

I



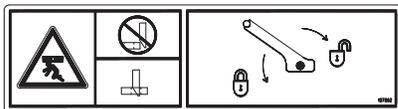
(Located by the floor pan inside the cab)

No Riders Keep Out From Under Work Tool Decal

DANGER: AVOID INJURY OR DEATH

- Keep out from under work tool, unless lift arm is supported. See “Lift Arm Support” on page 102.
- No riders! Never use work tools as work platform.

G



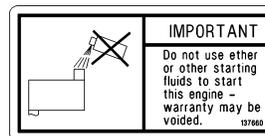
(Located on the top of the attachment mounting plate)

Attachment Lock Warning Decal

WARNING: AVOID INJURY OR DEATH

Before operating with attachment, check engagement of loader attachment bracket locking pin to the attachment.

J



(Located inside the engine compartment)

IMPORTANT Decal

Do not use ether or other starting fluids to start this engine – warranty may be voided.

H



(Located by the floor pan inside the cab)

Avoid Injury or Death Decal

WARNING: AVOID INJURY OR DEATH

- Read Operator’s Manual and all safety signs before using, maintaining or servicing the machine.
- Inspect work area; avoid all hazards.
- Operate only in well ventilated area.
- Keep away from electric power lines; avoid contact.
- Wear any needed Personal Protective Equipment.

Specifications

Fluids/Lubricants Types and Capacities

NOTE: Capacities shown are approximate.

Table 2: Fluids/Lubricants Types and Capacities

Component/ Application	Type	Quantity				
		RT175 (with interim Tier 4 Engines)	RT210 (with interim Tier 4 Engines)	RT175 (with Tier 4 Engines)	RT210 (with Tier 4 Engines)	RT250
Hydraulic Oil Tank	HVLPD 46 (HYD0530)	41.6 L (11 gal.)	52.2 L (13.8 gal.)	41.6 L (11 gal.)	52.2 L (13.8 gal.)	
Hydraulic System – Total	Biodegradable oil: AVILUB Syntofluid 46; PANOLIN HLP Synth 46	70.0 L (18.5 gal.)	81.4 L (21.5 gal.)	70.0 L (18.5 gal.)	81.4 L (21.5 gal.)	82.6 L (21.9 gal.)
Grease Fittings, Lift Arm	Lithium-saponified, brand-name multi- purpose grease MPG-A	As required				
Battery Terminals	SP-B acid-proof Grease	As required				
Diesel Fuel Tank	ASTM D975 with biodiesel content limited to 5% of DIN EN14214 type (no additives allowed!)	90.8 L (24.0 gal.) LSD or ULSD ¹ low sulfur or ultra-low sulfur, below 500 PPM.		90.8 L (24.0 gal.) ULSD ¹ ultra-low sulfur <u>only</u> , below 15 PPM.		
Engine Coolant	Long life coolant ASTM D4985, D6210 (United States) SAE J814C, J1941, J1034 or J2036 (international) (See “Coolant Compound Table” on page 39)	13.2 L (3.5 gal.)	14.4 L (3.8 gal.)	13.2 L (3.5 gal.)	14.4 L (3.8 gal.)	19.3 L (5.1 gal.)
Radiator Cap Pressure		0.90 bar (13 psi)				
Air Conditioning (option)	R 134a refrigerant	1134 g. (2.5 lbs.) @ 24° C (76° F)				
Final Drives: Motor Gearbox	Shell transaxle (synthetic fluid) or equivalent	SAE 75W90 1 L (1.06 qts.) ± 10%				SAE 80W90 0.8L (0.85 qts.)
Engine Oil (with filter)	IMPORTANT: Model RT210 with 4TNV98CT-NMSL Tier 4/5 engines: 0w-40 Full Synthetic All machines EXCEPT Model RT210 with 4TNV98CT-NMSL Tier 4/5 engines: Refer to the Engine Operator’s Manual for specific oil recommendations and additional information. Service Classification: API-CK-4 preferred; API-CJ-4 acceptable	10.4 L (11 qts.)				8.9 L (9.5 qts.)

1. Ultra-Low Sulfur Diesel (ULSD) fuel lubricity must have a maximum scar diameter of 0.45 mm, as measured by ASTM D6079 or ISO 12156-1, or a minimum of 3100 grams as measured by ASTM D6078. Contact your fuel supplier for details. Specification 1-D S15 or 2-D S15, ASTM D975.

Specifications

Dimensions

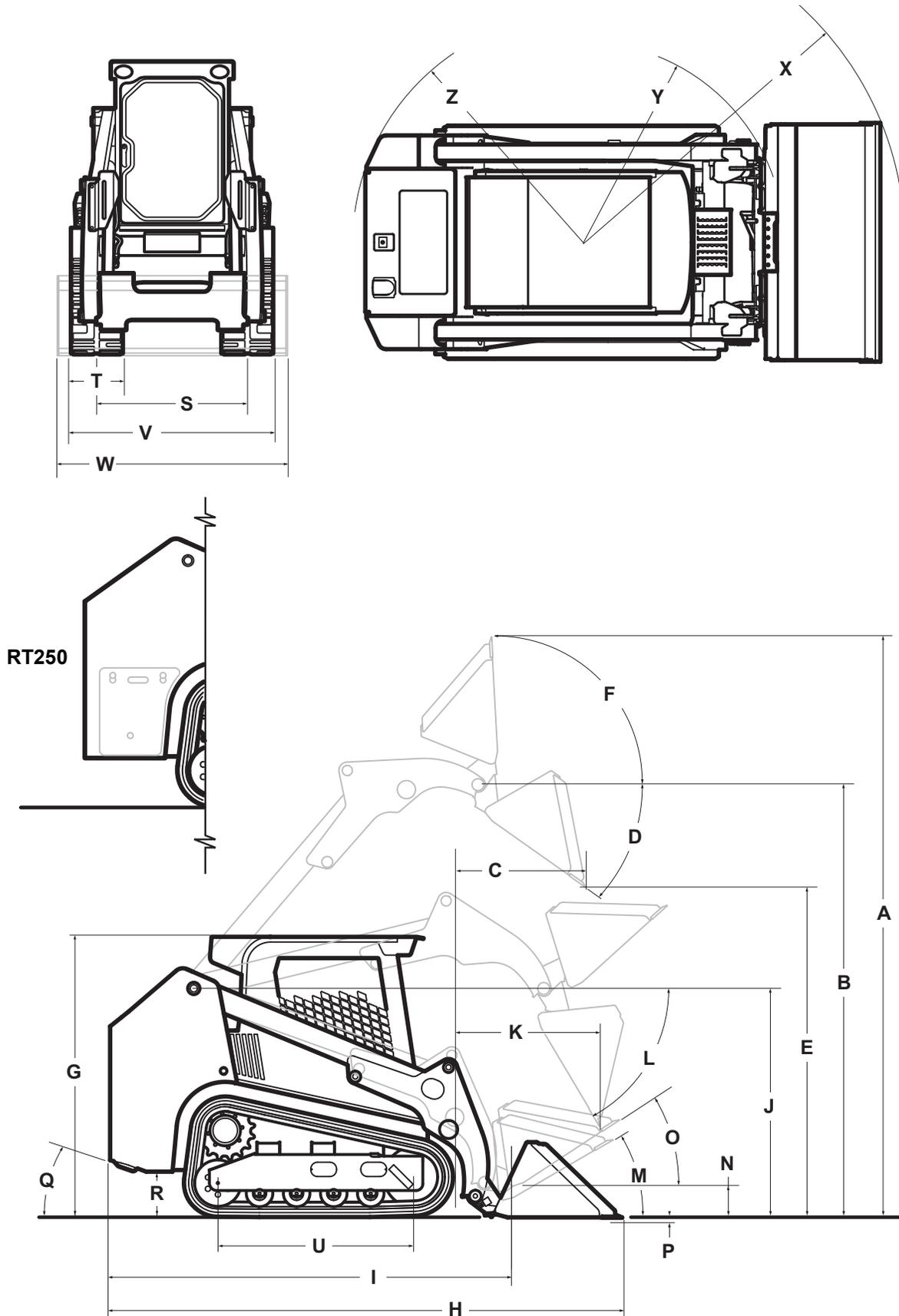


Table 3: Dimensions

		RT175	RT210	RT250
A	Overall Operating Height (fully raised)	4267 mm (168.0 in.)		
B	Height to Hinge Pin (fully raised)	3251 mm (128.0 in.)		
C	Reach (fully raised)	876 mm (34.5 in.)		
D	Dump Angle (fully raised)	40.2°	39.0°	41°
E	Dump Height (fully raised)	2489 mm (98.0 in.)		
F	Maximum Rollback Angle (fully raised)	102.5°		
G	Overall Height at ROPS	2103 mm (83.0 in.)	2111 mm (83.1 in.)	
H	Overall Length (with bucket and standard counterweight)	3658 mm (144.0 in.)	3762 mm (148.1 in.)	4008 mm (157.8 in.)
I	Overall Length (w/out bucket)	2814 mm (110.8 in.)	2959 mm (116.5 in.)	3221 mm (126.8 in.)
J	Specified Height	1715 mm (67.5 in.)	1720 mm (67.7 in.)	
K	Reach (at specified height)	790 mm (31.1 in.)	795 mm (31.3 in.)	
L	Dump Angle (at specified height)	75.0°		
M	Maximum Rollback Angle (at ground)	30.0°		
N	Carry Position	208 mm (8.2 in.)		
O	Max. Rollback Angle (at carry position)	31.6°		
P	Digging Position (+ above / -below ground)	23 mm (0.9 in.)	16 mm (0.6 in.)	13 mm (0.5 in.)
Q	Angle of Departure (standard counterweight)	30.4°	29.2°	25.0°
R	Ground Clearance	333 mm (13.1 in.)	335 mm (13.2 in.)	
S	Track Gage	1313 mm (51.7 in.)		
T	Track Shoe Width	320 mm (12.6 in.)	450 mm (17.7 in.)	
U	Crawler Base	1392 mm (54.8 in.)	1483 mm (58.4 in.)	1562 mm (61.5 in.)
V	Overall Width (w/out bucket)	1636 mm (64.4 in.)	1765 mm (69.5 in.)	
W	Bucket Width	1674 mm (65.9 in.)	1877 mm (73.9 in.)	2131 mm (83.9 in.)
X	Front Clearance Radius (with bucket)	2322 mm (91.4 in.)	2403 mm (94.6 in.)	2499 mm (98.4 in.)
Y	Front Clearance Radius (w/out bucket)	1448 mm (57.0 in.)	1504 mm (59.2 in.)	1544 mm (60.8 in.)
Z	Rear Clearance Radius (standard counterweight)	1577 mm (62.1 in.)	1641 mm (64.6 in.)	1796 mm (70.7 in.)
	Maximum Rollback at Specified Height	66.8°		
	Angle of Approach	90°		
	Grouser Height	25.4 mm (1.0 in.)		

Specifications

Payloads/Capacities

NOTE: *Pallet fork load center is the distance from the front face of the forks to the center of mass of the load.*

Table 4: Payloads/Capacities (Dirt/Construction Buckets)

	RT175	RT210	RT250
SAE Rated Operating Capacity @ 35% (standard counterweight)	794 kg (1750 lbs.)	953 kg (2100 lbs.)	1134 kg (2500 lbs.)
SAE Rated Operating Capacity @ 50% (standard counterweight)	1134 kg (2500 lbs.)	1361 kg (3000 lbs.)	1620 kg (3571 lbs.)
SAE Rated Operating Capacity @ 35% (optional counterweight)	841 kg (1855 lbs.)	1000 kg (2205 lbs.)	1258 kg (2773 lbs.)
SAE Rated Operating Capacity @ 50% (optional counterweight)	1202 kg (2650 lbs.)	1429 kg (3150 lbs.)	1797 kg (3962 lbs.)
SAE Tipping Load (standard counterweight)	2268 kg (5000 lbs.)	2722 kg (6000 lbs.)	3240 kg (7143 lbs.)
SAE Tipping Load (optional counterweight)	2404 kg (5300 lbs.)	2858 kg (6300 lbs.)	3594 kg (7924 lbs.)

Table 5: Payloads/Capacities (Pallet Forks - 48 in. [1229 mm])

15.7 in. (400 mm) Load Center per EN 474-3	RT175	RT210
SAE Rated Operating Capacity @ 35% (standard counterweight)	603 kg (1330 lbs.)	781 kg (1722 lbs.)
SAE Rated Operating Capacity @ 50% (standard counterweight)	862 kg (1900 lbs.)	1116 kg (2460 lbs.)
SAE Rated Operating Capacity @ 35% (optional counterweight)	651 kg (1435 lbs.)	829 kg (1827 lbs.)
SAE Rated Operating Capacity @ 50% (optional counterweight)	930 kg (2050 lbs.)	1184 kg (2610 lbs.)
SAE Tipping Load (standard counterweight)	1724 kg (3800 lbs.)	2231 kg (4919 lbs.)
SAE Tipping Load (optional counterweight)	1860 kg (4100 lbs.)	2367 kg (5219 lbs.)
19.7 in. (500 mm) Load Center per EN 474-3		
SAE Rated Operating Capacity @ 35% (standard counterweight)	582 kg (1282 lbs.)	738 kg (1627 lbs.)
SAE Rated Operating Capacity @ 50% (standard counterweight)	831 kg (1831 lbs.)	1054 kg (2324 lbs.)
SAE Rated Operating Capacity @ 35% (optional counterweight)	629 kg (1387 lbs.)	786 kg (1732 lbs.)
SAE Rated Operating Capacity @ 50% (optional counterweight)	899 kg (1981 lbs.)	1122 kg (2474 lbs.)
SAE Tipping Load (standard counterweight)	1661 kg (3662 lbs.)	2108 kg (4648 lbs.)
SAE Tipping Load (optional counterweight)	1797 kg (3962 lbs.)	2244 kg (4948 lbs.)
24 in. (610 mm) Load Center per SAE J1197		
SAE Rated Operating Capacity @ 35% (standard counterweight)	533 kg (1176 lbs.)	692 kg (1525 lbs.)
SAE Rated Operating Capacity @ 50% (standard counterweight)	762 kg (1680 lbs.)	988 kg (2179 lbs.)
SAE Rated Operating Capacity @ 35% (optional counterweight)	581 kg (1281 lbs.)	739 kg (1630 lbs.)
SAE Rated Operating Capacity @ 50% (optional counterweight)	830 kg (1830 lbs.)	1052 kg (2329 lbs.)
SAE Tipping Load (standard counterweight)	1524 kg (3360 lbs.)	1976 kg (4357 lbs.)
SAE Tipping Load (optional counterweight)	1660 kg (3660 lbs.)	2112 kg (4657 lbs.)

Weights

Table 6: Weights

	RT175	RT210	RT250
Operating Mass (standard counterweight) ¹	3903 kg (8605 lbs.)	4445 kg (9800 lbs.)	5203 kg (11 470 lbs.)
Operating Mass (optional counterweight) ¹	4044 kg (8915 lbs.)	4590 kg (10 120 lbs.)	5520 kg (12 170 lbs.)
Shipping Weight (standard counterweight)	3556 kg (7840 lbs.)	4028 kg (8880 lbs.)	4996 kg (11 015 lbs.)
Shipping Weight (optional counterweight)	3697 kg (8150 lbs.)	4132 kg (9110 lbs.)	4736 kg (10 440 lbs.)

1. Equipped with standard bucket, driver and full fluids.

Track Drive

Table 7: Track Drive

	RT175	RT210	RT250
Gradeability	30°		
Brakes	Mechanical / hydraulic; spring applied / hydraulically released		
Tractive effort	4498 kg (9917 lbs.)	5211 kg (11 489 lbs.)	5792 kg (12 770 lbs.)
Track Type / Track Rollers / Roller Type	Rubber / 3 / steel	Rubber / 4 / steel	
Track Dimensions (standard)	320 mm x 86 mm (12.5 in. x 3.4 in.) x 54 Pitches	450 mm x 86 mm (17.7 in. x 3.4 in.) x 56 Pitches	450 mm x 86 mm (17.7 in. x 3.4 in.) x 58 Pitches
Track Dimensions (optional)	400 mm x 86 mm (15.75 in. x 3.4 in.) x 54 Pitches	N/A	
Track Ground Contact Length	1395 mm (55 in.)	1483 mm (58.4 in.)	1562 mm (61.5 in.)
Ground Pressure (standard track)	0.44 kg/cm ² (6.2 psi)	0.33 kg/cm ² (4.7 psi)	0.37 kg/cm ² (5.3 psi)
Ground Pressure (optional track)	0.35 kg/cm ² (5.0 psi)	N/A	
Number of Track Rollers	3 (per side)	4 (per side)	
Travel Speed	Low: 8.5 kph (5.3 mph) High: 12.4 kph (7.7 mph)	Low: 9.8 kph (6.1 mph) High: 14.3 kph (8.9 mph)	Low: 9.3 kph (5.8 mph) High: 13.2 kph (8.2 mph)

Coolant Compound Table

Table 8: Coolant Compound Table

Outside Temperature Up to °F (°C)	Water % by volume	Anti-corrosion agent		Antifreeze % by volume
		in ³ /gal (cm ³ /L)	% by Volume	
39 (4)	99	2.6 (10)	1	–
14 (- 10)	79			20
-4 (- 20)	65			34
-13 (- 25)	59			40
-22 (- 30)	55			45
-44 (-42)	50			50

Specifications

Engine

Table 9: Engine

	RT175 (interim Tier 4 Engine)	RT175 (Tier 4 Engine)	RT210 (interim Tier 4 Engine)	RT210 (Tier 4 Engine)	RT250
Engine Make	Yanmar				Deutz
Engine Model	4TNV98-ZNMSR	4TNV98C-NMSL	4TNV98T- ZXNMSF/R	4TNV98CT- NMSL	TD3.6 L4
Design	In-line 4 cylinder, 4-stroke diesel, naturally aspirated		In-line 4 cylinder, 4-stroke diesel, turbocharged		
Exhaust Emission Compliance	interim Tier 4	Tier 4	interim Tier 4	Tier 4	Tier 4
Displacement	3.319 L (203 cu. in.)				3.621 L (221 cu. in.)
Bore and Stroke	98 x 110 mm (3.8 x 4.3 in.)				98 x 120 mm (3.8 x 4.7 in.)
Gross Power	52.1 kW (69.9 hp) @ 2500 rpm		54.7 kW (73.4 hp) @ 2500 rpm	53.7 kW (72.0 hp) @ 2500 rpm	55.4 kW (74.3 hp) @ 2300 rpm
Net Power	51.0 kW (68.4 hp) @ 2500 rpm		52.7 kW (70.7 hp) @ 2500 rpm		52.7 kW (70.7 hp) @ 2300 rpm
Peak Torque	242.7 Nm (179 lb.-ft.) @ 1600 rpm		279.3 Nm (206 lb.-ft.) @ 1800 rpm		330 Nm (243 lb.- ft.) @ 1400-1600 rpm
Low/High Idle	1000 / 2530 rpm				1000 / 2310 rpm
Rated - Full Load Speed	2500 rpm				2300 rpm
Fuel Injection System	Direct injection				
Fuel Delivery	In-line injection pump	High-pressure common rail	In-line injection pump	High-pressure common rail	
Fuel Filtering	In-line filter cartridge w/water trap and replaceable element				
Estimated Fuel Consumption - Average Load	@ Rated - full load speed 14.4 L/hr (3.8 gph) / @ Rated - 55% load speed 7.8 L/hr (2.1 gph)		@ Rated - full load speed 15.1 L/hr (4.0 gph) / @ Rated - 55% load speed 8.3 L/hr (2.2 gph)		@ Rated - full load speed 15.5 L/hr (4.1 gph) / @ Rated - 55% load speed 8.7 L/hr (2.3 gph)
Firing Order	1-3-4-2				
Normal Starting Aid	500W manifold heater	Glow plugs	500W manifold heater	Glow plugs	
Cold Starting Aid (Optional)	400W block heater				250W oil pan contact heater
Lubrication	Pressure system w/replaceable filter				
Crankcase Ventilation	External	Closed	External	Closed	
Max. Inclined Angle (engine still supplied with oil)	30° in all directions				
Cooling System	Water / glycol				
Permissible Coolant Temperature	110° C (230°F)				

Table 9: Engine

	RT175 (interim Tier 4 Engine)	RT175 (Tier 4 Engine)	RT210 (interim Tier 4 Engine)	RT210 (Tier 4 Engine)	RT250
Thermostat Rating	82° C (180°F) cracking / 95° C (203°F) full open				85° C (185°F) cracking / 95° C (203°F) full open
Permissible Coolant Temp	110°C (230°F)				
Fan Type / Ratio	Pusher / 1 : 0.9			Pusher / 1:1.04	Pusher / 1 : 1.2
Applied Regulation	EPA interim Tier 4	EPA Tier 4 final	EPA interim Tier 4	EPA Tier 4 final	
Aftertreatment System	N/A	DOC+DPF	N/A	DOC+DPF	DOC
Starter - Power	3 kW - 12 V				3.2 kW - 12 V
Alternator Voltage / Amperage	12 V / 95 A				
Operating Range– Ambient Temperature ¹	-15°C (+5°F) – +45°C (+113°F)				

1. Operation above temperature range may result in overheating; operation below temperature range may result in hard-starting.

Hydraulic System

General

Table 10: Hydraulic System : General

	RT175	RT210	RT250
Hydraulic Self-Leveling	Hydraulic self-leveling in raise mode only. Full time-Standard; Switchable-Optional		
Pump-to-Engine Ratio	1 : 1		
System Pressure Setting	207 bar (3000 psi) @ 2500 rpm		207 bar (3000 psi) @ 2300 rpm
Optional High-Flow Auxiliary Hydraulics System Pressure Setting	200 bar (2900 psi) @ 2500 rpm		200 bar (2900 psi) @ 2300 rpm
Port Relief Pressures			
Boom Lift	241 bar (3500 psi)		
Boom Lower	138 bar (2000 psi)		
Tilt Rollback	241 bar (3500 psi)		
Tilt Dump	241 bar (3500 psi)		

Specifications

Drive Hydraulics

Table 11: Hydraulic System : Drive Hydraulics

	RT175	RT210	RT250
Gear Box	2-stage Planetary Reduction 21.58:1 Ratio		2-stage Planetary Reduction 24.0:1 Ratio
Drive Speed	Low: 8.5 kph (5.3 mph) High: 12.4 kph (7.7 mph)	Low: 9.8 kph (6.1 mph) High: 14.3 kph (8.9 mph)	Low: 9.3 kph (5.8 mph) High: 13.2 kph (8.2 mph)
Tractive Effort	4498 kg (9917 lbs.)	5211 kg (11 489 lbs.)	5792 kg (12 770 lbs.)
Hydrostatic Drive Motors			
Type	Axial-piston with planetary gearbox reduction		
Rated Pressure	345 bar (5004 psi)		400 bar (5800 psi)
Displacement	Low: 1049 cm ³ (64.0 in ³) High: 680 cm ³ (41.5 in ³)	Low: 1098 cm ³ (67.0 in ³) High: 714 cm ³ (43.6 in ³)	Low: 1044 cm ³ (63.7 in ³) High: 672 cm ³ (41.0 in ³)
Maximum Output Torque	5162 Nm (3807 ft.-lbs.)	5979 Nm (4410 ft.-lbs.)	6646 Nm (4902 ft.-lbs.)
Rotating	Bi-directional		

Pumps

Table 12: Hydraulic System : Pumps

	RT175	RT210	RT250
Auxiliary Hydraulics Pump (Standard)			
Type	Gear		
Main Relief Valve Pressure	Standard Flow 207 bar (3000 psi)		207 bar (3000 psi) @ 2300 rpm
Displacement	28.02 cm ³ (1.71 in ³)	32.94 cm ³ (2.01 in ³)	40.97 cm ³ (2.50 in ³)
Theoretical Total Flow @ Rated Speed	70.0 L/m (18.5 gpm) @ 2500 rpm	82.5 L/m (21.8 gpm) @ 2500 rpm	94.3 L/m (24.9 gpm) @ 2300 rpm
Theoretical 100% Hydraulic Operating Power	24.2 kW (32.4 hp)	28.5 kW (38.2 hp)	32.5 kW (43.6 hp)
Auxiliary Hydraulics Pump (Optional - High-Flow)			
Type	Tandem gear		
Main Relief Valve Pressure	High-Flow 200 bar (2900 psi)		200 bar (2900 psi) @ 2300 rpm
Displacement	Section 1: 29.00 cm ³ (1.77 in ³) Section 2: 22.45 cm ³ (1.37 in ³)	Section 1: 31.79 cm ³ (1.94 in ³) Section 2: 22.45 cm ³ (1.37 in ³)	Section 1: 41.0 cm ³ (2.50 in ³) Section 2: 20.5 cm ³ (1.25 in ³)
Theoretical Total Flow @ Rated Speed	128.7 L/m (34 gpm)	136 L/m (35.9 gpm)	141.6 L/m (37.4 gpm) @ 2300 rpm
Theoretical 100% Hydraulic Operating Power	42.9 kW (57.5 hp)	45.3 kW (60.7 hp)	47.1 kW (63.2 hp)

Table 12: Hydraulic System : Pumps

Travel Drive System Hydrostatic Pump		
Type	Tandem axial piston	
Rated Pressure	345 bar (5004 psi)	400 bar (5800 psi)
Displacement (per rev.)	41.0 cm ³ (2.5 in ³)	49.2 cm ³ (3.0 in ³)
Pump to Engine Ratio	1 : 1	
Charge Pressure	17-24 bar (300-350 psi)	

Cylinders

Table 13: Hydraulic System : Cylinders

	RT175	RT210	RT250
Tilt Cylinders			
Type	Double-acting piston		
Rod / Bore Diameter	35 mm / 64 mm (1.38 / 2.50 in.)	38 mm / 70 mm (1.50 / 2.75 in.)	38 mm / 76 mm (1.50 / 3.00 in.)
Stroke Length	537 mm (21.14 in.)		
Closed Length	731 mm (28.76 in.)		
Pressure Rating	207 bar (3000 psi)		
Lift Cylinders			
Type	Double-acting piston		
Rod / Bore Diameter	38 mm / 64 mm (1.50 / 2.50 in.)	38 mm / 70 mm (1.50 / 2.75 in.)	44.5 mm / 76 mm (1.75 / 3.00 in.)
Stroke Length	766 mm (30.14 in.)		
Closed Length	994 mm (39.14 in.)		
Pressure Rating	207 bar (3000 psi)		

Forces and Cycle Times

Table 14: Hydraulic System : Forces and Cycle Times

	RT175	RT210	RT250
Bucket Breakout			
Breakout Force (tilt)	2429 kg (5354 lbs.)	3008 kg (6631 lbs.)	3803 kg (8384 lbs.)
Breakout Force (lift)	2275 kg (5016 lbs.)	2940 kg (6481 lbs.)	3373 kg (7437 lbs.)
Hydraulic Function Time			
SAE Raising Time - Lift	4.5 seconds	4.6 seconds	4.6 seconds
SAE Lowering Time - Lift	3.0 seconds.	3.2 seconds	3.1 seconds
SAE Dump Time - Tilt	1.0 secs.		
Dump Time - Tilt (stop to stop)	3.2 seconds	3.3 seconds	3.4 seconds
SAE Rollback Time - Tilt	0.6 seconds		0.7 seconds
Rollback Time - Tilt (stop to stop)	2.1 seconds	2.4 seconds	2.5 seconds

Specifications

Table 14: Hydraulic System : Forces and Cycle Times

Total Boom - Cycle Time	12.8 seconds	13.5 seconds	13.6 seconds
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Electrical System

Table 15: Electrical System

	RT175	RT210	RT250
Glow Plug (Engine Pre-heat)	Auto w/glow lamp		
Backup Alarm	112 + 4 dB(A) 2500 + 300 Hz		
Battery			
Type	Maintenance-free		
Volts	12 V		
Group Size	65	31	
Cold Cranking Amps @ Temperature	850 CCA @ -18°C (0°F)		950 CCA @ -18°C (0°F)
Minimum Reserve Capacity	140 minutes		

Sound Power/Pressure Levels

Table 16: Sound Power/Pressure Levels

	RT175 (interim Tier 4 Engine)	RT175 (Tier 4 Engine)	RT210 (interim Tier 4 Engine)	RT210 (Tier 4 Engine)
Noise Level / Environmental Level (EU Dir. 2000/14/EC)	103 dB(A)	101 dB(A)	103 dB(A)	101 dB(A)
Operator Ear (EU Dir. 2006/42/EC)	82 (+2.2) dB(A)	82 dB(A)	83 (+2.8) dB(A)	78 dB(A)

Vibration Levels

Table 17: Vibration Levels

	RT175	RT210
Whole-Body Vibration (ISO 2631-1)	$\leq 0.74 \text{ m/s}^2 (\pm 0.37k)$	$\leq 0.79 \text{ m/s}^2 (\pm 0.40k)$
Hand-Arm Vibration (ISO 5349-1)	$\leq 3.5 \text{ m/s}^2 (\pm 1.75k)$	$\leq 4.4 \text{ m/s}^2 (\pm 2.2k)$

Features

Standard Features

Table 18: Features : Standard Features

All-Tach [®] attachment mounting system	Dual-element air cleaner with indicator
Engine alert system with error code display	Elevated planetary final drives with SAHR disc brakes
Back-up alarm	Maintenance-free track rollers
Self-leveling hydraulic lift action	EH-controlled hydrostatic drive
Auxiliary hydraulics - proportional electric control/continuous flow	Hand and foot throttles
IdealTrax [™] automatic track tensioning system	Combination radiator and hydraulic oil cooler
12-volt battery	Drive sensitivity adjustment
Grid/manifold heater starter assist - automatic/manual	Interlock system for lift, tilt cylinders, auxiliary hydraulic functions and drives
Yanmar liquid-cooled diesel engine	Mechanical lift cylinder support
Horn	Rubber track undercarriage system
Independent hydraulic reservoir and cooler	Tilt-out foot pod - easy clean out
Joystick (electric-hydraulic) "hands-only" ISO controls	Vandalism lock provisions
Restraint bar and retractable seat belt	Single flange front / dual flange rear idlers
ROPS/FOPS - Level 2-approved	Two front and two rear halogen lights
Multi-function display screen - warning lights, gauges and configuration	Full-suspension seat - 6-way adjustable seat, controls and armrests
Two-speed hydrostatic drive system	Seat mounted controls and switches
Engine automatic shutdown system - low oil pressure	

Optional Features

Table 19: Features : Optional Features

Hydraglide [™]	High-flow auxiliary hydraulics
Cab enclosure	Air conditioning/HVAC with defrost
Swing-out door	High-capacity counterweight
Dual-hand (case controls)/ISO controls - selectable	Engine intake pre-cleaner
Power-A-Tach [®] attachment mounting system	AM/FM radio
Speed control, variable - selectable On/Off	Impact resistant swing-out door
Selectable (On/Off) self-leveling hydraulic lift action	Air suspension seat
Engine block heater	Strobe light
Fold-up door	

Specifications

Common Materials and Densities

Table 20: Common Materials and Densities

Material	Density	
	kg/m ³	lbs./ft. ³
Ashes	560-800	35-50
Brick-common	1792	112
Cement	1760	110
Charcoal	368	23
Clay, wet-dry	1280-1600	80-100
Coal	848-1008	53-63
Concrete	1840	115
Cinders	800	50
Coal-anthracite	1504	94
Coke	480	30
Earth-dry loam	1121-1442	70-90
Earth-wet loam	1281-1602	80-100
Granite	1488-1776	93-111
Gravel-dry	1602	100
Gravel-wet	1922	120
Gypsum-crushed	1840	115
Iron ore	2320	145
Lime	960	60
Lime stone	1440	90
Manure-liquid	1040	65
Manure-solid	720	45
Peat-solid	752	47
Phosphate-granular	1440	90
Potash	1088	68
Quartz-granular	1760	110
Salt-dry	1602	100
Salt-rock-solid	2160	135
Sand-dry	1728	108
Sand-wet	2000	125
Sand-foundry	1520	95
Shale-crushed	1440	90
Slag-crushed	1120	70
Snow	240-800	15-50
Taconite	1712	107

NOTE: To determine load weights, multiply maximum material density by bucket capacity. Refer to “Fields of Application” on page 14 for bucket capacities.

Controls

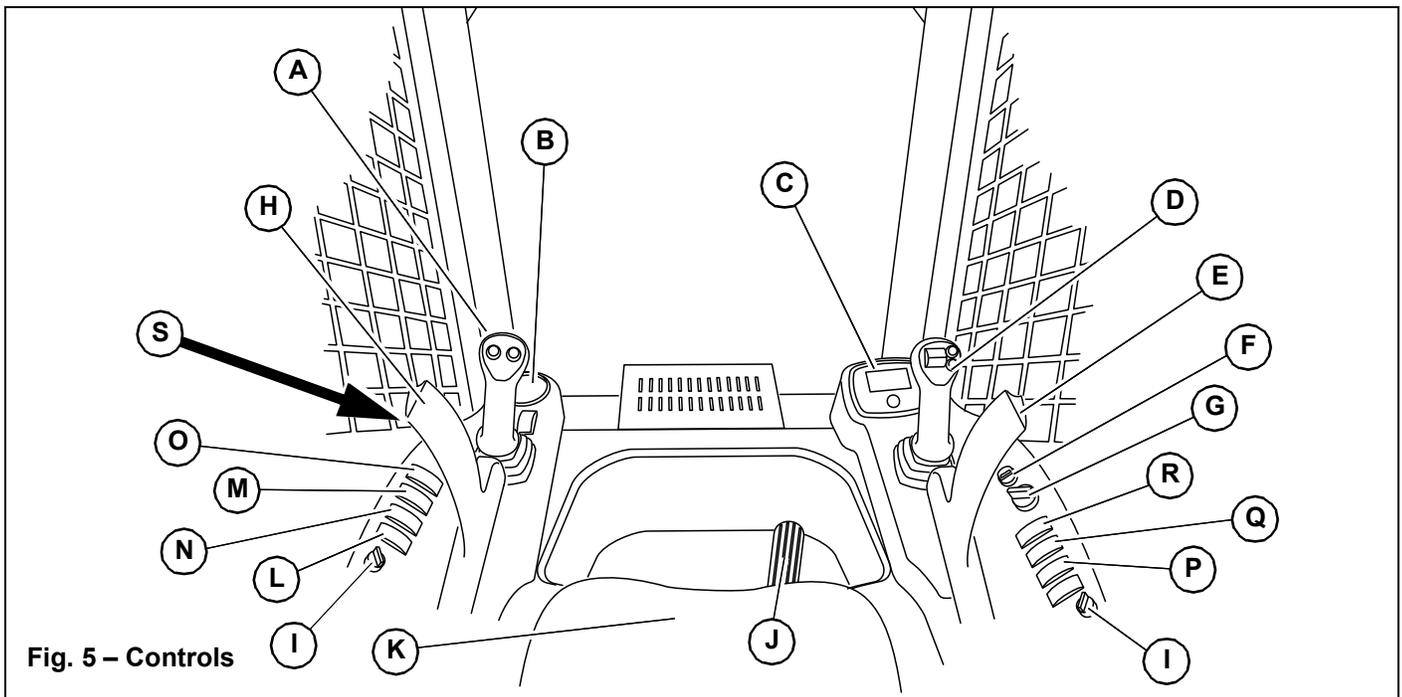


Fig. 5 – Controls

Table 21: Controls

Ref	Item	Description
A	Control Joystick - Left	Controls travel drive operation (and lift arm in option “D-H” control mode), horn and low/high speed travel mode. See “Control Joysticks” on page 55.
B	Cup Holder	Holds beverage containers up to 67mm (2-5/8”) in diameter.
C	Multi-Function Display	Displays operation status messages and configures performance options.
D	Control Joystick - Right	Controls attachment lift/tilt operation (travel drive and attachment tilt in “D-H” control mode), auxiliary hydraulic flow, lift arm float and optional Hydraglide™. See “Control Joysticks” on page 55.
E	Safety Bar/Arm Rest - Right	Applies parking brake, locks out work hydraulics and prevents engine start when in the raised position. See “Parking Brake/Work Hydraulics Lock-out” on page 60.
F	Ignition Switch	Controls ignition, engine start and run. See “Starting the Engine” on page 75.
G	Throttle Knob	Primary engine speed control. See “Throttle Controls” on page 63.
H	Safety Bar/Arm Rest - Left	Applies parking brake, locks out work hydraulics and prevents engine start when in the raised position. See “Parking Brake/Work Hydraulics Lock-out” on page 60.
I	Electrical Accessory Socket	12-volt accessory outlet.
J	Throttle Pedal	Supplemental engine speed control. See “Throttle Controls” on page 63.
K	Operator’s Seat	Seat plate according to ISO 7096 (located on seat).
L	Power-A-Tach® Switch	Controls Power-A-Tach®. See “Switches/Indicators” on page 49.
M	Self-Leveling Cancel Switch	Cancels optional self-leveling function. See “Switches/Indicators” on page 49.
N	Auxiliary Hydraulics Flow Switch	Controls high-flow auxiliary hydraulics. See “Switches/Indicators” on page 49 and “Auxiliary Hydraulics Operation” on page 107.
O	Parking Brake Switch	Controls the parking brake. See “Switches/Indicators” on page 49.
P	Rear Window Washer Switch	Controls rear window washer spray. See “Switches/Indicators” on page 49.
Q	Front Window Washer Switch	Controls front window washer spray. See “Switches/Indicators” on page 49.
R	Work Lights Switch	Controls work lights. See “Switches/Indicators” on page 49.
S	Cab Heat and A/C (not shown)	Controls heat and air conditioning. See “Cab Heat and Air Conditioning (Option)” on page 61.

Controls

Multi-Function Display

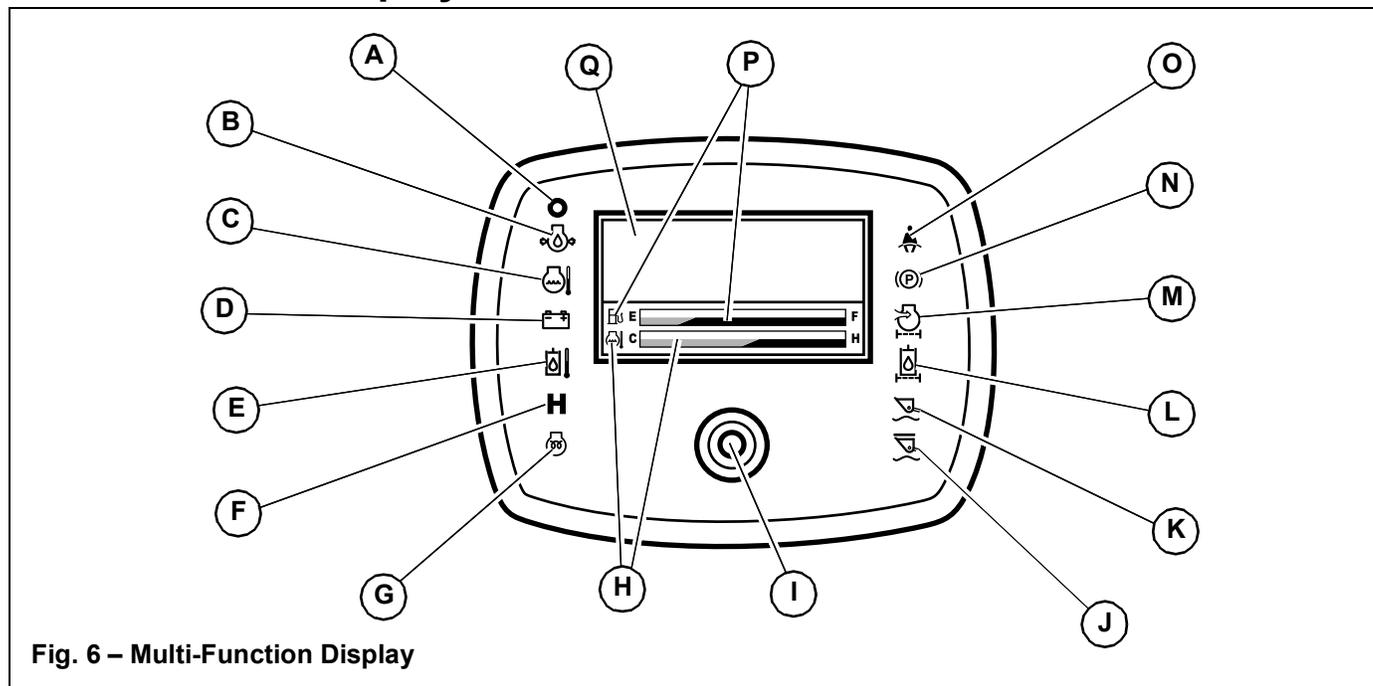


Fig. 6 – Multi-Function Display

Table 22: Multi-Function Display

No	Item	Description
A	Ambient Light Sensor	Senses ambient light for proper display screen contrast adjustment.
B	Engine Oil Pressure Warning Indicator	Is lit when engine oil pressure is too low. IMPORTANT! Immediately shut down the engine if this indicator is lit. Correct the problem before restarting the engine.
C	Coolant Temperature Warning Indicator	Is lit when coolant temperature is too high.
D	Battery Voltage Warning Indicator	Is lit when alternator is not charging the battery.
E	Hydraulic Oil Temperature Warning Indicator	Is lit when hydraulic temperature is too high.
F	High-Speed Travel Range Indicator	Is lit when high-speed travel range is activated.
G	Pre-Heat Indicator	Is lit when ignition switch is in the "I" (Run) position and engine pre-heat is required; goes out when engine pre-heat is complete.
H	Coolant Temperature Indicator	Displays coolant temperature.
I	Display Select Button	Used for screen selection and display/operation configuration. See "Screen Access" on page 50.
J	Hydraglide™ Indicator	Is lit when the Hydraglide™ lift arm cushion is activated.
K	Lift Arm Float Indicator	Is lit when the lift arm float is activated.
L	Hydraulic Oil Filter Warning Indicator	Is lit when hydraulic oil filter requires service. See "Changing Hydraulic Oil and Filter" on page 139.
M	Engine Air Filter Restriction Indicator	Is lit when engine air filter requires service. See "Engine Air Filters" on page 130.
N	Parking Brake Indicator	Is lit when parking brake is applied.
O	Seat Belt Reminder Indicator	Is lit when engine is started as a reminder to fasten the seat belt. See "Seat Belt" on page 73.
P	Fuel Gauge	Displays the level of fuel in the fuel tank. Status bar indicates Empty (E) to Full (F).
Q	Display Screen	Displays status / configuration information. See "Status, Maintenance and Error Code Screens" on page 50.

Switches/Indicators

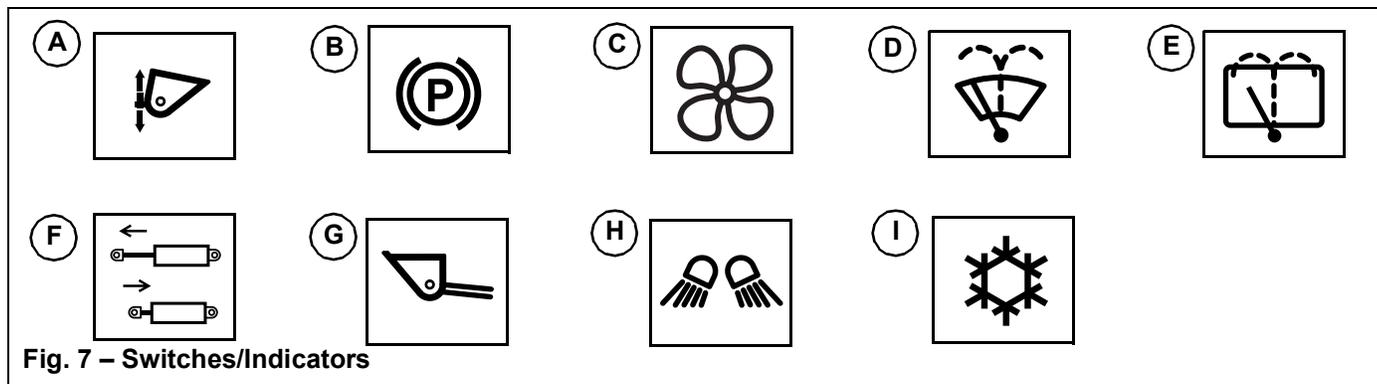


Fig. 7 – Switches/Indicators

Table 23: Switches/Indicators

No	Item	Description
A	Power-A-Tach®	Located on left panel. Press and hold bottom of switch to lock attachment onto the Power-A-Tach® quick attach system hitch; press and hold top of switch to unlock the attachment. See “Connecting/Disconnecting Attachments” on page 104.
B	Parking Brake	Press top of switch to apply parking brake. Press and hold top of switch to release parking brake. Indicator in switch is lit when parking brake is applied. IMPORTANT: <i>Parking brake is applied when either, or both, safety bar/ arm rests are in the raised position, operator is not in seat and door (if equipped) is opened.</i>
C	Heat/Air Conditioning Fan (HVAC)	Located on left panel. See “Cab Heat and Air Conditioning (Option)” on page 61.
D	Front Windshield Wiper/Washer (option)	Press bottom of switch to activate front windshield wiper; press and release top of switch to deactivate. Press and hold top of switch to operate front windshield washer spray. Indicator in switch is lit when front windshield wiper is activated.
E	Rear Windshield Wiper/Washer	Press bottom of switch to activate rear windshield wiper; press and release top of switch to deactivate. Press and hold top of switch to operate rear windshield washer spray. Indicator in switch is lit when rear windshield wiper is activated.
F	Auxiliary High-Flow Hydraulics	See “Auxiliary Hydraulics Operation” on page 107.
G	Self-Leveling Cancel (option)	Press top of switch to deactivate self-leveling; press bottom of switch to restore the self-leveling function. Indicator in switch is lit when self-leveling is deactivated.
H	Work Lights	Move switch to the middle position to activate the front work lights; press the top of switch to activate both the front and rear work lights; press bottom of switch to deactivate work lights. See “Work Lights” on page 67. Indicator in switch is lit when work lights are on.
I	Air Conditioning Compressor (HVAC)	Located on left panel. See “Cab Heat and Air Conditioning (Option)” on page 61.

Controls

Multi-Function Display Screens

The multi-function display screens provide the following functionality:

- Displays operational status such as engine RPM, coolant temperature, service hours and system voltage.
- Displays error fault codes.
- Configures displays settings.
- Configures control options.
- Audible alerts for selected error conditions.

Screen Access

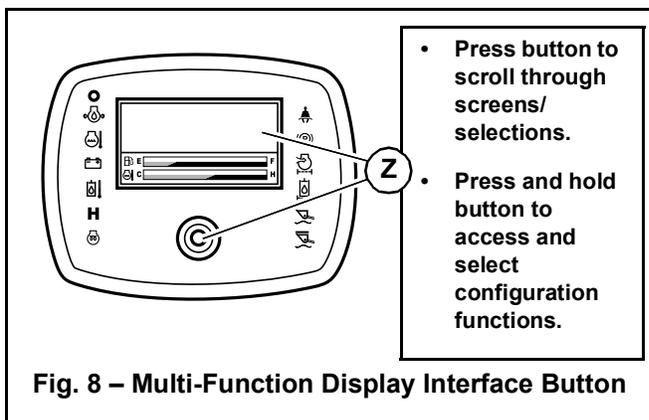


Fig. 8 – Multi-Function Display Interface Button

Press and release the multi-function display interface button (Z, Fig. 8) to scroll through the status screens and any current error or maintenance required screens.

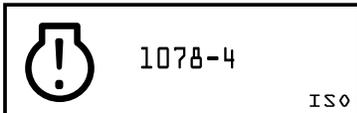
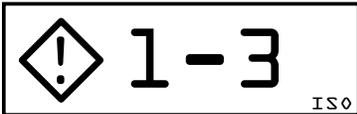
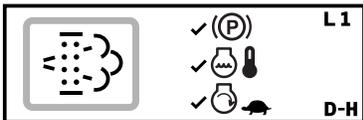
Press and hold the interface button for 5 seconds to display the configuration selection screens and to select a particular setting (page 52).

Status, Maintenance and Error Code Screens

Table 24: Status, Maintenance and Error Code Screens

Screen	Access/Description
Status Screens	
	<p>Coolant Temperature Screen</p> <p>Default screen when no error codes are active.</p> <p>Press and release interface button (Z, Fig. 8) as many times as required to access this screen. Displays coolant temperature in “°F” or “°C”, depending upon units selected in Temperature Units Configuration screen (M).</p>
	<p>Engine RPMs Screen</p> <p>Press and release interface button (Z, Fig. 8) as many times as required to access this screen. Displays engine crankshaft revolutions per minute.</p>
	<p>Battery Voltage Screen</p> <p>Press and release interface button (Z, Fig. 8) as many times as required to access this screen. Displays battery charge in volts.</p>
	<p>Accumulated Service Hours Screen</p> <p>Press and release interface button (Z, Fig. 8) as many times as required to access this screen. Displays accumulated operation time in hours. Time accumulates when engine is running.</p>

Table 24: Status, Maintenance and Error Code Screens

Screen	Access/Description
	<p>Low Fuel Screen Automatically displays when the fuel level is low.</p>
<p>Required Maintenance and Error Code Screens</p>	
	<p>Maintenance Required Screen Displays in the screen rotation along with status screens when scheduled maintenance is required. See page "Maintenance Schedule" on page 123. To dismiss this screen, press and hold the interface button (Z, Fig. 8). This screen will display in rotation when scrolling through the status screens. After stepping through all screens once, the display will freeze on this screen.</p>
	<p>Engine Error Code Screen Displays in the screen rotation along with status screens when engine errors occur. See "Engine Error Codes" on page 172. One error is displayed on a single screen; additional errors are displayed after stepping through all screens once. Error codes are dismissed when the underlying problems are solved.</p>
	<p>Aftertreatment Error Code Screen Displays in the screen rotation along with status screens when DPF emissions errors occur.</p>
	<p>Drive / Valve Error Code Screen Displays in the screen rotation along with status screens when drive / valve system errors occur. See "Drive and Valve Error Codes" on page 185.</p>
	<p>Limp Mode Activated Screen Limp mode allows limited drive function when drive system errors (3-10) occur which disable the drive system for safety reasons. Two limp mode codes can be displayed – "38" and "39". See "Travel Drive Error Condition Operation (Limp Mode)" on page 94.</p>
	<p>Module Communication Error Code Screen Displays in the screen rotation along with status screens when module communication errors occur.</p>
	<p>DPF Stationary Regeneration Request Screen <i>Models RT175 and RT210 with Tier 4 Engines</i> Displays when stationary Diesel Particulate Filter (DPF) regeneration is required. See "Diesel Particulate Filter (DPF) Regeneration Procedures" on page 78.</p>

Controls

Table 24: Status, Maintenance and Error Code Screens

Screen	Access/Description
	<p>DPF Filter Ash Cleaning Required</p> <p><i>Models RT175 and RT210 with Tier 4 Engines</i></p> <p>Displays when Diesel Particulate Filter (DPF) core exchange is required. See “Diesel Particulate Filter (DPF) Regeneration Procedures” on page 78.</p>

NOTE: Error codes remain displayed even if they are no longer active. To determine if an error is still active, press and release the multi-function button several times to refresh the display. If the error is no longer active, the code(s) will not reappear in the screen rotation.

Configuration Screens

Table 25: Configuration Screens

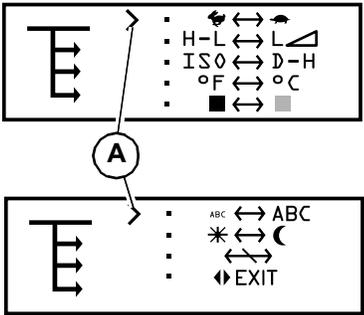
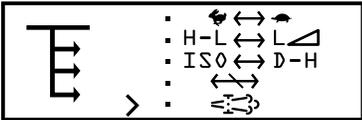
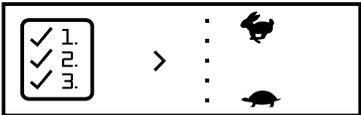
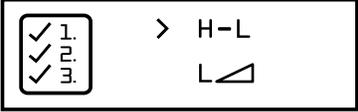
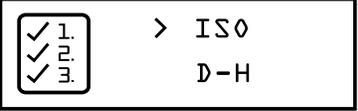
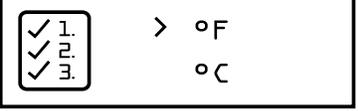
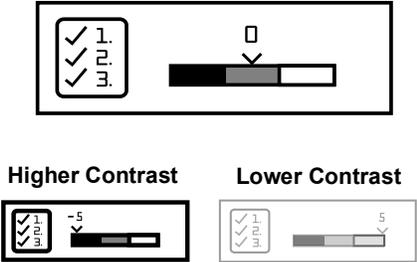
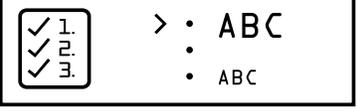
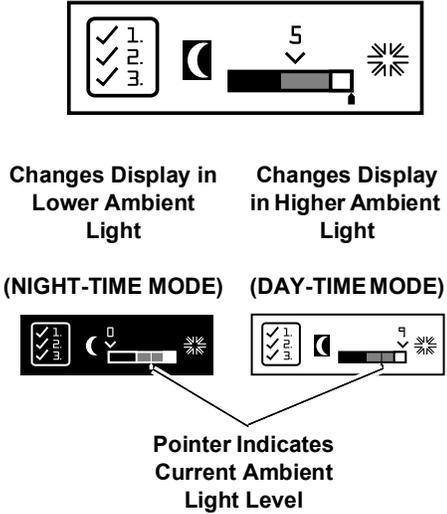
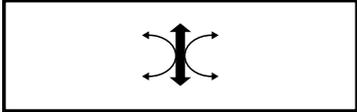
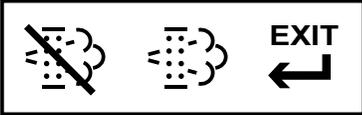
Item	Access/Description
<p>Configuration Selection Screens</p> 	<p>Configuration Selection Screens</p> <p>To access these screens, press and hold interface button (Z, Fig. 8) for 5 seconds. Press and release interface button (Z, Fig. 8) to move selection caret (A) down through the configuration selections. Press and hold interface button for 5 seconds to go to the configuration screen selected by selection caret (A).</p> <p>To exit the configuration selection screens, move selection caret (A) to the “EXIT” option and press and hold interface button for 5 seconds.</p>
	<p>DPF Regeneration Configuration Selection Screen</p> <p><i>Models RT175 and RT210 with Tier 4 Engines</i></p> <p>To access this screen, press and hold interface button (Z, Fig. 8) for 3 seconds. Press and release interface button (Z, Fig. 8) to move selection caret (A) down through the selections to the DPF regeneration configuration selection. Press and hold interface button for 5 seconds to go to the DPF regeneration configuration screen.</p> <p>To exit the configuration selection screen, move selection caret (A) to the “EXIT” option and press and hold interface button for 5 seconds.</p>
<p>Configuration Screens</p> 	<p>Control Sensitivity Configuration Screen</p> <p>To change joystick control sensitivity, press and release interface button (Z, Fig. 8) to scroll through selections and change control sensitivity. With the caret closer to the  symbol, joystick control becomes increasingly aggressive and immediate; with the caret closer to the  symbol, joystick control becomes less aggressive and more relaxed.</p> <p>Control sensitivity configuration changes are saved when exiting this screen. To exit this screen, press and hold interface button for 5 seconds.</p>

Table 25: Configuration Screens

Item	Access/Description
	<p>Travel Speed Limit Configuration Screen (Option)</p> <p>This screen displays only on machines equipped with the speed limit option. Press and release interface button (Z, Fig. 8) to choose between H-L (high/low) or speed limit travel drive modes. See “Travel Speed Range Selection” on page 64 for more information about the travel speed limit option.</p> <p>Vehicle speed limit configuration changes are saved when exiting this screen. To exit this screen, press and hold interface button for 5 seconds.</p>
	<p>Control Joystick ISO/D-H Pattern Selection Screen (Option)</p> <p>This screen displays only on machines equipped with the D-H control pattern option. Press and release interface button (Z, Fig. 8) to choose between ISO or D-H joystick control options. See “Control Joysticks” on page 55 for more information about the ISO and D-H control options.</p> <p>Control joystick pattern configuration changes are saved when exiting this screen. To exit this screen, press and hold interface button for 5 seconds.</p>
	<p>Coolant Temperature °F/°C Units Selection Screen</p> <p>Press and release interface button (Z, Fig. 8) to choose between coolant temperature display options (°F/°C).</p> <p>Coolant temperature units configuration changes are saved when exiting this screen. To exit this screen, press and hold interface button for 5 seconds.</p>
	<p>Display Screen Contrast Configuration Screen</p> <p>Press and release interface button (Z, Fig. 8) to adjust the screen contrast.</p> <p>Screen contrast changes are saved when exiting this screen. To exit this screen, press and hold interface button for 5 seconds.</p>
	<p>Display Screen Font Size Configuration Screen</p> <p>Press and release interface button (Z, Fig. 8) to adjust the font size.</p> <p>Font size changes are saved when exiting this screen. To exit this screen, press and hold interface button for 5 seconds.</p>

Controls

Table 25: Configuration Screens

Item	Access/Description
 <p>Changes Display in Lower Ambient Light</p> <p>Changes Display in Higher Ambient Light</p> <p>(NIGHT-TIME MODE) (DAY-TIME MODE)</p> <p>Pointer Indicates Current Ambient Light Level</p>	<p>Night/Day Display Change Configuration Screen</p> <p>To maximize display visibility, the display changes between a black-on-white display and a white-on-black display, depending upon the intensity of ambient light. The set point where this change occurs can be adjusted using this screen.</p> <p>Press and release interface button (Z, Fig. 8) to adjust the night/day display change set point. When the caret is closer to the ☀ symbol, the display changes in brighter ambient light; when it is closer to the 🌙 symbol, the display changes in lower ambient light.</p> <p>Night/day display configuration changes are saved when exiting this screen. To exit this screen, press and hold interface button for 5 seconds.</p>
	<p>Straight Tracking Adjust Screen</p> <p>This screen sets the drive to track straight in forward and reverse directions.</p> <p>See “Straight Tracking Adjust” on page 59 for more information about the straight tracking adjust feature.</p>
	<p>DPF Regeneration Configuration Screen</p> <p><i>Models RT175 and RT210 with Tier 4 Engines</i></p> <p>This screen:</p> <ul style="list-style-type: none"> • Displays DPF regeneration allow / inhibit status • Allows DPF reset regeneration to be inhibited • Initiates a forced DPF stationary regeneration <p>See “Diesel Particulate Filter (DPF) Regeneration Procedures” on page 78 for more information.</p>

Audible Alerts

The multi-function display screens also emits audible alerts (buzzer) under the following conditions:

Table 26: Audible Alerts

Item	Description
4 Hz alarm – 5 seconds	When ignition is activated.
2 Hz alarm	Engine temperature too high.
	Engine oil pressure too low.
	Hydraulic oil temperature too high
	Low battery / charging fault.

Control Joysticks

The control joystick forward and back, and right to left tilting movements perform the following functions:

- Track drive control
- Lift arm raise/lower and attachment tilt

Buttons and switches on the control joysticks perform the following functions:

- High/low speed mode control
- Lift arm float activation/deactivation
- Hydraglide™ activation/deactivation (optional)
- Horn operation
- Auxiliary hydraulics flow control (momentary and continuous)

Joystick Tilt Function ISO/D-H Control Patterns

Control joystick functions are factory-configured to follow ISO-pattern controls. An optional additional D-H control pattern factory option is available.

Machines equipped with the optional D-H control pattern can switch between ISO and D-H control pattern functionality using the multi-function display control joystick ISO/D-H pattern selection screen.

Activating D-H Control Pattern Option

NOTE: Machines not equipped with the optional D-H control pattern will not display the control joystick ISO/D-H pattern selection screen.

1. Hold down the interface button (Z, Fig. 9) on the multi-function display until the configuration selection screen (Fig. 10) displays.

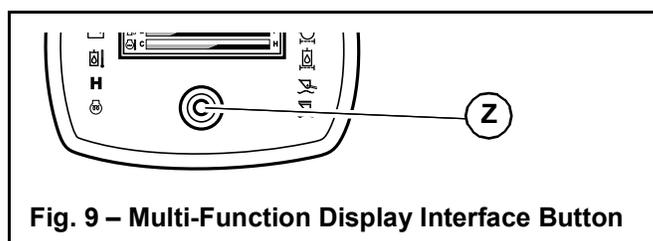


Fig. 9 – Multi-Function Display Interface Button

2. Press and release the interface button until the selection caret points to the “ISO/D-H” selection (Y, Fig. 10). Press and hold the interface button until the ISO/D-H Control Pattern Selection screen (Fig. 11) displays.

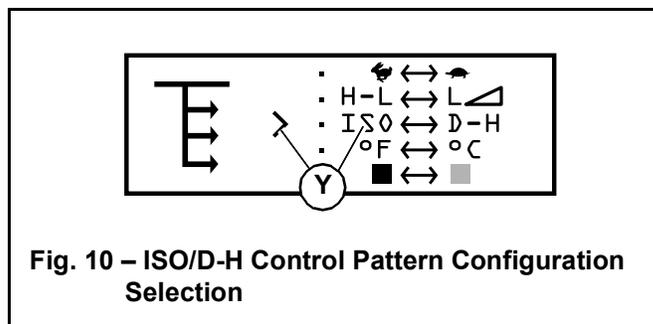
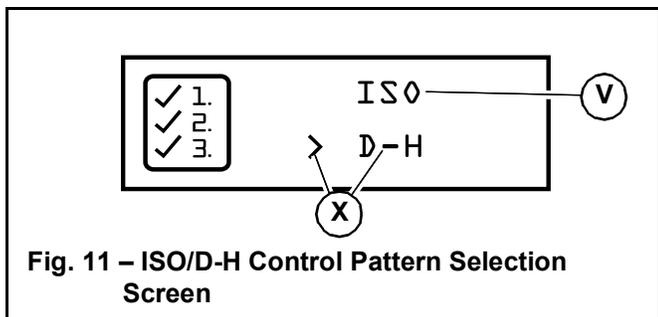


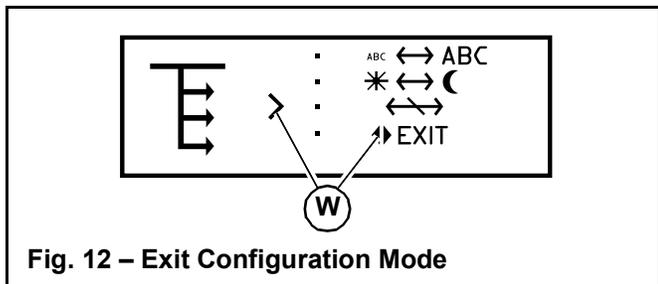
Fig. 10 – ISO/D-H Control Pattern Configuration Selection

Controls

- Press and release the interface button until the selection caret points to the “D-H” selection (X, Fig. 11). Press and hold the interface button until the configuration selection screen (Fig. 12) displays.



- Press and release the interface button until the selection caret points to the “EXIT” selection (W, Fig. 12). Press and hold the interface button until the home status screen displays. The D-H control pattern option is now activated.



Deactivating D-H Control Pattern Option

D-H control pattern option deactivation is identical to activation, with the exception of moving the selection caret to the “ISO” selection (V, Fig. 11).

Left Joystick Functions

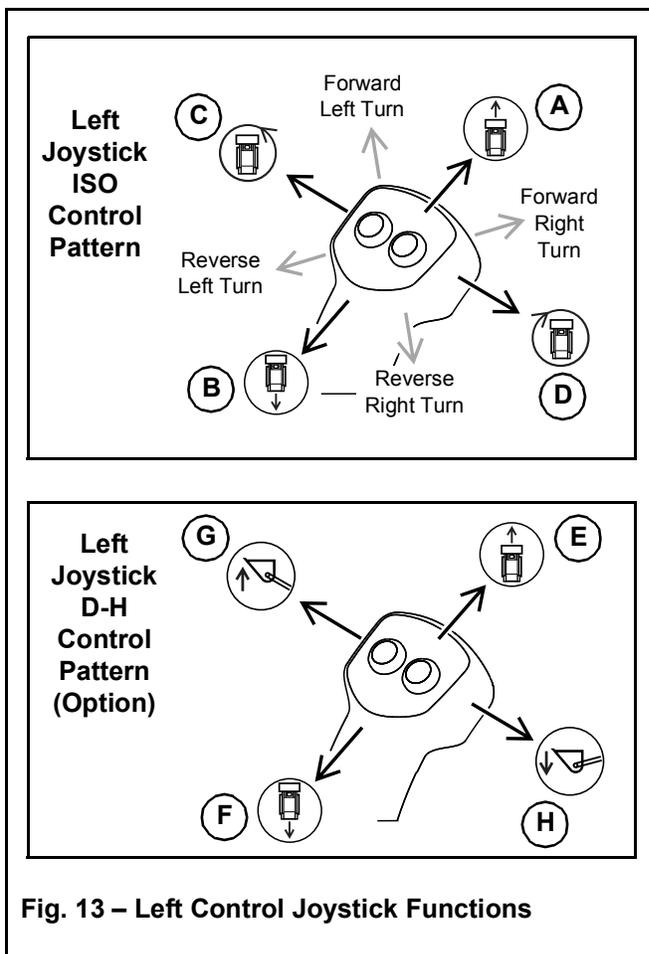


Table 27: Left Control Joystick Functions

	Joystick Direction	Function
ISO Control Pattern		
A	Forward	Track drive – forward
B	Rearward	Track drive – reverse
C	Left	Track drive – left turn ¹
D	Right	Track drive – right turn ¹
D-H Control Pattern (Optional)		
E	Forward	Track drive – left track forward
F	Rearward	Track drive – left track reverse
G	Left	Lift arm – up
H	Right	Lift arm – down

1. Tilting joystick directly left or right results in spin turns; tilting joystick diagonally results in more gradual turns.

Right Joystick Functions

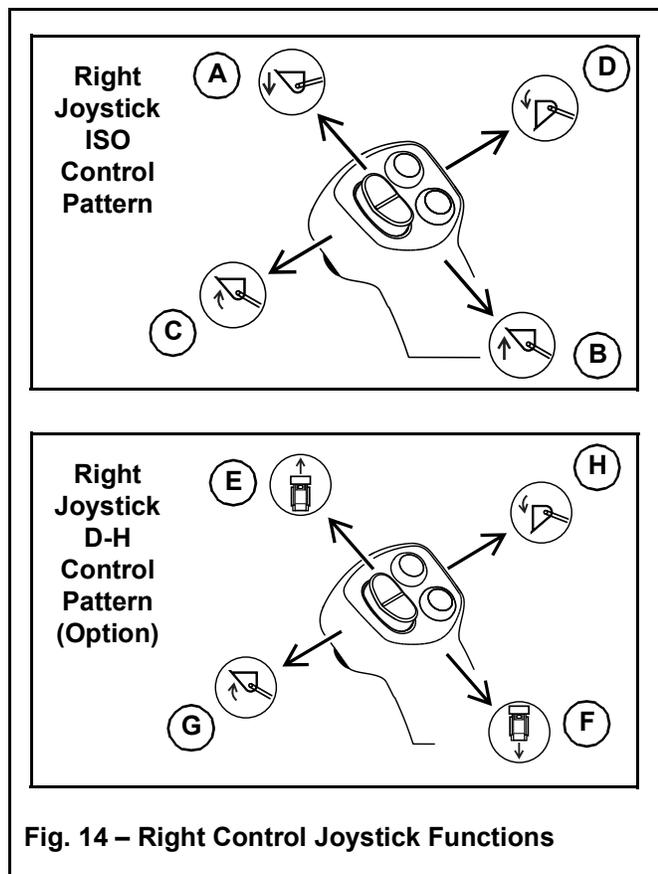


Fig. 14 – Right Control Joystick Functions

Joystick Buttons/Switch Functions

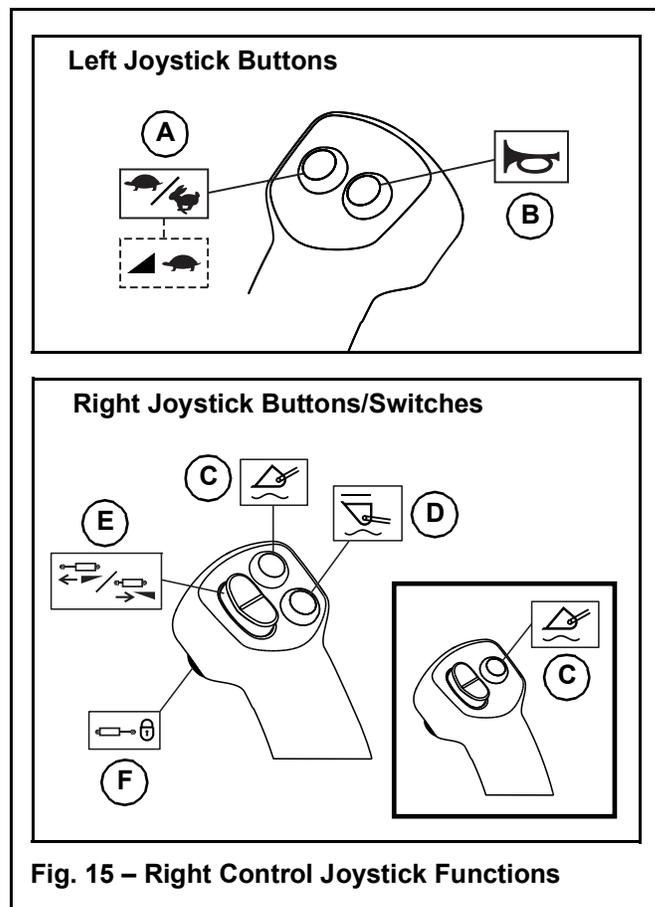


Fig. 15 – Right Control Joystick Functions

Table 28: Right Control Joystick Functions

	Joystick Direction	Function
ISO Control Pattern		
A	Forward	Lift arm – down
B	Rearward	Lift arm – up
C	Left	Attachment tilt – tilt back
D	Right	Attachment tilt – tilt forward
D-H Control Pattern (Optional)		
E	Forward	Track drive – right track forward
F	Rearward	Track drive – right track reverse
G	Left	Attachment tilt – tilt back
H	Right	Attachment tilt – tilt forward

Table 29: Joystick Button Functions

Button	Function
Left Joystick Buttons	
A	High/low drive speed selection (See “Travel Speed Range Selection” and “Travel Speed Limit (Option)” on page 64).
B	Horn
Right Joystick Buttons/Switch	
C	Lift arm float (See “Lift Arm Float” on page 99)
D	Hydraglide™ (See “Hydraglide™ Button (Option)” on page 67 and “Hydraglide™ Ride Control System (Option)” on page 100).
E	Auxiliary hydraulics flow (See “Powering Attachments with Hydraulic Function” on page 106).
F	Auxiliary hydraulics continuous flow lock (See “Auxiliary Hydraulics Operation” on page 107) Auxiliary hydraulics continuous flow will remain locked with the restraint bars in the raised position with the operator seat not occupied.

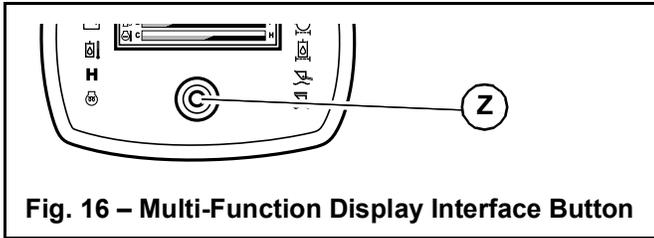
Controls

Joystick Control Sensitivity

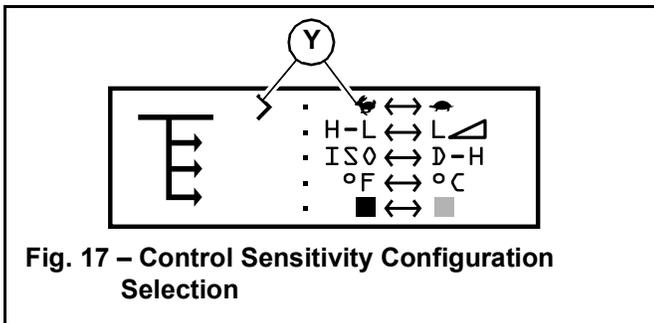
The sensitivity of the ISO drive controls can be configured to be more or less aggressive/immediate. Five levels of control sensitivity are available.

Configuring Control Sensitivity

1. Hold down the interface button (Z, Fig. 16) on the multi-function display until the configuration selection screen (Fig. 17) displays.



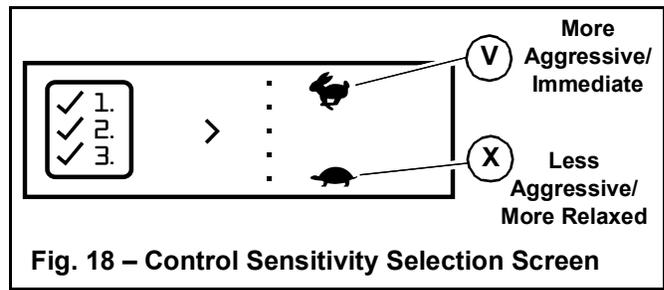
2. Press and release the interface button until the selection caret points to the / control sensitivity selection (Y, Fig. 17). Press and hold the interface button until the Control Sensitivity Selection screen (Fig. 18) displays.



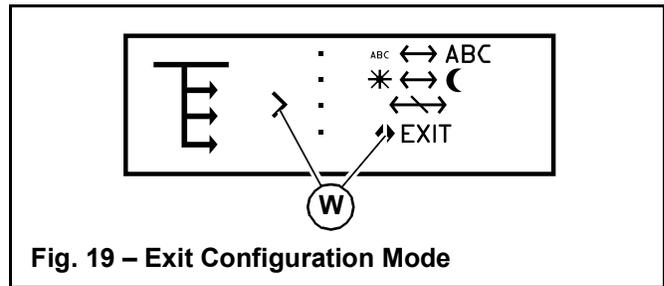
3. Press and release the interface button as required to select the desired level of control sensitivity (Fig. 18). Five levels of control sensitivity are available.

Move the selection caret toward the top of the screen (V []) for more aggressive and immediate control sensitivity; move the selection caret toward the bottom of the screen (X []) for less aggressive and more relaxed control sensitivity.

Press and hold the interface button for 5 seconds to save control sensitivity configuration changes.



4. Press and release the interface button until the selection caret points to the "EXIT" selection (W, Fig. 35).



5. Press and hold the interface button until the home status screen displays. The currently selected control sensitivity is now activated.

Straight Tracking Adjust

The straight tracking adjust feature sets the drive to track straight in forward and reverse directions.

To perform the straight tracking adjust procedure:

1. Move the machine to an open area away from bystanders.



Always move the machine to an open area, away from bystanders, before using the tracking adjust feature. The travel drive must be operated for several seconds in the forward and reverse directions during the tracking adjust procedure. Allow sufficient room away from bystanders, buildings, machinery and other objects.

2. Apply the parking brake.
3. If the controls are set to the option DH control pattern, set the controls to ISO pattern by deactivating the DH control pattern option. See “Deactivating D-H Control Pattern Option” on page 56.

NOTE: *The straight tracking adjust feature can only be set while in ISO mode. Adjustments cannot be made while in DH mode.*

Once straight tracking is adjusted, the setting applies when operating in either ISO or DH modes, and also top speed limit modes.

Additionally, straight tracking adjustment cannot be set while the travel speed limit option is activated. Perform straight tracking adjustment with regular High/Low travel speed activated.

4. Press and hold the interface button (Z, Fig.20) on the display until the configuration selection screen (Fig.21) displays.

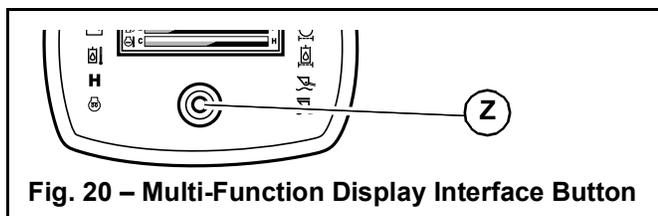


Fig. 20 – Multi-Function Display Interface Button

5. Press and release the interface button until the selection caret points to the straight tracking adjust \leftrightarrow selection (T, Fig. 21).

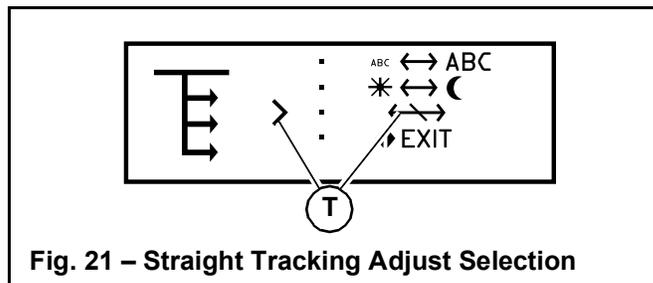


Fig. 21 – Straight Tracking Adjust Selection

6. Press and hold the interface button until the straight tracking adjust screen (U, Fig.22) displays.

NOTE: *Once this symbol is displayed, the tracking adjustment reverts to the original factory setting. The new adjustment will therefore be set relative to this original setting, not relative to where it was set previously.*

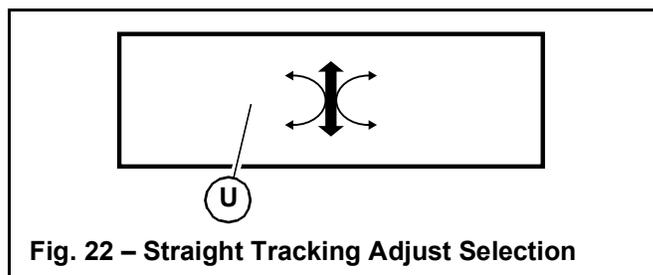


Fig. 22 – Straight Tracking Adjust Selection

7. Release the parking brake. See “Disengage Parking Brake” on page 74.
8. To set forward/reverse straight tracking:

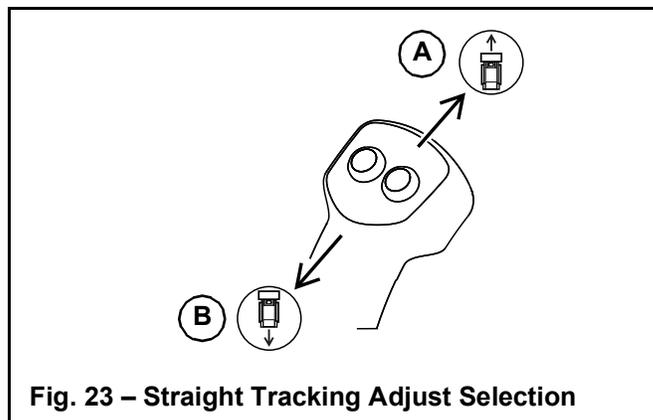


Fig. 23 – Straight Tracking Adjust Selection

Controls

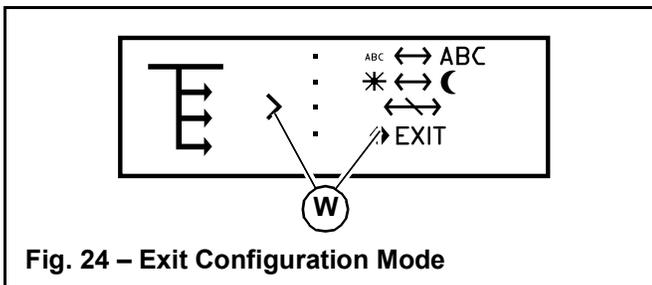
- **Forward direction** – While holding left joystick (A, Fig. 23) fully forward, move the joystick either slightly left or right as required until the machine is tracking straight. With the joystick held in this position, press and hold interface button (Z, Fig.20) until the straight tracking screen (U, Fig.22) is dismissed.

NOTE: The joystick needs to be moved fully forward when adjusting straight tracking or the setting will not be changed.

- **Reverse direction** – While holding the left joystick (B, Fig. 23) fully back, move the joystick either slightly left or right as required until the machine is tracking straight. With the joystick held in this position, press and hold the interface button (Z, Fig.20) until the straight tracking screen (U, Fig.22) is dismissed.

NOTE: The joystick needs to be moved fully back when adjusting straight tracking or the setting will not be changed.

9. Press and release the interface button until the selection caret points to the “EXIT” selection (W, Fig. 24). Press and hold the interface button until the home status screen displays.



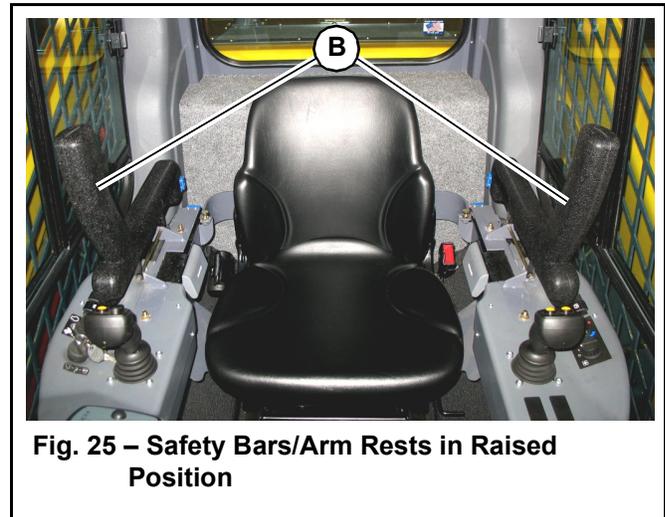
10. Operate the machine and verify that it tracks straight when the left joystick is pushed straight forward or back. Repeat this procedure if necessary.

NOTE: Once straight tracking is adjusted, the setting applies when operating in either ISO or DH modes, and also top speed limit modes.

Parking Brake/Work Hydraulics Lock-out

The parking brake is automatically applied whenever either of the safety bars/arm rests are in the raised position (B, Fig. 25).

NOTE: Raising the safety bars/arm rests also locks out work hydraulic functions.



NOTE: The parking brake is also applied whenever the operator leaves the seat, or if the cab door is opened.

IMPORTANT: The engine cannot be started with the safety bars/arm rests in the raised position, if the operator is not in the operator's seat, or if the cab door is not closed.

Cab Heat and Air Conditioning (Option)

Controls for cab heat and air conditioning are located on the left control panel.

Knob (A, Fig. 26) controls heat/air conditioning temperature. Rotate the knob clockwise for warmer temperature; counter-clockwise for cooler temperature.

Knob (B) controls heat/air conditioning fan speed. Rotate the knob clockwise to increase fan speed; counter-clockwise to decrease fan speed, Rotate the knob all the way counter-clockwise to turn the fan off.

Rocker switch (C) turns the air conditioning compressor on/off. Press the top of switch (C) to turn the compressor on; press the bottom to turn the compressor off.

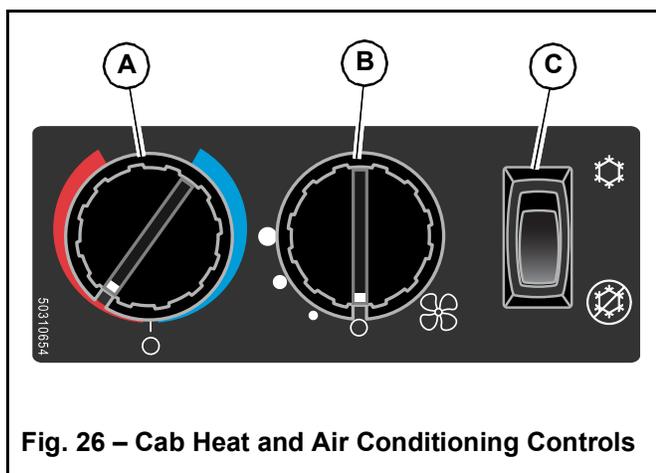


Fig. 26 – Cab Heat and Air Conditioning Controls

Operator's Seat

The operator's seat has adjustments for:

- Forward and back horizontal position (G, Fig. 27).
- Up and down vertical height/weight suspension (E).

WARNING

Never adjust the seat when the machine is in operation. Adjust the seat only when the machine is stopped and the arm rests/safety bars are in the raised position.

After adjustments, make sure the seat adjustment levers are fully engaged before using the machine.

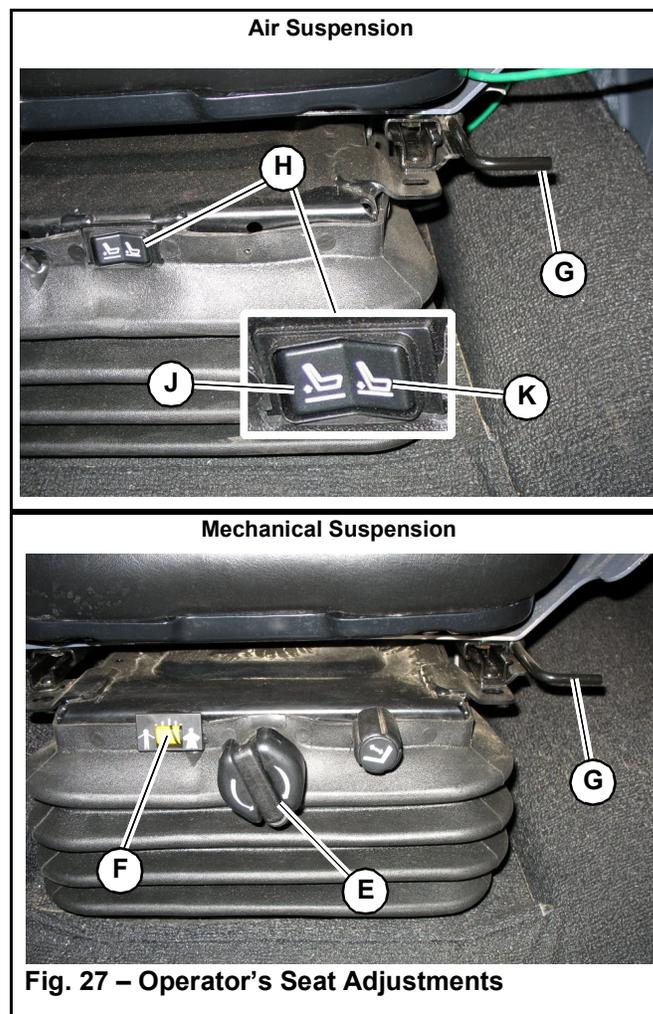


Fig. 27 – Operator's Seat Adjustments

Controls

Seat Forward and Back Horizontal Adjustment

While sitting in the operator's seat, pull up on handle (G, Fig. 27). Move the seat and control lever base forward or back as desired. Release bar (G) when the seat is in the desired position. Make sure the seat is locked in position after adjusting.

Seat Height Vertical Height/Weight Suspension Adjustment

Air Suspension

While sitting in the operator's seat, press the left/right side of toggle switch (H) as necessary to compensate for the drivers weight and preferred seat suspension stiffness. Toggle switch (H) to the left (K) to reduce support; toggle switch to the right (J) to increase support.

Mechanical Suspension

While sitting in the operator's seat, turn knob (E, Fig. 27) as necessary to center the black line on the yellow background in indicator (F).

Seat Belt



ALWAYS fasten the seat belt securely and properly. Never operate the machine without the seat belt fastened around the operator.

Keep the seat belt clean; dirt can impair seat belt operation. Check seat belt condition regularly and have damaged or worn belts immediately repaired by an authorized workshop.

After an accident, the seat belt strap is stretched and must be replaced with a new strap installed by an authorized workshop.

Make sure the seat belt is not twisted when it is fastened, and that it is fastened over the hips and not the stomach.

Fasten the seat belt tightly and securely. Remove hard, edged or fragile objects from your pockets or clothes that might lie between the seat belt and your body.

Fastening/Unfastening the Seat Belt

Fasten the seat belt around your hips and waist and insert tongue (A, Fig. 28) into clasp (B) until it clicks securely in place. Slack in the seat belt should automatically retract into seat belt spool (K).

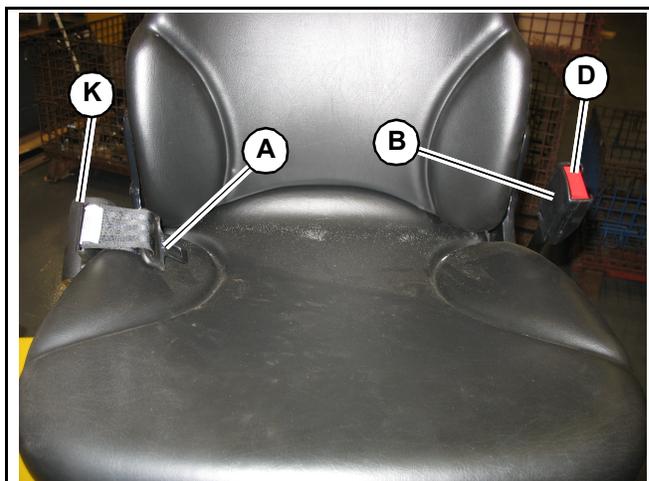


Fig. 28 – Seat Belt



If the seat belt spool does not retract slack in the seat belt, have it serviced immediately. Do not operate the machine until the seat belt is repaired.

Unfasten the seat belt by pressing button (D).

Armrest/Joystick Console Adjustment

The forward/rearward position of the armrests/ joystick consoles can be adjusted.

To adjust armrest/joystick console position, lift slide lock (Z, Fig. 29) and slide armrest/joystick console to the desired position. Release slide lock (Z) to lock the armrest/joystick console in place.

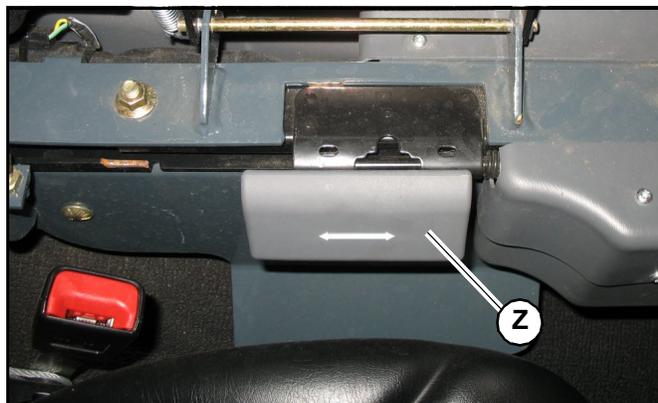


Fig. 29 – Armrest/Joystick Console Adjustment

Throttle Controls

Engine throttle controls engine speed, which determines available power.

Engine throttle is controlled with both a knob (I, Fig. 30) and a pedal (J).

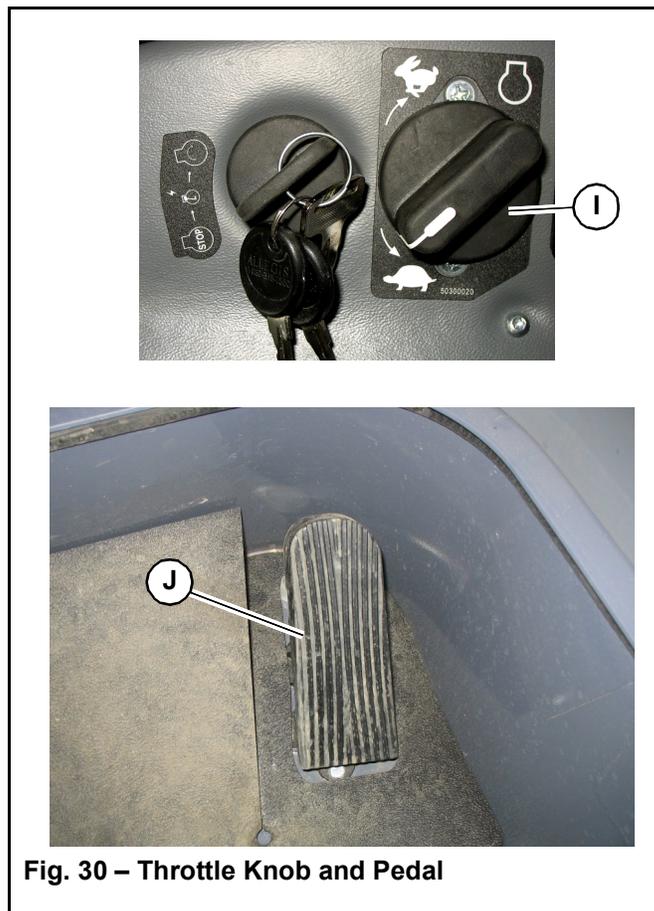


Fig. 30 – Throttle Knob and Pedal

The throttle knob (I) is the primary throttle control. Generally, the throttle is set with the knob to the desired idle/run position. The pedal can then be used to increase engine speed whenever additional power is required. When the pedal is released, the engine returns to the speed set by the throttle knob.

Controls

Travel Controls

Forward, reverse and turning functions are performed using the control joysticks. See “Control Joysticks” on page 55.

Travel Speed Range Selection

The machine has 2 travel speed ranges and one changeable speed limit option.

Pressing the speed range select button (K, Fig. 31) on the left control joystick toggles between the two speed ranges. Indicator (H) is lit when the high-speed travel range is selected; indicator (H) goes out when low-speed range is selected.

NOTE: *Low-speed range is automatically selected when the machine is started.*

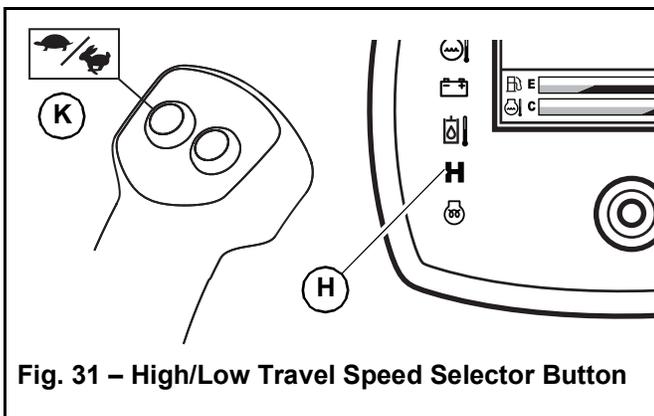


Fig. 31 – High/Low Travel Speed Selector Button

- Low-speed range:
 - Model RT175: 0-8.2 kph (0-5.1 mph).
 - Models RT210/RT250: 0-8.7 kph (0-5.4 mph).
- High-speed range:
 - Model RT175: 0-12.1 kph (0-7.5 mph).
 - Model RT210/RT250: 0-12.7 kph (0-7.9 mph).



WARNING

Reduce speed before shifting from high to low travel speed. Down-shifting from high- to low-speed drive while traveling at high speed may cause the machine to tip and can cause injury, loss of control and damage to the machine.

NOTE: *Use the low-speed range for loading, unloading, and operations requiring precise speed control. Use the high-speed range for distance traveling.*

Travel Speed Limit (Option)



Travel speed limiting allows for fine control over slower travel speeds.

When the travel speed limit option is activated, ten levels of speed limiting can be selected using the high/low speed selector button (K, Fig. 36).

NOTE: *See “Travel Speed Limit Option Operation” on page 66 for details about using the travel speed limit option when it is activated.*

Activating Travel Speed Limit Option

NOTE: *Machines not equipped with the travel speed limit option will not display the travel speed limit selection screen.*

1. Hold down the interface button (Z, Fig. 32) on the multi-function display until the configuration selection screen (Fig. 33) displays.

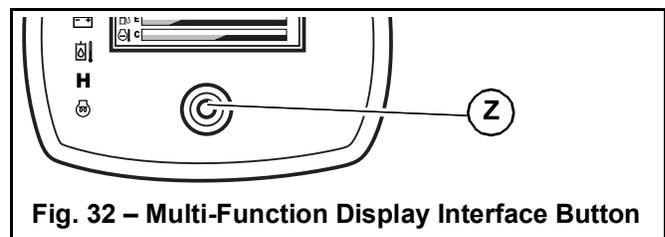
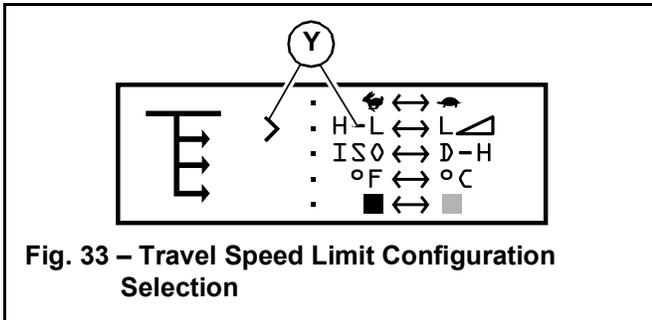


Fig. 32 – Multi-Function Display Interface Button

- Press and release the interface button until the selection caret points to the travel speed limit configuration selection (Y, Fig. 33). Press and hold the interface button until the Travel Speed Limit Selection screen (Fig. 34) displays.

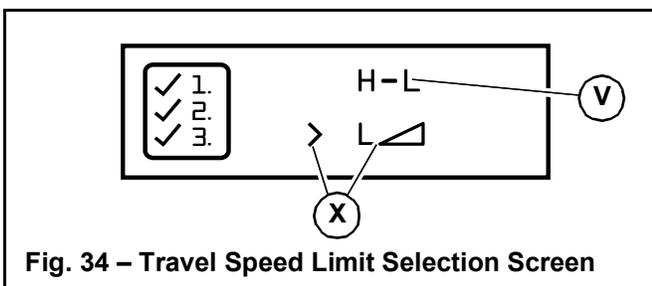


Deactivating Travel Speed Limit Option

The travel speed limit option is deactivated in two ways:

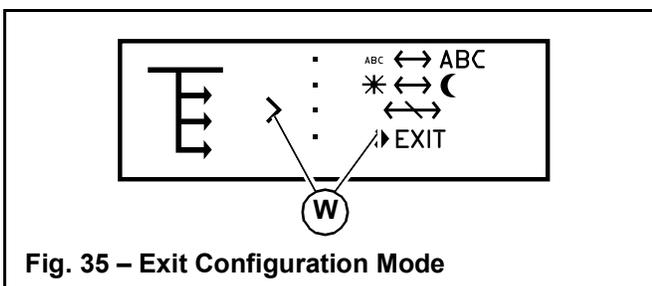
- Shut down the engine.
- Repeat travel speed limit activation, with the exception of moving the selection caret to the “H-L” selection (V, Fig. 34).

- Press and release the interface button until the selection caret points to the travel speed limit selection (X, Fig. 34). Press and hold the interface button until the configuration selection screen (Fig. 35) displays.



- Press and release the interface button until the selection caret points to the “EXIT” selection (W, Fig. 35). Press and hold the interface button until the home status screen displays. The travel speed limit option is now activated.

NOTE: *The machine reverts to “H-L” travel mode when the engine is shut down.*



Controls

Travel Speed Limit Option Operation



When the travel speed limit option is activated, the currently enabled speed limit range is displayed in the top right corner of the multi-function display screen (L, Fig. 36).

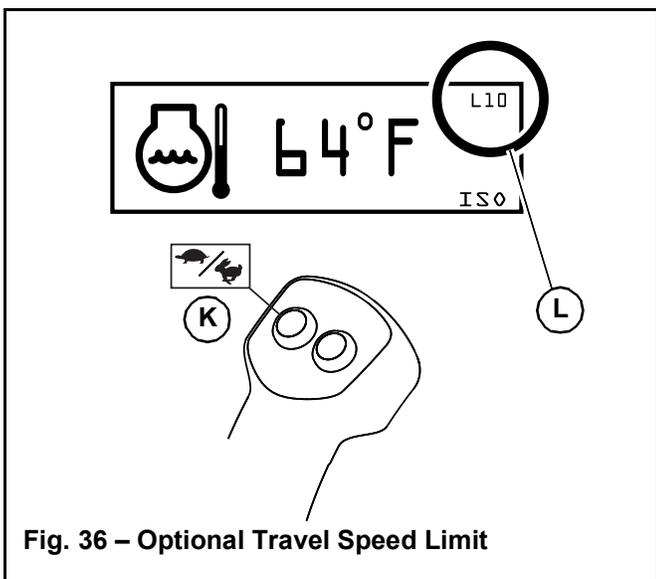


Fig. 36 – Optional Travel Speed Limit

Pressing the speed range selection button when the travel speed limit option is activated changes the speed limit range. Ten speed limit ranges are available and limit the travel speed to the following ranges when selected:

Table 30: Travel Speed Limit Option Settings

Speed Limit Range (L)	% of Available Speed Range:
L10	Not limited
L9	90%
L8	80%
L7	70%
L6	60%
L5	50%
L4	40%
L3	30%
L2	20%
L1	10%

Lift Arm Float Button



Make sure the bucket is lowered to the ground before activating the lift arm float. Activating float with an attachment raised will cause it to fall, which can cause severe injury or death.

Lift arm float is activated by lowering the attachment to the ground and using button (A, Fig. 37) on the right joystick. Press button (A) to activate float; press and hold button (A) for 5 seconds to engage continuous float activation. Press button (A) and quickly release to deactivate float.

NOTE: Indicator  on the multi-function display is lit whenever float is activated.

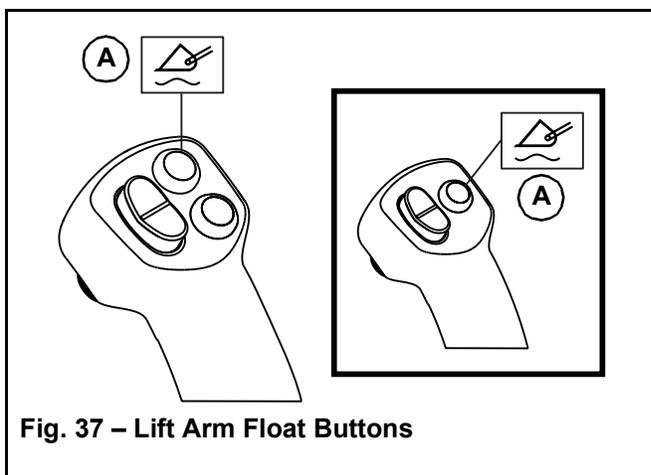


Fig. 37 – Lift Arm Float Buttons

For lift arm float operation information see “Lift Arm Float” on page 99.

Hydraglide™ Button (Option)

Hydraglide™ cushions lift arm loads during transport. It provides a smoother ride over uneven surfaces.

IMPORTANT: *Hydraglide™ is automatically deactivated when the machine is shut off.*

On the right joystick, press switch (H, Fig. 38) to toggle Hydraglide™ on/off.

NOTE: *Indicator  on the multi-function display is lit whenever Hydraglide™ is activated.*

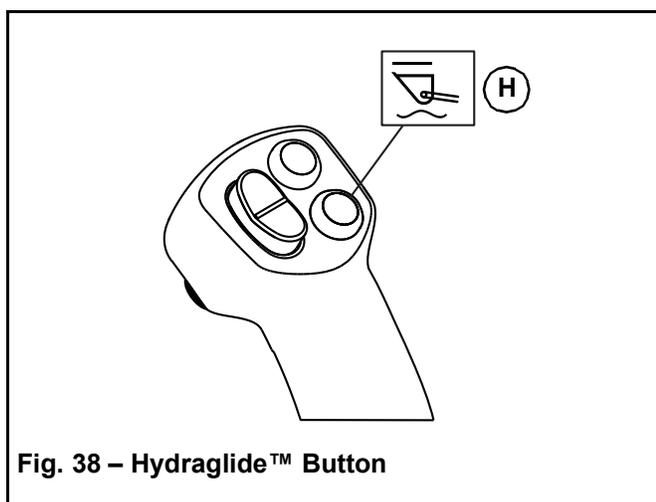


Fig. 38 – Hydraglide™ Button

For Hydraglide™ operation information see “Hydraglide™ Ride Control System (Option)” on page 100.

Work Lights

The switches for the work lights are located on the right console.

Work Lights



Switch off the work lights when traveling on public roads. Work lights can dazzle motorists and cause accidents.

The front and back work lights operate using the same 3-position switch (Y, Fig. 39).

Set switch (Y) to the middle position (V) to turn on the front work lights.

Set switch (Y) to the top (Z) position to turn both the front and back work lights on.

Set switch (Y) to the bottom (X) position to turn the work lights off.

NOTE: *Indicator (W) is on when the works lights are activated.*

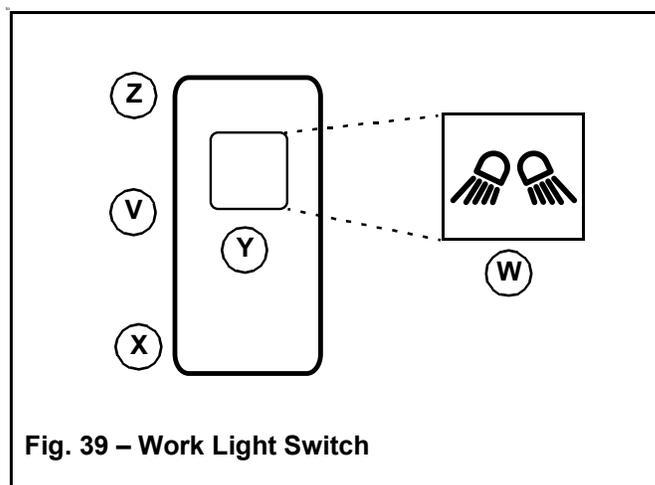


Fig. 39 – Work Light Switch

Controls

Battery Disconnect Switch (Option)



Fig. 40 – Battery Disconnect Switch

Before the engine can be started, the battery disconnect switch must be in the “on” position. The battery disconnect switch (A, Fig. 40) is located inside the storage box at the back left corner of the machine.

Open the storage box using key (D) supplied with the ignition key.

To disconnect the battery from the electrical system and disable all electrical functions: Turn the switch counter-clockwise to the “OFF” position.

To connect the battery to the electrical system and enable all electrical functions: Turn the switch clockwise to the “ON” position.

Windshield Wipers/Washer

Wiper/Washer Control

Press bottom (A, Fig. 41) of wiper switch (C) to activate the wipers. Press and release top (B) of wiper switch (C) to turn the wipers off.

NOTE: Indicator (D) is on when the wipers are activated.

Push and hold top (B) of wiper switch (C) to activate the washer spray. Release the button to stop the spray.

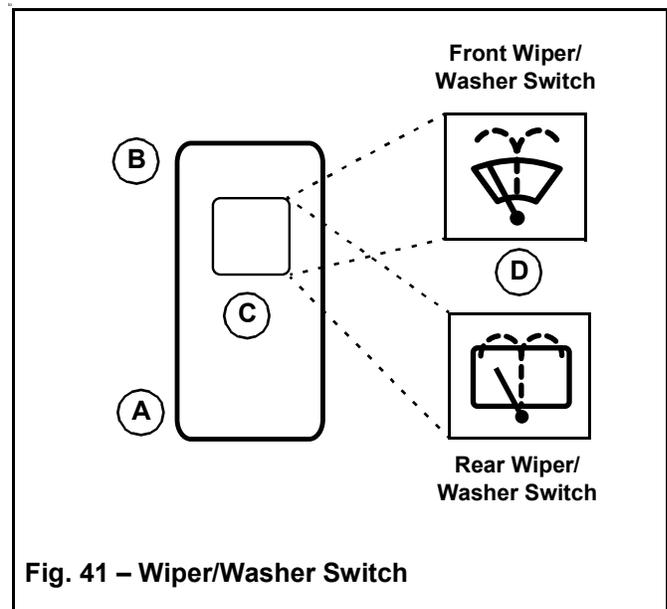


Fig. 41 – Wiper/Washer Switch

Washer Fluid Reservoir

See “Windshield Washer Reservoir” on page 161 for windshield washer reservoir location and filling information.

Operation



WARNING

Read and understand this entire manual. Follow warnings and instructions for operation and maintenance. Failure to follow instructions can result in injury or death.

Read and understand all safety decals before operating the machine. DO NOT operate the machine unless all factory-installed guards and shields are in place.

Be sure you are familiar with all safety devices and controls before operating the machine.

Know how to stop the machine before starting.

Use only Manitou-approved accessories or referral attachments. Manitou Group cannot be responsible for safety if the machine is used with non-approved accessories or attachments.

Check for correct function after adjustments or maintenance.

Operational Checks

Pre-Start Checks

Complete these checks before starting the engine and using the machine. Repair any problems before using the machine.

Table 31: Pre-Start Checks

Check	Refer To:
Fuel tank filled?	"Adding Fuel" on page 135
Engine oil level correct?	"Checking Engine Oil Level" on page 127
Hydraulic system oil level correct?	"Checking Hydraulic Oil Level" on page 138
Engine coolant level correct?	"Checking Coolant Level" on page 131

Table 31: Pre-Start Checks

Check	Refer To:
Windshield washer reservoir filled?	"Windshield Washer Reservoir" on page 161
Grease fittings properly lubricated?	"General Lubrication" on page 147
V-belt condition good/tension adjustment correct?	"Checking and Adjusting Belt Tension" on page 133
Track condition good?	
Lights, signals, indicators, warning lights, indicators and horn operating properly?	"Work Lights" on page 67
Windows, lights and steps clean?	
Attachment securely fastened to hitch?	"Connecting Attachments" on page 104
Overall machine condition (including attachments) for bends, cracks, broken or missing parts, etc.	
Engine cover securely closed and latched?	"Engine Access" on page 126
Rags, tools, debris and other loose objects removed? (check especially after maintenance)	
Approved warning triangle, hazard warning light and first aid kit in the machine?	If required by local regulations
Seat position correctly adjusted?	"Seat and Armrest/ Joystick Console Adjustment" on page 73
Armrests/joystick consoles correctly adjusted?	"Armrest/Joystick Console Adjustment" on page 63
Seat belt fastened?	"Seat Belt" on page 73
Parking brake applied?	"Parking Brake" on page 74

Operation

Checks During Operation

Complete these checks after starting the engine and during operation:

Table 32: Checks During Operation

Check	Refer To:
Always after Starting the Engine / During Operation	
Engine oil pressure and charge indicator lights not on?	"Multi-Function Display" on page 48
Park brake operating properly?	"Travel Drive Operation" on page 88
Coolant temperature within specification?	"Multi-Function Display" on page 48
Track drive/steering operating properly?	"Travel Drive Operation" on page 88
Engine exhaust excessively smoky?	
Anyone hazardingly close to the machine?	
Visually check if automatic track tensioning is operating correctly.	
Hydraulic functions sluggish or too sensitive?	Adjust control function sensitivity according to "Joystick Control Sensitivity" on page 58
Travel drive operation sluggish or too fast?	If equipped, adjust travel speed limit according to "Travel Speed Limit (Option)" on page 64
When Driving on Public Roads	
Attachments in transport position?	"Attachment Transport Position" on page 96
Machine work hydraulics locked-out?	"Parking Brake/Work Hydraulics Lock-out" on page 60

Parking Checks

Complete these checks when parking the machine:

Table 33: Parking Checks

Check	Refer To:
Always when Parking	
Mandatory Safety Shutdown Procedure performed?	"Mandatory Safety Shutdown Procedure" on page 20
Attachments lowered to the ground?	
Parking brake applied?	"Parking Brake/Work Hydraulics Lock-out" on page 60
Machine cab locked (especially if the machine will not be supervised).	
When Parking on Public Sites	
Machine adequately secure/cab locked?	

Before Operation

Cab Entry and Exit

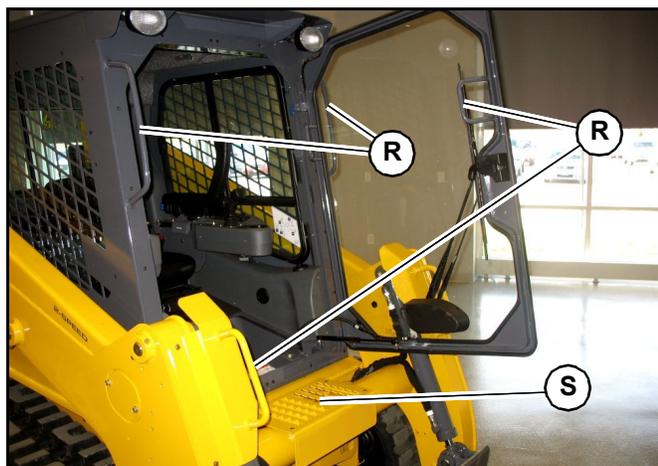


Fig. 42 – Cab Entry/Exit Handles/Steps



WARNING

Always perform the “Mandatory Safety Shutdown Procedure” on page 20 before exiting the machine.

Use only step (S, Fig. 42) and handles (R) on the machine when entering/exiting the cab. Keep the steps and the handles clean to ensure a secure hold at all times. Never use the control joysticks as hand holds. Remove dirt (oil, grease, earth, snow and ice) from handles (R), steps (S) and your shoes before entering the cab.

Always face the machine when entering/exiting.

When entering/exiting the cab, open the door fully to the locked position and check that it does not move (machines equipped with cab door).

Do not jump on or off the machine. Never climb onto or exit a moving machine.

Opening/Closing the Cab Door

Operate the door latch outside the cab using button (Z, Fig. 43) on the exterior door handle.



Fig. 43 – Cab Exterior Door Handle

Lock/unlock the door using the ignition key in the key slot in button (Z).

Operate the door latch inside the cab using lever (Y, Fig. 44) located along the interior door frame.

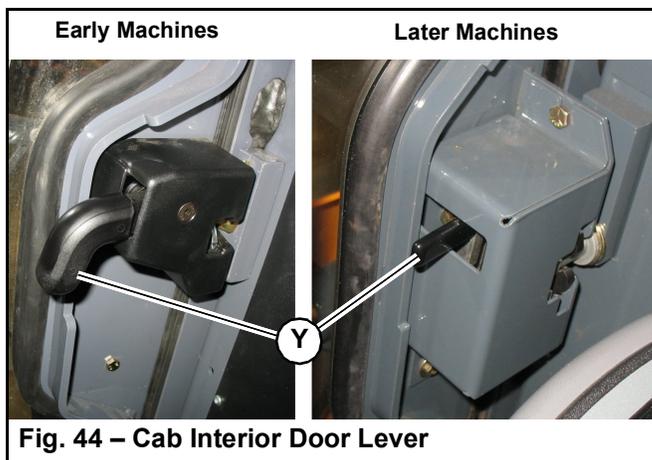


Fig. 44 – Cab Interior Door Lever

Operation

Cab Door Emergency Exit

Later machine cab doors can be removed from inside the cab to allow emergency exit.

1. Remove the locking clip (W, Fig. 45) from the door strut at the strut bracket. Disconnect the door strut from the bracket.
2. Pull cable tie (C) out of the door gusset.
3. Open the door as far as possible. Wiggle and lift the door off the hinges. Set the door aside in a stable position and exit the machine.



Fig. 45 – Door Strut

Cab Door Removal

If the cab door is removed, the jumper wire inside the left door pillar must be repositioned or the machine will not operate.

1. Unplug door switch wire connector (B, Fig. 46) from “Door Switch” wire connector (D).
2. Transfer jumper (J) from “Wiper Interlock” wire connector (E), to “Door Switch” wire connector (D).

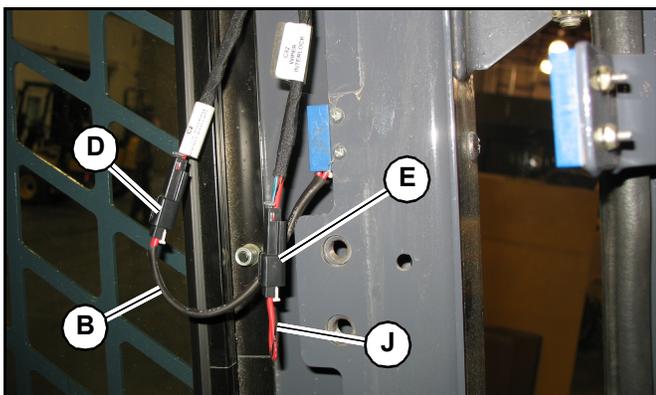


Fig. 46 – Door Switch Connection

Fold-Up Door (Option)

Opening the Fold-Up Door from the Outside:

- a. Unlock the door, if necessary.
- b. Push in the two buttons (A, Fig. 47) located on the outside of the lower door panel.

NOTE: Use the tabs located under the buttons for extra leverage.

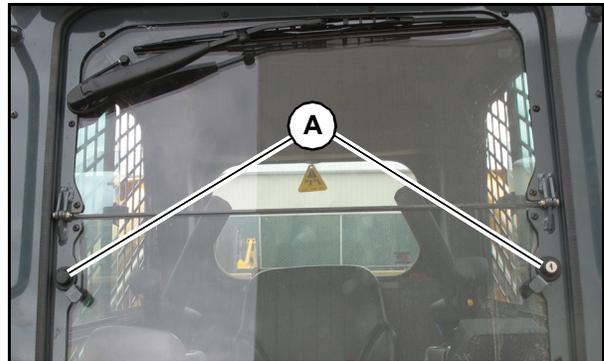


Fig. 47 – Opening the Door

- c. Pull up on the handle located at the bottom of the door.
- d. Push the door up to the ceiling of the cab until it latches into place.

Closing the Fold-Up Door from the Outside:

- a. Using small handles (B, Fig. 48), located on the underside of the door, pull the handles out and down sharply.
- b. Continue to pull down until reaching the bottom of the door frame, then use grab handle (C, Fig. 48) to push the door against the door frame until it latches.

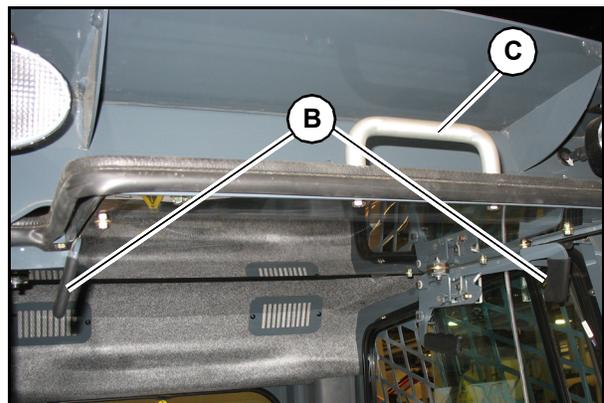


Fig. 48 – Closing the Door From the Outside

Closing the Door from the Inside:

- With the arm rests down, pull the door down and inward using large handles (D, Fig. 49) on the fold-up door.
- Continue to pull the door down until it latches against the cab.



Fig. 49 – Closing the Door from the Inside

Opening the Door from the Inside:

- Pull the two smaller handles (B, Fig. 48) on the inside of the door inward and then lift up.
- Push the door up to the ceiling until it latches.

Seat and Armrest/Joystick Console Adjustment

Adjust the operator's seat according to "Operator's Seat" on page 61.

Adjust the armrest/joystick position according to "Armrest/Joystick Console Adjustment" on page 63.

WARNING

Never adjust the seat and/or the armrest/joystick consoles when the machine is in operation. Adjust the seat and/or the armrest/joystick consoles only when the machine is stopped and the parking brake is applied.

All controls must be within easy reach. The operator must be able to move the throttle pedal and the control joysticks through the complete range of motion.

After adjustments, make sure levers for the seat and/or the armrest/joystick console adjustments are fully engaged before using the machine.

Seat Belt

Fasten the seat belt around your hips and waist and insert tongue (A, Fig. 50) into clasp (B) until it clicks securely in place. Slack in the seat belt should automatically retract into seat belt spool (K).

WARNING

Never operate the machine without the seat belt fastened. Repair or replace any damaged seat belt and lock parts before operation.

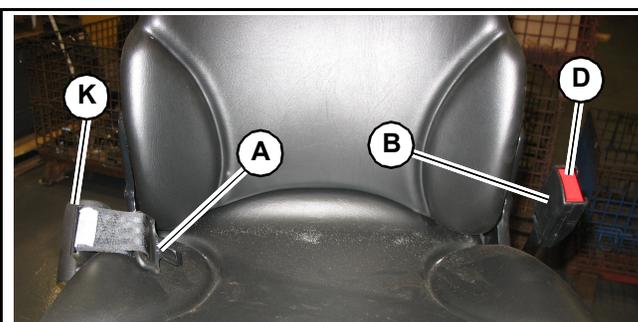


Fig. 50 – Seat Belt

WARNING

If the seat belt spool does not retract the slack in the seat belt, have it serviced immediately. Do not operate the machine if the seat belt is not fastened and working properly.

NOTE: Unfasten the seatbelt by pressing button (C).

Operation

Parking Brake

The parking is automatically applied whenever either of the safety bars/arm rests are in the raised position (B, Fig. 51), the operator leaves the seat or the cab front door is opened.

Before starting the engine, sit in the operator's seat and lower the safety bars/arm rests. On machines equipped with a cab, close the door.

NOTE: Raising the safety bars/arm rests, leaving the operator's seat or opening the cab door also locks out work hydraulic functions, with the exception of standard auxiliary hydraulics continuous flow.

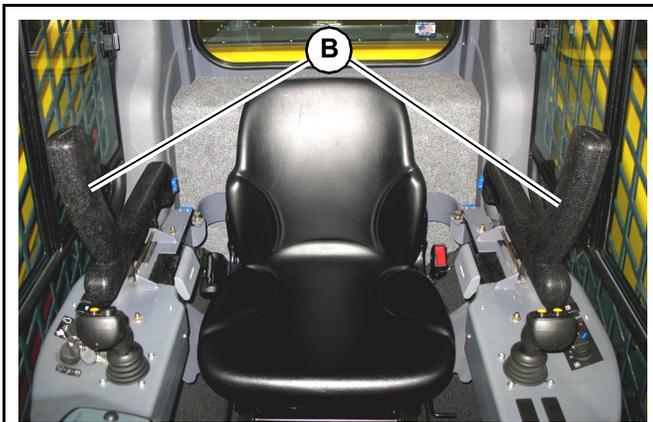


Fig. 51 – Safety Bars/Arm Rests in Raised Position

IMPORTANT: The engine cannot be started if the safety bars/arm rests are in the raised position, the cab door is open or the operator is not in the seat.

Disengage Parking Brake

1. Sit in the operator's seat and fasten the seat belt.
2. Close the cab door, if equipped.
3. Lower the safety bars/arm rests.
4. Start the engine.

NOTE: If the engine does not start due to failure to perform any of steps 1-3, the error code "0" is displayed on the multi-function display.

5. Press and hold the top of the parking brake switch (C, Fig. 52) for several seconds until the indicator lights in the switch and on the multi-function display go out.

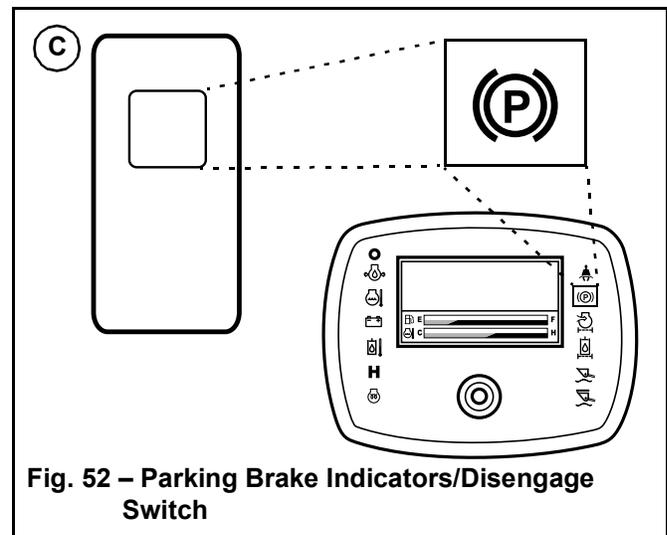


Fig. 52 – Parking Brake Indicators/Disengage Switch

Starting the Engine

NOTE: *The machine cannot be push- or tow-started. Attempting to push/tow start the machine may damage the drive system.*

1. Complete the “Pre-Start Checks” on page 69.
2. Sit in the operator’s seat and adjust the seat as required.

CAUTION

All controls must be within easy reach. The operator must be able to move the throttle pedal and the control joysticks through the complete range of motion.

3. Fasten the seat belt.

WARNING

Always fasten the seat belt before operating the machine. Repair or replace any damaged seat belt and lock parts before operation.

4. Close the swing-out cab door, if equipped.
5. Lower both arm rests/safety bars.

IMPORTANT: *The arm rests/safety bars must be lowered and the swing-out cab door must be closed before the engine can be started. An engine error code (0) will display on the multi-function display if the ignition is switched to the start position when the arm rests/safety bars are in the raised position, the operator’s seat is not occupied or the cab door is not closed.*

6. Insert the ignition key into the ignition switch (T, Fig. 53) and turn the key clockwise to the first detent. Wait for the multi-purpose display to initialize completely. Indicators on the multi-function display should light up; a beeping tone will sound for a few moments as a reminder to fasten the seat belt. The battery voltage and pre-heat indicators might stay lit for 3-30 seconds.

NOTE: *The pre-heat indicator may stay on for longer periods in colder ambient temperatures.*

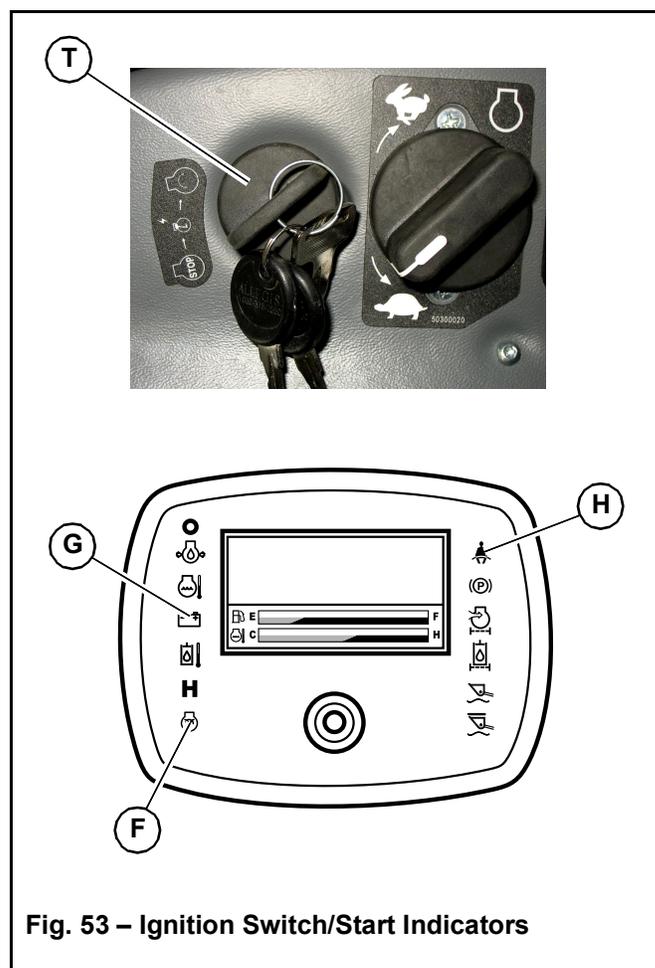


Fig. 53 – Ignition Switch/Start Indicators

NOTE: *When the key is turned clockwise to the first detent, seat belt indicator (H) activates and a tone sounds for 5 seconds as a reminder to fasten the seat belt.*

7. When the pre-heat indicator light (F) goes out, Turn the ignition key clockwise until the starter activates. Release the key when the engine starts.
8. If the engine does not start after 15 seconds, turn the ignition key all the way counter-clockwise, wait 1 minute and repeat steps 6-8. If the engine does not start after several attempts, see “Engine Troubleshooting” on page 165.
9. Disengage parking brake according to “Disengage Parking Brake” on page 74.

IMPORTANT: *The lift arm and drive hydraulics are inactivated if the parking brake is engaged.*

Operation

Cold-Starting

If operating in temperatures below 32°F (0°C), the following are recommended:

- Replace the engine oil with the proper viscosity oil according to the engine operator's manual.
- Make sure the battery is fully charged.
- Install an optional block heater on the engine. A block heater is recommended for starting in temperatures below 14°F (-10°C). Contact your dealer for engine heater options.

NOTE: *In ambient temperatures below -10° C (14° F), an engine block heater is recommended to reduce starter load and aid engine warm up. Starting the machine at these temperatures without a block heater will result in multiple glow/crank cycles or possible extended cranking time approaching 20 seconds.*

After Starting

Check that charge (G, Fig. 53) indicator goes out after the engine starts.

IMPORTANT: *If the charge and/or the engine oil pressure indicators do not go out when the engine is running, shut down the engine immediately and correct the problem. Damage to the engine may result if engine is run and the problem is not corrected.*

IMPORTANT: *Do not run a cold engine at full throttle when starting. Stressing a cold engine can damage the engine. Perform the following warm up procedure before using the machine after starting.*

IMPORTANT: *On model RT210 with serial numbers 921001 and up, the maximum engine speed during startup is limited to 1500 rpm if the ambient temperature is below 15°F (-10°C). This limit remains for approximately 10 seconds or less after startup. Advancing the throttle during this 10 second time frame requires throttling the engine back to below 1500 rpm to disengage the 1500 rpm limit.*

Warm Up



Operating the work hydraulics before the hydraulics are warmed up is dangerous, because response will be slow and the machine might move in unexpected ways. Additionally, operating the machine before proper warm-up can also damage the machine. Be sure to sufficiently warm up the machine before starting work.

IMPORTANT: *Do not operate the control joysticks suddenly until the hydraulic oil has reached operating temperature.*

1. After starting, allow the engine to run at low idle for a minimum of 5 minutes with no load (no drive, lift, tilt or auxiliary hydraulic functions).

NOTE: *On models RT175 and RT210 with Tier 4 engines, low engine idle speed is increased to 1100 rpm until engine reaches operating temperature.*

2. Run the engine at 1800 rpm with no load for 5 minutes.
3. Raise the lift arm so the attachment is off the ground.
4. Extend and retract each of the cylinders several times with no load.
5. Travel slowly forward and backward several times.
6. Additionally, in cold weather, tilt the attachment all the way forward and keep it there for 20-25 seconds. Repeat this step until the attachment tilt speed is normal.

NOTE: *Engine speed may be limited during a cold start and/or during a travel drive error condition. See “Travel Drive Error Condition Operation (Limp Mode)” on page 94.*

Run-In Period

The performance and service life of the machine is heavily dependent on using the machine carefully during its first 100 operating hours.

- Do not operate machine at the maximum rated operating capacity.
- Do not run the engine at a high speed for extended periods of time.
- Increase the load gradually while varying the engine speed.
- Follow the maintenance schedule. See “Maintenance Schedule” on page 123.

Stopping the Engine

Perform the “Mandatory Safety Shutdown Procedure” on page 20.

IMPORTANT: *Do not stop the engine at full throttle. Damage to the engine can result. Allow the engine to idle for approximately 2 minutes before shutting it off.*

Engine Stalling



If the engine should stall for any reason during operation, always turn the ignition key all the way counter-clockwise to the “OFF” position before re-starting the engine according to “Starting the Engine” on page 75.

Diesel Particulate Filter (DPF) Regeneration Procedures

Models RT175 and RT210 with Tier 4 Engines

The Diesel Particulate Filter (DPF) treats exhaust emissions in compliance with Tier 4 emission standards. The DPF filter relies on high exhaust temperatures. Periodic DPF maintenance (regeneration) is required, dependent upon machine operation load / temperature.

IMPORTANT: *Machines operated primarily at high loads and operating temperatures require less frequent DPF maintenance. Extended periods of engine idling rapidly increases DPF soot levels, requiring more frequent regeneration operations.*

There are 4 modes of DPF regeneration:

- **Passive / Assist Regeneration:** Occurs automatically without operator input. Passive/assist regeneration does not effect machine operation.
- **Reset Regeneration:** Occurs automatically, but can be inhibited by the operator. Increases exhaust gas temperatures. Reset regeneration occurs approximately every 100 hours of operation. See “Reset Regeneration” on page 79.

NOTE: *Reset regeneration effectiveness is improved if the machine is operated at mid- to high-throttle settings while this mode is in progress.*

- **Stationary Regeneration:** Requires operator action to initiate and takes approximately 25-30 minutes to complete. See “Stationary Regeneration” on page 79.
- **Recovery Regeneration:** Requires operator action to initiate and takes approximately 25-240 minutes to complete. See “Recovery Regeneration” on page 84.

IMPORTANT: *The machine cannot be operated and must be parked in a well-ventilated area away from flammable materials when stationary or recovery regeneration is in progress.*

IMPORTANT: The machine cannot be operated and must be parked in a well-ventilated area away from flammable materials when stationary or recovery regeneration is in progress.

⚠ WARNING

There is a possibility of carbon monoxide poisoning if stationary regeneration occurs in an enclosed space. Always perform stationary regeneration in a well-ventilated area.

⚠ WARNING

During regeneration, there will be high exhaust gas temperatures, even at low load. Stay clear of the DPF during regeneration.

Reset Regeneration

Reset regeneration occurs automatically (unless inhibited) approximately every 100 hours of operation.

NOTE: Reset regeneration effectiveness is improved if the machine is operated at mid- to high-throttle settings while regeneration is in progress.

During reset regeneration, exhaust gas temperature warning icon (R, Fig. 54) is displayed at the right edge of all status screens.

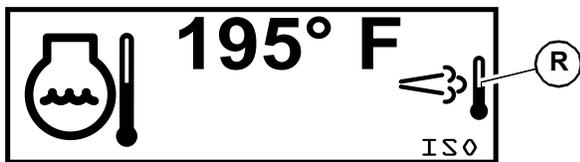


Fig. 54 – DPF Reset Regeneration Icon

NOTE: Reset regeneration can be prevented from occurring. See “Regeneration Inhibit” on page 82.

When DPF regeneration is inhibited, DPF regeneration icon (J, Fig. 55) is displayed at the bottom of all status screens.

If reset regeneration attempts to start but DPF regeneration is inhibited, a flashing DPF regeneration request icon (L) is displayed.

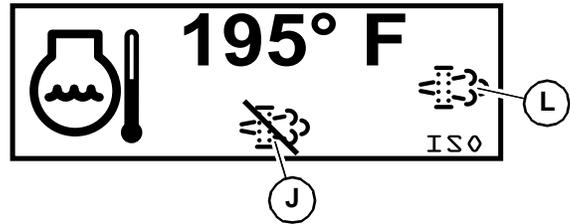


Fig. 55 – DPF Regeneration Inhibited

⚠ CAUTION

Permanently inhibiting regeneration is not recommended, as this will eventually cause significant reduction in engine power and will force premature DPF soot filter replacement.

Stationary Regeneration

Stationary regeneration may be periodically required to reduce DPF soot build-up. The frequency of stationary regeneration is dependent upon machine operation and engine load.

The machine cannot be used during stationary regeneration and cannot be moved without interrupting the stationary regeneration process.

When stationary regeneration needs to be performed, the DPF Stationary Regeneration Request Screen (Fig. 56) displays.

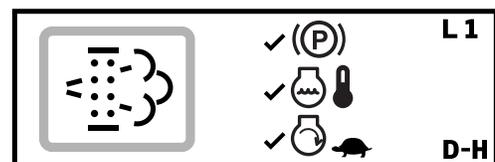


Fig. 56 – DPF Stationary Regeneration Request Screen

NOTE: The stationary regeneration request screen can be temporarily dismissed by pressing and releasing the interface button. The stationary regeneration request screen will return 1 minute after being dismissed, for as long as the request remains active.

Operation

IMPORTANT: Perform stationary regeneration as soon as possible when the stationary regeneration request screen displays. Postponing stationary regeneration for extended periods will cause significant reduction in engine power and will force premature DPF filter core replacement.

To proceed with stationary regeneration:

1. Park the machine in a safe, well-ventilated location away from flammable materials.
2. The following conditions need to be met before stationary regeneration continues:
 - a. Apply the parking brake using the parking brake switch or by lifting the safety bars/arm rests. A checkmark (M, Fig. 57) is displayed next to the parking brake icon in the middle of the stationary regeneration request screen.

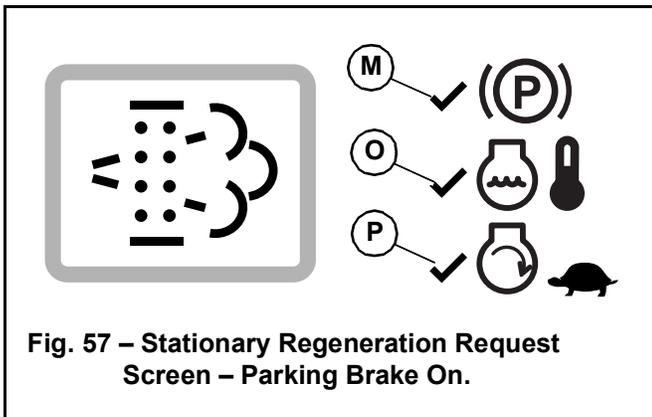


Fig. 57 – Stationary Regeneration Request Screen – Parking Brake On.

- b. When engine coolant has reached operating temperature (above 140° F / 60° C), a checkmark (O) is displayed next to the coolant temperature icon.
 - c. Place throttle controls to the lowest speed setting. A checkmark (P) is displayed next to the slow engine speed icon when the engine is running at low idle.
3. When all three checkmarks (M, O & P) are displayed on the stationary regeneration request screen, press and hold the interface button on the multi-function display until the DPF Stationary Regeneration In Progress screen (Fig. 58) is displayed.

4. Stationary regeneration progress is displayed in the center (X, Fig. 58) of the DPF Stationary Regeneration In Progress Screen.

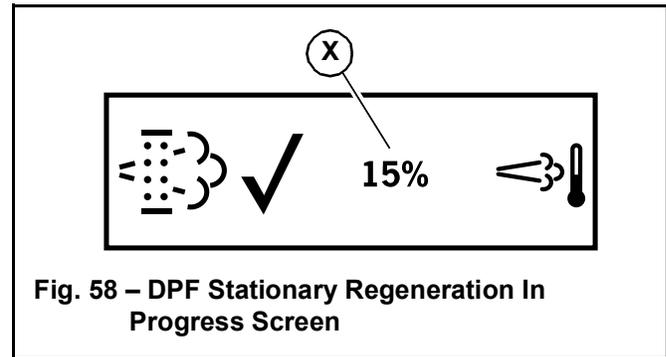


Fig. 58 – DPF Stationary Regeneration In Progress Screen

5. When stationary regeneration completes, the display returns to the coolant temperature status screen (Fig. 59).

NOTE: Stationary regeneration can be interrupted at any time by releasing the parking brake, advancing the throttle, or stopping the engine. Stationary regeneration must start again from the beginning if it is interrupted.

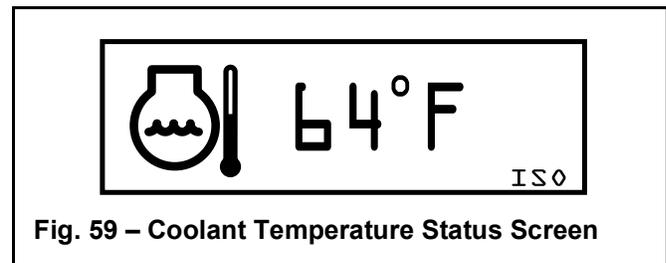


Fig. 59 – Coolant Temperature Status Screen

NOTE: Stationary regeneration takes approximately 25-30 minutes. When stationary regeneration completes, the display returns to the home status screen.

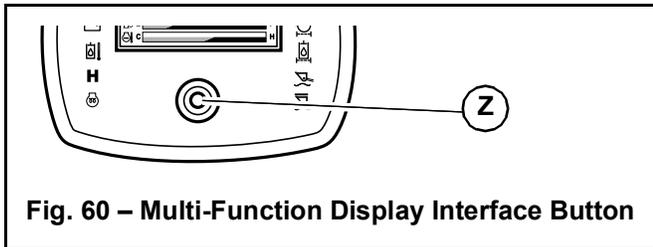


It is not necessary to stay in the machine during stationary regeneration. Keep the machine under observation while regeneration is in progress in case of malfunction. Keep bystanders away from the machine while regeneration is in progress.

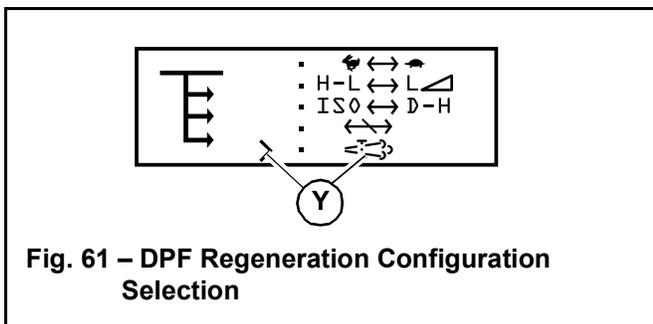
Forcing Stationary Regeneration

To perform stationary regeneration on-demand:

1. Hold down the interface button (Z, Fig. 60) on the multi-function display until the configuration selection screen displays.

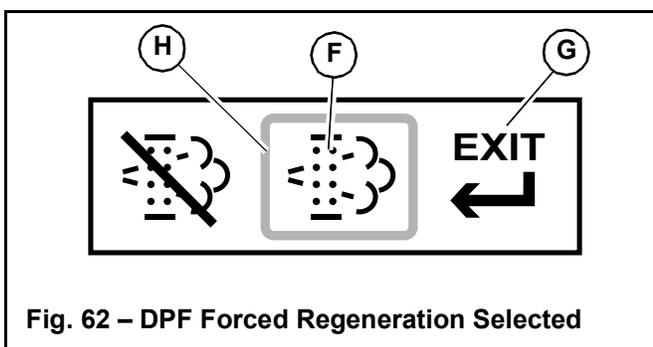


2. Press and release the interface button until the selection caret points to the  selection (Y, Fig. 61). Press and hold the interface button until the DPF Regeneration Screen (Fig. 62) displays.

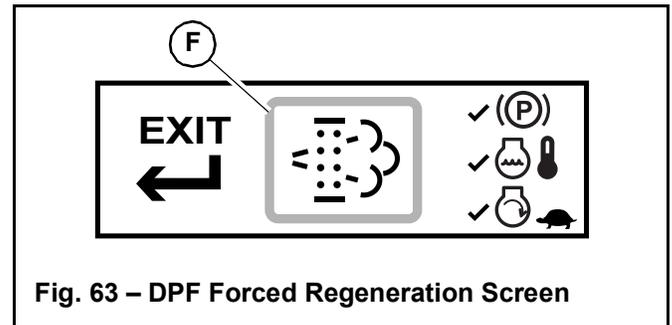


3. Press and release the interface button to move box (H, Fig. 62) around regeneration symbol (F), as shown in Fig.62.

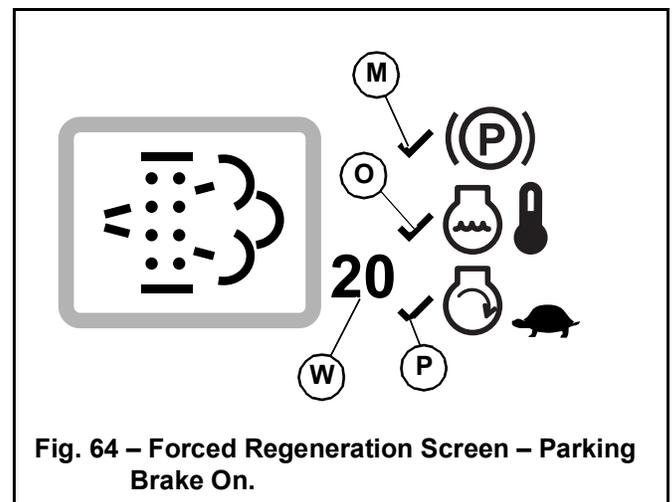
NOTE: Regeneration symbol (F) will display only if it has been greater than 50 hours since the last reset or stationary regeneration. The icon will also only display if the machine is at operating temperature (60°C [140° F]).



4. With box (F) around the regeneration symbol, press and hold the interface button until the DPF Forced Regeneration screen (Fig. 63) displays.



5. Park the machine in a safe, well-ventilated location away from flammable materials.
6. The following conditions need to be met before stationary regeneration can be initiated:
 - a. Apply the parking brake using the parking brake switch or by lifting the safety bars/arm rests. A checkmark (M, Fig. 64) is displayed next to the parking brake icon in the middle of the forced regeneration screen.



- b. When engine coolant has reached operating temperature (above 140° F / 60° C), a checkmark (O) is displayed next to the coolant temperature icon.
- c. Place throttle controls to the slow speed position. A checkmark (P) is displayed next to the slow engine speed icon when the engine is running at low idle.

Operation

- When all three checkmarks (M, O & P) are displayed on the forced regeneration screen, press and hold the interface button (Z, Fig. 67) on the multi-function display, until countdown (W, Fig. 64) reaches “0” and stationary regeneration begins.

NOTE: The DPF Stationary Regeneration Progress Screen (Fig. 65) displays with checkmark (A) confirming that stationary regeneration has started.

- Stationary regeneration progress is displayed in the center (X, Fig. 65) of the DPF Stationary Regeneration In Progress Screen. Engine speed automatically advances as required for the stationary regeneration process.

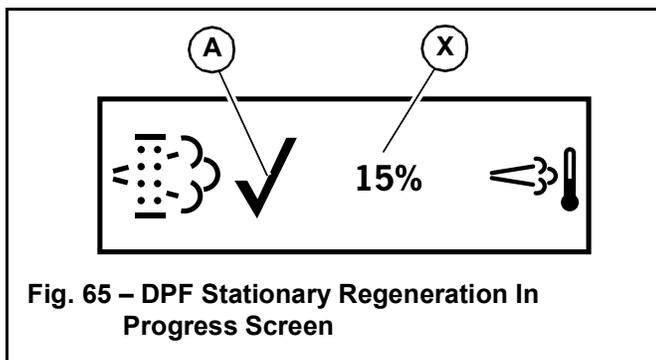


Fig. 65 – DPF Stationary Regeneration In Progress Screen

- When stationary regeneration is complete, the display returns to the coolant temperature status screen (Fig. 66).

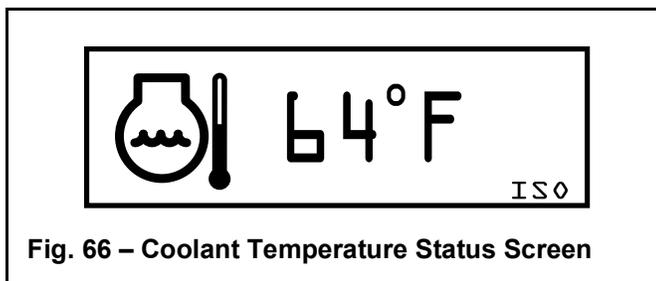


Fig. 66 – Coolant Temperature Status Screen

Regeneration Inhibit

NOTE: DPF regeneration inhibit prevents reset regeneration from occurring.

Reset regeneration can be prevented from occurring using the multi-function display DPF regeneration configuration screen:

- Hold down the interface button (Z, Fig. 67) on the multi-function display until the DPF Regeneration configuration selection screen (Fig. 68) displays.

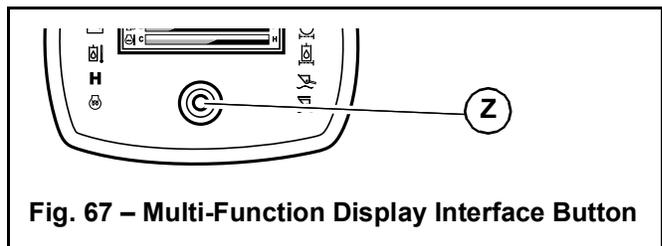


Fig. 67 – Multi-Function Display Interface Button

- Press and release the interface button until the selection caret points to the  selection (Y, Fig. 68). Press and hold the interface button until the DPF Regeneration Configuration (Fig. 69) screen displays.

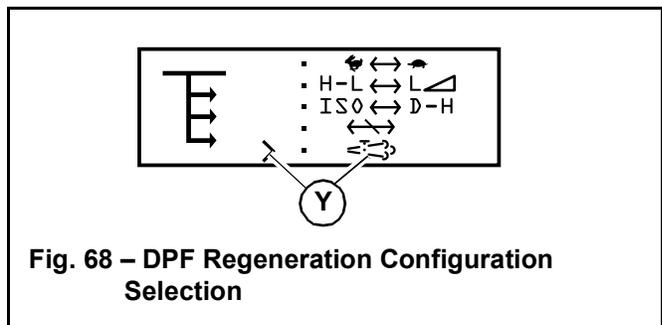


Fig. 68 – DPF Regeneration Configuration Selection

- Press and release the interface button to move box (H, Fig. 69) around the regeneration inhibit symbol, as shown Fig.69.

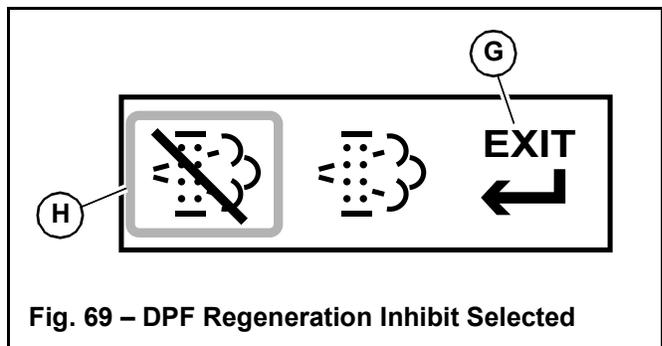


Fig. 69 – DPF Regeneration Inhibit Selected

NOTE: “EXIT” selection (G) returns the display to the configuration screen (Fig. 68).

4. With box (H) around the regeneration inhibit symbol, press and hold the interface button until the regeneration inhibit symbol blinks.
5. Press and release the interface button to move box (H) around the “EXIT” selection (G). Press and hold the interface button until the configuration selection screen displays.

NOTE: When DPF regeneration is inhibited, DPF regeneration icon (J, Fig. 70) is displayed at the bottom of all status screens.

If reset regeneration attempts to start but DPF regeneration is inhibited, a flashing DPF regeneration request icon (L) is displayed.

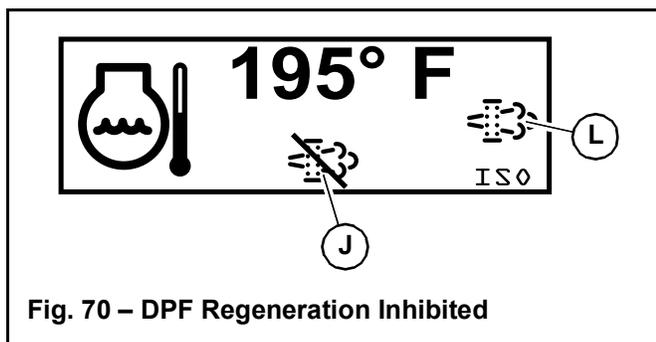


Fig. 70 – DPF Regeneration Inhibited



Permanently inhibiting regeneration is not recommended, as this will eventually cause significant reduction in engine power and will force premature DPF filter core replacement.

Cancelling Regeneration Inhibit

1. Hold down the interface button (Z, Fig. 71) on the multi-function display until the DPF Regeneration configuration selection screen (Fig. 72) displays.

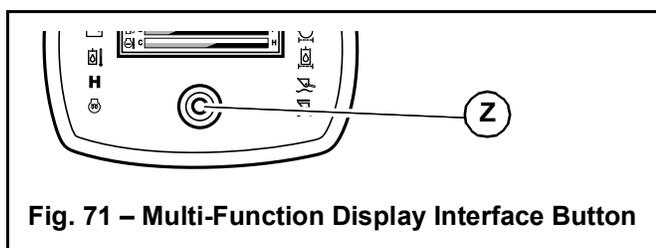


Fig. 71 – Multi-Function Display Interface Button

2. Press and release the interface button until the selection caret points to the  selection (Y, Fig. 72). Press and hold the interface button until the DPF Regeneration Configuration (Fig. 72) screen displays.

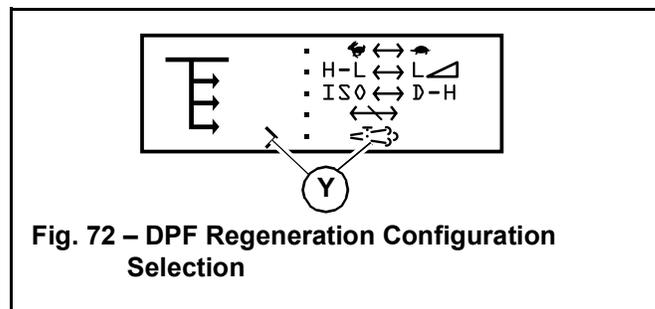


Fig. 72 – DPF Regeneration Configuration Selection

3. Cancel regeneration inhibit using one of the following two methods:

Method A:

- A-1. Press and release the interface button to move box (H, Fig. 73) around the regeneration inhibit symbol, as shown Fig.73.

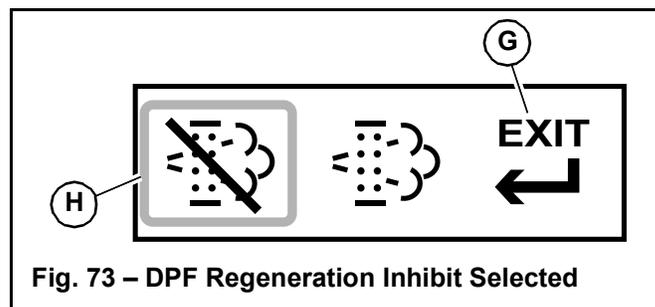


Fig. 73 – DPF Regeneration Inhibit Selected

Operation

A-2. With box (H) around the regeneration inhibit symbol, press and hold the interface button until the regeneration inhibit symbol stops blinking.

NOTE: Pressing and holding the interface button with box (H) around the regeneration inhibit symbol will toggle regeneration inhibit on and off: Regeneration inhibit is ON if the symbol IS blinking; regeneration inhibit is CANCELED if the symbol IS NOT blinking.

Method B:

B-1. Press and release the interface button to move box (H, Fig. 74) around the force regeneration symbol, as shown Fig.74.

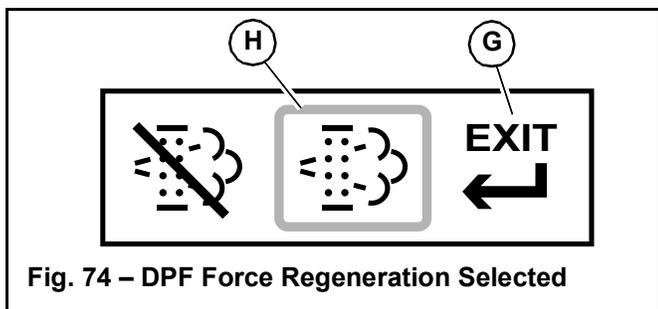


Fig. 74 – DPF Force Regeneration Selected

B-2. With box (H) around the symbol, press and hold the interface button until the DPF Forced Regeneration Screen (Fig. 63, page 81) displays. Forced regeneration can be initiated, or “EXIT” can be selected to return to the configuration selection screen.

NOTE: “EXIT” selection (G, Figs. 73 and 74) returns the display to the configuration selection screen without changing DPF regeneration settings.

Recovery Regeneration

Recovery regeneration may be periodically required to reduce heavy DPF soot build-up. The frequency of recovery regeneration is dependent upon machine operation and engine load.

The machine cannot be used during recovery regeneration and cannot be moved without interrupting the recovery regeneration process.

When recovery regeneration needs to be performed, the DPF Recovery Regeneration Request Screen (Fig. 75) displays.

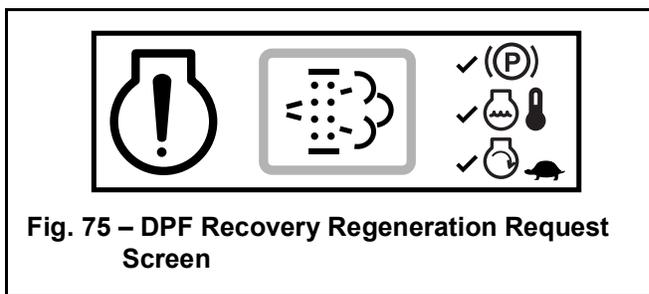


Fig. 75 – DPF Recovery Regeneration Request Screen

NOTE: The recovery regeneration request screen can be temporarily dismissed by pressing and releasing the interface button. The recovery regeneration request screen will return 1 minute after being dismissed, for as long as the request remains active.

IMPORTANT: Perform recovery regeneration as soon as possible when the recovery regeneration request screen displays. Postponing recovery regeneration for extended periods will cause significant reduction in engine power and will force premature DPF filter core replacement.

To proceed with recovery regeneration:

1. Park the machine in a safe, well-ventilated location away from flammable materials.
2. The following conditions need to be met before recovery regeneration continues:
 - a. Apply the parking brake using the parking brake switch or by lifting the safety bars/arm rests. A checkmark (M, Fig. 76) is displayed next to the parking brake icon in the middle of the recovery regeneration request screen.

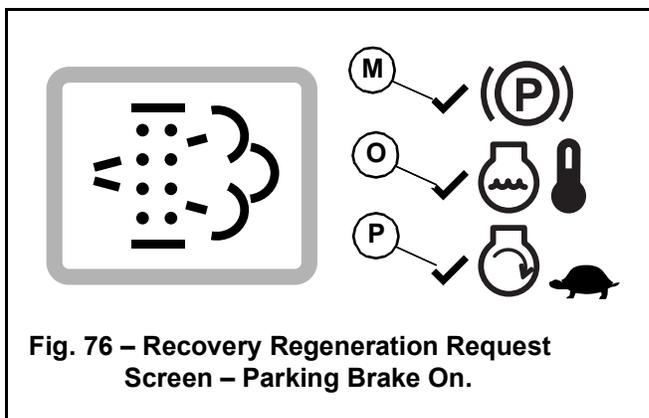
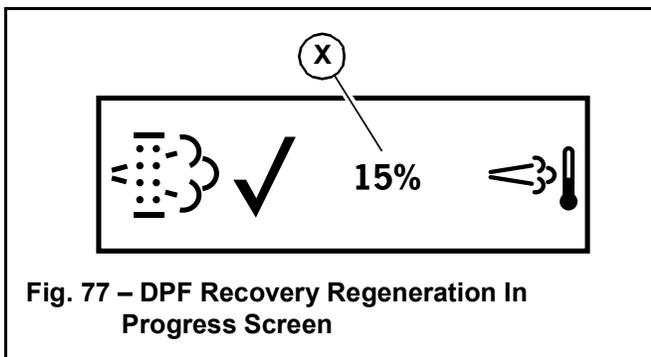


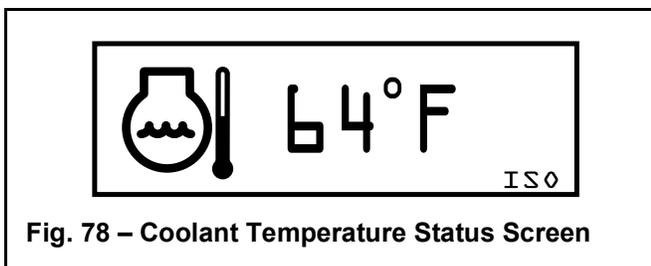
Fig. 76 – Recovery Regeneration Request Screen – Parking Brake On.

- b. When engine coolant has reached operating temperature (above 140° F / 60° C), a checkmark (O) is displayed next to the coolant temperature icon.
 - c. Place throttle controls to the lowest speed setting. A checkmark (P) is displayed next to the slow engine speed icon when the engine is running at low idle.
3. When all three checkmarks (M, O & P) are displayed on the recovery regeneration request screen, press and hold the interface button on the multi-function display until the DPF Recovery Regeneration In Progress screen (Fig. 77) is displayed.
 4. Recovery regeneration progress is displayed in the center (X, Fig. 58) of the DPF Recovery Regeneration In Progress Screen.



5. When recovery regeneration completes, the display returns to the coolant temperature status screen (Fig. 78).

NOTE: Recovery regeneration can be interrupted at any time by releasing the parking brake, advancing the throttle, or stopping the engine. Recovery regeneration must start again from the beginning if it is interrupted.



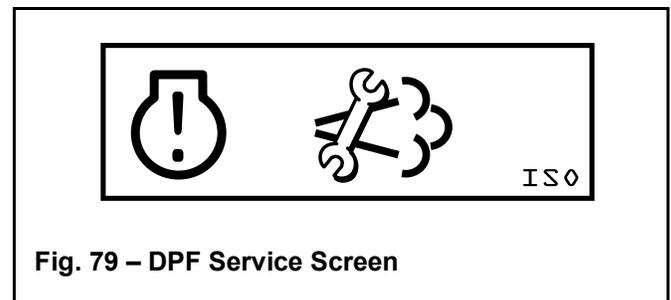
NOTE: Recovery regeneration takes approximately 25-240 minutes. When recovery regeneration completes, the display returns to the home status screen.



It is not necessary to stay in the machine during recovery regeneration. Keep the machine under observation while regeneration is in progress in case of malfunction. Keep bystanders away from the machine while regeneration is in progress.

DPF Service

DPF soot filter replacement is required when the DPF Service screen (Fig. 79) displays.



NOTE: Contact your dealer when the DPF Service screen displays.

Operation

After Operation

WARNING

Park the machine on firm, level ground. Raise the arm rests/safety bars to apply the parking brake and lock out the hydraulic controls.

WARNING

Always apply the lift arm support if leaving the machine with the lift arm in the raised position. See “Lift Arm Support” on page 102.

If you must park on a slope or an incline, park across the slope and block the machine to prevent movement.

WARNING

If parking on a street, use barriers, caution signs, lights, etc. to increase the visibility of the machine and prevent collisions. This is especially important at night, during bad weather and in high-traffic areas.

After performing the “Mandatory Safety Shutdown Procedure” on page 20, perform the following tasks and checks:

- Check for coolant, fuel and/or oil leaks. Inspect all hoses, working components, covers and chassis for damage or advanced wear. Repair or replace damaged, leaking, worn or otherwise compromised components before starting the machine again.
- Fill the fuel tank. See “Fluids/Lubricants Types and Capacities” on page 35.
- Remove any dirt and/or debris from the engine compartment.

- Remove any mud from the chassis. Clean any dirt or water from the cylinder rod surfaces to prevent corrosion and protect the cylinder seals.
- If parking the machine for an extended period, lock the cab door, the storage compartment, the battery and hydraulic filler compartments and the engine compartment. Take the keys with you.

Jump-Starting

WARNING

Two people are required for safe jump-starting. An additional person is required to remove the jumper cables with the operator remaining in the operator's seat once the engine is running.

WARNING

Do not jump-start a frozen battery, or it may explode. A discharged battery can freeze at 0°C (32°F).

IMPORTANT: *The external power source must deliver 12 volts. Supply voltages higher than 12V can damage the electrical systems of both machines. Only use authorized jumper cables that are in good condition.*

The booster battery must have a nominal voltage of 12-volts. The capacity (Ah, or Amp-hour rating) of the current-supplying battery must be approximately equal to that of the discharged battery. Factory-installed batteries are approximately 70 Ah capacity.

CAUTION

To reduce the risk of a short circuit, keep metal parts on your clothing and metal jewelry away from the positive (+) pole of the battery.

1. Turn the ignition switches of both machines to OFF. Be sure the machines are not touching each other. If the machine with the booster battery has a drive transmission, place the transmission into neutral and apply the parking brake.
2. Using the accessory key (supplied with the ignition key), unlock (H, Fig. 80) and open the battery compartment located at the rear left corner of the machine. Open the battery compartment cover and lock the cover open using pin (D).

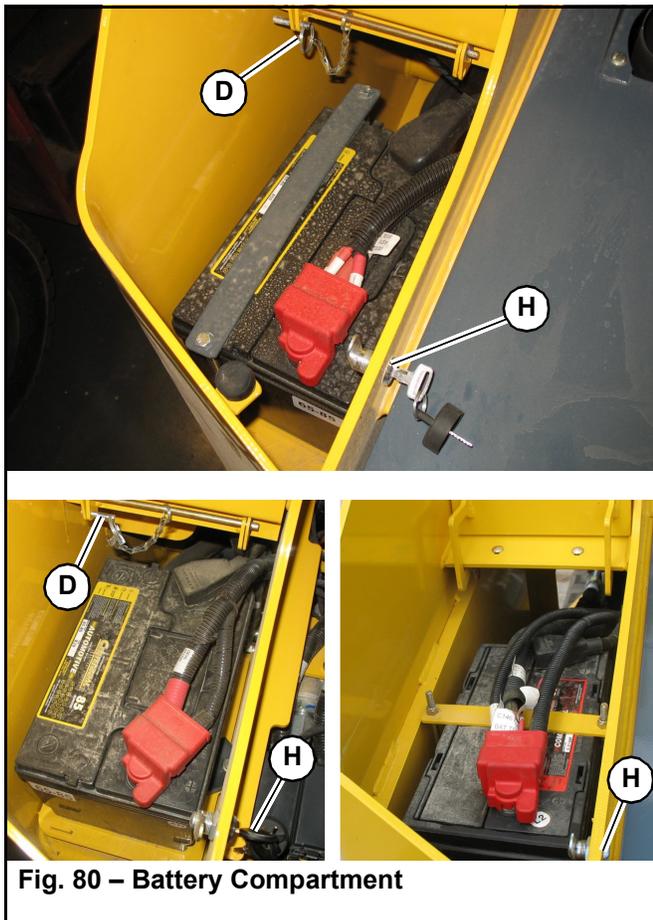


Fig. 80 – Battery Compartment

CAUTION

Always lock the battery compartment cover open using pin (D). Severe injuries can result if the battery compartment cover falls on hands and/or fingers.

3. Check that battery jumper cables have a sufficient diameter. Route the jumper cables so that they cannot catch on any moving objects or components.
4. Connect the positive jumper cable to the positive (+) terminal (S, Fig. 81) on the discharged battery.

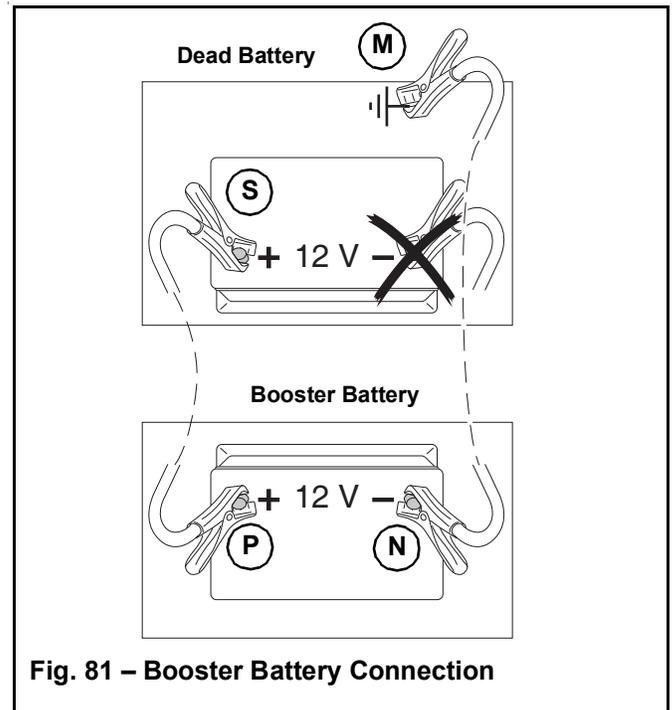


Fig. 81 – Booster Battery Connection

5. Connect the free end of the positive jumper cable to the positive (+) terminal (P) on the booster battery.
6. Connect the negative jumper cable to the negative (-) terminal (N) on the booster battery.
7. Open the rear door of the engine compartment (“Engine Access” on page 126) and connect the free end of the negative jumper cable to the rear door catch (M, Fig. 82) in the engine compartment.

Operation

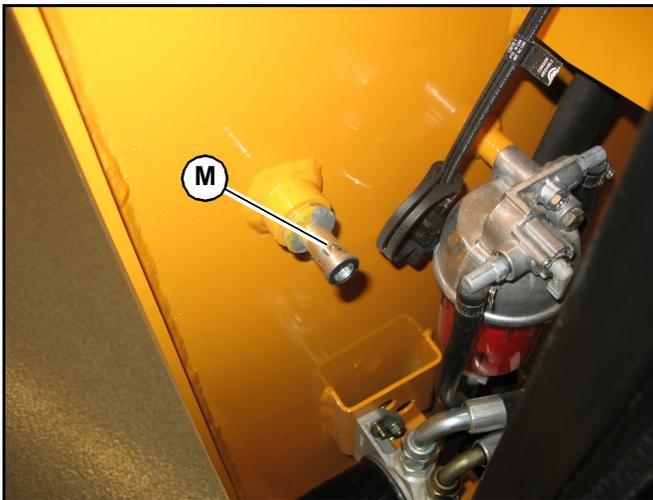


Fig. 82 – Chassis Ground/Rear Door Catch

WARNING

Do not connect the other end of the jump lead to the negative terminal of the dead battery. Gas emerging from the battery may ignite if sparks are formed.

8. Start the machine with the discharged battery. See “Starting the Engine” on page 75. If the engine does not start immediately, stop cranking after 10 seconds and repeat starting procedure after approximately 30 seconds.

After the Engine Starts:

1. With the operator remaining in the operator’s seat, the jumper cables are disconnected by a second person in reverse order of steps 4 – 6 to avoid sparking near the battery.
2. Close the rear door and the engine cover according to “Closing Engine Covers” on page 126.
3. Allow the machine to run for at least 30 minutes to re-charge the battery.

Travel Drive Operation

WARNING

Never allow anyone to enter inside the turning radius and the machine path.

Signal your intention to move by sounding the horn.

Traveling should be performed with the attachment in transport position. See “Attachment Transport Position” on page 96.

Avoid sudden stops, starts or turns.

Do not raise the arm rests/safety bars while traveling. Raising the arm rests/safety bars will apply the parking brake abruptly. Loss of control could result.

Do not switch off the ignition switch while traveling. Sudden braking will happen and loss of control could result.

Visually check behind you before traveling in reverse. Traveling in reverse without checking could result in collision with a person or obstacle.

Remove obstacles in the machine’s path before traveling with a load.

ISO Pattern Travel Drive Controls

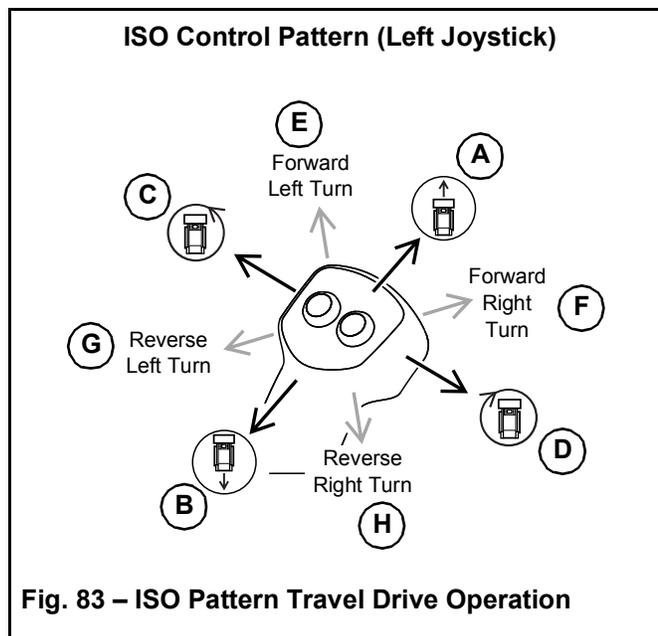


Fig. 83 – ISO Pattern Travel Drive Operation

ISO pattern travel drive is controlled exclusively using the left control joystick (Fig. 83):

- A. Push the left joystick forward to travel straight forward.
- B. Pull the left joystick rearward to travel straight in reverse.
- C. Tilt the left joystick to the left to spin-turn to the left.
- D. Tilt the left joystick to the right to spin-turn to the right.
- E. Tilt the left joystick diagonally forward and to the left to pivot turn forward and to the left.
- F. Tilt the left joystick diagonally forward and to the right to pivot turn forward and to the right.
- G. Tilt the left joystick diagonally rearward and to the left to pivot turn in reverse and to the left.
- H. Tilt the left joystick diagonally rearward and to the right to pivot turn in reverse and to the right.

D-H Pattern Travel Drive Controls (Option)

NOTE: See “Control Joysticks” on page 55 for information about switching to the optional D-H control pattern.

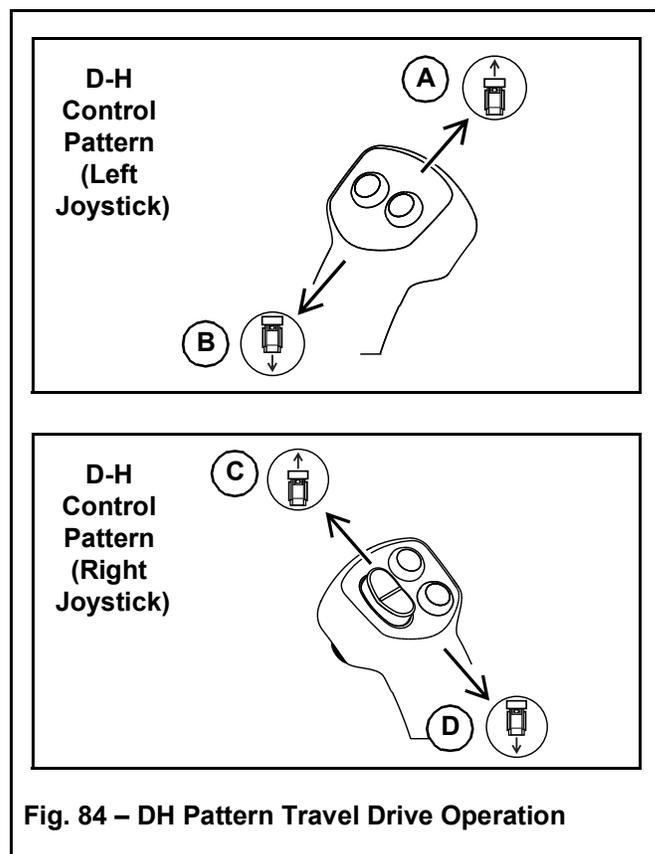


Fig. 84 – DH Pattern Travel Drive Operation

D-H pattern travel drive operation is shared between the right and left control joysticks (Fig. 84):

- A. Tilt the left joystick forward to drive the left track forward.
- B. Tilt the left joystick rearward to drive the left track in reverse.
- C. Tilt the right joystick forward to drive the right track forward.
- D. Tilt the right joystick rearward to drive the right track in reverse.

The left and right joysticks are used in combination for D-H pattern travel control.

- Both joysticks tilted forward: forward travel drive.
- Both joysticks tilted rearward: travel drive in reverse.

Operation

- One joystick forward/other joystick rearward: spin turns.
- One joystick forward more than other: pivot turns.

Straight Tracking Adjust

The straight tracking adjust feature sets the drive to track straight in forward or reverse when the left joystick is pushed/pulled forward or back.

See “Straight Tracking Adjust” on page 59 for information about performing the straight tracking adjust procedure.

Rubber Track Use Cautions and Tips

Carefully following the recommendations in this section will result in better track wear performance.



If possible, avoid traveling over broken or jagged stone, metal objects, on other sharp objects that could damage or cut the tracks.

Inspect tracks and undercarriage components for wear frequently. Worn components accelerate track wear

If possible, avoid traveling in areas with loose rocks that could get stuck in the tracks, or between the tracks and the track wheels.

Avoid using the machine in salt water areas. Salt can corrode the metal cores in the tracks.

Clean any fuel, oil, salt, fertilizer or chemical solvents that might get on the tracks. These substances could corrode the metal cores in the tracks.

Avoid traveling on roads immediately after asphaltting, or on other hot surfaces or over fires. Damage to the tracks could result.

If climbing steps or cobblestone, avoid climbing at an angle. Climb straight up the slope and do not change course at the top of the slope.

When climbing slopes. Do not suddenly change course at the point where the slopes starts.

Avoid traveling with one track on a slope or other raised surface and the other track on a flat surface.

Harder surfaces cause accelerated track and undercarriage component wear. Avoid sharp and spin turns on hard surfaces such as concrete.

Avoid drops that cause severe blows to the tracks.

High-speed operation and track slippage accelerate track and undercarriage component wear.

Avoid rubbing the sides of the tracks against walls or other vertical surfaces.

It is impossible to estimate track life, because track life is affected by operating conditions, maintenance and application.

Due to varying applications, there is no wear guarantee on rubber tracks. As a “rule of thumb”, however, rubber track life expectancy for track loaders in “dirt” applications can be up to 2 to 2-½ times the normal life of a set of pneumatic tires on a skid-steer loader.

IMPORTANT: *Track damage caused by heavy and/or abusive use is not covered under warranty. Damaged tracks cannot be repaired and must be replaced.*

To extend track life, the IdealTrax™ track tension is loosened when the engine is not running. When the engine is started, the tracks are automatically adjusted to the correct tension. Monitor the tracks at startup to ensure the automatic track tensioning system is working properly. Tracks running loose can de-track. Over-tightened tracks can cause power loss, excessive roller, idler bearing and sprocket wear, and track tearing.

Tracks and undercarriage should be cleaned regularly. Mud and/or debris buildup in the track rollers, sprockets and/or undercarriage structure can accelerate track wear. It prevents proper engagement between the mating surfaces of sprocket teeth and track links, can cause the tracks to be crowded off the rollers, and may prevent roller rotation, leading to roller and/or track failure. IdealTrax™ makes cleaning tracks and undercarriage easier due to increased clearance provided when the machine is off and tension on the tracks is relaxed.

Operation

Constant operation on slopes, side hills, crowns and depressions accelerates guide lug, idler, roller and sprocket wear. Avoid cutting across slopes. Instead, drive up or down them. It is best to climb straight up or down, and then turn when the machine is in a more level location.

Alternate turning direction from one side to the other. Always turning in one direction can accelerate sprocket tooth, track tread, guide lugs and roller flange wear.

Unnecessary track slippage accelerates undercarriage and track wear and can cut tracks. Avoid track slippage when driving into material and dig using the lift/tilt hydraulics. Be aware when track slippage occurs and adjust machine operation to prevent it.

Avoid making spin turns or pivot turns, which accelerate wear and cause de-tracking. Always make wide turns whenever possible.

Don't allow the sides of the tracks to strike against objects such as curbs or walls.

Avoid traveling with one track on a slope or a projecting object and the other track on a flat surface. Travel with both tracks on a level surface if possible. Operating tracks with the outside or inside edge of the track turned up on a curb, mound or stone can crack tracks or shear the rubber.

Operate slowly and carefully. High-speed operation accelerates wear on all undercarriage and track components.

Avoid traveling or operating on broken stone, jagged base rock, iron rods, scrap iron or other recycling-type materials. Rubber tracks are not intended for these surfaces.

Working in heavily stone-laden soils or conditions can cause damage or de-tracking due to stones becoming lodged in the idler or drive sprockets.

Rubber tracks are not intended for use in quarry, recycling or demolition applications.

Rubber track loaders are not intended for use with cold planers.

Harder surfaces cause accelerated wear on track treads, links, rollers, idlers, sprockets and other undercarriage components. To minimize wear, avoid routinely driving and turning on hard surfaces like asphalt and concrete.

Avoid allowing fuel, oil, salt or fertilizer to get on the tracks. These substances can corrode the metal cores in the rubber tracks. If these materials come in contact with the tracks, flush the tracks and undercarriage with clean water to remove the damaging materials.

Avoid operating in job sites where there are sharp objects, such as jagged rocks or broken concrete, which can damage the lug surface of the tracks. Use common sense when operating in conditions which are potentially damaging to rubber tires, because the same conditions are damaging to rubber tracks as well. Damaged tracks cannot be repaired and must be replaced, and are not warrantable for failures under these conditions.

Excessively worn undercarriage components will damage tracks. Monitor these components to ensure maximum track life. If replacing tracks, replace any worn undercarriage components at the same time.

Listen for unusual or loud track/undercarriage noises during operation. Loud/unusual noises often indicate worn tracks/undercarriage.

Sprocket Tooth Wear and Track Life

Worn sprockets are a typical cause of track damage and abnormal track noise. Check for sprocket wear often. Sprocket wear (B, Fig. 85) normally occurs along the sides and crests of the sprocket teeth (C). Use the sprocket tooth wear gauge (A - Manitou part # 50309811), included with the machine, to determine exact sprocket tooth wear:

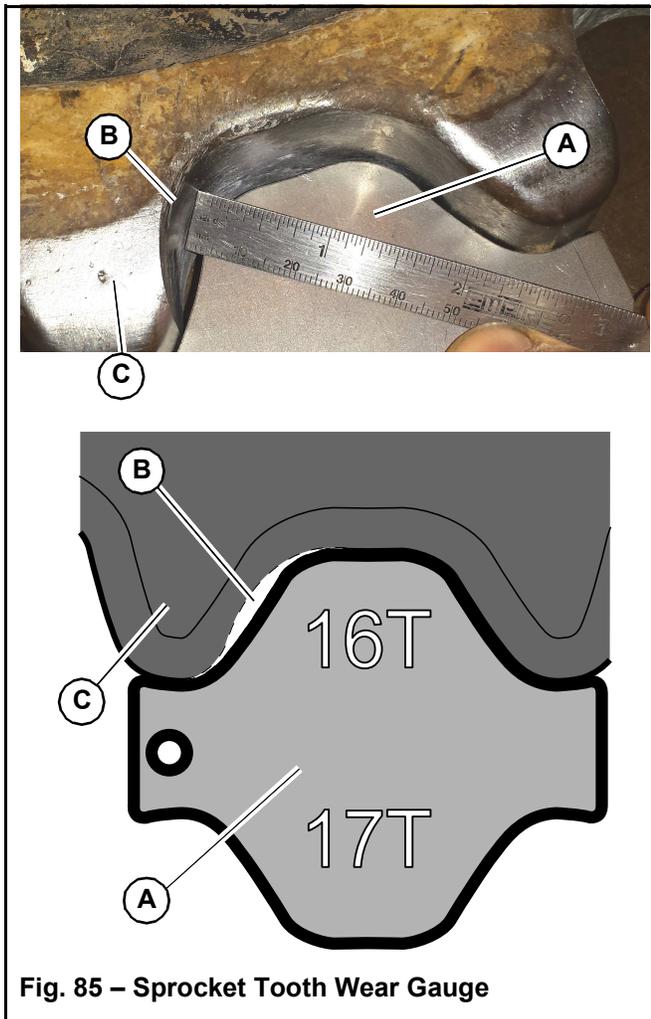


Fig. 85 – Sprocket Tooth Wear Gauge

- Hold the sprocket tooth wear gauge (A) against the sprocket teeth at the centerline of the sprocket as shown in the photograph. Wear gauge (A) has the same profile as the teeth on a new sprocket.

NOTE: *The sprocket tooth wear gauge is double-sided; one side is marked “16T” and is used for checking 16 tooth sprockets, the other side is marked “17T” and is used for checking 17 tooth sprockets.*

- Sprocket wear is considered excessive if 1/8” (4mm) of material is worn from any point along the sprocket tooth profile.
- Worn sprockets cannot be repaired and should be replaced. Refer to the parts manual for your machine for sprocket service part numbers when ordering. Rotating sprockets by swapping them from one side to the other can extend their service life, provided the wear is limited to one direction of travel.

IMPORTANT: *New tracks perform better and last longer with new sprockets because the mating surface profiles are matched.*



CAUTION

Always replace sprocket mounting hardware when replacing or re-attaching sprockets.

Operation

Travel Drive Error Condition Operation (Limp Mode)

For safety reasons, drive system error conditions 3-10 (see “Drive and Valve Error Codes” on page 185) will disable the drive system.

In order to transport the machine to a service area to correct the error condition, two alternate transport modes are provided:

- Limp mode (X, Fig. 86) – results from drive error codes 7-10.
- Open loop mode (Y) – results from drive error codes 3-6.

WARNING

Use extreme care when using alternate transport modes to compensate for the resulting loss of drive control. Alternate transport modes will not correct the drive error condition. Because of this, the following drive conditions will exist when using alternate transport modes:

- Limp Mode (X): Loss of forward or reverse on one of the tracks.
- Open Loop Mode (Y): Jerky drive control operation, even at low engine speed.

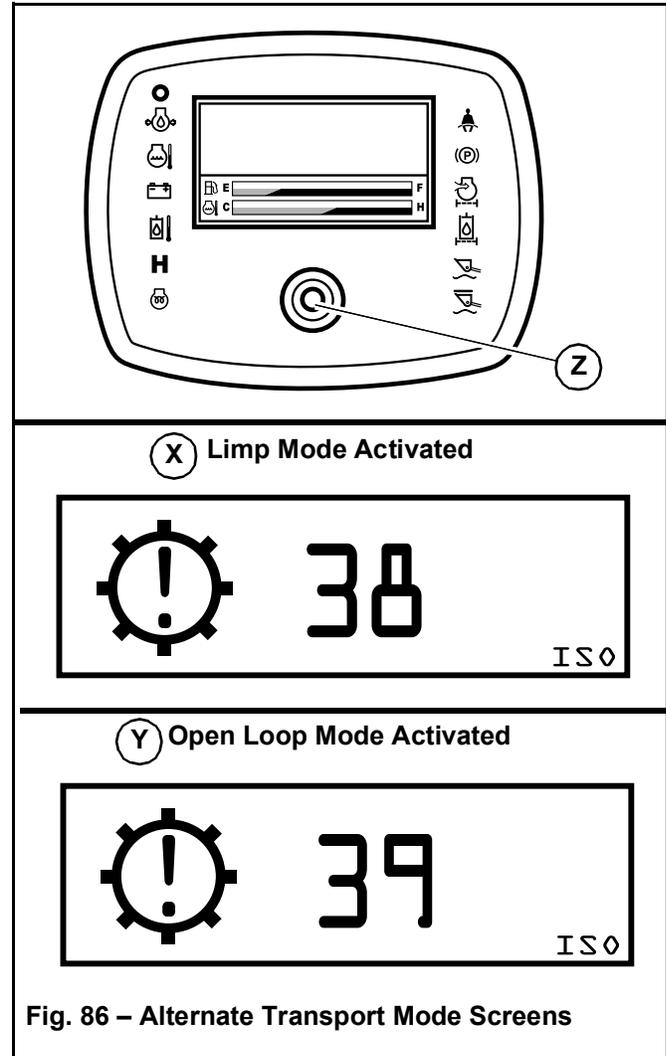
Drive very slowly and at the lowest possible engine speed when using either alternate transport mode. Keep bystanders well away from the machine when using either alternate transport mode.

Alternate Transport Mode Activation

NOTE: Alternate transport modes can only be activated if only 1 drive error (codes 3-10) condition exists. Limp modes are NOT available if more than 1 drive error condition exists.

1. Turn the ignition clockwise to the first detent.
2. Disengage parking brake according to “Disengage Parking Brake” on page 74.

3. Make sure the error code 3-10 is displayed on the multi-function display and press and hold the interface button (Z) on the display for 3 seconds. When either the limp mode (X) or the open loop mode (Y) screen displays, an alternate transport mode is activated.



Alternate Transport Mode Cancel

Limp modes are canceled if any of the following occur:

- The parking brake is activated using the switch on the control panel.
- The operator leaves the seat.
- The arm rests/safety bars are raised.
- The cab door is opened.
- The engine is shut down.

When limp mode is canceled through any one of these actions, the drive system will remain disabled until the error condition is corrected or limp mode is re-activated.

Backup Alarm

The backup alarm (R, Fig. 87) is installed inside the rear door.

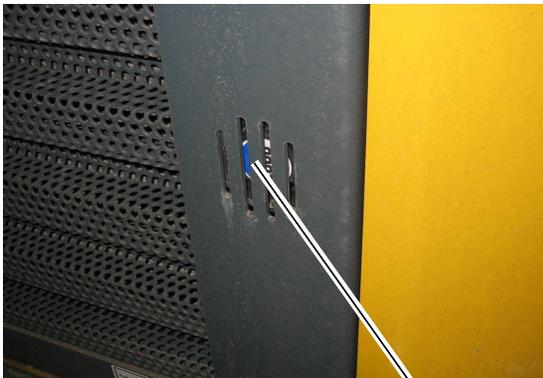
The backup alarm emits a tone whenever the drive system is operated in reverse.



DANGER

Do not rely exclusively on the backup alarm to alert others. Make sure that nobody is within the work area when traveling in reverse.

Later Machines



Early Machines



R

Fig. 87 – Optional Backup Alarm

Operation

Lift Arm Operation

WARNING

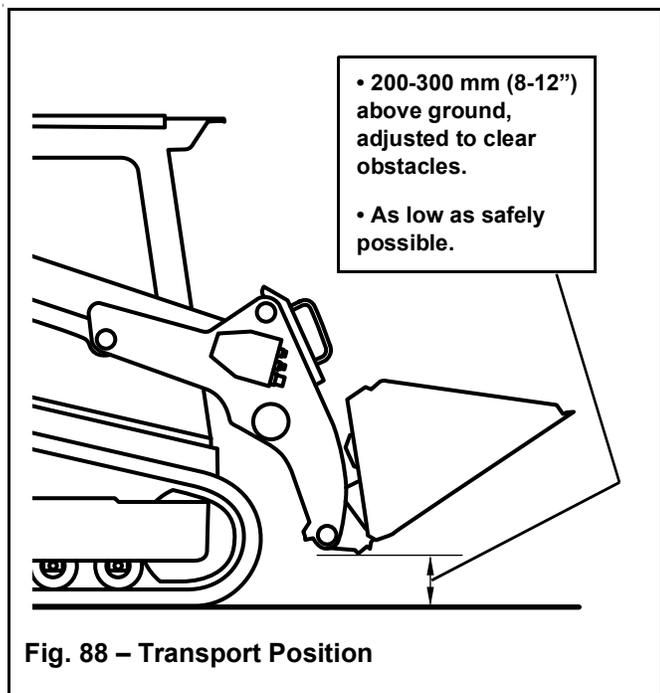
Do not lift loads exceeding rated operating capacity. See “Payloads/Capacities” on page 38.

Attachment Transport Position

WARNING

Always transport loads in transport position to minimize the possibility of tipping or rollover accidents and unstable balance conditions that can cause loss of control.

Carry materials 200-300 mm (8-12”) above the ground, and adjust as necessary to clear obstacles. Generally, carry the load as low as safely possible. Tilt buckets back, as shown in Fig. 88, to prevent spilling material.



Joystick Control Patterns

WARNING

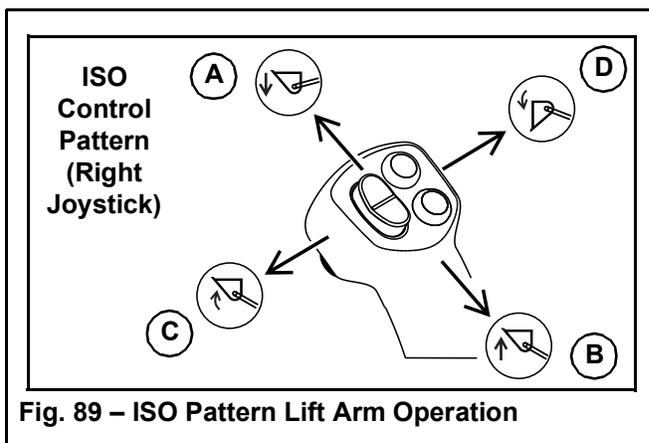
Always lock-out hydraulic functions by raising the arm rests/safety bars whenever parking the machine.

The control joysticks control lift arm raise and lower, attachment tilt, optional attachment quick-hitch lock, and auxiliary hydraulics flow control.

Two different control patterns are available for lift arm operation: ISO and D-H. See “Control Joysticks” on page 55 for information about switching between ISO and D-H control patterns.

NOTE: *The D-H control pattern is an optional feature.*

ISO Pattern Lift Arm Operation Controls



ISO pattern lift arm operation is controlled exclusively using the right control joystick (Fig. 89):

- A. Push the right joystick forward to lower the lift arm.

IMPORTANT: *The lift arm can be lowered if the engine is off by turning the ignition key clockwise to the first detent and pressing the float button on the right joystick (See “Lift Arm Float” on page 99).*

- B. Pull the right joystick backward to raise the lift arm.

- C. Tilt the right joystick to the left to tilt the attachment back.
- D. Tilt the right joystick to the right to tilt the attachment forward.

D-H pattern lift arm operation is shared between the right and left control joysticks (Fig. 90):

- A. Tilt the left joystick to the left to raise the lift arm.

IMPORTANT: *The lift arm can be lowered if the engine is off by turning the ignition key clockwise to the first detent and pressing the float button on the right joystick (See “Lift Arm Float” on page 99).*

- B. Tilt the left joystick to the right to lower the lift arm.
- C. Tilt the right joystick to the left to tilt the attachment back.
- D. Tilt the right joystick to the right to tilt the attachment forward.



CAUTION

The lift arm may fall abruptly when it is lowered with the engine off. Make sure no one is near the machine when lowering the lift arm with the engine off.

D-H Pattern Lift Arm Operation Controls (Option)

NOTE: See “Control Joysticks” on page 55 for information about switching to the optional D-H control pattern.



CAUTION

The lift arm may fall abruptly when it is lowered with the engine off. Make sure no one is near the machine when lowering the lift arm with the engine off.

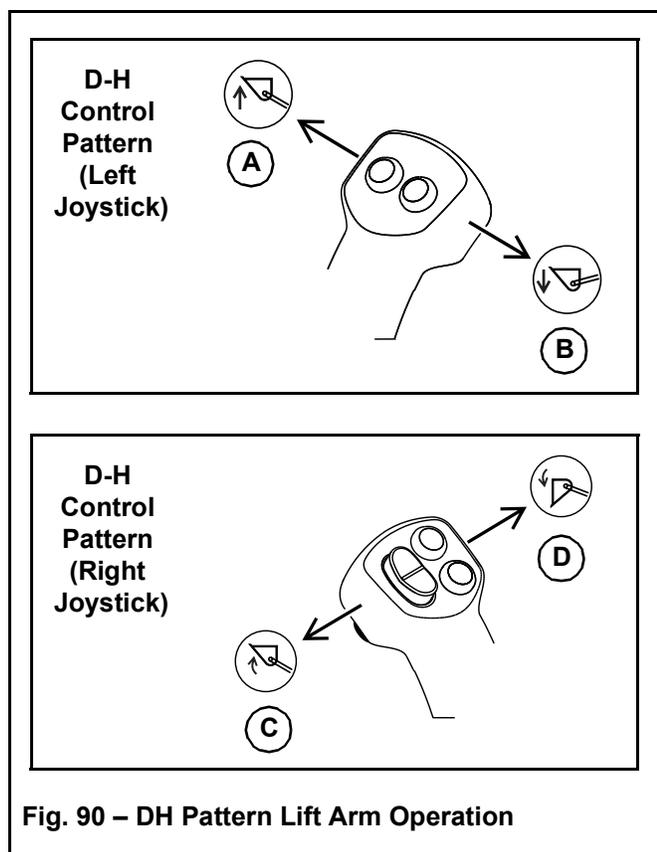


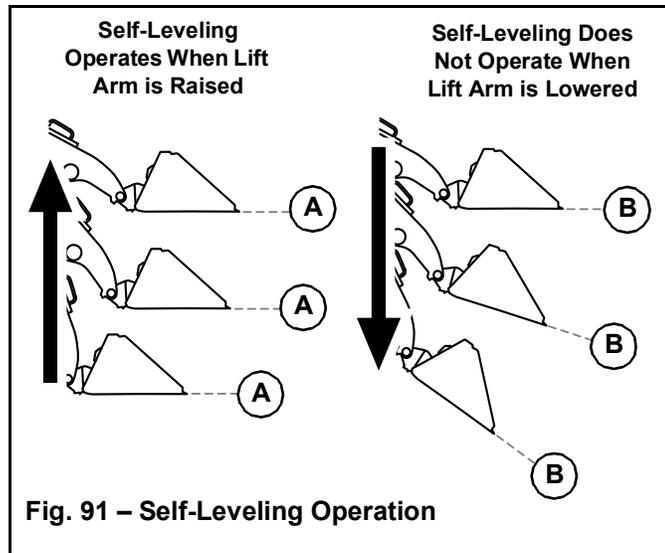
Fig. 90 – DH Pattern Lift Arm Operation

Operation

Self-Leveling

Self-leveling automatically keeps the tilt angle of the attachment constant, relative to the ground plane, (Fig. 91) when the lift arm is raised (A). This feature is especially useful when using pallet forks.

IMPORTANT: *Self-leveling operates only when the lift arm is raised: when the lift arm is lowered (B), self-leveling is not activated.*



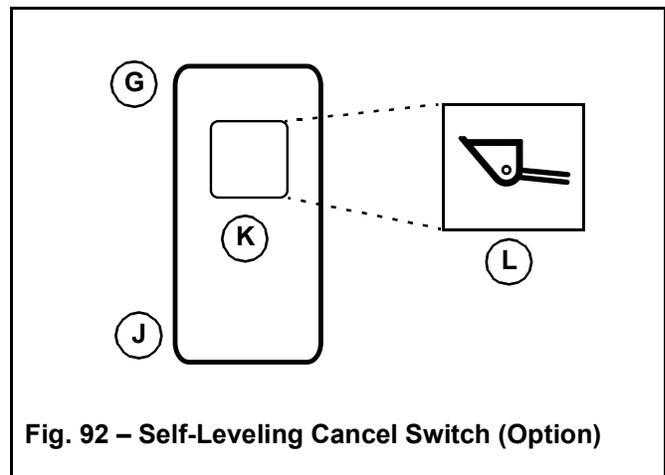
Self-Leveling Cancel (Option)

The self-leveling cancel option allows deactivation of the self-leveling feature.

To deactivate self-leveling, press the top (G, Fig. 92) of the self-leveling cancel switch (K). To restore self-leveling, press the bottom (J) of the self-leveling cancel switch.

NOTE: *The indicator in the switch is lit when the self-leveling cancel option is on and the self-leveling feature is deactivated.*

NOTE: *Self-leveling is activated by default. If the engine is shut off, Self-leveling defaults to the activated condition.*



Lift Arm Float

WARNING

Make sure the bucket is lowered to the ground before activating the lift arm float. Activating float with an attachment raised will cause the lift arm to fall rapidly to the ground, which can cause severe injury or death.

Do not drive the machine forward with the lift arm float activated. Damage to the machine and/or loss of control can result.

To activate lift arm float:

1. Lower the attachment to the ground.
2. Press button (A, Fig. 93) on the right joystick to activate float:
 - a. Press button (A, Fig. 93) momentarily to apply float momentarily.
 - b. Press and hold button (A, Fig. 93) on the right joystick for 5 seconds to activate continuous float.

NOTE: Indicator (B) in the multi-function display is lit when the lift arm float is activated. Indicator (B) blinks when momentary float is activated and is continuously lit when continuous float is activated.

Press button (A) again to deactivate continuous float.

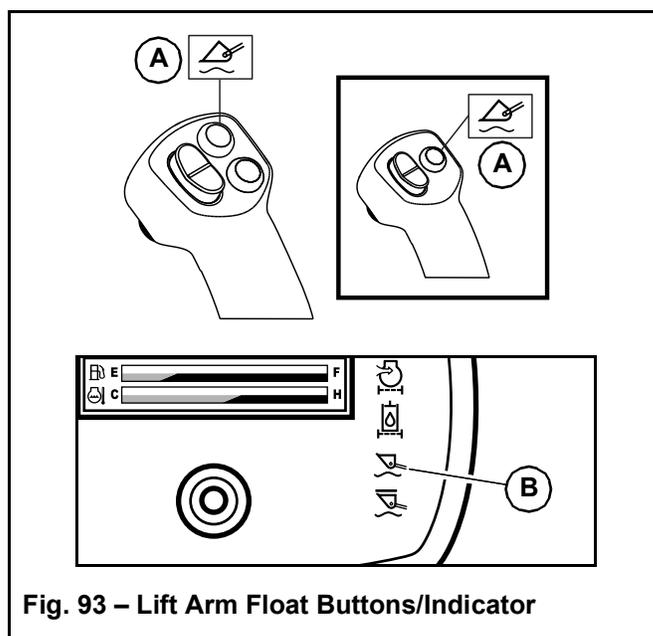


Fig. 93 – Lift Arm Float Buttons/Indicator

Operation

Hydraglide™ Ride Control System (Option)

Hydraglide™ cushions lift arm loads during transport. It provides a smoother ride over uneven surfaces.

IMPORTANT: *Hydraglide™ is automatically deactivated when the machine is shut off.*

IMPORTANT: *Do not use Hydraglide™ when digging. Precise control of the digging operation is difficult with the Hydraglide™ option activated.*

WARNING

Do not use Hydraglide™ when using pallet forks.

Activate Hydraglide™ when driving on public roads, for lighter loads, and for light off-road transport. Deactivate Hydraglide™ when working with heavy loads, such as when picking up excavated material.

WARNING

When Hydraglide™ is activated, the lift arm may drop slightly without a load, or several inches with a heavy load.

On the right joystick, press switch (H, Fig. 94) to toggle Hydraglide™ on/off.

The Hydraglide™ indicator (J) on the multi-function display lights up when Hydraglide™ is activated.

NOTE: *Indicator (J) in the multi-function display is lit when the Hydraglide™ option is activated.*

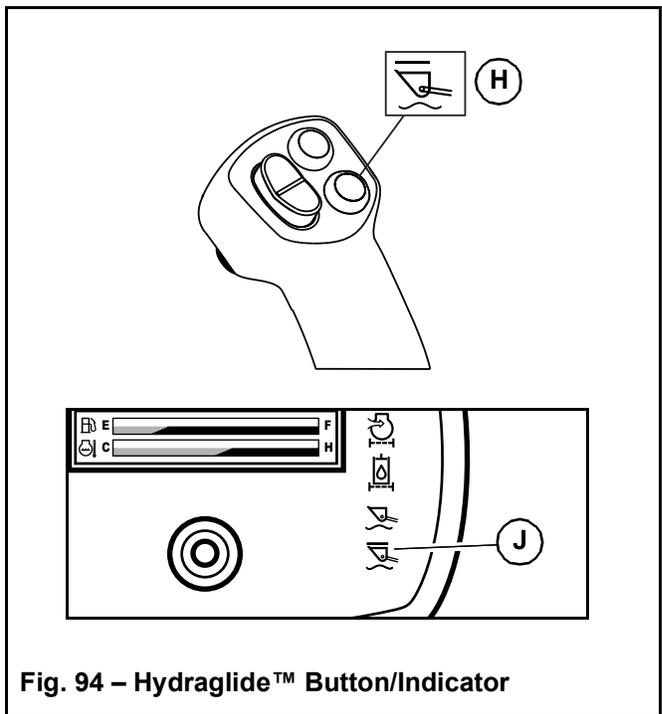


Fig. 94 – Hydraglide™ Button/Indicator

Hydraulics Control Lock

The hydraulics control are locked-out whenever either of the safety bars/arm rests are in the raised position (B, Fig. 95), the operator's seat is unoccupied or the cab door is open.

NOTE: *Raising the safety bars/arm rests also applies the parking brake.*

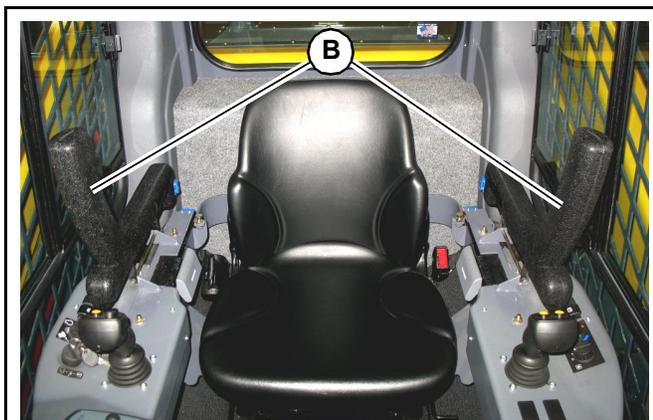


Fig. 95 – Safety Bars/Arm Rests in Raised Position



WARNING

Always raise the safety bars/arm rests to lock out hydraulics control and apply the parking brake whenever leaving the machine unattended.

Operation

Lift Arm Support

WARNING

A falling lift arm could result in severe injury or death.

If the lift arm must be left in the raised position, **BE SURE** to properly apply the lift arm support device.

The operator must not leave the operator's position if the lift arm is in the raised position unless the lift arm support device is properly applied.

WARNING

A second person on the outside of the machine is required to assist with applying the lift arm support.

Engage Lift Arm Support

1. Empty and remove the attachment.
2. Bring the machine to a complete stop on a level surface.
3. Raise the lift arm as high as it will go.
4. Move the drive controls to the neutral position.
5. Shut off the engine.

WARNING

The lift arm should remain in the raised position when the engine is stopped. If the lift arm is observed moving from the raised position, stay in the operator's position, lower the lift arm and exit the machine. Have the machine serviced by an authorized dealer before operating again.

6. Move the lift/tilt controls to verify that the controls do not cause movement of the lift arm and hitch plate.

7. Raise the safety bars/arm rests to apply the parking brake and lock out the hydraulic controls.
8. Stay in the machine sitting in the operator's position. A second person, on the outside of the machine, must:
 - a. Remove retaining fastener (Y, Fig. 96) securing lift arm support (Z) in the storage position.

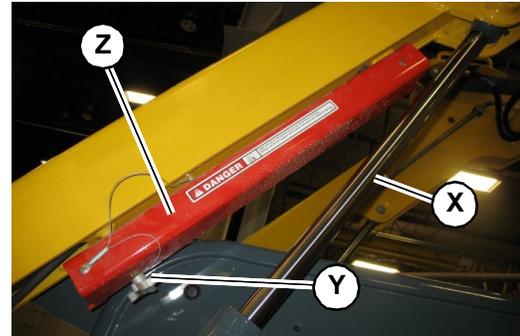


Fig. 96 – Lift Arm Support in Storage Position

- b. Position the lift arm support (Z, Fig. 97) over the lift arm cylinder rod (X, Fig. 96 and Fig. 98).

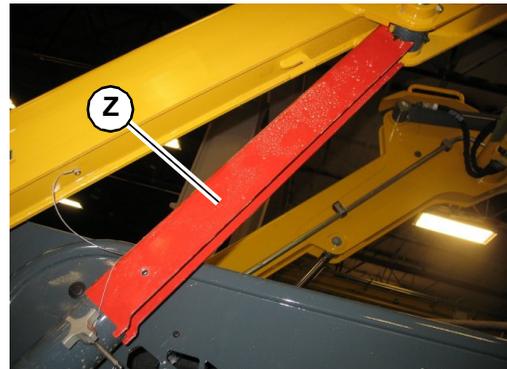


Fig. 97 – Lift Arm Support Applied

- c. Position the lift arm support with the curved end (E, Fig. 98) of the support tight against the end of the cylinder rod (P), and tabs (T) on the support hooked over cylinder tube head (C) as shown.

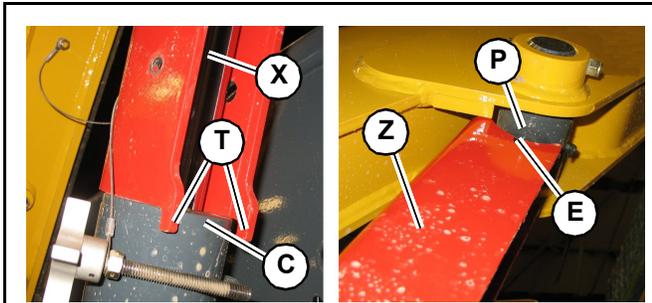


Fig. 98 – Lift Arm Support Proper Positioning

9. Start the machine and lower the lift arm against lift arm support (Z). Verify that lift arm support (Z) is properly positioned as shown in Fig. 98.

WARNING

The lift arm support device must be properly positioned to prevent the lift arm from falling, which could result in severe injury or death.

10. Shut off the engine.
11. Move the lift/tilt controls to verify that the controls do not cause movement of the lift arm and hitch plate.
12. Raise the safety bars/arm rests to apply the parking brake and lock out the hydraulic controls.
13. Unfasten the seat belt, remove the ignition key and take it with you. Exit the machine using the hand-holds.

Disengage Lift Arm Support

WARNING

A second person on the outside of the machine is required to assist with disengaging the lift arm support.

1. Start the engine and raise the lift arm as high as it will go.
2. Move the drive controls to the neutral position.
3. Shut off the engine.
4. Move the lift/tilt controls to verify that the controls do not cause movement of the lift arm and hitch plate.
5. Raise the safety bars/arm rests to apply the parking brake and lock out the hydraulic controls.
6. Stay in the machine in the operator's position. A second person, on the outside of the machine, must:
 - a. Remove lift arm support (Z, Fig. 99) from the cylinder rod.

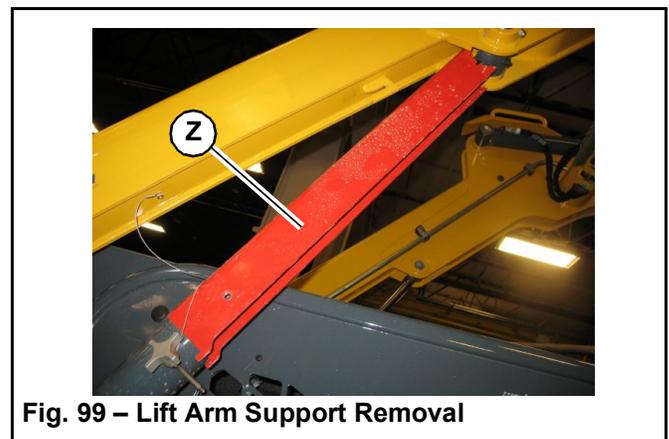


Fig. 99 – Lift Arm Support Removal

7. Securely insert notch (F, Fig. 100) on lift arm support (Z) into retaining hook (N) on the lift arm. Secure lift arm support (Z) in the storage position using retaining fastener (Y). Tighten fastener (Y) securely.

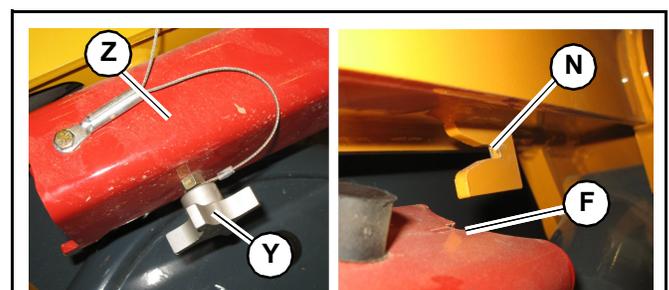


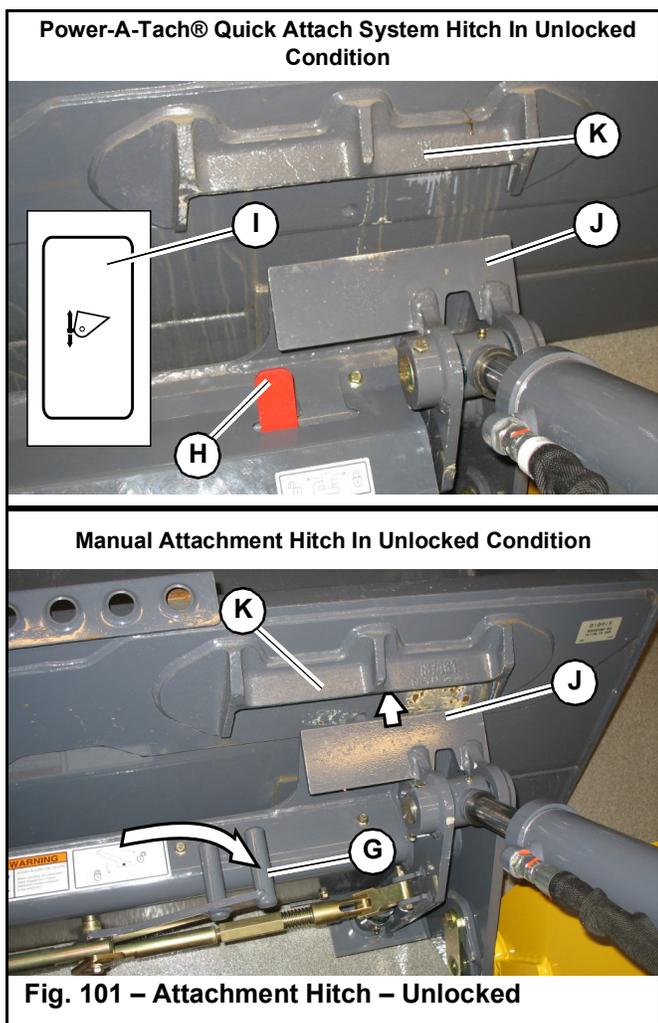
Fig. 100 – Lift Arm Support Storage Position

Operation

Connecting/Disconnecting Attachments

Connecting Attachments

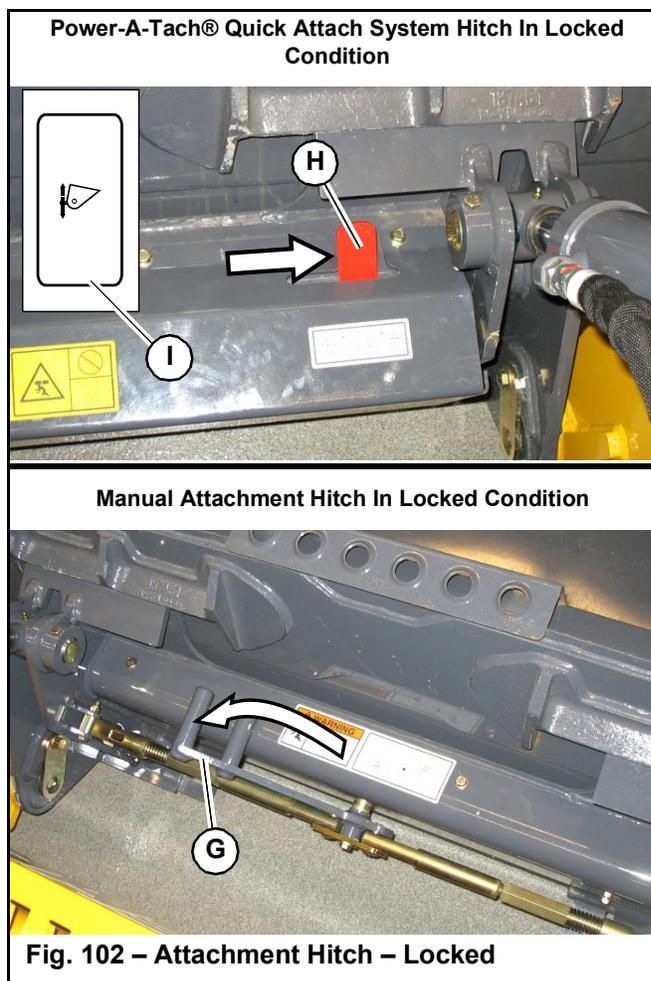
1. Place the attachment lock into the unlocked position (Fig. 101):
 - Power-A-Tach® system hitch – Press the bottom of hitch lock switch (I) until safety flags (H) have moved all the way in.
 - Manual attachment hitch – move hitch lock lever all the way to the right (G).



2. Tilt the attachment plate forward and drive the machine straight forward toward the back of the attachment.
3. Lower the lift arm so tabs (J) on the top of the attachment plate are aligned just under hooks (K) on the back of the attachment.

4. Tilt the attachment plate back until tabs (J) on the top of the attachment plate are engaged against hooks (K) on the back of the attachment.
5. Raise the lift arm slightly until the attachment is hanging from hooks (K) and tabs (J) are firmly inserted into the hooks. Tilt the attachment plate back, if necessary, so the back of the attachment is resting flat against the attachment plate.

6. Place the attachment lock into the locked position (Fig. 102):
 - Power-A-Tach® system hitch – Press the top of hitch lock switch (I) until safety flags (H) have moved all the way out.
 - Manual attachment hitch – Perform the “Mandatory Safety Shutdown Procedure” on page 20 and move hitch lock lever all the way to the left (G).



7. Make sure the locking pins (F, Fig. 103) are fully engaged down through the holes in the attachment.

Manual Attachment Hitch Shown, Power-A-Tach® Quick Attach System Hitch Similar

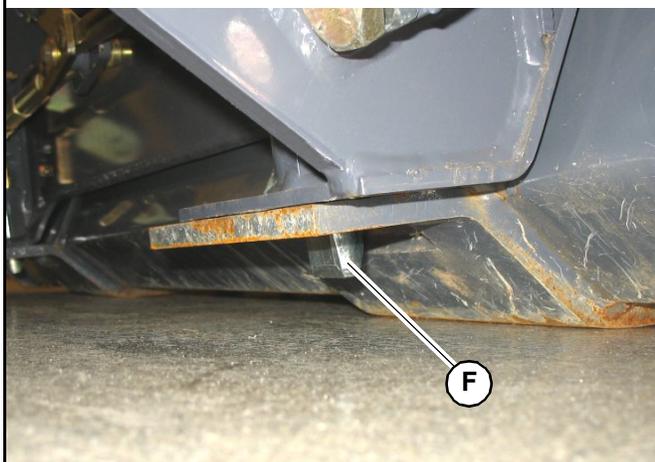


Fig. 103 – Attachment Locking Pins

WARNING

To prevent unexpected release of the attachment from the hitch, be sure to properly secure the hitch latch pins by hitch lock lever (G, Fig. 102) all the way to the left (manual All-Tach® hitch) or by ensuring that the safety flags (H, Fig. 102) are all the way to the outside (Power-A-Tach® hitch).

Locking pins (F) must be fully engaged through the holes in the attachment frame before using the attachment. The attachment could fall off if it is not locked on the hitch and cause serious injury or death.

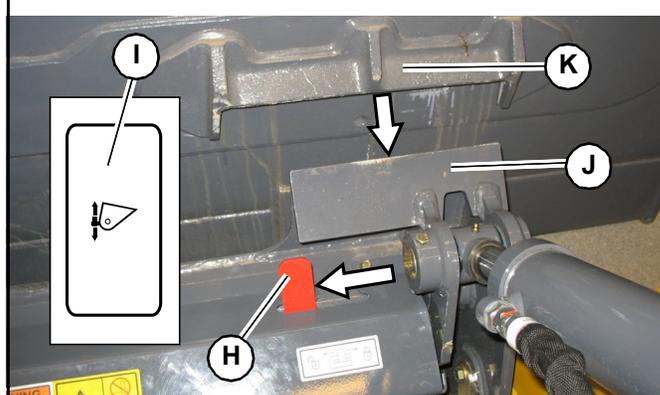
Disconnecting Attachments

WARNING

Position the attachment so that after disconnecting the attachment will stand safely and not tip over. Serious injury can occur if an attachment tips over onto a person.

1. Empty the attachment and drive to an open, level area to disconnect the attachment.
2. Lower the attachment to the ground.
3. Place the attachment lock into the unlocked position (Fig. 104):
 - Power-A-Tach® system hitch – Press the bottom of hitch lock switch (I) until safety flags (H) have moved all the way in.
 - Manual attachment hitch – Perform the “Mandatory Safety Shutdown Procedure” on page 20 and move hitch lock lever all the way to the right (G).

Power-A-Tach® Quick Attach System Hitch Disconnection



Manual Attachment Hitch Disconnection

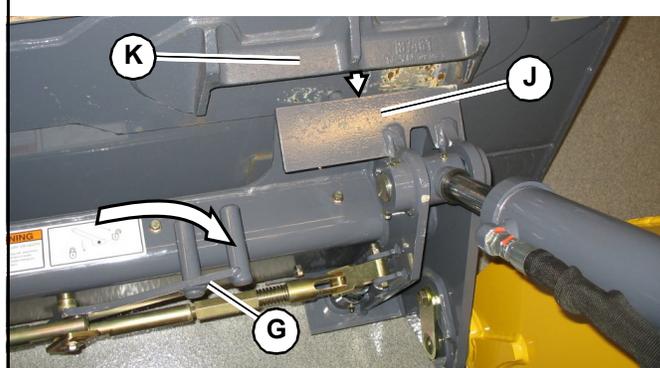


Fig. 104 – Attachment Hitch – Unlocked

4. Lower the lift arm until tabs (J) on top of the attachment plate disengage out of hooks (K) on the back of the attachment.
5. Look behind you for bystanders and obstacles. Drive straight back in reverse away from the attachment.

Operation

Powering Attachments with Hydraulic Function

Hydraulically-powered attachments are powered using the auxiliary hydraulics circuits.

Connecting Hydraulic Attachments to the Auxiliary Hydraulic Circuits

IMPORTANT: Connect hydraulically-powered attachment hoses to the auxiliary circuits after the attachment is secured to the hitch.

Disconnect hydraulically-powered attachment hoses from the auxiliary circuits before removing the attachment from the hitch.

NOTE: The connection procedure is the same for both the normal and the optional high-flow auxiliary hydraulic circuits.

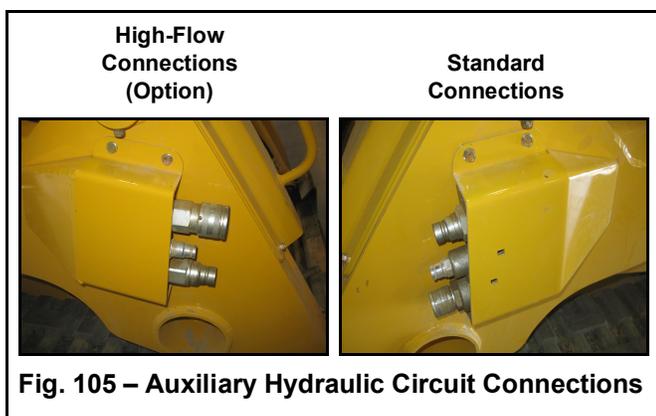


Fig. 105 – Auxiliary Hydraulic Circuit Connections

CAUTION

Only connect high-flow attachment couplers to the high-flow auxiliary couplers.

1. Empty the attachment and lower it to the ground.
2. Shut off the engine and turn off the ignition. Remove the ignition key and take it with you.
3. Raise the safety bars/arm rests to apply the parking brake.
4. Clean the hydraulic connections on the hoses and the connections.

5. Relieve the pressure in the standard auxiliary hydraulics circuit by pushing the attachment coupler firmly into the auxiliary coupler.
6. Continue to push the hose connections firmly onto the auxiliary hydraulic connections until they snap into place.

CAUTION

Route the hydraulic hoses so they do not get pinched when the attachment is tilted forward and back. Damaged or burst hydraulic hoses could result.

IMPORTANT: Always check hydraulic function of the attachment before use, to make sure the hydraulic hoses have not been installed in reverse.

NOTE: Pressure build-up caused by heat in hydraulic attachments left in direct sunlight can make it difficult to connect the quick-couplers to the fittings on the attachment.

Disconnecting Hydraulic Attachments from the Auxiliary Hydraulics Circuit

1. Empty the attachment and lower it to the ground.
2. Shut off the engine and turn off the ignition. Remove the ignition key and take it with you.
3. Raise the safety bars/arm rests to apply the parking brake.
4. Push on the hose connection locking rings until the hose connections release.

Auxiliary Hydraulics Operation

Standard-Flow Auxiliary Hydraulics Control

The toggle and trigger switches (A and B, Fig. 106) on the right joystick controls standard-flow auxiliary hydraulics.

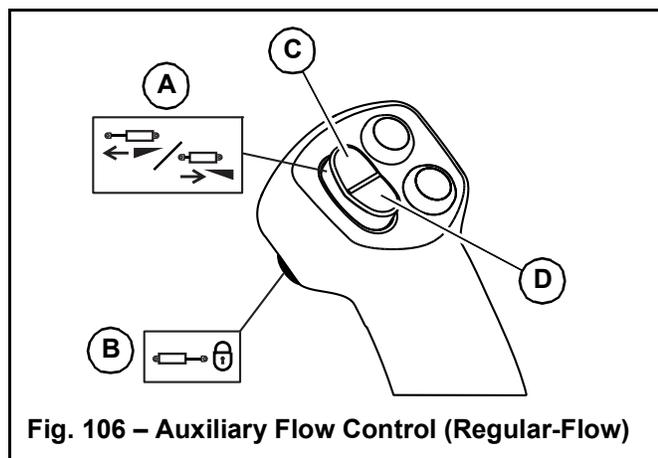


Fig. 106 – Auxiliary Flow Control (Regular-Flow)

Press the top (C) of toggle switch (A) to activate auxiliary hydraulics flow in one direction. Flow control is proportional: the flow rate increases as the toggle switch is moved further. Release the switch to stop the flow.

Press the bottom (D) of toggle switch (A) to activate auxiliary hydraulics flow in the opposite direction. Flow control is proportional: the flow rate increases as the toggle switch is moved further. Release the switch to stop the flow.

For continuous flow:

1. Move toggle switch (A) as far as it will go either forward or back – depending upon what direction flow is required.
2. While holding the toggle switch (A) at the full forward or full reverse position, press trigger button (B). Release trigger button first (B), then release toggle switch (A).

NOTE: Standard flow auxiliary hydraulics continuous flow can only be activated if toggle switch (A) is held in either the FULL forward or FULL reverse position.

To stop continuous standard-flow, press and release trigger switch (B).

NOTE: Standard flow auxiliary hydraulics will remain in continuous flow with the safety bars/arm rests the raised position, the operator's seat unoccupied and the cab door open.

NOTE: When ignition power is interrupted, auxiliary hydraulic function is reset to OFF.

High-Flow Auxiliary Hydraulics Control (Option)

The optional high-flow hydraulics connections are located on the right side of the machine. See Fig. 105 on page 106.

Press and release the top (G, Fig. 107) of the high-flow toggle switch (K) to activate high-flow auxiliary hydraulics flow in one direction.

Press and release the bottom (J) of the high-flow toggle switch (K) to activate high-flow auxiliary hydraulics flow in the opposite direction.

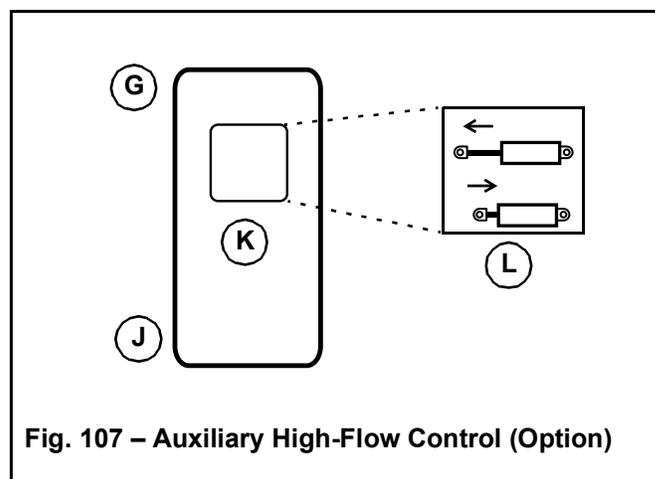


Fig. 107 – Auxiliary High-Flow Control (Option)

NOTE: Indicator (L) in the high-flow toggle switch (K) is lit when auxiliary hydraulics high-flow is activated.

To stop continuous high-flow, press and release switch (K)

NOTE: Continuous high-flow will stop if the safety bars/arm rests are raised, if the operator's seat is unoccupied, or if the cab door is opened.

Operation

WARNING

If the engine should stall for any reason during auxiliary high-flow hydraulics operation, always turn the ignition key all the way counter-clockwise to the “OFF” position before re-starting the engine according to “Starting the Engine” on page 75.

Optional 14-Pin Connector

Optional 14-pin connector (T, Fig. 108) is intended for attachments equipped with 14-pin compliant connections using direct 12 volt actuation control.

NOTE: Contact your dealer for information about approved 14-pin-equipped attachments.

Switch / Pin Assignments

Refer to Fig. 109 and table 34 for details about joystick switches and the associated pins in the 14-pin connector.

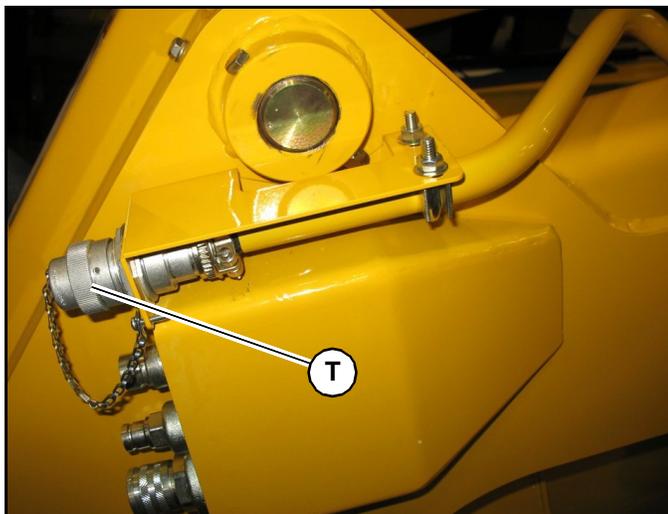


Fig. 108 – Optional 14-Pin Connector

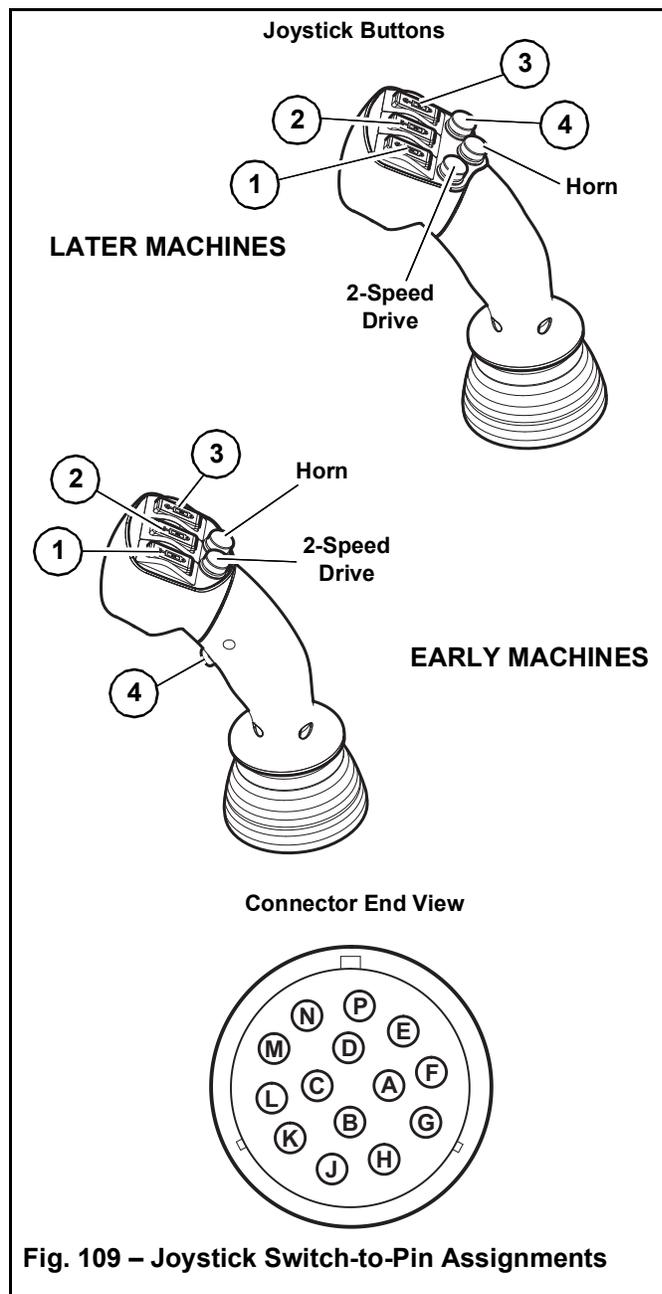


Fig. 109 – Joystick Switch-to-Pin Assignments

Table 34: 14-Pin Joystick and Pin Assignments

Joystick Switch	Switch Position	Switch Type	Connector Pin	Amp
1	Forward	Momentary	C	15
	Back		D	
2	Forward	Momentary	E	10
	Back		F	
3	Forward	Momentary	G	10
	Back		H	
4	Pressed	Latching	A	15

Table 34: 14-Pin Joystick and Pin Assignments

Joystick Switch	Switch Position	Switch Type	Connector Pin	Amp
Pin Description			Connector Pin	Amp
	Ground		B	15
	Power (with key ON)		K	15
	Not Assigned		L	N/A
	Not Assigned		M	N/A
	Not Assigned		N	N/A
	Not Assigned		P	N/A
	Not Assigned		J	N/A

NOTE: Depending upon the attachment, an adapter harness may be necessary. Refer to the documentation supplied with the attachment, or contact your dealer.

Working with Buckets

Buckets are mainly used for digging, loosening, lifting, transporting and loading loose or solid materials.

WARNING

Read the “Safety” section in this manual, starting on page 19, before working with a bucket. Pay special attention to the “During Operation” information, starting on page 21.

Always follow the information included in the “Safety” section. Serious injury or death can occur if the safety information is not followed.

Make sure the bucket is securely attached to the hitch before starting work. See “Connecting Attachments” on page 104.

CAUTION

Follow the recommendations in “Fields of Application” on page 14.

Digging Tips

When completing a digging task:

- When digging in a pit, exit the pit outside the digging line, through an area as level as possible.
- If possible, dig by removing adjacent strips.
- Drive forward when transporting a full bucket out of the digging area.
- Drive in reverse when transporting a full bucket down a steep slope.

Operation

Safety Instructions When Working with Buckets

WARNING

Avoid tilting a bucket back when the lift arm is fully raised. Material may fall over the rear of the bucket and onto the operator's position.

When on slopes, always set the lift arm to the transport position (“Attachment Transport Position” on page 96) and tilt the bucket fully back.

Secure heavy or awkward loads. If necessary, fit the rear of the bucket with a guard to prevent material from falling out of the back of the bucket.

Whenever possible, drive in reverse when transporting a bucket loaded with material down a steep slope.

Make sure you have a good view of the material you are digging, and of the area you will be working in.

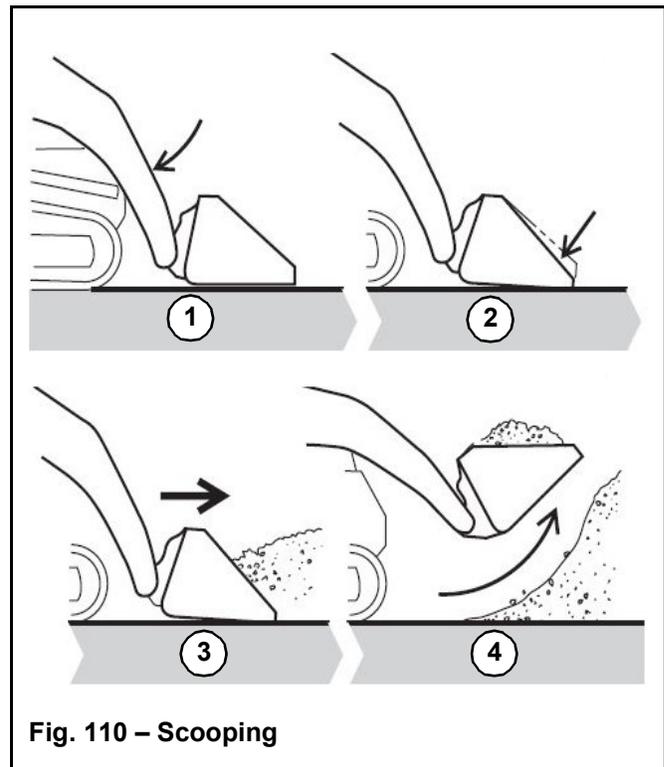
Working with Standard Buckets

Scooping

WARNING

Use extreme care when digging around foundations or walls. Never remove material that might compromise a wall or foundation.

1. Lower the bucket to the ground (Fig. 110).

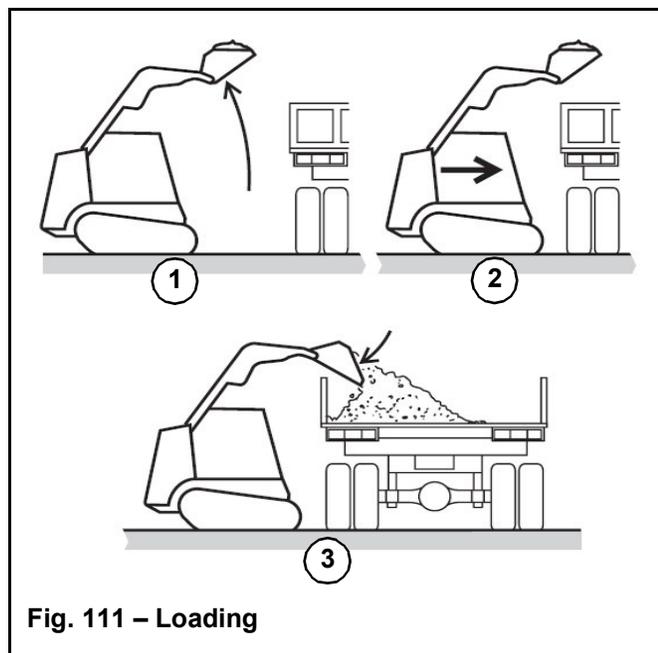


2. Tilt the bucket slightly forward so the bucket blade is pointing slightly down into the ground.
3. Drive forward until the bucket is filled with material. Adjust the bucket tilt as needed to remove an even layer of ground and to reduce track slip.
4. Tilt the bucket back and raise it to scoop up material.
5. Reduce engine speed and back out of the material.
6. Set the bucket to transport position. See “Attachment Transport Position” on page 96.

Loading

IMPORTANT: When the self-leveling feature is on, the tilt angle of the attachment is kept constant when the lift arm is raised: when the lift arm is lowered, self-leveling is not activated. Refer to “Self-Leveling” on page 98 for more information about the self-leveling feature.

1. Approach the truck and stop, then raise the bucket until the lower edge of the bucket clears the truck bed (Fig. 111).

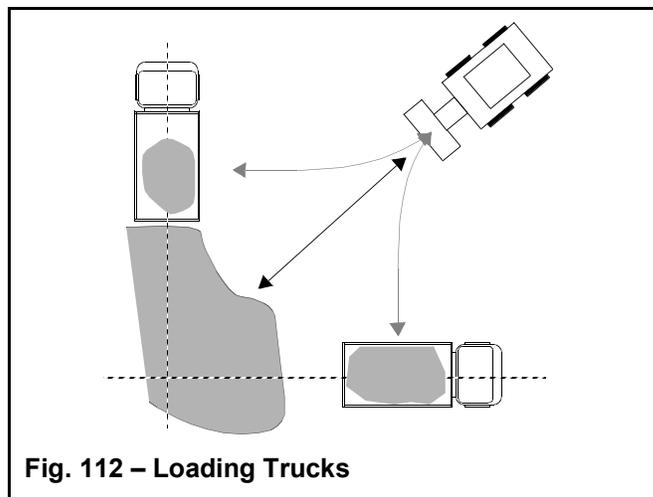


2. Drive slowly forward and stop at the position where the bucket will be dumped.
3. Tilt the bucket forward and dump the material into the truck bed.
4. When the truck is half-loaded, use the bucket to spread the load evenly.

Tips When Loading Trucks

When loading trucks:

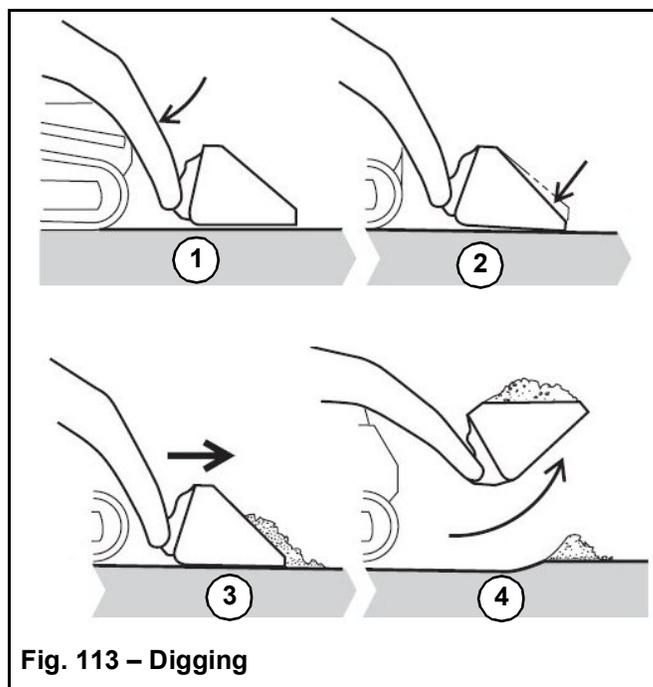
- The truck and machine working direction should form an angle of 45°. (Fig. 112).



- Only raise a full bucket to the height needed for dumping when you are driving in a straight line toward the truck.
- Dump with the wind behind you to keep dust away from your eyes, air filters and fans.

Digging

1. Lower the bucket to the ground (Fig. 113).

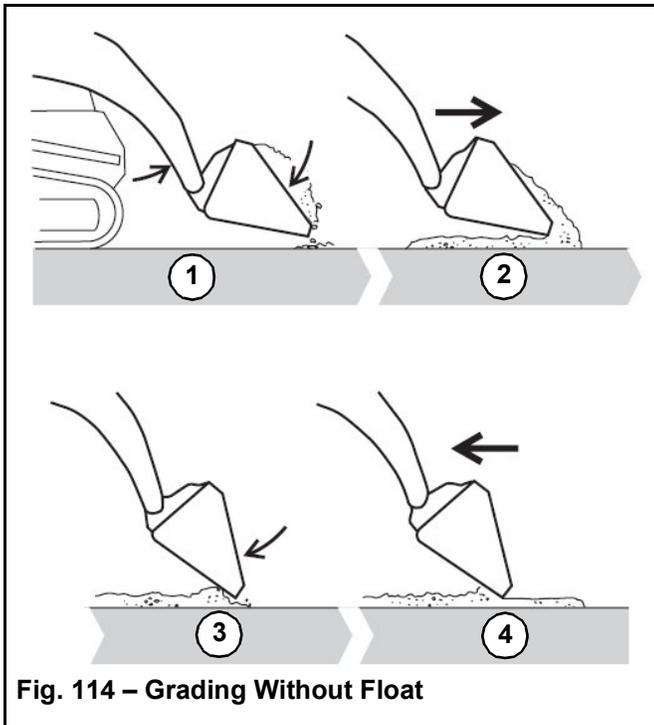


Operation

2. Tilt the edge of the bucket down at an angle appropriate for ground hardness.
3. Drive forward slowly, digging into the ground with the cutting edge of the bucket.
4. When the bucket is full, raise the bucket and tilt it back.

Grading without Float

1. Raise the bucket and tilt it forward (Fig. 114).



2. Release material from the bucket while driving forward.
3. Tilt the bucket forward and lower the front edge until it is slightly above the ground.
4. Drive in reverse, smoothing the material released in step 2 with the front edge of the bucket.

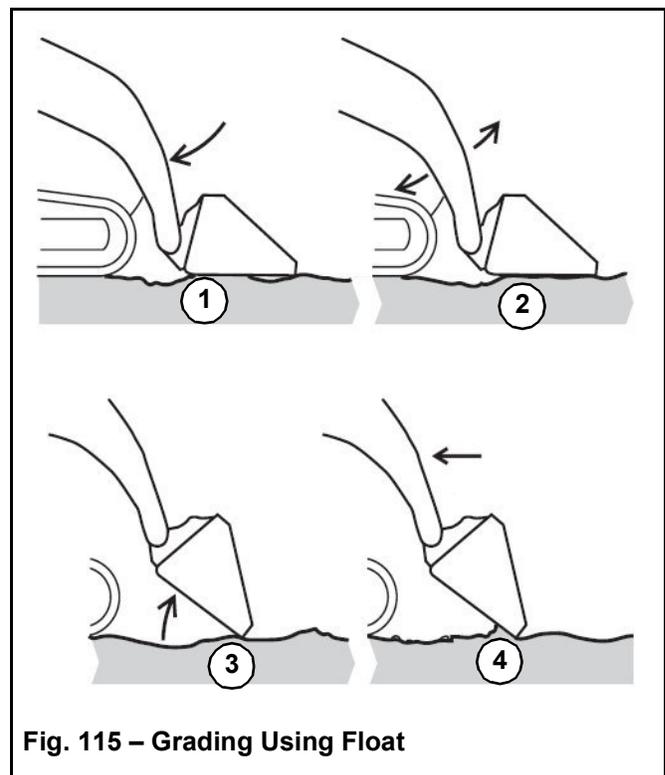
Grading Using Float



Make sure the bucket is lowered to the ground before activating the lift arm float. Activating float with an attachment raised will cause it to fall to the ground, which can cause severe injury or death.

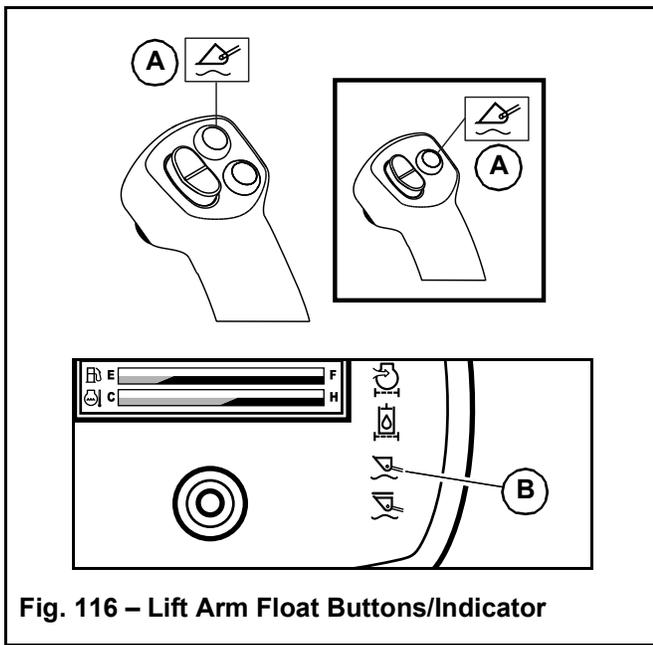
Do not drive the machine forward with the lift arm float activated. Damage to the machine and/or loss of control can result.

1. Lower the bucket to the ground (Fig. 115).



2. Press button (A, Fig. 116) on the right control joystick to activate the lift arm float. See “Lift Arm Float” on page 99 for more information about the float feature.

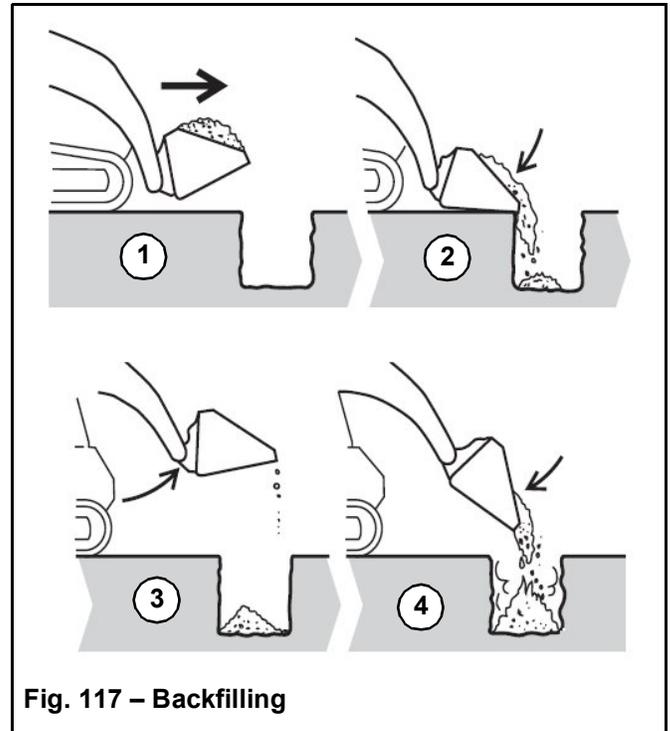
NOTE: Indicator (B) in the multi-function display is lit when the lift arm float is activated. Indicator (B) blinks when momentary float is activated and is continuously lit when continuous float is activated.



3. Tilt the bucket forward so it stands on the cutting edge (Fig. 115).
4. Drive in reverse, dragging the floating bucket. Adjust the tilt angle of the bucket while driving in reverse to control the spread of the material.
5. When finished, press button (A, Fig. 116) again to deactivate the lift arm float.

Backfilling

1. Lower the bucket a few inches from the ground (Fig. 117). Slowly drive up to the hole until the front edge of the bucket is over the near edge of the hole.



2. Tilt the bucket forward to dump material into the hole.
3. Tilt the bucket back and raise the bucket. Inspect the hole for proper filling.
4. Continue to dump material into the hole as necessary for proper fill.

Operation

Working with Pallet Forks

Safety Instructions When Working with Pallet Forks

WARNING

Read the “Safety” section in this manual, starting on page 19, before working with pallet forks. Pay special attention to the “During Operation” information, starting on page 21.

Follow all instructions in the Operator's Manual provided with the pallet forks.

Use only approved pallet forks. Use special caution and maintain tilt control at all times when using pallet forks.

Always follow the information included in the “Safety” sections. Serious injury or death can occur if the safety information is not followed.

Always approach the load from a straight-ahead position. Position the fork arms underneath the pallet, as far as they will go, so the load is distributed as closely as possible to the fork frame. Position the fork arms as far apart as possible, as allowed by the load. Load both fork arms evenly.

Lift, transport and unload loads only on firm and level ground with sufficient load-bearing capacity.

Always transport the load close to the ground as is safely possible. Observe minimum ground clearance.

Use pallet forks for material handling and/or material transport only.

Never lift a load using only one fork arm.

Make sure the fork arms are safely locked onto the fork frame before use.

Do not lift unstable material, or material that is not properly secured on the fork arms.

Never leave a machine with the forks raised or a load unattended. Make sure all persons stay clear of suspended loads.

WARNING

DO NOT exceed pallet fork load center and/or lifting capacity. See the pallet fork payload / capacities table on page 38.

Do not use high travel speed range when using pallet forks.

DO NOT use standard fork arms as reverse (inverted) forks.

Never allow a load to get closer than 6 m (20 ft.) to overhead electrical lines.

DO NOT push, pull or shove the fork arms, or move them in at a slanting angle; the resulting lateral forces can damage the fork arms.

DO NOT pull loads off the fork arms, or allow loads to fall onto the forks arms.

DO NOT tilt the pallet forks to raise loads.

DO NOT lift or transport molten material with pallet forks.

Repair work on fork arms must be performed only by authorized personnel.

Always keep pallet fork arms clean.

Secure loads as directed in the pallet fork Operator's Manual to prevent the loads from falling.

Never modify pallet fork arms.

Do not lift or transport persons on the pallet forks.

Do not drive on public roads with pallet forks installed on the machine.

Do not stack loads which are not properly packaged or have damaged pallets/stacking containers. Do not stack loads on top of loads, which may have shifted.

Always tilt pallet forks back slightly during transport to help retain the load.

 **WARNING**

Do not use bent, cracked, or otherwise damaged fork arms/pallet forks.

Always inspect pallet forks each time before using. Refer to the pallet fork manufacturer's documentation and/or contact the pallet fork manufacturer for information regarding safe pallet fork condition criteria:

- Check the fork arm locks for proper function and/or damage. Do not use pallet forks with damaged locks or locks that do not function properly.
- Visually check the fork arm hooks and/or bends for cracks and/or deformations. Do not use fork arms that are cracked and/or have deformations that make the fork arms unsafe.
- Do not use fork arms that have bends or blades that have more than 10 percent of the original material worn away.
- Check the fork arms blades and tips for deformations or holes.

Transporting Loads Using Pallet Forks

IMPORTANT: When the self-leveling feature is on, the tilt angle of the attachment is kept constant when the lift arm is raised. When the lift arm is lowered, self-leveling is not activated. Refer to "Self-Leveling" on page 98 for more information about the self-leveling feature.

Loading Pallet Forks

1. Stop the machine immediately in front of the material
2. Position the fork arms parallel to the ground.
3. Make sure the fork arms are adjusted as far apart as possible, as allowed by the load, and are both the same distance away from the center-line of the load.
4. Adjust the height of the fork arms to fit the lifting area at the bottom of the pallet.
5. Drive slowly and carefully forward until the fork frame contacts the material.
6. Make sure the pallet is evenly and safely positioned on the pallet fork arms.

Lifting Loads Using Pallet Forks

7. Apply the parking brake.
8. Slowly raise the pallet forks. Do not raise the pallet forks any higher than required. Make sure to not exceed pallet fork load center and/or lifting capacity.
9. Lower the load immediately if you are unsure of the load, the equipment, or in case of any unsafe circumstances.
10. Tilt the pallet fork frame back slightly, to help retain the load.

Transporting Load Using Pallet Forks

11. Make sure the area around and behind the machine is clear of bystanders and obstacles.
12. Slowly and carefully drive in reverse and lower the pallet forks to transport position ("Attachment Transport Position" on page 96), when it is safe to do so.

Operation

13. Carry the load as low as safely possible during transport. Observe minimum ground clearance.
14. Drive slowly and carefully forward straight toward the place where the load will be set down.

Setting Down Loads Using Pallet Forks

NOTE: *If the load will be placed on top of stacked material, make sure to align the load in the center of the stack.*

 **WARNING**

Do not stack loads which are not properly packaged or have damaged pallets/stacking containers. Do not stack loads, or on top of loads, which have shifted.

15. Raise the pallet forks slightly above where the load will be placed.
16. Tilt the pallet forks as needed to level the fork arms.
17. Carefully drive slowly forward until the load is positioned precisely above where the load will be placed. Use care when aligning the load with a stack.
18. Slowly and carefully lower the lift arm until the load is placed.
19. Make sure the fork arms are no longer bearing weight and are free to be retracted.
20. Make sure the area around and behind the machine is clear of bystanders and obstacles.
21. Slowly and carefully drive in reverse away from the placed load until the lift arm can be lowered to transport position. See “Attachment Transport Position” on page 96.
22. Slightly tilt the pallet fork frame backwards.

Lifting the Machine using a Crane

 **WARNING**

The crane and the lifting gear must be adjusted to the proper dimensions. Always lift the machine so it is horizontal when it is raised.

Make sure the crane and the lifting gear (cables, chains) have sufficient load-bearing capacity. The crane and the lifting gear must be adjusted to the proper dimensions.

Secure the machine against unintentional movement!

Keep clear of suspended loads.

Never lift with anyone in or on the machine.

Securely fasten the lifting gear to the machine at the designated lift points.

The crane lifting crew must include experienced crane operators only.

Lift the machine only with no attachments, with the exception that the standard bucket can remain attached. The bucket must be empty and set to transport position. See “Attachment Transport Position” on page 96.

Crane Lifting Preparation

IMPORTANT: *Crane handling requires lifting gear with a spreader bar with 4 ropes, chains, etc.*

1. If a bucket is attached, make sure it is emptied. Tilt the bucket back.
2. Lower the lift arm.
3. Raise the arm rests/safety bars to apply the parking brake and lock out the hydraulic functions.
4. Turn off the engine and remove the ignition key.
5. If equipped, close and lock the cab door. Do not allow anyone to stay in the cab.

6. Close the doors and the engine cover.
7. Connect spreader bar and chains to front and rear lift points as shown. The spreader bar length should allow for the lift chains to be as vertical as possible during lifting. The lifting chain lengths should allow for lifting the machine as level as possible.

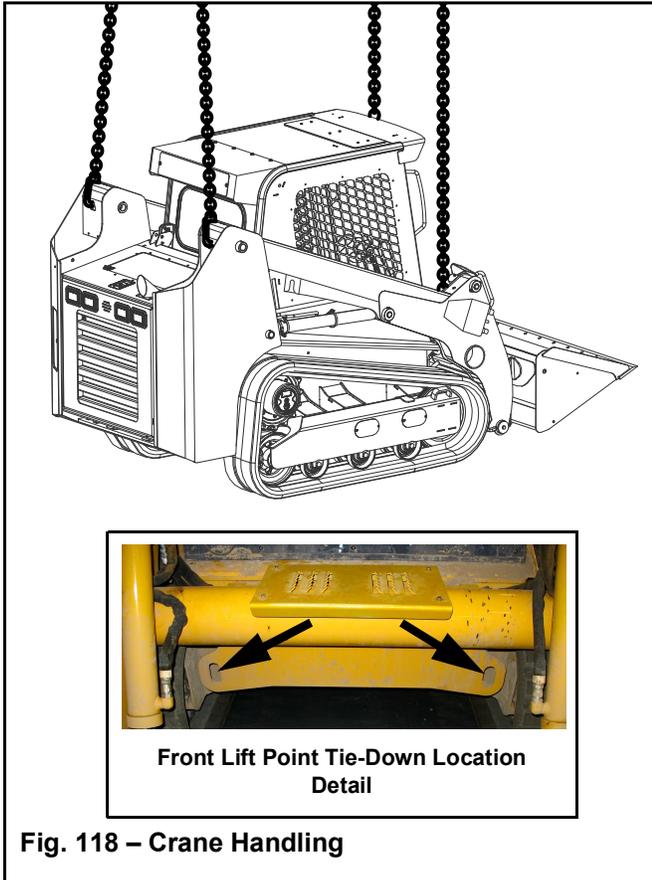


Fig. 118 – Crane Handling

CAUTION

Do not fasten the lifting gear to the cab to crane lift the machine.

8. Carefully raise the machine, keeping it as level as possible.

Loading and Transporting the Machine on a Transport Vehicle

WARNING

Do not exceed the transport vehicle's gross weight rating and the gross axle weight rating when loading and transporting the machine. The transport vehicle must have sufficient capacity for the size and weight of the machine. See "Specifications" on page 35.

Make sure the load does not fall short of the minimum axle load of the steering axle, otherwise the transport vehicle's steering could be seriously affected.

Remove any mud, snow or ice from the tracks on the machine to prevent slipping.

Position the machine at the lowest possible position on the transport platform, with the center of gravity of the load over center line of the transport vehicle. Distribute partial loads to ensure an even load on the axles on the transport vehicle.

Secure the machine properly so it cannot slip, slide, roll, tip over or fall, or cause the transport vehicle to tip over under transport conditions. Use anti-slip bases and linings, load-securing straps and chains, clamping beams, protective paddings, nets, edge protectors, etc. as needed to properly secure the load. Consider all possible transport conditions such as: heavy braking, evasive maneuvers, and uneven or rough roadways.

Adjust transport speed to the load, to the road/traffic conditions and to the handling of the transport vehicle.

Always use the proper tie-down points when using straps and chains. See "Component Identification" on page 13.

Operation

Loading and Securing the Machine

WARNING

Secure the loading ramps to the transport vehicle before loading. Position the loading ramps at the shallowest possible angle. Do not exceed an angle of 15°. Only use ramps with anti-skid surfaces.

Make sure the loading area is clear and access to it is not obstructed.

Make sure the driver of the transport vehicle knows the overall height, width and weight of the vehicle, including the loaded machine, before starting transport.

Know and follow the legal transport regulations for the area in which the transport will occur.

Make sure the loading ramps are free of mud, oil, grease, snow, ice, etc.

Know and follow the legal transport regulations for the area in which the transport will occur.

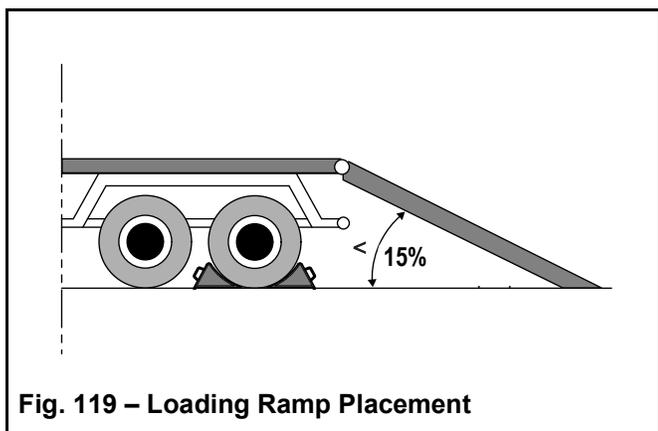


Fig. 119 – Loading Ramp Placement

1. Check the engine oil. The oil level must be at the “MAX” mark on the dipstick. Add oil if needed.

IMPORTANT: When loading and driving on ramps, the engine can be damaged if the engine oil level is too low.

2. Start the engine.
3. Raise the hitch plate/attachment enough so that it will not touch the loading ramps.

4. Slowly and carefully drive the machine in reverse onto the transport vehicle, with the bucket end facing down the ramp.
5. Do not adjust travel direction while traveling on the ramps. Instead, drive down off of the ramps, and re-align the machine with the ramps.
6. Position the machine at the lowest possible position on the transport platform, with the center of gravity of the load over center line of the transport vehicle.
7. Lower the bucket onto the loading area.
8. Stop the engine.
9. Raise the arm rests/safety bars to apply the parking brake and lock out the hydraulic functions.
10. Remove the ignition key.
11. Do not allow anyone to stay in the cab.
12. Close the doors and the engine cover.
13. Tie down the machine as follows:
 - a. Make sure the authorized maximum height is not exceeded.
 - b. Place blocks in front and behind tracks to prevent movement.
 - c. Securely strap the machine at the tie-down points (Fig. 120) to the platform. Use only belts or chains of sufficient capacity.

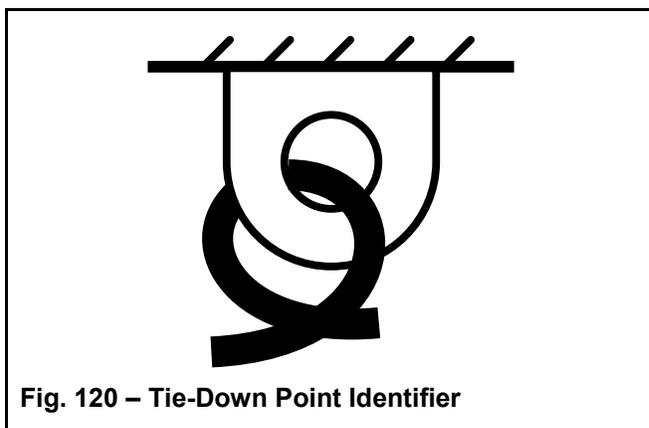


Fig. 120 – Tie-Down Point Identifier

IMPORTANT: Before transporting the machine through heavy rain, close off the exhaust pipe with a cap or suitable adhesive tape.

Storage Box

The machine is equipped with a locking storage box (Fig. 121) at the left rear corner of the machine.



Fig. 121 – Locking Storage Box

Use the accessory key (supplied with the ignition key) to lock/unlock the storage box.

NOTES

Maintenance

Proper care and service improves machine operational readiness and service life.

Perform maintenance as indicated in the “Maintenance Schedule” on page 123, or earlier if required by conditions.

WARNING

Read and understand the “Safety” Chapter in this manual, starting on page 19, before servicing the machine. Follow all applicable warnings and instructions. Check for correct function after performing maintenance. Failure to follow instructions can result in injury or death.

BEFORE performing any maintenance, perform the **MANDATORY SAFETY SHUTDOWN PROCEDURE**. See “Mandatory Safety Shutdown Procedure” on page 20.

Fluid leaks from hydraulic hoses or pressurized components can be difficult to see, but pressurized oil can have enough force to pierce the skin and cause serious injury. Always use a piece of wood or cardboard to check for suspected hydraulic leaks. Never use your hands. Obtain immediate medical attention if pressurized oil pierces the skin. Failure to obtain prompt medical assistance could result in gangrene or other serious damage to tissue.

Do not smoke or allow any open flames in the area while checking or servicing the hydraulic, battery and fuel systems because all contain highly flammable liquids or explosive gases, which can cause an explosion or fire if ignited.

Wear a face shield when disassembling spring loaded components or working with battery acid. Always wear eye protection to protect eyes from electric arcs from shorts, fluids under pressure, and flying debris or loose material. Wear a helmet or goggles with special lenses when welding or cutting with a torch.

WARNING

When working beneath a raised machine, always use blocks, jack-stands or other rigid and stable supports. Wear appropriate protective clothing, gloves and shoes. Keep feet, clothing, hands and hair away from moving parts.

Always apply the lift arm support when maintenance work requires the lift arm in the raised position. See “Lift Arm Support” on page 102.

NEVER weld on the machine without consulting the manufacturer. Special metals may be used, which require special welding techniques or parts be designed so that they should not be welded. **NEVER** cut or weld on fuel lines or tanks.

If repair welding is ever required, remove the positive (+) battery terminal connection before starting to weld. Be sure to attach the ground (-) cable from the welder as close as possible to the area to be repaired.

Allow only trained and authorized personnel, with full knowledge of safe procedures, to perform machine maintenance and service.

If any guards, shields and covers were removed during maintenance, **BE SURE** to replace them in their original positions **BEFORE** starting the machine.

Maintenance



CAUTION

Do not use the machine when maintenance is due. Postponed maintenance can result in a serious reduction of the service life of the machine, costly equipment failures, and contribute to unsafe operating conditions.

Do not perform maintenance or service not included in this manual. Maintenance and service not included in this manual should only be performed by a authorized repair shop.

IMPORTANT: *When washing the machine using water, do not direct the water onto any electrical connection, electrical component, or electronic components. Water may cause malfunction or damage. Power washing or other high-pressure jets may cause physical damage.*

Maintenance Schedule

IMPORTANT: Maintenance intervals apply to average operating conditions and loads. More frequent maintenance may be required depending upon the level and type of use.

Log all maintenance as it is performed in the “Maintenance Log” on page 163.

NOTE: Refer to the hour meter and the required maintenance display screen to determine maintenance interval timing. See “Maintenance Interval” on page 125.

Checks, Cleaning and Inspection

Table 35: Checks Cleaning and Inspection

Service Procedure	Maximum Interval		
	10 Hours (or daily)	250 Hours (or every 6 months)	500 Hours (or annually)
Clean machine	X		
Inspect machine for general wear/damage	X		
Check bucket cutting edge	X		
Check safety interlock system	X		
Inspect tracks for damage/wear	X		
Check automatic track tensioning	X		
Check engine oil level and condition	X		
Check coolant level and condition	X		
Check hydraulic fluid level and condition	X		
Check fuel level and fill if necessary	X		
Check windshield washer system and wiper blade, if applicable	X		
Check exhaust for excessive smoke emission	X		
Check hydraulic cylinder piston rods for damage/wear; clean if necessary	X		
Check ROPS structure (all fasteners must be installed and tightly secured)	X		
Check water separator and drain water, if present	X ¹		
Check coolant system for leaks, dirt and debris	X		
Check hydraulic hoses and tubes for cracks, leaks and/or debris	X		
Check hydraulic tank, valves and cylinders for leaks and/or damage	X		
Check coolant anti-freeze mixture		X	
Check belt tension and condition		X	
Check engine cover lock		X	
Check engine idle		X	
Clean radiator/oil cooler fins		X	
Check hinge pins, joint bushings, pivot bolts and bearings			X
Check engine mounts			X
Check exhaust system for damage			X
Clean battery terminals			X
Check timing belt			X
Check fuel injectors			X
Check electrical system for damage, wire routing			X

1. Model RT250: Multi-function screen displays the engine error code “97-12” if water is present in water separator. See “Engine Error Code Screen” on page 51 and “(Model RT250) Fuel prefilter sensor error” on page 174

Maintenance

Leakage Check

Table 36: Leakage Check

Service Procedure	Maximum Interval		
	10 Hours (or daily)	250 Hours (or every 6 months)	500 Hours (or annually)
Check engine for oil/coolant leaks	X		
Check cooling system for leaks	X		
Check hydraulic system for leaks	X		

Lubrication and Filter Changes

Table 37: Lubrication and Filter Changes

Service Procedure	Maximum Interval				
	10 Hours (or daily)	50 Hours (or weekly)	150 Hours (or every 4 months)	250 Hours (or every 6 months)	500 Hours (or annually)
Lubricate grease fittings according to lubrication diagram (See Fig. 157 on page 147)	X				
Change hydraulic oil return filter		X ¹			X
Travel motor gear oil		X ²	X ³		
Change engine oil/filter (Model RT210 with 4TNV98CT-NMSL Tier 4/5 engines)					X
Change engine oil/filter (All models except Models RT210 with 4TNV98CT-NMSL Tier 4/5 engines)				X ⁴	
Change cab air filter, if applicable				X ⁵	
Lubricate all levers, cables and hinges with oil				X	
Change outer air cleaner filter element; check and change inner air cleaner element if necessary				X ³	
Change fuel filter; clean pre-filter				X ⁶	
Change coolant					X
Change hydraulic oil					X

1. After first 50 hours; every 500 hours thereafter
2. RT250: After first 50 hours; every 1000 hours thereafter
3. All machines except RT250: After first 150 hours; every 1000 hours thereafter
4. After first 50 hours; every 250 hours thereafter
5. Replace if needed
6. RT250: every 1000 hours; 500 hours under extreme conditions

Functional Check

Table 38: Functional Check

Service Procedure	Maximum Interval		
	10 Hours (or daily)	250 Hours (or every 6 months)	500 Hours (or annually)
Check seat belt	X		
Check service and parking brake function	X		
Check joystick operation	X		
Check windshield wipers, if applicable	X		
Check control switches/buttons, indicators and audible warning devices	X		
Check installed lighting systems	X		

Maintenance Interval



Do not postpone maintenance. Postponed maintenance can result in a serious reduction to the service life of the machine, more serious and costly equipment failures and can contribute to unsafe conditions.

NOTE: The display screen on the multi-function display includes an “Accumulated Service Hours Screen”. See page 50. This screen displays accumulated operation time, which accumulates whenever the engine is running.

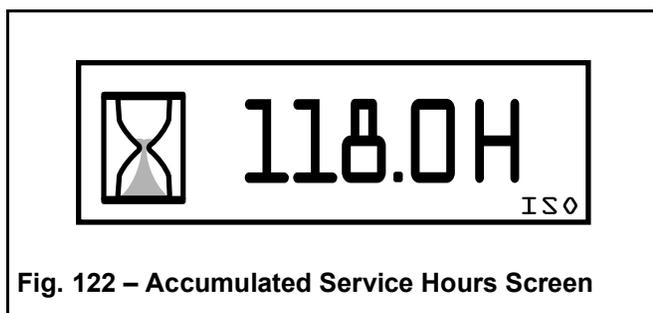


Fig. 122 – Accumulated Service Hours Screen

NOTE: Additional “Maintenance Required Screens” display at 50, 250, 500, 750, etc. (ongoing) service hour intervals. See page 50. These screens function as reminders that important maintenance is due.

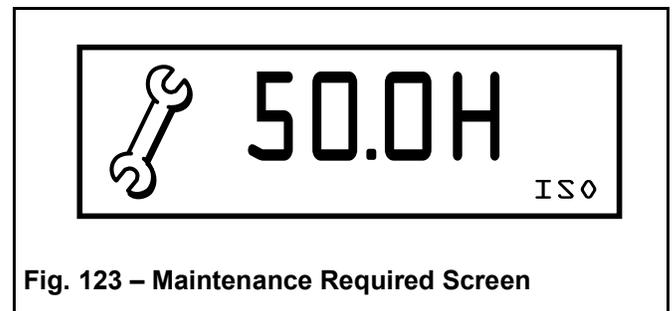


Fig. 123 – Maintenance Required Screen

IMPORTANT: “Maintenance required” screens display in rotation along with other status screens in the multi-function display. To dismiss “maintenance required” screens, press and hold the multi-function display interface button for 5 seconds.

IMPORTANT: If a “maintenance required” screen is not dismissed, it is still possible to page through the other screens for one rotation only. After this, the “maintenance required” screen will remain displayed until it is dismissed.

Maintenance

Engine Maintenance

Engine Access

1. Perform the “Mandatory Safety Shutdown Procedure” on page 20.
2. Use the ignition key to unlock the latch (A, Fig. 124) on the top engine compartment cover. Pull up on the latch and lift the cover.

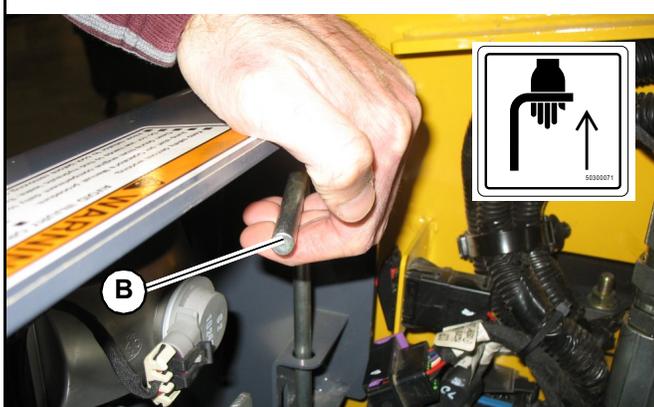
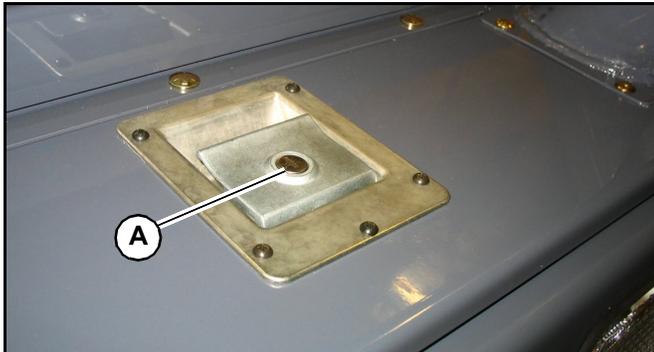


Fig. 124 – Engine Access

3. Pull up on handle (B) inside the top left lip of the rear door. Swing the door open to access engine components.

NOTE: Opening the rear door all the way engages stop (S, Fig. 125), which holds the door open.

Closing Engine Covers

1. Lift up on the rear door stop (S), and firmly close the rear door.

NOTE: It is important for the rear door to close and latch completely, so the top engine cover latch aligns properly with the pin on the rear door. Incomplete latching of the rear door/top cover may cause latches to stick.

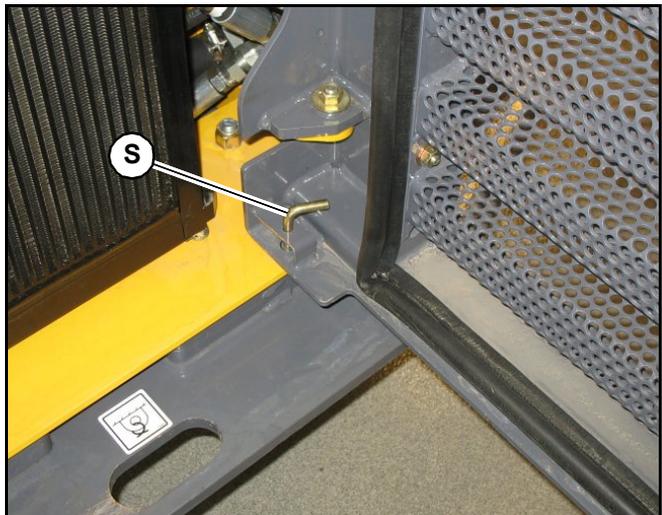


Fig. 125 – Engine Access

2. With the rear door completely closed and latched, firmly close the top engine cover until it is completely closed and latched.

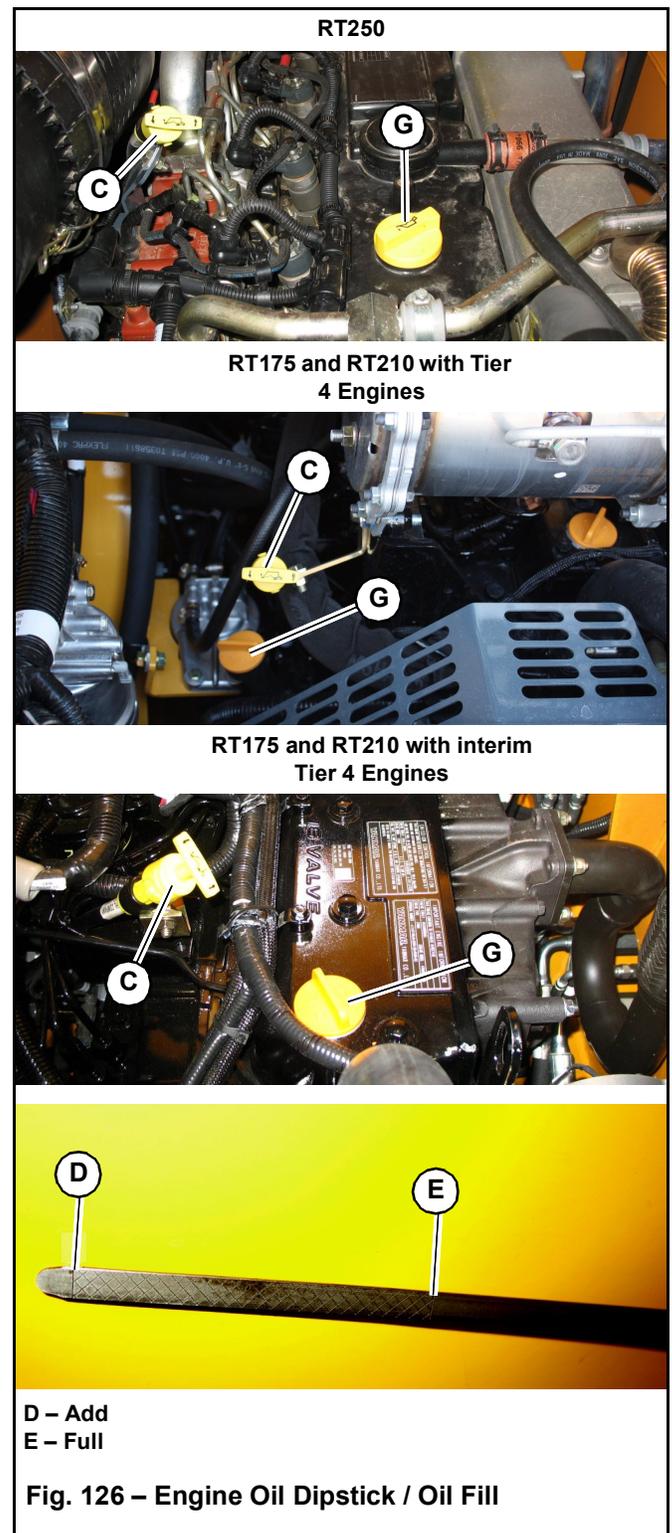
Engine Oil

Checking Engine Oil Level

Check the engine oil level daily before starting the machine, or after every ten hours of use.

1. Park the machine on a level surface.
2. Perform the “Mandatory Safety Shutdown Procedure” on page 20.
3. Wait until the engine has cooled. See “Maintenance and Service Safety Practices” on page 25.
4. Open the engine cover according to “Engine Access” on page 126.
5. Twist engine oil dipstick (C, Fig. 126) counter-clockwise to unlatch it. Remove the dipstick from the engine.
6. Wipe the dipstick with a clean cloth and replace it in the engine. Push it in until it is fully inserted.
7. Remove the dipstick again. The oil level should be within the “Add” and “Full” marking.
8. If the oil level is below the “Add” marking:
 - a. Clean the area around the oil fill cap (G) with a clean cloth.
 - b. Remove fill cap (G).
 - c. Add oil through the fill cap opening until the level reaches the “Full” mark.
 - d. Replace and tighten fill cap (G).

IMPORTANT: Do not over-fill the engine with oil. Damage could result.



Maintenance

Changing Engine Oil and Filter

Change the engine oil and filter after the first 50 hours of use, and every 250 hours thereafter.

1. Park the machine on a level surface.
2. Perform the “Mandatory Safety Shutdown Procedure” on page 20.
3. Wait until the engine has cooled, but is not completely cold. Oil will drain faster and more completely if it is warm.
4. Open the engine cover according to “Engine Access” on page 126.
5. Remove hardware (M, Fig. 127) securing engine drain plug access panel (N). Remove panel to access engine oil drain plug (O).

NOTE: On Model RT250, and Models RT175 and RT210 with oil filters located on the side of the engine, oil filter (D, Fig. 128) is accessed through the drain plug access hole (Q, Fig. 127).

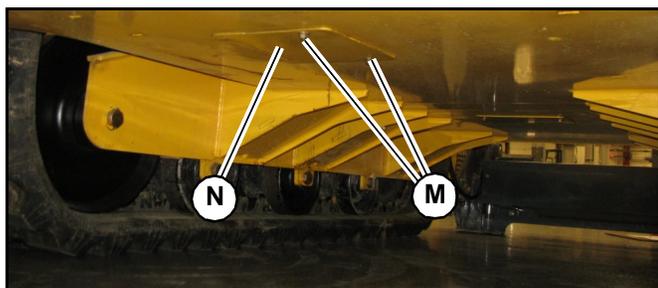


Fig. 127 – Engine Oil Drain Plug (Later Models RT175/RT210 Shown; RT250 Similar)

6. Position a waste oil collection container under the engine oil drain plug to catch draining oil.

IMPORTANT: Dispose waste engine oil according to environmental laws, or take to a recycling center for proper disposal. DO NOT pour waste engine oil onto the ground or down a drain.

7. Remove drain plug (O) from the engine oil pan and allow the oil to drain into the waste oil collection container.

NOTE: On early Models RT175 and RT210, oil drain plug (O) is located on the side of the oil pan.

8. Remove oil filter (D, Fig. 128), using a filter wrench if necessary. Carefully clean the filter head mounting surface with a clean cloth.

NOTE: On Model RT250, and Models RT175 and RT210 with oil filters located on the side of the engine, oil filter (D, Fig. 128) is accessed through the drain plug access hole (Q, Fig. 127).

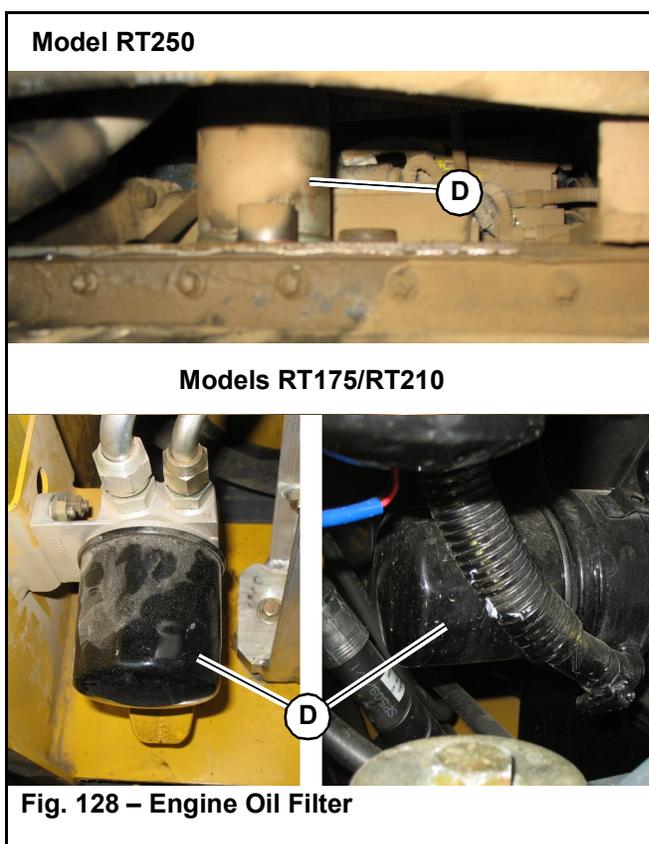


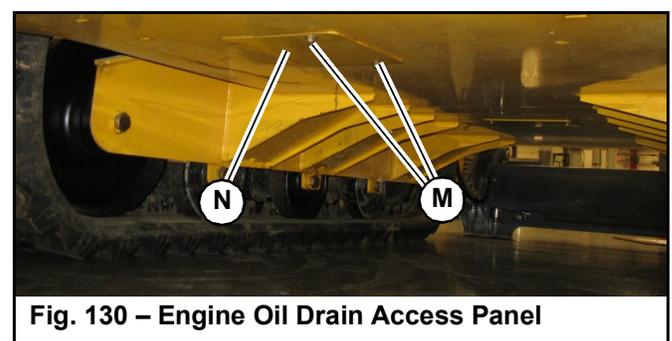
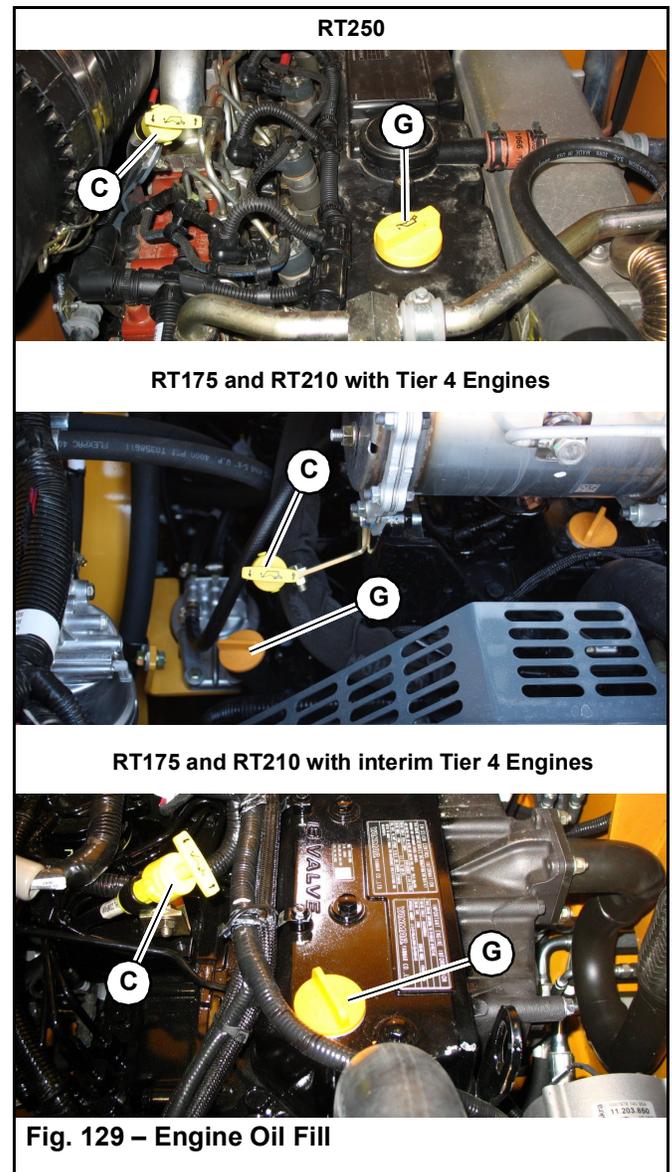
Fig. 128 – Engine Oil Filter

9. Apply a coating of clean oil on the new oil filter gasket. Install the filter and tighten 3/4 rotation past the point where the gasket contacts the filter head.
10. Re-install and tighten the drain plug.
11. Clean the area around oil fill cap (G, Fig. 129). Remove oil fill cap (G) and add the recommended type and amount of oil. See “Fluids/Lubricants Types and Capacities” on page 35. Replace and tighten oil fill cap (G) after the oil is added.

NOTE: *Oil capacity listed is approximate. Always verify proper oil level with the engine oil dipstick.*

IMPORTANT: *Do not over-fill the engine with oil. Damage could result.*

12. Start the engine and let it run for several minutes at low idle. Watch for leaks at the oil filter and drain plug. Stop the engine and wait for it to cool.
13. Check the oil level. Add oil if necessary until the oil level is at the “Full” mark on the dipstick (Fig. 126).
14. Replace engine drain plug access panel (N, Fig. 130). Secure with hardware (M).



Maintenance

Engine Air Filters

IMPORTANT: Do not operate the engine without the air cleaner components installed or damage to the engine could occur.

Check, and if necessary replace, the engine air filters after every 250 hours of use, or every 6 months, or whenever the engine air filter restriction indicator is lit (F, Fig. 131).

NOTE: The engine air filter restriction indicator (F, Fig. 131) on the multi-function display is lit whenever the air cleaner becomes restricted. When this indicator is lit, the air filters require inspection and may need replacement.

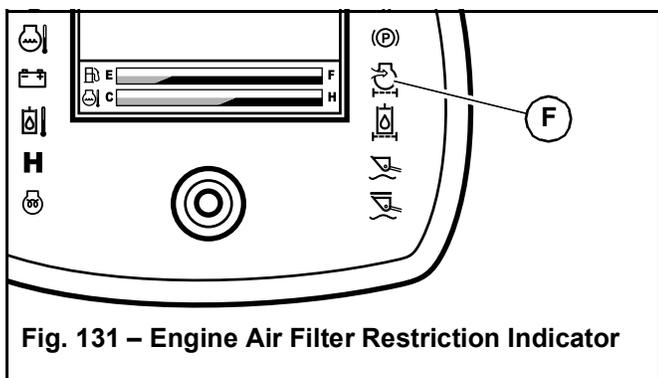


Fig. 131 – Engine Air Filter Restriction Indicator

The air cleaner consists of an outer (primary) filter element (G, Fig. 132 and Fig. 133), an inner (secondary) filter element (H) and an optional pre-cleaner.

Replace the inner filter element every third time the outer element is replaced, unless the outer element is damaged or the inner element is visibly dirty.

Be sure the air cleaner intake hose, clamps and mounting bracket hardware are properly tightened.

Changing Air Filter Elements

1. Perform the “Mandatory Safety Shutdown Procedure” on page 20.
2. Open the engine cover according to “Engine Access” on page 126.

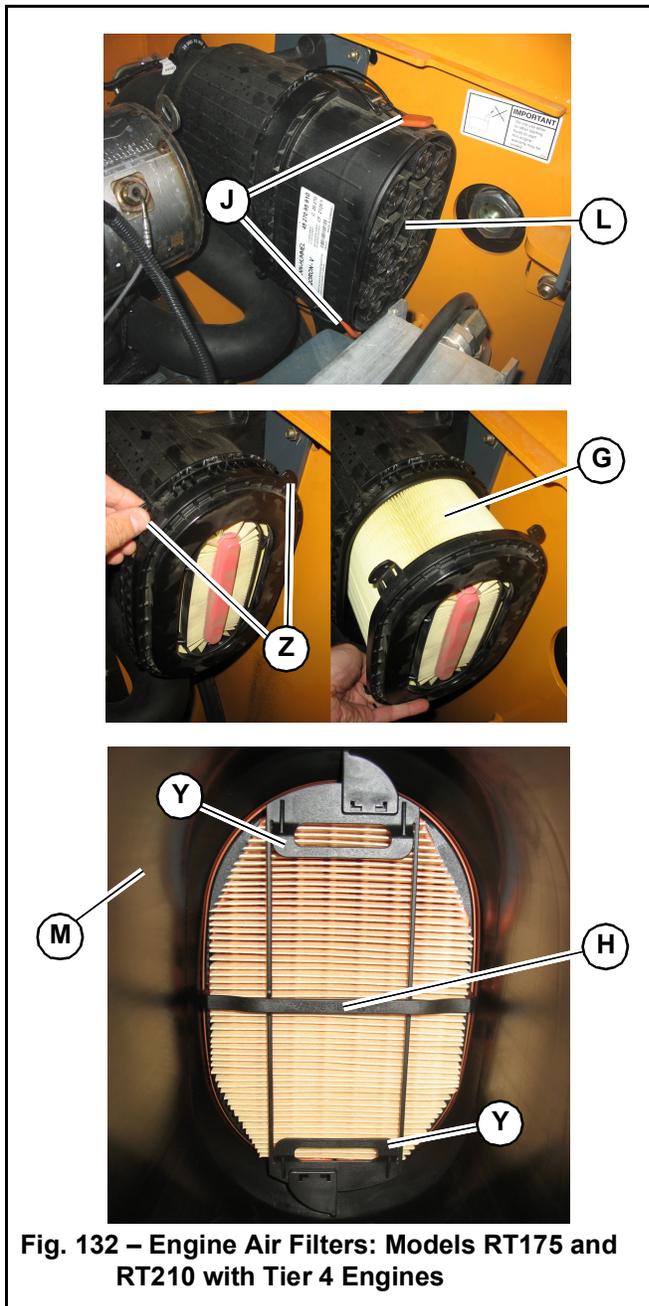


Fig. 132 – Engine Air Filters: Models RT175 and RT210 with Tier 4 Engines

3. Unlatch clamp (J, Figs. 132 and 133) on the air cleaner housing and remove the air filter cover (L).
4. Clean debris from inside the air cleaner housing (M) and air filter cover.



**Model RT250
Model RT175 and RT210 with interim Tier 4
Engines**

Fig. 133 – Engine Air Filters

- Carefully remove the outer filter element (G). Do not remove inner filter element (H) unless it will be replaced. If inner filter element (H) will not be replaced, skip to step 10.

NOTE: On Models RT175 and RT210 with Tier 4 engines, pull tabs (Z, Fig. 132) to remove out filter element (G) and pull tabs (Y) to remove inner filter element (H).

- Clean dirt from inside the air filter housing (M).

IMPORTANT: To prevent debris from entering the engine intake manifold, do not remove inner filter element (H) while cleaning the inside of the housing.

- Remove the inner filter element (H).
- Check the inside of the housing for damage.

- Install a new inner filter element (H).
- Install a new outer filter element (G).
- Replace air filter cover (L). Latch clamps (J). Make sure the cover is tightly secured and is seated properly in the housing.

Engine Cooling System

Checking Coolant Level

Check the coolant level daily before starting the machine, or after every ten hours of use.

- Park the machine on a level surface.
- Perform the “Mandatory Safety Shutdown Procedure” on page 20.
- Wait until the engine has cooled. See “Maintenance and Service Safety Practices” on page 25.
- Open the engine cover according to “Engine Access” on page 126.
- Model RT250:**
 - Wait for the machine to cool completely.



WARNING

Do not remove radiator cap when the coolant is hot. Serious burns may occur.

- Remove the radiator cap. Coolant level is correct when it is level with the bottom of the radiator fill tube.
- Models RT175/RT210:** Check the coolant level in the expansion reservoir (R, Fig. 134). Coolant level must be between the full (T) and low (S) marks on the expansion reservoir. Add coolant to the expansion reservoir as required.

IMPORTANT: The coolant system is specifically designed for coolant level top-off only through the expansion reservoir. Do not add coolant directly to the radiator.

Maintenance

Models RT175/RT210

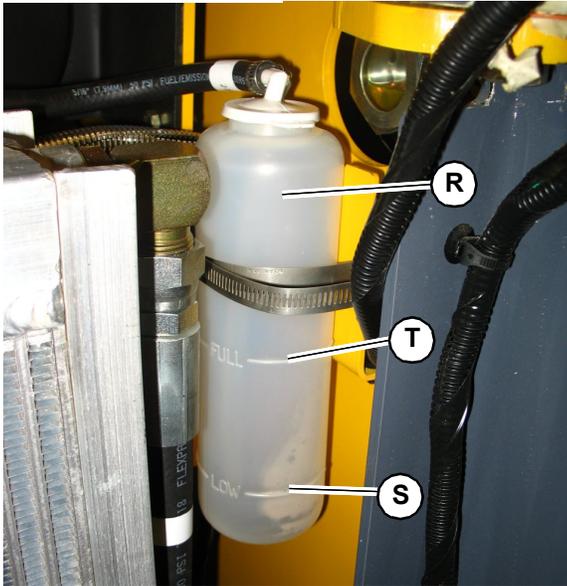


Fig. 134 – Coolant Expansion Reservoir

NOTE: Use a low-silicate ethylene glycol-based coolant, mixed with quality water and supplemental coolant additives (SCAs) suitable for heavy-duty diesel engines. See “Fluids/Lubricants Types and Capacities” on page 35 and the engine operation manual for additional information.

Cleaning Radiator Fins

The radiator fins can become blocked during use which will lead to reduced cooling function and engine overheating. Clean the radiator cooling fins after every 250 hours or 6 months of operation, whichever occurs first.

1. Perform the “Mandatory Safety Shutdown Procedure” on page 20.
2. Wait until the engine has cooled. See “Maintenance and Service Safety Practices” on page 25.
3. Open the engine cover according to “Engine Access” on page 126.
4. Clean the radiator fins by blowing air/water through the fins from the rear of the radiator, toward the engine.

IMPORTANT: Use caution! High pressure can damage radiator fins.

Draining/Refilling Cooling System

1. Park the machine on a level surface.
2. Perform the “Mandatory Safety Shutdown Procedure” on page 20.
3. Wait until the engine has cooled. See “Maintenance and Service Safety Practices” on page 25.
4. Open the engine cover. See “Engine Access” on page 126.



WARNING

Do not remove radiator cap when the coolant is hot. Serious burns may occur.

5. Slowly loosen radiator cap (P, Fig. 135) and allow pressure to escape. Remove cap.



Fig. 135 – Radiator Cap

6. Position a suitable collection container, with a minimum capacity of 15 L (4 gals.) underneath the radiator.

IMPORTANT: Dispose waste coolant according to environmental laws. DO NOT pour coolant onto the ground or down a drain.

7. Access radiator drain plug (X, Fig. 136) through access hole (Y) in the frame underneath the radiator. Using an allen wrench, remove radiator drain plug (X) and allow the coolant to drain into the container.

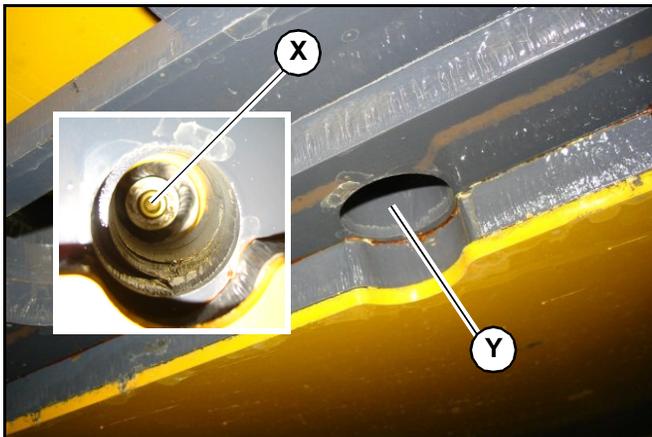


Fig. 136 – Radiator Drain Access

8. Replace the radiator drain plug and tighten securely.
9. Fill the radiator with coolant.

NOTE: Use a low-silicate ethylene glycol-based coolant, mixed with quality water and supplemental coolant additives (SCAs) suitable for heavy-duty diesel engines. See “Fluids/Lubricants Types and Capacities” on page 35 and the engine operation manual for additional information.

10. Reinstall radiator cap and tighten securely.
11. Start and run the engine until it reaches operating temperature.
12. Check the coolant level according to “Checking Coolant Level” on page 131.

Belt Maintenance

Check belt condition monthly, or after every 100 hours of use. Replace or adjust if necessary.

NOTE: On model RT250 machines, the belt is tensioned by a spring idler and requires no adjustment. Replace the belt if belt deflection exceeds 0.6” (15 mm). Refer to the engine operator’s manual for more details.

Checking and Adjusting Belt Tension

1. Perform the “Mandatory Safety Shutdown Procedure” on page 20.
2. Wait until the engine has cooled. See “Maintenance and Service Safety Practices” on page 25.
3. Open the engine cover according to “Engine Access” on page 126.
4. Inspect belt (A, Fig. 137) for damage. If damaged, have belts replaced by an authorized repair shop.

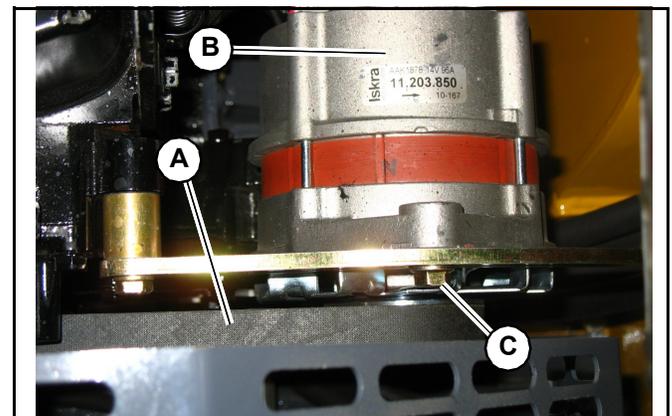


Fig. 137 – Belt

5. Press on belt (A) mid-way between pulleys to check deflection. The belt should not deflect more than 8 mm (5/16”).
6. If deflection is more than 8 mm (5/16”): Loosen adjustment bolt (C) and rotate alternator (B) outward until belt tension is correct. Tighten bolt (C) and re-check belt tension.

Maintenance

Air Conditioning Belt

Air conditioning belt (P, Fig. 138) tension is automatic and requires no adjustment.

Check air conditioning belt condition at regular intervals. If damaged, have the belt replaced by an authorized repair shop.

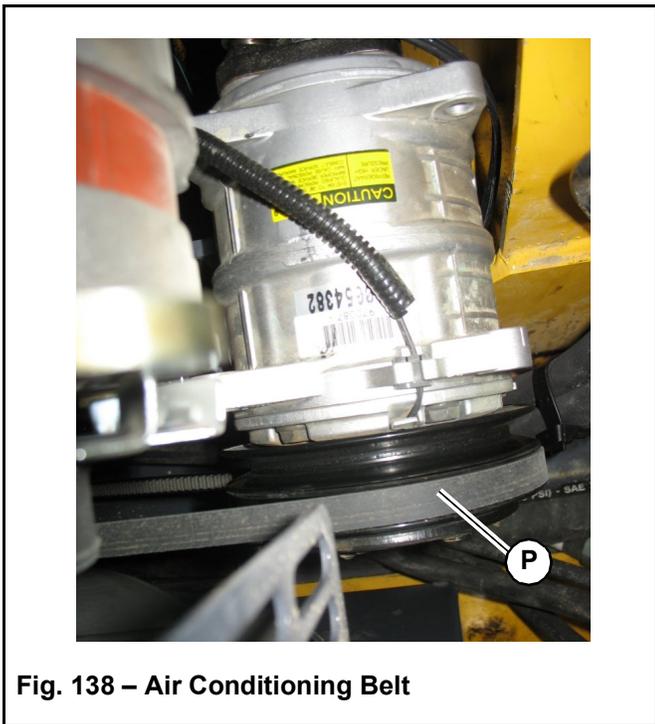


Fig. 138 – Air Conditioning Belt

DPF Service

Models RT175 and RT210 with Tier 4 Engines

DPF filter soot filter replacement is required when the DPF Service screen (Fig. 139) displays.

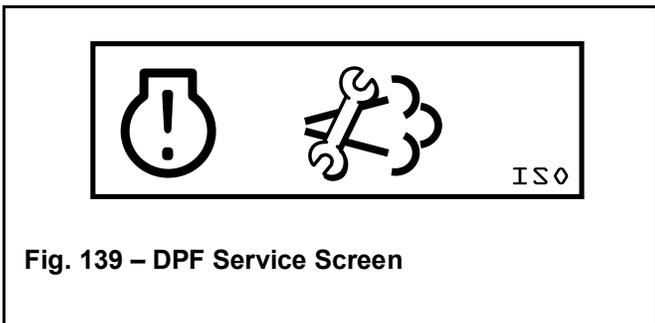


Fig. 139 – DPF Service Screen

NOTE: Contact your dealer when the DPF Service screen displays.

Fuel System Maintenance



Diesel fuel is flammable. Keep the machine away from open flames. Do not smoke when refueling or when working on the engine. Stop the engine before fueling.

Wear eye protection. The fuel system is under pressure and fuel could spray out when removing any fuel system component.

Wipe up spills immediately. NEVER use a shop rag to catch draining/leaking fuel. Vapors from the rag are flammable and explosive.

Failure to follow these instructions can cause fire and result in injury or death.



Use only proper types and grades of diesel fuel (See “Fluids/Lubricants Types and Capacities” on page 35).

NOTICE: The fuel tank is filled at the factory with United States off-road grade diesel fuel, which is dyed red for identification. It may take several fillings of the fuel tank before the red dye is purged from the fuel system.

Adding Fuel

WARNING

Static electricity can produce dangerous sparks at the fuel-filling nozzle. Do not wear polyester, or polyester-blend clothing while fueling. Before fueling, touch the metal surface of the machine away from the fuel fill to dissipate any built-up static electricity. Do not re-enter the machine but stay near the fuel filling point during refueling to minimize the build-up of static electricity. Do not use cell phones while fueling. Make sure the static line is connected from the machine to the fuel truck before fueling begins.

Ultra-Low Sulfur Diesel (ULSD) poses a greater static ignition hazard than earlier diesel formulations. Avoid death or serious injury from fire or explosion; consult with your fuel or fuel system supplier to ensure the entire fuel delivery system is in compliance with fueling standards for proper grounding and bonding practices.

1. Perform the “Mandatory Safety Shutdown Procedure” on page 20.
2. Use the ignition key to unlock fuel cap (F, Fig. 140) and remove the fuel cap from the fuel filler neck.

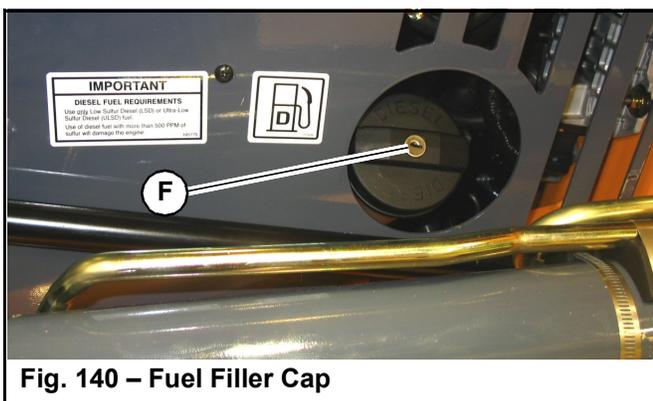


Fig. 140 – Fuel Filler Cap

3. Inspect the wire-mesh fuel strainer located in the filler neck opening and remove any accumulated residue. Replace the strainer if damaged.
4. Fill the fuel tank by adding fuel through the fuel filler neck opening.

IMPORTANT: See “Fluids/Lubricants Types and Capacities” on page 35 and the engine operation manual for proper fuels. Use of improper fuels can cause engine damage.

5. When the fuel tank is full, replace and lock fuel cap (F) in the fuel filler neck opening.

IMPORTANT: To provide for proper fuel system venting, do not top off the fuel tank.

Water Separator Inspection/Maintenance

WARNING

NEVER service the fuel system while smoking, while near an open flame, or after the engine has been operated and is hot.

IMPORTANT: Water in the fuel system can cause severe engine damage. Drain water from the fuel filter/water separator anytime water is present.

Inspect the water separator daily, or every day before use.

Model RT250: The engine error code “97-12” is displayed on the multi-purpose screen if water is present in the water separator. See “Engine Error Code Screen” on page 51 and “(Model RT250) Fuel prefilter sensor error” on page 174.

NOTE: Later models RT175/RT210 also display an error code if water is present in the water separator.

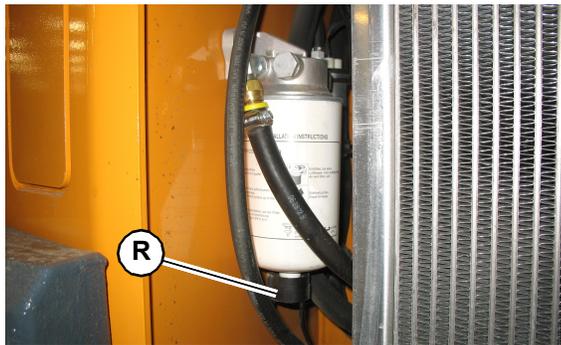
Models RT175/RT210: The water separator contains an indicator ring (M, Fig. 141) that floats on top of accumulated water. Under normal conditions, the ring sits at the bottom of the separator cup. If the ring is somewhere between the top and bottom the cup, water must be drained.

1. Perform the “Mandatory Safety Shutdown Procedure” on page 20.
2. Wait until the engine has cooled. See “Maintenance and Service Safety Practices” on page 25.

Maintenance

3. Open the engine cover according to “Engine Access” on page 126.

Model RT250



Models RT175/RT210

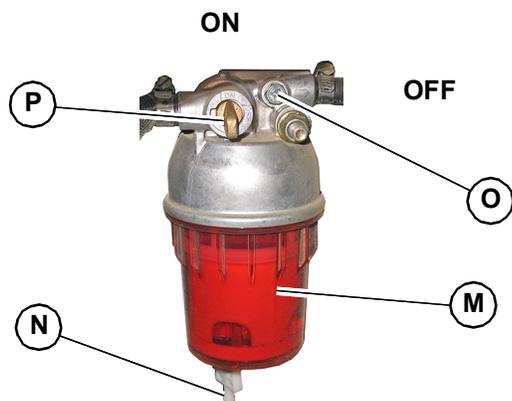


Fig. 141 – Water Separator

4. **Model RT250:** Inspect the water separator (Fig. 141) for the presence of water:
 - a. Position a suitable collection container underneath the water separator drain.
 - b. Twist drain fitting (R) at the bottom of the water separator. Allow water to drain until flow stops. Twist drain fitting (R) back to its original position to close.
5. **Models RT175/RT210:** Inspect the water separator (Fig. 141) for the presence of water:
 - If the indicator ring (M) is at the bottom of the cup, no action is required.
 - If the indicator ring (M) is floating off the bottom of the cup, water is present and needs to be drained.

6. Drain water from the water separator:
 - a. If water needs to be drained, position a suitable collection container underneath the water separator drain.
 - b. Turn the fuel shut-off valve lever (P) on the water separator to the OFF position.
 - c. Loosen drain plug (N) at the bottom of the water separator. Allow water to drain until indicator ring falls to the bottom of the cup.

NOTE: *If the water does not drain well, loosen vent plug (O).*

- d. Tighten drain plug (N) and discard fuel/water according to environmental laws.
 - e. Turn the fuel shut-off valve lever (P) on the water separator to the ON position. Tighten vent plug (O), if it was loosened.
7. Prime the fuel system by turning the ignition key to the ON position without starting the engine for 30 seconds.



CAUTION

Do not use the starter motor to crank the engine to prime the fuel system. Damage to the engine starter motor, coils, pinion/ring gear could result.

IMPORTANT: *Dispose waste fuel according to environmental laws. DO NOT pour fuel onto the ground or down a drain.*

Changing Fuel Filter

WARNING

NEVER service the fuel system while smoking, while near an open flame, or if the engine is hot.

Replace the fuel filter annually, or after every 500 hours of use.

IMPORTANT: Tier 4 Engines: The fuel filter change interval should be 250 hours when the available fuel has a sulfur content greater than 15 ppm.

IMPORTANT: interim Tier 4 Engines: The fuel filter change interval should be 250 hours when the available fuel has a sulfur content greater than 500 ppm.

1. Perform the “Mandatory Safety Shutdown Procedure” on page 20.
2. Wait until the engine has cooled. See “Maintenance and Service Safety Practices” on page 25.

NOTE: On Model RT250 machines, the fuel filter is located under the ROPS/FOPS, on the left side beneath the fuel tank. On all other machines, the fuel filter is located on the left side of the engine.

3. On Models RT175/RT210:

- a. Open the engine cover according to “Engine Access” on page 126.
- b. Turn fuel shut-off valve lever (P, Fig. 141) on the water separator to the OFF position.

4. On Model RT250:

- a. Lift the ROPS/FOPS according to “Raising ROPS/FOPS” on page 148.

5. Remove the fuel filter (Z, Fig. 142), using a filter wrench if necessary. Carefully clean the filter head mounting surface with a clean cloth.

NOTE: On Models RT175 and RT210, the fuel filter is accessed through the oil drain plug access panel (Fig. 127).

Model RT250



RT175/RT210



Fig. 142 – Engine Fuel Filter

6. Apply a coating of clean diesel fuel on the new fuel filter gasket. Install the filter and tighten 3/4 rotation past the point where the gasket contacts the filter head.
7. **Models RT175/RT210:** Turn shut-off valve on water separator to ON.
8. **Model RT250:** lower the ROPS/FOPS according to “Lower ROPS/FOPS” on page 149.
9. Prime the fuel system by turning the ignition key to the ON position without starting the engine for 30 seconds.

CAUTION

Do not use the starter motor to crank the engine to prime the fuel system. Damage to the engine starter motor, coils, pinion/ring gear could result.

Maintenance

Hydraulic System Maintenance

WARNING

Never use your hands to search for hydraulic fluid leaks; use a piece of paper or cardboard to find leaks. Escaping fluid under pressure can be invisible and can penetrate the skin, causing serious injury. If any fluid is injected into your skin, see a doctor at once. Injected fluid **MUST** be surgically removed, or gangrene may result.

Checking Hydraulic Oil Level

Check the hydraulic oil level daily before starting the machine, or after every ten hours of use.

1. Park the machine on a level surface. Fully retract all hydraulic cylinders (lift arm down; bucket flat).
2. Perform the “Mandatory Safety Shutdown Procedure” on page 20.
3. Wait until the engine has cooled. See “Maintenance and Service Safety Practices” on page 25.
4. Open the engine cover according to “Engine Access” on page 126.
5. Check the level of the hydraulic oil in the sight gauge (Y, Fig. 143) located in the right engine compartment wall. The oil level should be in the middle of the sight gauge (A).

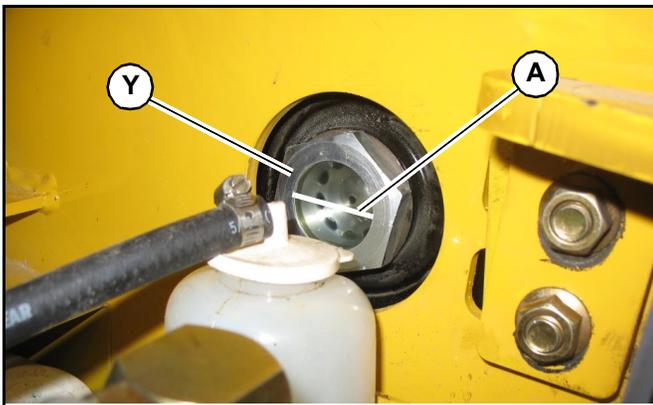


Fig. 143 – Hydraulic Oil Level Sight Gauge

6. If the hydraulic oil level is low, use the ignition key to unlock and open the hydraulic tank cover (H, Fig. 144), located on the top right of the machine next to the top engine cover. Lock tank cover open using pin (D).

CAUTION

Always prop the hydraulic tank cover open using pin (D). Severe injuries can result if the battery compartment cover falls on hands and/or fingers.

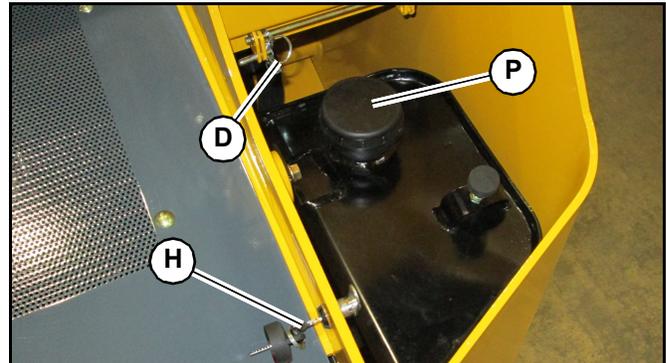


Fig. 144 – Hydraulic Oil Fill

7. Remove the hydraulic tank breather/oil fill cap (P).

NOTE: Slowly remove the hydraulic breather/oil fill cap (P). Allow the pressure to escape before completely removing the cap.

8. Add hydraulic fluid as required. See “Fluids/Lubricants Types and Capacities” on page 35 for proper hydraulic oil grade and type.

IMPORTANT: Do not mix different types/grades of hydraulic fluids.

Reinstall and tighten the oil fill cap. Close and lock the hydraulic tank cover.

Changing Hydraulic Oil and Filter

NOTE: *The hydraulic oil filter can be changed without changing the hydraulic oil or draining the hydraulic reservoir.*

Change the hydraulic oil filter after the first 50 hours, and after 500 hours or 1 year of use thereafter.

Change the hydraulic oil if it becomes contaminated, after major repairs, and after 500 hours or 1 year of use.

1. Perform the “Mandatory Safety Shutdown Procedure” on page 20.
2. Wait until the engine has cooled. See “Maintenance and Service Safety Practices” on page 25.
3. Open the engine cover according to “Engine Access” on page 126.
4. Position a waste oil collection container with a capacity of at least 83.5 L (22 gals.) underneath the hydraulic oil reservoir.

NOTE: *The hydraulic reservoir drain plug is accessed from underneath the machine at the right rear corner.*

5. Remove the hydraulic reservoir drain plug and allow the oil to drain completely.

IMPORTANT: *Always dispose of hydraulic fluids according to environmental laws or take to a recycling center for proper disposal. DO NOT pour onto the ground or down a drain.*

6. Remove the hydraulic oil return filter (D, Fig. 145), using a filter wrench if necessary. Carefully clean the filter head mounting surface with a clean cloth.

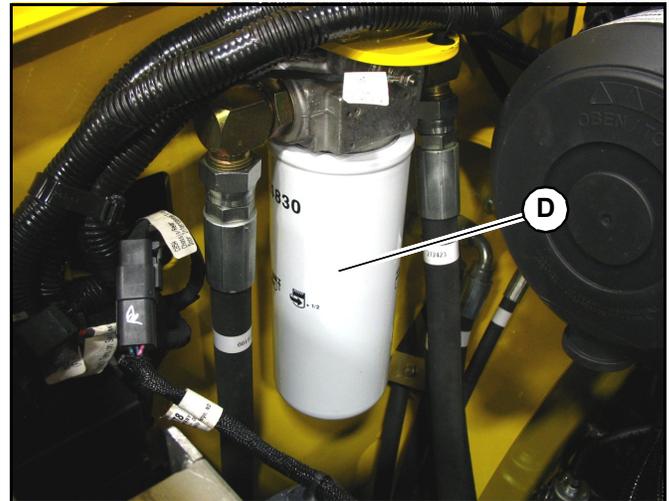


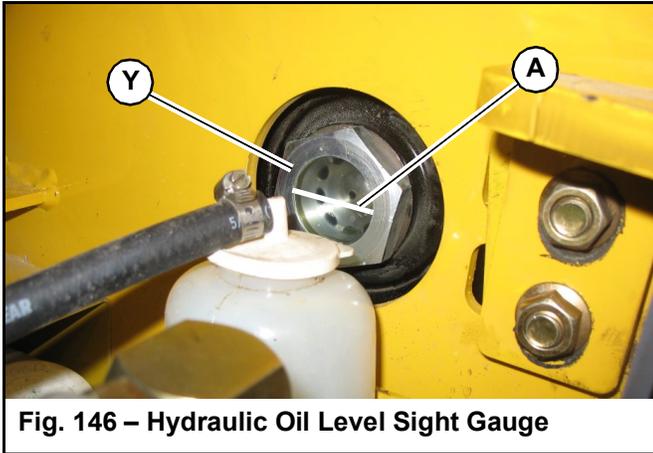
Fig. 145 – Hydraulic Oil Return Filter

7. Apply a coating of clean oil on the new oil filter gasket. Install the filter and tighten 3/4 rotation past the point where the gasket contacts the filter head.
8. Re-install and tighten the drain plug.
9. Using the key, unlock and open the hydraulic tank cover (H, Fig. 144), located on the top right of the machine next to the top engine cover.

Maintenance

10. Remove hydraulic breather/oil fill cap (P, Fig. 144) and add hydraulic oil until the level reaches the middle of the sight glass (A, Fig. 146). Replace and tighten the hydraulic oil fill cap. Close the engine compartment.

NOTE: See “Fluids/Lubricants Types and Capacities” on page 35 for proper hydraulic oil grade and type. Hydraulic oil capacity listed is approximate.



11. Start the machine. Cycle through all hydraulic functions several times to purge air from the hydraulic system. Shut down the machine according to “Mandatory Safety Shutdown Procedure” on page 20.
12. Check the machine for hydraulic oil leaks. Correct any leaks as required.
13. Add oil to the hydraulic system as required until the level reaches the middle of the sight glass (A). Replace and tighten the hydraulic oil fill cap.

Hydraulic Hose Maintenance

WARNING

Hydraulic hoses and connections must be inspected by a trained technician before the first use of the machine, and at least annually thereafter, for leaks and/or damage.

Leakages and damaged pressure hose/lines must be immediately repaired or replaced by an authorized service center.

Never use your hands to check for suspected hydraulic leaks. Always use a piece of wood or cardboard.

Leaks from hydraulic hoses or pressurized components can be difficult to see, but pressurized oil can have enough force to pierce the skin and cause serious injury.

Obtain immediate medical attention if pressurized oil pierces the skin. Failure to obtain prompt medical assistance could result in gangrene or other serious damage to tissue.

Always relieve hydraulic system pressure before performing any maintenance on the machine. Do not tighten leaking connections when the hydraulic system is under pressure.

WARNING

Never weld or solder damaged or leaking pressure lines and/or screw connections. Always replace damaged hydraulic components.

Hydraulic hoses must be replaced every six years from the date of manufacture, even if they do not appear damaged. The date of manufacture (month or quarter and year) is indicated on hydraulic hoses. See Fig. 147.

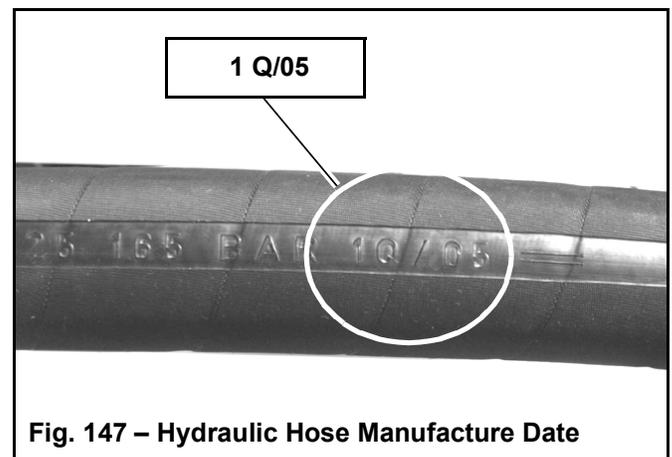
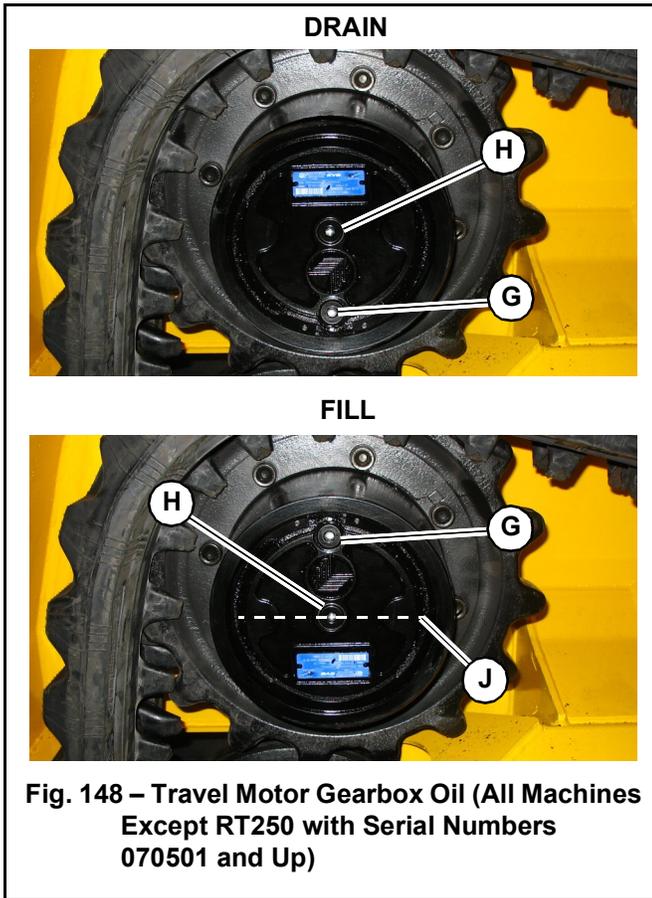


Fig. 147 – Hydraulic Hose Manufacture Date

Maintenance

Travel Motor Maintenance

Travel Motor Gearbox Oil (RT175/RT210)



Replace the travel motor gearbox oil if it becomes contaminated, after major repairs, after the first 150 hours of use and every 1000 hours or annually thereafter.

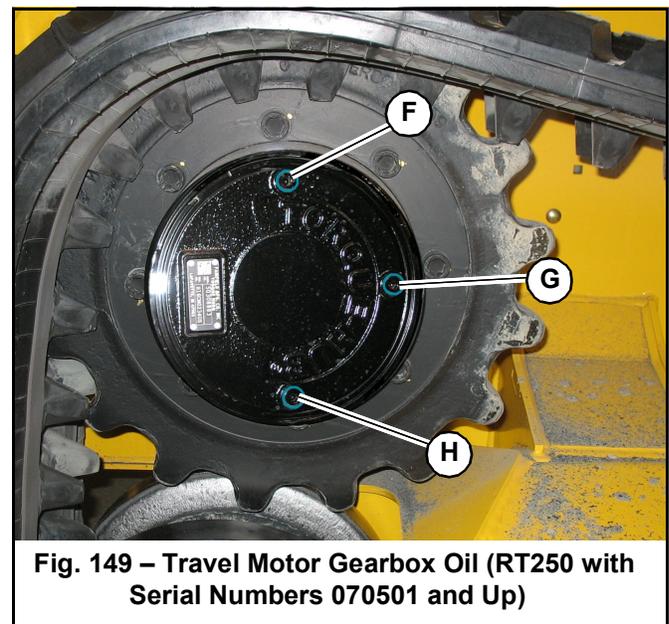
1. Park the machine with travel motor gearbox drain/fill hole plug (G, Fig. 148) at the bottom.
2. Perform the “Mandatory Safety Shutdown Procedure” on page 20.
3. Position a waste oil collection container with a 1 quart/liter (± 0.10 quarts/liters) underneath the drain/fill hole plug (G).

IMPORTANT: Always dispose of hydraulic fluids according to environmental laws or take to a recycling center for proper disposal. DO NOT pour onto the ground or down a drain.

4. Remove plug (H).

5. Remove drain/fill hole plug (G) and allow the oil to drain completely.
 6. Rotate the travel motor gearbox 180° so the drain/fill hole plug (G, Fig. 148) opening is at the top.
 7. Fill the travel motor gearbox with the correct grade and type oil. Fill to level (J, Fig. 148).
- NOTE:** Oil level will be visible at hole (H) when correct oil level is reached.
8. Clean and replace drain/fill hole and plugs (G and H). Tighten securely.
 9. Test the drive system and check for leaks.

Travel Motor Gearbox Oil (RT250)



Replace the travel motor gearbox oil if it becomes contaminated, after major repairs, after the first 50 hours of use and every 1000 hours or annually thereafter.

1. Park the machine with travel motor gearbox plugs (F, G and H, Fig. 149) positioned as shown in the figure.
2. Perform the “Mandatory Safety Shutdown Procedure” on page 20.
3. Position a waste oil collection container with a 1 quart/liter (± 0.10 quarts/liters) underneath plug (H).

IMPORTANT: Always dispose of hydraulic fluids according to environmental laws or take to a recycling center for proper disposal. DO NOT pour onto the ground or down a drain.

4. Remove plug (F) to allow for venting as the oil drains.
5. Remove plug (H) and allow the oil to drain completely.
6. Clean and replace plug (H). Tighten securely.
7. Remove plug (G).
8. Fill the travel motor gearbox through plug (F) hole with the correct grade and type oil until it reaches the level of plug (G) hole.

NOTE: Refer to “Fluids/Lubricants Types and Capacities” on page 35 for travel motor gearbox oil specifications. Motor gearbox oil capacity is approximately 0.8L (0.84 qts.).

9. Clean and replace plugs (F and G). Tighten securely.
10. Test the drive system and check for leaks.

Track Maintenance

Inspect the tracks daily for damage and wear.

IMPORTANT: To avoid damaging the tracks and to ensure maximum track life, refer to “Rubber Track Use Cautions and Tips” on page 91.

Observe the following conditions to extend track life:

- Avoid traveling or turning on broken stone, jagged rock, metal or other material that could damage or cut the tracks.
- Avoid traveling on riverbeds or areas with soft rocks that could become stuck in the tracks, which could cause damage to the tracks or cause the tracks to slip off.
- Avoid using the machine on the seashore. Sea salt can corrode the metal cores inside the tracks.

- Immediately wipe any spilled fuel, oil, salt or chemical solvents off of the tracks, as these substances can corrode the coupling in the metal cores in the tracks, causing corrosion and peeling
- Avoid traveling on freshly paved roads or on hot surfaces (e.g. fires, metal sheets exposed to direct sunlight, etc.). Hot surfaces can damage the lugs or cause irregular wear.
- Avoid moving earth in area where the tracks may slip, which can cause excessive lug wear.

Track Replacement

WARNING

Keeps hands clear from between the track and the idler when installing tracks. Crushing of body parts and amputation can result.

1. With the machine running and the drive system not moving, remove tension cylinder stop (K, Fig. 150) on the side on the machine with the track to be replaced.

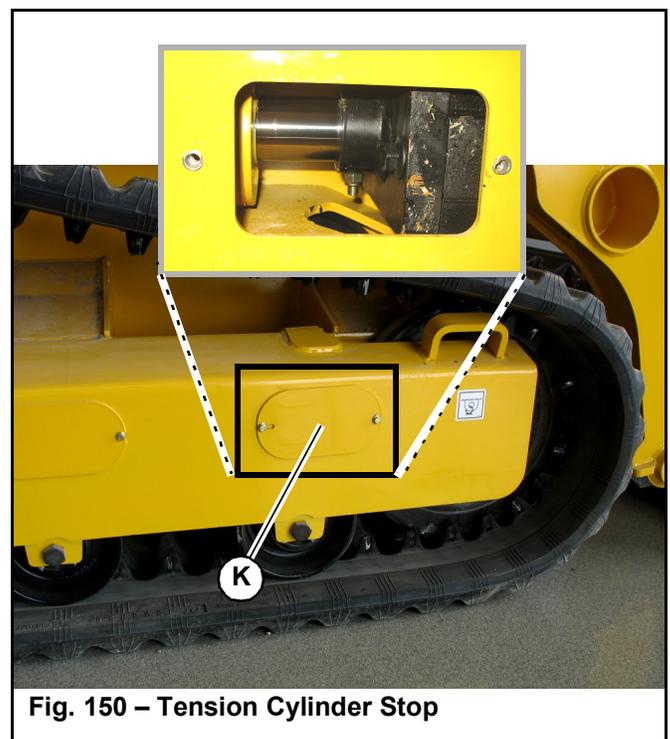


Fig. 150 – Tension Cylinder Stop

Maintenance

2. With the machine running and the drive system not moving, open the engine compartment. Press and hold the lock button (L, Fig. 151) on the track tension service switch, and press the top (M) of the switch to set the track tension cylinders into the service (retracted) position.

Models RT175/RT210 Shown; Other Machines Similar

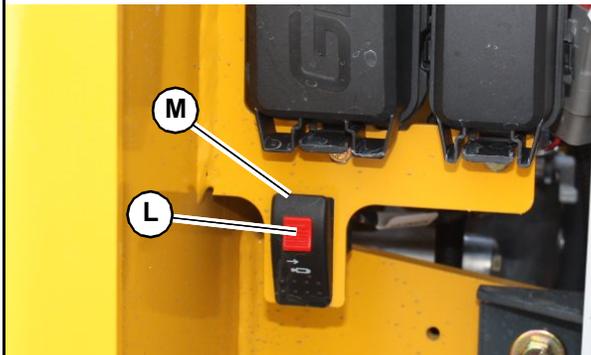


Fig. 151 – Track Tension Switch

3. When the track tension cylinders are in the service (retracted) position, shut off the machine.

WARNING

Use solid support blocking. Never rely on jacks or other inadequate supports when maintenance work is being done. Never work under any equipment supported only by jacks.

4. Raise the machine about 150 mm (6”), so the tracks are free to move.
5. Use a pry bar to pry/guide the old track at (R, Fig. 152) off the front idler wheel.

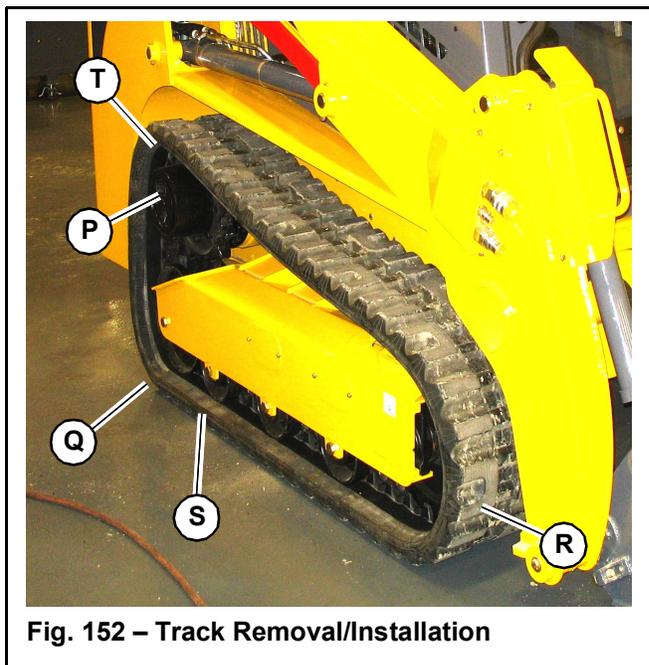


Fig. 152 – Track Removal/Installation

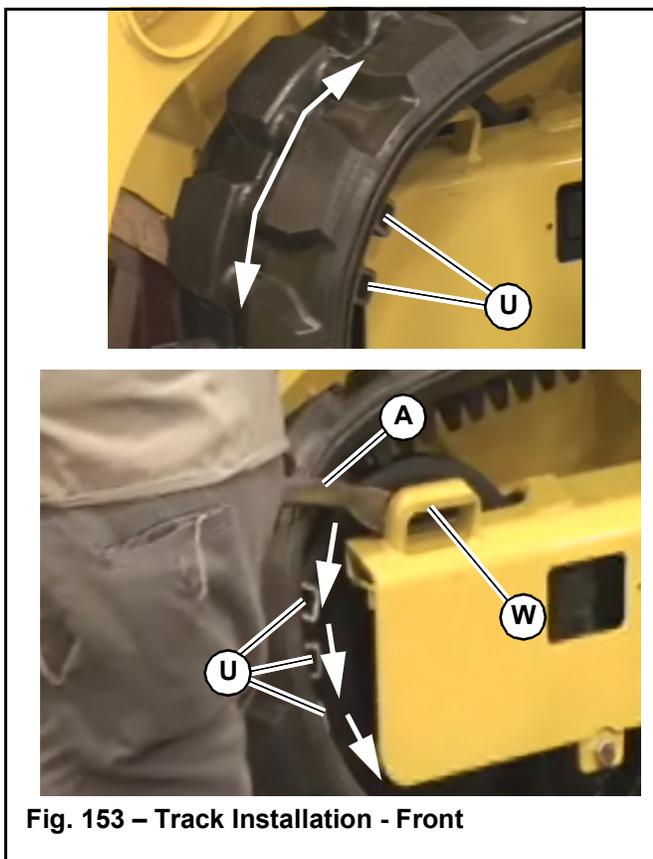
6. Using a hoist with a hook installed and a pry bar, lift/guide the old track at (T, Fig. 152) off the drive sprocket. Remove the old track.
 7. Using a hoist with a hook, lift the new track at (T), and manoeuvre the track under the rear idler wheel at (Q) using a pry bar and your foot.
- IMPORTANT:** Guides on the inside of the track must straddle the rear idler.
8. Place a block under the new track at (S), to hold the track against the bottom of the rear idler wheel.
 9. Using a hoist with a hook and a pry bar, lift/guide the new track at (T) onto the drive sprocket.

IMPORTANT: Lugs on the inside of the track must be fully engaged by drive sprocket (P).

WARNING

Keeps hands and feet clear from between the track and the idler/roller wheels when installing tracks. Crushing of body parts and amputation can result.

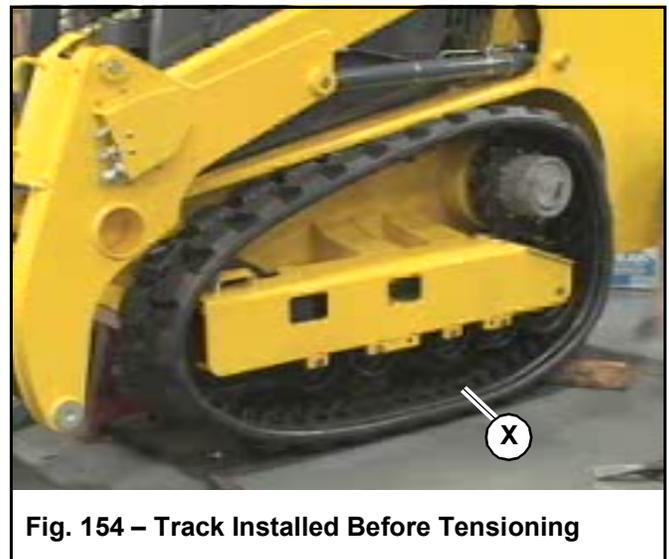
10. Using a pry bar (A, Fig. 153) and wedging blocks (U), pull/guide the new track at (R) over the front idler wheel, and under the bottom rollers. Carefully direct an assistant to start the machine and direct the assistant to operate the track drive slowly forward/back to work the track over the front idler wheel.



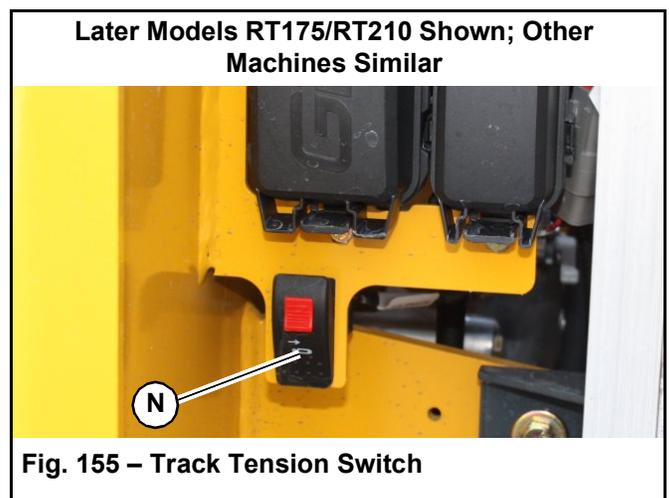
NOTE: Tie-down bracket (W) can be used as a lever point for prying the track into place over the front idler wheel.

IMPORTANT: Guides on the inside of the track must straddle the front idler and bottom roller wheels.

11. Make sure the new track is fully engaged around the idler and roller wheels, and in the drive sprocket, all the way around.
12. Remove any wedging blocks (U) that were used to guide the track.
13. Remove the block placed under the track at (S, Fig. 152).
14. The installed track should look similar to Fig. 154.

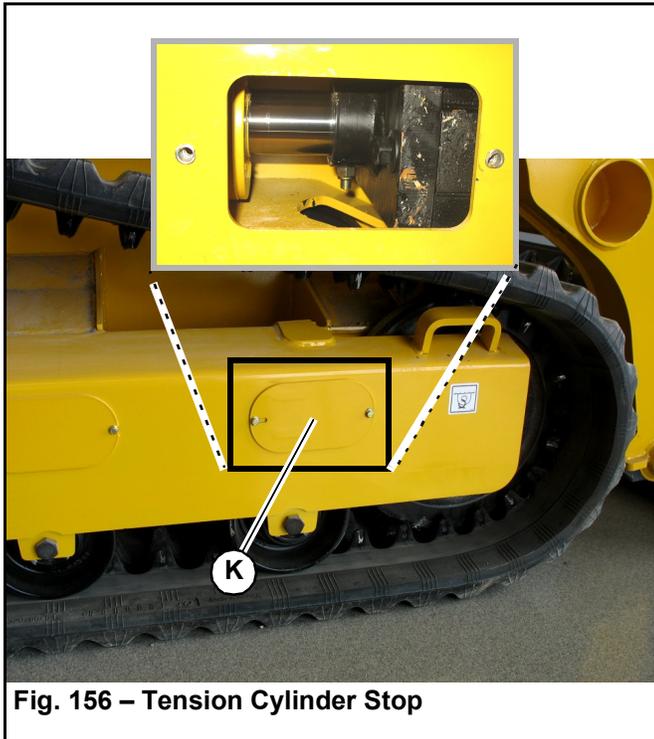


15. Start the machine, open the engine compartment and press the bottom of the track tension service switch (N, Fig. 155), to set the track tension cylinders into the operating (extended) position.



Maintenance

16. Once the track tension cylinder has returned to the operating (extended) position, re-install cylinder stop (K, Fig. 156).



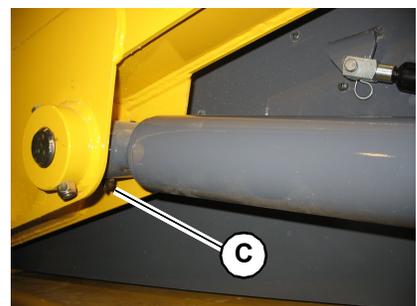
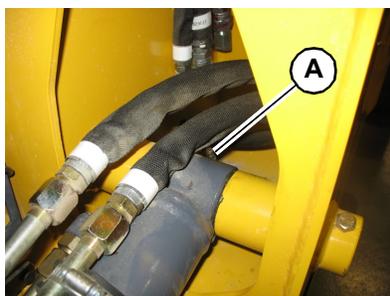
17. Operate the track drive forward/back to ensure the track is properly seated. Adjust track positioning if necessary.
18. Remove blocking and lower the machine to the ground.

General Lubrication

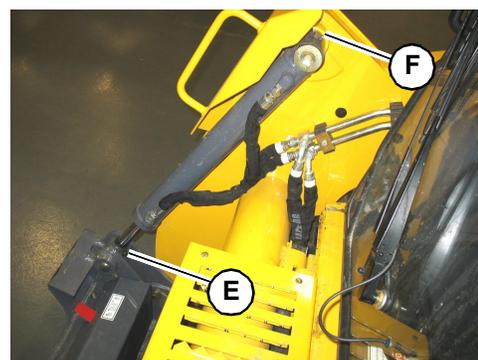
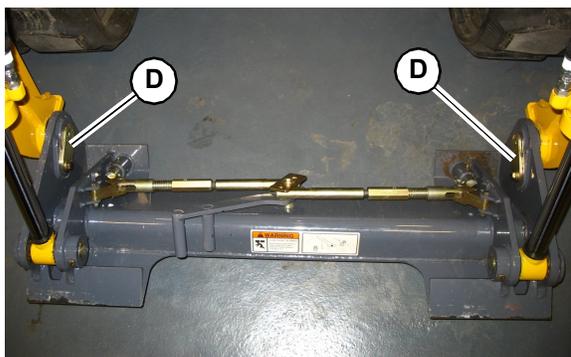
IMPORTANT: Use of lubricants not corresponding to manufacturer recommendations may invalidate warranty claims. Always dispose of waste lubrication oils and hydraulic fluids according to environmental laws or take to a recycling center for proper disposal. **DO NOT** pour fluids onto the ground or down a drain.

Refer to the following figures for grease fitting locations. See “Fluids/Lubricants Types and Capacities” on page 35 for proper grease specifications. Wipe dirt from the fittings before applying grease to prevent contamination. Replace any missing or damaged fittings. To minimize dirt build-up, avoid excessive greasing.

Lubricate Daily or After Every 10 Hours of Operation



Both Sides



- A – Back Lift Cylinder Grease Fittings (2)
- B – Top Lift Arm Grease Fittings (2)
- C – Front Lift Cylinder Grease Fittings (2)
- D – Attachment Hitch Pivot Points (2)
- NOTE: Lubricate (D) from inside of pin.

- E – Bottom Tilt Cylinder Grease Fittings (2)
- F – Top Tilt Cylinder Grease Fittings (2)

Fig. 157 – Lubrication

Maintenance

Tilting ROPS/FOPS

Tilting up the ROPS/FOPS provides access to hydraulic and electrical components.

Raising ROPS/FOPS

WARNING

Always secure the ROPS/FOPS to the chassis with anchor bolts and washers (M, Fig. 158) before driving or using the machine.

Always close the cab door before tilting the ROPS/FOPS.

Stay clear from underneath the ROPS/FOPS as it is tilted.

Check ROPS/FOPS tilt component condition at regular intervals. Replace damaged or worn parts immediately.

1. Perform the “Mandatory Safety Shutdown Procedure” on page 20.
2. Remove anchor bolts and washers (M, Fig. 158) securing the front of the ROPS/FOPS to the chassis.

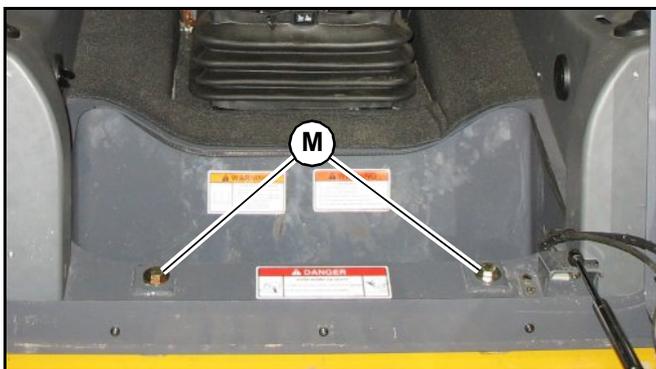


Fig. 158 – ROPS/FOPS Anchor Fasteners

3. On machines equipped with a cab, securely close and latch the cab door.
4. Close the engine cover.
5. Raise the ROPS/FOPS up as far as it will go (Fig. 159).

NOTE: Gas springs balance the ROPS/FOPS to aid raising and lowering.



Fig. 159 – ROPS/FOPS Tilting

6. With the ROPS/FOPS fully raised, tilt prop bar (P, Fig. 160) locks into the slot at the back of bracket (F), securing the ROPS/FOPS in the tilted position. Release the ROPS/FOPS to make sure it is locked in the raised position.

WARNING

Make sure to raise the ROPS/FOPS as far as it will go so the tilt prop bar securely locks the ROPS/FOPS in the raised position. Never allow anyone under the ROPS/FOPS if it is not securely locked in the raised position with the tilt prop bar.

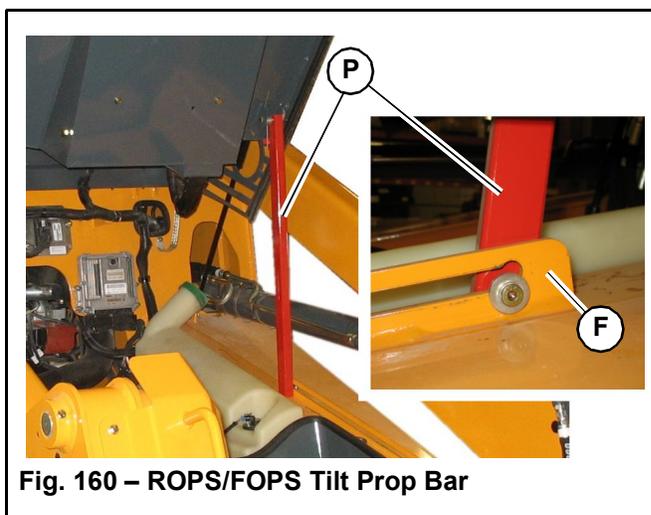
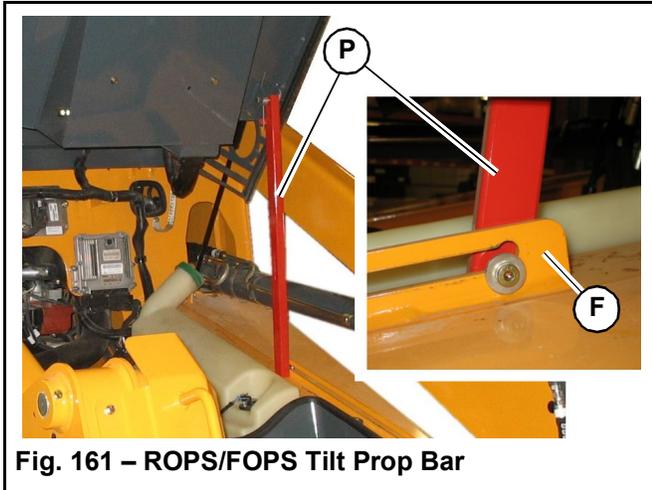


Fig. 160 – ROPS/FOPS Tilt Prop Bar

Lower ROPS/FOPS

1. Lift the ROPS/FOPS up slightly until tilt prop bar (P Fig. 161) clears the slot at the back of bracket (F). Push tilt prop bar (P) forward to allow the ROPS/FOPS to tilt forward and down.



2. Slowly and carefully tilt the ROPS/FOPS forward and down.

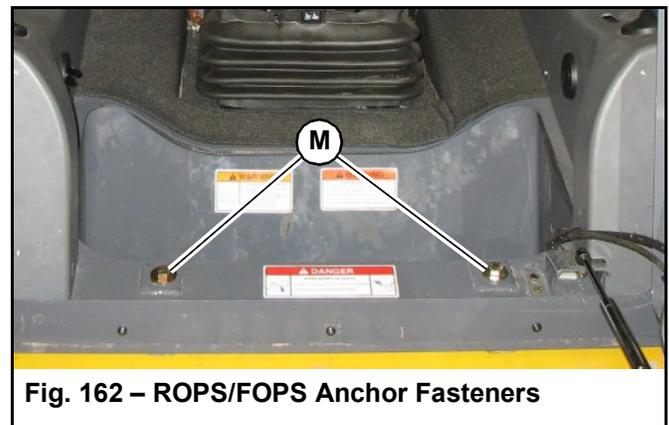
CAUTION

Stay clear from underneath the ROPS/FOPS as it is tilted down. Injury to limbs can result.

3. Secure the ROPS/FOPS to the chassis with anchor bolts and washers (M, Fig. 162). Torque anchor bolts to 75 lb.-ft. (102 Nm).

WARNING

Always secure the ROPS/FOPS to the chassis with anchor bolts and washers (M, Fig. 162) before driving or using the machine.



Maintenance

Electrical System

WARNING

Inspect and check the machine's electrical equipment at regular intervals. Defects, such as loose connections or scorched cables must be repaired before using the machine.

Only use proper, original equipment fuses with the specified current rating. Turn off the machine immediately if there are any problems with the electrical system.

Work on the machine's electrical system must be done only by a trained technician.

Battery

WARNING

Before servicing the battery or electrical system, disconnect the negative cable from the negative battery terminal, or if the machine is equipped with a battery disconnect switch, turn the switch to the "OFF" position.

Explosive gas is produced while a battery is in use or being charged. Keep flames or sparks away from the battery area. **ALWAYS** charge the battery in a well-ventilated area.

Do not jump-start a frozen battery, or it may explode. A discharged battery can freeze at 0°C (32°F).

To prevent short circuits keep metal parts on your clothing and metal watchbands away from the positive (+) terminal of the battery.

WARNING

Never lay a metal object on top of a battery, because a short circuit can result. Battery acid is harmful to skin and fabrics. If acid spills, follow these first-aid tips:

- If battery acid spills on any clothing, remove it immediately.
 - If acid contacts skin, rinse the affected area with running water for 10 to 15 minutes.
 - If acid contacts eyes, flood eyes with running water for 10 to 15 minutes. See a doctor at once. Never use any medication or eye drops unless prescribed by the doctor.
 - To neutralize acid spilled on the floor, use one of the following mixtures:
 - 0.5 kg (1 lbs.) of baking soda in 4 L (4 qts.) of water.
 - 0.5 L (0.5 qts.) of household ammonia in 4 L (4 qts.) of water.
-

To access the battery, use the ignition key to unlock (H, Fig. 163) and open the battery cover, located on the top left of the machine next to the top engine cover.

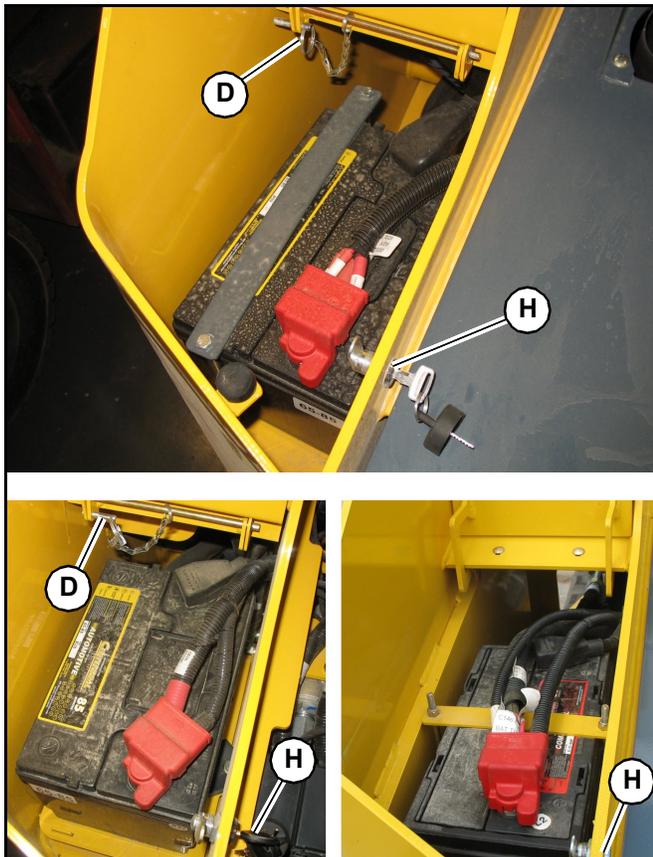


Fig. 163 – Battery Compartment

CAUTION

Always hold the battery compartment cover open when working on the battery. Use pin (D), if so equipped. Severe injuries can result if the battery compartment cover falls on hands and/or fingers.

Using a Booster Battery (Jump-Starting)

Jump-start the machine according to “Jump-Starting” on page 86.

Maintenance

Fuses and Relays

IMPORTANT: Blown fuses indicate electrical system malfunctions. Determine what caused the fuse to blow and repair the problem before replacing the fuse.

Engine Compartment Fuses/Relays Model RT250



Fig. 164 – RT250 Fuses – Engine Compartment

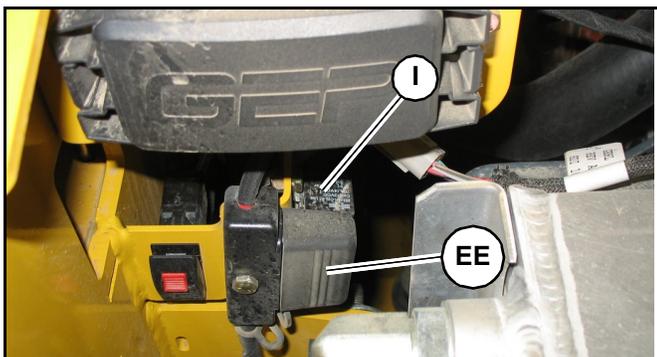


Fig. 165 – RT250 Power Relay, Maxi-Fuse

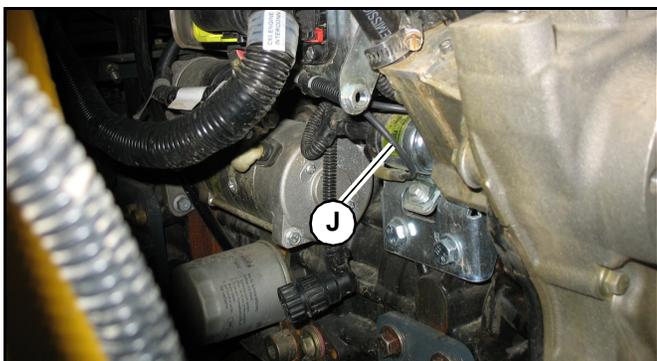


Fig. 166 – RT250 Engine Start Relay

Table 39: RT250 (SN 70501 and Up) Engine Compartment Relays

Relay	Circuit
A	Horn
B	HVAC
C	Air Conditioning Condenser Fan
D	Work Lights
E	Drive, Tilt (Controller 2)
F	Wipers
G	Parking Brake Switch, Power-A-Tach®
H	Fuel Pump
I	Power Relay, Ignition Switch, Dome Light
J	Engine Start Relay
K	Power-A-Tach® Relay
L	Glow Relay

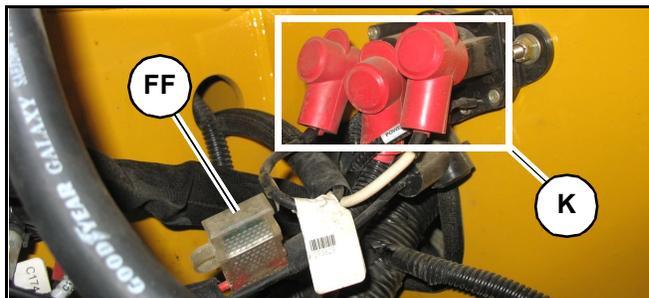


Fig. 167 – RT250 Power-A-Tach®, Glow Relays / Fuses

Table 40: RT250 (SN 70501 and Up) Engine Compartment Fuses

Relay		Circuit
Fuse	Rated Current / Resistance (A / Ω)	Protected Circuit
M	120Ω	CAN Terminating Resistor
N	30A	Fuel Pump, Power Splice
O	10A	Power/Relays, Main/Drive Logic Control Module

**Table 40: RT250 (SN 70501 and Up) Engine
Compartment Fuses**

P	10A	Tail Light, Backup Alarm, Radio
Q	20A	HVAC Condenser Fan
R	15A	Interlocks, 2-Speed, Hydraglide™, Lift, Tilt (Controller 3)
S	30A	ECU Constant Power
T	20A	Work Lights
U	20A	Lift, Standard/High-Flow Aux. Hydraulic Controllers (Controller 1 & High-Flow Module)
V	30A	HVAC Relay
W	10A	Auxiliary Power Outlets
X	10A	Parking Brake Relay, Power-A-Tach®
Y	10A	Horn
Z	20A	Wipers
AA	N/A	Not Used
BB	10A	Ignition
CC	15A	Track Tension, Self Level
DD	10A	Display, Joysticks, Seat/Door Switches
EE	80A	Power Relay, Ignition Switch, Dome Light
FF	30A	Power-A-Tach® System Hitch
GG	100A	Glow Relay Fuse

Maintenance

Engine Compartment Fuses/Relays

Model RT175 with Tier 4 Engines
(SN 811051 and Up)

Model RT210 with Tier 4 Engines
(SN 921651 and Up)

Model RT175 with Tier 4 Engines (SN 811051 and Up)
Model RT210 with Tier 4 Engines (SN 921651 and Up)



Fig. 168 – Fuses – Engine Compartment

Model RT175 with Tier 4 Engines (SN 811051 and Up)
Model RT210 with Tier 4 Engines (SN 921651 and Up)

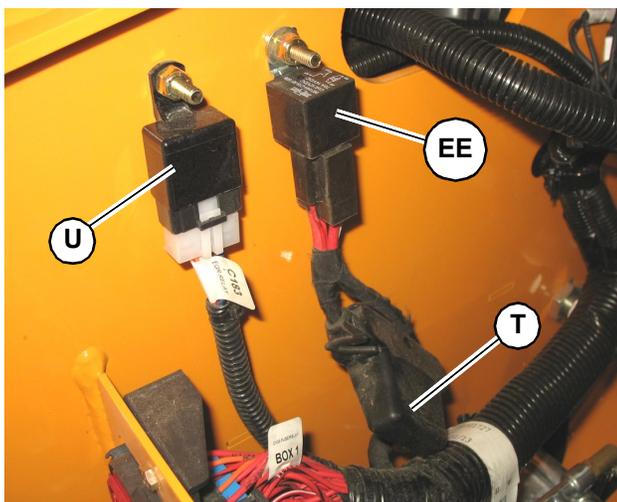


Fig. 169 – EGR and Engine Pre-heat Relays;
Engine Pre-heat Fuse

Table 41: Engine Compartment Relays/Fuses

Fuse	Rated Current / Resistance (A / Ω)	Protected Circuit
A	10	Drive Logic Control, Tilt (Controller 2)
B	15	Interlocks, 2-Speed, Hydraglide™, Float, High-Flow Auxiliary Hydraulics
C	20	Lift, Standard Auxiliary Hydraulics (Controller 1)
D	10	Park Brake, Power-A-Tach® Quick Attach System Hitch
E	30	HVAC Blower
F	10	Display, Joysticks, Seat/Door Switches
G	10	Ignition, Fuel Pump
H	20	HVAC Condenser Fan
I	20	Work Lights
J	10	Auxiliary Power Outlets
K	20	Wipers
L	15	Track Tension, Self Level
M	10	Horn
N	10	Rear Door Lights, Beacon/Auxiliary Lights
O	20	Engine ECU
P	20	EGR Valve
Q	120Ω	Resistor, Oil Pressure Switch
R	80	Main Power (maxi)
S	60	Starter Solenoid (maxi)
T	80	Glow Plugs (maxi)
Relay	Circuit	
U	EGR	
V	Drive, Tilt (Controller 2)	
W	HVAC	
X	Work Lights	
Y	Horn	
Z	AC Condenser Fan	
AA	Parking Brake Switch	
BB	Wiper Motors	
CC	Power Relay	
DD	Starter Solenoid	
EE	Glow Plugs	

Model RT175 with Tier 4 Engines (SN 811051 and Up)
 Model RT210 with Tier 4 Engines (SN 921651 and Up)

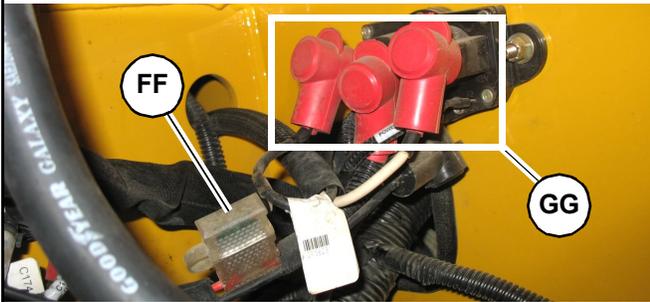


Fig. 170 – Power-A-Tach® Relay/Fuse

Table 42: Engine Compartment Fuses

Fuse/ Resister	Rated Current / Resistance (A / Ω)	Protected Circuit
FF	30A	Power-A-Tach® System Hitch
Relay		Circuit
GG		Power-A-Tach® Relay

Maintenance

Engine Compartment Fuses/Relays Model RT175 with interim Tier 4 Engines (SN 10951-811000)

Model RT210 with interim Tier 4 Engines (SN 21201-921000)

Model RT175 with interim Tier 4 Engines (SN 10951-811000)
Model RT210 with interim Tier 4 Engines (SN 21201-921000)

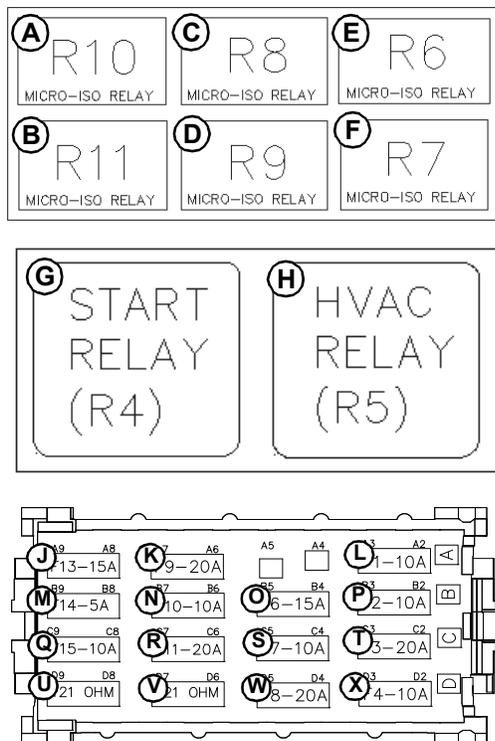


Fig. 171 – Fuses – Engine Compartment

Model RT175 with interim Tier 4 Engines (SN 10951-811000)
Model RT210 with interim Tier 4 Engines (SN 21201-921000)



Fig. 172 – Engine Pre-heat Relay

Table 43: Engine Compartment Relays/Fuses

Relay	Circuit	
A	Wiper Motors	
B	Parking Brake Switch	
C	Work Lights	
D	Drive, Tilt (Controller 2)	
E	Fuel Injection Pump	
F	Air Conditioning Condenser Fan	
G	Start	
H	HVAC	
I	Engine Pre-Heat	
Fuse	Rated Current / Resistance (A / Ω)	Protected Circuit
J	15A	Track Tension, Self Level
K	20A	Work Lights
L	10A	Drive Logic Control, Tilt (Controller 2)
M	20A	EU Headlights
N	10A	Auxiliary Power Outlets
O	10A	Interlocks, 2-Speed, Float, Hydraglide, High Flow Aux (Controller 3)
P	10A	Resistor, Oil Pressure Switch
Q	10A	Rear Door Lights, Radio
R	20A	Wipers
S	10A	Fuel Pump, Power Splice
T	20A	Lift, Standard Aux. Hydraulics (Controller 1)
U	120Ω	CAN-Bus Terminating Resistor
V	120Ω	Oil Pressure Switch Resistor
W	20A	HVAC Condenser
X	10A	Park Brake Light, Power-A-Tach

Model RT175 with interim Tier 4 Engines (SN 10951-811000)
 Model RT210 with interim Tier 4 Engines (SN 21201-921000)

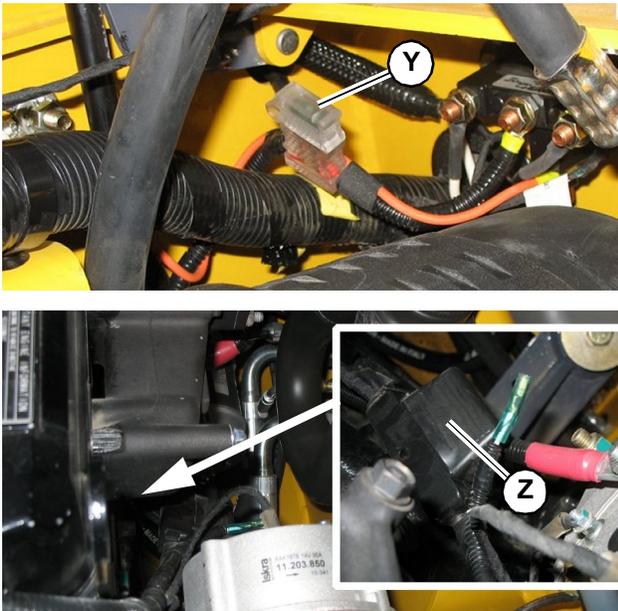


Fig. 173 – Fuses – Power-A-Tach®, Pre-Heat

Table 44: Engine Compartment Fuses

Fuse/ Resistor	Rated Current / Resistance (A / Ω)	Protected Circuit
Y	30A	Power-A-Tach® System Hitch
Z	60A	Engine Pre-heat

Fuses Under ROPS/FOPS

Model RT175 with interim Tier 4 Engines
 (SN 10951-811000)

Model RT210 with interim Tier 4 Engines
 (SN 21201-921000)

Model RT175 with interim Tier 4 Engines (SN 10951-811000)
 Model RT210 with interim Tier 4 Engines (SN 21201-921000)

Fuse Box Cover Shown Removed

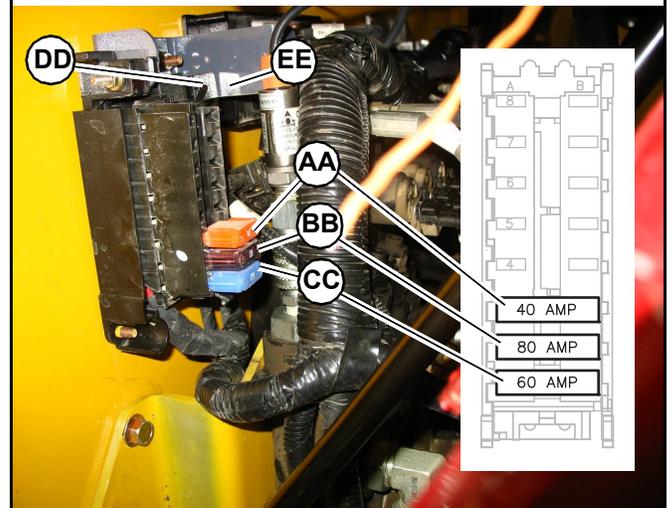


Fig. 174 – Fuses – Under ROPS/FOPS

Table 45: Fuses/Relays Under ROPS/FOPS

Fuse	Rated Current (Amp)	Protected Circuit
AA	40A	HVAC Relay Fuse (Maxi 3)
BB	80A	Power Relay, Ignition Switch, Dome Lights Fuse (Maxi 2)
CC	60A	Starter Solenoid Fuse (Maxi 1)
DD	N/A	Starter Solenoid Relay
EE	N/A	Main Power Relay

Maintenance

Control Modules

Electrical control modules are located on the chassis under the ROPS/FOPS.

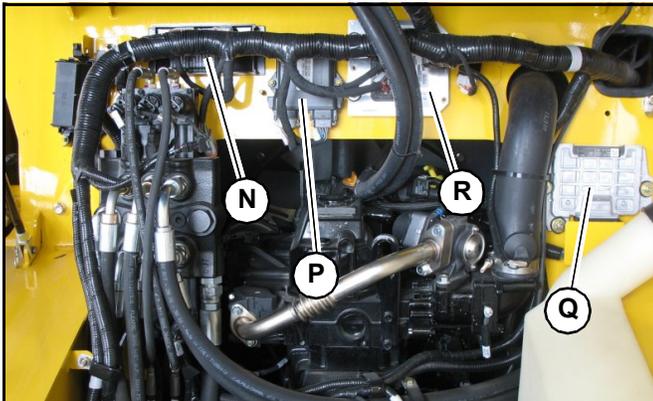


Fig. 175 – Control Modules (Models RT175/RT210 Shown; RT250 Similar)

Multi-function Control Module

Multi-function control module (N, Fig. 175) provides the following control functions:

- Horn
- Fuel sender input
- Starter and parking brake interlock logic
- Hydraulic and air filters indicator inputs
- Two-speed travel logic
- Safety logic control
- Lift arm float and Hydraglide™ logic

Lift Arm and Standard Auxiliary Flow Control Module

Control module (P) includes outputs for lift arm and standard auxiliary hydraulics flow function.

Engine Control Module (ECU)

Control module (Q) controls engine control logic and error reporting.

Main/Drive Control Module

Main/drive control module (R) provides the following control functions

- Logic for travel drive and main control valve
- Bucket function
- Transmission, control valve and controller communication error codes broadcast output

Long-Term Storage

If storing the machine for a long period (longer than 2 months), perform the procedures in this section.

Before Storage

1. Wash the entire machine. Treat vinyl surfaces in the operator's compartment with a vinyl protectant.
2. Perform all steps for long-term engine storage according to the engine operation manual.
3. Lubricate all grease fittings. See "General Lubrication" on page 147.
4. Check all fluid levels and top-off as necessary.
5. Add a fuel stabilizer to the fuel system according to the fuel supplier's recommendations.
6. Remove and fully charge the battery. Store the battery in a cool, dry location.
7. If the machine will not be operated for a month or longer, apply grease to all exposed hydraulic cylinder rod areas or retract all cylinders so rod exposure is minimized. Apply grease to any remaining rod areas.
8. Protect against extreme weather conditions such as moisture, sunlight and temperature. Fill the engine coolant system with the proper mix of antifreeze and water as required for expected temperatures according to "Coolant Compound Table" on page 39.

IMPORTANT: *Contact your dealer for additional storage preparation information if the machine will be stored in an environment where temperatures could range below -42°C (-44°F), and/or above 49°C (120°F).*

After Storage

1. Replace and re-connect the battery.
2. Perform all steps for returning the engine to service according to long-term engine storage section in the engine operation manual.
3. Check belt tension.
4. Check all fluid levels and top-off as necessary.
5. Start the engine. Observe all indicators. If all indicators are functioning properly and reading normally, move the machine outside.
6. When outside, park the machine and let the engine idle for at least 5 minutes.
7. Shut off the engine and walk around machine. Make a visual inspection looking for evidence of leaks.

Maintenance

Air Conditioning Maintenance

Test air conditioning function weekly. Reduced air conditioning function could indicate a low refrigerant level. Low refrigerant or refrigerant leaks can cause air conditioning compressor overheating and failure.

IMPORTANT: *Air conditioning system servicing should only be performed by trained, properly certified and licensed technicians and service centers.*

Air Conditioning Filters

Check the condition of the air conditioning filters every 250 hours of use and replace if necessary.

NOTE: *Extreme or dusty/dirty conditions may require more frequent maintenance.*

Cab Air Filter

1. Slide the operator's seat as far forward as it will go to provide access to the cab wall behind the seat.
2. Remove fasteners (A, Fig. 176) securing filter grilles (S) to the cab wall. Remove and discard the old filter elements.
3. Insert new filter elements and secure with grilles (S) and fasteners (A). Make sure the filter elements are completely seated in the openings and the grilles are firmly seated flush to the cab wall.

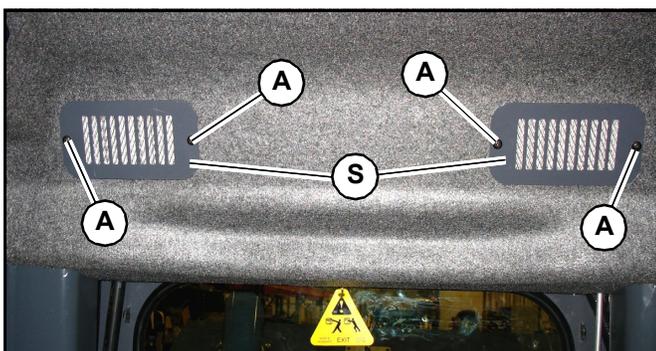


Fig. 176 – Cab Air Filters

Outside Air Intake Filter

1. Perform the “Mandatory Safety Shutdown Procedure” on page 20.
2. Remove hardware (F, Fig. 177) securing the outside air filter cover (G). Remove cover (G).
3. Remove old air filter (H).
4. Install new air filter (H), positioned so the side with the metal grate (Z) faces in.
5. If necessary, apply foam strips (I) to the outside edges of new air filter to provide a good seal.
6. Replace cover (H) and secure with hardware (F).

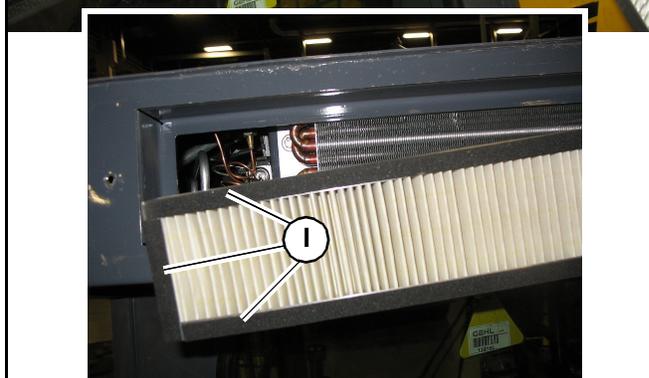
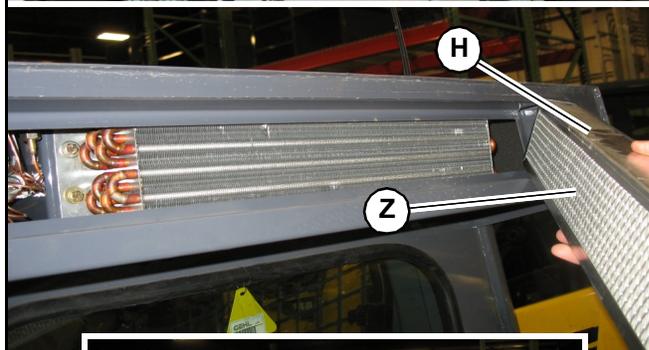
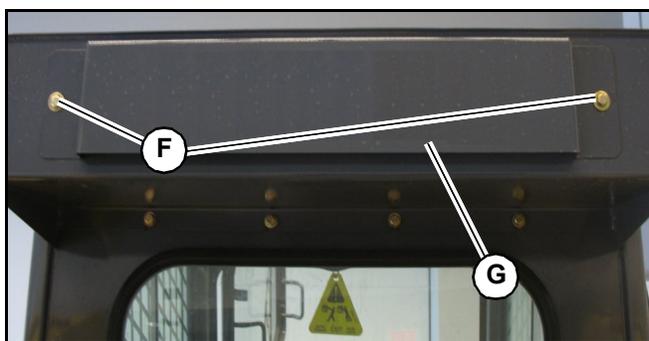


Fig. 177 – Air Conditioning Outside Air Intake Filter

Windshield Washer Reservoir

The windshield washer reservoir (R, Fig. 178) is located inside the engine compartment. Check the windshield washer reservoir level daily before starting the machine and fill if necessary.

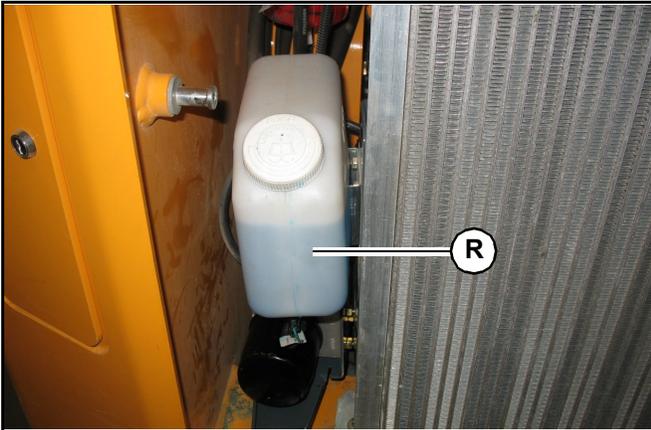


Fig. 178 – Windshield Washer Reservoir

IMPORTANT: *Fill the windshield washer fluid reservoir with a commercial windshield washer fluid or clean tap water only. Add a cleaning agent to the water if required. Add antifreeze to the water in cold weather.*

Maintenance

Final Shutdown / Decommissioning

IMPORTANT: *Dispose of all materials properly. Used oils/fluids are environmental contaminants and may only be disposed of at approved collection facilities. Never drain any oils/fluids onto the ground, dispose of in municipal waste collection containers, or in metropolitan sewer systems or landfills. Check state and local regulations for other material disposal requirements.*

If the machine will no longer be used as intended, shutdown, decommission and dispose of it according to the valid regulations.

Before Disposal

1. Shutdown the machine according to valid regulations regarding proper shutdown.
2. Park the machine on level, dry ground. Ensure the surface can support the weight of the machine. Ensure the location is protected against access by unauthorized persons.
3. Move the throttle to the low-idle position and allow the engine to cool for approximately 2 minutes.
4. Shut off the engine.
5. Move the lift/tilt control(s) to verify that the controls do not cause movement of the lift arm or hitch.
6. Raise the arm rests/safety bars to apply the parking brake and lock out the hydraulic controls.
7. Switch off all electrical switches.
8. Unfasten the seat belt, remove the ignition key and take it with you.
9. Ensure the machine cannot be operated after shutdown until further disposal.
10. Ensure no environmentally hazardous materials, fluids and/or fuel can escape the machine. Specifically check for leaks from the engine, the hydraulic system and the coolant system.
11. Ensure the machine poses no dangers in the place where it is standing.
12. Remove any dirt and/or debris from the engine compartment, the chassis and the cylinder rod surfaces.
13. Remove the battery.
14. Lock the cab door, the storage compartment, the battery and hydraulic filler compartments and the engine compartment. Remove the key(s) and take it/them with you.

Machine Disposal

Make sure all materials are disposed of in an ecologically sound manner.

Recycle the machine in accordance with the current state of the art at the time of recycling. Observe all accident prevention regulations.

Dispose of all parts at the recycling sites specific to the material of the part. Take care to separate different materials for recycling.

Troubleshooting

Engine Troubleshooting

Table 47: Engine Troubleshooting

Problem	Possible Cause	Corrective Action
Engine does not start	Error code "0". Arm rest/safety bar in raised position; cab door not closed (if equipped); operator's seat not occupied	Lower arm rests/safety bars to operating position. Engine will not start with either arm rest/safety bar raised, or the cab door open (if equipped). Occupy operator's seat
	Engine error code "1078-4"	Check starting circuit wiring
	Blown fuse	Check circuit and replace fuse. See "Fuses and Relays" on page 152
	Dead battery	Charge or replace battery. See "Jump-Starting" on page 86
	Operator not in operator's seat	Operator's seat must be occupied for the engine to start
	Malfunctioning seat switch or safety bar arm/rest switch	Replace seat switch or safety bar arm/rest switch
	Cab door open (if equipped)	Close cab door
	Starter malfunction	Contact dealer
	Engine electronics logic error	Contact dealer
	Multi-purpose display not completely initialized	Wait a few seconds for the multi-purpose display to start up completely after turning the ignition key clockwise to the first detent.
Engine turns over but does not start	Engine cranking speed too slow	Check battery and charge/replace as necessary Tighten cables at battery terminals
	Fuel tank empty	Fill tank and vent fuel system as necessary
	Fuel filter plugged or restricted	Replace fuel filter
	Paraffin separation in winter	Use winter grade diesel fuel
	Fuel line leakage	Tighten all threaded connections and clamps
	Pre-heating module malfunction	Check connection and voltage and charge/replace as necessary
	Fuel shut-off solenoid not energizing	Check electrical connections/voltage to shut-off solenoid
	Fuel filter restricted	Replace filter
	Fuel pump malfunction	Contact dealer
	Fuel shutoff valve on water separator closed	Open valve
	Fuel hose restriction	Check for pinched fuel hose

Troubleshooting

Table 47: Engine Troubleshooting

Problem	Possible Cause	Corrective Action	
Engine overheating	Engine oil level incorrect	Adjust oil level. See "Checking Engine Oil Level" on page 127	
	Cooling air circulation restricted	Turn engine off and allow it to cool. Remove restriction	
	Fan shroud improperly positioned	Contact dealer	
	Improper oil grade or oil excessively dirty	Change engine oil and filter. See "Changing Engine Oil and Filter" on page 128	
	Exhaust restricted	Turn engine off and allow it to cool. Remove restriction	
	Air filter restricted	Replace filter(s)	
	Low coolant level		Add coolant. See "Checking Coolant Level" on page 131
			Check for leaks in coolant system and repair/replace if necessary
	Loose/worn V-belt	Tighten/replace V-belt. See "Checking and Adjusting Belt Tension" on page 133	
	Dirty/restricted radiator	Clean radiator. See "Cleaning Radiator Fins" on page 132	
Fan belt slipping	Adjust belt tension / replace belt		
Engine runs, but travel drive does not operate	Parking brake applied	Disengage parking brake. See "Disengage Parking Brake" on page 74	
	Parking brake switch malfunction	Replace parking brake switch(es)	
	Blown fuse	Check circuit and replace fuse. See "Fuses and Relays" on page 152	
	Operator not in operator's seat	Operator's seat must be occupied for travel drive to operate	
	Cab door open (if equipped)	Close cab door. Cab door must be closed for travel drive to operate	
	Drive system component malfunction	See "Drive and Valve Error Codes" on page 185	
	Error code present?	See "Error Codes" on page 172	

Indicator Lamp Troubleshooting

Table 48: Indicator Lamp Troubleshooting

Indicator Icon	Indicator Description	Possible Cause	Corrective Action
	Engine oil pressure	Engine oil pressure too low	Stop engine immediately. Check oil level and add oil if necessary
		Engine oil level incorrect	Adjust oil level. See "Checking Engine Oil Level" on page 127
		Oil pump malfunction	Contact dealer

Table 48: Indicator Lamp Troubleshooting

Indicator Icon	Indicator Description	Possible Cause	Corrective Action
	Hydraulic oil temperature	Hydraulic oil temperature too hot	Check cooling system. See “Engine Cooling System” on page 131 Check hydraulic oil level
		Drive system continuously overloaded	Improve operation procedure
		Lift/tilt or auxiliary system continuously overloaded	Improve operation procedure
		Drive motor(s) or hydrostatic pump(s) internal damage/leakage	Contact dealer
		Oil cooler fins restricted	Clean oil cooler fins. See “Cleaning Radiator Fins” on page 132
		Hydraulic oil filter restricted	Replace filter
	Hydraulic oil filter	Hydraulic oil filter maintenance required	Replace hydraulic oil and filter. See “Changing Hydraulic Oil and Filter” on page 139 NOTE: During cold start in cold temperatures, this indicator may be activated until hydraulic oil warms to operating temperature
	Coolant temperature	Coolant level too low	Add coolant
		Air filter plugged	Replace air filter
		Coolant leak	Repair cooling system and top-off coolant
	Battery voltage	Alternator not charging properly	Adjust V-belt tension Repair/replace alternator
		Engine air filter restriction	Air filter dirty/restricted Blockage in air filter housing

Seal and Hose Troubleshooting

Table 49: Seal and Hose Troubleshooting

Problem	Possible Cause	Corrective Action
Oil, coolant or fuel leakage	Loose hose connection(s)	Tighten hose connections
	Damaged seals or hoses	Change seals/hoses as necessary
Hydraulic fluid leakage	Loose fittings	Tighten hydraulic connections
	Seals, hoses or lines damaged	Change seals, hoses or lines as necessary

Troubleshooting

Hydraulic System Troubleshooting

Table 50: Hydraulic System Troubleshooting

Problem	Possible Cause	Corrective Action
Hydraulics do not work or have poor performance	Error code present?	See "Error Codes" on page 172
	Low hydraulic oil level	Top-off hydraulic oil. See "Checking Hydraulic Oil Level" on page 138
	Hydraulic oil is not at operating temperature	Allow longer warm-up
	Engine to pump coupling or hydraulic pump damaged	Contact dealer
	Pressure limiting valves set too low or damaged	Contact dealer
	Hydraulic cylinder(s) damaged	Contact dealer
	Control valve(s) damaged	Contact dealer
	Engine speed too low	Adjust engine speed. See "Throttle Controls" on page 63
	Dirty/restricted air filter(s)	Replace filter(s) and/or remove restriction
	Incorrect fuel type/grade	Replace fuel with proper type/grade. See "Fluids/Lubricants Types and Capacities" on page 35
Attachment tilts forward with control in neutral	Hydraulic oil leaking past cylinder seals (internal and/or external)	Contact dealer
	Leaking hydraulic system components, such as hoses, tubes, fittings, valves, etc. Leak past spool in control valve	Repair as necessary
	Joystick/electrical malfunction	See "Error Codes" on page 172
Lift arm does not raise/lower	Parking brake applied	Disengage parking brake. See "Disengage Parking Brake" on page 74
	Lift spool in control valve not actuated or leaking	Contact dealer
	Joystick/electrical malfunction code displayed	See "Error Codes" on page 172
Attachment tilt not working, but lift arm work properly	Tilt spool in control valve not actuated or leaking	Contact dealer
	Joystick/electrical malfunction code displayed	See "Error Codes" on page 172
Lift arm does not raise but attachment tilt works properly	Lift spool in control valve not actuated or leaking	Contact dealer
	Joystick/electrical malfunction code displayed	See "Error Codes" on page 172
Hydraulic system overheating	Dirty hydraulic oil cooler	Clean hydraulic oil cooler
	Low hydraulic oil level	Top-off hydraulic oil. See "Checking Hydraulic Oil Level" on page 138
	Load too high	Reduce load

Table 50: Hydraulic System Troubleshooting

Problem	Possible Cause	Corrective Action
Lift and/or tilt functions inconsistent/jerky	Air in hydraulic system	Cycle lift and tilt cylinders to maximum stroke and maintain for a few seconds to clear air from the hydraulic system
	Low hydraulic oil level	Top-off hydraulic oil. See "Checking Hydraulic Oil Level" on page 138
	Cylinder(s) malfunction	Contact dealer
	Joystick/electrical malfunction code displayed	See "Error Codes" on page 172
Lift arm does not maintain position with control joysticks in neutral	Hydraulic oil leaking past cylinder seals (external leak)	Contact dealer
	Hydraulic oil leaking past lift spool in control valve	Contact dealer
	Leaking hydraulic hoses, tubes or fittings between control valve and cylinders	Contact dealer
Auxiliary hydraulics not functioning	Spool in control valve not actuated or leaking	Contact dealer
	Hydraulic oil leaking past seals	Contact dealer
	Auxiliary hydraulics connected improperly	Correct hydraulic connections

Hydrostatic Travel Drive System Troubleshooting

Table 51: Hydrostatic Travel Drive System Troubleshooting

Problem	Possible Cause	Corrective Action
Hydrostatic drive and lift/tilt not responsive	Hydraulic oil viscosity too heavy	Allow longer warm-up
		Replace hydraulic oil with proper type/grade. See "Fluids/Lubricants Types and Capacities" on page 35
	Control system malfunction with error code displayed	See "Error Codes" on page 172
Drive does not operate in either direction	Parking brake applied	Disengage parking brake. See "Disengage Parking Brake" on page 74
	Low hydraulic oil level	Top-off hydraulic oil. See "Checking Hydraulic Oil Level" on page 138
	Low or no charge pressure	Contact dealer
	Hydrostatic pump(s) relief valves malfunction	Contact dealer
	Control system malfunction with error code displayed	See "Error Codes" on page 172

Troubleshooting

Table 51: Hydrostatic Travel Drive System Troubleshooting

Problem	Possible Cause	Corrective Action
Drive system noisy	Hydraulic oil viscosity too heavy	Allow longer warm-up
		Replace hydraulic oil with proper type/grade. See "Fluids/Lubricants Types and Capacities" on page 35
	Low hydraulic oil level	Top-off hydraulic oil. See "Checking Hydraulic Oil Level" on page 138
	Air in hydraulic system	Cycle lift and tilt cylinders to maximum stroke and maintain for a few seconds to clear air from the hydraulic system
	Drive motor(s) or hydrostatic pump(s) internal damage/leakage	Contact dealer
Sluggish acceleration	Low hydraulic oil level	Top-off hydraulic oil. See "Checking Hydraulic Oil Level" on page 138
	Low hydraulic system charge pressure	Contact dealer
	Drive motor(s) or hydrostatic pump(s) internal damage/leakage	Contact dealer
	Engine running rough	Poor fuel quality or incorrect fuel type/grade. Replace fuel with proper type/grade. See "Fluids/Lubricants Types and Capacities" on page 35
		Restricted fuel filter/fuel system. Replace fuel filter; remove restriction. See "Changing Fuel Filter" on page 137
		Contact dealer
Drive sensitivity set too low	See "Control Sensitivity Configuration Screen" on page 52	
Travel drive does not track straight when left joystick is in the forward or reverse position	Drive system needs to be adjusted for straight tracking	See "Straight Tracking Adjust" on page 59

Electrical Troubleshooting

Table 52: Electrical Troubleshooting

Problem	Possible Cause	Corrective Action
Loss of electrical power	Battery terminals or cables loose or corroded	Clean battery terminals/cable connections and tighten
	Battery malfunction	Test battery. Recharge/replace as necessary
	Blown main fuse	Correct over-current problem and replace main fuse. See "Fuses and Relays" on page 152
Instrument display does not activate when ignition is on	Blown main fuse	Correct over-current problem and replace main fuse. See "Fuses and Relays" on page 152
	Battery terminals or cables loose or corroded	Clean battery terminals/cable connections and tighten
	Ignition switch malfunction	Replace switch
	In very cold weather, display screen slow to display	Wait a few minutes for display to activate
Starter does not engage when key switch turned to start position	Loose/corroded starter electrical connections	Check/tighten/clean connections
	Battery terminals or cables loose or corroded	Clean battery terminals/cable connections and tighten
	Starter relay malfunction	Contact dealer
	Battery malfunction	Test battery. Recharge/replace as necessary
	Starter solenoid malfunction	Contact dealer
	Starter or pinion malfunctioning	Repair/replace as needed
	Error code "0". Arm rest/safety bar in raised position; cab door not closed (if equipped) operator's seat not occupied	Lower arm rests/safety bars to operating position. Engine will not start with either arm rest/safety bar raised, or the cab door open (if equipped). Occupy operator's seat
Work/road lights malfunction	Single light not working; light bulb burned out, faulty wiring	Check and replace light bulb as needed, check wiring connections
	No lights; blown fuse	Correct over-current problem and replace fuse. See "Fuses and Relays" on page 152
	Light switch malfunction	Replace light switch
	Poor electrical ground	Check ground wire connections

Troubleshooting

Miscellaneous Troubleshooting

Table 53: Miscellaneous Troubleshooting

Problem	Possible Cause	Corrective Action
Non-functional cab heater	Thermostat oriented in housing with support bales/arms blocking feed hole to heater hose. (SOME heat delivered through heater)	Replace thermostat; align bales/arms properly (parallel to engine crankshaft) in housing.

Error Codes

The tables in this section describe error codes which may be reported on the multi-function display screen. More than one error can be reported at one time, and each error code will display on a separate screen. Multiple errors will be reported on a summary screen. See “Multi-Function Display” on page 48.

NOTE: *Error codes remain displayed after the error is corrected. Press the display several times to rotate through all display screens to refresh the display; corrected error codes will not reappear in the screen rotation.*

Controller Communication Error Codes

NOTE: See “Control Modules” on page 158 for controller locations.

Table 54: Controller Communication Error Codes

Error Code	Error Description
1-2	No Communication between engine control module to display
1-3	No Communication between drive / lift arm / standard aux. flow control module to display
1-4	No Communication between display to main / drive control module
1-5	No Communication between multi-function control module to display
27	No CAN communication engine control module to main / drive control module
28	No CAN Communication main / drive control module to display
29	No CAN Communication drive / lift arm / standard aux. flow control module to main / drive control module

Engine Error Codes

Models RT175/RT210 Yanmar Engine Diagnostic Trouble Codes (DTC)

Table 55: Yanmar Engine Diagnostic Trouble Codes (DTC)

DTC			Error Item	
SPN	FMI	P-Code	Part	State
28	0	P1126	Acceleration Sensor 3	Sensor failure (throttle in open position)
28	1	P1125	Acceleration Sensor 3	Sensor failure (throttle in closed position)
28	2	P0224	Acceleration Sensor 3	Intermittent fault
28	3	P0223	Acceleration Sensor 2	Acceleration sensor 2 fault (high voltage)
28	4	P0222	Acceleration Sensor 2	Acceleration sensor 2 fault (low voltage)
29	0	P1226	Travel Pedal Position Sensor "B"	Above normal operation range
29	1	P1225	Travel Pedal Position Sensor "B"	Below normal operation range

Table 55: Yanmar Engine Diagnostic Trouble Codes (DTC)

DTC			Error Item	
SPN	FMI	P-Code	Part	State
29	3	P0227	Acceleration Sensor 3	Acceleration sensor 3 fault (high voltage)
29	3	P0228	Acceleration Sensor 3	Acceleration sensor 3 fault (high voltage)
29	8	P1127	Acceleration Sensor 3	Sensor failure (pulse communication)
29	8	P1227	Travel Pedal Position Sensor "B"	Communication fault
29	15	P1228	Travel Pedal Position Sensor "B"	Not available
51	3	P02E9	Intake Throttle Opening Sensor	Intake throttle opening sensor fault (high voltage)
51	4	P02E8	Intake Throttle Opening Sensor	Intake throttle opening sensor fault (low voltage)
91	2	P0124	Acceleration Sensor 1	Intermittent fault
91	3	P0123	Acceleration Sensor 1	Acceleration sensor 1 fault (high voltage)
91	4	P0122	Acceleration Sensor 1	Acceleration sensor 1 fault (low voltage)
100	1	P1198	Oil Pressure Switch	Low oil pressure fault alarm
100	4	P1192	Oil Pressure Switch	Oil pressure switch open circuit
102	3	P0238	EGR Low Pressure Side Sensor	EGR low pressure side sensor fault (high voltage)
102	4	P0237	EGR Low Pressure Side Sensor	EGR low pressure side sensor fault (low voltage)
102	13	P0236	EGR Low Pressure Side Sensor	Abnormal learning value
102	10	P1673	EGR Low Pres. Sensor Malfunction	After-treatment error
105	3	P040D	Intake Air Temperature Sensor	Intake air temperature sensor fault (high voltage)
105	4	P040C	Intake Air Temperature Sensor	Intake air temperature sensor fault (low voltage)
105	10	P1676	Intake Air Temp. Sensor Malfunction	After-treatment error
108	2	P2230	Barometric Pressure Sensor	Intermittent fault
108	3	P2229	Atmospheric Pressure Sensor	Atmospheric pressure sensor fault (high voltage)
108	4	P2228	Atmospheric Pressure Sensor	Atmospheric pressure sensor fault (low voltage)
108	10	P1231	Atmospheric Pressure Sensor	Atmospheric pressure sensor characteristic fault
110	0	P0217	Cooling Water Temperature Sensor	Cooling water temperature sensor temperature abnormally high (overheat)
110	2	P0119	Cooling Water Temperature Sensor	Intermittent fault
110	3	P0118	Cooling Water Temperature Sensor	Cooling water temperature sensor fault (high voltage)
110	4	P0117	Cooling Water Temperature Sensor	Cooling water temperature sensor fault (low voltage)
110	10	P1674	Coolant Temp. Sensor Malfunction	After-treatment error
157	0	P0088	Abnormal Rail Pressure	Actual rail pressure rise error
157	3	P0193	Rail Pressure Sensor	Rail pressure sensor (high voltage)
157	4	P0192	Rail Pressure Sensor	Rail pressure sensor (low voltage)
157	15	P0093	Abnormal Rail Pressure	Rail pressure deviation error during the actual rail pressure rise
157	16	P000F	PLV (Common Rail Pressure Limit Value)	PLV open valve
157	18	P0094	Abnormal Rail Pressure	Rail pressure deviation error during the actual rail pressure drop
158	0	P0563	System Voltage	Too high
158	1	P0562	System Voltage	Too low

Troubleshooting

Table 55: Yanmar Engine Diagnostic Trouble Codes (DTC)

DTC			Error Item	
SPN	FMI	P-Code	Part	State
167	1	P1568	Charge Switch	Charge alarm
167	5	P1562	Charge Switch	Charge switch open circuit
172	3	P0113	New Air Temperature Sensor	New air temperature sensor fault (high voltage)
172	4	P0112	New Air Temperature Sensor	New air temperature sensor fault (low voltage)
173	3	P0546	Exhaust Air Temperature Sensor	Exhaust air temperature sensor fault (high voltage)
173	4	P0545	Exhaust Air Temperature Sensor	Exhaust air temperature sensor fault (high voltage)
173	10	P1677	Exhaust Temp. Sensor Malfunction	After-treatment error
174	0	P0168	Fuel Temperature Sensor	Fuel temperature sensor temperature abnormally high
174	3	P0183	Fuel Temperature Sensor	Fuel temperature sensor fault (high voltage)
174	4	P0182	Fuel Temperature Sensor	Fuel temperature sensor fault (low voltage)
190	16	P0219	Overspeed	Overspeed
237	13	U3002	CAN 2	VI (CAN message) reception data fault
237	31	U0168	CAN 2	VI (CAN message) reception time-out error
412	3	P041D	EGR Gas Temperature Sensor	EGR gas temperature sensor fault (high voltage)
412	4	P041C	EGR Gas Temperature Sensor	EGR gas temperature sensor fault (low voltage)
412	10	P1675	EGR Gas Temp Sensor Malfunction	After-treatment error
628	2	P1605	ECU Internal Fault	FlashROM checksum error (data sheet 1)
628		P1606	ECU Internal Fault	FlashROM checksum error (data sheet 2)
628	12	P0605	ECU Internal Malfunction	FlashROM checksum error (main software)
630	2	P1601	ECU Internal Fault	EEPROM error
630	12	P0601	EEPROM	EEPROM memory deletion error
633	3	P0629	SCV (MPROP)	SCV (MPROP) high side VB short-circuit
633	5	P0627	SCV (MPROP)	SCV (MPROP) open circuit
633	6	P1642	SCV (MPROP)	SCV (MPROP) high side GND short-circuit
638	2	P1214	Engine	Malfunction
638	3	P1213	Engine Fuel Rack Position Actuator	Shorted to high source
638	4	P1212	Engine Fuel Rack Position Actuator	Shorted to low source
638	7	P1211	Engine Fuel Rack Position Actuator	Mechanical malfunction
639	12	U0001	High Speed CAN	Communication fault
651	3	P1271	Injector 1 (Cylinder Number 4)	Injector 1 short-circuit
651	5	P0204	Injector 1 (Cylinder Number 4)	Injector 1 open circuit (inherent location of the injector)
651	6	P0271	Injector 1 (Cylinder Number 4)	Injector 1 coil short-circuit
651	11	P0272	Injector 1 (Cylinder Number 4)	Injector 1 unclassified
652	3	P1262	Injector 1 (Cylinder Number 3)	Injector 1 short-circuit
652		P1268	Injector 4 (Cylinder Number 3)	Injector 4 short-circuit
652	5	P0203	Injector 1 (Cylinder Number 3))	Injector 1 open circuit (inherent location of the Injector)
652		P0203	Injector 4 (Cylinder Number 3)	Injector 4 open circuit (inherent location of the injector)
652	6	P0268	Injector 1 (Cylinder Number 3)	Injector 1 coil short-circuit
652		P0268	Injector 4 (Cylinder Number 3)	Injector 4 coil short-circuit

Table 55: Yanmar Engine Diagnostic Trouble Codes (DTC)

DTC			Error Item	
SPN	FMI	P-Code	Part	State
652	11	P1263	Injector 1 (Cylinder Number 3)	Injector 1 unclassified
652		P1269	Injector 4 (Cylinder Number 3)	Injector 4 unclassified
653	3	P1265	Injector 2 (Cylinder Number 2)	Injector 2 short-circuit
653	5	P0202	Injector 2 (Cylinder Number 2)	Injector 2 open circuit (inherent location of the injector)
653	6	P0265	Injector 2 (Cylinder Number 2)	Injector 2 coil short-circuit
653	11	P1266	Injector 2 (Cylinder Number 2)	Injector 2 unclassified
654	3	P1262	Injector 3 (Cylinder Number 1)	Injector 3 short-circuit
654	5	P0201	Injector 3 (Cylinder Number 1)	Injector 3 open circuit (inherent location of the injector)
654	6	P0262	Injector 3 (Cylinder Number 1)	Injector 3 coil short-circuit
654	11	P1263	Injector 3 (Cylinder Number 1)	Injector 3 unclassified
1078	4	P0340	Fuel Injection Pump Speed Sensor	Shorted to low source
1079	2	P1644	Sensor 5V	Intermittent fault
1079	3	P0643	Sensor 5V	Shorted to high source
1079	4	P0642	Sensor 5V	Shorted to low source
1136	0	P0634	ECU Internal Temperature	Too high
1136	2	P1664	ECU Internal Temperature Sensor	Intermittent fault
1136	3	P0669	ECU Internal Temperature Sensor	Shorted to high source
1136	4	P0668	ECU Internal Temperature Sensor	Shorted to low source
1202	2	U423	Immobilizer	System fault
1209	3	P0473	EGR High Pressure Side Sensor	EGR low pressure side sensor fault (high voltage)
1209	4	P0472	EGR High Pressure Side Sensor	EGR low pressure side sensor fault (low voltage)
1209	13	P0471	EGR High Pressure Side Sensor	Abnormal learning value
1209	10	P1679	EGR High Pres. Sensor Malfunction	After-treatment error
1210	3	P1203	Engine Fuel Rack Position Sensor	Shorted to high source
1210	4	P1202	Engine Fuel Rack Position Sensor	Shorted to low source
1485	2	P068A	Main Relay	Power off without main relay self-holding/main relay early opening
1485	4	P0686	ECU Main Relay	Shorted to low source
1485	7	P068B	Main Relay	Main relay contact stuck
2791	0	P0404	EGR Valve	EGR over-voltage malfunction
2791	1	P1404	EGR Valve	EGR low voltage malfunction
2791	7	P1409	EGR Valve	EGR feedback malfunction
2791	9	U0401	EGR Valve	EGR ECM data fault
2791	12	P0403	EGR Valve	Open circuit between the EGR motor coils
2797	6	P1146	Injector (Common)	Injector drive circuit (bank 1) short-circuit (common circuit for number 1, number 4)
2798	6	P1149	Injector (Common)	Injector drive circuit (bank 2) short-circuit (common circuit for number 2, number 3)
2950	3	P1658	Intake Throttle Drive Circuit	Power short-circuit of throttle valve drive H bridge output 1

Troubleshooting

Table 55: Yanmar Engine Diagnostic Trouble Codes (DTC)

DTC			Error Item	
SPN	FMI	P-Code	Part	State
2950	4	P1659	Intake Throttle Drive Circuit	GND short-circuit of throttle valve drive H bridge output 1
2950	5	P0660	Intake Throttle Drive Circuit	No-load of throttle valve drive H bridge circuit
2950	6	P1660	Intake Throttle Drive Circuit	Overload on the drive H bridge circuit of the throttle valve
2951	3	P1661	Intake Throttle Drive Circuit	VB power short-circuit of throttle valve drive H bridge output 2
2951	4	P1662	Intake Throttle Drive Circuit	GND short-circuit of throttle valve drive H bridge output 2
3059	5	P053A	Poor Intake Heater Connection	Intake heater error
3242	0	P1436	DPF Inlet Temperature Sensor	DPF inlet temperature sensor temperature abnormally high
3242	3	P1428	DPF Inlet Temperature Sensor	DPF inlet temperature sensor fault (high voltage)
3242	4	P1427	DPF Inlet Temperature Sensor	DPF inlet temperature sensor fault (low voltage)
3242	10	P167E	DPF Inlet Temp. Sensor Malfunction	After-treatment error
3250	0	P1426	DPF Intermediate Temperature Sensor	DPF intermediate temperature sensor temperature abnormally high (post-injection failure)
3250	1	P0420	DPF Intermediate Temperature Sensor	DPF intermediate temperature sensor temperature abnormally low
3250	3	P1434	DPF Intermediate Temperature Sensor	DPF intermediate temperature sensor fault (high voltage)
3250	4	P1435	DPF Intermediate Temperature Sensor	DPF intermediate temperature sensor fault (low voltage)
3250	10	P167A	DPF Intermediate Temp Sensor Malfunction	After-treatment error
3251	0	P2452	DPF Differential Pressure Sensor	DPF differential pressure sensor differential pressure abnormally high
3251	3	P2455	DPF Differential Pressure Sensor	DPF differential pressure sensor fault (high voltage)
3251	4	P2454	DPF Differential Pressure Sensor	DPF differential pressure sensor fault (low voltage)
3251	13	P2453	DPF Differential Pressure Sensor	Abnormal learning value
3609	3	P1455	DPF High Pressure Sensor	DPF high pressure side sensor fault (high voltage)
3609	4	P1454	DPF High Pressure Sensor	DPF high pressure side sensor fault (low voltage)
3609	10	P167C	DPF High Pres. Sensor Malfunction	After-treatment error
3719	0	P1424	DPF OP Interface	Backup mode
3719	7	P1446	DPF OP Interface	Recovery regeneration prohibition
3719	9	P1445	DPF OP Interface	Recovery regeneration failure
3719	16	P1421	DPF OP Interface	Stationary regeneration standby
3720	0	P1420	DPF OP Interface	Ash cleaning request 2
3720	16	P242F	DPF OP Interface	Ash cleaning request 1
4257	12	P0611	Injector (Common)	Injector drive IC error
4795	31	P226D	DPF Substrate Removed	After-treatment error
37251	16	P1437	DPF	Maintenance (maintenance not performed for a given period of time)
522241	2	P1224	Engine Fuel Rack Actuator Relay	Intermittent fault

Table 55: Yanmar Engine Diagnostic Trouble Codes (DTC)

DTC			Error Item	
SPN	FMI	P-Code	Part	State
522241	3	P1223	Engine Fuel Rack Actuator Relay	Circuit fault B
522241	4	P1222	Engine Fuel Rack Actuator Relay	Circuit fault A
522241	7	P1221	Reserved	N/A
522242	2	P1244	Cold Start Device	Intermittent fault
522242	3	P1243	Cold Start Device	Circuit fault B
522242	4	P1242	Cold Start Device	Circuit fault A
522243	2	P1234	Air Heater Relay	Intermittent fault
522243	3	P1233	Air Heater Relay	Circuit fault B
522243	4	P1232	Air Heater Relay	Circuit fault A
522243	5	P0543	Start Auxiliary Relay	Start auxiliary relay interrupted
522243	6	P0541	Start Auxiliary Relay	Start auxiliary relay GDN interrupted
522251	3	P1403	EGR Stepping Motor "A"	Circuit fault B
522251	4	P1402	EGR Stepping Motor "A"	Circuit fault A
522252	3	P1413	EGR Stepping Motor "B"	Circuit fault B
522252	4	P1412	EGR Stepping Motor "B"	Circuit fault A
522253	3	P1423	EGR Stepping Motor "C"	Circuit fault B
522253	4	P1422	EGR Stepping Motor "C"	Circuit fault A
522254	3	P1433	EGR Stepping Motor "D"	Circuit fault B
522254	4	P1432	EGR Stepping Motor "D"	Circuit fault A
522314	0	P1217	Engine Coolant Temperature	Abnormal temperature
522323	0	P1101	Air Cleaner Switch	Air cleaner clogged alarm
522329	0	P1151	Oil/Water Separator switch	Oil/water separator alarm
522400	2	P0336	Crank Sensor	Crank signal malfunction
522400	5	P0037	Crank Sensor	No crank signal
522401	2	P0341	Cam Sensor	Cam signal malfunction
522401	5	P0342	Cam Sensor	No cam signal
522401	7	P1341	Cam Sensor	Angle offset failure
522402	4	P1340	Aux Speed Sensor	Shorted to low source
522567	12	U1401	EGR	EGR target value out of range
522571	3	P1641	SCV (MPROP)	SCV (MPROP) low side VB short-circuit
522571	6	P1643	SCV (MPROP)	SCV (MPROP) low side GND short-circuit
522572	6	P062A	SCV (MPROP)	High-pressure pump drive circuit (drive current [high level])
522572	11	P1645	SCV (MPROP)	High-pressure pump drive circuit (pump overload error)
522573	0	P2463	DPF	Over-accumulation (method C)
522574	0	P1463	DPF	Over-accumulation (method P)
522575	7	P2458	DPF	Regeneration defect (stationary regeneration failure)
522576	12	P160E	EEPROM	EEPROM memory read error
522577	11	P2459	DPF	Regeneration defect (stationary regeneration not performed)
522578	12	P160F	EEPROM	EEPROM memory write error

Troubleshooting

Table 55: Yanmar Engine Diagnostic Trouble Codes (DTC)

DTC			Error Item	
SPN	FMI	P-Code	Part	State
522579	12	P1405	EGR	Short-circuit between the EGR motor coils
522580	12	P0488	EGR	EGR position sensor malfunction
522581	7	P148A	EGR	EGR stuck open valve malfunction
522582	7	P049D	EGR	EGR initialization malfunction
522583	1	P1410	EGR	EGR high temperature thermistor malfunction
522584	1	P1411	EGR	EGR low temperature thermistor malfunction
522585	12	P1613	ECU Internal Malfunction	CY146 SPE/SPI communication error
522588	12	P1608	ECU Internal Malfunction	Excessive supply 1 voltage error
522589	12	P1617	ECU Internal Malfunction	Dropped/Insufficient supply 1 voltage error
522590	12	P1609	ECU Internal Malfunction	Sensor supply voltage error 1
522591	12	P1618	ECU Internal Malfunction	Sensor supply voltage error 2
522592	12	P1619	ECU Internal Malfunction	Sensor supply voltage error 3
522593	12	P1624	ECU Internal Malfunction	Power for sensor SRC low error
522594	3	P160A	ECU Internal Malfunction	Actuator drive circuit 1 VB short-circuit
522595	3	P1625	ECU Internal Malfunction	Actuator drive circuit 2 VB short-circuit
522596	9	U0292	CAN 2	TSC1 (CAN message) reception time out (SA1)
522597	9	U1301	CAN 2	TSC1 (CAN message) reception time out (SA2)
522598	11	P160B	ECU Internal Malfunction	SW reset (recovery) execution 1
522599	9	U1292	CAN 2	Y_ECR1 (CAN message) reception time out error
522599	11	P1636	ECU Internal Malfunction	SW reset (recovery) execution 2
522600	9	U1293	CAN 2	Y_EC (CAN message) reception time out error
522600	11	P1637	ECU Internal Malfunction	SW reset (recovery) execution 3
522601	9	U1294	CAN 2	Y_RSS (CAN message) reception time out error
522601	12	P160D	ECU Internal Malfunction	WDA/ABE shut off due to dropped voltage
522602	12	P1639	ECU Internal Malfunction	WDA/ABE shut off due to excessive voltage
522603	9	U1296	CAN 2	VH (CAN message) reception time out
522603	12	P1640	ECU Internal Malfunction	WDA/ABE shut off due to unknown cause
522605	9	U1298	CAN 2	Y_ECM3 (CAN message) reception time out
522609	9	U1300	CAN 2	Y_ETCP1 (CAN message) reception time out
522610	9	U101B	CAN 1	CAN1 (for EGR): Reception time out error
522610	19	U040C	EGR	CAN1 (for EGR): Reception data length error
522611	9	U1107	CAN1/Exhaust Throttle	Exhaust throttle (CAN message from the exhaust throttle time out)
522617	12	U1401	EGR Valve	EGR target value out of range
522618	9	U1302	CAN 2	EBC1 (CAN message) reception time out error
522619	9	U1303	CAN 2	Y_DPFIF (CAN message) reception time out
522623	7	P1647	Acceleration Sensor 1/2	Dual accelerator sensor (open position)
522624	7	P1646	Acceleration Sensor 1/2	Dual accelerator sensor (closed position)
522727	12	P1610	ECU Internal Fault	Sub-CPU error A
522727	12	P1611	ECU Internal Fault	Sub-CPU error B
522727	12	P1612	ECU Internal Fault	Sub-CPU error C
522728	12	P1620	ECU Internal Fault	Engine map data version error

Table 55: Yanmar Engine Diagnostic Trouble Codes (DTC)

DTC			Error Item	
SPN	FMI	P-Code	Part	State
522730	8	U1167	Immobilizer	Pulse communication fault
522730	12	U0167	Immobilizer	Communication fault
522744	4	P1626	ECU Internal Malfunction	Actuator drive circuit 1 GND short-circuit
522746	12	P1438	Exhaust Throttle	Voltage fault
522747	12	P1439	Exhaust Throttle	Motor fault
522748	12	P1440	Exhaust Throttle	Sensor system fault
522749	12	P1441	Exhaust Throttle	MPU fault
522750	12	P1442	Exhaust Throttle	PCB fault
522751	19	P1443	Exhaust Throttle	CAN fault
522994	4	P1633	ECU Internal Malfunction	Actuator drive circuit 2 GND short-circuit
522994	12	P1607	ECU Internal Malfunction	WDA/ABE communication error
522994	12	P1615	ECU Internal Malfunction	CY320 SPI communication error
522994	12	P1616	ECU Internal Malfunction	MSC communication error of R2S2
523249	5	P0008	Cam Sensor	No signal from both sensors
523460	7	P1670	Rail Pressure Control/Sensor	Rail pressure fault (operation time error during RPS limp mode)
523462	13	P1648	Injector (Correction Value)	IQA corrected injection amount for injector 1
523463	13	P1649	Injector (Correction Value)	IQA corrected injection amount for injector 2
523464	13	P1650	Injector (Correction Value)	IQA corrected injection amount for injector 3
523465	13	P1651	Injector (Correction Value)	IQA corrected injection amount for injector 4
523468	9	P1665	PLV (Common Rail Pressure Limit Value); Rail Pressure Sensor	Rail pressure fault (controlled rail pressure error after PLV valve opening)
523469	0	P1666	Rail Pressure Sensor	Rail pressure fault (PLV opening timing error)
523470	0	P1667	Rail Pressure Sensor	Rail pressure fault (PLV opening timing error)
523471	6	P1467	ECU Internal Malfunction	Actuator drive circuit 3 GND short-circuit
523473	12	P1469	ECU Internal Malfunction	AD converter fault 1
523474	12	P1470	ECU Internal Malfunction	AD converter fault 2
523475	12	P1471	ECU Internal Malfunction	External monitoring IC and CPU fault 1
523476	12	P1472	ECU Internal Malfunction	External monitoring IC and CPU fault 2
523477	12	P1473	ECU Internal Malfunction	ROM fault
523478	12	P1474	ECU Internal Malfunction	Shutoff path fault 1
523479	12	P1475	ECU Internal Malfunction	Shutoff path fault 2
523480	12	P1476	ECU Internal Malfunction	Shutoff path fault 3
523481	12	P1477	ECU Internal Malfunction	Shutoff path fault 4
523482	12	P1478	ECU Internal Malfunction	Shutoff path fault 5
523483	12	P1479	ECU Internal Malfunction	Shutoff path fault 6
523484	12	P1480	ECU Internal Malfunction	Shutoff path fault 7
523485	12	P1481	ECU Internal Malfunction	Shutoff path fault 8
523486	12	P1482	ECU Internal Malfunction	Shutoff path fault 9
523487	12	P1483	ECU Internal Malfunction	Shutoff path fault 10
523488	0	P1484	ECU Internal Malfunction	Recognition error of engine speed
523489	0	P1668	PLV (Common Rail Pressure Limit Value); Rail Pressure Sensor	Rail pressure fault (the actual rail pressure is too high during PRV limp mode)

Troubleshooting

Table 55: Yanmar Engine Diagnostic Trouble Codes (DTC)

DTC			Error Item	
SPN	FMI	P-Code	Part	State
543491	0	P1669	Rail Pressure Control/Sensor	Rail pressure fault (injector B/F temp error during PLV4 limp home)

Models RT250 Deutz Engine Error Codes

Table 56: Deutz Engine Error Codes

Error Code	Engine Error Code Type	Error Description
51-3	EGR valve actuator error	Short-circuit to battery or open load; short-circuit to battery on ECU pin A19; actuator error EGR-Valve – internal error, short-circuit to battery or open load; power reduction may result
51-4		ECU detects a short-circuit to ground; short-circuit to ground or battery on ECU pin A19; ECU voltage under limit; actuator error EGR-Valve; internal error, short-circuit to ground; throttle valve over-limit power reduction may result
51-5		Signal range check low, measured current is below target; actuator error EGR valve (2.9;3.6) or throttle-valve (6.1,7.8); internal error; short-circuit to ground; power reduction may result
51-6		Signal range check high; overload by short-circuit; internal error; load over limit; short-circuit to battery or open load; power reduction may result
51-7		Actuator position for EGR valve is not plausible; internal error; angular misalignment of the flap (deviation from setpoint > 7%); internal error, position error of throttle flap (deviation > 7%); power reduction may result
51-11		Powerstage actuator temperature limit reached due to high current; actuator error EGR valve (2.9;3.6) or throttle valve (6.1,7.8); internal error; temperature over-limit
94-1		Sensor error
94-3	Low fuel pressure; signal range check high/low; possible short or open load	
94-4	Low fuel pressure; signal range check low	
97-3	Water in fuel; maximum voltage exceeded	
97-4	Water in fuel; minimum voltage exceeded	
97-12	Fuel pre-filter sensor error	Fuel filter water level sensor: the maximum level is exceeded; water in fuel level pre-filter; maximum value exceeded; water level over limit (bad fuel quality)

Table 56: Deutz Engine Error Codes

Error Code	Engine Error Code Type	Error Description
102-2	Charged air pressure error	Charged air pressure above warning threshold
		Charged air pressure above shut-off threshold
102-3		Sensor voltage out of target range; sensor error charged air pressure; signal range check high; short-circuit to battery or open load
102-4		Sensor voltage out of target range; charged air pressure sensor error; signal range check low; short-circuit to ground
105-0	Sensor error	Charge air temperature downstream above target range; charged air cooler temperature; system reaction initiated, charge air temperature (downstream) over-warning threshold; engine power loss or shutdown may result
105-3		Charge air temperature sensor: sensor voltage out of target range; charged air temperature sensor error; signal range check high, short-circuit to battery or open load
105-4		Charge air temperature sensor: sensor voltage out of the target range; charged air temperature sensor error; signal range check low; short-circuit to ground
107-0	Air filter sensor error	Air filter differential pressure: the pressure difference of the intake air between the filter inlet and outlet above target range, pressure value above warning threshold
111-1	Engine coolant temperature	Coolant level too low
157-3	Rail pressure error	Measured sensor voltage out of target range; rail pressure sensor error; signal range check high, short-circuit to battery or open load
157-4		Voltage of sensor measured by ECU is out of the target range; sensor error rail pressure; signal range check high, short-circuit to battery or open load
168-0	Sensor error battery voltage	Battery voltage out of target range; physical range check high for battery voltage; battery voltage over-limit
168-1		Battery voltage out of target range; physical range check low for battery voltage; battery voltage below limit
168-3		Voltage above normal or shorted high
168-2		Voltage measured by ECU is out of the target range
168-4		Voltage below normal or shorted low
639-14	CAN Bus error	CAN-Bus 0 "BusOff-Status"

Troubleshooting

Table 56: Deutz Engine Error Codes

Error Code	Engine Error Code Type	Error Description
651-3	Electrical error	Current below normal or open circuit; injector cyl.1 (in firing order); interruption of electric connection
652-3		Injector cyl. 3: the current drop measured by ECU is above the target range; injector 2 short-circuit, injector 3 short-circuit
652-5		Injector cyl. 3: interruption of electrical connection; injector cyl. 2, interruption of electric connection; injector cyl. 3, interruption of electric connection;
653-3	Electrical error	Injector cyl. 4: voltage too high; injector cyl. 3 short-circuit; injector cyl. 4 short-circuit
653-5		Voltage too low; Injector cyl. 4: interruption of electrical connection; injector cyl. 3, interruption of electric connection; injector cyl. 4, interruption of electric connection;
654-3	Electrical error	Voltage above normal or shorted high; Injector cyl. 2: the current drop measured by ECU is above the target range; injector cyl. 4 short-circuit; injector cyl. 2 short-circuit
654-5		Injector cyl. 2: interruption of electrical connection; injector cyl. 4, interruption of electric connection; injector cyl. 2, interruption of electric connection
677-3	Short-circuit	Start relay (high side powerstage): current drop/drain above target range; starter relay; short-circuit, short-circuit HighSide-output to battery or LowSide-Output to battery
677-4		Start relay (high side powerstage): current drop/drain above target range; starter relay; short-circuit, short-circuit HighSide-output to ground or LowSide-Output to ground
677-5	No load error	Start relay (low side powerstage): current drop above target range; starter relay; no load error, Open circuit/disconnection LowSide-Output
677-12	Powerstage over-temperature error	Start relay (low side powerstage): current drop above target range; starter relay; powerstage over-temperature
898-9	Timeout error	Timeout error; limp mode activated
1079-13	ECU error	Internal hardware monitoring: deviation of target range of power supply voltage of sensor output 1; sensor supply voltage monitor 1 error (ECU), error in sensor voltage 1
1080-13		Internal hardware monitoring: deviation of target range of power supply voltage of sensor output 2; sensor supply voltage monitor 2 error (ECU), error in sensor voltage 2
1109-2	Engine shut-off error	Engine shut-off demand ignored
1231-14	CAN BusOff error	CAN bus 1: the ECU not allowed to send messages, because status "BusOff" is detected, "BusOff-Status", CAN BusOff error; CAN 1 (engine/diagnostic CAN)

Table 56: Deutz Engine Error Codes

Error Code	Engine Error Code Type	Error Description
1237-2	Override switch error	ECU receives a permanent signal; Override switch; plausibility error
523009-9	PRV error	Rail pressure relief valve: open frequency exceeds specification; Pressure Relief Valve (PRV) reached maximum allowed opening count; PRV needs to be exchanged
523009-10		Rail pressure relief valve open longer than specification allows; Pressure relief valve (PRV) reached maximum allowed open time; PRV open longer than 300 minutes
523350-4	Injector short-circuit	Injector cylinder-bank 1; short-circuit
523352-4		Injector cylinder-bank 2; short-circuit
523354-12	Injector error	Error of its injector high current output; Injector powerstage output defect
523470-7	PRV error	Rail pressure out of expected average range; Maximum rail pressure in limp home mode exceeded (PRV), Monitoring for maximum rail pressure in limp home mode with PRV
523470-2		Rising pressure forces pressure Relief Valve (PRV) open; force-open fails
523470-11		Rail pressure relief valve can't be opened due to railpressure; Pressure Relief Valve (PRV) error; rail pressure out of tolerance range; averaged rail pressure is outside the expected tolerance range
523470-12		Rail pressure relief valve open; Pressure Relief Valve (PRV) forced to open; system reaction initiated, fault path indicating shutoff condition in case of open PRV; power reduction may result
523470-14		Rail pressure relief valve open; Pressure Relief Valve (PRV) is open, Pressure relief valve (PRV) in rail is open; power reduction may result
523550-12		T50 switch timeout
523601-13	(ECU) error	Internal hardware monitoring: deviation of target range of power supply voltage of sensor output 3; sensor supply voltage monitor 3 error (ECU), Error in sensor voltage 3
523612-12	Software error	ECU internal software error; power reduction may result
523612-14		Internal ECU monitoring detection reported error
		Internal hardware monitoring: ECU CPU reset and cause is logged internally; no item created in error memory; software reset CPU, software visibility resets in DSM

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Table 56: Deutz Engine Error Codes

Error Code	Engine Error Code Type	Error Description
523613-0	Rail pressure error	Rail pressure: fuel pressure in rail below target range dependant on engine speed; rail pressure disrupted, positive governor deviation; maximum positive rail pressure deviation exceeded concerning set fuel flow; power reduction may result
		Rail pressure: fuel pressure in rail exceeds target range dependant on engine speed; rail pressure disrupted, maximum negative rail pressure deviation with metering unit on lower limit is exceeded
		Rail pressure: fuel pressure in rail exceeds target range dependant on engine speed; rail pressure disrupted, leakage detected based on fuel quantity balance; power reduction may result
		Rail pressure: fuel pressure in rail exceeds target range dependant on engine speed; rail pressure disrupted, maximum rail pressure exceeded
523613-1		Rail pressure: fuel pressure in rail below target range dependant on engine speed; minimum rail pressure exceeded
523613-2	Metering unit error	Rail pressure: fuel pressure in rail exceeds target range dependant on engine speed; metering unit setpoint in overrun mode not plausible; power reduction may result
523615-3	Short-circuit	Current drain above target range; metering unit (fuel system); short-circuit to battery high/low side; power reduction may result; power reduction may result
523615-4		Current drain below target range; metering unit (fuel system); short-circuit to battery high/low side; power reduction may result
523615-5	Fuel system error	Fuel metering unit: the ECU detects no load or temperature excess of the ECU component for power supply of the valve; Metering unit (fuel system); open load; power reduction may result
523698-11	SCR error	Engine shut-off due to supervisory function
523776-9	Timeout error	Timeout error; limp mode activated
523895-13	Injector adjustment error	Missing or wrong injector adjustment value programming (IMA) injector 1 (in firing order)
523896-13		Missing or wrong injector adjustment value programming (IMA) injector 2 (in firing order)
523897-13		Missing or wrong injector adjustment value programming (IMA) injector 3 (in firing order)
523898-13		Missing or wrong injector adjustment value programming (IMA) injector 4 (in firing order)

Table 56: Deutz Engine Error Codes

Error Code	Engine Error Code Type	Error Description
523906-3	Fuel pump error	Short to battery in fuel feed pump circuit; electric fuel pre-supply pump short to battery
523906-4		Short to ground in fuel feed pump circuit; electric fuel pre-supply pump; short-circuit to ground; Short cut to ground
523906-5		Electric fuel feed pump output open load; electric fuel pre-supply pump open load; cable break
523906-12		Powerstage fuel pump circuit temperature too high; Electrical fuel pre-supply pump; powerstage over-temperature
523982-0	Powerstage diagnosis disabled	High battery voltage
523982-1		Low battery voltage
524057-2	Fuel system error	Electric fuel pump; fuel pressure build-up error
524108-9	Messaging/timeout error	Missing EGR throttle valve CAN message; CAN-Transmit-Frame ComEGRTVActr timeout error; (missing CAN Bus message) timeout error
524109-9		Missing message of EGR throttle valve; timeout error of CAN-Receive-Frame ComRxEGRTVActr; timeout error (missing CAN Bus message)

Drive and Valve Error Codes

Table 57: Drive and Valve Error Codes

Error Code	Error Description	Fault Cause	Fault Action	Corrective Action
-1	No Faults (not shown on display)			
0	Start interlock fault	Start interlock switches not closed. Seat switch, Restraint bar switches and/or front door switch are not closed when the engine is not running.	Engine will not start.	<p>Check wiring connections on seat, restraint bar and front door (if equipped) switches.</p> <p>Check switch-to-magnet alignment on restraint bar and front door proximity switches.</p> <p>If not equipped with a front door, check for the presence of the switch jumper on ROPS harness C2 dropout.</p>

Troubleshooting

Table 57: Drive and Valve Error Codes

Error Code	Error Description	Fault Cause	Fault Action	Corrective Action
1 (5)	Pump right sensor neutral drift fault	<p>Front pump swash plate not in neutral at startup; swash sensor out of calibration (if applicable).</p> <p>Failure of one or both of the front solenoid valves, wiring fault or mechanical failure in pump. If accompanied by code 5, front sensor ground wire open or short.</p>	Both pumps are disabled; Parking brake will not disengage.	<p>Check rear sensor calibration, recalibrate sensor if req'd. Refer to the Service Manual.</p> <p>Check wiring and connectors on front sensor and front solenoid valves.</p> <p>Check Controller2 wiring and connectors.</p> <p>Check pump for mechanical damage.</p> <p>Check sensor supply and signal voltages. Refer to the Service Manual.</p> <p>Check rear solenoid valves for mechanical damage.</p> <p>Check resistance of front solenoid valve coils. Refer to the Service Manual.</p> <p>Replace front sensor or front solenoid valves.</p>
2 (6)	Pump left sensor neutral drift fault	<p>Rear pump swash plate not in neutral at startup; swash sensor out of calibration (if applicable).</p> <p>Failure of one or both of the rear solenoid valves, wiring fault or mechanical failure in pump. If accompanied by code 6, rear sensor ground wire open or short.</p>	Both pumps are disabled; Parking brake will not disengage.	<p>Check rear sensor calibration, recalibrate sensor if req'd. Refer to the Service Manual.</p> <p>Check wiring and connectors on rear sensor and rear solenoid valves.</p> <p>Check controller2 wiring and connectors.</p> <p>Check pump for mechanical damage.</p> <p>Check sensor supply and signal voltages. Refer to the Service Manual.</p> <p>Check rear solenoid valves for mechanical damage.</p> <p>Check resistance of rear solenoid valve coils. Refer to the Service Manual.</p> <p>Replace rear sensor or rear solenoid valves.</p>

Table 57: Drive and Valve Error Codes

Error Code	Error Description	Fault Cause	Fault Action	Corrective Action
3 (4) (5) (35)	Pump right sensor wiring fault	Front pump swash sensor signal voltage out of range, shorted to ground, shorted to supply or open. May be accompanied by codes 4, 5 and/or 35.	Both pumps will be disabled at first. Then both pumps could be run in open loop mode (See "Travel Drive Error Condition Operation (Limp Mode)" on page 94).	Check front sensor wiring and connector. Check front sensor supply and signal voltages. Refer to the Service Manual. Check controller2 wiring and connectors Replace front sensor.
4 (3) (6) (35)	Pump left sensor wiring fault	Rear pump swash sensor signal voltage out of range, shorted to ground, shorted to supply or open. May be accompanied by codes 3,6 and/or 35.	Both pumps will be disabled at first. Then both pumps could be run in open loop mode (See "Travel Drive Error Condition Operation (Limp Mode)" on page 94).	Check rear sensor wiring and connector. Check rear sensor supply and signal voltages. Refer to the Service Manual. Check controller2 wiring and connectors Replace rear sensor.
5 (1) (3)	Pump right sensor out-of-range range fault	Front pump swash sensor does not follow command to solenoid valves. Failure of one or both of the front solenoid valves, wiring fault or front sensor ground wire shorted or open. May be accompanied by codes 1 and/or 3.	Both pumps will be disabled at first. Then both pumps could be run in open loop mode (See "Travel Drive Error Condition Operation (Limp Mode)" on page 94).	Check front sensor and front solenoid valve wiring and connectors. Check correct harness connections between front and rear sensors and forward and reverse solenoid valves. Check controller2 wiring and connectors. Check resistance of front solenoid valves. Refer to the Service Manual. Replace front sensor or front solenoid valves.

Troubleshooting

Table 57: Drive and Valve Error Codes

Error Code	Error Description	Fault Cause	Fault Action	Corrective Action
6 (2) (4)	Pump left sensor out-of-range fault	Rear pump swash sensor does not follow command to solenoid valves. Failure of one or both of the rear solenoid valves, wiring fault or rear sensor ground wire shorted or open. May be accompanied by codes 2 and/or 4.	Both pumps will be disabled at first. Then both pumps could be run in open loop mode (See "Travel Drive Error Condition Operation (Limp Mode)" on page 94).	<p>Check rear sensor and rear solenoid valve wiring and connectors.</p> <p>Check correct harness connections between front and rear sensors and forward and reverse solenoid valves.</p> <p>Check controller2 wiring and connectors.</p> <p>Check resistance of rear solenoid valves. Refer to the Service Manual.</p> <p>Replace front sensor or rear solenoid valves.</p>
7	Left forward drive pump solenoid wiring or coil fault	Left top solenoid valve coil and/or wiring connection is shorted or open.	Both pumps will be disabled at first. Then both pumps could be run in limp mode with no forward movement on left track.	<p>Check left/top solenoid valve coil wiring and connector.</p> <p>Check resistance of left/top solenoid valve coil. Refer to the Service Manual.</p> <p>Check controller2 connector and wiring.</p>
8	Left reverse drive pump solenoid wiring or coil fault	Left bottom solenoid valve coil and/or wire connection is open or short.	Both pumps will be disabled at first. Then both pumps could be run in limp mode with no reverse movement on left track.	<p>Check left/bottom solenoid valve coil wiring and connector.</p> <p>Check resistance of left/bottom solenoid valve coil. Refer to the Service Manual.</p> <p>Check controller2 connector and wiring.</p>
9	Right reverse drive pump solenoid wiring or coil fault	Right top solenoid valve coil and/or wire connection is open or short.	Both pumps will be disabled at first. Then both pumps could be run in limp mode with no reverse movement on right track.	<p>Check right/top solenoid valve coil wiring and connector.</p> <p>Check resistance of right/top solenoid valve coil. Refer to the Service Manual.</p> <p>Check controller2 connector and wiring.</p>
10	Right forward drive pump solenoid wiring or coil fault	Right bottom solenoid valve coil and/or wire connection is open or short.	Both pumps will be disabled at first. Then both pumps could be run in limp mode with no forward movement on right track.	<p>Check right/bottom solenoid valve coil wiring and connector.</p> <p>Check resistance of right/bottom solenoid valve coil. Refer to the Service Manual.</p> <p>Check controller2 connector and wiring.</p>

Table 57: Drive and Valve Error Codes

Error Code	Error Description	Fault Cause	Fault Action	Corrective Action
11	Attachment forward tilt valve solenoid B wiring or coil fault	Top center solenoid valve coil and/or wire connection is open or short.	Attachment forward tilt function is disabled.	<p>Check top/center solenoid valve coil wiring and connector.</p> <p>Check resistance of top/center solenoid valve coil. Refer to the Service Manual.</p> <p>Check controller2 connector and wiring.</p>
12	Attachment backward tilt valve solenoid A wiring or coil fault	Bottom center solenoid valve coil and/or wire connection is open or short.	Attachment backward tilt function is disabled.	<p>Check bottom/center solenoid valve coil wiring and connector.</p> <p>Check resistance of bottom/center solenoid valve coil. Refer to the Service Manual.</p> <p>Check controller2 wiring and connectors.</p>
13	Control valve upper auxiliary solenoid wiring or coil fault	Top right solenoid valve coil and/or wire connection is open or short.	Auxiliary hydraulics forward flow function is disabled: no hydraulic flow out of top standard auxiliary QD when proportional switch on right joystick is moved forward/up.	<p>Check top/right solenoid valve coil wiring and connector.</p> <p>Check resistance of top/right solenoid valve coil. Refer to the Service Manual.</p> <p>Check controller1 wiring and connectors.</p>
14	Control valve lower auxiliary solenoid wiring or coil fault	Bottom right solenoid valve coil and/or wire connection is open or short.	Auxiliary hydraulics reverse flow function is disabled: no hydraulic flow out of bottom standard auxiliary QD when prop. switch on right joystick is moved back/down.	<p>Check bottom/right solenoid valve coil wiring and connector.</p> <p>Check resistance of bottom/right solenoid valve coil. Refer to the Service Manual.</p> <p>Check controller1 wiring and connectors.</p>
15	Lift arm up control valve lower solenoid wiring or coil fault	Bottom left solenoid valve coil and/or wire connection is open or short.	Lift arm raise function is disabled.	<p>Check bottom/left solenoid valve coil wiring and connector.</p> <p>Check resistance of bottom/left solenoid valve coil. Refer to the Service Manual.</p> <p>Check controller1 wiring and connectors.</p>
16	Lift arm down control valve upper solenoid wiring or coil fault	Top right valve solenoid valve coil and /or wire connection is open or short.	Lift arm lower function is disabled.	<p>Check right/top solenoid valve coil wiring and connector.</p> <p>Check resistance of right/top solenoid valve coil.</p> <p>Check controller1 wiring and connectors.</p>

Troubleshooting

Table 57: Drive and Valve Error Codes

Error Code	Error Description	Fault Cause	Fault Action	Corrective Action
22	Left joystick output data fault	Internal error on one or both of the X and Y axes of the left joystick.	Faulty axis is disabled. Functional axis remains operational.	Check joystick wiring and connector. Replace joystick.
23	Right joystick output data fault	Internal error on one or both of the X and Y axes of the right joystick.	Faulty axis is disabled. Functional axis remains operational.	Check joystick wiring and connector. Replace joystick.
24	No left joystick CAN communication	No CAN communication with the left joystick.	ISO control pattern: Both pumps are disabled. Dual-hand control pattern: Both pumps and lift arm function are disabled.	Check joystick wiring and connector. Check joystick supply voltage (9 volts minimum).
25	No right joystick CAN communication	No CAN communication with the right joystick.	ISO control pattern: lift arm raise/lower, attachment tilt and standard auxiliary hydraulics flow are disabled. Dual-hand control pattern: Both pumps, attachment tilt and standard auxiliary hydraulics are disabled.	Check joystick wiring and connector. Check joystick supply voltage (9 volts minimum).
27 (1-2)	No CAN communication: engine ECU to controller2	CAN messages not being sent from engine ECU to controller2. May be accompanied by code 1-2.	Engine anti-stall functionality disabled.	Check connector and wiring on and between engine ECU and controller2.
28 (1-4)	No CAN communication from controller2 to multi-function display IMPORTANT: Only for troubleshooting with the diagnostic laptop tool; will not appear on multi-function display due to missing CAN connection	CAN messages not being sent from controller2 to multi-function display. May be accompanied by code 1-4.	Lift arm raise/lower, attachment tilt and standard auxiliary hydraulics are disabled.	Check connector and wiring on display and controller2. Check cab-to-chassis harness connector on rear wall of cab.
29 (1-3)	No CAN communication from controller1 to controller2	CAN messages not being sent from controller1 to controller2. May be accompanied by code 1-3.	Lift arm raise/lower and standard auxiliary hydraulics are disabled.	Check connector and wiring on and between controller1 and controller2.

Table 57: Drive and Valve Error Codes

Error Code	Error Description	Fault Cause	Fault Action	Corrective Action
35	Pump swash plate sensor supply voltage fault	Supply voltage for swashplate sensors is faulty. Swash sensor output voltage is out of range.	Both pumps are disabled.	Check connector and wiring to sensors. Check sensor supply voltage. Refer to the Service Manual.
36	Battery voltage out-of-range fault	Battery voltage is out of range.	Both pumps, lift arm raise/lower, attachment tilt and standard auxiliary hydraulics are disabled.	Check alternator, battery and charging circuit. Check battery voltage (9- 16 volts). Check all power and ground connections to controller2.
37	Pump and attachment tilt solenoid supply voltage out-of-range fault	Supply voltage to solenoid valves controlled by controller2 is out-of-range.	Both pumps and attachment tilt are disabled.	Check solenoid voltage (9- 16 volts). Check controller2 Power Relay. Check fuses to controller2. Check wiring and connectors on controller2 and on solenoid valves.
38	Limp mode (See "Travel Drive Error Condition Operation (Limp Mode)" on page 94)	Any pump solenoid fault (codes 7-10).	Applies when solenoid codes 7-10 are active. Functional pump solenoids will operate at reduced output (20% of max). The faulty solenoid will remain disabled.	See individual pump solenoid fault codes (7-10). Limp mode is only operable with a single solenoid/sensor fault. If there are multiple solenoid and sensor faults, limp mode is inoperable and both pumps will remain disabled.
39	Open loop mode (See "Travel Drive Error Condition Operation (Limp Mode)" on page 94)	Any pump sensor fault (codes 3-6).	Applies when sensor codes 3-6 are active. The remaining operating swash plate sensor will also be disabled. The pump solenoids will operate the pump without feedback at reduced output.	See individual pump sensor fault codes (3-6). Open loop mode is only operable with a single sensor/solenoid fault. If there are multiple sensor/solenoid faults, open loop mode is inoperable and both pumps will remain disabled.
1-2 (27)	No CAN communication from engine ECU to multi-function display	CAN messages not being sent from engine ECU to multi-function display. May be accompanied by code 27.	Engine parameters not displayed.	Check connector and wiring on and between engine ECU and multi-function display. Check cab to chassis harness connector on rear wall of cab.
1-3 (1-4) (29)	No CAN communication from controller1 to multi-function display	CAN messages not being sent from controller1 to multi-function display. May be accompanied by codes 29 and 1-4.	Both pumps and multiple functions may be disabled.	Check connector and wiring on and between controller1, controller2 and multi-function display. Check cab to chassis harness connector on rear wall of cab.

Troubleshooting

Table 57: Drive and Valve Error Codes

Error Code	Error Description	Fault Cause	Fault Action	Corrective Action
1-4 (1-3)	No CAN communication from multi-function display to controller2	CAN messages not being sent from the multi-function display to controller2. May be accompanied by code 1-3.	Both pumps and multiple functions may be disabled.	Check connector and wiring on and between controller1, controller2 and multi-function display. Check cab to chassis harness connector on rear wall of cab.
1-5	No CAN communication from controller3 to multi-function display.	CAN messages not being sent from controller3 to the multi-function display.	Multiple functions may be disabled.	Check connector and wiring on and between controller3 and the multi-purpose display. Check cab to chassis harness connector on rear wall of cab.

NOTES

Schematics

Schematic Conventions

Table 57: Harness Names / Circuit No. Sets - Circuit Types Within Sets / Wire Colors

Harness Naming Conventions	Circuit Sets		Wire Color Abbreviations	
Harness Name	Circuit No. Sets	Circuit Types Within Set	Wire Color	Abbreviation
HC = Harness/Chassis	1 – 299	12 Volt Grounds	Red	R
HE = Harness/Engine	300 – 399	Low Voltage Grounds	Pink	PK
HM = Harness/Operator (Controls)	400 – 599	12V Power	Orange	O
HR = Harness/ROPS	600 – 699	5V Power	Yellow	Y
HD = Harness/Rear Door	700 – 799	CAN, Data Link	White	W
HL = Harness/European Lighting	800 – 999	Engine, Engine ECU	Gray	GY
HA = Harness/Power-A-Tach	1000 – 1199	Hydraulic Controls	Light Blue	LTBE
HP = Harness/High-Flow Attachments	1200 – 1399	Lights	Blue/Dark Blue	DKBE
BC = Battery Cable	1400 – 1499	Emission Controls	Violet	V
HJ = Jumper Lead	1500 – 1599	Safety Systems	Light Green	LTGN
FLY = Flying Leads & Device	1600 – 1699	Auxiliary Circuits	Green	GN
BBAR = Buss Bar	1700 –	Un-Defined at this time	Dark Green	DKGN
			Tan	T
			Brown	BN
			Black	BK

Schematics

Model RT250 (SN 70501 and Up) Schematics

RT250 Fuse/Relay Locations Index

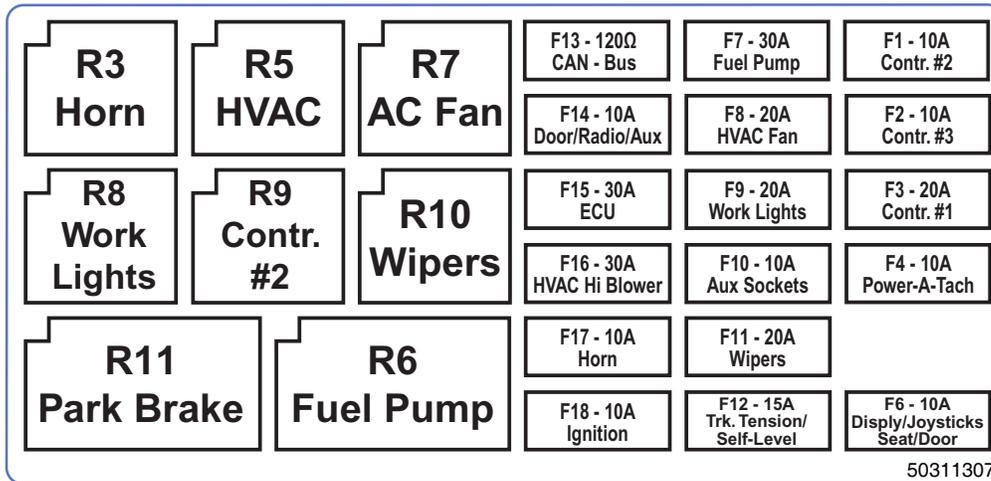


Fig. 179 – RT250 Relay/Fuse Box Decal

Table 58: RT250 Relays

Relay	Schematic Page	Circuit / Notes	Relay	Schematic Page	Circuit / Notes
R1	196	Power / Relay not in fuse box; refer to page 152	R3	200	Horn
R5	200	HVAC	R6	200	Fuel Pump
R7	200	AC Condenser Fan	R8	200	Front Work Lights
R9	200	Controller #2 Power	R10	200	Wiper Motors
R11	200	Park Brake Switch, Power-A-Tach	R12	196	Glow / Relay not in fuse box; refer to page 152
R13	205	Power-A-Tach / Relay not in fuse box; refer to page 152			

Table 59: RT250 Fuses / Resistors

Fuse	Amp	Schematic Page	Protected Circuit / Notes	Fuse	Amp	Schematic Page	Protected Circuit / Notes
Maxi	80	196	Power Relay, Ignition Switch, Dome Light	Mega 1	100	196	Glow Relay
F1	10	199	Power Relay, Main Power, Controller #2	F2	15	199	Controller #3 Power
F3	20	199	Controller #1 Power	F4	10	199	Park Brake Light, Power-A-Tach Switch
F5	N/A	N/A	N/A	F6	10	199	Display, Joysticks, Seat and Door Switches
F7	30	199	Fuel Pump, Power Splice	F8	20	199	HVAC Condenser Relay
F9	20	199	Work Lights	F10	10	199	Auxiliary Power Outlets
F11	20	199	Wipers	F12	15	199	Track Tension, Self-Level

Table 59: RT250 Fuses / Resistors

Fuse	Amp	Schematic Page	Protected Circuit / Notes	Fuse	Amp	Schematic Page	Protected Circuit / Notes
F13	N/A	199	CAN Terminating Resistor / 120 Ohms	F14	10	199	Tail Lights, Backup Alarm, Radio
F15	30	199	ECU Constant Power	F16	30	200	HVAC Relay
F17	10	200	Horn Relay	F18	10	196	Ignition
F19	3	210	Radio	ATO 1	30	205	Power-A-Tach V-Battery
L1	N/A	198	CAN Terminating Resistor / 120 Ohms	L2	N/A	197	CAN Terminating Resistor / 120 Ohms

RT250 Connector / Splice Locations Index

Table 60: RT250 Connector Names / Schematics Locations

Name	Schematic Page								
C1	196	C2	211	C3	207	C4	207	C5	202
C6	202	C7	202	C8	202	C9	201	C10	201
C11	203	C12	202	C13	203	C14	205	C15	203
C16	202	C17	203	C18	205	C19	202	C20	202
C21	204	C22	201	C23	201	C24	201	C25	205
C26	N/A	C27	210	C28	210	C29	206	C30	210
C31	210	C32	196	C33	207	C34	210	C35	N/A
C36	208	C37	207	C38	210	C39	N/A	C40	N/A
C41	N/A	C42	210	C43	N/A	C44	N/A	C45	206
C46	N/A	C47	N/A	C48	209	C49	N/A	C50	N/A
C51	N/A	C52	N/A	C53	196	C54	N/A	C55	N/A
C56	N/A	C57	N/A	C58	N/A	C59	N/A	C60	201
C61	N/A	C62	206	C63	N/A	C64	196	C65	197
C66	198	C67	201	C68	206	C69	206	C70	206
C71	205	C72	205	C73	205	C74	211	C75	206
C76	206	C77	210	C78	208	C79	208	C80	210
C81	207	C82	204	C83	196	C84	210	C85	211
C86	211	C87	211	C88	204	C89	204	C90	196, 199, 202, 203, 204, 205, 206, 207, 208, 210, 211,212
C91	209	C92	208	C93	197	C94	208	C95	197
C96	202	C97	202	C98	N/A	C99	201	C100	201
C101	203	C102	N/A	C103	212	C104	N/A	C105	N/A
C106	N/A	C107	196	C108	211	C109	200	C110	206
C111	207	C112	208	C113	208	C114	209	C115	207
C116	207	C117	207	C118	207	C119	209	C120	206
C121	205	C122	210	C123	210	C124	205	C125	203

Schematics

Table 60: RT250 Connector Names / Schematics Locations

Name	Schematic Page	Name	Schematic Page	Name	Schematic Page	Name	Schematic Page	Name	Schematic Page
C126	211	C127	199, 206, 210	C128	212	C129	212	C130	212
C131	197	C132	209	C133	N/A	C134	N/A	C135	N/A
C136	N/A	C137	N/A	C138	N/A	C139	209	C140	N/A
C141	N/A	C142	196, 206, 207, 208, 210, 211	C143	199, 207	C144	N/A	C145	N/A
C146	196	C147	205	C148	N/A	C149	N/A	C150	210
C151	207	C152	197	C153	197	C154	196, 199, 200	C155	196
C156	N/A	C157	N/A	C158	N/A	C159	N/A	C160	209
C161	N/A	C162	N/A	C163	N/A	C164	N/A	C165	N/A
C166	198	C167	197	C168	196	C169	N/A	C170	N/A
C171	N/A	C172	N/A	C173	N/A	C174	196	C175	N/A
C176	209	C177	209	C178A	209	C178B	209	C179	196
C180	N/A	C181	N/A	C182	197	C183	N/A	C184	N/A
C185	196	C186	205	C187	197	C188	N/A	C189	N/A
C190	197	C191	196	C192	196				

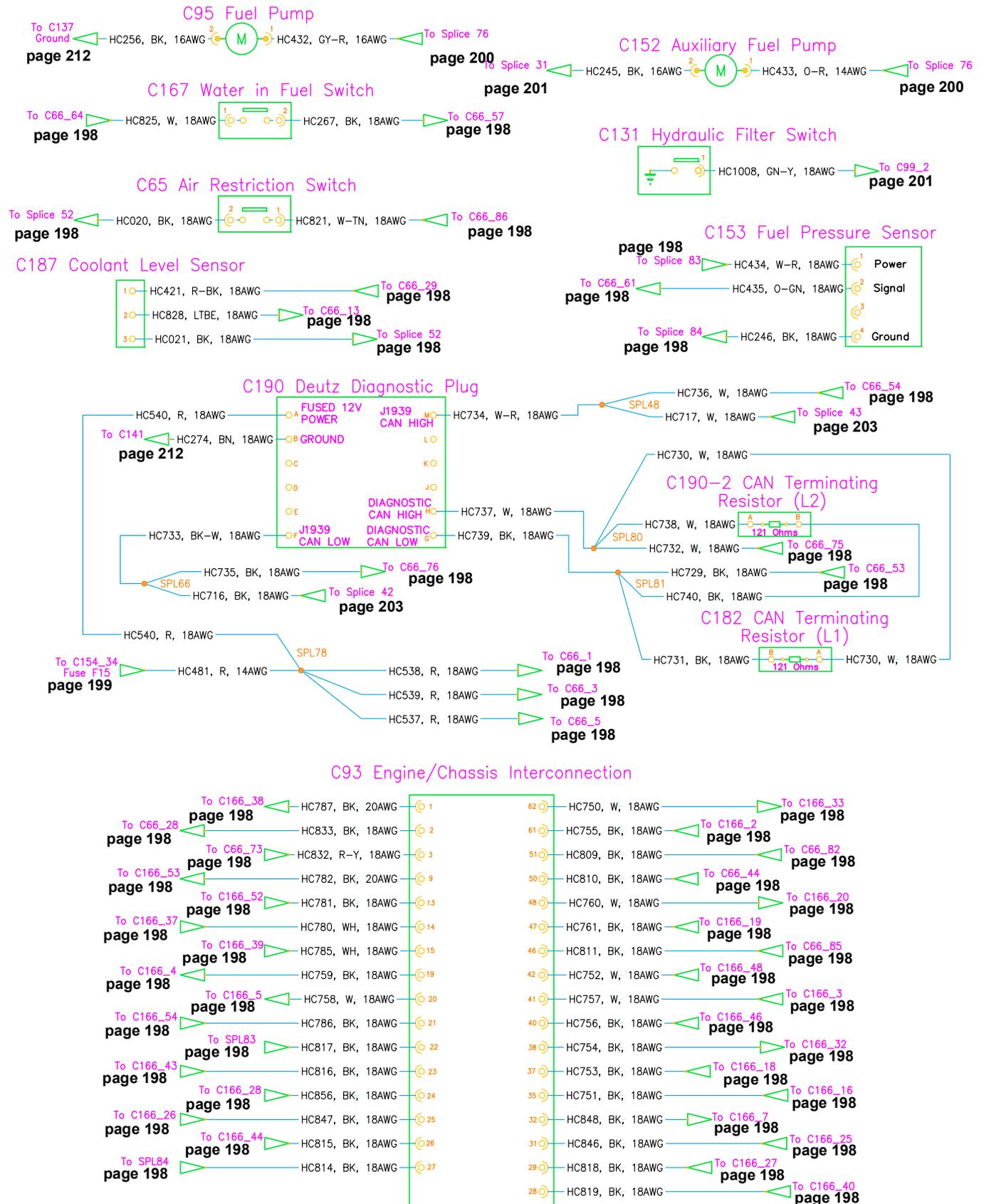
Table 61: RT250 Splice Locations and Functions

Name	Schematic Page	Function	Name	Schematic Page	Function
SPL1	207	Rear Door Ground	SPL2	207	Rear Door Ground
SPL3	208	Wiper Ground	SPL4	207	Rear Work Light Power
SPL5	205	High-Flow Reverse Power	SPL6	207	Rear Door Alarm Power
SPL7	211	Cab Power	SPL8	204	CAN Low
SPL9	211	CAN High	SPL10	204	CAN Low
SPL11	204	CAN High	SPL12	204	Cab Control Ground
SPL13	204	Cab Control Ground	SPL14	208	Cab Ground
SPL15	210	Cab Ground	SPL16	204	Cab Control Ground
SPL17	205	Cab Ground	SPL18	211	Seat Power
SPL19	208	ROPS Ground	SPL20	202	Drive Pump Power
SPL21	198	Throttle Ground	SPL22	208	Wiper Power
SPL23	207	ROPS Work Light Power	SPL24	199	Radio/Beacon Power
SPL25	207	ROPS Ground	SPL26	206	HVAC High Speed Power
SPL29	202	Swash Plate Sensor Power	SPL30	202	Swash Plate Sensor Ground
SPL31	201	Chassis Hydro Ground	SPL32	201	Chassis Hydro Ground
SPL33	212	Chassis Ground	SPL35	201	Float Solenoid Power
SPL36	202	Drive Pump Power	SPL37	202	Controller #2 Power
SPL40	206	A/C Power	SPL41	206	HVAC High Speed Power
SPL42	203	CAN Low	SPL43	203	CAN High
SPL44	201	Park Brake Power	SPL45	212	Chassis Ground
SPL46	209	EU Lighting Power	SPL47	212	Chassis Ground
SPL49	196	Main Switched Power	SPL50	199	Main Switched Power
SPL52	198	Sensor Ground	SPL53	204	Throttle Power

Table 61: RT250 Splice Locations and Functions

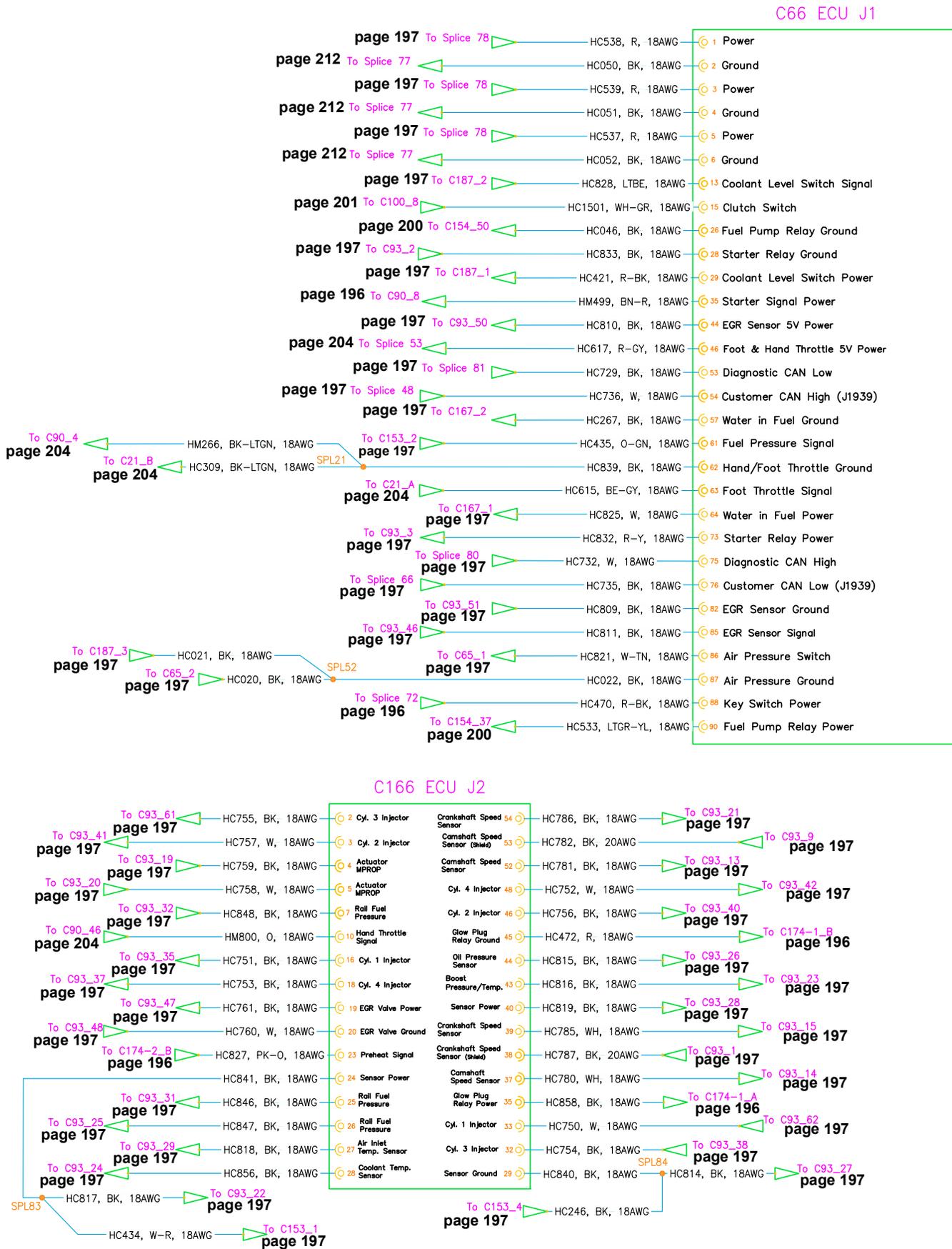
Name	Schematic Page	Function	Name	Schematic Page	Function
SPL54	196	Main Switched Power	SPL56	202	Tilt Solenoid Power
SPL57	199	Cab & ROPS Power	SPL58	209	EU Running Light
SPL59	209	EU High Beam	SPL60	209	EU Low Beam
SPL61	209	EU Flasher	SPL62	209	EU Brake Light
SPL63	212	ROPS Ground	SPL64	204	CAN High
SPL65	204	CAN Low	SPL66	197	CAN Low
SPL72	196	Ignition Switched Power	SPL74	199	Power Splice
SPL75	199	Power Splice	SPL76	200	Fuel Pump Power
SPL77	212	ECU Ground	SPL78	197	ECU Power Splice
SPL80	197	Diagnostic CAN High	SPL81	197	Diagnostic CAN Low
SPL82	205	High Flow Forward Power	SPL83	198	Sensor Power
SPL84	198	Sensor Ground	SPL90	209	EU Lighting Power
SPL91	209	EU Lighting Ground	SPL97	209	EU Lighting Switched Power
SPL98	206	HVAC Control Power	SPL99	212	Chassis Ground
SPLB	199	Power Splice	SPLC	199	Power Splice
SPLD	199	Power Splice	SPLE	199	Power Splice
SPLF1	196	Power Splice	SPLF2	196	Power Splice

Engine Sensors – Models RT250

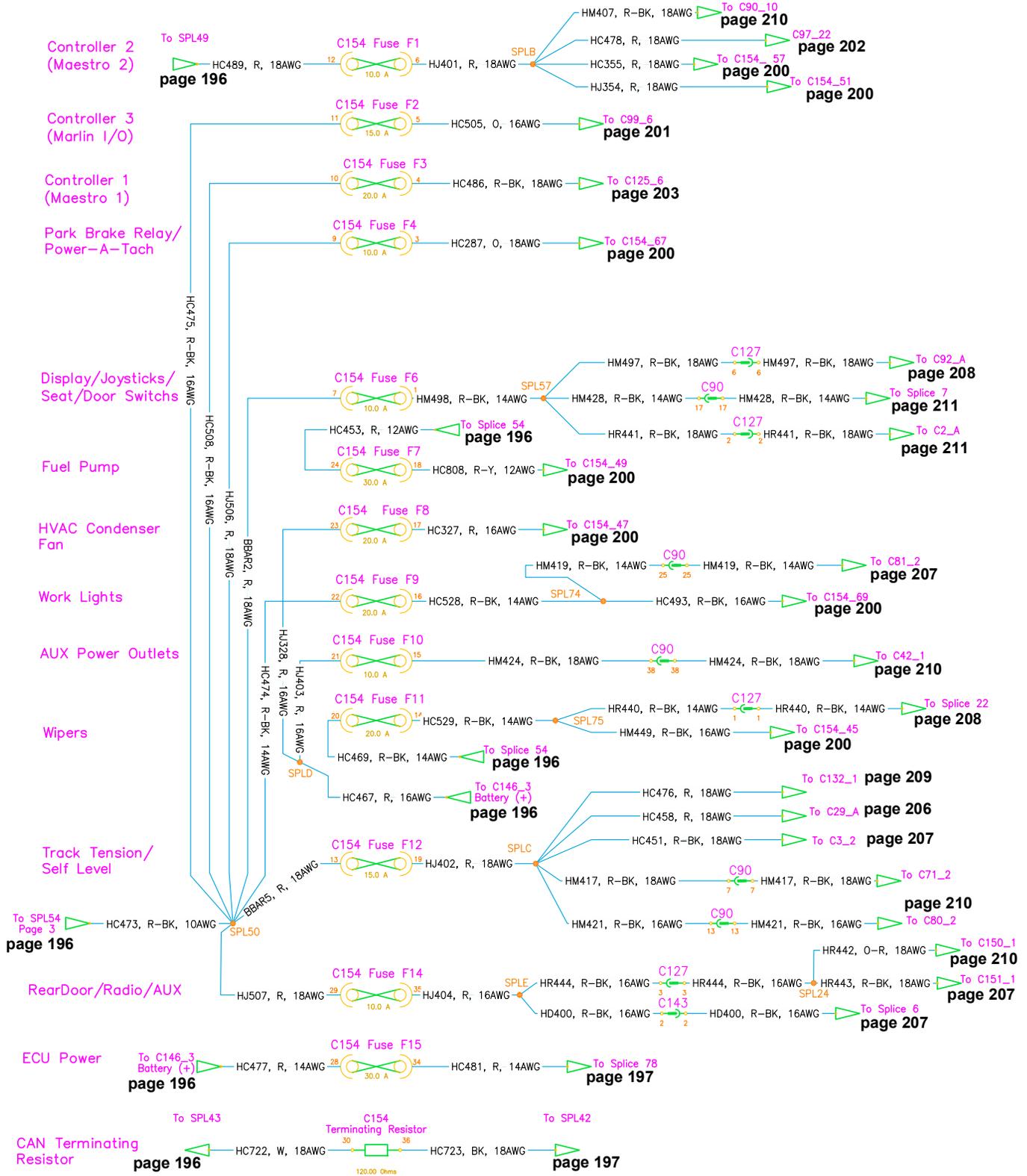


Schematics

Engine ECU – Models RT250

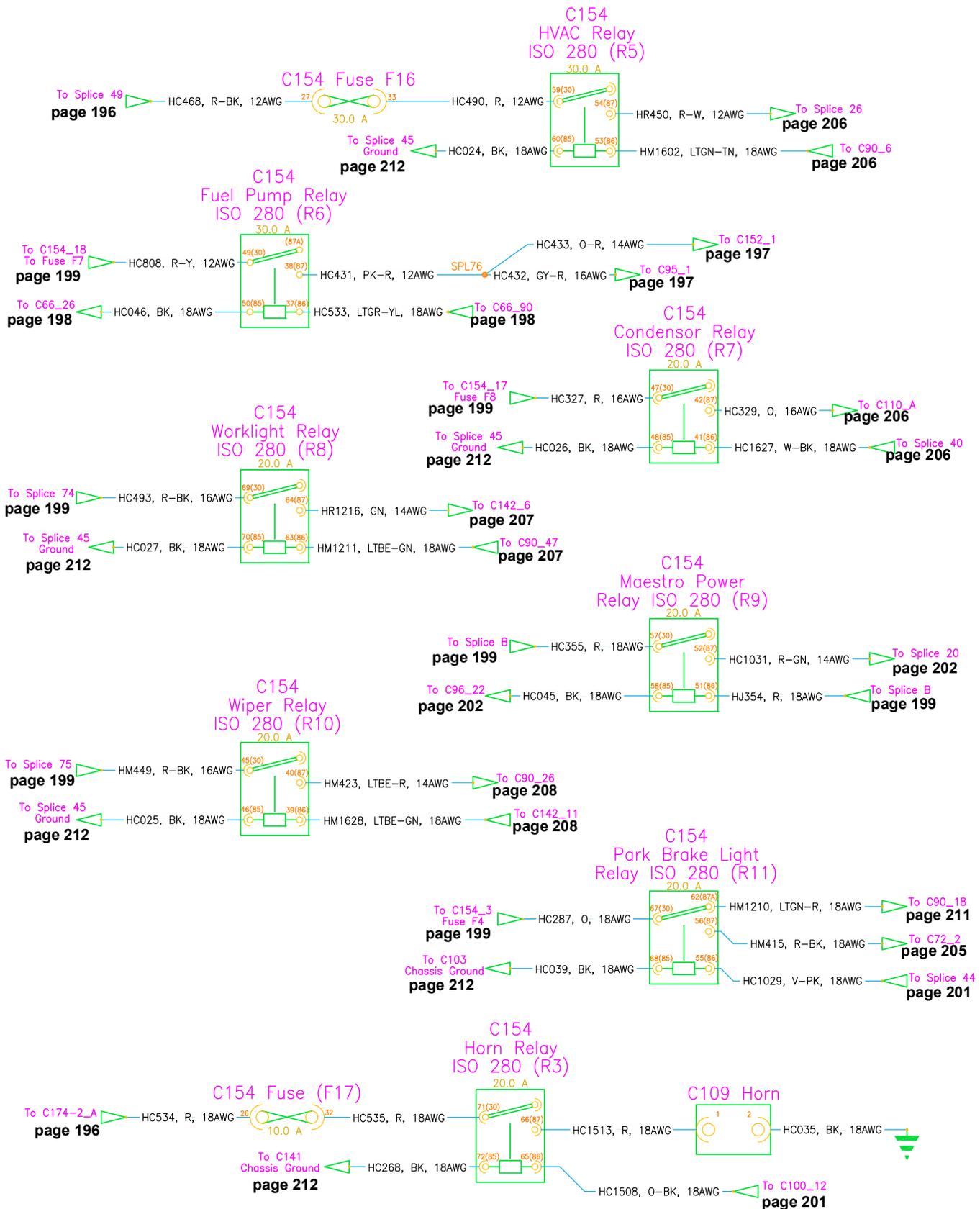


Power Distribution/Fuses – Models RT250

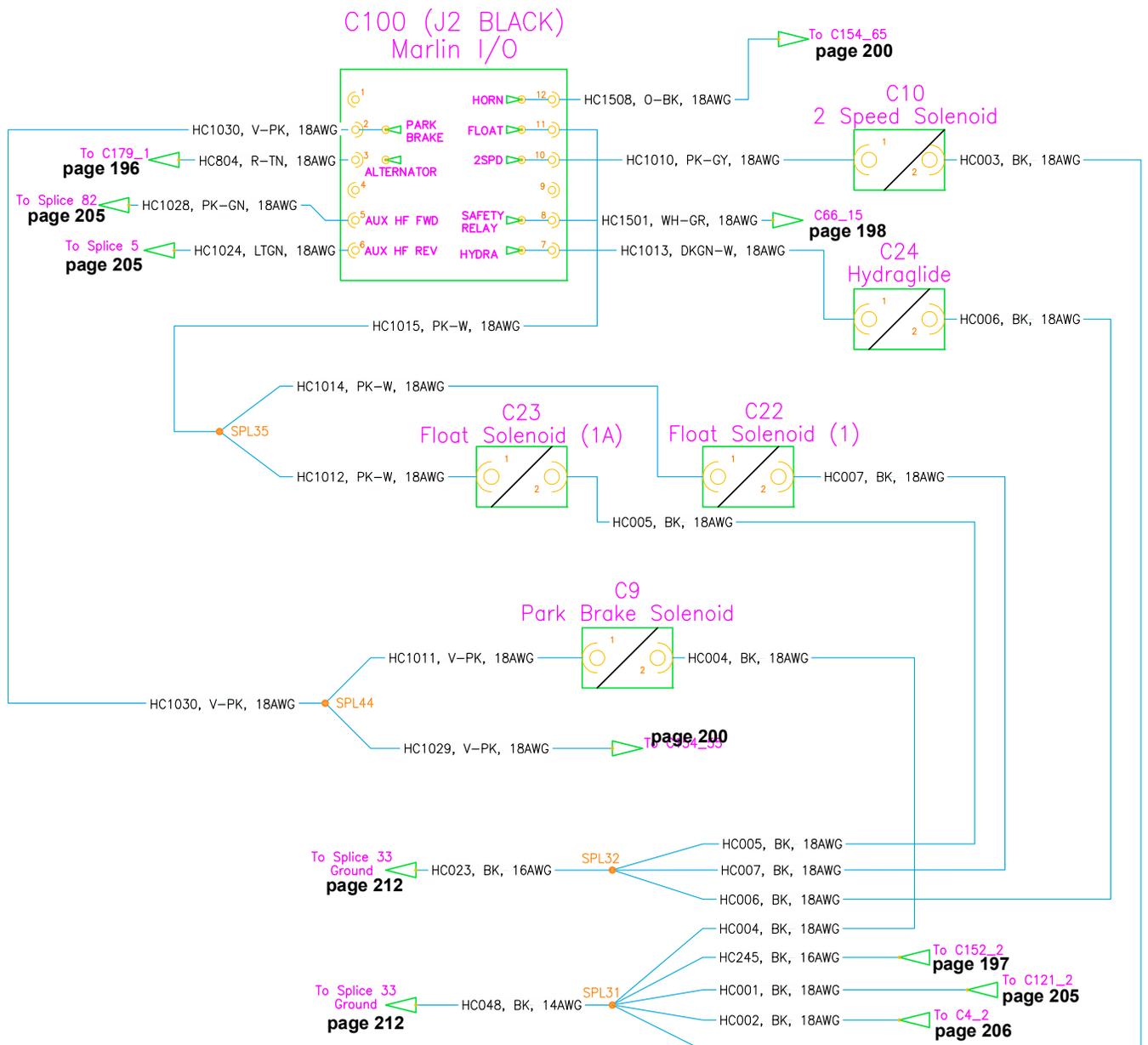
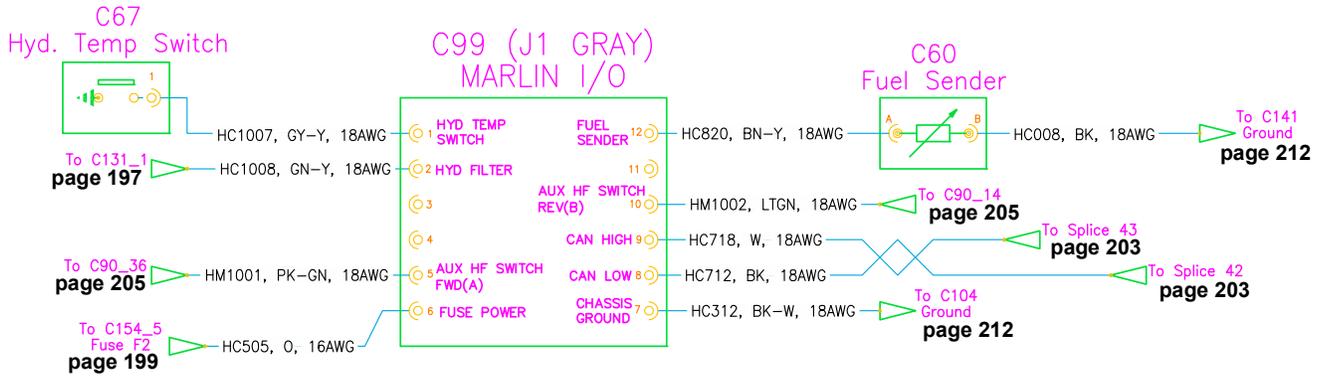


Schematics

Power Distribution/Relays – Models RT250

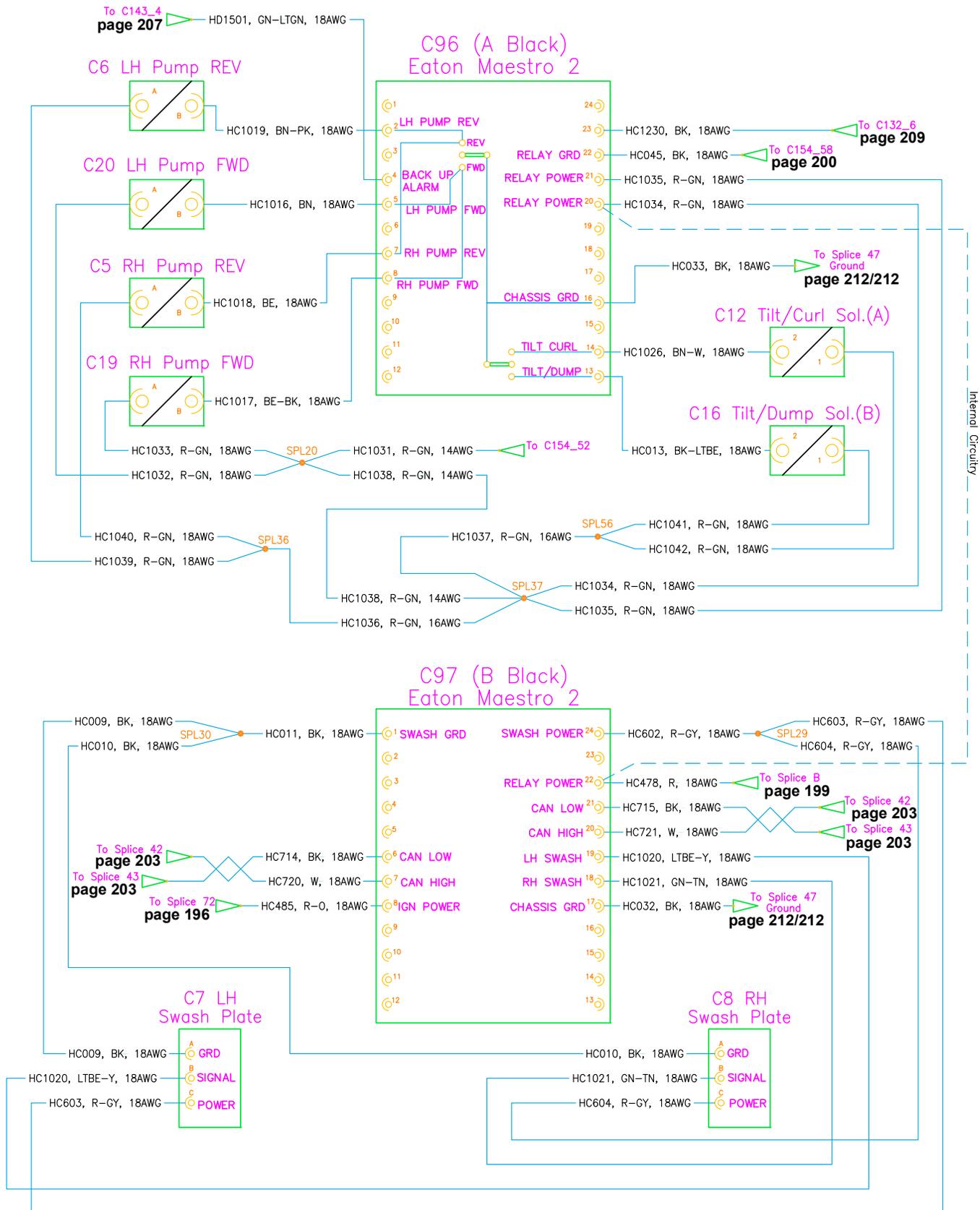


I/O Controller – Models RT250

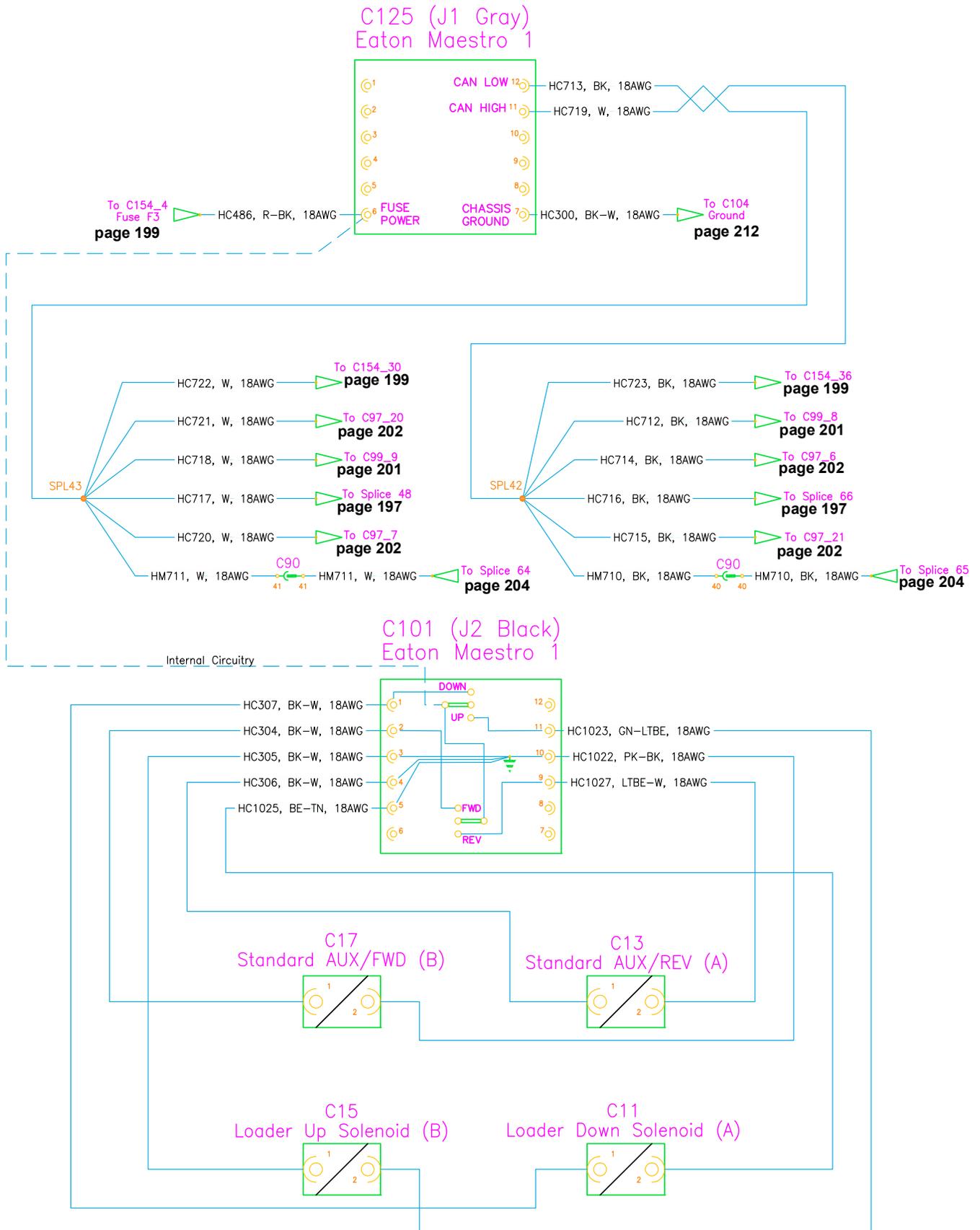


Schematics

Solenoid Controller A – Models RT250



Solenoid Controller B – Models RT250

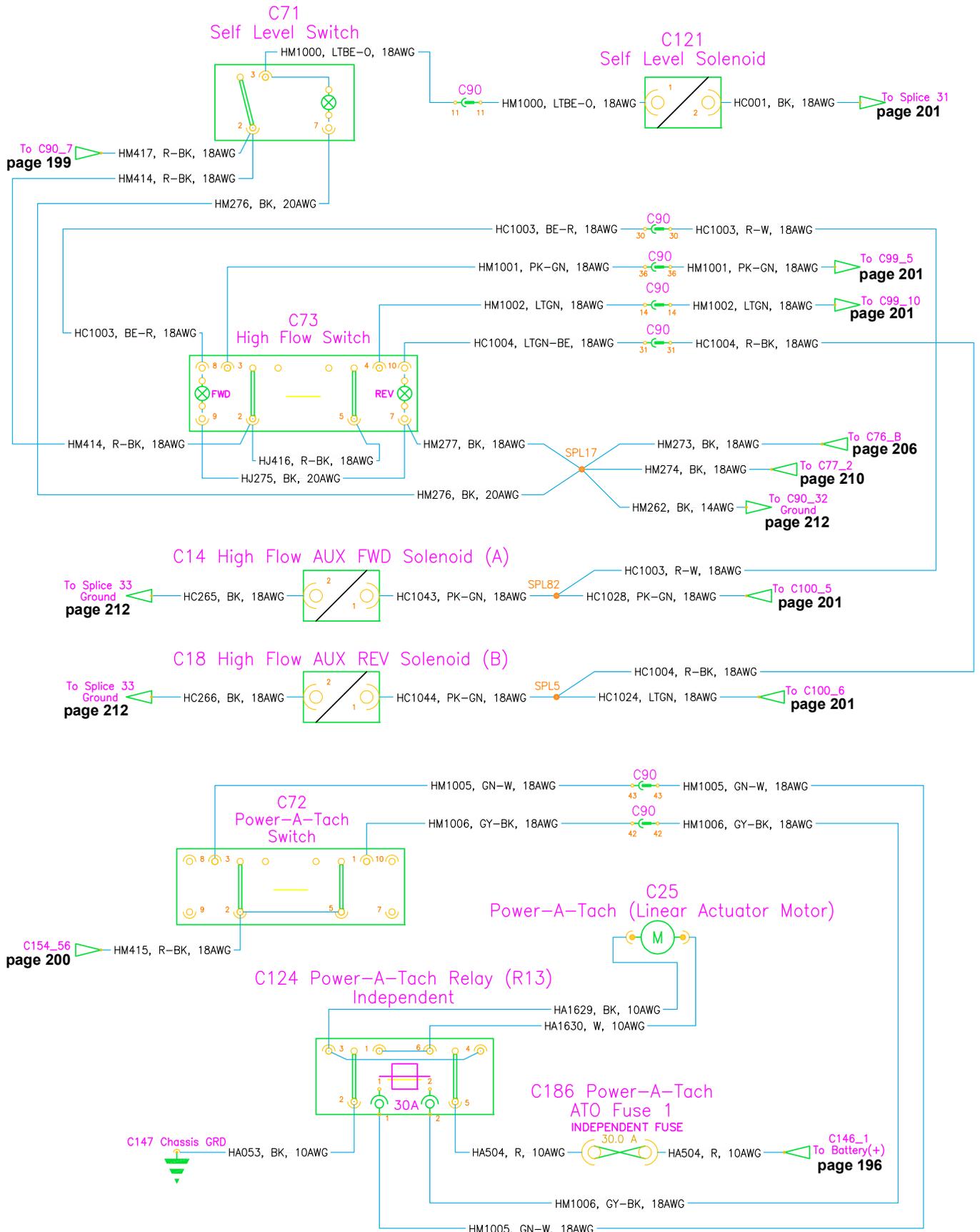


Schematics

Operator/Drive Controls – Models RT250

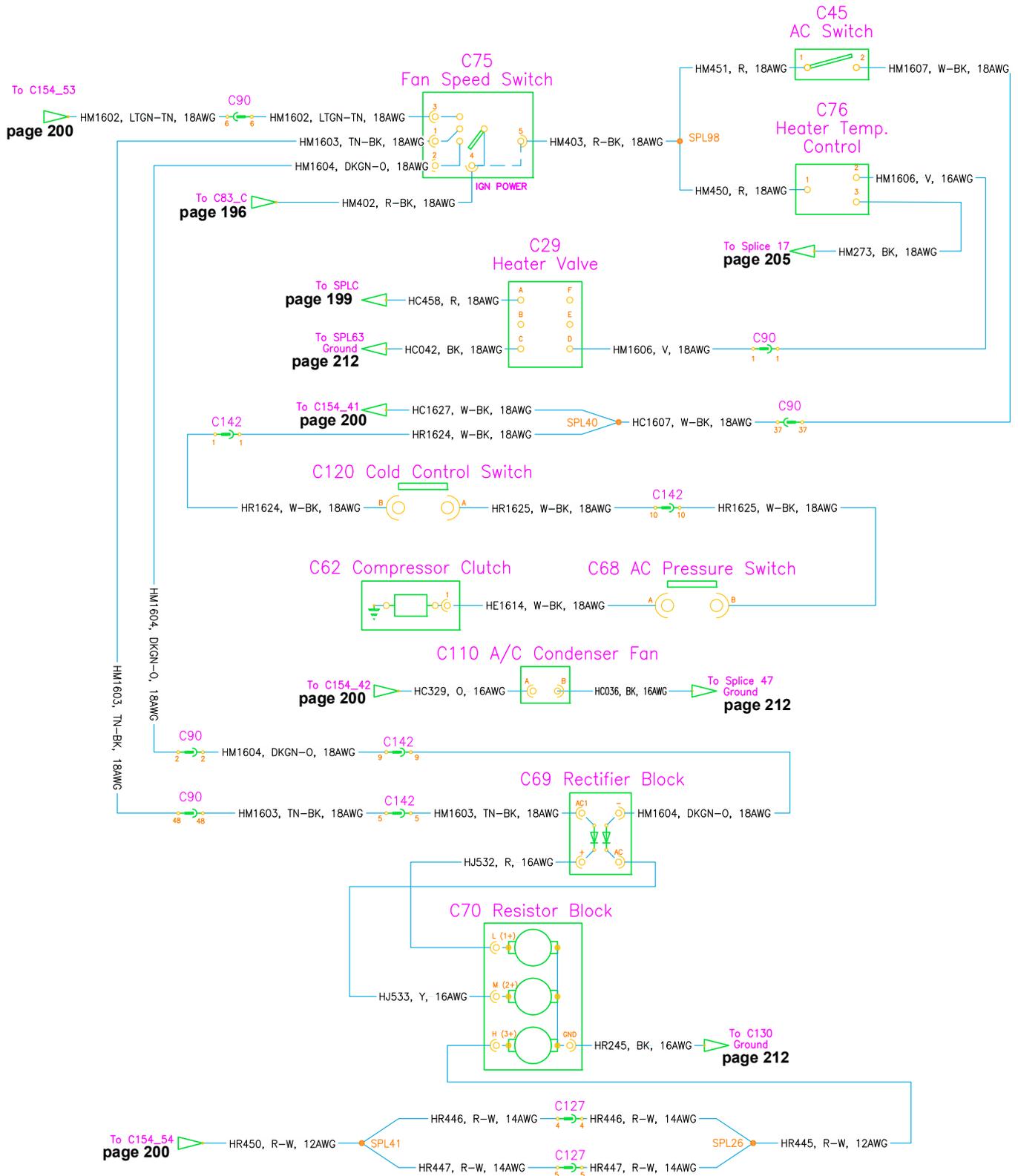


High-Flow/Self-Level/Power-A-Tach® Quick Attach System – Models RT250

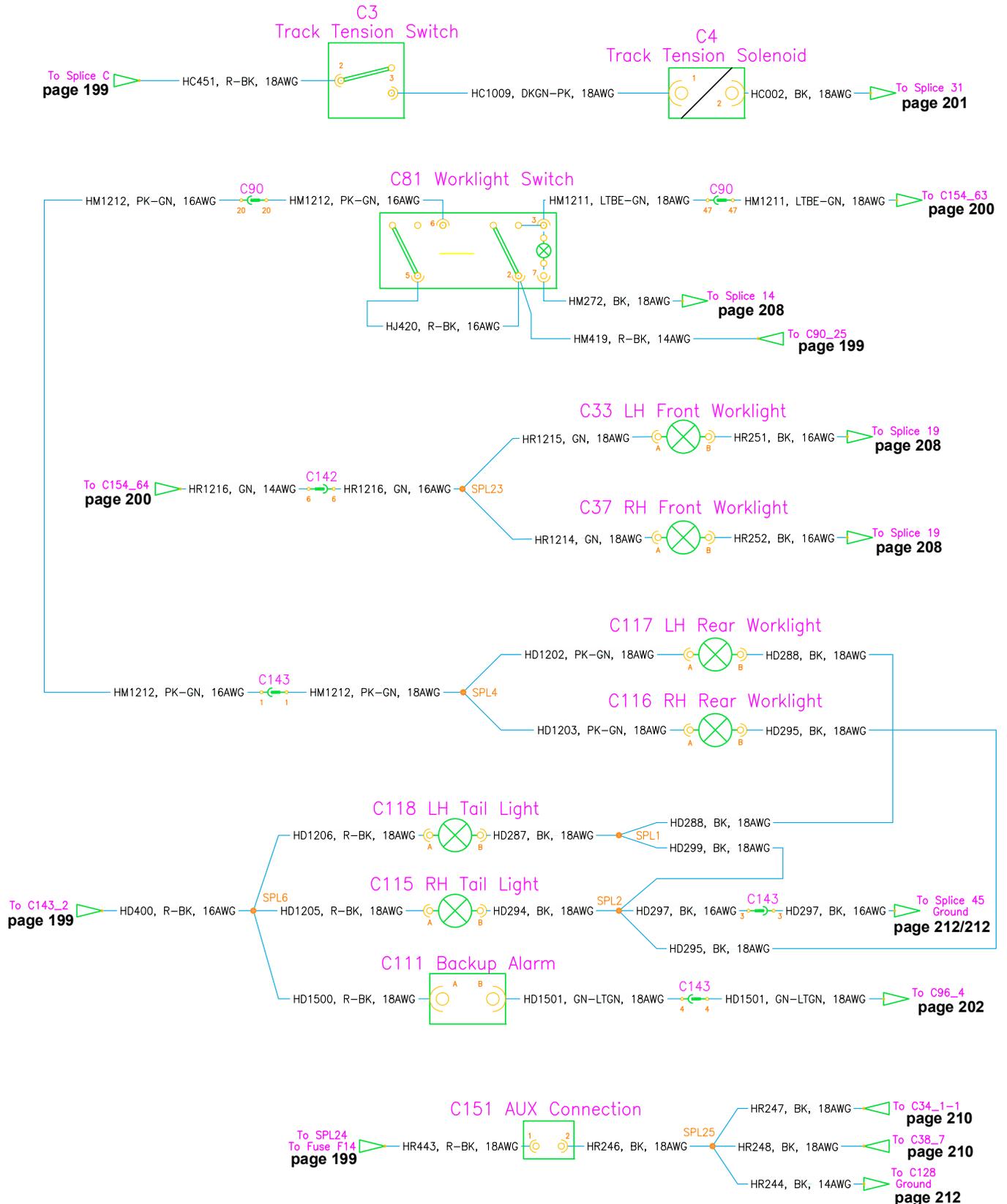


Schematics

HVAC – Models RT250

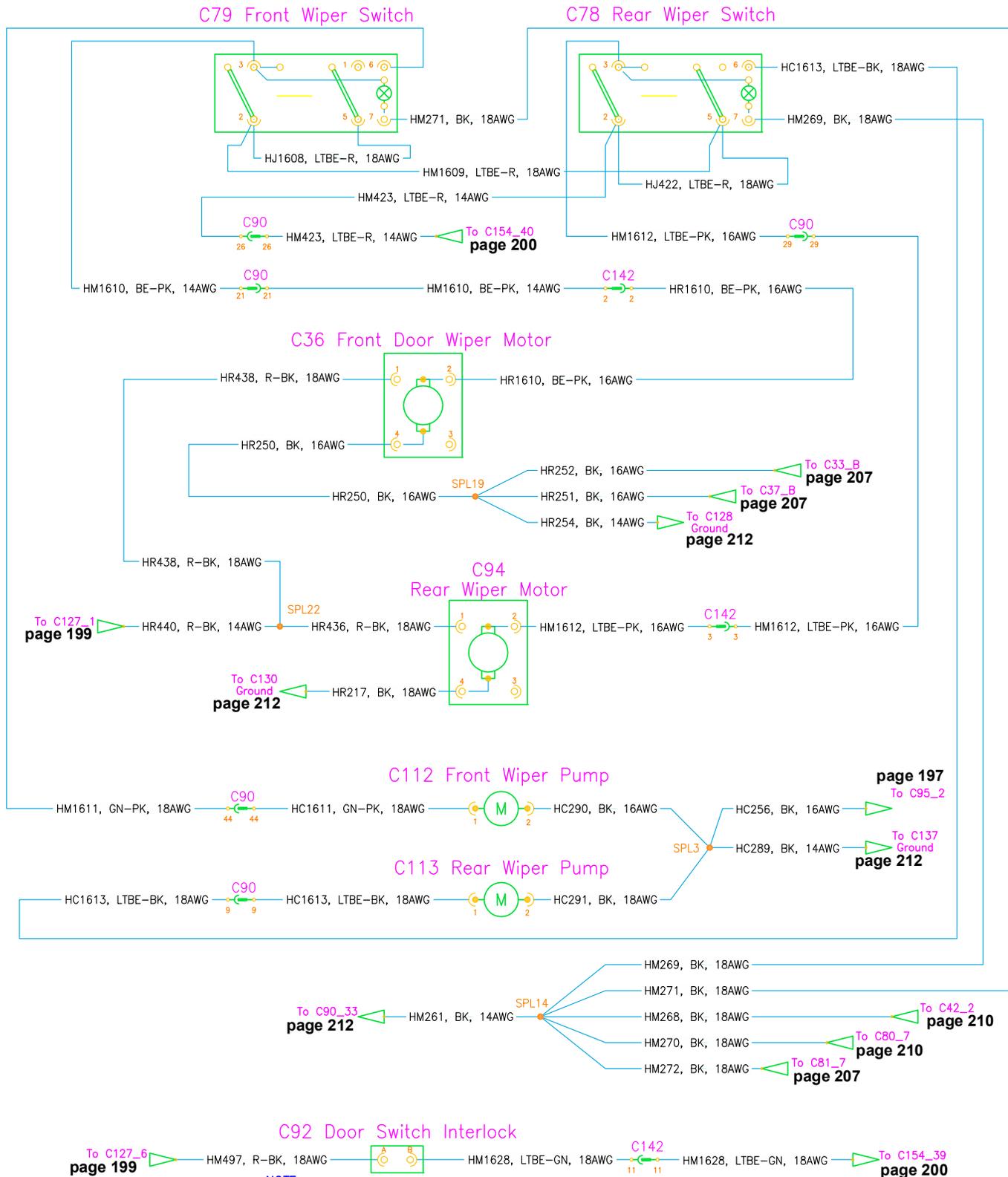


Track Tension/Work Lights – Models RT250

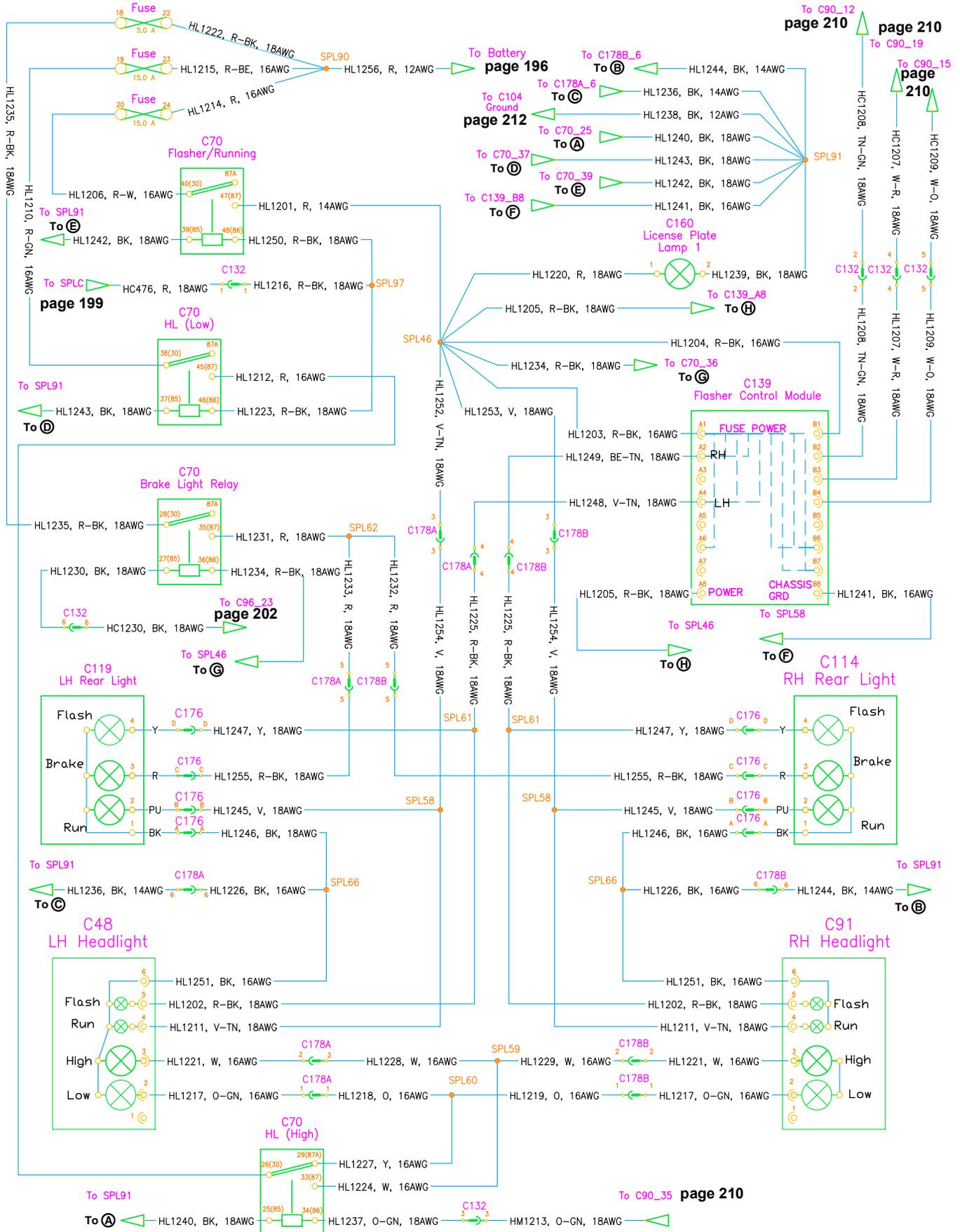


Schematics

Wipers/Washer Pump – Models RT250

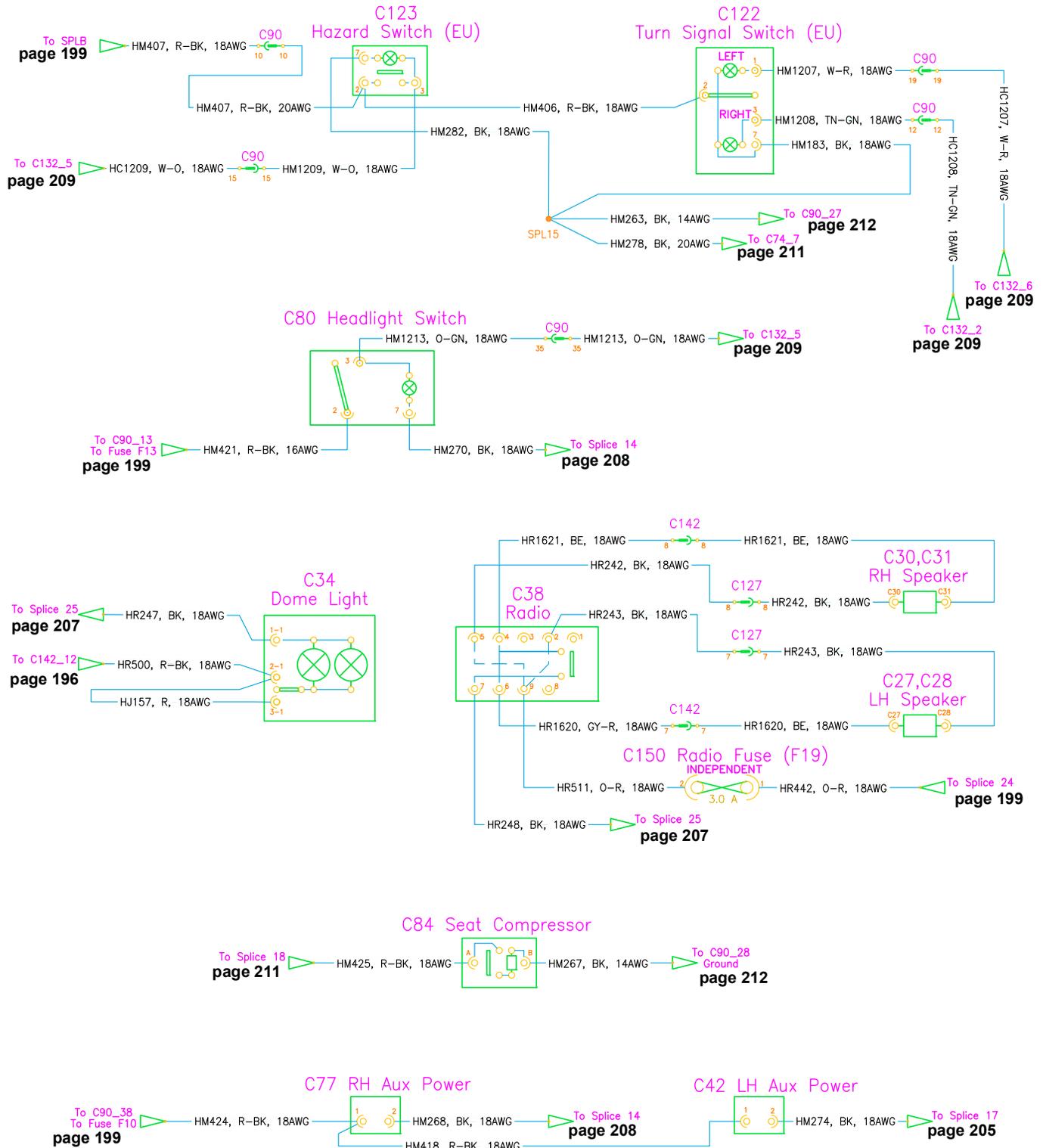


EU Road Lighting – Models RT250

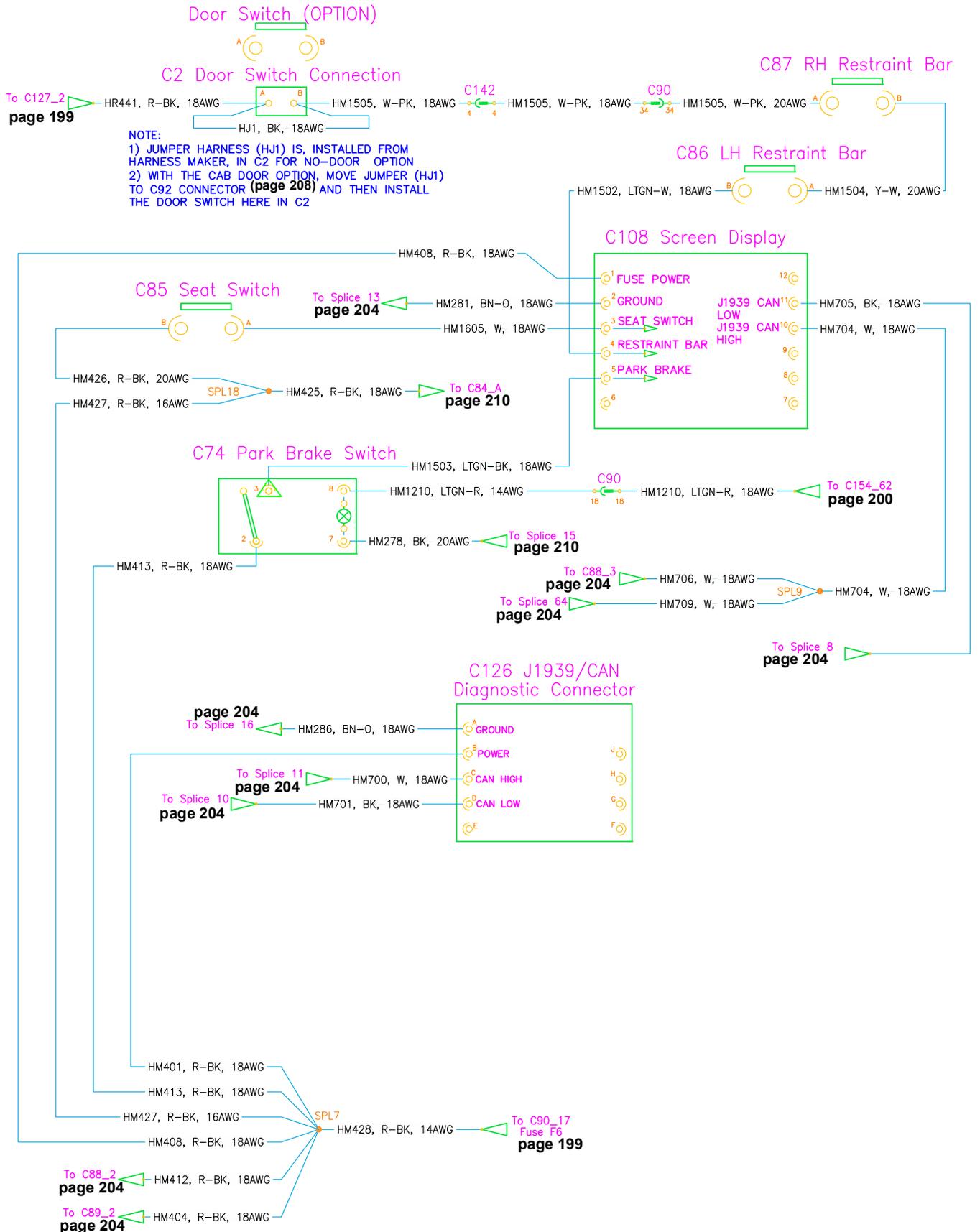


Schematics

Auxiliary Power/Dome Light/Radio – Models RT250

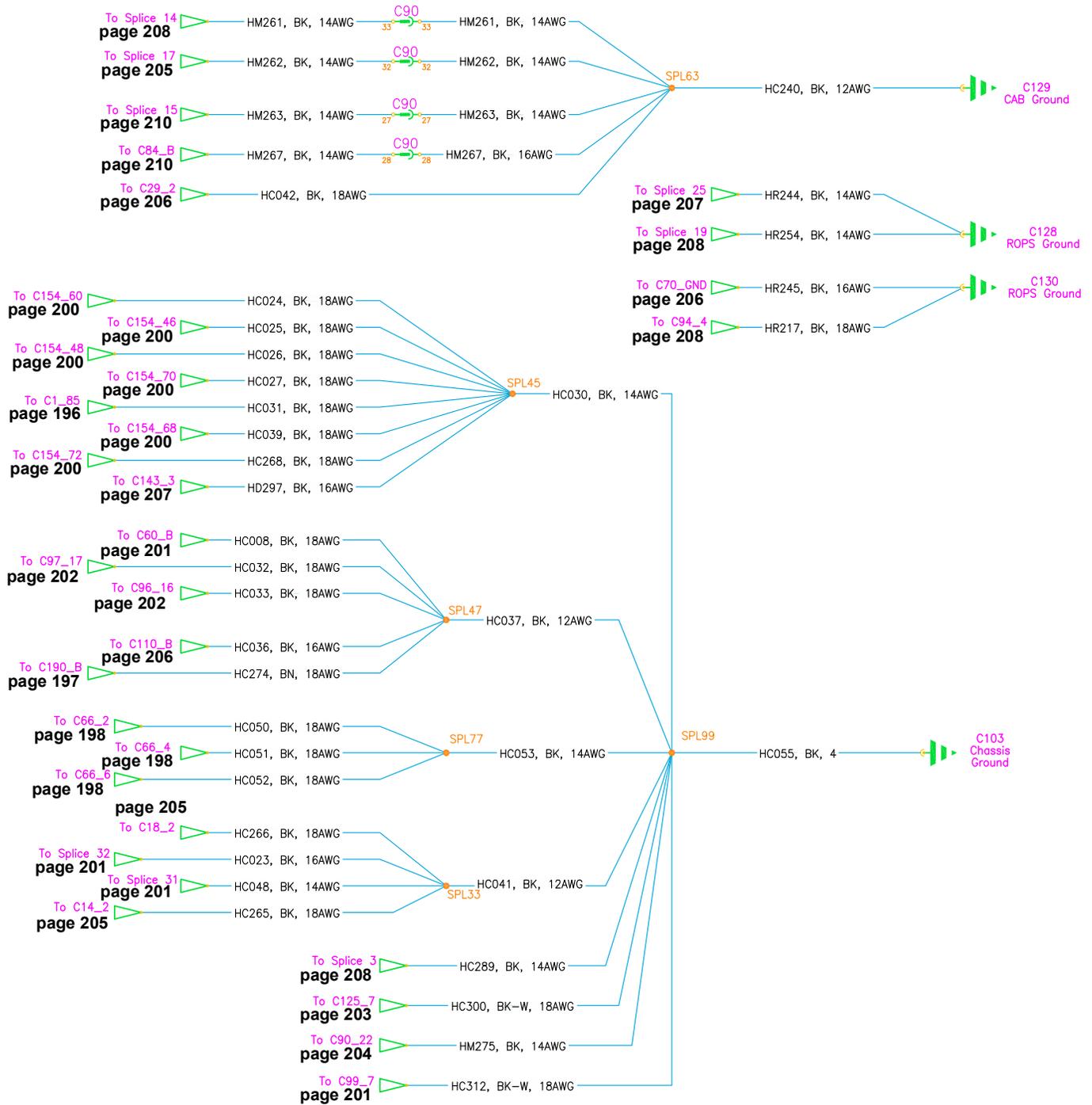


Operator CAN Interface – Models RT250



Schematics

Grounds – Models RT250



Model RT175 with Tier 4 Engines (Serial Numbers 811051 and Up) Model RT210 with Tier 4 Engines (Serial Numbers 921651 and Up)

Models RT175 and RT210 with Tier 4 Engines – Fuse/Relay Locations Index

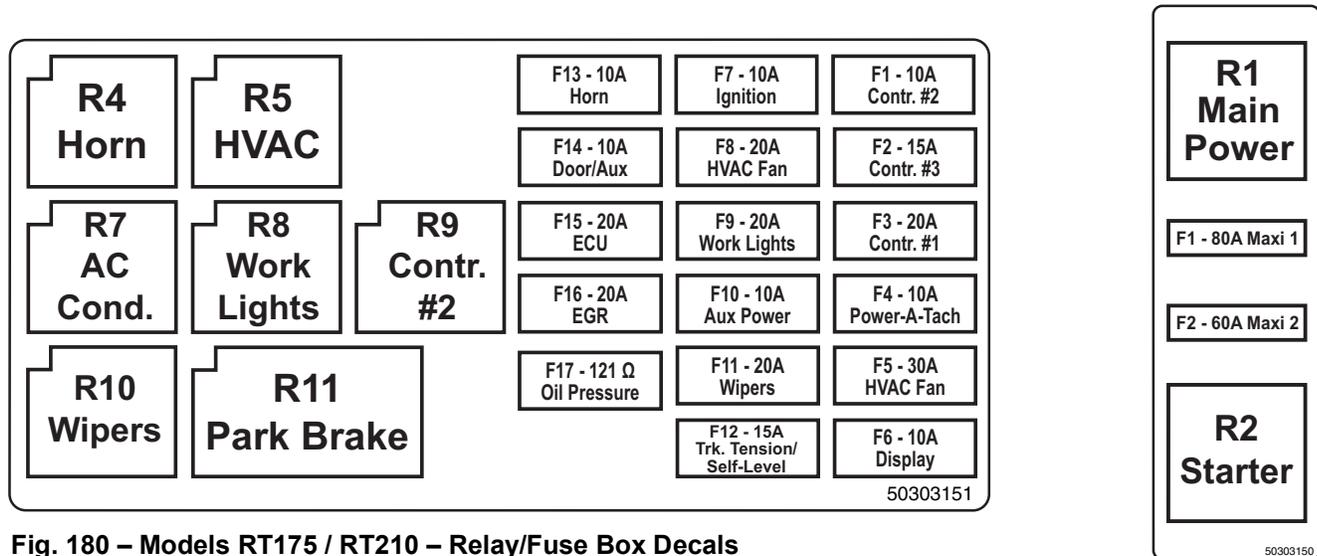


Fig. 180 – Models RT175 / RT210 – Relay/Fuse Box Decals

Table 62: Models RT175 / RT210 – Relays

Relay	Schematic Page	Circuit / Notes	Relay	Schematic Page	Circuit / Notes
R1	216	Main Power	R2	216	Starter Solenoid
R3	216	Glow Plug / Relay not in fuse box; glow plugs	R4	218	Horn
R5	218	HVAC	R6	218	EGR / Relay not in fuse box; refer to page 154
R7	218	AC Condenser Fan	R8	218	Work Lights
R9	218	Controller #2 (Maestro 2)	R10	218	Wiper Motor
R11	218	Park Brake Switch	R13	226	Power-A-Tach / Relay not in fuse box; refer to page 155

Table 63: Models RT175 / RT210 – Fuses / Resistors

Fuse	Amp	Schematic Page	Protected Circuit / Notes	Fuse	Amp	Schematic Page	Protected Circuit / Notes
F1	10	217	Controller #2 (Maestro 2)	F2	15	217	Controller #3 (Marlin I/O) Power
F3	20	217	Controller #1 (Maestro 1)	F4	10	217	Park Brake Light, Power-A-Tach Switch
F5	30	217	HVAC Blower	F6	10	217	Display, Joysticks, Seat and Door Switches
F7	10	217	Ignition, Fuel Pump	F8	20	217	HVAC Condenser
F9	20	217	Work Lights	F10	10	217	Auxiliary Power Outlets
F11	20	217	Wipers	F12	15	217	Track Tension, Self-Level
F13	10	217	Horn	F14	10	217	Rear Door Lights, Radio, Beacon Light

Schematics

Table 63: Models RT175 / RT210 – Fuses / Resistors

Fuse	Amp	Schematic Page	Protected Circuit / Notes	Fuse	Amp	Schematic Page	Protected Circuit / Notes
F15	20	217	Engine ECU	F16	20	217	EGR Valve
F17	N/A	221	Oil Pressure Resistor / 120 Ohm	Maxi 1	80	216	Main Power
Maxi 2	60	216	Starter Solenoid	Maxi 3	80	216	Glow Plugs
ATO 1	30	226	Power-A-Tach V-Battery				

RT175 / RT210 with Tier 4 Engines Connector / Splice Locations Index

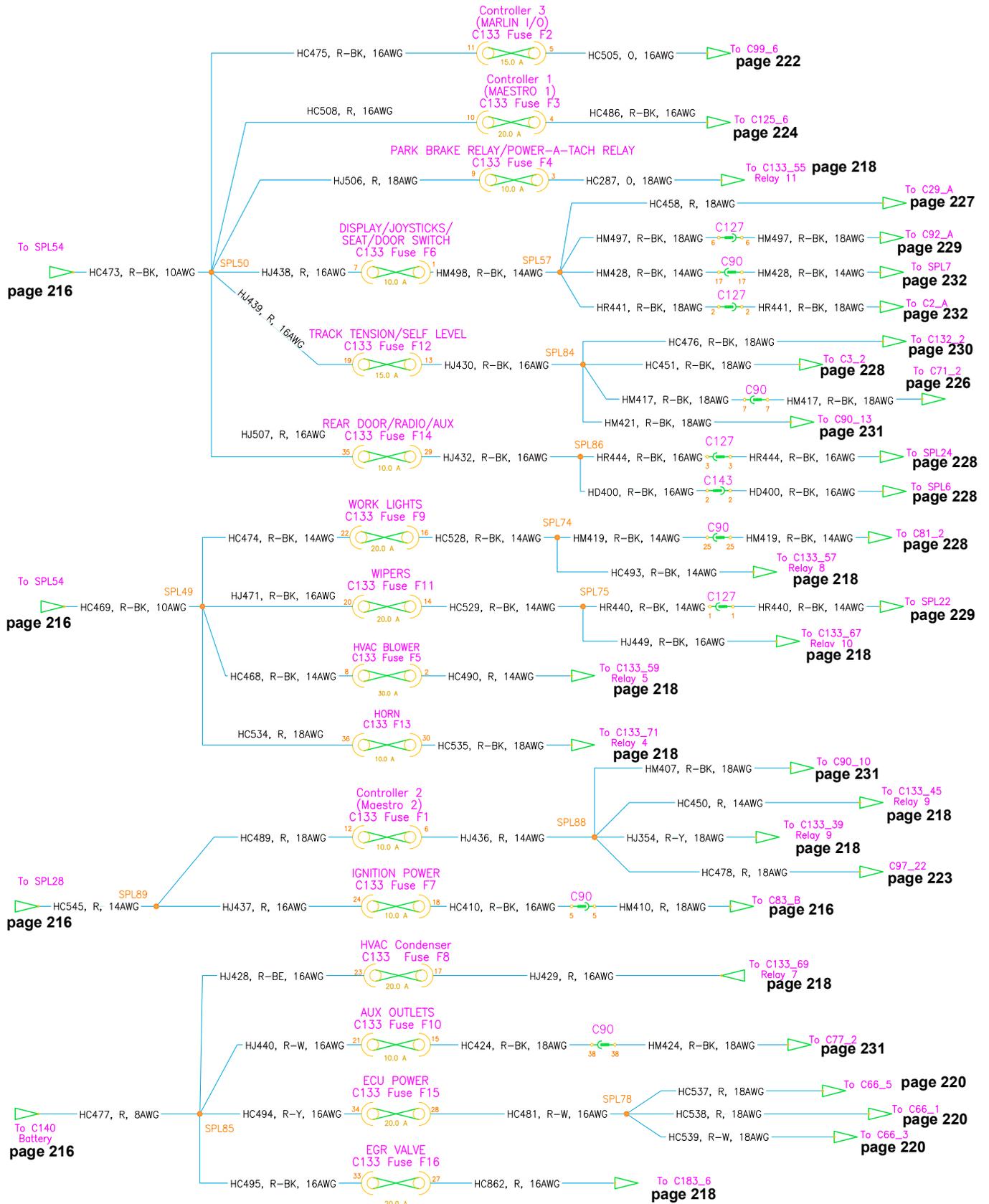
Table 64: RT175 / RT210 Connector Names / Schematics Locations

Name	Schematic Page	Name	Schematic Page	Name	Schematic Page	Name	Schematic Page	Name	Schematic Page
C1	216	C2	232	C3	228	C4	228	C5	223
C6	223	C7	223	C8	223	C9	222	C10	222
C11	224	C12	223	C13	224	C14	226	C15	224
C16	223	C17	224	C18	226	C19	223	C20	223
C21	225	C22	222	C23	222	C24	222	C25	226
C26	228	C27	231	C28	231	C29	227	C30	231
C31	231	C32	216	C33	228	C34	231	C37	228
C38	231	C41	219	C42	231	C45	216	C48	230
C53	216	C60	222	C62	227	C64	216	C65	219
C66	220	C67	222	C68	227	C69	227	C70	227, 230
C71	226	C72	226	C73	226	C74	232	C75	227
C76	227	C77	231	C78	229	C79	229	C80	231
C81	228	C82	225	C83	216	C84	231	C85	232
C86	232	C87	232	C88	225	C89	225	C90	216, 217, 224, 225, 226, 227, 228, 229, 231, 232, 233
C91	230	C92	229	C93	219	C94	229	C95	219
C96	223	C97	223	C99	222	C100	222	C101	224
C103	233	C107	216	C108	232	C110	227	C111	228
C112	229	C113	229	C114	230	C115	228	C116	228
C117	228	C118	228	C119	230	C120	227	C121	226
C122	231	C123	231	C124	226	C125	224	C126	232
C127	217, 227, 231	C128	233	C129	233	C130	233	131	219
C132	230	C133	217, 218, 221	C139	230	C140	216	C142	227, 228, 229, 231, 232
C143	217, 228	C146	216	C150	231	C160	230	C166	221
C168	216	C174	216	C176	217	C178A	230	C178B	230
C180	219	C181	216	C182	216, 219, 227	C183	218	C185	216
C186	226	C191	216	C192	216	C202	219	C203	219

Table 65: RT175 / RT210 Connector Names / Splice Locations and Functions

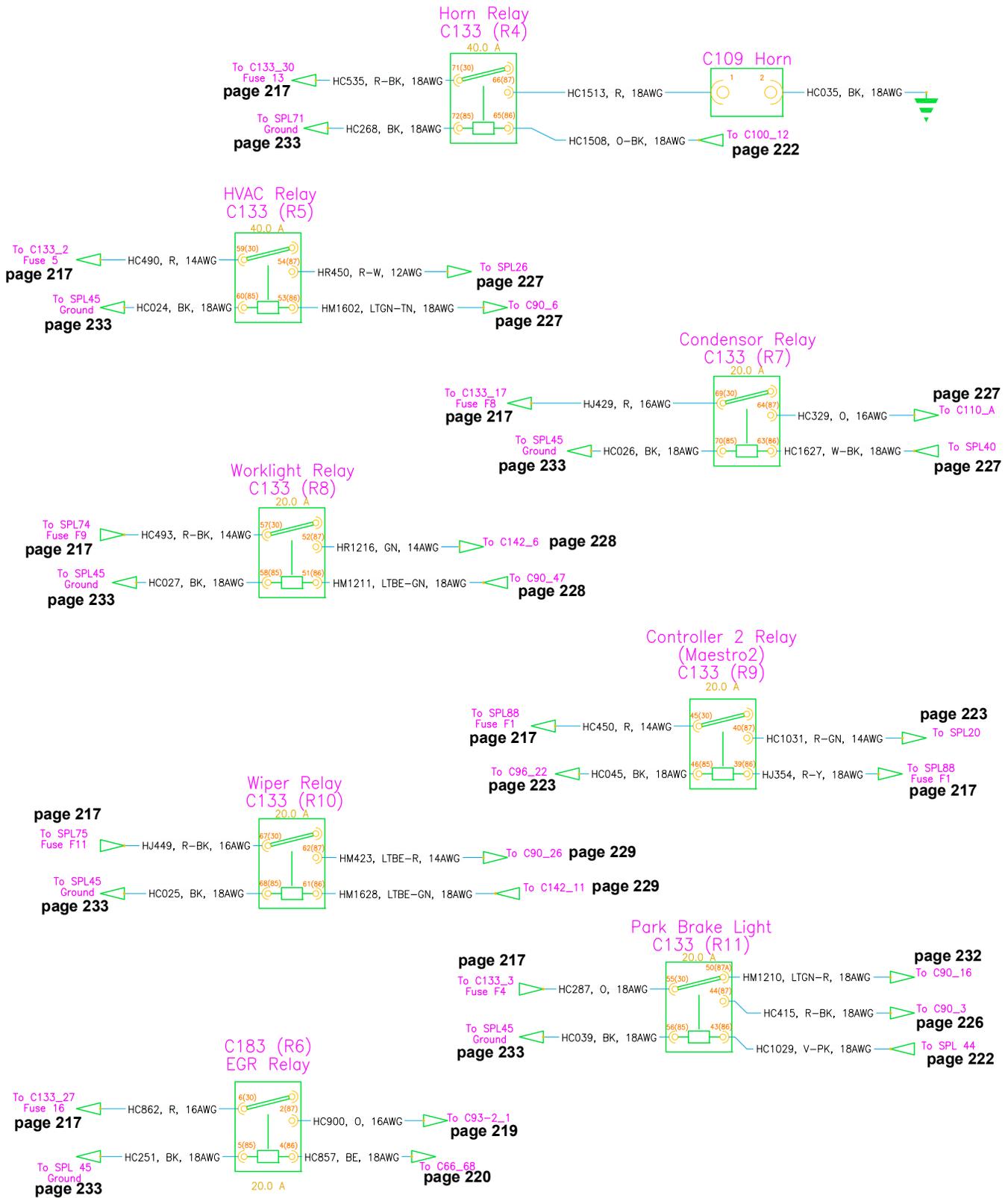
Name	Schematic Page	Function	Name	Schematic Page	Function
SPL1	228	Rear Door Ground	SPL2	228	Rear Door Ground
SPL3	229	Wiper Ground	SPL4	228	Rear Work Light Power
SPL5	226	HF Aux Rev. Power	SPL6	228	Rear Door Power
SPL7	232	Cab Power	SPL8	225	CAN Low
SPL9	232	CAN High	SPL10	225	CAN Low
SPL11	225	CAN High	SPL12	225	Cab Control Ground
SPL13	225	Cab Control Ground	SPL14	229	Cab Ground
SPL15	231	Cab Ground	SPL16	225	Cab Control Ground
SPL17	226	Cab Ground	SPL18	232	Seat Power
SPL19	229	ROPS Ground	SPL20	223	Drive Pump Power
SPL21	219	DPF Sensor Ground	SPL22	229	Wiper Power
SPL23	228	ROPS Work Light Power	SPL24	228	Radio/Beacon Power
SPL25	228	ROPS Ground	SPL26	227	HVAC High Spd Power
SPL27	219	Power Splice	SPL28	216	Main Power
SPL29	223	Swash Sensor Power	SPL30	223	Swash Sensor Ground
SPL31	222	Chassis HYD Ground	SPL32	222	Chassis HYD Ground
SPL33	233	Chassis Ground	SPL35	222	Float Solenoid Power
SPL36	223	Drive Pump Power	SPL37	223	Controller #2 Power
SPL39	233	Chassis Ground	SPL40	227	A/C Power
SPL41	227	HVAC High Spd Power	SPL42	224	CAN Low
SPL43	224	CAN High	SPL44	222	Park Brake Power
SPL45	233/	Chassis Ground	SPL46	229	Flasher Power
SPL47	233	Chassis Ground	SPL49	217	Main Switched Power
SPL50	217	Main Switched Power	SPL51	219	Oil Pressure Switch
SPL54	216	Main Switched Power	SPL56	223	Tilt Solenoid Power
SPL57	217	Cab & ROPS Power	SPL58	230	EU Running Light
SPL59	230	EU High Beam	SPL60	230	EU Low Beam
SPL61	230	EU Flasher	SPL62	230	EU Brake Light
SPL63	233	ROPS Ground	SPL64	225	CAN High
SPL65	225	CAN Low	SPL66	230	EU Rear Ground
SPL71	233	Chassis Ground	SPL74	217	Power Splice
SPL75	217	Power Splice	SPL77	219	HPP Pump CAN
SPL78	217	ECU Power Splice	SPL79	219	HPP Pump CAN
SPL80	216	Ignition Switched Power	SPL82	226	HF Aux FWD Power
SPL84	217	Power Splice	SPL85	217	Power Splice
SPL86	217	Power Splice	SPL88	217	Power Splice
SPL89	217	Power Splice	SPL90	230	EU Lighting Power
SPL91	230	EU Lighting Ground	SPL97	230	EU Lighting Switched Power
SPL98	227	HVAC Control Power	SPL99	233	Chassis Ground

Power Distribution/Fuses – Models RT175 / RT210 with Tier 4 Engines

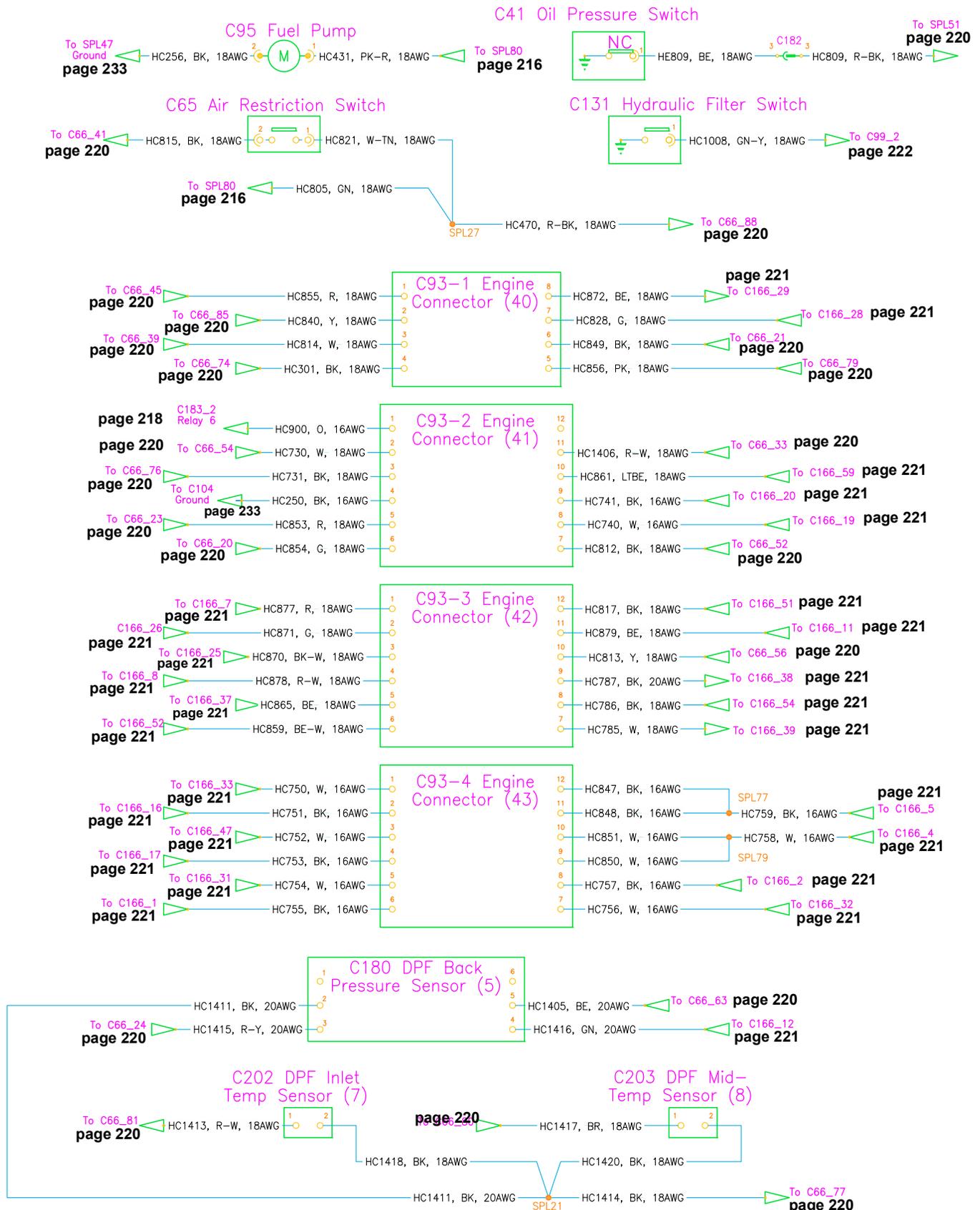


Schematics

Power Distribution/Relays – Models RT175 / RT210 with Tier 4 Engines



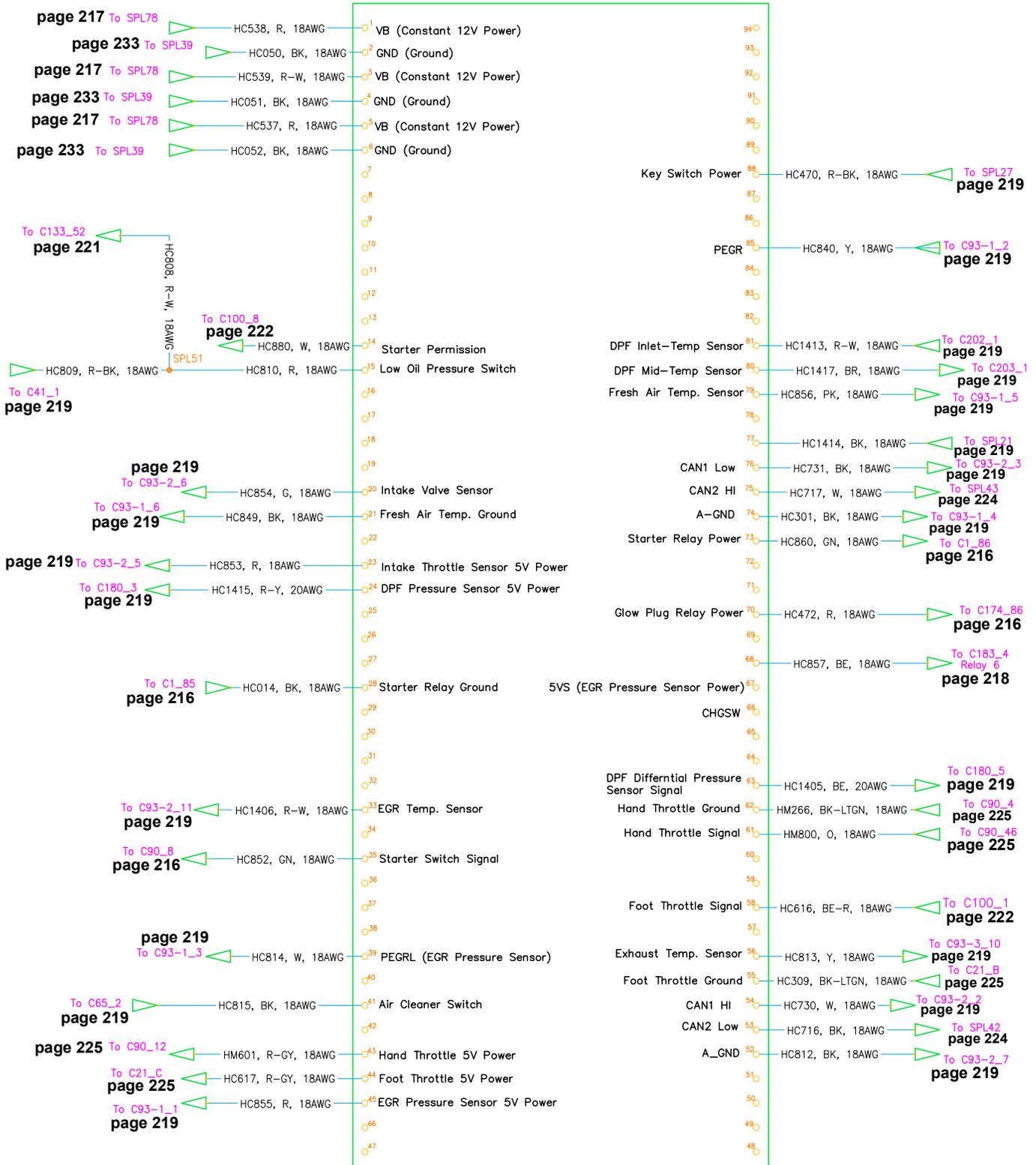
Engine Sensors – Models RT175 / RT210 with Tier 4 Engines



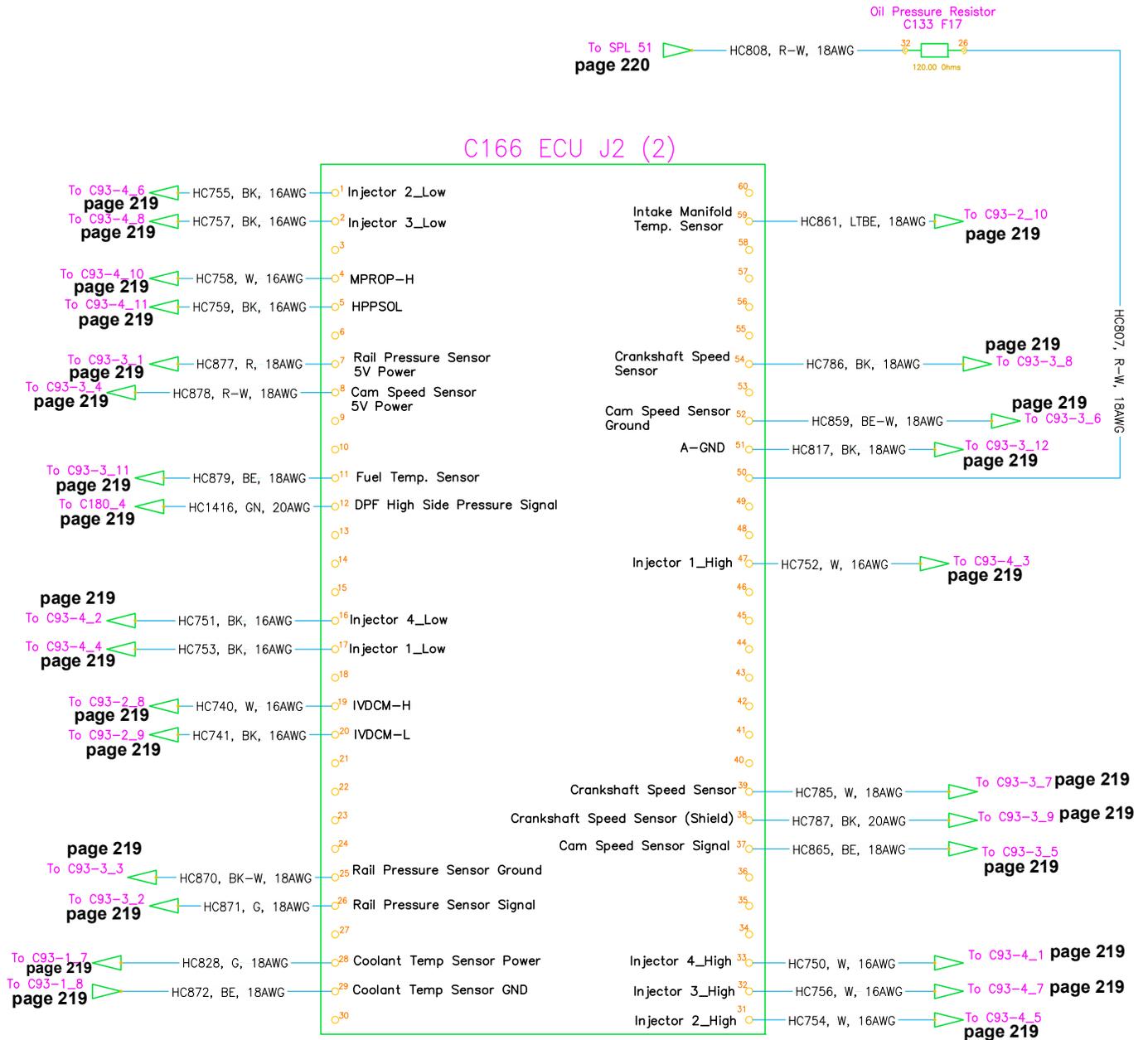
Schematics

Engine ECU – Models RT175 / RT210 with Tier 4 Engines

C66 ECU J1 (1)

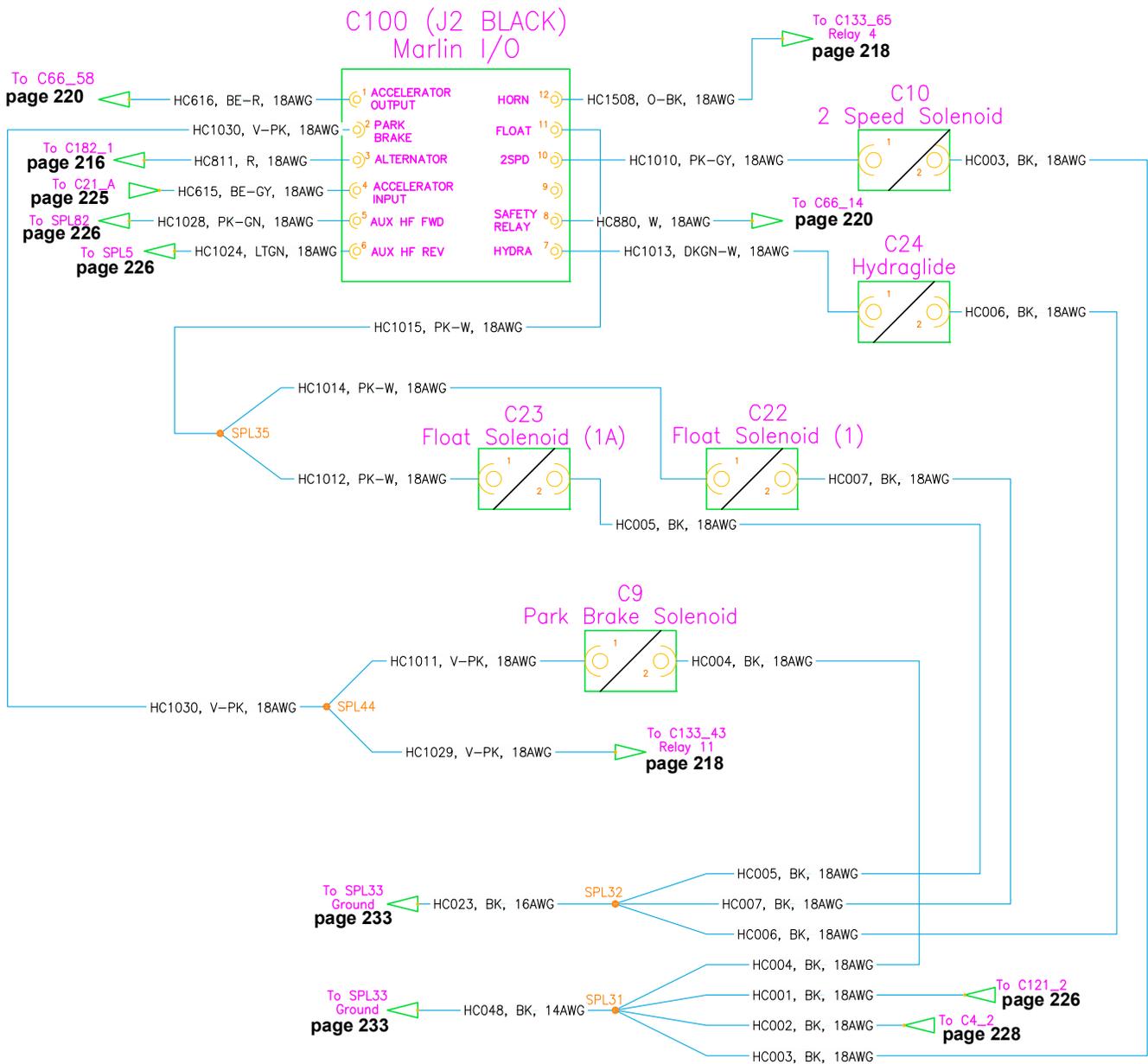
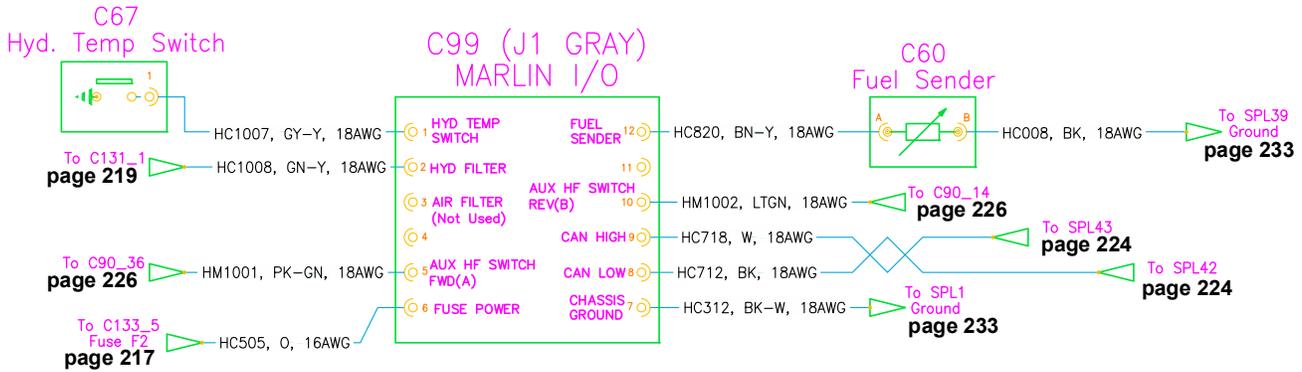


Engine ECU (Continued) – Models RT175 / RT210 with Tier 4 Engines

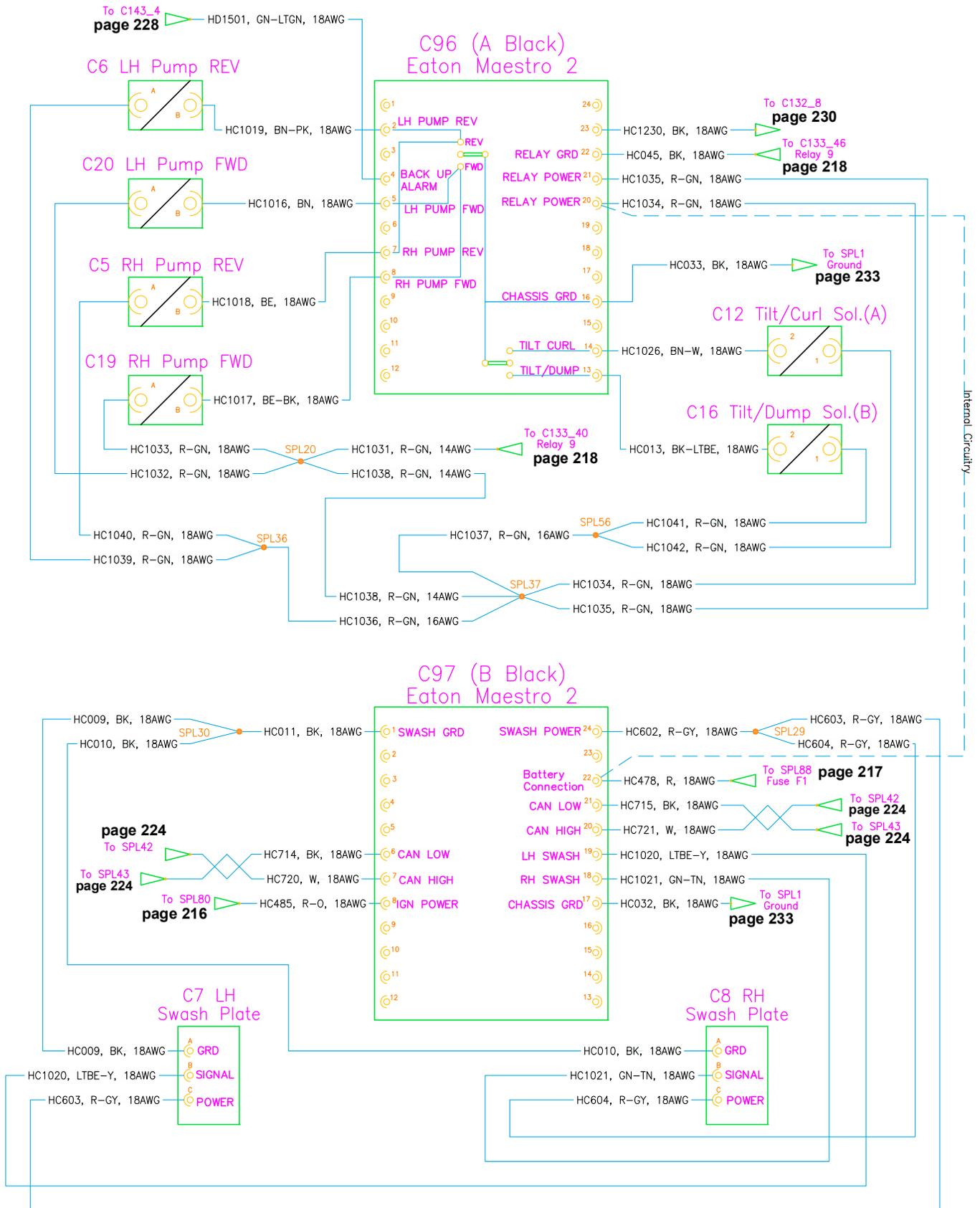


Schematics

I/O Controller – Models RT175 / RT210 with Tier 4 Engines

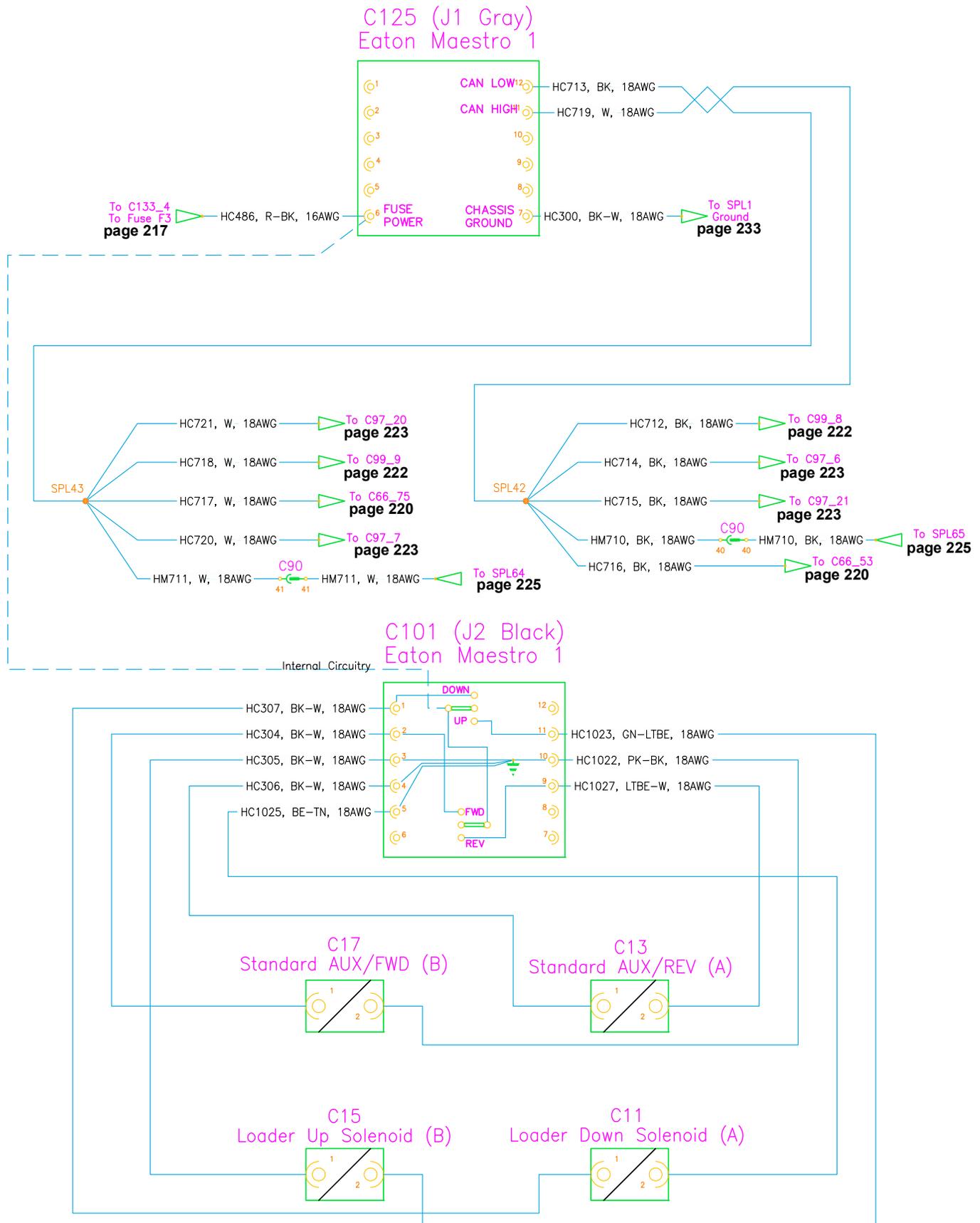


Solenoid Controller A – Models RT175 / RT210 with Tier 4 Engines

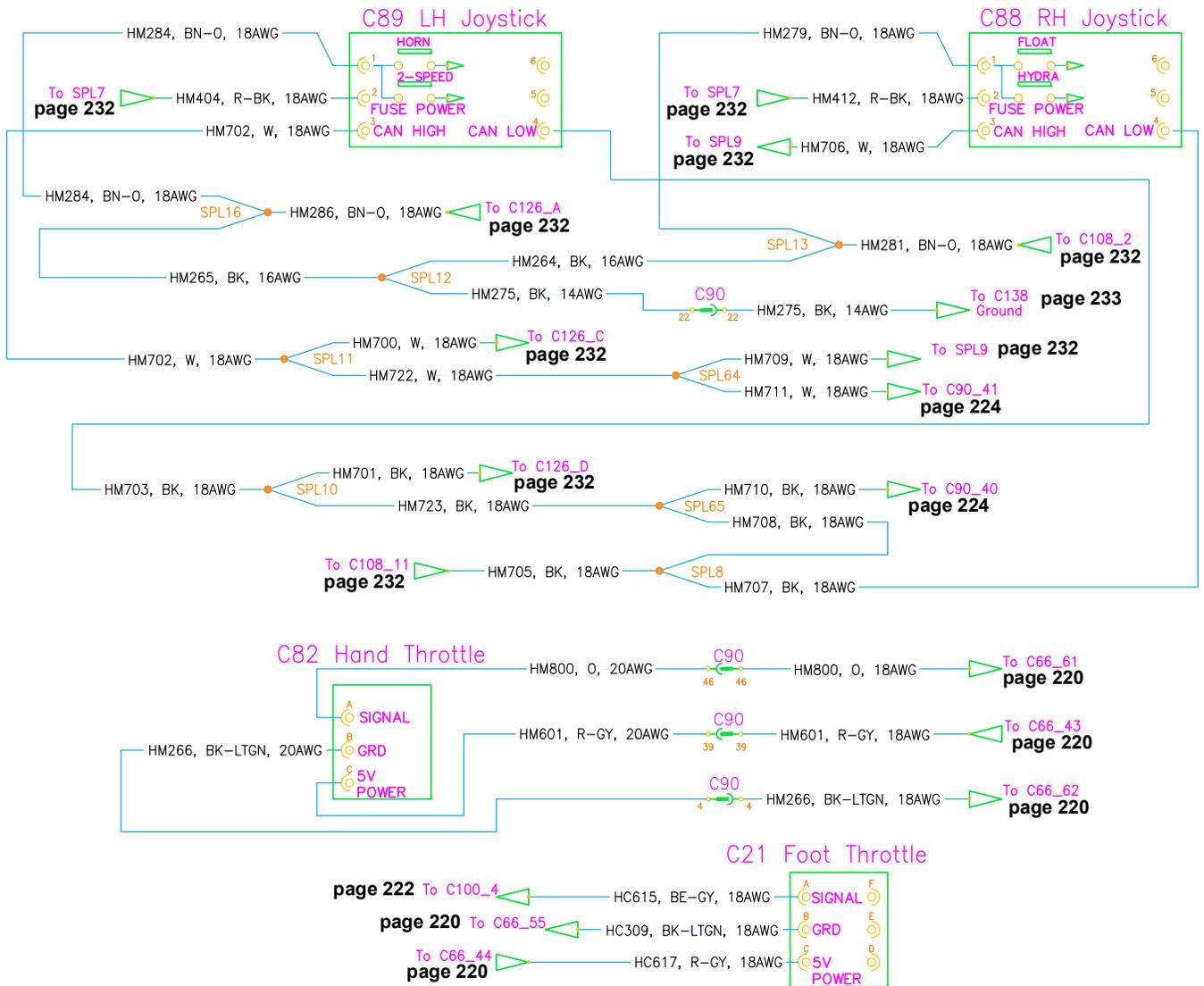


Schematics

Solenoid Controller B – Models RT175 / RT210 with Tier 4 Engines

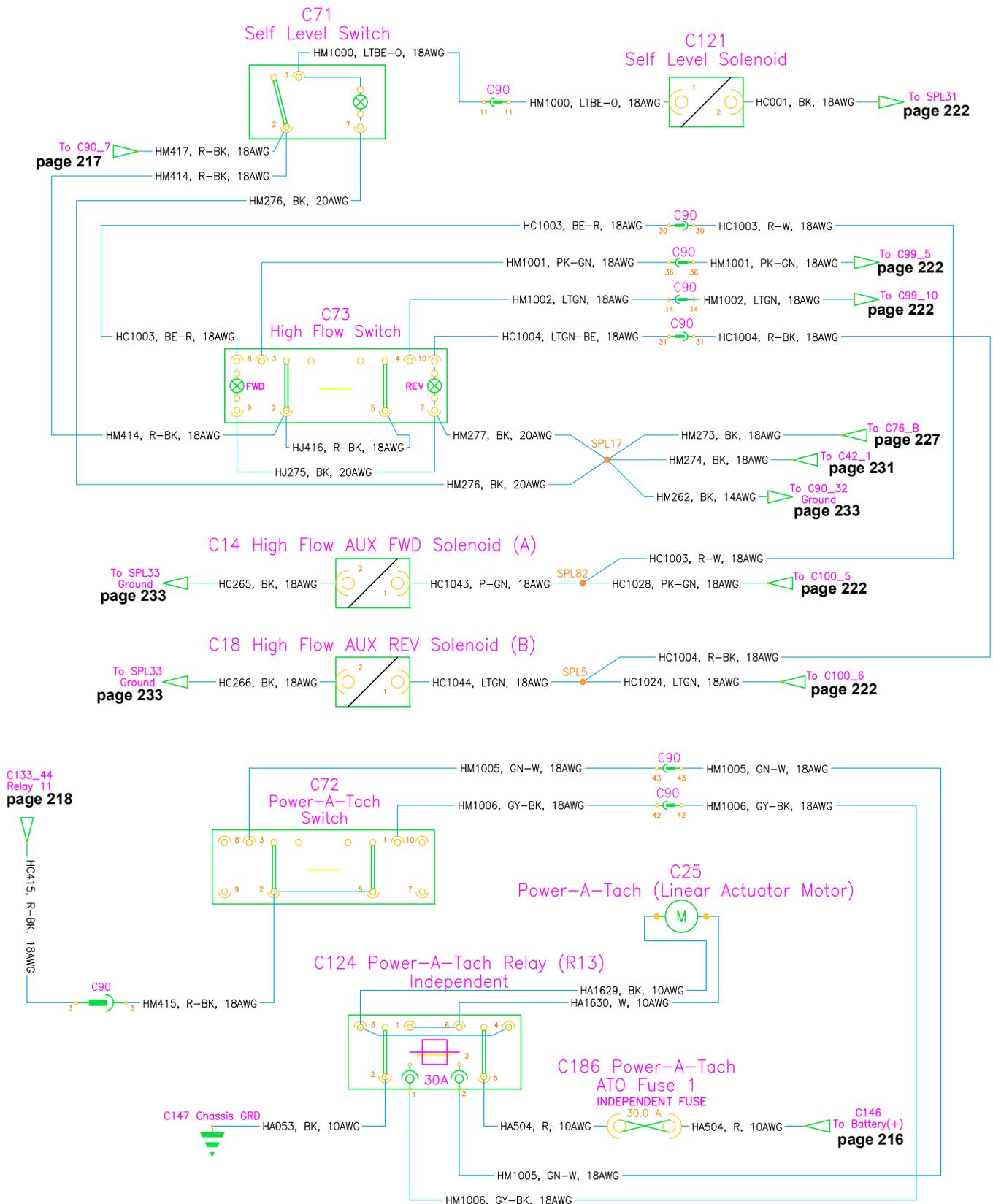


Operator/Drive Controls – Models RT175 / RT210 with Tier 4 Engines

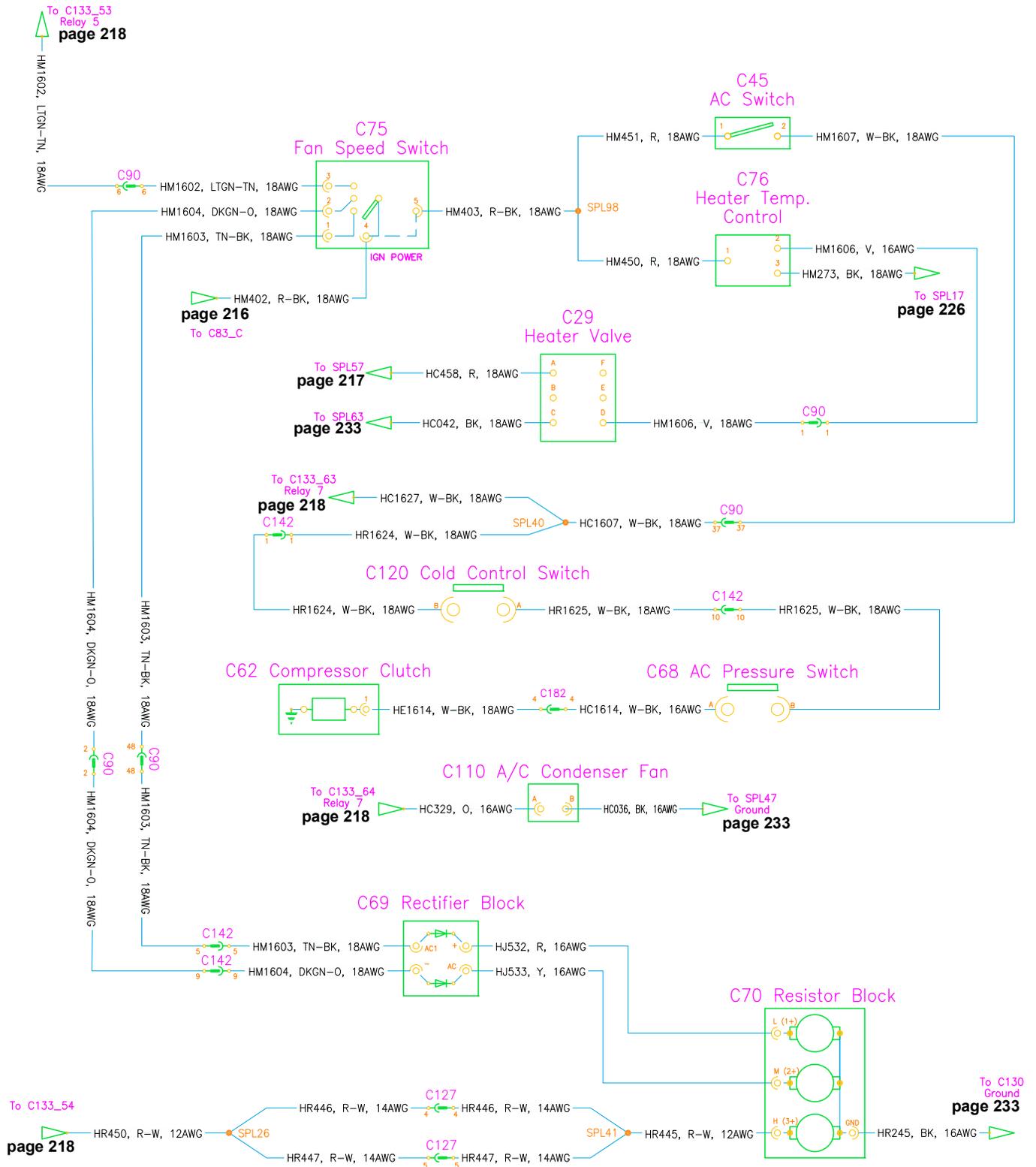


Schematics

High-Flow/Self-Level/Power-A-Tach® Quick Attach System – Models RT175/RT210 with Tier 4 Engines

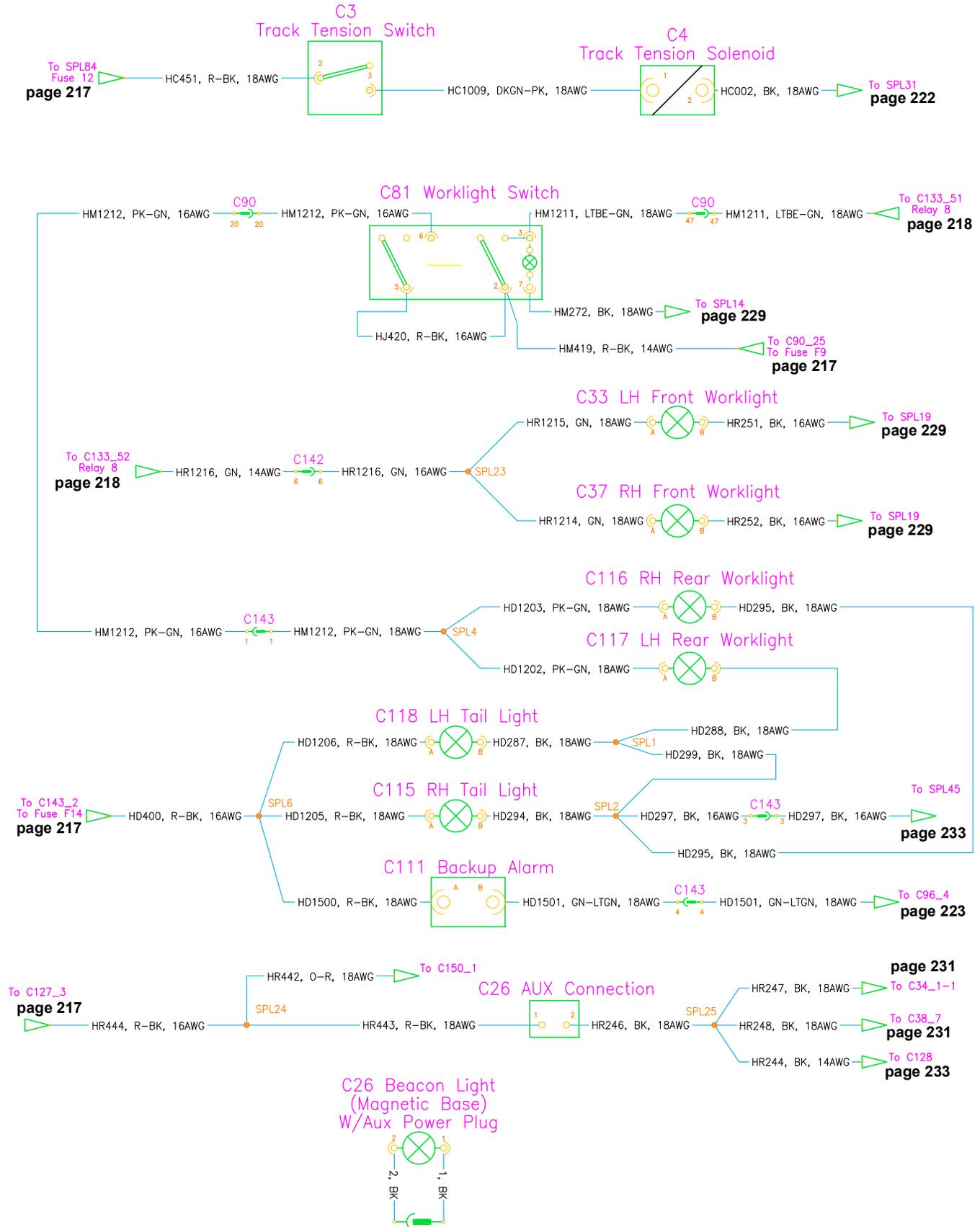


HVAC – Models RT175 / RT210 with Tier 4 Engines

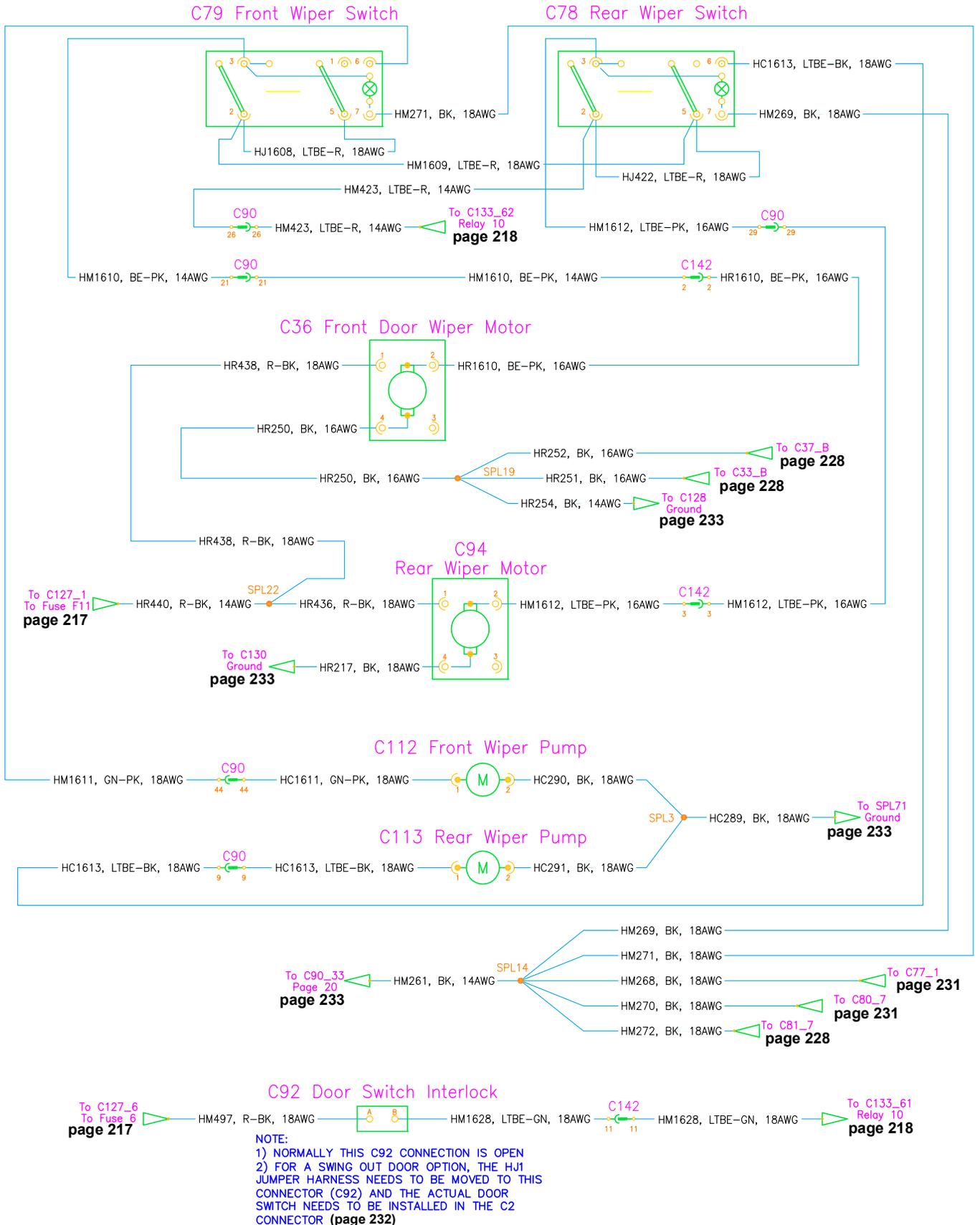


Schematics

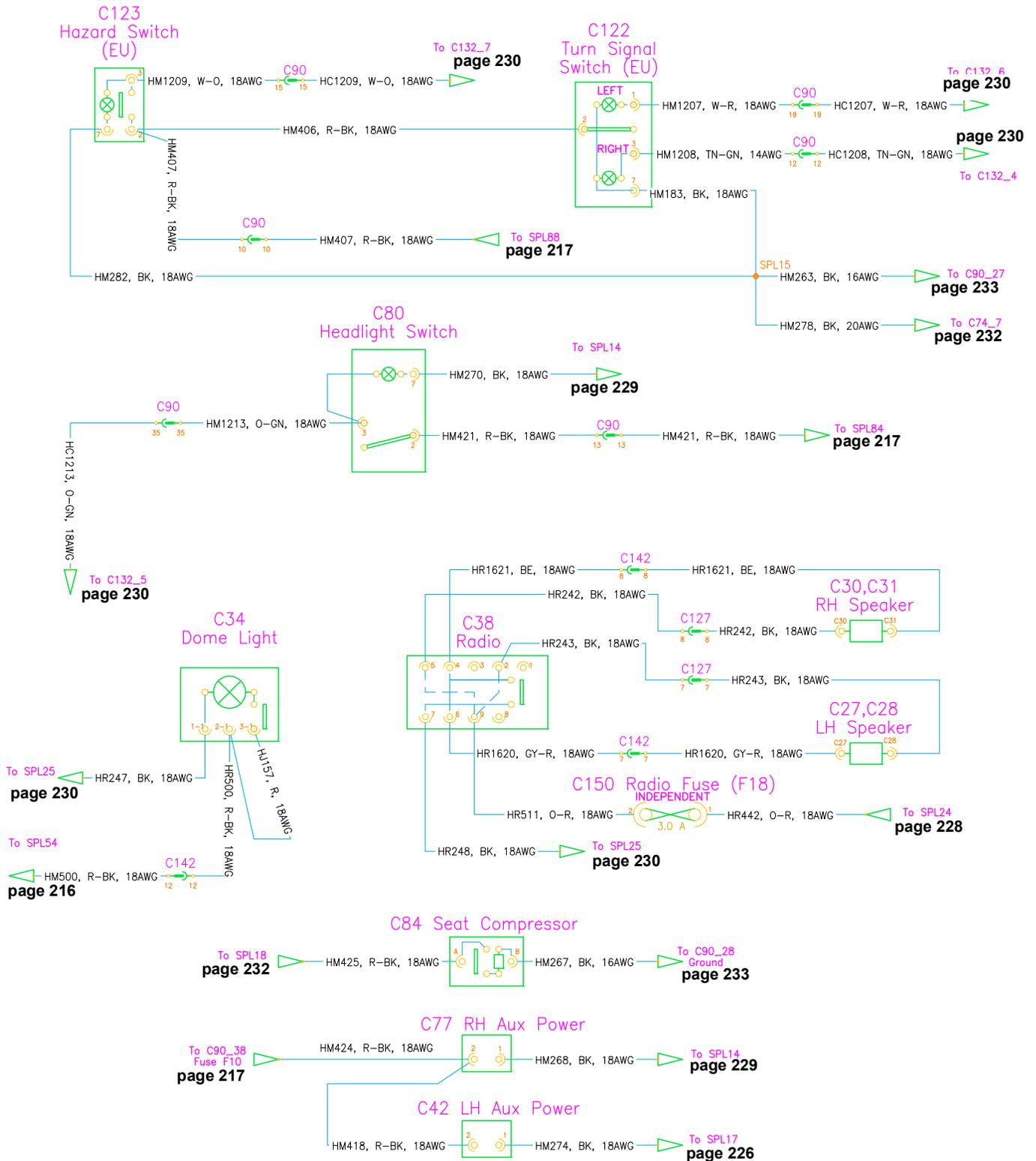
Track Tension/Work Lights – Models RT175 / RT210 with Tier 4 Engines



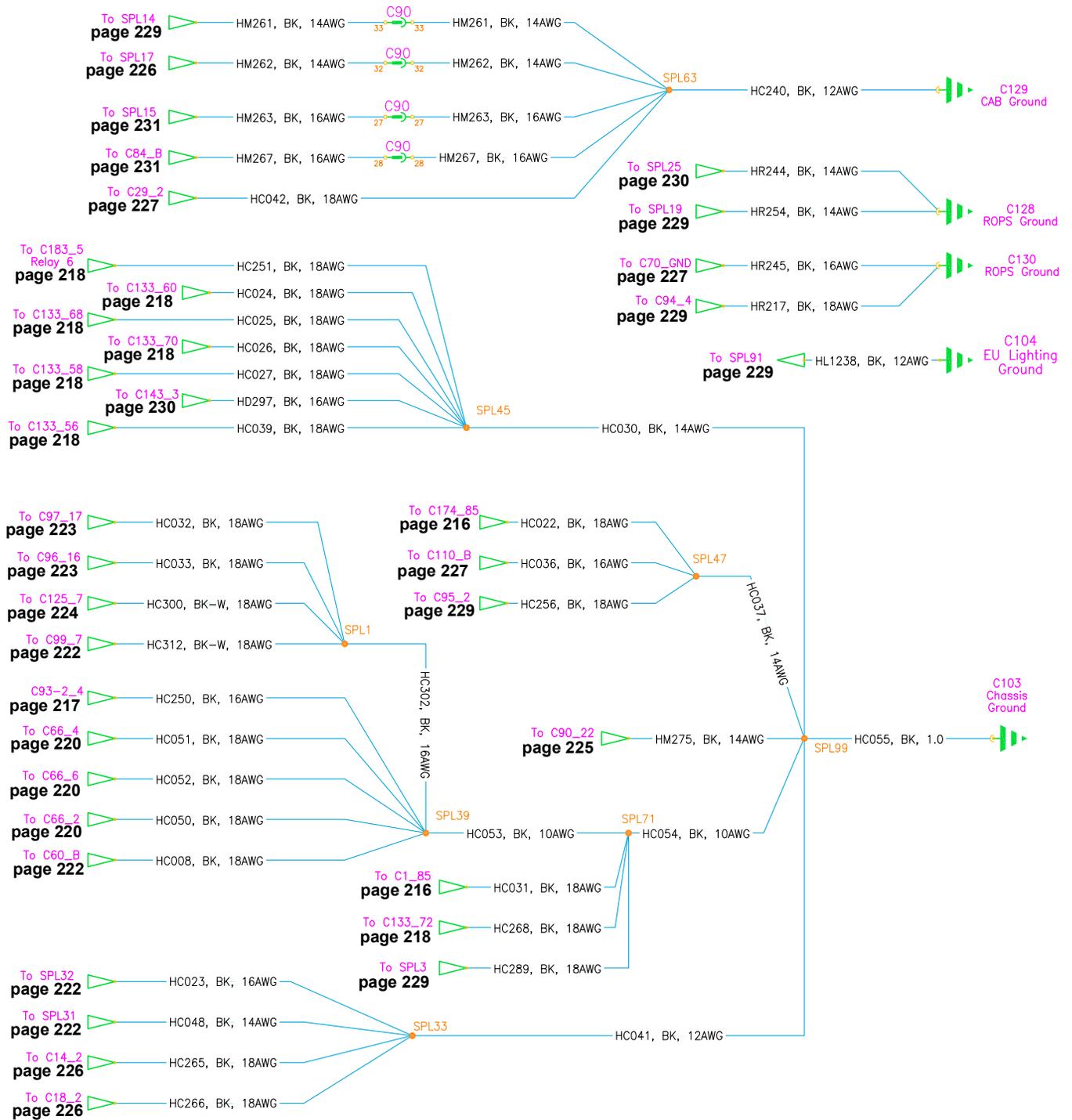
Wipers/Washer Pumps – Models RT175 / RT210 with Tier 4 Engines



Auxiliary Power/Dome Light/Radio – Models RT175 / RT210 with Tier 4 Engines



Grounds – Models RT175 / RT210 with Tier 4 Engines

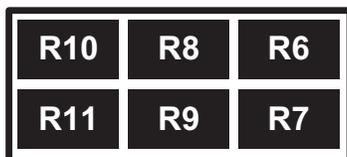


Schematics

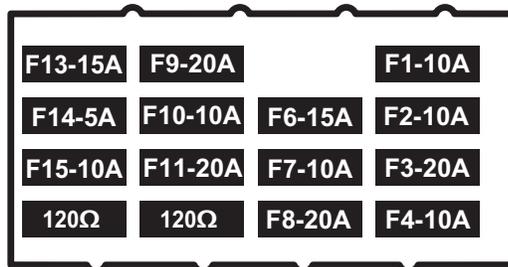
**Model RT175 with interim Tier 4 Engines
(Serial Numbers 10951 - 811000)
Model RT210 with interim Tier 4 Engines
(Serial Numbers 21201 - 921000)**

*RT175 (Serial Numbers 10951 - 811000), RT210 (Serial Numbers 21201 - 921000)
Fuse/Relay Locations Index*

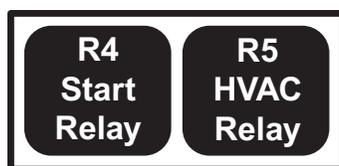
C134 – RELAY BLOCK



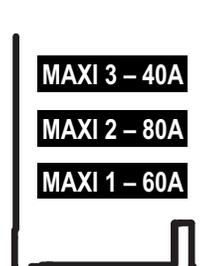
C133 – FUSE BLOCK



C135 – RELAY BLOCK



C51 – FUSE BLOCK



**Fig. 181 – RT175 / RT210 with interim Tier 4 Engines Relay/
Fuse Box Decals Detail**

Table 66: RT175 / RT210 with interim Tier 4 Engines - Relays

Relay	Schematic Page	Circuit / Notes	Relay	Schematic Page	Circuit / Notes
R1	238	Power / Relay not in fuse box; refer to page 157	R2	238	Starter Solenoid / Relay not in fuse box; refer to page 157
R3	240	Main / Relay not in fuse box; refer to page 157	R4	242	Start
R5	247	HVAC	R6	240	Rack Actuator
R7	247	AC Condenser Fan	R8	248	Work Lights
R9	243	Maestro 2 Power	R10	249	Wiper Motors
R11	242	Park Brake Switch	R12	238	Engine Pre-Heat / Relay not in fuse box; refer to page 156

Table 67: RT175 / RT210 with interim Tier 4 Engines - Fuses / Resistors

Fuse	Amp	Schematic Page	Protected Circuit / Notes	Fuse	Amp	Schematic Page	Protected Circuit / Notes
F1	10	248	Drive Logic Control, Tilt (Controller 2)	F2	10	241	Interlocks, 2-Speed, Float, Hydraglide, High Flow Aux (Controller 3)
F3	20	241	Lift, Standard Aux. Hydraulics (Controller 1)	F4	10	241	Park Brake Light, Power-A-Tach
F6	10	241	Display, Joysticks, Seat and Door Switches	F7	10	241	Fuel Pump, Power Splice
F8	20	247	HVAC Condenser	F9	20	241	Work Lights
F10	10	248	Auxiliary Power Outlets	F11	20	241	Wipers
F12	N/A	239	Oil Pressure Switch Resistor / 120 Ohms	F13	15	241	Track Tension, Self-Level
F14	20	241	EU Headlights	F15	10	241	Rear Door Lights, Radio
F16	N/A	244	CAN-Bus Terminating Resistor / 120 Ohms	F17	3	249	Radio
Maxi1	60	238	Starter Solenoid	Maxi2	80	238	Power Relay, Ignition Switch, Dome Lights
Maxi3	40	247	HVAC Relay	Maxi 4	60	238	Engine Pre-Heater
ATO1	30	246	Power-A-Tach V-Battery				

RT175 (Serial Numbers 10951 - 811000), RT210 (Serial Numbers 21201 - 921000) Connector / Splice Locations Index

Table 68: RT175 / RT210 with interim Tier 4 Engines - Connector Names / Schematics Locations

Name	Schematic Page								
C001	249	C1	238	C2	252	C3	248	C4	248
C5	243	C6	243	C7	245	C8	245	C9	242
C10	242	C11	244	C12	243	C13	244	C14	246
C15	244	C16	243	C17	244	C18	246	C19	243
C20	243	C21	245	C22	242	C23	242	C24	242
C25	246	C26	250	C27	250	C28	250	C29	247
C30	250	C31	250	C33	250	C36	249	C37	250
C38	250	C41	239	C42	248	C43	239	C44	239
C45	247	C46	238	C47	239	C48	251	C49	239
C50	239	C51	238, 247	C53	238	C60	242	C61	239
C62	247	C63	238	C65	239	C66	240	C67	242
C68	247	C69	247	C70	247, 251	C71	246	C72	246
C73	246	C74	252	C75	247	C76	247	C77	248
C78	249	C79	249	C80	248	C81	250	C82	245
C83	238	C84	252	C85	252	C86	252	C87	252

Schematics

Table 68: RT175 / RT210 with interim Tier 4 Engines - Connector Names / Schematics Locations

Name	Schematic Page	Name	Schematic Page	Name	Schematic Page	Name	Schematic Page	Name	Schematic Page
C88	245	C89	245	C90	238, 240, 241, 244, 245, 246, 247, 248, 249, 250, 252, 253	C91	251	C92	249
C93	238, 239, 247	C95	239	C96	243	C97	243	C99	242
C100	242	C101	244	C103	253	C104	253	C105	238
C106	240	C108	252	C109	242	C110	247	C111	250
C112	249	C113	249	C114	251	C115	250	C116	250
C117	250	C118	250	C119	251	C120	247	C121	246
C122	248	C123	248	C124	246	C125	244	C126	252
C127	241, 247, 250	C128	253	C129	253	C130	253	C131	239
C132	251	C133	239, 241, 244, 247, 248	C134	240, 242, 243, 247, 249, 250	C135	238, 247	C136	238
C137	253	C138	253	C139	251	C142	238, 247, 249, 250, 252	C143	241, 243, 249, 250, 253
C146	238	C148	250	C150	250	C160	251	C176	251
C178	251	C192	238						

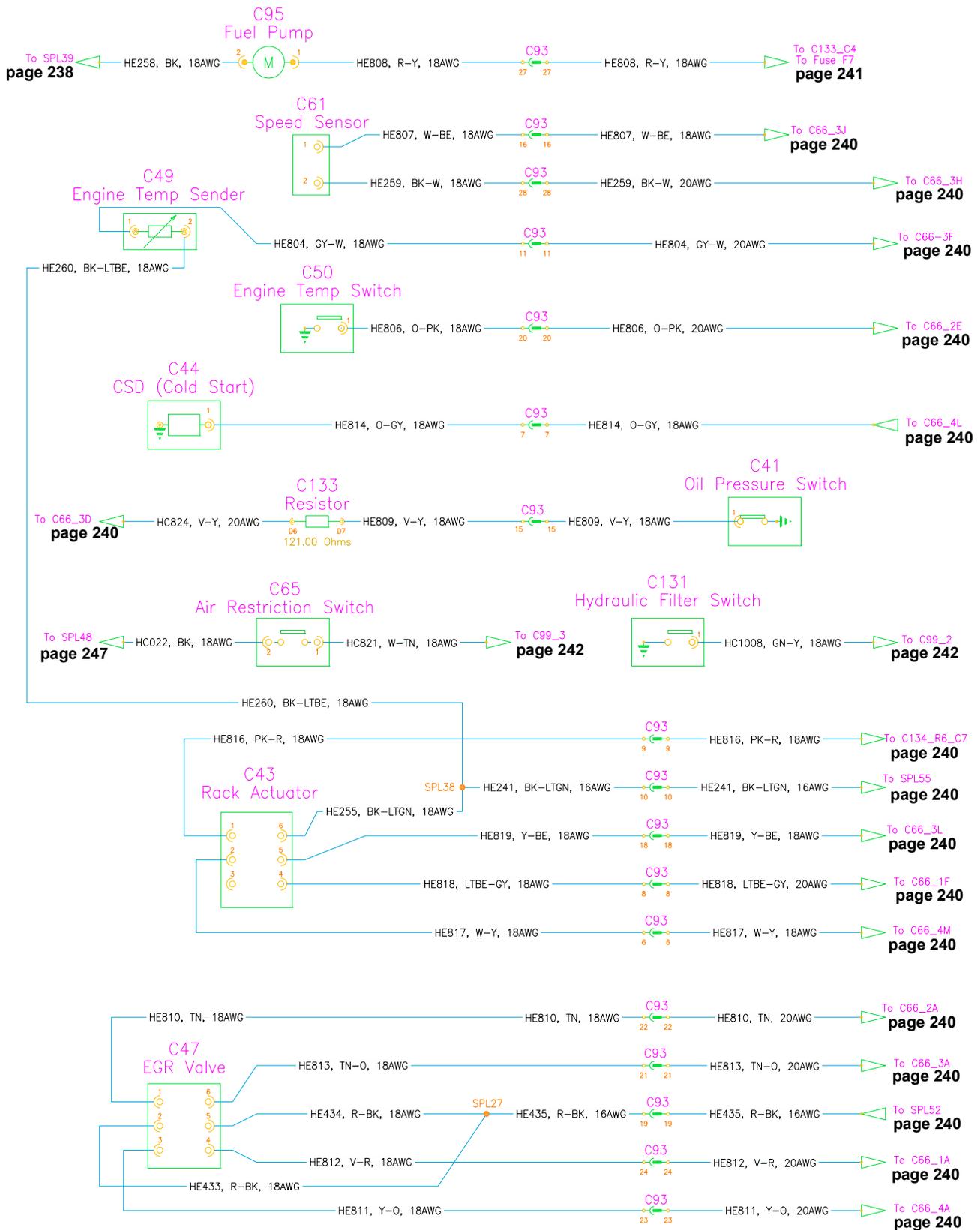
Table 69: RT175 / RT210 with interim Tier 4 Engines - Connector Names / Splice Locations and Functions

Name	Schematic Page	Function	Name	Schematic Page	Function
SPL1	250	Rear Door Ground	SPL2	250	Rear Door Ground
SPL3	249	Rear Door Ground	SPL4	250	Rear Work Light Power
SPL5	246	High Flow Rev.	SPL6	250	Rear Door Power
SPL7	252	Cab Power	SPL8	252	CAN Low
SPL9	252	CAN High	SPL10	252	CAN Low
SPL11	252	CAN High	SPL12	245	Cab Control Ground
SPL13	245	Can Control Ground	SPL14	249	Cab Ground
SPL15	248	Cab Ground	SPL16	245	Cab Control Ground
SPL17	246	Cab Ground	SPL18	252	Seat Power
SPL19	249	ROPS Ground	SPL22	249	Wiper Power
SPL23	250	ROPS Work Light Power	SPL24	241	Radio/Beacon Power
SPL25	250	ROPS Ground	SPL26	247	Rectifier Power
SPL27	239	EGR Power	SPL28	238	Main Power
SPL29	245	Swash Ground	SPL30	245	Swash Power
SPL31	242	Chassis HYD Ground	SPL32	242	Chassis HYD Ground
SPL33	253	Chassis Ground	SPL34	242	Chassis Ground
SPL35	242	Float Solenoid	SPL36	243	Pump Power
SPL37	243	Maestro 2 Power	SPL38	239	Rack Actuator Power
SPL39	238	Air Heater Ground	SPL40	247	A/C Power
SPL41	247	Resistor Block Power	SPL42	244	CAN Low

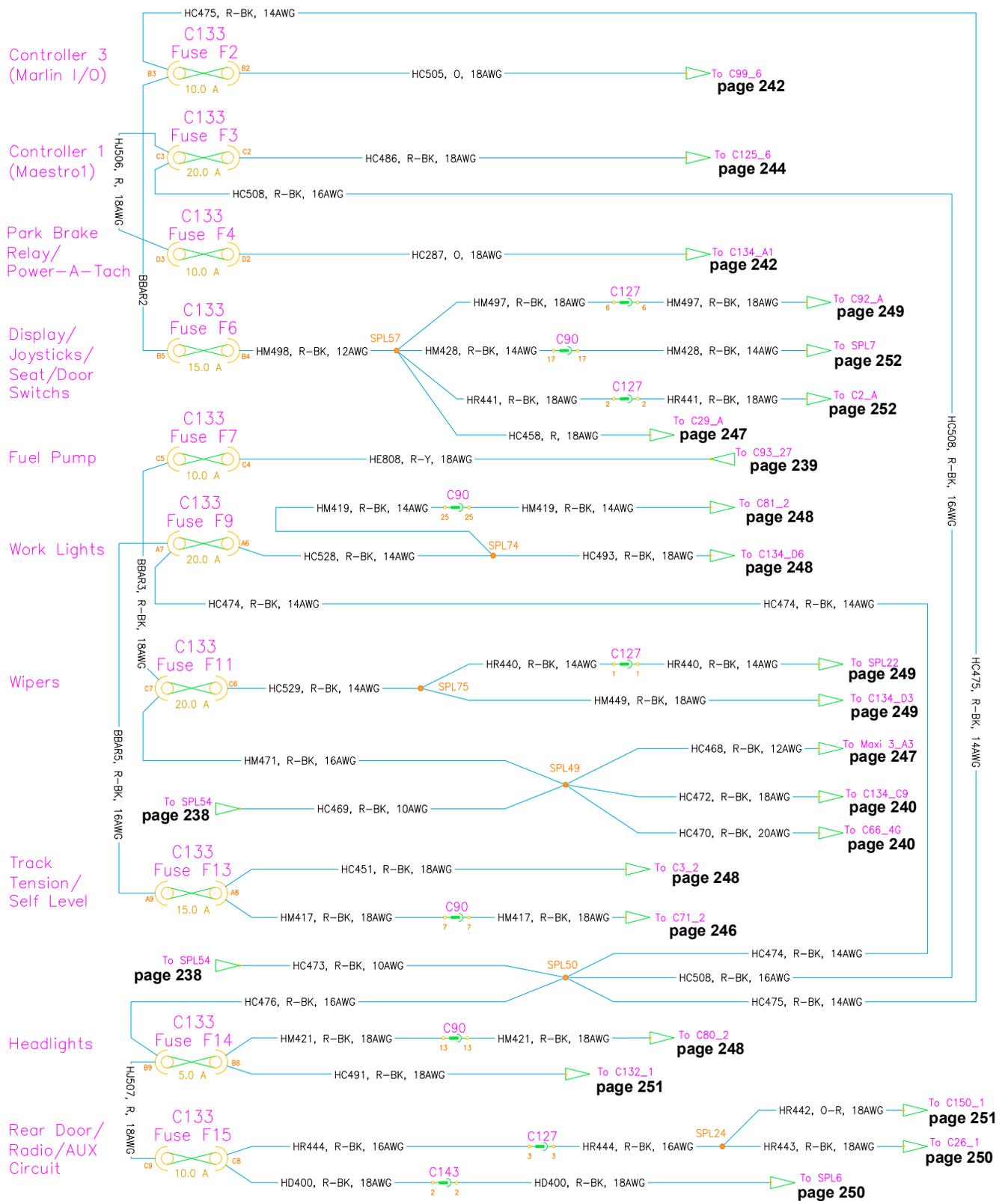
Table 69: RT175 / RT210 with interim Tier 4 Engines - Connector Names / Splice Locations and Functions

Name	Schematic Page	Function	Name	Schematic Page	Function
SPL43	244	CAN High	SPL44	242	Park Brake Power
SPL45	253	Chassis Ground	SPL46	251	Flasher Power
SPL47	253	Chassis Ground	SPL48	247	Chassis Ground
SPL49	241	Main Switched Power	SPL50	241	Main Switched Power
SPL51	248	Controller Power	SPL52	240	ECU Power
SPL53	245	Throttle Power	SPL54	238	Main Switched Power
SPL55	240	ECU Ground	SPL56	243	Pump Power
SPL57	241	Cab & ROPS Power	SPL58	251	Running Lights
SPL59	251	High Beam Power	SPL60	251	Low Beam Power
SPL61	251	Flasher Power	SPL62	251	Brake Lights
SPL63	253	ROPS Ground	SPL64	252	CAN High
SPL65	252	CAN Low	SPL66	251	EU Road Lights Ground
SPL74	241	Power Splice	SPL75	241	Power Splice
SPL76	238	Power Splice	SPL77	253	ECU Ground
SPL82	246	High Flow Fwd	SPL90	251	EU Road Lights Power
SPL91	251	EU Road Lights Ground	SPL97	251	EU Road Lights Switched Power
SPL98	247	HVAC Controls Power	SP99	253	Chassis Ground

Engine Sensors – Model RT175 / RT210 with interim Tier 4 Engines

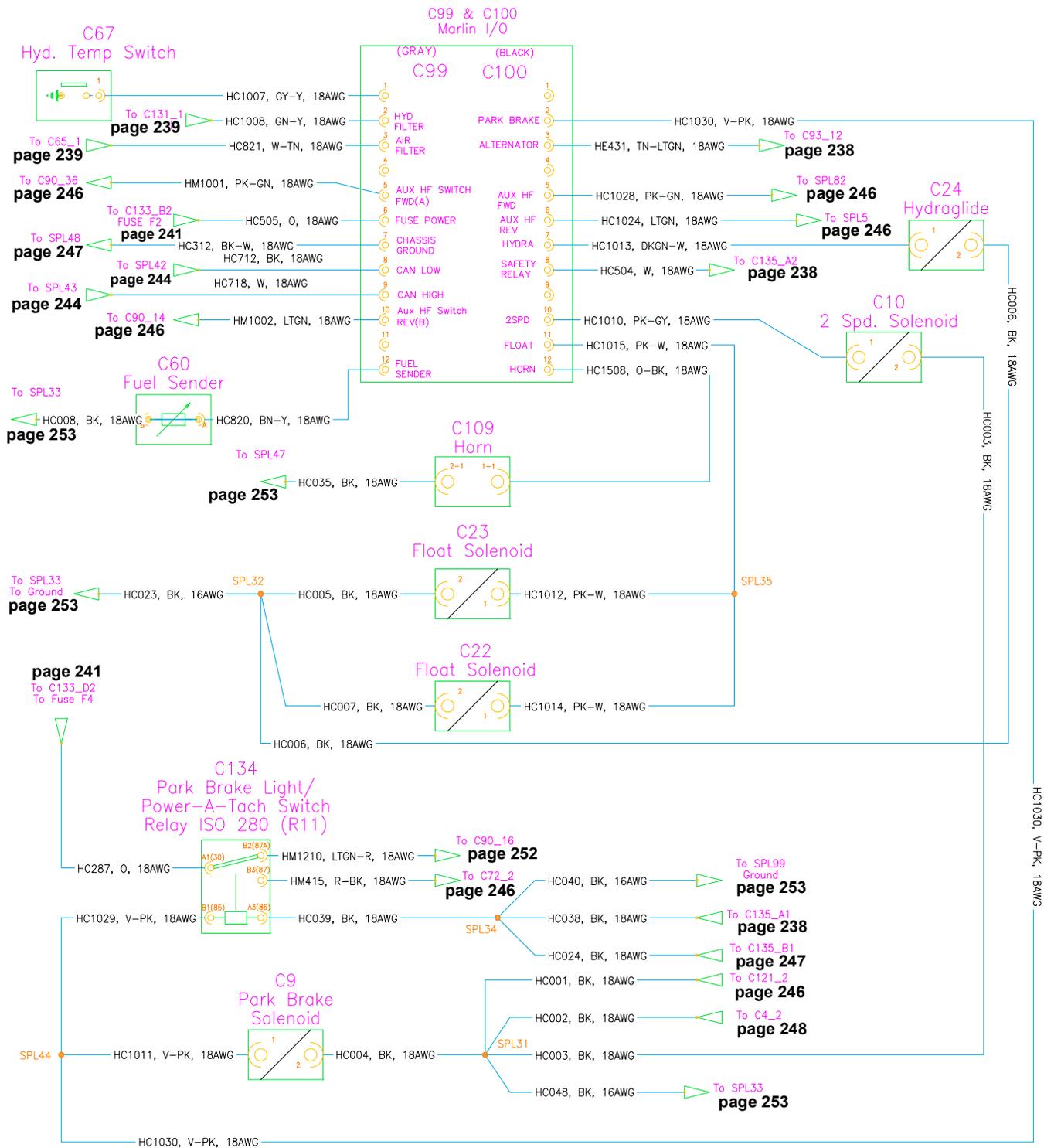


Power Distribution – Model RT175 / RT210 with interim Tier 4 Engines

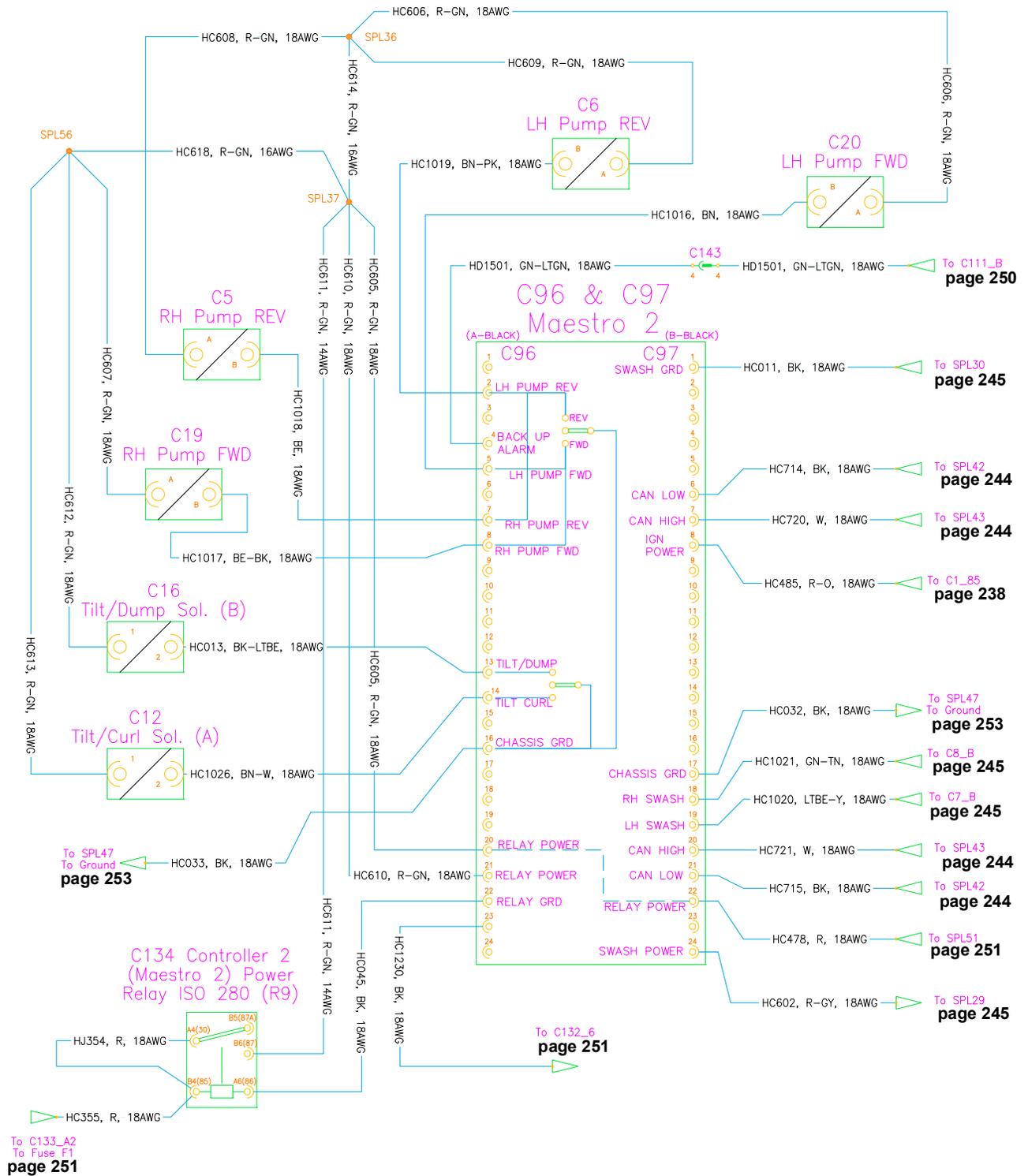


Schematics

Controller 3 – Model RT175 / RT210 with interim Tier 4 Engines

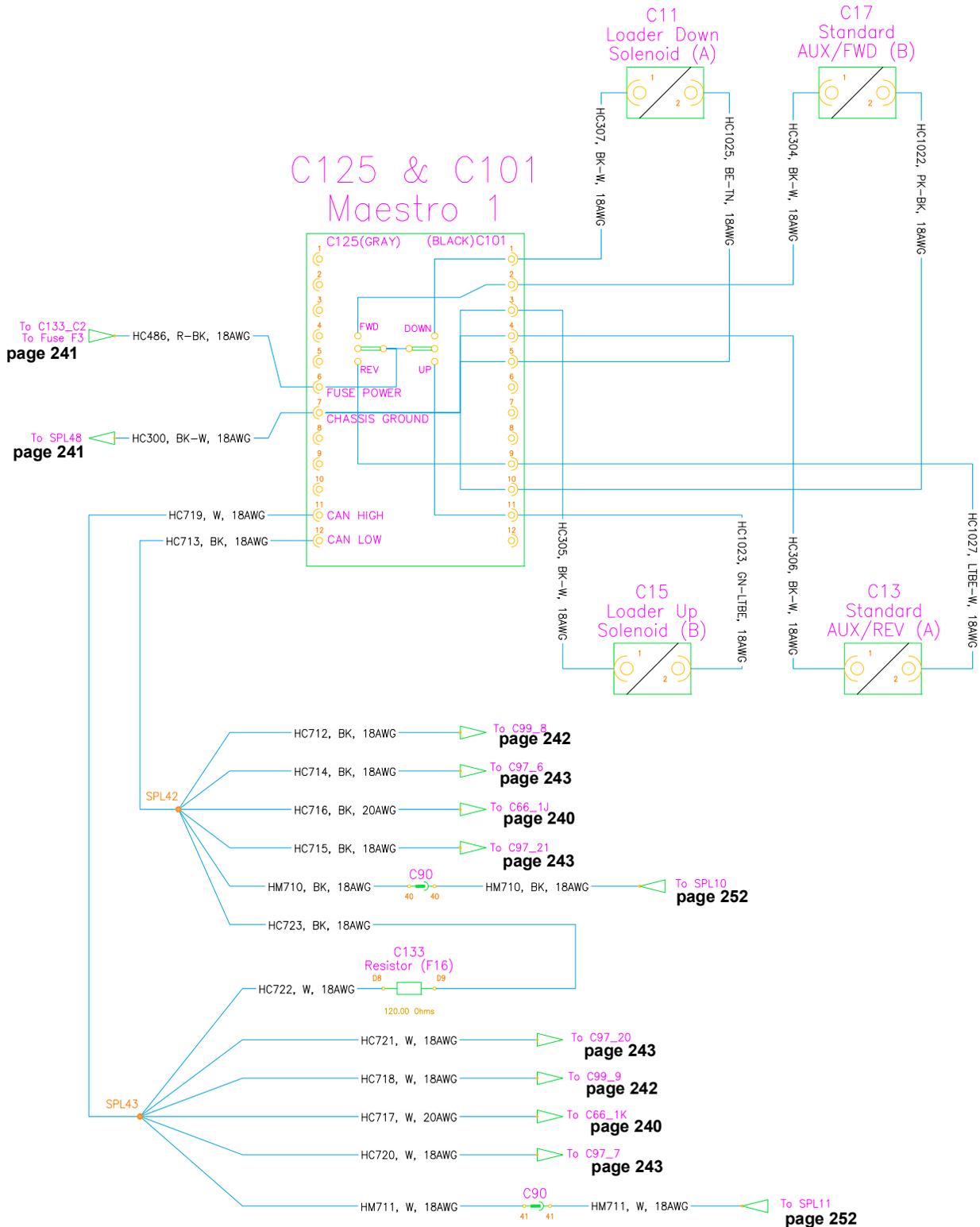


Controller 2 – Model RT175 / RT210 with interim Tier 4 Engines

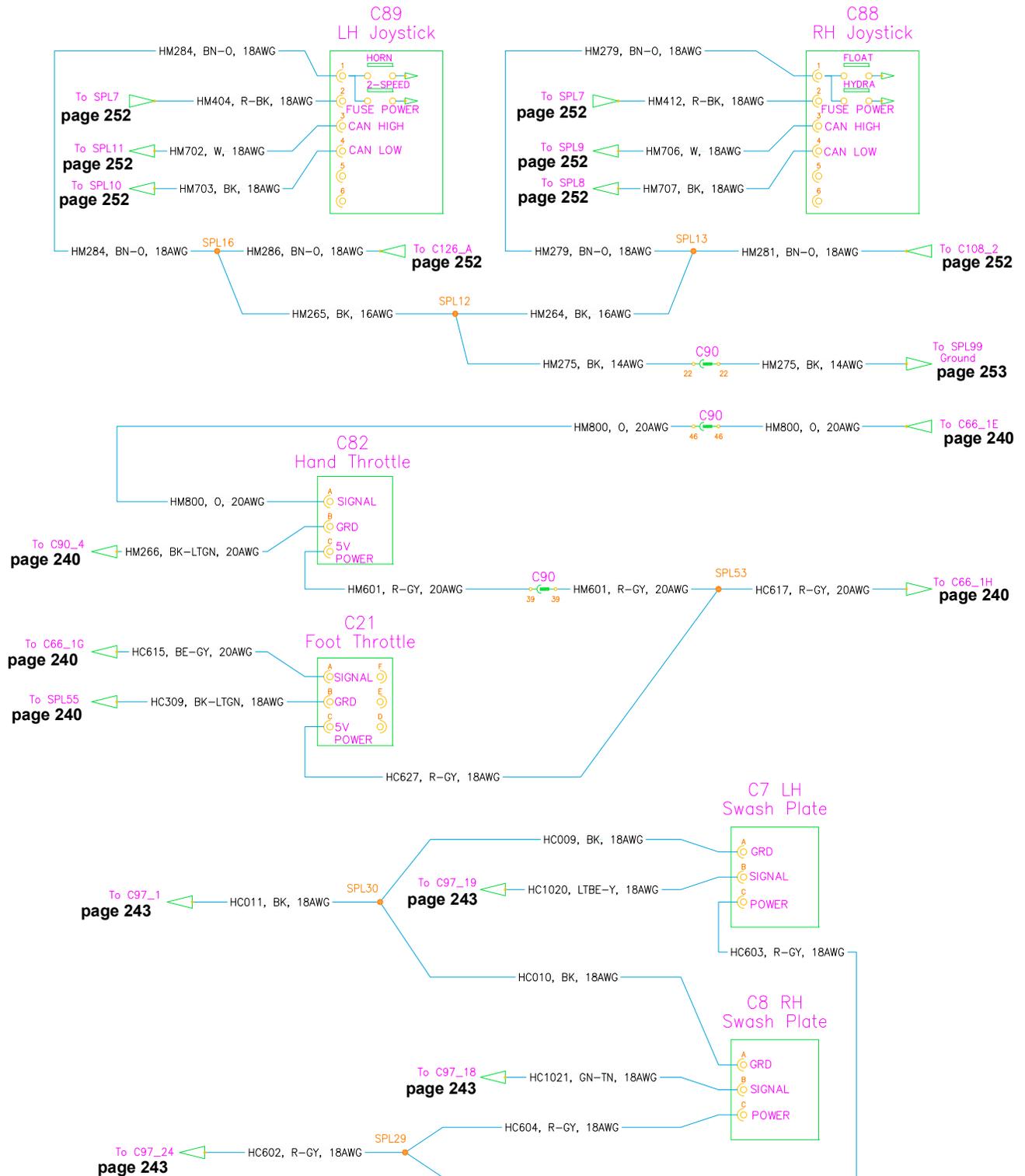


Schematics

Controller 1 – Model RT175 / RT210 with interim Tier 4 Engines

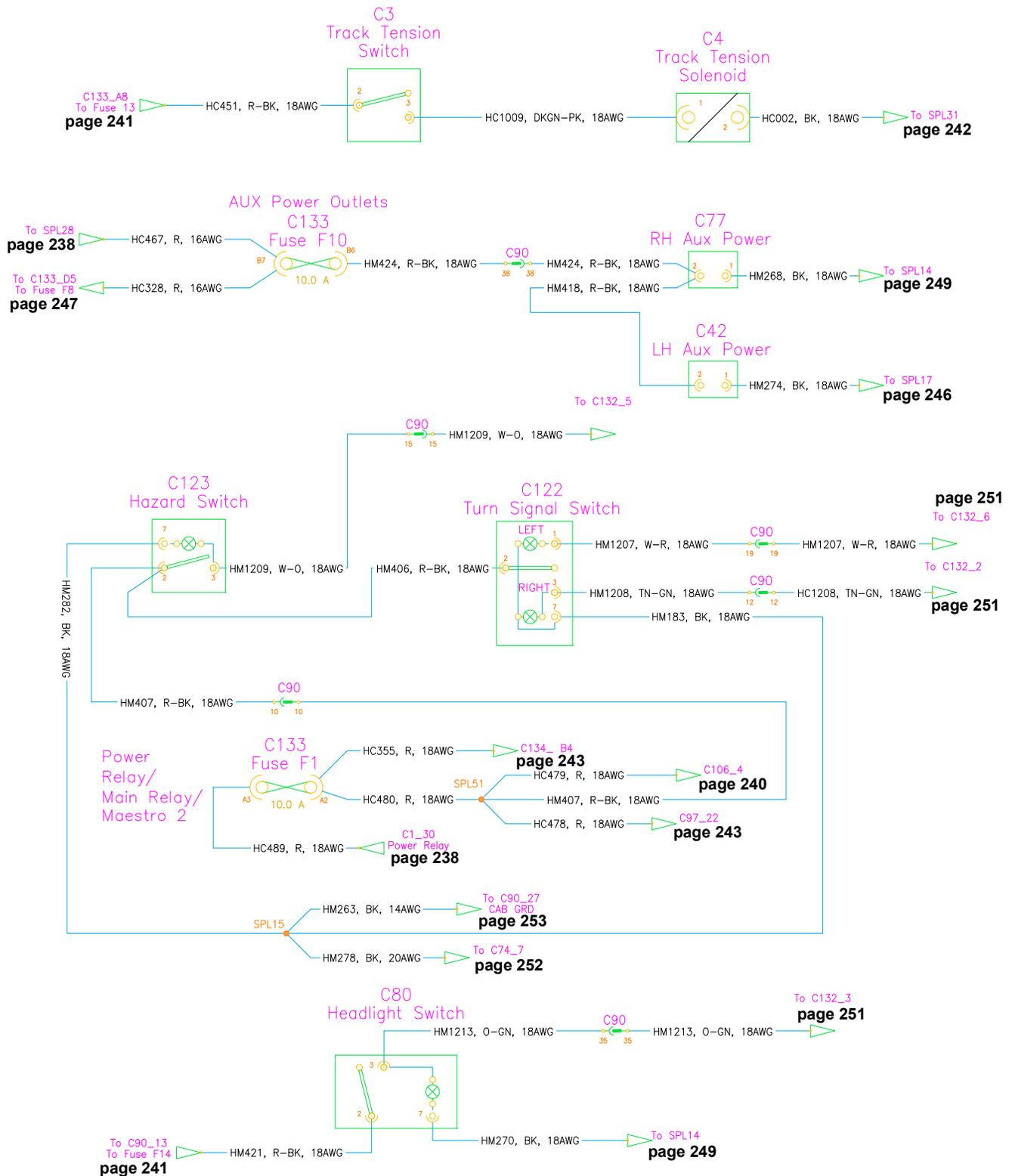


Operator/Drive Controls – Model RT175 / RT210 with interim Tier 4 Engines

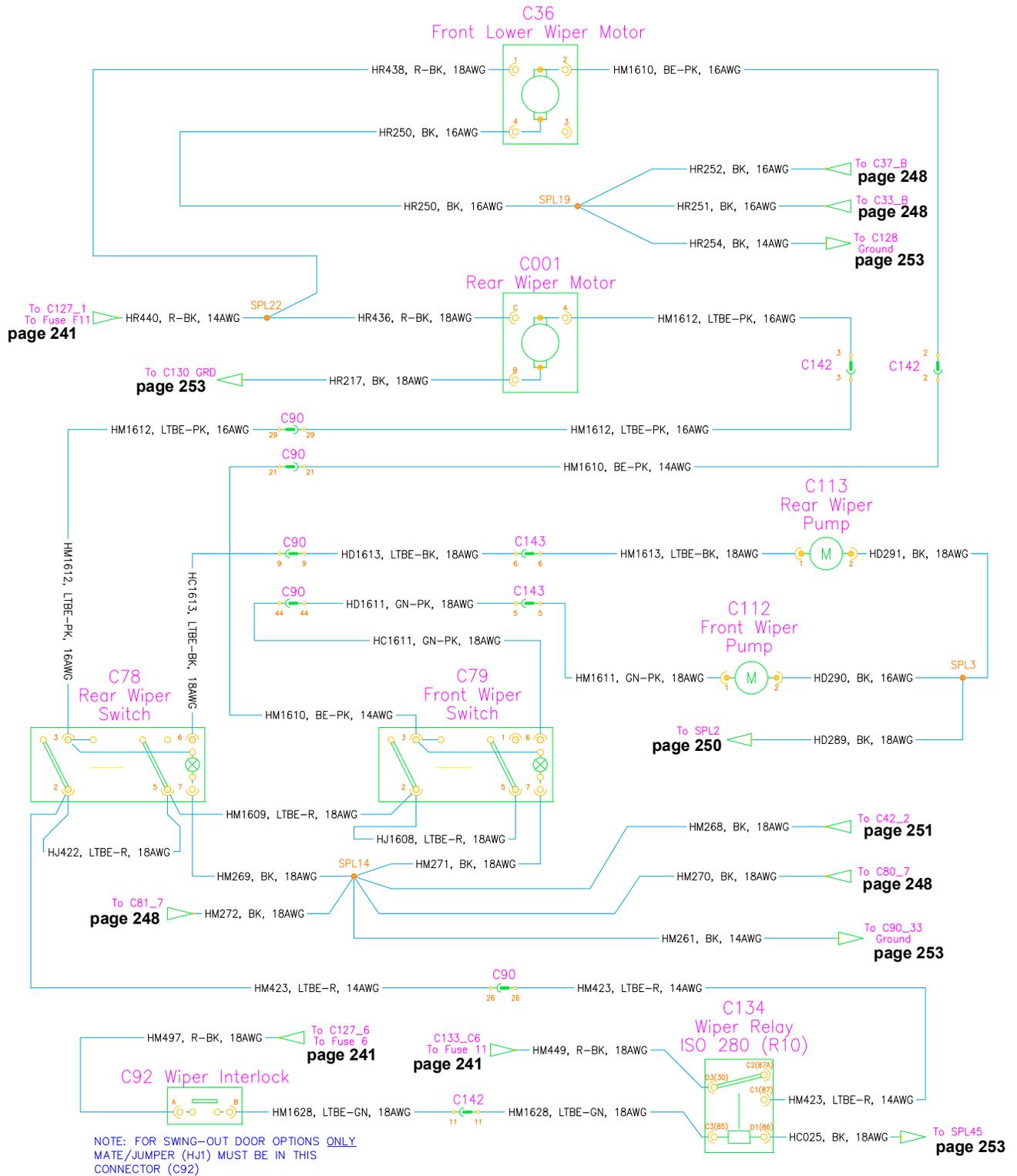


Schematics

Track Tension/Lighting Control – Model RT175 / RT210 with interim Tier 4 Engines

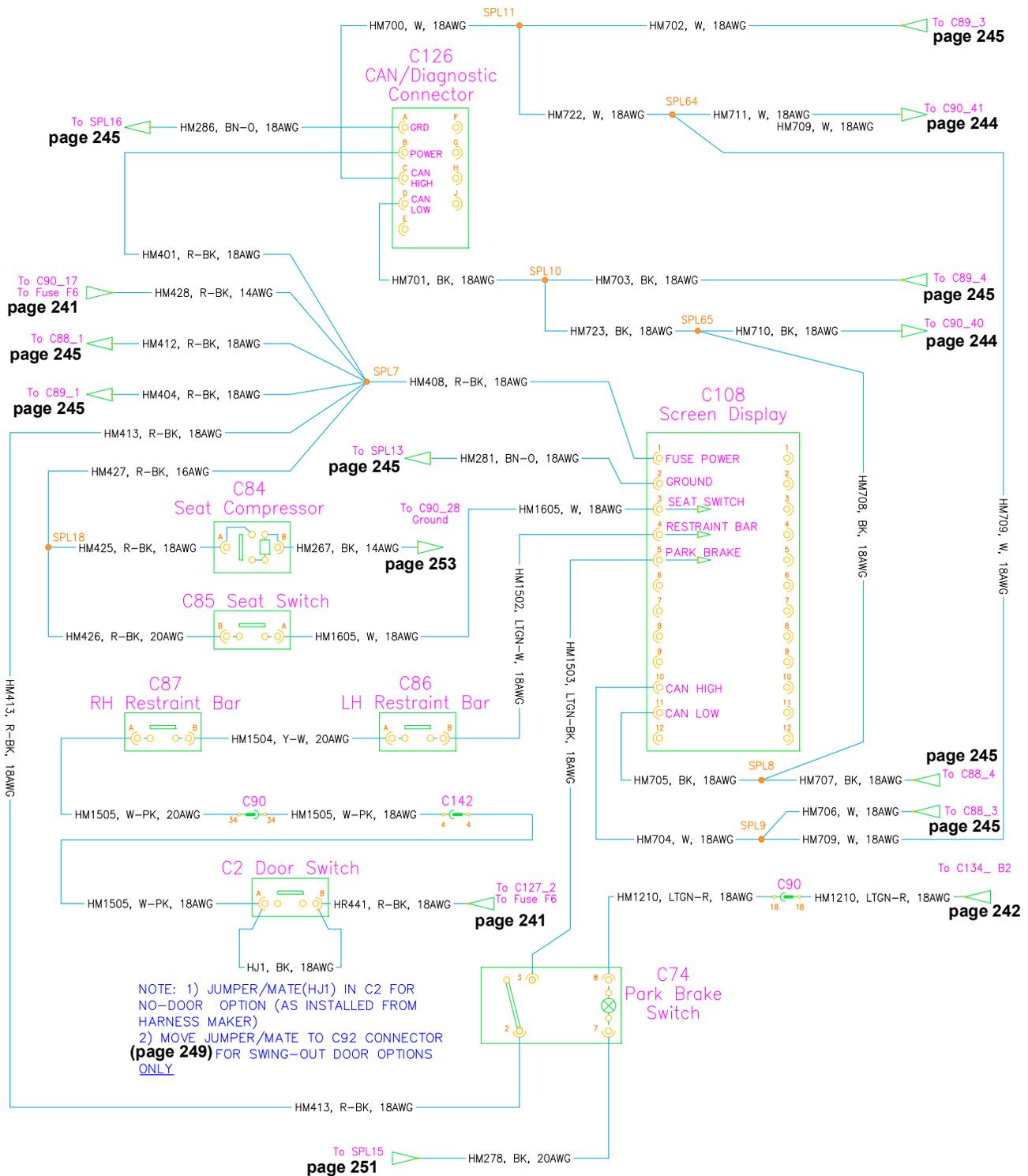


Wipers/Washer Pumps – Model RT175 / RT210 with interim Tier 4 Engines

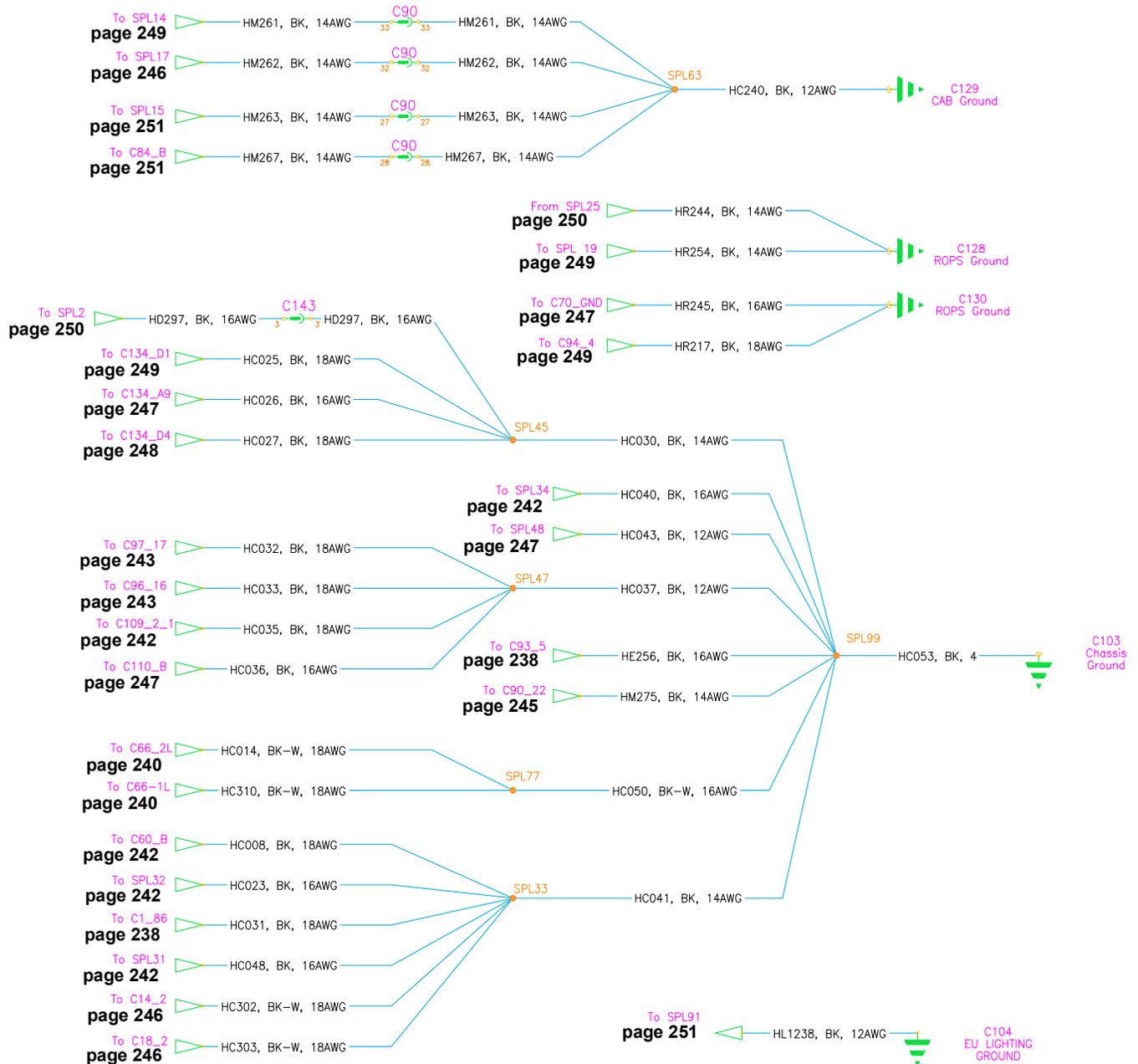


Schematics

Operator Display/CAN Interface – Model RT175 / RT210 with interim Tier 4 Engines

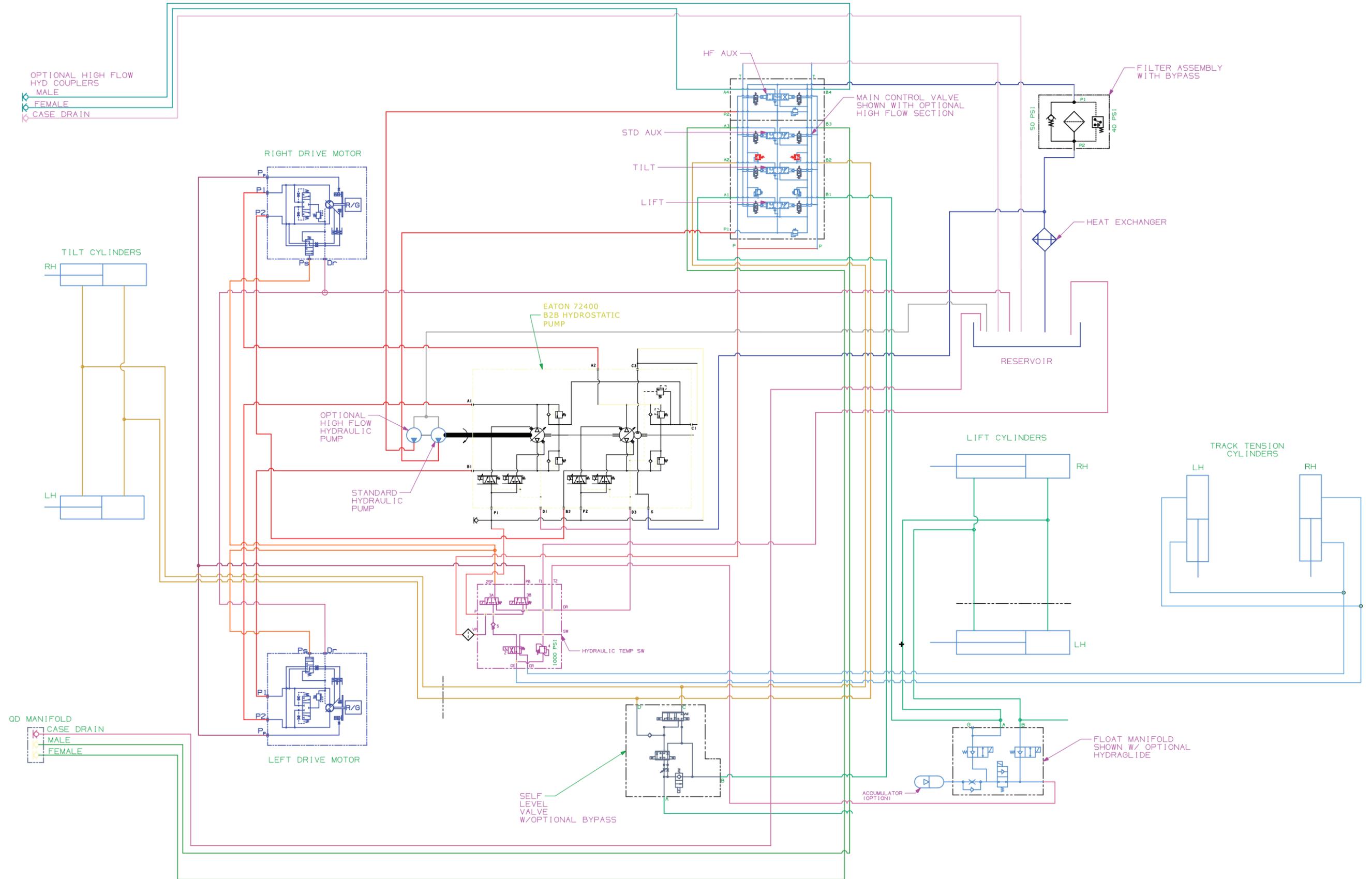


Grounds – Model RT175 / RT210 with interim Tier 4 Engines



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Hydraulic Schematic



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EC Declaration of Conformity

1. Manufacturer: **Manitou Group**
2. Address: **One Gehl Way
West Bend, WI 53095-0179 U.S.A.**
3. Technical Construction File Location:
**Manitou Americas, Inc.
One Gehl Way
West Bend, WI 53095-0179
U.S.A.**
4. Authorized Representative:
5. Address:
6. **We hereby declare that the machine listed below conforms to EC Directives: 2004/108/EC (EMC), 2006/42/EC (Machinery) and 2000/14/EC (Noise Emission), as amended by 2005/88/EC.**
7. In accordance with EN/ISO Standards:
8. Category: **EARTH-MOVING MACHINERY/LOADERS/
COMPACT/SEATED OPERATOR**
9. Models: **RT175, RT210, RT250**
10. Directive/Conformity Assessment Procedure/Notified Body:

2004/108/EC	Type-test	Self-certification
2006/42/EC	Self-certification	-----
2000/14/EC	Annex VIII – Full Quality Assurance	TÜV Industrie Service GmbH – TÜV SÜD Group Westendst. 199, D-80686 München, GERMANY

NOTES

Torque Specifications

Note: Use these torque values when tightening hardware (excluding: locknuts and self-tapping, thread forming and sheet metal screws) unless specified otherwise.

Hydraulic fittings with various seals (light application). All torque values are in Nm (lb.-ft.) unless marked otherwise.					
Thread	Straight pipe fitting with thread and screwed plug (GE)			Non-return valve with elastic seal	Identification aid outside Ø
	Sealing washer	Elastic seal	O-ring		
M10X1.0	9 (7)	18 (13)	15 (11)	18 (13)	10 mm (0.4 in.)
M12X1.5	20 (15)	25 (18)	25 (18)	25 (18)	12 mm (0.5 in.)
M14X1.5	35 (26)	45 (33)	26 (35)	35 (26)	14 mm (0.6 in.)
M16X1.5	45 (33)	55 (41)	40 (30)	50 (37)	16 mm (0.6 in.)
M18X1.5	55 (41)	70 (52)	45 (33)	70 (52)	18 mm (0.7 in.)
M22X1.5	65 (48)	125 (92)	60 (44)	125 (92)	22 mm (0.9 in.)
M27X2.0	90 (66)	180 (133)	100 (74)	145 (107)	27 mm (1.0 in.)
M33X2.0	150 (111)	310 (229)	160 (118)	210 (155)	33 mm (1.3 in.)
M42X2.0	240 (177)	450 (332)	210 (155)	360 (266)	42 mm (1.7 in.)
M48X2.0	290 (214)	540 (398)	260 (192)	540 (398)	48 mm (1.9 in.)
G1/8A	9 (7)	13 (18)	15 (11)	18 (13)	9.73 mm (0.4 in.)
G1/4A	35 (26)	35 (26)	30 (22)	35 (26)	13.16 mm (0.5 in.)
G3/8A	45 (33)	70 (52)	45 (33)	50 (37)	16.66 mm (0.7 in.)
G1/2A	65 (48)	90 (66)	55 (41)	65 (48)	20.96 mm (0.8 in.)
G3/4A	90 (66)	180 (133)	100 (74)	140 (103)	26.44 mm (1.0 in.)
G1A	150 (111)	310 (229)	160 (118)	190 (140)	33.25 mm (1.3 in.)
G1 1/4A	240 (177)	450 (332)	210 (155)	360 (266)	41.91 mm (1.7 in.)
G1 1/2A	290 (214)	540 (398)	260 (192)	540 (398)	47.80 mm (1.9 in.)

Hydraulic fittings with various seals (heavy application). All torque values are in Nm (lb.-ft.) unless marked otherwise.					
Thread	Straight pipe fitting with thread and screwed plug (GE)			Non-return valve with elastic seal	Identification aid outside Ø
	Sealing washer	Elastic seal	O-ring		
M12X1.5	20 (15)	35 (26)	35 (26)	35 (26)	12 mm (0.5 in.)
M14X1.5	35 (26)	55 (41)	45 (33)	45 (33)	14 mm (0.6 in.)
M16X1.5	45 (33)	70 (52)	55 (41)	55 (41)	16 mm (0.6 in.)
M18X1.5	55 (41)	90 (66)	70 (52)	70 (52)	18 mm (0.7 in.)
M20X1.5	55 (41)	125 (92)	80 (59)	100 (74)	20 mm (0.8 in.)
M22X1.5	65 (48)	135 (100)	100 (74)	125 (92)	22 mm (0.9 in.)
M27X2.0	90 (66)	180 (133)	170 (125)	135 (100)	27 mm (1.0 in.)
M33X2.0	150 (111)	310 (229)	310 (229)	210 (155)	33 mm (1.3 in.)
M42X2.0	240 (177)	450 (332)	330 (243)	360 (266)	42 mm (1.7 in.)
M48X2.0	290 (214)	540 (398)	420 (310)	540 (398)	48 mm (1.9 in.)
G1/8A	35 (26)	55 (41)	45 (33)	45 (33)	13.16 mm (0.5 in.)
G1/4A	45 (33)	80 (59)	60 (44)	60 (44)	16.66 mm (0.7 in.)
G3/8A	65 (48)	115 (85)	75 (55)	100 (74)	20.96 mm (0.8 in.)
G1/2A	90 (66)	180 (133)	170 (125)	145 (107)	26.44 mm (1.0 in.)
G3/4A	150 (111)	310 (229)	310 (229)	260 (192)	33.25 mm (1.3 in.)
G1A	240 (177)	450 (332)	330 (243)	360 (266)	41.91 mm (1.7 in.)
G1 1/4A	290 (214)	540 (398)	420 (310)	540 (398)	47.80 mm (1.9 in.)

With coarse-pitch thread. All torque values are in Nm (lb.-ft.) unless marked otherwise.

Thread	Threads according to DIN 912, DIN 931, DIN 933, etc.			Threads according to DIN 7984	
	8.8	10.9	12.9	8.8	10.9
M5	5.5 (4.1)	8 (6)	10 (7)	5 (4)	7 (5)
M6	10 (7)	14 (10)	17 (13)	8.5 (6.3)	12 (9)
M8	25 (18)	35 (26)	42 (31)	20 (15)	30 (22)
M10	45 (33)	65 (48)	80 (59)	40 (30)	59 (44)
M12	87 (64)	110 (81)	147 (108)	69 (51)	100 (74)
M14	135 (100)	180 (133)	230 (170)	110 (81)	160 (118)
M16	210 (155)	275 (203)	350 (258)	170 (125)	250 (184)
M18	280 (207)	410 (302)	480 (354)	245 (181)	345 (254)
M20	410 (302)	570 (420)	690 (509)	340 (251)	490 (361)
M22	550 (406)	780 (575)	930 (686)	460 (339)	660 (487)
M24	710 (524)	1000 (738)	1190 (878)	590 (435)	840 (620)
M27	1040 (767)	1480 (1092)	1770 (1305)	870 (642)	1250 (922)
M30	1420 (1047)	2010 (1482)	2400 (1770)	1200 (885)	1700 (1254)

With fine-pitch thread. All torque values are in Nm (lb.-ft.) unless marked otherwise.

Thread	Threads according to DIN 912, DIN 931, DIN 933, etc.			Threads according to DIN 7984	
	8.8	10.9	12.9	8.8	10.9
M8X1.0	25 (18)	37 (27)	32 (43)	22 (16)	32 (24)
M10X1.0	50 (37)	75 (55)	88 (65)	43 (32)	65 (48)
M10X1.25	49 (36)	71 (52)	83 (61)	42 (31)	62 (46)
M12X1.25	87 (64)	130 (96)	150 (111)	75 (55)	110 (81)
M12X1.5	83 (61)	125 (92)	145 (107)	72 (53)	105 (77)
M14X1.5	135 (100)	200 (148)	173 (235)	120 (89)	175 (129)
M16X1.5	210 (155)	310 (229)	360 (266)	180 (133)	265 (195)
M18X1.5	315 (232)	450 (332)	530 (391)	270 (199)	385 (284)
M20X1.5	440 (325)	630 (465)	730 (538)	375 (277)	530 (391)
M22X1.5	590 (435)	840 (620)	980 (723)	500 (369)	710 (524)
M24X2.0	740 (546)	1070 (789)	1250 (922)	630 (465)	900 (664)
M27X2.0	1100 (811)	1550 (1143)	1800 (1328)	920 (679)	1300 (959)
M30X2.0	1500 (1106)	2150 (1586)	2500 (1844)	1300 (959)	1850 (1364)

SAE Torque Values

NOTE: All torque values are in lb.-ft.

UNIFIED NATIONAL THREAD	GRADE 2		GRADE 5		GRADE 8	
	DRY	LUBED	DRY	LUBED	DRY	LUBED
8-32	19*	14*	30*	22*	41*	31*
8-36	20*	15*	31*	23*	43*	32*
10-24	27*	21*	43*	32*	60*	45*
10-32	31*	23*	49*	36*	68*	51*
1/4-20	66*	50*	9	75*	12	9
1/4-28	76*	56*	10	86*	14	10
5/16-18	11	9	17	13	25	18
5/16-24	12	9	19	14	25	20
3/8-16	20	15	30	23	45	35
3/8-24	23	17	35	25	50	35
7/16-14	32	24	50	35	70	55
7/16-20	36	27	55	40	80	60
1/2-13	50	35	75	55	110	80
1/2-20	55	40	90	65	120	90
9/16-12	70	55	110	80	150	110
9/16-18	80	60	120	90	170	130
5/8-11	100	75	150	110	220	170
5/8-18	110	85	180	130	240	180
3/4-10	175	130	260	200	380	280
3/4-16	200	150	300	220	420	320
7/8-9	170	125	430	320	600	460
7/8-14	180	140	470	360	660	500
1-8	250	190	640	480	900	680
1-12	270	210	710	530	1000	740



WARNING



THIS OPERATOR'S MANUAL IS PROVIDED FOR OPERATOR USE

DO NOT REMOVE FROM THIS MACHINE

Do not start, operate or work on the machine until you carefully read and thoroughly understand the contents of this Operator's Manual.

Failure to follow safety, operating and maintenance instructions can result in serious injury to the operator or bystanders, poor operation, and costly breakdowns.

If you have any questions on proper operation, adjustment or maintenance of the machine, contact your dealer or the Manitou Group Service Department before starting or continuing operation.



For Support and Service, Contact Your Dealer
www.gehl.com/dealer-locator



GEHL

Manitou Group
One Gehl Way, West Bend, WI 53095-0179 U.S.A.
www.gehl.com

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