GEHL

Form No.
50950004
BP1212
English

V400
V400 (EU)

Skid-Steer Loaders

Operator's Manual

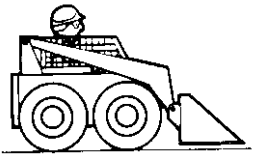
Manitou Americas, Inc., in cooperation with the Society of Automotive Engineers, has adopted this Safety Alert Symbol to pinpoint precautions which, if not properly followed, can create a safety hazard. When you see this symbol in this manual or on the machine itself, you are reminded to BE ALERT! Your personal safety is involved!

Operators must have instructions before running the machine. Untrained operators can cause injury or death.

CORRECT

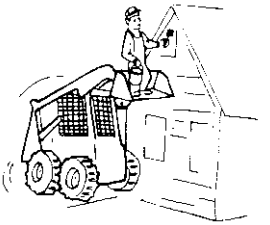
Read Operator's Manual before using machine.

WRONG



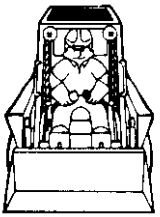
Never use loader without ROPS/FOPS. Never modify the ROPS/FOPS structure.

WRONG



Never use the loader to lift personnel.

CORRECT



Always fasten seatbelt snugly. Always keep feet on the floor/pedals when operating loader.

WRONG

Do not use loader around explosive dust or gas, or where exhaust can contact flammable material.

V400 Skid-Steer Loader
Operator's Manual

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Loader Model Number	
Loader Serial Number	
Engine Serial Number	

EC DECLARATION OF CONFORMITY

1. Manufacturer: **Manitou Americas, Inc.**
2. Address: **One Gehl Way**
   West Bend, WI 53095-0179 U.S.A.

3. Technical Construction File Location:
   Manitou Interface and Logistics Europe SA/NV
   Chaussée de Wavre SN
   1360 PERWEZ
   Belgium
4. Authorized Representative:
5. Address:

6. **We hereby declare that the model(s) listed below conforms to EC Directives: 2004/108/EC (EMC), 97/23/EC (Pressure Equipment), 2006/42/EC (Machinery) and 2000/14/EC (Noise Emission), as amended by 2005/88/EC.**
7. In accordance with EN/ISO Standards:
   EN ISO 3450:1996, ISO 6165
8. Category: **EARTH-MOVING MACHINERY/ LOADERS/COMPACT**
9. Model(s): **V400**
10. Directive/Conformity Assessment Procedure/Notified Body:

2004/108/EC	**Type-test**	**Self-certification**
97/23/EC	**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**

CHAPTER 1

INTRODUCTION

This Operator's Manual provides the owner/operator with information for operating, maintaining and servicing model V400 skid-steer loaders. More important, this manual provides an operating plan for safe and proper use of the machine. Major points of safe operation are detailed in the *Safety* chapter of this manual.

Users should read and understand the contents of this manual completely and become familiar with the machine before operating it. Contact your authorized Gehl dealer if you have any questions concerning information in this manual, require extra manuals, and for information concerning the availability of manuals in other languages.

Throughout this manual information is provided set in *italic* type and introduced by the word ***Note*** or ***Important***. Read carefully and comply with those messages – it will improve operating and maintenance efficiency, help avoid breakdowns and damage, and extend the machine's life.

A manual storage box in the operator's compartment behind the seat holds the Operator's Manual and AEM Safety Manual (also available in Spanish). Please return the manuals to this box and keep them with the unit at all times. If this machine is resold, these manuals should be given to the new owner.

The attachments and equipment available for use with this machine have a wide variety of applications. Read the manual provided with the attachment to learn how to safely maintain and operate the equipment. Be sure the machine is suitably equipped for the type of work to be performed.

Do not use this machine for any applications or purposes other than those described in this manual or those applicable for approved attachments. If the machine is to be used with special attachments or equipment other than those approved by Manitou Americas, consult your Gehl dealer. Any person using non-approved attachments or making unauthorized modifications is responsible for the consequences.

The Gehl dealership network stands ready to provide any assistance that may be required, including providing genuine Gehl service parts. All service parts should be obtained from your Gehl dealer. Provide complete information about the part and include the model and serial numbers of the machine. Record these numbers in the space provided on the Table of Contents page as a handy reference.

Please be aware that Manitou Americas strives to continuously improve its products and reserves the right to make changes and improvements in the design and construction of any part without incurring the obligation to install such changes on any previously delivered unit.

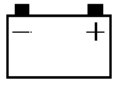
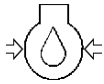
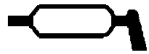
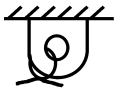
If this machine was purchased "used," or if the owner's address has changed, please provide your Gehl dealer or Gehl Service Department with the owner's name and current address, along with the machine model and serial number. This will allow the registered owner information to be updated, so that the owner can be notified directly in case of an important product issue, such as a safety update program.

Loader Identification

1. Attachment Bracket
2. Restraint Bar
3. Front Work Lights
4. Tilt Cylinders
5. Lift Arm
6. Tires
7. Lift Arm Support Device
8. Auxiliary Couplers

1. Roll-Over/Falling Object Protective System (ROPS/FOPS)
2. Lift Cylinder
3. Engine Cover
4. Rear Work Lights
5. Tail Lights (Position Lights)
6. Rear Door
7. Fuel Cap Cover

Control/Indicator Symbols

 Power Off	 Power On	 Engine Start	 Battery Charge	 Electrical Power
 Worklight w/Tail Lights	 Worklight	 Safety Alert	 Hazard Flasher	 Fasten Seatbelt
 Horn	 Read Operator's Manual	 Volume – Full	 Volume – Half Full	 Volume – Empty
H-L High – Low	**N** Neutral	**F** Forward	**R** Reverse	 Parking Brake
 Engine Air Filter	 Engine Oil	 Engine Oil Filter	 Engine Oil Pressure	 Fuel Filter
 Engine Temperature	 Hydraulic System	 Hydraulic Oil Temperature	 Hydraulic Oil Filter	 Grease Lubrication Point
 Glow Indicator Lamp	 Diesel Fuel	 Chaincase Oil	 Clockwise Rotation	 Counterclockwise Rotation
 Fast	 Slow	 Ride Control	 Engine Malfunction Shutdown	 Bucket – Float
 Bucket – Rollback	 Bucket – Dump	 Lift Arm – Lower	 Lift Arm – Raise	 Service Hours
 Lift Point	 Tie-Down	 Diesel Water Separator	 Power-A-Tach®	

Notes

CHAPTER 2

SAFETY

This safety alert symbol means Attention! Become alert! Your safety is involved! It stresses an attitude of safety consciousness and can be found throughout this Operator's Manual and on the decals on the machine.

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

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

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

Some photographs in this manual may show doors, guards or shields open or removed for illustrative purposes only. Be sure that all doors, guards and shields are in their proper operating positions before starting the engine to operate the unit.

Different applications may require optional safety equipment, such as a back-up alarm, mirror, strobe light or an impact-resistant front door. Be sure you know the job site hazards and equip the machine as needed.

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

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

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

Mandatory Safety Shutdown Procedure

Before cleaning, adjusting, lubricating or servicing the unit, or leaving it unattended:

1. Move the drive control handle(s) to the neutral position.
2. Lower the lift arm and attachment completely. If the lift arm *must* be left in the raised position, BE SURE to properly engage the lift arm support device (page 22).
3. Move the throttle to the low idle position, shut off the engine and remove the key.
4. Before exiting, move the lift/tilt control(s) to verify that the controls do not cause movement of the lift arm and hitch.

Safety Reminders

Before Starting

- Do not modify the ROPS/FOPS unless instructed to do so in 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.
- To ensure safe operation, replace damaged or worn-out parts with genuine Gehl service parts.
- Gehl loaders are designed and intended to be used only with Gehl attachments and approved attachments. To avoid possible personal injury, equipment damage and performance problems, use only attachments that are approved for use on and within the operating capacity of the machine. Contact your dealer or Gehl Service Department for information on attachment approval and compatibility with specific machine models. Manitou Americas cannot be responsible if the machine is used with a non-approved attachment.
- Remove all trash and debris from the machine each day, especially in the engine compartment, to minimize the risk of fire.
- Always face the loader and use the handholds and steps when getting on and off the loader. Do not jump off the loader.
- Never use starting fluid (ether).
- Walk around the machine and warn all nearby personnel before starting the machine.
- Always perform a daily inspection of the machine before using it. Look for damage, loose or missing parts, leaks, etc.

During Operation

- Machine stability is affected by: load being carried, height of the load, machine speed, abrupt control movements and driving over uneven terrain. **DISREGARDING ANY OF THESE FACTORS CAN CAUSE THE LOADER TO TIP, THROWING THE OPERATOR OUT OF THE SEAT OR LOADER, RESULTING IN DEATH OR SERIOUS INJURY.** Therefore: ALWAYS operate with the seatbelt fastened and the restraint bar lowered. Do not exceed the machine's Rated Operating Capacity. Carry the load low. Move the controls smoothly and gradually, and operate at speeds appropriate for the conditions.
- When operating on inclines or ramps, always travel with the heavier end of the loader toward the top of the incline for additional stability.
- Do not raise or drop a loaded bucket or fork suddenly. Abrupt movements under load can cause serious instability.
- Never activate the float function with the bucket or attachment loaded or raised, because this will cause the lift arm to lower rapidly.
- Do not drive too close to an excavation or ditch; be sure that the surrounding ground has adequate strength to support the weight of the loader and the load.
- Never carry riders. Do not allow others to ride on the machine or attachments, because they could fall or cause an accident.
- Always look to the rear before backing up the skid-steer loader.
- Operate the controls only from the operator's seat.
- Always keep hands and feet inside the operator's compartment while operating the machine.
- New operators must operate the loader in an open area away from bystanders. Practice with the controls until the loader can be operated safely and efficiently.
- Wear safety goggles and head protection while operating the machine. Operator must wear protective clothing when appropriate.
- Exhaust fumes can kill. Do not operate this machine in an enclosed area unless there is adequate ventilation.
- When parking the machine and before leaving the seat, check the restraint bar for proper operation. The restraint bar, when raised, deactivates the lift/tilt control and auxiliary hydraulics, and applies the parking brake.

Maintenance

- Never attempt to by-pass the key switch to start the engine. Use only the jump-starting procedure detailed in the *Operation* chapter of this manual.
- Never use your 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. Failure to heed could lead to serious injury to the eyes or other parts of the body.
- Do not smoke or have any spark-producing equipment in the area while filling the fuel tank or while working on the fuel or hydraulic systems.

Potential Hazards

A skid-steer loader operator must ALWAYS be conscious of the working environment. Operator actions, the environmental conditions and the job being preformed require the full attention of the operator so that safety precautions can be taken.

ALWAYS maintain a safe distance from electric power lines and avoid contact with any electrically charged conductor or gas line. Accidental contact or rupture can result in electrocution or an explosion. 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, for the local “Digger's Hotline” number or the proper local authorities for utility line locations BEFORE starting to dig!

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. workweek. NIOSH also recommends substituting less hazardous materials when feasible, using respiratory protection and regular medical examinations for exposed workers.

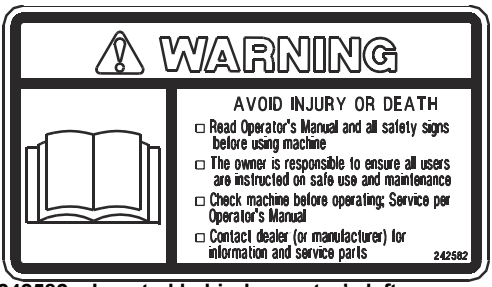
Safety Decals

The skid-steer loader has decals that provide safety information and precautions around the loader. These decals must be kept legible. If missing or illegible, they must be replaced promptly. Replacements can be obtained from your Gehl dealer. If there is a decal on a part that is to be replaced, be sure that the decal is applied to the replacement part.

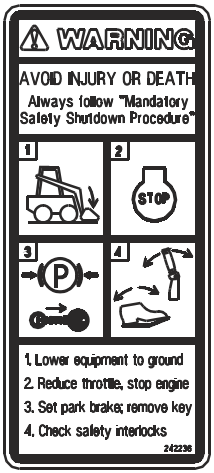
New Decal Application

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 location. Text decals begin on page 9; no-text decals begin on page 13.

ANSI-Style Safety Decals inside the ROPS/FOPS

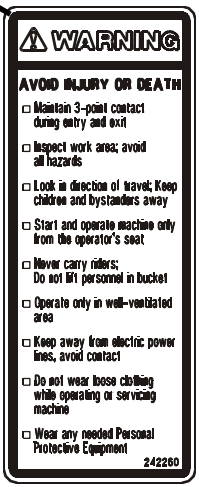


242582 – Located behind operator's left shoulder



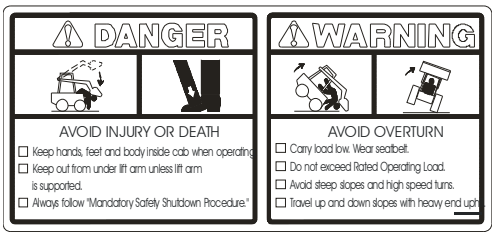
242236 – Located on upper right instrument panel

242397 – Located on lower left instrument panel

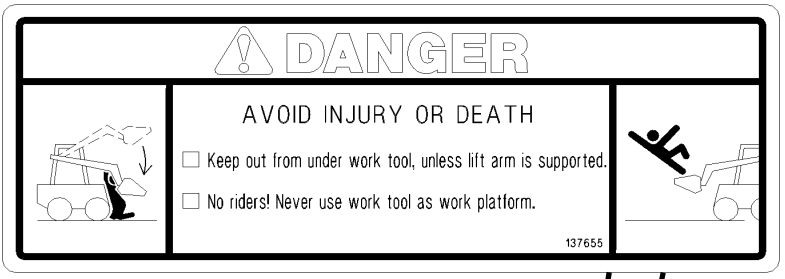


242260 – Located on upper left instrument panel

137647 – Located on operator's lower left side

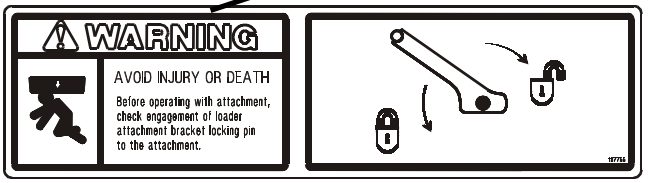


ANSI-Style Safety Decals on the outside of the Loader

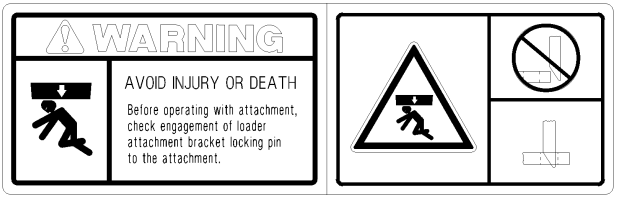


137655 – Located on front of loader and crossmember

132166 – Located on rear window emergency exit

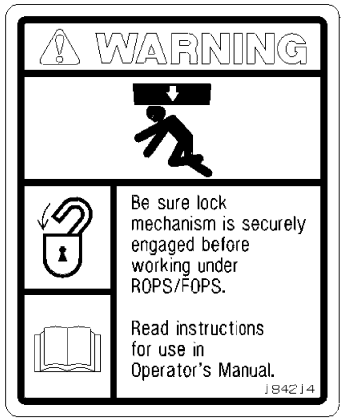


137755 – Located on lift arm crossmember (manual hitch loaders only)



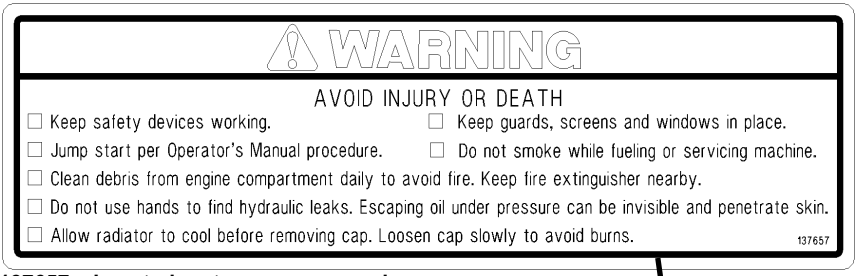
139101 – Located on lift arm crossmember (power hitch loaders only)

ANSI-Style Safety Decals on the outside of the Loader

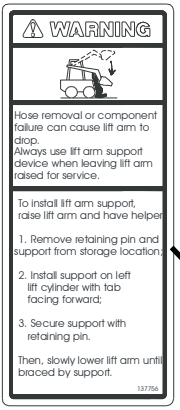


184214 – Located under the ROPS/FOPS

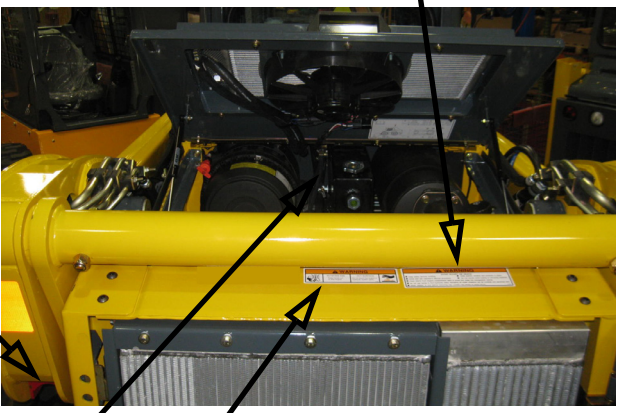
ANSI-Style Safety Decals in the Engine Compartment

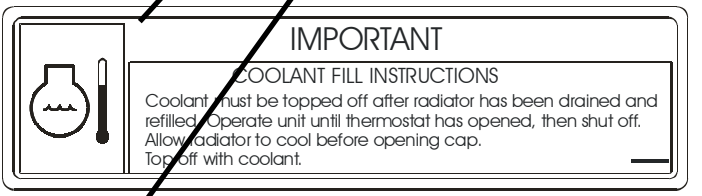


137657 – Located on tower crossmember

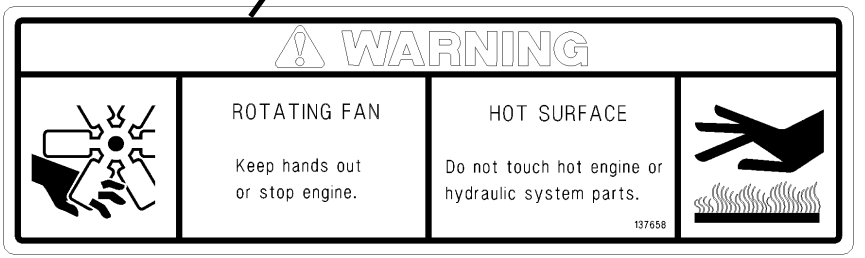


137756 – Located on lift arm support device



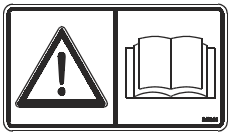


191499 – Located on coolant tank



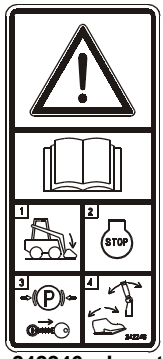
137658 – Located on tower crossmember

ISO-Style (used Internationally) Safety Decals inside the ROPS/FOPS



242568 – Located behind operator's left shoulder

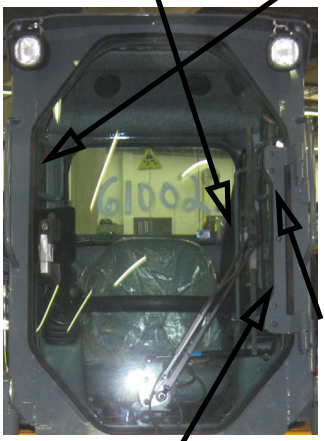
Safety alert: Read Operator's Manual and all safety signs before using machine. The owner is responsible to ensure all users are instructed on safe use and maintenance.

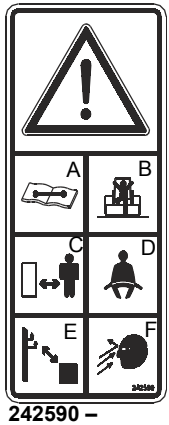


Safety alert: Always follow "Mandatory Safety Shutdown Procedure" in Operator's Manual.

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

242246 – Located on right instrument panel

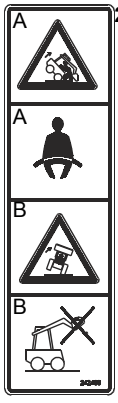




242590 – Located on left instrument panel

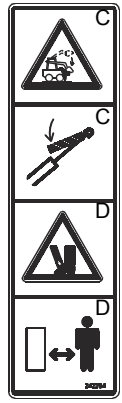
Safety alert:

A – Check machine before operating; Service per Operator's Manual. Contact dealer (or manufacturer) for information and service parts.
B – Maintain 3-point contact during entry and exit.
C – Inspect work area. Avoid all hazards. Look in direction of travel. Keep children and bystanders away.
D – Start and operate machine only from seat.
E – Keep away from power lines; avoid contact.
F – Wear any needed Personal Protective Equipment. Do not wear loose clothing while operating or servicing machine.



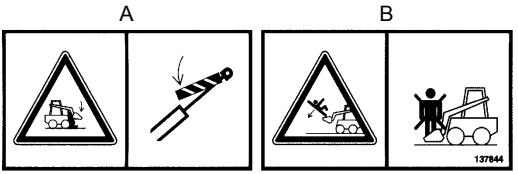
242408 – Located on operator's lower left side

A – Forward tip hazard: Fasten seat belt. Carry load low. Do not exceed Rated Operating Load.
B – Side tip hazard: Avoid steep slopes and high speed turns. Travel up and down slopes with heavy end uphill.
C – Crush hazard: Keep out from under lift arm unless lift arm is supported.
D – Crush hazard: Keep hands, feet and body inside cab when operating.



242284 – Located on operator's lower right side

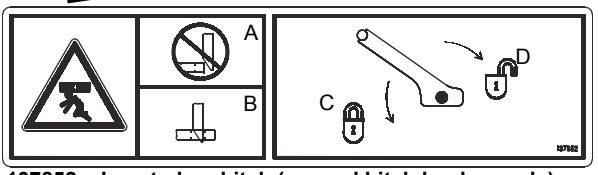
ISO-Style (used Internationally)
Safety Decals on the outside of the Loader



137844 – Located on front of loader and crossmember

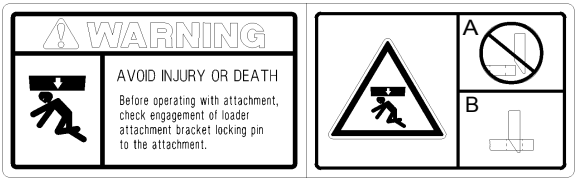
A – Crush hazard: Keep out from under work tool unless lift arm is supported.
B – Fall hazard: No riders. Never use work tool as work platform.

132166 – Located on rear window emergency exit



137852 – Located on hitch (manual hitch loaders only)

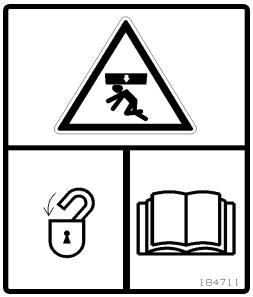
Crush hazard: Before operating with attachment, check engagement of hitch locking pin to the attachment:
A – Incorrect attachment engagement
B – Correct attachment engagement
C – Lock hitch lever
D – Unlock hitch lever



139101 – Located on hitch (power hitch loaders only)

Crush hazard: Before operating with attachment, check engagement of hitch locking pin to the attachment:
A – Incorrect attachment engagement
B – Correct attachment engagement

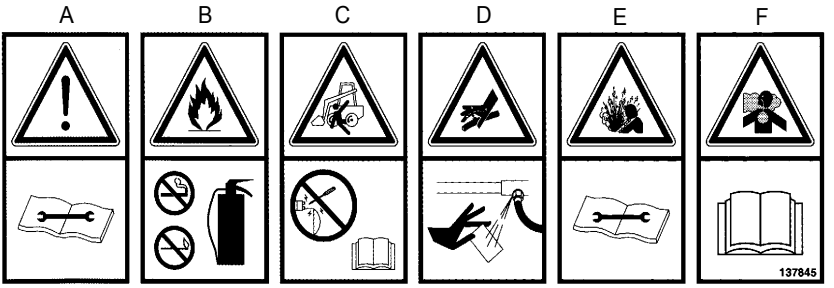
ISO-Style (used Internationally)
Safety Decals on the outside of the Loader



184711 – Located under the ROPS/FOPS

Crush hazard: Be sure lock mechanism is securely engaged before working under ROPS/ FOPS. Read instructions for use in Operator's Manual.

ISO-Style (used Internationally)
Safety Decals in the Engine Compartment



137845 – Located on tower crossmember

A – Safety alert: Keep safety devices in place and in working order. Keep guards, screens and windows in place.

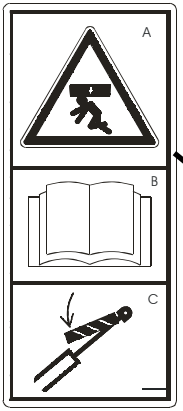
B – Fire hazard: Do not smoke while fueling or servicing machine. Clean debris from engine compartment daily to avoid fire. Keep fire extinguisher nearby.

C – Run-over hazard: Jump-start per Operator's Manual procedure.

D – Oil injection hazard: Do not use hands to find hydraulic leaks. Escaping oil under pressure can be invisible and penetrate skin. Use a piece of cardboard to find leaks.

E – Burn hazard: Allow radiator to cool before removing cap. Loosen cap slowly to avoid burns.

F – Suffocation hazard: Operate only in a well-ventilated area.

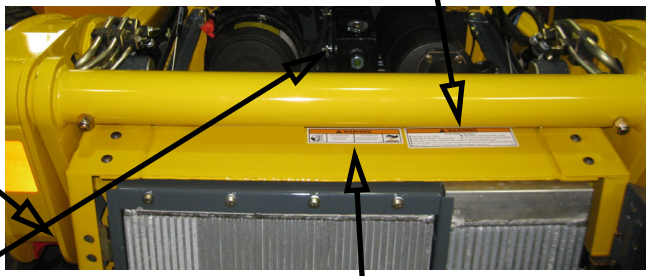


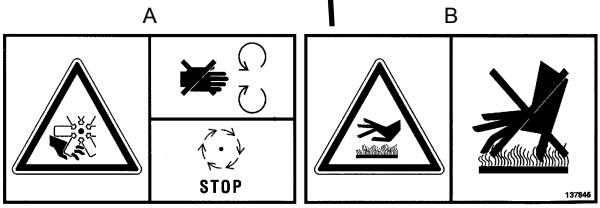
137853 – Located on lift arm support device

A – Crushing hazard; whole body.

B – Read Operator's Manual.

C - Lock lift cylinder.



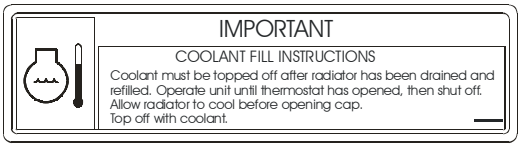


137846 – Located on tower crossmember

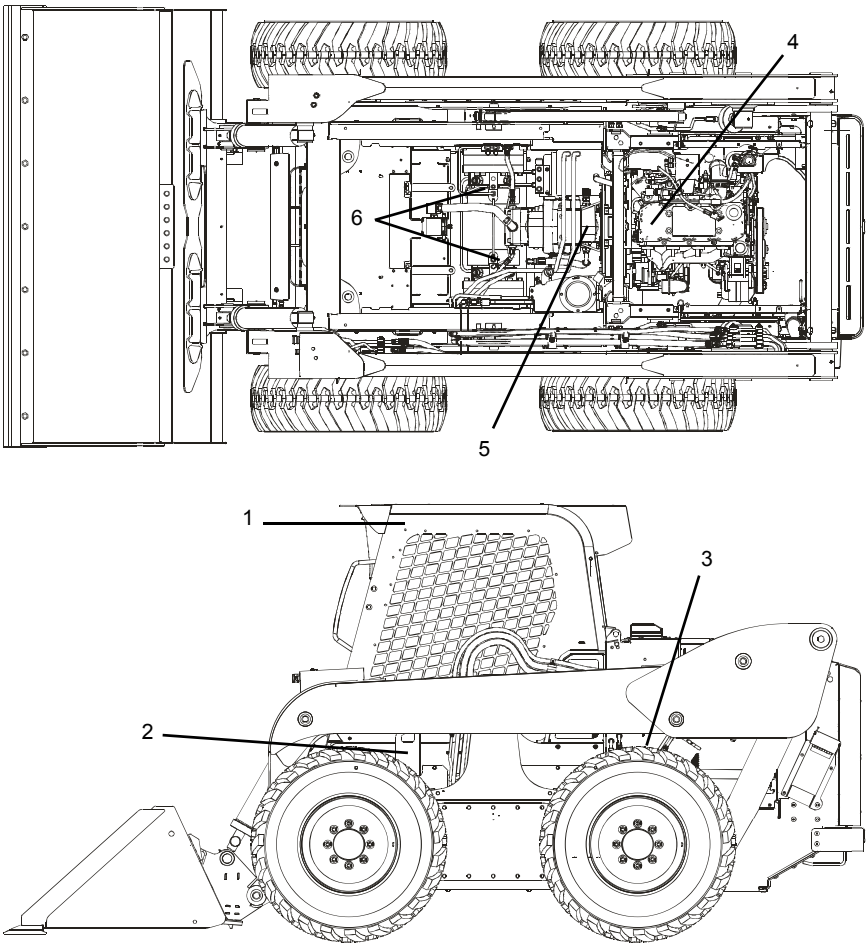
A – Rotating fan: Keep hands out or stop engine.

B – Hot surface: Do not touch hot engine or hydraulic system parts.

191499 – Located on coolant tank



Product and Component Plate Locations



Product and Component Plates

1. Operator protective system plate: with, e.g., model, certification and operator protective system serial number
2. Seat plate according to ISO 7096
3. Product plate: with Product Identification Number and, e.g., model/type designation
4. Engine plate: with, e.g., type designation, product and serial numbers
5. Component plate hydrostatic pump: with, e.g., product and serial numbers
6. Component plate drive motor: with, e.g., product and serial numbers

Notes

CHAPTER 3

CONTROLS AND SAFETY EQUIPMENT

⚠ WARNING Become familiar with and know how to use all safety devices and controls on the skid-steer loader before operating it. Know how to stop loader operation before starting it. This Gehl loader is designed and intended to be used only with Gehl attachments or Manitou Americas-approved referral attachments or accessories. Manitou Americas cannot be responsible for operator safety if the loader is used with non-approved attachments.

Guards and Shields

Whenever possible and without affecting loader operation, guards and shields are provided to protect against potentially hazardous areas. In many places, safety decals are also provided to warn of potential hazards and/or to display special operating procedures.

⚠ WARNING Read and thoroughly understand all safety decals on the loader before operating it. Do not operate the loader unless all factory-installed guards and shields are properly secured in place.

Operator Restraint Bar

Lower the operator restraint bar after entering the operator's compartment and sitting in the seat. The restraint bar is securely anchored to the ROPS/FOPS. The operator must be seated with the restraint bar in its lowered position to start or operate the skid-steer loader. Refer to *Safety Interlock System* on page 20 for more information.

The dual joystick and hand/foot loaders restraint bar provides for-aft adjustment that allows the operator to determine the most comfortable position of the restraint bar. The right and left portions of the restraint bar system can be adjusted independent of one another by pushing the lever on the lower inside of either pad. The restraint pad can then be used to adjust to the desired position. The restraint pad locks in place when it is released. T-Bar loaders do not have an adjustable restraint bar.

⚠ WARNING Never defeat the operator restraint bar or seat switch electrically or mechanically. Always wear the seatbelt.

Operator's Seat

The seat is mounted on rails for rearward and forward repositioning. A spring-loaded lever unlocks the seat position adjustment mechanism.

Suspension seat: A weight adjustment knob is provided for individual operator adjustment.

Air Suspension Seat (optional): Adjust air suspension seat by pushing in the knob on the air seat to increase the amount of suspension. Pull knob out to release air and decrease the suspension level.

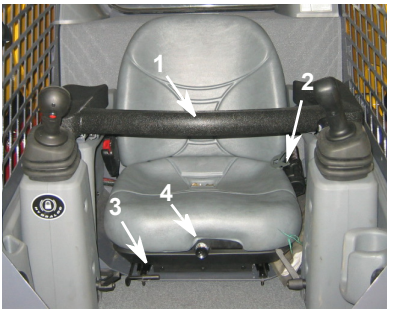


Figure 1 Operator's Seat

1. Restraint Bar
2. Seatbelt
3. Seat Position Adjustment Lever
4. Suspension Seat Weight Adjustment Knob (optional)

Upper-Torso Restraint

⚠ WARNING **Always wear the upper-torso restraint when operating in High speed.**

The seatbelt should always be fastened during operation.

Important: *Inspect the seatbelt(s) for damage before use, and replace if damaged. Keep seatbelt(s) clean. Use only soap and water to wash seatbelt(s). Cleaning solvents can cause damage to seatbelt(s).*

Safety Interlock System

Hydraloc™

⚠ WARNING **NEVER defeat the safety interlock system by mechanically or electrically bypassing any switches, relays or solenoid valves.**

An interlock system is provided on the loader for operator safety. Together with solenoid valves, switches and relays, the interlock system:

- Prevents the engine from starting unless the operator is sitting on the seat and the operator restraint bar is lowered.
- Disables the lift arm, auxiliary hydraulics, attachment tilt and wheel drives whenever the operator leaves the seat, turns the keyswitch to OFF or raises the restraint bar.

Note: *The auxiliary hydraulic circuit can be detented in the "on" position for continuous operation with the restraint bar raised and operator out of the seat. (See Auxiliary Hydraulic Controls, page 41.)*

Testing the Safety Interlock System

Before exiting the machine, check the safety interlock system for proper operation:

Restraint Bar

With the engine running, raise the restraint bar. Test each of the controls. There should be no more than a slight movement of the lift arm, hitch and machine. If there is any significant movement, troubleshoot and correct the problem immediately. Contact your dealer if necessary.

Seat Switch

With the engine off and the restraint bar lowered, unfasten the seatbelt, and lift your weight off the seat. Try to start the engine. If the engine starts, turn off the engine, troubleshoot and correct the problem. Contact your dealer if necessary.

ROPS/FOPS

The ROPS/FOPS (Roll-Over/Falling Object Protective Structure) is designed to provide protection for the operator from falling objects and in a tip over accident, if the operator is secured inside the operator's compartment by the seatbelt and restraint bar.

⚠ WARNING **Never operate the loader with the ROPS/FOPS removed or locked back.**

Parking Brake

This skid-steer loader is equipped with a spring-applied, hydraulic-released parking brake. The parking brake engages when the operator lifts the restraint bar, exits the seat or shuts off the engine. The brake can also be applied manually by using the switch located on the left instrument panel. A red indicator in the switch lights when the parking brake is applied.

Figure 2 Parking Brake Switch

Horn

On dual joystick and hand/foot loaders, pressing the right button on the left control handle sounds the horn. On t-bar loaders, pressing the bottom button on the left control handle sounds the horn.

Rear Window Emergency Exit

The ROPS/FOPS rear window has three functions: noise reduction, flying objects barrier and emergency exit.

To use the emergency exit, pull on the yellow warning tag at the top of the window and remove the seal. Push or kick out the window and then exit.

See your local automotive glass specialist to reinstall the window.

Lift Arm Support Device

The lift arm support device is used as a cylinder lock to prevent the raised lift arm from lowering unexpectedly. Be sure to install the support device when the lift arm is raised for service. When the support device is not being used, return it to its storage position. The support device is a safety device, which must be kept in proper operating condition at all times. The following steps ensure correct usage:

⚠ WARNING With the key switch OFF and the solenoid valve working properly, the lift arm will stay raised when the lift control is moved to lower the lift arm. If the valve does not hold the lift am and it begins to lower do not leave the operator's compartment. Instead, lower the lift arm and exit the machine. Then, contact your Gehl dealer immediately to determine why the lift arm lowers while the key switch is OFF.

Installation

To install the lift arm support device:

1. Raise the lift arm to near full height.
2. Stop the engine.
3. Move the lift arm control to "lower" to verify that the lift arm is being held in the raised position by the safety interlock system.
4. Have an assistant remove the lift arm support device from its storage location (Figure 4) on the left side of the machine and install the lift arm support device on the left lift cylinder (Figure 3).

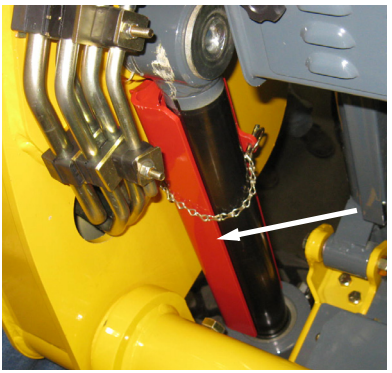


Figure 3 Lift Arm Support Device Engaged

5. Secure the support device to the lift cylinder rod with the attached lock pin and chain.
6. Restart engine.
7. Slowly lower the lift arm until it engages and locks against the lift arm support device.
8. Stop the engine, and exit the machine.

Removal

⚠ WARNING The safest method of installing and removing the lift arm support device requires two people – one person inside the loader and another person outside the loader to install the support device.

To return the lift arm support device to its storage position:

1. Start the engine;
2. Raise the lift arm fully;
3. Stop the engine;
4. Verify that the lift arm is being held in the raised position by the safety interlock system.

⚠ WARNING With the key switch OFF and the solenoid valve for the safety interlock system functioning properly, the lift arm will stay raised when the lift control is moved to "lower". If the lift arm moves, do NOT leave the operator's compartment. Instead, have an assistant remove the support device for you. Then, contact your Gehl dealer to determine the reason why the lift arm lowers while the key switch is in the OFF position.

Figure 4 Lift Arm Support Device Storage Location

5. Have an assistant remove the lift arm support device.
6. Lower the lift arm and secure the lift arm support device with the lynch pin in the storage location (Figure 4).

Accessory Plug

The 12-V accessory plug is located at the bottom of the right instrument panel.

Dome Light

The dome light is located on the right side of the ROPS/FOPS headliner. Push on the dome light to switch it on.

Work Lights

Loaders have two sets of work lights. The front work lights are located at the top of the ROPS/FOPS. The rear work lights are located at the top of the rear door.

Heater (optional)

Loaders with the optional heater have two control knobs on the left instrument panel for controlling fan speed and heater temperature (see Figure 5).

1. **Fan Speed Control:** Controls the air flow.
2. **Temperature Control:** The potentiometer switch is a rotary dial for control of heat functions.

Heater and Air Conditioner (optional)

Loaders with the combination heater/air conditioner have two control knobs on the left instrument panel for controlling fan speed and heater/air conditioner temperature.

1. **Fan Speed Control:** Controls the air flow.
2. **Temperature Control:** The potentiometer switch is a rotary dial for control of heat and air conditioning functions.

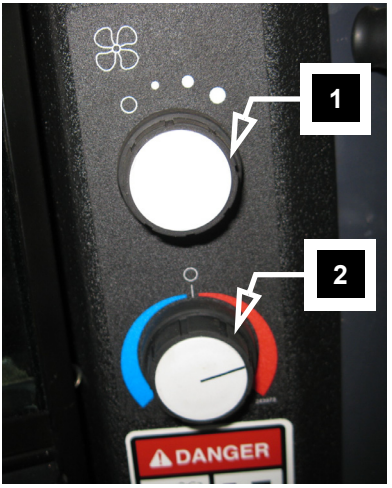


Figure 5 Heater/ Air Conditioner Controls

Engine Speed Control

An engine speed control (Figure 6) is provided for setting the engine speed. Move the control clockwise to increase the engine speed, and counter-clockwise to decrease the engine speed.

Figure 6 Engine Speed Control

With dual joystick and t-bar controls, a foot pedal (Figure 7) is provided as a secondary throttle, which can be used to override the engine speed control. If the foot throttle is released, the engine will return to the speed set by the engine speed control.

Figure 7 Foot Throttle (Joystick and T-Bar controls)

Two-Speed Drive (Travel Mode Only)

Dual joystick and hand/foot loaders use the left button on the left control handle for shifting between High (H) and Low (L). T-Bar loaders use the top button on the left control handle. Shifting to High allows the machine to exceed 6.42 mph (10,3 km/h), up to a maximum speed of 12.5 mph (20 km/h). When the loader is in High (H) an H icon on the Indicator and Warning Light Display (page 27) will illuminate. Press the button once to activate, and again to deactivate.

Note: *Speed varies slightly with tire size.*

⚠ WARNING When two-speed drive is activated, down shifting to single-speed drive while traveling at full speed is not recommended and damage may result.

⚠ WARNING Hydraglide™ Ride Control System

Dual joystick and hand/foot loaders use the right button on the right control handle for shifting between normal mode and ride control mode. T-Bar loaders use the top button on the right control handle. The ride control system provides a smoother ride over uneven surfaces. Press the button once to activate the system, and again to deactivate. The ride control system is automatically deactivated when the machine is shut off.

⚠ WARNING When ride control is activated, the lift arm may drop slightly without a load, or several inches with a heavy load.

Float Control

Dual joystick and hand/foot loaders use the top middle button on the right control handle for shifting between normal mode and float mode. T-Bar loaders use the bottom button on the right control handle. This mode allows the lowered lift arm to follow the ground contour while traveling over changing ground conditions. Press and hold the button for ten seconds or longer to detent, and press again to deactivate. The float mode is automatically deactivated when the machine is shut off.

Attachment Mounting

The skid-steer loader is equipped with either the standard manual All-Tach® hitch or optional Power-A-Tach® hitch for mounting a bucket or other attachments (Figure 8).

All-Tach® Hitch

A manual latch lever engages the latch pins. While standing outside the machine, rotate the lever all the way to the left to engage the latch pins. Rotate the lever (as viewed from the front) all the way to the right to disengage the latch pins. (Refer to page 46 for more information.)

Figure 8 All-Tach® Hitch

⚠ WARNING To prevent unexpected release of the attachment from the hitch, be sure to secure the latch pins by rotating the lever all the way to the hitch.

Power-A-Tach® System

One switch is used to operate the Power-A-Tach System hitch. The hitch will not operate if the parking brake switch is activated or if the restraint bar is in its vertical (open) position. (Refer to page 46 for more information.)

To retract the hitch pins:

Press up on the Power-A-Tach switch on the right instrument panel.

To extend the hitch pins:

Press down on the Power-A-Tach switch on the right instrument panel.

⚠ WARNING To prevent unexpected release of the attachment from the hitch, be sure the latch pins are secure by verifying that the pin flags have moved fully to the outside of the hitch.

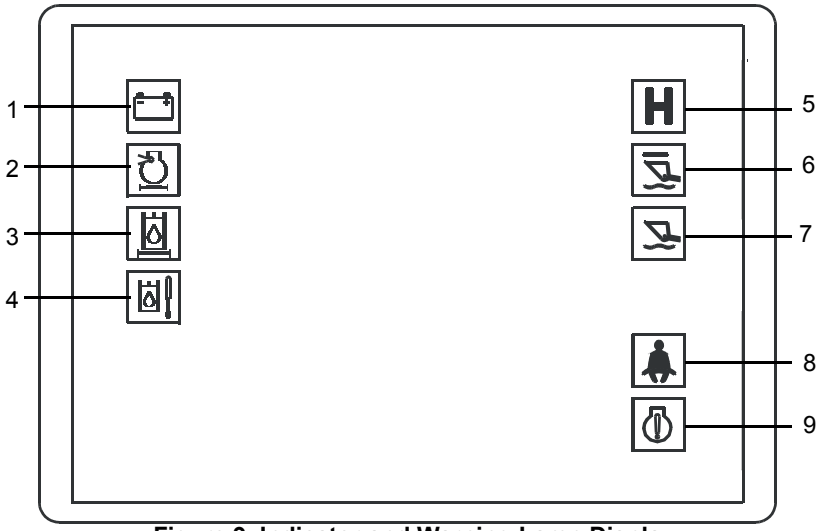


Figure 9 Indicator and Warning Lamp Display

The instrument panels and the indicator and warning lamp display (Figure 9) contain the switches and indicator lamps. Symbols on the indicator lamps are visible only when the indicator lamp are on.

Indicator and Warning Lamp Display

1. **Battery** – Lights if the charging voltage is too high or too low. During normal operation this indicator should be OFF.
2. **Engine Air Filter** – Lights when a restriction in the engine air filter is detected. Warning the operator to clean or replace the element in the engine air cleaner. During normal operation this indicator should be OFF.
3. **Hydraulic Oil Filter** – Lights if the hydraulic filter becomes restricted, warning the operator to stop the engine, allow the engine to cool, and then change the oil and filter. During normal operation this indicator should be OFF.
4. **Hydraulic Oil Temperature** – Lights if the hydraulic oil is too hot, warning the operator to reduce the hydraulic load and determine the cause of the high temperature. During normal operation this indicator should be OFF.
5. **High-Speed** – Lights when two-speed is engaged.
6. **Hydraglide™ Ride Control System** – Lights when the ride control system is activated.
7. **Float Indicator** – Lights when the lift arm "float" function is activated.
8. **Fasten Seatbelt** – A momentary visual (and audible) indicator to remind the operator to fasten the seatbelt(s).
9. **Engine Malfunction Shutdown Indicator** – Lights when the engine electronic control unit (ECU) has detected a failure warranting an automatic shutdown. The indicator lamp also displays error codes when the key switch is turned to the "on" position. See Engine Diagnostics chart on page 71.

Information Center Electronic Display

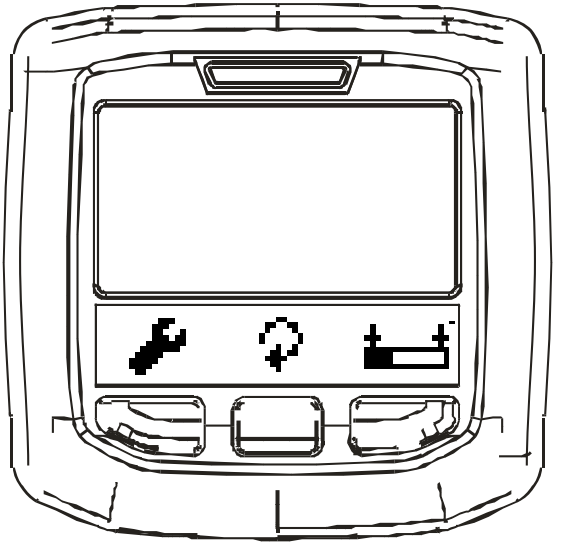


Figure 10 Information Center Electronic Display

The information center electronic display module is a three-button liquid crystal display (LCD) display located above the right instrument panel and it affords the operator a real time informational display of numerous engine, coolant, fuel, battery and environmental parameters. The diagnostic trouble codes (DTC) for this system are shown in the Engine Diagnostic Chart (page 71).

During normal operation, the buttons have no specific functions, the display is used exclusively to provide diagnostic codes. When pressing any button once, a dynamic pop-up menu appears. The menu contains function icons aligned above the associated button. The user selects the required function from the displayed menu. After a few seconds, the menu will be hidden.

⚠ WARNING If the LCD is broken, care must be taken with any leaking fluid. If LCD fluid gets onto your skin, wipe with a cloth and wash the area with mild soap and water. If LCD fluid gets into your eyes, thoroughly rinse your eyes with clean water for several minutes and seek medical assistance. If the LCD fluid is swallowed, rinse your mouth thoroughly with clean water, then drink a substantial volume of water and induce vomiting. Then seek medical assistance.

Display Modes - Information Center Electronic Display

The information center is used to display live parameters and diagnostic trouble codes available on the J1939 bus. By pressing the center button the user can scroll through the available parameters on the vehicle's network. A complete list of supported parameters can be found in the Supported Parameters section.

At any time in any display mode, the user can select the tool icon (left button) to access the setting menu and change the current display mode. See Settings Menu section.

Single Screen

This mode is used to monitor one parameter at a time. The screen also displays the associated parameter icon, the description, the units and a bar graph.

Bar Graph Limits Adjust

The Single Screen mode has a special function for bar graph limits minimum and maximum adjustment. This can be done by selecting the related parameter and then pressing the limits button (right button). The unit should now display the bar graph limits adjust mode. Use +/- for adjustment and select Exit when finished.

Dual Screen

The Dual Screen mode is used to monitor two parameters at a time. The screen also displays the associated parameter icon and units. To change to dual screen mode press the left “wrench” button. This will bring up an option screen with the top line “display mode” will be highlighted. Press the center “arrow” button to change the screen display to dual, multi or DTC screen. Press the left “wrench” button to return to the main display.

Multi-Screen

The Multi-Screen mode is used to monitor a list of four parameters selected by the user. Every item is listed with its associated icon and units.

DTC Screen

The DTC Screen mode is used to display Data Trouble Codes according to SAE J1939-73. The main screen displays all vehicle active faults (DM1) and occurs faults (DM2). A bright bulb means that the current fault is active while a dark bulb means that the current fault has occurred. The header contains the total active/inactive faults, the associated SPN and FMI and the numbers of occurrences as well.

DTC Detailed Information

For a given DTC, the user may select the ? function from the menu. A detailed screen of the selected DTC including the SPN description (Header), the FMI Description (Header), the fault status (Status), the SPN Number (SPN), the FMI Number (FMI), the total number of occurrences (OCC) and the related node source address (SRC) will then appear.

Display Mode

This setting is used to select the current display mode: Single, Dual, Multi or DTC.

Language

The user can select various supported languages for interface display.

Fuel Level Source

With Input mode selected, the device reads the fuel level signal from the discrete sensor input. In this mode, the local information is also broadcast on the J1939 network to other nodes. In Network mode, the device reads the fuel signal from the associated PGN on the J1939 network.

Alarm Output

When enabled the external alarm device is turned on when a new active fault (DM1) occurs. The alarm is turned off when all new active faults have been acknowledged. In Disable mode, the external device is never activated.

Demo Mode

By enabling this option, the users can test the unit even though is not connected to the vehicle network. The network feed is replaced by a simulation lead that allows the user to display every supported SPNs. Moreover some Data Trouble Codes (DTC) are also generated. This is disabled by default at power on.

Tier4 Popout Mode

This option enables pop-up monitoring of the selective catalytic reduction (SCR) parameters available in J1939. When enabled, any status change will appear in a pop-up window even if the main window does not monitor the TIER4 parameters.

Contrast /Backlight

Contrast and backlight commands according to the user's preferences.

Units

The system supports many combinations of units depending on the user's preferences. Distance, Pressure and Volume units could be selected independently. Default settings correspond to all other measurements units.

Fuel Tank Calibration

This submenu is related to the discrete fuel input calibration. By doing the calibration sequence, the user can calibrate the fuel sender response for any custom tank in three points. The best way to do this is to start with an empty thank and fill it with fuel during the process. The bar graph level represents the resistance signal value as read from the discrete input. The response profile may be different according to the sender characteristics.

Factory settings

This is intended to turn the unit back to the original factory settings. All current settings will be lost.

Supported Parameters

The following two pages list the supported parameters of the information center electronic display.

Information Center Electronic Display (cont.)

SPN #	PGN #	Description	Icon
46	65198	Pneumatic Supply Pressure	
52	65262	Engine Intercooler Temperature	
84	65265	Wheel-Based Vehicle Speed	
91	61443	Accelerator Pedal Position 1	
92	61443	Engine Percent Load At Current Speed	
94	65263	Engine Fuel Delivery Pressure	
96	65276	Fuel Level 1	
98	65263	Engine Oil Level	
100	65263	Engine Oil Pressure	

SPN #	PGN #	Description	Icon
102	65270	Engine Intake Manifold #1 Pressure	
105	65270	Engine Intake Manifold #1 Temperature	
106	65270	Engine Air Inlet Pressure	
107	65270	Engine Air Filter 1 Differential Pressure	
108	65269	Barometric Pressure	
109	65263	Engine Coolant Pressure	
110	65262	Engine Coolant Temperature	
111	65263	Engine Coolant Level	
114	65271	Net Battery Current	
115	65271	Alternator Current	
127	65272	Transmission Oil Pressure	

SPN #	PGN #	Description	Icon
158	65271	Keyswitch Battery Potential	
167	65271	Charging System Potential (Voltage)	
168	65271	Battery Potential / Power Input 1	
172	65269	Engine Air Inlet Temperature	
173	65270	Engine Exhaust Gas Temperature	
174	65262	Engine Fuel Temperature 1	
175	65262	Engine Oil Temperature 1	
176	65262	Engine Turbocharger Oil Temperature	
177	65272	Transmission Oil Temperature	
183	65266	Engine Fuel Rate	
184	65266	Engine Instantaneous Fuel Economy	

Information Center Electronic Display (cont.)

SPN #	PGN #	Description	Icon
185	65266	Engine Average Fuel Economy	
190	61444	Engine Speed	
191	61442	Transmission Output Shaft Speed	
246	65255	Total Vehicle Hours	
247	65253	Engine Total Hours of Operation	
441	65164	Auxiliary Temperature 1	
512	61444	Driver's Demand Engine - Percent Torque	
513	61444	Actual Engine - Percent Torque	
517	65256	Navigation-Based Vehicle Speed	
523	61445	Transmission Current Gear	
524	61445	Transmission Selected Gear	

SPN #	PGN #	Description	Icon
975	65213	Estimated Percent Fan Speed	
1032	65201	Total ECU Distance	
1081	65252	Engine Wait to Start Lamp	
1387	65164	Auxiliary Pressure #1	
1761	65110	Catalyst Tank Level	
1762	61448	Hydraulic Pressure	
3031	65110	Catalyst Tank Temperature	
3241	64948	Aftertreatment 1 Exhaust Gas Temperature 1 (upstream)	
3245	64947	Aftertreatment 1 Exhaust Gas Temperature 3 (downstream)	
3697*	64892	Particulate Trap Lamp Command	
3700*	64892	Particulate Trap Active Regeneration Status	

SPN #	PGN #	Description	Icon
3701*	64892	Particulate Trap Status	
3703*	64892	Particulate Trap Active Regeneration Inhibited Due to Inhibit Switch	
3719	64891	Particulate Filter 1 Soot Load Percent	
3720	64891	Particulate Filter 1 Ash Load Percent	

Left Panel

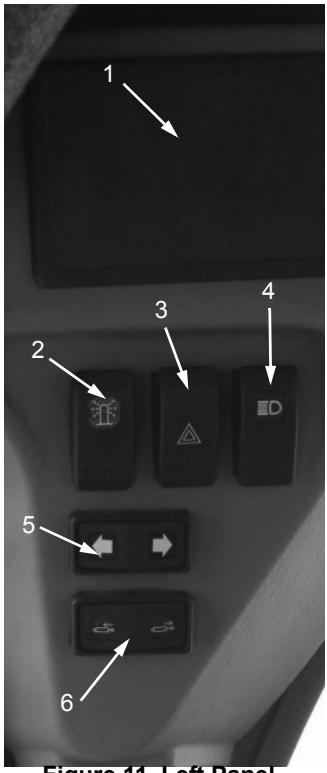


Figure 11 Left Panel

1. **Indicator and Warning Lamp Display** – See page 27.
2. **Rotating Beacon/Strobe Switch (optional)** – Controls the warning lamp (strobe or beacon).
3. **Hazard/Flasher Switch (optional)** – Controls hazard/flasher.
4. **High/Low Beam Switch (EU optional)** – Controls road head lights between main/upper beams and dimmed/lower beams. Switch does not turn lights on or off.
5. **Turn Signal Switch (EU optional)** – Used to turn on turn indicator lights. Directional indicator lights are the same lights as the flashers. The flashers will override the turn signals.
6. **High-Flow Auxiliary Switch (optional)** – Controls the direction of hydraulic oil flow. Push the right side of the rocker switch for forward flow, or the left side for reverse flow. To disengage, push and release either side of the switch, or raise the restraint bar. Turning off the machine and restarting the engine will also reset the high-flow to neutral.
7. **Light Switch** – Master control of the lights. Push the right side of the rocker switch to activate front and rear lights, or to the left side for deactivation of the front and rear lights. Also provides power to a machine equipped with flashers.
8. **Light Switch** – Controls all the lights on the loader. Push the rocker switch to the middle detent for front work lights and rear position lights. Push the rocker switch fully to the right for front work lights and rear work lights operation.

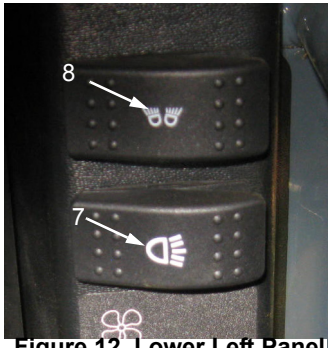


Figure 12 Lower Left Panel

Right Panel

1. **Information Center Electronic Display** – See page 28.
2. **Parking Brake Switch** – Used to manually apply the parking brake. Lights when the parking brake is applied.
3. **Front Wiper/Washer (optional)**
4. **Rear Wiper/Washer (optional)**
5. **Accessory Switch (optional)**
6. **Keyswitch** – In a clockwise rotation, the positions are:
   - **OFF Position** – With the key vertical, power from the battery is disconnected from the controls and instrument panel electrical circuits. This is the only position from which the key can be inserted or removed.
   - **ON (or RUN) Position** – With the key turned one position clockwise from vertical, power from the battery is supplied to all control and instrument panel circuits.
   - **START Position** – With the key turned fully clockwise, the electric starter engages, to start the engine. Release the key to RUN position after the engine starts.

Note: *The engine cannot be started unless the operator is sitting in the seat and the restraint bar is lowered.*

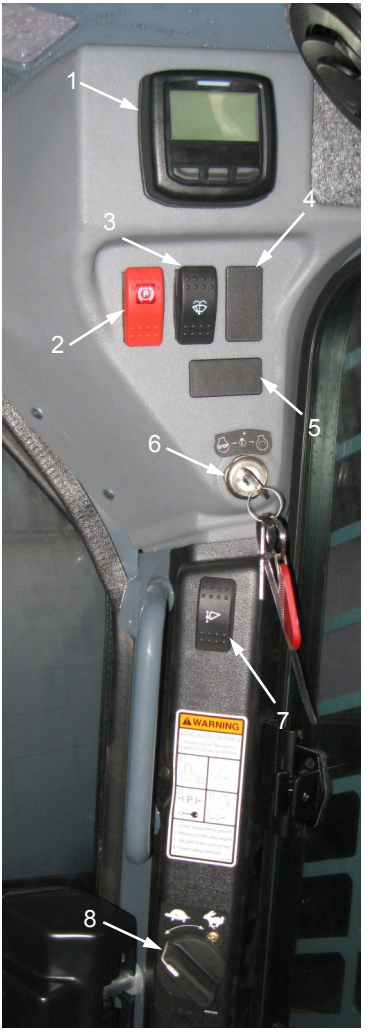


Figure 13 Right Panel

7. **Power-A-Tach® System Switch** – Used to actuate the Power-A-Tach® System. Press the top of the switch to retract (release) the hitch pins; press the bottom of the switch to extend (engage) the hitch pins (see page 26).
8. **Engine Speed Control** – Controls the engine speed. Move the control clockwise to increase and counter-clockwise to decrease the engine speed.

Joystick Controls

The loader may be equipped with dual joystick controls, (Figure 14). The left joystick controls the drive, and the right joystick controls the lift/tilt.

Figure 14 Dual Joystick Controls
1. Lift/Tilt Control
2. Drive Control

Drive Controls

Forward, reverse, speed and turning maneuvers are accomplished by movement of the left joystick. To go **forward**, push the drive control forward; for **reverse**, pull the control rearward. To turn **right**, push the control right; to turn **left**, push the control left. To go **forward and left**, move the control forward and left. To go **forward and right**, move the control forward and right. To move **back and left**, move the control back and to the right. To move **back and right**, move the control back and to the left.

⚠ WARNING **Be sure the joystick controls are in neutral before starting the engine. Operate the controls gradually and smoothly. Excessive speed and quick control movements without regard for conditions and circumstances are hazardous and could cause an accident.**

Moving the joystick farther from neutral increases the speed steadily to the maximum travel speed. Tractive effort decreases as speed increases. For maximum tractive effort, move the joystick only slightly away from the neutral position. The engine may stall if the control is moved too far forward when loading the bucket.

Lift/Tilt Control

Moving the lift arm and tilting the attachment are accomplished by movement of the right joystick. To **raise** the lift arm, pull the control straight rearward; to **lower** the lift arm, push the control straight forward. To **tilt the attachment forward and downward**, move the control to the right; to **tilt the attachment up and back**, move the control to the left.

Note: *The speed of the lift/tilt motion is directly proportional to the amount of joystick movement and engine speed.*

To place the lift arm into the "float" position, push and hold the top middle button on the right joystick. This mode allows the lowered lift arm to follow the ground contour while traveling over changing ground conditions. An indicator lamp in the left instrument panel will blink when float is activated.

⚠ WARNING **Never push the float control button with the attachment raised, because this will cause the lift arm to lower very rapidly.**

Releasing the float button will cancel the float mode if the button was pressed less than five seconds. If the float mode button is pressed longer than five seconds, the float feature will stay on and the float indicator lamp will stay lighted until the button is pressed again or the machine is turned off.

Hand/Foot Controls

The loader may be equipped with hand/foot controls (Figure 15). The handles control the drive and the foot pedals control the lift/tilt.

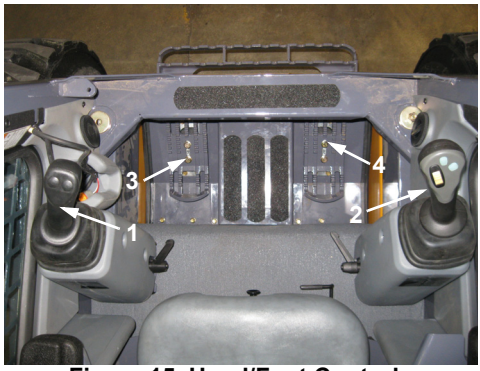


Figure 15 Hand/Foot Controls

1. Left Drive Control Handle
2. Right Drive Control Handle
3. Lift Control Pedal
4. Tilt Control Pedal

Drive Controls

Forward, reverse, speed and turning maneuvers are accomplished by movement of the control handles. To go **forward**, push both handles forward; for **reverse**, pull both handles rearward. For **turning**, move one handle farther forward or rearward than the other handle. Turn direction is determined by which handle is moved farther forward. To turn left, move the right handle farther forward than the left handle; to turn right, move the left handle farther forward than the right handle. For sharp turns, move the handles in opposite directions.

⚠ WARNING **Be sure the controls are in neutral before starting the engine. Operate the controls gradually and smoothly. Excessive speed and quick control movements without regard for conditions and circumstances are hazardous and could cause an accident.**

Moving the handles farther from neutral increases the speed steadily to the maximum travel speed. Tractive effort decreases as speed increases. For maximum tractive effort, move the handles only slightly away from the neutral positions. The engine will stall if the handles are moved too far forward when loading the bucket.

Lift/Tilt Controls

Moving the lift arm and tilting the attachment are accomplished by movement of the foot pedals. The left pedal raises and lowers the lift arm; the right pedal tilts the attachment. To **raise** the lift arm, push down on the back of the left pedal with your left heel; to **lower** the lift arm, push down on the front of the left pedal with the toes of your left foot. To **tilt the attachment forward and down**, push down on the front of the right pedal with the toes of your right foot; to **tilt the attachment up and back**, push down on the back of the right pedal with your right heel.

Note: *The speed of the lift/tilt motion is directly proportional to the amount of pedal movement and engine speed.*

To place the lift arm into the "float" position, push and hold the top middle button on the right-hand control. This mode allows the lowered lift arm to follow the ground contour while traveling over changing ground conditions. An indicator lamp in the left instrument panel will blink when float is activated.

⚠ WARNING **Never push the float control button with the attachment raised, because this will cause the lift arm to lower very rapidly.**

Releasing the float button will cancel the float mode if the button was pressed less than five seconds. If the float mode button is pressed longer than five seconds, the float feature will stay on and the float indicator lamp will stay lighted until the button is pressed again or the machine is turned off.

T-Bar Controls

The loader may be equipped with t-bar controls (Figure 16). The left t-bar controls the drive, and the right t-bar controls the lift/tilt.

Drive Controls

Forward, reverse, speed and turning maneuvers are accomplished by movement of the left t-bar. To go **forward**, push the control forward; for **reverse**, pull the control rearward. To turn **right**, turn the control clockwise; to turn **left**, turn the control counterclockwise. For gradual turns, move the t-bar slightly forward or rearward. For sharp turns, turn the control clockwise or counterclockwise.

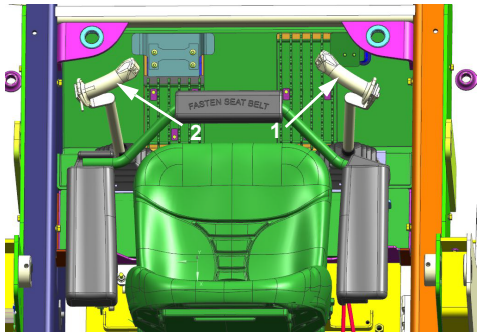


Figure 16 T-Bar Controls

1. Lift/Tilt Control
2. Drive Control

Moving the t-bar farther from neutral increase the speed steadily to the maximum travel speed. Tractive effort decreases as speed increases. To get maximum tractive effort, move the t-bar only slightly away from the neutral position. The engine will stall if the control is moved too far forward when loading the bucket.

⚠ WARNING Be sure the controls are in neutral before starting the engine. Operate the controls gradually and smoothly. Excessive speed and quick control movements without regard for conditions and circumstances are hazardous and could cause an accident.

Lift/Tilt Control

Moving the lift arm and tilting the attachment are accomplished by movement of the right t-bar. To raise the lift arm, pull the control straight rearward; to **lower** the lift arm, push the control straight forward. To **tilt the attachment forward and downward**, twist the control clockwise; to **tilt the attachment up and back**, twist the control counterclockwise.

Note: *The speed of the lift/tilt motion is directly proportional to the amount of t-bar movement and engine speed.*

To place the lift arm into the "float" position, push and hold the bottom button on the right t-bar. This mode allows the lowered lift arm to follow the ground contour while traveling over changing ground conditions. An indicator lamp in the left instrument panel will blink when float is activated.

⚠ WARNING **Never push the float control button with the attachment raised, because this will cause the lift arm to lower very rapidly.**

Auxiliary Hydraulic System

Auxiliary hydraulics are used with attachments that have a mechanism requiring hydraulic power.

⚠ WARNING Always be sure the auxiliary hydraulic control is in neutral before starting the loader or disconnecting the auxiliary hydraulic couplers.

Standard-Flow Auxiliary Hydraulic Control

Loaders are equipped with a standard-flow auxiliary hydraulic system with flat-face couplers. The couplers are located on top of the lift arm on the left side.

Figure 17 Joystick Electric Auxiliary Control

Hand/Foot and Joystick Control Loaders Equipped with Electric Auxiliary: The yellow thumb switch located on the right-hand control controls the direction and amount of flow. The farther the switch is moved from center, the higher the flow to the auxiliary circuit. The direction of flow is reversed when the thumb switch is moved in the opposite direction from the center. Pushing the switch upward will pressurize the standard auxiliary male coupler. For continuous operation, move the switch in either direction and push the red trigger button, located on the front of the grip for five seconds, and release. To cancel continuous operation, push the red button or move the yellow switch in either direction.

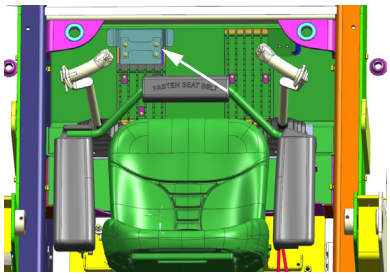


Figure 18 T-Bar Auxiliary Control Pedal

T-Bar Control Loaders Equipped with Electric Auxiliary: A foot pedal is used to control the direction of hydraulic oil flow. Rotating the foot pedal to the right will pressurize the standard auxiliary inboard coupler. Rotating the foot pedal to the left will pressurize the outboard auxiliary coupler. Depress the pedal for approximately 15 seconds in either direction to detent. To stop the auxiliary detent flow, bump the foot pedal in either direction.

High-Flow Auxiliary Hydraulic Control (Optional)

In addition to a standard-flow auxiliary hydraulic system, loaders may be equipped with a reversible high-flow auxiliary hydraulic system. The couplers are located on top of the right lift arm. The high-flow auxiliary hydraulic system is used for operating certain hydraulic attachments (e.g., cold planer, snowblower) that require higher flows.

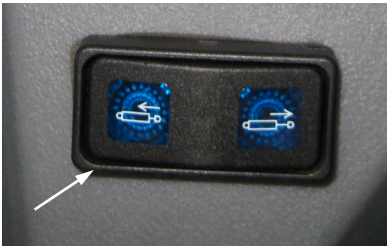


Figure 19 High-Flow Auxiliary Switch

The high-flow auxiliary switch controls the direction of hydraulic oil flow. The switch is located on the upper left side instrument panel. Push the right side of the rocker switch for forward flow, or the left side for reverse flow. Pushing the switch to the right will pressurize the high-flow male coupler. To disengage, push and release either side of the switch. Turning off the machine, raising the restraint bar, or restarting the engine will also reset the high-flow to neutral. A lamp on either side of the switch will illuminate when the high-flow auxiliary hydraulic system is engaged.

Battery Disconnect Switch

A battery disconnect switch is located at the front of the loader, beneath the left control handle, behind a panel with a swell latch. Turn the switch to the OFF position to disconnect the batteries from the electrical system.

Figure 20 Battery Disconnect Switch

CHAPTER 4

OPERATION

⚠ WARNING Before starting the engine and operating the loader, review and comply with all safety recommendations in the *Safety* chapter of this manual. Know how to stop the loader before starting it. Also, be sure to fasten and properly adjust the seatbelt(s) and lower the operator restraint bar.

Before Starting the Engine

Before starting the engine and running the loader, refer to the *Controls and Safety Equipment* chapter and become familiar with the various operating controls, indicators and safety devices on the loader.

Fuel

Cummins will allow up to a 5% (B5) mixture of BioDiesel.

Starting the Engine

The following procedure is recommended for starting the engine:

1. Carefully step up onto the back of the bucket or attachment and grasp the handholds to enter the operator's compartment.
2. Close the door, fasten the seatbelt(s) and lower the restraint bar.
3. Verify the following:
   - the lift/tilt, drive and auxiliary hydraulic controls are in their neutral positions,
   - the parking brake switch is ON.

Note: *When the key is turned to the RUN position, an indicator lamp will light on the instrument panel and a buzzer will sound momentarily to remind users to fasten the seatbelt.*

4. Turn the key to the START position.

Note: *If temperature is below 32°F (0°C), see Cold-Starting Procedure, on page 44.*

Important: *Do not engage the starter for longer than 15 seconds at a time. Longer use can overheat and damage the starter. If the engine fails to start within 15 seconds, return the key to the OFF position or check for engine error codes. Allow the starter to cool for 20 seconds and repeat step 4.*

After the engine starts, allow a five minute low idle warm-up period before operating the controls.

Important: *If the indicator warning lamps do not go off, stop the engine and investigate the cause.*

Cold-Starting

If the temperature is below 32°F (0°C), the following is recommended to make starting the engine easier:

- Replace the engine oil with API-CI-4 and SAE 10W-30 oil, or lighter as recommended by the viscosity chart;
- Make sure the battery is fully charged;
- Install a block heater on the engine.

Let the engine run for a minimum of five minutes to warm the engine and hydraulic fluid before operating the loader.

A block heater is recommended for starting in temperatures of 20°F (-7°C) or lower. See your dealer for heater options.

Cold-Starting Procedure

⚠ WARNING Do not use starting fluid (ether) with pre-heat systems. An explosion can result, which can cause engine damage, injury or death.

1. Turn the key to the RUN position. A wait-to-start symbol will appear on the information center electronic display. Wait for this symbol to go out.
2. Turn the key to the START position.
3. If engine does not start, return key to OFF position and repeat steps 1 and 2.

Stopping the Loader

The following procedure is the recommended sequence for stopping the loader:

1. Check that the drive control handle(s) is (are) in neutral position.
2. Lower the lift arm and rest the attachment on the ground.
3. Turn throttle knob back to the low idle position (and release the throttle pedal for joystick and t-bar control machines). Allow the engine to idle for five minutes if the engine was operated under full load.
4. Turn the keyswitch to the OFF position and remove the key.
5. Move the lift/tilt control to verify that the safety interlock system is preventing movement.
6. Raise the restraint bar, unfasten the seatbelt(s) and grasp the handholds while climbing out of the operator's compartment.

Note: *The skid-steer loader is equipped with a spring-applied automatic parking brake. The parking brake is applied when the operator lifts the restraint bar, leaves the operator's seat or shuts off the engine, or actuates the parking brake switch.*

Parking the Loader

Park the loader away from traffic on level ground. If this is not possible, park the loader across the incline and block the tires to prevent movement.

Jump-starting

If the batteries become discharged or do not have enough power to start the engine, use jumper cables and the following procedure to jump-start the engine.

⚠ WARNING **The ONLY safe method for jump-starting a discharged battery is for TWO PEOPLE to perform the following procedure. The second person removes the jumper cables so that the operator does not have to leave the operator's compartment with the engine running. NEVER make jumper cable connections directly to the starter solenoid of either engine. DO NOT start the engine from any position other than on the operator's seat and then ONLY after being sure ALL controls are in "neutral."**

Closely follow the procedure, in order, to avoid personal injury. In addition, to protect your eyes wear safety glasses and avoid leaning over the batteries while jump-starting.

DO NOT jump-start the batteries if they are frozen, because they may rupture or explode.

Note: *BE SURE the jumper battery is a 12-volt D.C. battery.*

1. Turn the keyswitches of both vehicles to OFF be sure both vehicles are in "neutral" and NOT touching each other.
2. Connect the positive (+) jumper cable to the positive (+) remote battery terminal (Figure 21) on the disabled loader first. DO NOT allow the positive clamps to touch any metal other than the positive (+) remote battery terminal.
3. Connect the other end of the positive jumper cable to the jumper vehicle's battery positive (+) terminal.
4. Connect the negative (-) jumper cable to the jumper vehicle's battery negative (-) terminal.

Figure 21 Positive (+) Remote Battery Terminal

5. Make the final negative (-) jumper cable connection to the negative (-) remote battery terminal (Figure 22) on the disabled loader. DO NOT allow the negative clamps to touch any metal other than the negative (-) remote battery terminal.
6. Start the loader. If it does not start at once, start the jumper vehicle's engine to avoid excessive drain on the booster battery.
7. After the disabled loader is started and running smoothly, have the second person remove the jumper cables [negative (-) jumper cable first] from the jumper vehicle's battery and then from the disabled loader, while being careful NOT to short the two cables together.

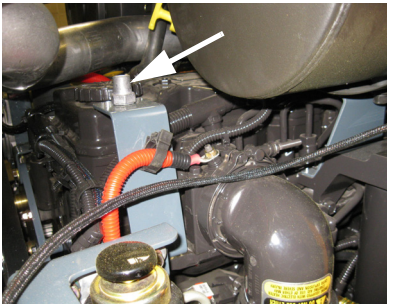


Figure 22 Negative (-) Remote Battery Terminal

Allow sufficient time for the skid-steer loader batteries to build up a charge before operating the loader or shut off the engine.

Changing Attachments

⚠ WARNING To prevent unexpected release of the attachment from the hitch, be sure to properly secure the hitch latch pins by rotating the latch levers fully (manual All-Tach® hitch), or by verifying that the pin flags moved fully to the outside of the hitch. (Power-A-Tach® hitch.) Locking pins 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.

On a manual hitch (Figure 23), two latch levers engage the latch pins to secure the attachment.

Connecting Attachments

1. **Manual hitch:** Rotate the latch lever to the right as viewed from the front to fully retract the latch pins.

   Power hitch: Activate the switch to unlock the hitch and fully retract the latch pins. (See page 26 for a detailed description of this procedure.)
2. Start the loader engine and be sure the lift arm is lowered and in contact with the loader frame.
3. Align the loader squarely with the back of the attachment.

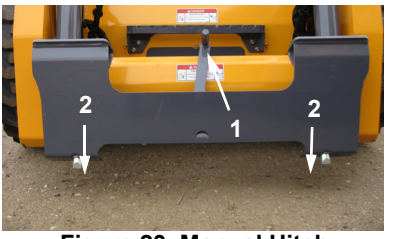


Figure 23 Manual Hitch
1. Latch Lever
2. Latch Pins

4. Tilt the hitch forward until the top edge of the hitch is below the flange on the back side of the attachment and centered between the vertical plates.
5. Slowly drive the loader forward and, at the same time, tilt the hitch back to engage the flange on the back side of the attachment.
6. Stop forward travel when the flange is engaged, but continue to tilt the hitch back to lift the attachment off the ground.
7. **Manual hitch:** Exercise the MANDATORY SAFETY SHUTDOWN PROCEDURE (page 6). Leave the operator's compartment and rotate the latch lever to the left when viewed from the front to fully engage the latch pins.

   Power hitch: Press the Power-A-Tach switch on the right instrument panel to extend the hitch pins and to lock the hitch and fully engage the latch pins.

Important: *To check that the attachment is properly installed tilt the attachment forward slightly, apply downward pressure to the attachment prior to operating.*

Connecting Auxiliary Hydraulic Couplings

Note: *With the engine off, key in the ON position and the restraint bar down, the auxiliary hydraulic control can be moved to relieve any pressure in the hydraulic system. Because the auxiliary hydraulics system is controlled using pilot pressure stored in an accumulator, the engine must have been run recently.*

Standard-Flow Auxiliary Hydraulics

Couplers are located on the left lift arm. When the auxiliary control switch is activated in either direction, the inside and outside couplers can be "pressure," or "return" depending on which direction the switch is activated. The smaller center coupler is for the case drain.

High-Flow Auxiliary Hydraulics (optional)

Couplers are located on the right lift arm. When the auxiliary control switch is activated in either direction, the inside and outside couplers can be "pressure," or "return" depending on which direction the switch is activated. The smaller center coupler is for the case drain.

⚠ WARNING **Only connect high-flow attachment couplers to the high-flow auxiliary couplers.**

Removing Attachments

1. Tilt the hitch back until the attachment is off the ground.
2. Exercise the MANDATORY SAFETY SHUTDOWN PROCEDURE (page 6).
3. With the engine off, leave the operator's compartment and disconnect the auxiliary hydraulic hoses.
4. **Manual hitch:** Rotate the latch lever to the right when viewed from the front to fully retract the latch pins.

   Power hitch: Start the engine, press the top edge of Power-A-Tach switch on the right instrument panel to retract the hitch pins to unlock the hitch and fully retract the latch pins. Release the switch.

5. Start the engine (if it is not already on) and be sure that the lift arm is fully lowered and in contact with the loader frame.
6. Tilt the hitch forward and slowly back the loader away until the attachment is free from the loader.

Self-Leveling

The feature is intended to automatically keep the attachment level while the lift arm is being raised.

Using a Bucket

⚠ WARNING Always maintain a safe distance from electric power lines and avoid contact with any electrically charged conductor or gas line. Accidental contact or rupture can result in electrocution or an explosion. Contact the "Call Before You Dig" referral system at 8-1-1 in the U.S., or 888-258-0808 in the U.S. and Canada or proper local authorities for utility line locations before starting to dig.

Driving over Rough Terrain

When traveling over rough terrain, activate the ride control system and drive slowly with the bucket lowered.

Driving on an Incline

When traveling on an incline, travel with the heavy end pointing uphill.

Digging with a Bucket

Approach the digging site with the lift arm slightly raised and the bucket tilted forward until the edge contacts the ground. Dig into the ground by driving forward and gradually lowering the lift arm (Figure 24).

When the bucket is filled, tilt the bucket back and back the loader away from the material. Rest the lift arm against the loader frame before proceeding to the dumping area.

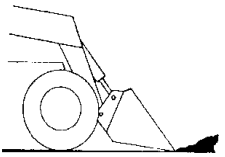


Figure 24 Digging

⚠ WARNING Always carry the loaded bucket with the lift arm resting on the loader frame. For additional stability when operating on inclines, always travel with the heavier end of the loader toward the top of the incline.

Loading a Bucket

Approach the pile with the lift arm fully lowered and the bucket tilted slightly forward until the edge contacts the ground. Drive forward into the pile, lifting the lift arm and tilting back the bucket to fill it. Back away from the pile (Figure 25).

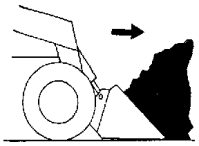


Figure 25 Loading

Dumping the Load onto a Pile

Carry a loaded bucket as low as possible until the pile is reached. Gradually stop forward motion and raise the lift arm high enough so that the bucket clears the top of the pile. Then, slowly move the loader ahead to position the bucket to dump the material on top of the pile. Dump the material and then back the loader away while tilting the bucket back and lowering the lift arm.

⚠ WARNING Never push the "float" button with the bucket or attachment raised, because this will cause the lift arm to lower rapidly.

Dumping the Load into a Truck (or Hopper)

Carry the loaded bucket low and approach the vehicle (or hopper.) Stop as close to the side of the truck (or hopper) as possible while allowing for clearance to raise the lift arm and loaded bucket. Next, raise the lift arm until the bucket clears the top of the truck (or hopper) and move the loader ahead to position the bucket over the inside of the truck (or hopper.) Dump the material and then back away while tilting the bucket back and lowering the lift arm (Figure 26).

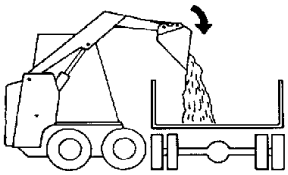


Figure 26 Dumping into a Truck (or Hopper)

Dumping the Load over an Embankment

⚠ WARNING Do not drive too close to an excavation or ditch. Be sure the surrounding ground has adequate strength to support the weight of the loader and the load.

Carry the loaded bucket as low as possible while traveling to the dumping area. Stop the loader where the bucket extends half-way over the edge of the embankment. Tilt the bucket forward and raise the lift arm to dump the material. Dump the material, and then back away from the embankment while tilting the bucket back and lowering the lift arm.

Scraping with a Bucket

For scraping, the loader should be operated in the forward direction. Position the lift arm down against the loader frame. Tilt the bucket cutting edge forward at a slight angle to the surface being scraped. While traveling slowly forward with the bucket in this position, material can flow over the cutting edge and collect inside the bucket (Figure 27).

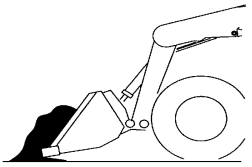


Figure 27 Scraping

Leveling the Ground

Drive the loader to the far edge of the area to be leveled. Tilt the bucket forward to position the bucket cutting edge at a 30 to 45 degree angle to the surface being leveled. Then place the lift arm into "float" position and drive the loader rearward, dragging the dirt and, at the same time, leveling it (Figure 28).

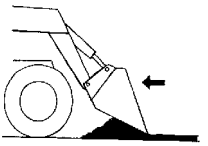


Figure 28 Leveling the Ground

Note: *The "float" detent is activated by pressing the top middle button on the right control handle.*

⚠ WARNING Check that the work area is clear of people and obstacles. Always look in the direction of travel.

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)

This section will cover primarily WBV issues, because evaluations have shown that operation of mobile compact construction equipment on jobsites typically results in HAV levels less than the allowed exposure limit of 2.5 m/s^2.

Employers in 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 job site, how the machine is used, and proper training all play important roles in reducing vibration exposure.

Vibration exposure results from:

- worksite conditions
- how the machine is operated
- the machine characteristics

Common causes of high WBV vibration 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 machine speed appropriately.
   - Adjust the controls, mirrors and seat suspension for comfortable operation.
   - 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.
   - Vary traffic patterns to avoid exposure to rough terrain.
4. Maintain the equipment
   - Ensure correct tire pressures.
   - Check that seat suspension and all controls work smoothly and properly.

Vibration Levels

The following table shows typical Whole-Body and Hand-Arm Vibration levels for Gehl V400 skid-steer loaders.

Whole-Body and Hand-Arm Vibration Levels*

Control	Whole-Body		Hand-Arm	
	Vibration m/s^2	Uncertainty m/s^2	Vibration m/s^2	Uncertainty m/s^2
Dual Joystick	0.69	0.34	1.33	0.67
T-Bar	0.89	0.45	1.00	0.50
Hand/Foot	0.93	0.47	1.20	0.60

*Whole-Body Vibration levels in accordance with ISO 2631-1. Hand-Arm Vibration levels in accordance with ISO 5349-1.

Highway Travel

If it becomes necessary to move the loader a long distance, use a properly rated trailer. (See *Transporting the Loader* on page 55.) For short distance highway travel, attach an SMV (Slow-Moving Vehicle) emblem (purchased locally) to the back of the loader. For highway operation, install the optional amber strobe light. Check state and local laws and regulations.

Storing the Loader

If the skid-steer loader is to be stored for a period in excess of two months, the following procedures are suggested:

1. Fully inflate the tires.
2. Lubricate all grease zerks.
3. Check all fluid levels and replenish as necessary. (Review and follow the engine manufacturers recommendations from the Engine Operator's Manual.)
4. Add stabilizer to the fuel per the fuel supplier's recommendations. If the fuel has a mixture of BioDiesel, empty the fuel tank before storing.
5. Turn the electrical disconnect switch to its OFF position and remove the batteries, charge them fully and store in a cool, dry location.
6. Protect against extreme weather conditions such as moisture, sunlight and temperature.

Removing Loader from Storage

1. Check the tire air pressure and inflate the tires if they are low.
2. Connect the batteries and check that the electrical disconnect switch is turned to its ON position.
3. Check all fluid levels (engine oil, transmission/hydraulic oil, engine coolant and any attached implements). (Review and follow the engine manufacturers recommendations from the Engine Operator's Manual.)
4. Start the engine. Observe all gauges. If all gauges are functioning properly and reading normal, move the machine outside.
5. Once outside, park the machine and let the engine idle for at least five minutes.
6. Shut the engine off and walk around machine. Make a visual inspection looking for evidence of leaks.

⚠ WARNING Park the truck or trailer on a level surface. Be sure the vehicle and its ramps have the weight capacity to support the loader. Make sure the vehicle surface and its ramps are clear of debris and slippery material that may reduce traction. Move the loader on and off the vehicle ramp slowly and carefully. Failure to follow these instructions could result in an overturn accident.

Observe all local regulations governing the loading and transporting of equipment (Reference: U.S. Federal Motor Carrier Safety Regulations, Section 392). Ensure that the hauling vehicle meets all safety requirements before loading the skid-steer loader.

1. Block the front and rear of the hauling vehicle's tires.
2. If the loader has an attachment, lift it slightly off the ground.
3. Back the loader slowly and carefully up the ramp onto the vehicle.
4. Lower the loader attachment to the vehicle deck, turn off the engine and remove the key.

Figure 29 Left Front Tie-Down / Front Retrieval - Right Side Same

5. Fasten the loader to the hauling vehicle at the points indicated by the tie-down decals (Figure 29 and Figure 30).
6. Measure the clearance height of the loader and hauling vehicle. Post the clearance height in the cab of the vehicle.

Figure 30 Rear Tie-Down/Rear Retrieval

Lifting the Loader

The loader can be lifted using a single-point or four-point lift kit, which are available from your Gehl dealer.

⚠ WARNING

- **Before lifting, check the lift kit for proper installation.**
- **Never allow riders in the operator's compartment while the loader is lifted.**
- **Keep everyone a safe distance away from the loader while it is lifted.**
- **Loader may only be lifted with an empty bucket or empty pallet forks, or with no attachment. Never lift the loader with attachments other than those stated.**

Lift equipment used and its installation is the responsibility of the party conducting the lift. All rigging MUST comply with applicable regulations and guidelines.

1. Using suitable lift equipment, hook into the lift eyes. Adjust the length of the slings or chains to lift the loader level.

Note: *The loader my be slightly off level (10 degrees max.) when lifted.*

2. Center the hoist over the ROPS/FOPS. To prevent shock loading of the equipment and excessive swinging, slowly lift the loader off the ground. Perform all movements slowly and gradually. As needed, use a tag line to help position the loader and keep it from swinging.

CHAPTER 5

SERVICE

⚠ WARNING Before servicing the machine, unless expressly instructed to the contrary, exercise the MANDATORY SAFETY SHUTDOWN PROCEDURE (page 6).

After service has been performed, be sure to restore all guards, shields and covers to their original positions before resuming operation.

This *Service* chapter details procedures for performing routine maintenance checks, adjustments and replacements. Most procedures are referred to in the *Troubleshooting* and *Maintenance* chapters of this manual. Refer to the *Maintenance Interval Chart* (page 99) for service intervals. Refer to the separate engine manual for engine-related adjustments, lubrication and service procedures.

Note: *All service procedures, except those described under the Dealer Services topic are owner-operator responsibilities.*

Important: *Always dispose of waste lubricating oils and hydraulic fluids according to local regulations or take to a recycling center for disposal. Do not pour onto the ground or down the drain.*

Dealer Services

The following areas of component service, replacement and adjustments require special tools and knowledge for proper servicing and should be performed only by your authorized Gehl skid-steer loader dealer: hydrostatic drive components, hydraulic system pumps, valves, hydraulic cylinders, electrical components (other than battery, fuses or relays).

Sliding Side Window Removal Procedure

The sliding side windows inside the ROPS/FOPS can be removed for cleaning. To begin, open the cab door and slide one of the side windows to the rear. Using a non-marring tool, separate the front plastic rail underneath the sliding window from the window frame. Pull the plastic rail forward until it releases from the window frame. Then slide the side window to the front and separate the rear plastic rail from the window frame in the same manner, pulling the rail rearward to release it from the window frame. The sliding side window may now be removed from the ROPS/FOPS. To reinstall the window, reverse the removal steps.

Figure 31 Rail removed from window frame.

Replacement Parts

Part Description	Gehl Part No.
Air Cleaner Element, Primary (outer)	105070
Air Cleaner Element, Secondary (inner)	105071
Hydraulic Oil Filter Element	189742
Engine Oil Filter Element	50350434
Fuel Filter Element	50350435
Fuel Separator Element	50350073
Fresh Air Intake Filter (heater option)	195660
Recirculation Air Filter (heater option)	242832 (2 per)

Note: *Part numbers may change. Your Gehl dealer will always have the latest part numbers.*

Important: *To ensure continued warranty coverage, use only genuine Gehl replacement filters.*

Loader Raising Procedure

To raise the skid-steer loader so all four tires are off the ground, use the procedure below:

⚠ WARNING Do not rely on a jack or hoist to maintain the raised position without additional blocking and supports. Serious personal injury could result from improperly raising or blocking the loader.

1. To block the loader, obtain enough suitable blocks (solid wood, hard plastic or metal) so all of the tires are raised off the ground.

Figure 32 Loader Properly Blocked

2. Using a jack or hoist capable of lifting the fully-equipped weight of the loader (with all attached options), lift the rear of the loader until the rear tires are off the ground.
3. Stack wooden, hard plastic or metal blocks under the flat part of the loader chassis. They should run parallel with, but not touch, the rear tires.
4. Slowly lower the loader until its weight rests on the blocks. If the tires still touch the ground, raise the loader again, add more blocks and lower again.
5. Repeat steps 2 through 4 for the front end. When the procedure is finished, all four tires are off the ground, so they could be removed.

Loader Lowering Procedure

When service or adjustment procedures are complete, the loader can be lowered from the raised position. To lower the loader onto its tires:

1. Using a jack or hoist, raise the front of the loader until its weight no longer rests on the front blocks.
2. Carefully remove the blocking under the front of the loader.
3. Slowly lower the loader until the front tires are resting on the ground.
4. Repeat steps 1 through 3 for the rear of the loader. When the procedure is finished, all four tires will be on the ground and the blocks removed from under the loader.

Engine Compartment Access

To open the engine compartment, lift the engine cover. Then pull the rear door latch up (Figure 33) and carefully swing open the rear door. There is another rear door latch near the top hinge pin of the door to secure the door open.

Additionally, the radiator swings out for service (Figure 34). Pull up the spring-loaded latch that secures the radiator to the chassis bumper and place the latch grip in its welded tab placeholder, then pull the radiator outward.

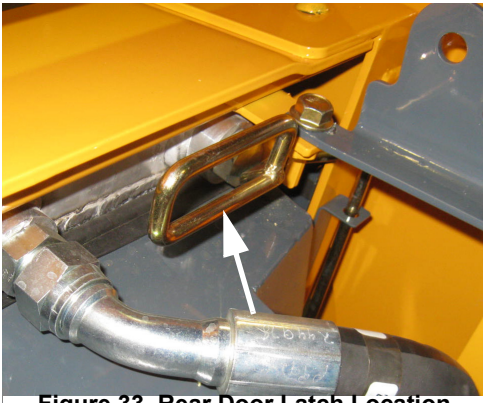


Figure 33 Rear Door Latch Location

Figure 34 Engine Compartment Access Door and Cover

Tilting Back the ROPS/FOPS

A manual lock mechanism is used as a gas spring lock to prevent the raised ROPS/FOPS from lowering unexpectedly. The manual lock mechanism engages to lock the ROPS/FOPS in a tilted-back position.

To tilt back the ROPS/FOPS, remove two hex nuts on two anchor bolts at the front of the ROPS/FOPS. Tilt it back slowly, moving the control handles out of the way. Two gas-charged springs help tilt it back. A self-actuating lock mechanism will engage to lock when the ROPS/FOPS is in a rolled-back position. To lower the ROPS/FOPS, return the lock mechanism to the unlocked position (flipper up). Lower the ROPS/FOPS slowly onto the chassis. Reinstall the anchor bolts, washers and locknuts. Refer to the Torque Specifications chart (page 109) for torque information.

Figure 35 ROPS/FOPS Lock Mechanism – Engaged

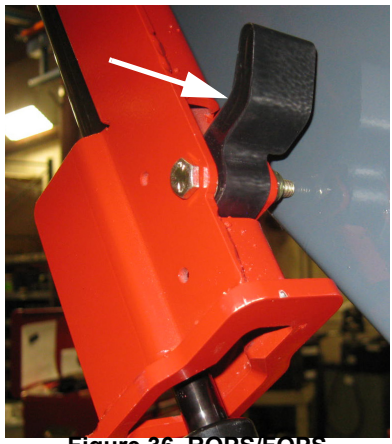


Figure 36 ROPS/FOPS Lock Mechanism – Disengaged

⚠ WARNING Never operate the loader with the ROPS/FOPS removed or tilted back. Be sure the lock mechanism is securely engaged when the ROPS/FOPS is tilted back. Be sure to reinstall the anchor bolts, washers and locknuts before resuming operation. Additionally, DO NOT raise or lower the lift arm with the ROPS/FOPS rolled back.

Adjustments

Control Handles

The control handles do not require routine adjustment. Refer to the *Service Manual* for the initial setup procedure.

Removing Foreign Material

The loader should be cleared daily of dirt and other foreign materials in the following areas:

- around the lift cylinders
- at the front of the loader
- on the hitch, especially around tilt cylinder
- around the hydraulic oil reservoir breather
- in the engine compartment
- in the operator's compartment

Important: *Build-up of foreign materials in these areas can interfere with the operation of the loader, cause component damage or become a fire hazard.*

Lubrication

Listed below are the temperature ranges and types of lubricants for this machine. Refer to the separate engine manual for more information regarding engine lubricants, quantities and grades required.

Note: *Refer to the specific service sections for detailed information on periodic checking and replenishing of lubricants.*

Refer to Figure 37 for grease fitting locations. Wipe dirt from the fittings before greasing them to prevent contamination. Replace any missing or damaged fittings. To minimize dirt build-up, avoid excessive greasing.

Important: *Always dispose of waste lubricating oils and hydraulic fluids according to local regulations or take to a recycling center for disposal. Do not pour onto the ground or down the drain.*

System	Lubricant
Hydraulic System Oil	Use Petro Canada HVI60, Mobil DTE 15M or equivalent, which contain anti-rust, anti-foam and anti-oxidation additives, and conforms to ISO VG46. **Entire System Capacity:** 24.50 U.S. gallons (92,7 L) **Bare Reservoir Capacity:** 16.75 U.S. gal. (63,4 L)
Chaincase Oil	Use SAE grade 15W-40 or 10W-30 motor oil. **Capacity** (each side): 12 U.S. quarts (11,4 L)
Grease Fittings	Use lithium-based grease.
Engine Oil	Important: Refer to the Engine Operator's Manual for specific engine oil recommendations. Below 32°F (0°C) – Use SAE Grade* 10W-30 Above 32°F (0°C) – Use SAE Grade* 15W-40 *Service Classification: API-CI-4 **Capacity:** 11.75 U.S. quarts (11,1 L)

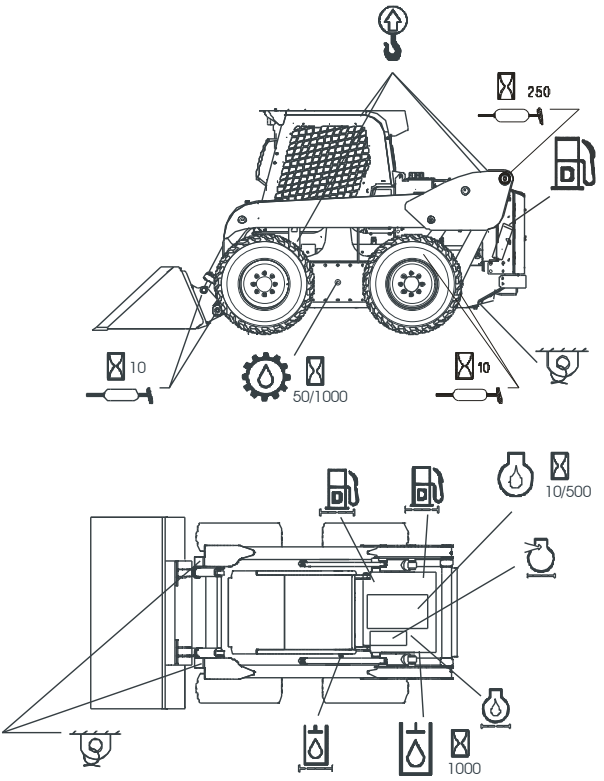


Figure 37 Service Locations

Lubrication Procedure	10 Hours (or Daily)	250 Hours	500 Hours (or Yearly)	1000 Hours (or Yearly)
Check Engine Oil Level (page 70)	●			
Check Hydraulic Oil Level (page 83)	●			
Grease Hitch, Hitch-related Cylinder Pivots and Latch Pins (page 63)	●			
Grease Lift Arm Pins (page 63)	●	●		
Check Oil Level in Chaincases (page 65)		●		
Change Engine Oil and Filter (page 70)	◆		●	
Change Hydraulic Oil Filter (page 83)	◆		●	
Change Hydraulic Oil (page 84)				●
Change Chaincase Oil (page 65)	◆			●
Check & Drain Water Separator (page 71)	●			

◆ Perform the initial procedure at 50 hours, then at the indicated intervals.

Chaincases

There is a chaincase on each side of the loader. Refer to the *Maintenance Interval Chart* (page 99) for change intervals. Refer to the *Lubrication* chart (page 64) for the type of lubricant.

Checking and Adding Oil

1. Park the loader on a level surface and raise the lift arm, refer to the *Lift Arm Support Device Engagement Procedure* (page 22). Shut off the engine and remove the key.
2. At the front of each chaincase and on top of the chaincase there is a fill location underneath a bolt-in cover. Unbolt the cover to access the fill spot (Figure 38).
3. At the front of the loader are two plugs in the chassis (Figure 40). The top plug is the oil level check plug, while the lower plug is the chaincase drain plug.
4. Remove the oil level check plug on the side of the chaincase to be serviced. The oil level should be at the plug level or no more than 1/4 in. (6 mm) below it.
5. If the oil level is low, add oil through the fill plug until the oil level reaches the check plug hole. Reinstall the plugs.

Figure 38 Bolt-in Cover over chaincase fill spot

Figure 39 Fill Plug Location

Draining Oil

1. Park the loader on a level surface, or on a sloping surface with the loader facing downhill and the tires blocked.
2. Remove the chaincase drain plug on each chaincase and drain the oil into a suitable container.
3. Reinstall and tighten the drain plugs.
4. Refill the chaincases at the fill plugs per the procedure above.

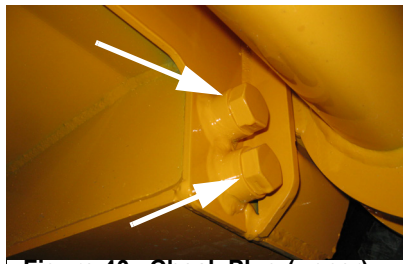


Figure 40 Check Plug (upper) and Drain Plug (lower)

Drive Chains

Drive chains are located in the chaincase on each side of the machine. Refer to the *Maintenance Interval Chart* (page 99) for tension check interval.

Checking Chain Tension

1. Raise the loader following the *Loader Raising Procedure* (page 59).
2. Rotate each tire by hand. The proper amount of chain defection should be 1/8 inch to 1 inch (3 to 25 mm) forward and rearward tire movement. If the chain defection is more than 1 inch (25 mm) or less than 1/8 inch (3 mm) in either direction, the chains should be adjusted.

Adjusting Chain Tension

1. Raise the loader following the *Loader Raising Procedure* (page 59).
2. Remove the tire from the axle to be adjusted.
3. Loosen (but **DO NOT** remove) the bolts holding the axle to the chaincase.
4. **Front Chain Tension** – To tighten the front chain, move the front axle assembly toward the front of the loader. To loosen the chain, move the front axle assembly toward the rear of the loader.

   Rear Chain Tension – To tighten the rear chain, move the rear axle assembly rearward. To loosen the chain, move the rear axle assembly toward the front of the loader.
5. After proper tension is achieved, retighten the bolts.

Important: *Be careful not to over-tighten the drive chains. Over-tightening will cause premature drive chain and axle sprocket wear.*

6. Reinstall the tire.
7. Repeat steps 2 through 6 for any other axle requiring adjustment.
8. Lower the loader following the *Loader Lowering Procedure* (page 60).

Engine Air Cleaner

Important: *Failure to follow proper filter servicing instructions could result in catastrophic engine damage.*

The air cleaner assembly consists of an outer (primary) filter element and an inner (secondary) filter element. There is an electrical air filter restriction indicator for monitoring the condition of the elements. If the air filter becomes restricted, this indicator will trigger a lamp light in the left information center electronic display to warn the operator that the air cleaner requires service. For replacement elements, refer to the *Replacement Parts* chart (page 58).

The outer element should be replaced only when the restriction indicator lamp lights. The inner element should be replaced every third time the outer element is replaced, unless the outer element is damaged or the inner element is visibly dirty.

Along with a daily check of the restriction indicator, check that the air cleaner intake hose and clamps, and the mounting bracket hardware are properly secured.

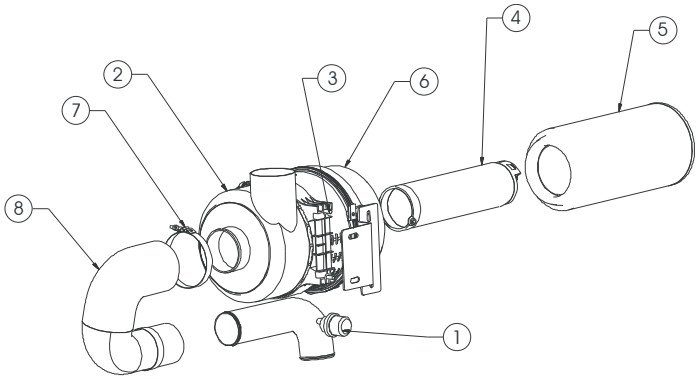


Figure 41 Dual-Element Air Cleaner

1. Restriction Indicator
2. Element Housing
3. Mounting Bracket
4. Inner Filter Element
5. Outer Filter Element
6. Element Cover and Dust Ejector
7. Hose Clamp
8. Air Intake Tube

Access

1. Open the engine cover and then the rear door (page 60).
2. Unlatch the three clamps on the air cleaner cover and remove the cover. Clean out any dirt built up in the cover assembly.

Outer Element

1. Carefully pull the outer element out of the housing. Never remove the inner element unless it is to be replaced.
2. Clean out any dirt built up in the housing. Leave the inner element installed during this step to prevent debris from entering the engine intake manifold.
3. Use a trouble light inside the outer element to inspect for bad spots, pinholes or ruptures. Replace the outer element if any damage is noted. The outer element must be replaced if it is oil- or soot-laden.

Note: *Cleaning the outer element is not recommended.*

Inner Element

Note: *Replace the inner element only if it is visibly dirty or if the outer element has been replaced three times.*

1. Before removing the inner element from the housing, clean out any dirt built up in the housing. Leave the inner element installed during this step to prevent debris from entering the engine intake manifold.
2. Remove the inner element.

Reinstallation

1. Check the inside of the housing for any damage that may interfere with the elements.
2. Be sure that the element sealing surfaces are clean.
3. Insert the element(s), making sure that they are seated properly.
4. Secure the cover to the housing with the three clamps.
5. Check the hose connections and make sure they are all fitted and tightened properly.

Note: *Periodically inspect intake system tubes, rubber elbows and connections. Inspect for cracks, loose fits and loose clamps. Tighten or replace as needed. Intake system must be air tight.*

Note: Refer to the *Maintenance Interval* chart (page 99) for change intervals. Refer to the *Replacement Parts* chart (page 58) for filter part numbers.

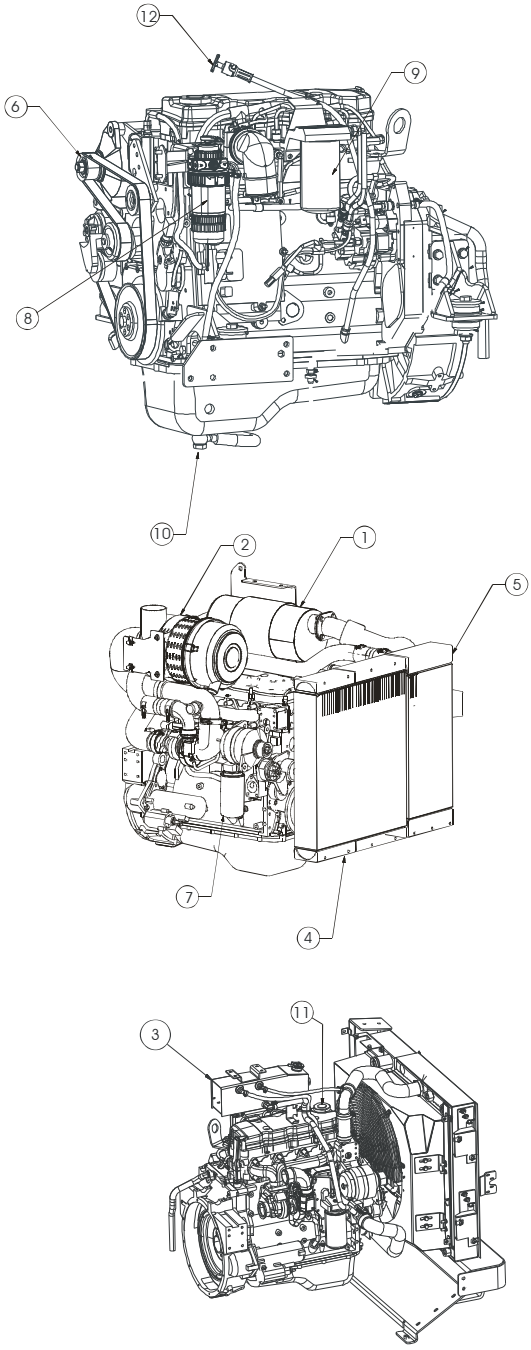


Figure 42 Engine Service Components

1. Muffler
2. Air Cleaner
3. Coolant Tank
4. Heat Exchanger
5. Cooler
6. Alternator Belt
7. Engine Oil Filter
8. Water Separator
9. Fuel Filter
10. Engine Oil Drain
11. Engine Oil Fill Cap
12. Engine Oil Dipstick

Refer to the *Maintenance Interval* chart (page 99) for change intervals. Refer to the *Replacement Parts* chart (page 58) for filter part numbers.

Refer to the Engine Operator's Manual for detailed engine information.

Checking Engine Mounting Hardware

All bolts that secure the engine mounting brackets to the engine and the loader frame should be checked and re-torqued as necessary. Refer to the *Torque Specifications Chart* (page 109) for torque information.

⚠ WARNING **Allow hot engine and hydraulic system components to cool before servicing.**

Checking Engine Oil Level

Open engine cover (page 60), pull out the dipstick and check the oil level. Markings on the dipstick represent FULL and LOW (add oil) levels.

Changing Engine Oil and Filter

Note: *For new units, the initial oil change should be after the first 50 hours.*

Important: *Always dispose of waste lubricating oil according to local regulations or take to a recycling center for disposal; do not pour onto the ground or down the drain.*

The engine oil filter is located on the left side of the engine. Access the filter by removing the left rear access panel (two rubber latches), (Figure 43).

Figure 43 One of two (1 of 2) rubber latches on left side access cover

Access for draining the engine oil is located on the belly plate of the chassis inside the left rear tire (Figure 44).

To add new oil, open the engine access cover. Remove the oil fill cap and add the recommended type and quantity of oil. Refer to the *Lubrication* chart, page 63. Visually inspect the remote oil drain hose for damage or leaks.

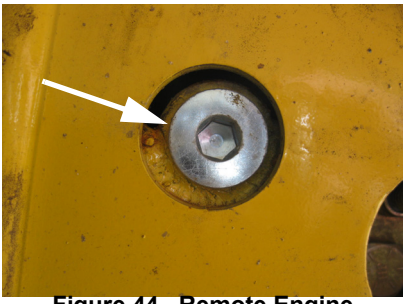


Figure 44 Remote Engine Oil Drain Cap

Changing Fuel Filter

The fuel filter is located on the right side of the engine. Unlatch the right engine access panel to access the filter and clean dirt from around the filter head. Remove the filter from the engine. Replace with a new filter element. Lubricate the seal on the new filter element with fuel before installing. Pump the hand primer on the water separator to fill the element, if it was not filled prior to installation. Start the engine and check for leaks. See page 69 for location on the engine.

Checking the Water Separator

The water separator is located between the fuel tank and main fuel filter and is used to remove finely dispersed water in diesel fuel. Check on a daily basis and drain if necessary. If excess water collects in the separator an alarm will be shown on the information center electronic display. Water can be drained from the separator by opening the valve located at the bottom of the separator bowl.

Note: *A water-in-fuel sensor leading from the bottom of the separator may need to be unplugged to open the valve.*

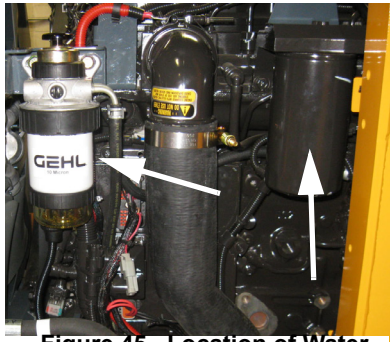


Figure 45 Location of Water Separator (L) and Fuel Filter (R)

After draining the separator, prime the fuel system with a hand pump located on top of the separator (Figure 45).

Engine Diagnostic Chart

When detecting faults, the information center electronic display (page 28) uses a diagnostic trouble code (DTC) screen to alert the operator to the occurrence of the fault conditions.

The following pages list descriptions, diagnostic trouble codes and fault codes for the engine.

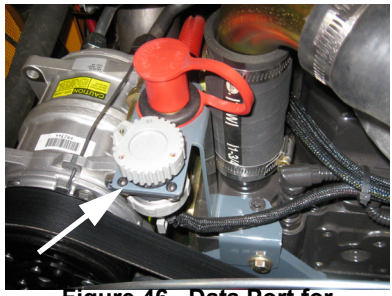


Figure 46 Data Port for the Engine

A1. J1939 FMIs and Descriptions

FMI=0 Data valid but above normal operational range—(applies to J1939)
The signal communicating information is within a range that is defined acceptable and valid, but the real world condition is above what would be considered normal by the predefined limits for that particular measure of the real world condition (Region **"e"** of signal range definition). Broadcast of data values is continued as normal.

FMI=1 Data valid but below normal operational range—(applies to J1939)
The signal communicating information is within a defined acceptable and valid range, but the real world condition is below what would be considered normal by the predefined limits for that particular measure of the real world condition (Region **"d"** of signal range definition). Broadcast of data values is continued as normal.

FMI=2 Data erratic, intermittent or incorrect—(applies to J1939)
Erratic or intermittent data includes all measurements that change at a rate that is not considered possible in the real world condition and must be caused by improper operation of the measuring device or its connection to the ECM.
Incorrect data includes any data not received and any data that is exclusive of the situations covered by FMIs 3, 4, 5, and 6 below. Data may also be considered incorrect if it is inconsistent with other information collected or known about the system.

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

FMI=3 Voltage above normal or shorted to high source—(applies to J1939)
a. A voltage signal, data or otherwise, is above the predefined limits that bound the range (Region **"g"** of the signal range definition).

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

b. Any signal external to an engine control module whose voltage remains at a high level when the ECM commands it to low.

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

FMI=4 Voltage below normal or shorted to low source—(applies to J1939)
a. A voltage signal, data or otherwise, is below the predefined limits that bound the range (Region **"f"** of the signal range definition).

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

b. Any signal external to an engine control module whose voltage remains at a low level when the ECM commands it to high.

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

FMI=5 Current below normal or open circuit—(applies to both J1939 and J1587)
a. A current signal, data or otherwise, is below the predefined limits that bound the range (Region **"f"** of the signal range definition).

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

b. Any signal external to an engine control module whose current remains off when the ECM commands it on.

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

FMI=6 Current above normal or grounded circuit—(applies to both J1939 and J1587)
a. A current signal, data or otherwise, is above the predefined limits that bound the range (Region **"g"** of the signal range definition).

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

b. Any signal external to an engine control module whose current remains on when ECM commands it off.

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

FMI=7 Mechanical system not responding or out of adjustment—(applies to J1939)
Any fault that is detected as the result of an improper mechanical adjustment, an improper response or action of a mechanical system that, with a reasonable confidence level, is not caused by an electronic or electrical system failure. This type of fault may or may not be directly associated with the value of general broadcast information.

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

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

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

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

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

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

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

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

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

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

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

particular measure of the real world condition (Region **"i"** of signal range definition). Broadcast of data values is continued as normal.

FMI=16 Data valid but above normal operating range - moderately severe level—(applies only to J1939)
The signal communicating information is within a defined acceptable and valid range, but the real world condition is above what would be considered normal as determined by the predefined moderately severe level limits for that particular measure of the real world condition (Region **"k"** of signal range definition). Broadcast of data values is continued as normal.

FMI=17 Data valid but below normal operating range - least severe level—(applies only to J1939)
The signal communicating information is within a defined acceptable and valid range, but the real world condition is below what would be considered normal as determined by the predefined moderately severe level limits for that particular measure of the real world condition (Region **"j"** of signal range definition). Broadcast of data values is continued as normal.

FMI=18 Data valid but below normal operating range - moderately severe level—(applies only to J1939)
The signal communicating information is within a defined acceptable and valid range, but the real world condition is below what would be considered normal as determined by the predefined moderately severe level limits for that particular measure of the real world condition (Region **"j"** of signal range definition). Broadcast of data values is continued as normal.

FMI=19 Received network data in error—(applies only to J1939)
Any failure that is detected when the data received via the network is found substituted with the "error indicator" value (e.g. FE $_{16}$, see J1939-71). This type of failure is associated with received network data. the component used to measure the real world signal is wired directly to the ECM sourcing the data to the network and not to the ECM receiving the data via the network. This FMI is applicable to Regions **"f"** and **"g"** of the signal range definition. This type of fault may or may not be directly associated with the value of general broadcast information.

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

FMI=20-30 Reserved for assignment by the SAE J1939 Subcommittee—(applies only to J1939)

- *Applies ONLY to J1939*

FMI=31 Not available or condition exists—(applies only to J1939)
Used to indicate that the FMI is not available or that the condition, that is identified by the SPN exists. When no applicable FMI exists for the reported SPN, FMI 31 can be used. Also, in cases where the reported SPN name has the failure information in it, FMI 31 can be used to indicate that the condition reported by the SPN exists. This type of fault may or may not be directly associated with the value of general broadcast information.

Appendix B. SAE Diagnostic Trouble Codes and Cummins Fault Codes

Fault Code	J1939 SPN	J1939 FMI	Lamp Color	J1939 SPN Description	Cummins Description
111	629	12	Red	Controller #1	Engine Control Module Critical internal failure - Bad intelligent Device or Component
115	612	2	Red	System Diagnostic Code # 2	Engine Speed/Position Sensor Circuit lost both of two signals from the magnetic pickup sensor - Data Erratic, Intermittent, or incorrect
122	102	3	Amber	Boost Pressure	Intake Manifold Pressure Sensor Circuit – Voltage Above Normal, or Shorted to High Source
123	102	4	Amber	Boost Pressure	Intake Manifold Pressure Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
124	102	16	Amber	Boost Pressure	Intake Manifold 1 Pressure - Data Valid but Above Normal Operational Range - Moderately Severe Level
131	91	3	Red	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor Circuit - Voltage Above Normal, or Shorted to High Source
132	91	4	Red	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
133	974	3	Red	Remote Accelerator	Remote Accelerator Pedal or Lever Position Sensor Circuit – Voltage Above Normal, or Shorted to High Source
134	974	4	Red	Remote Accelerator	Remote Accelerator Pedal or Lever Position Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
135	100	3	Amber	Engine Oil Pressure	Oil Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
141	100	4	Amber	Engine Oil Pressure	Oil Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
143	100	18	Amber	Engine Oil Pressure	Oil Pressure Low – Data Valid but Below Normal Operational Range - Moderately Severe Level
144	110	3	Amber	Engine Coolant Temperature	Coolant Temperature Sensor Circuit – Voltage Above Normal, or Shorted to High Source
145	110	4	Amber	Engine Coolant Temperature	Coolant Temperature Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
146	110	16	Amber	Engine Coolant Temperature	Coolant Temperature High - Data Valid but Above Normal Operational Range - Moderately Severe Level
147	91	1	Red	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor Circuit – Abnormal Frequency, Pulse Width, or Period
148	91	0	Red	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor Circuit – Abnormal Frequency, Pulse Width, or Period
151	110	0	Red	Engine Coolant Temperature	Coolant Temperature Low - Data Valid but Above Normal Operational Range - Most Severe Level
153	105	3	Amber	Intake Manifold #1 Temp	Intake Manifold Air Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source
154	105	4	Amber	Intake Manifold #1 Temp	Intake Manifold Air Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
155	105	0	Red	Intake Manifold #1 Temp	Intake Manifold Air Temperature High – Data Valid but Above Normal Operational Range - Most Severe Level
187	3510	4	Amber	5 Volts DC Supply	Sensor Supply Voltage #2 Circuit – Voltage Below Normal, or Shorted to Low Source

Engine Diagnostic Chart (cont.)

193	520199	3	Amber	Cruise Control	Cruise Control (Resistive) Signal Circuit - Voltage Above Normal, or Shorted to High Source
194	520199	4	Amber	Cruise Control	Cruise Control (Resistive) Signal Circuit - Voltage Below Normal, or Shorted to Low Source
195	111	3	Amber	Coolant Level	Coolant Level Sensor Circuit - Voltage Above Normal, or Shorted to High Source
196	111	4	Amber	Coolant Level	Coolant Level Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
197	111	18	Amber	Coolant Level	Coolant Level - Data Valid but Below Normal Operational Range - Moderately Severe Level
199	1661	4	Amber	Engine Automatic Start Lamp	Engine Automatic Start Lamp Driver Circuit - Voltage Above Normal, or Shorted to High Source
211	1484	31	None	J1939 Error	Additional Auxiliary Diagnostic Codes logged - Condition Exists
212	175	3	Amber	Oil Temperature	Engine Oil Temperature Sensor 1 Circuit - Voltage Above Normal, or Shorted to High Source
213	175	4	Amber	Oil Temperature	Engine Oil Temperature Sensor 1 Circuit - Voltage Below Normal, or Shorted to Low Source
214	175	0	Red	Oil Temperature	Engine Oil Temperature - Data Valid but Above Normal Operational Range - Most Severe Level
221	108	3	Amber	Barometric Pressure	Barometric Pressure Sensor Circuit – Voltage Above Normal, or Shorted to High Source
222	108	4	Amber	Barometric Pressure	Barometric Pressure Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
227	3510	3	Amber	5 Volts DC Supply	Sensor Supply Voltage #2 Circuit – Voltage Above Normal, or Shorted to High Source
231	109	3	Amber	Coolant Pressure	Coolant Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
232	109	4	Amber	Coolant Pressure	Coolant Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
233	109	18	Amber	Coolant Pressure	Coolant Pressure - Data Valid but Below Normal Operational Range - Moderately Severe Level
234	190	0	Red	Engine Speed	Engine Speed High - Data Valid but Above Normal Operational Range - Most Severe Level
235	111	1	Red	Coolant Level	Coolant Level Low - Data Valid but Below Normal Operational Range - Most Severe Level
237	644	2	Amber	External Speed Input	External Speed Input (Multiple Unit Synchronization) - Data Erratic, Intermittent, or Incorrect
238	3511	4	Amber	System Diagnostic code # 1	Sensor Supply Voltage #3 Circuit – Voltage Below Normal, or Shorted to Low Source
239	3511	3	Amber	System Diagnostic code #2	Sensor Supply Voltage #3 Circuit - Voltage Above Normal, or Shorted to High Source
241	84	2	Amber	Wheel-based Vehicle Speed	Vehicle Speed Sensor Circuit - Data Erratic, Intermittent, or Incorrect
242	84	10	Amber	Wheel-based Vehicle Speed	Vehicle Speed Sensor Circuit tampering has been detected – Abnormal Rate of Change
244	623	4	Amber	Red Stop Lamp	Red Stop Lamp Driver Circuit - Voltage Below Normal, or Shorted to Low Source
245	647	4	Amber	Fan Clutch Output Device Driver	Fan Control Circuit - Voltage Below Normal, or Shorted to Low Source
249	171	3	Amber	Ambient Air Temperature	Ambient Air Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source
256	171	4	Amber	Ambient Air Temperature	Ambient Air Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
261	174	16	Amber	Fuel Temperature	Engine Fuel Temperature - Data Valid but Above Normal Operational Range - Moderately Severe Level

Engine Diagnostic Chart (cont.)

263	174	3	Amber	Fuel Temperature	Engine Fuel Temperature Sensor 1 Circuit - Voltage Above Normal, or Shorted to High Source
265	174	4	Amber	Fuel Temperature	Engine Fuel Temperature Sensor 1 Circuit - Voltage Below Normal, or Shorted to Low Source
268	94	2	Amber	Fuel Delivery Pressure	Fuel Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect
271	1347	4	Amber	Fuel Pump Pressurizing Assembly #1	High Fuel Pressure Solenoid Valve Circuit – Voltage Below Normal, or Shorted to Low Source
272	1347	3	Amber	Fuel Pump Pressurizing Assembly #1	High Fuel Pressure Solenoid Valve Circuit – Voltage Above Normal, or Shorted to High Source
281	1347	7	Amber	Fuel Pump Pressurizing Assembly #1	High Fuel Pressure Solenoid Valve #1 – Mechanical System Not Responding Properly or Out of Adjustment
284	1043	4	Amber	Internal Sensor Voltage Supply	Engine Speed/Position Sensor (Crankshaft) Supply Voltage Circuit - Voltage Below Normal, or Shorted to Low Source
285	639	9	Amber	SAE J1939 Datalink	SAE J1939 Multiplexing PGN Timeout Error - Abnormal Update Rate
286	639	13	Amber	SAE J1939 Datalink	SAE J1939 Multiplexing Configuration Error – Out of Calibration
287	91	19	Red	Accelerator Pedal Position	SAE J1939 Multiplexing Accelerator Pedal or Lever Sensor System Error - Received Network Data In Error
288	974	19	Red	Remote Accelerator	SAE J1939 Multiplexing Remote Accelerator Pedal or Lever Data Error - Received Network Data In Error
292	441	14	Red	Auxiliary Temperature 1	Auxiliary Temperature Sensor Input 1 - Special Instructions
293	441	3	Amber	OEM Temperature	Auxiliary Temperature Sensor Input # 1 Circuit - Voltage Above Normal, or Shorted to High Source
294	441	4	Amber	OEM Temperature	Auxiliary Temperature Sensor Input # 1 Circuit - Voltage Below Normal, or Shorted to Low Source
295	108	2	Amber	Barometric Pressure	Barometric Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect
296	1388	14	Red	Auxiliary Pressure	Auxiliary Pressure Sensor Input 1 - Special Instructions
297	1388	3	Amber	Auxiliary Pressure	Auxiliary Pressure Sensor Input # 2 Circuit - Voltage Above Normal, or Shorted to High Source
298	1388	4	Amber	Auxiliary Pressure	Auxiliary Pressure Sensor Input # 2 Circuit - Voltage Below Normal, or Shorted to Low Source
319	251	2	Maint	Real Time Clock Power	Real Time Clock Power Interrupt - Data Erratic, Intermittent, or Incorrect
322	651	5	Amber	Injector Cylinder #01	Injector Solenoid Cylinder #1 Circuit – Current Below Normal, or Open Circuit
323	655	5	Amber	Injector Cylinder #05	Injector Solenoid Cylinder #5 Circuit – Current Below Normal, or Open Circuit
324	653	5	Amber	Injector Cylinder #03	Injector Solenoid Cylinder #3 Circuit – Current Below Normal, or Open Circuit
325	656	5	Amber	Injector Cylinder #06	Injector Solenoid Cylinder #6 Circuit – Current Below Normal, or Open Circuit
331	652	5	Amber	Injector Cylinder #02	Injector Solenoid Cylinder #2 Circuit – Current Below Normal, or Open Circuit
332	654	5	Amber	Injector Cylinder #04	Injector Solenoid Cylinder #4 Circuit – Current Below Normal, or Open Circuit
334	110	2	Amber	Engine Coolant Temperature	Coolant Temperature Sensor Circuit – Data Erratic, Intermittent, or Incorrect

Engine Diagnostic Chart (cont.)

338	1267	3	Amber	Vehicle Accessories Relay Driver	Idle Shutdown Vehicle Accessories Relay Driver Circuit - Voltage Above Normal, or Shorted to High Source
339	1267	4	Amber	Vehicle Accessories Relay Driver	Idle Shutdown Vehicle Accessories Relay Driver Circuit - Voltage Below Normal, or Shorted to Low Source
341	630	2	Amber	Calibration Memory	Engine Control Module data lost - Data Erratic, Intermittent, or Incorrect
342	630	13	Red	Calibration Memory	Electronic Calibration Code Incompatibility - Out of Calibration
343	629	12	Amber	Controller #1	Engine Control Module Warning internal hardware failure - Bad Intelligent Device or Component
349	191	16	Amber	Transmission Output Shaft Speed	Transmission Output Shaft Speed - Data Valid but Above Normal Operational Range - Moderately Severe Level
351	627	12	Amber	Controller #1	Injector Power Supply - Bad Intelligent Device or Component
352	3509	4	Amber	5 Volts DC Supply	Sensor Supply Voltage #1 Circuit – Voltage Below Normal, or Shorted to Low Source
386	3509	3	Amber	5 Volts DC Supply	Sensor Supply Voltage #1 Circuit – Voltage Above Normal, or Shorted to High Source
415	100	1	Red	Engine Oil Pressure	Oil Pressure Low – Data Valid but Below Normal Operational Range - Most Severe Level
418	97	15	Maint.	Water in Fuel Indicator	Water in Fuel Indicator High - Data Valid but Above Normal Operational Range – Least Severe Level
422	111	2	Amber	Coolant Level	Coolant Level - Data Erratic, Intermittent, or Incorrect
425	175	2	Amber	Oil Temperature	Engine Oil Temperature - Data Erratic, Intermittent, or Incorrect
428	97	3	Amber	Water in Fuel Indicator	Water in Fuel Sensor Circuit - Voltage Above Normal, or Shorted to High Source
429	97	4	Amber	Water in Fuel Indicator	Water in Fuel Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
431	558	2	Amber	Accelerator Pedal Low Idle Switch	Accelerator Pedal or Lever Idle Validation Circuit - Data Erratic, Intermittent, or Incorrect
432	558	13	Red	Accelerator Pedal Low Idle Switch	Accelerator Pedal or Lever Idle Validation Circuit - Out of Calibration
435	100	2	Amber	Engine Oil Pressure	Oil Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect
441	168	18	Amber	Electrical Potential (Voltage)	Battery #1 Voltage Low - Data Valid but Below Normal Operational Range – Moderately Severe Level
442	168	16	Amber	Electrical Potential (Voltage)	Battery #1 Voltage High - Data Valid but Above Normal Operational Range – Moderately Severe Level
449	157	0	Red	Injector Metering Rail 1 Pressure	Fuel Pressure High - Data Valid but Above Normal Operational Range – Moderately Severe Level
451	157	3	Amber	Injector Metering Rail 1 Pressure	Injector Metering Rail #1 Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
452	157	4	Amber	Injector Metering Rail 1 Pressure	Injector Metering Rail #1 Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
488	105	16	Amber	Intake Manifold	Intake Manifold 1 Temperature - Data Valid but Above Normal Operational Range - Moderately Severe Level
489	191	18	Amber	Transmission Output Shaft Speed	Transmission Output Shaft Speed - Data Valid but Below Normal Operational Range - Moderately Severe Level

Engine Diagnostic Chart (cont.)

497	1377	2	Amber	Switch Circuit	Multiple Unit Synchronization Switch Circuit - Data Erratic, Intermittent, or Incorrect
523	611	2	Amber	System Diagnostic code # 1	OEM Intermediate (PTO) Speed switch Validation - Data Erratic, Intermittent, or Incorrect
527	702	3	Amber	Circuit - Voltage	Auxiliary Input/Output 2 Circuit - Voltage Above Normal, or Shorted to High Source
528	93	2	Amber	Switch - Data	Auxiliary Alternate Torque Validation Switch - Data Erratic, Intermittent, or Incorrect
529	703	3	Amber	Circuit - Voltage	Auxiliary Input/Output 3 Circuit - Voltage Above Normal, or Shorted to High Source
546	94	3	Amber	Fuel Delivery Pressure	Fuel Delivery Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
547	94	4	Amber	Fuel Delivery Pressure	Fuel Delivery Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
551	558	4	Amber	Accelerator Pedal Low Idle Switch	Accelerator Pedal or Lever Idle Validation Circuit - Voltage Below Normal, or Shorted to Low Source
553	157	16	Amber	Injector Metering Rail 1 Pressure	Injector Metering Rail #1 Pressure High – Data Valid but Above Normal Operational Range - Moderately Severe Level
554	157	2	Amber	Injector Metering Rail 1 Pressure	Fuel Pressure Sensor Error - Data Erratic, Intermittent, or Incorrect
559	157	18	Amber	Injector Metering Rail 1 Pressure	Injector Metering Rail #1 Pressure Low – Data Valid but Below Normal Operational Range - Moderately Severe Level
584	677	3	Amber	Starter Solenoid Lockout Relay Driver Circuit	Starter Relay Circuit - Voltage Above Normal, or Shorted to High Source
585	677	4	Amber	Starter Solenoid Lockout Relay Driver Circuit	Starter Relay Circuit - Voltage Below Normal, or Shorted to Low Source
595	103	16	Amber	Turbocharger 1 Speed	Turbocharger #1 Speed High - Data Valid but Above Normal Operational Range – Moderately Severe Level
596	167	16	Amber	Alternate Potential (voltage)	Electrical Charging System Voltage High – Data Valid but Above Normal Operational Range - Moderately Severe Level
597	167	18	Amber	Alternate Potential (voltage)	Electrical Charging System Voltage Low – Data Valid but Below Normal Operational Range - Moderately Severe Level
598	167	1	Red	Alternate Potential (voltage)	Electrical Charging System Voltage Low – Data Valid but Below Normal Operational Range - Most Severe Level
599	640	14	Red	Engine External Protection Input	Auxiliary Commanded Dual Output Shutdown - Special Instructions
649	1378	31	Maint	Engine Oil Change Interval	Change Lubricating Oil and Filter – Condition Exists
687	103	18	Amber	Turbocharger 1 Speed	Turbocharger #1 Speed Low - Data Valid but Below Normal Operational Range – Moderately Severe Level
689	190	2	Amber	Engine Speed	Primary Engine Speed Sensor Error – Data Erratic, Intermittent, or Incorrect
691	1172	3	Amber	Turbocharger #1Compressor Inlet Temperature	Turbocharger #1 Compressor Inlet Temperature Sensor Circuit – Voltage Above Normal, or Shorted to High Source
692	1172	4	Amber	Turbocharger #1Compressor Inlet Temperature	Turbocharger #1 Compressor Inlet Temperature Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
697	1136	3	Amber	Sensor Circuit - Voltage	ECM Internal Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source
698	1136	4	Amber	Sensor Circuit - Voltage	ECM Internal Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source

Engine Diagnostic Chart (cont.)

719	22	3	Amber	Crankcase Pressure	Extended Crankcase Blow-by Pressure Circuit - Voltage Above Normal, or Shorted to High Source
729	22	4	Amber	Crankcase Pressure	Extended Crankcase Blow-by Pressure Circuit - Voltage Below Normal, or Shorted to Low Source
731	723	7	Amber	Engine Speed Sensor #2	Engine Speed/Position #2 mechanical misalignment between camshaft and crankshaft sensors - Mechanical System Not Responding Properly or Out of Adjustment
757	2802	31	Amber	Electronic Control Module	Electronic Control Module data lost - Condition Exists
778	723	2	Amber	Engine Speed Sensor #2	Engine Speed Sensor (Camshaft) Error – Data Erratic, Intermittent, or Incorrect
779	703	11	Amber	Auxiliary Equipment Sensor Input	Warning Auxiliary Equipment Sensor Input # 3 (OEM Switch) - Root Cause Not Known
951	166	2	None	Cylinder Power	Cylinder Power Imbalance Between Cylinders - Data Erratic, Intermittent, or Incorrect
1117	627	2	None	Power Supply	Power Lost With Ignition On - Data Erratic, Intermittent, or Incorrect
1139	651	7	Amber	Injector Cylinder # 01	Injector Cylinder #1 - Mechanical System Not Responding Properly or Out of Adjustment
1141	652	7	Amber	Injector Cylinder # 02	Injector Cylinder #2 - Mechanical System Not Responding Properly or Out of Adjustment
1142	653	7	Amber	Injector Cylinder # 03	Injector Cylinder #3 - Mechanical System Not Responding Properly or Out of Adjustment
1143	654	7	Amber	Injector Cylinder # 04	Injector Cylinder #4 - Mechanical System Not Responding Properly or Out of Adjustment
1144	655	7	Amber	Injector Cylinder # 05	Injector Cylinder #5 - Mechanical System Not Responding Properly or Out of Adjustment
1145	656	7	Amber	Injector Cylinder # 06	Injector Cylinder #6 - Mechanical System Not Responding Properly or Out of Adjustment
1239	2623	3	Amber	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor 2 Circuit - Voltage Above Normal, or Shorted to High Source
1241	2623	4	Amber	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor 2 Circuit - Voltage Below Normal, or Shorted to Low Source
1242	91	2	Red	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor 1 and 2 - Data Erratic, Intermittent, or Incorrect
1256	1563	2	Amber	Control Module Identification Input State	Control Module Identification Input State Error - Data Erratic, Intermittent, or Incorrect
1257	1563	2	Red	Control Module Identification Input State	Control Module Identification Input State Error - Data Erratic, Intermittent, or Incorrect
1852	97	16	Amber	Water in Fuel Indicator	Water in Fuel Indicator - Data Valid but Above Normal Operational Range - Moderately Severe Level
1911	157	0	Amber	Injector Metering Rail	Injector Metering Rail 1 Pressure - Data Valid but Above Normal Operational Range - Most Severe Level
2111	52	3	Amber	Coolant Temperature	Coolant Temperature 2 Sensor Circuit - Voltage Above Normal, or Shorted to High Source
2112	52	4	Amber	Coolant Temperature	Coolant Temperature 2 Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
2113	52	16	Amber	Coolant Temperature	Coolant Temperature 2 - Data Valid but Above Normal Operational Range - Moderately Severe Level
2114	52	0	Red	Coolant Temperature	Coolant Temperature 2 - Data Valid but Above Normal Operational Range - Most Severe Level
2115	2981	3	Amber	Coolant Pressure	Coolant Pressure 2 Circuit - Voltage Above Normal, or Shorted to High Source

Engine Diagnostic Chart (cont.)

2116	2981	4	Amber	Coolant Pressure	Coolant Pressure 2 Circuit - Voltage Below Normal, or Shorted to Low Source
2117	2981	18	Amber	Coolant Pressure	Coolant Pressure 2 - Data Valid but Below Normal Operational Range - Moderately Severe Level
2182	1072	3	Amber	Engine Brake Output # 1	Engine Brake Actuator Driver 1 Circuit - Voltage Above Normal, or Shorted to High Source
2183	1072	4	Amber	Engine Brake Output # 1	Engine Brake Actuator Driver 1 Circuit - Voltage Below Normal, or Shorted to Low Source
2185	3512	3	Amber	System Diagnostic code # 1	Sensor Supply Voltage #4 Circuit – Voltage Above Normal, or Shorted to High Source
2186	3512	4	Amber	System Diagnostic code # 1	Sensor Supply Voltage #4 Circuit – Voltage Below Normal, or Shorted to Low Source
2195	703	14	Red	Auxiliary Equipment Sensor	Auxiliary Equipment Sensor Input 3 Engine Protection Critical - Special Instructions
2215	94	18	Amber	Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid but Below Normal Operational Range - Moderately Severe Level
2216	94	1	Amber	Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid but Above Normal Operational Range – Moderately Severe Level
2217	630	31	Amber	Calibration Memory	ECM Program Memory (RAM) Corruption - Condition Exists
2249	157	1	Amber	Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Data Valid but Below Normal Operational Range - Most Severe Level
2261	94	15	Maint	Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid but Above Normal Operational Range - Least Severe Level
2262	94	17	Maint	Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid but Below Normal Operational Range - Least Severe Level
2263	1800	16	Amber	Battery Temperature	Battery Temperature - Data Valid but Above Normal Operational Range - Moderately Severe Level
2264	1800	18	Amber	Battery Temperature	Battery Temperature - Data Valid but Below Normal Operational Range - Moderately Severe Level
2265	1075	3	Amber	Electric Lift Pump for Engine Fuel	Fuel Priming Pump Control Signal Circuit – Voltage Above Normal, or Shorted to High Source
2266	1075	4	Amber	Electric Lift Pump for Engine Fuel	Fuel Priming Pump Control Signal Circuit – Voltage Below Normal, or Shorted to Low Source
2292	611	16	Amber	Fuel Inlet Meter Device	Fuel Inlet Meter Device - Data Valid but Above Normal Operational Range - Moderately Severe Level
2293	611	18	Amber	Fuel Inlet Meter Device	Fuel Inlet Meter Device flow demand lower than expected - Data Valid but Below Normal Operational Range - Moderately Severe Level
2311	633	31	Amber	Fuel Control Valve #1	Fueling Actuator #1 Circuit Error – Condition Exists
2321	190	2	None	Engine Speed	Engine Speed / Position Sensor #1 - Data Erratic, Intermittent, or Incorrect
2322	723	2	None	Engine Speed Sensor #2	Engine Speed / Position Sensor #2 - Data Erratic, Intermittent, or Incorrect
2345	103	10	Amber	Turbocharger 1 Speed	Turbocharger speed invalid rate of change detected - Abnormal Rate of Change
2346	2789	15	None	System Diagnostic Code #1	Turbocharger Turbine Inlet Temperature (Calculated) - Data Valid but Above Normal Operational Range – Least Severe Level
2347	2790	15	None	System Diagnostic Code #1	Turbocharger Compressor Outlet Temperature (Calculated) - Data Valid but Above Normal Operational Range – Least Severe Level

Engine Diagnostic Chart (cont.)

2363	1073	4	Amber	Engine Compression Brake Output # 2	Engine Brake Actuator Circuit #2 – Voltage Below Normal, or Shorted to Low Source
2365	1112	4	Amber	Engine Brake Output # 3	Engine Brake Actuator Driver Output 3 Circuit - Voltage Below Normal, or Shorted to Low Source
2367	1073	3	Amber	Engine Compression Brake Output # 2	Engine Brake Actuator Circuit #2 – Voltage Above Normal, or Shorted to High Source
2368	1112	3	Amber	Engine Brake Output # 3	Engine Brake Actuator Driver 3 Circuit - Voltage Above Normal, or Shorted to High Source
2372	95	16	Amber	Engine Fuel Filter Differential Pressure	Fuel Filter Differential Pressure - Data Valid but Above Normal Operational Range - Moderately Severe Level
2373	1209	3	Amber	Exhaust Gas Pressure	Exhaust Gas Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
2374	1209	4	Amber	Exhaust Gas Pressure	Exhaust Gas Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
2375	412	3	Amber	Exhaust Gas Recirculation Temperature	Exhaust Gas Recirculation Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source
2376	412	4	Amber	Exhaust Gas Recirculation Temperature	Exhaust Gas Recirculation Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
2377	647	3	Amber	Fan Clutch Output Device Driver	Fan Control Circuit - Voltage Above Normal, or Shorted to High Source
2425	730	4		Intake Air Heater # 2	Intake Air Heater 2 Circuit - Voltage Below Normal, or Shorted to Low Source
2426	730	3		Intake Air Heater # 2	Intake Air Heater 2 Circuit - Voltage Above Normal, or Shorted to High Source
2555	729	3	Amber	Inlet Air Heater Driver #1	Intake Air Heater #1 Circuit - Voltage Above Normal, or Shorted to High Source
2556	729	4	Amber	Inlet Air Heater Driver #1	Intake Air Heater #1 Circuit - Voltage Below Normal, or Shorted to Low Source
2557	697	3	Amber	Auxiliary PWM Driver #1	Auxiliary PWM Driver #1 - Voltage Above Normal, or Shorted to High Source
2558	697	4	Amber	Auxiliary PWM Driver #1	Auxiliary PWM Driver #1 - Voltage Below Normal, or Shorted to Low Source
2963	110	15	None	Engine Coolant Temperature	Engine Coolant Temperature High - Data Valid but Above Normal Operational Range - Least Severe Level
2973	102	2	Amber	Boost Pressure	Intake Manifold Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect

Hydraulic System

Refer to the *Maintenance Interval Chart* (page 99) for service intervals. Refer to the *Replacement Parts* chart (page 58) for filter part numbers.

Checking Hydraulic Oil Level

Inside the engine compartment, the loader has a hydraulic tank dipstick left of the air cleaner assembly. To check the level, run the engine at IDLE and remove the dipstick. Clean the dipstick and replace in its holder. Remove the dipstick again and check the fluid level, (Figure 47).

Add hydraulic oil as required in the hydraulic oil fill tube. Refer to the *Lubrication* chart (page 63). Replace the fill cap.

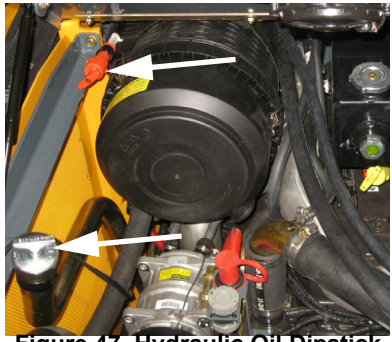


Figure 47 Hydraulic Oil Dipstick and Fill Tube

Changing Hydraulic Oil Filter

The hydraulic oil filter element is located underneath a flat cover plate on top of the reservoir tank. To change the hydraulic filter element:

1. Park the loader on a level surface and raise the lift arm, refer to the *Lift Arm Support Device Engagement Procedure* (page 22). Shut off the engine and remove the key.
2. Tilt back the ROPS/FOPS, refer to the ROPS/FOPS Procedure (page 61).
3. Remove the left side access cover.
4. Clean any dirt/debris off the surface of the filter housing.
5. Remove four bolts on the cover plate and remove the plate and spring.
6. Pull up on the filter element and remove it from the reservoir (Figure 49).

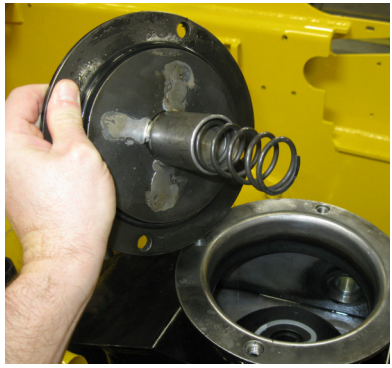


Figure 48 Hydraulic Oil Filter Cap and Spring

7. Install the new filter element in the reservoir.
8. After properly positioning the spring, reinstall the cover plate and its hardware.
9. Refill the hydraulic oil reservoir with oil (if needed). Refer to the *Lubrication* chart (page 63).

Figure 49 Hydraulic Oil Filter Element

Changing Hydraulic Oil

The hydraulic oil must be replaced if it becomes contaminated, after major repairs and after 1000 hours or one year of use.

1. Under the loader near the left rear tire, unbolt a small left rear floor plate cover to access the drain plug.
2. Install a catch pan of sufficient capacity under the oil reservoir. See page 63.
3. Remove the drain plug on the reservoir tank and allow the oil to drain (Figure 50).
4. Reinstall the drain plug and floor plate cover.
5. Change the oil filter.
6. Refill the reservoir. Refer to the *Lubrication* chart (page 63).
7. Start the engine and operate the hydraulic controls.
8. Stop the engine and check for leaks at the filter and reservoir drain plug.
9. Check the fluid level and add fluid, if needed.

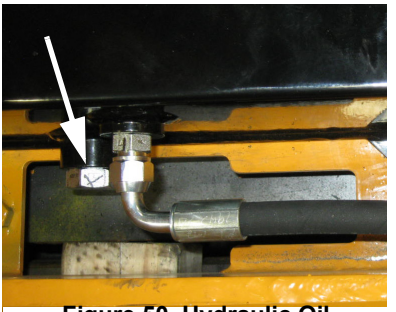


Figure 50 Hydraulic Oil Reservoir Drain Plug

Bucket Cutting Edge

The bucket cutting edge should be replaced when it is worn to within 1 in. (25 mm) of the bucket body.

Alternator Belt

Refer to the separate engine manual for setting proper belt tension. If the belt is worn, cracked or otherwise deteriorated, replace the belt following the procedure in the engine manual.

Wheel Nuts

Wheel nut torque must be checked before initial operation and every two hours thereafter until the wheel mounting hardware torque remains at 240 ft.-lbs. (325 N·m). When wheels are removed and reinstalled this procedure must be repeated.

Lift Arm Pivots

The All-Tach® pivot should be torqued every 250 hours to 380 ft.-lbs. (515 N·m). Refer to the *Maintenance Interval Chart* (page 99).

Cooling System

Important: *Check the cooling system daily to prevent overheating, loss of performance and engine damage.*

Checking Coolant Level

1. With the engine at operating temperature, open the engine cover. Looking at its visual sight gauge, check that the coolant tank fluid is half way up on the sight glass of the coolant tank (Figure 51).
2. Allow the coolant to cool. Do not remove the cap when the coolant is hot. Serious burns may occur.
3. Add premixed coolant, 50% water and 50% ethylene glycol, to the tank if the coolant level is low.

Figure 51 Coolant Tank Visual Sight Gauge

Cleaning the Cooling System

⚠ WARNING Allow sufficient time for the oil radiator to cool before working on or near it. Parts get extremely hot during operation and can burn you.

The radiator assembly is mounted between the engine and the hinged rear door. When operating correctly, air is blown through the openings between the fins by the engine fan. During operation dust and debris can build up on the engine side of the radiator and restrict air flow through the fins. To remove this restriction, use compressed air and direct the flow through the fins from the rear of the radiator toward the engine.

1. Lower the lift arm and stop the engine. Allow the machine to cool.
2. Raise the engine cover and open the rear door (page 60).

3. Pull up on the radiator lock pin and put it in its placeholder (Figure 52), then swing the radiator out (Figure 34).
4. As necessary, clean the radiator and air cooler by blowing compressed air through the fins from the rear, toward the engine.

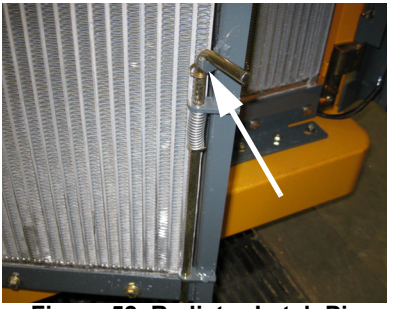


Figure 52 Radiator Latch Pin Placeholder

Draining/Flushing the Cooling System

1. Lower the lift arm and stop the engine. Allow the machine to cool.
2. Raise the engine cover and open the rear door (page 60).
3. Remove the radiator cap on the coolant tank (Figure 51).
4. Open the drain cock on the radiator (Figure 53) and drain the coolant into a suitable container.

Note: *Coolant must be drained from the radiator and the engine.*

5. Close the drain cock.

Note: *Protect the cooling system by adding premixed 50% water and 50% ethylene glycol to the system.*

Figure 53 Radiator Drain Cock

6. Fill the radiator fully and the coolant tank to half full.
7. Reinstall the radiator cap and run the engine until it is at operating temperature.
8. Stop the engine and let it cool. Check the coolant level. Add more fluid, if necessary.

⚠ WARNING Inflating or servicing tires can be dangerous. When possible, trained personnel should service and mount tires. To avoid possible death or serious injury, follow the safety precautions below.

To keep tire wear even, rotate the tires from front to rear and rear to front.

It is important to keep the same size tire on each side of the loader to prevent excessive wear on tires, chains, or other damage. If different sizes are used, tires will be turning at different speeds, causing excessive wear.

Note: *The tread bars of all tires should point the same direction.*

- BE SURE the rim is clean and free of rust.
- Lubricate the tire beads and rim flanges with a soap solution. Do NOT use oil or grease.
- Use a clip-on tire chuck with remote hose and gauge, allowing you to stand clear while inflating the tire.
- NEVER inflate beyond 35 psi (240 kPa) to seat the beads. If the beads have not seated by the time the pressure reaches 35 psi (240 kPa), deflate the assembly, reposition the tire on the rim, lubricate both parts and re-inflate. Inflation pressure beyond 35 psi (240 kPa) with unseated beads may break the bead or rim with explosive force sufficient to cause death or serious injury.
- After seating the beads, adjust the inflation pressure to the recommended operating pressure.
- Do NOT weld, braze or otherwise attempt to repair and use a damaged rim.

Checking Tire Pressure

Correct tire pressure should be maintained to enhance operating stability and extend tire life. Refer to the chart below for proper inflation pressures.

Tire Size	Inflation Pressure	
	psi	kPa
14 x 17.5 12-ply Heavy-Duty Flotation	65	450
14 x 17.5 14-ply Heavy-Duty Flotation	65	450
14 x 17.5 14-ply Severe-Duty	65	450

Heater/Air Conditioner Filters

The optional heater and heater/air conditioner include two filters: fresh air intake and recirculation air.

Refer to the *Replacement Parts* topic (page 58) for filter part numbers. Filters should be replaced as needed.

Fresh Air Intake Filter: Located directly behind the cover on the HVAC (heating, ventilating and air conditioning) housing mounted on the upper rear corner of the cab. Remove the threaded knobs on both sides of the cover to access the filter.

Recirculation Air Filters: Located behind the covers in the headliner directly above the rear window. The access, remove the screws on either side of the covers.

Important: *Keeping the cab clean will reduce need for service and help ensure proper air conditioner and heater operation. Failure to do so can cause evaporator and heater core plugging, fan noise, vibration and failure.*

Fuse Panels

The main fuse panels (Figure 54) are located behind two covers in the operator's compartment directly behind the operator's foot area, as well as the electrical engine disconnect switch. The illustrations of the fuse panels on this page may be rotated for easier reading.

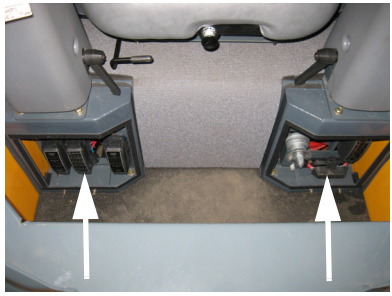


Figure 54 Main Fuse Panels and Engine Disconnect Switch

POWER RELAY 3
START SOL 30
BLOWER FAN 30
POWER RELAY 4

POWER RELAY 1
AC COND 30
POWER RELAY 2

SOL LOCK	AUX		HORN		START SAFETY
				DIAG CON 3	ENG CNTRL
	ECU 30	KEY SW 10	ECU 5	FAN 15	

SEAT AIR 15	REAR WIPER 10	ACCESS CHASSIS 20	FRONT WIPER 15	POWER TACH 3	
FAN MOD 5	ACCESS ROPS 20	GAUGES 10	DOME LIGHT 10	INTER-LOCK 10	
SOL LOCK 15	AC/HEAT 20	RADIO 10	FLASHER 15	REAR WK LIGHT 15	
LIGHTS MARKER 10	AC/2 SP 10	HORN 10	B/U ALARM 5	AUX CONT 10	FRONT WK LIGHT 15

Battery

⚠ WARNING Before servicing the batteries or electrical system, be sure the electrical engine disconnect switch is in the OFF position or disconnect the negative (ground) battery cable.

The batteries on the loader are 12-volt, group 24, wet-cell batteries. To access the batteries, remove the floor mat and pull up on the center foam cover (Figure 54) between the control handles to release it from its fasteners, then unbolt the metal cover beneath the crossmember.

The battery top must be kept clean. Clean it with an alkaline solution (ammonia or baking soda and water). After foaming has stopped, flush the battery top with clean water. If the terminals and cable connection clamps are corroded or have a build-up, disconnect the cables and clean the terminals and clamps with the same alkaline solution. Apply protective spray to prevent corrosion.

⚠ WARNING Explosive gas is produced when a battery is in use or being charged. Keep flames and sparks away from the battery area. ALWAYS charge the battery in a well-ventilated area.

Never lay a metal object on top of a battery, because a short circuit can result.

Battery acid is harmful on contact with skin or fabrics. If acid spills, follow these first-aid tips:

1. **Immediately remove any clothing on which acid spills.**
2. If acid contacts the skin, rinse the affected area with running water for 10 to 15 minutes.
3. If acid contacts the eyes, flood the 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.
4. To neutralize acid spilled on the floor, use one of the following mixtures:
   a. **1 pound (0.5 kg) of baking soda in 1 gallon (4 L) of water, or**
   b. **1 pint (0.5 L) of household ammonia in 1 gallon (4 L) of water**

Whenever a battery is removed, be sure to disconnect the negative (-) battery terminal connection first.

CHAPTER 6

TROUBLESHOOTING

Electrical System

Problem	Possible Cause	Remedy
Entire electrical system does not function.	Battery disconnect switch is in OFF position.	Turn battery disconnect switch to ON.
	Main wiring harness connectors at rear of ROPS/ FOPS not properly plugged in.	Check main harness connectors.
	Faulty keyswitch.	Replace keyswitch.
	10 amp fuse blown (key switch).	Replace keyswitch.
	Battery terminals or cables loose or corroded.	Clean battery terminals and cables and retighten them.
	Battery is faulty.	Test battery, replace as needed.
No instrument panel lamps with keyswitch turned to "ON."	Fuse has blown.	Replace fuse.
	Main wiring harness connectors at rear of ROPS/ FOPS not properly plugged in.	Check main harness connectors.
	Battery terminals or cables are loose or corroded.	Clean battery terminals and cables and retighten them.
Starter will not engage when key is turned to START.	Battery terminal or cables loose or corroded.	Clean terminal, cables and retighten
	Battery discharged or defective.	Recharge or replace battery.
	Seat or restraint bar switch malfunctioning or not actuated.	Contact your dealer.
	Ignition wiring, seat switch, restraint bar switch, etc. loose or disconnected.	Check wiring for poor connections, broken leads; repair wiring or connection.
	Start safety relay malfunction located in fuse panel.	Verify proper operation.
	Starter solenoid not functioning.	Contact your dealer.
	Starter relay malfunctioning.	Verify relay is working properly, replace.
	Starter or pinion faulty.	Remove starter; repair/ replace as needed.
	Engine fault code: (ECU will not allow crank if certain faults are present).	Contact your dealer.

Electrical System

Problem	Possible Cause	Remedy
Work lights not functioning properly.	Single light not working; light bulb burned out, faulty wiring.	Check and replace light bulb as needed. Check wiring connection to light.
	No lights; 10 or 15 ampere light fuse blown.	Check circuit and locate trouble before replacing fuse.
	Faulty light switch(es) or poor ground.	Check ground wire connections. Replace light switch.
Lift/Tilt and/or drive solenoids do not work.	Wiring to solenoids disconnected or faulty.	Troubleshoot circuit, repair.
	Restraint bar or seat switch malfunction.	Contact your dealer.
	Faulty solenoid valve coil.	Contact your dealer.
	Solenoid relay malfunctioning.	Verify relay is working properly, replace.
	Faulty fuse.	Verify relay is working properly if not, replace.

Engine

Problem	Possible Cause	Remedy
Engine turns over but will not start.	Engine cranking speed too slow.	Battery requires recharging or replacing, or, in cold temperatures, pre-warm the engine.
	Auxiliary valve engaged.	Return control valves to neutral.
	Fuel tank empty.	Refill fuel tank.
	Water in fuel filter	Purge water from filter.
	Engine fault codes displayed.	Identify problem and correct.
	Engine not warm enough.	Install block heater.
	Ambient temperature too low.	Install block heater.
	Fuel filter plugged.	Replace filter.
	Fuel pump not working.	Contact your dealer.
Engine overheats.	Crankcase oil level too low or too high.	Add or remove oil as required.
	Fan air circulation blocked or restricted.	With engine off, remove blockage or restriction.
	Hydraulic fan malfunctioning	Check module for power or hydraulic malfunction.
	Grade of oil improper or excessively dirty.	Drain and replace with proper grade new oil.
	Exhaust restricted.	Allow exhaust to cool, remove restriction.
	Air filter restricted.	Replace filter(s).
	Low coolant level.	Add coolant.

Hydrostatic Drive System

Problem	Possible Cause	Remedy
No response from either hydrostatic drive or the lift/tilt systems.	Hydraulic oil viscosity too heavy.	Allow longer warm-up or replace oil with proper viscosity oil.
	Hydraulic oil too low.	Check for low oil level in reservoir, add oil.
	Drive coupling failure.	Replace coupling.
Traction drive will not operate in either direction.	Parking brake is engaged.	Disengage parking brake.
	Hydraulic oil level low.	Check for low oil level in reservoir, add oil.
	Low or no charge pressure.	Contact your dealer.
	Hydrostatic pump(s) relief valves malfunctioning.	Contact your dealer.
	Restraint bar raised.	Lower restraint bar.
	Restraint bar or seat switch malfunctioning.	Contact your dealer.
Sluggish acceleration.	Air in hydraulic system.	Cycle lift and tilt cylinders to maximum stroke and maintain pressure for short time to clear air from system. Also check for low oil level in reservoir, fill as needed.
	Hydraulic oil level too low.	Check for low oil level in reservoir, add oil.
	Hydrostatic system charge pressure low.	Contact your dealer.
	Drive motor(s) or hydrostatic pump(s) have internal damage or leakage.	Contact your dealer.
Hydrostatic drive overheating.	Drive system overloaded continuously.	Improve efficiency of operation.
	Lift/tilt or auxiliary system overloaded continuously.	Improve efficiency of operation.
	Drive motor(s) or hydrostatic pump(s) have internal damage or leakage.	Contact your dealer.
	Oil cooler fins plugged with debris.	Clean oil cooler fins.
	Hydrostatic oil filter plugged or restricted.	Replace filter.
	Loader being operated in high temperatures with no air circulation.	Reduce duty cycle; improve air circulation.

Hydraulic System

Problem	Possible Cause	Remedy
Hydrostatic (drive) system is noisy.	Hydraulic oil viscosity too heavy.	Allow longer warm-up or replace oil with proper viscosity oil.
	Air in hydraulic system.	Cycle lift and tilt cylinders to maximum stroke and maintain pressure for short time to clear air from system. Also check for low oil level in reservoir, fill as needed.
	Drive motor(s) or hydrostatic pump(s) have internal damage or leakage.	Contact your dealer.
Right side doesn't drive in either direction. Left side operates normally.	Relief valves on rear hydrostatic pump malfunctioning.	Contact your dealer.
Right side doesn't drive in one direction.	Relief valve on rear hydrostatic pump malfunctioning.	Contact your dealer.
	Rear hydrostatic pump malfunctioning.	Contact your dealer.
Left side doesn't drive in either direction. Right side operates normally.	Relief valves on front hydrostatic pump malfunctioning.	Contact your dealer.
Left side doesn't drive in one direction.	Relief valve on front hydrostatic pump malfunctioning.	Contact your dealer.
	Front hydrostatic pump malfunctioning.	Contact your dealer.
Lift/Tilt controls fail to respond.	Restraint bar raised.	Lower restraint bar.
	Hydraulic oil viscosity too heavy.	Allow longer warm-up or replace with proper viscosity oil.
	Hydraulic oil level low.	Check oil level in reservoir. If oil is low, check for external leak, repair and add oil.
	Solenoid valve malfunctioning.	Check electrical connections to pilot solenoid and repair.
	Restraint bar or seat switch malfunctioning.	Contact your dealer.

Hydraulic System

Problem	Possible Cause	Remedy
Hydraulic cylinder action is slow for lift and/or tilt functions.	Low engine speed.	Operate engine at higher speed.
	Hydraulic oil viscosity too heavy.	Allow longer warm-up or replace with proper viscosity oil.
	Hydraulic oil level low.	Check oil level in reservoir. If oil is low, check for an external leak. Repair and add oil.
	Hydraulic oil leaking past cylinder piston seals.	Contact your dealer.
	Worn pump.	Contact your dealer.
	Solenoid valve malfunctioning or one of the two cartridges on solenoid valve malfunctioning.	Check electrical connections to pilot solenoid and repair connections as needed. If solenoid valve is still not functioning properly, contact your dealer.
	Load-sense malfunctioning	Contact your dealer.
Bucket does not level on the lift cycle.	Self-leveling valve misadjusted or malfunctioning.	Contact your dealer.
Jerky lift arm and bucket action.	Seat or restraint bar switch malfunctioning.	Contact your dealer.
	Air in hydraulic system.	Cycle/lift and tilt cylinders to maximum stroke and maintain pressure for short time to clear air from system.
	Oil in hydraulic reservoir low.	Check and add oil.
No down pressure on the bucket.	Float or Hydraglide activated.	Turn off float and Hydraglide.
	Tilt cylinders malfunctioning.	Contact your dealer.
	Malfunctioning relief valve in main control valve.	Contact your dealer.
Bucket drifts down with tilt control in neutral.	Oil leaking past tilt cylinder seals (internal or external).	Contact your dealer.
	Self-leveling valve malfunctioning.	Contact your dealer.
	Leaking hydraulic hoses, tubes or fittings between control valve and cylinders.	Check oil level in reservoir. If oil is low, check for external leaks, repair and add oil.
Bucket will not tilt, lift arm works properly.	Tilt spool in control valve not actuated or leaking.	Check tube connections to valve.

Hydraulic System

Problem	Possible Cause	Remedy
Lift arm does not raise, bucket tilt works properly.	Lift spool in control valve not actuated or leaking.	Check tube connections to valve.
Lift arm does not maintain raise position with left control in NEUTRAL.	Oil leading past lift cylinder seals (internal or external).	Contact your dealer.
	Oil leaking past lift spool in control valve.	Contact your dealer.
	Self-leveling valve malfunctioning.	Contact your dealer.
	Leaking hydraulic hoses, tubes or fittings between control valve and cylinders.	Inspect hoses and tubes, tighten fittings as needed. Replace as needed.
Lift arm will not lower or raise.	Lift arm support device engaged.	Raise lift arm and remove support device.
	Restraint bar not lowered.	Lower restraint bar.
	Seat or restraint bar switch malfunction.	Contact your dealer.
Auxiliary hydraulics do not function.	Restraint bar raised.	Lower the restraint bar.
	Pilot solenoids malfunctioning.	Check electrical connections to pilot solenoids, repair connections as needed. If still not functioning properly, contact your dealer.
	Control handle malfunctioning	Contact your dealer.
	Foot pedal malfunctioning	Contact your dealer.
	T-Bar controls - Fan/All-tach module malfunctioning	Contact your dealer.
	Restraint bar or seat switch malfunctioning.	Contact your dealer.

Hydraulic System

Problem	Possible Cause	Remedy
High-flow auxiliary functions slowly.	Low engine speed.	Operate engine at higher speed.
	Hydraulic oil level low.	Add oil.
	Hydraulic oil viscosity too heavy.	Allow longer warm-up, or replace oil with proper viscosity oil.
High-flow auxiliary does not function.	Restraint bar raised.	Lower the restraint bar.
	Pilot solenoids malfunctioning.	Check electrical connections to solenoid, repair connections as needed. If still not functioning properly, contact your dealer.
	Switch malfunctioning	Contact your dealer.
	Module malfunctioning	Contact your dealer.
	Solenoid malfunctioning	Contact your dealer.
	Restraint bar or switch malfunctioning.	Contact your dealer.

CHAPTER 7

MAINTENANCE

This *Maintenance Interval* chart was developed to match the *Service* chapter of this manual. Detailed information on each service procedure is in the *Service* chapter. A *Maintenance Log* follows this chart for recording maintenance performed. Recording 10-hour (or daily) service intervals is impractical and is not recommended.

Important: *Under severe operating conditions, more frequent service than the recommended intervals may be required. You must decide, based on your use, if your operation requires more frequent service.*

Service Procedure	Maximum Interval		
	10 Hours (or Daily)	250 Hours	500 Hours (or Annually)
Remove Foreign Material (page 62)	●		
Check Engine Air Cleaner Restriction Indicator (page 67)	●		
Check Engine Oil Level (page 70)	●		
Check Hydraulic Oil Level (page 83)	●		
Check Tire Pressures (page 87)	●		
Grease Hitch, Hitch-related Cylinder Pivots and Latch Pins (page 63)	●		
Check Bucket Cutting Edge (page 84)	●		
Test Safety Interlock System (page 20)	●		
Check Coolant Level (page 85)	●		
Clean Cooling System (page 85)	●		
Grease Lift Arm Pins (page 63)		●	
Check Drive Chain Tension (page 66)		●	
Check Wheel Nuts Torque (page 85)	❍	●	
Check All-Tach® Pivot Torque (page 85)		●	
Check Oil Level in Chaincases (page 65)		●	
Check Alternator/Fan Belt Tensions (page 84)		●	
Change Engine Oil and Filter (page 70)	❑	●	
Change Hydraulic Oil Filter (page 83)	❑		●
Check Battery (page 90)			●
Check Engine Mounting Hardware (page 70)			●
Change Fuel Filter (page 71)			●
Change Hydraulic Oil (page 84)			◆
Check and Drain Water Separator (page 71)	●		
Change Chaincase Oil (page 65)	❑		◆

❍ Perform the initial procedure at 2 hours then at "●" intervals.
☐ Perform the initial procedure at 50 hours then at "●" or "◆" intervals.
❖ Severe operating conditions.
◆ Perform the procedure at 1000 hours.

Maintenance Log

Date	Hours	Service Procedure

Maintenance Log

Date	Hours	Service Procedure

Maintenance Log

Date	Hours	Service Procedure

CHAPTER 8

SPECIFICATIONS

Loader Specifications

Specification	V400
Operating Weight (approx)	11,100 lbs. (5035 kg)
Shipping Weight (approx)	10,140 lbs. (4599 kg)
Rated Operating Load[1]	4000 lbs. (1814 kg)
Engine	
Make	Cummins (Turbocharged)
Model	QSB4.5
Displacement	273 cu. in. (4,5 L)
Power (net)	99 hp (74 kW) @ 2200 rpm
Peak Torque	326 ft.-lb. (442 N·m) @ 1300 rpm
Hydraulic System (theoretical)	
Main Hydraulic System Pressure	3450 psi (238 bar)
Standard-Flow Rating	32.0 gpm (121,1 L/min)
High-Flow System Pressure	3450 psi (238 bar)
High-Flow Rating	41.0 gpm (155,2 L/min)
Electrical	
Battery	12-Volt DC, 675 CCA
Starter	12-Volt DC (4.8 kW)
Alternator	130-amperes
Capacities	
Chaincase (each)	12 U.S. qts. (11,4 L)
Engine Oil	11.75 U.S. qts. (11,1 L)
Engine Coolant	16 U.S. qts. (15,1 L)
Fuel Tank	31.25 U.S. gal. (118,3 L)
Bare Hydraulic Reservoir	16.75 U.S. gal. (63,4 L)
Entire Hydraulic System	24.50 U.S. gal. (92,7 L)
Maximum Travel Speed - Low	6.42 mph (10,3 kph)
Maximum Travel Speed - High	12.5 mph (20,0 kph)
Sound Levels (with EU Sound Attenuation Package)	
Sound Pressure Level (Operator Ear)	85 dB(A)
Sound Power Level (Environmental)	101 dB(A)

1. Operating load rated with an 84 in. (2134 mm) 27.0 cu. ft. (0.76 m3) Dirt/ Construction bucket and 14 x 17.5 NHS tires in accordance with SAE J818 and ISO 14397-1.

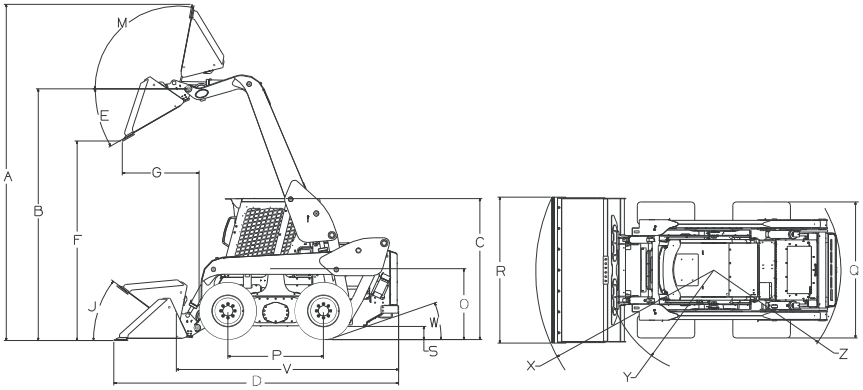
Standard Features

- Information Center Electronic Display
- Hydraulic Oil Temperature Indicator Lamp
- Battery Charge Indicator Lamp
- Seatbelt Indicator Lamp and Buzzer
- Choice of three control types: Hand/Foot, Dual Joystick or T-Bar
- Hand Throttle
- Acoustical Cab Material and Headliner
- Adjustable Operator Restraint Bar with Armrests (Hand/Foot and Dual Joystick only)
- ROPS/FOPS (ISO 3471, ISO 3449 Level II)
- Skid Plate for Clean Out
- Interior Dome Light
- Self-Leveling Lift Action
- Hydraloc™ System – Brakes and Interlock for Starter, Lift Cylinders, Tilt Cylinders, Auxiliary Hydraulics, Wheel Drives
- Upper-torso Restraint
- Dual-Element Air Cleaner with Visual Indicator
- Anti-Vandalism Rear Door
- Pre-Heat Starting Assist
- Servo-Controlled Hydrostatic Drive
- Lift Arm Support Device
- Dual Front and Rear Halogen Work Lights and Dual Tail Lights
- Bi-directional Auxiliary Hydraulics with Flat-Faced Couplers
- All-Tach® Attachment Mounting System: Single-Lever (manual)
- Engine Auto-Shutdown System
- Emergency Exit Rear Window
- Adjustable Suspension Seat
- Hydraglide™ Ride Control System
- Two-Speed Drive
- Foot Throttle/Dual Joystick and T-Bar
- Battery Disconnect Switch
- Horn

Optional Features

- 3-inch Wide Seatbelt – where required by law
- Sliding Side Windows
- Rear-View Mirror
- Front Door with Wiper
- Operator's Compartment Heater/Defroster/Air Conditioner with Filters
- Audible Back-Up Alarm
- Strobe Light
- Bucket Bolt-On Cutting Edge Kits
- Engine Block Heater
- Bi-directional High-Flow Auxiliary Hydraulics with Flat-Faced Couplers
- Impact-Resistant Front Door Window
- Engine Air Pre-Cleaner
- Single and Four-Point Lift
- Power-A-Tach®
- EU Completing Package (EU Only)
- Air Suspension Seat

Dimensional Specifications



V400		27.0 ft³ (0.76 m³) Bucket w/14 x 17.5 Tires	
		inches	mm
A	Overall Operation Height – Fully Raised	186.8	4745
B	Height to Hinge Pin – Fully Raised	143.6	3647
C	Overall Height – Top of ROPS	82	2083
D	Overall Length – Bucket Down	158.5	4026
E	Dump Angle at Full Height	31°	
F	Dump Height	114.8	2916
G	Dump Reach – Bucket Full Height	39.5	1003
J	Rollback at Ground	31°	
M	Rollback Angle at Full Height	100°	
O	Seat to Ground Height	41.2	1046
P	Wheel Base – Nominal	54.6	1387
Q	Overall Width – Less Bucket[1]	79.5	2019
R	Bucket Width – Overall	84	2134
S	Ground Clearance – to Chassis (Between Wheels)	7.3	185
V	Overall Length (Less Bucket)	121.5	3086
W	Departure Angle	19°	
X	Clearance Circle – Front (With Bucket)	88.5	2248
Y	Clearance Circle – Front (Less Bucket)	50.8	1290
Z	Clearance Circle – Rear	70.5	1791

1. Overall width (Q) is dependent upon the amount of wheel offset.

V400

Note: Use the Common Materials and Densities table (page 107) for selecting the appropriate bucket.

Dirt/Construction Buckets

Description	Weight		V400 Rating
84 in./27.0 ft³ (2134 mm/0.76 m³)	875 lbs. (397 kg)		4000 lbs. (1814 kg)
84 in./27.0 ft³ HD (2134 mm/0.76 m³)	989 lbs. (449 kg)		3963 lbs. (1798 kg)
90 in./29.0 ft³ (2286 mm/0.82 m³)	919 lbs. (417 kg)		4000 lbs. (1814 kg)

Landscaping/Grading

Description	Weight		V400 Rating
84 in./23.3 ft³ (2134 mm/0.66 m³)	822 lbs. (373 kg)		4000 lbs. (1814 kg)

Light Material

Description	Weight		V400 Rating
90 in./37.0 ft³ (2286 mm/1.05 m³)	918 lbs (416 kg)		4000 lbs. (1814 kg)

Pallet Forks - 48 in. (1229 mm)

Description	Weight		V400 Rating
For 15.7 in. (400 mm) Load Center per EN 474-3	470 lbs. (213 kg)		3695 lbs. (1676 kg)
For 19.7 in. (500 mm) Load Center per EN 474-3	470 lbs. (213 kg)		3433 lbs. (1557 kg)
For 24 in. (670 mm) Load Center per SAE J1197	470 lbs. (213 kg)		3190 lbs. (1447 kg)

Common Materials and Densities

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

Note: *The densities listed are average values and intended only as a guide for bucket selection. For a material that is not in the table, obtain its density value before selecting the appropriate bucket.*

Bucket Selection

To use the table, find the material to be loaded and its maximum density. Then multiply the volumetric rating of the attachment by the material density to determine if the attachment can safely be used. See page 106 for a listing of attachments and their ratings.

Where the material density is listed as a range (snow at 15-50 lbs./ft^3, for example), always use the maximum density (50 lbs./ft^3 in this example) for making calculations. Also, see the following examples.

Example 1: Clay (density of 80-100 lbs./cu. ft.) is to be hauled with a V400 model skid loader using a 84 in. dirt/construction bucket (SAE J742-rated heaped capacity of 27.0 cu. ft.). With this bucket, the V400 has a rating of 4000 lbs. Multiplying the maximum density of the material by the bucket capacity (100 x 27.0) yields a load that weighs 2700 lbs. This number is less than the machine rating and thus indicates that the loader/bucket combination is safe to use in this application.

CHAPTER 9

TORQUE SPECIFICATIONS

Use these torque values when tightening hardware (excluding locknuts, and self-tapping, thread-forming, and sheet metal screws) unless otherwise specified.

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

METRIC COARSE THREAD	GRADE 8.8		GRADE 10.9		GRADE 12.9	
	DRY	LUBED	DRY	LUBED	DRY	LUBED
M6-1	8	6	11	8	13.5	10
M8-1.25	19	14	27	20	32.5	24
M10-1.5	37.5	28	53	39	64	47
M12-1.75	65	48	91.5	67.5	111.5	82
M14-2	103.5	76.5	145.5	108	176.5	131
M16-2	158.5	117.5	223.5	165.5	271	200

*All torque values are in ft.-lbs., except those marked with an *, which are in in.-lbs. For metric torque value (N·m), multiply ft.-lbs. value by 1.355, or the in.-lbs. value by 0.113.

GEHL COMPANY

WARRANTY

GEHL COMPANY, hereinafter referred to as 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 Gehl 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 STATEMENT; ALL OTHER TERMS WILL CONTINUE TO APPLY.

SOME STATES DO NOT PERMIT THE EXCLUSION OF 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 parts or attachments; accident or other casualty.
6. Liability for incidental or consequential damages of any type, including, but not limited to lost profits and 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.

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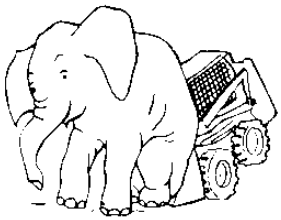
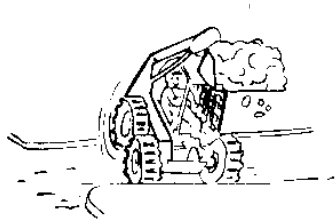
WRONG



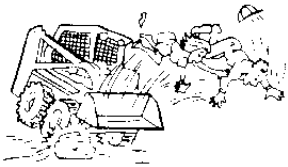
Never exceed rated operating load.

WRONG



Always carry attachment as low as possible. Do not travel or turn with the lift arm raised. Load, unload and turn on flat level surface.

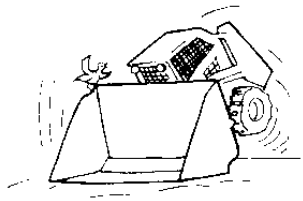
WRONG



Never carry riders.

Keep bystanders away from work area.

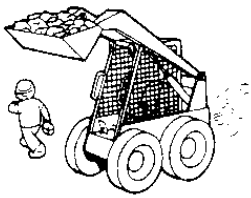
WRONG



Never modify equipment.

Use only attachments approved for model loader.

WRONG



Never leave loader with engine running or with lift arm up. To park, engage parking brake and put attachment flat on the ground.

⚠ WARNING ⚠

THIS OPERATOR'S MANUAL IS PROVIDED FOR OPERATOR USE

DO NOT REMOVE FROM THIS MACHINE

Do not start, operate or work on this 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 this machine, contact your dealer or the Gehl Service Department before starting or continuing operation.

California Proposition 65 Warnings

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer and birth defects or other reproductive harm.
Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. Wash hands after handling battery.

GEHL®

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