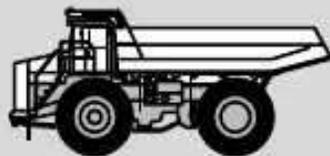




**TEREX** 



**TR45/60**

Operation - Safety - Maintenance

<https://www.besttruckmanuals.com/>

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Ref No. OHE 817-839 July 2003

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**ONLY TRAINED PERSONNEL SHOULD BE  
ALLOWED TO OPERATE THIS VEHICLE**

The operator is responsible and must be familiar with the contents of the Operator's Handbook and any local regulations prior to operating this vehicle.



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## **CALIFORNIA Proposition 65 Warnings**

**WARNING:** Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

**WARNING:** Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm.  
**Wash hands after handling.**

---

## **SPARE PARTS STATEMENT**

When carrying out repairs, alterations or fitting attachments, it is important that only genuine spare parts are used to ensure the operating safety of the machine is not impaired.

It is only by using genuine parts that the technical requirements stipulated by the manufacturer can be maintained.

If a General Operating Approval is issued for this machine, it may be considered null and void if non-genuine parts are used.



## EC DECLARATION OF CONFORMITY

| MANUFACTURERS NAME AND FULL ADDRESS  |                    |                                 |                          |
|--|--------------------|---------------------------------|--------------------------|
| TEREX EQUIPMENT LIMITED,<br>MOTHERWELL,<br>SCOTLAND,<br>ML1 5RY  |                    |                                 |                          |
| DESCRIPTION OF MACHINERY   |                    |                                 | DIRECTIVES COMPLIED WITH |
| MAKE:  | TEREX              |                                 | 87/404/EEC      97/23/EC |
| MODEL:   | TR45 RIGID TRUCK   |                                 | 89/336/EEC               |
|  | TR60 RIGID TRUCK   |                                 | 98/37/EEC                |
|  |                    |                                 | 2000/14/EC               |
| UNIT SERIAL NO.  |                    |                                 | DATE OF MANUFACTURE:     |
| INSPECTOR:   |                    |                                 |                          |
| THE ABOVE MACHINERY, TAKING INTO ACCOUNT THE STATE OF THE ART,<br>COMPLIES WITH, OR IS DESIGNED AND CONSTRUCTED AS FAR AS POSSIBLE TO COMPLY WITH,<br>THE ESSENTIAL HEALTH AND SAFETY REQUIREMENTS OF THE MACHINERY DIRECTIVE. |                    |                                 |                          |
| FOR AND ON BEHALF OF THE MANUFACTURER:   |                    |                                 |                          |
| NAME:  | GEORGE McADAM      | SIGNATURE: <i>George McAdam</i> |                          |
| POSITION:  | TECHNICAL DIRECTOR |                                 |                          |

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## INTRODUCTION

This Handbook is provided as a guide to familiarize the operator and serviceman with the controls, recommended inspections, start-up, operating, shutdown and parking procedures for the TR45 and TR60 Trucks.



Look for this symbol to point out important safety precautions. It means: **ATTENTION! BECOME ALERT! YOUR SAFETY AND THE SAFETY OF OTHERS IS INVOLVED!**

### Safety Precautions

The truck should be properly operated and maintained to keep it in safe, efficient operating condition. Be sure that all controls are free of mud, grease, or other matter that might cause slips hazardous to the operator, serviceman, or other personnel or equipment. Report all malfunctions to those responsible for maintenance and do not operate the equipment until corrected. Normal service or maintenance performed as required can prevent unexpected and unnecessary downtime.

This Handbook describes general inspections, servicing and operation with the normal safety precautions required for normal servicing and operating conditions. It is not a guide however, for other than normal conditions or situations, and therefore, servicemen and operators must be safety conscious and alert to recognize potential servicing or operating safety hazards at all times, and, take necessary precautions to ensure safe servicing and operation of the truck.

READ the CIMA Safety Manual supplied with this truck.



## **WARNING**

**These trucks are equipped with cylinders containing compressed nitrogen gas. Transportation of these trucks by any method may require a special permit from the appropriate authority of the country involved. Consult your dealer for details.**

All information, illustrations and specifications contained in this publication are based on the latest product information available at the time of publication. The right is reserved to make changes at any time without notice.

Continuing improvement and advancement of the design may cause changes to your truck which may not be included in this publication. Each publication is reviewed and revised, as required, to update and include these changes in later editions.

This Handbook contains lubrication and routine servicing instructions, most of which can be performed in the field. Maintenance manuals containing repair/rebuild procedures can be obtained from your dealer.

## Truck Identification

While reading this handbook you will notice references to controls and equipment which may not be found on all trucks. It is important that you know your truck and its equipment and how to operate it properly.

Information regarding the truck model, code and chassis serial number is found on the unit serial number plate mounted on the left-hand side of the truck adjacent to the steps. The truck model and serial number should always be referenced in any correspondence with your dealer or factory.

There is a dealer serving every part of the world where these products are sold. Your dealer is ready to provide you with any additional information needed and should be consulted for additional publications for this truck.



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## **Theft Deterrent Practices**

### **General**

The owner/operator should take the following precautions to discourage theft, to aid in the recovery in the event that the truck is stolen, or to reduce vandalism.

### **Actions to Discourage Theft and Vandalism**

Remove all keys any time the truck is left unattended.

At night lock all doors and attach, secure or lock all anti-vandalism and anti-theft devices on the truck.

Immobilize the truck by removing a critical electrical or starting system device.

Upon receipt of a truck, record the truck serial number and the serial numbers of all major components and attachments. Keep this list up to date and filed in a safe location for fast retrieval.

Place a decal or notice on the truck that all serial numbers are recorded.

Discourage the thief! Inspect the gates and fences of the machinery storage yard or construction site. Keep trucks in well-lit areas and ask the local law

enforcement authorities to make frequent checks around the storage yard or work site.

Establish liaison with neighbours and ask them to watch equipment left at job sites and to report any suspicious activities to the local law enforcement authorities.

Make frequent inventories of trucks to promptly detect losses or vandalism.

---

### **Actions to Aid in Recovery of Stolen Trucks**

In the event of theft, immediately notify the law enforcement authorities having jurisdiction. Provide the investigating officer with name, type of equipment, chassis and serial numbers of major attachments and components. It is helpful to show the investigating officer an Operator's Handbook, photographs and advertising, to familiarize him with the appearance of the truck.

Report the theft to the insurance company. Provide the model and all serial numbers.

Report the model and serial numbers of the stolen truck to a dealer handling the respective line of equipment. Request that the dealer forward this same information to the equipment manufacturer.



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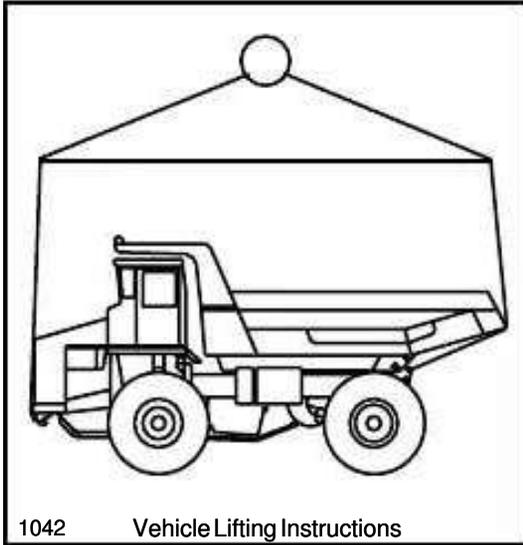
## **2 - Safety Precautions**

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## SAFETY PRECAUTIONS

### General

- \* Read this Operator's Handbook and learn the operating characteristics and limitations of the machine. Know what operating clearances the machine requires.
- \* Read the CIMA Safety Manual and follow the recommended safety precautions.
- \* Know clearances of all side and overhead obstructions such as wires, bridges, etc., for operating safely.
- \* Always know all traffic rules, signs, flags and hand signals used on the job and know who has the responsibility for signalling.
- \* Be aware of operating hazards that weather changes can create on the job. Know proper procedures to follow when a severe rain or electrical storm strikes.
- \* Never attempt to operate or work on a machine when not feeling physically fit.
- \* Know what safety equipment is required and use it. Such equipment may be:
  - Hard hat, safety glasses, reflector-type vests, respirators and ear plugs.
- \* Never wear loose clothing, rings, watches etc., that might catch levers and controls and cause loss of control.
- \* Keep hands and controls free from water, grease and mud to assure nonslip control.
- \* Handle fuels and lubricants carefully and clean up spills to avoid fire and slipping hazards.



- \* Clean any mud, grease or oil from controls, handrails, ladders and decks. Lash necessary tools securely and remove all loose items before operating machine.
- \* Never rush. Walk, do not run.
- \* Never carry more than one passenger and only in the passenger seat.

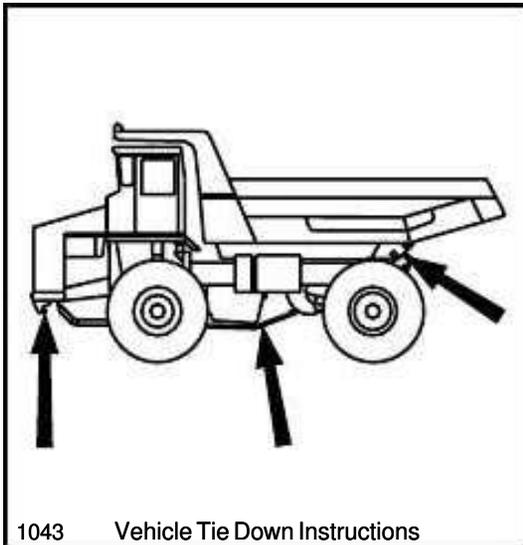


### **WARNING**

The protection offered by the roll over protective structure may be impaired if the Cab Guard or Body Guides have been subjected to any modification or damage.

### **Vehicle Lifting Precautions**

- \* Prior to lifting, the vehicle should be parked on a level surface, wheels blocked and the park/emergency brake disengaged.
- \* The vehicle should be lifted using a spreader bar if possible. Lift using FOUR slings from the lifting points provided at the front bumper and the rear of the chassis. Refer to the 'SLINGING INSTRUCTIONS' decal mounted on the left-hand side of the machine, adjacent to the ladders. If in any doubt contact your dealer for further information.



### **Vehicle Tie Down Precautions**

- \* The vehicle should be secured at the tie down points located at the front bumper, the transmission guard and at the safety pin location at the rear of the chassis.

---

## Preventing Fire Hazards

### General Fire Precautions

- \* Make sure machine has fire extinguisher and that it is accessible and fully charged. (Not furnished with machine).
- \* Never use an open flame as a light anywhere on or around the machine.
- \* Clean all dirt, oil, grease and other fluids from systems and components to minimize fire hazards and aid in spotting loose or leaking hoses, fittings etc.
- \* Check the engine compartment for trash, oily rags or other debris that could cause fires before starting the engine.
- \* Don't let greasy, oily rags or similar hazards accumulate in the cab.
- \* If the machine has been operated with an under inflated tyre. Make sure that the tyre has cooled sufficiently before parking and leaving the machine unattended.

### Flammable Fluid Precautions

- \* Don't use diesel fuel or other flammable fluids for cleaning purposes. Use approved, nonflammable solvents.
- \* Make sure all fluid system caps, drain cocks, valves, fittings, hoses, etc., are secure and leak free.
- \* Never use an open flame (match, lighter etc.) when checking fuel, lubricant, coolant and battery fluid levels or when checking for fluid leaks. Use a flashlight or other safe lighting only.

- 
- \* Shut off engine and use extra caution if engine is hot when refuelling. Ground the hose spout to prevent sparks when spout is touched to fuel tank filler tube.
  - \* Never smoke while checking or adding fuel or other fluids or handling fluid containers and hoses.
  - \* Use care and do not stand downwind when adding fuel or other flammable fluids to tanks and reservoirs to avoid fluids being blown or splashed onto clothing.
  - \* Close fuel tank shut-off valves, if used, before servicing fuel system.
  - \* When preparing machines or components for storage, seal and tape all openings and close containers tightly to seal in all volatile inhibitor fluids and compounds used.
  - \* Follow manufacturer's recommendations when handling and using engine-starting fluids and disposing of spent containers. Do not puncture or burn empty containers. These fluids are explosive and highly flammable.

### **Electrical Hazard Precautions**

- \* Never smoke or allow open flames or sparks near batteries.
- \* Leave battery box open when charging batteries in machine for adequate ventilation of explosive gas (hydrogen) produced.
- \* Always disconnect batteries before repairing electrical system to avoid danger of fire-causing sparks. Disconnect battery ground cable first and reconnect last.

- 
- \* Always disconnect batteries and alternator leads before carrying out any welding on the machine.
  - \* Never check battery charge by placing metal objects across battery posts to avoid sparks at battery posts.
  - \* Use jumper cables only as recommended. Improper use can result in battery explosion or unexpected machine motion.
  - \* Never operate engine starter for more than 30 seconds and allow two minutes between cranking periods for cooling. An overheated starter could cause a fire.
  - \* If electric coolant or lubricant heaters are used, be sure to follow heater manufacturer's recommendations for use to avoid electrical and/or fire hazards.

## **Mounting and Dismounting**

- \* Only use steps and handrails provided to mount or dismount machine. Do not grasp steering wheel; any pressure in the accumulator will turn the front wheels.
- \* Always face the access system and maintain at least three points of support to mount or dismount machine.
- \* Always use care when mounting machine with oil covered, frosted, or iced fenders, decks, handrails or steps.
- \* Never mount or dismount a moving machine. Never jump off the machine.

---

## **Pre-Starting**

- \* If engine is to be started and run indoors, ensure proper ventilation to remove deadly exhaust gases.
- \* Always perform 'Pre-Starting Inspection' instructions described on page 4-2 to ensure the machine is ready for operation.
- \* Always walk around the machine to make sure no-one is working on, underneath or close to the machine before starting the engine or operating the machine.
- \* Adjust, secure and latch the seat and fasten the seat belt before starting the machine.
- \* Sound horn before starting the engine or beginning to move the machine; two blasts for forward and three blasts for reverse.

## **Starting**

- \* Do not start the engine or operate any control if there is a 'DO NOT OPERATE' or similar warning sign attached to any control.
- \* Use jumper cables only as recommended. Improper use can result in battery explosion or unexpected machine motion.
- \* Always obey 'Starting the Engine' instructions described on page 4-7.
- \* Do not bypass the machine's neutral-start system. The neutral-start system must be repaired if it malfunctions.
- \* Start and operate the machine only from the operator's station.

---

## Operating

- \* Ensure all cab glass, mirrors and light lenses are clean during machine operation for maximum visibility.
- \* Always keep cab floor clear of anything that could restrict full operation of pedals.
- \* Always make sure all gauges, warning/indicator lights and controls are working properly before operating machine.
- \* Always perform 'Pre-Operating Checks' described on page 4-10 to ensure the machine is ready for operating.
- \* Always wear seat belts when operating the machine.
- \* In the event of a loss of steering pump output pressure, a fully-pressurized accumulator provides a maximum of two lock to lock turns of the front wheels. A red warning light on the instrument panel illuminates when steering pressure falls below 83 bar (1 200 lbf/in<sup>2</sup>) If this light illuminates, indicating a loss of steering power, the machine must be stopped immediately and no further operation attempted until the fault is corrected.
- \* Do not operate if exposed personnel enter the immediate work area.
- \* Sound horn before starting engine or beginning to move machine; two blasts for forward and three blasts for reverse.
- \* Watch for ground crew and other personnel on foot. Sound horn as a warning before setting machine in motion and when approaching ground crew.
- \* Be sure the body is fully down before moving the machine.
- \* Always try to face or look in the direction of travel.

- 
- \* Use extreme caution and turn on lights at night or when fog, dust or similar hazards limit visibility. Do not overdrive your headlights.
  - \* Observe instruments frequently. Report any defects or unusual noises in machine during operation.
  - \* Stay in gear when driving downhill. Do not coast with transmission in neutral. Select the proper gear and maintain safe speed with the service brakes or/ and retarder (if fitted). Always maintain safe speeds for haul road operating conditions for maximum control. Reduce speed before turning.
  - \* Always operate straight up or down slopes whenever possible, side-hill operation can cause sideslip and possible roll-over.
  - \* Slow down when moving in congested areas. Do not race with other machines. Stop in authorized areas only, except in emergency.
  - \* Brake firmly in one application. Do not FAN the pedal. Never operate the machine if a warning light indicates a fault in the brake system.
  - \* Always give loaded machines the right-of-way when your machine is empty.
  - \* Always watch for holes, soft edges or other hazards when backing to dump over a spoil bank.
  - \* Always apply the brakes with the Parking-Emergency brake control when the machine is being loaded or when dumping a load.
  - \* Always stay in the cab when machine is being loaded.
  - \* Always lower the body and shut down the machine, according to the procedure under "Stopping the Engine" described on page 4014, before leaving the machine unattended. If on a grade wheels should be blocked.

---

## Roading

- \* Match speed to road conditions.
- \* Yield the right of way when required. Obey the rules of the road.
- \* Stay as close to the side of the road as possible. Pass other equipment only when the road is clear and enough room and reserve power are available.
- \* Stop at appropriate intervals to inspect the machine and allow the tyres to cool. Tyre air pressure will rise during operation. Do not reduce tyre pressure. Excess speed will cause tyres to heat up. Reduce your travel speed, not tyre pressure.
- \* Use accessory lights and devices at night or in poor visibility. Carry a flare kit. Do not overdrive your headlights.

---

## Lubrication and Servicing

- \* Do not allow unauthorized personnel to service or maintain this machine. Study the Operator's Handbook and Service Manual before starting, operating or servicing this machine. Always follow procedures and safety precautions detailed throughout the Service Manual.
- \* Always attach a 'DO NOT OPERATE' or similar warning sign to ignition switch or a control before cleaning, lubricating or servicing the machine.
- \* Never allow anyone to work on the machine while it is moving. Make sure no one is on the machine before working on it.
- \* Do not work under or near unblocked or unsupported body. Always use the body safety pins.
- \* Do not work under or near any unblocked or unsupported linkage, part or truck.
- \* Always relieve pressure before servicing any pressurized system. Follow the procedures and safety precautions detailed in the Service Manual.
- \* Always shut down machine according to the procedure under 'Stopping The Engine' described on page 4-14 before cleaning, lubricating or servicing the machine except as called for in this Handbook or the Service Manual.
- \* When changing oil in the engine, transmission and hydraulic systems, or removing hydraulic lines, remember that the oil may be hot and can cause burns to unprotected skin.
- \* When working on or around exhaust components, remember that the components may be hot and can cause burns to unprotected skin.
- \* Always deflate tyre before attempting to remove any embedded objects or removing the tyre and rim assembly from the machine.
- \* Always use a self-attaching chuck with a long airline and stand to one side while the tyre is inflating. Refer to Section 160-0050, WHEEL RIM AND TYRE in the Service Manual.

---

## Wheels and Tyres

If tyres on a machine were inflated at the factory with dry nitrogen gas, the tyre walls will be marked 'N' and the following factory installed decal will be found mounted on either side of the cab platform and the body.

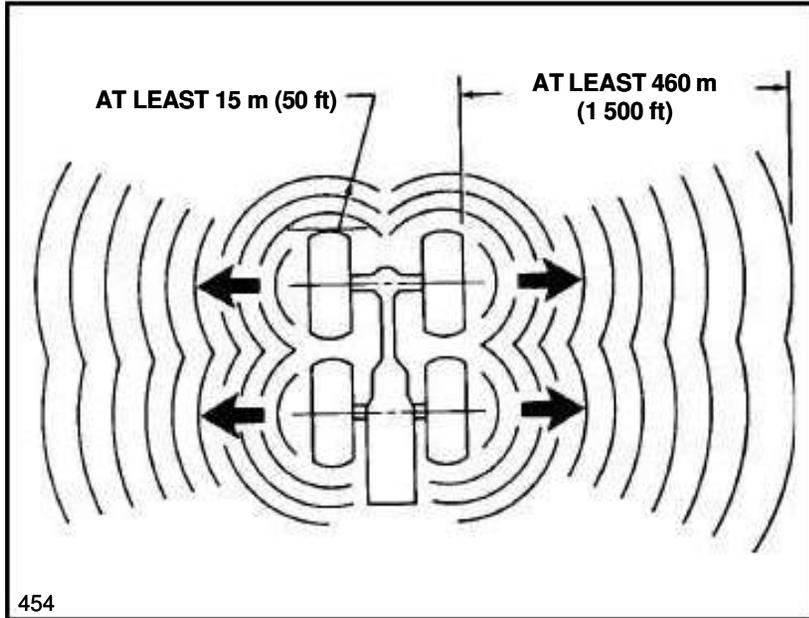
**NOTICE**  
TYRES ON THIS MACHINE ARE FACTORY INFLATED WITH DRY NITROGEN. IT IS RECOMMENDED THAT DRY NITROGEN BE USED EXCLUSIVELY FOR ALL TYRE PRESSURE ADJUSTMENTS AS WELL AS INFLATION OF REPLACEMENT TYRES.

Nitrogen gas improves tyre pressure retention, increases tyre life by reducing carcass oxidation from within, minimizes rim rust, and has no known detrimental effect on the tyre. It also reduces the potential of a tyre explosion because it is an inert gas and will not support combustion inside the tyre. The same tyre inflation pressure used for air inflation should be used for nitrogen inflation. Refer to Section 160-0050, 'WHEEL RIM AND TYRES' of the machine Service Manual for recommended procedures for inflating and pressure adjusting tyres with dry nitrogen gas. Only proper nitrogen charging equipment operated by personnel trained in its use should be used.



### **WARNING**

**Never mix components of one manufacturer's rims with those of another. Using the rim base of one manufacturer with the lock ring of another or vice versa is dangerous. The lock ring of one may not fully engage with the lock ring groove of the other. Always consult the rim manufacturer for proper matching, assembly and safety instructions. Also, use and servicing of damaged, worn out or improperly assembled rim assemblies is a very dangerous practice. Failure to comply with the above warnings could result in an explosion from tyre pressure causing serious property damage and serious personnel injury or death.**



## Avoid Tyre Explosion Hazard



### WARNING

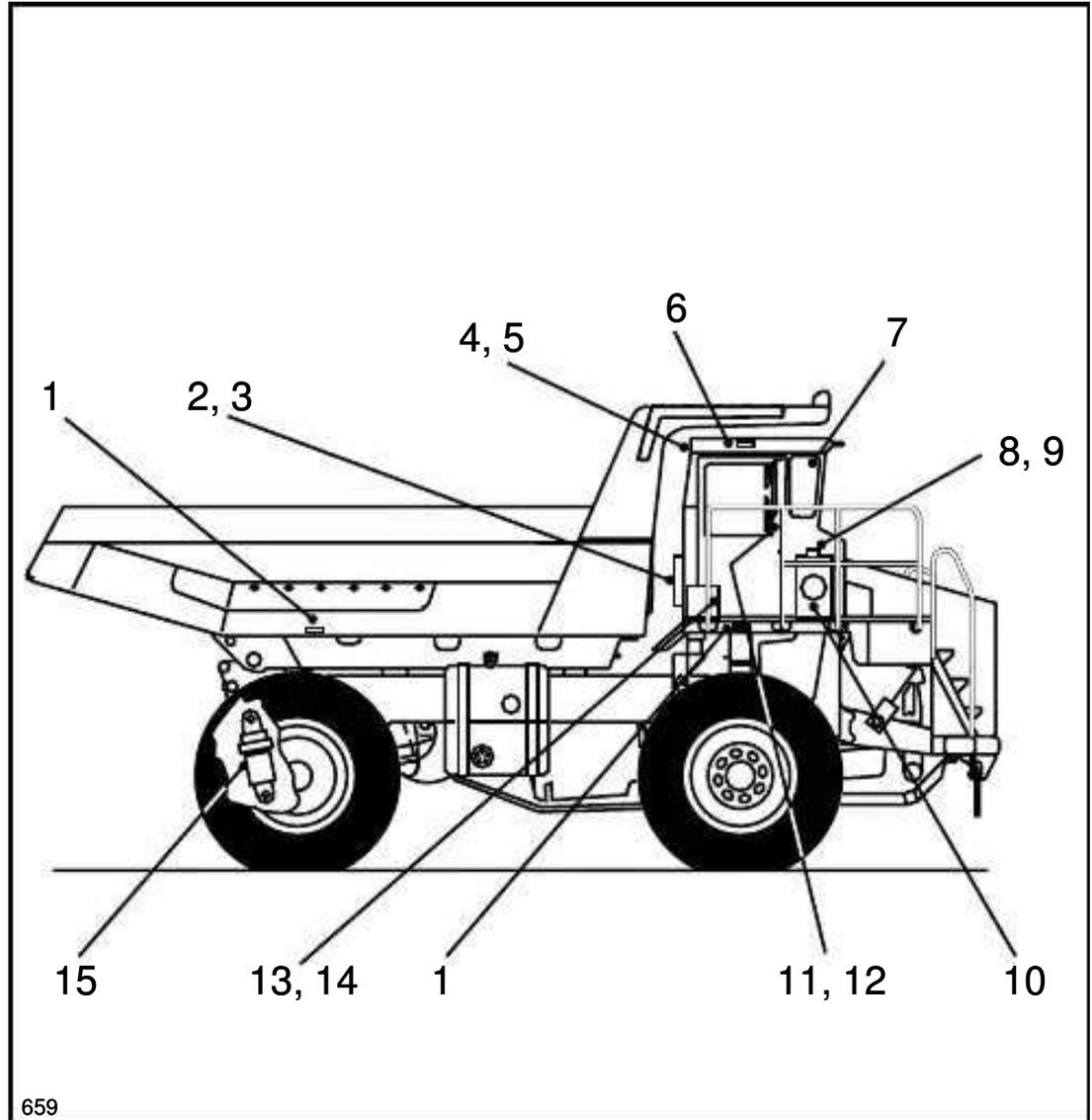
Whenever a machine's tyre(s) is (are) exposed to excessive heat such as a machine fire or extremely hot brakes, the hazard of a subsequent violent tyre explosion must be recognized. All nearby persons must avoid approaching the machine so as not to be physically endangered in the event of an explosion of the tyre and rim parts. The machine should be moved to a remote area, but only when this can be done with complete safety of the operator operating or towing the machine. All other persons should stay clear of the machine. The fire or overheated brakes, wheel etc., should be extinguished or cooled from a safe distance. Do not attempt to extinguish the fire or cool the machine by use of hand-held fire extinguishers. If it is absolutely necessary to approach a machine with a suspect tyre, approach only from the front or the back. Stay at least 15 m (50 ft) from the tread area. Keep observers out of the area and at least 460 m (1500 ft) from the tyre sidewall. Refer to the accompanying sketch. The tyre(s) should be allowed at least eight (8) hours cooling time after the machine is shut down or the fire extinguished before approaching closer.

## Decals and Instruction Plates

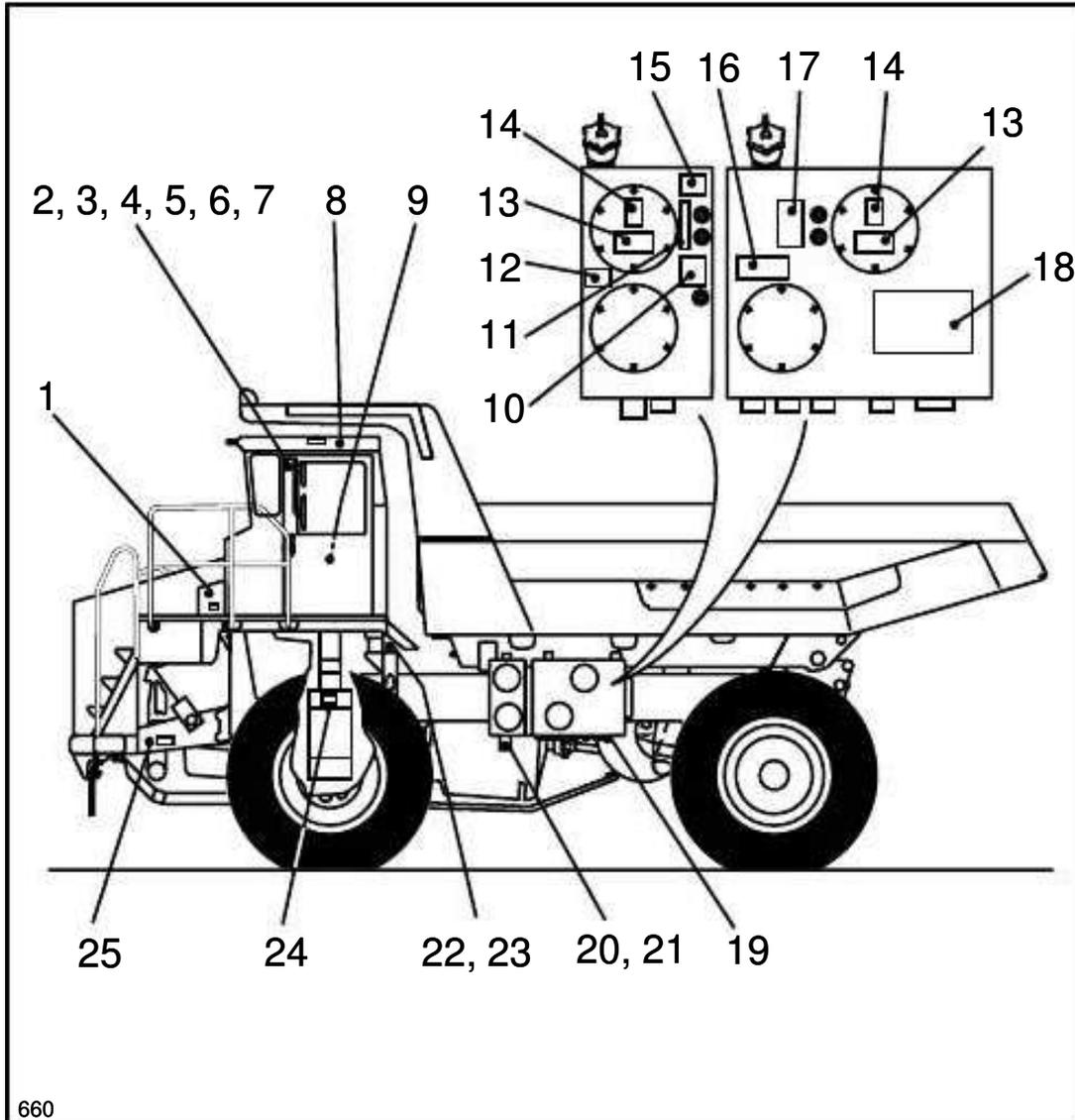
Decals and instruction plates fitted to these machines may vary from country to country to suit local needs. These

pages contain a brief description and the location of the decals and instruction plates that may appear on your machine.

1. Tyre Warning
2. Accumulator Precautions
3. Accumulator Charging Instructions
4. Operating On A Grade Instructions
5. Vehicle Parking Instructions
6. Acoustic Foam Precautions
7. Symbol Identification Chart
8. Radiator Cap Warning
9. Radiator Fill Instructions
10. Air Cleaner Information
11. Vehicle Overall Height
12. Steering Wheel Lock
13. Negative Earth
14. Battery Cable Warning
15. Ride Strut Pressure Warning



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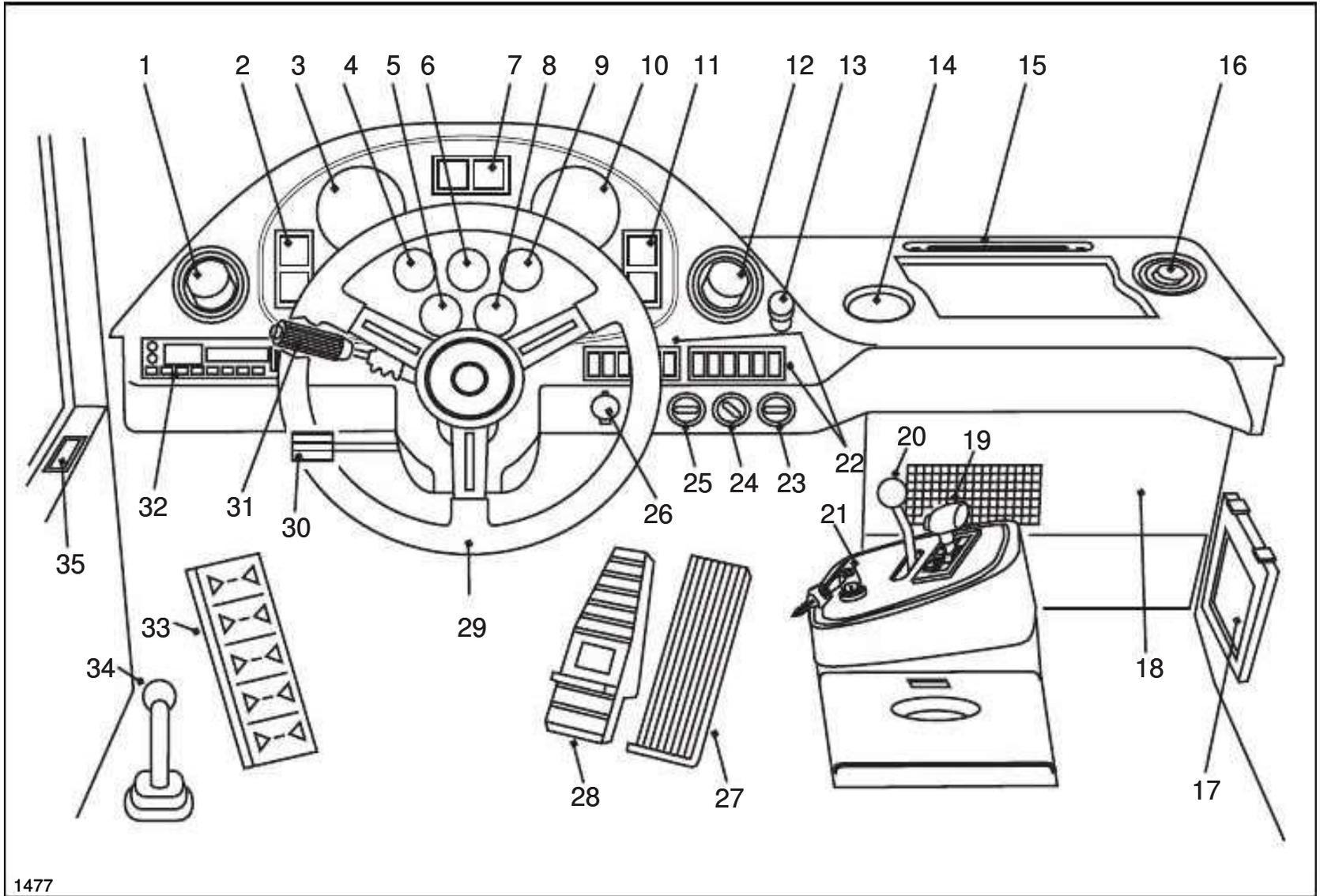
1. Alternator Precautions
2. CEC (ATEC) Welding Warning
3. Engine Instructions
4. Body Control Lever Positions
5. Retarder Positions
6. CEC (ATEC) Switches
7. Pre-operating Instructions
8. Acoustic Foam Precautions
9. Pre-operating Instructions
10. Hydraulic Oil Decal
11. Sight Gauge Plate
12. Hydraulic Oil Pressure Plate
13. Anti-Syphon Instructions
14. Instruction Plate
15. Hydraulic Oil Level
16. Instruction Decal
17. Hydraulic Oil Level
18. Lubrication Chart
19. Pressure Test Points
20. Accumulator Charging Instructions
21. Accumulator Precautions
22. Pressure Test Points
23. Pressure Test Points
24. Ride Strut Pressure Warning
25. Machine Serial Plate





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## **3 - Controls and Operating**



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## CONTROLS AND INSTRUMENTS

1. Face Vent/Side Window Demister
2. Warning Lights
3. Tachometer/Hourmeter
4. Engine Water Temperature Gauge
5. Engine Oil Pressure Gauge
6. Fuel Gauge
7. Warning Lights
  
8. Transmission Oil Pressure Gauge
9. Transmission Oil Temperature Gauge
10. Speedometer/Odometer
11. Warning Lights
12. Face Vent
13. Park/Emergency Brake Control
14. Cup Location
15. Windscreen Demister
16. Side Window Demister
17. Document Holder
18. Fuse Box Cover
19. Transmission Gear Shift Selector
20. Retarder Control
21. Ignition and Starter Key Switch
22. Switches
23. Blower Control
24. Air Conditioner Control
25. Heater Control
26. Accessory Lamp Socket
  
27. Accelerator Control
28. Service Brake Control
29. Steering Wheel
30. Steering Wheel Adjustment Lock
31. Headlight Dipper, Direction Indicator, Windscreen Wiper/Washer and Horn Control
  
32. Radio/Cassette Player
33. Foot Rest
34. Body Control Lever
35. Electric Window Switch
36. Interior Light (Not Shown). Located above dash.
37. Cup Holder (Not Shown). Located on back wall.

## BASIC DATA

### Warning Lights

#### 1. Alternator Charging (Red) -

Illuminates to indicate when the alternator is not charging.

#### 2. Engine Water Temperature (Red) -

Illuminates when the engine water temperature rises above the safe operating temperature.

#### 3. Engine Water Level (Amber) -

Illuminates when the engine water level drops below the safe operating level.

#### 4. Air Cleaner Restriction (Amber) -

Illuminates to indicate that the air filters are needing cleaned or replaced.

#### 5. Engine Oil Pressure (Red) -

Illuminates when the engine oil pressure drops below the safe operating pressure.

#### 6. Engine Stop Light (Red) -

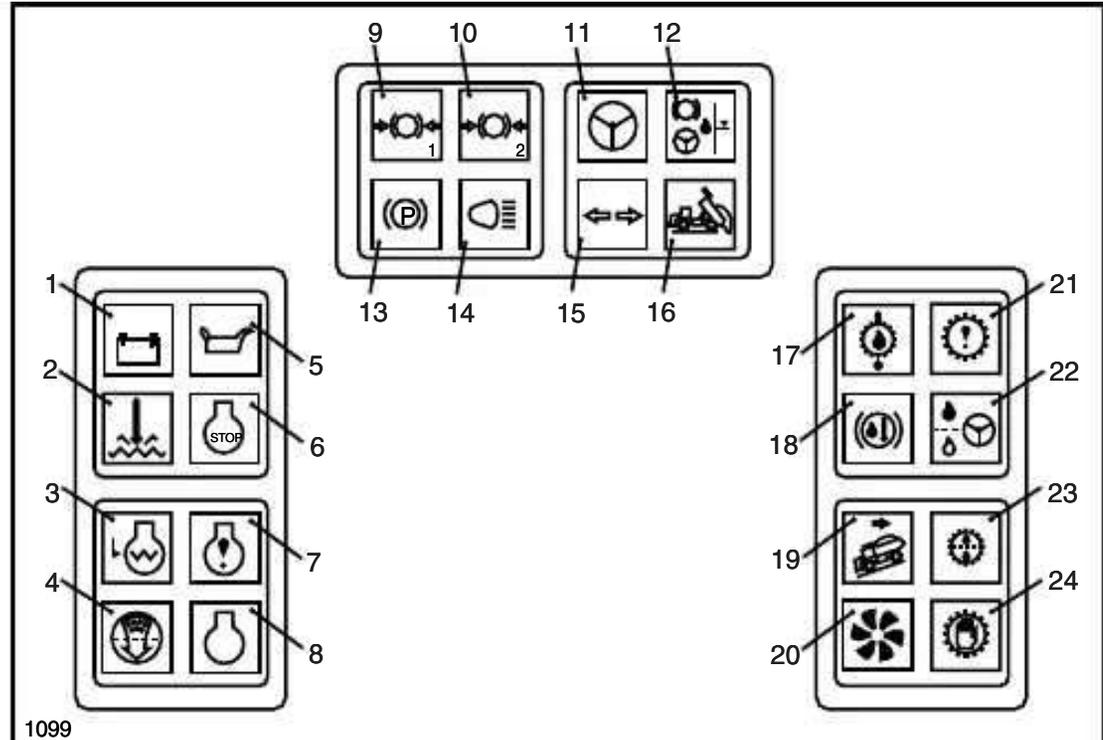
When the 'Stop' light comes on, the computer has detected a major malfunction in the engine that requires immediate attention. Stop the machine when this light illuminates and do not operate until the fault is corrected.

#### 7. Engine Warning Light (Yellow) -

When the 'Warning' light comes on, the

computer has detected a fault in the engine which may result in a power loss.

The fault should be diagnosed and



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corrected at the earliest opportunity.

#### 8. Engine Protection Fluid Light (Amber) -

Illuminates when a fault has been detected in the engine. Light remains on as long as the fault is occurring. The fault should be diagnosed and corrected at the earliest opportunity. If the fault

continues to get worse the light will flash and the engine power and/or speed will be gradually reduced. Stop the machine and

do not operate until the fault is corrected.

#### 9. Front Brake Accumulator Pressure (Red) -

Illuminates to warn of low pressure in the front brake system accumulator. Stop the machine if this light illuminates and do not operate until the fault is corrected.

#### 10. Rear Brake Accumulator Pressure (Red) -

Illuminates to warn of low pressure in the rear brake system

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accumulator. Stop the machine if this light illuminates and do not operate until the fault is corrected.

**11. Low Steering Pressure (Red)** - Illuminates when the steering system oil pressure drops below 83 bar (1200 lbf/in<sup>2</sup>). Stop the machine when this light illuminates and do not operate until the fault is corrected.

**12. Steering & Braking Tank Low Oil Level (Red)** - Illuminates when the level in the tank falls below the safe operating level. Stop the machine when this light illuminates and do not operate until the fault is corrected.

**13. Parking Brake (Red)** - Illuminates when the parking brake is applied.

**14. Headlight Main Beam (Blue)** - Illuminates when headlights are operated on main beam.

**15. Direction Indicator (Green)** - Flashes when the indicator lights are operating.

**16. Body-up (Amber)** - Illuminates to indicate that the body is NOT resting on the chassis. Never move the machine until this light goes OUT.

**17. Transmission Oil Temperature (Red)** - Illuminates when the transmission oil temperature rises above the safe operating temperature.

**18. Brake Hydraulic Oil Temperature (Red)** - Illuminates if brake cooling hydraulic oil overheats. Reduce speed and shift transmission to the range that will maintain an engine speed as high as possible, without exceeding the maximum recommendation, to increase oil circulation and cooling. If the trouble persists, stop the machine and have the fault corrected.

**19. Retarder Indicator (Amber)** - Illuminates when the retarder is applied.

**20. In-converter Indicator (Green)** - Illuminates when the transmission is in Torque Converter drive. It goes OUT when Lockup is engaged.

**21. Check Trans (Red)** - Illuminates to alert of a fault in the transmission shift system or abnormal transmission temperature. The light will illuminate when the ignition keyswitch is turned to position '1' to provide a bulb and system check and should go off a few seconds after the engine is started.

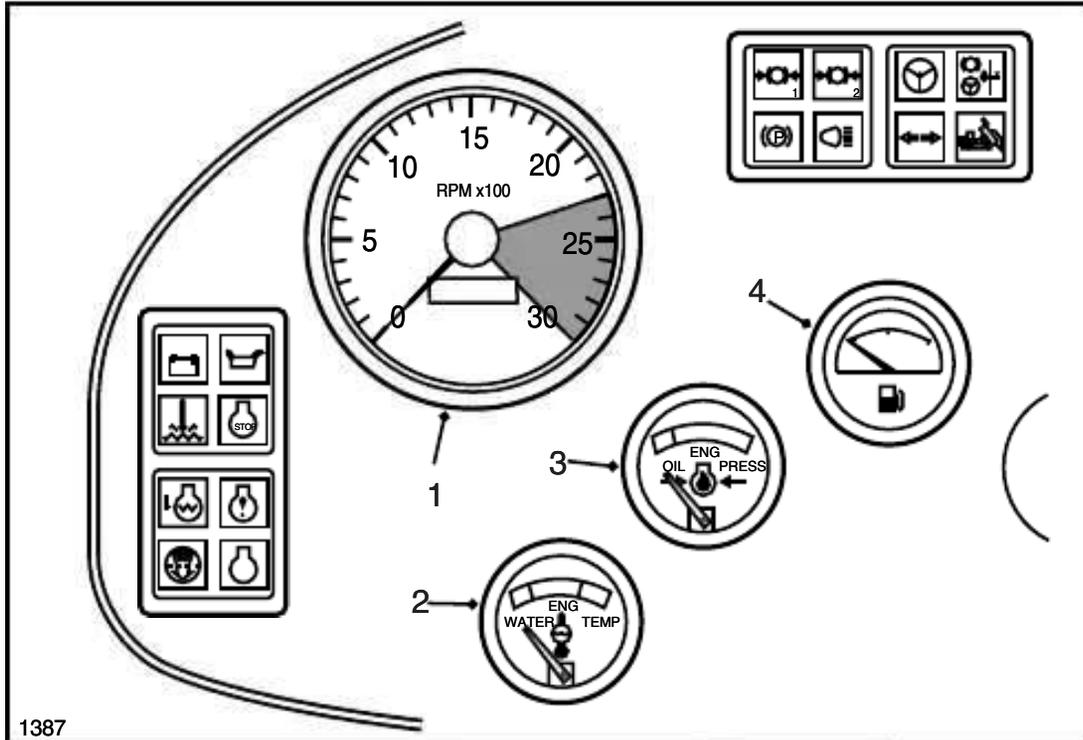
**22. Steering Filter Restriction (Amber)** - Illuminates when the filter is restricted, indicating that a filter change is required.

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**23. Transmission Oil Filter Restriction (Amber)** - Illuminates when the filter is restricted, indicating that a filter change is required. Transmission will not upshift from first gear while this light is illuminated.

**24. Transmission Overspeed Light** - Illuminates when the transmission ECU senses transmission speed above 2350 rev/min.

**Note:** For further information on items 21 and 24, refer to 'Transmission' section on page 34.



## Instruments

**1. Tachometer/Hourmeter** - Driven from the engine ECM, the tachometer indicates the engine speed in revolutions per minute. The needle shows the variations in engine operating speed. Never accelerate the engine to speeds indicated by the red zone on the dial face. A digital hourmeter is incorporated in the tachometer to record total hours of engine operation. The readings can be used for operating and service records.

**2. Engine Water Temperature Gauge** - This gauge should read in the green zone, after the engine has warmed. If gauge reads in the red zone, stop the engine until the fault is corrected.

**3. Engine Oil Pressure Gauge** - This gauge should read in the lower end of the green zone at normal operating speeds and may fall to the lower end of the yellow zone at engine idle. Stop the engine if the needle does not rise above the red zone until the fault is corrected.

**4. Fuel Gauge** - Indicates the level in the fuel tank. Fill the tank before parking the machine overnight to minimize condensation over the tank. Avoid a dry tank condition which requires bleeding the fuel system.

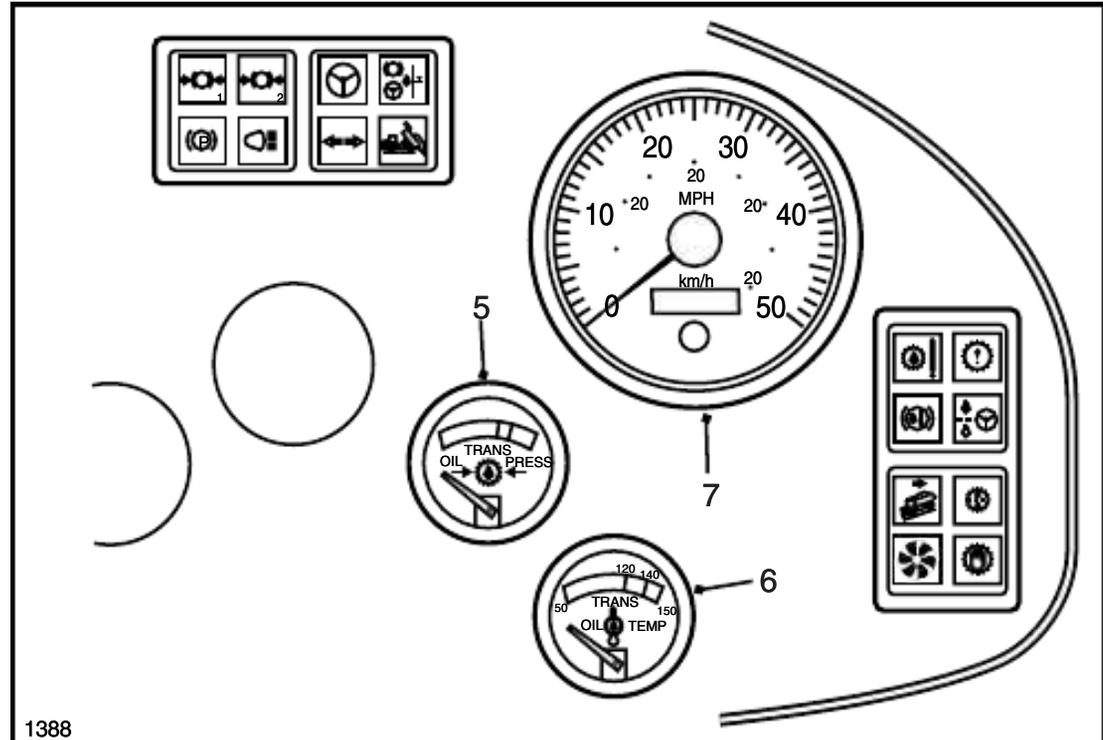
## 5. Transmission Oil Pressure

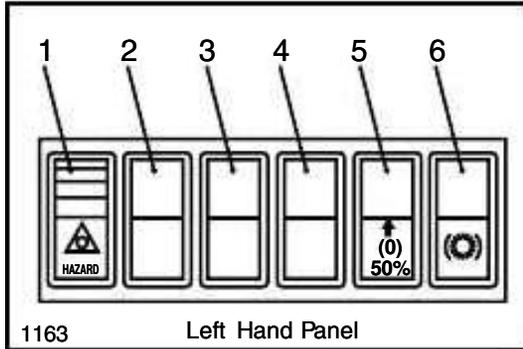
**Gauge** - Indicates transmission clutch application oil pressure. The reading will vary during shifts and with varying speeds and loads. The needle should remain in the green zone during normal operation but might rise into the upper red zone for short periods under heavy loading. When the load decreases, the needle should return to the green zone and may fall momentarily into the lower red zone. If the needle remains in either of the extreme zones for extended periods, stop the machine until the fault is corrected.

## 6. Transmission Oil Temperature

**Gauge** - This gauge should read in the green zone during normal operation. Refer also to 'General Transmission Operation' on page 3-35 and 'Retarder' section on page 3-18 for variations from normal.

**7. Speedometer/Odometer** - Driven by a signal from the CEC, the speedometer indicates travel speed in kilometres per hour and miles per hour. A digital odometer is incorporated in the speedometer to record the distance travelled by the vehicle at any given time.





## Switches

**1. Hazard Warning Lights** - Press bottom of switch to make turn indicators flash simultaneously as hazard warning lights. The light in the switch and direction indicator warning light on the right hand dash panel will flash. To switch hazard lights

off; press the top of the switch.

**2. Position not used.**

**3. Position not used.**

**4. Position not used.**

**5. Front Brake Pressure Reduction (Optional)** - Press bottom of switch to give a 50% reduction in front brake pressure. The lower front pressure reduces the risk of wheel lockup in slippery conditions. To return to full front brake pressure; press the top of the switch.

**6. Retarder Selection Switch** - Allows the operator to select which retarder is employed when using the retarder control lever.

Pressed at top = Disc Brake

Pressed at bottom = Transmission

**7. Sidelight and Headlight** - Press bottom of switch to the first position to operate side, tail and panel lights. The lights in the other switches will illuminate. Press switch to the second position to operate the headlights. To switch lights off; press the top of the switch.

**8. Position not used.**

**9. Warning Light Test Switch** - Pressing the switch with the ignition switched on will illuminate warning lights 1, 2, 3, 4, 5, 9, 10, 11, 17, 18, 20, 22 and 23 and the buzzer will sound, to provide a bulb and system check. Refer to 'Warning Lights' section on pages 4, 5 and 6 for details. The light in the switch will illuminate with the panel lights.

**10. Diagnostic Request Switch** - To check for active fault codes:

- a. - turn the ignition key switch to the 'OFF' ('0') position.
- b. - press the diagnostic switch to the 'ON' position.
- c. - turn the ignition key switch to position '1'.

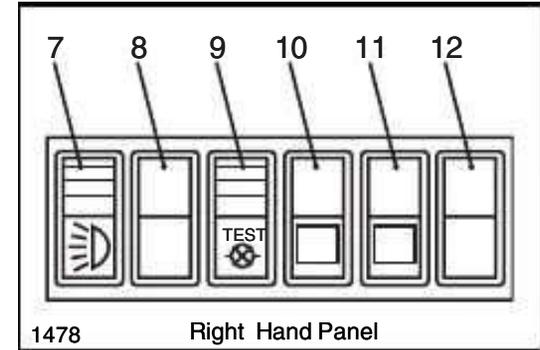
If no active codes are recorded the 'Stop', 'Warning' and 'Fluid' lights will illuminate and stay on. If active codes are recorded the 'Stop', 'Warning' and 'Fluid' lights will illuminate momentarily. The yellow 'Warning' and red 'Stop' lights will begin to flash the code of the recorded fault. Refer to pages 25 & 26 for details of the fault codes.

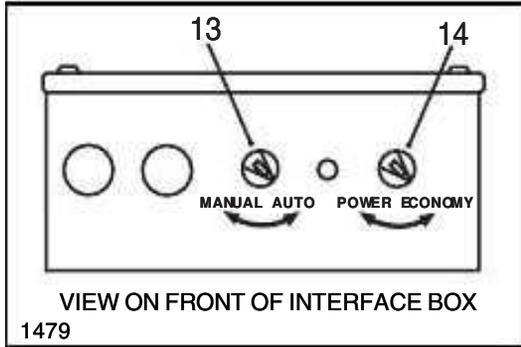
**Note:** If switch is pressed 'ON' during normal operation, the 'Stop' light will illuminate, however, this does not indicate an engine malfunction and the light will go out when the switch is pressed 'OFF'.

**11. Diagnostic Search Switch** - When the engine is in diagnostic mode this switch is used to search through a list of fault codes, ie. pressing the top of the switch momentarily will advance to the next active fault code, pressing the bottom of the switch will go back to the previous code.

On machines which have a Low Idle Adjustment feature, this switch can also be used to increase or decrease (in increments of 25 RPM) the idle or intermediate speed of the engine.

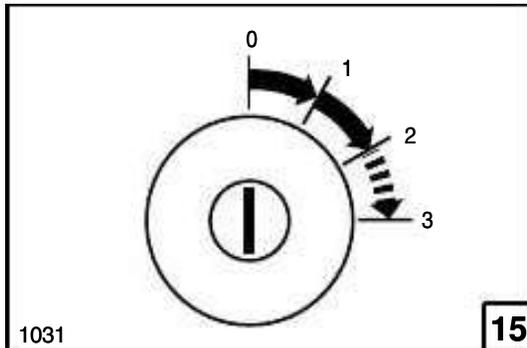
**12. Position not used.**





**13. Manual Mode Switch** - Allows the service technician to change the operation of the transmission from automatic to manual.  
 Automatic - Normal operation.  
 Manual - Service Functions.

**14. Mode Selection Switch** - Allows the service technician to select between the transmission 'POWER' and 'ECONOMY' shift schedules.



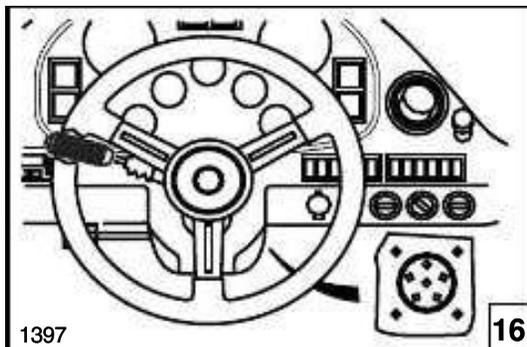
**15. Ignition and Starter Key Switch** - The combined switch operates the ignition and starter motor. The key can only be withdrawn from position '0'.

'0' - Ignition switched off. Disconnects the batteries making all electrical systems inoperative (with the exception of a supply to the ECM & CEC memory, interior light and to the radio). This position also cuts off fuel to shut down the engine.

'1' - Turn key clockwise to connect the batteries to the electrical systems.

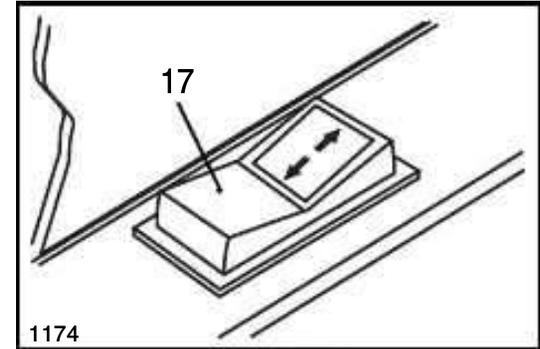
'2' - Ignition switched on, instruments, gauges and warning lights register as appropriate. All electrical systems are operative. The key must remain in this position whilst operating the machine.

'3' - Starter motor operates. The key when released will return to position '2'.



**16. Remote Diagnostic Test Point** - (Located under the dash panel, on the steering column mounting bracket). Plug in connector for diagnostic data reader (DDR).

**17. Electric Window Switch** - Press bottom of switch to lower window; press top of switch to raise window.



## Controls

### Headlight Dipper, Direction

### Indicator, Windscreen Wiper/Washer and Horn

#### 1. Headlight Dipper and Flasher:

Control downwards = Main Beam  
 Neutral Position = Dipped Beam  
 Control Upwards = Headlight Flash

#### 2. Direction Indicator:

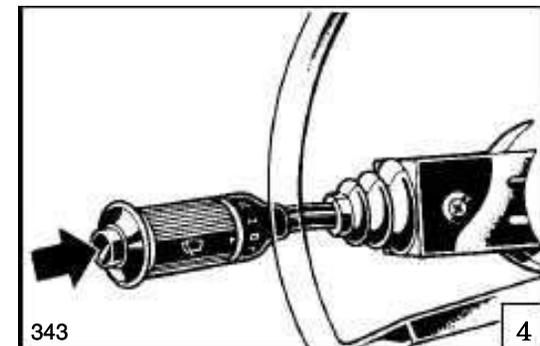
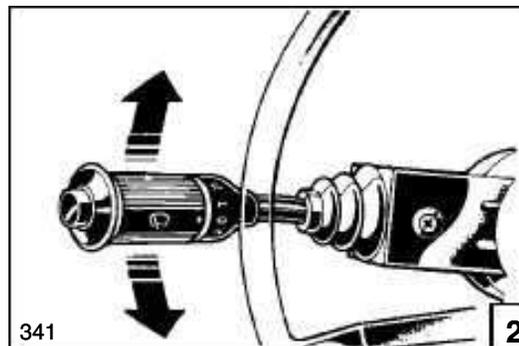
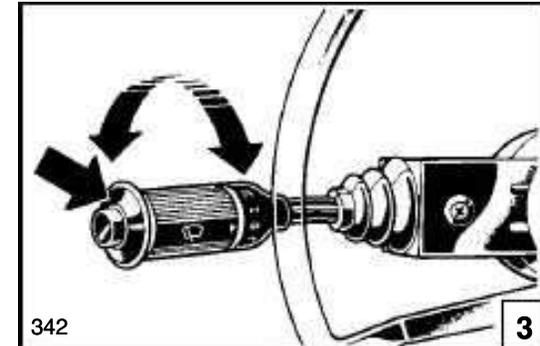
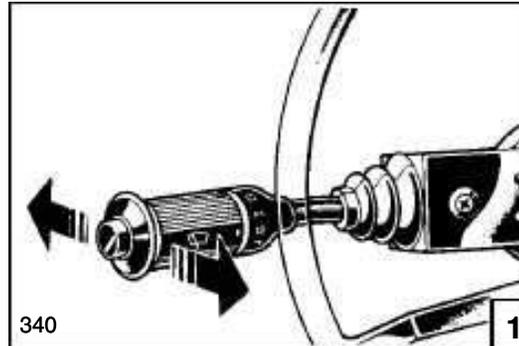
Control rearwards ≡ Left Indicators  
 Control forwards ≡ Right Indicators

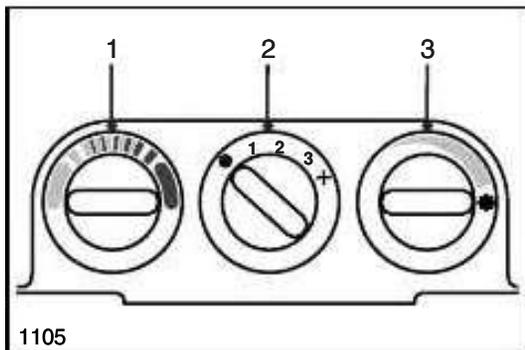
#### 3. Windscreen Wiper/Washer:

Position J = Not used  
 Position 0 = Neutral Position  
 Position 1 = Wiper Slow Speed  
 Position 2 = Wiper Fast Speed  
 Ring Pushed = Windscreen Wash

#### 4. Horn:

Button pushed in = Horn Sounds



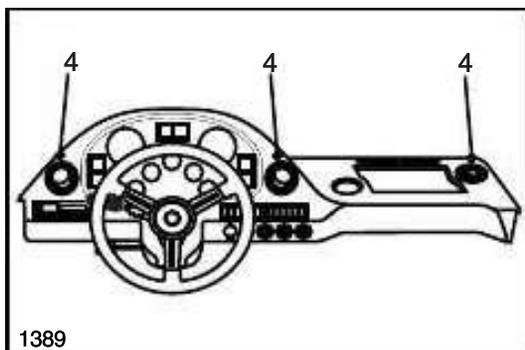


## Heater

Blower control (2) is rotated to select one of three blower speeds.

Temperature control (1) is rotated to vary heater output temperature. Heater output air is unheated with the control turned fully anticlockwise and heated by turning clockwise.

Heater/air conditioner outlets (4) may be adjusted to control air flow output by opening and closing the control flaps. Air direction can be adjusted by rotating complete outlet.



## Air Conditioner

Keep all windows and vents closed.

Blower control (2) is rotated to select one of three blower speeds. The air conditioning will not operate if the blower control is not switched on.

Temperature control (3) adjusts the air conditioner output temperature. Rotating the control to the right provides maximum cooling.

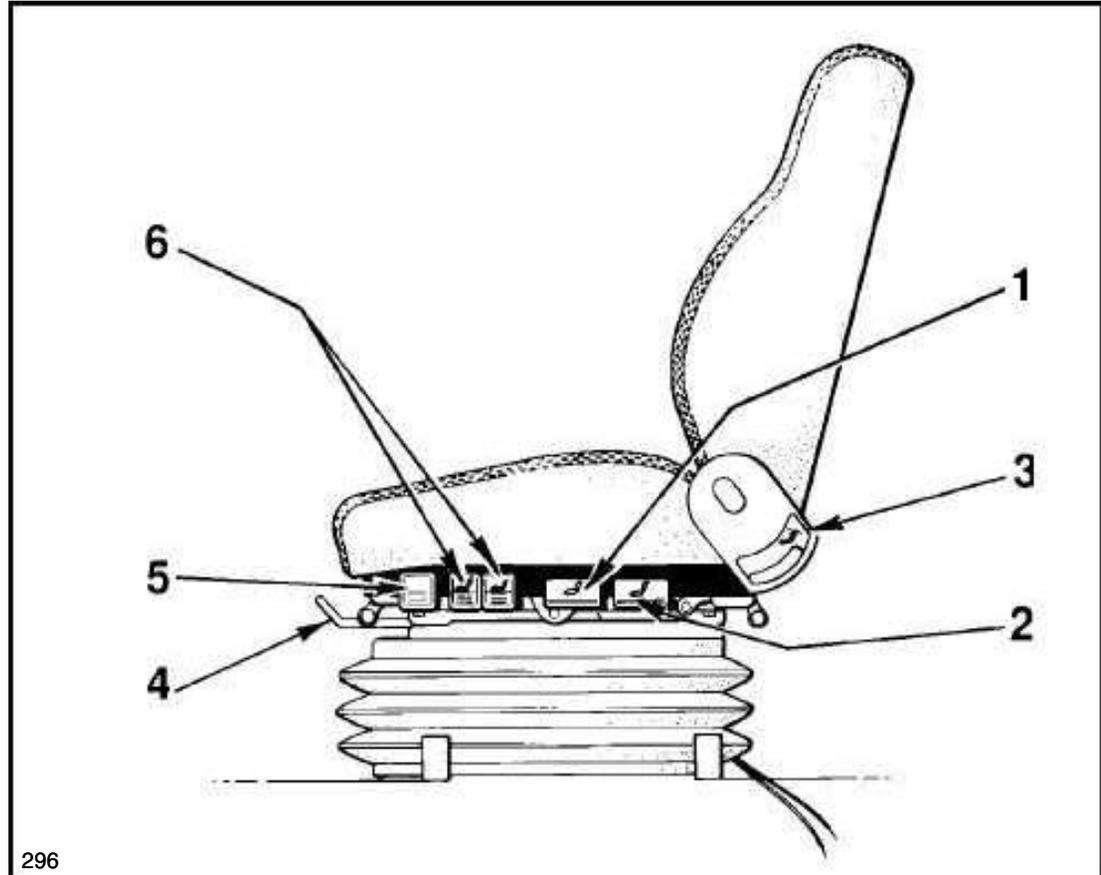
Heater/air conditioner outlets (4) may be adjusted to control air flow output by opening and closing the control flaps. Air direction can be adjusted by rotating complete outlet.

## Operator's Seat - Air Suspension

The air seat only reacts when the driver sits on the seat. When unoccupied the seat sinks to the lowest position to allow easier access. The incorporated suspension block out maintains seat in position for driving.

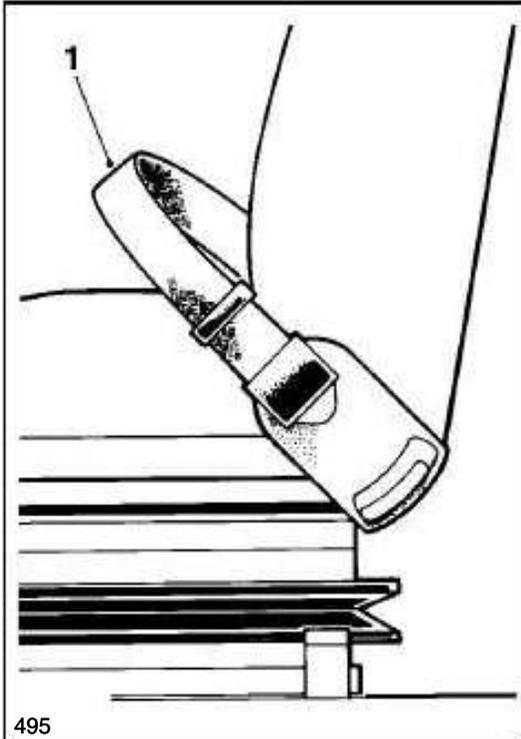
The following is the list of controls to adjust the seat:

1. Height and slope adjustment, front.
2. Height and slope adjustment, rear.
3. Backrest adjustment.
4. Horizontal adjustment.
5. Weight adjustment
6. Air lumbar support adjustment. Press buttons to inflate or deflate the two air cushions in the back of the seat, to suit the exact shape of the drivers back.



### WARNING

Do not attempt to adjust the seat or seat belt while the machine is moving. Loss of control may result. Stop the machine; apply the brakes; then adjust.



## Seat Belt

Retractable seat belts are installed on both operators seat and jump seat. The seat belts require no external adjustment and allow freedom of movement for proper manipulation of all controls.



### **WARNINGS**

**Always wear seat belt when operating the machine.**

**Always check condition of seat belts and mounting hardware before operating the machine.**

**Any signs of looseness or wear should be reported to your Service Department or Dealer for repair or replacement immediately.**

**Replace seat belt at least once every three years, regardless of appearance.**

**Do not attempt to adjust seat or seat belt while machine is moving. Loss of control may result. Stop machine; apply brakes; then adjust.**

## MACHINE CONTROLS

### Braking

The dual circuit brake system is applied during normal operation by using the Service Brake Pedal or, in an emergency, by using the Park/Emergency Brake Control.

A 'Front Brake Accumulator' warning light and a 'Rear Brake Accumulator' warning light are located on the instrument panel. If any of these lights illuminate during operation, stop the machine, apply the parking brake and do not operate until the fault is corrected.

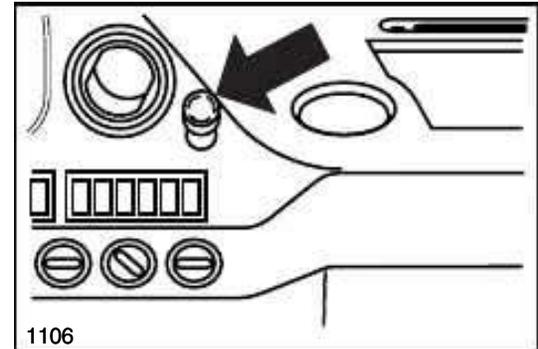
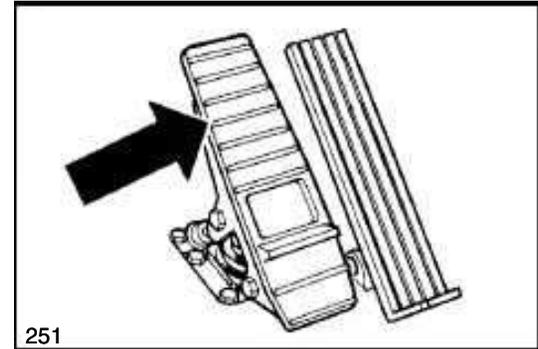
### Service Brake

This is a floor mounted pedal operated by the right foot. Depress the pedal as required by speed, load and road conditions to slow or stop the machine. Release the pedal as the machine slows until, when stopped, the pedal is depressed just enough to hold it stationary.

### Park/Emergency Brake

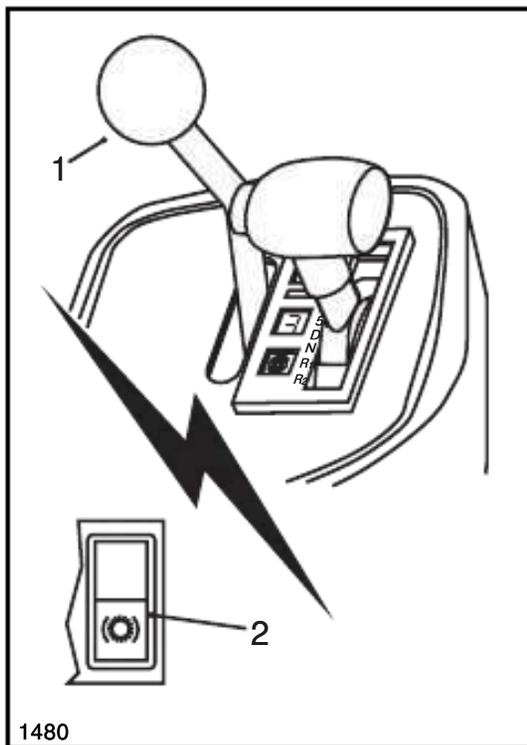
Pushing the control in will apply the spring operated parking brakes within the rear brake assemblies and the service brakes at all wheels. The parking brake warning light on the instrument panel will illuminate when the control is pushed in. To release the brakes; turn the control clockwise.

The Park/Emergency Brake Control should only be used to stop the machine in an emergency, or, for applying the parking brake once the machine has been stopped. For normal braking the service brake pedal should be employed.



### WARNING

Always apply the parking brake before leaving the operator's seat.



## Retarder

This control lever (1) is used to apply retardation to the truck. Retardation is the term used for applying a continuous braking force to hold the truck to a safe steady speed when descending grades.

The retarder is OFF when the lever is fully forward and is APPLIED as the lever is pulled back. Maximum retardation is obtained when the lever is in the fully back position. The retarder may be used anytime to slow down. If additional braking is required apply the service brakes. The retarder is not meant for bringing the machine to a halt, or for sudden deceleration - the service brakes should be employed for this purpose.

When the retarder is applied, the 'Retarder Indicator Light' on the instrument panel will illuminate and an orange coloured warning light at the rear of the truck will illuminate to warn following vehicles.

Retardation of this truck may be achieved by using the DISC BRAKE RETARDER or the TRANSMISSION RETARDER.

Machines fitted with Disc Brake and Transmission Retarders have a 'Retarder Selection Switch' (2). This selects which retarder will be employed when using the retarder control. Pressed at top = Disc Brake, Pressed at bottom = Transmission. Machines which do not have a transmission retarder fitted do not have the selection switch fitted.

The operator should select the correct gear range to match the site conditions. Application of the retarder gives the transmission enhanced retardation through 6th and 5th gears until 4th gear is attained.

**Note:** In order to obtain the maximum retardation and cooling effect during retardation, the engine speed should be maintained as high as possible without exceeding the maximum recommendation.



### WARNING

**Do not use the retarder for parking the vehicle. Only use the parking-emergency brake control for this purpose.**

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## Retarder Operation

Before the machine crests the top of a grade and starts down, the operator should slow the machine with the service brakes and downshift to the gear range which would be used to ascend the grade. The retarder should be applied before starting the descent. Machine downgrade speed (with the retarder applied as required) in the gear range selected should be high enough to keep the engine operating at governed speed with the throttle closed (operator's foot off the accelerator pedal). This will ensure maximum oil circulation and cooling. If the rate of descent is too slow, the transmission should be upshifted to the next highest gear range. If the rate of descent is too fast, the gear range selected is too high and the operator must slow the machine by using the service brakes, then downshift into a lower gear range which will allow a safe descent and efficient retarder operation.

### Oil Temperature - Disc Brake

The disc brake hydraulic temperature warning light on the instrument panel will illuminate and an electric horn will sound if the oil flowing through the disc brake assemblies overheats. If alarm is activated, reduce downgrade travel speed. If the trouble persists, stop the machine and have the fault corrected.

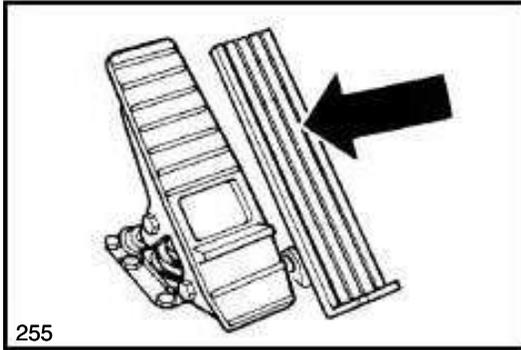
### Oil Temperature - Transmission

During normal operation the transmission oil temperature gauge should read in the green zone. However, during transmission retarder operation oil temperature can enter the yellow 'RETARDER ON' zone but should not enter the red zone. Do not allow the temperature to stay at or near the top of the yellow zone for more than 3 minutes. Reduce downgrade travel speed to avoid the oil overheating and possible damage to the transmission.



### WARNING

**Great care should be used if applying the retarder when road surfaces are slippery. Retarder braking effect will occur only at the driving axle and could make vehicle control difficult.**



## Engine

### Electronic Foot Pedal

The electronic foot pedal provides an electronic signal to the engine's fuel control system in proportion to the degree of pedal actuation.

**Note:** The electronic controlled engine will override the electronic foot pedal position until the engine is warmed up to the correct operating temperature. The engine **MUST** be started with the foot 'OFF' the electronic foot pedal.

### QUANTUM Electronic Fuel System

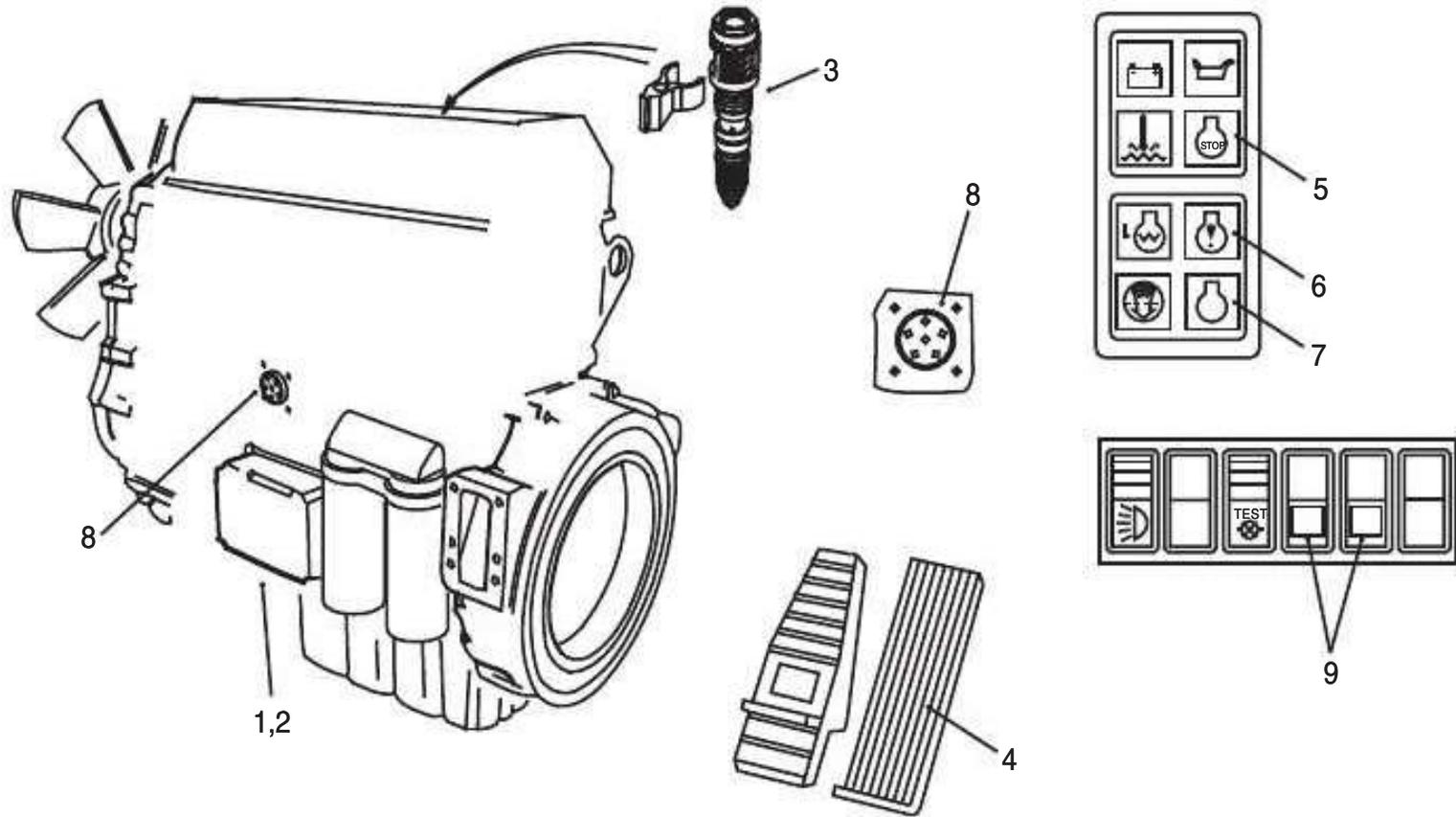
This machine is equipped with the Quantum Electronic Fuel System, an electronic engine control system, which continually monitors the engine and warns the operator when a problem develops. The system also takes action to prevent damage to the engine and, provides the serviceman with diagnostic capabilities so that problems can be corrected quickly and easily.



#### **WARNING**

**Before any welding is done on a machine equipped with the Quantum Electronic Fuel System, disconnect the following in this order: Battery earth cable, battery supply cable, alternator earth cables, alternator supply cables, transmission connector, ECM interface harness connector (30 pin RHS), ECM power harness connector (5 pin RHS) and ECM sensor harness connector (30 pin LHS). Turn off ignition key switch to isolate the batteries before disconnecting any components.**

**After welding connect all of the above in the reverse order.**



- 1 - Electronic Control Module (ECM)
- 2 - Programmable Read Only Memory (PROM)
- 3 - Quantum Fuel System Injectors

- 4 - Electronic Foot Pedal
- 5 - 'Stop' Light
- 6 - 'Warning' Light

- 7 - 'Fluid' Light
- 8 - Diagnostic Test Points
- 9 - Diagnostic Switches

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## **QUANTUM Electronic Fuel System - Description**

**1. Electronic Control Module (ECM)** - Receives electronic inputs from the driver as well as from sensors that provide information electronically, such as oil pressure and temperature and intake manifold pressure. This information is used to control

both the quantity of fuel injected and injection timing.

**2. Programmable Read Only Memory (PROM)** - Located in the ECM and encoded with the operating software. Additional information is programmed into the EEPROM. This information controls the horsepower rating, torque curve, maximum engine speed and engine protection devices. The ECM processes this information and sends electronic signals to the Electronic Fuel System Injectors where the precise amount of fuel is injected into the engine.

**3. Electronic Fuel System Injectors** - The injector is a lightweight, compact unit that injects diesel fuel directly into the combustion chamber. The amount of fuel injected and the beginning of injection timing is determined by the ECM. The ECM sends a command pulse which activates the injector solenoid.

The injector performs four functions:

- a - Creates the high fuel pressure required for efficient injection.
- b - Meters and injects the exact amount of fuel required to handle the load.
- c - Atomizes the fuel for mixing with the air in the combustion chamber.
- d - Permits continuous fuel flow for component cooling.

Electronic fuel system injectors are self compensating and virtually eliminate engine tune-ups.

**Note:** Never apply 12 or 24 volts directly to terminals on the injector or engine sensors as they will burn out. Before removing injectors, the fuel passages must be blown out to prevent fuel flow from entering the cylinder head.

---

## **QUANTUM Electronic Fuel System - Operation**

When the 'Stop' light on the dash panel illuminates, the computer has detected a major malfunction in the engine that requires immediate attention. It is the operators responsibility to shut down the engine to avoid serious damage.

The machine is equipped with an engine protection derate system, which records fault codes when an out-of-range conditions is found. The 'Fluid' light illuminates when the engine protection derate system is initiated. The engine power and speed will be gradually reduced depending on the level of severity of the out-of-range condition. The 'Fluid' light will start to flash if the out-of-range condition continues to get worse. The operator **MUST** shut down the engine to avoid serious damage.

The engine should not be restarted after it has been shut down after activation of the engine protection derate system unless the problem has been diagnosed and corrected.

Conditions that will cause the amber 'Fluid' light to come on are; Low coolant level, High coolant temperature, Idle validation/throttle pedal switch mismatch, High intake manifold temperature, Low oil pressure and High fuel rail pressure.

Whenever the 'Stop', 'Warning' or 'Fluid' light comes on, the Electronic Fuel System computer will determine where the problem is and will store this information in its memory. If the malfunction is intermittent, the lights will come on and go off as the computer senses the changing engine condition.

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A special diagnostic data reader (INSITE) is available that can be plugged into the engine computer memory to extract information related to the cause of the problem. Once the malfunction has been corrected, the Electronic Fuel System will return the engine to normal operation. The data reader can now distinguish between active codes and those stored in the historic code memory (inactive codes). Inactive codes can only be viewed using the data reader. The fault code recorded in the ECM memory will remain until it is erased by a technician.

The operator can check for active faults by turning the ignition key switch to the 'OFF' position, switching the diagnostic switch 'ON' and then turning the ignition key switch to position '1'. If no active fault codes are recorded, all three ('Stop', 'Warning' & 'Fluid') lights will come on and stay on. If active codes are recorded, all three lights will come on momentarily. The yellow ('Warning') and red ('Stop') lights will begin to flash the code of the recorded fault. The fault codes flash in the following sequence: the yellow light flashes once, then there is a pause where both lights are off. Then the numbers of the recorded fault code flash in red. There is a pause between each number. When the number is done, the yellow light flashes again. e.g. yellow flashes once - pause - red flashes twice - pause - red flashes three times - pause - red flashes five times - pause - yellow flashes once, indicates fault code 235. The number will repeat in the same sequence until the system is advanced to the next active fault code or the diagnostic switch is switched to the 'OFF' position. Refer to 'Electronic Fuel System Diagnostic Codes' table for fault code descriptions.

## ELECTRONIC FUEL SYSTEM DIAGNOSTIC CODES

| Error Code | Description  | Fault Lamp |
|------------|--|------------|
| 111        | ECM Hardware Internal Failure - Mission disabling            | Red        |
| 112        | Timing Actuator - Mechanically stuck                         | Red        |
| 113        | Timing Actuator - Component shorted high                     | Yellow     |
| 114        | Timing Actuator - Component shorted low                      | Yellow     |
| 115        | Engine Speed Sensor - Both signals lost                      | Red        |
| 116        | Fuel Timing Pressure Sensor - Component shorted high         | Red        |
| 117        | Fuel Timing Pressure Sensor - Component shorted low          | Red        |
| 118        | Fuel Pump Pressure Sensor - Component shorted high           | Yellow     |
| 119        | Fuel Pump Pressure Sensor - Component shorted low            | Yellow     |
| 121        | Engine Speed Sensor - One signal lost                        | Yellow     |
| 122        | Boost Pressure Sensor - Component shorted high               | Yellow     |
| 123        | Boost Pressure Sensor - Component shorted low                | Yellow     |
| 131        | Throttle Position Sensor - Component shorted high            | Red        |
| 132        | Throttle Position Sensor - Component shorted low             | Red        |
| 135        | Oil Pressure Sensor - Component shorted high                 | Yellow     |
| 141        | Oil Pressure Sensor - Component shorted low                  | Yellow     |
| 143        | Oil Pressure Sensor - Data below normal range                | Amber      |
| 144        | Engine Coolant Temperature Sensor - Component shorted high   | Yellow     |
| 145        | Engine Coolant Temperature Sensor - Component shorted low    | Yellow     |
| 151        | Engine Coolant Temperature Sensor - Data above normal range  | Amber      |
| 153        | Intake Manifold Temperature Sensor - Component shorted high  | Yellow     |
| 154        | Intake Manifold Temperature Sensor - Component shorted low   | Yellow     |
| 155        | Intake Manifold Temperature Sensor - Data above normal range | Amber      |
| 221        | Ambient Air Pressure Sensor - Component shorted high         | Yellow     |
| 222        | Ambient Air Pressure Sensor - Component shorted low          | Yellow     |
| 231        | Coolant Pressure Sensor - Component shorted high             | Yellow     |
| 232        | Coolant Pressure Sensor - Component shorted low              | Yellow     |
| 233        | Coolant Pressure, Engine Protection - Low coolant pressure   | Amber      |
| 234        | Engine Speed - Data above normal range                       | Red        |
| 235        | Engine Coolant Level - Data below normal range               | Amber      |
| 254        | Fuel Shut-off Valve - Component shorted low                  | Red        |

## ELECTRONIC FUEL SYSTEM DIAGNOSTIC CODES

| Error Code | Description  | Fault Lamp |
|------------|--|------------|
| 259        | Fuel Shutoff Solenoid - Fuel shutoff valve stuck open  | Red        |
| 261        | Fuel Temperature, Engine Protection - Fuel temperature high                                    | Amber      |
| 263        | Fuel Temperature Sensor - Component shorted high   | Yellow     |
| 265        | Fuel Temperature Sensor - Component shorted low  | Yellow     |
| 316        | Fuel Pump Actuator - Component shorted high or low   | Yellow     |
| 318        | Fuel Pump Flow - Mismatch between estimated and desired pressures                              | Yellow     |
| 342        | ECM Not Calibrated - ECM software mission disabling failure                                    | Red        |
| 343        | ECM Hardware Failure - Warning non mission disabling   | Yellow     |
| 346        | ECM Software - Read/write, checksum error - Non mission disabling                              | Yellow     |
| 415        | Oil Pressure Sensor - Data indicates very low oil pressure                                     | Amber      |
| 422        | Engine Coolant Level Sensor Signals - Data invalid   | Yellow     |
| 423        | Fuel Timing Pressure Sensor - In-range failure   | Yellow     |
| 431        | Throttle Position Idle Validation Switch - Invalid   | Yellow     |
| 432        | Throttle Position Idle Validation Switch - Switch position & throttle percent mismatch failure | Amber      |
| 441        | Battery Voltage, Unswitched - Data below normal engine range                                   | Yellow     |
| 442        | Battery Voltage, Unswitched - Data above normal engine range                                   | Yellow     |
| 451        | Fuel Pressure Sensor - Component shorted high  | Red        |
| 452        | Fuel Pressure Sensor - Component shorted low   | Red        |
| 455        | Fuel Control Valve - Component shorted high or open  | Red        |
| 467        | Timing Fueling Flow - Mismatch between estimated and desired timing                            | Yellow     |
| 468        | Fueling Rail Flow - Mismatch between estimated and desired rail pressure                       | Yellow     |
| 511        | Fuel Control Valve - Component shorted low   | Red        |
| 514        | Fuel Control Valve - Actuator mechanically stuck open  | Red        |
| 524        | Alternate Droop Switch Fault   | Yellow     |
| 551        | Idle Validation Circuit - No voltage detected on both off-idle and idle pins                   | Red        |
| 553        | Engine Fueling Pressure Exceeded - Data above normal range                                     | Red        |
| 554        | Fuel Pressure Sensor - In-range failure  | Yellow     |
| 555        | Blowby Pressure, Engine Protection - Blowby pressure high                                      | Amber      |
| 719        | Blowby Pressure Sensor - Component shorted high  | Yellow     |
| 728        | Blowby Pressure Sensor - Component shorted low   | Yellow     |
| 753        | Engine Speed Sensor - Engine speed signals do not match  | Off        |

## Steering

The steering wheel position can be adjusted as required for the most convenient operating position. To adjust, pull out adjustment lock and tilt steering wheel up or down as desired; release lever to lock adjustment.

The steering system provides full-time hydraulic power with a continuous-running pump and a pressurized accumulator. The accumulator helps maintain a constant flow of hydraulic power to operate the steering cylinders.

To steer the front wheels, rotate the steering wheel in the desired direction to the required radius of turn. The front wheels will turn only as the steering wheel is turned and at a rate of turning directly proportional to steering wheel speed. The front wheels will stop and hold position when the steering wheel is stopped. To return the front wheels to the straight ahead position or to the opposite direction, turn the steering wheel in the opposite direction.

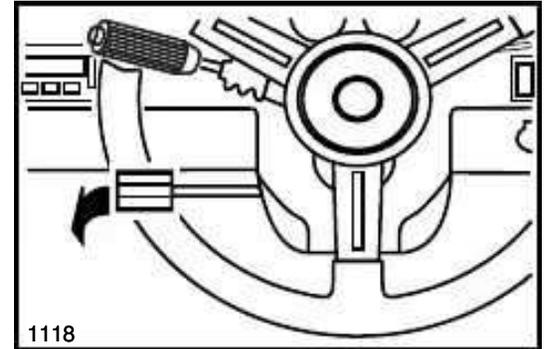


### WARNING

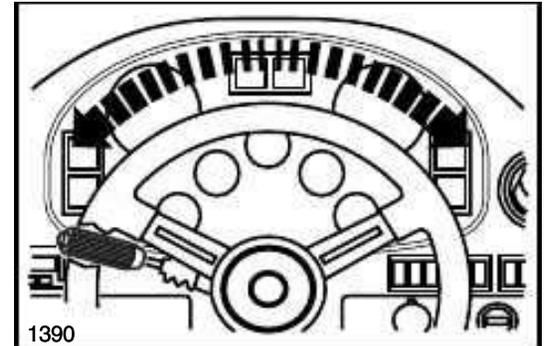
**In the event of loss of steering pump output pressure, a fully-pressurized accumulator provides a maximum of two lock to lock turns of the front wheels. A red warning light on the instrument panel illuminates and a buzzer sounds when steering pressure falls below 83 bar (1200 lbf/in<sup>2</sup>). If this warning light illuminates, indicating a loss of steering power, the machine must be stopped immediately and no further operation attempted until the fault is corrected.**

**The accumulator slowly bleeds down after engine shut-off to prevent accidental steering. However, accumulator pressure should be dissipated after engine shut-off by turning the steering wheel in both directions to avoid accidental steering during bleed down.**

**Improper steering control unit repair or hose connections can cause sudden and forceful steering wheel movement when engine is started. Keep hands off steering wheel when starting engine.**



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## Transmission

This machine is equipped with an CEC (Commercial Electronic Control) shift system, to operate the transmission. The CEC shift system continually monitors the transmission and shift system electrical components and warns the operator when a problem develops. It also takes action to prevent damage to the transmission, and provides the serviceman with diagnostic capabilities so that problems can be corrected quickly and easily.



### **WARNING**

**Before any welding is done on a machine equipped with a CEC shift system, disconnect battery equalizer ground cables, battery cables from terminal posts (ground cable first), battery equalizer positive cables and electrical connections at the ECU to avoid damage to electrical components. Turn off the main key switch to isolate the batteries before disconnecting any components.**

In addition, CEC provides the following systems designed to protect the operator and mechanical components:

**REVERSE INHIBIT** - Prevents gear selection if engine is operating at more than 20% throttle.

**HOIST INTERLOCK PRESSURE SWITCH** - The ECU will shift the transmission from Reverse to Neutral if the body control lever is moved to the 'Raise' position. When this circuit has been activated, moving the transmission shift lever to Neutral, the re-selecting Reverse, will engage Reverse gear whilst the body is held in the 'Raise' position. This feature is only operational in the normal automatic driving mode, either power or economy. It is not activated during the manual mode.



### **WARNING**

**The standard procedure for raising the body must still be adhered to.**

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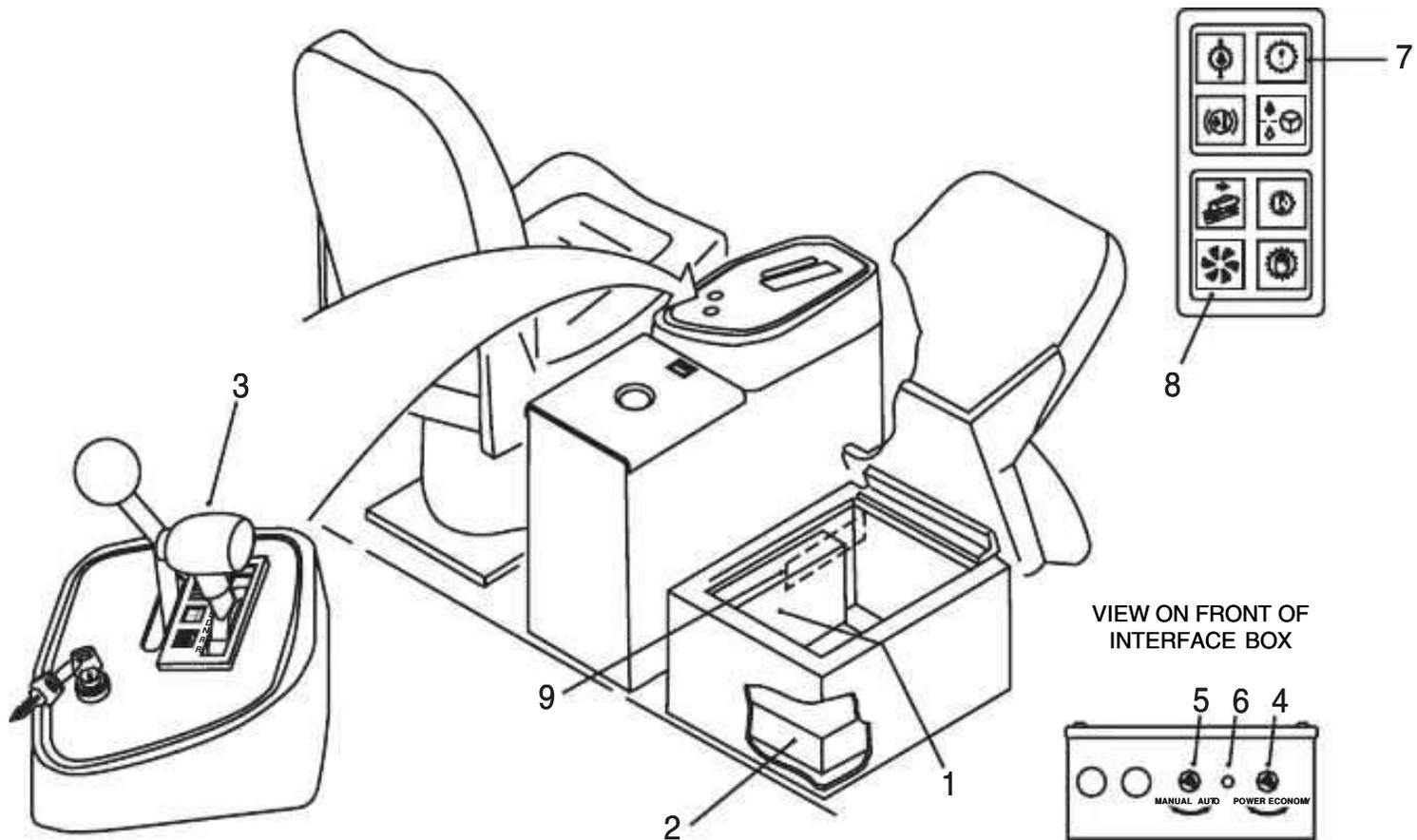
**BODY UP INTERLOCK** - When the body is raised, the CEC system will only allow the transmission to operate in First gear. This feature is only operational in the normal automatic driving mode, either power or economy. It is not activated during the manual mode.

**PARKING BRAKE INTERLOCK** - If the parking brake is applied while the transmission is in Neutral, the CEC system will prevent a shift out of Neutral to protect the brake components. If the parking brake is applied while the transmission is in gear, the parking brake interlock will not function and normal shifts will occur.

**LOCK-IN-GEAR** - The lock-in-gear feature is designed to protect the transmission from damage should wheel spinning or lockup occur due to poor traction or panic braking. The ECU will delay making a shift for several seconds and then, if the condition fails to correct itself, locks in gear and prevents any further shifting. The Check Trans warning light will come on. If this occurs, the ECU must be reset before normal operation may be resumed.

To reset the ECU if the transmission has locked in gear because of wheel spinning or a panic stop, stop the machine, select 'Neutral', apply the parking brake, and shut down the engine. Wait ten seconds, then restart the engine. Select 'Reverse', then 'Neutral'. The Check Trans warning light should go 'Off'.

**COLD WEATHER STARTS** - During cold weather starts, if the transmission temperature is below  $-24^{\circ}\text{C}$  ( $-10^{\circ}\text{F}$ ) the Check Trans warning light will illuminate and the ECU will prevent the transmission from being shifted out of Neutral. Between  $-24^{\circ}\text{C}$  ( $-10^{\circ}\text{F}$ ) and  $-7^{\circ}\text{C}$  ( $19^{\circ}\text{F}$ ) the light will go out and the ECU will only permit operation in First or Reverse gears. Above  $-7^{\circ}\text{C}$  ( $19^{\circ}\text{F}$ ), normal operation will be permitted.



- 1. Electronic Control Unit (ECU)
- 2. Interface Box
- 3. Gear Shift Selector

- 4. Mode Selection Switch
- 5. Manual Mode Switch
- 6. Manual Mode Warning Light

- 7. Check Trans Warning Light
- 8. In-converter Indicator Light
- 9. Digital Data Line

## Description and Operation

**1. Electronic Control Unit (ECU)** - Contains an electronic microcomputer. The ECU receives information in the form of electronic signals from switches and sensors, processes the information, and sends electronic signals to the

appropriate solenoids which control the transmission.

**2. Interface Box** - Contains fuses and relays.

**3. Gear Shift Selector** - The shift selector is a remote mounted lever type. The gear shift selector is connected to the ECU by a wiring harness. The shift lever has 6 forward ranges and 2 reverse ranges, as well as a neutral position.



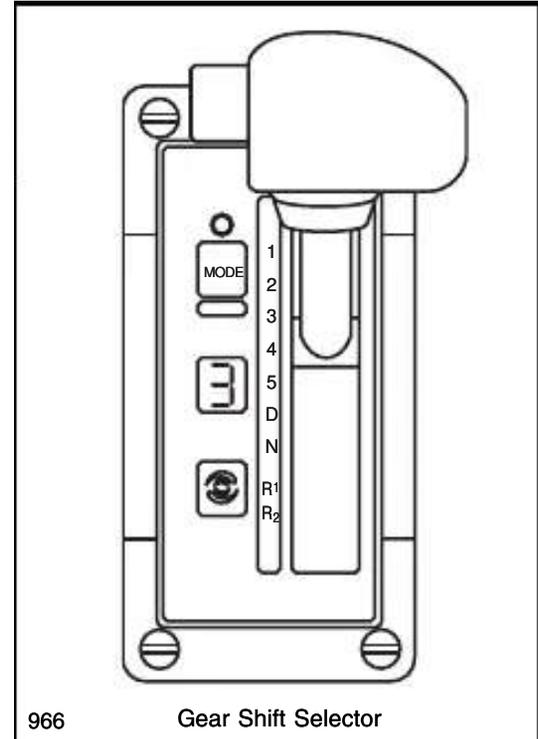
### WARNING

Do not allow the vehicle to coast in Neutral. This practice can result in severe transmission damage.

The shift selector has a single digit LED display, that during normal operation will display the gear selected (*Not gear attained*). Diagnostic information can be displayed on the single digit LED display by pressing the diagnostic display button. There is a hold override button that must be pressed when shifting between R, N and D. The hold override button is released when desired selector position is reached. The selector lever can move freely between D and the number ranges without pressing the hold override button.

The transmission upshifts and downshifts automatically between first range and the highest range selected on the range selector in direct response to throttle position and transmission output speed.

When Reverse is selected the reverse alarm sounds and the reverse light illuminates at the rear of the vehicle. This feature warns personnel to the immediate rear of the vehicle that the operator has shifted to reverse.



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through all six forward ranges as required by loads and travel speeds. Selecting a lower range (4th, 3rd etc.) limits the highest range to which the transmission will automatically upshift.

If a lower range is selected while moving forward, the transmission automatically downshifts sequential to the selected lower range at maximum controlled engine speeds. Downshifts will not occur until vehicle is slowed by use of the service brakes and/or retarder.

When shifting from neutral to start from a standstill, or to reverse direction, decelerate the engine to idle speed. To move forward, select drive 'D' and accelerate the engine to the vehicle load and speed requirements. The transmission will automatically upshift from 1st through 6th ranges as travel speed increases.

With the throttle fully depressed, and the mode selection switch in the Power position, the transmission upshifts to the next higher range when the engine attains maximum rated speed, since maximum power train output is needed under this condition. At lower throttle settings where minimum power train performance is required, the transmission will upshift to the next higher range at less than maximum rated engine speed.

Upgrades or soft spots might slow travel speed, even at full throttle, requiring transmission downshifts to maintain maximum powertrain performance. When this occurs, the transmission downshifts automatically.

Shift the transmission to the next lowest range if transmission 'Hunting' or 'Shift Cycling' occurs.

When temporarily stopped, such as for yielding the right-of-way to a loaded vehicle, the transmission can be left in the selected range and the vehicle held stationary with the service brakes.

However, when stopped for a more extended period with the engine left running, shift the transmission to neutral to avoid unnecessary heat buildup and apply the parking brake.



## WARNING

Always select Neutral and apply the parking brake before leaving the operator's seat.

**4. Mode Selection Switch** - Gives the option to select between transmission 'POWER' and 'ECONOMY' shift schedules. The transmission must be in Neutral before the switch will function.

The transmission torque converter is equipped with a lockup clutch which, when engaged by the ECU, locks the converter pump and turbine together as a single unit and allows power to be transmitted mechanically from the engine directly to the transmission gearing on a 1 to 1 ratio. When the lockup clutch is disengaged, the torque converter acts as a fluid coupling, multiplying torque when engine speed is significantly higher than transmission output shaft speed.

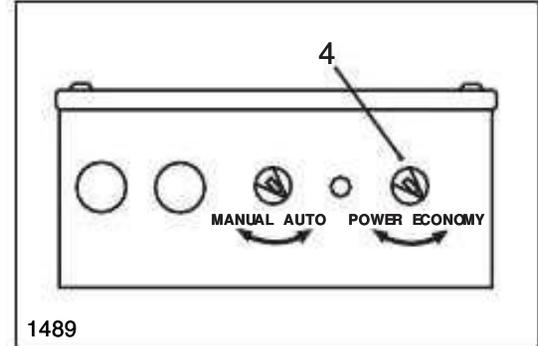
When the Mode Selection Switch is in the 'POWER' position, the ECU controls operation of the lockup clutch according to signals received by the throttle position sensor (giving engine speed as a percent of throttle), the transmission output shaft speed sensor, and range selector. The ECU may delay application of the lockup clutch and allow torque multiplication by the torque converter to

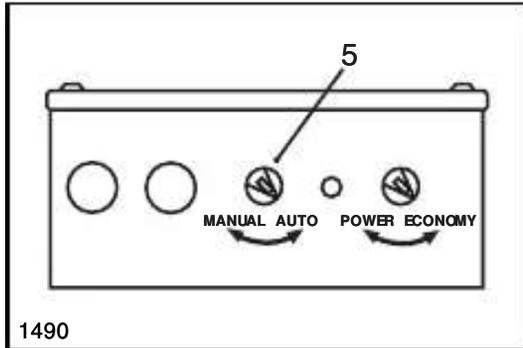
take place until a balance is achieved between engine speed and transmission output shaft speed before activating the lockup clutch.

### Power versus Economy Mode

The POWER mode is designed for applications involving heavy loads and hilly duty cycles where performance rather than fuel economy is of prime importance.

The ECONOMY mode is designed for applications involving lighter loads and level duty cycles or where fuel economy is more important than performance.





timed, preprogrammed schedule where in Second through Sixth gears the lockup clutch is disengaged only long enough to allow the torque converter's fluid coupling to absorb shift shock. Otherwise, the lockup clutch is engaged and no torque multiplication takes place in Second through Sixth gears.

**5. Manual Mode Switch** - The manual mode facility is designed as a Service Technician facility to allow stall checks and clutch pressure checks to be implemented by Service Personnel, and permit movement of the vehicle, if necessary, to a repair area. With the manual mode switch in the 'On' position, the body up interlock and hoist interlock pressure switch mechanisms are disengaged.



**WARNING**

**This allows unauthorised selection of reverse or any forward gear with the body raised, constituting a safety hazard. Operators must not use the manual mode facility when working the vehicle! It is recommended that the mode selection key is removed from the unit and retained in a safe place until required by Service personnel.**

**Note:** The manual mode can only be used if the mode selection switch is in the Power position and the transmission is in neutral.



**WARNING**

**Do not operate engine for more than 30 seconds at full throttle with transmission in gear and output stalled as this will result in severe overheat damage to the transmission.**



## WARNING

The manual mode is not intended to be used for normal operations. The machine should only be driven at very low speeds in first or reverse gears if the manual mode is activated, or damage to the transmission may result.

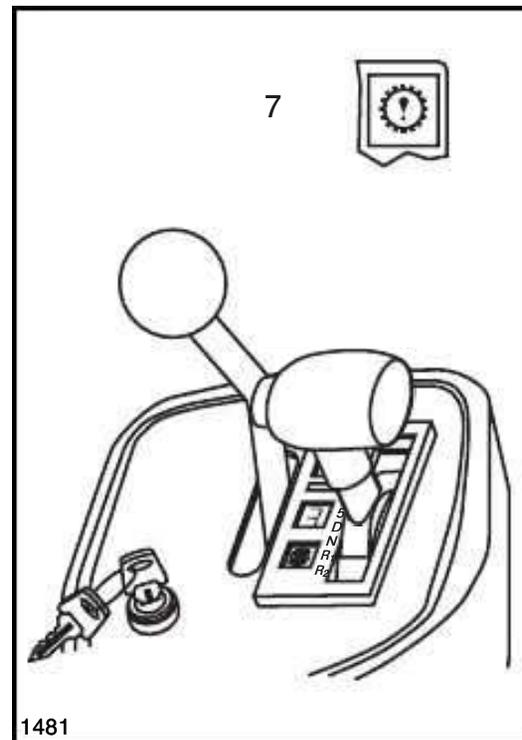
**6. Manual Mode Warning Light** - This light is located on the front face of the CEC-2 interface box. The Manual Mode Warning Light illuminates to alert the operator when the transmission has been switched to operate in the manual mode. The light should be 'Off' during normal operation.

**7. Check Trans Warning Light** - Illuminates to alert of a minor fault in the transmission shift system or abnormal transmission temperature. The warning light will come 'On' when the ignition keyswitch is turned to position '1' to provide a bulb and system check and should go 'Off' a few seconds after the engine is started and the transmission oil pressure rises.

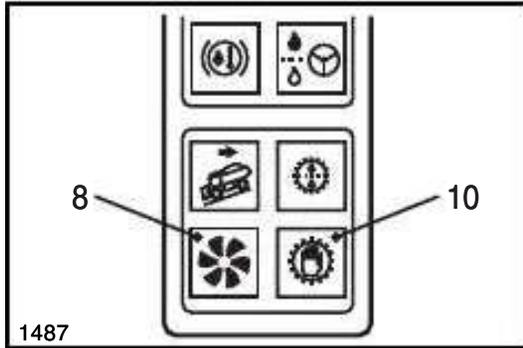
The check trans warning light will come 'On' during operation if the ECU has detected a minor fault in an electrical component or abnormal transmission oil temperature. If transmission oil temperature is too high, stop the machine, select

Neutral (N), and increase engine speed to allow a greater flow of oil to the cooler until the temperature drops to normal operating range. In most cases, a minor fault triggering the check trans warning light will not prevent normal operation from continuing but, depending on the nature of the problem, the ECU could take action to protect the transmission from damage, such as preventing operation in high gear ranges. If the check trans warning light comes 'On', have the problem diagnosed and corrected at the earliest opportunity.

**8. In-converter Indicator Light** - Illuminates when the transmission is in torque converter drive. It goes 'Off' when Lockup is engaged. In order to avoid unnecessary waste of fuel, if traffic or other road conditions permit, the operator



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should modify throttle position, or gear held to achieve a steady road speed with the torque converter lockup engaged (Indicator Light 'Off'). The Lockup relay in the interface box is also activated by the 20 bar (290 psi) pressure switch on the foot brake pedal. When this switch is activated the converter in light will be illuminated due to the transmission dropping out of converter lock up, avoiding engine stall.

**9. Digital Data Line** - Located in the right hand side of the transmission control tower. Plug in connector for diagnostic data reader (DDR).

**10. Transmission Overspeed Light** - Illuminates when the transmission ECU senses transmission speed above 2350 rev/min.

## GENERAL TRANSMISSION OPERATION

Watch for wide deviations from normal readings on the transmission oil temperature gauge during machine operation. If the transmission oil temperature gauge, on vehicles which do not have a transmission retarder fitted, shows oil temperature consistently rising above the green zone (43 - 135° C; 100 - 275° F) under normal operating conditions; check for external causes. If none are evident shift to Neutral (N) and operate the engine at 1 200 - 1 500 rev/min. If the transmission oil temperature does not decrease into the green zone within 2 or 3 minutes, the cause of the overheating should be corrected before the machine is operated further. Watch the oil temperature gauge when operating on upgrades, also. If the oil temperature goes into the red zone (135 - 176° C; 275 - 350° F), select the range which will limit upshifts to the highest range in which the transmission will operate within the normal temperature range. If upshifting must be consistently limited to ranges lower than normal for the loads and the grades encountered to prevent overheating the transmission oil, the causes should be determined and corrected. On vehicles fitted with a transmission retarder, it is permissible to operate with the gauge showing in the yellow zone, during operation of the transmission retarder.

## Retrieving Diagnostic Codes

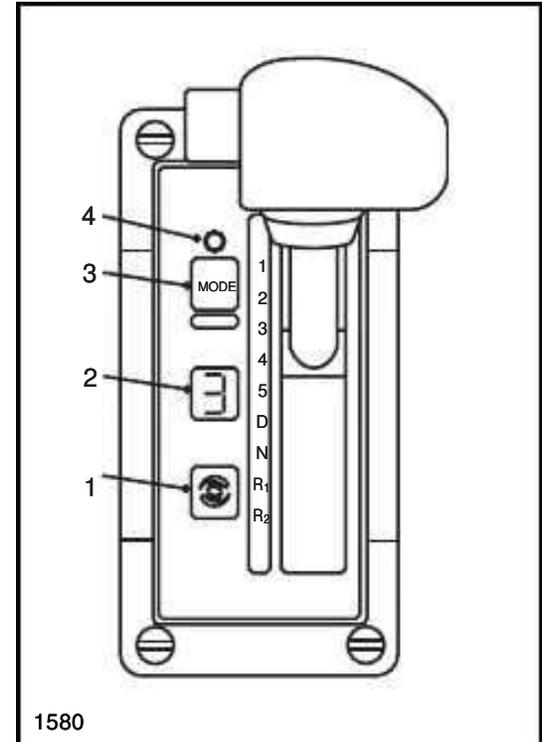
Diagnostic fault codes can be retrieved from the CEC2 system using the gear shift selector or by plugging in the diagnostic data reader (DDR). To obtain diagnostic codes using the gear shift selector:

- Check transmission warning light on dash will illuminate when ECU detects a fault.
- Stop truck and select 'Neutral'.
- Press diagnostic button (1) on gear shift selector. Display (2) on gear shift selector will flash one digit at a time.
- Display starts with code position D1, D2, etc, followed by the two digit main code, then the two digit subcode.
- To advance to the next code, press the mode button (3). Up to five codes can be stored.
- Active codes are indicated by illumination of the mode light (4).

## Clearing Diagnostic Codes

- To clear active codes, press and hold mode button (3) for 3 to 5 seconds.
- To clear inactive codes, press and hold mode button (3) for 8 to 10 seconds.

To exit diagnostic mode, press diagnostic button (1). Refer to table for diagnostic code description.



## CEC2 DIAGNOSTIC CODES

| Main Code     | Sub Code      | Description                                     | Check Trans Light |
|---------------|---------------|---|-------------------|
| 13            | 12            | ECU input voltage low                           | Yes               |
| 13            | 23            | ECU input voltage high                          | Yes               |
| <del>21</del> | <del>23</del> | <del>Throttle sensor failed low</del>           | <del>Yes</del>    |
| 22            | 14            | Engine speed sensor                             | Yes               |
| 22            | 15            | Turbine speed sensor                            | Yes               |
| 22            | 16            | Output speed sensor                             | Yes               |
| 23            | 12            | Primary shift selector                          | Yes               |
| 23            | 12            | Primary shift selector mode function            | No                |
| 23            | 14            | Secondary shift selector                        | Yes               |
| 23            | 15            | Secondary shift selector mode function          | No                |
| <del>24</del> | <del>16</del> | <del>Shift selector display line fault</del>    | <del>Yes</del>    |
| 24            | 23            | Sump fluid temperature hot                      | Yes               |
| 25            | 11            | Output speed sensor, zero speed, 1st            | Yes               |
| 25            | 22            | Output speed sensor, zero speed, 2nd            | Yes               |
| 25            | 33            | Output speed sensor, zero speed, 3rd            | Yes               |
| 25            | 44            | Output speed sensor, zero speed, 4th            | Yes               |
| 25            | 55            | Output speed sensor, zero speed, 5th            | Yes               |
| 25            | 66            | Output speed sensor, zero speed, 6th            | Yes               |
| <del>25</del> | <del>33</del> | <del>Output speed sensor, zero speed, 3th</del> | <del>Yes</del>    |
| 26            | 00            | Throttle source not detected                    | No                |
| 33            | 12            | Sump fluid temperature sensor failed low        | Yes               |
| 33            | 23            | Sump fluid temperature sensor failed high       | Yes               |
| 34            | 12            | Factory calibration compatibility number wrong  | Yes               |
| 34            | 13            | Factory calibration fault                       | Yes               |
| 34            | 14            | Power off fault                                 | Yes               |
| 34            | 15            | Diagnostic queue fault                          | Yes               |
| 34            | 16            | Real time fault                                 | Yes               |
| 34            | 17            | Customer modifiable constants fault             | Yes               |
| 35            | 00            | Power interruption                              | No                |
| 35            | 16            | Real time interruption                          | Yes               |

## CEC2 DIAGNOSTIC CODES

| Main Code | Sub Code | Description                                      | Check Trans Light |
|-----------|----------|--|-------------------|
| 36        | 00       | Hardware/software not compatible                 | Yes               |
| 45        | 12       | General solenoid failure - F                     | Yes               |
| 45        | 13       | General solenoid failure - K                     | Yes               |
| 45        | 14       | General solenoid failure - B                     | Yes               |
| 45        | 15       | General solenoid failure - G                     | Yes               |
| 45        | 16       | General solenoid failure - E                     | Yes               |
| 45        | 21       | General solenoid failure - H/J                   | Yes               |
| 45        | 22       | General solenoid failure - A                     | Yes               |
| 45        | 23       | General solenoid failure - D                     | Yes               |
| 45        | 24       | General solenoid failure - I                     | Yes               |
| 45        | 26       | General solenoid failure - C                     | Yes               |
| 46        | 21       | High-side overcurrent, H/J solenoid              | Yes               |
| 46        | 26       | High-side overcurrent, C, D, E solenoid          | Yes               |
| 46        | 27       | High-side overcurrent, A, B, F, G, I, K solenoid | Yes               |
| 56        | 11       | Range verification ratio test, 1st               | Yes               |
| 56        | 22       | Range verification ratio test, 2nd               | Yes               |
| 56        | 33       | Range verification ratio test, 3rd               | Yes               |
| 56        | 44       | Range verification ratio test, 4th               | Yes               |
| 56        | 55       | Range verification ratio test, 5th               | Yes               |
| 56        | 66       | Range verification ratio test, 6th               | Yes               |
| 56        | 77       | Range verification ratio test, R1 or 7th         | Yes               |
| 56        | 88       | Range verification ratio test, R2 or 8th         | Yes               |
| 65        | 00       | Engine rating too high                           | Yes               |
| 66        | 00       | Serial communications interface                  | No                |
| 69        | 27       | ECU, inoperative A, B, F, G, I, K solenoid       | Yes               |
| 69        | 28       | ECU, inoperative H/J solenoid                    | Yes               |
| 69        | 29       | ECU, inoperative C, D, E solenoid                | Yes               |
| 69        | 33       | ECU, COP fault                                   | Yes               |
| 69        | 34       | ECU, EEPROM fault                                | Yes               |
| 69        | 35       | ECU, EEPROM fault                                | Yes               |
| 69        | 42       | SPI output failure                               | No                |
| 69        | 43       | SPI input failure                                | Yes               |

## Body Control

The lever to the left of the operator's seat controls the hydraulic valve which operates the body hoist cylinders. The four operating positions of the lever from front to rear are as follows:

**'LOWER'** - This position provides hydraulic force to power-down the body. It is needed when the body cannot be started downward from the fully raised position by gravity. When the body starts lowering by gravity, the lever should be moved to the 'FLOAT' position.

**'FLOAT'** - The lever should be moved to this position while the body is lowering by gravity and should remain in this position until the body must be operated again. The control lever should always be kept in 'FLOAT' while the machine is in motion.

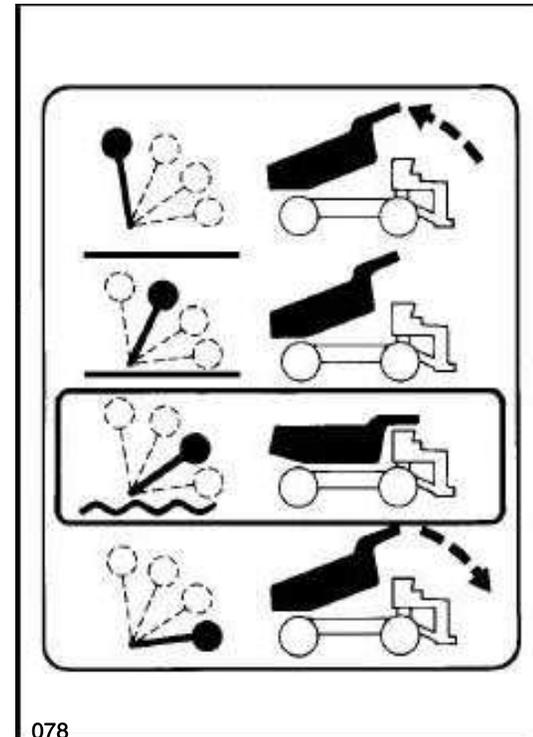
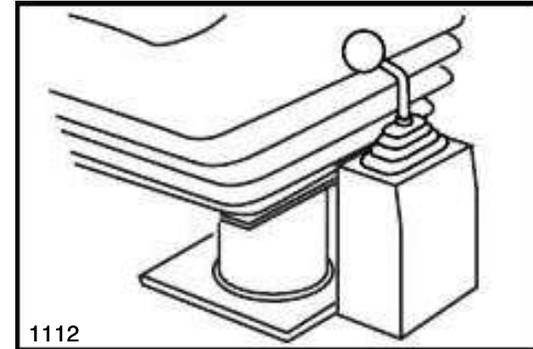
**'HOLD'** - Moving the lever to this position while the body is being raised or lowered traps the oil in the body hoists to stop and hold the body at any desired height. The lever will remain in the detented 'HOLD' position when released.

**'RAISE'** - This position directs oil to extend the body hoists and raise the body. When released, the lever will be spring-returned to the 'HOLD' position.



### WARNING

**Pressurized system. Before carrying out any maintenance on the body control system, pressure must be dissipated from the pilot valve accumulator. Shut-off the engine and operate the body control lever in both directions approximately 15 times to discharge the accumulator. A pressure gauge can be fitted to the remote test point at the accumulator valve to check pressure readings.**



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### **Raising the Body**

Before raising the body, allow the engine to slow to idle, make sure the rear wheels are on firm level ground, shift the transmission to Neutral and hold the machine stationary by applying the brakes with the Parking-Emergency brake control.

Move the body control lever all the way back to the 'RAISE' position and accelerate the engine. The body can be stopped at any point by moving the lever to 'HOLD'. Decelerate the engine as the last stages of the body hoists begin to extend to slow the raising speed as the hoists approach their maximum extensions.

When the body has been raised to the desired height, move the control lever to the 'HOLD' position until the body is to be lowered.

### **Lowering the Body**

To lower the body, move the control lever to the 'FLOAT' position to allow the body's weight to lower it to the frame. Body descent can be stopped at any position by moving the lever back to the 'HOLD' position. If the body does not begin to lower by its own weight, such as after dumping downgrade, move the control lever all the way forward to the 'LOWER' position and power the body downward until it begins lowering by gravity. Then move the lever to 'FLOAT' to allow the body to lower the rest of the way to the chassis.

Make sure that the body is completely lowered and the control lever is in 'FLOAT' before releasing the brakes and moving the machine.



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## **4 - Operating The Truck**

## OPERATING THE TRUCK

### Pre-Starting Inspection

\* Before the engine is started ensure the machine is ready for operation.

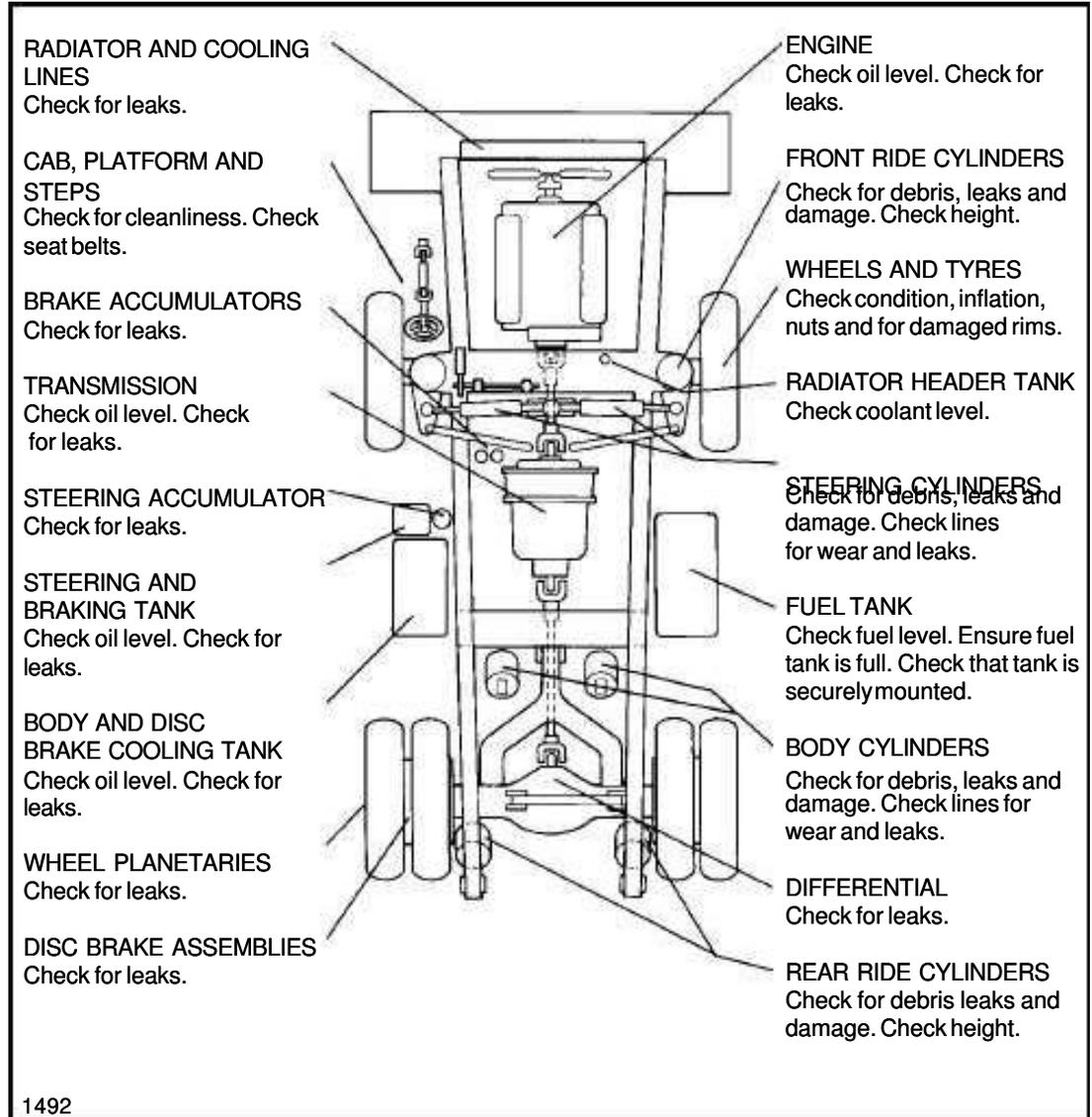
\* The machine should be in a level position to permit accurate checking of fluid quantities in the engine and other components.

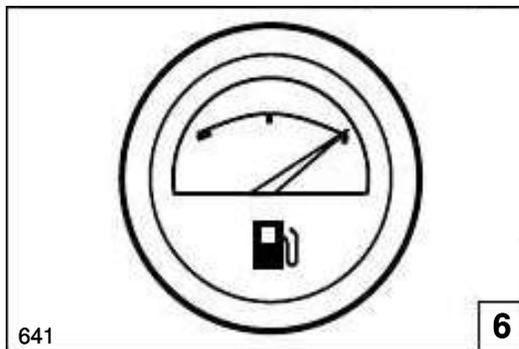
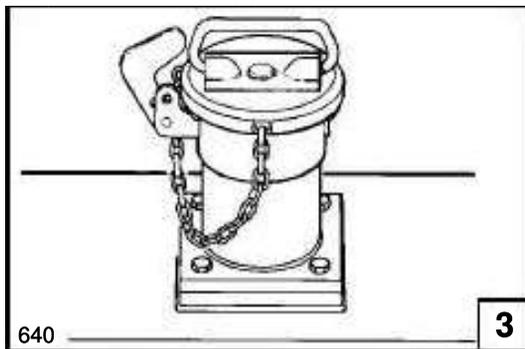
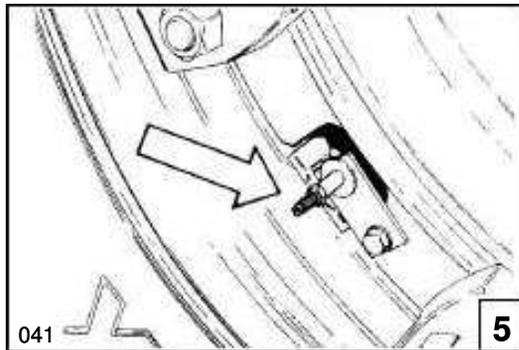
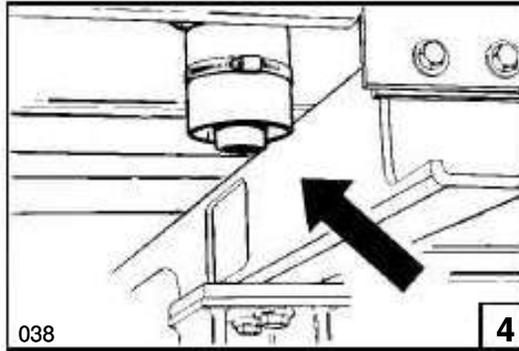
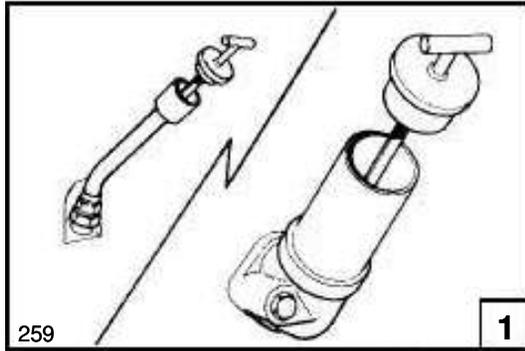
\* Make sure parking brake is applied and block wheels securely to prevent accidental movement of the machine while checking component levels.

\* Test all lights, warning signals, controls and instruments for proper operation.

\* Walk around the machine and carry out the Inspections and Component

Checks described in the drawing opposite and on the following pages.





## Component Checks

**1. Engine** - With the engine off, check oil level. The oil level should be between the lower and upper marks

on the dipstick. Add oil if low.

**2. Fuel Filters** - Drain sediment and water from sump until fuel runs clear.

**3. Radiator Header Tank** - Check coolant level. Add if low.



### WARNING

Press button in centre of cap to bleed pressure before removing cap completely. Fill to bottom of filler neck.

In subfreezing temperatures, be sure that the coolant contains sufficient antifreeze.

**4. Air Cleaner Vacuator Valve(s)** - Check for proper operation. Clean if required.

**5. Tyres** - Carefully inspect all tyres for cuts, bruises, or other damage and proper inflation for the loads to be carried. Inflate all tyres to the recommended pressure while cold.

**6. Fuel Level Gauge** - Check fuel level. Tank should be filled at end of each shift to prevent condensation.

### 7. Body and Disc Brake Cooling

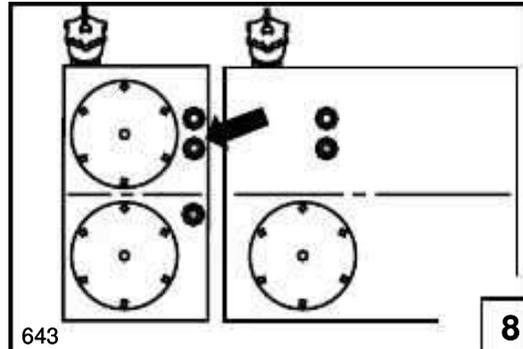
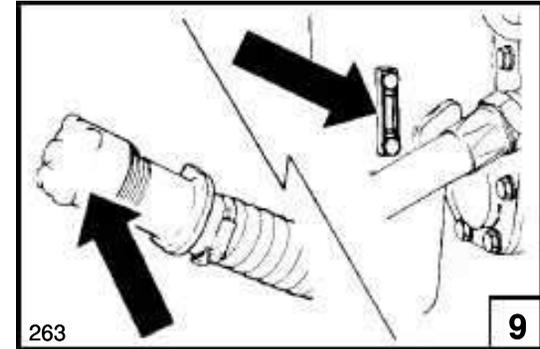
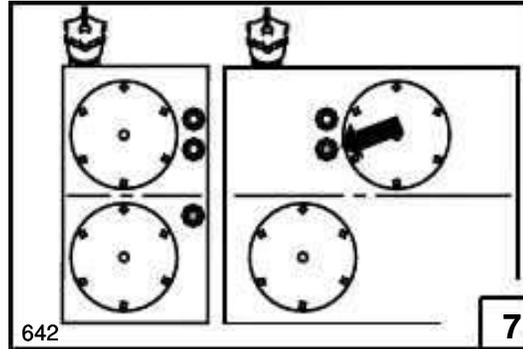
**Tank - Cold Oil Level** - The bottom sight gauge should show full. Add fluid, if low.

**8. Steering and Braking Tank - Cold Oil Level** - With the engine off, turn the steering wheel back and forth to dissipate any pressure in the steering accumulator. Oil should be showing in the middle sight gauge. Add fluid, if low.

### 9. Transmission - Cold Oil Level -

This check is made only to determine if the transmission contains sufficient oil for safe starting. Make sure there is some oil showing on the sight gauge before starting the engine. Add oil if low.

**10. Seat and Seat Belts** - Adjust the seat position and lap belt as required to allow complete machine control at all times with minimum fatigue. Make sure the seat belt does not restrict movement for proper machine operation.



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## Suspension Ride Struts

Suspension ride struts are oiled and charged with nitrogen to ensure optimum ride comfort. However, ride struts may have been lowered during transportation of the machine. These struts must be correctly set prior to operating the machine.

The ride struts contain a mixture of nitrogen and oil, so when the struts are lowered, some oil will be lost along with the nitrogen. Although only a small amount of oil may be lost, this will still affect the final ride height, so it is important that ride struts contain the correct volume of oil.

To recharge the ride struts, nitrogen pressures are given in the table below. These pressures are dependant on oil levels being correct, refer to Section 180, SUSPENSION SYSTEM in the Maintenance Manual. Use suitable lifting equipment to fully extend ride struts and charge with nitrogen.

**Note:** The heights given are intended as reference only, cylinders should always be set according to pressure. Refer to Section 180, SUSPENSION SYSTEM in the Maintenance Manual for full details.

| Truck  | TR35       | TR40       | TR45       | TR60       | TR70       | TR100      |
|--|------------|------------|------------|------------|------------|------------|
| Front Ride Struts - bar (lbf/in <sup>2</sup> ) | 11.7 (170) | 13.8 (200) | 13.8 (200) | 13.8 (200) | 17.2 (250) | 16.3 (240) |
| Height - mm (in)                               | 143 (5.6)  | 168 (6.6)  | 168 (6.6)  | 168 (6.6)  | 158 (6.2)  | 158 (6.2)  |
| Rear Ride Struts - bar (lbf/in <sup>2</sup> )  | 5.5 (80)   | 7 (100)    | 7 (100)    | 8.3 (120)  | 8.3 (120)  | 8.3 (120)  |
| Height - mm (in)                               | 365 (14.4) | 556 (21.9) | 556 (21.9) | 505 (19.9) | 378 (14.9) | 381 (15)   |

**Note:** It is advised to charge the ride struts by an additional 20 lbf/in<sup>2</sup> to allow for pressure lost while carrying out pressure checks.

After recharging, the machine should be operated to allow ride struts to settle. Then if ride heights are incorrect, the oil levels should be checked.

---

## Engine Operation

**Note:** The electronic controlled engine will override the electronic foot pedal position until the engine is warmed up to the correct operating temperature. The engine **MUST** be started with foot 'OFF' the electronic foot pedal.

Do not place engine under **FULL LOAD** at **FULL SPEED IMMEDIATELY** after starting. **ALWAYS** allow the engine to fully circulate lubricant and warm up gradually before operating at full speed and full load.

Operate engine at top rated speed when maximum power is needed for the load.

**NEVER** idle the engine more than 5 minutes at a time; shut it off.

If any gauge operates outwith its normal operating range or a warning light illuminates, shut engine down immediately and report to service or maintenance personnel.

If the 'Stop', 'Warning' and/or 'Fluid' warning lights illuminate, during operation of the machine, take effective action to stop the engine and correct the fault, as described under 'Electronic Fuel System Operation, in Section 3 of this handbook.



### **WARNING**

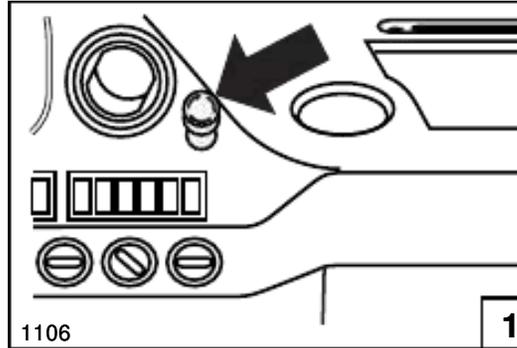
**Never start the engine indoors unless proper exhaust ventilation is provided to remove deadly exhaust gases. Once the engine is running, move the machine outdoors as soon as possible. Exhaust gases are hazardous and can cause unconsciousness and death.**

**Operating the engine beyond high idle speed can cause severe engine damage. The engine speed must not exceed 2 400 rev/min under any circumstances. When descending a steep grade, use a combination of transmission gears, retarder and service brakes to control the vehicle and engine speed.**

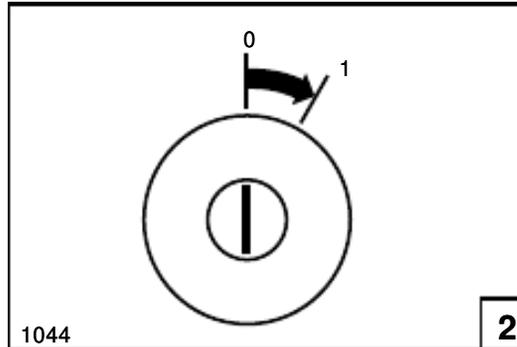
## Starting the Engine

Attention to the warning lights and instruments when starting the engine, and operating, will help the operator monitor the machine systems and components.

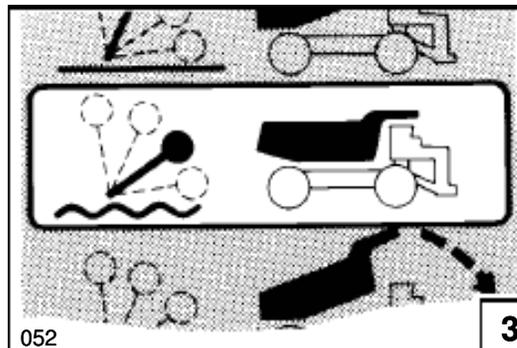
1. Make sure the park-emergency brake control is in the 'PARK' position.



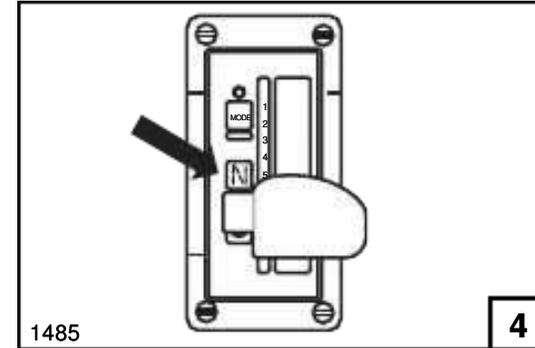
2. Insert switch key and turn clockwise to position '1'.



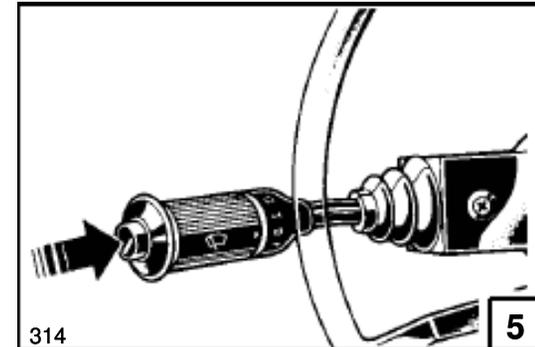
3. Make sure the body control lever is in the 'FLOAT' position.



4. Make sure the transmission shift selector is in the 'NEUTRAL' position.

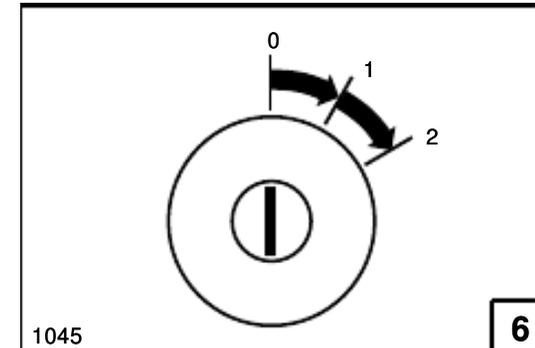


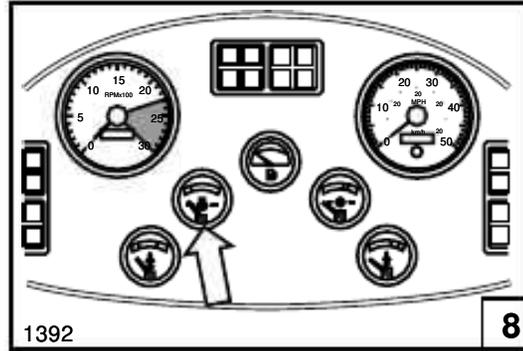
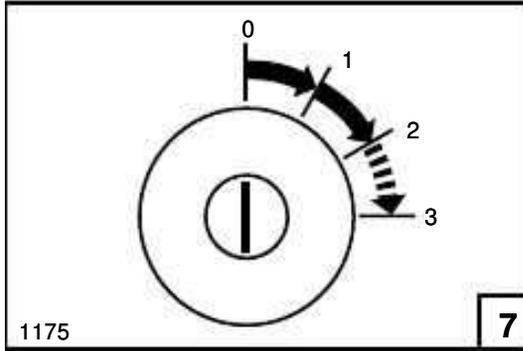
5. Press horn control to sound horn.



**Note:** Always sound horn before starting engine or operating any control.

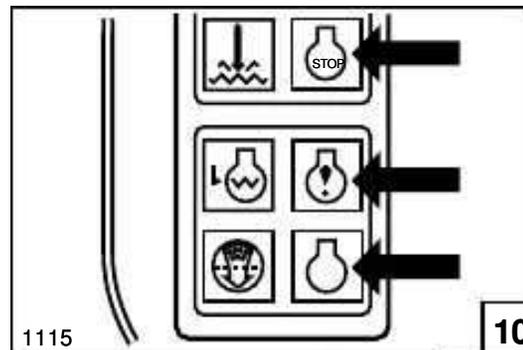
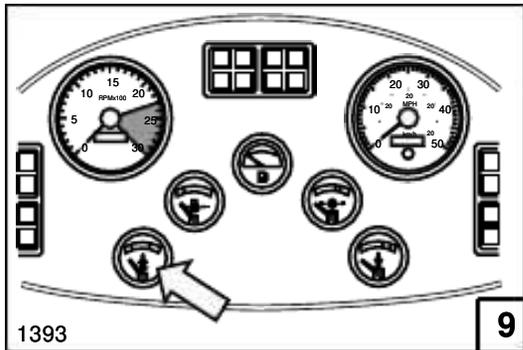
6. Turn key switch to position '2' to switch on the ignition. Press warning light test switch to test operation of warning lights.





7. Turn key further clockwise against spring pressure to position '3' to crank the engine. Release the key as soon as the engine starts firing.

**Note:** Never crank the engine more than 30 seconds continuously. Allow starter(s) at least 2 minutes cooling time between cranking periods to avoid overheating.



8. Check the engine oil pressure gauge. Within 10 to 15 seconds at engine idle, the gauge needle should rise into the yellow zone. If the needle does not rise within 15 seconds, shut off the engine and do not operate until the fault is identified and corrected.

9. Observe the engine water temperature gauge. After a few minutes running time at moderate load and varying speed, the gauge needle should be in the green zone. If the needle moves into the red zone, the engine is over heated and should be shut down immediately.

10. The red 'Stop', yellow 'Warning' and amber 'Fluid' lights will illuminate for approximately 2 seconds, one after another, to check their operation. The lights will remain on until a fault code is recorded.

---

## Starting the Engine with Jumper Cables



### WARNING

**Hazardous hydrogen gas and sulphuric acid. Check for required voltage and polarity connections to discharged batteries. Excessive booster voltage and/or incorrect jumper cable connections, open flame, lighted cigar, or other ignition source can cause battery explosion/fire. Keep all sources of ignition away from batteries. Do not lean over batteries, and wear eye protection at all times to prevent personal injury.**

**Do not jump start a vehicle by using arc welding equipment. Currents and voltages are dangerously high and cannot be sufficiently reduced to make the method safe.**

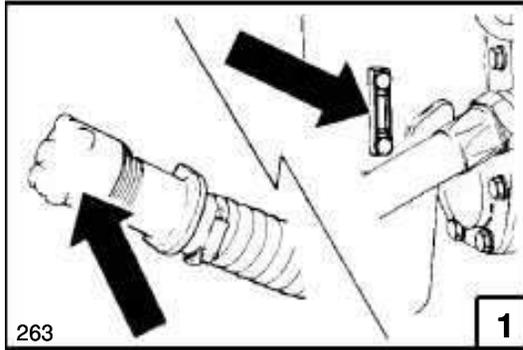
**Note:** Be sure machines are not touching each other. Use cables that are equal to cable size on the machine, for example (1/0) or (2/0).

If jumper cables are used to start an engine, be sure to follow this procedure:

Connect one end of a jumper cable, usually coloured red, to the discharged battery 'POSITIVE' (+) post. Connect the other end of the same cable to the 'POSITIVE' (+) post on the booster or charged battery.

Connect one end of the second cable, usually coloured black, to the 'NEGATIVE' (-) post of the booster battery. Connect the other end of the 'NEGATIVE' (-) cable to machine frame for grounding so that if a spark occurs, it is away from battery fumes (explosive hydrogen).

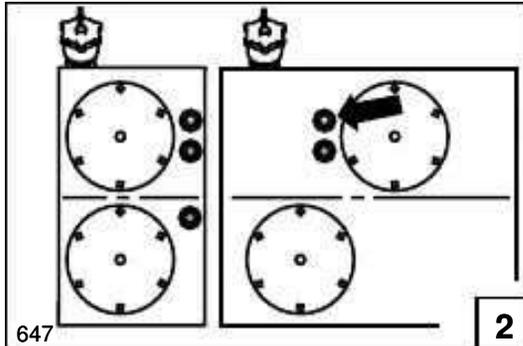
Check for cause of failure on the dead battery.



## Pre-Operating Checks

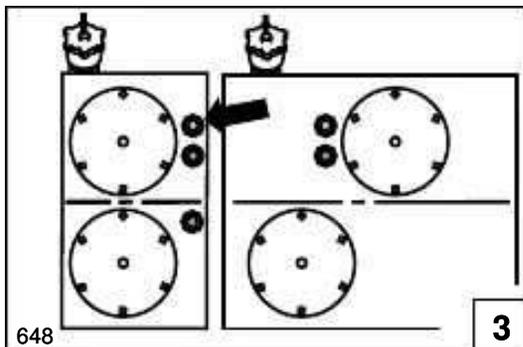
Make sure all cab glass, mirrors and lights are clean. Test all controls to ensure they are functioning properly. Select 'REVERSE' momentarily on the transmission shift selector to make sure the reverse alarm sounds.

**1. Transmission - Hot Oil Level -** The parking brake must be applied and the road wheels securely blocked while carrying out this check. With the engine idling, transmission in 'NEUTRAL' and at normal operating temperature, the top of the oil column should be visible in the sight gauge. Add oil if low. If the top of the column is above the sight gauge, the transmission is overfull and oil should be drained.



**2. Body and Rear Brake Cooling Hydraulic Tank - Hot Oil Level -** Operate the body hoist cylinders to their fully-extended positions to charge all cylinders and lines then lower the body. With the engine running, and body fully lowered, the oil level should show in the top sight gauge. Add oil if low. Under all conditions the bottom sight gauge should show full.

**3. Steering and Braking Hydraulic Tank - Hot Oil Level -** With the engine running, oil at operating temperature and accumulators charged, oil must be between the top and middle sight gauges. Shut down the engine and operate the steering left and right to discharge steering accumulator. Operate treadle valve continuously to discharge braking accumulators. Oil should show in the top sight gauge.



## BRAKE FUNCTION CHECKS

In addition to the above checks, the following brake function checks can be carried out to determine if both the service and emergency brake systems are functional before operating the machine.



## **WARNING**

**Make sure the area around the machine is clear of personnel and obstructions before carrying out these checks.**

**If the machine moves during these checks, stop the machine, apply the parking brake and do not operate until the fault is corrected.**

**Note:** The following checks are NOT intended to measure maximum brake holding ability. If NEW brake pads are fitted, they MUST be burnished as per the manufacturers recommendations before carrying out the checks.

### **Service Brake Holding Ability Check**

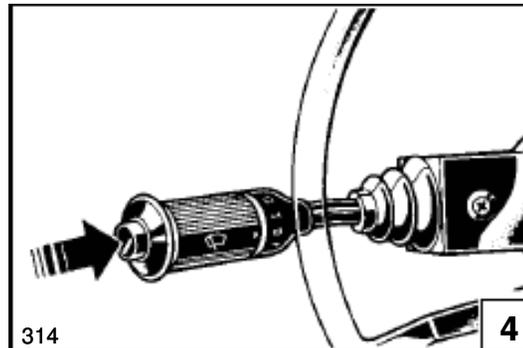
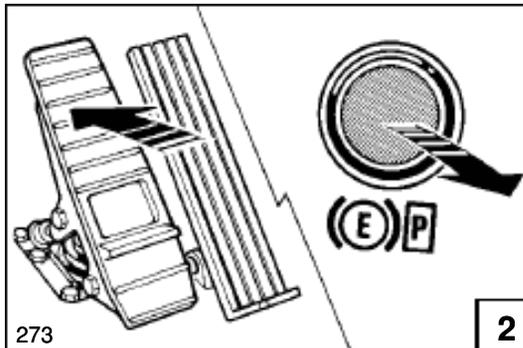
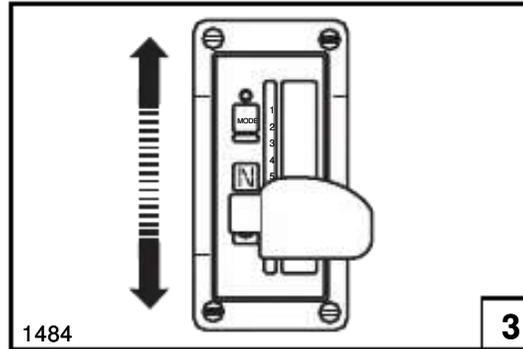
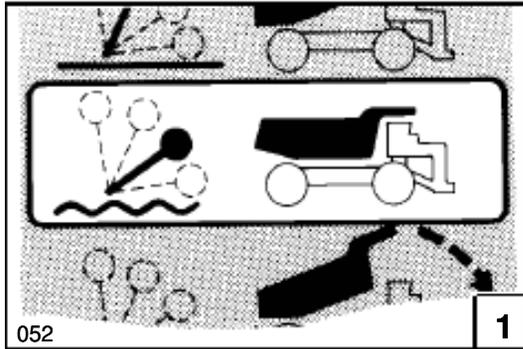
Depress the service brake pedal and select 1st gear on the transmission shift selector. Pull the park/emergency brake control out to release the brakes. Depress accelerator control and accelerate engine to 1 350 rev/min. The machine should not move. Decelerate engine, shift transmission to 'NEUTRAL' and apply the parking brake before releasing the service brake.

### **Emergency Brake Holding Ability Check**

Depress the service brake pedal, release the park/emergency brakes, select first gear, apply the park/emergency brakes and release the service brake pedal. Depress accelerator control and accelerate engine to 1 350 rev/min. The machine should not move. Decelerate engine and shift transmission to 'NEUTRAL'.

**Note:** Brake holding effort required to hold a machine static at a specific engine speed, can vary from machine to machine due to differences in engine performance, powertrain efficiency, etc., as well as differences in brake holding ability.

**Note:** As an indication of system deterioration, the engine speed at which point the machine moved, with the service or emergency brakes applied, can be compared against the engine speed your machine was able to hold to on a previous check.



## Driving and Stopping

Before driving off observe all instruments and warning lights. All instruments should operate in their normal range and all warning lights should be out except possibly the Direction Indicator and Headlight Main Beam warning lights.

Make sure the area around the machine is clear of personnel and obstructions before driving off.

In the first few minutes of travel, check carefully for the required steering, braking, engine and transmission power response for maximum operating safety.

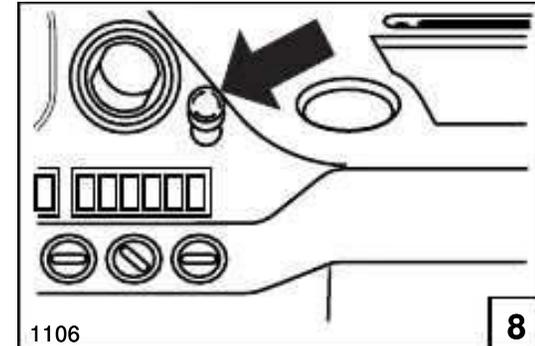
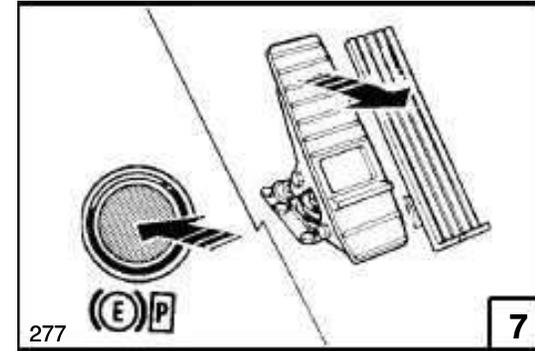
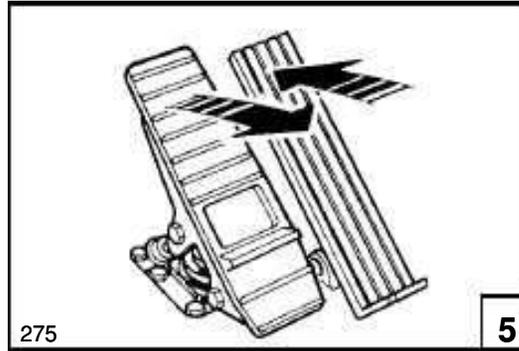
1. Make sure the body is fully down and body control lever is in the 'FLOAT' position.
2. Apply the service brake and release the parking brake.
3. Select the driving direction and the required range.
4. Sound horn; two blasts for forward and three blasts for reverse.

5. Release the service brake, apply the accelerator and move off.

6. To stop the machine release the accelerator and depress the service brake pedal. Release the service brake as the machine slows until, when stopped, the pedal is depressed just enough to hold the machine stationary.

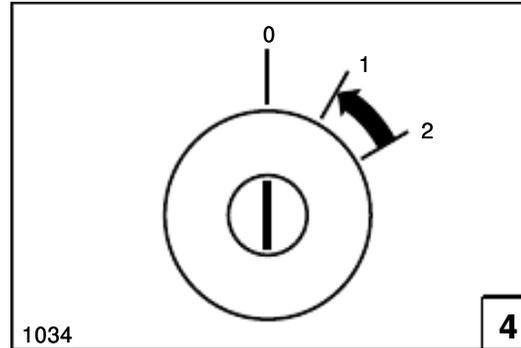
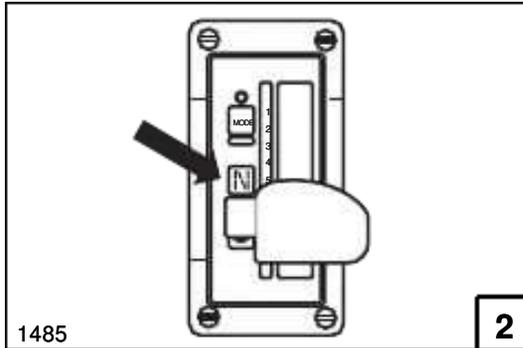
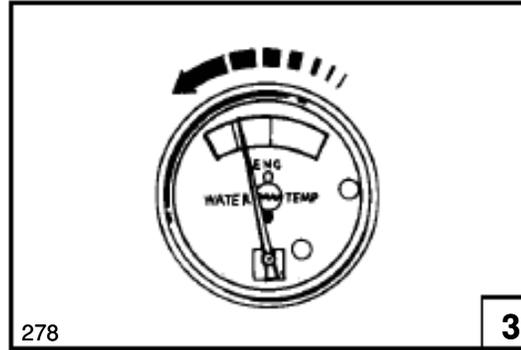
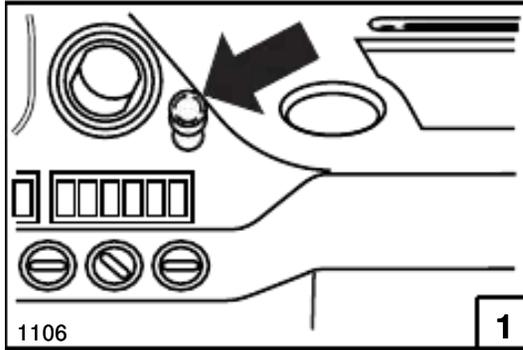
7. When the machine has stopped, shift the transmission to Neutral, apply the parking brake and release the service brake.

8. If the service brake does not stop the machine. Apply the parking - emergency brake. This should only be applied to stop the machine in an emergency.



**WARNING**

**There is no mechanical connection between the engine and wheels on machines with converter transmissions. The parking brake must always be applied when the engine is started.**



## Stopping the Engine

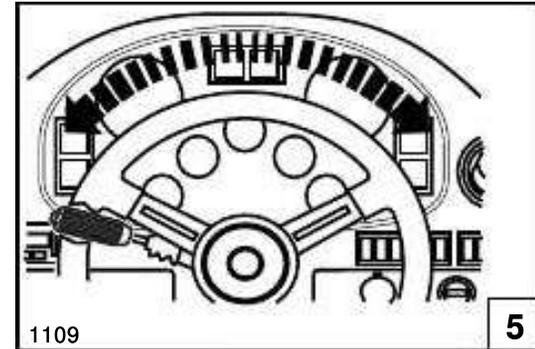
1. Make sure the parking-emergency brake control is in the 'PARK' position.

2. Make sure the transmission is in NEUTRAL.

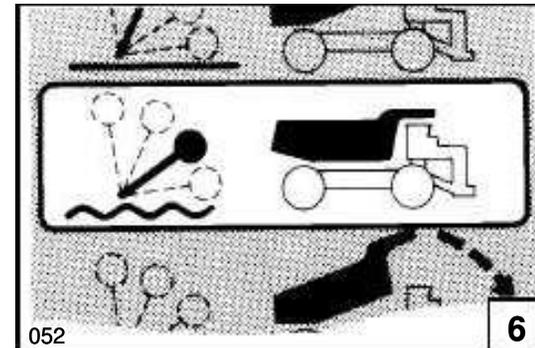
3. Allow the engine to idle 3 - 5 minutes after a full load operation before shutting it off. This allows the engine to cool gradually and uniformly.

4. To stop the engine, turn the ignition key switch to position '1'.

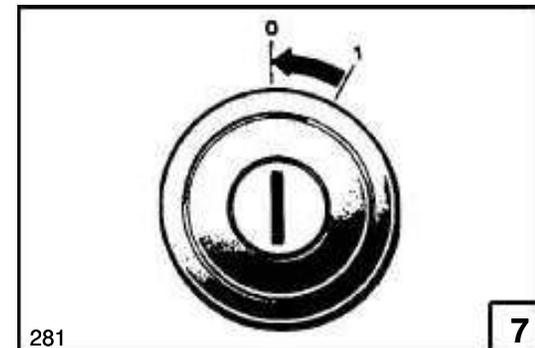
5. Turn the steering wheel in both directions to dissipate the pressure in the steering accumulator to prevent accidental steering during bleed down.

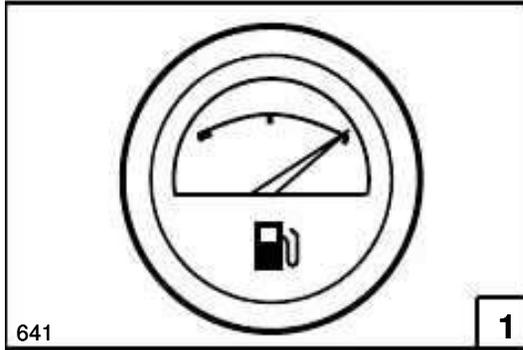


6. Make sure the body control lever is in the 'FLOAT' position.



7. Turn the ignition key switch to the 'OFF' position ('0').

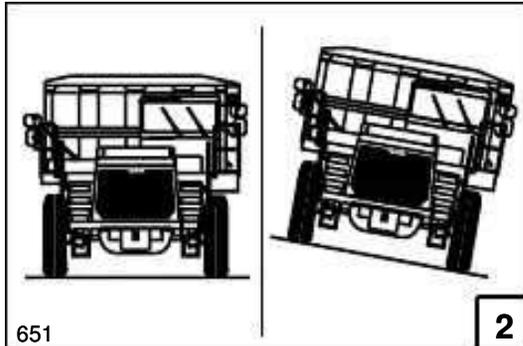




## Parking

When parking the machine overnight, or for an extended period, the following procedure in addition to that given in 'Stopping the Engine' will help maintain it in good condition for subsequent use:

1. Fill the fuel tank completely, to prevent condensation. If security kit is supplied, keep it locked.
2. Always park the machine on level ground where possible. If the machine must be parked on a grade, position the machine at right angles to the grade and block the wheels securely.
3. If below freezing temperatures are expected, make sure the cooling system has sufficient antifreeze to prevent the coolant freezing. If antifreeze cannot be added to the cooling system, drain the cooling system completely.



Check all tyres, hoses, wiring, tubing and fittings for cuts, ply separation, abrasion, fraying, or other damage or deterioration. Inspect for structural damage to the cab, body and chassis. Attach warning signs to the steering wheel or to a control to alert others if lubricant has been drained, batteries removed etc..



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## **5 - Working the Truck**

## WORKING THE TRUCK

Off-highway trucks are used on a variety of hauling jobs, from mine overburden removal to dam building. Every truck operation, regardless of the type of job, can be divided into four phases; loading, hauling, dumping and the empty return.

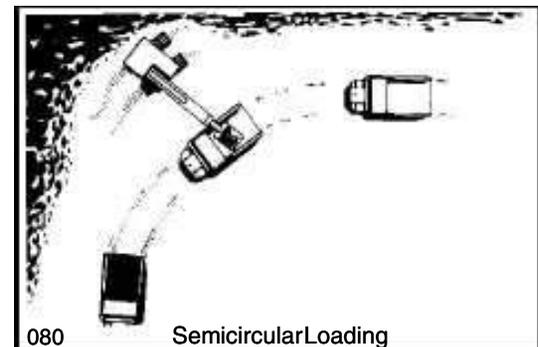
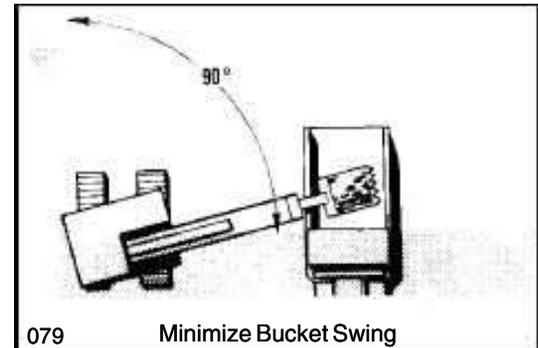
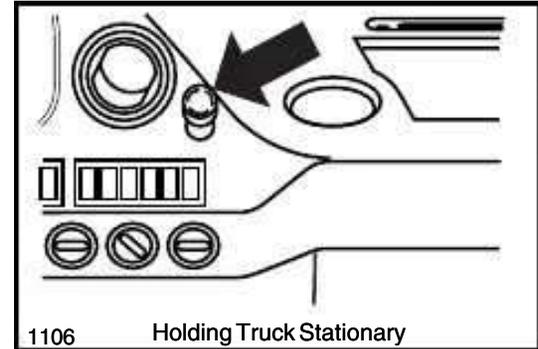
**Note:** After coming to a stop for loading or unloading the truck, the Parking-Emergency Brake control can be pushed in to hold the brakes in the applied position as though the foot brake is depressed.

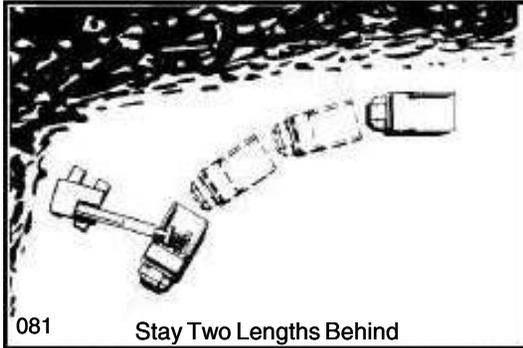
### Loading

The most common methods of loading trucks are with hydraulic excavators, rope shovels, and front end loaders. For maximum material movement, the truck operator must help the loading machine operator hold loading time to a minimum. The fewer manoeuvres the truck must make to get into loading position, the sooner loading can start. And the shorter the distance the loading unit bucket must travel between the cut, or stockpile and the truck body, the more passes it can make in a given period of time and the quicker the truck can be loaded.

Ideally, the hydraulic excavator or rope shovel should require 90° or less swing to dump into the truck body for best loading efficiency. Required turning and backing to position the truck for loading should be held to a minimum. A common loading method is to have trucks travel a semicircle in the loading area. This method eliminates all backing. Waiting machines should stay about two truck-lengths behind the one being loaded to avoid any spillage from the loading machine bucket or truck body. The operator of the waiting truck is also better able to judge the best spot for his truck when it is his turn to be loaded.

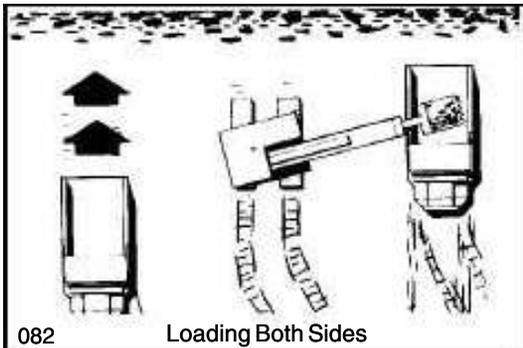
On some jobs, the loading machine might work most efficiently when trucks are positioned on both sides of the loader. Thus, while one truck is being loaded, another can move into position on the opposite side of the loader and the loading machine can swing over to load the next truck with a minimum of lost time. Since





the truck is usually backed into the loading position with this method, the operator must be alert and careful while backing.

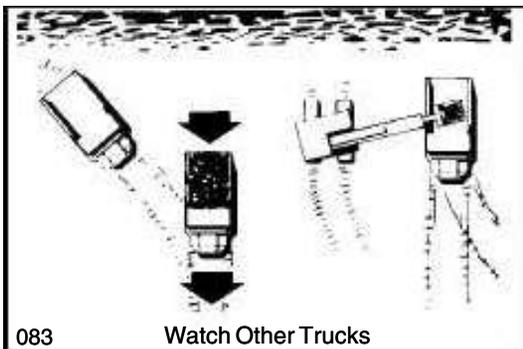
For fastest, most accurate loading when being loaded by a front end loader, the truck operator should spot his machine on the most level area and at an angle to the face of the bank or stockpile. This minimizes loader travel time, particularly with a raised, full bucket. Where possible, the truck should also locate downwind of the loader when dusty-type material is being loaded on a windy day. This practice improves both working conditions and visibility for the loader operator.



A cleanup dozer or small loader is often working in conjunction with the main loading machine to keep the area clear of bucket spillage for maximum efficiency of the loading operation. The truck operator must always be alert to the position of the cleanup machine when entering the loading area to avoid congestion, and for maximum safety.

The following precautions should be observed when approaching the loading area and while being loaded -

Avoid rocks and other shovel spillage that can needlessly damage tyres or other truck components. Allow the cleanup machine sufficient time to clear up such debris.



Do not move the truck into loading position with the shovel bucket swinging overhead. Large rocks that might fall from the bucket can be dangerous to both the truck and operator.

Keep your head and arms inside the cab during loading to avoid the danger of falling rocks or other shovel spillage.

When the loader operator signals that the truck is loaded, sound two blasts on the horn, release the brakes and shift the transmission to drive (D). Move out of the loading area and onto the haul road with the least possible delay to allow any waiting truck to move into the loading position as soon as possible.

## Hauling

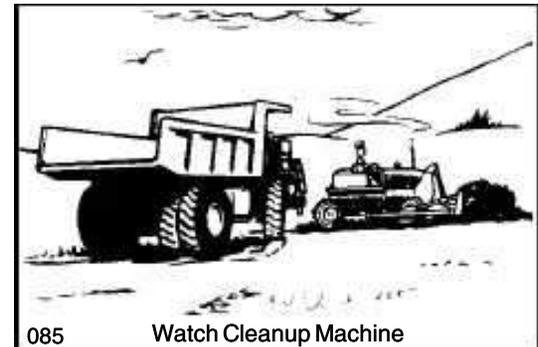
While travelling the haul road, always maintain a safe speed for the haul road conditions and grades. Never allow the machine to move or coast with the transmission in 'NEUTRAL'!

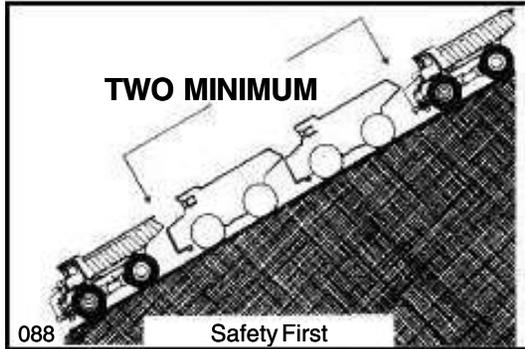
When approaching downgrades, select the proper transmission range and use the retarder and service brakes as required to maintain safe descent speed without over-speeding the engine or gaining excess travel speed. Generally, the transmission range required for ascending is also correct for descending a grade.

Always remain a safe distance behind the machine ahead, particularly on downgrades. A good rule-of-thumb to follow is to allow two (2) truck-lengths between machines for each 15 km/h (10 mile/h) of travel speed under normal operating conditions. Under adverse conditions, allow more room for safe operation. On jobs on which minimum distance between machines is specified for the haul road, be sure to observe the regulations at all times. Such regulations would be established for the safety of everyone on the job.

Pay attention to haul road conditions to avoid rocks, holes, or other obstacles. Such obstacles not only present hazards to safe operation, but can needlessly damage tyres and suspensions if not avoided.

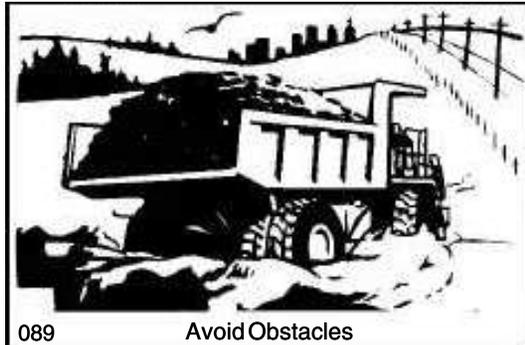
Be sure to reduce speed and come to a full stop, as required, at intersections, rail-roads, public highways etc.. Where a 'FLAGMAN' is stationed to direct traffic, always stay alert and follow his directions.



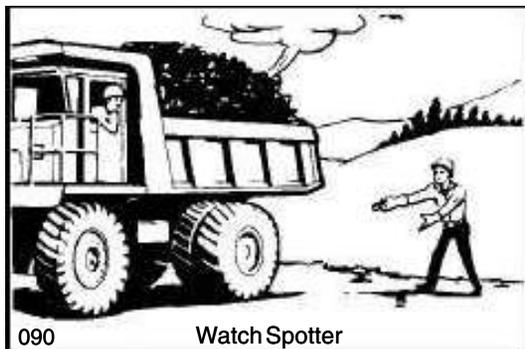


## Dumping

The dumping operation usually depends upon the type of material being hauled. For instance, overburden and other waste material is usually dumped over a spoil bank or piled into large mounds. The dumping on a job of this type might be controlled by a dump 'SPOTTER', 'FLAGMAN' or 'BANKSMAN' or second person who directs the truck to its dumping area. The 'SPOTTER' is needed due to the limited rear visibility the operator has with a loaded truck of this size. While backing to dump, the operator must watch the 'SPOTTER' at all times and follow his direction. Under no circumstances should the operator leave his seat to gain better visibility while backing. Always remain seated to maintain maximum machine control.



Mineral ores, blasted rock etc., are usually dumped into a hopper or crusher where it is processed before shipment. When dumping into a hopper, the operator, in order to avoid excess wear on the tyres, must avoid hitting the protecting rail at the hopper. If a DRIVEOVER HOPPER is used, the operator must avoid rubbing the tyre inner sidewalls.



When hauling dirt or rock from a borrow pit into a fill area such as an earth-fill dam, the load is usually dumped in a string with other loads and the loads smoothed out with a crawler tractor. When dumping on a fill of this type, the operator usually works alone and picks his own dumping place. To save bulldozer work and cleaning up, the load should be dumped as close as possible to the preceding load. The operator should pull past the preceding load, turn in line with the string and back his truck until it is within a few feet of the last load. This assures that the load will fall in the right place.

No matter what kind of job the operator is working, there are a few things which are common to all jobs and which the operator should observe -

When dumping over a spoil bank without a 'SPOTTER', know how close the machine can safely approach the edge under all weather conditions. If in doubt as to dumping safety, dump the load a safe distance from the edge so that it

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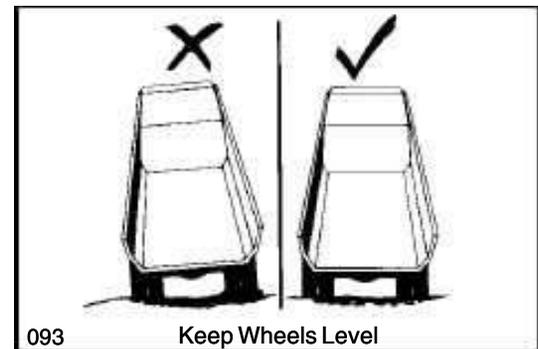
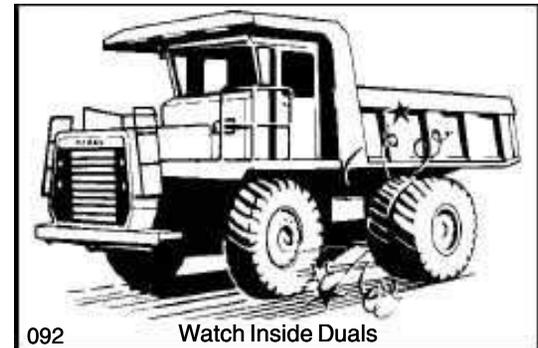
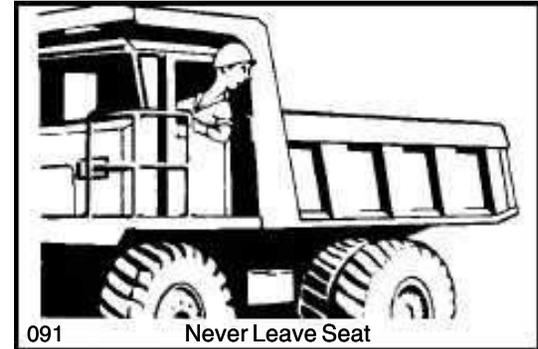
can be pushed over the edge later.

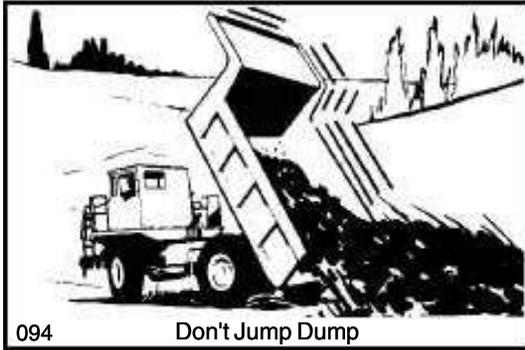
Before raising the body, make sure the rear wheels are on firm level ground. If one wheel is higher than the other, a twisting strain is imposed upon the body hinge pins, hoists and chassis. Stop the machine, allow the engine to slow to idle, shift the transmission to 'NEUTRAL' and apply the brakes with the Parking-Emergency Brake control to hold the machine stationary.

Push the body control lever back into the 'RAISE' position and accelerate the engine. Decelerate the engine to slow the raising speed as the hoists approach their maximum extension. When the body has been raised to the desired height, release the control lever into the 'HOLD' position until the body is to be lowered. Do not hold the lever in the 'RAISE' position when the hoists are fully extended to prevent unnecessary hydraulic system relief valve operation.

NEVER 'JUMP DUMP' the machine by bouncing the rear tyres against a stop block, or otherwise jarring the body in its raised position to dislodge stuck or frozen material. The tremendous loads that this practice develops on the body pin area, chassis and hydraulic system can cause needless, extensive stresses.

Once the load has been dumped, push the control lever down into the 'FLOAT' position to allow the body's weight to lower it to the chassis. If the body does not begin to lower by its weight, push the control lever down into the 'LOWER' position and power the body down until it begins to lower by gravity. Then release the control lever into the 'FLOAT' position.





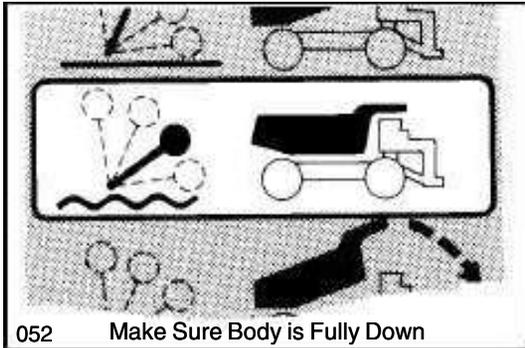
## Empty Return

Make sure the body is completely lowered, the body control lever is in the 'FLOAT' position, and the transmission is shifted to the correct range before releasing the brakes and moving away from the dump site.



### WARNING

**DO NOT drive the truck with the body up. Apart from effecting the stability of the truck, there can be severe danger from contacting overhead electric cables, trees, or bridges over the haul route.**



Except for the above, the procedure for returning empty to the loading area is the same as that given earlier for 'HAULING'.





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## **6 - Rading**

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## ROADING



### WARNING

**These machines are equipped with cylinders containing compressed nitrogen gas. Transportation of these machines by any method may require a special permit from the appropriate authority of the country involved. Consult your Dealer for details.**

## General

'ROADING' (operating a truck over public highways) requires special care and attention. Trucks, because of their large size, are slower and less manoeuvrable than most other vehicles encountered on the road. Yet, while on the road, they must be operated for extended periods of time at or near maximum speeds.

Before 'ROADING' a truck for an extended distance between jobs, or between widely scattered sections of a job, the machine must be properly equipped and in good condition. It is also recommended to carry a 'Warning Triangle'.

The operator must use extra care while on the public highways and remain constantly alert, especially for overhead cables and low bridges.

Necessary permits must be obtained from the proper authorities before the machine is 'ROADED' on public highways.

## Preparation Prior to Roding

### Lubrication

Thoroughly lubricate and service all components and systems as described under 'LUBRICATION AND SERVICING' in this handbook and/or service manuals for this machine.

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## Inspection

Perform all pre-starting and post-starting checks described in this Handbook. Pay particular attention to the function of all instruments and lights, and make any repairs necessary.

**Note:** Improper tyre inflation during over-the-road operation can cause rapid tyre deterioration by overheating. Tyre pressures increase with heat. Always check pressures while tyre is cold. Consult your tyre dealer for proper pressures and tyre speed limits for roading.

**Note:** Make sure the body control lever is in the 'FLOAT' position. Failure to comply to this caution could result in overheating the hydraulic oil and failure of the hydraulic system components.

Check the inflation pressures of all tyres, while cold, with an accurate tyre pressure gauge. Inflate tyres if necessary, while cold, to the recommended pressure for 'ROADING'. Inspect all tyres thoroughly and carefully for stones or other debris embedded in the treads or carcasses. Inspect for cuts, bruises, burned beads, abnormal wear and damaged wheels rims. Replace any damaged or excessively worn tyres.

Check all hoses, drain cocks, fuel level check cocks, and other potential sources of leaks. Make sure that all leaks are repaired and that all drain cocks are functioning. Make sure that all lights are in good working order. Make sure that all warning flags, oversize load signs etc. are in place and secure.

Clean all glass and adjust the seat for proper operation of all controls.

Check all lights and other controls for proper operation.

Make sure the truck body is empty, fully lowered and the body control lever is in the 'FLOAT' position.

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## In Case of Trouble

If trouble develops en route, move machine off the road at the first safe parking place, and shut off the engine. Carefully note as many of the symptoms of the trouble as possible, such as rough engine operation with loss of power and overheating, or loss of speed and transmission clutch pressure with normal engine operation etc..

If the area in which the trouble occurs requires that the machine be left unattended while the trouble is reported by phone, disconnect a battery cable and apply security locks, if so equipped, before leaving the parked machine. Make sure body is completely lowered and the parking brake is applied.

Report the following data as soon as possible.

1. Exact location.
2. Destination.
3. The nature of the trouble (with as many details as possible) and the time and conditions under which it happened.
4. The telephone number at which the machine operator can be reached.

**Note:** Do not attempt to restart or operate the machine unless instructed to do so. An engine, pump, transmission or other component that develops a minor defect can be completely destroyed in just a few extra minutes of unnecessary operation.



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## **7 - Moving Disabled Truck**

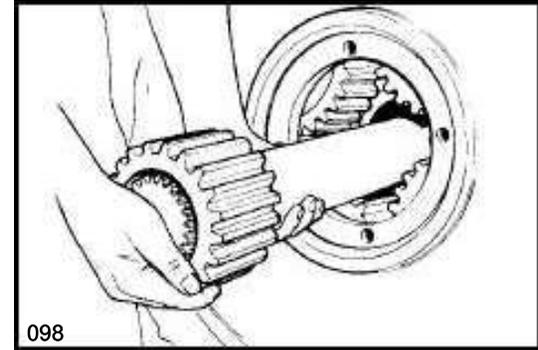
## MOVING DISABLED TRUCK

Any unusual power train noises noted while operating the truck should be reported to those responsible for maintenance. Should the power train, hydraulic or electrical systems fail, the machine should be stopped and shut down

immediately until suitable repairs can be made. If the failure is in the power train and the truck must be moved to a service area or workshop to make required repairs, remove the drive flange covers from the drive wheels and pull the axle shafts and final drive planetary sun gears from the planetary assemblies. This will prevent any possible additional damage, which may be caused by the drive wheels turning the power train as the machine is towed. Replace the covers on the drive wheels to retain lubricant and prevent entry of dirt.

If possible, start the engine to provide the required hydraulic pressure for steering and braking. Never allow riders on a machine being towed without sufficient hydraulic pressure for safe steering and braking.

If the nature of the trouble prevents engine operation, repairs must be made on the site of the breakdown, or special arrangements made for towing the machine safely to the repair area without steering and braking power.



### WARNING

**Uncontrolled machine movement hazard. There is no mechanical connection between the machine wheels and the engine when the parking brake is released. Before releasing the parking brake, make sure the machine wheels are secured with chock-blocks to prevent or restrict unexpected machine movement. When moving the machine with insufficient hydraulic pressure and power for safe steering and braking, use extreme caution to ensure personnel and property safety.**

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If the parking brake must be released, but the engine cannot be operated to provide the required hydraulic power needed to release the brake, refer to the machine service manual Section 165-0030, for parking brake release with auxiliary hydraulic power source. See **WARNING** on previous page.

Connect a suitable towing bar to one of the lugs on the front bumper of the disabled machine and reverse another machine, in a straight and in-line manoeuvre, towards the disabled machine. Connect the opposite end of the towing bar to the towing point on the rear axle of the recovery machine and ensure that it is securely locked.

**Note:** An alternative method of towing a disabled machine is by connecting an A-Frame arrangement to the lugs on the front bumper of the disabled machine and the towing point of the recovery machine.

To prevent possible damage to the transmission, the towing speed should never exceed 10 km/h (6.2 mile/h) and the distance towed should not be longer than 10 km (6.2 miles).



**WARNING**

**If using a chain or cable, be sure it is strong enough for the expected load and properly secured.**

**When pulling, take up the slack slowly to avoid jerking. A chain or cable which fails under load can cause serious injury. Stand clear. Do not pull through a kinked chain or cable. Do not pull or tow unless the operator's compartment is guarded against or out of reach of a whipping chain or cable. Attach only to the towing points. Failure to follow these instructions could cause serious injury or death.**





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## **8 - Lubrication and Servicing**

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## **SAFETY PRECAUTIONS**

Do not allow unauthorized personnel to service or maintain this truck. Study the Operator's Handbook and Maintenance Manual before starting, operating or

servicing this truck. Always follow procedures and safety precautions detailed in the Service Manual.

Always attach a 'DO NOT OPERATE' or similar warning sign to ignition switch or a control before cleaning, lubricating or servicing the truck.

Never allow anyone to work on the truck while it is moving. Make sure no one is on the truck before working on it.

Do not work under or near an unblocked or unsupported body. Always use the body safety pins.

Do not work under or near any unblocked or unsupported linkage, part or truck.

Always relieve pressure before servicing any pressurized system. Follow the procedures and safety precautions detailed in the Maintenance Manual.

Always shut down the engine according to the procedure under 'Stopping The Engine', described on page 4-14, before cleaning, lubricating or servicing the truck, except as called for in this Handbook or the Maintenance Manual.

When changing oil in the engine, transmission and hydraulic systems or removing hydraulic lines, remember that the oil may be hot and can cause burns to unprotected skin.

When working on or around exhaust components, remember that the components may be hot and can cause burns to unprotected skin.

Always deflate the tyre before attempting to remove any embedded objects or removing the tyre and rim assembly from the truck.

Always use a self-attaching chuck with a long airline, and, stand to one side while the tyre is inflating. Refer to Section 160-0050 in the Maintenance Manual.

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## LUBRICATION AND SERVICING



### WARNING

These trucks are equipped with engine and transmission oil pans which permit operation at maximum gradeability as designated in the 'Performance Data' section of the relevant Sales Specification Sheet.

Lubrication is an essential part of preventive maintenance. It is important that the instructions, regarding types of lubricants and the frequency of their application, be followed to prolong the useful life of the truck. Periodic lubrication of moving parts reduces to a minimum the possibility of mechanical failures.

All change and service periods are recommendations based on average operating conditions. Lubricants showing evidence of excessive heat, oxidation or dirt should be changed more frequently to prevent these conditions.

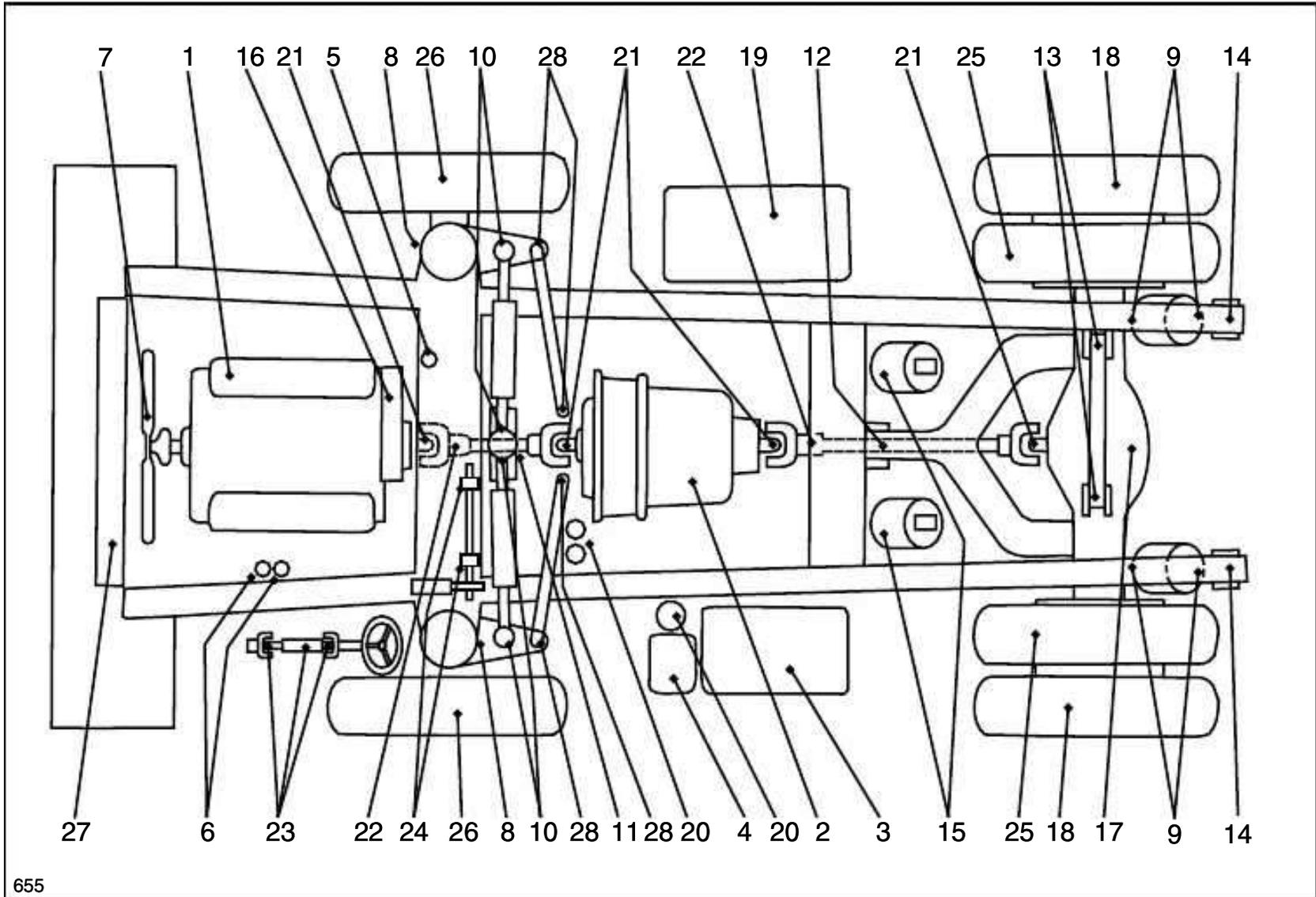
Lubricant change and service periods must be established on the basis of individual job conditions utilizing oil sampling and recommendations from lubricant suppliers.

Thoroughly clean all fittings, caps, plugs etc., to prevent dirt from entering any system while carrying out servicing procedures. Lubricants must be at operating temperature when draining.

**Note:** Do not operate any system unless oil level is within the recommended operating levels as indicated on oil level dipstick, sight gauge or level plug.

Small circles on the following illustration represent points at which lubrication and/or servicing must take place, at the intervals indicated on the left hand side of the lubrication and service chart. The numbered circles on the illustration contain

reference numbers which correspond to the reference numbers in the 'Ref. Points' column of the lubrication and service chart.



## LUBRICATION AND SERVICE CHART

| Interval Hours | Ref. Points                        | Identification  | Service Instructions                                  | No. of Points | Lubricant  | Service/Quantities |
|----------------|------------------------------------|---|---|---------------|------------|--------------------|
| 10             | 1                                  | Engine  | Check oil level. Add if low.                          | 1             | EO         | As Required        |
|                | 2                                  | Transmission  | Check oil level. Add if low.                          | 1             | EO         | As Required        |
|                | 3                                  | Main Hydraulic Tank   | Check oil level. Add if low.                          | 1             | HO         | As Required        |
|                | 4                                  | Steering Hydraulic Tank   | Check oil level. Add if low.                          | 1             | HO         | As Required        |
|                | 5                                  | Radiator Header Tank  | Check coolant level. Add if low.                      | 1             | Antifreeze | See Page 8         |
|                | -                                  | Steering Filter   | Check W/Light. Replace element if reqd.               | 1             | -          | See Page 9         |
|                | 6                                  | Rear Disc Brake Filter(s)   | Check indicator. Replace element if reqd.             | -             | -          | See Page 9         |
|                | -                                  | Fuel Filter/Water Separator   | Drain water and sediment.                             | 2             | -          | -                  |
|                | 7                                  | Cooling Fan   | Visually inspect for debris and damage.               | 1             | -          | -                  |
|                | -                                  | Drive Belts   | Visually inspect all belts.                           | -             | -          | See Page 10        |
|                | 8 & 9                              | Front and Rear Ride Cylinders                                       | Visually inspect heights.                             | 4             | -          | Serv man 180-0050  |
|                | -                                  | Air Cleaner Restriction W/Light                                     | Check. Replace element if reqd.                       | 1             | -          | -                  |
|                | -                                  | Air Cleaner Vacuator Valve(s)                                       | Check for proper operation.                           | -             | -          | -                  |
|                | -                                  | Tyres   | Check condition. Check pressures when tyres are cold. | 6             | -          | Serv man 160-0050  |
| -              | Controls, Instruments and W/Lights | Check for proper operation.   | -   | -             | -          |                    |
| -              | General Inspection                 | Check for leaks and worn/damaged parts. Repair/replace as required. | -   | -             | -          |                    |
| 50             | 8                                  | Front Ride Cylinders  | Lube.   | 2             | EP, NLGI   | 20 Strokes         |
|                | 9                                  | Rear Ride Cylinder Spherical Bushings                               | Lube.   | 4             | EP, NLGI   | See Note           |
|                | 10                                 | Steering Cylinders  | Lube.   | 4             | EP, NLGI   | See Note           |
|                | 28                                 | Steering Linkage (TR60 only)  | Lube.   | 4             | EP, NLGI   | See Note           |
|                | 11                                 | Steering Pivot Pin  | Lube.   | 2             | EP, NLGI   | See Note           |
|                | 12                                 | A-Frame Nose Spherical Bushing                                      | Lube.   | 1             | EP, NLGI   | See Note           |
|                | 13                                 | Banjo Stabilizer Spherical Bushings                                 | Lube.   | 2             | EP, NLGI   | See Note           |
|                | 14                                 | Body Hinge Pins   | Lube.   | 2             | EP, NLGI   | See Note           |
| 15             | Body Hoist Bushings                | Lube.   | 4   | EP, NLGI      | See Note   |                    |

## LUBRICATION AND SERVICE CHART (CONTINUED)

| Interval Hours | Ref. Points                        | Identification                          | Service Instructions                    | No. of Points | Lubricant   | Service/Quantities |
|----------------|------------------------------------|---|---|---------------|-------------|--------------------|
| 250            | 1                                  | Engine                                  | Drain and refill.                       | 1             | EO          | See Page 12        |
|                | -                                  | Engine Oil Filters                      | Replace filters.                        | -             | -           | Serv man 110-0030  |
|                | -                                  | Engine Fuel Filters                     | Replace filters.                        | 2             | -           | Serv man 110-0030  |
|                | -                                  | Engine Coolant Additive                 | Check DCA concentration and replenish.  | -             | DCA4        | See Page 9         |
|                | -                                  | Engine Coolant Filter(s)                | Replace filter(s) if required.          | -             | -           | See Page 9         |
|                | -                                  | Engine Crankcase Breather               | Clean.                                  | 1             | -           | Ref Engine Manual  |
|                | 7                                  | Engine Cooling Fan                      | Check condition.                        | 1             | -           | See Page 9         |
|                | 16                                 | Engine Power Takeoff                    | Check oil level. Add if low.            | 1             | EPL         | -                  |
|                | 17                                 | Differential                            | Check oil level. Add if low.            | 1             | EPL         | -                  |
|                | 18                                 | Wheel Planetaries                       | Check oil level. Add if low.            | 2             | EPL         | -                  |
|                | -                                  | Differential Breather                   | Clean.                                  | 1             | -           | -                  |
|                | -                                  | Transmission Breather                   | Clean.                                  | 1             | -           | -                  |
|                | -                                  | Alternator Drive Belt                   | Check belt tension. Adjust if required. | 1             | -           | See Page 10        |
| -              | Accessory Drive Belts (if fitted)  | Check belt tension. Adjust if required. | -                                       | -             | See Page 10 |                    |
| -              | Front Brake Pads                   | Check wear. Replace as required.        | 2                                       | -             | See Page 10 |                    |
| 500            | 19                                 | Fuel Tank                               | Clean filler neck screen and cap.       | -             | -           | -                  |
|                | -                                  | Air Cleaner(s)                          | Clean primary tubes and inlet screens.  | -             | -           | -                  |
|                | 20                                 | Accumulators                            | Check nitrogen pressures.               | 3             | -           | -                  |
|                | 21                                 | Driveline Universal Joints              | Lube (if grease nipple fitted).         | -             | *EP, NLGI   | See Note           |
|                | 22                                 | Driveline Slip Joints                   | Lube (if grease nipple fitted).         | -             | *EP, NLGI   | See Note           |
|                | 23                                 | Steering Column Universal Joints        | Lube.                                   | 3             | *EP, NLGI   | See Note           |
| -              | Hydraulic & Steering Tank Breather | Clean.                                  | 1                                       | -             | -           |                    |
| 1 000          | -                                  | Hydraulic System Pressure Checks        | Check pressures at check points.        | -             | -           | See Page 10        |
|                | -                                  | Main Hydraulic Filter                   | Replace elements.                       | 2             | -           | See Page 10        |
|                | 6                                  | Rear Disc Brake Filter(s)               | Replace element(s).                     | -             | -           | See Page 10        |
|                | 2                                  | Transmission                            | Drain and refill.                       | 1             | EO          | See Page 12        |
|                | -                                  | Transmission Oil Filter                 | Replace element.                        | 1             | -           | -                  |

| <b>LUBRICATION AND SERVICE CHART (Continued)</b> |             |                                     |                         |               |            |                    |
|--|-------------|-------------------------------------|-------------------------|---------------|------------|--------------------|
| Interval Hours                                   | Ref. Points | Identification                      | Service Instructions    | No. of Points | Lubricant  | Service/Quantities |
| 1 500  | -           | Engine Crankcase Breather           | Clean/Replace           | 1             | -          | Ref Engine Manual  |
|  | 16          | Engine Power Takeoff                | Drain and refill        | 1             | EPL        | See Page 12        |
|  | 17          | Differential                        | Drain and refill        | 1             | EPL        | See Page 12        |
|  | 18          | Wheel Planetaries                   | Drain and refill        | 2             | EPL        | See Page 12        |
|  | -           | Fan Idler Pivot Arm                 | Lube                    | 1             | EP, NLGI   | See Note           |
| 2 000  | 3           | Main Hydraulic Tank                 | Drain and refill        | 1             | HO         | See Page 12        |
|  | -           | Main Hydraulic Tank Suction Screens | Remove and clean        | 2             | -          | -                  |
|  | 4           | Steering Tank                       | Drain and refill        | 1             | HO         | See Page 12        |
|  | -           | Steering Filter                     | Replace element         | 1             | -          | See Page 11        |
|  | -           | Steering Tank Suction Screen        | Remove and clean        | 1             | -          | -                  |
|  | 19          | Fuel Tank                           | Drain and refill        | 1             | Diesel     | See Page 12        |
| 4 000  | 27          | Cooling System                      | Drain, flush and refill | 1             | Antifreeze | See Page 12        |
|  | -           | Air Conditioning Compressor         | Drain, flush and refill | 1             | PAG Oil    | See Page 12        |
| 5 000  | 26          | Front Wheel Bearings                | Repack                  | 2             | *EP, NLGI  | *                  |

\* - Fill compartment one half full.

Note - Lubricate slowly until excess lube is seen.

EO- Engine Oil. Refer to chart under 'Recommended Lubricants'.

EPL- Extreme Pressure Gear Lubricant meeting specification MIL-L-2105C.

HO - Hydraulic Transmission Oil meeting Specification EMS19058 Refer to chart under 'Recommended Lubricants'.

EP, NLGI - Extreme Pressure Lithium No. 2 Grease.

Refer to chart under 'Recommended Lubricants'.

\*EP, NLGI - Extreme Pressure Lithium No. 2 Grease (without 'Molybdenum'). Refer to chart Under 'Recommended Lubricants'.

PAG Oil - Polyalkylene Glycol (PAG) Compressor Lubricating Oil - Low Viscosity (ISO46).

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## MISCELLANEOUS SERVICING

### WHEN REQUIRED

**Seat Belts** - Inspect seat belts and replace if damaged.

**Note:** Replace seat belts at least once every three years, regardless of appearance.

**Windscreen Wipers and Washers** - Inspect wiper blades and replace if damaged. Top up washer reservoir.

**Wheel Rim Nuts** - After first 10 hours of operation re-torque nuts to 690 Nm (510 lbf ft). Check torque every 50 hours (weekly) thereafter.

### EVERY 10 HOURS OF OPERATION

**Walk Around Inspection** - Inspect the machine as described in Section 4.

**Engine** - Visually check engine for damage, loose or frayed belts and listen for any unusual noises.

**Engine Air Cleaner(s)** - Check air cleaner piping, hoses and clamps. Change air cleaner element only when air cleaner flow restriction warning light illuminates. Service vacuator valves daily. Inspect and remove any obstructions from the

vacuator valve lips. Valve lips should be open and pliable with engine stopped.  
**Note:** Service air cleaner(s) more often under extremely dusty operating conditions.

**Radiator Header Tank** - Check coolant level and add if low. Fill radiator header tank with coolant until coolant reaches the bottom of the filler neck and holds at that level.

**Note:** Any time a significant amount of coolant is added, the DCA4 concentration MUST be checked. If the concentration is low, engine damage will result.

Conversely, over-inhibiting antifreeze solutions can cause silicate dropout. Refer to Section 2-10-0010, COOLING SYSTEM, in the Maintenance Manual.

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**Steering, Braking and Body Hoist Systems** - Check for correct operation of all systems before operating the truck.

**Steering Filter** - Check steering filter restriction warning light with the truck empty, brakes released, oil at normal operating temperature, engine operating at 1 500 rev/min and while turning the steering wheel at one turn/sec. If the warning light illuminates, the filter element should be replaced.

**Rear Disc Brake Filter(s)** -

Replace element(s) when indicator shows oil at the replace element level.

### **AFTER FIRST 150 HOURS OF OPERATING NEW OR REBUILT COMPONENTS**

**Transmission** - Drain oil, replace filters and refill.

**Differential** - Drain oil and refill.

**Planetaries** - Drain oil and refill.

### **EVERY 250 HOURS OF OPERATION**

**Oil Can Points** - Oil accelerator linkage, hinges, and other working parts with engine oil.

**Coolant Additive** - Check and replenish DCA4 concentration as described in Section 210-0000, COOLING SYSTEM, in the Maintenance Manual.

**Coolant Filter(s)** - Replace coolant filter(s) if required. When testing the DCA4 concentration, depending on the level of DCA4, the coolant filter(s) may not necessarily have to be changed. Refer to Section 210-0010, COOLING SYSTEM, in the Maintenance Manual.

**Cooling Fan** - Visually check the fan for cracks, loose rivets, and bent or loose blades. Check fan mounting and tighten if required. Replace any fan that is damaged.

---

**Note:** The fan belt is maintained to the correct belt tension by a spring loaded idler arm, therefore, there is no need to check or adjust belt tension.

**Drive Belts** - Visually check the belts and replace if they are cracked or frayed. Adjust belts that have a glazed or shiny surface which indicates belt slippage.

Correctly installed and tensioned belts will show even pulley and belt wear. Refer to Section 110-0030, ENGINE AND MOUNTING, in the Maintenance Manual for drive belt tension and adjustment of new and used drive belts.

**Front Brakes** - Check pads and discs for wear and replace where necessary.

**Note:** This service interval applies to normal driving. Check more frequently under more severe conditions. Thickness of pad friction material should never be allowed to wear below 3 mm (0.12 in).

## **EVERY 1 000 HOURS OF OPERATION**

**Hydraulic System Pressure Checks** - Check all steering, body and braking system pressures.

**Note:** Instructions for checking pressure, and locations of pressure check points, are contained in the relevant service manual section. If the pressures are outwith the specified settings then components in the relevant system should be inspected, repaired or replaced to ensure the correct operation of the system. All

safety instructions in the relevant sections should be strictly adhered to.

**Main Hydraulic Filter** - Clean filter housing and install new element.

**Rear Disc Brake Filter(s)** - Replace filter element(s) when indicator sight gauge shows replacement is necessary, or after 1 000 hours of operation, whichever comes first.

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## **EVERY 2 000 HOURS OF OPERATION**

**Steering Filter** - Clean filter housing and install new element when indicated, or after 2 000 hours of operation, whichever comes first.

## **ENGINES AND TRANSMISSIONS**

All information contained in the 'LUBRICATION AND SERVICE CHART' was extracted from the relevant manufacturers 'Operation and Maintenance Manual', and was correct at time of publication. User should ensure that information contained in this chart reflects the information shown in the relevant manufacturers 'Operation and Maintenance Manual' supplied with the truck. Maintenance procedures should be carried out in conjunction with any additional procedures contained in the relevant manufacturers 'Operation and Maintenance Manual', at the intervals specified.

## SERVICE CAPACITIES

|        |                              |           | Service Capacities |        |        |        |
|--------|------------------------------|-----------|--------------------|--------|--------|--------|
| Ref.   |                              |           | TR45               |        | TR60   |        |
| Points | Identification               | Lubricant | litres             | US gal | litres | US gal |
| 1      | Engine Crankcase and Filters | EO        | 55                 | 14.5   | 55     | 14.5   |
| 2      | Transmission and Filters     | EO        | 68                 | 18     | 85     | 22.5   |
| 3      | Main Hydraulic Tank          | HO        | 216                | 57     | 216    | 57     |
| -      | Main Hydraulic System        | HO        | 258                | 68     | 258    | 68     |
| 4      | Steering Hydraulic Tank      | HO        | 61                 | 16     | 61     | 16     |
| -      | Steering Hydraulic System    | HO        | 85                 | 22.5   | 72     | 19     |
| 27     | Cooling System               | Coolant   | 144                | 38     | 170    | 45     |
| 19     | Fuel Tank                    | Diesel    | 606                | 160    | 606    | 160    |
| 8      | Front Ride Cylinders (Each)  | HO        | 14                 | 3.7    | 14     | 3.7    |
| 9      | Rear Ride Cylinders (Each)   | HO        | 17                 | 4.5    | 17     | 4.5    |
| 16     | Engine Power Takeoff         | EPL       | 4                  | 1.1    | 4      | 1.1    |
| 17     | Differential                 | EPL       | 60                 | 15.8   | 52     | 13.7   |
| 18     | Wheel Planetaries (Total)    | EPL       | 66                 | 17.4   | 43     | 11.4   |
| -      | Air Conditioning Compressor  | PAG Oil   | 0.135              | 0.036  | 0.135  | 0.036  |

**Note:** Capacities given are approximate. Work to dipstick, sight gauges or level plugs. Use table in conjunction with 'Recommended Lubricants' table.

## RECOMMENDED LUBRICANTS

| COMPONENT  | LUBRICANT  | VISCOSITY (See Note 1*)                                |                    |
|--|--|--|--------------------|
|  |  | Ambient Temp   | Recommendation     |
| Engine   | Engine oil with 1.00% sulphated ash is recommended.<br>Sulphated ash must not exceed 1.85% limit.<br>API code CH-4, ACEA-E5. See Note 2* | -10° C and above                                       | SAE 20W-40         |
|  |  | -25° to 35° C  | SAE 10W-30         |
| Transmission                                     | Engine oil, API code CH-4, ACEA-E5. Preheat is required below minimum temperatures shown. See Note 3*.                                   | Ambient Temp   | Recommendation     |
|  |  | -30° to 25° C  | SAE 0W-20 (Arctic) |
|  |  | -27° to 25° C  | DEXRON-III         |
|  |  | -20° to 15° C  | SAE 10W            |
|  |  | -15° to 45° C  | SAE 15W-40         |
|  |  | 0° to 35° C  | SAE 30             |
| 10° to 45° C                                     | SAE 40   |  |                    |
| Cooling System                                   | Heavy Duty Coolant. Refer to Section 210-0010, COOLING SYSTEM, in the Service Manual.  |  |                    |
| Fuel Tank  | Diesel Fuel Oil with maximum sulphur 0.5%.   | DIN EN590  |                    |
| Differential<br>Planetary Gears<br>Power Takeoff | Multipurpose Extreme Pressure type gear oil meeting MIL-L-2105C Specifications (No Zinc Additive). See Note 4*.                          | SAE 80W-90<br>at ambient temperatures of -18° to 32° C |                    |
| Grease Fittings                                  | Multipurpose Extreme Pressure Lithium Grease (which may or may not contain 'Molybdenum'), with a typical melting point of 190° C.        | No. 2 Consistency                                      |                    |
| Drivelines<br>Steering Column<br>Wheel Bearings  | Multipurpose Extreme Pressure Lithium Grease (without 'Molybdenum'), with a typical melting point of 190° C.                             | No. 2 Consistency                                      |                    |
| Air Conditioning<br>Compressor                   | Polyalkylene Glycol (PAG)<br>Compressor Lubricating Oil - Low Viscosity  | ISO46<br>SP 10   |                    |

\* - Notes and temperature conversions are listed on the following page.

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| <b>RECOMMENDED LUBRICANTS (Continued)</b> |  |   |
|---|--|---|
| COMPONENT                                 | LUBRICANT  | VISCOSITY (See Note 1)  |
| Ride Cylinders                            | Hydraulic oil meeting MIL-L-2104B Specification.                       | SAE 10W   |
| (Nitrogen/Oil)<br>Hydraulic System        | Hydraulic Transmission Oil meeting Specification EMS19058. See Note 5. | SAE 10W<br>at ambient temperatures of -18° to 32° C<br><br>SAE 30W<br>at ambient temps of 32° C and above |

**Note 1** - Consult your lubricant supplier for the correct viscosity of lubricant to use when ambient temperatures are consistently above or below those listed.

**Note 2** - Cummins Engine Co. do not recommend any specific brand of engine oil but the use of oils that meet API categories. Cummins recommend use of only the multi-graded viscosity oils shown for the various ambient temperatures listed.

**Note 3** - Operation below the minimum temperatures listed for the oil used without proper preheat or warm-up results in greatly reduced transmission life. If auxiliary heating is available, preheat the oil to the minimum temperature limit. If not available, run the engine at part throttle with the transmission in neutral to raise the fluid temperature.

**Note 4** - If rear axle has limited slip differential, an EP oil with limited slip additives should be used because using standard SAE 90 oil may result in very loud noise and jerking of the wheels when driving slowly round sharp corners.

**Note 5** - Typical SAE 10W oils complying with Specification EMS19058 are:

|                   |                |                       |
|-------------------|----------------|-----------------------|
| KUWAIT TO4        | TEXACO TEXTRAN | TOTAL TRANSMISSION AC |
| SHELL DONAX TC    | MOBILTRANS HD  | BP AUTRAN 4           |
| ESSO TORQUE FLUID | CASTROL TFC    |                       |

Other lubricant suppliers may have comparable products and should be consulted for confirmation.

| <b>Temperature Conversions</b> |     |     |     |     |    |    |    |    |    |    |    |    |    |    |     |     |     |     |
|--------------------------------|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|
| ° Celsius                      | 32  | 30  | 27  | 25  | 20 | 18 | 15 | 10 | 0  | 10 | 15 | 25 | 32 | 35 | 38  | 45  | 93  | 190 |
| ° Fahrenheit                   | -26 | -22 | -17 | -13 | -4 | 0  | 5  | 14 | 32 | 50 | 59 | 77 | 90 | 95 | 100 | 113 | 200 | 375 |

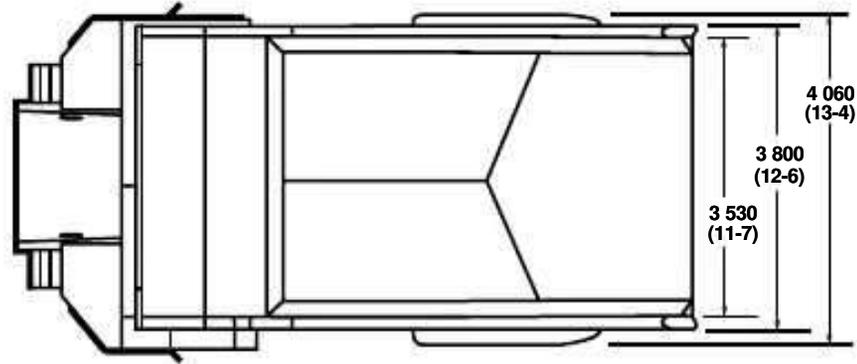
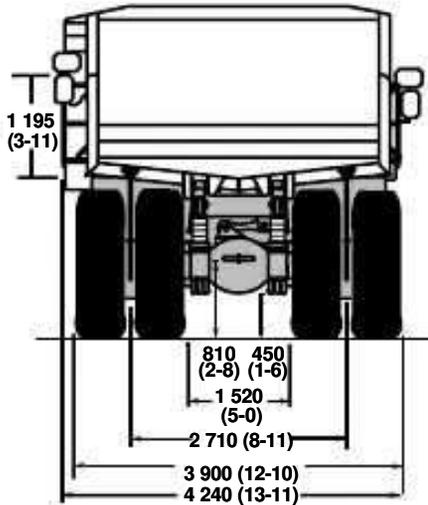


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## **9 - Technical Data**

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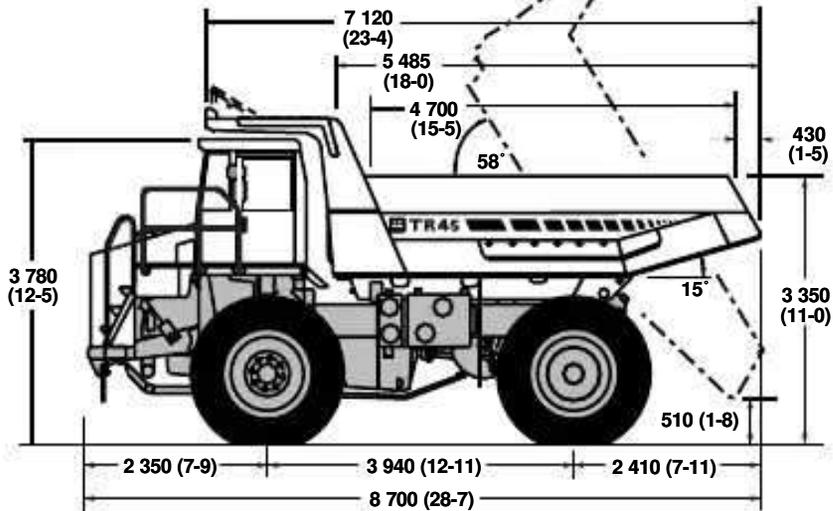
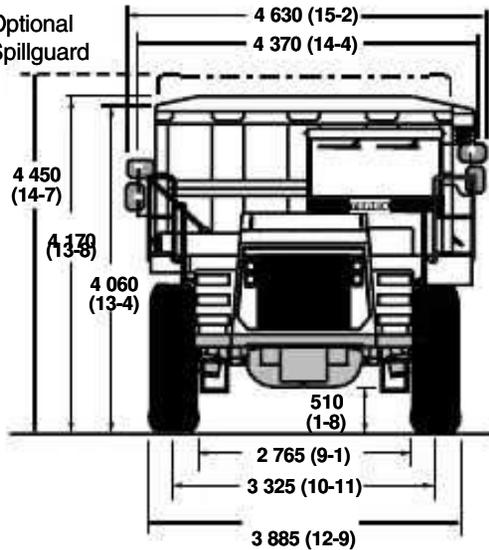
Max.  
Body  
Depth



Vehicle Clearance Diameter (SAE) 21 m (69ft)

7 380 (24-2)

Optional  
Spillguard



## TECHNICAL DATA TR45

### ENGINE

Make/Model ..... Cummins QSK19-C525  
 Type ..... 4 Cycle, Turbocharged/Low Temperature

Gross Power at 2 100 rev/min ..... 392 kW (525 hp, 532 PS)  
 Net Power at 2 100 rev/min ..... 370 kW (495 hp, 502 PS)

Aftercooled. Electronic Management.

**Note:** Power ratings to SAE J1995 Jun 90. Engine emission meets Tier II USA EPA/CARB MOH 40 CFR 89 and proposed EU non-road mobile machinery directive.

Maximum Torque ..... 2 407 Nm (1 775 lbf ft)  
 at 1 300 rev/min  
 Number of Cylinders/Configuration ..... 6, in line  
 Bore x Stroke ..... 159 x 159 mm (6.25 x 6.25 in)  
 Total Displacement ..... 18.9 litres (1 150 in<sup>3</sup>)  
 Starting ..... Electric  
 Maximum Speed, Full Load ..... 2 100 rev/min  
 Maximum Speed, No Load ..... 2 300 rev/min  
 Idle Speed ..... 700/750 rev/min  
 Safe Operating Angle ..... 30°/60% Grade

### TRANSMISSION

Make/Model ..... Allison M5610AR  
 automatic electronic control with soft shift feature.  
 Remote mounted in the frame. Integral torque converter and planetary gearing. Six speeds forward, two reverse. Automatic converter lockup action in all speed ranges. Downshift inhibitor. Intregal hydraulic retarder.

| Speeds With Standard Differential |      |      |      |      |      |      |
|-----------------------------------|------|------|------|------|------|------|
| Forward                           |      |      |      |      |      |      |
| Gear                              | 1    | 2    | 3    | 4    | 5    | 6    |
| Ratio                             | 4.00 | 2.68 | 2.01 | 1.35 | 1.00 | 0.67 |
| km/h                              | 11.3 | 16.8 | 22.4 | 33.4 | 45.2 | 65.0 |
| mile/h                            | 7.0  | 10.5 | 13.9 | 20.7 | 28.0 | 40.4 |
| Reverse                           |      |      |      |      |      |      |
| Gear                              | 1    | 2    |      |      |      |      |
| Ratio                             | 5.12 | 3.46 |      |      |      |      |
| km/h                              | 7.1  | 12.9 |      |      |      |      |
| mile/h                            | 4.4  | 8.0  |      |      |      |      |

### DRIVE AXLE

Heavy duty axle with single reduction spiral bevel gear differential, full floating axle shafts, and planetary reduction at each wheel.

|                       |          |          |
|-----------------------|----------|----------|
| Ratios:               | Standard | Optional |
| Differential .....    | 3.15:1   | 3.73:1   |
| Planetary .....       | 5.66:1   | 5.66:1   |
| Total Reduction ..... | 17.83:1  | 21.11:1  |

### SUSPENSION

**Front:** King pin strut type independent front wheel suspension by self-contained, variable rate, nitrogen/oil cylinders.

**Rear:** Variable rate nitrogen/oil cylinders with A-frame linkage and lateral stabilizer bar.

Maximum Strut Stroke  
Front..... 251 mm (9.9 in)  
Rear ..... 182 mm (7.2 in)  
Maximum Rear Axle Oscillation .....  $\pm 6.5$  Degrees

### WHEELS AND TYRES

Wheel Rim Width ..... 13 in  
Wheel Rim Width (Optional) ..... 15 in  
Standard Tyres (Front & Rear) ..... 18.00 R 33\*\* Radial  
Optional Tyres (Front & Rear)..... 21.00 R 35\*\* Radial

**Note:** It is recommended that for tyres both listed and unlisted, the user should consult the tyre manufacturer and evaluate all job conditions in order to make the proper selection.

### BRAKES

#### Service

All hydraulic brake system. Transmission mounted pressure compensating pump provides hydraulic pressure for brakes and steering. Independent circuits front and rear. Each circuit incorporates a nitrogen accumulator which stores energy to provide consistent braking response.

Front Brake Circuit Pressure ..... 159 bar (2 300 lbf/in<sup>2</sup>)  
Rear Brake Circuit Pressure ..... 52 bar (750 lbf/in<sup>2</sup>)  
Accumulators:  
Nitrogen Precharge Pressure ..... 55 bar (800 lbf/in<sup>2</sup>)

#### Front:

Type ..... Dry Disc with 1 calliper per wheel  
Disc Diameter ..... 660 mm (25.5 in)  
Pad Area, Total ..... 1 395 cm<sup>2</sup> (216 in<sup>2</sup>)

#### Rear:

Type ..... Oil cooled, multiple friction discs (14 total), completely sealed from dirt and water.  
Braking Surface, Total ..... 38 310 cm<sup>2</sup> (5 938 in<sup>2</sup>)  
Cooling Flow, Max. .... 553 litres/min (146 US gal/min)

### Parking

Application of rear brakes by springs in brake disc pack.  
Hydraulically released.  
Hold-off Pressure ..... 83 bar (1 200 lbf/in<sup>2</sup>)

### Retardation

Modulated lever control of rear disc pack.  
Retarder Actuation Pressure ..... up to 33 bar (480 lbf/in<sup>2</sup>)

### Emergency

Push button solenoid control applies service and parking brakes. Automatically applies when engine is switched off. Parking brake applies should system pressure fall below a predetermined level.

Brakes conform to ISO 3450, SAE J1473 OCT 90.

## STEERING SYSTEM

Independent hydrostatic steering with closed-centre steering valve, accumulator and pressure compensating piston pump.

Accumulator provides uniform steering regardless of engine speed. In the event of loss of engine power it provides steering of approximately two lock-to-lock turns. A low pressure indicator light warns of system pressure below 83 bar (1 200 lbf/in<sup>2</sup>). Steering meets ISO 5010, SAE J53.

System Pressure ..... 159 bar (2 300 lbf/in<sup>2</sup>)  
Relief Pressure ..... 207 bar (3 000 lbf/in<sup>2</sup>)

Steering Cylinders ..... Double Acting, Single Stage  
Accumulator  
Oil Capacity ..... 14.0 litres (3.70 US gal)  
Nitrogen Precharge Pressure ..... 55 bar (800 lbf/in<sup>2</sup>)  
Steering Angle (Left and Right) ..... 39°  
Pump:  
Type ..... Piston  
Capacity at 2 100 rev/min ..... 1.4 litres/s (22 US gal/min)

## BODY HYDRAULICS

Two body hoist cylinders are mounted between the frame rails. Cylinders are two-stage with power down in the second stage.

System Relief Pressure ..... 190 bar (2 750 lbf/in<sup>2</sup>)  
Pump:  
Type ..... Gear  
Capacity at 2 100 rev/min . 227 litres/min (60 US gal/min)

Control Valve ..... Servo Controlled, Open Centre  
Body Raise Time ..... 13 Seconds  
Body Lower Time ..... 9 Seconds

## ELECTRICAL

Type ..... 24 Volt, Negative Ground  
Battery ..... Two, 12 Volt, 165 Ah each, Maintenance Free  
Accessories ..... 24 Volt  
Alternator ..... 70 Amp  
Starter ..... 8.9 kW

## BODY

Longitudinal 'V' type floor with integral transverse box-section stiffeners. The body is exhaust heated and rests on resilient impact absorption pads.

Body wear surfaces are high hardness (360-440 BHN) abrasion resistant steel. Yield strength of plates 1 000 MPa (145 000 lbf/in<sup>2</sup>).

Plate Thicknesses:

Floor ..... 19 mm (0.75 in)  
Side ..... 10 mm (0.39 in)  
Front, lower ..... 10 mm (0.39 in)

ROPS Cabguard SAE J1040 Feb 86. ISO 3471

Volumes:

Struck (SAE) ..... 19.6 m<sup>3</sup> (25.6 yd<sup>3</sup>)  
Heaped 2:1 (SAE) ..... 26.0 m<sup>3</sup> (34.0 yd<sup>3</sup>)

## SERVICE CAPACITIES

|                                     |                             |
|-------------------------------------|-----------------------------|
| Engine Crankcase and Filters .....  | 55 litres (14.5 US gal)     |
| Transmission and Filters .....      | 68 litres (18 US gal)       |
| Cooling System .....                | 144 litres (38 US gal)      |
| Fuel Tank .....                     | 606 litres (160 US gal)     |
| Steering Hydraulic Tank .....       | 61 litres (16 US gal)       |
| Steering System .....               | 85 litres (22.5 US gal)     |
| Body and Brake Cooling Tank .....   | 216 litres (57 US gal)      |
| Body and Brake Cooling System ..... | 368 litres (97 US gal)      |
| Planetaries (Total) .....           | 66 litres (17.4 US gal)     |
| Differential .....                  | 60 litres (15.8 US gal)     |
| Front Ride Strut (Each) .....       | 14 litres (3.7 US gal)      |
| Rear Ride Strut (Each) .....        | 17 litres (4.5 US gal)      |
| Power Takeoff .....                 | 4 litres (1 US gal)         |
| Air Conditioning Compressor .....   | 0.135 litres (0.036 US gal) |

## Typical Noise Levels

Operator Ear (ISO 6394) ..... 80 dbA

\*Exterior Sound Rating (SAE J88 JUN 86) ..... 88 dbA

\* - The above result is for the mode giving the highest exterior sound level when measured and operated as per the

prescribed procedures of the standard. Results shown are for the vehicle in base configuration.

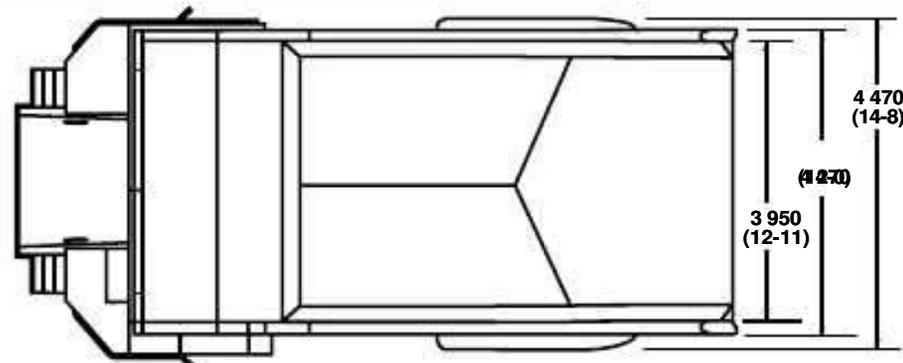
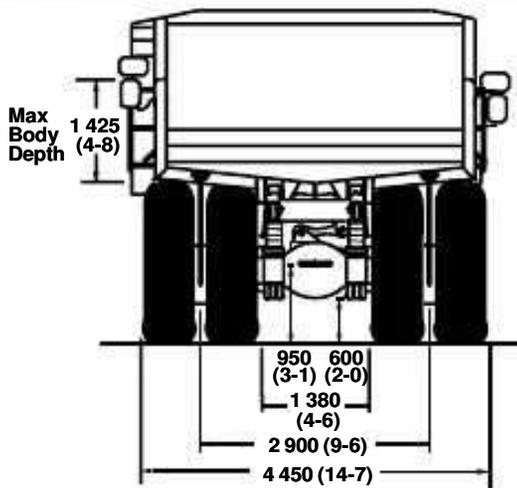
**Note:** Noise Level Exposure to the operator and bystander personnel may be higher depending upon proximity to buildings, rock piles, machinery etc.. The actual job site Noise Level Exposure must be measured and applicable regulations complied with in respect to Employee Hearing Protection.

## VEHICLE WEIGHTS (MASS)

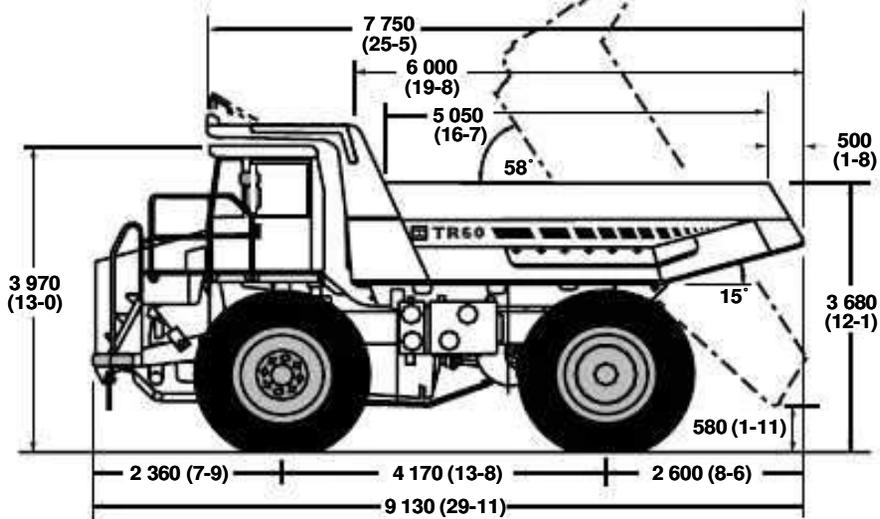
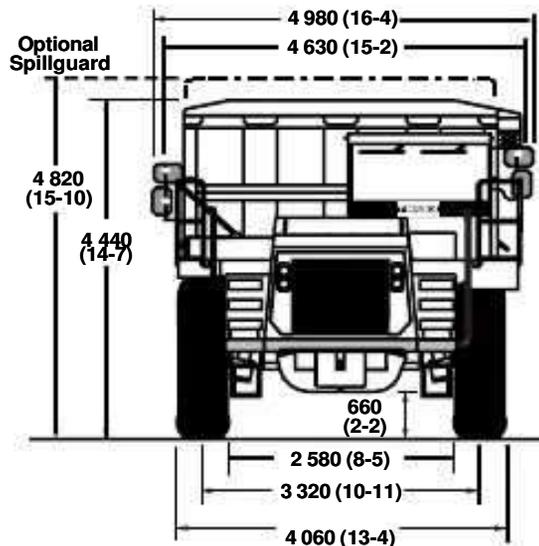
|   | kg            | lb            |
|---|---------------|---------------|
| Chassis, with hoists  | 27 835        | 61 365        |
| Body, standard  | 37 305        | 80 500        |
| <b>PAYLOAD, maximum</b>   | <b>40 825</b> | <b>90 000</b> |
| Maximum Gross Weight*   | 77 960        | 171 870       |
| FOR UNIT EQUIPPED WITH OPTIONAL BODY LINER PLATES:  |               |               |
| Chassis, with hoists  | 27 835        | 61 365        |
| Body, heavy duty  | 10 800        | 23 810        |
| Net Weight  | 38 635        | 85 175        |
| <b>PAYLOAD, maximum</b>   | <b>39 325</b> | <b>86 700</b> |
| Maximum Gross Weight*   | 77 960        | 171 870       |
| * Maximum permissible gross vehicle weight with options, attachments, full fuel tank and payload. |               |               |
| <b>WEIGHT DISTRIBUTION</b>  | Front Axle    | Rear Axle     |
| Empty %   | 48            | 52            |
| Loaded %  | 34            | 66            |

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**TR60 Technical Data  
On Following Page**



Vehicle Clearance Diameter (SAE) 21 m (68-10)



Dimensions in mm (ft-in)

## TECHNICAL DATA TR60

### ENGINE

Make/Model ..... Cummins QSK19-C650  
 Type ..... 4 Cycle, Turbocharged/Low Temperature

Gross Power 1 500 through 2 100 rev/min ..... 485 kW  
 (650 hp, 659 PS)  
 Net Power 1 500 through 2 100 rev/min ..... 462 kW  
 (620 hp, 628 PS)

**Note:** Power ratings to SAE J1995 Jun 90. Engine emission meets Tier II USA EPA/CARB MOH 40 CFR 89 and proposed EU non-road mobile machinery directive.

Maximum Torque ..... 3 084 Nm (2 275 lbf ft)  
 at 1 300 through 1 500 rev/min  
 Number of Cylinders/Configuration ..... 6, in line  
 Bore x Stroke ..... 159 x 159 mm (6.25 x 6.25 in)  
 Total Displacement ..... 18.9 litres (1 150 in<sup>3</sup>)  
 Starting ..... Electric  
 Maximum Speed, Full Load ..... 2 100 rev/min  
 Maximum Speed, No Load ..... 2 350 rev/min  
 Idle Speed ..... Self Adjusting  
 Safe Operating Angle ..... 30°/60% Grade

### TRANSMISSION

Make/Model ..... Allison M6610AR  
 automatic electronic control with soft shift feature.  
 Remote mounted in the frame. Integral TC 682 torque converter and planetary gearing. Six speeds forward, two

reverse. Automatic converter lockup action in all speed ranges. With body up, gear range is limited to 1st forward only. Downshift inhibitor. Intregal hydraulic retarder.

### DRIVE AXLE

Heavy duty axle with single reduction spiral bevel gear differential, full floating axle shafts, and planetary reduction at each wheel.

Ratios:  
 Differential ..... 3.73:1  
 Planetary ..... 5.80:1  
 Total Reduction ..... 21.63:1

| Speeds With 24.00 R 35 Tyres |                       |                        |                         |                         |                         |                         | TABLE 964 |
|------------------------------|-----------------------|------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-----------|
| Forward                      |                       |                        |                         |                         |                         |                         |           |
| Gear                         | 1                     | 2                      | 3                       | 4                       | 5                       | 6                       |           |
| Ratio                        | 4.00                  | 2.68                   | 2.01                    | 1.35                    | 1.00                    | 0.67                    |           |
| km/h                         |                       |                        |                         |                         |                         |                         |           |
| mile/h                       | 9.5<br><del>3.9</del> | 14.2<br><del>8.8</del> | 18.9<br><del>11.8</del> | 28.2<br><del>17.5</del> | 38.1<br><del>23.7</del> | 57.0<br><del>35.5</del> |           |
| Reverse                      |                       |                        |                         |                         |                         |                         |           |
| Gear                         | R1                    | R2                     |                         |                         |                         |                         |           |
| Ratio                        | 5.12                  | 3.46                   |                         |                         |                         |                         |           |
| km/h                         | 7.4                   | 11.0                   |                         |                         |                         |                         |           |
| mile/h                       | 4.6                   | 6.8                    |                         |                         |                         |                         |           |

## SUSPENSION

**Front:** King pin strut type independent front wheel suspension by self-contained, variable rate, nitrogen/oil cylinders.

**Rear:** Variable rate nitrogen/oil cylinders with A-frame linkage and lateral stabilizer bar.

### Maximum Strut Stroke

Front..... 251 mm (9.9 in)

Rear ..... 182 mm (7.2 in)

Maximum Rear Axle Oscillation .....  $\pm$  6.5 Degrees

## WHEELS AND TYRES

Wheel Rim Width ..... 17 in

Standard Tyres (Front & Rear) ..... 24.00 R 35\*\* Radial

**Note:** It is recommended that for tyres both listed and unlisted, the user should consult the tyre manufacturer and evaluate all job conditions in order to make the proper selection.

## BRAKES Service

All hydraulic brake system. Transmission mounted pressure compensating pump provides hydraulic pressure for brakes and steering. Independent circuits front and rear. Each circuit incorporates a nitrogen accumulator which stores energy to provide consistent braking response.

Front Brake Circuit Pressure ..... 159 bar (2 300 lbf/in<sup>2</sup>)

Rear Brake Circuit Pressure ..... 52 bar (750 lbf/in<sup>2</sup>)

### Accumulators:

Nitrogen Precharge Pressure ..... 55 bar (800 lbf/in<sup>2</sup>)

### Front:

Type ..... Dry Disc with 1 calliper per wheel

Disc Diameter ..... 710 mm (28 in)

Pad Area, Total ..... 1 395 cm<sup>2</sup> (216 in<sup>2</sup>)

### Rear:

Type ..... Oil cooled, multiple friction discs,  
completely sealed from dirt and water.

Braking Surface, Total ..... 47 151 cm<sup>2</sup> (7 308 in<sup>2</sup>)

### Parking

Application of rear brakes by springs in brake disc pack.

Hydraulically released.

Hold-off Pressure ..... 83 bar (1 200 lbf/in<sup>2</sup>)

### Retardation

Modulated lever control of rear disc pack. .... 510 kW (685 hp)  
continuous.

Retarder Actuation Pressure ..... up to 33 bar (480 lbf/in<sup>2</sup>)

### Emergency

Push button solenoid control applies service and parking brakes. Automatically applies when engine is switched off.

Parking brake applies should system pressure fall below a predetermined level.

Brakes conform to ISO 3450, SAE J1473 OCT 90.

## STEERING SYSTEM

Independent hydrostatic steering with closed-centre steering valve, accumulator and pressure compensating piston pump.

Accumulator provides uniform steering regardless of engine speed. In the event of loss of engine power it provides steering of approximately two lock-to-lock turns. A low pressure indicator light warns of system pressure below 83 bar (1 200 lbf/in<sup>2</sup>). Steering meets ISO 5010, SAE J53.

System Pressure ..... 159 bar (2 300 lbf/in<sup>2</sup>)  
Relief Pressure ..... 207 bar (3 000 lbf/in<sup>2</sup>)

Steering Cylinders ..... Double Acting, Single Stage  
Accumulator  
Oil Capacity ..... 14.0 litres (3.70 US gal)  
Nitrogen Precharge Pressure ..... 55 bar (800 lbf/in<sup>2</sup>)  
Steering Angle (Left and Right) ..... 39°  
Pump:  
Type ..... Piston  
Capacity at 2 100 rev/min ..... 1.4 litres/s (22 US gal/min)

## BODY HYDRAULICS

Two body hoist cylinders are mounted between the frame rails. Cylinders are two-stage with power down in the second stage.

System Relief Pressure ..... 190 bar (2 750 lbf/in<sup>2</sup>)  
Pump:  
Type ..... Gear  
Capacity at 2 100 rev/min ..... (60 US gal/min)

Control Valve ..... Servo Controlled, Open Centre  
Body Raise Time ..... 13 Seconds  
Body Lower Time ..... 9 Seconds

## ELECTRICAL

Type ..... 24 Volt, Negative Ground  
Battery ..... Two, 12 Volt, 165 Ah each, Maintenance Free  
Accessories ..... 24 Volt  
Alternator ..... 70 Amp  
Starter ..... 8.9 kW

## BODY

Longitudinal 'V' type floor with integral transverse box-section stiffeners. The body is exhaust heated and rests on resilient impact absorption pads.

Body wear surfaces are high hardness (360-440 BHN) abrasion resistant steel. Yield strength of plates 1 000 MPa (145 000 lbf/in<sup>2</sup>).

Plate Thicknesses:

Floor ..... 19 mm (0.75 in)  
Side ..... 10 mm (0.39 in)  
Front, lower ..... 10 mm (0.39 in)

ROPS Cabguard SAE J1040 Feb 86. ISO 3471

Volumes:

Struck (SAE) ..... 26 m<sup>3</sup> (34 yd<sup>3</sup>)  
Heaped 2:1 (SAE) ..... 35 m<sup>3</sup> (46 yd<sup>3</sup>)

## SERVICE CAPACITIES

|                                     |                             |
|-------------------------------------|-----------------------------|
| Engine Crankcase and Filters .....  | 55 litres (14.5 US gal)     |
| Transmission and Filters .....      | 85 litres (22.5 US gal)     |
| Cooling System .....                | 170 litres (45 US gal)      |
| Fuel Tank .....                     | 606 litres (160 US gal)     |
| Steering Hydraulic Tank .....       | 61 litres (16 US gal)       |
| Steering System .....               | 72 litres (19 US gal)       |
| Body and Brake Cooling Tank .....   | 216 litres (57 US gal)      |
| Body and Brake Cooling System ..... | 258 litres (68 US gal)      |
| Planetaries (Total) .....           | 43 litres (11.4 US gal)     |
| Differential .....                  | 52 litres (13.7 US gal)     |
| Front Ride Strut (Each) .....       | 14 litres (3.7 US gal)      |
| Rear Ride Strut (Each) .....        | 17 litres (4.5 US gal)      |
| Power Takeoff .....                 | 4 litres (1 US gal)         |
| Air Conditioning Compressor .....   | 0.135 litres (0.036 US gal) |

## Typical Noise Levels

Operator Ear (ISO 6394) ..... 79 dbA

\*Exterior Sound Rating (SAE J88 JUN 86) ..... 89 dbA

\* - The above result is for the mode giving the highest exterior sound level when measured and operated as per the prescribed procedures of the standard. Results shown are for the vehicle in base configuration.

**Note:** Noise Level Exposure to the operator and bystander personnel may be higher depending upon proximity to buildings, rock piles, machinery etc.. The actual job site Noise Level Exposure must be measured and applicable regulations complied with in respect to Employee Hearing Protection.

## Vehicle Weights (Mass)

|  | kg               | lb               |
|--|------------------|------------------|
| Chassis, with hoists   | 30 600           | 67 460           |
| Body, standard<br>Net Weight   | 10 650<br>41 250 | 23 480<br>90 940 |
| <b>PAYLOAD, maximum</b>  | <b>54 430</b>    | <b>120 000</b>   |
| Maximum Gross Weight*  | 95 680           | 210 940          |
| FOR UNIT EQUIPPED WITH OPTIONAL HARD ROCK BODY:  |                  |                  |
| Chassis, with hoists   | 30 600           | 67 460           |
| Body, with wear plates<br>Net Weight   | 13 280<br>43 880 | 29 180<br>96 580 |
| <b>PAYLOAD, maximum</b>  | <b>51 880</b>    | <b>114 380</b>   |
| Maximum Gross Weight*  | 95 680           | 210 940          |
| * Maximum permissible gross vehicle weight with options, attachments, full tank and payload. |                  |                  |
| <b>WEIGHT DISTRIBUTION</b>   | Front Axle       | Rear Axle        |
| Empty %  | 48               | 52               |
| Loaded %   | 34               | 66               |



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## **10 - Symbol Identification**

<https://www.besttruckmanuals.com/>

# SYMBOL IDENTIFICATION

These pages explain the meaning of symbols that may appear on your machine.

|                         |   |                 |   |           |   |                |   |
|-------------------------|---|-----------------|---|-----------|---|----------------|---|
| Basic Warning Symbol    |    | Switch 'Off'    |    | Hourmeter |    | Unlock         |    |
| Pressurised Compartment |    | Negative Ground |    | Fast      |    | Basic Engine   |    |
| Master Switch           |    | Ammeter         |    | Slow      |    | Engine Starter |    |
| Switch 'On'             |  | Circuit Breaker |  | Lock      |  | Engine Rev/Min |  |

Engine  
'Off'



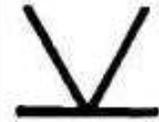
Basic  
Transmission



Transmission  
Converter  
Lockup



Minimum  
or  
Low



Emergency  
Engine  
Shut Off



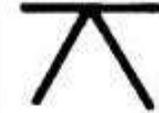
Transmission  
Oil



Air  
Pressure



Maximum  
or  
High



Engine  
Oil



Transmission  
Oil  
Pressure



Air Filter  
or  
Restriction



Basic  
Hydraulic  
Oil Symbol



Engine  
Oil  
Pressure



Transmission  
Oil  
Temperature



Starter  
Air  
Pressure



Hydraulic  
Oil  
Filter



Engine  
Oil  
Filter



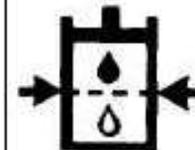
Transmission  
Oil Filter



Oil Level



Hydraulic  
Oil Filter  
Pressure



Hot Hydraulic Oil



Heating



Light Flood



Horn



Coolant Temperature



Fuel Gauge or Fill Tube



Light Low Beam



Windshield Wiper



Coolant 'Cold'



Fuel Filter



Light High Beam



Windshield Defroster



Coolant 'Hot'



Fuel Shut-Off



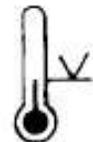
Instrument Panel Light



Windshield Washer



Cooling



Basic Lights Symbol



Lamp Test



Blower Fan



|                         |   |                       |   |                       |   |                      |   |
|-------------------------|---|-----------------------|---|-----------------------|---|----------------------|---|
| Heater                  |    | Parking Brake         |    | Low Steering Pressure |    | Body 'Hold'          |    |
| Air Conditioner         |    | Brake Oil Temperature |    | High Speed or Level   |    | Body 'Lower'         |    |
| Inside Air Circulation  |    | Turn Left             |    | Low Speed or Level    |    | Body 'Float'         |    |
| Outside Air Circulation |    | Turn Right            |    | Body Up               |    | Dumptruck 'Retarder' |    |
| Parking Brake           |  | Tilt Steering Column  |  | Body 'Raise'          |  | Neutral              |  |

Lift Point



Clutch  
'Disengage'



Do Not Lift



Brake  
Applied -  
Clutch  
Engaged



Forward



Brake  
Applied -  
Clutch  
Disengaged



Reverse



Clutch  
'Engaged'



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## NOTES

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## NOTES

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## NOTES