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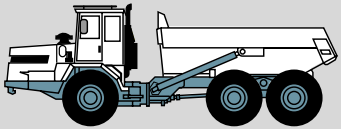

TA35/TA40

Operation - Safety - Maintenance

WHEN RE-ORDERING THIS HANDBOOK,
SPECIFY - **PART NUMBER 15275590**

TECHNICAL PUBLICATIONS DEPARTMENT
TEREX EQUIPMENT LIMITED
MOTHERWELL, SCOTLAND ML1 5RY
Ref No. OHE 836/820 June 2005

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.

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, MOTHERWELL, SCOTLAND, ML1 5RY

DESCRIPTION OF MACHINERY			DIRECTIVES COMPLIED WITH	
MAKE:	TEREX		87/404/EEC	97/23/EC
MODEL:	TA35 ARTICULATED TRUCK		89/336/EEC	
	TA40 ARTICULATED 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,
COMPLIES WITH, OR IS DESIGNED AND CONSTRUCTED AS FAR AS POSSIBLE TO COMPLY WITH,
THE ESSENTIAL HEALTH AND SAFETY REQUIREMENTS OF THE MACHINERY DIRECTIVE.

FOR AND ON BEHALF OF THE MANUFACTURER:

NAME:	PAUL DOUGLAS	SIGNATURE:
POSITION:	CHIEF ENGINEER	

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CONTENTS

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 TA35 and TA40 Articulated 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 vehicle 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 assure safe servicing and operation of the vehicle.

READ the CIMA Safety Manual supplied with this vehicle.

WARNING

These vehicles are equipped with cylinders containing compressed nitrogen gas. Transportation of these vehicles 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 vehicle 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.

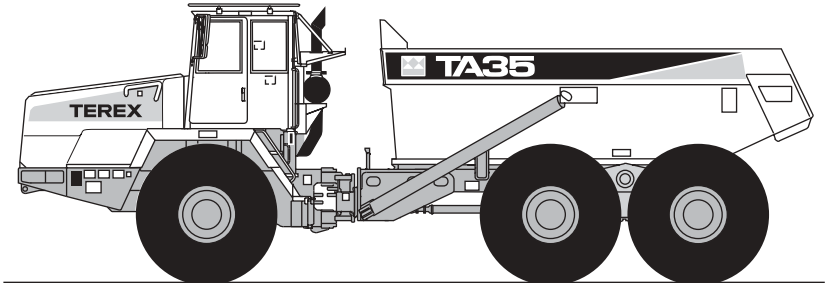
This Handbook contains lubrication and routine servicing instructions, most of which can be performed in the field. Service manuals containing repair/rebuild procedures can be obtained from your dealer.

Machine Identification

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

Information regarding the vehicle model, code and chassis serial number is found on the unit serial number plate on the rear right of the front frame. The vehicle 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. Your dealer is ready to provide you with any additional information needed and should be consulted for additional publications for this vehicle.



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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 vehicle is stolen, or to reduce vandalism.

Actions to Discourage Theft and Vandalism

Remove all keys any time the vehicle is left unattended.

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

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

Upon receipt of a vehicle, record the vehicle 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 vehicle that all serial numbers are recorded.

Discourage the thief! Inspect the gates and fences of the machinery storage yard or construction site. Keep vehicles 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 vehicles to promptly detect losses or vandalism.

Actions to Aid in Recovery of Stolen Vehicles

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 vehicle.

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

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

2 - Safety Precautions

SAFETY PRECAUTIONS

General

* Read this Operator's Handbook and learn the operating characteristics and limitations of the vehicle. Know what operating clearances the vehicle 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.

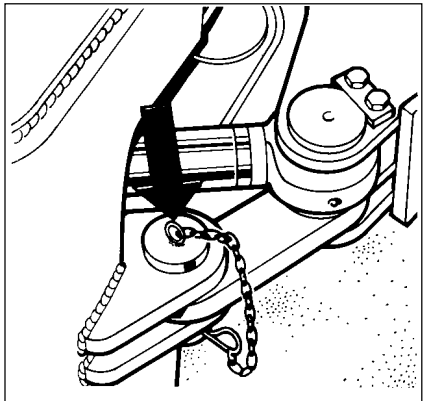
* Never attempt to operate or work on a machine when not feeling physically fit.

* Know what safety equipment is required and use it. Such equipment may be: Hard hat, safety glasses, reflector type vests, respirators, ear plugs etc..

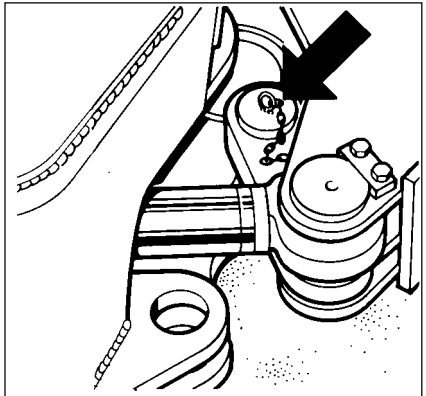
* Never wear loose clothing, rings, watches etc., that might catch levers and controls and cause loss of control.

* 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.



327 Steering Lock Bar Locked Position



328 Steering Lock Bar Stowed Position

* Clean any mud, grease or oil from controls, handrails, ladders and decks. Lash necessary tools securely and remove all loose items before operating the vehicle. 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 and falling object protective structure may be impaired if it has been subjected to any modification or damage. Unauthorized modification will void certification.**

Articulation and Oscillation Locks

* Always connect the steering lock bar and oscillation lock pin before working in the articulation area, before lifting the vehicle and during transporting of this vehicle by trailer/vessel.

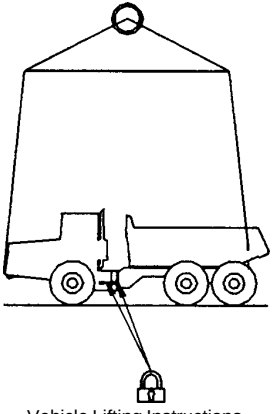
* Always disconnect the steering lock bar and oscillation lock pin and secure in the 'Stowed' position before operating the vehicle. The vehicle would not be free to steer otherwise.

Vehicle Lifting Precautions

* Prior to lifting, the vehicle should be parked on a level surface, wheels blocked, steering lock bar connected, oscillation lock pin inserted and the parking brake disengaged.

* The vehicle should be lifted using a spreader bar if possible. Lift using FOUR slings from the lifting points provided at the bumper end of the front chassis and at the rear of the body.

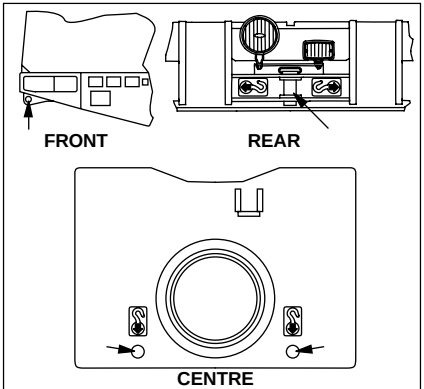
  Note: Be aware that this vehicle is free to oscillate if not lifted correctly. If in any doubt contact your dealer for further information.



919 Vehicle Lifting Instructions

Vehicle Tie Down Precautions

* The vehicle should be secured at the tie down points located at the bumper end of the front chassis, the front face of the trailer chassis and the tow pin at the rear of the trailer chassis.



1010 Vehicle Tie Down Instructions

Preventing Fire Hazards

General Fire Precautions

* Make sure the vehicle has a 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 vehicle.

* Clean all dirt, oil, grease and other fluids from systems and components to minimize fire hazards and aid in spotting loose or leaking lines, fittings etc..

* Check the engine compartment for rubbish, 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 vehicle has been operated with an under inflated tyre. Make sure that the tyre has cooled sufficiently before parking and leaving the vehicle 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, lines 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 lines.

* 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, alternator leads, engine ECU, transmission ECU and body hydraulic joystick 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 vehicle 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 hand holds provided to mount or dismount the vehicle. Do not grasp steering wheel.

* Always face the access system and maintain at least three points of support to mount or dismount the vehicle.

* Always use care when mounting the vehicle with oil covered, frosted, or iced fenders, decks, hand holds or steps.

* Never mount or dismount a moving vehicle. Never jump off the vehicle.

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 vehicle is ready for operation.

* Always walk around the vehicle to make sure no-one is working on, underneath or close to the vehicle before starting the engine or operating the vehicle.

* Adjust, secure and latch the seat and fasten the seat belt before starting the vehicle.

* Sound horn before starting the engine or beginning to move the vehicle; 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 vehicle motion.

* Always obey 'Starting the Engine' instructions described on page 4-6.

* Do not bypass the vehicle’s neutral-start system. The neutral-start system must be repaired if it malfunctions.

* Start and operate the vehicle only from the operator’s station.

Operating

* Ensure all cab glass, mirrors and light lenses are clean during vehicle 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 vehicle.

* Always perform 'Pre-Operating Checks' described on page 4-9 to ensure the vehicle is ready for operating.

* Always wear seat belts when operating the vehicle.

* In the event of a loss of steering system supply pressure, a red warning light on the instrument panel will illuminate. If this light illuminates, indicating a loss of steering power, the vehicle 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 vehicle; 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 vehicle in motion and when approaching ground crew.

* Be sure the body is fully down before moving the vehicle.

* Always try to face or look in the direction the vehicle is travelling.

* 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 vehicle 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 and/or retarder. Always maintain safe speeds for haul road operating conditions for maximum control. Reduce speed before turning.

* In the event of a loss of electric power to the gear shift control, the transmission will automatically shift to NEUTRAL. If this occurs, stop the vehicle using the service brakes, apply the parking brake and do not operate until the fault is corrected.

* 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 vehicles. Stop in authorized areas only, except in emergency.

* Brake firmly in one application. Do not FAN the pedal. Never operate the vehicle if a warning light indicates a fault in the braking system.

* Always give loaded vehicles the right-of-way when your vehicle 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 vehicle is being loaded or when dumping a load.

* Always stay in cab when being loaded.

* Always lower the body and shut down the vehicle according to the procedure under 'Stopping The Engine' described on page 4-14 before leaving the vehicle unattended. If on a grade wheels should be blocked.

Roading

* Match speed to road conditions.

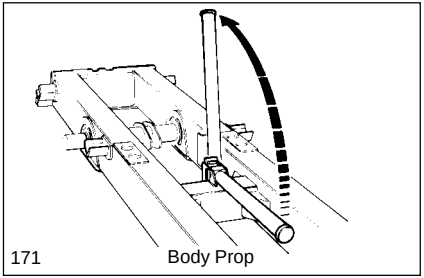
* Yield the right of way when required. Obey the rules of the road.

* 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 vehicle 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


171 Body Prop

* Do not allow unauthorized personnel to service or maintain this vehicle. Study the Operator's Handbook and Maintenance Manual before starting, operating or servicing this vehicle. Always follow procedures and safety precautions detailed throughout the Maintenance Manual.

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

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

* Do not work under or near unblocked or unsupported body. Always use the body safety prop. The body safety prop must only be used when the body is empty.

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

* Always install the steering lock bar before making adjustments or servicing the vehicle with the engine running. Refer to 'General' safety section.

* Always shut down vehicle according to the procedure under 'Stopping The Engine', described on page 4-14, and turn off the master switch before cleaning, lubricating or servicing the vehicle except as called for in this Operators Handbook or the Maintenance Manual.

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

* 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 vehicle.

* 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 Maintenance Manual.

Wheels and Tyres

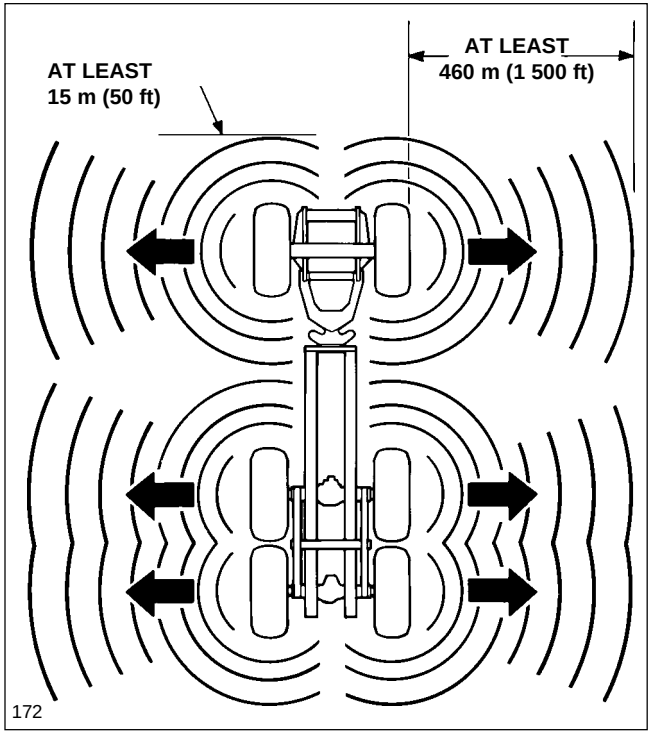
If tyres on the vehicle were inflated at the factory with dry nitrogen gas, the tyre walls will be marked 'N' and the following factory installed decal will be found mounted on the fenders.

NOTICE
TYRES ON THIS VEHICLE 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, Nitrogen Inflation of Tyres of the vehicle Maintenance 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 manufacturers 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

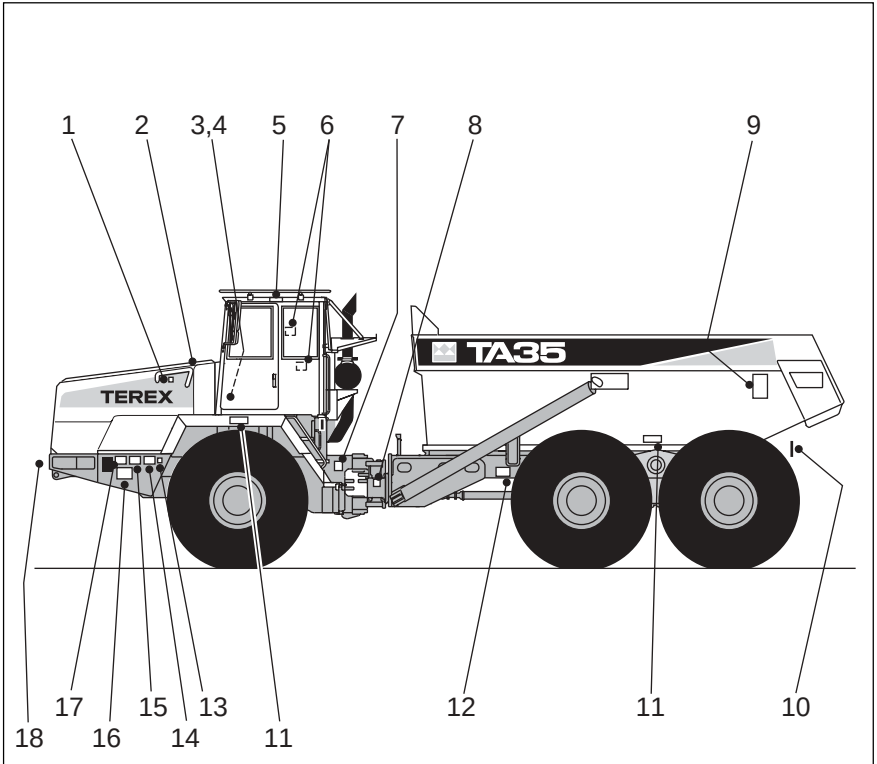
WARNING

Whenever a vehicle'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 vehicle so as not to be physically endangered in the event of an explosion of the tyre and rim parts. The vehicle should be moved to a remote area, but only when this can be done with complete safety of the operator operating or towing the vehicle. All other persons should stay clear of the vehicle. 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 vehicle by use of hand-held fire extinguishers. If it is absolutely necessary to approach a vehicle 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 (1 500 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 vehicles 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 vehicle.

1. Engine Running Warning
2. Radiator Fill
3. Fuse Identification
4. ROPS and FOPS Certification Plate
5. Acoustic Foam Precautions
6. Emergency Exit (Inside and Outside)
7. Pivot Area Precautions
8. Lube Instructions - Pivot Pins
9. Vehicle Lifting Hook
10. Vehicle Tie-down Hook
11. Tyre Inflation - Nitrogen Fill
12. Body Prop Precautions
13. Battery Negative Earth
14. Alternator Precautions
15. Welding Precautions
16. Vehicle Lifting Instructions
17. ECU Welding Precautions
18. Vehicle Lifting Hook



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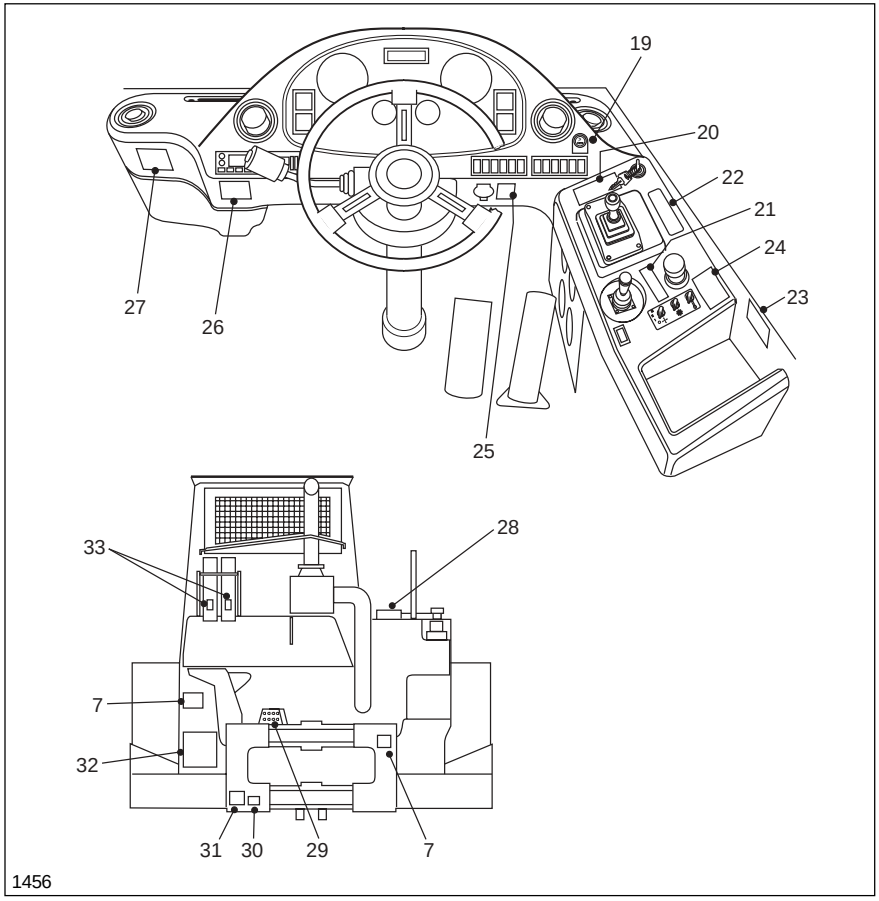
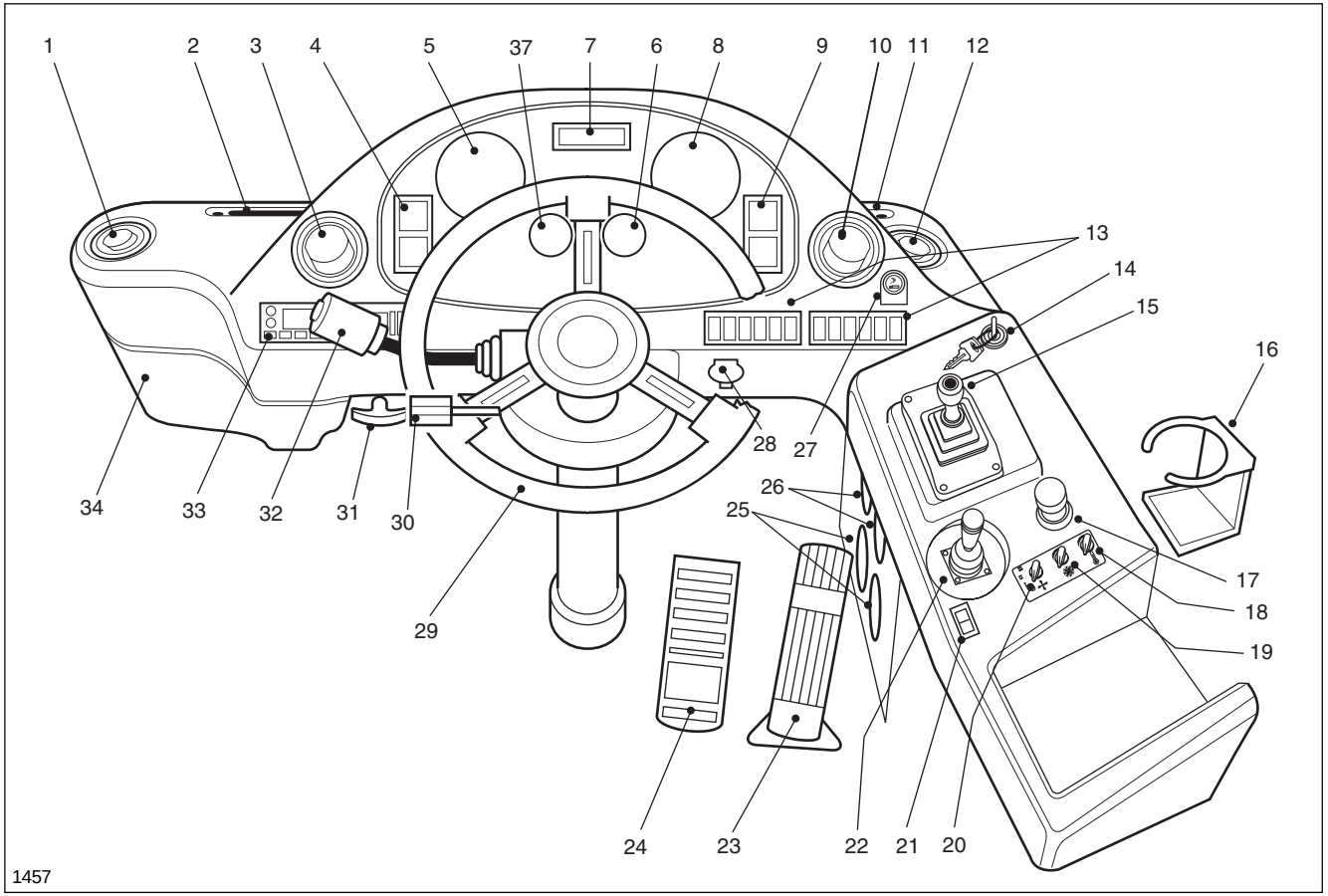


19. Cigar Lighter 24 V
20. Transmission Shift Control
21. Park/Emergency Brake Control
22. Differential Lock Precautions
23. Document Holder
24. Hydraulic Control Lever
25. Hand Lamp
26. Back Alarm
27. Pre-operating Instructions
28. Hydraulic Oil Recommendations
29. Remote Lube and Pressure Points
30. CE Certification
31. Machine Serial Plate
32. Service Instruction Plate
33. Accumulator Precautions

3 - Controls and Operating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CONTROLS AND INSTRUMENTS

1. Side Window Demister
2. Windscreen Demister
3. Face Vent
4. Warning Lights
5. Tachometer/Hourmeter
6. Transmission Oil Temperature Gauge
7. LCD Display
8. Speedometer/Odometer
9. Warning Lights
10. Face Vent
11. Windscreen Demister
12. Side Window Demister
13. Switches
14. Ignition and Starter Key Switch
15. Transmission Gear Shift Control
16. Cup Holder
17. Park/Emergency Brake Control
18. Heater Control
19. Air Conditioner Control
20. Blower Control
21. Retarder Switch (TA35 only)
22. Body Control Lever
23. Accelerator Control
24. Service Brake Control
25. Recirculation Vents
26. Leg Vents
27. Cigar Lighter
28. Accessory Lamp Socket
29. Steering Wheel
30. Steering Wheel Adjustment Lock
31. Hood Release Catch
32. Headlight Dipper, Direction Indicator, Windscreen Wiper/Washer, Horn Control
33. Radio/Cassette Player
34. Fuse Box Cover
35. Interior Light (Not Shown) Located above right hand side window
36. Emergency Exit Hammer (Not Shown) Located above cup holder
37. Fuel Gauge

BASIC DATA
Warning Lights

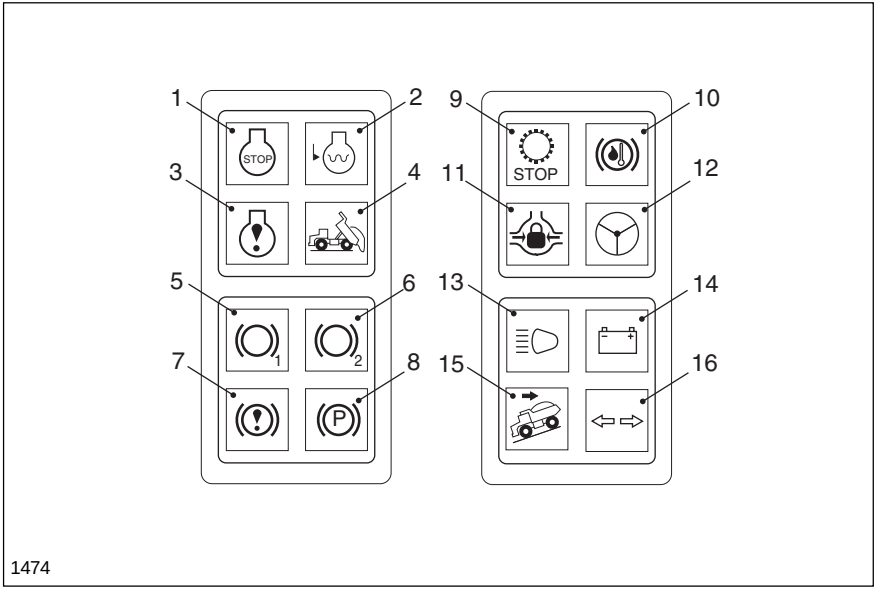
1. Engine Stop Light (Red) - When the 'Stop Engine' light comes on, the computer has detected a major malfunction in the engine that requires immediate attention. It is the operators responsibility to shut down the engine to avoid serious damage.

2. Warning Light - Not used on this machine.

3. Engine Check Light (Amber) - When the 'Check Engine' light comes on, the computer has detected a fault in the engine. The fault should be diagnosed and corrected at the earliest opportunity.

4. Body-Up (Amber) - Illuminates to indicate that the body is not resting on the chassis. Vehicle should not be moved until this light goes out.

5. Tractor Brakes Overstroke (Red) - Illuminates if the brake system pressure is low. A buzzer also sounds. If light illuminates, stop vehicle and investigate the cause.



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6. Trailer Brakes Overstroke (Red) - Illuminates if the brake system pressure is low. A buzzer also sounds. If light illuminates, stop vehicle and investigate the cause.

7. Brake Pressure Differential (Red) - Illuminates to warn of a change in the balance between the pressures in the front and rear brake systems. A buzzer also sounds. If light illuminates, stop vehicle and investigate the cause.

8. Parking Brake (Green) - Illuminates to indicate the parking brake is applied.

9. Transmission Stop Warning Light (Red) - Illuminates for 2 seconds when the ignition is turned on and should go out when the engine starts. Illuminates to indicate any of the following conditions:
High retarder temperature
High transmission sump temperature
Engine overspeed
If light illuminates, stop the engine and investigate the cause.

10. Brake Cooling Oil (Red) - (TA40 only) Illuminates to warn of high brake cooling oil temperature.

11. Differential Locks (Amber) - Illuminates when the differential locks are applied.

12. Emergency Steering (Red) - Illuminates to warn of a fault in the steering system supply pressure. Illuminates when the ignition is turned on and should go out when the engine starts. If light illuminates, stop vehicle and investigate the cause.

13. Main Beam (Blue) - Illuminates when headlights are switched on and dip control is not engaged.

14. Alternator Charging (Red) - Illuminates to indicate when the alternator is not charging.

15. Retarder Apply (Amber) - (TA40 Only) Illuminates when transmission retarder is applied.

16. Direction Indicators (Green) - Flashes when the indicator lights are operating.

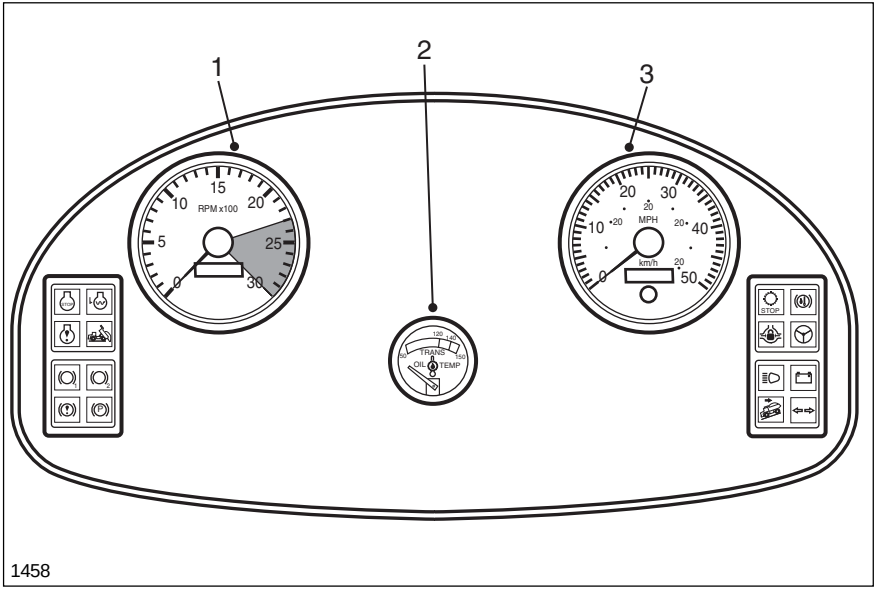
Note: All warning/indicator lights, with the exception of the main beam, body-up, transmission 'Stop' and direction indicators will illuminate to provide a bulb and system check when the ignition is on and the light test switch is pressed. Refer to page 3-8, for details of the test switch.

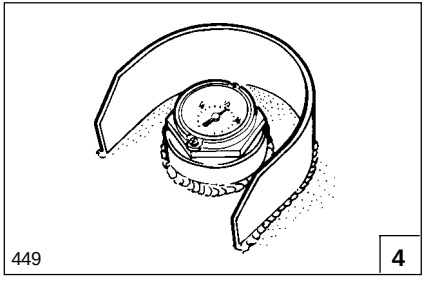
Instruments

1. Tachometer/Hourmeter - Driven from the alternator, the tachometer indicates the number of engine crankshaft 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.

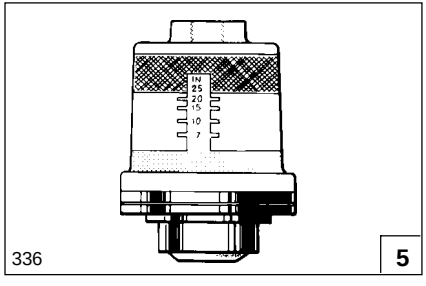
2. Transmission Oil Temperature Gauge - Indicates transmission oil operating temperature. This gauge should read in the green zone during normal operation and may read in the yellow zone during use of the retarder. If the needle rises into the red zone, stop engine and investigate the cause.

3. Speedometer/Odometer - Driven by a signal from the ECU, 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.



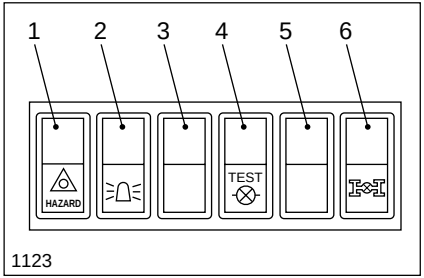


4. Fuel Level Gauge - Indicates the level in the fuel tank. Capacity 463 litres (122 US gal). Fill the tank before parking the vehicle overnight to minimize condensation in the tank. Avoid a dry tank condition which requires bleeding the fuel system.



5. Air Cleaner Restriction Gauge - Indicates the degree of restriction as the yellow band rises in the gauge window. The filter element should be cleaned or replaced if the yellow band locks in place when the engine is shut down. Reset the gauge by pressing button on gauge with engine running.

Switches



1. Hazard Warning Light - Press bottom of switch to make turn indicators flash simultaneously as hazard warning lights. The direction indicator warning light, on the instrument panel will flash. To switch hazard lights off; press the top of the switch.

2. Flashing Beacon (Optional) - Press bottom of switch to operate the roof mounted flashing beacon. To switch off; press the top of the switch.

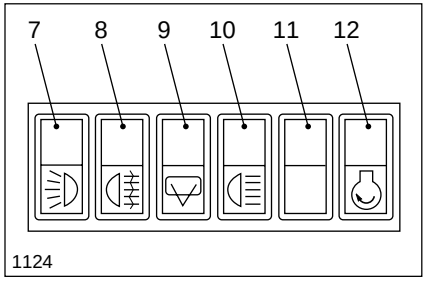
3. Position Unused.

4. Warning Light Test - Pressing the switch with the ignition switched on will illuminate the warning lights to provide a bulb and system check. Refer to 'Warning Light' section on pages 4 and 5 for details.

Note: Test switch should never be pressed with the machine in motion.

5. Position Unused.

6. Differential Lock - Press bottom of switch to request the inter-axle differential locks. The differential lock warning light on the instrument panel will illuminate when the differential locks actually engage. To switch off; press the top of the switch. Refer to 'Differential Lock' section on page 3-40 for operating instructions.



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. Rear Fog Lamp (Optional) - Pressing the bottom of the switch when the headlights are on will operate the high intensity rear fog lamp for use in conditions of poor visibility. To switch off; press top of switch.

9. Rear Screen Wiper and Washer Switch - Press bottom of switch to operate the rear screen wiper. Press switch again for wash. To switch off; press top of switch.

10. Rear Work Light (Optional) - Press bottom of switch to operate the work lights to illuminate the body. To switch off; press top of switch.

11. Position Unused.

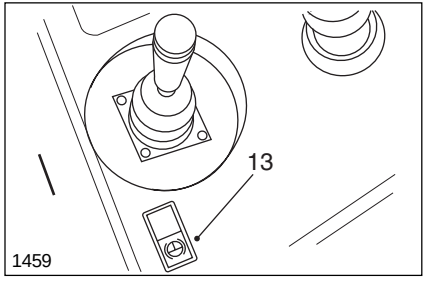
12. Diagnostic Request/Stop Engine Override Switch - Operates as a diagnostic request switch when:

a - the engine is not running and ignition is 'On'.

b - the engine is idling and not in an engine protection condition.

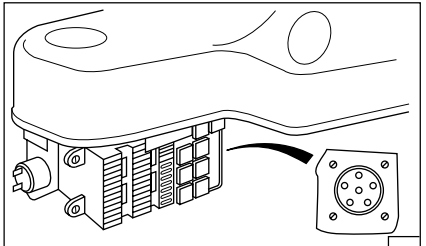
Pressing and releasing the switch will flash out the engine codes. Pressing the switch a second time will stop the engine codes flashing.

Note: Inactive codes are displayed on Check Engine Light and active codes are displayed on Stop Engine Light. Code 25 means no codes present.
Operates as a Stop Engine Override Switch when the engine is in a rampdown protection mode for any of the following:
Low Coolant Level
High Coolant Temperature
Low Oil Pressure
High Oil Temperature



13. Retarder Switch (TA35) - Pressing the bottom of the switch will request and engage the transmission retarder, provided the transmission is in 'lockup'. To disengage retarder; press the top of the switch.
Note: On TA40 machines, retarder switch is incorporated in brake pedal.

14. Diagnostic Test Point - (Located under the dash panel, adjacent to the fuse banks). Plug in connector for diagnostic data reader (DDR).



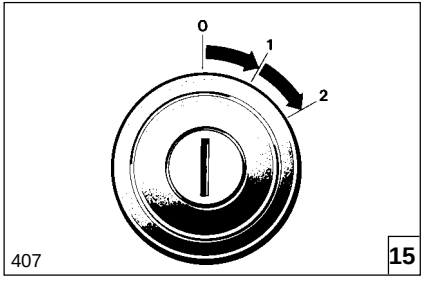
15. Ignition and Starter Key Switch - The combined switch operates the ignition and starter motor.

'0' - Ignition switched off. All electrical systems are inoperative. This position also cuts off fuel to shut down the engine.

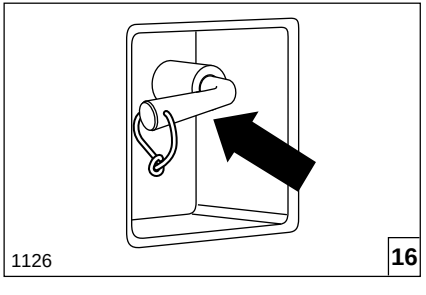
'1' - Ignition switched on, instruments, gauges and warning lights register as appropriate. All electrical systems are operative. The key must remain in this position whilst operating the vehicle.

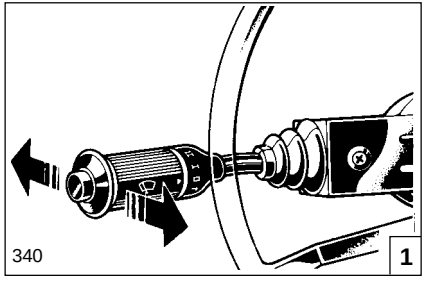
'2' - Starter motor operates. The key when released will return to position '1'.

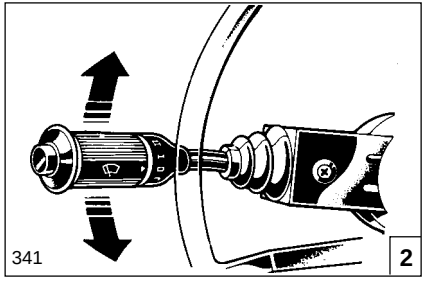
The key can only be withdrawn from position '0'.

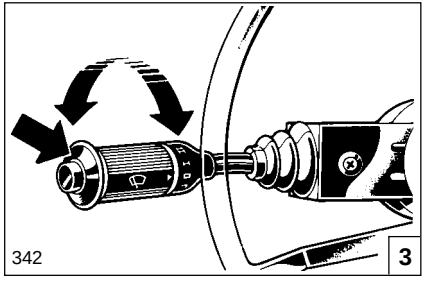


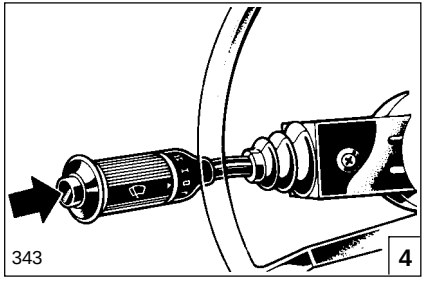
16. Battery Master Switch - (Located on the left hand side of the tractor frame) Turn key clockwise to connect the batteries to the electrical circuits. Switch key off and remove when leaving vehicle unattended.











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:

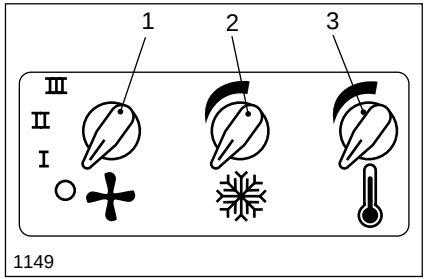
Button pushed in = Horn Sounds

Heater

Blower control (1) is rotated to select one of three blower speeds.

Temperature control (3) 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.



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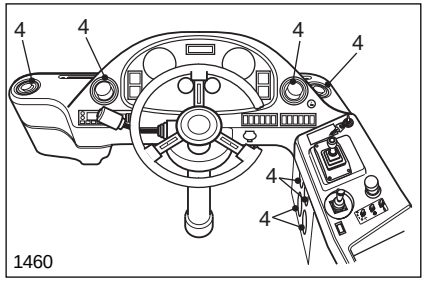
Air Conditioner

Keep all windows and vents closed.

Blower control (1) is rotated to select one of three blower speeds. The air conditioning will not operate if the blower control is not switched on.

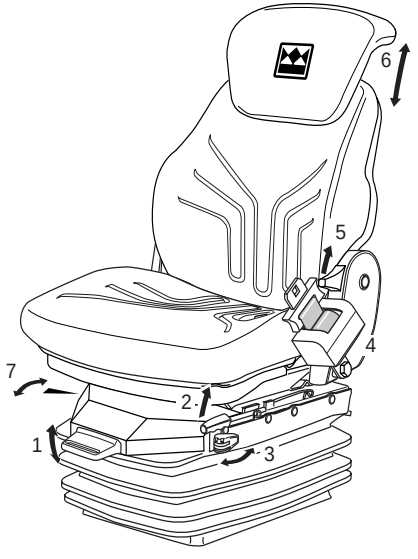
Temperature control (2) adjusts the air conditioner output temperature. Rotating the control right provides maximum cooling.

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.



1460

Note: When the air conditioning is switched on, the Kysor DST engine cooling fan automatically engages.



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Operator's Seat - Air Suspension (Grammer)

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 following is the list of controls to adjust the seat:

1. Height and weight adjustment.

2. Horizontal adjustment (sliderails).

3. Fore/aft isolator (forward position - unlocked, rearmost position - locked).

4. Seat belt.

5. Backrest angle adjustment.

6. Backrest height adjustment.

7. Damper adjustment (4 positions; forward position - hardest setting, rearmost position - softest setting).

WARNING

The cab is for protection of the operator and adheres to the mandatory standard for Roll Over Protection Structure (ROPS).

A prerequisite for protection is that the operator remain in the cab, with the seat belt securely fastened. Should the vehicle begin to roll, hold onto the steering wheel.

WARNING

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

Operator's Seat - Operation

To achieve the most comfortable driving position, adjust the seat as follows;

1. Sit in seat.

2. Pull up and release height and weight adjustment (1) handle - this will reset the seat to the predetermined height setting - 'bounce' lightly until a 'click' is heard, the seat position in now engaged properly.

3. Pull up horizontal adjustment handle (2) and move seat forwards or backwards, release handle when required position is achieved.

4. Pull up (or push down) height and weight adjustment (1) handle and hold until the require height position is achieved, release handle - 'bounce' lightly until a 'click' is heard, the seat position in now engaged properly.

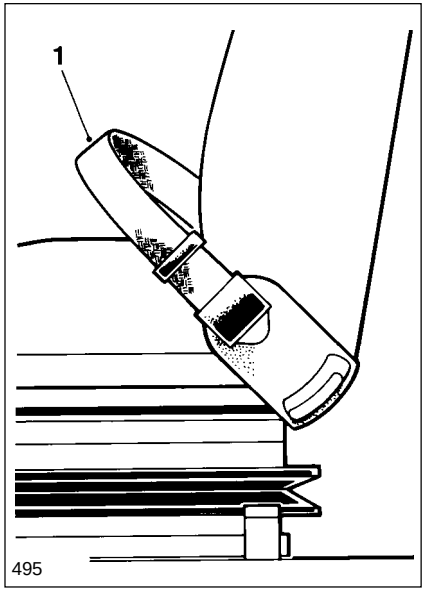
5. Pull up handle (5) and adjust backrest to the required angle (5), release handle when required position is achieved.

6. Pull up (or push down) backrest (6) to the required height.

7. Set damper adjustment (7) position to suit driving conditions, (4 positions; forward position - hardest setting, rearmost position - softest setting).

8. Set fore/aft isolator (3) position to suit driving conditions, (forward position - unlocked, rearmost position - locked).

9. Engage seat belt (4).



Seat Belt

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

Note: Passenger seat belt has a release button mounted on the under side of the seat belt barrel. This button must be pressed and held to extract the seat belt.

WARNING

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.

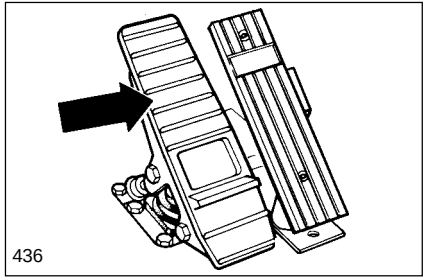
Do not attempt to adjust seat or seat belt while machine is moving. Loss of control may result. Stop machine; apply brakes; then adjust.

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 Parking-Emergency Brake Control.

A 'Brake System Balance' warning light, 'Front Brake System' warning light and a 'Rear Brake System' warning light are located on the instrument panel. A buzzer will also sound if the brake pressure is low. If any of these lights illuminate and/or the buzzer sounds, stop the machine, apply parking brake and do not operate until the fault is corrected.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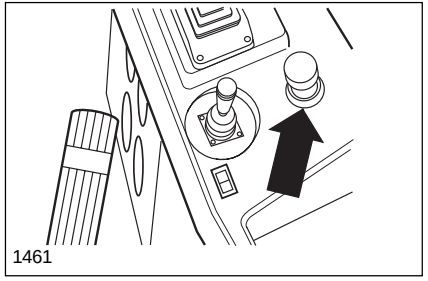
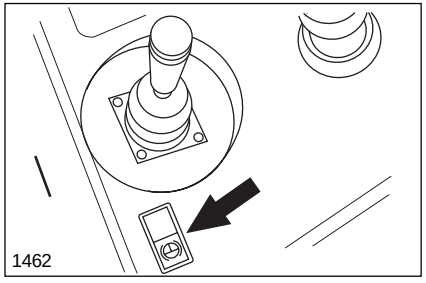
Service Brake
This is a floor mounted pedal operated by the right foot. Depress the pedal as required by speed, load and road conditions, to slow or stop the machine. Release the pedal as the machine slows until, when stopped, the pedal is depressed just enough to hold it stationary. Do not 'FAN' the pedal.
Note: TA40 machines have an advanced retarder switch incorporated in the brake pedal. For the first 7° of pedal travel, the transmission retarder will be applied. Further depression of the pedal will apply the service brakes.
Note: Pedal movement will be experienced when applying or releasing the Parking-Emergency Brake Control.


1461

Parking - Emergency Brake
Pushing the control in will apply the spring operated driveline mounted parking brake 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; pull the control out.

The Parking-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 switch is used to request the transmission retarder on TA35 machines. The retarder is engaged when the bottom of the switch is pressed and provided that the transmission 'Stop' warning light is OUT and the transmission is in 'lockup'. To disengage retarder, press the top of the switch. On TA40 machines, the retarder switch is incorporated in the brake pedal. The first 7° of pedal travel engages the retarder, provided that the transmission 'Stop' warning light is OUT and the transmission is in 'lockup'. Further depression of pedal applies service brakes. To disengage retarder, release brake pedal.

The retarder is used to apply a continuous braking force to hold the truck to a safe steady speed when descending grades, to reduce the need for service brake applications, thus reducing service brake wear and preventing overheating. 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.

Retarder Operation

Before the machine starts down the grade, release accelerator, slow the machine with the service brakes, select the required gear, and apply the retarder. For maximum retardation, oil circulation and cooling, the machine downgrade speed (retarder applied) in the gear selected should be high enough to keep the engine operating at governed speed. Generally the gear used to ascend a grade is also correct for its descent. If the rate of descent is too slow, the transmission should be upshifted to the next highest gear. If the rate of descent is too fast, the service brakes should be applied and the transmission shifted into a lower gear which will allow a safe descent and efficient retarder operation.

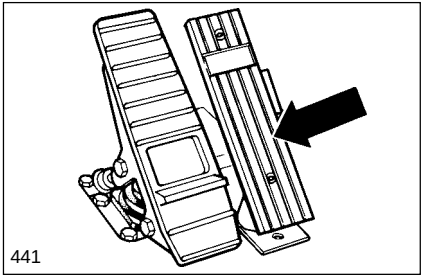
Frequent use of the retarder will result in higher transmission oil temperatures. Therefore, the oil temperature gauge should be checked frequently. During normal operation the gauge should read in the green zone. However, during retarder operation the gauge can read in the yellow zone.

Provided the vehicle is not in an overspeed condition, the transmission 'Stop' warning light will illuminate when the transmission oil temperature reaches 140° C (284° F). The retarder will automatically disengage when the oil temperature reaches 150° C (302° F). The speed must be reduced by using the service brakes so that the oil is cooled down. Reduce downgrade travel speed to avoid the oil overheating and possible damage to the transmission.

The transmission will automatically upshift through the gears (to 6th) to prevent the engine overspeeding, the service brakes should be applied to reduce travel speed.

With the accelerator released, the retarder will automatically engage when the engine speed reaches 2 100 rev/min and it will disengage at 1 950 rev/min to prevent engine overspeeding.

If the vehicle is approaching an overspeed condition, the transmission performs an upshift at an engine speed of 2 500 rev/min to the next highest gear to decrease the engine speed, whether in manual or automatic mode. If 6th gear is already selected, the retarder is automatically engaged at 2600 rev/min to decrease the engine speed irrespective of the accelerator position. The retarder is disengaged at 2450 rev/min. A fault code will be displayed and recorded by the TCU. If the oil temperature reaches 150° C (302° F) the retarder is disengaged and a fault code will be displayed and recorded by the TCU.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Engine

Electronic Foot Pedal

The electronic foot pedal provides an electrical signal to the engine's fuel control system in proportion to the degree of pedal actuation.
Note: The engine MUST be started with foot 'OFF' the electronic foot pedal.

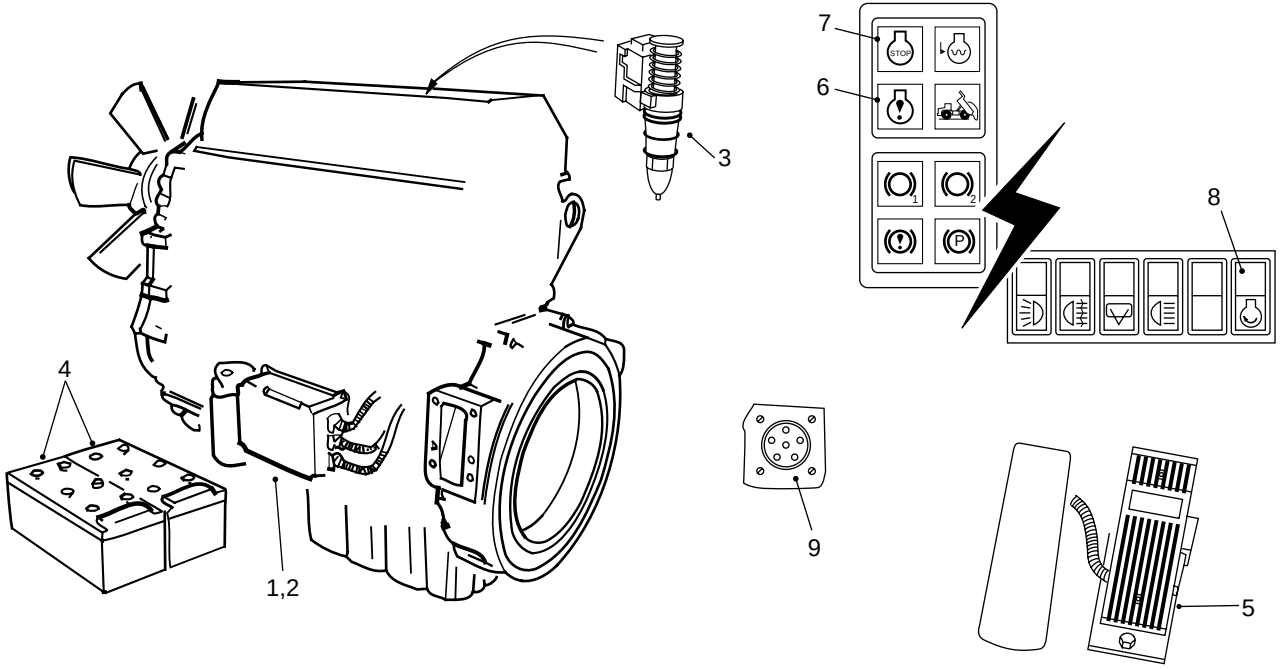
Detroit Diesel Electronic Control (DDEC)

This machine is equipped with the Detroit Diesel Electronic Control (DDEC) which continually monitors the engine and warns the operator when a problem develops. The DDEC 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 DDEC system, disconnect the following in this order: Battery earth cable, battery supply cable, alternator earth cables, alternator supply cables, body hydraulics joystick, transmission (Est-37) connector, ECM interface harness connector (30 pin RHS), ECM power harness connector (5 pin RHS), ECM sensor harness connector (30 pin LHS) and ECM engine to transmission datalink connector (6 pin RHS). Turn off battery master switch 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 - Electronic Unit Injectors (EUI)
4 - Batteries
5 - Electronic Foot Pedal
6 - Check Engine Light
7 - Stop Engine Light
8 - Diagnostic Request/Stop Engine Override Switch
9 - Diagnostic Test Point

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DDEC III & IV Description

1. Electronic Control Module (ECM) - Receives electronic inputs from the driver as well as from mounted 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 Unit Injectors (EUI) where the precise amount of fuel is injected into the engine.

3. Electronic Unit Injectors (EUI) - The EUI 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 EUI 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 unit 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.

DDEC III & IV Operation

The DDEC system operates from a 24 volt supply. However, in the event of a loss of power supply, the system will operate at reduced voltage. At reduced voltage the electronic control system will detect a malfunction and the check engine light on the dash panel will illuminate.

At this point the ECM will go into backup control and a change in engine operation will be noticed. The engine will operate only at reduced rev/min until the battery voltage reaches a point where it will no longer function and the engine will shut down. The machine can still be operated when the check engine light is illuminated, however, the fault should be diagnosed and corrected at the earliest possible opportunity.

Note: When the stop engine 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 the DDEC engine protection system, which records the stop engine malfunction in the ECM. The stop engine and check engine lights illuminate when the engine protection system is initiated. The engine will immediately reduce to 70% of the available torque. Rampdown then commences over a 30 second period and reduces the engine to 40% of the available torque.

To allow for the possibility of the engine protection system being activated while the machine is operating in a critical situation, a stop engine override switch is provided. If the switch is pressed and released during rampdown, the 30 second timer will reset, restoring torque to the level immediately following illumination of the stop engine and check engine lights. The switch must be pressed and released again to obtain a subsequent override.

Note: The operator must continue to reset the automatic engine protection system by pressing and releasing the stop engine override switch at intervals of approximately 15 to 20 seconds.

Note: The ECM will record the number of times the override is activated after the fault occurs. Available Torque is the actual torque available from the engine when the fault occurred based on the actual rev/min when the fault occurred.

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

Conditions that will cause the Stop Engine Light to come on are; Low Coolant Level, High Coolant Temperature, Low Oil Pressure and High Oil Temperature.

Whenever the check engine light or stop engine light comes on, the DDEC 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.

A special diagnostic data reader (DDR) 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 DDEC system will return the engine to normal operation. The DDR can now distinguish between active codes and those stored in the historic code memory. The malfunction code recorded in the ECM memory will remain until it is erased by a technician.

When the engine is not running and the ignition is on, or, the engine is idling and not in an engine protection condition, engine faults can be diagnosed by the operator. Pressing and releasing the diagnostic request switch will cause the check engine light or stop engine light to flash a code number indicating the fault, e.g. flash twice - pause - flash five times - pause indicates a code 25. Code 25 indicates all systems are operating correctly. Pressing the switch a second time will stop the engine codes flashing. Refer to 'DDEC III & IV Diagnostic Codes' table for other code descriptions.

Note: Only one light will be flashing at any one time. When code flashing is initiated, the active codes (or code 25) will be flashed on the stop engine light, then the inactive codes (or code 25) will be flashed on the check engine light. When all of the inactive codes have been flashed, the process of flashing the codes will repeat until the conditions for code flashing are no longer satisfied.

⚠ WARNINGS

The operator of a DDEC-equipped vehicle must not attempt to use or read a DDR of any kind while the vehicle is operating. Doing so can result in loss of control, which may cause vehicle damage and may result in personal injury.

⚠ When engine or electronics system diagnosis is required on a DDEC-equipped vehicle, this must be done by a person other than the operator. The operator must maintain control of the moving vehicle while the assistant performs the diagnosis.

DDEC IV DIAGNOSTIC CODES

DDEC Code # (Flashed)	PID	SID	FMI	DDEC Description
-	240	-	2	Fram checksum incorrect
-	251	-	10	Clock module abnormal rate
-	251	-	13	Clock module fault/failure
-	-	253	13	Incompatible calibration version
-	-	254	0	External failed RAM
-	-	254	1	Internal failed RAM
-	-	254	6	Entered boot via switches
11	187	-	4	VSG sensor voltage low
11	187	-	7	VSG switch system not responding
12	187	-	3	VSG sensor high
13	111	-	4	Coolant level sensor input voltage low
13	111	-	6	Add coolant level sensor input voltage low
14	52	-	3	Intercooler coolant temperature sensor input voltage high
14	110	-	3	Coolant temperature sensor input voltage high
14	175	-	3	Oil temperature sensor input voltage high
15	52	-	4	Intercooler coolant temperature sensor input voltage low
15	110	-	4	Coolant temperature sensor input voltage low
15	175	-	4	Oil temperature sensor input voltage low
16	111	-	3	Coolant level sensor input voltage high
16	111	-	5	Add coolant level sensor input voltage high
17	72	-	3	Throttle plate position sensor input voltage high
17	51	-	3	Throttle position sensor input voltage high
18	72	-	4	Bypass position sensor input voltage low
18	51	-	4	Throttle plate position sensor input voltage low
21	91	-	3	TPS input voltage high
22	91	-	4	TPS input voltage low
23	174	-	3	Fuel temperature sensor input voltage high
23	-	65	3	Oxygen content circuit input voltage high
24	174	-	4	Fuel temperature sensor input voltage low

DDEC IV DIAGNOSTIC CODES

DDEC Code # (Flashed)	PID	SID	FMI	DDEC Description
24	-	65	4	Oxygen content circuit input voltage low
25	-	-	-	Reserved for 'No Codes'
26	-	25	1	Auxiliary shutdown #1 active
26	-	61	11	Auxiliary shutdown #2 active
27	171	-	3	Ambient air temperature sensor input voltage high (Release 2.00 or later only)
27	172	-	3	Air temperature sensor input voltage high
27	105	-	3	Intake manifold temperature sensor input voltage high
28	171	-	4	Ambient air temperature circuit failed low (Release 2.00 or later only)
28	172	-	4	Air temperature sensor input voltage low
28	105	-	4	Intake manifold temperature sensor input voltage low
31	-	51	3	Aux. output #3 open circuit (high side) - S3
31	-	51	4	Aux. output #3 short to ground (high side) - S3
31	-	51	7	Aux. output #3 mechanical system fail - S3
31	-	52	3	Aux. output #4 open circuit (high side) - T3
31	-	52	4	Aux. output #4 short to ground (high side) - T3
31	-	52	7	Aux. output #4 mechanical system fail - T3
32	-	238	4	SEL open circuit
32	-	238	3	SEL short to battery (+)
32	-	239	3	CEL short to battery (+)
32	-	239	4	CEL open circuit
33	102	-	3	Turbo boost pressure sensor input voltage high
34	102	-	4	Turbo boost pressure sensor input voltage low
35	100	-	3	Oil pressure sensor input voltage high
35	19	-	3	High range oil pressure sensor input voltage high
36	100	-	4	Oil pressure sensor input voltage low
36	19	-	4	High range oil pressure sensor input voltage low
37	94	-	3	Fuel pressure sensor input voltage high

DDEC IV DIAGNOSTIC CODES

DDEC Code # (Flashed)	PID	SID	FMI	DDEC Description
37	18	-	3	High range fuel pressure sensor input voltage high
37	95	-	3	Fuel restriction sensor input voltage high
38	94		4	Fuel pressure sensor input voltage low
38	18	-	4	High range fuel pressure sensor input voltage low
38	95	-	4	Fuel restriction sensor input voltage low
41	-	21	0	Too many SRS (missing TRS)
42	-	21	1	Too few SRS (missing SRS)
43	111	-	1	Coolant level low
44	52	-	0	Intercooler coolant temperature high
44	110	-	0	Coolant temperature high
44	172	-	0	Air inlet temperature high
44	175	-	0	Oil temperature high
44	105	-	0	Intake manifold temperature high
45	100	-	1	Oil pressure low
45	19	-	1	High range oil pressure low
46	168	-	1	ECM battery voltage low
46	-	232	1	Sensor supply voltage low
47	94	-	0	Fuel pressure high
47	102	-	0	Turbo boost pressure high
47	106	-	0	Air inlet pressure high
47	164	-	0	Injection control pressure high
47	18	-	0	High range fuel pressure high
48	18	-	1	High range fuel pressure low
48	94	-	1	Fuel pressure low
48	106	-	1	Air inlet pressure low
48	164	-	1	Injection control pressure low
52	-	254	12	A/D conversion fail
53	-	253	2	Non-voilatile checksum incorrect
53	-	253	12	EEPROM write error

DDEC IV DIAGNOSTIC CODES

DDEC Code # (Flashed)	PID	SID	FMI	DDEC Description
53	-	253	13	Out of calibration
54	84	-	12	Vehicle speed sensor fault
55	-	231	12	J1939 data link fault
55	-	248	8	Proprietary datad link fault (Master)
55	-	248	9	Proprietary datad link fault (Receiver)
56	-	250	12	J1587 data link fault
57	-	249	12	J1922 data link fault
58	92	-	0	Torque overload
61	-	xxx	0	Injector xxx response time long
62	-	26	3	Aux. output #1 short to battery (+) - F3
62	-	26	4	Aux. output #1 open circuit - F3
62	-	40	3	Aux. output #2 short to battery (+) - A2
62	-	40	4	Aux. output #2 open circuit - A2
62	-	53	3	Aux. output #5 short to battery (+) - W3
62	-	53	4	Aux. output #5 open circuit - W3
62	-	54	3	Aux. output #6 short to battery (+) - X3
62	-	54	4	Aux. output #6 open circuit - X3
62	-	55	3	Aux. output #7 short to battery (+) - Y3
62	-	55	4	Aux. output #7 open circuit - Y3
62	-	56	3	Aux. output #8 short to battery (+) - A1
62	-	56	4	Aux. output #8 open circuit - A1
62	-	26	7	Aux. output #1 mechanical system not responding properly - F3
62	-	40	7	Aux. output #2 mechanical system not responding properly - A2
62	-	53	7	Aux. output #5 mechanical system not responding properly - W3
62	-	54	7	Aux. output #6 mechanical system not responding properly - X3
62	-	55	7	Aux. output #7 mechanical system not responding properly - Y3
62	-	56	7	Aux. output #8 mechanical system not responding properly - A1
63	-	57	3	PWM #1 short to battery (+)
63	-	57	4	PWM #1 open circuit

DDEC IV DIAGNOSTIC CODES

DDEC Code # (Flashed)	PID	SID	FMI	DDEC Description
63	-	58	3	PWM #2 short to battery (+)
63	-	58	4	PWM #2 open circuit
63	-	59	3	PWM #3 short to battery (+)
63	-	59	4	PWM #3 open circuit
63	-	60	3	PWM #4 short to battery (+)
63	-	60	4	PWM #4 open circuit
63	-	57	0	PWM #1 above normal range
63	-	57	1	PWM #1 below normal range
63	-	58	0	PWM #2 above normal range
63	-	58	1	PWM #2 below normal range
63	-	59	0	PWM #3 above normal range
63	-	59	1	PWM #3 below normal range
63	-	60	0	PWM #4 above normal range
63	-	60	1	PWM #4 below normal range
64	103	-	8	Turbo speed sensor input failure
64	103	-	0	Turbo overspeed
65	51	-	0	Throttle plate position above normal range
65	51	-	1	Throttle plate position below normal range
65	51	-	2	Throttle plate position erratic
65	51	-	7	Throttle plate not responding
65	107	-	3	Air filter restriction sensor voltage high
65	107	-	4	Air filter restriction sensor voltage low
66	-	76	0	Engine knock level above normal range
66	-	76	3	Engine knock level sensor input voltage high
66	-	76	4	Engine knock level sensor input voltage low
66	-	76	7	Engine knock level sensor not responding
66	-	99	3	Oil filter restriction sensor voltage high
66	-	99	4	Oil filter restriction sensor voltage low
67	109	-	3	Coolant pressure sensor input voltage high

DDEC IV DIAGNOSTIC CODES

DDEC Code # (Flashed)	PID	SID	FMI	DDEC Description
67	109	-	4	Coolant pressure sensor input voltage low
67	106	-	3	Air inlet pressure sensor input voltage high
67	106	-	4	Air inlet pressure sensor input voltage low
67	20	-	3	High range coolant pressure sensor input voltage high
67	20	-	4	High range coolant pressure sensor input voltage low
68	-	230	6	TPS idle validation circuit fault (short to ground)
68	-	230	5	TPS idle validation circuit fault (open circuit)
71	-	xxx	1	Injector xxx response time short
72	84	-	0	Vehicle overspeed
72	84	-	11	Vehicle overspeed (absolute)
72	-	65	0	Oxygen content too high
72	-	65	1	Oxygen content too low
73	-	151	14	ESS transmission stuck in gear
73	-	226	11	Transmission neutral switch failure (ESS Transmission)
73	-	227	2	Aux. analog input data erratic, intermittent, or incorrect (ESS transmission)
73	-	227	3	Aux. analog input #1 voltage high (ESS transmission)
73	-	77	0	Gas valve position above normal range
73	-	77	1	Gas valve position below normal range
73	-	77	3	Gas valve position input voltage high
73	-	77	4	Gas valve position input voltage low
73	-	77	7	Gas metering valve not responding
73	107	-	0	Air filter restriction high
74	99	-	0	Oil filter restriction high
74	70	-	4	Optimized idle safety loop short to ground
75	168	-	0	ECM battery voltage high
75	-	232	0	Sensor supply voltage high
76	121	-	0	Engine overspeed with engine brake
81	-	20	3	Timing actuator (dual fuel) input voltage high

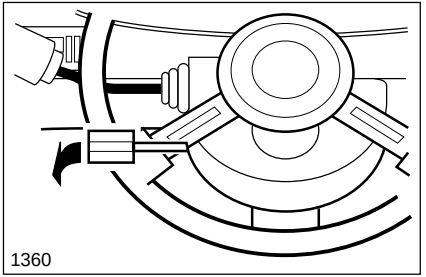
DDEC IV DIAGNOSTIC CODES				
DDEC Code # (Flashed)	**PID**	**SID**	**FMI**	**DDEC Description**
81	98	-	3	Oil level sensor input voltage high
81	101	-	3	Crankcase pressure sensor input voltage high
81	164	-	3	Injection control pressure circuit voltage high
81	173	-	3	Exhaust temperature sensor input voltage high
82	-	20	4	Timing actuator (dual fuel) input voltage low
82	98	-	4	Oil level sensor input voltage low
82	101	-	4	Crankcase pressure sensor input voltage low
82	164	-	4	Injection control pressure circuit voltage low
82	173	-	4	Exhaust temperature sensor input voltage low
83	98	-	0	Oil level high
83	101	-	0	Crankcase pressure high
83	173	-	0	Exhaust temperature high
83	173	-	4	Exhaust temperature sensor input voltage low
83	73	-	0	Pump pressure high
84	98	-	1	Oil level low
84	101	-	1	Crankcase pressure low
85	190	-	0	Engine overspeed
86	73	-	3	Pump pressure sensor input voltage high
86	108	-	3	Barometric pressure sensor input voltage high
87	73	-	4	Pump pressure sensor input voltage low
87	108	-	4	Barometric pressure sensor input voltage low
88	109	-	1	Coolant pressure low
88	20	-	1	High range coolant pressure low
89	95	-	0	Fuel restriction high
89	111	-	12	Maintenance alert coolant level fault

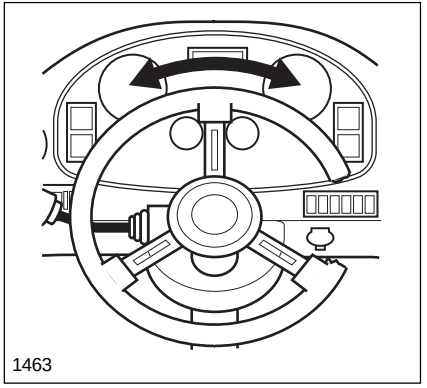
Steering

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.

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

Emergency steering pressure is provided by a ground-driven emergency pump mounted on the transmission. An indicator lamp (on the right hand bank of warning lamps in the cab) illuminates to warn of a fault in the steering system supply pressure. If the lamp illuminates, stop the machine and investigate the cause. The indicator lamp illuminates when the ignition is turned on and should go out when the engine starts.


1360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⚠ WARNING

Before any welding is done on a machine equipped with an EST-37 shift system, disconnect battery earth cable, battery supply cable alternator earth cables, alternator supply positive cables, electrical connections at the ECU and body hydraulics joystick to avoid damage to electrical components. Turn off battery master switch to isolate the batteries before disconnecting any components.

EST-37 Automatic Shift Transmission

The EST-37 transmission is equipped with an electronic control unit (ECU) which 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.

When a fault occurs, a two digit error code will be displayed on the LCD display on the dash panel. The error code is also recorded in the transmission ECU, and can be accessed by the serviceman by plugging in a data reader to extract information relating to the fault. The error code recorded in the ECU memory will remain until it is erased by a technician.

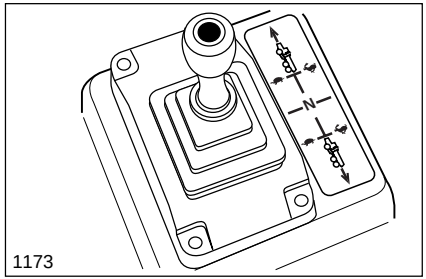
If a major fault is detected, it is the operators responsibility to shut down the machine as soon as it is safe to do so. The machine should not be restarted until the fault has been diagnosed and corrected.

Refer to 'Description of Fault Codes Ergocontrol' table for a list of fault codes and checks on page 3-36.

The EST-37 transmission control has been designed to provide the driver with maximum operational flexibility by allowing the choice of automatic or manual gear selection to optimize vehicle performance under all operating conditions.

The transmission provides six forward gears, three reverse gears and a neutral position. The gear positions are indicated on the LCD display located on the dash panel (refer to page 3-34 for details). The transmission will only operate in the gear selected by the operator in the manual range, or, when the lever is in the automatic range, shifts will occur automatically between 1st and 6th gear, depending on operating requirements. The reverse gears 1st through 3rd are manual mode only.

VTS-3 Shift Controller - Operation: The shift controller has 3 positions the lever can rest in, Forward, Neutral (N) and Reverse. Within each of these positions, the gear can be changed by pushing the lever to the right (+) to upshift or to the left (-) to downshift. In the Neutral position, this can be used to preselect the starting gear (the default being 2nd gear).



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The shift controller has a 'Function' button on the top of the lever which is used to switch between automatic and manual modes. Press the function button from 'NEUTRAL' and move the lever forward to select automatic mode, when driving normal upshifting and downshifting will occur. If required, a gear can be held in manual mode by pressing the function button once, to resume full automatic mode the function button should be pressed again. Manual gears can also be selected by pushing the lever to the left for lower gears or to the right for higher gears, again by pressing the function button once automatic mode will be resumed.

Note: The transmission will only allow gearshifting when the predetermined values have been reached.

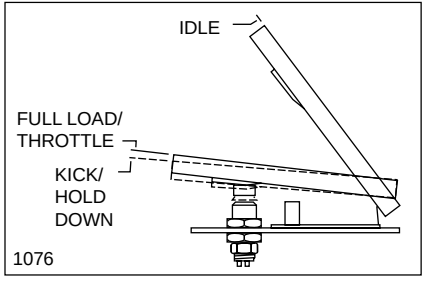
Note: There is no shift inhibitor in the gear shift control, therefore, no resistance would be felt while moving through the gear ranges.

The gear lever housing sends a signal to the electronic control unit, which in turn will only allow the engine to be started when the gear lever is in the 'NEUTRAL' position. The gear shift lever must always be placed in 'NEUTRAL' and the parking brake applied when starting the engine, or whenever the machine is left unattended.

When shifting from 'NEUTRAL' to start from a standstill, or to reverse direction, decelerate the engine to idle speed before selecting the proper gear. When 'REVERSE' is selected, the 'Reverse Alarm' sounds and the 'Reverse Light' illuminates to warn personnel to the rear of the machine that reverse gear has been selected.

During reversing operations it is recommended to reduce engine speed, use only 1st or 2nd gear and never exceed 10 km/h (6.2 mile/h).

The electronic control system distinguishes between the throttle position (or load ranges) depending on the governor position (injection pump). On a light throttle opening, the transmission will give earlier upshifts and later downshifts than when operating at full throttle.



A kickdown facility, which can be used when automatic mode is selected, allows for the possibility of selecting a lower gear by pressing down fully on the throttle pedal and holding. This can be used to provide a downshift on demand provided that the vehicle speed is within the range allowable. That is, the vehicle is not travelling at a speed that would result in the engine overspeeding in the lower gear. When driving with kickdown, the transmission will give earlier downshifts and later upshifts. To disengage the transmission kickdown, release the throttle pedal and allow it to return to a light throttle position.

When operating in automatic range with the display indicating that the transmission has downshifted to 2nd gear, there are two options for providing a further downshift as conditions indicate.

1. 1st gear can be manually selected by pushing the shift lever to the left.

2. Kickdown can be selected from 2nd automatic, when the transmission will downshift to 1st gear, depending upon vehicle speed.

When the kickdown is released the transmission will upshift to 2nd automatic, provided that the forward speed has increased sufficiently to allow this to happen, and that the shift lever is in the automatic mode.

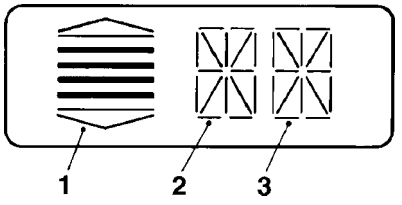
A dashboard display is provided which indicates gear selected and driving direction as follows:

Manual Mode - When driving with shift selector in manual range, the bars only are shown in position 1, and, driving direction and gear selected are indicated in positions 2 and 3.

Automatic Mode - When driving with shift selector in automatic range, a full display of bars and arrows are shown in position 1, and, driving direction and gear selected are indicated in positions 2 and 3.

Under certain conditions the transmission may start to 'hunt' between gears when in automatic mode. The transmission changes up and down between two gears at short intervals because there is not sufficient power to sustain driving in the higher gear, but is sufficient for upshifting from the lower gear. By using the shift display, it can be established which gears are involved and in these circumstances the lower gear should be selected using the shift control lever. Automatic mode should be reselected at the earliest opportunity.

During machine operation, watch for wide deviations from normal readings on the transmission oil temperature gauge. If the gauge shows the oil temperature rising above the green zone during normal operation, or above the yellow zone during retarder operation, the machine must be stopped and inspected for external oil leakage. If no leaks are found, shift to 'NEUTRAL' 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.



1 - Bars show gear ranges and full display (as 'shown) indicates driving in automatic mode.

2 - Display shows actual driving direction.

3 - Display shows actual gear in use.

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Note: In cold weather, the transmission oil should be warmed up by running the engine at idle speed with the gear selector in neutral, since the system will not operate satisfactorily if the oil is too cold.

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

When stopped for a more extended period with the engine left running, shift to 'NEUTRAL' to avoid unnecessary heat buildup, and apply the parking brake.

WARNINGS

Always select the correct drive direction and gear before releasing the parking brake.

Never allow the machine to coast with the transmission in 'NEUTRAL'.

When running down a gradient the engine speed should not be allowed to drop below 1 200 rev/min, at which point, lockup would disengage preventing retarder operation.

In the event of a loss of electric power to the gear shift control, the transmission will automatically shift to 'NEUTRAL'. If this occurs, stop the machine using the service brakes and apply the parking brake. Do not operate until the fault has been repaired.

Always select 'NEUTRAL' and apply the parking brake before leaving the operators seat.

The retarder will automatically disengage when the oil temperature reaches 150° C (302° F), irrespective of engine speed .

DESCRIPTION OF FAULT CODES ERGOCONTROL				
Code	**Operator Action**	**Mode**	**Meaning**	**Service Action**
1 1 1 2	Stop and investigate	Direction signal: no operation Range signal: normal	Electrical problem on TCU input from gear selector	Check cables from gear selector to TCU
2 5 2 6 2 7 2 8	Drive truck to next service	Substitute mode (controlled pressure ramps, converter lockup clutch disengages during gear shifts)	Electrical problem on analog TCU input	Check cables to load sensor/ temp. Sensors, check setting of load sensor
3 1 3 2 3 3 3 4 3 5 3 6 3 7 3 8 3 9 3 A 3 B 3 C 3 E	Drive truck to next service	Substitute mode (controlled pressure ramps, converter lockup clutch disengages during gear shifts)	Electrical problem on speed sensors	Check cables and setting of sensors
5 6 5 7 5 8	Drive truck to next service	Substitute mode (controlled pressure ramps, converter lockup clutch disengages during gear shifts)	Electrical problem on CANBUS	Check cables to engine TCU
6 5 6 6 6 9 6 A 6 B 6 E 6 F	Drive truck to next service	Substitute mode (controlled pressure ramps, converter lockup clutch disengages during gear shifts)	Electrical problem on CANBUS	Check cables to engine TCU

DESCRIPTION OF FAULT CODES ERGOCONTROL				
Code	**Operator Action**	**Mode**	**Meaning**	**Service Action**
7 1 7 2 7 3 7 4 7 5 7 6 7 7 7 8 7 9	Stop and investigate	Limp home	Electrical problem on transmission solenoids	Check cables to transmission control valve
8 1 8 2 8 3 8 4 8 5 8 6 8 7 8 8 8 9	Stop and investigate	Limp home	Electrical problem on transmission solenoids	Check cables to transmission control valve
9 1 9 2 9 3 9 A 9 B 9 C 9 D 9 E 9 F	Drive truck to next service	No converter lockup clutch, difflock, retarder	Electrical problem on peripheral solenoids.	Check cables to converter lockup clutch, difflock, retarder

DESCRIPTION OF FAULT CODES ERGOCONTROL				
Code	**Operator Action**	**Mode**	**Meaning**	**Service Action**
A 1 A 2 A 3 A 4 A 5 A 6	Drive truck to next service	No converter lockup clutch, difflock, retarder	Electrical problem on peripheral solenoids.	Check cables to converter lockup clutch, difflock, retarder
B 1 B 2 B 3 B 4 B 5 B 6 B 7 B 8 B 9 B A B B B D B E B F	Stop and investigate	Limp home	Mechanical or hydraulic problem in clutches or faulty speed reading	Check transmission pressure, speed
C 3	Stop and investigate	Normal - No reaction	High oil temperature at T.C.	Allow truck to cool. Check oil level and temperature sensor
D 1 D 2 D 3 D 4 D 5 D 6	Stop	No operation	Electrical problem on power supply	Check fuses/cables of power supply
E 3 E 4	Drive truck	Normal	Electrical problem at display	Check cables to display

DESCRIPTION OF FAULT CODES ERGOCONTROL

Code	Operator Action	Mode	Meaning	Service Action
F 1 F 3 F 5 F 6	Stop	F1-F5: No operation	General fault	(F6) Start AEB, else replace TCU

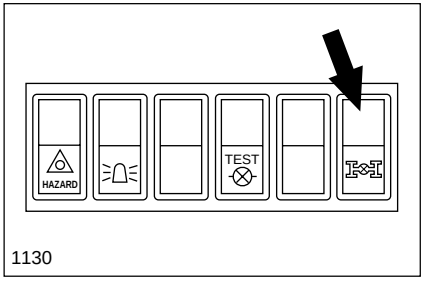
Abbreviations: TCU = Transmission Control Unit
AEB = Self Calibration Clutches
TC = Torque Converter

Operator Warning Codes

Code	Meaning	Action
W E	Will show when engine speed is above 2 500 rev/min.	Reduce engine speed, apply brakes / retarder
L R	Limp home in reverse	Shows as a consequence having a ‘B’ code. See above
L F	Limp home in forward	Shows as a consequence having a ’7, 8 or B’ code. See above
W S	Warning sump	High oil temperature in sump. Reduce engine power and speed
W R	Warning retarder temperature	Reduce vehicle speed, apply brakes
W T	Warning torque converter temperature	High oil temperature at T.C. Reduce engine power and speed
N N	Selector not in neutral position when switched on	Code clears by moving selector to neutral
E E	TCU heavily damaged or program faulty	No drive, system completely disabled

Note: Operator Warning Codes give pre-warning indication of a potential fault

Differential Lock



1130

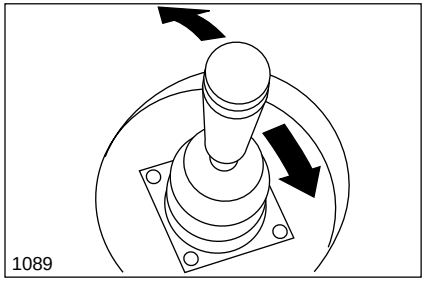
The differential lock switch engages the differential locks in both the transmission drop-box differential and the centre axle thru-drive differential for improved traction when operating in soft or slippery conditions. The amber 'Differential Lock' switch illuminates to alert the operator when the differential locks are requested. The amber 'Differential Lock' warning light on the instrument panel will illuminate when all the differential locks are actually engaged.

Note: Automatically-acting limited slip differentials in each axle will retain traction on most surfaces, therefore it should only be necessary to engage the differential locks in extreme conditions.

To apply the differential locks, stop the machine with the service brakes and operate the Differential Lock switch. Stop the machine and disengage the differential locks as soon as conditions allow.

Note: Before driving in soft or slippery conditions, stop and engage differential locks. Spinning wheels can result in damage to the transmission and axle differentials.

Note: Disengage differential locks before driving on firm ground.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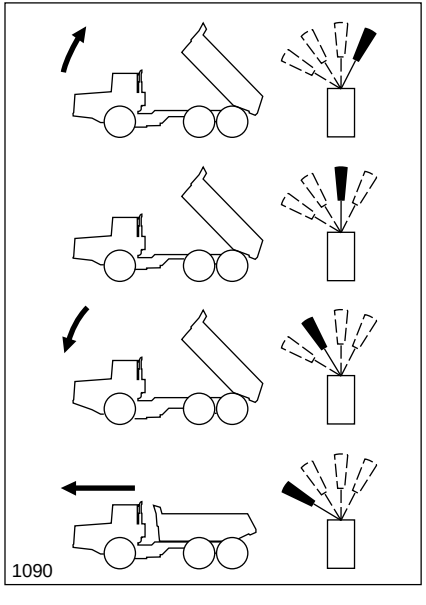

1090

Body Control

This lever operates the body hoist cylinders. The four operating positions of the lever are -

Raise - Pushing the lever back and holding it in this position will raise the body. When released, the lever will spring back to the 'HOLD' position.

Hold - This position stops and holds the body at any desired height. The lever will remain in the 'HOLD' position when released.

Power Down - Pushing the lever forward and holding it in this position provides hydraulic force to power-down the body. When released, the lever will spring back to the 'HOLD' position.

Float - The control lever should remain in this position until the body is to be operated again. The control lever should always be kept in 'FLOAT' while the machine is in motion.

Note: The body control lever must remain in the 'FLOAT' position until it is necessary to operate the body again. Failure to comply to this could result in overheating the hydraulic oil and failure of the hydraulic system components.

Note: A proximity sensor prevents the body being fully powered down onto the chassis. At a predetermined height, the sensor automatically defaults the body control valve to the detented 'FLOAT' condition.

Note: If an electrical failure occurs, the body control valve will automatically default to the 'HOLD' condition. The cause of the electrical fault must be investigated and corrected.

4 - Operating The Truck

OPERATING THE TRUCK

Pre-Starting Inspection

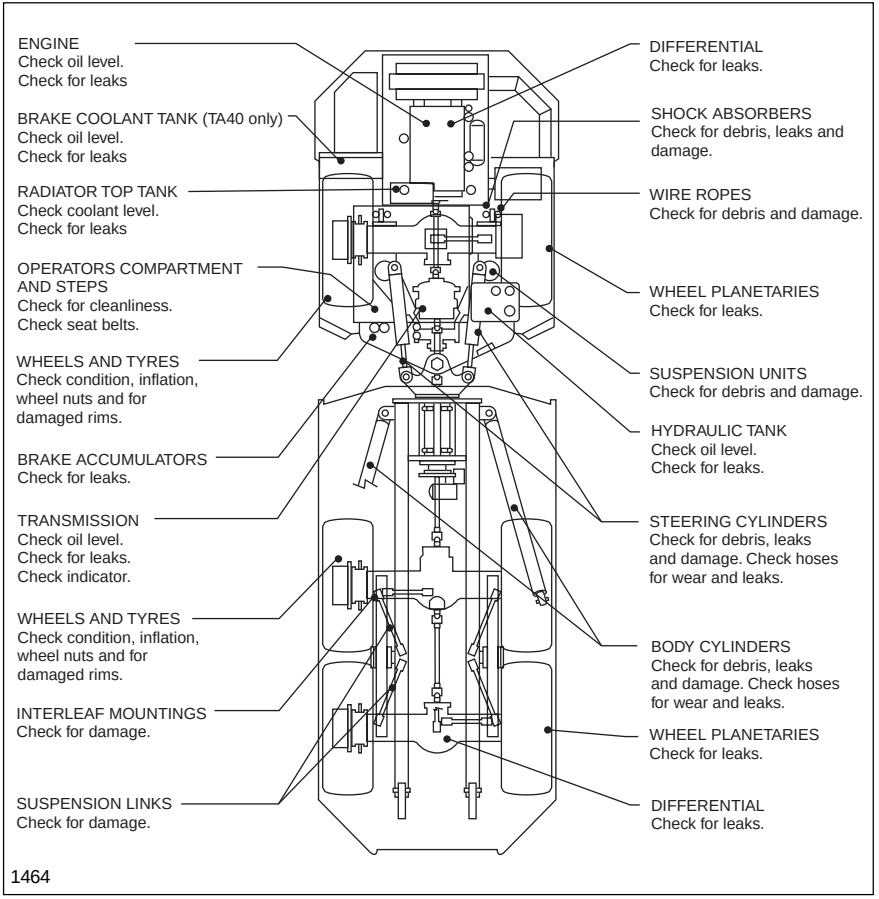
* Before the engine is started ensure the vehicle is ready for operation.

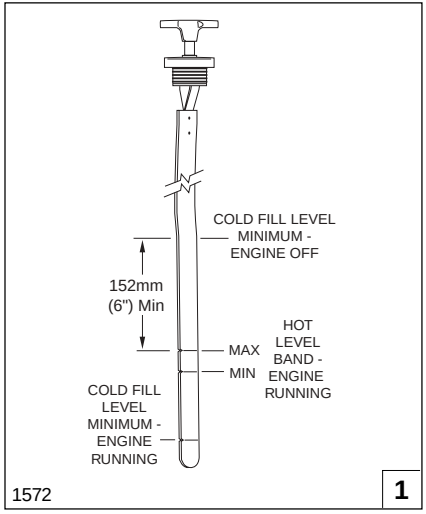
* The vehicle should be in a level position to permit accurate checking of fluid quantities in the engine and other components.

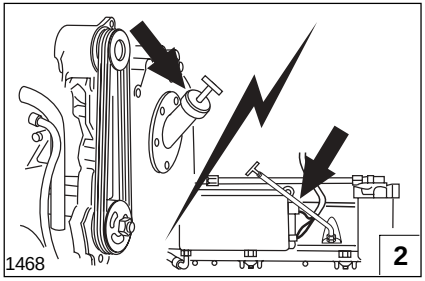
* Make sure parking brake is set and block wheels to prevent accidental movement of the vehicle while checking component levels.

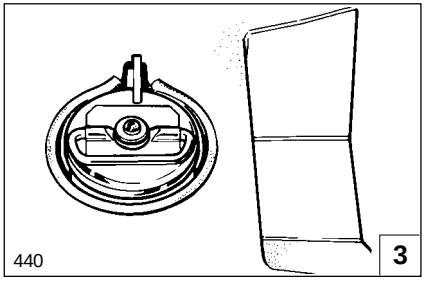
* Test all lights and horn for proper operation.

* Walk around the vehicle and carry out the Inspections and Component Checks described in the drawing opposite and on the following pages.









Component Checks

1. Transmission - Cold Oil Level - Engine off - This check is made only to determine if the transmission contains sufficient oil for safe starting. Make sure oil level is well above the upper mark on the dipstick. Add oil if low.

2. Engine - With engine off, check engine oil level. The oil level should be up to the upper dot on the dipstick. If the level only reaches the lower dot, the oil should be topped up immediately.

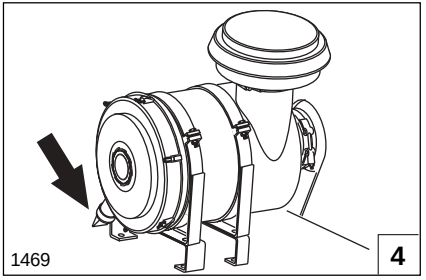
Note: The dash marks on the dipstick are for performing an oil check after the engine is shut down. After one or two minutes, the level should be up to the top dash mark.

3. Radiator Top Tank - Check Coolant Level.

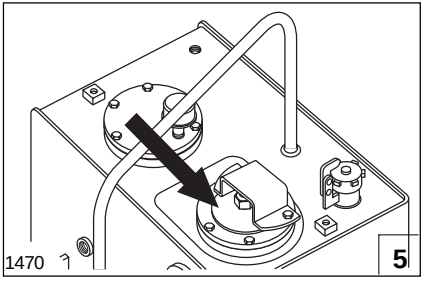
> **WARNING**
> **Press button in centre of cap to bleed pressure before removing cap completely. Fill to bottom of filler neck.**

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

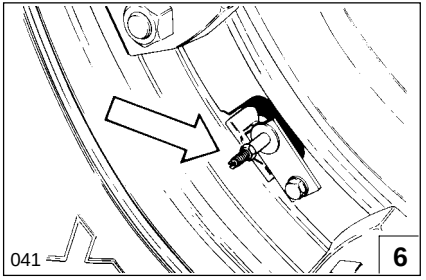
4. Engine Air Cleaner Dust Valve - Check for plugged dust cap valve. Unplug valve and clean air cleaner dust cup if required.

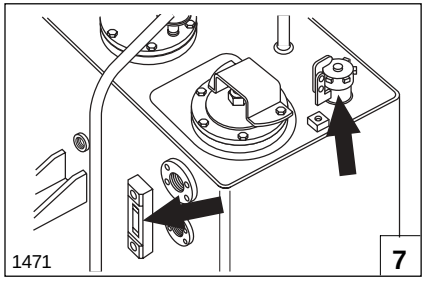


5. Hydraulic Filter - Check filter indicator and have filter element replaced if necessary.

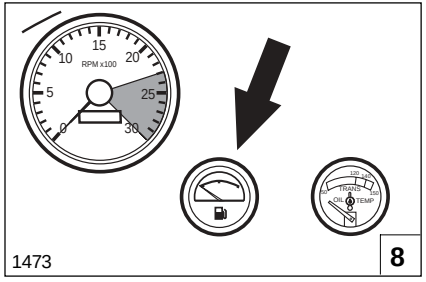


6. Tyres - Carefully inspect all tyres for cuts, bruises, or other damage, and, proper inflation for the loads to be carried. Inflate all tyres to the recommended pressure while cold.

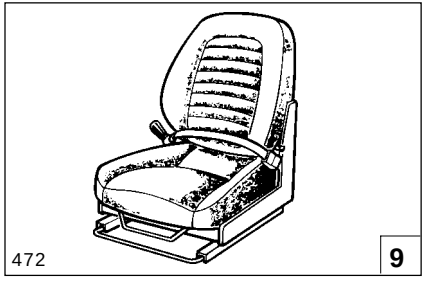




7. Hydraulic Tank - Oil Level Check - Operate the body hoist cylinders to their fully-extended positions to charge cylinders and lines then lower the body. With the engine off, the sight gauge should show half full. Add oil if low.



8. Fuel Level - Check fuel level gauge. Tank should be filled at end of each shift.



9. 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.

Engine Operation

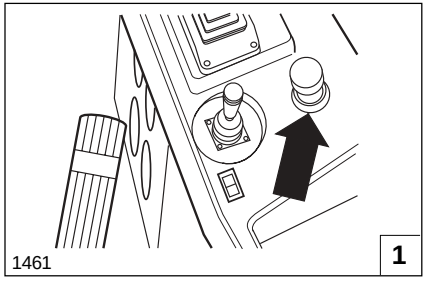
Note: The engine MUST be started with foot 'OFF' the electronic foot pedal.

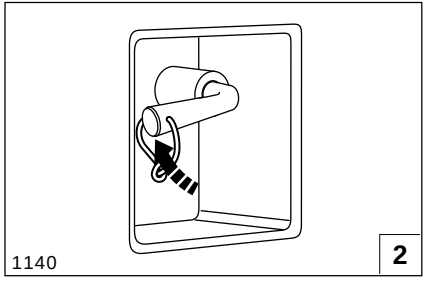
Operate engine at top rated speed when maximum power is needed for the load.

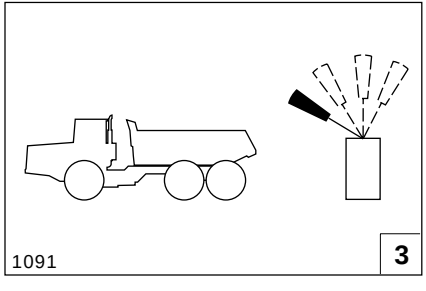
NEVER idle the engine for more than 5 minutes at a time; shut it off.

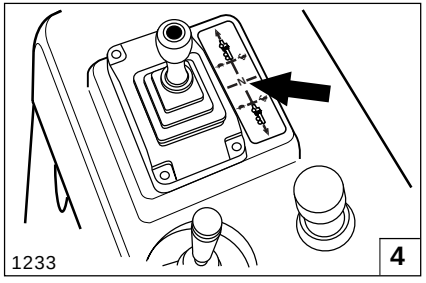
If 'Check Engine' light and/or 'Stop Engine' light illuminate during operation of the vehicle, take effective action to stop the engine and correct the fault, as described under 'DDEC Operation', in Section 3 of this handbook.

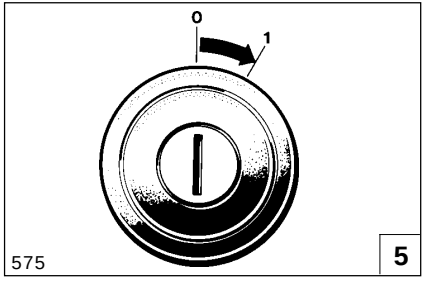
> ⚠ **WARNING**
> **Never start the engine indoors unless proper exhaust ventilation is provided to remove deadly exhaust gases. Once the engine is running, move the machine outdoors as soon as possible. Exhaust gases are hazardous and can cause unconsciousness and death.**

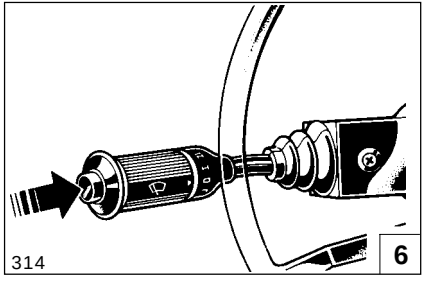












Starting the Engine

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

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

2. Turn master switch to 'ON' position.

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

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

5. Insert switch key and turn clockwise to position '1' to switch on the ignition. Press warning light test switch to test operation of warning lights.

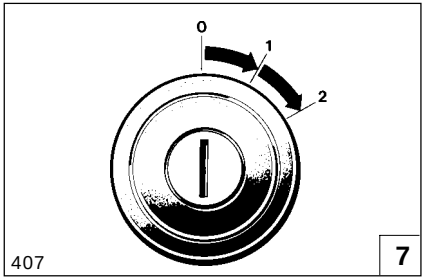
6. Press horn control to sound horn.

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

7. Turn key farther clockwise, against spring pressure, to position '2' to crank engine; release key as soon as engine starts firing.

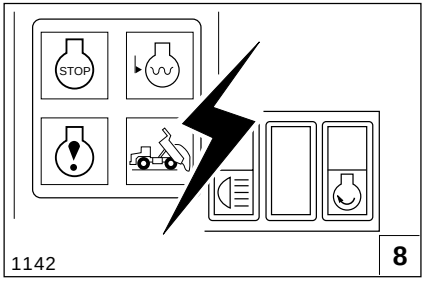
Note: Engine MUST be started with foot 'OFF' the accelerator pedal.

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



8. The amber 'Check Engine' and red 'Stop Engine' lights should come on, and then go out after 6 - 10 seconds. If the amber 'Check Engine' light does not go out, have the system checked out as soon as possible. If the red 'Stop Engine' light does not go out after 6 - 10 seconds, or illuminates during operation, stop the engine immediately.

Note: In an emergency operation situation only, the 'Stop Engine Override' switch may be used for a short period of time to allow the vehicle to be brought to a safe stop.



Starting the Engine with Jumper Cables

WARNINGS

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 vehicles are not touching each other. Use cables that are equal to cable size on the vehicle, 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.

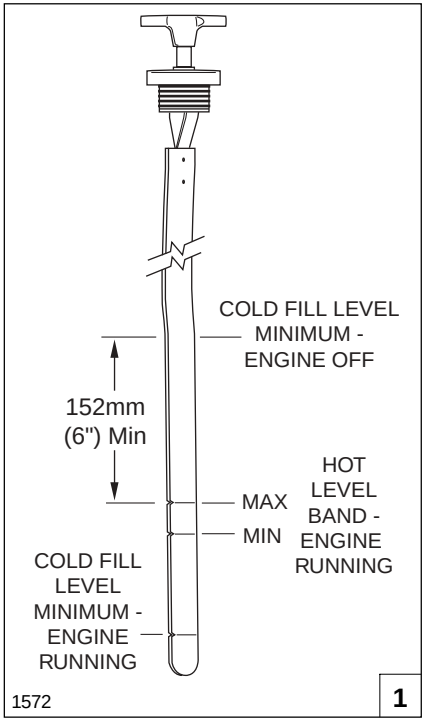
Connect one end of the second cable, usually coloured black, to the 'NEGATIVE' (-) post of the booster battery. Connect the other end of the 'NEGATIVE' (-) cable to machine frame for grounding so that if a spark occurs, it is away from battery fumes (explosive hydrogen).

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. Move transmission gear shift control momentarily to 'REVERSE' to make sure the reverse alarm sounds.

1. Transmission - Hot Oil Level - Apply the parking brake, select neutral gear and start the engine. Allow vehicle to idle in neutral for approximately 20 seconds. Transmission oil gauge on the dash should show a steady reading. With parking brake applied, foot on service brake and engine idling, select each gear position in turn. Allow vehicle to remain in each gear for 5 - 10 seconds. Return gear selector to neutral and with engine idling, check the oil level. Oil level should be up to, but not over, the upper mark on the dipstick.



BRAKE FUNCTION CHECKS

In addition to the 'Pre-Operating 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 vehicle.

WARNING

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

If the vehicle moves during these checks, stop the vehicle, 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

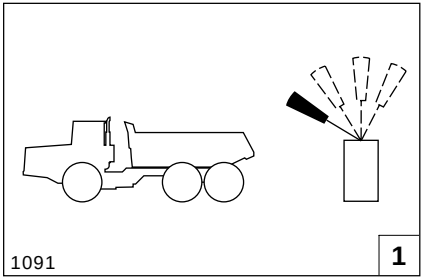
Depress service brake pedal and move transmission gear shift control to Forward 1st. gear. Pull the parking-emergency brake control out to release the brakes. Depress accelerator control and accelerate engine to 1 350 rev/min. The machine should not move. Decelerate engine, shift transmission to 'NEUTRAL'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

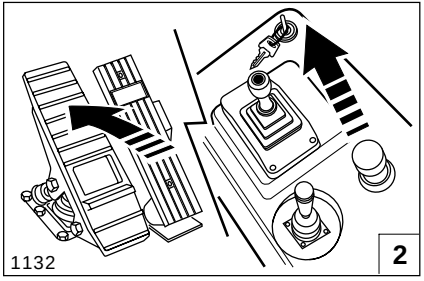
Emergency Brake Holding Ability Check

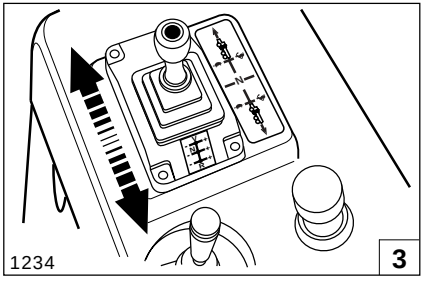
Push parking-emergency brake control in to apply 'EMERGENCY' brakes and shift the transmission to Forward 1st. gear. Depress accelerator control and accelerate engine to 1 350 rev/min. The machine should not move. Decelerate engine and move gear shift control to 'NEUTRAL'.

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

Note: As an indication of system deterioration, the engine rev/min at which point the machine moved, with the service or emergency brakes applied, can be compared against the engine rev/min your specific 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, Headlight Mainbeam and Differential Lock warning lights.

Make sure the area around the vehicle 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 the 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 gear.

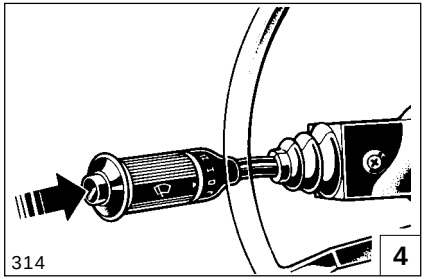
4. Sound horn; two blasts for forward and three blasts for reverse.

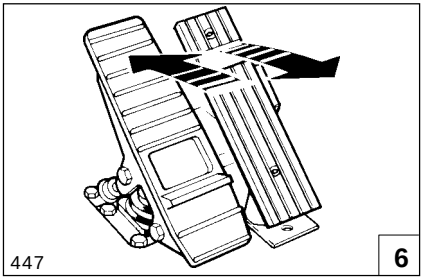
5. Release the service brake, apply the accelerator and move off. Shift up a gear as speed and conditions allow. Shift down a gear, only after the top speed of the next lower gear has been reached. If necessary the machine should be slowed to this speed by use of the service brake and/or the retarder.

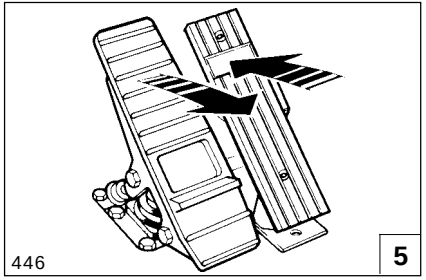
6. To stop the machine release the accelerator and depress the service brake pedal. Release the service brake as the machine slows until, when stopped, the pedal is depressed just enough to hold the machine stationary. Do not 'FAN' the pedal

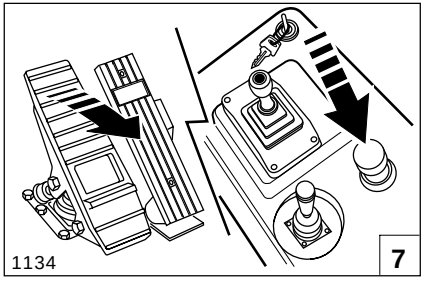
7. When the machine has stopped, apply the parking-emergency brake, shift the transmission to 'NEUTRAL' and release the service brake.

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.



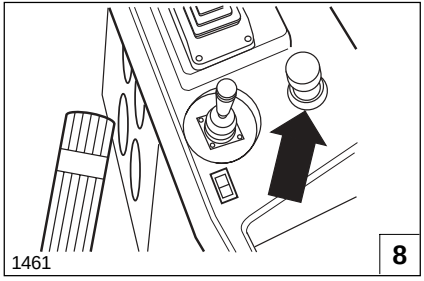


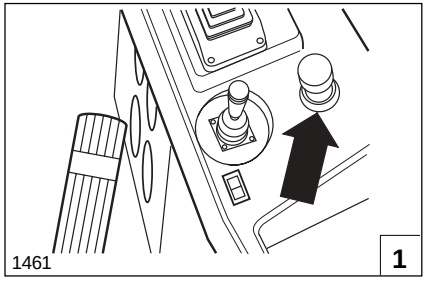


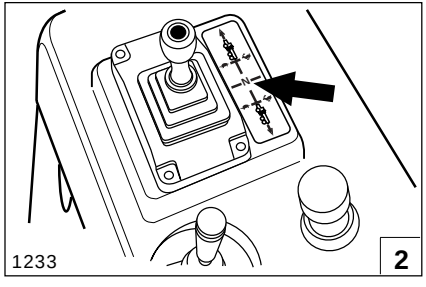


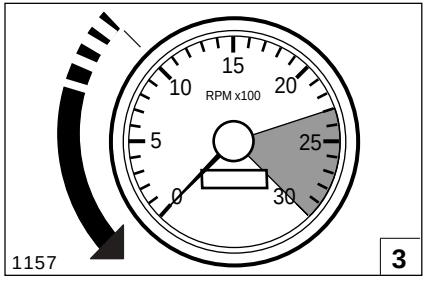
⚠ WARNING

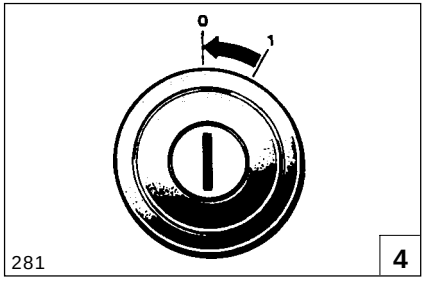
There is no mechanical connection between the engine and wheels on vehicles with converter transmissions. The parking brake must always be applied when the engine is switched off.

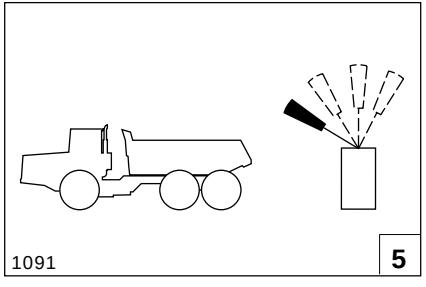


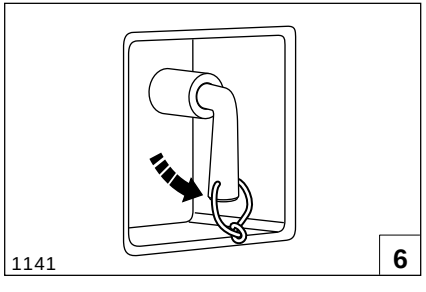












Stopping the Engine

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

2. Make sure the transmission is in 'NEUTRAL'.

3. Allow the engine to run between idle and 1 000 rev/min with no load for 4 or 5 minutes. This allows the engine to cool and the turbocharger to slow down. Shutdown the engine.

Note: Stopping a turbocharged engine immediately after high speed operation may cause damage to the turbocharger as it will continue to turn without an oil supply to the bearings.

4. Turn ignition key switch to the 'OFF' position. This cuts off the power supply to the DDEC system which in turn shuts down the engine.

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

6. Turn battery master switch 'OFF'.

Parking

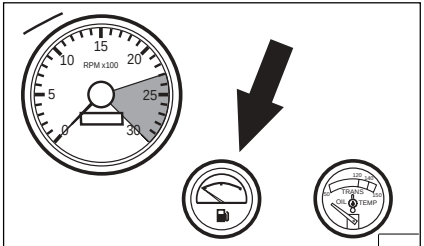
When parking the machine overnight, or for an extended period, the following procedure in addition to that given in 'Stopping the Engine' will help maintain it in good condition for subsequent use:

1. Fill the fuel tank completely before parking the machine overnight, or for extended periods, to prevent condensation. If security kit is supplied, keep it locked.

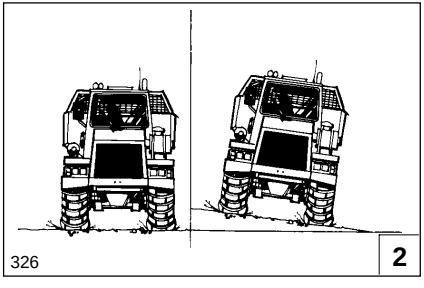
2. Always park on level ground where possible. If it must be parked on a grade, position machine at right angles to the grade and block wheels securely.

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 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..



1473 **1**

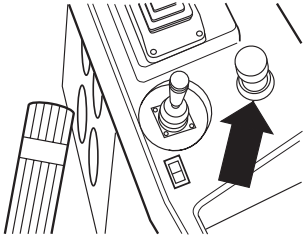

326 **2**

5 - Working the Truck

WORKING THE TRUCK

Off-highway articulated trucks are used on a variety of hauling jobs, from sand and gravel pits to road construction and mining. 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.



1461 Holding Truck Stationary

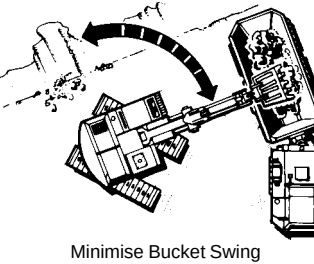
Loading

⚠ WARNING

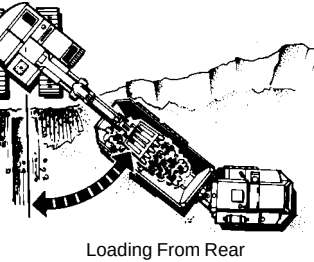
Should the vehicle be fitted with a tailgate. Cohesive material must not be loaded into the body. There is a risk of injury to the driver if a tailgate is used with a cohesive material.

Note: When loading the operator should be diligent and always aware of the material which is to be loaded onto the vehicle. At any time, should he feel that a load constitutes an obvious safety hazard, he has the right and duty to refuse to load this onto the vehicle.

The most common methods of loading articulated trucks are with hydraulic excavators, and front end loaders. The trucks can be loaded equally well from the rear or the side using hydraulic excavators or rope shovels. Ideally, excavators should require 90° or less swing. With a backhoe excavator a very efficient loading method is with the backhoe on top of the bank loading over the rear of the truck at the base of the bank. Backhoe slew angles can be small, leading to very short cycle times.



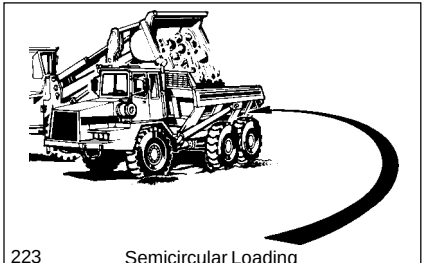
220 Minimise Bucket Swing



221 Loading From Rear

222 Manoeuvring In Restricted Areas

For maximum material movement, the truck operator must help the loading machine operator keep loading time to a minimum. 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.
The fewer manoeuvres the truck must make to get into the loading position, the sooner loading can start. In restricted areas it may be necessary to turn and reverse the truck into the loading position.



223 Semicircular Loading

If the required space is available the truck can travel round without the need to reverse. 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 able to judge the best spot for his truck when it is his turn to be loaded.

224 Loading Both Sides

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 stop 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 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 worked 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.

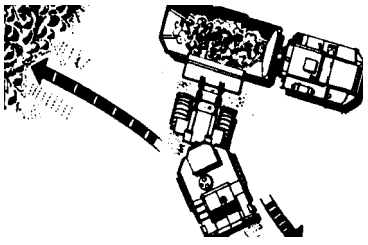
The following precautions should be observed when approaching the loading area and while being loaded -

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.

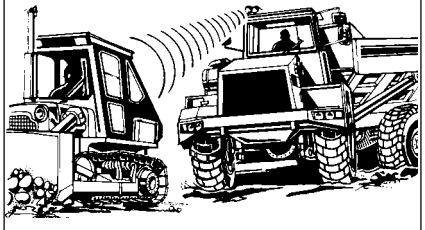
Do not move the truck into loading position with the shovel bucket swinging overhead. Large rocks that might fall from the bucket can be dangerous to both the operator and the truck.

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

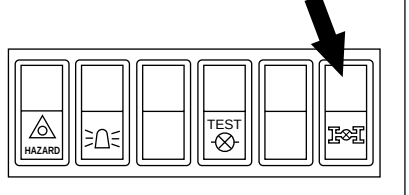
When the loader operator signals that the truck is loaded, sound two blasts on the horn, select the correct gear and release the brakes. Move out of the loading area and onto the haul road, with the least possible delay, to allow any waiting truck to move into the loading position as soon as possible.



225 Loading With Front End Loader

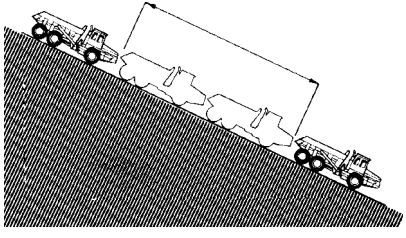


226 Watch Cleanup Machine

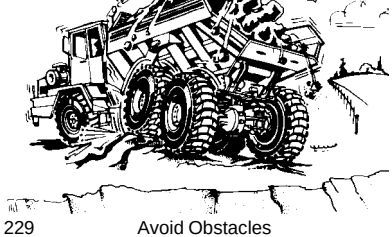


1130 Driving On Soft Or Slippery Conditions

227 Maintain Safe Speeds



228 Safety First



229 Avoid Obstacles

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 or encountering extremely soft or slippery conditions, stop the machine and engage the differential locks. Do not engage the differential locks when machine is moving or wheels are spinning. Disengage the locks as soon as conditions return to normal.

When approaching downgrades, select the proper transmission gear 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 16 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 are 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, railroads, public highways etc. Where a 'FLAGMAN' is stationed to direct traffic, always stay alert and follow his directions.

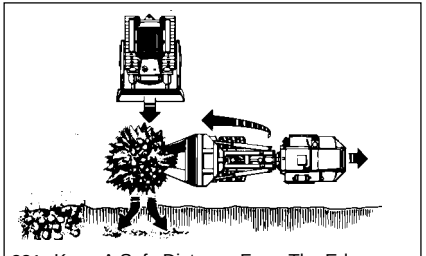
Dumping

When dumping the operator should steer the vehicle ensuring that it is straight and with the load on level ground. 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. 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.

230 Manoeuvring To Dump

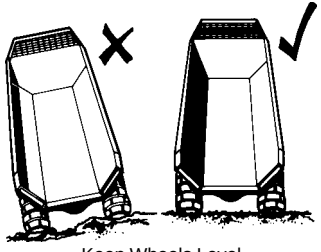
Mineral ores, blasted rock etc., are usually dumped into a hopper, or crusher, where it is processed. When dumping into a hopper, the operator, in order to avoid excess wear on the tyres, must avoid hitting the protecting rail at the hopper. If a DRIVEOVER HOPPER is used, the operator must avoid rubbing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

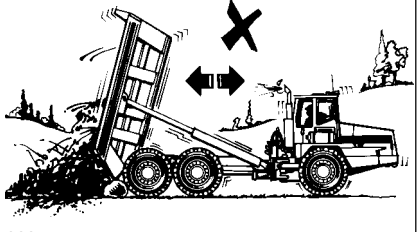


231 Keep A Safe Distance From The Edge

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 can be pushed over the edge later.



232 Keep Wheels Level



233 Don't Jump Dump

Before raising the body, make sure that 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.

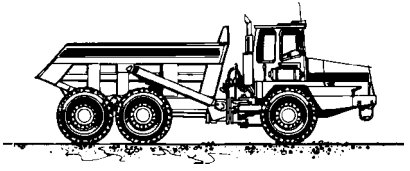
Once the load has been dumped, push the control lever forward into the 'POWER DOWN' position and accelerate the engine. As the hoists approach their fully retracted positions, decelerate the engine and push the body control lever fully forward into the 'FLOAT' position, allowing the body's weight to lower it to the chassis. A proximity sensor prevents the body being fully powered down hydraulically, at a predetermind body height, the sensor will automatically default the body control valve to the detented 'FLOAT' condition.

Empty Return

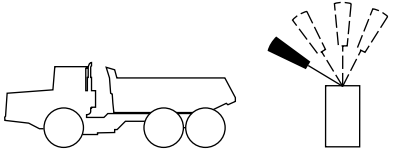
Make sure the body is completely lowered, the body control lever is in the 'FLOAT' position, and the transmission is shifted to the correct gear before releasing the brakes and moving away from the dump site.

> **WARNING**
>
> **Do NOT drive the truck with the body up. No articulated truck is stable in this condition and, apart from the risk of a rear-end topple, 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'.



234 Make Sure Body is Fully Down



1091 Keep Control Lever in 'FLOAT'

6 - 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 vehicle 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 vehicle is 'ROADED' on public highways.

Preparation Prior to Roading

Lubrication

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

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

Note: Make sure the differential lock switch remains in the 'OFF' position when roading. Failure to comply to this could result in damage to the transmission and axle components.

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.

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 sufficiently tightened to avoid subsequent loosening. 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 the lights, horn, windscreen wipers, heater, defroster, headlight dip control, and all controls for proper operation.

Make sure the truck body is empty, fully lowered and the body control lever is in the 'FLOAT' position. If spill guard extension is fitted, this should be removed and placed inside body.

Make sure the differential lock switch is in the 'OFF' position.

Shift transmission through all gears while slowly accelerating engine.

In Case of Trouble

If trouble develops on route, move the vehicle 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 vehicle be left unattended while the trouble is reported by phone, disconnect a battery earth cable and apply security locks, if so equipped, before leaving the parked vehicle. Make sure the 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 vehicle operator can be reached.

Note: Do not attempt to restart or operate the vehicle 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.

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 vehicle 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, it is advisable to carry out the following procedures to prevent any possible additional damage, which may be caused by the wheels turning the power train as the vehicle is driven or towed.

If the transmission is at fault, disconnect the drivelines to the axles and engine before moving the vehicle.

If a differential or planetary is at fault, carry out the following procedure for the component concerned: Disconnect drivelines, remove planetary covers and remove the axle shafts. Remove the pinion gears from their covers. Replace the planetary pins in the covers, and refit the planetary covers on the drive wheels to retain lubricant and prevent ingress of dirt.

If possible, start the engine to provide the required hydraulic pressure for 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 vehicle safely to the repair area without braking and steering power.

Note: Never allow riders on a vehicle being towed without sufficient hydraulic pressure for safe braking.

If the parking brake must be released, but the engine cannot be operated to provide the required hydraulic pressure, the brake can be released manually by following this procedure:

WARNINGS

Disconnecting transmission from engine will prevent the steering pump from operating, making the vehicle difficult to steer.

Removing the driveline between the parking brake and the rear axles or removing the axle shafts and planetary covers or pinion gears from the axles will make the parking brake ineffective.

Uncontrolled vehicle movement hazard. There is no mechanical connection between the vehicle wheels and the engine when the parking brake is released. Before releasing the parking brake, make sure the vehicle wheels are secured with chock blocks to prevent or restrict unexpected vehicle movement.

⚠ WARNINGS

When moving the vehicle with insufficient hydraulic pressure, for safe braking and steering, use extreme caution to ensure personnel and property safety.

⚠ Make sure the parking brake actuator is returned to its original position, and the parking brake is operating correctly, before removing the chock blocks from the wheels.

Block all wheels securely. Turn the hex-head on the parking brake actuator anticlockwise until the brake pads are free from the disc. When the hydraulic system is repaired, return the actuator to its original position by turning the hex-head fully clockwise.

Connect a suitable towing bar to one of the lugs on the tractor frame of the disabled vehicle and reverse another vehicle, in a straight and in-line manoeuvre, towards the disabled vehicle. Connect the opposite end of the towing bar to the towing pin of the recovery vehicle and ensure that it is securely locked.

Note: An alternative method of towing a disabled vehicle is by connecting an A-Frame arrangement to the lugs on the tractor frame of the disabled vehicle and the towing pin of the recovery vehicle.

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).

8 - Lubrication and Servicing

⚠ SAFETY PRECAUTIONS

Do not allow unauthorized personnel to service or maintain this machine. Study the Operator's Handbook and Maintenance Manual before starting, operating or servicing this machine. Always follow procedures and safety precautions detailed in the Maintenance 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 prop. Body prop must only be used when the body is empty.

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

Always shut down machine according to the procedure under 'Stopping The Engine', described on page 4-15. Turn off the master switch before cleaning, lubricating or servicing the machine except as called for in this Handbook or Maintenance Manual.

Always install steering lock bar before adjusting or servicing the machine with the engine running. Refer to 'General' safety section on page 2-2.

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

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 Maintenance Manual.

LUBRICATION AND SERVICING

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 machine. Periodic lubrication of moving parts reduces to a minimum the possibility of mechanical failures.

Thoroughly clean all fittings, caps, plugs etc., to prevent dirt from entering the system while servicing.

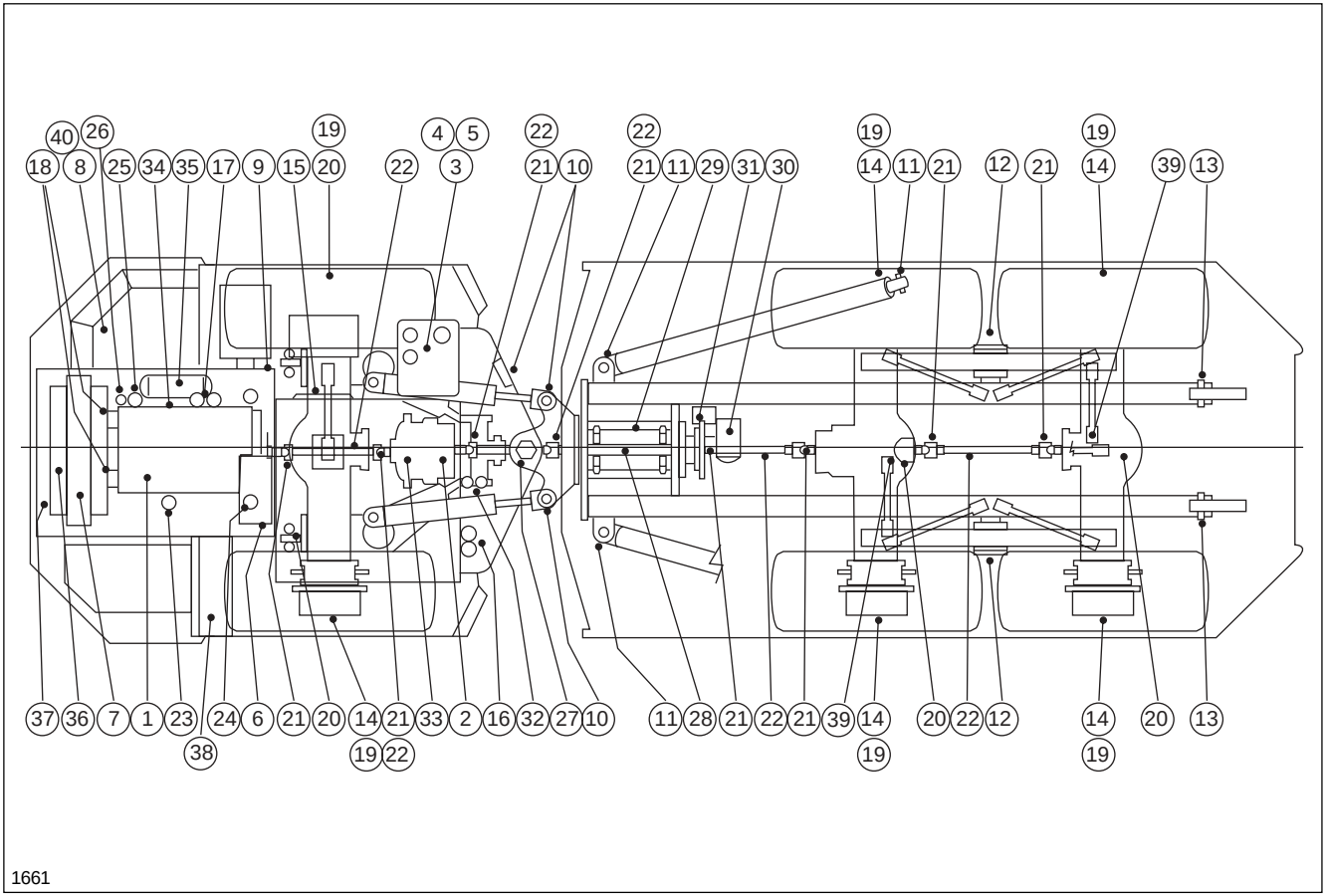
Lubricants must be at operating temperature when draining.

Do not operate any system unless oil level is within the operating range as indicated on oil level dip stick, sight gauge or level plug.

Small circles on the following illustrations represent points at which lubrication or servicing must take place, at the intervals indicated on the left-hand side of the lubrication chart.

The numbered circles on the illustrations contain reference numbers which correspond to the 'Ref. Points' column of the chart.

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.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18 8 25 34 35 17 9 15 20 22 3 21 10 21 11 29 31 30 14 11 21 12 21 14 39 13
37 36 7 1 23 24 6 21 20 14 21 33 2 16 32 27 10 11 28 21 22 21 39 14 20 22 12 14 20 13
38 19 22 19 19

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LUBRICATION AND SERVICE CHART

Interval Hours	Ref. Points	Identification	Service Instructions	No. of Points	Lubricant	Service Quantities
	1	Engine	Check oil level. Add if low.	1	EO	As required
	2	Transmission	Check oil level. Add if low.	1	EO	As required. See Note 3
	3	Hydraulic Tank	Check oil level. Add if low.	1	HO	As required
	38	Brake Coolant Tank (TA40 only)	Check oil level. Add if low	1	HTO	As required
	4	Hydraulic Oil Filter Indicator	Check. Replace element if required.	1		
	6	Radiator Top Tank	Check coolant level. Add if low.	1		
	8	Fuel Tank	Check fuel level. Add if low.	1		As required
10	-	Fuel Lines	Check for leaks.			
	-	Turbocharger	Check for leaks.			
	-	Hydraulic Systems	Check for proper operation.			
	9	Air Filter Restriction Gauge	Check. Replace element if required.	1		
	-	Air Cleaner Vacuator Valve	Check for proper operation.	1		
	-	Tyres	Check condition and pressure.	6		Refer to Page 3
	-	Transmission Oil Gauge	Check temperature readings.			
	-	General	Check for debris, leaks and damage.			
	28	Oscillation Bushes	Lube.	2	EP, NLGI	See Note 1
	12	Suspension Beam and Panhard Bushings	Lube.	6	EP, NLGI	See Note 1
	13	Body Hinge Pins	Lube.	2	EP, NLGI	See Note 1
	14	Wheel Rim Nuts (TA40)	Check torque.	138		540 Nm (400 lb ft)
	14	Wheel Rim Nuts (TA35)	Check torque.	138		730 Nm (540 lb ft)
50	15	Cab Ventilation Filter	Inspect and clean if required.			
	18	Drive Belts	Check tension. Adjust if required.			See Engine Manual
	-	Battery Electrolyte	Check level. Add if low.	2		As Required.
150	-	Engine Air Cleaner	Check. Clean inlet screen.	1	-	-
	1	Engine	Drain oil and refill.	1	EO	See Page 13
	7	Radiator	Clean and inspect radiator fins.	1		See Note 6
	8	Fuel Tank	Drain water and sediment from tank.	1	-	-
	10	Steering Cylinder Pins	Lube.	4	EP, NLGI	See Note 1
250	11	Body Cylinder Pins	Lube.	4	EP, NLGI	See Note 1
	17	Engine Oil Filters	Replace.	3	EO	See Page 13
	-	Transmission Breather	Clean if required.	1	-	-
	19	Wheel Planetaries	Check oil level. Add if low.	6	EPL	As required

LUBRICATION AND SERVICE CHART (Continued)

Interval Hours	Ref. Points	Identification	Service Instructions	No. of Points	Lubricant	Service Quantities
	20	Differentials	Check oil level. Add if low.	3	EPL & LZ	As required
	23	Primary Fuel Filter	Replace.	1		
	24	Secondary Fuel Filter	Replace.	1		
250	28	Oscillation Pivot	Check end float. Adjust if required.	2		
	30	Parking Brake Slack Adjuster	Lube	1		
	31	Parking Brake Pads	Check wear. Replace/adjust if required.	2		
	-	Service Brake Pads (TA35)	Check wear. Replace if required	12		
	36	Fuel Cooler	Clean and inspect cooler fins.	1		See Note 6
	37	Charge Air Cooler	Clean and inspect cooler fins.	1		See Note 6
	25	Coolant Filter	Replace	1		
	-	Coolant Inhibitor	Check inhibitor concentration.			
	26	Water Pump	Inspect drain hole. Clean if required	1		
500	-	Engine Mounting Bolts	Check torque.	4		265 Nm (195 lb ft)
	-	Transmission Mounting Bolts	Check torque.	4		Front 300 Nm (220 lb ft) Rear 265 Nm (195 lb ft)
	-	Engine Crankcase Pressure	Check and record.			
750	5	Hydraulic Oil Filter	Clean housing and replace element.	1		
	-	Engine Air Cleaner	Replace element			
	-	Alternator	Check terminals and wiring.			
	2	Transmission	Drain oil and refill.	1	EO	See Page 13
	8	Fuel Tank	Replace cap filter/cartridge.	1		
	15	Cab Ventilation Filter	Replace.	1		
	19	Wheel Planetaries (TA35)	Drain oil and refill.	6	EPL	See Page 13
	20	Differentials (TA35)	Drain oil and refill.	3	EPL & LZ	See Note 4
	27	Articulation Bearing	Lube.	2	EMS19057	See Note 2
1 000	29	Driveshaft Bearings	Check oil level. Add if low.	1	EPL	To fill plug. See Note 5
	32	Transmission Oil Filters	Replace.	2		
	33	Transmission Internal Oil Filter	Clean.	1		
	38	Brake Coolant Tank (TA40 only)	Drain oil and refill.Change filter/breather	1	HTO	See Page 14
	38	Brake Coolant Tank Breather	Replace	1		TA40 Only
	-	Exhaust System	Check for leaks. Repair if damaged.			
	-	Crankcase Breather	Clean.	1		
	-	Door Hinges	Lube.	2	EP, NLGI	See Note 1
	-	Service Brakes (TA40)	Check wear indicator pins	6		

LUBRICATION AND SERVICE CHART (Continued)

Interval Hours	Ref. Points	Identification	Service Instructions	No. of Points	Lubricant	Service Quantities
	1	Engine	Steam clean	1		
	7	Radiator and Cooling System	Drain, flush and refill.		Coolant	See Page 13
	21/22	Drivelines (Low Maintenance)	Check for leaks and damage.	-	-	See Page 12
	27	Articulation Pivot Nut	Check torque	1		1 425 Nm (1 050 lb ft)
2 000	36	Fuel Cooler	Strip, clean and inspect	1		
	37	Charge Air Cooler	Strip, clean and inspect	1		
	18	Drive Belts	Replace all belts.			
	40	OCDB Filter	Replace.			
2 250	3	Hydraulic Tank	Drain oil and refill.	1	HO	See Page 13
	-	Suction Screens and Strainers	Clean.	2		
4 000	-	Thermostats and Seals	Replace.			
6 000	34	Engine Oil Cooler	Strip, clean and inspect.	1		
	35	Transmission Oil Cooler	Strip, clean and inspect.	1		

Notes on 'Lubrication and Service Chart'

Note - Capacities given are approximate - work to dipstick, sight gauges or level plugs.

Note 1 - Lubricate slowly until excess lube is seen.

Note 2 - Remove plugs and fit lube fittings. Lubricate slowly until excess lube is seen. Remove fittings and refit plugs.

Note 3 - Check with the engine idling and the transmission at its normal operating temperature.

Note 4 - When refilling centre axle ensure that 3rd differential unit is primed with 1 litre (1.75 UK pints) of oil before filling drive head.

Note 5 - Remove plug from port on underside of oscillation hub. Plug is removed to drain the cavity of any oil that enters the cavity when filling. Remove grommet and level plug on side of oscillation hub. Add oil if required. Refit all plugs.

Note 6 - Clean radiator and cooler fins more often when operating under extremely dusty conditions.

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

* - Refer to chart under 'Recommended Lubricants'.

HO - Hydraulic Oil. Refer to 'Recommended Lubricants'.

EPL - Extreme Pressure Lubricant specification MIL-L-2105 D.

EP, NLGI - Extreme Pressure, Lithium No. 2 Grease (which may, or may not, contain Molybdenum).

*EP, NLGI - Extreme Pressure, Lithium No. 2 Grease (without Molybdenum).

EMS19057 - Extreme Pressure, Lithium Complex Grease. Refer to 'Recommended Lubricants'.

HTO - Hydraulic Transmission Oil. Refer to 'Recommended Lubricants'.

LZ - Lubrizol 6178

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

MISCELLANEOUS SERVICING INFORMATION

WHEN REQUIRED

Seat Belts - Inspect for damage and replace if required.
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 (TA40) - After first 10 hours of operation re-torque nuts to 540 Nm (400 lb ft). Check torque every 50 hours (weekly) thereafter.
Wheel Rim Nuts (TA35) - After first 10 hours of operation re-torque nuts to 730 Nm (540 lb ft). Check torque every 50 hours (weekly) thereafter.

EVERY 10 HOURS OF OPERATION (DAILY)

Walk Around Inspection - Inspect the vehicle as described in Section 4-2 of the Operator's Handbook.

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

Engine Air Cleaner - Change air cleaner element only when the yellow band of the air restriction gauge locks up in the orange. Service vacuator valve daily. Inspect and remove any obstructions from the vacuator valve lips which should be open and pliable with the engine stopped.
Note: Service air cleaners more often when operating under extremely dusty conditions.

Engine Crankcase - Check oil level and add if low.

To allow checking before starting as well as immediately after shutting down the engine, the oil dipstick is provided with two types of marks:

1. Dot Marks - Before starting up after a major shut down period the oil level should be up to the top dot mark (Cold level).

2. Dash Marks - Upon shutting down the engine at low idling (wait 1 to 2 minutes) the oil level should be up to, but not over, the top dash mark (Hot level).

Transmission - Check oil level and add oil if low. Refer to Section 120-0010, TRANSMISSION AND MOUNTING in the Service Manual, for correct oil level check procedure.

Hydraulic Tank - Check oil level and add oil if low. With the engine off and body down the oil should be visible in the bottom of the top sight gauge.

Brake Coolant Tank (TA40 only) - Check oil level and add oil if low.

Radiator - Check coolant level and add if low. Fill the 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 coolant inhibitor MUST be checked. If the concentration is low, engine damage will result. Conversely, over-inhibiting antifreeze solutions can result in silicate dropout. Refer to Section 210-0000, COOLING SYSTEM, in the Service Manual.

AFTER FIRST 100 HOURS OF OPERATING NEW OR REBUILT COMPONENTS

Hydraulic Oil Filter - Clean filter housing and install new element at 100 hours of operation, or when indicated, whichever comes first.

Brake Cooling Oil Filter (TA40 only) - Clean filter within brake coolant tank after 100 hours of operation.

AFTER FIRST 500 HOURS OF OPERATING NEW OR REBUILT COMPONENTS

Transmission - Drain oil, replace remote mounted filters, clean internal filter and finger magnet. Refill transmission.

Differentials - Drain lubricant and refill to level plug.
Note: When refilling centre axle ensure that 3rd differential unit is primed with 1 litre (1.75 UK pints) of oil before filling drive head.

Planetaries - Drain lubricant and refill to level plug.

EVERY 250 HOURS OF OPERATION

General Inspection - Check entire vehicle for leaks, loose bolts and nuts or damaged parts. Examine the vehicle, particularly the chassis, for cracks or broken welds. Repair where necessary.

Service Brakes (TA35) - Check pads and discs for wear and replace where necessary. Test for proper function.
Note: This service interval applies to normal driving. Check the pads more frequently under more severe conditions. Thickness of pad friction material should never be allowed to wear below 3 mm (0.12 in).

Parking Brake - Check pads and discs for wear and replace where necessary. Test for proper function.
Note: This service interval applies to normal driving. Check the pads more frequently under more severe conditions. Thickness of pad friction material should never be allowed to wear below 3 mm (0.12 in).

Oil Can Points - Oil working parts with engine oil.

EVERY 1 000 HOURS OF OPERATION (6 MONTHS)

Service Brakes (TA40) - Check indicator wear pins for signs of wear and replace friction plates where necessary. Test for proper function.
Note: This service interval applies to normal driving. Check the pins more frequently under more severe conditions. In the fully worn plate condition the indicator pin is flush with the bottom of the counterbore.

Transmission - Drain oil, replace remote mounted filters, clean internal filter and finger magnet. Refill transmission.

Hydraulic Oil Filter - Clean filter housing and install new element when indicated, or after 1000 hours of operation, whichever comes first.

Brake Coolant Tank (TA40 only) - Drain oil, replace filter and breather. Refill brake coolant tank. Replace tank breather.

Axles (TA35) - Drain lubricant and refill to level plug.
Note: When refilling centre axle ensure that 3rd differential unit is primed with 1 litre (1.75 UK pints) of oil before filling drive head.

Parking Brake - Check pads and disc for wear. Adjust or replace if required. Test for proper function. Thickness of pad friction material should never be allowed to wear below 3 mm (0.12 in).

Articulation Bearings - IMPORTANT - Use only grease which conforms to EMS19057 specification. Remove plugs and fit lube fittings. Lubricate slowly until excess lube is seen. Remove lube fittings and refit plugs.

Driveshaft Bearings - Remove plug from port on underside of oscillation hub. Plug is removed to drain the cavity of any oil that enters the cavity when filling. Remove grommet and level plug on side of oscillation hub. Add oil if required. Refit all plugs.

Grease Points - Grease door hinges.

EVERY 2 000 HOURS

Drivelines - Visually check Low Maintenance drivelines for leaking or damaged seals.
Note: Low Maintenance drivelines can be identified by having plugs fitted to the spiders, not grease nipples.

Axles (TA40) - Drain lubricant and refill to level plugs.
Note: When refilling centre axle ensure that 3rd differential unit is primed with 1 litre (1.75 UK pints) of oil before filling drive head.

Hydraulic Oil Tank - Drain oil, remove and clean suction screens and strainers. Reinstall suction screens and strainers and refill hydraulic oil tank.

ENGINES AND TRANSMISSIONS

All information contained in the 'Lubrication and Service Chart' was extracted from the relevant manufacturers Operators Manual and was correct at time of publication. User should ensure that information contained in this chart, regarding Engines and Transmissions, reflects the information shown in the relevant manufacturers Operators Manuals supplied with the vehicle. 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.

RECOMMENDED LUBRICANTS

COMPONENT	LUBRICANT	*CAPACITY	SPECIFICATIONS	API CODE	SAE GRADE
Engine (Including Filters)	Engine Oil with 1.00% sulphated ash limit is recommended. Sulphated ash must not exceed 1.85% limit	37 litre (9.8 US gal)		CH-4	15W-40
Transmission (Including Filters) (dry fill)	Engine Oil with 1.85% max. sulphated ash limit	56 litre (14.8 US gal)		CH-4	See Trans. Oil Table.
Hydraulic System (Including Lines)	Hydraulic Transmission Oil	209 litre (45 US gal)	See Hydraulic Oil Table (See Note 2)		
Cooling System	Anti-freeze, Ethylene Glycol	80 litre (21.1 US gal)			
Differential - TA40 (Front)	Extreme Pressure Gear Lubricant	37.5 litre each (9.9 US gal)	MIL-L-2105 D (See Note 3)	GL-5	80W-90 LS
Differential - TA40 (Centre)	Extreme Pressure Gear Lubricant	38 litre (10 US gal)	MIL-L-2105 D (See Note 3)	GL-5	80W-90 LS
Differential - TA40 (Rear)	Extreme Pressure Gear Lubricant	31.5 litre (8.3 US gal)	MIL-L-2105 D (See Note 3)	GL-5	80W-90 LS
Planetaries - TA40	Extreme Pressure Gear Lubricant	8.5 litre each (2.2 US gal)	MIL-L-2105 D (See Note 3)	GL-5	80W-90 LS
Differentials - TA35 (Front,Centre,Rear)	Extreme Pressure Gear Lubricant	31 litre each (8.2 US gal)	MIL-L-2105 D (See Note 3)	GL-5	80W-90 LS
Planetaries - TA35	Extreme Pressure Gear Lubricant	9 litre each (2.4 US gal)	MIL-L-2105 D (See Note 3)	GL-5	80W-90 LS

RECOMMENDED LUBRICANTS - continued					
COMPONENT	LUBRICANT	*CAPACITY	SPECIFICATIONS	API CODE	SAE GRADE
Fuel Tank	Diesel Fuel Oil with max. sulphur 0.5%	463 litre (122 US gal)	DIN EN590		
Grease Nipples**	Extreme Pressure Lithium Grease				No.2 Consistency
Driveshaft through Bearings	Extreme Pressure Gear Lubricant	1.50 litre (0.40 US gal)	MIL-L-2105 D	GL-5	80W-90
Articulation Bearings	Extreme Pressure Lithium Complex		EMS 19057		
Air Conditioning Compressor	Polyalklene Glycol (PAG) Compressor Lubricating Oil - Low Viscosity	0.125 litre (0.033 US gal)	ISO46 SP 10		
Brake Cooling System (TA40 only)	Hydraulic Transmission Oil	199 litre (52.6 US gal)	MIL-L-2104 E MIL-L-46152 B/C	CF,CD,SF	

Recommended Lubricants notes

***** Capacities given are approximate, work to dipstick, sight gauges or level plugs.

****** Refer to the 'Recommended Lubricants Table' for the different applications. DO NOT use on the Articulation or Oscillation bearings.

Note 1 - Operation below the minimum temperatures listed for the oil used without proper preheat or warm-up results in greatly reduced transmission life. Proper warm-up requires 20 minutes minimum operation in neutral (with engine at part throttle) before operating the transmission in gear.

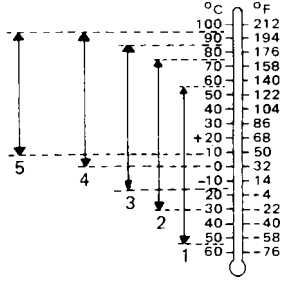
Note 2 - Hydraulic Transmission Oil meeting Specification EMS19058 is suitable for use in the hydraulic system.

Note 3 - Axles have limited slip differentials. If use of standard SAE 90 oil results in very loud noise and jerking of the wheels when driving slowly round sharp corners, an EP oil with limited slip additives should be used.

Note 4 - Automatic Transmission Fluids (ATF) may only be used when the ambient temperature is less than - 10° C (14° F). Should the temperature increase, it is necessary to switch to engine oil.

LUBRICANT GRADE SELECTION GUIDE AT AMBIENT (START-UP) TEMPERATURE

HYDRAULIC OIL



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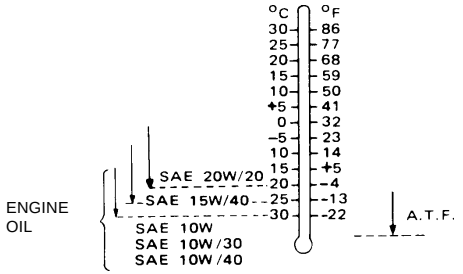
	SAE	API CODE	MIL-SPEC
1	-	-	MIL-H-5606A
2	DEXRON Auto Trans. Fluid		
3	10W	CC/CD	MIL-L-2104 B/C
4	20W/20	CC/CD	MIL-L-2104 B/C
5	30	CC/CD	MIL-L-2104 B/C

TRANSMISSION OIL



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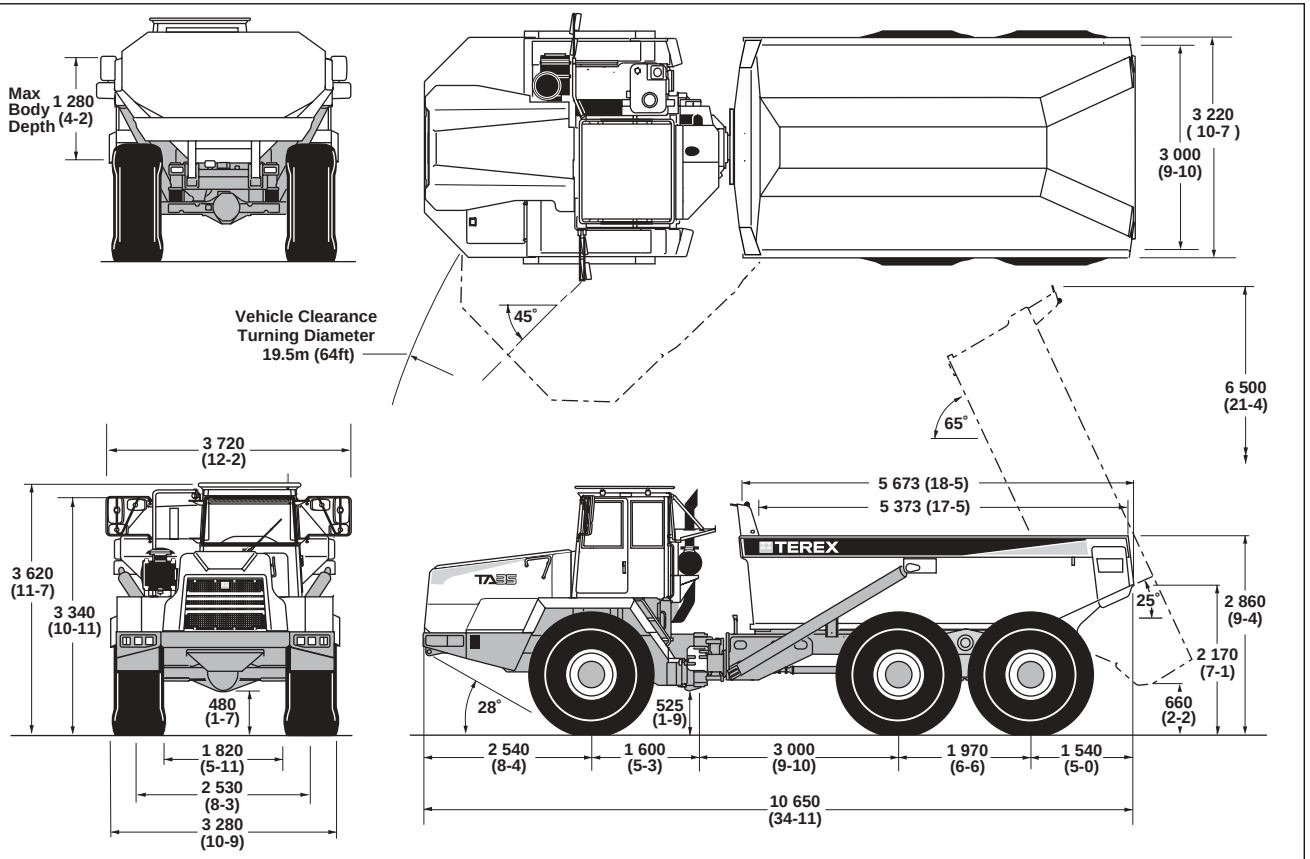
(See Note 4)

Note: Consult your lubricant supplier for correct viscosity of lubricant when ambient temperatures are consistently above or below those listed.

9 - Technical Data



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Dimensions in mm (ft-in)

TECHNICAL DATA -TA35

ENGINE

Make/Model ..... Detroit Diesel Series 60
Type ..... Four cycle, direct injection diesel, water-cooled, turbocharged and aftercooled. Electronic management.
Gross power at 2 200 rev/min ..... 298 kW (400 hp, 406 PS)
Net power at 2 200 rev/min ..... 280 kW (375 hp, 380 PS)

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

Max Torque ..... 1 830 Nm (1 350 lb ft) at 1 350 rev/min
Number of cylinders/configuration ..... 6 cylinder, in line
Bore and stroke ..... 130 x 160 mm (5.12 x 6.30 in)
Total Displacement ..... 12.7 litres (774 in^3)
Injector ..... 10 mm
Air cleaner ..... Dry type, double element
Starting ..... Electric
Maximum Speed (No load) ..... 2 325 rev/min
Maximum Speed (Full load) ..... 2 200 rev/min
Idle Speed ..... 700 rev/min
Maximum Operating Slope ..... 30° (57% Grade)

TRANSMISSION

Make/Model ..... ZF 6WG 310 Automatic with manual override. The transmission consists of a torque converter close-coupled to a 6 speed gearbox with integral output transfer gearing. Automatic shifting throughout the range, with kickdown feature. Lockup in all forward gears. A torque-proportioning output differential transmits drive permanently to front and rear axles. This differential may be locked by the driver for use in difficult traction conditions. Integral hydraulic retarder.

Pressures:
Main ..... 16 + 2 bar (232 + 30 lbf/in^2)
Lockup (Wk) ..... 14 ± 1 bar (190 + 15 lbf/in^2)
Converter 'IN' ..... 7.6 bar (110 lbf/in^2) at 2 300 rev/min
Converter 'OUT' ... 4.8 bar (70 lbf/in^2) at 2 300 rev//min
Converter Relief Valve ..... 8.5 bar (123 lbf/in^2)
Retarder ..... 6 bar (87 lbf/in^2)

Temperatures:
Normal ..... 80° - 110° C (176° - 230° F)
Maximum ..... 120° C (248° F)

Stall Speed ..... 1 795 ± 50 rev/min

Ratios:
Torque Converter 1.84:1
Transmission ..... Refer to table below

Note: During reversing operations it is recommended to reduce engine speed, use only 1st or 2nd gear and never exceed 10 km/h (6.2 mile/h).

Forward						
Gear	1	2	3	4	5	6
Ratio	5.35	3.45	2.21	1.42	0.97	0.62
km/h	5.7	8.9	13.9	21.7	31.8	49.3
mile/h	3.5	5.5	8.6	13.5	19.8	30.6
Reverse						
Gear	1	2	3			
Ratio	5.35	2.21	0.97			
km/h	5.7	13.9	31.8			
mile/h	3.5	8.6	19.8			

AXLES

Three axles in permanent all-wheel drive with differential coupling between each axle to prevent driveline wind-up. Heavy duty axles with fully-floating axle shafts and outboard planetary gearing.

Automatic limited slip differentials in each axle. Leading rear axle incorporates a through-drive differential to transmit drive to the rearmost axle. Locking of this differential is actuated simultaneously with the transmission output differential lock.

Ratios:

Differential	3.70:1
Planetary	6.35:1
Total Reduction	23.51:1

SUSPENSION

Front: Axle located by a leading A-frame permitting both vertical movement and oscillation. Rubber cone suspension medium with heavy duty hydraulic dampers.

Axle Vertical Travel ..... 105 mm (4.2 in)

Rear: Each axle is coupled to the frame by three rubber-bushed links with lateral restraint by a transverse link. Pivoting inter-axle balance beams equalise load on each rear axle. Suspension movement is cushioned by rubber/metal laminated compression units between each axle and underside of balance beam ends. Pivot points on rear suspension linkages are rubber-bushed and maintenance-free.

Axle Vertical Travel ..... ± 115 mm (± 4.5 in)
Axle Oscillation ..... ± 9°

BRAKES

All hydraulic braking system with dry disc on each wheel and single heavy-duty calliper per disc. Independent circuits for front and rear brake systems. Warning lights and audible alarm indicate low brake system pressure. Brake system conforms to ISO 3450, SAE J1473.

Actuating Pressure ..... 159 ± 6.2 bar (2 300 ± 90 lbf/in²)
Pump Type ..... Piston
Capacity at 2 100 rev/min 1.44 litre/s (22.7 US gal/min)

Discs:

Diameter	470 mm (18.5 in)
Thickness	20 mm (0.79 in)

Parking: Spring-applied, hydraulic-released disc on rear driveline.

Emergency: Automatic application of driveline brake should pressure fall in main brake hydraulic system. Service brakes may also be applied using the parking-emergency brake control.

Retardation: Hydraulic retarder integral with transmission.

WHEELS AND TYRES

Wheels ..... Five-piece Earthmover rims with 23 Stud Fixing
Size:
Standard ..... 25 x 22.00 in for 26.5 R25** tyres
Tyres:
Standard ..... 26.5 R25** Radial

Inflation Pressures (Bridgestone):

	Front	Rear
26.5 R25**	3.75 bar (54 lbf/in²)	4.75 bar (69 lbf/in²)

Inflation Pressures (Michelin):

	Front	Rear
26.5 R25**	3.25 bar (57 lbf/in²)	4.0 bar (58 lbf/in²)

Note: Tyre pressures should be regarded as nominal only. 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.

HYDRAULIC SYSTEM

Steering and Body

The steering and body hydraulic systems are supplied with oil from a common tank by the main hydraulic pump. Gear pump driven from power takeoff on transmission. The components are protected by advanced full flow filtration to 12 micron particle size on the return line.

Pump capacity (at 2258 rpm) ..... 7.03 litre/s (111 US gal/min)

Steering

Hydrostatic power steering by two double-acting, cushioned steering cylinders. Actuating pressure for steering operation is supplied by the main hydraulic gear pump.

Emergency steering pressure is provided by a ground driven pump mounted on the transmission. An indicator lamp signals should the emergency system activate. Conforms to SAE J53.

System pressure ..... 206 bar (3000 lbf/in²)
Steering Angle (left and right) ..... 45°
Lock to Lock Turns, steering wheel 4
Clearance Turning Diameter (SAE) ..... 19.5 m (64 ft)

Body

Two single-stage, double-acting hoist cylinders, cushioned at both ends of stroke. Electro servo assisted hoist control. Actuating pressure for body hoist is supplied by the main hydraulic gear pump.

System pressure ..... 172 bar (2500 lbf/in²)
Control Valve ..... Pilot Operated, Open Centre
Body Raise Time (loaded) ..... 16 sec
Body Lower Time (power down) ..... 12 sec

ELECTRICAL SYSTEM

Type ..... 24 volt, Negative Ground.
Battery ..... Two, 12 Volt, 175 Ah each, Maintenance Free
Accessories ..... 24 Volt
Alternator ..... 70 Amp

BODY

All welded construction, fabricated from high hardness (min. 360 BHN) 1 000 MPa (145 000 lbf/in²) yield strength steel. 25° tail chute angle provides good load retention without tailgate.

Plate Thicknesses:
- Floor and Tailchute ..... 15.0 mm (0.59 in)
- Sides ..... 12.0 mm (0.47 in)
- Front ..... 10.0 mm (0.39 in)

Volume:
- Struck (SAE) ..... 14.5 m³ (19.0 yd³)
- Heaped 2:1 (SAE) ..... 19.5 m³ (25.5 yd³)

SERVICE CAPACITIES

Fuel tank ..... 463 litres (122 US gal)
Hydraulic System
(Steering, Braking & Body) ..... 209 litres (55 US gal)
Cooling System ..... 80 litres (21.1 US gal)
Engine Crankcase (with filters) ..... 37 litres (9.8 US gal)
Transmission & filters (dry fill) ..... 56 litres (14.8 US gal)
Differentials - ZF (Front, Centre, Rear) 31 litres (8.2 US gal)
Planetaries - ZF ..... 9 litres (2.4 US gal)
Driveshaft Bearings ..... 1.5 litres (0.4 US gal)
Air Conditioning Compressor ..... 0.125 litres (0.033 US gal)

Typical Noise Levels

Operator Ear (ISO 6394) 80dbA

*Exterior Sound Rating (ISO 6395) ..... 112 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		
Standard Vehicle	**kg**	**lb**
Net Distribution		
Front Axle	13 600	29 985
Centre Axle	7 400	15 315
Rear Axle	7 100	15 650
Net Weight	**28 100**	**61 950**
Payload	**32 000**	**70 545**
Gross Distribution		
Front Axle	17 700	39 020
Centre Axle	21 350	47 070
Rear Axle	21 050	46 405
Gross Weight	**60 100**	**132 495**
Bare Chassis	22 490	49 580
Body	4 950	10 910
Body Hoists (pair)	660	1 455

Ground Pressures		
At 15% sinkage of unloaded radius and specified weights		
26,5 R25	**Net**	**Loaded**
Front	109 kPa (15.8 psi)	142 kPa (20.6 psi)
Rear	57 kPa (8.3 psi)	169 kPa (24.5 psi)

TA40 Technical Data
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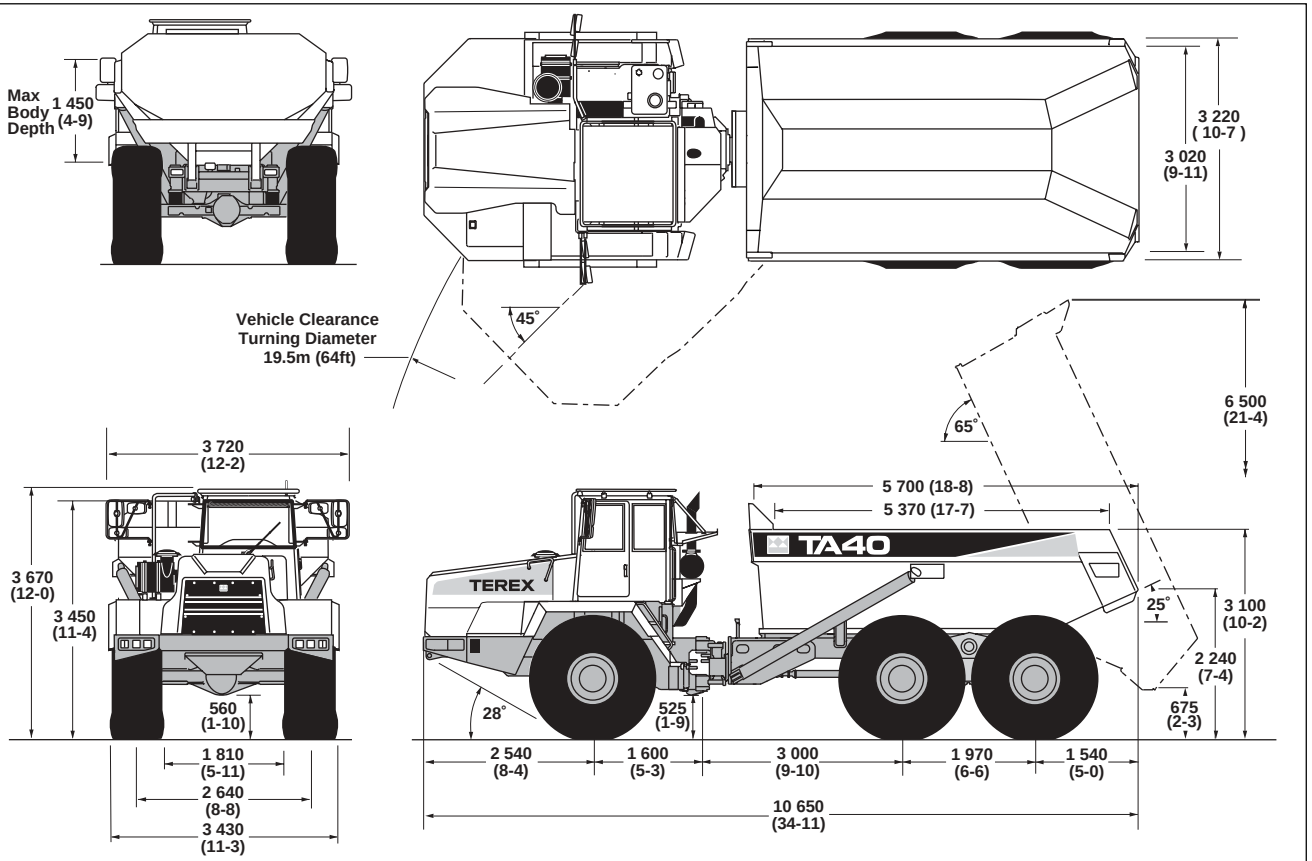

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Dimensions in mm (ft-in)

TECHNICAL DATA - TA40

ENGINE

Make/Model ..... Detroit Diesel Series 60
Type ..... Four cycle diesel, turbocharged with air-to-air charge cooling, water-cooled. Electronic management.
Gross power at 2 200 rev/min ..... 332 kW (445 hp, 451 PS)
Net power at 2 200 rev/min ..... 291 kW (390 hp, 395 PS)

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

Max Torque ..... 2 000 Nm (1 475 lb ft) at 1 350 rev/min
Number of cylinders/configuration ..... 6 cylinder, in line
Bore and stroke ..... 130 x 160 mm (5.12 x 6.30 in)
Total Displacement ..... 12.7 litres (774 in^3)
Injector ..... 10 mm
Air cleaner ..... Dry type, double element
Starting ..... Electric
Maximum Speed (No load) ..... 2 325 rev/min
Maximum Speed (Full load) ..... 2 200 rev/min
Idle Speed ..... 700 rev/min
Maximum Operating Slope ..... 30° (57% Grade)

TRANSMISSION

Make/Model ..... ZF 6WG 310 Automatic with manual override. The transmission consists of a torque converter close-coupled to a 6 speed gearbox with integral output transfer gearing. Automatic shifting throughout the range, with kickdown feature. Lockup in all forward gears. A torque-proportioning output differential transmits drive permanently to front and rear axles. This differential may be locked by the driver for use in difficult traction conditions. Integral hydraulic retarder.

Pressures:
Main ..... 16 + 2 bar (232 + 30 lbf/in^2)
Lockup (Wk) ..... 14 ± 1 bar (190 + 15 lbf/in^2)
Converter 'IN' ..... 7.6 bar (110 lbf/in^2) at 2 300 rev/min
Converter 'OUT' ... 4.8 bar (70 lbf/in^2) at 2 300 rev//min
Converter Relief Valve ..... 8.5 bar (123 lbf/in^2)
Retarder ..... 6 bar (87 lbf/in^2)

Temperatures:
Normal ..... 80° - 110° C (176° - 230° F)
Maximum ..... 120° C (248° F)

Stall Speed ..... 1 835 ± 50 rev/min

Ratios:
Torque Converter 1.84:1
Transmission ..... Refer to table below

Note: During reversing operations it is recommended to reduce engine speed, use only 1st or 2nd gear and never exceed 10 km/h (6.2 mile/h).

Forward						
Gear	1	2	3	4	5	6
Ratio	5.35	3.45	2.21	1.42	0.97	0.62
km/h	6.0	9.3	14.6	22.7	33.3	51.7
mile/h	3.7	5.8	9.1	14.1	20.7	32.1
Reverse						
Gear	1	2	3			
Ratio	5.35	2.21	0.97			
km/h	6.0	14.6	33.3			
mile/h	3.7	9.1	20.7			

AXLES

Three axles in permanent all-wheel drive with differential coupling between each axle to prevent driveline wind-up. Heavy duty axles with fully-floating axle shafts and outboard planetary gearing.

Automatic limited slip differentials in each axle. Leading rear axle incorporates a through-drive differential to transmit drive to the rearmost axle. Locking of this differential is actuated simultaneously with the transmission output differential lock.

Ratios:

Differential	4.86:1
Planetary	4.94:1
Total Reduction	24.0:1

SUSPENSION

Front: Axle located by a leading A-frame permitting both vertical movement and oscillation. Rubber cone suspension medium with heavy duty hydraulic dampers.

Axle Vertical Travel ..... 105 mm (4.2 in)

Rear: Each axle is coupled to the frame by three rubber-bushed links with lateral restraint by a transverse link. Pivoting inter-axle balance beams equalise load on each rear axle. Suspension movement is cushioned by rubber/metal laminated compression units between each axle and underside of balance beam ends. Pivot points on rear suspension linkages are rubber-bushed and maintenance-free.

Axle Vertical Travel ..... ± 115 mm (± 4.5 in)
Axle Oscillation ..... ± 9°

BRAKES

Full hydraulic braking system with enclosed, forced oil-cooled multiple discs on each wheel. Independent circuits for front and rear brake systems. Warning lights and audible alarm indicate low brake system pressure. Brake system conforms to ISO 3450, SAE J1473.

Actuating Pressure ..... 138 ± 6.2 bar (2 000 ± 90 lbf/in²)
Pump Type ..... Triple stage gear
Capacity at 2 200 rev/min .... 2.02 litre/s (32 US gal/min) combined

Braking surface (tractor) .. 802837 mm² (1244.4 in²)/brake
Braking surface (trailer) ..... 535225 mm² (829.6 in²)/brake

Parking: Spring-applied, hydraulic-released disc on rear driveline.

Emergency: Automatic application of driveline brake should pressure fall in main brake hydraulic system. Service brakes may also be applied using the parking-emergency brake control.

Retardation: Hydraulic retarder integral with transmission.

WHEELS AND TYRES

Wheels ..... Five-piece Earthmover rims with 23 Stud Fixing
Size:
Standard ..... 25 x 25.00 in for 29.5 R25** tyres
Tyres:
Standard ..... 29.5 R25** Radial

Inflation Pressures (Bridgestone):

	Front	Rear
29.5 R25**	3.5 bar (51 lbf/in²)	4.25 bar (62 lbf/in²)

Inflation Pressures (Continental):

	Front	Rear
29.5 R25**	3.5 bar (51 lbf/in²)	4.25 bar (62 lbf/in²)

Inflation Pressures (Michelin):

	Front	Rear
29.5 R25**	3.0 bar (44 lbf/in²)	3.65 bar (53 lbf/in²)

Note: Tyre pressures should be regarded as nominal only. 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.

HYDRAULIC SYSTEM

Steering and Body Hoist

The steering and body hydraulic systems are supplied with oil from a common tank by the main hydraulic pump. Gear pump driven from power takeoff on transmission. The components are protected by advanced full flow filtration to 12 micron particle size on the return line.

Pump capacity (at 2258 rpm) ..... 7.03 litre/s (111 US gal/min)

Steering

Hydrostatic power steering by two double-acting, cushioned steering cylinders. Actuating pressure for steering operation is supplied by the main hydraulic gear pump.
Emergency steering pressure is provided by a ground driven pump mounted on the transmission. An indicator lamp signals should the emergency system activate. Conforms to SAE J53.

System pressure ..... 206 bar (3000 lbf/in²)
Steering Angle (left and right) ..... 45°
Lock to Lock Turns, steering wheel 4
Clearance Turning Diameter (SAE) ..... 19.5 m (64 ft)

Body Hoist

Two single-stage, double-acting hoist cylinders, cushioned at both ends of stroke. Electro servo assisted hoist control. Actuating pressure for body hoist is supplied by the main hydraulic gear pump.

System pressure ..... 172 bar (2500 lbf/in²)
Control Valve ..... Pilot Operated, Open Centre
Body Raise Time (loaded) ..... 16 sec
Body Lower Time (power down) ..... 12 sec

ELECTRICAL SYSTEM

Type ..... 24 volt, Negative Ground.
Battery ..... Two, 12 Volt, 175 Ah each, Maintenance Free
Accessories ..... 24 Volt
Alternator ..... 70 Amp

BODY

All welded construction, fabricated from high hardness (min. 360 BHN) 1 000 MPa (145 000 lbf/in^2) yield strength steel. 25° tail chute angle provides good load retention without tailgate.

Plate Thicknesses:
- Floor and Tailchute ..... 15.0 mm (0.59 in)
- Sides ..... 12.0 mm (0.47 in)
- Front ..... 10.0 mm (0.39 in)

Volume:
- Struck (SAE) ..... 17.0 m^3 (22.2 yd^3)
- Heaped 2:1 (SAE) ..... 22.0 m^3 (28.8 yd^3)

SERVICE CAPACITIES

Fuel tank ..... 463 litres (122 US gal)
Hydraulic System
(Steering, Braking & Body) ..... 209 litres (55 US gal)
Brake Cooling System ..... 199 litres (52.6 US gal)
Cooling System ..... 80 litres (21.1 US gal)
Engine Crankcase (with filters) ..... 37 litres (9.8 US gal)
Transmission & filters (dry fill) ..... 56 litres (14.8 US gal)
Differential - Dana (Front) ..... 37.5 litres (9.9 US gal)
Differential - Dana (Centre) ..... 38 litres (10 US gal)
Differential - Dana (Rear) ..... 31.5 litres (8.3 US gal)
Planetaries - Dana ..... 8.5 litres (2.2 US gal)
Driveshaft Bearings ..... 1.5 litres (0.4 US gal)
Air Conditioning Compressor ..... 0.125 litres (0.033 US gal)

Typical Noise Levels

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

*Exterior Sound Rating (ISO 6395) ..... 112 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.

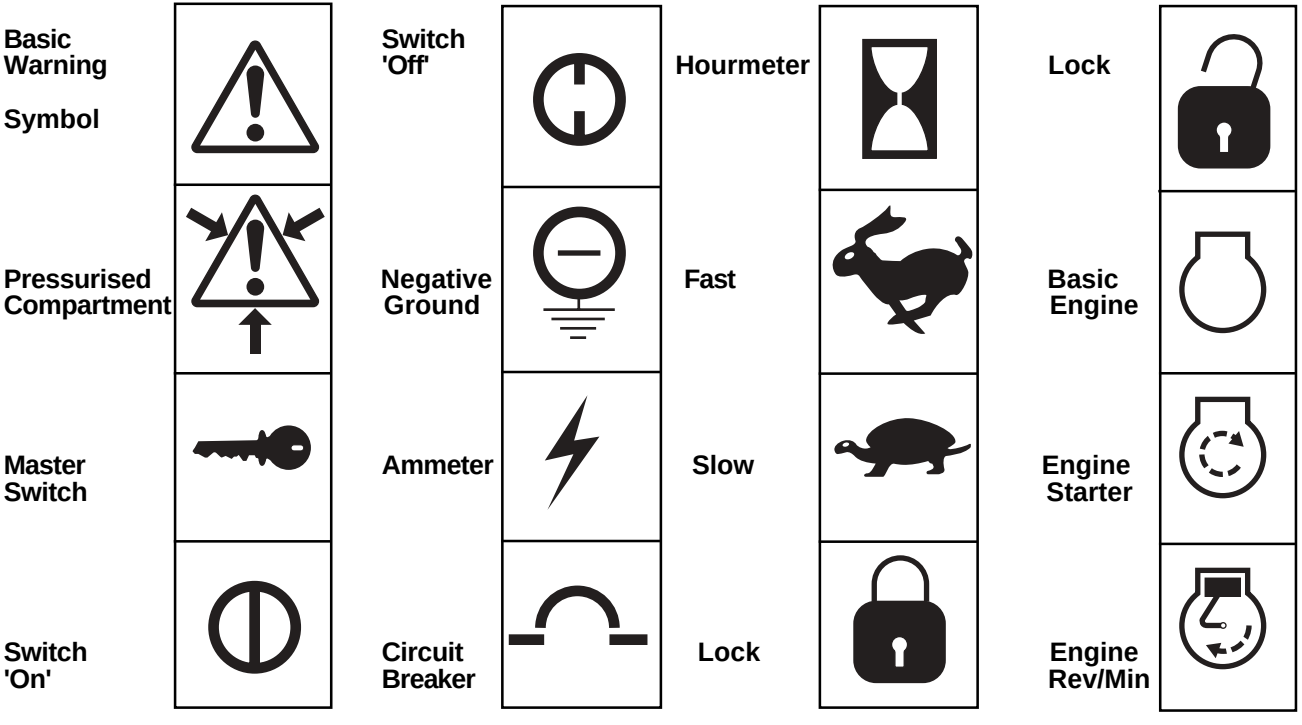
VEHICLE WEIGHTS		
Standard Vehicle	**kg**	**lb**
Net Distribution		
Front Axle	15 275	33 675
Centre Axle	7 750	17 085
Rear Axle	7 705	16 985
Net Weight	**30 730**	**67 745**
Payload	**36 500**	**80 470**
Gross Distribution		
Front Axle	20 170	44 465
Centre Axle	23 530	51 875
Rear Axle	23 530	51 875
Gross Weight	**67 230**	**148 215**
Bare Chassis	24 670	54 390
Body	5 400	11 905
Body Hoists (pair)	660	1 455

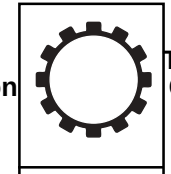
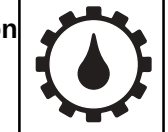
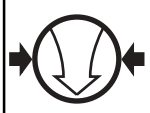
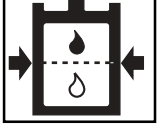
Ground Pressures		
At 15% sinkage of unloaded radius and specified weights		
29,5 R25	**Net**	**Loaded**
Front	102 kPa (14.8 psi)	135 kPa (19.6 psi)
Rear	52 kPa (7.5 psi)	158 kPa (22.9 psi)

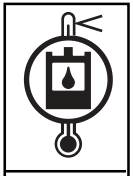
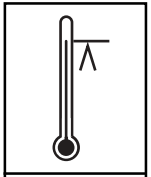
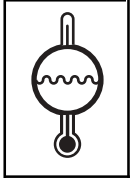
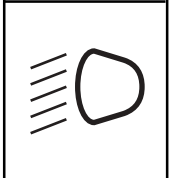
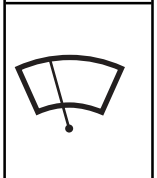
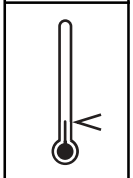
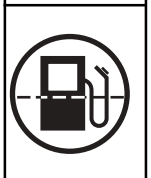
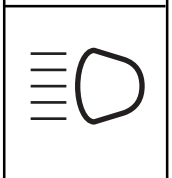
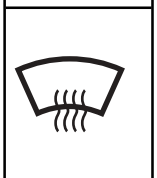
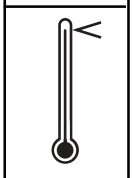
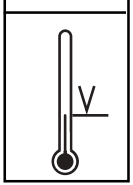
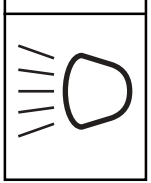
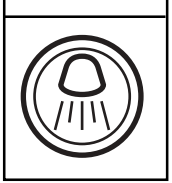
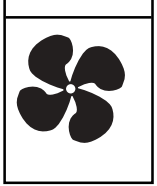
10 - Symbol Identification

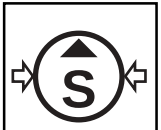
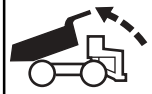
SYMBOL IDENTIFICATION

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



Engine 'Off'		Basic Transmission		Transmission Convertor 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	

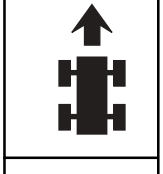
Hot Hydraulic		Heating		Light Flood		Horn	
Coolant Temperature		Fuel Gauge Or Fill tube		Light Low Beam		Windshield Wiper	
Coolant 'cold'		Fuel Filter		Light High Beam		Windshield Defroster	
Coolant 'Hot'		Fuel Shut-Off		Instrument Panel light		Windshield Washer	
Cooling		Basic Lights Symbol		Lamp Test		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		Turn Right		Body Up		Dumpertruck 'Retarder'	
Parking Brake		Tilt Steering		Body 'Raise'		Neutral	

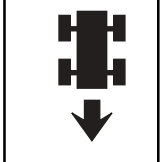
Lift Point

Do Not Lift

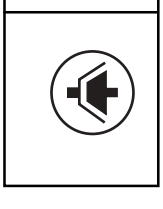
Forward



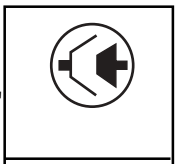
Reverse



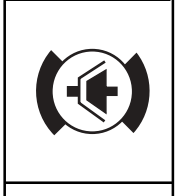
Clutch 'Engaged'



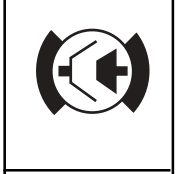
Clutch 'Disengaed'



Brake Applied Clutch Engaged

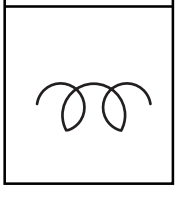


Brake Applied Clutch Disengaged

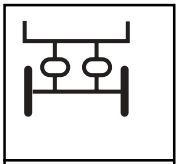


Water in Fuel

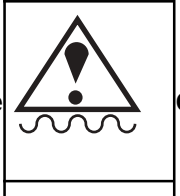
Wait to Start



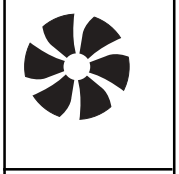
Bowl Suspension



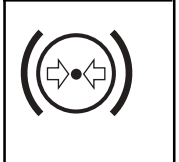
Maintenance



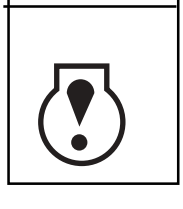
Transmission Convertor



Brake air Pressure

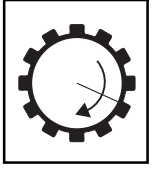


Engine Check



Engine Stop

Trans. Over speed



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