TEREX

TEREX Equipment Limited Maintenance Manual

MAINTENANCE MANUAL

TR100 Tier 2

15503547
SM883

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TEREX

TEREX Equipment Limited Maintenance Manual Re-order

MAINTENANCE MANUAL
TR100 Tier2
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This controlled document is the original instruction and should remain with the vehicle at all times.

Revision: July 2011

TEREX

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Maintenance Manual

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For further information on the subject matter detailed within this operator handbook, please refer to Terex Equipment Limited Service Manuals and Product Parts Books.

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Please refer to TEREX Specification Sheets or consult Factory Representatives to ensure that information is current.

IMPORTANT SAFETY NOTICE

Proper service and repair is important to the safe, reliable operation of all motor vehicles. The service procedures recommended and described in this publication, are effective methods for performing service operations. Some of these service operations require the use of tools specially designed for the purpose. The special tools should be used when, and as recommended.

It is important to note that this publication contains various WARNINGS and NOTES which should be carefully read in order to minimize the risk of personal injury to personnel, or the possibility that improper service methods will be followed which may damage the vehicle or render it unsafe. It is also important to understand these WARNINGS and NOTES are not exhaustive. It is not possible to know, evaluate and advise the service trade of ALL conceivable ways in which service might be carried out, or, of the possible hazardous consequences of each way. Consequently, no such broad evaluation has been undertaken. Accordingly, anyone who uses a service procedure, or tool, which is not recommended, must first satisfy themselves thoroughly that neither their safety, nor vehicle safety, will be jeopardized by the service method he/she selects.

Safety Alert Symbol
The safety alert symbol is used to alert you to a potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

Hazard Classification
A multi-tier hazard classification system is used to communicate potential personal injury hazards. The following signal words used with the safety alert symbol indicate a specific level of severity of the potential hazard. Signal words used without the safety alert symbol relate to property damage and protection only. All are used as attention getting devices throughout this manual as well as on deals and labels fixed to the machinery to assist in potential hazard recognition and prevention.

DANGER	**DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	**WARNING** indicates an potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	**CAUTION** indicates an potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
CAUTION	**CAUTION** used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

WARNING
Never use parts which are altered, modified, or weakened in operation. This can seriously jeopardise the integrity of the machine and could result in property damage or serious personal injury.

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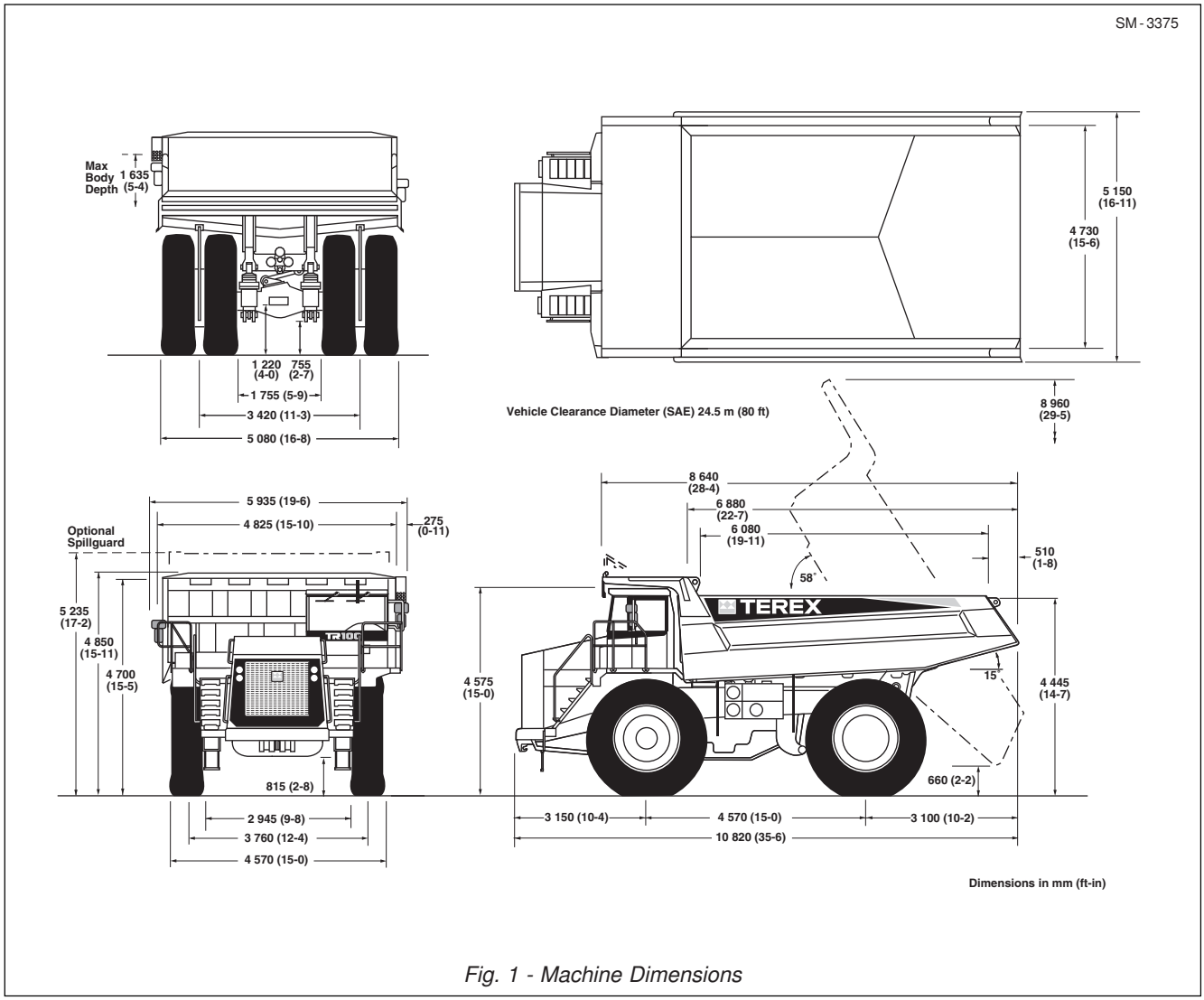

Fig. 1 - Machine Dimensions

ENGINE

Make/Model ..... Detroit Diesel 16V 2000
Type ..... 4 Cycle Turbocharged/Aftercooled Electronic Management
Gross Power at
2 100 rev/min ..... 783 kW (1 050 hp, 1 094 PS)
Net Power at 2 100 rev/min ..... 703 kW (943 hp, 982 PS)

Note: Power ratings to SAE J1995 June 1990. Engine emission meets Tier II USA EPA/CARB MOH 40 CFR 89 and EU NRMM (non-road mobile machinery) directive.

Maximum Torque ..... 4461 Nm (3415 lbf ft) at 1350 rev/min
Number of Cylinders/Configuration 16V
Bore x Stroke ..... 130 x 150 mm (5.12 x 5.91 in)
Total Displacement ..... 31.86 l (1 948 in³)
Starting ..... Electric
Maximum Speed, Full Load ..... 2100 rev/min
Maximum Speed, No Load ..... 2250 rev/min
Idle Speed ..... 700 rev/min

TRANSMISSION

Make/Model ..... Allison H 8610 AR CEC 2
Automatic electronic control with soft shift feature. Remote mounted in the frame with integral TC890 torque converter and planetary gearing. Six speeds forward, one reverse. Automatic converter lockup action in all speed ranges. Downshift inhibitor. Hydraulic retarder.

Speeds With Standard Planetary						
Forward						
Gear	1	2	3	4	5	6
Ratio	4.00	2.68	2.01	1.35	1.00	0.67
km/h	9.5	14.2	18.9	28.2	38.1	57.0
mile/h	5.9	8.8	11.8	17.5	23.7	35.5
Reverse						
Gear	R1	R2				
Ratio	5.12	3.46				
km/h	7.4	11.0				
mile/h	4.6	6.8				

DRIVE AXLE

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

Ratios:	Standard	Optional
Differential	3.73:1	3.15:1
Planetary	5.80:1	5.8:1
Total Reduction	21.63:1	18.27:1

SUSPENSION

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

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

Maximum Strut Stroke
- Front ..... 229 mm (9.0 in)
- Rear ..... 175 mm (6.9 in)

Maximum Rear Axle Oscillation ..... ± 7.5 Degrees

WHEELS AND TYRES

Wheel Rim Width ..... 17 in
Tyres (Front & Rear)
- Standard ..... 24.00 R 35** Radial
- Optional ..... 24.00-49 (48 PR) E-3

Inflation Pressures (Front & Rear) ..... 6 bar (87 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.

BRAKES

Service

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

Front Brake Circuit Pressure ..... 110 bar (2300 lbf/in²)
Rear Brake Circuit Pressure ..... 52 bar (750 lbf/in²)
Accumulators:
- Nitrogen Precharge Pressure ..... 55 bar (800 lbf/in²)

Front:
- Type ..... Dry Disc with 1 calliper per wheel
- Disc Diameter ..... 710 mm (38 in)
- Pad Area, Total ..... 2788 cm² (320 in²)

Rear:
- Type ..... Oil cooled, multiple friction discs, completely sealed from dirt and water.
- Braking Surface, Total ..... 67390cm² (13573 in²)

Parking

Application of rear brakes by springs in brake disc pack. Hydraulically released.
Hold-off Pressure ..... 83 bar (1200 lbf/in²)

Retardation

Modulated lever control of rear disc pack.
Retarder Actuation Pressure ..... up to 33 bar (480 lbf/in²)

Emergency

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

Brakes conform to ISO 3450, SAE J1473 OCT 90.

STEERING SYSTEM

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

Accumulator provides uniform steering regardless of engine speed. In the event of loss of engine power it provides steering of approximately two lock-to-lock turns. A low pressure indicator light warns of system pressure below 83 bar (1200 lbf/in²). Steering meets SAE J53.

System Pressure ..... 159 bar (2300 lbf/in²)
Relief Pressure ..... 207bar (3000 lbf/in²)
Steering Cylinders ..... Double Acting, Single Stage
Accumulator:
- Oil Capacity ..... 16.4 l (4.33 US gal)
- Nitrogen Precharge Pressure ..... 55 bar (800 lbf/in²)

Steering Angle (Left and Right) ..... 42°
Pump:
- Type ..... Piston
- Capacity at 2100 rev/min ..... 1.575 l/s (25 US gal/min)

BODY HYDRAULICS

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

System Relief Pressure ..... 190 bar (2750 lbf/in²)
Pump:
- Type ..... Gear
- Capacity at 2 100 rev/min ..... 6.1 l/s (97 US gal/min)

Control Valve ..... Servo Controlled, Open Centre
Servo System Pressure ..... 35 bar (508 lbf/in²)
Servo Relief Pressure ..... 40 bar (580 lbf/in²)
Body Raise Time ..... 16.3 Seconds
Body Lower Time ..... 18 Seconds

ELECTRICAL

Type ..... 24 V, Negative Ground
Battery ..... Four, 12 V, 210 Ah each, Maintenance Free
Accessories ..... 24 V
Alternator ..... 70 Amp
Starter ..... Two, 9 kW

BODY

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

Body wear surfaces are high hardness (360-440 BHN) abrasion resistant steel. Yield strength of plates 1000 MPa (145000 lbf/in²).

Plate Thicknesses:

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

ROPS Cabguard SAE J1040 Feb 86. ISO 3471

Volumes:

Struck (SAE)	41.6 m³ (54.4 yd³)
Heaped 3:1	51.2 m³ (67.0 yd³)
Heaped 2:1 (SAE)	55.5 m³ (72.6 yd³)

TYPICAL NOISE LEVELS

OPERATOR EAR (ISO 6394) ..... 83 dbA

*EXTERIOR SOUND RATING
(ISO 6395) ..... 93 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 unit 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.

SERVICE CAPACITIES

Engine Crankcase and Filters	108 litres (28.5 US gal)
Transmission and Filters	100 litres (26 US gal)
Cooling System	304 litres (80.3 US gal)
Fuel Tank	1275 litres (337 US gal)
Steering Hydraulic Tank	61 litres (16.1 US gal)
Steering System	72 litres (19 US gal)
Body and Brake Cooling Tank	297 litres (78.5 US gal)
Body and Brake Cooling System	564 litres (149 US gal)
Planetaries (Total)	57 litres (15.1 US gal)
Differential	61 litres (16.1 US gal)
Front Ride Strut (Each)	27 litres (7.1 US gal)
Rear Ride Strut (Each)	18 litres (4.8 US gal)
Power Takeoff	1.5 litres (0.4 US gal)

VEHICLE WEIGHTS (MASS)		
	kg	lb
Chassis, with hoists	53240	117380
Body, standard	15380	33900
Net Weight	68620	151280
PAYLOAD, maximum	**90720**	**200000**
Maximum Gross Weight*	159340	351280
FOR UNIT EQUIPPED WITH OPTIONAL BODY LINER PLATES:		
Chassis, with hoists	53240	117380
Body, with wear plates	20910	46100
Net Weight	74150	163480
PAYLOAD, maximum	**85190**	**187800**
Maximum Gross Weight*	159340	351280
* Maximum permissible gross vehicle weight with options, attachments, full fuel tank and payload.		
WEIGHT DISTRIBUTION	Front Axle	Rear Axle
Empty %	49	51
Loaded %	34	66

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Welding

⚠ WARNINGS
Before any welding is done on a machine equipped with any electronic systems, disconnect the following (if applicable) in this order: Battery earth cable, battery supply cable, alternator earth cables, alternator supply cables and electrical connections at the engine ECM, transmission ECU, body control lever, hydraulics ECU and cab bulkhead to avoid damage to electrical components. Turn off battery master switch to isolate the batteries before disconnecting any components.
After welding connect all of the above in the reverse order.

⚠
Before any welding is done ensure all paint has been removed from the area to be welded. Failure to do so may result in hazardous fumes being given off from the paint.

Note: Always fasten the welding machines ground cable to the piece/frame being welded if possible.

Electric arc welding is recommended for all welded frame repairs. Since the nature and extent of damage to the frame cannot be predetermined, no definite repair procedure can be established. As a general rule however, if parts are twisted, bent or pulled apart, or a frame is bent or out of alignment, no welding should be done until the parts are straightened or realigned.

Successfully welded repairs will depend to a great extent upon the use of the proper equipment, materials and the ability of the welder. The Customer Support Department can be consulted regarding the feasibility of welding repairs.

⚠ WARNING
Welding and flame cutting cadmium plated metals produce odourless fumes which are toxic. Recommended industrial hygiene practice for protection of the welding operator from the cadmium fumes and metallic oxides requires enclosure ventilation specifically designed for the welding process. A respiratory protective device such as the M.S.A. 'Gasfoe' respirator with G.M.A. cartridge will provide protection against cadmium, fumes and metallic oxides. The 'Gasfoe' respirator has been approved by the U.S. Bureau of Mines: Approval number 23B-10, and is designed to protect against gases, vapours, and/or metal fumes.

Note: The current from the welding rod always follows the path of least resistance. If, for example, the ground clamp is attached to the rear frame when welding is performed on the front frame, the current must pass a frame connection to return to the welding machine. Since the pivot coupling offers the least resistance but not a sound electrical connection, small electric arcs may be set up across the moving parts which may cause welding blotches on their wearing surfaces and increase the wear rate of these components.

General Welding Procedure

The following general procedure should be used for the repair of defects outwith the vicinity of alloy steel castings.

1. Completely ARC-AIR gouge or grind out the crack until sound metal is reached. If ARC-AIR method is employed, pre-heat area to 100° C (212° F), measure 3 - 4" either side of repair prior to gouging. On completion of gouging grind to remove thin carbon layer.

2. Apply dye-penetrant check to ensure crack has been completely removed.

3. Pre-heat area to 100° C (212° F), measured 3 - 4" either side of repair. Avoid local overheating.

4. Weld completely using E-7016 electrodes. Care must be taken to ensure electrodes are protected from moisture pick-ups at all times.

5. Allow repair weld to cool slowly.

6. Grind and blend repair to original contour. Paint heat damaged areas.

The following general procedure should be used for the repair of defects in alloy steel castings and in the welds joining steel castings.

1. Completely ARC-AIR gouge or grind out the crack until sound metal is reached. If ARC-AIR method is employed, pre-heat area to 200° C (392° F), measure 3 - 4" either side of repair prior to gouging. On completion of gouging grind to remove thin carbon layer.

2. Apply dye-penetrant check to ensure crack has been completely removed.

3. Pre-heat area to 200° C (392° F), measured 3 - 4" either side of repair. Avoid local overheating.

4. Weld completely using E-7016 electrodes. Care must be taken to ensure electrodes are protected from moisture pick-ups at all times.

5. On completion of welding, post-heat repair area to 400° C (752° F), measure 3 - 4" either side of repair.

6. If welding has to be interrupted for any reason, e.g. overnight, post-heat immediately as in Step 5.

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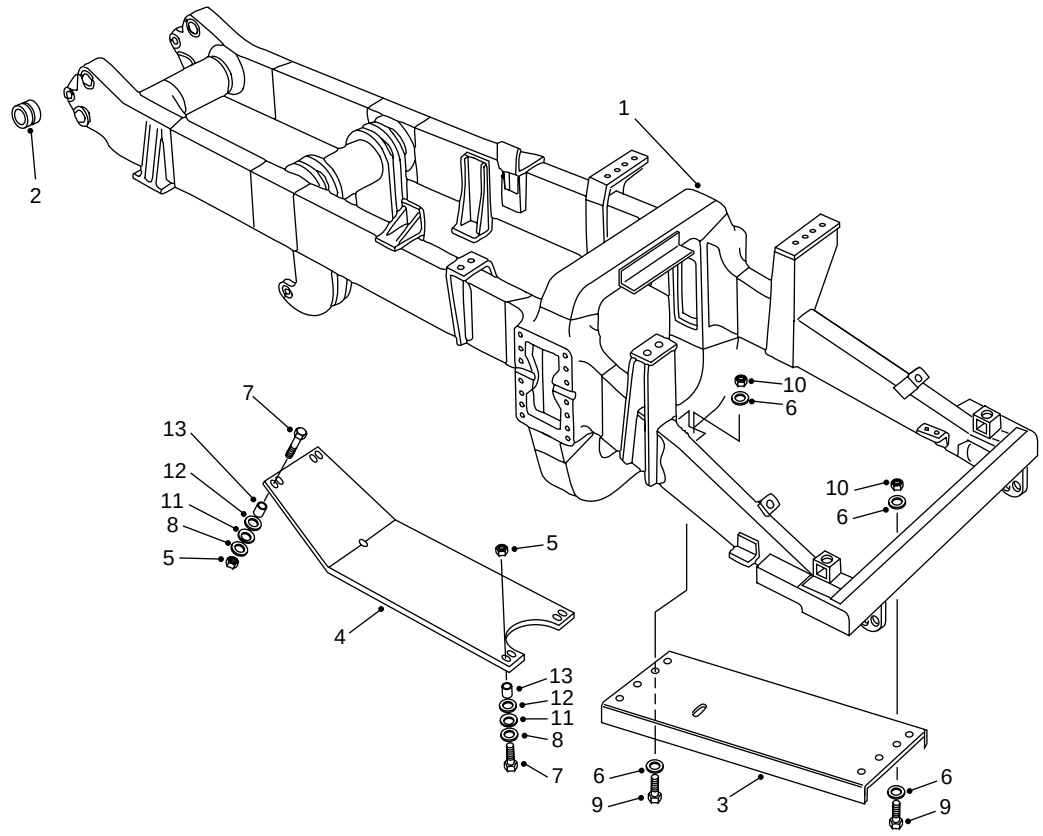


1 - Frame Assembly
2 - Bushing
3 - Engine Guard
4 - Transmission Guard
5 - Nut
6 - Hardened Washer
7 - Bolt
8 - Hardened Washer
9 - Bolt
10 - Nut
11 - Spring Disc
12 - Hardened Washer
13 - Hardened Spacer

Fig. 1 - Exploded View of Chassis and Guards

REMOVAL

⚠ WARNING
To prevent personal injury and property damage, be sure wheel chocks, blocking materials and lifting equipment are properly secured and of adequate capacity to do the job safely.

To remove any of the components shown in Figs. 1 through 6 (or similar components) the following procedures should be carried out.

1. Position the vehicle in a level work area, apply the parking brake and switch off the engine.

2. Turn steering wheel several times to relieve pressure in the steering circuit. Block all road wheels.

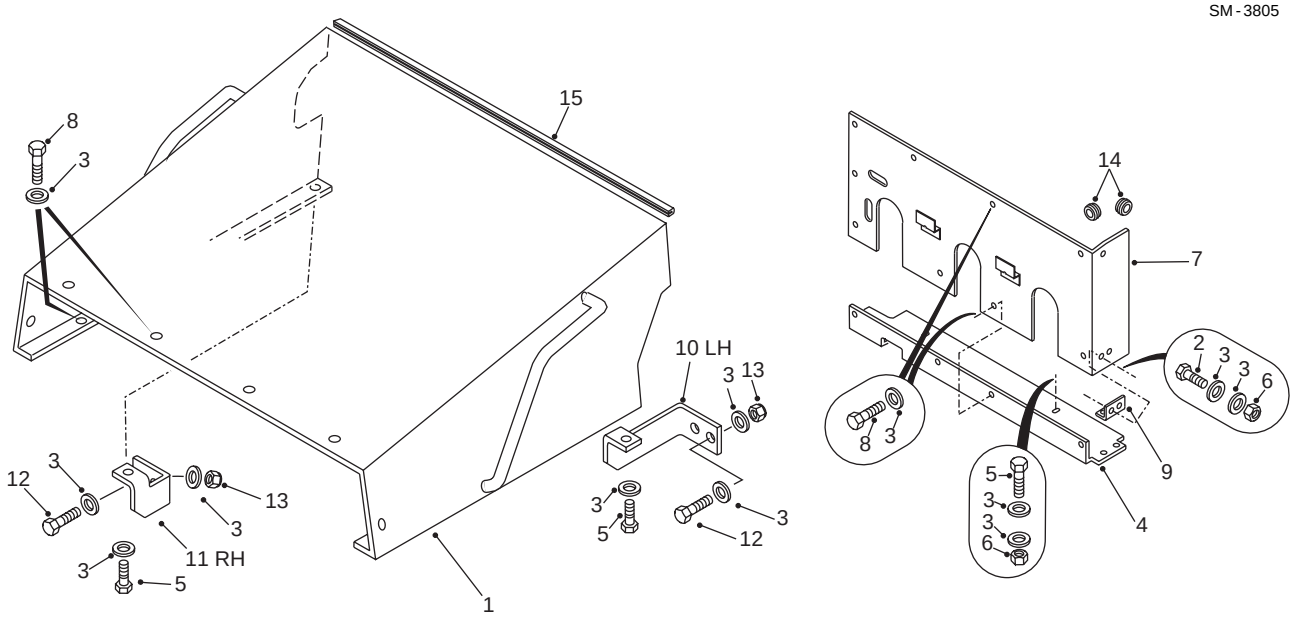
3. Attach a suitable lifting device to the component and remove mounting hardware. Remove the component from the vehicle.

INSTALLATION

Note: Tighten all fasteners to standard torques listed in Section 300-0080, STANDARD BOLT AND NUT TORQUE SPECIFICATIONS.

⚠ WARNING
To prevent personal injury and property damage, be sure wheel chocks, blocking materials and lifting equipment are properly secured and of adequate capacity to do the job safely.

Using a suitable lifting device, align the component to be installed in position on the chassis. Secure the component securely to the chassis with mounting hardware removed during removal.



1 - Hood Assembly
2 - Bolt
3 - Hardened Washer
4 - Base Plate
5 - Bolt
6 - Nut
7 - Baffle Plate Assembly
8 - Bolt
9 - Bracket
10 - Bracket - LH
11 - Bracket - RH
12 - Bolt
13 - Locknut
14 - Grommet
15 - Beading

Fig. 2 - Exploded View of Hood and Mounting

MAINTENANCE

Inspection

Inspect the frame and attached parts at intervals not exceeding 250 hours for cracked or broken welds and bending/twisting of the frame. Any defects found should be repaired before they progress into major failures. Contact your dealer for recommended weld and repair instructions.

Welding

Note: It is important that the electrical connections are disconnected in the following order to prevent damage to the electrical components:

a. Disconnect battery equalizer ground cables.
b. Disconnect battery cables from terminal posts (ground cable first).
c. Disconnect battery equalizer positive cables.
d. Disconnect electrical connections at the ECU.

After welding, reconnect all of the above in the reverse order.

Electric arc welding is recommended for all chassis welding. Since the nature and extent of damage to the frame cannot be predetermined, no definite repair procedure can be established. As a general rule however, if parts are twisted, bent or pulled apart, or a frame is bent or twisted, no welding should be done until the parts are straightened or realigned.

Successfully welded repairs will depend to a great extent upon the use of the proper equipment, materials and the ability of the welder. The Service Department can be consulted regarding the feasibility of welding repairs.

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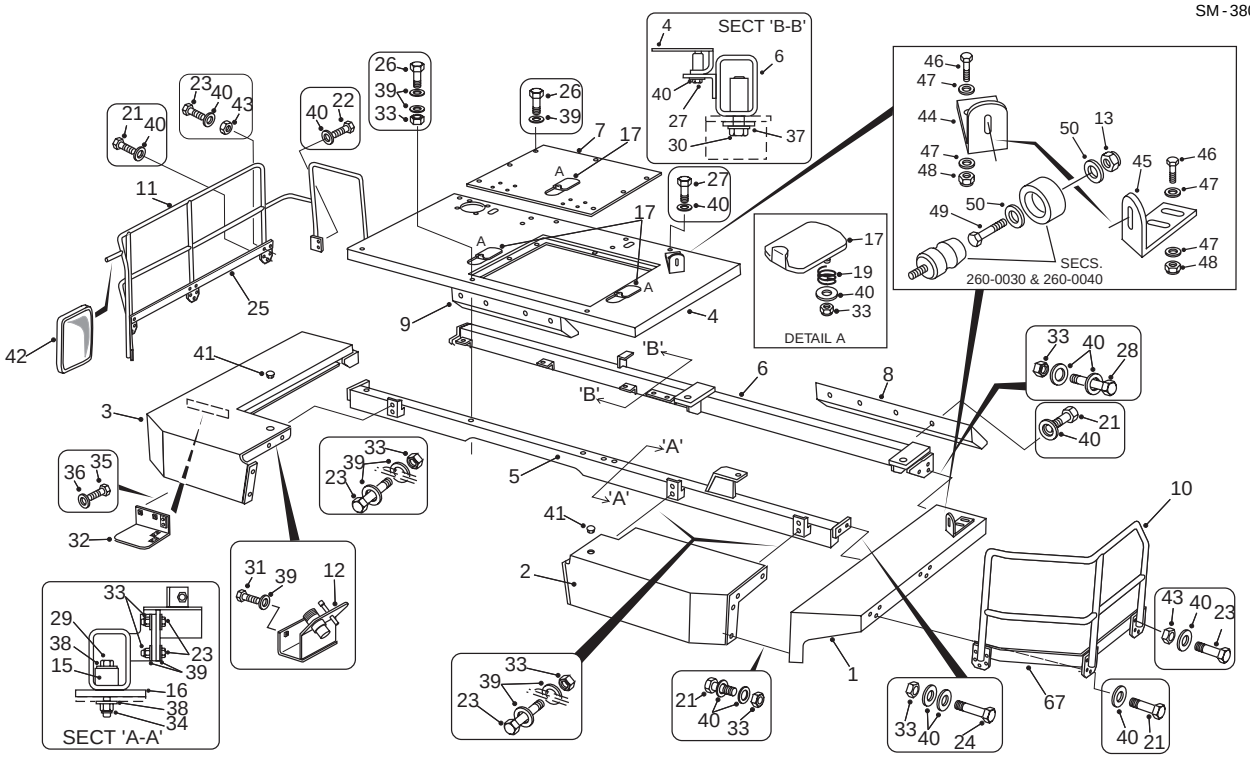
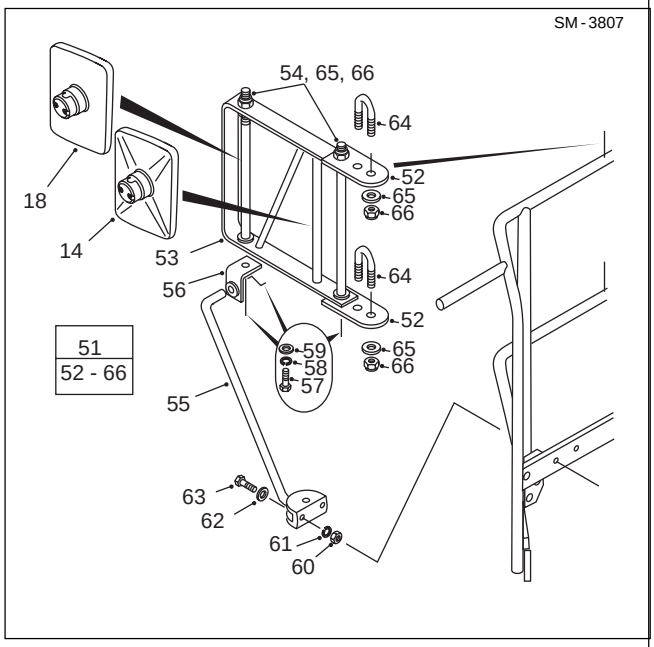
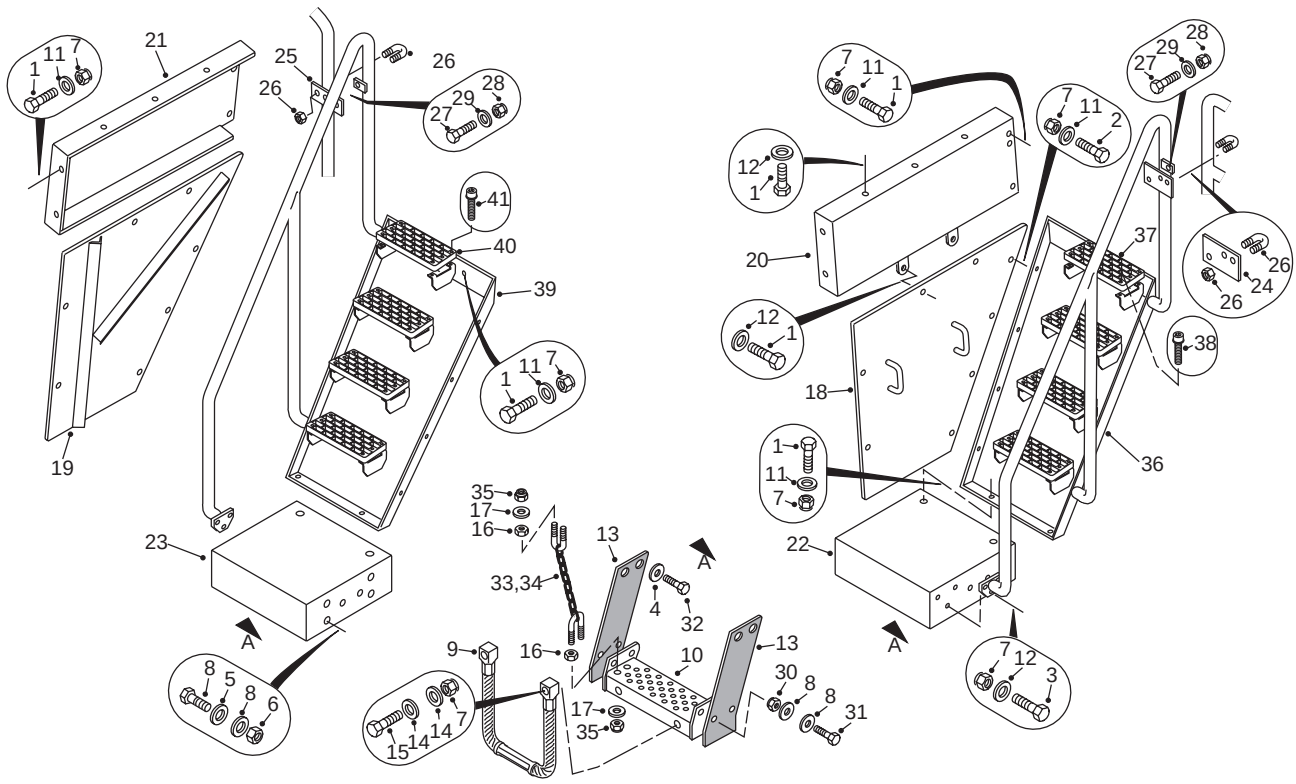




1 - Fender Extension
2 - Fender Assembly - LH
3 - Fender Assembly - RH
4 - Platform Assembly - RH
5 - Front Crossmember
6 - Rear Crossmember
7 - Cover Plate
8 - Mudguard
9 - Mudguard
10 - Handrail - LH
11 - Handrail - RH
12 - Plate Assembly
13 - Locknut
14 - Mirror
15 - Spring
16 - Spacer
17 - Cover Plate Assy
18 - Mirror
19 - Spring
20 - Hardened Washer
21 - Bolt
22 - Bolt
23 - Bolt
24 - Bolt
25 - Kick Plate RHS
26 - Bolt
27 - Bolt
28 - Bolt
29 - Bolt
30 - Bolt
31 - Bolt
32 - Plate Cover
33 - Locknut
34 - Nut
35 - Bolt
36 - Lockwasher
37 - Hardened Washer
38 - Hardened Washer
39 - Hardened Washer
40 - Hardened Washer
41 - Plug
42 - Wide Angle Mirror
43 - Nut
44 - Bent Plate
45 - Bolt
46 - Nut
47 - Hardened Washer
48 - Locknut
49 - Bolt
50 - Washer
51 - Mirror Attachment Assy
52 - Plate
53 - Mirror Arm Assy
54 - Mirror
55 - Rod Assy
56 - Bracket Assy
57 - Bolt
58 - Lockwasher
59 - Washer
60 - Nut
61 - Lockwasher
62 - Washer
63 - Bolt
64 - U-Bolt
65 - Nut
66 - Locknut
67 - Kick Plate LHS

Fig. 3 - Exploded View of Fenders and Mounting



1 - Bolt
2 - Bolt
3 - Bolt
4 - Washer
5 - Bolt
6 - Nut
7 - Locknut
8 - Hardened Washer
9 - Step Assembly
10 - Rung
11 - Hardened Washer
12 - Hardened Washer
13 - Rubber Strip
14 - Hardened Washer
15 - Bolt
16 - Nut
17 - Washer
18 - Hoodside - LH
19 - Hoodside - RH
20 - Panel Assembly - LH
21 - Panel Assembly - RH
22 - Bumper Extension - LH
23 - Bumper Assembly - RH
24 - Bracket
25 - Bracket
26 - 'U' Bolt & Nut
27 - Bolt
28 - Nut
29 - Hardened Washer
30 - Nut
31 - Bolt
32 - Bolt
33 - Chain Assembly
34 - 'U' Bolt
35 - Locknut
36 - Step Assembly LH
37 - Step
38 - Capscrew
39 - Step Assembly LH
40 - Step
41 - Capscrew

Fig. 4 - Exploded View of Ladders and Handrails

Painting

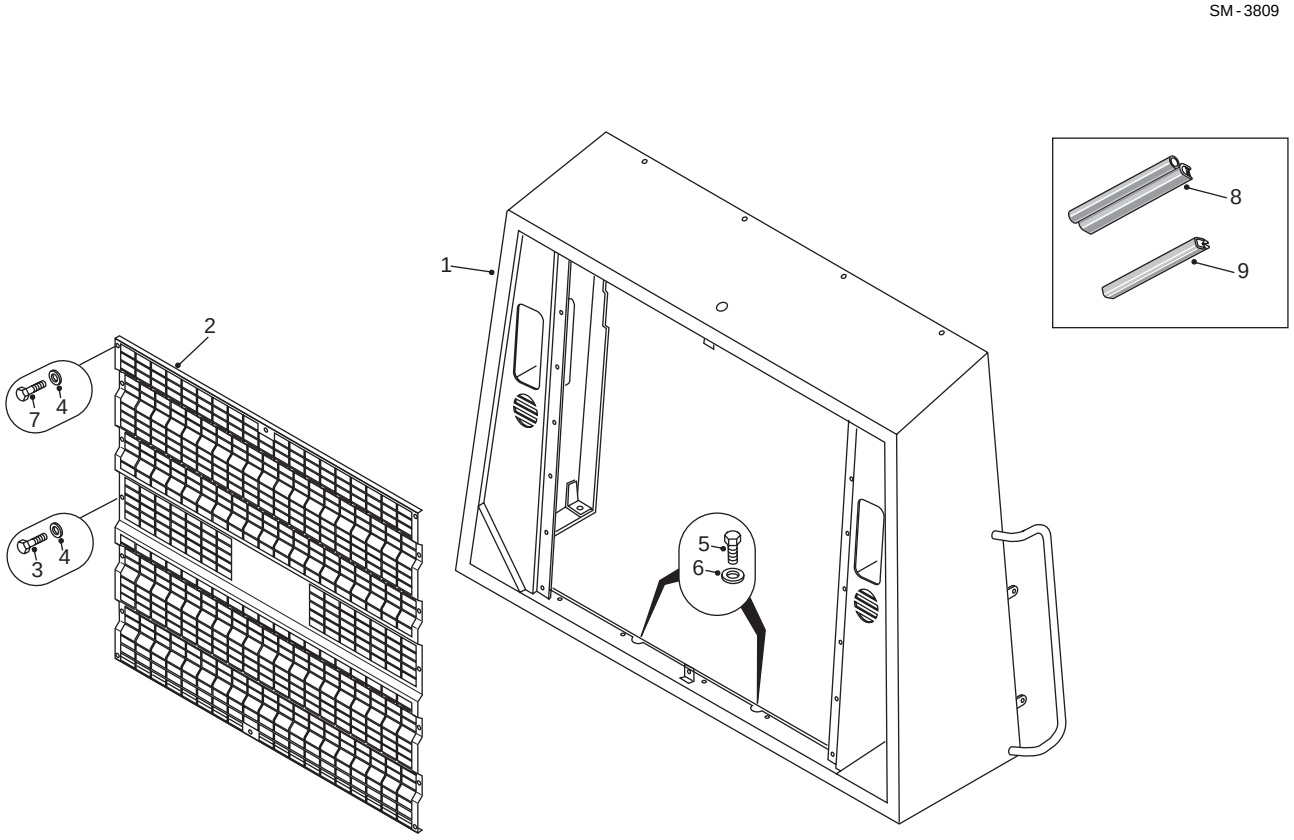
A check of the condition of the paint should be made approximately twice a year and chassis repainted if necessary.

If painting of the actual frame of the unit is required, thoroughly clean the areas to be painted. Apply a primer coat of red oxide and then a finish coat of polyurethane enamel.

To keep rust and corrosion to a minimum, periodic painting of abrasions and other exposed metal areas on the frame is highly recommended.

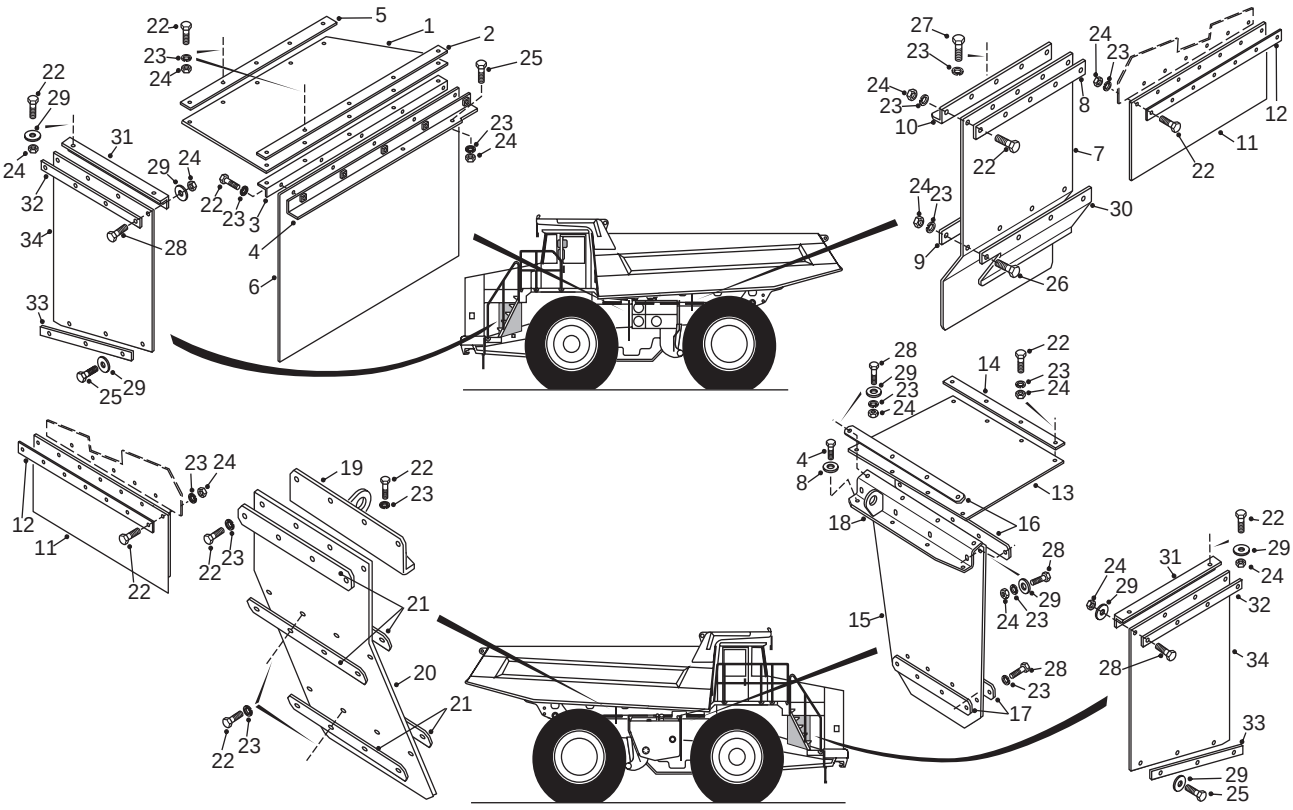
SPECIAL TOOLS

There are no special tools required for procedures outlined in this section. Refer to Section 300-0070, SERVICE TOOLS for part numbers of general service tools required. These tools are available from your dealer.



1 - Radiator Guard
2 - Grille - Bottom
3 - Bolt
4 - Hardened Washer
5 - Bolt
6 -Hardened Washer
7 - Bolt
8 - Excluder
9 - Beading

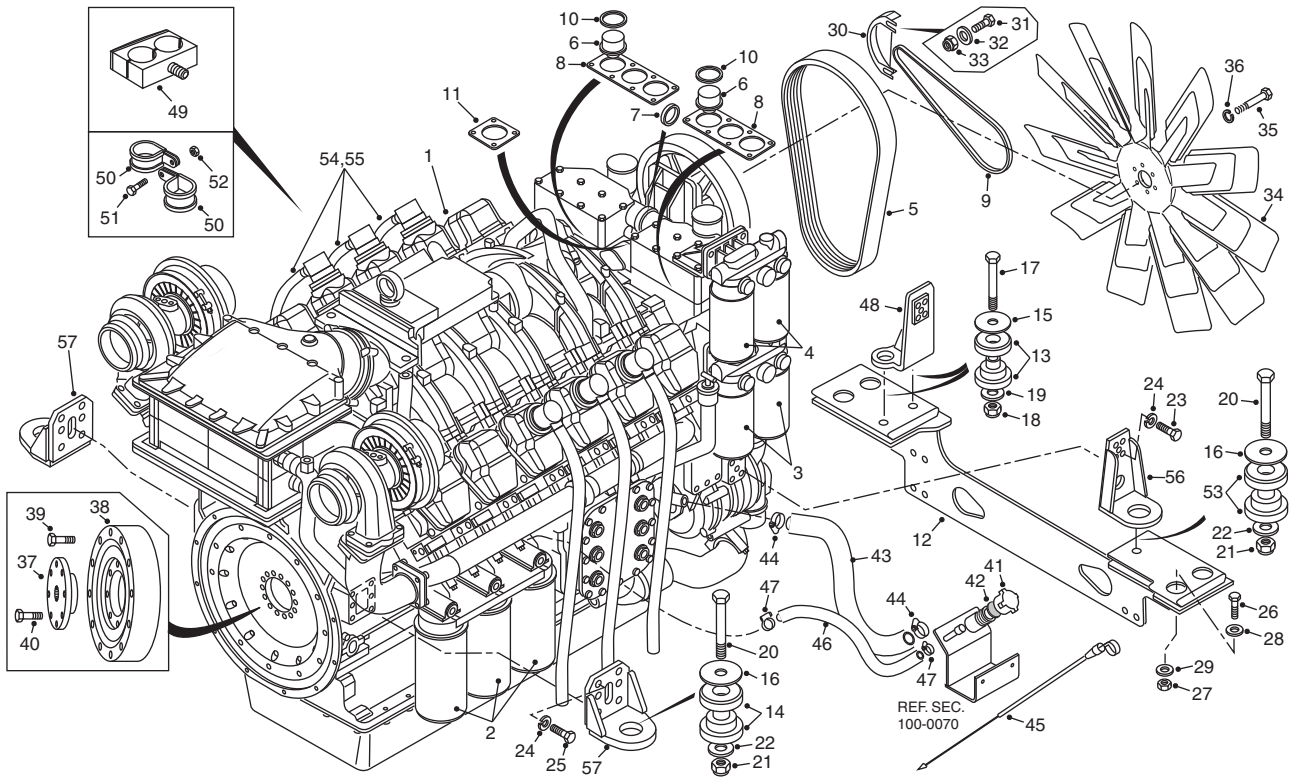
Fig. 5 - Exploded View of Radiator Guard and Mounting



1 - Mudflap LH
2 - Clamping Plate
3 - Bracket LH
4 - Support Angle Assy
5 - Clamping Plate
6 - Mudflap RH
7 - Mudflap LH Rear
8 - Backing Plate
9 - Backing Plate
10 - Angle Support
11 - Mudflap
12 - Backing Plate
13 - Mudflap - RH Front Upper
14 - Clamping Plate
15 - Mudflap - RH Front Lower
16 - Clamp Plate
17 - Clamp Plate
18 - Front Mud Bracket Assy
19 - Bracket Assy
20 - Mudflap RH Rear
21 - Backing Plate
22 - Bolt
23 - Lockwasher
24 - Nut
25 - Bolt
26 - Bolt
27 - Bolt
28 - Bolt
29 - Hardened Washer
30 - Bent Plate
31 - Angle
32 - Plate
33 - Plate
34 - Mudflap Engine Bay

Fig. 6 - Mudguards

* * * *



1 - Engine
2 - Lube Oil Filter
3 - Primary Fuel Filter
4 - Secondary Fuel Filter
5 - Fan Belt
6 - Thermostat
7 - Thermostat Seal
8 - Gasket
9 - Belt
10 - Seal Ring
11 - Gasket
12 - Crossmember
13 - Isolation Mount
14 - Isolation Mount
15 - Snubbing Washer
16 - Snubbing Washer
17 - Bolt
18 - Locknut
19 - Hardened Washer
20 - Bolt
21 - Nut- Nylon Insert
22 - Hardened Washer
23 - Bolt
24 - Lockwasher
25 - Bolt
26 - Bolt
27 - Locknut
28 - Hardened Washer
29 - Hardened Washer
30 - Alternator Guard
31 - Bolt
32 - Hardened Washer
33 - Nut
34 - Fan Blade
35 - Bolt
36 - Lockwasher
37 - Flange Coupling
38 - Flywheel Coupling
39 - Bolt
40 - Bolt
41 - Filler Cap
42 - Gasket
43 - Hose
44 - Clamp
45 - Dipstick
46 - Dipstick Hose
47 - Clamp
48 - Front Mounting Brkt
49 - Clamp
50 - P-Clip
51 - Bolt
52 - Nut
53 - Isolation Mount
54 - Bulk Hose
55 - Clamp
56 - Front Mounting Brkt
57 - Rear Mounting Brkt

Fig. 1 - Engine and Mounting

DESCRIPTION

Numbers in parentheses refer to Fig. 1.

For engine make, model and specification, refer to Section 000-0000, GENERAL INFORMATION. For engine servicing and repair data refer to the engine manufacturers service manual.

The engine is mounted to the frame by mounting crossmember (12) and two mounting brackets (10 & 48) at the front of engine (1) and two rear mounts (11). Rubber isolation mounts (13 & 14) through engine mounts provide sufficient flexibility to absorb varying engine vibration and torsional loads.

There are three full-flow oil filters (2) mounted on the right hand side of engine (1) in a downward position. The filters are of the throw away, spin-on type. Oil supplied by the engine oil pump passes through oil filters (2) before reaching the various moving parts of engine (1). The oil is forced by pump pressure through a passage in the filter adaptor and into the

elements. Impurities are filtered out as the oil passes through the elements and out through another passage in the filter adaptor.

There are four spin-on type fuel filters mounted on the right hand side of engine (1), two primary fuel filters (3) and two secondary fuel filters (4). Primary fuel filters (3) are in the fuel flow and act as strainers and secondary fuel filters (4) filter the fuel after having passed through primary fuel filters (3).

DETROIT DIESEL ELECTRONIC CONTROL (DDEC)

Description

Refer to Fig. 2.

> ⚠ **WARNING**
> **Before any welding is done on a machine equipped with the DDEC IV system, disconnect the following in this order: Battery equalizer ground cable, battery earth cable, battery equalizer supply cable, battery supply cable, alternator earth cables, alternator supply cables, transmission connector, ECM interface harness connectors (30 pin RHS), ECM powerharness connectors (5 pin RHS), ECM engine to transmission datalink connectors (6 pin RHS), ECM sensor harness connectors (30 pin LHS) and ECM injector harness connectors (5 pin LHS - 2 connectors) (Note: this engine is equipped with 2 ECMs). Turn off ignition key switch to isolate the batteries before disconnecting any components.**
>
> **After welding connect all of the above in the reverse order.**

The engine is equipped with DDEC IV which which continually monitors the engine and warns the operator when a problem develops. The DDEC IV 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.

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.

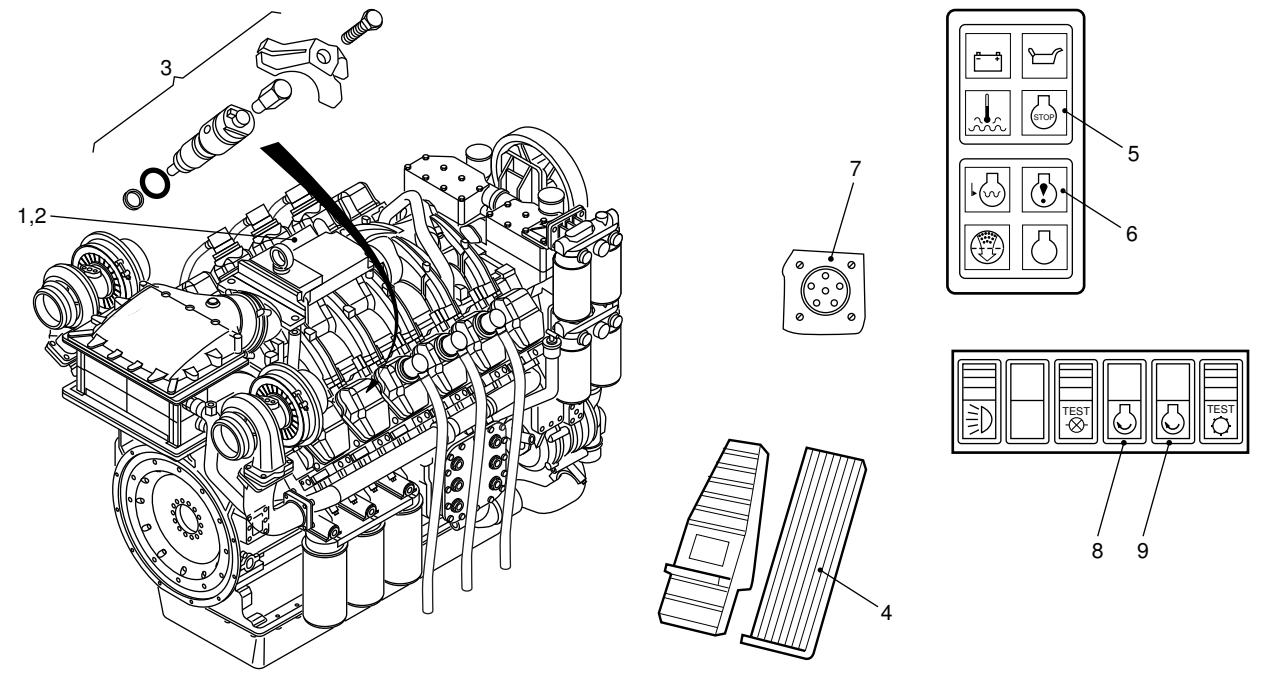
Note: Never apply 12 V directly to terminals on the injector or engine sensors as they will burn out. Before removing injectors, the fuel passages must be blown out to prevent fuel flow from entering the cylinder head.

4. 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.

5. Stop Engine Light - 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.

6. Check Engine Light - 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.



1 - Electronic Control Module (ECM)
2 - Programmable Read Only Memory (PROM)
3 - Electronic Unit Injectors (EUI)
4 - Electronic Foot Pedal
5 - Stop Engine Light
6 - Check Engine Light
7 - Diagnostic Test Point
8 - Master ECM Diagnostic Request/Stop Engine Override Switch
9 - Receiver ECM Diagnostic Request Switch

Fig. 2 - DDEC IV Components

7. Diagnostic Test Point - Plug in connector for diagnostic data reader (DDR).

8. Master ECM 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

9. Receiver ECM Diagnostic Request 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.

Operation

Numbers in parentheses refer to Fig. 2.

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 (1) 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 ECM (1). 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 (8) 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 stop engine (5) and check engine (6) 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 stop engine override switch (8) at intervals of approximately 15 to 20 seconds.

Note: ECM (1) 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 check engine light (6) or stop engine light (5) 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 ECM (1) memory will remain until it is erased by a technician.

⚠ 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.

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 diagnostic request switch (8) will cause check engine light (6) or stop engine light (5) 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 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 stop engine light (5), then the inactive codes (or code 25) will be flashed on check engine light (6). 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.

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
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

DDEC IV DIAGNOSTIC CODES

DDEC Code # (Flashed)	PID	SID	FMI	DDEC Description
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
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
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

DDEC IV DIAGNOSTIC CODES

DDEC Code # (Flashed)	PID	SID	FMI	DDEC Description
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
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
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

DDEC IV DIAGNOSTIC CODES

DDEC Code # (Flashed)	PID	SID	FMI	DDEC Description
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
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