VERSATILE

Service Manual

FORD
NEW HOLLAND

Tractor
1156

Engine Systems
Fuel System
Electrical System
Clutch
Transmission & Brake System

Vol. 1

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Reprinted

CONTENTS

SAFETY, OPERATION AND GENERAL INFORMATION

SAFETY PRECAUTIONS

Practically all service work involves the need to drive the tractor. The Operator's Manual, supplied with each tractor, contains detailed safety precautions relating to driving, operating and servicing. These precautions are as applicable to the service technician as they are to the operator, and should be read, understood and practiced by all personnel.

Prior to undertaking any maintenance, repair, overhaul, dismantling or re-assembly operations, whether within a workshop facility or out "in the field," consideration should be given to factors that may have an effect upon safety, not only upon the mechanic carrying out the work, but also upon bystanders.

PERSONAL CONSIDERATIONS

- Loose clothing can cause accidents. Check to see that you are suitably clothed.
- Some jobs require special protective equipment.
- **Skin Protection**
  Used motor oil may cause skin cancer. Follow work practices that minimize the amount of skin exposed and the length of time used oil stays on skin.
- **Eye Protection**
  The smallest eye injury may cause loss of vision. Injury can be avoided by wearing eye protection when engaged in chiselling, grinding, welding, and painting.
- **Breathing Protection**
  Fumes, dust and paint spray are unpleasant and harmful. These can be avoided by wearing respiratory protection.
- **Hearing Protection**
  Loud noise may damage your hearing, and the greater the exposure the worse the damage. If the noise is excessive, wear ear protection.
- **Hand Protection**
  It is advisable to use a protective cream before work to prevent irritation and skin contamination. After work clean your hands with soap and water. Solvents may harm the skin.
- **Foot Protection**
  Substantial or protective footwear with reinforced toe-caps will protect your feet from falling objects. Additionally, oil-resistant soles will help to avoid slipping.
- **Special Clothing**
  For certain work it may be necessary to wear flame or acid-resistant clothing.
- Avoid injury through incorrect handling of components. Make sure you are capable of lifting the object. If in doubt get help.

EQUIPMENT CONSIDERATIONS

- **Machine Guards**
  Before using any machine, check to be sure that the machine guards are in position and serviceable. These guards not only prevent parts of the body or clothing from coming in contact with the moving parts of the machine, but also ward off objects that might fly off the machine and cause injury.
- **Lifting Appliances**
  Be sure that lifting equipment, such as chains, slings, lifting brackets, hooks and eyes are thoroughly checked before use. If in doubt, select stronger equipment than is necessary.

  Never stand under a suspended load or a raised implement.
- **Compressed Air**
  The pressure from a compressed air line is often higher than 100 psi (6.9 bar). It is perfectly safe if used correctly. Misuse may cause injury.

Never use compressed air to blow dust, filings and dirt away from your work area unless the correct type of nozzle is fitted and eye protection is used.

Compressed air is not a cleaning agent, it will only move dust, from one place to another. Look around before using an air hose as bystanders may get grit into their eyes, ears or skin.

- **Hand Tools**
  Many cuts, abrasions and injuries are caused by defective tools. Never use the wrong tool for the job, as this generally leads either to some injury or to a poor job.

  Never use:

  — A hammer with a loose head or split handle.
  — Spanners or wrenches with splayed or worn jaws.
  — Spanners or files as hammers; or drills, clevis pins or bolts as punches.

For removing or replacing hardened pins use a copper or brass drift rather than a hammer alone.

For dismantling, overhaul and assembly of major and sub components, always use the Special Service Tools recommended. They will reduce the work effort, labor time and the repair cost.

Always keep tools clean and in good working order.

- **Electricity**
  Electricity has become so familiar in day to day usage, that its potentially dangerous properties are often overlooked. Misuse of electrical equipment can endanger life.

  Before using any electrical equipment — particulary portable appliances — make a visual check to make sure that the cable is not worn or frayed and that the plugs and sockets are intact. Make sure you know where the nearest isolating switch for your equipment is located.

GENERAL CONSIDERATIONS

- **Solvents**
  Use only cleaning fluids and solvents that are known to be safe. Certain types of fluids can cause damage to components, such as seals, and can cause skin irritation. Solvents should be checked that they are suitable not only for the cleaning of components and individual parts, but also that they do not affect the personal safety of the user.

- **Housekeeping**
  Many injuries result from slipping or tripping on, objects or material left lying around by a careless worker. Prevent these accidents from occurring. If you notice a hazard, don't ignore it — remove it.

  A clean, hazard-free place of work improves the surroundings and daily environment for everybody.

- **Fire**
  Fire has no respect for persons or property. The destruction that a fire can cause is not always fully realized. Everyone must be constantly on guard.

  — Extinguish matches, cigars, and cigarettes, before throwing them away.
  — Work cleanly, disposing of waste material into proper containers.
  — Locate the fire extinguishers and find out how to operate them.
  — Do not panic — warn those near and raise the alarm.
  — Do not allow or use an open flame near the fuel tank, battery or component parts.

- **First Aid**
  In the type of work that mechanics are engaged in, dirt, grease, and fine dusts settle upon the skin and clothing. If a cut, abrasion or burn is disregarded, it may be found that a septic condition has formed within a short time. What appears at first to be trivial could become painful and injurious. It only takes a few minutes to have a fresh cut dressed, but it will take longer if you neglect it. Make sure you know where the First Aid box is located.

- **Cleanliness**
  Cleanliness of the fuel and hydraulic system is essential for optimum performance. When carrying out service and repairs, plug all hose ends and component connections to prevent dirt entry.

  Clean the exterior of all components before carrying out any form of repair. Dirt and abrasive dust can reduce the efficiency and working life of a component and lead to costly replacement. Use of a high pressure washer or steam cleaner is recommended.

OPERATIONAL CONSIDERATIONS

- Transport the tractor safely using a strong chain, cable or tow bar attached securely to the front frame or drawbar of tractor. Do not tow faster than 15 mph (25 km/h).

  Use a trailer of at least 25 ton (22,680 kg) capacity to haul the tractor.

  Chain the tractor securely to the trailer, chock the wheels, set the parkbrake and engage the articulation lock to limit the tractor movement.

- Park the tractor on a clear, level area. Stop the engine, if at all possible, before performing any service. Center the steering, put all controls in neutral, set the parkbrake, shut down the engine and remove the key. Engage the articulation lock and chock the wheels.

- Place a warning sign on tractors which, due to service or overhaul, would be dangerous to start. Disconnect the battery leads if leaving such a unit unattended. Always disconnect the ground lead first. When reconnecting, connect the ground lead last.

- Do not attempt to start the engine while standing beside the tractor or attempt to bypass the neutral start switch.

- Avoid prolonged running of the engine in a closed building or in an area with inadequate ventilation as exhaust fumes are highly toxic.

- Always turn the radiator cap to the first stop to allow pressure in the system to dissipate when the coolant is hot.

- If possible take the unit to an area which has a hard working surface, preferably concrete.

- If it is necessary to raise the tractor for ease of servicing or repair, make sure that safe and stable supports are installed beneath the axle housings, casings, etc., before commencing work.

- Before loosening any hydraulic hose, lower the attachment to the ground, switch off the engine and relieve all hydraulic pressure by operating the control lever several times. This will remove the danger of personal injury from oil pressure or accidently dropping the attachment.

- Prior to pressure testing, make sure all hoses and connections on the tractor and the test equipment are in good condition and tightly sealed. Pressure readings must be taken with gauges specified. The correct procedure should be rigidly observed to prevent damage to the system or the equipment, and to eliminate the possibility of personal injury.

WARNING: ESCAPING FLUID OF ANY KIND UNDER PRESSURE CAN PENETRATE THE SKIN CAUSING SERIOUS INJURY.

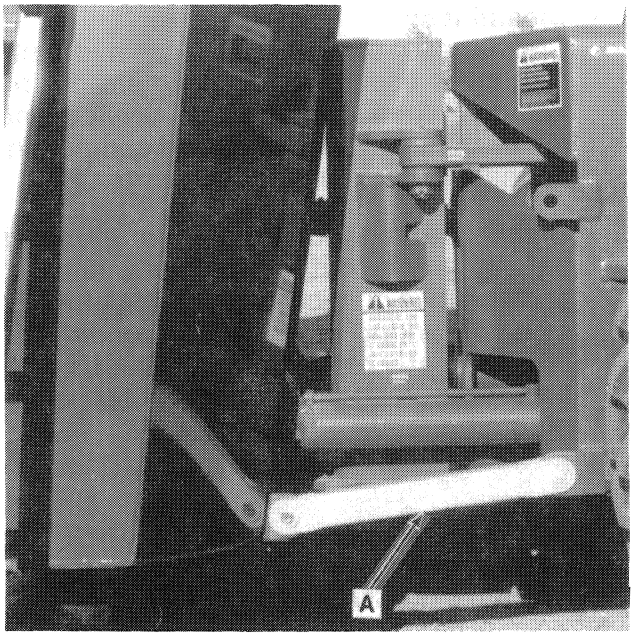
- **DO NOT USE YOUR HAND TO CHECK FOR LEAKS. USE A PIECE OF CARDBOARD OR PAPER TO SEARCH FOR LEAKS.**

- **STOP THE ENGINE AND RELIEVE PRESSURE BEFORE CONNECTING OR DISCONNECTING LINES.**

- **TIGHTEN ALL CONNECTIONS BEFORE STARTING THE ENGINE OR PRESSURIZING THE LINES.**

- **IF ANY FLUID IS INJECTED INTO THE SKIN, OBTAIN MEDICAL ATTENTION IMMEDIATELY OR GANGRENE MAY RESULT.**

Articulation Lock **Figure 1**
A Lock bar in stored position



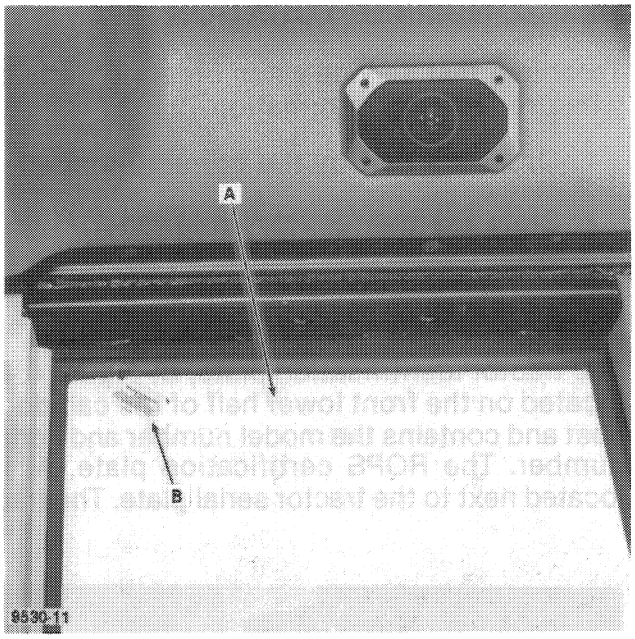
Articulation Lock **Figure 2**
A Lock bar in locked position

- When inflating tires to the recommended pressure for seating beads use a remote chuck and keep hand away from the tire.

- When inflating tires beware of over inflation — constantly check the pressure. Over inflation can cause tires to burst and result in personal injury.

- Use the articulation lock, A, Figures 1 and 2, during stationary applications, servicing, jacking or overhaul operations. Before engaging the lock, drive the tractor to a level surface, put the steering straight, engage the parkbrake, put the gearshift in neutral and stop the engine. Remove the pin securing the lock bar in the storage position on the rear frame. Lower the bar into the lock position on the rear of the front frame and secure with the pin. It may be necessary to start the engine and articulate the frame slightly to be sure the lockpin is engaged.

  When disengaging the lock bar, secure it in the storage position with the pin.



Emergency Exit **Figure 3**
A Side window
B Pull cord

CAUTION: DO NOT ALLOW PERSONNEL TO ENTER THE ARTICULATION AREA WITH THE ENGINE RUNNING, UNLESS THE ARTICULATION LOCK AND THE PARKBRAKE ARE ENGAGED.

DO NOT INSERT FINGERS THROUGH HOLES WHILE INSTALLING THE ARTICULATION LOCK.

- The cab has two exits which may be used in an emergency, the door and the side window.

  Open the side window, A, Figure 3, by completely pulling the cord, B, from the side window moulding and pushing the window from the frame. Start pushing the window in an upper corner and work around the edges until the window comes free.

Safety precautions are very seldom the figment of someone's imagination. They are the result of sad experience, where most likely someone has paid dearly through personal injury.

Heed these precautions and you will protect yourself accordingly. Disregard them and you may duplicate the sad experience of others.

SERVICE SAFETY

Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all machinery as well as the personal safety of the individual doing the work. This Service Manual provides general directions for accomplishing service and repair work with tested, effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools, and parts for servicing machines, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this manual must first establish that he compromises neither his personal safety nor the integrity of the machine by his choice of methods, tools or parts.

SERVICE TECHNIQUES

Clean the exterior of all components before carrying out any form of repair. Dirt and abrasive dust can reduce the efficient working life of a component and lead to costly replacement.

Time spent on the preparation and cleanliness of the working surfaces will pay dividends in making the job easier and safer and will result in the overhauled components being more reliable and efficient in operation.

Use cleaning fluids which are known to be safe. Certain types of fluid can cause damage to O-rings and cause skin irritation. Solvents should be checked that they are suitable for the cleaning of components and also that they do not risk the personal safety of the user.

Replace O-rings, seals or gaskets whenever they are disturbed. Never mix new and old seals or O-rings, regardless of condition. Always lubricate new seals and O-rings with the same type of lubricant that is contained in the system, i.e., refrigerant lubricant for A/C fittings.

When replacing component parts use the correct tool for the job.

HOSES AND TUBES

Always replace hoses and tubes if the flare end connections are damaged.

When installing a new hose, loosely connect each end and make sure the hose takes up the designed position before tightening the connection. Clamps should be tightened sufficiently to hold the hose without crushing and to prevent chafing.

The hoses are the arteries of the unit; be sure they are in good condition when carrying out repairs or maintenance, otherwise the machine's output and productivity will be affected.

After hose replacement to a moving component, check that the hose does not foul by moving that component through the complete range of travel.

Be sure any hose which has been installed is not kinked or twisted.

Hose connections which are damaged, dented, crushed or leaking restrict oil flow and the productivity of the components being served. Connectors which show signs of movement from their original position have failed, and will ultimately separate completely.

A hose with a chafed outer cover will allow water entry. Concealed corrosion of the wire reinforcement will subsequently occur along the hose length with resultant hose failure.

Ballooning of the hose indicates an internal leakage due to structural failure. This condition rapidly deteriorates and total hose failure soon occurs.

Kinked, crushed, stretched or deformed hoses generally suffer internal structural damage which can result in oil restriction, a reduction in the speed of operation and ultimate hose failure.

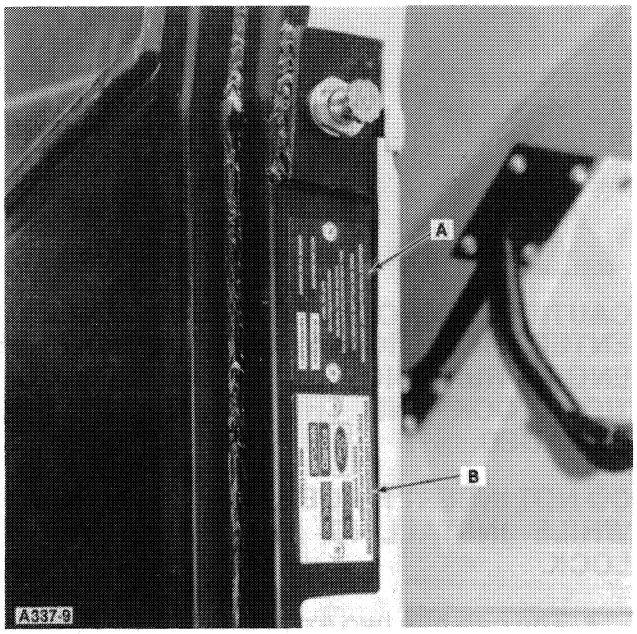
Free-moving, unsupported hoses must never be allowed to touch each other or related working surfaces. This causes chafing which reduces hose life.

SERIAL NUMBER LOCATION

To obtain fast service when ordering parts or when requesting information:

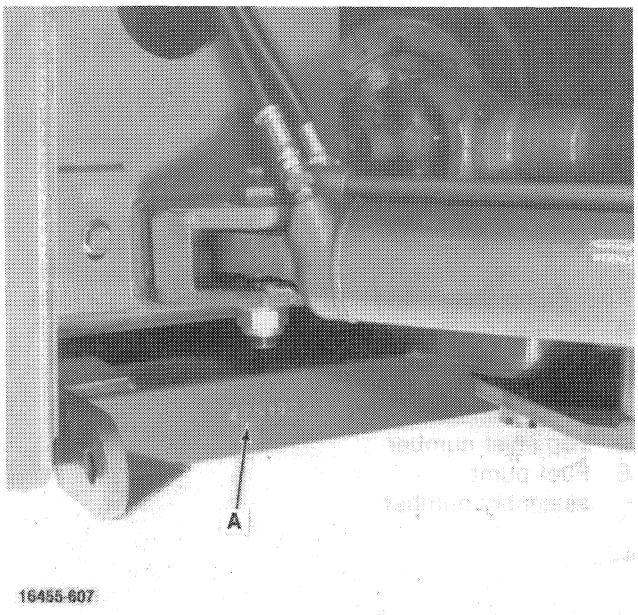
1. Order the part by the correct number.
2. State the tractor year and model.
3. Include the tractor and the engine serial numbers.

The tractor identification plate, B, Figure 4, is located on the front lower half of the cab door post and contains the model number and serial number. The ROPS certification plate, A, is located next to the tractor serial plate. The trac-



Tractor Identification **Figure 4**
A ROPS identification plate
B Tractor serial plate

tor serial number, A, Figure 5, is also stamped on the rear left corner of the front frame for quick reference.



Tractor Identification **Figure 5**
A Serial number at rear of front frame

ENGINE

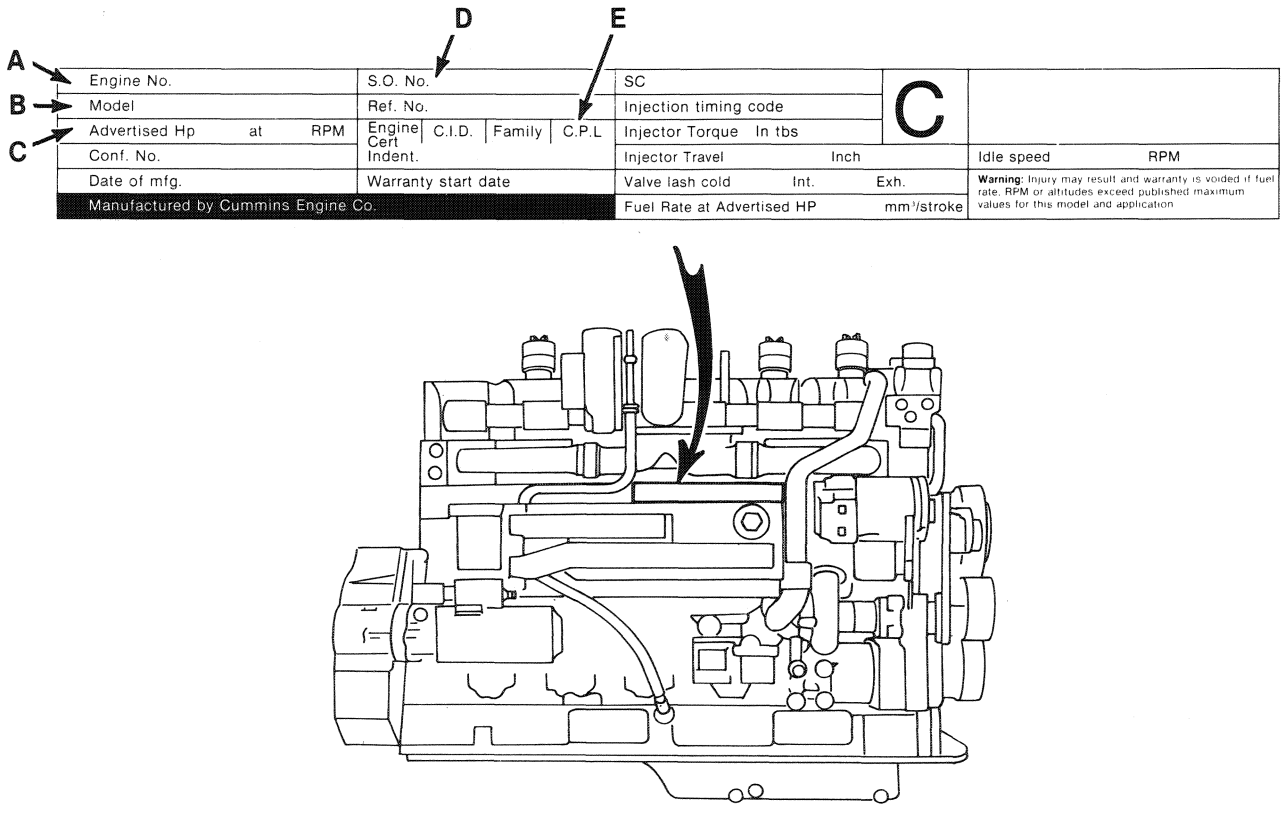
The engine serial number and data plate, Figure 6, is located on the right side of the engine block. This plate contains specific information about the engine which should be used when ordering parts and requesting service information.

The model number provides the following information:

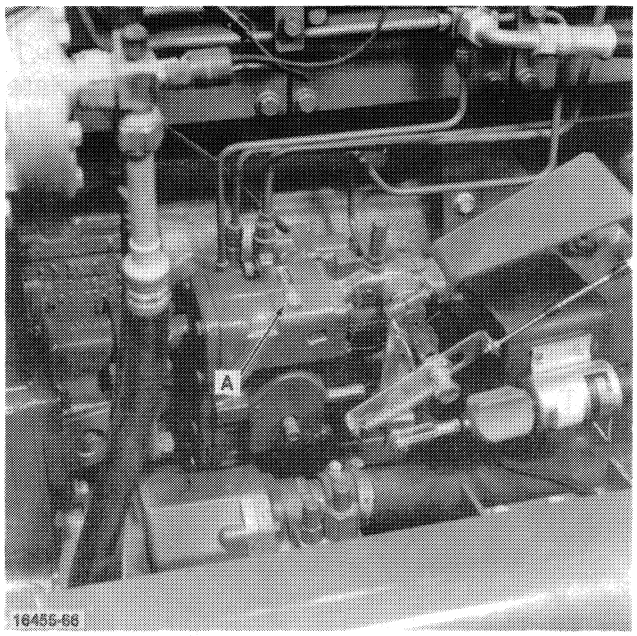
K T A 19

- 19 = Displacement in Litres
- A = Engine is Aftercooled
- T = Engine is Turbocharged
- K = Series (Family of Engines)

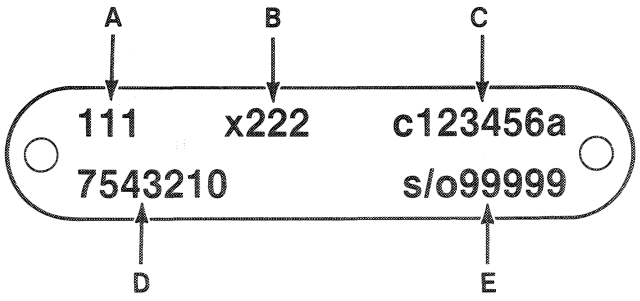
NOTE: The engine plate must not be changed unless authorized by Cummins Engine Company, Inc.



Engine Data Plate **Figure 6**
A Engine serial number
B Model designation
C Horsepower at rated rpm
D Shop order number
E Control parts list



Fuel Pump Data Plate **Figure 7**
A Plate location



Fuel Pump Data Plate **Figure 8**
A Control parts list number
B Calibration code
C Serial number
D Top level number
E Fuel pump assembly number

FUEL PUMP

The fuel pump serial number and data plate, is located on the top of the fuel pump, A, Figure 7, at the left front corner of the engine. It provides information for fuel pump calibration as shown in Figure 8.

FUEL, FLUIDS AND LUBRICANTS

Fuels

The 1156 tractor operates on No. 2 diesel fuel. It will also operate satisfactorily on other fuels within the following specifications:

- Less than one percent sulphur content.
- Sediment and water less than 0.1 percent
- Cetane number of at least 40. A higher cetane number fuel may be necessary at low temperatures or high altitudes.
- Pour point below the lowest expected temperature.
- Less than 0.02 percent ash content.
- Viscosity of 1.4 to 5.8 mm^2/s at 37.8° C (100°F).

Refer to Cummins manual for further details.

Coolant

Water: Clean and preferably soft

Antifreeze: Use a good commercial grade glycol base antifreeze in the proportions recommended by its manufacturer. Do not use oil base or alcohol base antifreeze. Foaming and jelling could result and damage the cooling system.

IMPORTANT: Do not use calcium chloride solution. It is harmful to the cooling system.

Check the engine coolant level daily and keep it within 2 in. (50 mm) of the surge tank filler neck. When adding coolant due to leakage, use the following mixture.

One unit of DCA to one gallon US (3.75 L) water. Mix this solution at a 1:1 ratio with the proper antifreeze-water mixture.

Battery Fluid

Check the battery charge every 90 days with a battery load tester. Recharge the batteries as required. See Electrical System, Section 3.

Lubricants

CD (Commercial grade) oil is used in turbocharged diesel engines. It provides protection from bearing corrosion, engine wear and high temperature deposits.

SF (Service grade) provides increased oxidation stability and improved anti-wear. It also protects against rust, engine deposits and corrosion.

Engine Oil

Check the engine oil daily. Do not mix brands or grades of oil. If it is necessary to change brands of oil, completely drain the engine and replace both filters before filling. Oil consumption may vary between 1 and 3 qt US (1 to 3 L) per day depending on loads and operating conditions.

Viscosity	Ambient Temperature
15W-40 US Ford 121	Above 14°F (-10°C)
FTO 15W-40 (Canada)	Above 14°F (-10°C)
10W-30 CD/SF	Above -10°F (-23°C)

NOTE: Cummins recommends the use of synthetic oil below −10°F (−23°C) in arctic conditions.

Differential and Planetary Oil

Use SAE 85W140GL5 for temperatures above 90°F (32°C).

Use SAE 80W90GL5 for temperatures below 90°F (32°C).

Hydraulic and Transmission Oil*

Use Ford 134 (US) or FTO 134 (Canada).*

*For consistantly high ambients above 90°F (32°C) a 20/50 weight oil may be used.

Grease

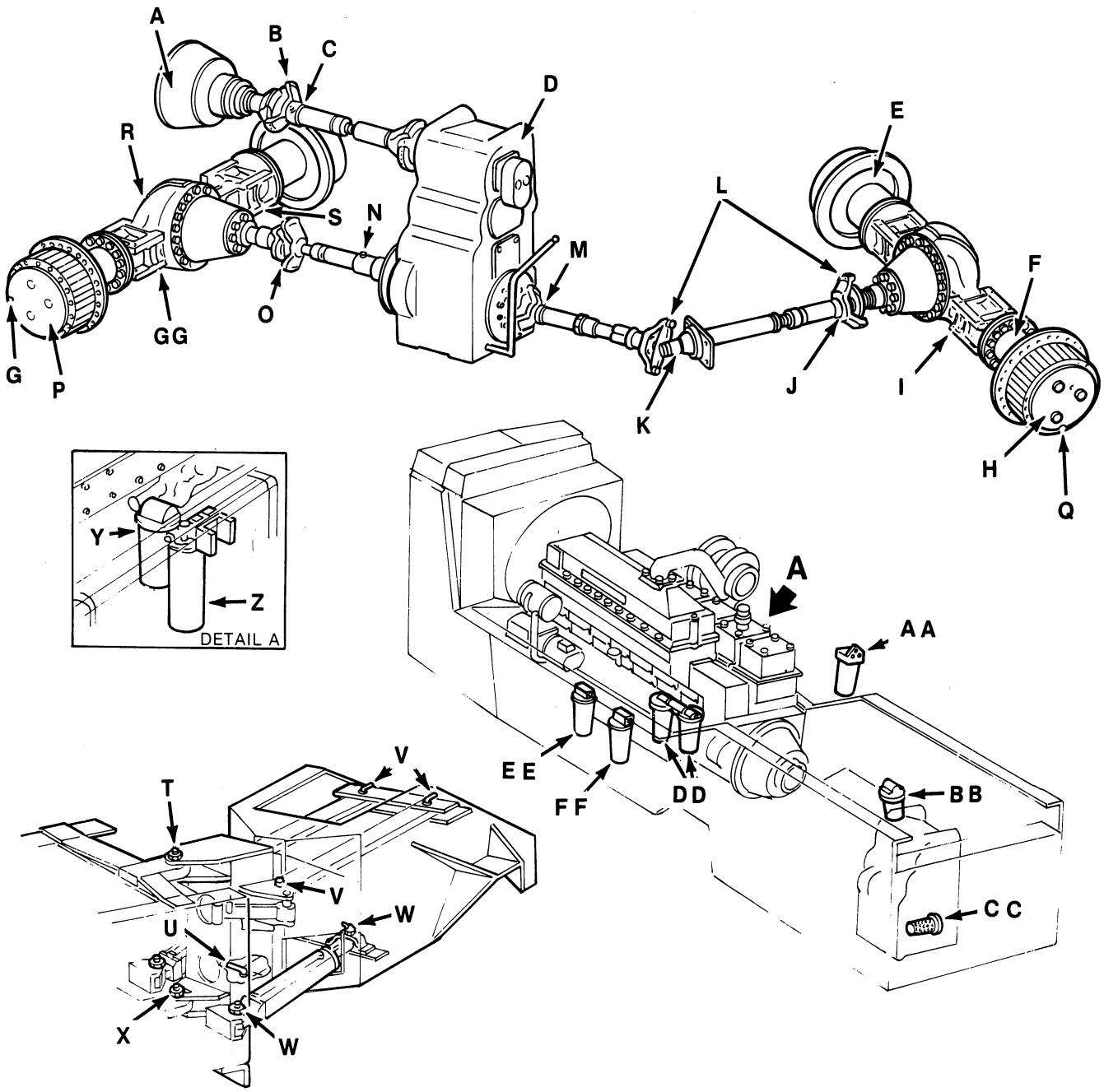
Use lithium base grease for extreme pressure conditions. Use SAE high temperature, multipurpose grease for all other fittings.

LUBRICATION SCHEDULE

Service intervals recommended in this manual are based on operation under average conditions. Service the tractor more frequently when operating in conditions of severe heat, cold, dust or humidity. The lubrication schedule lists the points and frequency of lubrication. Refer to the equivalency chart for the lubricant brands meeting the required specifications. Figure 9 shows the tractor lubrication points.

	AS REQUIRED	DAILY 10 HOURS	WEEKLY 50 HOURS	MONTHLY 250 HOURS	500 HOURS	ANNUALLY	LUBRICANT[4]	NUMBER OF LOCATIONS	SERVICE POINTS/ LOCATIONS[5]
Change fuel system filter					•	•		1	AA
Check brake fluid level			•	•	•	•	D	1	
Change coolant/install precharge element						•		1	Y
Change coolant filter (DCA)				•	•			1	Y
Change engine oil and filters	•[1]			•	•	•	A	2	D,D,Z
Lubricate differentials/planetaries				•	•	•	C	6	I,S, H,P
Change planetary/differential oil	•[2]				•	•	C	6	Q,G, F,R
Change hydraulic oil					•	•	B	1	
Change hydraulic suction filter					•	•		1	EE
Change hydraulic return filter				•	•	•		1	FF
Change trans oil, wash filter screen					•	•	B	1	CC
Change trans return filter	•[3]			•	•	•		1	BB
Lubricate drivelines			•	•	•	•	F	11	
Lubricate driveline steady bearing			•	•	•	•	E	1	K
Lubricate rear main pivot frame			•	•	•	•	E	1	U
Lubricate upper and lower pivots frame			•	•	•	•	E	2	T,X
Lubricate drag link pivot bearings			•	•	•	•	E	4	V
Lubricate steering cylinder pivots			•	•	•	•	E	4	W
Lubricate clutch cross shaft			•	•	•	•	F	2	A
Lubricate clutch shaft support bearing			•	•	•	•	F	1	A
Lubricate clutch release bearing		•	•	•	•	•	F	1	A
Lubricate door hinge pins						•	A	2	

1. Change oil after the first 50 hours of operations and every 250 hours thereafter.
2. Change oil after the first 50 hours of operation and every 500 hours thereafter.
3. Change filter after the first 50 hours of operation and every 250 hours thereafter.
4. See Lubricant Brand Equivalency Chart.
5. See Figure 10 for servicing point locations.



Lubrication Points and Filter Locations

Figure 9

- A Clutch
- B Universal joint
- C Slip joint
- D Transmission
- E Rear axle
- F Differential (rear)
- G Drain (planetary)
- H Axle planetary (rear)
- I Differential oil level (rear)
- J Slip joint (rear)
- K Steady bearing
- L Universal joints (rear)
- M Slip joint (rear)
- N Slip joint (front)
- O Universal joint
- P Axle planetary (front)
- Q Drain (planetary)
- R Differential (front)
- S Differential oil level (front)
- T Main frame pivot (upper)
- U Main frame pivot (rear)
- V Drag link pivots
- W Steering cylinder pivots
- X Main frame pivot (lower)
- Y Coolant DCA filter
- Z Engine oil bypass filter
- AA Fuel filter
- BB Transmission oil filter
- CC Transmission oil screen
- DD Engine oil filters
- EE Hydraulic suction filter
- FF Hydraulic return filter
- GG Front Axle

LUBRICANT BRAND EQUIVALENCY CHART

	FNH Versatile	Imperial	Shell	Texaco	Gulf	Classification
A Engine	Ford 121 AMV FTO	Essolube XD3	Rotella T	Ursa Super Plus	Low Ash Super Duty 15W40	Factory Fill is SAE 15W40 SF/CD above 40°F (4°C)
B Transmission	HyGear 23 Ford 134 FTO 134	Hydraul 56	Donax TD	Texamatic TDH	Duratran	SAE 20 SF/CD above 40°F (4°C)
	HyGear 24 Ford 134 FTO 134	Hydraul 50	Donax TDL			SAE 5W20 below 40°F (4°C) **See Note 1.**
C Differential / Planetary	85W-140 Gear Oil 80W-90 Gear Oil	Gear Oil GX	Spirax HD	Multigear EP	Gearlube	SAE 85W140 GL5 above 32°F (0°C) SAE 80W90 below 32°F (0°C)
D Brake Fluid Glycol Base	FP209	Super H.D. Heavy Duty 450	Brake Fluid	H.D. Brake	SAE J 1703F Fluid	All weather conditions DOT 3 or 5
E Grease	ITM 1C13713	Unitol	Alvania EP2	Marfak AP	Super Crown EP2	SAE multipurpose grease, high temp All weather conditions
F Clutch Release Bearing & Carrier Brg. and Drivelines		Unirex EP2	Alvania #2 Retinax A	Premium RB		Extreme pressure high temp. +350°F (+173.3°C) to -10°F (-23°C) lithium complex grease NLGI grade 1 or 2

Note 1
A 20W50 engine oil may be used in high ambient temperature applications.

STORING THE TRACTOR

NOTE: Storage refers to periods of approximately six months.

Preparation

1. Change the hydraulic oil.
2. Change the transmission oil.
3. Change the engine coolant.
4. Drain and flush the gear oil from the differentials and planetary gear housings. Fill with new oil.
5. Change the engine oil and filters.
6. Start the engine. While the engine is warming up, operate the transmission, hydraulic system, steering and differentials to distribute new lubricant to components. Warm the engine to at least 160°F (70°C). It may be necessary to shield the radiator to achieve this temperature. Stop the engine.
7. Clean the tractor of all debris, dirt and accumulated grease.
8. Drive the tractor to the storage location.
9. Relieve tension on the alternator, compressor and fan belts.
10. Coat all exposed hydraulic cylinder shaft areas with grease or a rust preventative.

Storing

1. Use plastic bags or tape to seal the following openings: air cleaner inlet, exhaust muffler, fuel tank breather, air intake filter, and engine crankcase breather.
2. Touch up all scratches or chips.
3. Block up the tractor to remove weight from the tires.
4. Cover the tires if they will be exposed to heat and/or direct sunlight.
5. If the tractor is to be stored outside, cover it with a waterproof canvas or other protective material.

STORING BATTERIES

WARNING: AVOID SMOKING NEAR THE BATTERY CHARGING AREA DURING OR FOR ONE HOUR FOLLOWING CHARGING.

1. Check the battery charge. If required, charge the batteries.
2. Remove the batteries from the tractor and store them in a cool, dry, weatherproof area. Do not store the batteries on a concrete floor.

REMOVAL FROM STORAGE

1. Remove the protective covering from the tractor tires and seals from the air intake filter, exhaust muffler, fuel tank and engine crankcase breather.
2. Remove the blocks. Lower the tractor onto the tires.
3. Correct any leaks.
4. Inflate the tires to the recommended pressure.
5. Install the fully charged batteries. Tighten the cable clamps at both ends.
6. Tension the alternator, compressor and fan belts.
7. Check the fluid level of the engine crankcase, axles and differentials, transmission, hydraulic reservoir, master brake cylinder reservoir and engine coolant radiator.
8. If the fuel filter is changed during or after storage, be sure that the filter, pump and lines are primed.
9. Drain any sediment from the fuel tanks.

INITIAL ENGINE START-UP

Initial engine start-up can place abnormal loads on the cranking system. Do not crank the engine longer than 30 seconds. Allow at least 2 minutes between cranking cycles to permit the starting motor to cool and the batteries to recover.

IMPORTANT: On the initial start of the engine, do not increase the speed above 1000 RPM, unless necessary to prevent stalling, until the engine oil pressure is normal.

See Engine Starting and Cold Start procedures in the Operator's Manual.

If the engine does not start after 30 seconds, refer to the Fuel System Priming procedure in Section 2.

If the engine still does not start, observe the exhaust during cranking. If the exhaust is clear, the engine is not receiving fuel. Check the following:

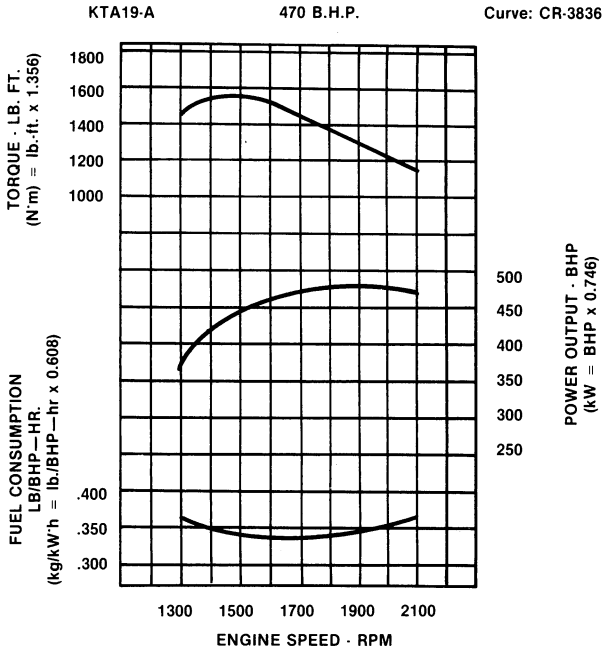
1. Fuel level by inserting a clean stick through the tank filler neck.
2. Fuel line obstruction or loose union connection.
3. Fuel filter for plugging.
4. Operation of the fuel solenoid valve.
5. Fuel system for adequate priming.
6. Fuel pump operation for delivery of fuel.
7. Fuel for the correct grade for the ambient temperature.

SECTION 1
ENGINE SYSTEMS

CONTENTS

1B. COOLING SYSTEM

SECTION 1
ENGINE SYSTEMS
CUMMINS SIX CYLINDER KTA19-A470 ENGINE



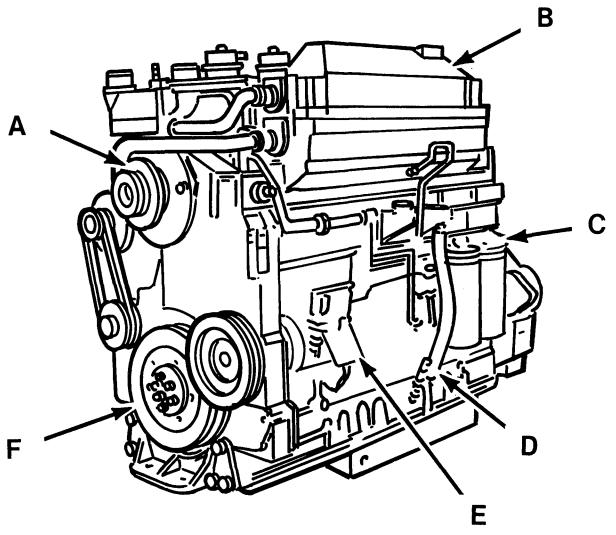
Torque Chart **Figure 1-1**

DESCRIPTION AND OPERATION

The Versatile 1156 tractor uses a Cummins Big Cam III six cylinder KTA19-A470 engine. This section contains service procedures for the engine-related subsystems. For service procedures and engine overhaul information not covered in this manual, refer to "Cummins Assistance" in this section. Operation, maintenance and engine service manuals are available from the Cummins Engine Company via any of their authorized dealers and distributors worldwide.

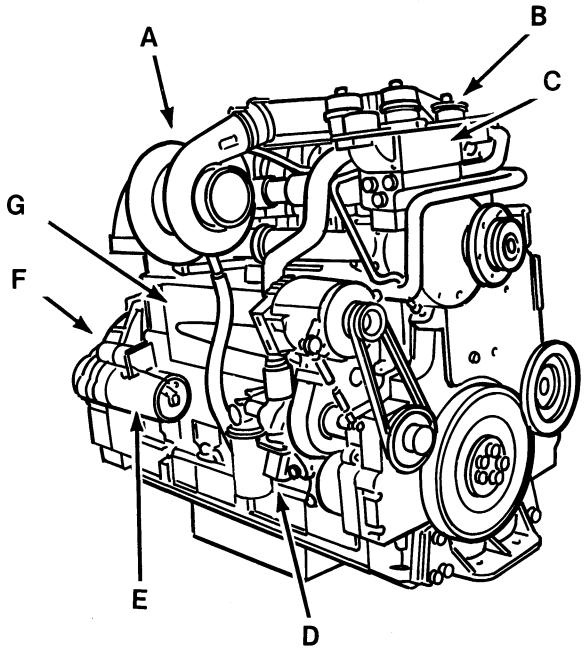
Efficiency of this engine is enhanced by the use of a CROSS-FLOW CYLINDER HEAD with the exhaust manifold on one side of the head and the intake manifold on the other. Coupled with 4 VALVES PER CYLINDER (2 intake, 2 exhaust) the engine is able to process huge quantities of fuel/air mixture for maximum efficiency and ample torque over a wide rpm range.

A "Constant Power" engine achieves peak power over a wide range of engine speeds. Therefore, even though the engine is lugged down, the horsepower output of the engine remains constant. Refer to Figure 1-1. Torque builds very quickly, much faster than the decrease in rpm, for the first 10% of rpm reduction. Torque then increases more gradually until maximum torque is reached. The "Constant-Power" engine maintains horsepower even though rpm declines. The "CONSTANT-POWER" concept is an exclusive feature of Cummins engines. "Constant Power" is the ability to produce a nearly uniform power output over a broad operating range. This is achieved by increasing the peak torque to provide more power at reduced engine speeds. The increased torque at lower engine speeds translates directly into more usable power.



Engine-Fuel Pump Side **Figure 1-2**

A Fan hub
B Aftercooler
C Full flow oil filter
D Dipstick
E Fuel pump
F Vibration damper



Engine-Exhaust Side **Figure 1-3**

A Turbocharger
B Cooler outlet
C Thermostat housing
D Coolant inlet
E Starting motor
F Flywheel housing
G Engine oil cooler

External Engine Component Identification

The illustrations which follow show the locations of the major external engine components, the filters, and other service and maintenance points. Refer to Figures 1-2 and 1-3.

Engine Break-In

The Cummins engine used in the Model 1156 tractor has been run on a dynamometer before installation but not enough to be considered broken-in.

1. Do not operate the engine at more than 3/4 load for the first 24 hours of operation. Full load should only be held for short intervals during the next 24 hours of operation. (3/4 load is approximately one gear lower than the highest gear the tractor can pull a specific load.)

2. Check oil level every 8 to 10 hours for the first 100 hours of operation.

3. Follow recommendations outlined in the Cummins operator's manual supplied with the tractor.

CUMMINS ASSISTANCE

The Cummins Engine Company backs its engines with service and complete parts support. A service network of more than 3,000 Cummins distributors and dealers, the largest in the world devoted exclusively to diesel engines, are available for assistance. Technicians are trained to provide the Cummins owner with sound advice, expert service and professional treatments at all Cummins locations.

Before calling for assistance write down the following information and have it ready:

A. Type and make of equipment
B. Engine model and serial number
C. Total hours of operation
D. Nature of problem

The following is a list of Cummins Assistance locations:

Canadian Division

Cummins Diesel of Canada, Ltd.
700 Dorval Drive
Suite 600
Oakville, Ontario
Canada L6K 3V3
Phone: 416-842-8070

Eastern Regional

Cummins Engine Company, Inc.
10 Wright Street
Suite 401
Westport, Connecticut 06880
Phone: 203-226-7951

Northern Division

Cummins Engine Company, Inc.
1100-31st Street
Suite 275
Downers Grove, Illinois 60515
Phone: 312-852-6604

Plains Division

Cummins Engine Company, Inc.
Twin Towers, North
Suite 633
8585 North Stemmons Freeway
Dallas, Texas 75247
Phone: 214-638-5410

Rocky Mountain Division

Cummins Engine Company, Inc.
Plaza West Building, Suite 318
5670 S. Syracuse Circle
Englewood, Colorado 80111
Phone: 303-773-2866

Southern Division

Cummins Engine Company, Inc.
6425 Powers Ferry Road, N.W.
Suite 120
Atlanta, Georgia 30339
Phone: 404-955-5025

Western Division

Cummins Engine Company, Inc.
375 North Wiget Lane
Suite 220
Walnut Creek, California 94598
Phone: 415-943-6901

TROUBLESHOOTING

The troubleshooting chart lists most problems related to the engine systems. For more detailed troubleshooting information, contact your local Cummins Distributor.

SYMPTOM	POSSIBLE CAUSE	REMEDY
Engine does not start	• Water in fuel	Drain water.
	• Dirty fuel filters/lines	Change filter.
	• External fuel leaks/air in lines	Tighten fittings.
	• Faulty fuel shutoff solenoid	Refer to "Electrical" Section 3.
	• Wrong fuel/poor grade fuel	Drain and refill.
	• Fuel system not primed	Prime system.
	• Faulty cold start	Refer to "Cold Start" Troubleshooting
Engine starts, runs poorly	• Water in fuel	Drain water.
	• Dirty fuel filters/lines	Replace filters.
	• External fuel leaks/air in lines	Repair leaks and prime system
	• Dirty injector nozzles	Refer to Cummins engine repair manual.
	• Faulty fuel shutoff solenoid	Repair or replace.
	• Wrong fuel/poor grade fuel	Drain and replace.
	• Fuel system not primed	Prime system.
	• Faulty muffler	Repair or replace.

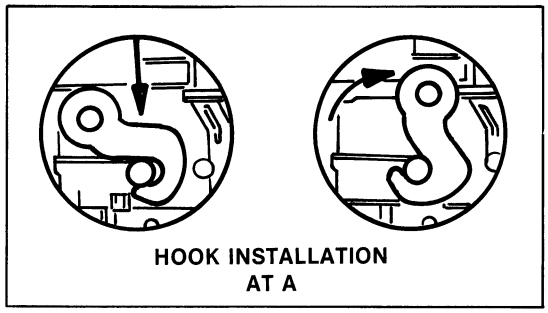
COLD START TROUBLESHOOTING

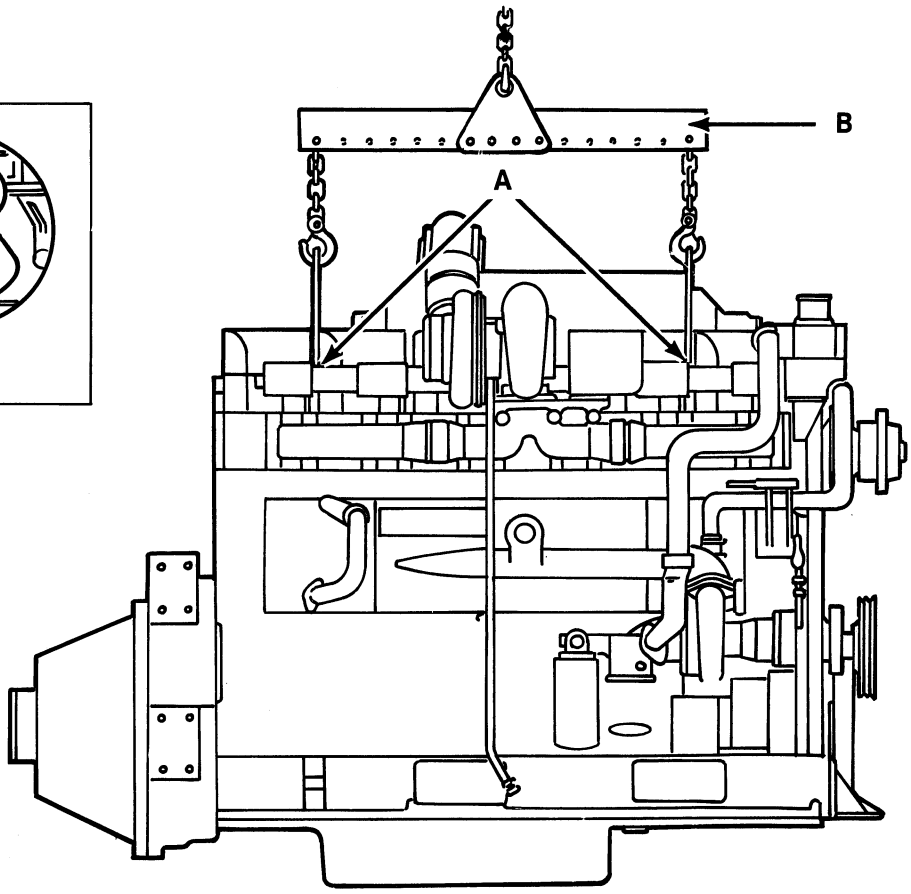
SYMPTOM	POSSIBLE CAUSE	REMEDY
Engine will not start.	• Cylinder empty • Cylinder not seated • Capillary tube plugged • Atomizer plugged • Atomizer directed incorrectly • Ground cable clamp loose. • Solenoid defective • Defective valve • Defective Thermoguard™	Replace. Tighten. Clean or replace. Clean or replace. Aim spray correctly against the intake manifold airflow. Tighten. Replace. Replace. Replace.
Excess smoke at idle	• Dirty fuel filters/lines • Dirty injector nozzles • Wrong fuel/poor grade of fuel	Replace filters. Refer to Cummins Engine Repair Manual. Drain and replace
Excess smoke under load	• Dirty fuel filters/lines • Dirty injector nozzles • Wrong fuel/poor grade fuel • Restricted air intake • Restricted air filters • High exhaust back pressure • Faulty muffler • Air intake leak • Faulty turbocharger	Replace filters. Refer to Cummins Engine Repair Manual. Drain and replace. Remove restriction. Replace filters. Repair or replace muffler. Repair or replace muffler. Detect leak and repair. Repair or replace. Refer to Cummins Engine Repair Manual
Loss of/or low power	• Dirty fuel filters/lines • External fuel leaks/air in lines • Plugged fuel tank vent • Dirty injector nozzles • Throttle linkage not adjusted • Wrong fuel/poor grade fuel • Internal fuel leak • Restricted air intake • Restricted air filters • High exhaust back pressure • Air intake leak • Faulty turbocharger • Oil level too high	Clean fuel system. Repair leaks and prime system. Clean vent. Refer to Cummins Engine Repair Manual. Adjust linkage Drain and replace fuel Repair leak. Remove restriction. Replace filters. Repair or replace muffler. Detect leak and repair. Repair or replace, refer to Cummins Engine Repair Manual Lower level.
Low engine rpm	• Dirty fuel filters/lines • External fuel leaks/air in lines • Throttle linkage not adjusted	Replace filters. Tighten lines. Adjust.

SYMPTOM	POSSIBLE CAUSE	REMEDY
Excess fuel consumption	• Dirty fuel filters/lines • External fuel leaks/air in lines • Dirty injector nozzles • Wrong fuel/poor grade fuel • Internal fuel leak • Restricted air intake • Restricted air filters • High exhaust back pressure • Faulty turbocharger • Oil level too high	Replace filters. Tighten lines. Refer to Cummins Repair Manual. Drain and replace. Repair leak. Remove restriction. Replace filters. Repair or replace muffler. Repair or replace, refer to Cummins Repair Manual. Lower oil level.
Poor deceleration	• Dirty fuel filters/lines • External fuel leaks/air in lines • Throttle linkage not adjusted	Clean fuel system. Repair leaks and prime system Adjust.
Erratic idle speed	• External fuel leaks/air in lines • Plugged fuel tank vent • Throttle linkage not adjusted • Wrong fuel/poor grade fuel • Internal fuel pump governor malfunction.	Repair leaks and prime system. Clean vent. Adjust. Drain and refill. Refer to Cummins repair manual.
Surging at governed rpm	• Internal fuel pump govenor malfunction. • External fuel leaks/air in lines • Throttle linkage not adjusted	Refer to Cummins repair manual. Repair leaks and prime system. Adjust.
Engine stalls	• External fuel leaks/air in lines • Plugged fuel tank vent • Faulty fuel shutoff solenoid • Throttle linkage not adjusted • Wrong fuel/poor grade fuel • Internal fuel leak	Repair leaks and prime system Clean vent. Replace. Adjust. Drain and refill. Repair leak.
Dilution of oil	• Wrong fuel/poor grade fuel • Internal fuel leak • Internal coolant leak • Wrong grade oil	Drain and refill. Repair leak. Repair leak. Drain and refill.
High operating temperature	• Wrong fuel/poor grade fuel • High exhaust back pressure • Faulty water pump • Insufficient coolant • Faulty thermostats • External coolant leak • Dirty radiator externally or internally • Improper coolant mix • Oil level too high • Oil level too low	Drain and refill. Repair or replace muffler. Repair or replace pump. Add coolant. Replace. Repair leak. Remove and clean at authorized radiator repair shop. Drain and refill with proper mixture. Lower oil level. Add oil.

SYMPTOM	POSSIBLE CAUSE	REMEDY
Continually clogged air cleaner	• Faulty muffler • Faulty aspirator system • Faulty indicator/gauge	Replace muffler. Replace pre-cleaner. Replace gauge.
Excessive exhaust noise	• Faulty muffler • Faulty turbocharger	Replace muffler. Repair or replace.
Low operating temperature	• Faulty thermostats • Faulty indicator/gauge • Improper coolant mix • Low ambient temperature • Engine not loaded	Replace. Refer to "Electrical Section". Drain and refill with proper mixture. Cover grill area with suitable air restrictor Increase load by selecting higher gear and idling back.
Loss of coolant	• Faulty indicator/gauge • Internal coolant leak • External coolant leak	Refer to "Electrical Section." Repair leak. Repair leak.
Coolant dirty	• Internal coolant leak • DCA not serviced	Repair leak. Recharge.
Air in coolant	• Internal coolant leak • External coolant leak • Internal combustion chamber leak	Repair leak. Repair leak. Refer to Cummins Repair Manual.
Coolant freezes	• Improper coolant mix	Drain and refill.
Excessive corrosion	• DCA not serviced	Clean and recharge.
Low oil pressure	• Internal coolant leak • Oil level too high • Wrong grade oil • Dirty oil filters • Oil leaks • Internal fuel leak	Repair leak. Drain to proper level. Drain and refill. Replace oil and filters. Repair oil leak. Detect and repair.
Excessive oil consumption	• Restricted air intake • Oil level too high • Wrong grade oil • Dirty oil filters • Internal fuel leak	Detect and repair. Drain to proper level. Drain and refill. Replace oil and filters. Detect and repair.

BASIC ENGINE





Engine Lifting
A Lifting hooks
B Lift fixture

Figure 1-4

ENGINE MOUNT REPLACEMENT

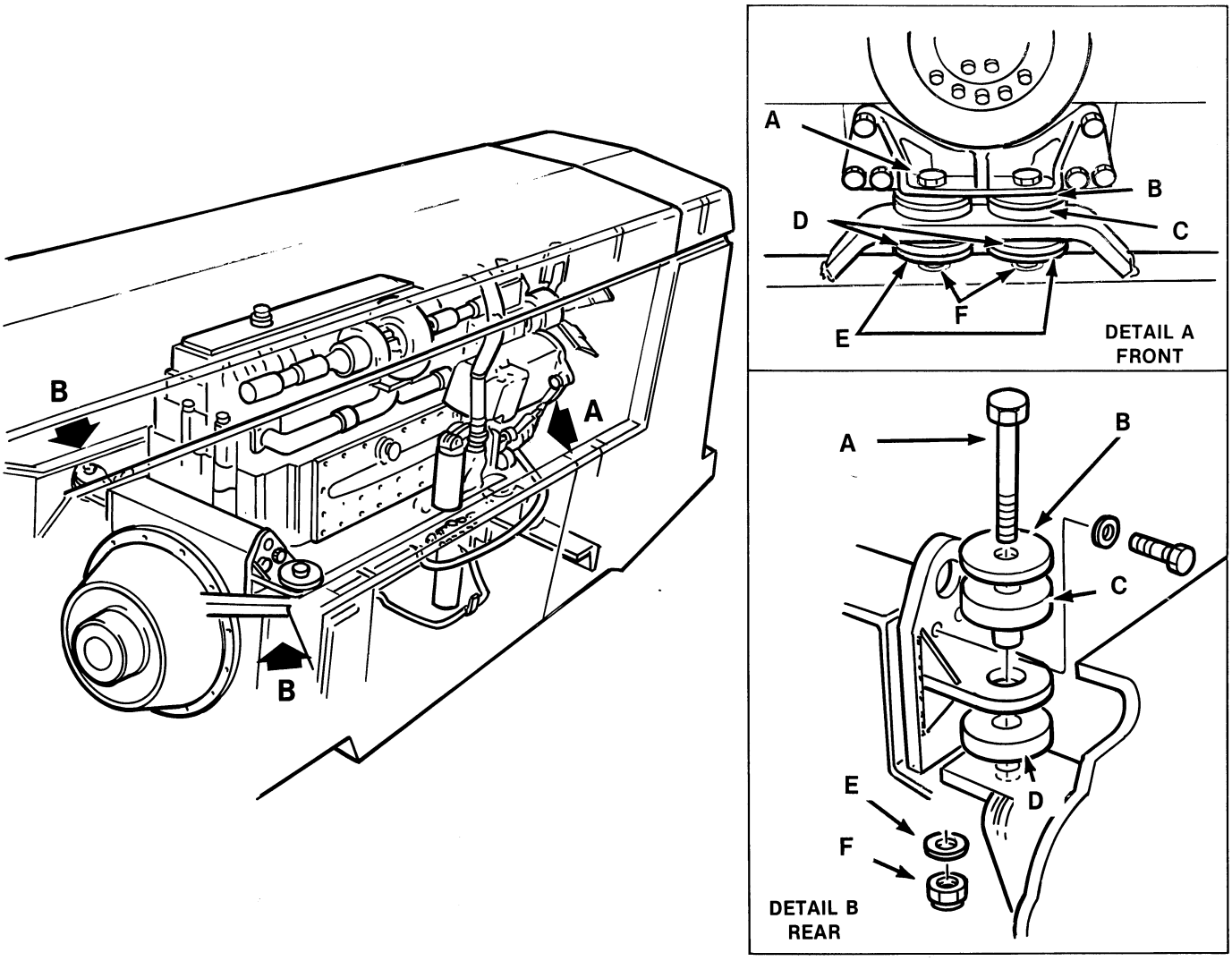
NOTE: The lift fixture, Figure 1-4 is available from the Cummins Engine Distributor as tool number ST1286 for the hooks and ST1258 for the lift bar.

Front Mounting Pads
Refer to Figure 1-4A, Detail A:

WARNING: DO NOT PUT FINGERS BETWEEN THE FRAME AND ENGINE MOUNT. USE A TOOL TO REMOVE AND POSITION THE ISOLATOR PADS.

1. Engage the articulation lock and the parkbrake. Chock the wheels. Refer to "Safety Operation and General Information".
2. Install the engine lifting hooks Figure 1-4. Place an overhead hoist into position ready to raise the front of the engine.
3. Remove the engine mount locknuts F, isolator washers E, and lower isolators D, Figure 1-4A.
4. Raise the engine 1/2" (12 mm) and place safety stands under the engine.
5. Remove the capscrews A, isolator washers B, and top isolator pads C.
6. Replace the top isolator washers B, and isolator pads C. Position the new pads so they are properly centered for maximum vibration dampening and install the cap screws A.

   NOTE: Always replace the isolator pads as a set.



Engine Mounts **Figure 1-4A**

Front Detail "A"

A Cap screws
B Washers
C Isolator pads
D Lower isolators
E Isolator washers
F Locknuts

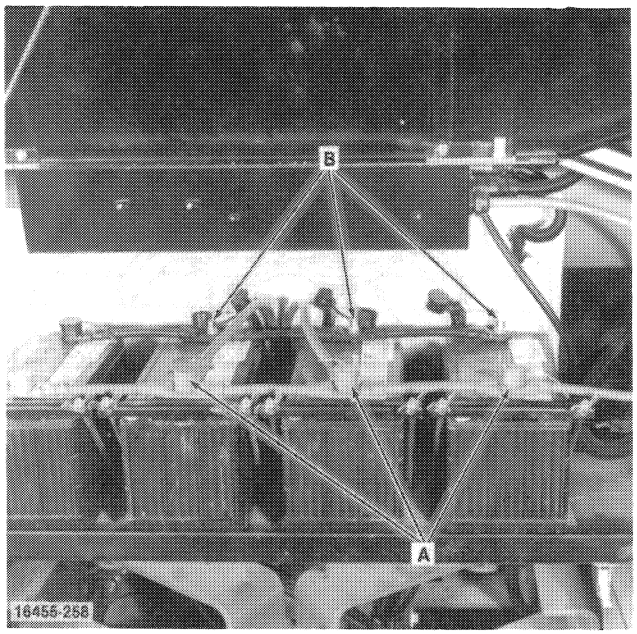
Rear Detail "B"

A Cap screw
B Isolator washers
C Upper isolators
D Isolator pad
E Washer
F Locknut

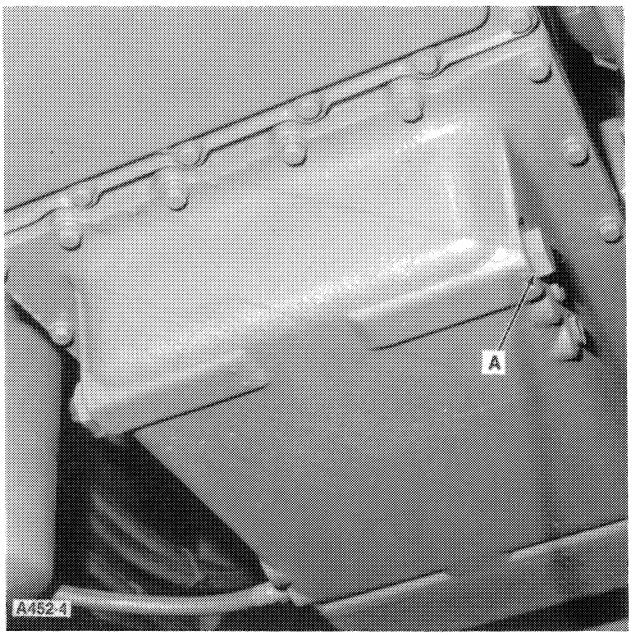
7. Remove the safety stands and lower the engine.
8. Install the lower isolators D, isolator washers E, and locknuts F. Torque the locknuts to 75 lbs.-ft. (95 N·m)

Rear Mounting Pads
Refer to Figure 1-4A, Detail B:

1. Engage the articulation lock and the parkbrake. Chock the wheels. Refer to "Safety Operation and General Information."
2. Install the engine lifting hooks Figure 1-4. Place an overhead hoist into position ready to raise the rear of the engine.
3. Remove the engine mount locknuts F, plain washers E, cap screws A, isolator washers B, and top isolators C.
4. Raise the engine up 1/2" (12 mm) and place safety stands under the engine.
5. Replace the lower isolator pads, D. Position the new pads so they are properly centered for maximum vibration dampening.



Batteries **Figure 1-5**
A Positive cables
B Negative cables - ground



Oil Pan **Figure 1-6**
A Drain plug

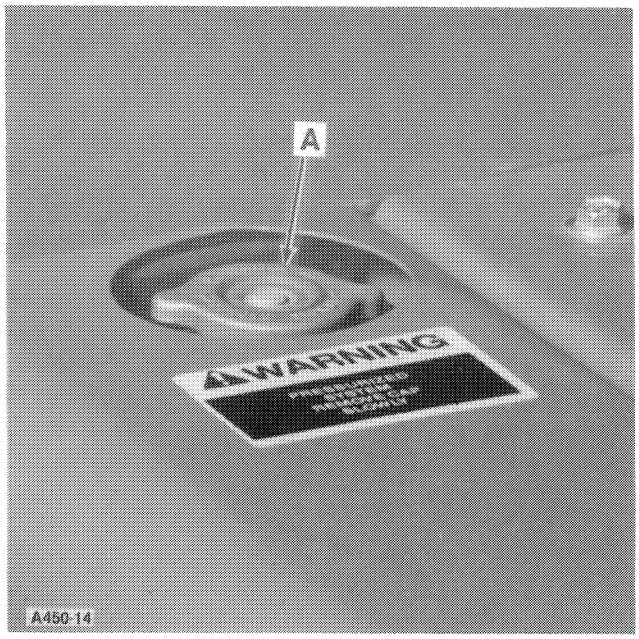
NOTE: Always replace the isolator pads as a set.

6. Remove the safety stands and lower the engine.
7. Install the upper isolators C, isolator washers B, capscrews A, flat washers E, and locknuts F. Torque the locknuts to 75 lbs.-ft. (95 N·m)

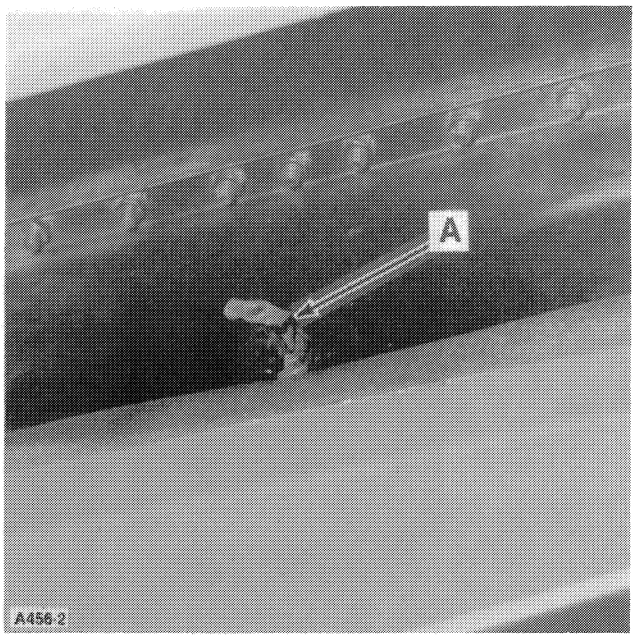
ENGINE REMOVAL AND REPLACEMENT

WARNING: SET THE PARKBRAKE, CHOCK THE WHEELS, ENGAGE ARTICULATION LOCK, AND DISCONNECT THE BATTERY BEFORE STARTING WORK ON THE ENGINE.

1. Disconnect the three battery ground cables B, Figure 1-5, and then disconnect the three positive cables A.
2. Remove the drain plug A, Figure 1-6 and drain the engine oil. Allow 10 minutes to drain completely and install the drain plug. Torque to 65 lbs.-ft. (80 N·m).

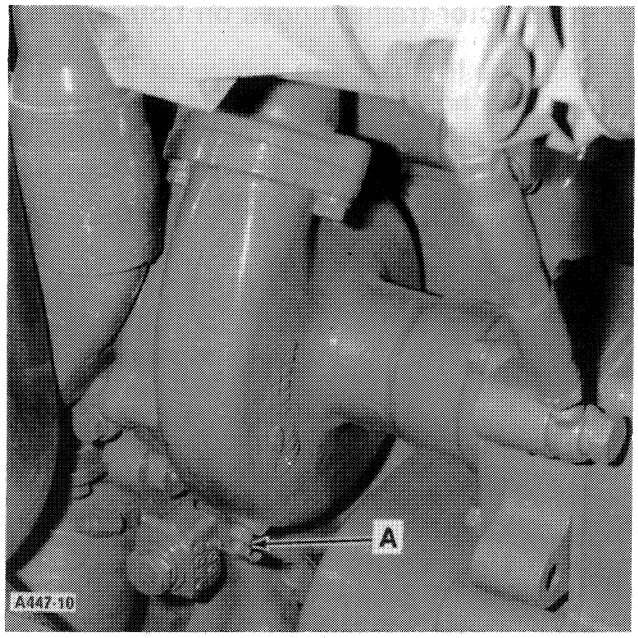


Radiator **Figure 1-7**
A Radiator cap

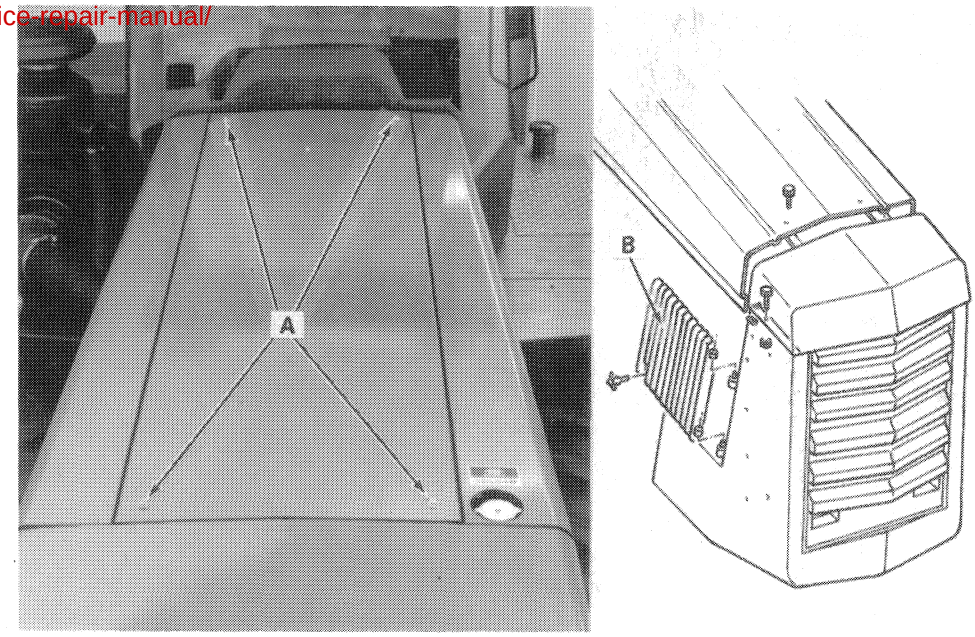


Radiator **Figure 1-8**
A Drain cock

3. Drain the cooling system by removing the radiator cap, A, Figure 1-7. Open the drain cocks, A, Figure 1-8, on the radiator, and water pump, A, Figure 1-9.



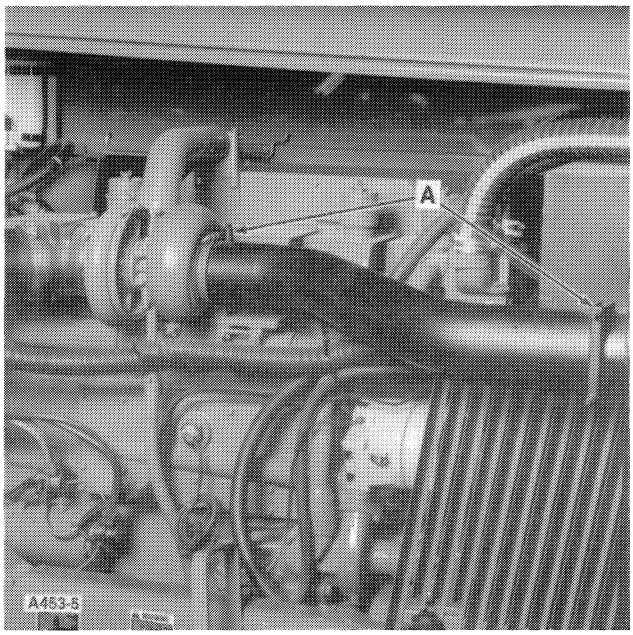
Water Pump **Figure 1-9**
A Drain cock



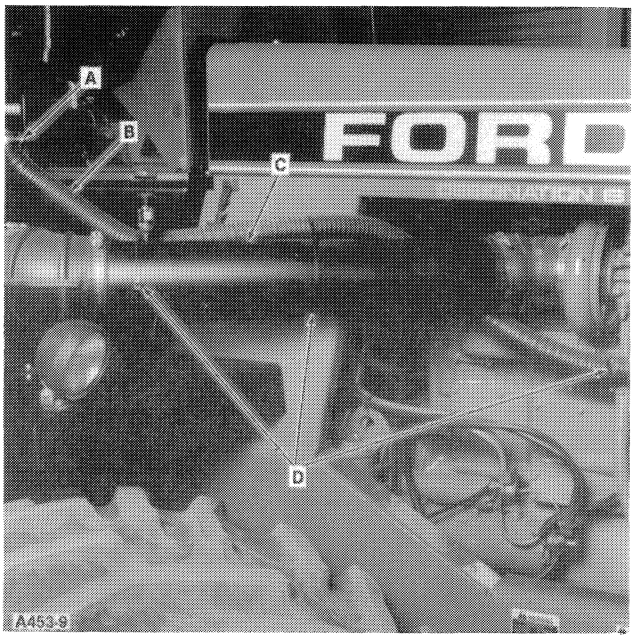
Hood
A Cap screws
B Fan guards

Figure 1-10

4. Remove fan guards B, Figure 1-10, from the tractor frame hinges on both sides.
5. Remove the four cap screws at the front and rear hood supports A, Figure 1-10 and disconnect the windshield washer hose under the hood. Use a suitable hoist to remove the hood from the tractor.
6. Release the clamps, A, Figure 1-11, at both ends of the exhaust pipe. Remove the exhaust pipe and cover the turbocharger and muffler openings.
7. Cut the tie straps, D, Figure 1-12, and release clamps, A, from the aspirator hose, B, and remove the hose from the muffler and air precleaner.



Exhaust Pipe **Figure 1-11**
A Clamps



Air Intake **Figure 1-12**
A Clamps
B Aspirator hose
C Air intake tube
D Tie straps