

Product: New Holland Ford 1215 Tractor Service Repair Manual
Full Download: <https://www.aresairmanual.com/downloads/new-holland-ford-1215-tractor-service-repair-manual/>

Tractor 1215

Supplement to
1120, 1220 Tractor
Service – #42112020



SERVICE MANUAL



NEW HOLLAND

Sample of manual. Download All 154 pages at:
<https://www.aresairmanual.com/downloads/new-holland-ford-1215-tractor-service-repair-manual/>

40121510 6/95

Reprint

FOREWORD

Only components unique to the 1215 tractor are contained in this manual. For all other components of the tractor, refer to the appropriate sections of the 1120-1220 Service Manual #42112020.

Each section contains information on general operating principles, detailed inspection and overhaul procedures, and where applicable, troubleshooting, special tools and specifications.

The material contained in this manual was correct at the time of going to print, but New Holland North America, Inc. policy is one of continuous improvement, and the right to change prices, specifications, equipment or design at any time without notice is reserved. All data in this manual is subject to production variations, so overall dimensions and weights should be considered as approximate only, and the illustrations do not necessarily depict the unit to standard built specification.

New Holland North America, Inc.

PART 1 ENGINE SYSTEMS

CHAPTER 1 ENGINE AND LUBRICATION SYSTEM

Section	Page
A. DESCRIPTION AND OPERATION	1-2
B. ENGINE - OVERHAUL	
• CYLINDER HEAD AND RELATED COMPONENTS (REFER TO 1120-1220 REPAIR MANUAL)	
• ENGINE FRONT COVER, TIMING GEARS, AND OIL PUMP (REFER TO 1120-1220 REPAIR MANUAL)	
• CONNECTING RODS, BEARINGS, PISTONS, RINGS, AND CYLINDER BLOCK (REFER TO 1120-1220 REPAIR MANUAL)	
• MAIN BEARINGS AND CRANKSHAFT	1-4

CHAPTER 2 COOLING SYSTEMS

Section	Page
A. DESCRIPTION AND OPERATION	1-8
..... (REFER TO 1120-1220 REPAIR MANUAL)	
B. COOLING SYSTEM - OVERHAUL	1-8
..... (REFER TO 1120-1220 REPAIR MANUAL)	

CHAPTER 3 TROUBLESHOOTING, SPECIFICATIONS, AND SPECIAL TOOLS

Section	Page
A. TROUBLESHOOTING	1-9
B. SPECIFICATIONS	1-15
C. SPECIAL TOOLS	1-24

PART 1 ENGINE SYSTEMS

CHAPTER 1 ENGINE AND LUBRICATION SYSTEM

Section	Page
A. DESCRIPTION AND OPERATION	1-2
B. ENGINE - OVERHAUL	
• CYLINDER HEAD AND RELATED COMPONENTS (REFER TO 1120-1220 REPAIR MANUAL)	
• ENGINE FRONT COVER, TIMING GEARS, AND OIL PUMP (REFER TO 1120-1220 REPAIR MANUAL)	
• CONNECTING RODS, BEARINGS, PISTONS, RINGS, AND CYLINDER BLOCK (REFER TO 1120-1220 REPAIR MANUAL)	
• MAIN BEARINGS AND CRANKSHAFT	1-4

A. DESCRIPTION AND OPERATION

The Model 1215 tractor is equipped with a three cylinder in-line, liquid cooled, four cycle overhead valve engine, Figure 1. The engine model is identified by a code number cast into the side of the engine block as shown in the following chart.

ENGINE CODE	TRACTOR MODEL	HORSEPOWER
S723	F1215	15

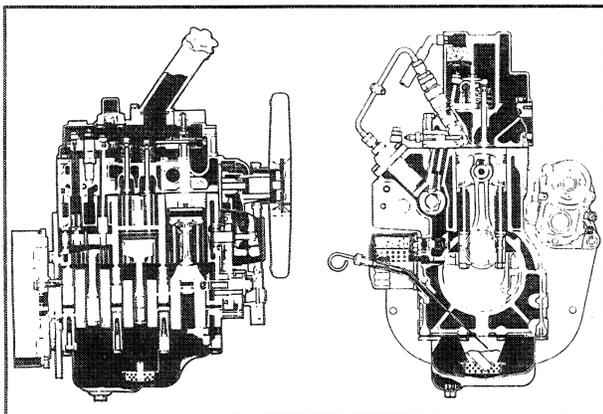


Figure 1
Three Cylinder - Model 1215

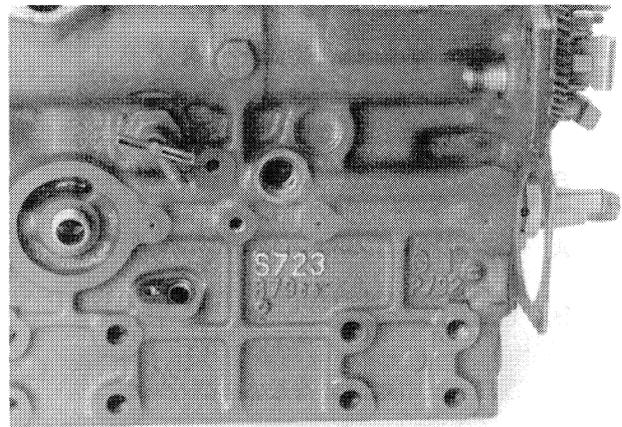


Figure 2
Block I.D.

CYLINDER HEAD AND VALVE TRAIN COMPONENTS

The cylinder head incorporates the valve assemblies, rocker shaft, rocker arm components, and pre-combustion chambers.

The intake manifold is incorporated into the left-hand side of the valve cover assembly.

Standard size only valves are utilized with valve guides. Only standard size valves are available for service.

The Model 1215 has a one-piece rocker shaft assembly.

A pre-combustion chamber is located between the injector assembly and the combustion chamber of the cylinder. This provides an area for initial ignition of the fuel for improved starting. A glow plug located in the head extends into the pre-combustion chamber. When energized, it preheats the fuel air mixture for improved fuel ignition under cold weather conditions.

CYLINDER BLOCK ASSEMBLY

The cylinder block assembly contains the pistons, connecting rods, crankshaft, camshaft, timing gears, and engine oil pump.

The engine crankshaft is supported by four main bearings. The front main bearing is a full circle bearing located in the block. The second, third, and fourth main bearings are split liners located in holders bolted to the block.

The camshaft assembly is supported on two roller bearings, with one located on each end of the block.

The engine uses a straight connecting rod and a three ring piston.

LUBRICATION SYSTEM

A gear rotor type oil pump is driven by the crankshaft gear and is located in a bore in the front end of the engine block. The oil pick-up tube attaches to the rear of the pump and extends into the oil pan sump.

OIL FLOW

Oil is picked up from the sump by the intake tube and drawn into a lower side drilling in the block to the oil pump.

Pressurized oil from the pump flows through passages in the block, past the relief valve, and through the oil filter. It then returns to the area of the drilled bolt of the oil transfer tube located on the right-hand side of the block.

The relief valve is mounted in the side of the block and intersects the main oil passage. When the oil pressure becomes higher than the rated value, oil is discharged through the relief valve into the crankcase sump.

Pressurized oil flows from the oil gallery through passages in the block crankshaft bearings. Drilled passages in the crankshaft connect the oil passage from the main bearings to the connecting rod journals.

The remaining portion of the oil is directed through the external tube to the cylinder head. The external tube is attached by drilled bolts between the side of the block and the front of the cylinder head. Oil flows from the main oil gallery, through the tube and a passage in the head to No. 1 rocker shaft pedestal, into the rocker shaft. Oil flows through a small hole in the rocker arms and lubricates the valve stems, push rods, and tappets.

Oil flows from the top of the head back to the crankcase sump. Cylinder walls, pistons, and piston pins are splash-lubricated by the crankshaft.

ENGINE OIL FILTER

Because engine oil becomes contaminated with dust, carbon particles, metal dust, and sludge, it is directed through a filter before entering the engine lubrication passages. The filter is a full-flow type. All of the oil from the pump is routed through the filter. To protect the engine from a loss of lubrication, the filter contains a relief valve which opens if the element becomes plugged.

B. ENGINE - OVERHAUL

CRANKSHAFT

ASSEMBLY AND INSTALLATION

Before installing the crankshaft in the engine block:

1. Measure the inside bearing diameter of the front main bearing, Figure 3, and crankshaft front journal diameter.
2. Subtract the diameter of the front journal from the inside bearing diameter of the front main bearing.
 - If the clearance is more than 0.0079 in. (0.2 mm), replace the main bearing or re-grind the journal with undersize main bearing.

In addition, check the main bearing clearance of each of the three center main bearings as follows:

1. Position a piece of plasti-gauge of the correct size across the full width of each bearing liner at approximately 1/4 in. off center, Figure 4.
2. Install the bearing holder and tighten the bolts to the specified torque, Figure 5.

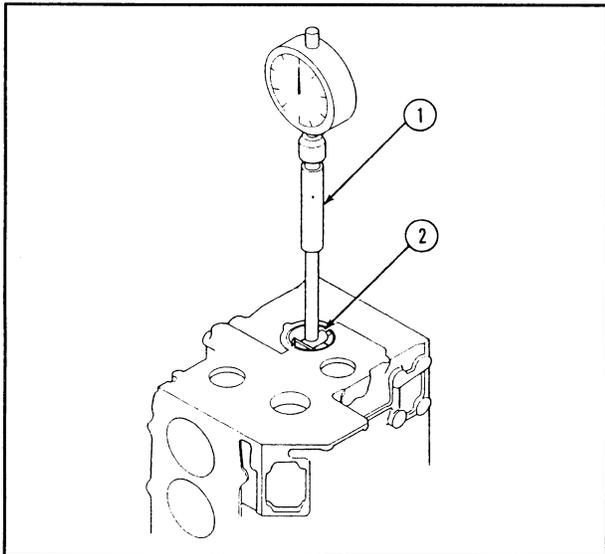


Figure 3

Front and Rear Bearing Wear Check

1. Bore Gauge
2. Front Bearing Bore

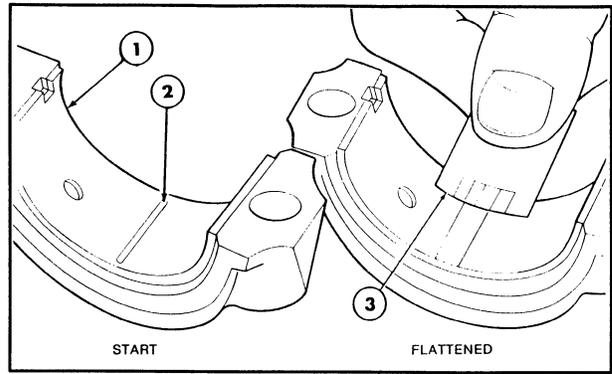


Figure 4

Main Bearing Liner Clearance Check

1. Bearing Liner
2. Plasti-gauge
3. Scale

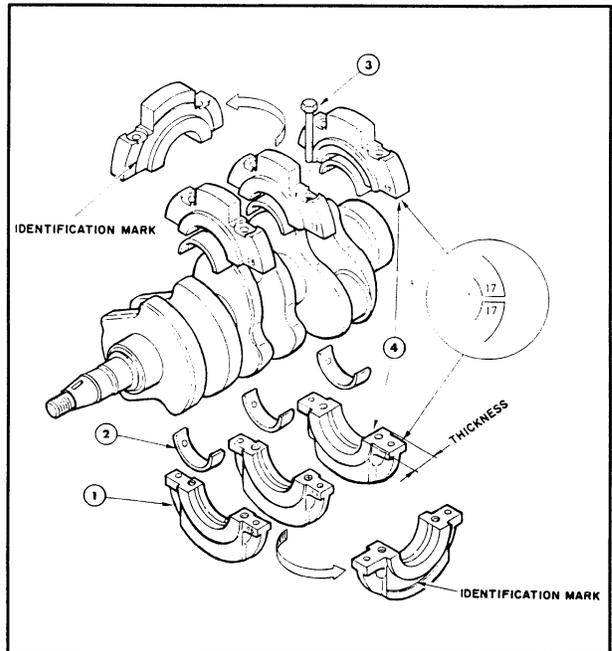


Figure 5

Main Bearing Holder Installation

1. Bearing Holder (made of cast iron)
2. Bearing Liner
3. Holder Bolts
4. Rear Bearing Holder (made of aluminum die cast)

3. Remove the bearing holder and use the plasti-gauge scale to check the flattened plasti-gauge.
 - The width of the plasti-gauge at the widest point establishes the minimum clearance, and the width at the narrowest point establishes the maximum clearance. The difference between the two readings indicates the taper.
4. Replace the bearing liners, or grind the crankshaft journals to obtain the correct bearing clearance. See "Specifications," Chapter 3.
5. Install the bearing liner with oil groove to the upper bearing holder, and the bearing liner without oil groove to the lower bearing holder.
6. Inspect the aluminum bearing holder thickness. If the thickness is less than 0.848 in. (21.55 mm), replace the bearing holder with a new one.
7. Reinstall the bearing holders on the crankshaft. Be sure the holders are correctly positioned on the shaft, and that the stepped part is facing forward, Figure 6.
8. Tighten the bearing holder bolts on the cast iron bearing holder to 18-22 ft. lbs. (25-29 N·m) torque, Figure 5.

Tighten the bearing holder bolts on the aluminum die cast bearing holder to 14-18 ft. lbs. (19.61-24.51 N·m) torque, Figure 5.

9. Install the crankshaft in the block from the rear. Be careful not to damage the front bearing liner when inserting the crankshaft.
10. Install the main bearing holder retaining bolt and tighten to 18-22 ft. lbs. (25-29 N·m).

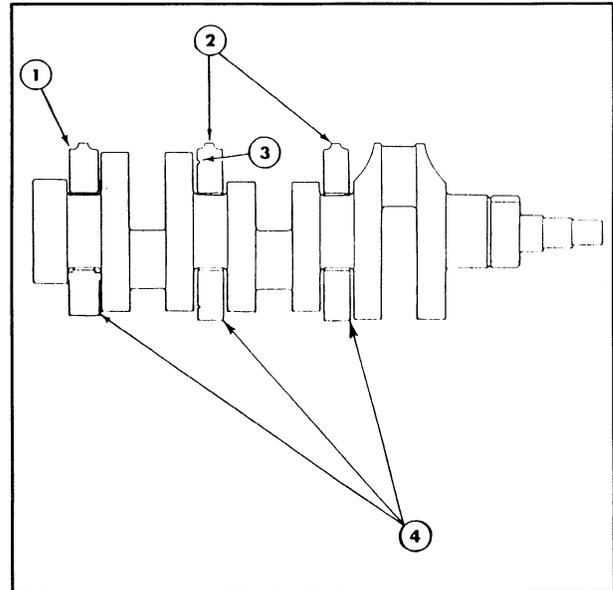


Figure 6
Crankshaft Installation

- | | |
|-------------------------------------------------------|--------------------------------------------------|
| 1. Rear Bearing Holder
(made of aluminum die cast) | 3. Center Main Bearing Holder-Mark |
| 2. Main Bearing Holders
(made of cast iron) | 4. Stepped Part - Forward Identification Marking |

11. Using a dial indicator, check the crankshaft end play.
 - If the end play is greater than 0.028 in. (0.7 mm), replace the bearing holder made of aluminum die cast .
 - If the end play is within specifications, install the remaining bearing holder retaining bolts and tighten to the specified torque, Figure 7.

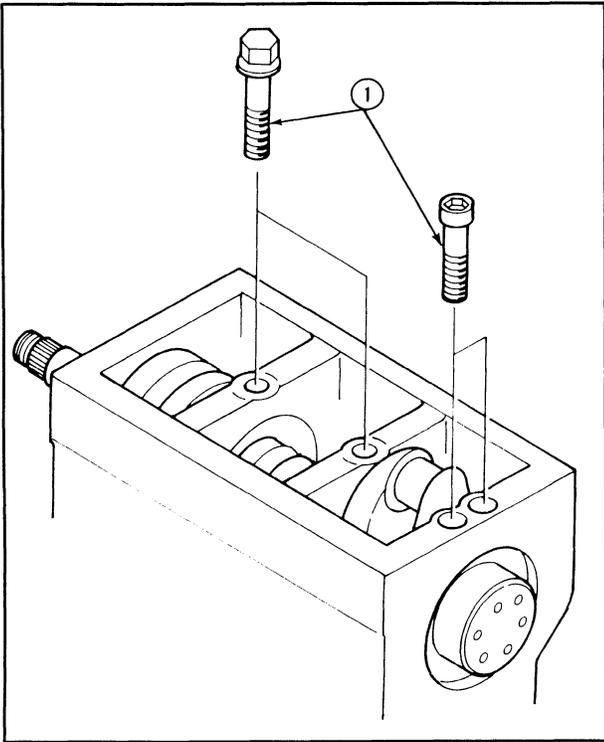


Figure 7

Main Bearing Holder Installation

1. Bearing Holder Retaining Bolts

12. Position the rear crankshaft oil seal on the shaft.
13. Apply liquid gasket sealer to the rear plate attaching surface and install the rear plate, Figure 8.
14. Tighten the retaining bolts to 34-40 ft. lbs. (46-54 N·m) torque.

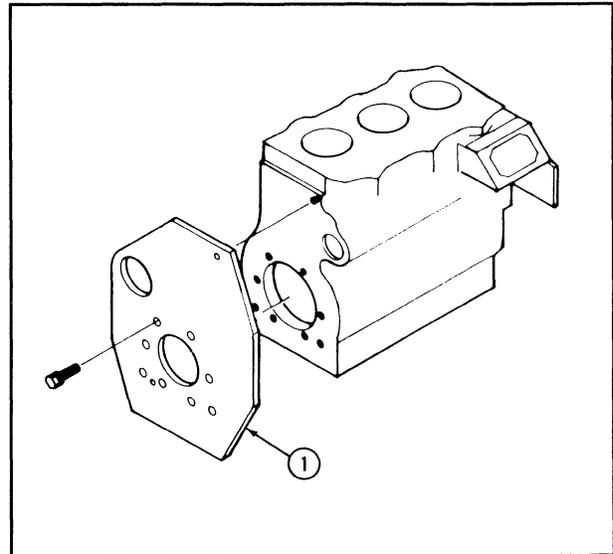


Figure 8

Installing the Rear Plate

1. Rear Plate

CRANKSHAFT JOURNAL WEAR LIMIT AND BEARING USAGE

	WEAR LIMIT	REMARKS
Taper	.002 in. (0.05 mm)	Re-grind to 0.010 in or 0.020 in. (.25 mm or .50 mm) Undersize
Out-of-Round	.002 in. (0.05 mm)	Straighten or Replace Crankshaft
Journal Diameter - Main Bearing (See Figure 4)	1.7998-1.8002 in. (45.714-45.725 mm) #1, 2, 3	Use 0.010 in. (.25 mm) Undersize Bearings
	1.7994-1.7998 in. (45.704-45.715 mm) #4	
	1.7899-1.7904 in. (45.464-45.475 mm) #1, 2, 3	Use 0.020 in. (.50 mm) Undersize Bearings
	1.7895-1.7899 in. (45.454-45.465 mm) #4	
Less than 1.787 in. (45.4 mm)	Replace Crankshaft	
Journal Diameter - Crankpin	1.5242-1.5246 in. (38.714-38.725 mm)	Use 0.010 in. (.25 mm) Undersize Bearings
	1.5143-1.5148 in. (38.464-38.475 mm)	Use 0.020 in. (.50 mm) Undersize Bearings
	Less than 1.512 in. (38.4 mm)	Replace Crankshaft

PART 1

ENGINE SYSTEMS

CHAPTER 2

COOLING SYSTEMS

Section	Page
A. DESCRIPTION AND OPERATION	
..... (REFER TO 1120-1220 REPAIR MANUAL)	
B. COOLING SYSTEM - OVERHAUL	
..... (REFER TO 1120-1220 REPAIR MANUAL)	

PART 1 ENGINE SYSTEMS

CHAPTER 3 TROUBLESHOOTING, SPECIFICATIONS, AND SPECIAL TOOLS

Section	Page
A. TROUBLESHOOTING	1-9
B. SPECIFICATIONS	1-15
C. SPECIAL TOOLS	1-24

A. TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE
Engine Does Not Develop Full Power	<ol style="list-style-type: none"> 1. Clogged air cleaner 2. Fuel line obstructed 3. Improper injection timing 4. Improper nozzle injection pressure and angle 5. Low cylinder compression 6. Insufficient fuel injection 7. Improper valve lash adjustment 8. Burned, worn, or sticking valves 9. Blown head gasket 10. Worn or sticking piston ring
Engine Will Not Stop	<ol style="list-style-type: none"> 1. Defective engine stop wire
Low Cylinder Compression	<ol style="list-style-type: none"> 1. Burned, worn, or sticking valves 2. Bent valve stem 3. Broken or weak valve spring 4. Blown cylinder head gasket 5. Worn or sticking piston ring 6. Blown piston

TROUBLESHOOTING (Continued)

CONDITION	POSSIBLE CAUSE
Poor Engine Idling	<ol style="list-style-type: none"> 1. Improper injection timing 2. Air in injection pump 3. Improper governor adjustment
Engine Knocks	<ol style="list-style-type: none"> 1. Diluted or thin oil 2. Insufficient oil supply 3. Low oil pressure 4. Worn crankshaft thrust bearing 5. Excessive flywheel runout 6. Excessive connecting rod or main bearing clearance 7. Seized bearing 8. Clogged oil passages 9. Bent or twisted connecting rod 10. Crankshaft journals out-of-round 11. Excessive piston-to-cylinder bore clearance 12. Excessive piston ring side clearance 13. Broken or damaged rings 14. Excessive piston pin clearance 15. Seized piston 16. Piston pin retainer loose or missing 17. Improper valve lash adjustment 18. Worn valve lifter 19. Excessive timing gear backlash

**TROUBLESHOOTING
(Continued)**

CONDITION	POSSIBLE CAUSE
Low Oil Pressure	<ol style="list-style-type: none">1. Engine oil level low2. Wrong grade of oil3. Clogged oil pump filter4. Faulty oil pressure relief valve5. Worn oil pump assembly, or broken oil pipe6. Excessive main or connecting rod bearing clearance7. Restriction in pump inlet tube
Oil Pressure Warning Light Fails to Operate	<ol style="list-style-type: none">1. Bulb burned out2. Oil pressure sensor is faulty3. Warning light circuit faulty
Excessive Oil Consumption	<ol style="list-style-type: none">1. Engine oil level too high2. Leakage in cylinder head gasket3. Oil loss past the pistons and rings4. Worn, broken, or sticking piston rings5. Clogged return hole of oil ring6. Worn valves and/or valve guides, or worn seals7. Leakage past oil seals and gaskets8. External oil leaks from the engine

TROUBLESHOOTING (Continued)

CONDITION	POSSIBLE CAUSE
Engine Does Not Start	<ol style="list-style-type: none"> 1. Faulty starter switch 2. Insufficient charging or complete discharge of the battery 3. Lack of fuel 4. Air mixed in the fuel system 5. Clogged fuel filter 6. Irregular or faulty fuel supply 7. Glow plug not heating 8. Improper lubricating oil viscosity 9. Clogged air cleaner 10. Burned out fuse
Engine Stops While Operating	<ol style="list-style-type: none"> 1. Lack of fuel in the fuel tank 2. Clogged fuel filter 3. Air mixed in the fuel system 4. Faulty components
Undesirable Exhaust Color (White or Pale)	<ol style="list-style-type: none"> 1. Excess engine oil 2. Improper lubricating oil viscosity 3. Faulty injection timing
Undesirable Exhaust Color (Black or Light Grey)	<ol style="list-style-type: none"> 1. Unsuitable fuel 2. Excess injection 3. Faulty engine component 4. Overloading 5. Clogged air cleaner

**TROUBLESHOOTING
(Continued)**

CONDITION	POSSIBLE CAUSE
Engine Overheats	<ol style="list-style-type: none">1. Insufficient amount of coolant in the radiator2. Hose connection leaking, or collapsed hose3. Radiator leakage4. Loose, worn, or broken V-belt5. Radiator fins bent or clogged6. Radiator cap not sealing, or faulty cap7. Thermostat not operating properly8. Insufficient amount of engine oil9. Water pump not operating properly10. Improper valve clearance11. Restriction in the exhaust system12. Improperly installed cylinder head gasket13. Rust and/or scale clogged water ports14. Extended engine idling
Excessive Fuel Consumption	<ol style="list-style-type: none">1. Improper injection timing2. Leakage at the injection pipe connectors3. Leakage at the fuel shutoff valve4. Improperly adjusted nozzle
Temperature Gauge Fails to Reach Normal Operating Temperature	<ol style="list-style-type: none">1. Faulty temperature sender2. Faulty thermostat

TROUBLESHOOTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
Coolant Loss - Boil Over	<p><i>Refer to the possible causes of overheating (page 1-9) in addition to the following:</i></p> <ol style="list-style-type: none"> 1. Overfilled cooling system 2. Quick shutdown after hard (hot) run 3. Air in system resulting in occasional "burping" of coolant 4. Insufficient antifreeze, allowing coolant boiling point to be too low 5. Antifreeze deteriorated from age or contamination 6. Leaks due to loose hose clamps, loose nuts, bolts, drain valve, faulty hoses, or defective radiator 7. Faulty head gasket 8. Cracked head, manifold, or block 	<ol style="list-style-type: none"> 1. Reduce coolant level to proper specification. 2. Allow engine to run at fast idle prior to shutdown. 3. Purge system. 4. Add antifreeze to raise boiling point. 5. Replace coolant. 6. Pressure test system to locate leak, then repair as necessary. 7. Replace head gasket. 8. Replace as necessary.
Coolant Entry Into Crankcase or Cylinder	<ol style="list-style-type: none"> 1. Faulty head gasket 2. Crack in head, manifold, or block 	<ol style="list-style-type: none"> 1. Replace head gasket. 2. Replace as necessary.
Noise	<ol style="list-style-type: none"> 1. Fan contacting shroud 2. Loose water pump impeller 3. Glazed fan belt 4. Loose fan belt 5. Rough surface on drive pulley 6. Water pump bearing worn 7. Belt alignment 	<ol style="list-style-type: none"> 1. Reposition shroud and check engine mounts. 2. Replace pump. 3. Apply silicone or replace belt. 4. Adjust fan belt. 5. Replace pulley. 6. Remove belt to isolate. Replace belt. 7. Check for improper pulley locations.
Temperature Lamp On or Gauge Reads Hot, But Temperature is OK	<ol style="list-style-type: none"> 1. Wrong sending unit 2. Sending wire shorted to ground 	<ol style="list-style-type: none"> 1. Install correct sending unit. 2. Locate area of contact and repair insulation.

B. SPECIFICATIONS**GENERAL**

Tractor Model	1215
Engine Model	S723
Number of Cylinders	3
Bore X Stroke	2.83 x 2.83 in. (72 x 72 mm)
Displacement	53.6 cu. in. (879 cc)
Compression Ratio	23:1
Rated Speed (rpm)	2500
Muffler	Vertical
Firing Order	1-2-3
Idle Speed (rpm)	850-900
Maximum No-Load Speed	2650-2700 rpm
Cylinder Arrangement	In-Line Vertical
Valve Arrangement	Overhead
Compression Pressure @200 rpm (Cylinder Speed)	427 ± 70 psi
Variation Between Cylinders	70 psi

SPECIFICATIONS (Continued)

CYLINDER HEAD

Head Warp Standard	0.002 in. less than (0.05 mm)
Maximum	0.005 in. (0.12 mm)
Valve Seat Width Standard	.067-0.083 (1.7-2.1 mm)
Maximum	.098 in. (2.5 mm)
Valve Seat Sink Standard	.0334-.0453 in. (0.85-1.15 mm)
Maximum	.0708 in. (1.8 mm)
Valve Angle	45°
Piston to Valve Clearance	.039 in. (1.0 mm) at Piston TDC (minimum clearance .031 in. [0.8 mm])

CYLINDER BLOCK

Bore Standard	2.8342-2.8348 in. (71.990-72.005 mm)
Maximum	2.8425 in. (72.2 mm)
Head Surface Warp Standard	.002 in. (.05 mm)
Maximum	.005 in. (.12 mm)
Re-Bore Size .020 oversize in. (0.5 mm)	2.8539-2.8545 in. (72.490-72.505 mm)
.040 oversize in. (1.0 mm)	2.8736-2.8742 in. (72.990-73.005 mm)

If bore size exceeds 2.88 in. (73.2 mm), replace the block.

SPECIFICATIONS (Continued)

PISTON PIN

Diameter Standard	0.8267-0.8268 in. (20.998-21.002 mm)
Minimum	0.826 in (20.98 mm)
Pin-to-Bushing Clearance Standard	.0003-.0009 in. (0.008-0.023 mm)
Maximum	.0031 in. (0.08 mm)

PISTON RING

End Gap 1st Ring	.0059-.0106 in. (0.15-0.27 mm)
2nd Ring	.0047-.0094 in. (0.12-0.24 mm)
Oil Ring	.0078-.0138 in. (0.2-0.35 mm)
Maximum	.039 in. (1.0 mm)
Compression Ring-to-Groove Clearance Standard (1st Ring)	0.00236-0.00394 in. (0.06-0.1 mm)
(2nd Ring)	0.002-0.004 in. (0.05-0.09 mm)
Maximum	0.010 in (0.25 mm)
Oil Ring-to-Groove Clearance Standard	0.0008-0.0024 in. (0.02-0.06 mm)
Maximum	0.006 in. (0.15 mm)
Ring Width 1st Compression	0.079 in. (2.0 mm)
2nd Compression	0.059 in. (1.5 mm)
Oil Compression	0.157 in. (4.0 mm)
Oversize	0.020 in. & 0.040 in. (0.5 mm & 1.0 mm)

SPECIFICATIONS (Continued)

PISTON

Diameter Standard	2.8316-2.8322 in. (71.9225-71.9375 mm)
Minimum	2.823 in. (71.7 mm)
Bore Clearance Standard	.0022-.0034 in. (0.0575-0.0875 mm)
Maximum	.010 in. (0.25 mm)
Piston Pin Bore Standard	.8267-.8268 in. (20.998-21.002 mm)
Maximum	.827 in. (21.016 mm)
Piston Pin Clearance Standard	-.00015- +.00015 in. (-0.004- +0.004 mm)
Maximum	.0008 in. (.02 mm)
Available Oversizes	0.020 in. & 0.040 in. (0.5 mm & 1.0 mm)

CONNECTING ROD

Rod Twist Standard	0.003 in. /3.937 in. (0.08 mm /100 mm)
Maximum	0.008 in. /3.937 in. (0.2 mm /100 mm)
Rod Bend Standard	.002 in. /3.937 in. (0.05 mm /100 mm)
Maximum	.059 in. /3.937 in. (.15 mm /100 mm)
Crankshaft Side Play Standard	0.004-0.012 in. (0.1-0.3 mm)
Maximum	0.028 in. (0.7 mm)
Crankshaft Bearing Clearance Standard	0.001-0.003 in. (0.035-0.083 mm)
Maximum	0.008 in. (0.2 mm)

SPECIFICATIONS (Continued)

CRANKSHAFT

Journal Diameter Standard Minimum	1.8096-1.81 in. (45.964-45.975 mm) 1.787 in. (45.4 mm)
Crankpin Diameter Standard Minimum	1.534-1.5344 in. (38.964-38.975 mm) 1.512 in. (38.4 mm)
Runout Standard Maximum	0.001 in. (0.03 mm) 0.002 in. (0.06 mm).
End Play Standard Maximum	002-.011 in. (0.05-0.3 mm) .0196 in . (0.5 mm)
No. 4 Bearing Holder Thickness (made of aluminum die cast) Standard Minimum	.860-.864 in. (21.85-21.95 mm) .0848 in. (21.55 mm)
Cylinder Block Bearing Diameter Standard Undersize (0.25 mm) Undersize (0.5 mm)	1.8096-1.810 in. (45.964-45.975 mm) 1.7998-1.8002 (45.714-45.725 mm) 1.7899-1.79903 in. (45.464-45.475 mm)
Journal-to-Cylinder Block Bearing Clearance Standard Maximum	0.0015-0.0036 in. (0.039-0.092 mm) 0.0079 in. (0.2 mm)
Main Journal Re-grind Size .010 Undersize (.25 mm)	1.7998-1.8002 in. (45.714-45.725 mm) #1, 2, 3 1.7994-1.7998 in. (45.454-45.465 mm) #4
.020 Undersize (.50 mm) (See Figure 4)	1.7899-1.7904 in. (45.464-45.475 mm) #1, 2, 3 1.7895-1.7899 in. (46.169-46.179 mm) #4
Crankpin Re-grind Size .010 Undersize (.25 mm) .020 Undersize (.50 mm)	1.5242-1.5246 in. (38.714-38.725 mm) 1.5143-1.5148 in. (38.464-38.475 mm)

SPECIFICATIONS (Continued)

CRANKSHAFT

Stem Diameter-Intake Standard	0.2738-0.2744 in. (6.955-6.97 mm)
Minimum	0.271 in. (6.89 mm)
Stem Diameter-Exhaust Standard	.2732-.2736 in. (6.94-6.95 mm)
Minimum	.269 in. (6.84 mm)
Guide Clearance-Intake Standard	0.001-0.002 in. (0.03-0.06 mm)
Maximum	0.008 in. (0.2 mm)
Guide Clearance-Exhaust Standard	.0019-.0029 in. (0.05-0.075 mm)
Maximum	0.010 in. (0.25 mm)
Valve Margin Standard	.0364-.0423 in. (0.925-1.075 mm)
Minimum	.0197 in. (0.5 mm)
Valve Lash Cold Condition	0.008 in. (0.2 mm)
Valve Spring-Free Height Standard	1.378 in. (35 mm)
Minimum	1.319 in. (33.5 mm)
Valve Spring-Squareness Standard	.0472 in. (1.2 or less mm)
Maximum	.079 in. (2.0 mm)
Valve Timing-Intake Open Before TDC	13°
Close After BDC	43°
Valve Timing-Exhaust Open Before TDC	43°
Close After BDC	13°
Load Required to Compress Spring to 1.2 in. (30.4 mm) Standard	17.857 lbs. (8.1 kg)
Minimum	15.43 lbs. (7 kg)

SPECIFICATIONS (Continued)

CAMSHAFT

Cam Height-Valve Standard	1.041-1.043 in. (26.445-26.5 mm)
Minimum	1.027 in. (26.1 mm)
Bend Standard	.001 in. (.03 mm)
Maximum	.004 in. (0.1 mm)
Cam Height-Fuel Standard	1.335-1.341 in. (33.94-34.06 mm)
Minimum	1.33 in. (33.8 mm)

PUSH RODS

Length	6.18 in. (157 mm)
Diameter	.248 in. (6.3 mm)

ROCKER ARM

Shaft Diameter Standard	.4587-.4594 in. (11.65-11.668 mm)
Minimum	.456 in. (11.57 mm)
Shaft-to-Rocker Clearance Standard	.00126-.00268 in. (.032-.068mm)
Maximum	0.008 in. (0.2 mm)

**SPECIFICATIONS
(Continued)**

LUBRICATION SYSTEM

Pressure Relief Valve Opening Pressure (Sq. In.)	43-71 psi (3.0-5.0 kg/cm ²) (at 2600 engine rpm)
Rotor-to-Vane Clearance Standard Maximum	.0039-.006 in. (0.1-0.15 mm) 0.010 in. (0.25 mm)
Rotor-to-Cover Clearance Standard Maximum	0.004-0.006 in. (0.1-0.15 mm) 0.008 in. (0.20 mm)

COOLING SYSTEM

Type of System	Pressurized Liquid with Recirculating Bypass
Water Pump Type Drive Belt Deflection (Tension)	Centrifugal V-belt 0.2 in. (5 mm) when 2.2 lbs (1 kg) force is applied midway between pulleys
Fan Diameter	13.386 in. (340 mm)
Thermostat Starts to Open Fully Open	180° F (82° C) 203° F (95° C)
Radiator Cap Pressure Rating	13 psi (0.9 kg/cm ²)
Coolant Capacity	Ethylene glycol and water in a 50/50 mixture 3.69 U.S. Quarts (3.5 Liters)

**SPECIFICATIONS
(Continued)**

TORQUE SPECIFICATIONS

Connecting Rod Cap Bolts 21.7-25.3 ft. lbs. (29.4-34.3 N·m)

Crankshaft Main Bearing Holders 18-22 ft. lbs. (25-29 N·m)
(made of cast iron)

Crankshaft Main Bearing Holder 14.46-18.08 ft. lbs. (19.61-24.51 N·m)
(made of aluminum die cast)

Main Bearing Holder Retaining Bolts 18-22 ft. lbs. (25-29 N·m)

Crankshaft Pulley Retaining Nut 87-94 ft. lbs. (118-127 N·m)

Engine Rear Plate Bolts 34-39.8 ft. lbs. (46.1-53.9 N·m)

Engine Front Plate Bolts 6.5-10 ft. lbs. (9-12 N·m)

Flywheel Retaining Bolts 50.6-57.9 ft. lbs. (68.6-78.4 N·m)

Head Bolts 36.2-38.3 ft. lbs. (49-51.9 N·m)

Oil Transfer Tube Banjo Bolts 7.2-9.4 ft. lbs. (9.8-12.7 N·m)

Bolt, Nut	General Torque Values	
	Standard Bolt	Special Bolt
M 6	3.6-5.1 ft. lbs. (4.9-6.9 N·m)	6.1-8.3 ft. lbs. (8.3-11.3 N·m)
M 8	9.4-12.3 ft. lbs. (12.7-16.7 N·m)	16.6-21.0 ft. lbs. (22.6-28.4 N·m)
M 10	18.8-24.6 ft. lbs. (25.5-33.3 N·m)	32.6-41.2 ft. lbs. (44.1-55.9 N·m)
M 12	27.5-34.7 ft. lbs. (37.3-47.1 N·m)	55.7-61.5 ft. lbs. (65.7-83.4 N·m)
M 16	63.7-81.0 ft. lbs. (86.3-110 N·m)	110-136 ft. lbs. (149-184 N·m)
M 18	83.9-104 ft. lbs. (114-141 N·m)	145-174 ft. lbs. (196-235 N·m)
M 20	106-132 ft. lbs. (144-179 N·m)	177-213 ft. lbs. (240-289 N·m)

C. SPECIAL TOOLS

Oil Pump Port Block Remover Tool	Tool No. 11097
Oil Pump Port Block Installer Tool	Tool No. 11063A
Dial Indicator (Magnetic Base)	Tool No. 1345
Micrometer	0-1 inch
Micrometer	1-2 inch
Micrometer	2-3 inch
Small Hole Gauge	3/4-1 inch
Cylinder Bore Gauge	2-3 inch
Cylinder Bore Gauge	1-2 inch
Engine Oil Pressure Test Fitting	Tool No. FNH 00011
1/8 in. BRT Pipe - 7/16 in. JIC	
Engine Compression Test Adapter	Tool No. FNH 00120

PART 2 FUEL SYSTEM

CHAPTER 1 INJECTION PUMP

Section	Page
A. DESCRIPTION AND OPERATION	2-2
B. REMOVAL AND INSTALLATION	2-6
C. TIMING	2-8

CHAPTER 2 INJECTORS

Section	Page
A. DESCRIPTION AND OPERATION	2-16
B. REMOVAL AND INSTALLATION	2-17
C. OVERHAUL	2-18

CHAPTER 3 TROUBLESHOOTING, SPECIFICATIONS, AND SPECIAL TOOLS

Section	Page
A. TROUBLESHOOTING	2-19
B. SPECIFICATIONS	2-22
C. SPECIAL TOOLS	2-23
D. FUEL INJECTION PUMP SPECIFICATION STANDARDS	2-23

PART 2

FUEL SYSTEM

CHAPTER 1

INJECTION PUMP

Section	Page
A. DESCRIPTION AND OPERATION	2-2
B. REMOVAL AND INSTALLATION	2-6
C. TIMING	2-8

A. INJECTION PUMP - DESCRIPTION AND OPERATION

The fuel injection pump is a constant stroke, in-line pump, Figures 1 and 2. It operates at one-half engine speed and contains one pumping element for each cylinder. The pump elements accurately meter and deliver the fuel to the injectors, Figure 3.

Each of the pumping elements consists of a barrel and plunger lapped together to give an accurate fit. Two diametrically opposed drillings in the barrel form fuel inlets, and the barrel is splined (with a master spline) for correct location within the pump body, Figure 3.

An annular groove is machined around the plunger, into which fuel leaking between the barrel and plunger may accumulate. This leakage provides lubrication to the barrel and plunger surfaces.

The plunger has a fuel port which terminates in a helical groove (6), that is machined in the periphery of the plunger (2), Figure 3.

The elements operate as follows (Figure 3):

Position A

With the plunger at the bottom of the stroke, fuel flows into the barrel through the two inlet ports to fill the space above the plunger, the center drilling, and the helical groove.

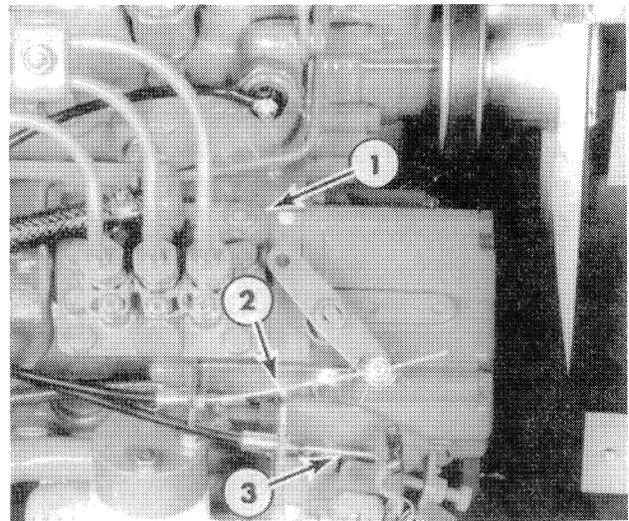


Figure 1
Fuel Injection Pump

- | | |
|---------------------|---------------------------|
| 1. Pump Assembly | 3. Throttle Control Cable |
| 2. Engine Stop Wire | |

Position B

As the plunger rises, the two inlet ports in the barrel are just covered and the fuel is trapped. This point is called "spill cut-off" or "point of injection." Further upward movement of the plunger tends to compress the trapped fuel until the delivery valve, which acts as a non-return and unload valve, is lifted from the seat. This allows the fuel to pass along the pipeline to the injector. The pressure developed lifts the injector needle valve off the seat, and injection takes place.

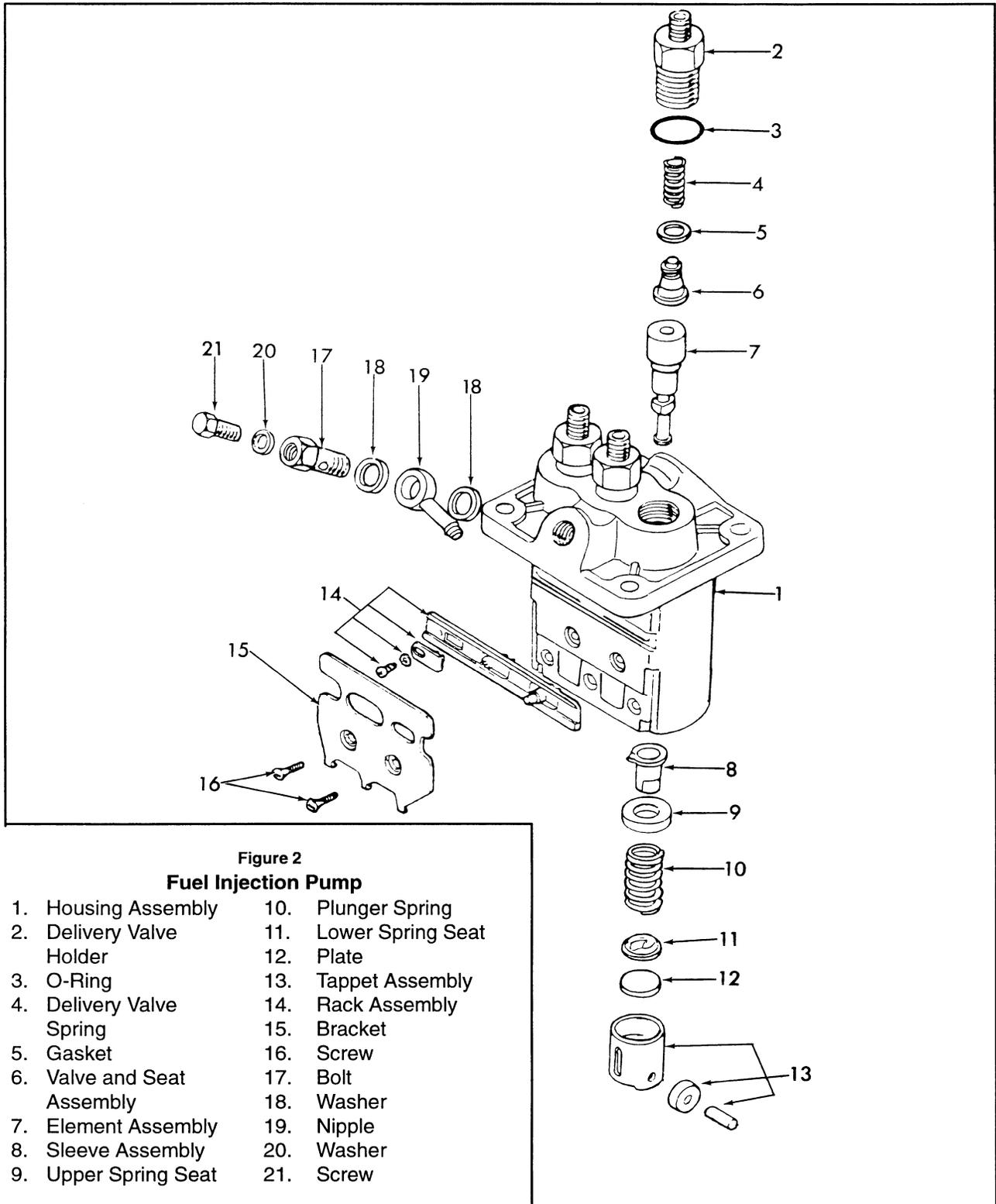


Figure 2
Fuel Injection Pump

- | | |
|----------------------------|-----------------------|
| 1. Housing Assembly | 10. Plunger Spring |
| 2. Delivery Valve Holder | 11. Lower Spring Seat |
| 3. O-Ring | 12. Plate |
| 4. Delivery Valve Spring | 13. Tappet Assembly |
| 5. Gasket | 14. Rack Assembly |
| 6. Valve and Seat Assembly | 15. Bracket |
| 7. Element Assembly | 16. Screw |
| 8. Sleeve Assembly | 17. Bolt |
| 9. Upper Spring Seat | 18. Washer |
| | 19. Nipple |
| | 20. Washer |
| | 21. Screw |

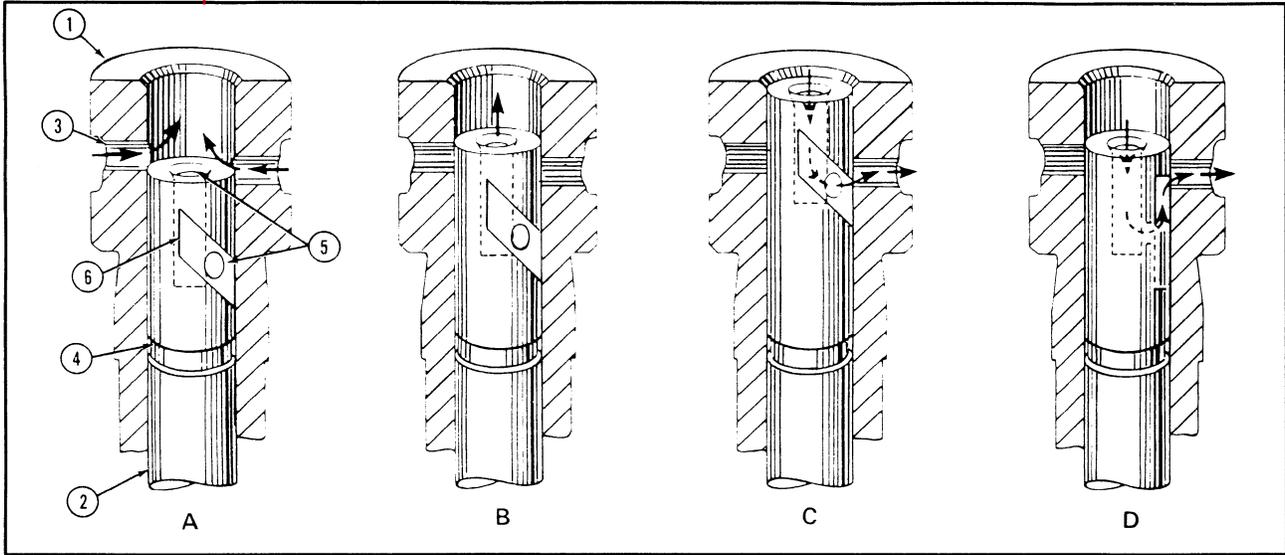


Figure 3
Fuel Injection Pump

- | | | | |
|------------|-------------------|--------------------------------|-------------------|
| 1. Barrel | 3. Fuel Inlet | 5. Fuel Port - Center Drilling | 6. Helical Groove |
| 2. Plunger | 4. Annular Groove | | |

Position C

Injection ceases when the upper edge of the helical groove just uncovers the lower edge of the inlet port. The pressurized fuel is allowed to escape through the drilling to the low pressure area of the inlet port.

This pressure drop causes the injector needle valve to close and injection to cease. The plunger continues to the top of the stroke and is returned by a spring for the next cycle.

The effective pumping stroke is the distance between the top of the plunger and the point on the helical groove which uncovers the inlet port.

If the plunger is rotated clockwise so the helical groove uncovers the inlet port at a lower point on the plunger, the pump stroke and the amount of fuel injected will be increased. Conversely, if the plunger is rotated counterclockwise, the effective pumping stroke and the amount of fuel injected will be reduced.

The plunger is made to rotate by an arm at the base of the plunger. This arm engages with a fork on the control rod, and the movement of the control rod towards the rear of the engine turns the plunger clockwise and increases the fuel flow.

Position D

At this stage, the plunger has rotated to a position where the helical groove has reached the bottom of the inlet port before the plunger has risen sufficiently to close both inlet ports.

During the remainder of the plunger stroke, the helical groove remains in contact with the inlet ports, so no pressure is produced and no injection can take place.

This is the “no delivery” or “stop” position, which occurs when the stop lever moves the control rod to the fully forward position.