Stanadyne®

Integrated Fuel System (IFS) Operation and Instruction Manual

CONTENTS

GENERAL

A. Purpose of the Manual

This manual is expressly intended to provide qualified, trained diesel fuel injection technicians the information necessary to prepare to and test the Standyne Integrated Fuel System. In addition to this manual all special tools and test equipment as outlined herein are needed, as well as all service pertinent literature and individual pump specifications containing the calibration information and parts breakdown.

This manual is not intended to be used by untrained, inexperienced persons to attempt to service the product. Such unauthorized service could result in violations of emission regulations, pump damage, or possibly engine damage. No service should be performed on IFS's before studying this manual and becoming familiar with the principles and instructions which follow.

B. Model Numbering System

The system's serial number, date code and John Deere part number are located on the unit pump's upper shoulder surface. Refer to the Identification and Cross Reference table in Service Bulletin 557 to obtain the Stanadyne system part number.

Compact Pencil Nozzles (CPN®) are marked with an injector serial number, injector part number, date code and an injector inscription code as shown in Figure 2. Again reference Service Bulletin 557 to determine which CPN is specified for each system.

Unit Pump/System Identification

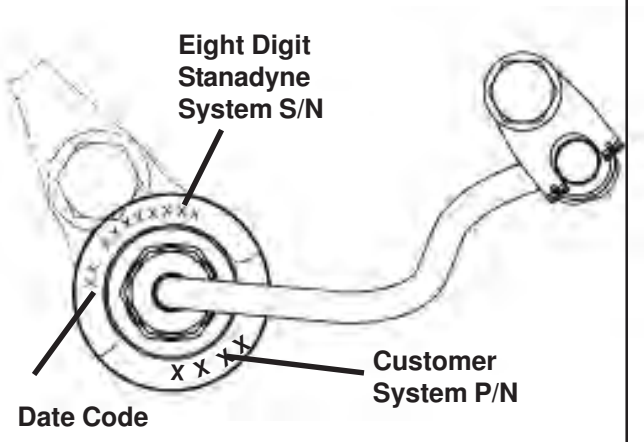


Fig. 1

Compact Pencil Nozzle Identification

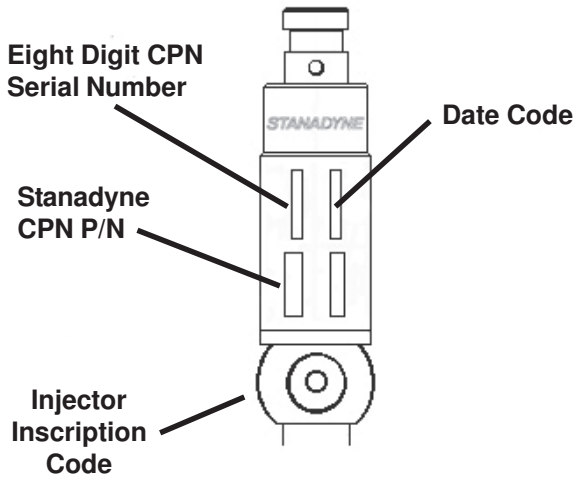


Fig. 2

SECTION 1 - CONSTRUCTION AND OPERATION

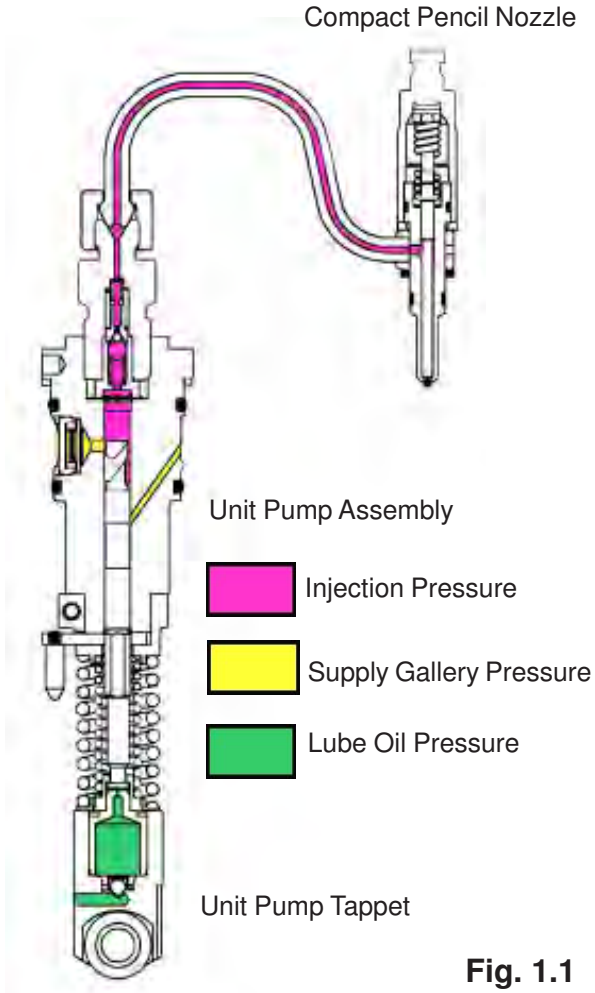


Fig. 1.1

A. Components and Fuctions

The Integrated Fuel System (IFS) is an assembly of the following three components. (A) The Unit Pump Tappet, (B) the Unit Pump Assembly, and (C) the Compact Pencil Nozzle (CPN). The unit pump is capable of pressures of 1200 bar with a maximum fuel delivery of 100mm3/stroke at 3600 engine rpm. The injector is a Compact Pencil Nozzle designed to operate at pressures up to 1500 bar. Since the CPN is designed with a no-leak-off feature, the entire system can be installed under the engine valve cover.

At the pumping end of the plunger, a precision ground helix covers and uncovers, dependent on the plunger position, the charging port in the pump body.

During the charging cycle the unit pump tappet follows the backside of the cam, allowing the spring-loaded plunger to move downward. As the plunger moves downward the helix's top edge uncovers the inlet port, allowing inlet fuel to fill the pumping chamber (Fig. 1.2).

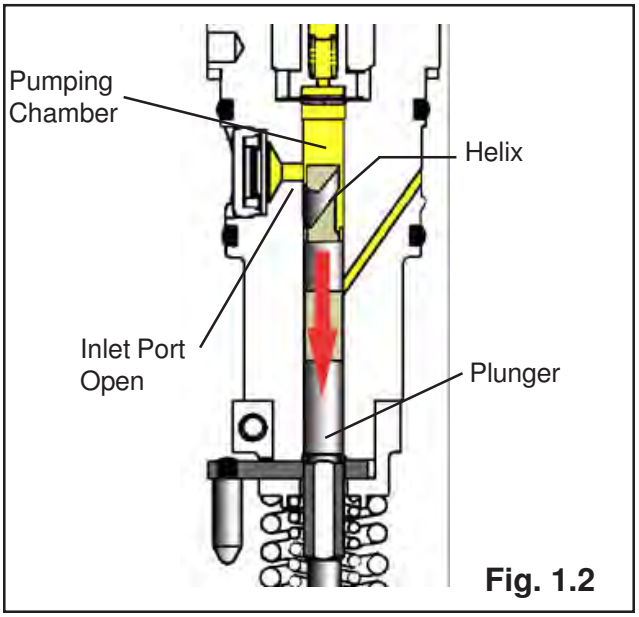


Fig. 1.2

As the unit pump tappet is forced to rise due to the rotation of the engine driven cam, it causes the plunger to lift towards the pump body. The helix part of the plunger at a point defined by governor rack position closes off the inlet port. Fuel will no longer be spilled back through the inlet port; instead now it will be pumped at a much higher pressure to the injector (Fig. 1.3).

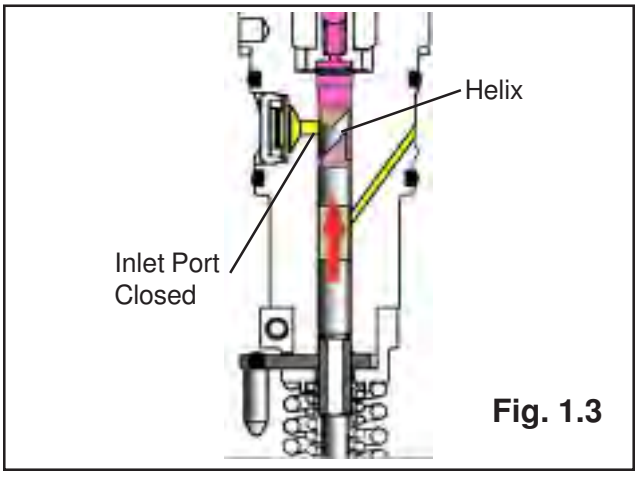


Fig. 1.3

As the plunger continues to be lifted by the cam and tappet assembly, the bottom edge of the helix will eventially uncover the charging port. As this port starts to be uncovered, injection pressure plus further displaced fuel due to the plunger continuing to rise is spilled out the port, thereby lowering the pressure in the pumping chamber and ending the injection event. (Fig. 1.4).

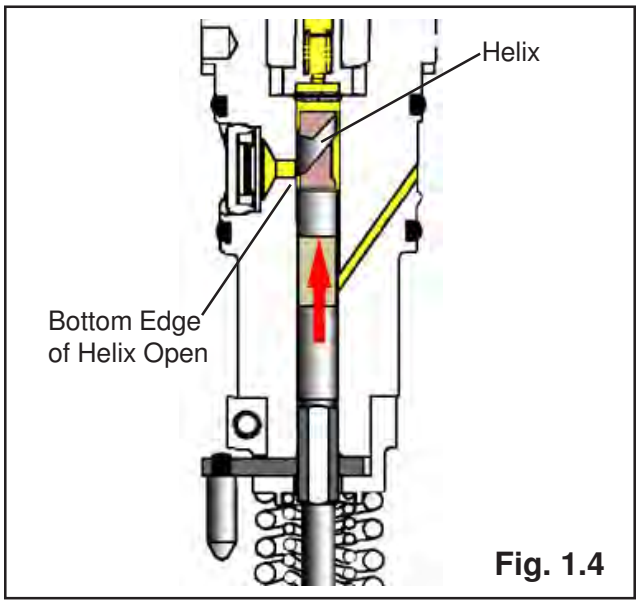


Fig. 1.4

An engine driven governor, through linkage to the unit pumps, controls the rotational position of the pumping plunger. By turning the plunger different profiles on the helix will control the opening and closing of the charging port, tailoring timing and fuel delivery (Fig. 1.5).

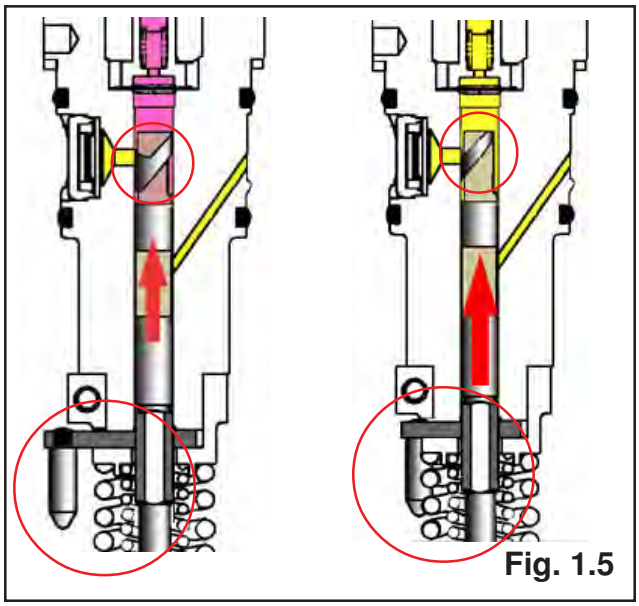


Fig. 1.5

Figure 1.6 is a layout of a typical helix. The upper edge of the helix controls start of pumping (timing). The lower ramp controls fuel quantity delivered. The starting zone of the helix produces an advance in timing and a delivery of a large quantity of fuel, both of which are needed for engine starting. The full load zone provides less advance timing (lower upper ramp location) and less fuel than the starting zone. When the engine is operating in a no load -to- light load condition the governor rotates the plunger so that the light load zone of the helix controls the covering and uncovering of the charging port as follows: With a decrease in load, engine speed increases causing the governor to rotate the plunger which will cause a decrease in fuel with a corresponding increase in advance. As load increases, engine speed drops and the governor moves the plunger in the opposite direction, which increases fuel and decreases advance.

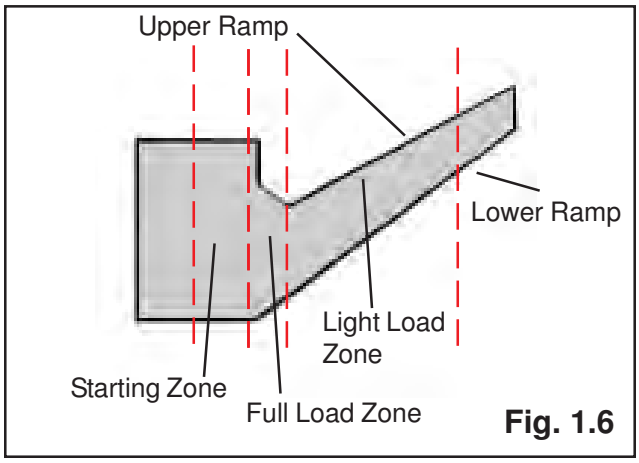


Fig. 1.6

During cold engine operation, especially after starting, fuel injected into the relatively cool cylinders will take a longer period of time to heat up to self-ignition temperature. If the delay in ignition becomes too great some fuel may not be burned, resulting in white smoke emissions. Advancing the pump timing increases the time that the fuel is exposed to lower than normal heat in the combustion chamber. During cold engine operation, pressurized engine oil is sent to the cold advance piston in the unit pump tappet. The cold advance piston and the unit pumps

plunger are lifted together to a higher position (1.5mm) in relationship to the unit pump body, causing an advance in pump timing. A ball check at the base of the piston prevents pumping forces from collapsing the advance. When the engine reaches normal temperatures, oil pressure to the cold start advance is shut off. Residual pressure in the piston cup bleeds out through the orifice located in the cup end that contacts the plunger allowing the piston to return to its seated position (Fig 1.7).

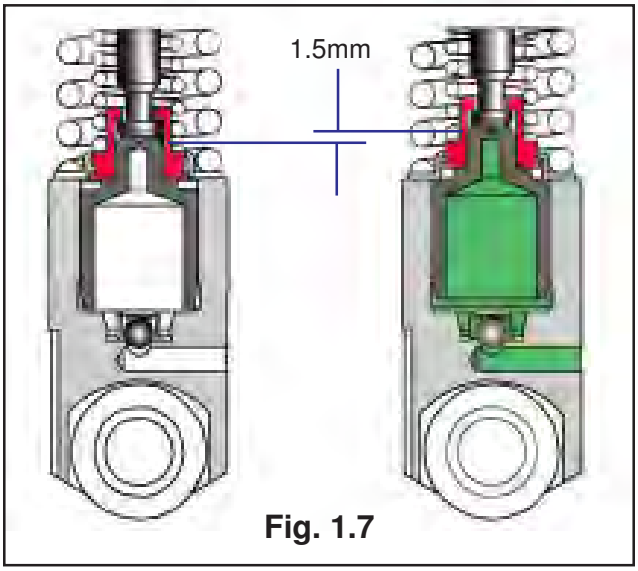


Fig. 1.7

To meet today's and future emission standards, start of injection (SOI) to engine timing is critical. As previously explained, start of pumping that directly controls start of injection commences when the plunger rises in the pump body far enough that the pump plunger helix covers the inlet port.

This pumping event timing is affected by engine deck height and the tolerance stack-up of pump components. Engine deck height is the distance from the base circle (low point on the cam lobe) of the cam to the IFS pump seating surface on the cylinder head. To account for both engine, unit pump tappet and unit pump tolerances that would affect pump-to-engine timing, a correction shim of a specified thickness is placed under the unit pumps seating surface. The correct timing shim for each IFS is selected during pump calibration at the factory and by the Authorized Service Dealers during the Pump Following Service Calibration.

SECTION 2- COMPACT PENCIL NOZZLE SERVICING

A. Special Service Tools

38021 Cap Nut Wrench
38474 Carbon Seal Re-sizing Tool
38605 CPN Calibration Line
37745 CPN Holding Fixture

B. Preparation and Cleaning

Refer to the 99002 Pencil Nozzle Repair Manual

C. Hydraulic Lock-up Elimination

The CPN is a no-leak-off design with no provisions for return fuel plumbing since the Integrated Fuel System is located internally in the engine. Unlike nozzle operation with an injection pump, there is no reduction in line pressure on a nozzle tester between injections. This will cause the cap nut area to fill with high pressure fuel, eventually balancing the pressure in the nozzle body preventing the valve from lifting off its seat. This at first will cause non-repeatable pressure readings and eventually an inoperable injector. Therefore, it is important to drain the cap prior to testing and if these symptoms become apparent during testing, disconnect the injector from the nozzle tester and drain the cap nut as follows:

Step 1 Place the CPN in the vise supported 37745 CPN Holding Fixture. Loosen the cap nut using the 38021 CPN Cap Installation/ Removal Tool and a 3/4 " (19 mm) wrench.

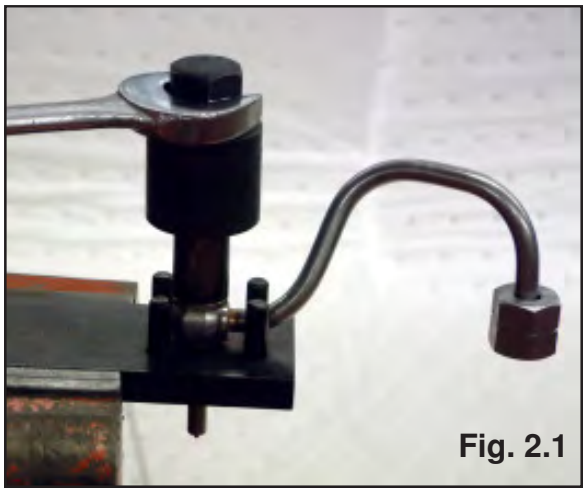


Fig. 2.1

Step 2 Hold the CPN in a position so that when unthreading the cap nut from the injector the spring and shim will not fall out of the cap nut. Tip the cap to drain the fuel from the cap while not allowing the spring, shim, spring seat, and lift stop from falling out of the cap. Refer to Figure 2.2

Fig. 2.2

Step 3 Apply a coating of clean calibrating fluid to the 35685 o-ring seal (Reference Figure 2.3) and hand tighten the cap nut onto the CPN body. Place the CPN in the 37745 holding fixture and using the 38021 CPN Cap Installation/Removal Tool tighten the cap to 110-120 lbf-·in (12.4-13.6 N•m) with a 3/4" (19mm) socket. Refer to Figure 2.3

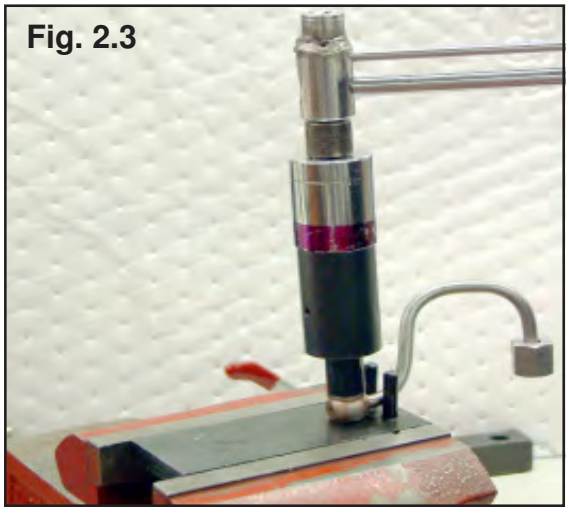


Fig. 2.3

D. Testing

1. Using the 38605 CPN Calibration Line, connect the CPN to the nozzle tester with the CPN tip angled downward (Figure 2.4).

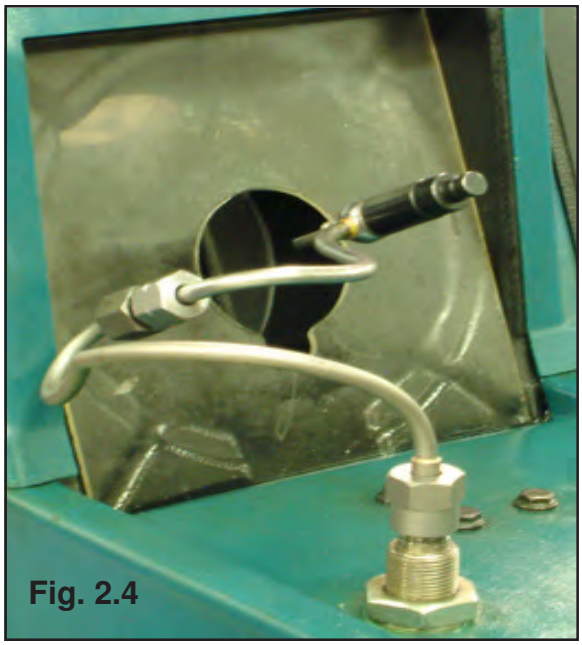


Fig. 2.4

2. Chatter – Close the pressure gauge valve and operate the tester rapidly. The nozzle should chatter. Chatter is a rapid opening and closing of the nozzle valve while fuel is being pumped through the nozzle. It is audible and can also be felt in the handle of the nozzle tester. At this time also check for quality of the spray pattern (an even finely atomized plume from each spray orifice). If the nozzle does not operate, drain the cap nut as described under Hydraulic Lock Up Elimination, reconnect to nozzle tester and check for chatter and spray again.

3. Nozzle Opening Pressure – Open the nozzle tester gauge valve and raise the pressure slowly until the nozzle valve opens. Note what the maximum pressure reading is on the gauge before the pressure sharply drops off. Repeat several times and if large variations between these readings are noted, disconnect the CPN from the nozzle tester, drain the cap nut as described in the Hydraulic Lock Up Elimination section and retest.

4. Seat Condition – With the nozzle tip pointed downward and the gauge closed, operate the tester rapidly to firmly seat the valve. Dry the nozzle tip thoroughly. Open the gauge valve and raise the pressure to 250 - 350 PSI (17-24 bar) below the measured opening pressure. While maintaining the pressure for 10 seconds, no droplet should separate from the nozzle tip. Slight dampness or a drop forming is permissible with a used nozzle.

5. Return oil — Raise the pressure slowly to at least 2600 PSI (179 bar). Release lever and note the time it takes the pressure to decay from 2500 PSI (172 bar) to 2000 PSI (138 bar), 5 seconds minimum. This check should be performed using SAE J967 / ISO 4113 calibration fluid at room temperature (70º - 80ºF [21º– 27ºC]).

E. Adjusting Opening Pressure

Step 1 Refer to the individual CPN specification for the specified opening pressure and available shims for adjusting the opening pressure.

Step 2 If the opening pressure is out of specification, a shim change can be made to adjust the opening pressure.

Step 3 Disconnect the injector from the nozzle tester. Mount the CPN in the 37745 Holding Fixture. Using the 38021 Cap Nut Wrench Tool loosen the Nozzle Holder Cap Nut.

Step 4 Remove the Lift Stop, Pressure Adjusting Shim, Pressure Adjusting Spring and Spring Seat from the Nozzle Holder Body Assembly. Reference Figure 2.5.

NOTE: Because components of individual CPN's are matched at the factory to control flow and needle lift, never intermix the components from one CPN with another.

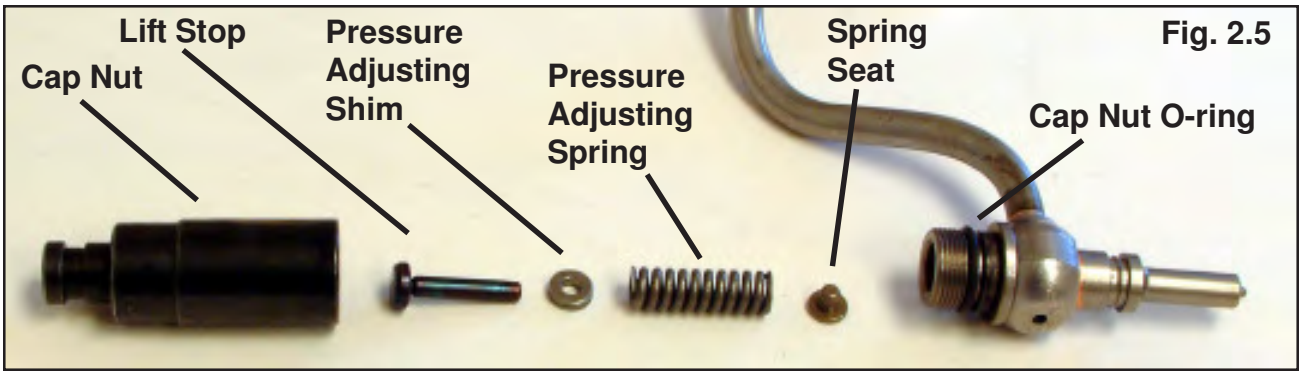


Fig. 2.5

Step 5 Measure the existing shim's thickness.

Step 6 Replace the existing pressure adjusting shim with an appropriate shim to obtain the specified opening pressure. A change of .001" (.025 mm) in shim thickness will cause a 30 PSI (206 kPa) change in pressure (shims are listed on the individual injector specification). Assemble the components back into the body assembly after lubricating the 35685 cap nut o-ring seal.

Step 7 Place the CPN into the holding fixture and using the cap nut wrench, tighten the cap nut to 110–120 lbf.-in. (12.4-13.6 N•m).

Step 8 Re-check opening pressure.


Fig. 2.6

F. Needle Lift Adjustment

At this time needle lift cannot be measured or adjusted in the field.

G. Replacement of the Carbon Stop Seal, Plain Washer and O-Ring Seal

The 16389 carbon stop seal, 35685 o-ring seal, and the 35686 plain washer must be replaced on all CPN's that are serviced. These components, along with the 36528 carbon stop seal installation tool, are contained in the 36530 CPN Seal Kit. The installation instructions are as follows:

Step 1 Slide the new plain washer onto the nozzle holder assembly until it rests against the line banjo.


Fig. 2.7

Step 2 Place the carbon stop seal installation tool over the nozzle tip and slide the carbon stop seal over the 36528 installation tool (Reference Figures 2.6 and 2.7) until the seal drops into the groove on the nozzle holder body assembly. Remove and discard the installation tool.

Step 3 A newly installed Carbon Stop Seal will not return to size immediately. To squeeze the carbon seal's outside diameter to the correct size, with a rocking motion push the 38474 Carbon Seal Re-sizing Tool over the end of the nozzle tip after installing a new carbon seal as shown.

Fig. 2.7

SECTION 3 - TEST BENCH REQUIREMENTS AND PROCEDURES

A. Test Equipment

- **Test bench**:
  10 HP direct drive
  Lube oil pressure capability:
  3.5 Bar (50 PSI)
  Mounting plate: 107mm pilot dia.
  Drive coupling: 30 mm taper
- **Laptop Computer**: (Not included)
  DAQ Card and DAQ Cable
  Stanadyne Proprietary DE Fuel Injection System Software
- **39105 IFS Service Equipment Kit**
  (Reference Fig. 3.1)

①	39106	IFS Cam Box
②	39142	Hose & Fitting Kit
③	39152	Hex Bit Socket Assy.
④	39155	Cable, Pump Interface Module
⑤	39156	Pump Interface Module
⑥	39234	Tappet Extraction Tool
⑦	—	IFS Cam Box Storage Case
	99972	IFS Software CD-ROM (Not shown)

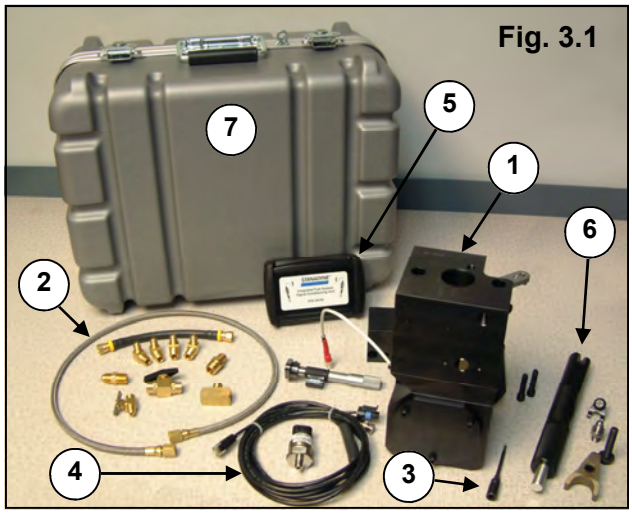


Fig. 3.1

B. Cam Box Mounting

These instructions are for a typical test bench set-up. Additional pipe/tube fittings may be required in some cases to properly connect the cam box to the test bench.

Step 1 Remove the Cam Box subassembly from the storage case and inspect the contents.

Mount the cam box to an appropriate 107 mm pilot diameter mounting plate (Fig. 3.2) and install the mounting plate and cam box assembly onto the test bench pedestal.

CAUTION: The cam box assembly is heavy - approx. 68 lbs (30.8 kg).

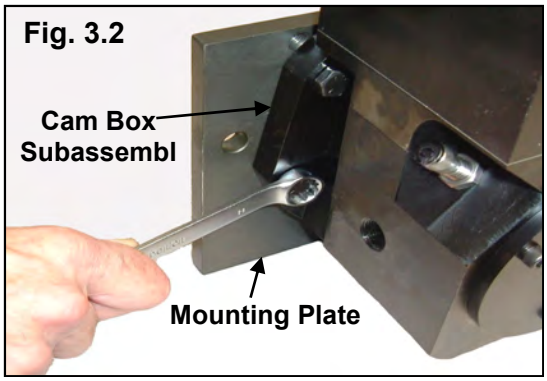


Fig. 3.2

Step 2 Install the drive coupling, 39136 lock washer, and 39135 hex nut (Fig. 3.3) onto the drive shaft. Tighten the nut to 100 ft-lbs (135 N·m). *NOTE: Drive Coupling orientation to the Drive Shaft key slot is not required.*

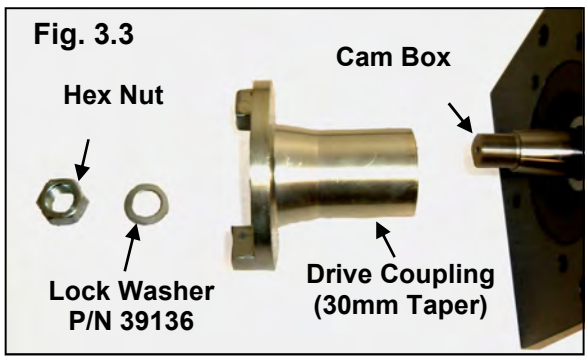


Fig. 3.3

Step 3 Position the mounting pedestal and connect the drive coupling to the test bench.

Step 4 Assemble the CPN Nozzle Block onto the cam box (Fig 3.4). Index the diamond shaped alignment pin and install the two 5/16–18 x 1.5" cap screws. Tighten the cap screws to 180-220 lbf-in (20-25 N·m).

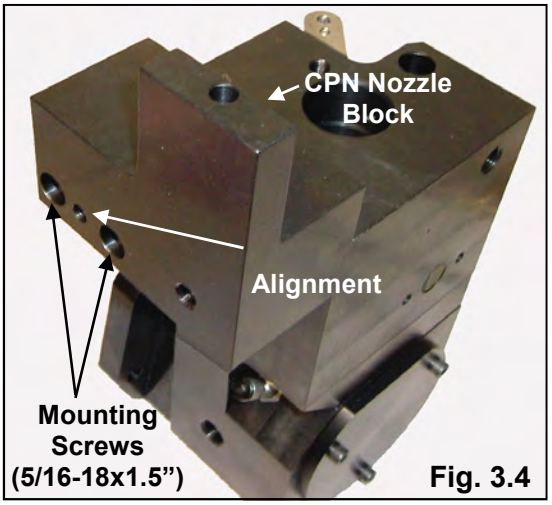


Fig. 3.4

Install the 39142 Hose and Fitting Kit

NOTE: Use a suitable thread sealant on all tapered pipe thread (NPT) fittings.

Step 5 Install the three 90˚ elbow fittings (1/4" NPT to 1/4" Tube) into the following cam box ports: calibrating oil supply and lube oil supply ports shown in Figure 3.5, and the calibrating oil return port shown in Figure 3.6. Do not tighten at this time.

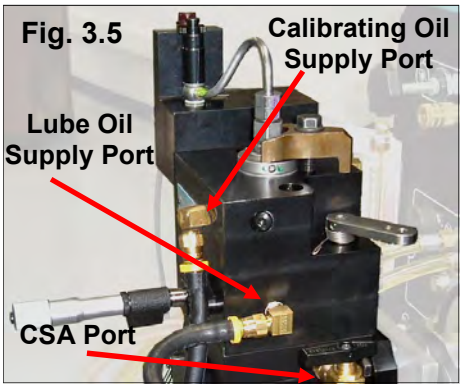


Fig. 3.5

Install the pipe-to-tube adapter (3/8" NPT to 3/8" Tube) into the lube oil return port (Fig. 3.6) and tighten it securely.

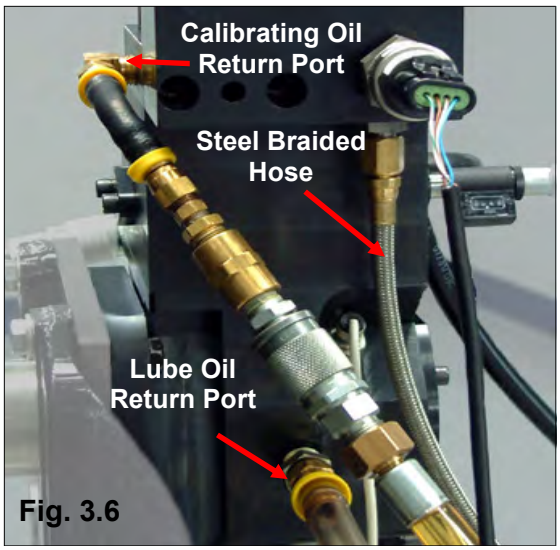


Fig. 3.6

Install the pipe nipple (3/8" NPT to 1/4" NPT - Fig. 3.7a), into the Cold Start Advance (CSA) port (Fig. 3.7b) and tighten it securely. Turn the Lube oil Supply 90˚ elbow until it is tight in the position shown in Fig. 3.5 & Fig.3.7b. Securely assemble the remaining components in Figure 3.7a into the configuration shown in Fig. 3.7b.

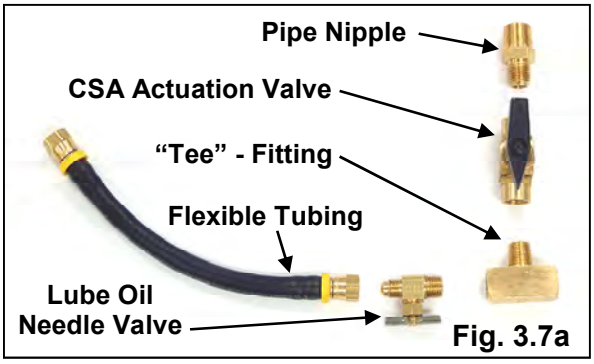


Fig. 3.7a

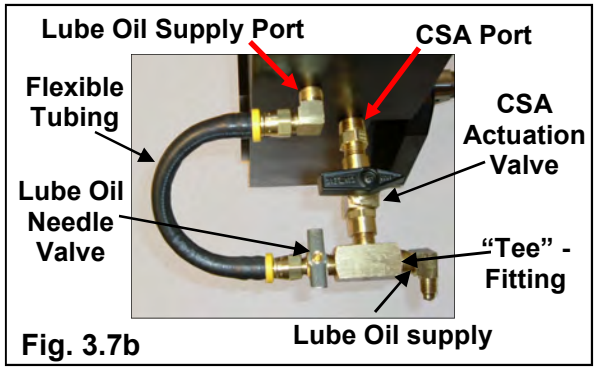


Fig. 3.7b

Before tightening the remaining fittings, determine a safe routing for the test bench's Lube Oil and Calibrating Oil tubing. Tighten the brass fittings securely in the cam box and connect the test bench hoses.

Adjust lube oil needle valve: Turn the needle in until it lightly bottoms and then backing it out 1/4 to 1/2 turn.

NOTE: Only a small amount of oil flow is required for proper lubrication. Should the flow of lube oil become excessive, the cam shaft cavity will fill and overflow through the rack adjusting hole. Should this happen, close the needle valve slightly.

Step 6 Ensure the "red" O-ring seal (P/N 27607) is seated on the Flow Restriction Connector (Fig 3.7). Thread the flow restriction connector into the nozzle block (Fig. 3.8) and tighten to 110-130 lbf-in (12.4-14.7 N·m). Connect the steel braided hose (Fig. 3.6) to the flow restriction connector and to one of the test bench's fuel delivery measurement systems "cylinders". The steel braided hose has 36˚ tapered tube fittings on each end. .

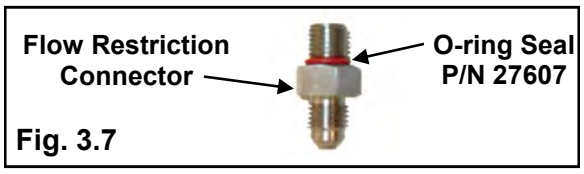


Fig. 3.7

Apply thread sealant to the threads of the Start of Injection (SOI) Pressure Transducer and install it into the nozzle block (Fig. 3.8) tightening securely.

NOTE: Use care when applying thread sealant, to prevent sealant material from entering the transducer feed hole.

Step 7 Due to manufacturing tolerances, each cam box has a unique micrometer offset. This setting ensures

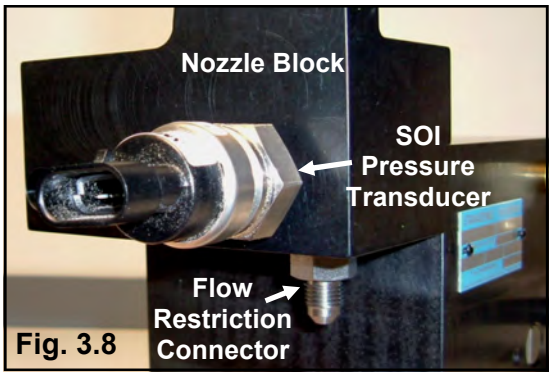


Fig. 3.8

precise rack position orientation and consistency between cam boxes. The offset dimension is stamped on the cam box nameplate as shown in Fig. 3.9. and is pre-set at the factory.

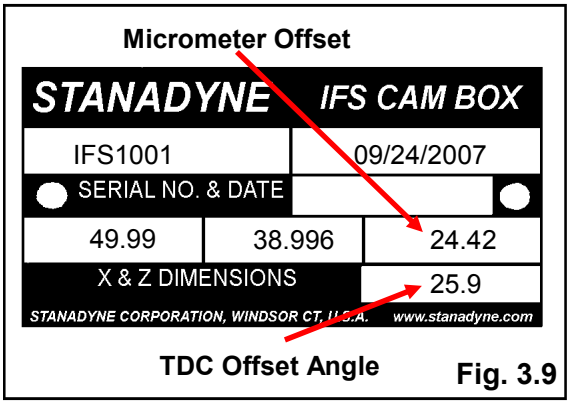


Fig. 3.9

To verify the micrometer offset: Remove the o-ring seal from the micrometer adapter. Place the micrometer and adapter assembly on a flat surface, turn the micrometer in until it's spindle contacts the flat surface (Fig. 3.10). The reading should match the micrometer offset number stamped on the cam box nameplate (Fig. 3.9).

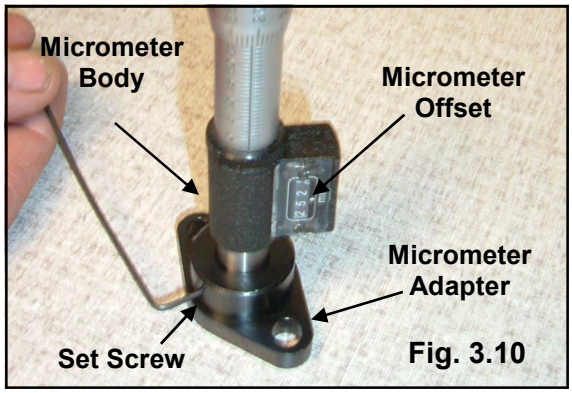


Fig. 3.10

If the micrometer offset position is incorrect, the micrometer must be repositioned in the micrometer adapter as follows:

Ensure the o-ring seal in the micrometer adapter is removed. Adjust the micrometer to the factory offset dimension. Loosen the set screw. Hold the adapter flush to the flat surface and firmly push the micrometer body down in the adapter until the spindle contacts the flat surface. Verify the micrometer offset reading and tighten the set screw securely.

Step 8 Insert the o-ring seal (P/N 30343) into the groove in the micrometer adapter. Using the two 1/4"-20 x .75" screws, mount the micrometer adapter to the cam box (Fig. 3.12). Tighten the screws to 60-70 lbf-in (6.8-7.9 N·m).

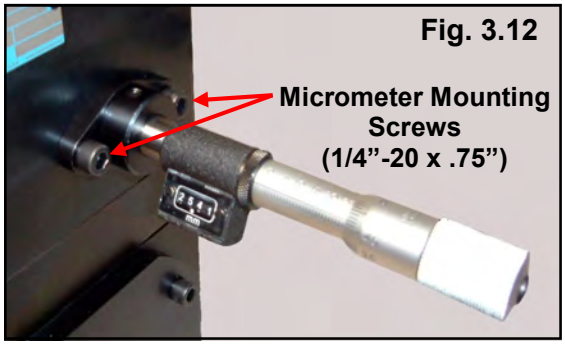


Fig. 3.12

Step 9 Slowly rotate the drive while looking into the TDC sensor hole on the cam box, visibly center the pin on the cam shaft in the hole. Thread the TDC sensor all the way in until it lightly contacts the pin then back it out approximately 1/8 - 1/4 of a turn. Holding the sensor stationary, tighten the jam nut securely.

Step 10 As shown in Figure 3.13, connect the Pump Interface Module Cable (1). Connect the cable to the 39156 Pump Interface Module (4), the SOI pressure Sensor (2) and the TDC magnetic pick-up (3). Connect the DAQ cable (5) to the Pump Interface Module (4) and to the DAQ card in the computer (6).

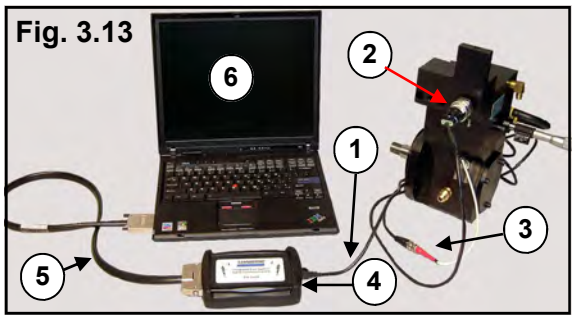


Fig. 3.13

Step 11 Load the IFS Service Equipment Software 99972 by inserting the CD-ROM into the CD drive. The IFS Calibration Software installation wizard will guide you through the installation process which only takes a few minutes to complete.

The operator will be requested to verify a destination location for the programs installation. The default location is C:\Program Files\IFS Calibration\.

Once the installation is complete, a shortcut icon is automatically placed on the computers desktop.

Step 12 To access the IFS program, select the IFS icon on the desktop and open the program. The first time the program is opened, the operator is requested to input a "TDC Offset number" (Fig. 3.14). This number is

Fig. 3.14

specific to each cam box and is stamped on the cam box nameplate in the location shown in Figure 3.9. Once this information has been entered it will be used as the default value and will not need to be entered again for future tests.

Step 13 To begin a test sequence, select the "New Test" button. Some basic identification data must be entered and the specific model number and test routine selected prior to testing.

Because the IFS serial number is used in the test results file name, the number must be entered twice to verify that it is entered correctly. Once the serial number entry has been verified it will change to a Green font color.

Service Dealer identification numbers are matched to an internal table of authorized service agencies. Once the number has been verified it will change in font color to Green. Once this information has been entered it will be used as the default value and will not need to be entered again for future tests.

The IFS model number that is to be tested is chosen from a pull down menu, accessed by selecting the arrow in the "Pump Model Number" field.

Choose the desired test routine from the pull down menu activated in the "Select Test Routine" field.

NOTE: The Manual Mode is not functional at this time.

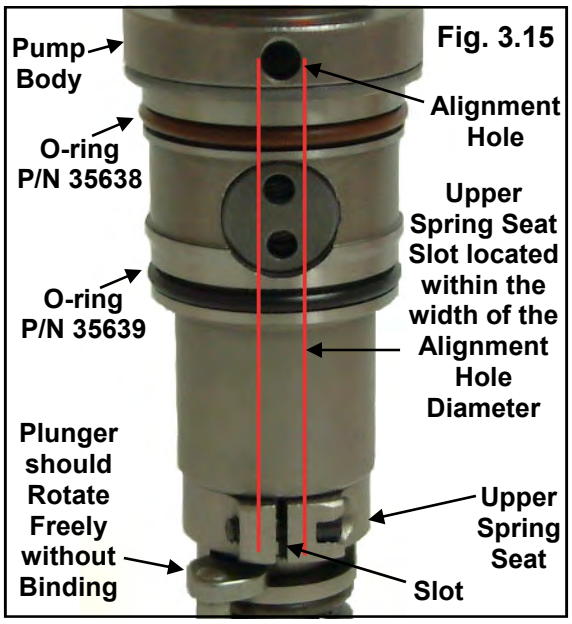
C. System Calibration Checks: As Received for Service

When an IFS system is received for service it should be cleaned and visually inspected prior to mounting in the IFS cam box.

Step 1 Inspect the cam follower roller for rotation and condition. Ensure the CSA piston moves within the tappet body bore. Inspect the cam follower springs on the unit pump to ensure that neither the inner or outer springs are broken.

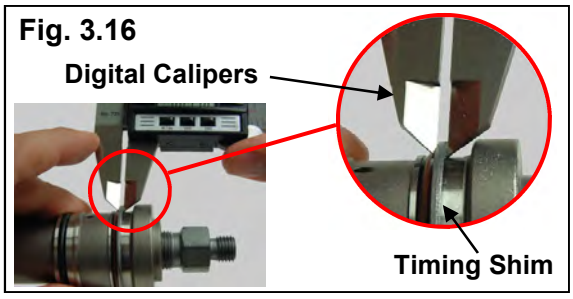
Step 2 Check the pumping plunger for rotation without binding (Fig. 3.15).

Step 3 Verify that the upper spring seat slot location is within the width of the alignment hole diameter in the pump body (Fig. 3.15)



Step 4 Measure and record the shim thickness if supplied (Fig. 3.16). Otherwise, use a 1.65mm thick timing shim (P/N 35998) for initial testing*.

*** For this reason timing is not used as a consideration for warranty.**



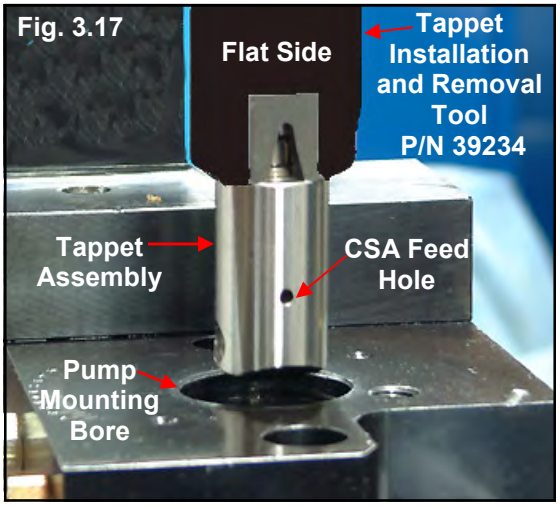
Step 5 Replace the upper o-ring seal (Fig. 3.15) P/N 35639 (brown) and the lower o-ring seal P/N 35638 (black).

Mounting the Unit Pump into the IFS Cam Box:

Step 1 Remove the CPN from the Unit Pump.

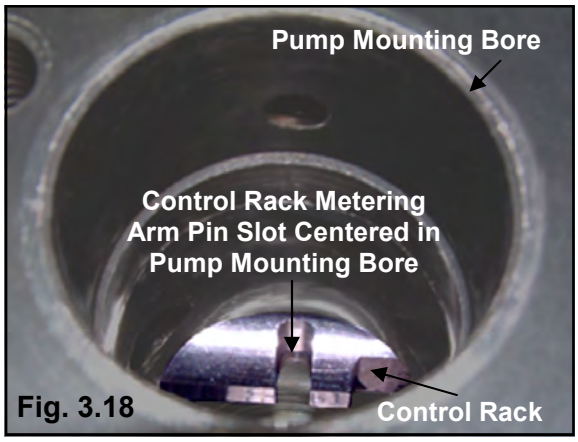
Step 2 Look into the pump mounting hole and rotate the drive until the base circle (low side) of the cam lobe is visible in the hole.

Step 3 Place the tappet assembly on to the magnetic end of the 39234 Tappet Extraction Tool (Fig. 3.17). Orient the CSA feed hole position to the flat side of the tool. In this position the tappet's guide pin slot will align with the guide pin in the tappet bore.



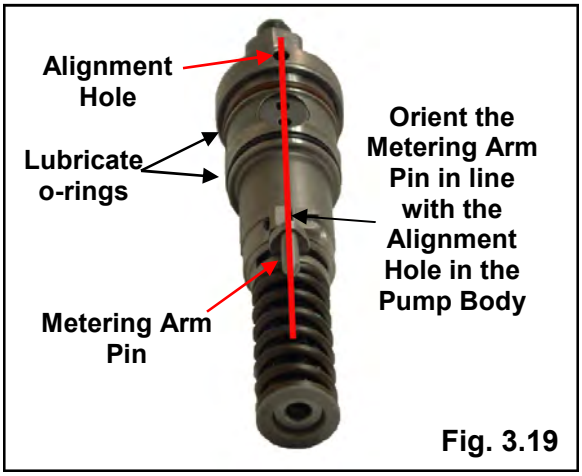
Hold the 39234 Tappet Tool with tappet over the pump mounting bore so that the flat portion of the tool is facing the control rack. Insert the tappet assembly into the unit pump bore. Ensure that the tappet's guide pin slot indexes with the pin in the tappet block and that the cam follower roller is fully seated against the cam shaft. Push down on the plunger to release the tappet assembly from the magnet.

Step 4 Center the position of the control rack metering arm pin slot within the pump mounting bore (Fig. 3.18).



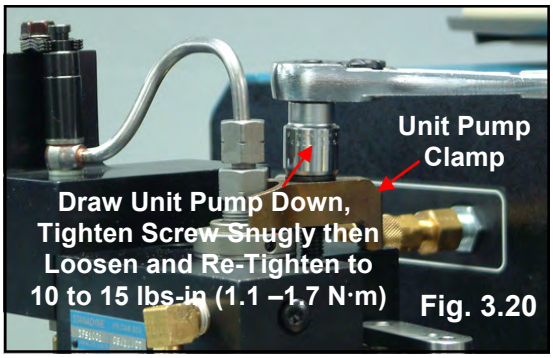
Step 5 Lubricate the upper and lower o-ring seals on the pump body (Fig. 3.19).

Step 6 Position the Metering Arm so that the metering arm pin lines up with the pump body fixture hole as is shown in Figure 3.19.

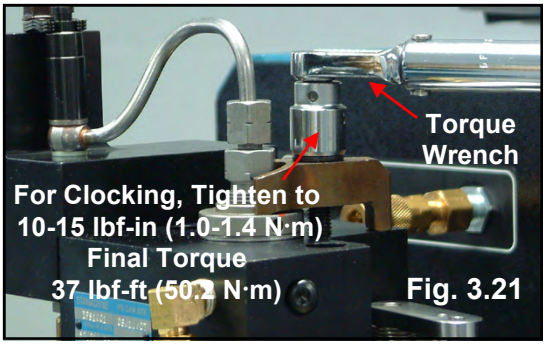


Step 7 Install the unit pump into the Cam Box. Use the alignment hole as a reference to index the metering arm pin with the control rack slot (Fig. 3.19).

Step 8 Install the pump hold-down clamp and screw. Tighten the hold-down clamp screw to draw the unit pump down into the cam box (Fig. 3.20).



Step 9 After seating the pump body in the cam box, loosen the hold down screw slightly and then tighten it to approximately 10 to 15 lbs-in (1.1 –1.7 N•m) as shown in Figure 3.21. This will provide a slight drag while rotating the unit pump during the clocking procedure.



Pump Clocking

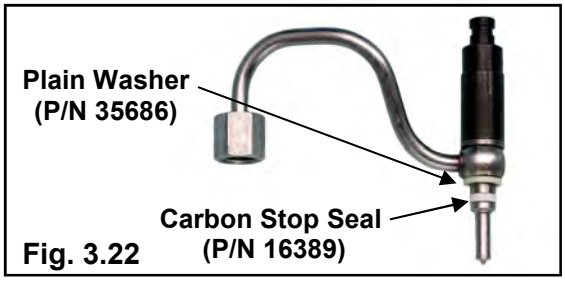
Step 1 Move the control rack to the maximum fuel position by setting the micrometer to 2.63mm.

Step 2 Turn the pump body slightly (about 1/4—1/2 of a turn) in a counterclockwise direction to remove any pre-load on the metering arm pin. Then turn the unit pump clockwise (a slight drag should be felt) until the pump stops rotating. This will remove any remaining clearance between the metering arm, control rack and micrometer spindle. Hold the pump stationary and tighten the hold down clamp to 37 lbs-ft. (50.2 N·m).

Step 3 Re-check the clocking dimension. Turn the micrometer thimble out several turns. Turn the micrometer in until it stops. A reading of between 2.63 and 2.81mm should be attained. If the micrometer reading is outside of these parameters, return to Step 1.

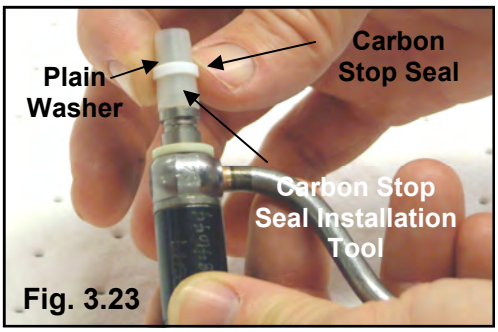
Mount the CPN

Step 1 Remove the Carbon Stop Seal (P/N 16389) and Plain Washer (P/N 35686) as shown in Figure 3.22.



Step 2 The CPN must be purged of air prior to system testing or the injection timing may be skewed during the test. To ensure that no air is entrapped within the injector, the CPN should be hydraulically locked using a suitable nozzle tester. Slowly increase the tester pressure until the nozzle opens, return to a pressure just below the nozzle opening pressure and maintain this pressure until the CPN is hydraulically locked (Reference Service Bulletin 557).

Step 3 Install a new plain washer and carbon stop seal (Fig. 3.23) provided in the IFS Parts Kit (P/N 36529).



Step 4 Allow the Carbon Stop Seal to relax for a few minutes. Then use the Carbon Stop Seal Re-sizing Tool in a slight rocking motion to squeeze the seal into its final size (Fig. 3.24).

Fig. 3.24

Step 5 Apply a thin coat of assembly grease to the carbon stop seal.

Step 6 Guide the CPN nozzle tip into the nozzle block, align the CPN inlet tubing with the discharge fitting of the pump.

Step 7 Use the injector clamp to draw the nozzle tip and carbon stop seal into the nozzle block. Tighten the injector clamp screw to 20 lbf-ft (27.1 N•m).

Step 8 Tighten the injector inlet piping nut to 23 lbf-ft (31.2 N•m) using a 17mm flare nut socket while holding the unit pump discharge fitting stationary with a 19mm wrench.

Step 9 Select the appropriate IFS model number test routine in the software and follow the instructions displayed in the text box of the IFS program.

D. System Settings: Following System Service

Step 1 With the test bench and cam box set assembled as described earlier. Use either the original timing shim or a 1.65mm timing shim (P/N 35998), install and clock the IFS as described in part "*C System Calibration Checks: As Received for Service*" in this section.

Step 2 Select the appropriate IFS system number and test routine in the software and follow the instructions displayed in the text box of the IFS program.

Step 3 Unit pump assemblies may require setting of the metering arm maximum and minimum stop positions.

NOTE: Replacement unit pump assemblies are not preset at the factory and will require this adjustment. Original equipment unit pump assemblies will have an alignment line scribed on the pump body and upper spring seat (Fig. 3.25).

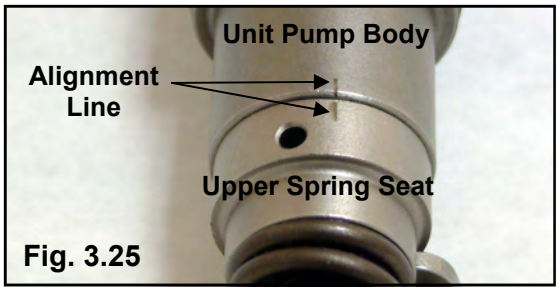


Fig. 3.25

The stop positions are adjusted by changing the radial position of the Upper Spring Seat. This is accomplished by first adjusting the unit pump assembly in the cam box to a specified low idle fuel delivery. Then repositioning the upper spring seat to the full fuel rack position.

Low Idle Fuel Delivery Setting

The IFS test following service routine asks the user to verify the upper spring seat position by checking the fuel delivery at low idle speed using a specific rack position.

NOTE: The speeds and rack positions differ for each IFS model, always reference the individual system test routine or service specification for actual setting parameters.

If the fuel delivery is acceptable, the program will prompt the user to proceed to Step 3d to record it. If the fuel delivery is outside of the given parameters, the user will be requested to proceed to Step 3a where the upper spring seat is adjusted as follows:

a. Adjust the bench speed to 0 RPM. Loosen the CPN Line Nut and the Unit Pump Clamp. Rotate the Unit Pump in the direction shown in Figure 3.26 to adjust the fuel delivery.

NOTE: The amount of pump rotation required for adjustment is very small.

Tighten the unit pump clamp and CPN line nut.

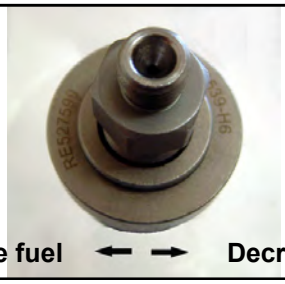


Fig. 3.26

b. Return the test bench to the speed specified in the test routine and verify the micrometer setting. Check the fuel delivery - if it is incorrect repeat step **a**; if it is within tolerance proceed to step **c**.

c. Stop the test bench (0 RPM). Loosen the upper spring seat screw with the Spring Seat Torque Tool (P/N 39152). Apply enough pressure to the screw to hold the spring seat in contact with the metering arm and micrometer. Adjust the micrometer to 2.63mm and tighten the upper spring seat screw to 18-22 lbf-in (2.0–2.5 N•m) as shown in Figure 3.27.

Check the micrometer setting for 2.63-2.81mm by backing the micrometer out, then turning it in until it stops. Repeat the upper spring seat setting if necessary.

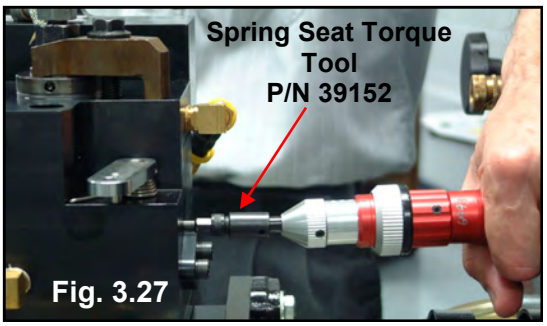


Fig. 3.27

d. Set the micrometer position and the test bench speed as specified in the test routine. Record the fuel delivery. If the fuel delivery is incorrect return to step **a**.

Step 4 The rest of the test routine includes check points for fuel delivery, cold start advance operation and injection timing at various speeds.

Injection Timing Adjustment

The injection timing is monitored continuously while the test routine is in operation. However, a specific step in the "Test Following Service" routine to verify the timing for adjustment purposes. Injection timing is adjusted by placing a timing shim under the unit pump body collar to change the relational position of the roller tappet and the cam lobe

The program user will be prompted to "Check Shim". When selected, the actual injection timing is compared to the specified timing parameters. The program will then return an appropriate set of instructions based on the results of the comparison. The user is then either instructed to proceed to the next step (timing is within tolerance) or to replace the timing shim (timing is out of tolerance).

If the injection timing is out of tolerance, the program will calculate the dimensional difference of the timing shim in use versus the shim size that is required. A positive or negative number in millimeters will be displayed. If positive add or, if negative subtract that amount to or from the existing shim thickness (Reference Fig. 3.16, Page 12). Using the resulting thickness dimension determine the correct shim part number from the Unit Pump Timing Shims table at the end of this manual or on the individual IFS service specification. Replace the timing shim as follows:

a. Remove the CPN from the unit pump and remove the unit pump assembly from the Cam Box.

b. Visually check the location of the upper spring seat. If the seat position is not within the acceptable limits as shown in Figure 3.15 on page 12, the IFS assembly is worn beyond acceptable limits and should be replaced.

   If the upper spring seat position is within the limits, replace the timing shim with the correct shim.

   NOTE: If shim replacement is not required, the inspection of the upper spring seat location will need to be performed when the pump is removed at the conclusion of the test routine.

c. Mount the IFS assembly in the cam box and clock unit pump assembly as described earlier in part “C” of this section.

d. Return the micrometer position and test bench speed to the required settings, select “Verify Shim”. The program will check the timing and either prompt the user to repeat the timing shim replacement or proceed to the next step.

Cold Start Advance Operation

The test routine verifies cold start advance operation by prompting the user to open the CSA activation valve (Reference Figure 3.7b, Page 9).

Should the CSA fail to activate, ensure that the lube oil needle valve is set to 1/2 turn out from the seated position. If the CSA continues to fail operationally, inspect the tappet assembly and CSA piston. If the piston fit is incorrect (very loose, difficult to move by hand or seized in the bore) the tappet assembly will need to be replaced.

Step 5 For the remainder of the system settings follow the latest edition of the individual IFS specification and the appropriate test routine from the latest version of the IFS service equipment program.

E. Preparation for Returning an IFS to the Customer.

The IFS seal kit (P/N 36529) contains the seals necessary for unit pump and CPN engine installation. A protective sleeve and shipping cap for the CPN are also provided to prevent contamination during handling.

1. Replace the two o-ring seals on the unit pump.
2. Replace the carbon dam seal and the plain washer on the CPN.
3. Carefully put the protective shipping cap (P/N 26888) over the valve end of the CPN.

4. Hand tighten the CPN to the Unit Pump Body.
5. Slide the Roller Tappet Assembly into the woven protection sleeve, then slide the Unit Pump spring into the other end of the sleeve.
6. If possible, it is also recommended that each assembled IFS be placed in a poly bag.

SECTION 4 - TABLES

A. Identification and Cross Reference Table

CPN Part Number	Inscription Code	Stanadyne IFS Part Number	John Deere IFS Part Number	Application
36595	J	37740	RE527597	4T LT OEM
		38231	RE530788	4T LT OEM
		38232	RE530793	1500 Generator Set
		38239	RE530802	1800 Generator Set
		38262	RE530869	4T LT OEM
36597	K	37741	RE527598	4T/5T OEM, 317, 320, 325 SSL & 304J, 244J, 4WDL
		37742	RE527599	5TW OEM, 328 Skid Steer Loader
		38225	RE530790	4T/4TW, 5T OEM
		38226	RE530792	5TW OEM
		38234	RE530795	1800 Generator Set
		38236	RE530797	1500 Generator Set
		38237	RE530800	4T/5T OEM, 317, 320, 325 Skid Steer Loader
		38238	RE530801	5TW OEM, 328 Skid Steer Loader
36601	M	38227	RE530789	332 Skid Steer Loader
		38228	RE530791	5H OEM
		38233	RE530794	1500 Generator Set
		38235	RE530796	1800 Generator Set
36848	R	38230	RE530798	4520, 4720, & 5325 Tractor
		38243	RE530824	5325 Tractor
36850	S	38229	RE530799	5225 Tractor
		38240	RE530803	4120/4320 Tractor
		38244	RE530825	5225 Tractor
38145	T	38242	RE530823	4120/4320 Tractor
		39185	RE534688	313/315 Skid Steer Loader
38147	V	38241	RE530822	4520/4720 Tractor

B. Compact Pencil Nozzle Shims

Part No.	Thickness Inches (mm)	Part No.	Thickness Inches (mm)
35646	0.0945 (2.40)	35654	0.0787 (2.00)
35647	0.0925 (2.35)	35655	0.0768 (1.95)
35648	0.0906 (2.30)	35656	0.0748 (1.90)
35649	0.0886 (2.25)	35657	0.0728 (1.85)
35650	0.0866 (2.20)	35658	0.0709 (1.80)
35651	0.0846 (2.15)	35659	0.0689 (1.75)
35652	0.0827 (2.10)	35660	0.0669 (1.70)
35653	0.0807 (2.05)	35661	0.0650 (1.65)

C. Unit Pump Timing Shims

Part No.	Size (mm)	Part No.	Size (mm)
35991	1.3	36189	1.825
36179	1.325	36001	1.85
35992	1.35	36190	1.875
36180	1.375	36002	1.9
35993	1.4	36191	1.925
36181	1.425	36003	1.95
35994	1.45	36192	1.975
36182	1.475	36004	2.0
35995	1.5	36193	2.025
36183	1.525	36005	2.05
35996	1.55	36194	2.075
36184	1.575	36006	2.1
35997	1.6	36195	2.125
36185	1.625	36007	2.15
35998	1.65	36196	2.175
36186	1.675	36008	2.2
35999	1.7	36197	2.225
36187	1.725	36009	2.25
35716	1.75	36845	2.275
36188	1.775	36846	2.3
36000	1.8		

D. Torque Values & Cam Box Settings

1. Compact Pencil Nozzle - Cap Nut	110-120 lbf-in (12.4-13.6 Nm)
2. CPN Inlet Piping Nut	23 lbf-ft (30 Nm)
3. Upper Spring Seat Screw	18-22 lbf-in (2.0-2.5 Nm)
4. Unit Pump Mounting Clamp	37 lbf-ft (50.2 Nm)
5. CPN Mounting Clamp	20 lbf-ft (27.1 Nm)
6. Drive Hub Retaining Nut	100 lbf-ft (135 Nm)
7. Nozzle Block Mounting Screws	180-220 lbf-in (20-25 Nm)
8. Micrometer Adapter Mounting Screws	60-70 lbf-in (7-8 Nm)
9. Flow Restriction Connector	110-130 lbf-in (12.4-14.7 Nm)
10. Lube Oil Needle Valve	Turn in till contact, back out 1/2 turn
11. TDC Sensor Air Gap	.005 in. (.12mm), Turn in till contact, back out 1/4 turn

Stanadyne LLC
92 Deerfield Road, Windsor, CT 06095, U.S.A
www.stanadyne.com

Stanadyne S.p.A.
Via Matteotti 158
25014 Castenedolo (Brescia), Italia

Stanadyne Amalgamations Private Ltd.
9 Industrial Area 2, Marai Malai Nagar, Kanchi Puram District 603209, India

Stanadyne Changshu Corporation
Intersection of Jinmen Road and Huangshan Road, Jiangsu, China

99976 Printed in U.S.A. Rev. 09/15