SERVICe BULLETIN

DATE: July 24, 2008
NO: 60R8

SUPERSEDES: S.B. 60R7 dated July 22, 2004

SUBJECT: PUMPING PLUNGER REPLACEMENT

PUMP MODELS AFFECTED: ALL

To achieve the high pressures necessary for efficient fuel injection, each pumping plunger used in Stanadyne rotary fuel injection pumps is precision fit. Therefore, should plunger replacement become necessary for any reason, it is imperative that the correct plungers are utilized. When selecting service replacement pumping plungers refer to the individual pump specification and this bulletin to ensure the proper plunger size and configuration is selected.

Plunger Identification

Pumping plungers are grouped into basic sizes according to outside diameter, then graded further by size into four select fits, “A” through “D”. In addition, pumping plungers are available in two different lengths (Short or Long) and with two end face configurations (Conical or Radiused), as pictured in the attached chart.

Basic Plunger Size Groups

Basic plunger size can be determined by either measuring plunger diameter or by using the plunger size code found in the last two digits before the “dash” in the Stanadyne Model Number, as shown in Figure 1.

<table>
<thead>
<tr>
<th>Plunger Size Code</th>
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<th>Plunger Size Code</th>
<th>Size (inches)</th>
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<tr>
<td>33</td>
<td>0.330</td>
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</tr>
</tbody>
</table>

Examples:

DBGFC627-1LQ uses 0.270 inch plungers
DB2435-5879 uses 0.350 inch plungers

Figure 1

Plunger size group part numbers are listed in the part number column of the pump service specification. Do not order pumping plunger by the basic size group part number.
Plunger Size Grading
Each basic plunger size group is further graded into diameter increments of 0.000025 inch (0.00635mm) for precision bore to plunger fitment. Each diameter increment is given a letter designation (“A” through “D”), with size “A” being the largest of each basic size group. The plunger bore(s) on each hydraulic rotor assembly is/are measured and the matching plunger grading letter is etched into their base, as shown in Figure 2.

Some rotors may have oversized plunger bore(s) (0.002” [0.0508mm] oversize). To identify these rotors a “-2” is etched on the rotor base in addition to the grading letter. Rotors with this designation would require replacement plungers to be ordered from the oversize (O/S) column of the attached chart and/or the oversize plunger group listed on the service specification.

Plunger Length
Pumping plungers are classified as either “Short” or “Long”, except those used in DE pump models which have a unique length (0.4530” [11.51mm]). A pair of “long” plungers (0.470” [11.94mm]) are used in every rotary pump model (except DE). Whereas, hydraulic rotors with provisions for four pumping plungers are fitted with an additional pair of “short” plungers (Reference Figure 3).

IMPORTANT: Each plunger bore is fitted with either short or long pumping plungers, they are never be mixed within a bore.

Plunger End Design (Refer to the pictures on the attached chart)
All “Long” pumping plungers (including DE plungers) have a radius-end design. However, “Short” pumping plungers may have either a conical-end design or a radius-end design depending on the application. DB4, DM4 and DC four-cylinder
pumps and DS eight-cylinder pumps use short plungers with a radius-end design while DB4, DM4 and DC six-cylinder pumps use short conical-end design plungers.

Originally, DC six-cylinder pumps were equipped with radius-end design short plungers. But in the late 1970’s, all DC six cylinder head and rotors were fitted with the DM4 style conical-end design plungers to standardize plunger types.

Grooved Plungers
Occasionally, during installation of the “zero clearance” E.I.D. governor weight retainers on automotive DB2 models (Reference S.B. 426), the rotor plunger bore can become distorted. When fitted with plungers, the bore distortion can create a minimum clearance condition where the lubricity film could be reduced to the point of hampering plunger movement during low pressure charging. To ensure adequate lubricity under these conditions, the 0.310 inch (7.87mm) diameter “long” plungers now include lubrication grooves as shown in Figure 4.

![Figure 4](image)

Please reference S.B. 426 for correct installation procedures for the “zero clearance” E.I.D. governor weight retainers

DE Pump Models
DE pump models (both four and six cylinder configurations) are fitted with two 0.4530 inch (11.51mm) long, 0.350 inch (8.89mm) diameter pumping plungers. Plunger codes, grading letters and oversize designations are identified in the same manner as the other pumping plungers outlined in this bulletin.

Technical Support Group
Product Support Department

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Changes</th>
</tr>
</thead>
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<td></td>
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<tr>
<td>6</td>
<td>6/04</td>
<td>Addition of DE plunger information and up-date chart</td>
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<td>7</td>
<td>7/04</td>
<td>Correct part numbers for .310 C &amp; D size plungers</td>
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<tr>
<td>8</td>
<td>7/08</td>
<td>Revise P/N’s for short .250 plungers, Expand identification information</td>
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### Pumping Plungers For Stanadyne Rotary Fuel Injection Pumps

#### Table of Plunger Sizes and Models

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<thead>
<tr>
<th>Size</th>
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<th>DE Plungers</th>
<th>Short Plungers</th>
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</table>

** Grooved Design.

** Basic group number only. Do not order this number. Order only the number which corresponds with the letter code of the required size and type.

**NOTE:** If individual specifications call for plunger part numbers not shown in this chart, refer to Service Price List #99526 for possible supersession information.
Ever since the early 1950’s when it first made its appearance on diesel engines, the Stanadyne injection pump has been famous for its ability to provide stable governor regulation for the operation of power generation sets and other close governor regulation applications. The feature that has made this possible is the “speed droop governor”.

Governor regulation of 3-5% can easily be attained with the speed droop governor and fine adjustments can be made while the engine is operating. Precise control of governor regulation is achieved by decreasing or increasing the effective length (and thereby the rate) of the governor control spring. The governor control spring is threaded onto an adjustable thimble arrangement, called the control rod assembly, and is adjusted by turning the external adjusting cap assembly. Turning the adjusting cap in the clockwise direction, viewed from the transfer pump end, shortens the control spring, making it less sensitive and thereby increasing governor regulation. Turning the adjusting cap in the counterclockwise direction increases governor sensitivity, thereby decreasing the governor regulation.

Stanadyne currently has two versions of the speed droop governor in use in the field today as shown in Figure 1. DB and DC pump models use a knurled type adjusting cap which is retained in position by the transfer pump end plate. DM, DB4 and DB2 pump models utilize a slotted type adjusting cap which is retained by a locking cap. Servicing instructions for both types follow.

**Governor Dash Pot**

Some speed droop equipped applications require a governor dash pot assembly. The dash pot assembly aids in preventing engine surging and improves steady state performance by damping out oscillations of the governor control spring. The dash pot consists of a spring, piston, and barrel assembly with a bleed orifice. The device is anchored on the throttle shaft and is connected to the governor arm as shown in Figure 2.
Assembly Instructions

NOTE: The assembly and adjustment procedures stated in this service bulletin are for typical generator applications. Always refer to the injection pump specification for any specific assembly and/or adjustment procedures.

1. Install governor arm, with linkage hook assembly and governor linkage spring attached, into the governor cavity of the pump housing. Slide pivot shaft through the housing and governor arm with the knife edge on the pivot shaft facing the transfer pump end of the pump as shown in Figure 3. Install pivot shaft seal and retaining nut to each end of pivot shaft and tighten alternately to 20-25 lbf-in (2.3-3 N·m) for standard (P/N 12214) pivot shaft or 10-15 lbf-in (1-1.5 N·m) for thin fuel application pivot shaft (P/N 18273).

* Pump models with short throttle shaft bushings require a throttle shaft spacer on each side of the barrel assembly.
2. For pump models with a governor dash pot, thread the damper spring onto the governor arm spring tab. Thread damper piston onto loose end of the damper spring and install governor arm assembly as described in Step No. 1. **NOTE:** Install head and rotor assembly and the metering valve assembly before proceeding to step No. 3.

3. Install control rod assembly, with end plate removed on DB and DC models, through threaded hole from inside of pump housing.

4. Slide control rod guide with washer in place (O-ring and washer on DB and DC models) over end of control rod assembly and thread into the housing finger tight while pushing down on the metering valve assembly. Tighten to 70-80 lbf-in (8-9 N·m).

5. Insert control rod pin into hole at the end of the control rod and position it as shown in Figure 3.

6. **DB and DC pump models only**
   Install adjusting cap seal into seal groove on control rod guide. Align roll pin slot in adjusting cap with control rod pin at end of control rod and slide over the seal on the control guide. Install transfer pump end plate and tighten the four end plate screws to 25-30 lbf-in (3-3.5 N·m).

7. **DM, DB4, and DB2 models only**
   Install adjusting cap seal into seal groove on the adjusting cap assembly. Align roll pin slot in adjusting cap with the control rod pin at the end of the control rod and slide into the control rod guide. Thread droop control locking cap onto control rod guide and tighten while supporting the control rod guide in place.

8. With control spring bushing threaded up against the control spring guide, as shown in Figure 3, thread the control spring five full turns onto the spring guide. **NOTE:** The standard number of spring turns onto the control spring guide is five (5) unless otherwise stated on the pump specification. Slip the free end of the control spring over the formed tabs of the governor arm with the bent-in end part of the control spring between the two tabs.

9. Reassemble the throttle and shut-off shaft assemblies and install a new shut-off cam or retaining clip (reference specification). **NOTE:** Check and reset linkage gap to specification, if necessary, before installing shut-off cam or retaining clip.

10. For pumps with a governor dash pot, slide the damper barrel assembly over the damper piston and slide throttle shaft assembly through the damper barrel, throttle shaft spacer and the throttle lever as shown in Figure 2. **NOTE:** Pump models with short throttle shaft bushings require a throttle shaft spacer on each side of the barrel assembly.

11. With the throttle shaft assembly in the low idle position and the governor control spring relaxed, the forked end of the throttle lever should straddle and engage the flats on the control rod bushing. Adjust the low idle screw until the forks of the throttle lever make contact with the flats on the control guide.
bushing, then back the screw out 1/4 of a turn. This will ensure no preload exists on the speed droop spring. Tighten the low idle lock nut to 30-35 lbf-in (3.5-4 N·m).

12. Turn adjusting cap counterclockwise (from the transfer pump end) to end of adjustment, then turn clockwise 1/16 of a turn. This prevents binding between the throttle shaft lever and the control rod bushing. The speed droop assembly is now positioned for minimum droop.

TEST BENCH CALIBRATION PROCEDURES
Speed droop equipped pumps are calibrated in the same manner as other governor application pumps with the exception of low idle and speed droop adjustments. Provided below are notes on low idle screw and speed droop adjustment procedures.

Low Idle Screw Adjustment
The position of the low idle screw is set during assembly of the speed droop and establishes the necessary relationship of the internal components. Engine idle speed for most applications is merely a function of the governor spring rate and
regulation, and will generally be in the range of 800 – 1100 RPM. On some applications where the generator set manufacturer desires a higher idle speed than this, it is permissible to adjust the low idle screw in to increase idle speed.

**Never back out the low idle screw on a speed droop equipped pump or disengagement of the throttle lever from the guide bushing could result.**

**Speed Droop Adjustment**
Refer to the individual pump specification to determine the amount of adjustment required and where in the calibration sequence it occurs. Speed droop adjustments can be prior to, during or after the calibration is completed, depending on the engine manufacturer’s preference. All pump settings are done with the speed droop in the minimum position when there is no reference of speed droop adjustment on the specification.

*NOTE: Since high idle speed and final droop adjustments are made on the engine, it is necessary to reset both the high idle screw and the speed droop adjusting cap back to the original calibration set points before performing as received pump calibration checks. Please reference the injection pump specification for exact instructions.*

**ON-ENGINE SPEED DROOP ADJUSTMENT PROCEDURE**

*NOTE: Always refer to the engine manufacturer’s manual for exact setting procedures. These instructions are for typical applications only.*

1. Start engine and apply approximately 50% load until it reaches operating temperature. *Note: If excessive surging occurs during the warm-up period, turn the speed droop adjusting cap clockwise until surging stops.*

2. When the engine has reached operating temperature, position throttle to attain full load speed (e.g., 1800 RPM) and apply 100% load. Adjust the throttle if necessary to obtain satisfactory 100% load performance.

3. Remove load and check for specified no-load speed or frequency. If incorrect, adjust speed droop adjusting cap slightly (clockwise for increased droop or counterclockwise for less droop). If surging exists upon removing the load, turn the adjusting cap clockwise to eliminate. *NOTE: Whenever speed droop adjustments are made, accompanying throttle position adjustments will also be necessary.*

4. Recheck 100% load and no-load performance and readjust as necessary.

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<table>
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<tr>
<th>Revision</th>
<th>Date</th>
<th>Changes</th>
</tr>
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<tr>
<td>3</td>
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<td>Added dead coil count information</td>
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</table>
SUBJECT: ELECTRICAL SHUTOFF SOLENOID SERVICE PROCEDURES
MODELS AFFECTED: D SERIES FUEL INJECTION PUMPS (EXCEPT DS)

General Information
Electrical shutoff solenoids are included in many Stanadyne pump applications to accomplish engine shutdown by interrupting the fuel delivery to the engine. Their use is desirable for several reasons, including operator convenience, anti-theft protection, and elimination of bulky cables and linkages. An important safety feature of the Stanadyne electric shutoff solenoid is its ability to close the metering valve and shut off fuel delivery independent of governor action.

Two basic types of electrical shutoff (ESO) devices are used in Stanadyne injection pumps as shown in Figures 1a and 1b. Energized to run (ETR) solenoids are the most common. They are energized continuously while the engine is running and when de-energized, will cause the engine to shut off.

Energized to shutoff (ETSO) solenoids (Figure 1b) are used less frequently. These are designed to be energized only momentarily when engine shutdown is desired.
NOTE: Electric shutoff solenoids rely on the flow of fuel through the pump and back to the fuel tank to dissipate heat generated by the coil when energized. Therefore, an ESO coil may be damaged if left energized for an extended period without the engine operating and a supply of fuel flowing around the coil. For this reason, a spring-loaded or push-button type switch must be used in ETSO applications. Similarly, ETR solenoids should not be left energized for more than short periods of time when the engine is not running or when the pump housing is not full of fuel.

ETR Versus ETSO Solenoids
All Stanadyne E.S.O.'s are now plunger-type solenoids rather than the older "flapper type" for greater debris resistance and longer life. All Energized to Run ESO's are now of the "high force" type which utilize a longer coil for increased pull in and drop out forces Fig. 2a). Since Energized to Shutoff solenoids are reversed in the governor cover, the longer high force type of solenoid cannot be used due to interference with the throttle shaft. As a result, ETSO solenoids continue to be the "standard force" type (Fig. 2b).

ESO part numbers and coil voltage are stamped on the frame (Reference the Application and Supersession Chart on page 10). Solenoid date codes (such as B83 or 1186) appear either on the frame or on the coil encapsulation.

Grounding Devices
ESO's are grounded by means of a sheet metal strap, P/N 20951, mounted between one solenoid terminal and the adjacent governor cover retaining screw as shown in Figure 3a. Refer to the individual specification to determine which terminal is grounded for a given application. The 20951 grounding strap is sold separately as well as being provided in solenoid mounting and grounding kit 26431. It should be used on all applications where the front governor cover screws are accessible. Grounding wire 18491 (Figure 3b) is supplied in Kit 21710 for old style aneroid applications or as needed when interference of the strap with an accessory such as an aneroid bracket exist.
Serviceable Solenoid Parts And Servicing

Since the introduction of plunger-type solenoids, Stanadyne does not recommend solenoid arm travel or spring force adjustments of any type. An electric shutoff solenoid's ability to pass the test specification criteria should be your guide as to whether solenoid replacement is necessary. Servicing of solenoids should be limited to blowing off accumulated debris with compressed air and wiping with a clean cloth. If plunger stickiness is encountered, the solenoid may be carefully disassembled, cleaned and reassembled. Replacement parts are limited to springs, spring sleeves and insulating tubes should these become unserviceable or lost during servicing. Available part numbers are as follows:

<table>
<thead>
<tr>
<th>P/N</th>
<th>Description</th>
<th>Usage</th>
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<tr>
<td>12480</td>
<td>Shutdown Coil Arm Spring</td>
<td>ETR ESO’s</td>
</tr>
<tr>
<td>12481</td>
<td>Shutdown Coil Arm Spring</td>
<td>ETSO ESO’s</td>
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<tr>
<td>16396</td>
<td>Coil Arm Spring Sleeve</td>
<td>All ESO’s</td>
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<tr>
<td>23190</td>
<td>Insulating Tubes</td>
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Installation Of Solenoid To Governor Cover

Since ESO's are not provided with any mounting or grounding hardware except for the two P/N 23190 insulating tubes, Stanadyne provides an ESO mounting and grounding kit, P/N 26431, which consists of the following parts:

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<th>P/N</th>
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<td>12049</td>
<td>Terminal Contact Lock Washer</td>
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</tr>
<tr>
<td>12500</td>
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<td>12519</td>
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<td>14760</td>
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<td>18501</td>
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<tr>
<td>20951</td>
<td>Terminal Grounding Strap</td>
<td>1</td>
</tr>
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</table>
This kit contains enough hardware to mount and ground both the ESO solenoid and a Housing Pressure Cold Advance (HPCA) solenoid (if the pump is so equipped) in the governor cover. Solenoid terminals and terminal insulators must also be purchased separately - refer to the individual specifications for part numbers.

A typical ESO installation is shown in Figure 4. Refer to the individual specification for the exact component arrangement. Tighten retaining nuts to 10-15 lb.-inches. (1.1-1.7 Nm) exercising care not to twist the grounding strap.

**Cover Modifications - Energized To Run (ETR) Solenoids**

When it becomes necessary to replace an old-style flapper-type solenoid with a current high force plunger-type, it may be necessary to replace rework the governor cover slightly in two areas as shown in Figure 5 to prevent interference. One source of interference is due to a slight raised area on the

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Figure 4

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Figure 5

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Relieve inside corners of cover if the high force solenoid frame does not rest flush with the cover

Chamfer to prevent interference with the raised area of the solenoid frame

.125"(3.2mm)
solenoid arm pivot area of plunger-type solenoid frames. All governor covers now have these chamfers cast in but if a plunger-type solenoid is being installed in an older cover without the chamfers, the interference between the raised area on the frame and the cover could render the solenoid inoperable upon installation. It is recommended that the chamfer be filed or machined into the cover at the edge of the rear cutout as shown in Figure 5 to the dimensions shown any time a plunger-type solenoid is installed into a governor cover that does not have the chamfers already cast in. The other possible area of interference is in the inside, front corners of the cover due to the additional length of the high force solenoid frame. Again, newer style covers are relieved in this area but if a high force solenoid is being installed in an older cover and it does not fit flush to the underside of the cover, it will be necessary to relieve the corners of the cover to provide clearance.

Cover Modifications - Energized To Shutoff (ETSO) Solenoids

Frame Interference
When it becomes necessary to install a plunger-type, Energized to Shutoff (ETSO) solenoid into an older governor cover, it will be necessary to rework the cover as shown in Figure 6 in order to ensure free travel of the solenoid arm. As mentioned previously, the chamfer at the edge of the front cutout is needed to prevent interference with the raised area of the plunger-type solenoid frame design. The chamfer can be filed or machined to the dimensions shown. Current production covers have the chamfer cast in. NOTE: Failure to relieve the cover in this manner could result in the plunger-type solenoid being rendered inoperable upon installation.

![Figure 6](image)

Arm Travel
If after ETSO solenoid installation, incomplete fuel shutoff is encountered during pump calibration, it may be due to the upper part of the arm contacting the inside of the cover before the plunger has pulled in completely.
If this occurs, the cover may be reworked as shown in Figure 6. However, whenever a cover is reworked as shown in Figure 6 to accommodate an ETSO solenoid, the increased arm travel may, under certain circumstances, result in the ETSO solenoid arm "jumping over" the linkage hook resulting in an "Intermittent Shutoff" and/or "No Start" complaint (Ref. Figure 7).

To prevent this condition, Stanadyne has begun producing ETSO solenoids (P/N's 26921 and 26922) with the arm lengthened by 1mm (0.040 inches). These ESO's can be identified by the absence of the two dimples on the solenoid arm as shown below in Figure 8.

When installing an ETSO solenoid with the shorter arm into a cover relieved as shown in Figure 6, it will be necessary to install two extra insulating washers, P/N 12500 on the solenoid terminals between the solenoid frame and the cover as shown in Figure 9. This will position the solenoid approximately .040 inches (1 mm) deeper in the pump housing.

**IMPORTANT:** Never install the two extra P/N 12500 insulating washers between the cover and the solenoid frame on ETSO solenoids with the lengthened arm.
Installation Of Governor Cover To Pump

Extreme care must be taken when assembling a governor cover and ETR ESO solenoid to a pump. It is possible to locate the pivot arm on the wrong side of the linkage hook tab, thus "locking" the linkage hook and metering valve in the "full run" position, blocking all governor action. If this condition exists when the pump is installed on the engine, the engine may accelerate to dangerously high speeds upon starting. The recommended method of ensuring proper installation of a governor cover containing an ETR shutoff solenoid is to use service tool 26528 as shown below in Figure 10. With the tool installed as shown, place the cover in position on the pump housing. Twist the 26528 tool to release it and slide it out from between the cover and the housing taking care not to dislodge or damage the cover seal.

Service tool 26528 is designed to be used with any type of energized to run solenoid (standard or high force) to ensure proper cover installation and should be used any time a governor cover with and ETR ESO is installed on a pump. However, in the event that tool 26528 is not available, the governor cover can be installed as follows.
1. Remove the three governor cover screws and washers and set aside.

2. Move the governor cover down towards the top of the pump from a position further toward the drive shaft end than its final assembled position as shown in Figure 11 to ensure the pivot arm is positioned on the proper side of the linkage hook.

3. Just before the cover seal touches the housing, slide the cover into alignment, install the cover screws and washers, and tighten screws to 35-45 lbf.-inches (4.0-5.1 Nm).

---

**Bench Test Procedures - Energized to Run Solenoids**

Many pump specifications for ETR applications now call for a pull-in voltage check. To perform this check, first set the voltage at the ESO terminals by connecting the ESO to the variable voltage source and connecting a separate voltmeter (preferably digital) to the ESO terminals as shown in Figure 12. Turn the voltage source on and adjust the variable voltage supply to the pull-in voltage requirement called for on the individual specification (usually 8.8 or 10.0 volts on 12 volt systems and 17.6 volts on 24 volt systems), then remove the voltmeter. Once the voltage source is "calibrated" to the correct pull-in voltage, it will only be necessary to turn the voltage source off and on to perform pull-in tests. Do not adjust the voltage up to the desired level to perform the pull-in test - merely turn the voltage supply off and then back on to perform this test. Check the operation of the ESO solenoid at the speeds and throttle position(s) indicated on the individual specification. **NOTE: Do not attempt to check ETR solenoid operation with the governor cover removed from the pump as the governor linkage spring aids solenoid operation.**
Bench Test Procedures - Energized to Shutoff Solenoids
An ESO coil of one half system voltage is normally specified for ETSO applications. This is because these solenoids are energized only momentarily to shut down the engine and because these solenoids have to overcome the linkage spring force instead of being assisted by it.

Use the voltage called for on the individual specification when testing ETSO solenoids to avoid damaging the coil. If a test voltage isn't specified, use the coil voltage. Only leave an ETSO solenoid energized long enough to check for fuel shutoff and never leave an ETSO solenoid energized for an extended period of time with voltage greater than coil voltage applied.

Mechanical Override Device
A special accessory is used in some "D" series pump applications with ETR solenoids. If an electrical failure occurs or the necessary voltage is unavailable to power the solenoid, the solenoid arm can be locked mechanically in the "run" position to permit emergency operation.

The override consists of a guide and rod assembly mounted in the rear of a special governor cover, which aligns the rod with the solenoid pivot arm (Figure 13). When the rod is pushed in it moves the ESO pivot arm to the energized position leaving the linkage hook free to operate. To accomplish fuel shutoff, the override rod is pulled out.

To disassemble, remove the governor cover. Remove the lock ring and pull the control rod from the cover. Loosen and remove the guide, washer and seal. To assemble, install the washer and seal onto the guide and thread into cover. Insert rod and secure with a new lock ring from inside.

Applications
The following is a compilation of the high force ESO part numbers and the standard force solenoid part numbers and the individual solenoids and kits which they supersede.
# ELECTRIC SHUTOFF SOLENOID
## APPLICATION AND SUPERSESSION INFORMATION

<table>
<thead>
<tr>
<th>Current ESO P/N</th>
<th>Coil Voltage and Application</th>
<th>Superseded Standard Force ESO Part Numbers</th>
<th>ESO's</th>
<th>ESO Kits</th>
</tr>
</thead>
<tbody>
<tr>
<td>26214 (High force)</td>
<td>12V ETR</td>
<td>21323&lt;br&gt;21584&lt;br&gt;21806&lt;br&gt;22314&lt;br&gt;22315&lt;br&gt;24145&lt;br&gt;27360</td>
<td>21805&lt;br&gt;22261</td>
<td>22146&lt;br&gt;22146&lt;br&gt;22149&lt;br&gt;27647</td>
</tr>
<tr>
<td>26922 (Standard force)</td>
<td>12V ETSO Coil (used with 24V system voltage)</td>
<td>18694</td>
<td></td>
<td>22262</td>
</tr>
<tr>
<td>26921 (Standard force)</td>
<td>6V ETSO Coil (used with 12V system voltage)</td>
<td>18694</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26387 (High force)</td>
<td>24V ETR</td>
<td>21807&lt;br&gt;21997&lt;br&gt;24149&lt;br&gt;27011&lt;br&gt;27012</td>
<td>18693</td>
<td>22147&lt;br&gt;24164&lt;br&gt;24164&lt;br&gt;24164&lt;br&gt;24164</td>
</tr>
<tr>
<td>22113</td>
<td>32V ETR</td>
<td>18693</td>
<td>22147&lt;br&gt;22146&lt;br&gt;22149&lt;br&gt;27647</td>
<td>22260</td>
</tr>
</tbody>
</table>

*Technical Support Group<br>Product Support Department*
SERVICE BULLETIN

DATE: July 19, 2005

SUPERSedes: S.B. 125R5 dated 4/23/02

SUBJECT: FIELD CONVERSION FOR OPERATION WITH REDUCED LUBRICITY FUELS

Stanadyne pumps are typically designed to operate with Number 2 Diesel Fuel (DF-2) which provides no more than a 460 micron wear scar diameter when tested using a High Frequency Reciprocating Rig per ISO 12156-1 and 2.

Stanadyne has compiled the following information for our service network to allow for field conversions of Stanadyne mechanical fuel injection pumps for operation with fuels having reduced lubricity. Such fuels would typically include DF-1, Jet fuels, Kerosene, etc. as noted in the chart below.

Stanadyne recommends the use of special transfer pump and drive components to reduce wear and extend the life of the pump when operated with reduced lubricity fuels. In addition to the transfer pump and drive components, specially plated governor components are recommended for applications which are equipped with speed droop governors when operating with these fuels.

Stanadyne has established the following guidelines for operation of our fuel injection pumps with standard and the special components. Whenever a pump is converted for reduced lubricity fuel operation, it is imperative that the end user understands that the special components were developed for operation with fuels listed within the recommended and acceptable categories. Fuels listed within the emergency category such as JP-4, should be used as such, on an emergency basis only.

<table>
<thead>
<tr>
<th>FUEL USAGE WITH STANDARD COMPONENTS</th>
<th>FUEL USAGE WITH SPECIAL REDUCED LUBRICITY COMPONENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended</td>
<td>DF-2, No. 2-D</td>
</tr>
<tr>
<td></td>
<td>DF-2, No. 2-D, DF-1, No. 1-D</td>
</tr>
<tr>
<td>Acceptable</td>
<td>DF-1*, No. 1-D*, No. 4-D</td>
</tr>
<tr>
<td></td>
<td>JP-4, TS</td>
</tr>
</tbody>
</table>

* Diesel fuel grade No. 1 is only acceptable for use with standard components when ambient temperatures are below 32° F (0° C).

NOTE: Reference the Stanadyne Service Policies and Procedures Manual 99666 for information regarding the use of Biodiesel fuels.
NOTE: Home heating oils commonly carry the same No. 1 and No. 2 grade designations as Diesel fuel and are sometimes used interchangeably with those grades of Diesel. Some home heating oils, do not contain the additives that are in road fuels and could affect proper engine operation. It is also illegal in many area to utilize these oils for over-the-road use when their cost does not include applicable road taxes.

Use the following table to determine which part changes are required to implement field conversions for reduced lubricity fuel use. Compare the individual pump specification to the table in order to identify which standard components have a reduced lubricity replacement part.

### Conversion Parts for Reduced Lubricity Fuel Usage

<table>
<thead>
<tr>
<th>Remove</th>
<th>Install</th>
<th>Description</th>
<th>Model Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>DB</td>
</tr>
<tr>
<td>20511</td>
<td>37268¹</td>
<td>Transfer Pump Blades (was 20803)</td>
<td>X</td>
</tr>
<tr>
<td>20512</td>
<td>37449¹</td>
<td>Transfer Pump Blades (was 20804)</td>
<td>X</td>
</tr>
<tr>
<td>34758</td>
<td>37265¹</td>
<td>Transfer Pump Blades (was 33499)</td>
<td>X</td>
</tr>
<tr>
<td>34759</td>
<td>37267¹</td>
<td>Transfer Pump Blades (was 33501)</td>
<td></td>
</tr>
<tr>
<td>16753</td>
<td>37452¹</td>
<td>Transfer Pump Liner (was 18658)</td>
<td></td>
</tr>
<tr>
<td>21232</td>
<td>37447¹</td>
<td>Transfer Pump Liner (was 22988)</td>
<td></td>
</tr>
<tr>
<td>11620</td>
<td>29709</td>
<td>Governor Thrust Washer</td>
<td>X</td>
</tr>
<tr>
<td>23272</td>
<td>20222</td>
<td>Governor Thrust Washer</td>
<td>X</td>
</tr>
<tr>
<td>19860</td>
<td>23856</td>
<td>Governor Thrust Washer</td>
<td></td>
</tr>
<tr>
<td>21522</td>
<td>24691</td>
<td>Drive Shaft Spring Washer</td>
<td></td>
</tr>
<tr>
<td>26468</td>
<td>26358</td>
<td>Drive Shaft Thrust Washer</td>
<td></td>
</tr>
<tr>
<td>26469</td>
<td>26361</td>
<td>Shaft Retaining Ring</td>
<td></td>
</tr>
<tr>
<td>10213</td>
<td>29138</td>
<td>Drive Shaft</td>
<td></td>
</tr>
<tr>
<td>21519</td>
<td>28573</td>
<td>Drive Shaft</td>
<td></td>
</tr>
<tr>
<td>23364</td>
<td>24108</td>
<td>Drive Shaft</td>
<td></td>
</tr>
<tr>
<td>23452</td>
<td>26238</td>
<td>Drive Shaft</td>
<td></td>
</tr>
<tr>
<td>24623</td>
<td>26538</td>
<td>Drive Shaft (Ref. S.B. 419)</td>
<td></td>
</tr>
<tr>
<td>26179</td>
<td>26238</td>
<td>Drive Shaft</td>
<td></td>
</tr>
<tr>
<td>26386</td>
<td>26538</td>
<td>Drive Shaft (Ref. S.B. 419)</td>
<td></td>
</tr>
<tr>
<td>28825</td>
<td>23820</td>
<td>Drive Shaft</td>
<td></td>
</tr>
<tr>
<td>29183</td>
<td>27639</td>
<td>Drive Shaft</td>
<td></td>
</tr>
<tr>
<td>30941</td>
<td>30940</td>
<td>Drive Shaft</td>
<td></td>
</tr>
<tr>
<td>30500</td>
<td>31325</td>
<td>Drive Shaft</td>
<td></td>
</tr>
<tr>
<td>34828</td>
<td>32901</td>
<td>Drive Shaft</td>
<td></td>
</tr>
<tr>
<td>33886</td>
<td>33925</td>
<td>Drive Shaft</td>
<td></td>
</tr>
<tr>
<td>19870</td>
<td>33817²</td>
<td>Rotor Retainer</td>
<td>X</td>
</tr>
<tr>
<td>32859</td>
<td>33818²</td>
<td>Rotor Retainer</td>
<td>X</td>
</tr>
</tbody>
</table>

¹ These transfer pump components are made from a different material and supersede the components previously specified for reduced lubricity fuels. They are not compatible with the previous components and must therefore not be intermixed (Reference Service Bulletin 304R9).

² Part numbers 33817 and 33818 can be used only in pump models with pressure compensating transfer pumps (Reference S.B. 444A). These rotor retainers have a notch on the outside diameter to distinguish them from P/N’s 19870 and 32859.
# Additional Conversion Parts for Applications Equipped With Speed Droop Governors

<table>
<thead>
<tr>
<th>Remove</th>
<th>Install</th>
<th>Description</th>
<th>Model Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>DB</td>
</tr>
<tr>
<td>12214</td>
<td>20224</td>
<td>Pivot Shaft</td>
<td>X</td>
</tr>
<tr>
<td>12358</td>
<td>20225</td>
<td>Linkage Hook Adjusting Link*</td>
<td>X</td>
</tr>
<tr>
<td>17605</td>
<td>30418</td>
<td>Governor Linkage Hook Assembly</td>
<td>X</td>
</tr>
<tr>
<td>18021</td>
<td>29120</td>
<td>Governor Linkage Hook Assembly</td>
<td>X</td>
</tr>
<tr>
<td>21201</td>
<td>20214</td>
<td>Governor Weight</td>
<td>X</td>
</tr>
<tr>
<td>19858</td>
<td>28974</td>
<td>Governor Weight</td>
<td></td>
</tr>
<tr>
<td>22284</td>
<td>23858</td>
<td>Governor Weight</td>
<td></td>
</tr>
<tr>
<td>28089</td>
<td>28681</td>
<td>Governor Weight Retainer</td>
<td></td>
</tr>
<tr>
<td>29111</td>
<td>28681</td>
<td>Governor Weight Retainer</td>
<td></td>
</tr>
<tr>
<td>29294</td>
<td>29296</td>
<td>Governor Weight Retainer (Spline)</td>
<td></td>
</tr>
<tr>
<td>28370</td>
<td>28681</td>
<td>Governor Weight Retainer</td>
<td></td>
</tr>
<tr>
<td>19893</td>
<td>23860</td>
<td>Governor Weight Retainer</td>
<td></td>
</tr>
<tr>
<td>14482</td>
<td>26304</td>
<td>Governor Arm</td>
<td></td>
</tr>
<tr>
<td>15421</td>
<td>20217</td>
<td>Governor Arm</td>
<td></td>
</tr>
<tr>
<td>24929</td>
<td>20219</td>
<td>Governor Arm</td>
<td></td>
</tr>
<tr>
<td>29707</td>
<td>20956</td>
<td>Governor Arm</td>
<td></td>
</tr>
<tr>
<td>29060</td>
<td>20956</td>
<td>Governor Arm</td>
<td></td>
</tr>
<tr>
<td>21312</td>
<td>14483</td>
<td>Governor Thrust Sleeve</td>
<td></td>
</tr>
</tbody>
</table>

* Replace the linkage hook adjusting link when the pump specifies a governor linkage hook assembly other than a 18021 or a 17605.

## Identification

Pumps converted for reduced lubricity fuel operation should be identified by stamping the name plate “RLFC” (Reduced Lubricity Fuel Components) on the name plate below the pump model number, as shown in the figure below.

![Stamp RLFC in this location](image)

## Warranty

Conversions for reduced lubricity fuel operation are made at the request and expense of the customer and as such, Stanadyne will not accept warranty claims for these modifications.

### Technical Support Group

Product Support Department

### Revision Date Changes

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>2/02</td>
<td>Updated conversion parts chart and corrected part number errors</td>
</tr>
<tr>
<td>6</td>
<td>7/05</td>
<td>Add new T.P. components and update conversion parts chart. Changed nameplate stamping from LVFC to RLFC.</td>
</tr>
</tbody>
</table>
When turbocharged diesel engines are accelerated, the turbocharger speed lags behind engine speed. The injection pump however, will normally deliver full load fuel quantities during acceleration resulting in unburned fuel and excessive smoke until full turbocharger speed and boost pressure are attained. To address this condition, Stanadyne offers a device called an aneroid as an option on its DB Series injection pumps.

The aneroid consists of a spring loaded diaphragm connected to a rod which actuates the pump’s shutoff lever (Reference Figure 1). Engine intake manifold pressure (boost pressure) is fed to the aneroid. When the pressure is low the aneroid moves the shut-off lever to a reduced fuel position, which restricts metering valve travel and limits fuel delivery. When manifold pressure increases, it overcomes the spring force and moves the shutoff cam out of contact with the metering valve linkage assembly allowing the pump to deliver full fuel (Reference Figure 2).

Checking Aneroid Operation

Aneroid operation may be checked without removing it from the pump or disturbing adjustments. The aneroid should be inspected for correct operating pressure settings and shutoff lever travel (Reference the individual pump specification and the adjustment section of this bulletin). Also, inspect the aneroid for leakage and for binding during operation.
Connect a filtered, regulated and measurable air pressure source to the boost pressure inlet fitting. *NOTE:* Operating pressures are very low, an accurate gage with a range of 0 - 30 p.s.i. (0 – 207 kPa), calibrated in 0.5 p.s.i. (3.5 kPa) increments is recommended. Refer to the individual pump specification for the operating pressure and shutoff lever travel settings for each application. If service or adjustments are necessary, refer to the appropriate section of this bulletin.

**Service and Replacement**

The aneroid is a non-serviceable sealed component. If aneroid replacement is required, it must be replaced as an assembly. Originally sold separately without the aneroid rod and boot, a new family of aneroid assemblies was released in 2000 that included the 19776 aneroid rod and a 16809 aneroid boot (Reference Figure 4).

Since the introduction of the complete assemblies, the aneroid has undergone some internal design changes and the addition of a lock nut to the aneroid rod on some assemblies (Reference Figure 3 & 4). The new complete aneroid assemblies now supersede all previous aneroid assemblies as shown in the table below.

<table>
<thead>
<tr>
<th>Aneroid Assemblies</th>
<th>Current</th>
<th>Supersedes</th>
</tr>
</thead>
<tbody>
<tr>
<td>34995</td>
<td></td>
<td>18232, 34660</td>
</tr>
<tr>
<td>35222</td>
<td></td>
<td>18423, 34661</td>
</tr>
<tr>
<td>35222</td>
<td></td>
<td>33594, 34662</td>
</tr>
<tr>
<td>35224</td>
<td></td>
<td>33594, 34663</td>
</tr>
<tr>
<td>40586</td>
<td></td>
<td>—</td>
</tr>
</tbody>
</table>

Always refer to the individual pump model service specification to determine which aneroid to use. *NOTE:* The boost pressure inlet fittings (P/N’s 31104 and 40587) are now available for service replacement, as shown in Figures 3 & 4.
Removal

Always remove the aneroid and bracket from the pump as an assembly. If the aneroid or bracket do not require replacement, they should not be disassembled.

*Caution: Do not submerge the aneroid assembly in oil or solvents. Doing so may wash away the dry lubricant used on the internal diaphragm.*

For the following procedures reference Figure 4.

1. If the pump is equipped with an aneroid tamper resistant shield (P/N 33081), remove it per the “Aneroid Tamper Resistant Shield” section of this bulletin.

2. Remove the outer aneroid retaining clip from the aneroid rod, using snap ring pliers P/N 13337 or equivalent.

3. Disengage the aneroid rod from the shutoff lever.

4. Remove the aneroid bracket mounting fasteners and remove the bracket and aneroid as an assembly.

*Note: There are several different styles of aneroid brackets in use. Figures 4 shows a typical top mounted aneroid bracket and Figure 5 shows a typical side mounted aneroid bracket.*
Installation

1. Install the aneroid and mounting bracket assembly on the pump. For a top mounting bracket (Figure 4), tighten the screws to 35-45 lbf-in. (4.0-5.1 N•m). For a side mounted bracket (Figure 5), tighten the rear governor cover screw to 35-45 lbf-in. (4.0-5.1 N•m) and tighten the nut on the head locking screw stud to 70-80 lbf-in. (7.9-9.0 N•m).

2. Do not attach the aneroid rod to the pump shutoff lever at this time. Pump calibration should be performed with the aneroid rod disconnected and the shutoff lever held in the “Run” position. Aneroid adjustments should be performed following pump calibration, as outlined in the Adjustment Section of this bulletin.

Aneroid/Bracket Disassembly and Reassembly

While the aneroid and its bracket should normally be left assembled, should either component require replacement, disassembly and reassembly may be performed as follows:

1. Clamp the aneroid bracket in a vise.
2. Remove the boot from the aneroid body assembly, unscrew and remove the aneroid rod from the aneroid piston. If equipped, the lock nut must be loosened prior to removing the aneroid rod from the aneroid piston. Wrench flats have been added to the aneroid piston to prevent the piston from rotating.
3. Remove the aneroid body retaining nut using the P/N 18031 Aneroid Retaining Nut Wrench and remove the aneroid from the bracket.

**Note:** The 17954 aneroid retaining nut has been superseded by P/N 34303. The 34303 aneroid retaining nut is thicker and has a large lead-in chamfer to reduce the possibility of thread damage during assembly.
4. To reassemble, secure the bracket in a vise and install the aneroid body into the bracket. Position the aneroid inlet fitting according to the position indicated on the individual pump specification.

5. Assemble the aneroid retaining nut to the aneroid body and tighten the nut to 455-505 lbf-in. (51.4-57.0 N·m) using tool 18031.

6. Attach the boot to the aneroid rod and thread the rod (with the lock nut installed on the aneroid rod, if equipped) into the aneroid piston. Lightly bottom the aneroid rod in the piston and then back it out approximately three (3) turns, leaving the lock nut loose until the final aneroid adjustments are made. Install the aneroid and bracket assembly as outlined in the Installation section of this bulletin.

**Adjustments**

Aneroid adjustments include setting; 1) the amount of fuel reduced during low boost pressure conditions; 2) shutoff lever travel; and 3) activation pressures (shutoff lever lift-off and full travel). Adjustments should be performed in the following order, unless otherwise stated on the latest edition of the service specification.

*Note: All adjustments are made with the aneroid and bracket installed on the pump and the throttle lever in the full fuel position (W.O.T.).*

1. Set the forward shutoff lever adjusting screw (Figure 6 & 7) to obtain the required fuel delivery stated on the individual pump specification. This will establish the maximum amount of fuel delivered when the aneroid is retracted in the minimum or no boost position.

2. Set the rear shutoff adjusting screw (Figure 6 & 7) to obtain the amount of shut off lever travel (Figure 7) stated on the pump specification.

3. Install the boot to aneroid body. Ensure that the aneroid rod is backed out approximately three (3) turns from the fully bottomed position in the aneroid piston. Install the inner retaining clip on the aneroid rod (Figure 4) and connect the rod to the pump shutoff lever.

![Diagram of Aneroid System](image-url)
4. Connect the regulated air pressure source to the aneroid inlet. Cycle the pressure between 0 and 7 p.s.i. (0 – 48.3 kPa), a minimum of three (3) times, and check for smooth motion.

**Note:** If the shutoff lever is of the standard type (lever positioned by hole location, Figure 7) skip steps 5-8 and go to step 9 for the remainder of the adjustment procedure. If the shutoff lever is an adjustable type (Figure 6) proceed as follows for lift off pressure adjustment.

5. Loosen, but do not remove, the center screw and the locking screw.

6. Hold the forward adjusting screw against the stop boss on the housing. Cycle the air pressure between 0 and 4 p.s.i. (0 – 27.6 kPa) to confirm that the shutoff lever rotates freely.

7. While holding the forward adjusting screw against the stop boss, set the air pressure to the mean (middle) of the lift-off pressure given on the pump specification.

8. Tighten the center screw to 35-40 lbf.-inches (3.9-4.5 N·m) then tighten the locking screw to 25-30 lbf.-inches (2.8-3.4 N·m).

9. Set air supply to 0 p.s.i. (0 kPa) and install a small piece of shim stock (approximately .004 inch (.102 mm)) between the forward adjusting screw and the stop boss on the housing (Reference Figures 6 and 7).

10. Slowly increase the air pressure to determine at what pressure the forward adjusting screw lifts off the stop boss. Movement can be detected when the shim stock falls or slips free from under the forward adjusting screw. Proceed as follows according to the shutoff lever type in use.

   a. If the shutoff lever is the adjustable type, as shown in Figure 6, and the lift off pressure is not within the specified pressure range then repeat steps 5-10 until lift off is within specification.

   b. If the shutoff lever is the standard type (lever positioned by hole location, as shown in Figure 7) adjust the lift off as follows. Slowly increase the air pressure to determine at what pressure the forward adjusting screw lifts off the stop boss. Movement can be detected when the shim stock falls or slips free from under the forward adjusting screw.
If the air pressure required to obtain shutoff lever lift off exceeds the pressure indicated on the pump specification, disengage the rod from the shutoff lever, and turn the rod out one turn (lengthen).

If the lever travel requires less pressure than indicated, turn the rod in one turn (shorten). Repeat this step until the lift off pressure is achieved at the pressure stated on the pump specification.

Once the aneroid rod length is set, if equipped with a lock nut, apply one drop of Loctite 242 to the aneroid rod/lock nut thread interface. Tighten the lock nut to 30-40 lbf-inches (3.4-4.5 N•m), while preventing rotation of the piston assembly. The aneroid rod must fit freely into the lever assembly without twisting the internal diaphragm (Figure 3).

11. Once the aneroid is set, install the outer retaining clip and recheck the response and the repeatability of the pressure settings.

**Aneroid Tamper Resistant Shield**

Some pump models equipped with aneroids were also fitted with an aneroid shield (Figure 8) designed to prevent tampering with the aneroid adjustments. The shield surrounds the shutoff lever and aneroid rod and is mounted to the governor cover by four (4) tamper resistant screws.

The shield is no longer used in production and it is recommended that whenever a pump is received for service with an aneroid shield, remove and discard the shield and its four (4) mounting screws before returning it to the customer.

**Pump Models with both Aneroid and ST-125 Woodward Governor**

Pumps equipped with both the ST-125 Woodward Electronic Governor (Reference S.B. 509) and an aneroid assembly require two shutoff cams (P/N’s 14966 and 34361) to control the metering valve position. The 34361 shutoff cam (Figure 9) is installed on the shutoff shaft and allows the aneroid to move the metering valve linkage hook assembly independently from the 14966 shutoff cam that is activated by the Woodward governor actuator.
Pump models equipped with ST-125 Controllers also use a special governor linkage hook assembly (P/N 34370), which has a larger vertical tab to allow engagement of both shutoff cams. The pump housing assembly is fitted with one long and one short throttle shaft bushing to accommodate the use of the additional shutoff cam. Both shutoff cams may be removed using the shutoff cam removal tool P/N 20992. All shutoff cams (including 34361) must be replaced with a new shutoff cam after removal (Reference S.B. 157).

**NOTE:** The actuator shaft of the ST-125 Woodward Electronic Governor should be supported during installation of the 34361 and 14966 shutoff cams to prevent damage to the shaft. Improper governor performance may result if the actuator shaft is bent or damaged during assembly.

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**Revision** | **Date** | **Changes**
--- | --- | ---
5 | 03/00 | Added information about new aneroid part numbers, adjustable shutoff levers, use with Woodward Governors, and aneroid tamper resistant shield.
6 | 02/01 | Added aneroid supersession information and inlet boost pressure fitting part number. Modified adjustment procedures
7 | 12/09 | Added information regarding the addition of a lock nut on some aneroids and a new barbed fitting.
Transfer Pump Blade and Liner Materials
Stanadyne D series mechanical fuel pumps employ two types of transfer pump blades and liners depending on the type of fuel the pump is going to be operated with. For applications designed to be operated on traditional diesel fuel, standard blades and liners have been found to provide very satisfactory service life (Ref. Figure 1a for standard blade identification).

When the OEM customer anticipates that the application will be operated on reduced viscosity fuels such as Jet-A or JP8 or with reduced lubricity diesel fuels, they can specify blades and liners made of tougher materials to achieve a satisfactory service life (Ref. Figure 1b for identification). To determine the correct transfer pump components to use in a given fuel pump, always refer to the individual specification.

Note: On occasions, a pump that does not specify low viscosity transfer pump components may have been modified by customer request to include LVFC. In such cases, the pump’s nameplate is stamped “LVFC” to identify this modification. Reference S.B. 125 for additional information on field conversions for low viscosity fuel operation.

A change in the material used to produce the low viscosity fuel use blades and liners took place in June 2005. The new low viscosity transfer pump components are made from a new material which offers the same resistance to wear as the previous M2 tool steel parts but only if the blades and liner are all made from the same material.
other words no mixing of the different material blade and liner types is permissible. Whenever transfer pump blade or liner replacements are performed, be sure that all components are of the same type of material. Failure to do so will result in the premature wear of one or more of the components.

With the introduction of the new sintered transfer pump blades and liners for low viscosity fuel applications, the previous M-2 components will become obsolete and will be superseded by the corresponding sintered material component as stocks are depleted. Identification of the two types of low viscosity blades is shown in Figure 1b and liners are shown in Figure 2.

**Transfer Pump Liners**
Both traditional fuel use and low viscosity fuel use transfer pump liners for D series mechanical pumps are pictured below in Figure 2. Again, be sure to use the liner specified and always use blades made of the corresponding material in order to obtain the proper service life.

### Transfer Pump Liner Identification

<table>
<thead>
<tr>
<th>Traditional Fuel Application</th>
<th>Low Viscosity Fuel Application</th>
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<tr>
<td>M-2</td>
<td>Current Material</td>
</tr>
<tr>
<td>16753 Notched</td>
<td>18658 Dimpled</td>
</tr>
<tr>
<td>21232 None</td>
<td>22988 Dimpled</td>
</tr>
<tr>
<td></td>
<td>37452 Drill Point</td>
</tr>
<tr>
<td></td>
<td>22988 Etched P/N</td>
</tr>
<tr>
<td></td>
<td>37447 Drill Point</td>
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<tr>
<td></td>
<td>37447 Etched P/N</td>
</tr>
</tbody>
</table>

**Figure 2**

**Standard and Oversize Blades**
A number of rotors have oversized blade slots (.001 inch [.254 mm] wider than normal), making it necessary to offer oversize blades. Part numbers in parentheses in Figure 3 are the oversize versions of each blade type. Oversized blades, part numbers 20512, 20804 and 37449, are blackened for identification. To determine if an oversize blade should be used in a particular rotor slot, try fitting an oversized blade into each of the four rotor slots. If the oversized blade fits freely into any of the slots, oversize blades should be used in these slots. Standard size blades must be used in any slots that will not accept oversize blades. It is permissible to use any combination of standard and oversize blades in the same rotor.
Fitted Blades for Low Speed Fuel Limiter (LSFL) Equipped Pumps

The fit of the transfer pump blades in the rotor slots of pumps equipped with Low Speed Fuel Limiter is critical. To ensure proper operation of the LSFL, two more blade thicknesses in addition to the standard and oversize versions are use in pumps equipped with the LSFL feature. The additional blade sizes are also available for both traditional diesel fuel and for low viscosity fuel use. The four fitted blade sizes and identification markings are shown in Figure 3.

<table>
<thead>
<tr>
<th></th>
<th>+.0015 Slot size “A”</th>
<th>+.001 Slot Size “B”</th>
<th>+.0005 Slot Size “C”</th>
<th>Standard Slot Size “D”</th>
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<tr>
<td>Traditional Diesel Fuel</td>
<td>34758</td>
<td>20512</td>
<td>34759</td>
<td>20511(20512)</td>
</tr>
<tr>
<td>Low Viscosity Fuel M2</td>
<td>33499</td>
<td>20804</td>
<td>33501</td>
<td>20803 (20804)</td>
</tr>
<tr>
<td>Low Viscosity Fuel</td>
<td>37265</td>
<td>37266 (37449*)</td>
<td>37267</td>
<td>37268</td>
</tr>
<tr>
<td>Sintered Material</td>
<td></td>
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</table>

*NOTE: Blade P/N 37266 is used for production purposes and is the same dimensionally as P/N 37449 except it has a groove for identification instead of being blackened. Therefore, P/N 37266 is superseded for service by P/N 37449.

The choice of four sizes provides greater control of the blade to slot clearance. In production, the blade slots are measured and the rotors are marked (Reference Figure 4) with the appropriate letter size (A, B, C, or D) to ensure the best fit blade is used.

![Letter Marking on Rotor to Indicate Blade Slot Size](Figure 4)
In service, replacement blades should be selected in the same manner. Example: if the rotor is marked with the letter “C” with a 21232 transfer pump liner, then four P/N 34759 blades should be installed.

*NOTE:* Some production pumps were built with a blade one size smaller than the letter marking on the rotor, due to blade binding during assembly. If this situation is encountered and blade replacement is needed, use the same size blades that were originally installed. Always check blade fit during assembly to ensure the correct blade goes in the corresponding rotor slot.

Please be reminded that only rotors in pumps equipped with low speed fuel limiters will have letter markings on the rotor and require the use of the additional two blade sizes. Pumps without fuel limiters should continue to use the appropriate standard and/or oversize (+.001”) blades only.

Technical Support Group  
Product Support Department

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
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<tr>
<td>8</td>
<td>1/03</td>
<td>Added identification change and P/N’s 34758 and 34759</td>
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<tr>
<td>9</td>
<td>7/05</td>
<td>Added introduction of sintered blades and liners</td>
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GENERAL MOTORS CORPORATION

SUBJECT: AUTOMOTIVE MODEL DB2 FUEL INJECTION PUMP

The purpose of this bulletin is to briefly describe the primary features of the automotive Model DB2 fuel injection pump. This pump incorporates some special innovations that distinguish it from the basic Model DB2 industrial/agricultural pump and provide the engine performance required in a road vehicle. Further information, including overhaul and repair instructions, may be found in the DB2 manual (Service Publication 99009), the individual pump service specifications, and other service literature referenced at the end of this bulletin.

Figures 1A, 1B and 1C show cutaway views of various automotive Model DB2 pumps. The item numbers correspond to the list on Pages 3 - 5. Some of these items will be covered in detail later in the bulletin.

1978 and 1979 Auto
1980 Truck

FIGURE 1A

*1980 Truck Only
1. Min-Max Governor - A newly designed assembly which controls the engine speed at low idle and governor cutoff, while permitting direct throttle control by the operator at all other speeds. A single piece throttle shaft actuates the assembly.

2. Plunger Solenoid Electric Shutoff (Figures 1A, 1B and 1C) - This redesigned solenoid prevents the buildup of magnetic debris between the armature and coil. Refer to Service Bulletin No. 108 for assembly instructions.

3. Housing Pressure Cold Advance Solenoid (Figure 1C) - Provides greater advance movement during starting and warm-up by reducing housing pressure.

4. Metering Valve and Arm Assembly (Figures 1A, 1B and 1C) - A cantilevered spring is used to hold the metering valve against the guide stud and prevent vertical vibration of the valve in its bore.

5. Air Vent (Figures 1A, 1B and 1C) - Takes the place of the usual vent wire in the DB/DM head. The assembly is made accessible by removing only the governor cover.

6. Transfer Pump (Figures 1A, 1B and 1C) - The end cap has a 7/16”-20 inverted male flare inlet. A regulating piston stop bushing replaces the seal in the pressure regulator.

7. Residual Pressure Balancing Rotor (Figures 1A, 1B, 1C and 2) - This rotor incorporates a series of small vent ports leading to the delivery spring chamber, which simultaneously register with the head outlets after each injection period. These vents balance the residual pressure variations between injection lines.

8. Thermal Relief Groove (Figures 1A, 1B, 1C and 3) - Thermal shock can cause a head assembly to contract resulting in a seizure of the head and rotor assembly. A reduction in rotor diameter at the area between the ports was added to allow sufficient clearance during cold, high speed acceleration.

9. Cam Ring (Figures 1A, 1B and 1C) - The cam ring for this high speed, low output application is designed for automotive pre-chamber engines and is made from high strength, sintered metal. An axial identification groove is located on one face of the ring.

10. Speed Advance (Figure 1A) - All automotive pumps before 1980 and truck pumps in 1980 and 1981 are equipped with a speed advance mechanism which, because of the incorporation of a smaller (1/2") power piston, produces a speed/light load effect.

11. Mechanical/Light Load Advance (Figures 1B and 1C) - This system reduces emissions by increasing injection timing advance at low throttle settings.

12. Housing (Figures 1A, 1B and 1C) - The housing has a slightly larger flange and bolt circle than the Model DB, but the scalloped bolt holes enable the service technician to repair and test using standard DB test bench adapters. Three cast-in bosses on the right side are for mounting a vacuum operated, transmission modulator on some applications. A dynamic timing mark appears on the flange, and timing can be adjusted on the engine through the use of a wrench boss cast on the front of the housing. A steel throttle stop is cast into the housing.
13. Pin Retained Drive Shaft and Pilot Tube (Figures 1A and 1B) - The drive shaft employs three cup seals -- two to prevent fuel leakage from the pump into the crankcase and one to prevent engine lube oil from entering the pump. The center seal is made of a special rubber compound for sealing during low temperature operation. The shaft is retained by a pin through the pilot tube at the shear groove location. The steel pilot tube has a larger outside diameter and protrudes from the housing further than the bronze tubes. A groove and hole in the pilot tube connects to a weep hole in the housing neck to provide early detection.

14. O-ring Retained Drive Shaft (Figures 1C and 4) - Drive shaft retention in 1981 model pumps is accomplished by means of an O-ring which seats in a groove on the drive shaft and contacts the inner edge of the pilot tube when installed. In addition, the drive shaft configuration has been changed to a low mass weight saving design. Drive shaft seal placement and drive tang form are the same as in previous models.

CAUTION: Some provisions must be made to hold the drive shaft in place during air leak testing of the pump, or serious injury might result.

FIGURE 4

15. Temperature Sensitive Idle Compensator (Figures 1A, 1B and 1C) - A bimetallic strip is attached to the governor arm. This strip maintains correct engine idle speed at elevated ambient temperatures.

16. Ball Pivot Governor Arm (Figures 1C and 5) - 1981 model pump design has eliminated the use of the governor arm pivot shaft through the adoption of a ball pivot governor arm. In this system, a rounded pin (1) is cast into the housing (2) just above the pilot tube (3). The end of the pin fits into a concave section in the governor arm (4). The opposing forces of the governor arm spring and the flyweights move the governor arm on this pivot point. housings for 1981 model pumps are easily identifiable by the lack of holes for a through pivot shaft.

FIGURE 5

II. MIN-MAX GOVERNOR OPERATION

Because this pump application is intended for automotive use, an all-speed governor was not desired. A special "min-max" governor was developed, two versions of which are shown in Figure 6A. This device controls engine speed only in two separate ranges - idle and maximum engine speed cutoff. At all other loads and speeds it acts as a solid link between the accelerator and the metering valve. This is accomplished through the use of two different springs on the governor capsule. The operation of the unit is shown in Figures 6B, 6C and 6D.

Internal Idle Spring

External Idle Spring

FIGURE 6A

Figure 6B shows the relationship between the governor parts when the engine is running at idle. The low force developed by the governor weights is balanced by the idle spring force, and this balance of forces positions the metering valve throughout the low idle range.

Idle Speed

FIGURE 6B
In Figure 6C, the governor is in a typical mid-load range condition. Here the throttle is at approximately half travel, the idle spring is fully collapsed, and the governor weights have moved out partially. Because the governor spring is assembled to the capsule under a preload which the governor weight force cannot overcome until the engine reaches the maximum rated speed, the capsule assembly acts as a solid link against the governor arm. This permits the operator to control the metering valve position with the throttle over the mid-load range.

**FIGURE 6C**

With the throttle in the full load position, as shown in Figure 6D, the engine speed (with no load) and the pump speed increase until the governor weights have generated enough force to deflect the main governor spring. Governor arm movement turns the metering valve to the shut-off position, restricting fuel delivery and preventing engine overspeed.

**FIGURE 6D**

**III. HOUSING PRESSURE COLD ADVANCE**

This system is designed to allow more advance at cranking and engine warm-up. It consists of a solenoid assembly, mounted in a redesigned governor cover, and a ball check return connector. The electrical signal which controls the operation of the solenoid is generated by a sensing unit mounted on one of the cylinder heads. Initial movement is therefore dependent on the engine temperature.

**FIGURE 7A**

Figure 7A shows the activated solenoid (1) in the cold advance position. The plunger (2) moves in the direction shown, and the rod (3) contacts the return connector ball (4). When the ball is moved off its seat, housing pressure is reduced due to an increased flow through the connector. Because of the lowered housing pressure, resistance to advance piston movement is correspondingly diminished and the piston is allowed to move further in the advance direction.

**FIGURE 7B**

When the engine temperature reaches a predetermined value, the electrical signal to the solenoid ceases and the plunger is returned to the position shown in Figure 7B. Return connector spring pressure now controls the movement of the ball check; normal operating housing pressure and advance operation are then maintained.
IV. FUEL FLOW

Fuel flow through the automotive system is nearly identical to our other systems. The schematic diagram in Figure 8A shows the major components.

Fuel is drawn through a strainer in the tank by the engine driven diaphragm-type boost pump. Fuel at approximately 5 p.s.i. pressure passes through the Model 50 or Model 75 fuel filter (Figure 8B). After passing through the filter, the fuel flows into the pressure regulator and then into the transfer pump.

FIGURE 8B
The transfer pump boosts the fuel pressure to approximately 12-130 p.s.i. depending upon pump speed. When the fuel exits the transfer pump, it is routed in several different directions. A portion of the fuel goes to a passage in the head locating screw to operate the advance mechanism; the remainder enters a circular channel in the hydraulic head from which radial passages lead to the vent wire assembly, the metering valve, and the transfer pressure test tap.

Threaded into the top of the head next to the metering valve, the vent wire assembly allows air, and a controlled amount of fuel, to escape into the housing and to return eventually to the tank via the return circuit after cooling and lubricating the pump. It is made up of a hollow screw into which a “J” wire is installed. The wire is free to vibrate in the same manner as vent wires in other pump models. This action keeps the orifice free of debris. A selection of screw assemblies, containing different wire sizes, is made available so that the correct amount of return fuel may be obtained.

A ball check fitting in the governor cover maintains a constant housing pressure while allowing fuel and air to return to the tank. Only a portion of the fuel which enters the pump is injected into the engine cylinders while the remainder returns to the fuel tank.

The metering valve allows (depending on its position), a varying amount of fuel to charge the plungers.
V. AUTOMOTIVE ADVANCE MECHANISMS

A. Speed Advance (with light load sensitivity) - Used on 1978 and 1979 Automotive pumps and 1980 truck pumps - See Figures 9A, 9B and 9C.

This advance system relies on two design factors to accomplish speed advance with light load advance separation - power piston size and bleed orifice size. The power piston is 1/2" in diameter, and the bleed orifice in the head locating screw is much larger than in other models.

Cam loading is transmitted to the power-side advance components where, due to the smaller piston size, high reaction pressures are generated. These high reaction pressures, in conjunction with the large bleed orifice size, allow the cam to retard more at full load than in the standard speed advance systems. When the pumping volume is small, light load advance occurs because there is less resistance to cam movement than when the pumping volume is higher. The net result of this effect is speed/light load advance separation.

A typical speed/light load advance graph is shown in Figure 9C.

![Figure 9A](image)

**FIGURE 9A**

When the pump is operating, the plungers move outward a distance which is directly proportional to the volume of fuel passing the metering valve. The force required to displace the plungers inward during the pumping stroke and the momentum of the rotor assembly transmitted by the rollers combine to produce the cam loading force. This force tends to turn the cam in the direction of rotor rotation (retarded timing). Cam loading force varies directly with fuel delivery, so that a low delivery produces a low force, and a high delivery produces a high force.

![Figure 9B](image)

**FIGURE 9B**

B. Mechanical/Light Load Advance - Used on some 1980 and 1981 automotive Model DB2 pumps.

Two subsystems are combined to form the mechanical/light load advance. The first is a servo advance mechanism which is operated by transfer pump pressure and which positions the cam ring in response to throttle setting and engine load. The major component parts of the advance are the servo advance piston (standard or oversize), the cam advance pin, the servo advance valve, the servo advance plunger, and the mechanical/light load advance spring. This system is housed in the standard DB2 advance boss location and receives transfer pump pressure from the head locating screw.

The second subsystem is the mechanical link between the throttle shaft and the servo advance plunger. This link is composed of a face cam connected to the end of the throttle shaft and a rocker lever assembly connected to the side of the pump housing by a pivot pin. A roller is attached to the upper end of the lever and rides on the sur-
face of the face cam. The lower end of the lever contacts the protruding end of the servo advance plunger.

During pump operation, a rotary force is imparted to the cam ring by the cam rollers during injection. It acts in the direction of rotor movement and is transmitted through the cam advance pin to the servo advance piston. This force continually urges the piston toward the retard position.

An opposing force is supplied by transfer pump pressure acting on one end of the servo advance piston. The position of the servo advance valve in the piston bore regulates this force and determines the degree of advance achieved at any throttle setting or load. It is, in turn, the differential between mechanical/light load spring force and transfer pump pressure applied across the servo advance valve that locates the valve in the piston bore. Additional advance at low throttle settings is provided by the face cam to rocker lever action which changes the reference point of the spring.

Housing pressure acting on the spring side end of the advance piston forms a resistance to its movement at all speeds. If housing pressure is reduced at speeds below full advance, further advance piston movement will occur. This effect is used in the housing pressure cold advance system for 1981 models. A description of this system is given on page 5.

To help understand the following description of mechanical/light load advance operation, refer to Figures 10A through 10F. Figure 10A shows the cam ring and advance mechanism in the retard position as it would be at cranking. The advance piston (1) is moved toward the power plug side and the servo advance valve (2) is in the position shown. With the throttle closed, the roller (3) rides on the low portion of the face cam (4) and no change is made in the reference point of the mechanical/light load advance spring (5).

As the engine accelerates, increasing transfer pump pressure is directed through the head locating screw (6) to the housing passage (7) shown in Figure 10B. This passage empties into an elongated groove (8) in the advance piston. Fuel then flows around the groove to the cam advance pin (9) and into the piston bore.

**FIGURE 10B**

With the servo valve in the position shown in Figure 10C, fuel enters the transverse passages (10) in the advance piston and fills the single longitudinal passage (11) which extends to the piston end. An orifice screw (12) is located at this point to restrict the flow of fuel and to eliminate fluctuations.
caused by the varying amounts of cam loading during each pumping cycle. Fuel then fills the cavity between the advance piston and the power piston plug (13); the pressure acts on the surface of the piston and urges it, against cam loading force, toward the spring side plug (14). This linear piston motion is converted to a rotary motion of the cam (15) which advances the beginning of pumping. See Figure 10D.

FIGURE 10D

Advance piston movement and cam ring rotation will continue as long as pump speed and transfer pump pressure increase. When pump speed stabilizes, the force of cam loading will balance the power piston force, and piston movement will cease. The servo valve, which has been moved toward the spring side end plug by the force of transfer pump pressure, tends to hover over the transverse passage due to the balancing spring force. At stable pump speed, the valve’s forward edge contacts the edge of the transverse passage, sealing transfer pump pressure in the longitudinal passage and piston cavity. Increased pump speed, or transfer pump pressure, will again move the valve, against spring force, to open the transverse passage and permit further advance action.

FIGURE 10E

If the pump speed is decreased, transfer pump pressure also decreases. The reduced force on the servo valve allows the advance spring to move the valve toward the cam advance pin and align the transverse passages (16) in the valve with the passages in the piston. See Figure 10E. Fuel then flows through the valve and into the piston bore. Pressure in the power plug side piston cavity is reduced and the cam loading force urges the valve toward the retard position as shown in Figure 10F. Fuel in the piston bore is vented into the housing. This action continues until the movement of the piston relative to the now stationary servo valve repositions the two parts as shown in Figure 10C and the piston transverse passages are opened to transfer pump pressure.

During the initial degrees of throttle travel, the face cam and lever assembly (17) positions the advance spring at its outboard location. This permits greater movement of the advance piston and cam ring before the servo valve begins to close the transverse passages; increased advance action at low throttle settings is then achieved. As the throttle travel angle is expanded, the ramp on the face cam actuates the lever assembly, moving the plunger (18) and the spring reference point toward the cam pin.

At a predetermined throttle angle, the surface of the face cam becomes a flat plane and the spring reference point becomes fixed. Advance action after this point is regulated by the spring rate. It should be emphasized that the action of the face cam and lever assembly does not change the rate of the action spring or its loading, only its reference point.
A system adjusting screw (19) is provided in the plunger end of the lever assembly.

VI. SPECIAL DISASSEMBLY AND REASSEMBLY PROCEDURES

Complete disassembly and overhaul of automotive DB2 pump models should be accomplished in conjunction with instruction in the DB2 manual (basic pump) and individual pump specifications. This section contains procedures which are either new or unique to the automotive Model DB2.

A. Pin Retained Drive Shaft - Before mounting 1978 through 1980 model pumps on the holding fixture, remove the drive shaft retaining pin from the pilot tube (Figure 11A). This is done with a 1/16" drift. Note that one of the pilot tube holes is smaller than the other. The pin must be installed through the small hole first. Likewise, removal must be made by driving the pin from the large hole out through the small hole.

NOTE: Care should be taken not to damage the pilot tube during this step. The center seal on the drive shaft may be torn if any burrs are left at these holes.

FIGURE 11A
The retaining pin has a slight upset on one end to provide an interference fit in the smaller hole of the pilot tube. These pins should be used only once.

After removing the retaining pin, the drive shaft may be withdrawn(Figure 11B). The letter "T" is stamped near the tang of the shaft and is referred to during installation of the pump to the engine. The "T" should be facing upward as the pump is installed on the engine with the crankshaft spotted on T.D.C. No. 1 cylinder, compression stroke. When installing the drive shaft to the pump, be sure that the drilled timing mark on the end of the drive tang matches up with the mark in the rotor drive slot.

FIGURE 11B

B. O-Ring Retained Drive Shafts - Drive shafts in 1981 pump models are retained with an O-ring and are removed by pulling the shaft out of the pump. A careful inspection should be made to ensure that no pieces of the O-ring break off and remain in the pump. Follow instructions in the previous paragraph for timing (Reference Figure 4).

C. Min-Max Governor - To disassemble the min-max governor, first remove the sleeve, idle spring, and guide from the push rod; then remove the spring from the guide.

FIGURE 12A
NOTE: In the late 1979 through early 1981 configuration, the end of the spring which contacts the governor arm has the end coil turned in to prevent incorrect installation of the spring to the sleeve. If this spring is assembled backwards, a loss of low idle governor control will result. See Figure 12A.
Place the block in a copper jawed vise, as shown in Figure 12B, and unscrew the rod using an 11/32" wrench or socket. Remove the spring and washer from the rod.

**FIGURE 12B**

When reassembling the governor capsule, thread the rod through the block so that two or three threads are exposed at the back of the block. This will give an initial low setting to work from on the test stand. The minimum retention torque for the rod is 5 lb-f in at any installation. Parts which do not meet this requirement should be replaced.

C. Mechanical/Light Load Advance Assembly - If a vacuum module is mounted on the pump, it must be removed prior to disassembly of advance components. Also remove the drive pin from the throttle shaft using the appropriate drift punch.

**FIGURE 13A**

The mechanical lever assembly may be removed by prying off the retaining rings from the rocker lever pin. Use a screwdriver as shown in Figure 13A. Discard the rings. Push out the pin and remove the lever assembly. Except for the servo advance adjusting screw, no further disassembly of the lever is permitted. If the roller is worn or damaged, the assembly must be replaced.

**FIGURE 13B**

Loosen the face cam screw using a 5/32" hex bit (or Torx Bit Socket 22939). Because the throttle shaft is grooved at this point, the screw must be completely withdrawn to allow for removal of the face cam.

When reinstalling the face cam on the throttle shaft, place a .004" -.006" shim between the throttle shaft washer and the housing boss to obtain a .005" clearance. With the lever assembly in place and the throttle in the idle position, squeeze the throttle shaft assembly and face cam tightly toward each other and rotate the face cam so that the lever roller rests approximately in the middle of the low idle step. See Figure 13B. Tighten the face cam screw. Final adjustment will be made on the test bench.

**VII. TESTING - See Service Bulletin No. 80**

A. Test Bench Requirements - The automotive Model DB2 pump requires a test bench capable of at least 2250 RPM shaft speed. The test bench must be equipped with the following items.

1. A Zero Backlash Coupling - A zero backlash coupling reduces testing errors by smoothly transmitting the torque to the pump.

2. A Digital Tachometer - The superior accuracy of the digital tachometer is necessary for setting checkpoint
speeds within the plus or minus 5 ERPM allowed by the specifications.

3. A Variable Voltage Source - an adjustable voltage source is required to test the operation of the electric shut-off solenoid and to check the correct pull-in voltage point. This check ensures that the solenoid will operate in the event that the vehicle system voltage drops below normal. The operation of the housing pressure cold advance solenoid should also be checked. See individual pump specification sheets.

4. Test Gauges - Required as follows:
   a. A 0 - 160 p.s.i.(0 - 1.130mPa) pressure gauge calibrated in 1 p.s.i. divisions, to measure transfer pump pressure. The gauge should be located as close as possible to the pump, and the in-line shutoff should be at the pump.
   b. A pressure gauge, calibrated 0 - 30 p.s.i.(0 - 607mPa) to measure housing pressure.
   c. A vacuum gauge, calibrated 0 - 30 Hg.(0 - 101mPa), in the supply line with a shut-off valve between the gauge and the tank, to test transfer pump lift.
   d. A flowmeter for measuring return oil should be used with a three-way valve which permits the flowmeter to be in use only during the return oil check.
   e. A temperature gauge, located at the pump inlet, to monitor inlet fuel temperature.

5. Calibrating Nozzles and Injection Lines - Automotive pumps may be tested with either of two combinations depending upon the specification requirements. Check each individual specification sheet for the proper combination, or serious calibration errors may result.

Examples:

   a. 1978 and 1979 pumps use the 21953 pencil nozzles set at 1800, minus 50, plus 100, p.s.i. opening pressure, with .072" I.D. by 25" long lines.
   b. 1980 and 1981 automotive and truck pumps use 0.5mm orifice plate nozzles(AMBAC)* set at 1700, plus or minus 25, p.s.i., with .0931" I.D. by 25" long lines.

B. Mounting the Pump - The pilot tube in the automotive Model DB2 has a larger diameter (1.172-1.173inches)(29.77-29.79mm) and protrudes more from the housing(.710-.720inches)(18.03-18.29mm) than those used in the Model DB. It may be necessary to modify the mounting bracket to accept this pilot tube. The scalloped bolt holes in the flange permit mounting this model on the same bolt arrangement used for the Model DB. Removal of the drive shaft in the automotive Model DB2 will permit use of the standard 10224 drive shaft to drive this model on the test bench.

A test bench plumbing circuit is shown in Figure 14. Note the orifice fitting Part No. 13211, which is located in the inlet line between the supply pump and the shut-off valve. At low speeds, such as cranking, the oil temperature at the pump inlet decreases due to their reduction of flow into the pump. The orifice fitting permits hot oil to circulate constantly, thereby maintaining proper calibrating oil temperature (110°-115°F) at all speeds and loads.

*American Bosch Division
AMBAC Industries, Inc.
3664 Main Street
Springfield, Massachusetts 01107
FIGURE 14
C. Special Service Tools - The special service tools required for service of the automotive Model DB2 are contained in kit 22037.

1. Advance Test Gauge 21734 - The 21734 advance test gauge (Figure 15) measures cam advance movement in 1/4 degree increments. The gauge scale magnifies cam movement 10 times to provide easier, more accurate calibration of the automatic advance. The base contains two plugs, either of which may be removed in order to install a housing pressure tap which is provided in the kit. Advance gauge installation is accomplished by removing the timing line cover and seal from the pump and mounting the gauge using the screws and seal provided. Use of a universal-type hex wrench will facilitate assembly of the mounting screws. Service Bulletin 337 describes this gauge and its use in greater detail.

![Figure 15]

2. Throttle Lever Gauge 21914 - Proper throttle shaft travel is critical on this application. On vehicles equipped with a transmission vacuum modulator, throttle position information is sent to the transmission via a valve mounted externally on the pump throttle shaft. Throttle lever gauge 21914 sets the correct low idle angle.

Clamp throttle lever gauge 21914 securely in a vise and mount the pump so that the flange rests flat on the gauge. Back out the spring-loaded low idle screw and the maximum travel screw and rotate the throttle lever counterclockwise until the throttle ball stud contacts the gauge arm (Figure 16). Hold the lever in this position and turn the low idle screw in until it contacts the stop boss. This establishes the 41° movement of the throttle ball stud from the vertical centerline of the throttle shaft. With this step completed, the pump should be removed from the gauge and installed on the test stand.

![Figure 16]

3. Throttle Lever Protractor 22089 - This device may be used to check both the part load throttle angle and the total throttle travel. A rubber grommet in the center of the protractor allows it to be mounted on the throttle shaft and rotated to set a 0° position. See Figure 17.

**NOTE:** On some 1980 pump models, the left timing line window has been eliminated from the housing. The center ridge of the mechanical/light load advance lever assembly may be used as a convenient vertical centerline and 0° set point.

![Figure 17]

4. Air Timing Tool 21916 - The automotive Model DB2 is timed to the engine by aligning a stamped timing line on the pump flange with its mating line on the engine's pump mounting adapter. Air timing tool, 21916, (Figure 18) is equipped with an optical gauge to check the position of the timing mark and a scribe to remark the flange when necessary.
FIGURE 18

To check an existing timing mark, loosen the setscrew which retains the scribe in the fixture. Remove the spring and scribe and replace with the optical gauge. Rotate the pump drive shaft to a vertical position so that the etched "T" faces upward. Install the air timing tool making sure that the drive shaft tang is seated into its proper location in the tang locating fixture. Connect a supply of dry, filtered air 60 to 100 p.s.i. to the number one (1) discharge fitting of the pump. The number one fitting can be identified by a "1" stamped on the housing. An arrow is also stamped to indicate direction of pump rotation. Loosen the four (4) socket head cap screws that secure the tang locating fixture to the scribe body. Rotate the tang locating fixture in the direction of rotation until the cam rollers can be felt making contact with the cam ring. This will be the beginning of injection.

NOTE: Occasionally two contact points will be felt. Use the last one for timing purposes.

Hold the drive shaft in this position and rotate the scribe body until the timing mark on the pump mounting flange is clearly aligned with the scribed lines on the optical gauge. The number of degrees can then be determined by counting the number of increments from the "O" mark on the tang of the locating fixture, to the pointer on the scribe body.

To re-mark a housing flange or to mark an un-marked housing, preset the air timing tool to the correct timing line position indicated on the individual pump specification sheet. Rotate the pump drive shaft to a vertical position so that the etched "T" faces upward. Install the air timing tool equipped with the spring and scribe, making sure that the drive shaft tang is seated into its proper location in the tang locating fixture. Connect a supply of dry, filtered air of 60 to 100 p.s.i. to the number one (1) discharge fitting of the pump.

Rotate the air timing tool in direction of rotation until the cam rollers can be felt making contact with the cam ring. At this point, lock the toggle clamp and strike the scribe firmly with the mallet. The degree figure indicated on the specification will correctly position the tool for marking the timing line regardless of whether injection timing is judged by beginning or end of injection. Roller contact (beginning of injection at the pump) is used as a reference point, and setting the tool to the degree figure shown on the specification will provide the correct line mark position for each model. Check the line position after marking with previous procedure.

CAUTION: 1980 pump models are equipped with the residual pressure balancing rotor which has eight vent passages connecting all of the cylinder discharge ports approximately 10° of rotor rotation after discharge. If the rotor is turned this far during air timing, high pressure air will be vented from all eight discharge fittings at once. Because of this, it is suggested that a clean rag be secured over the discharge fittings during the timing process.

Additional items in the 22027 tool kit are as follows:

- Orifice Plug 13211
- Nozzle Locknut Adapter 18958
- Nozzle Pressure Adjusting Wrench 20605
- Transfer Pump Pres. Test Adapt. 21900
- Retaining Compound 21915 (Not Illust.)
- Synkut Lubricant 22204 (Not Illust.)
- Drive Shaft Installation Tool 22727
- Hex Bit, 3/8” Square Drive 22736
- Torx Bit Socket 22939
- Face Cam Torx Socket 22977
The following literature may be consulted for further information on the topics listed:

Service Bulletin No. 63 - Accessory Execution Codes
Service Bulletin No. 80 - Bench Testing
Service Bulletin No. 95 - Governor Linkage Gap Setting Procedure
Service Bulletin No. 106 - Torque Setting
Service Bulletin No. 108 - ESO Service Procedures
Service Bulletin No. 143 - Delivery Valves
Service Bulletin No. 171 - Pilot Tube Replacement
Service Bulletin No. 285 - O-ring Identification
Service Bulletin No. 337 - Advance Gauge 21734
Service Bulletin No. 338 - Oversize Cam Rings
Service Bulletin No. 339 - Throttle Shaft Assemblies
Service Bulletin No. 340 - Nozzle Inlet Connections for G.M. Applications
Service Bulletin No. 342 - Linkage Gap Settings - 260 and 350 Engine Applications
Service Bulletin No. 343 - Rough Idle
Service Bulletin No. 344 - Shortened Throttle Shafts
Service Bulletin No. 345 - Drive Shaft Installation Tool 13369
Service Bulletin No. 351 - Identification Codes
Service Bulletin No. 352 - Metering Valve Arm Pin Placement
Service Bulletin No. 358 - Increased Advance Hole Plug Torque
Service Bulletin No. 360 - Min/Max Capsule Change and Torque Requirements
Service Bulletin No. 360A - Internal Idle Spring Min/Max Governor
Service Bulletin No. 361 - Face Cam Screw Modification and Face Cam Retention
Service Bulletin No. 363 - Advance Plunger Seal No. 22702 (Plug Assembly 22894)
Service Bulletin No. 364 - Rework of Servo Advance Piston Assembly
Service Bulletin No. 365 - Lacquer Sealing of Pump Fasteners
Service Bulletin No. 367 - Service Housing Assemblies
Service Bulletin No. 368 - Copper Infiltrated Transfer Pump Blades

Service Letter No. 181 - General Motors 350 Warranty Procedure
Service Letter No. 188 - Gasoline Diesel Mixtures in Returned Pumps
Service Letter No. 205 - General Motors Pump Conversions
Service Letter No. 212 - 1980 Automotive Pump Specifications
Service Letter No. 213 - General Motors Parts Recall
Service Letter No. 214 - General Motors 350 Diesel Application Update Letter No. 10
Service Letter No. 215 - Replacement Program for Governor Weight Retainer No. 17513 In Model DB2 Pumps for G.M. Applications

Service Publication No. 99009 - DB2 Overhaul Manual
Service Publication No. 99929 - Tool Manual

SAE Paper No. 790699

REVISIONS

<table>
<thead>
<tr>
<th>Number</th>
<th>Date</th>
<th>Changes</th>
</tr>
</thead>
</table>
SUBJECT: OVERSIZE CAM RINGS

Due to an occasional manufacturing variance, it sometimes becomes necessary to enlarge the inside diameter of some cam rings .006 inches (.15 mm) above the nominal dimension.

Identification Methods

Identification Notch
(.006 Oversize Inside Diameter)

Identification Groove
(Sintered Material)

New Part Number

Etched Note
(Inside Dia. Oversize)

Part Number & -O

Etched Note
(Inside Dia. Oversize)

Figure 1a

Figure 1b

Some "+6" cams are identified by a new part number and an identification notch (Refer to Figure 1a). Another method for identifying "+6" cams is the addition of a "-0" to the standard part number (See Figure 1b). Both styles incorporate the following etched note:

I.D.O.S.
Set R-R +.006

(Inside Diameter Oversize)

Service Information

When a pump which has an oversize cam ring is serviced, the roller to roller dimension must be adjusted to .006 inches over specification.

NOTE: Failure to compensate the roller to roller dimension will result in low fuel delivery.
Replacement Information

Oversize cam rings are used in production but are not sold as serviceable items. If it is necessary to replace a "+6" cam, refer to the following chart for the correct standard size cam ring part number. Also, reference S.B. 99 (S.B. 332 for DM 4 plunger pumps) to determine if the leaf spring (or shoes for DM pumps) must be changed in order to obtain the correct roller to roller setting.

*NOTE:* When a standard size cam ring is used to replace an oversize one, the roller to roller setting must be set back to the original specification. Failure to do so will result in high fuel delivery.

### Oversize Cam Ring Replacement Information

<table>
<thead>
<tr>
<th>Type</th>
<th>Original Std. Size P/N</th>
<th>Original O/S +.006&quot; P/N</th>
<th>Replacement Std. Size P/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive</td>
<td>21116</td>
<td>22075</td>
<td>21116 or 26000</td>
</tr>
<tr>
<td></td>
<td>22339</td>
<td>22625</td>
<td>22339 or 27835</td>
</tr>
<tr>
<td></td>
<td>22392</td>
<td>22626</td>
<td>26000</td>
</tr>
<tr>
<td></td>
<td>23057</td>
<td>23065</td>
<td>23065 or 26001</td>
</tr>
<tr>
<td></td>
<td>23119</td>
<td>23120</td>
<td>27833</td>
</tr>
<tr>
<td></td>
<td>23824</td>
<td>23825</td>
<td>23824 or 27834</td>
</tr>
<tr>
<td>Ag/Industrial</td>
<td>21357</td>
<td>22137</td>
<td>21687</td>
</tr>
<tr>
<td></td>
<td>21371</td>
<td>22139</td>
<td>18784</td>
</tr>
<tr>
<td></td>
<td>21686</td>
<td>21686-O</td>
<td>21686</td>
</tr>
<tr>
<td></td>
<td>21687</td>
<td>21687-O</td>
<td>21687</td>
</tr>
</tbody>
</table>

Technical Support Group
Product Support Department
SUBJECT: SERVO SPEED LIGHT LOAD ADVANCE

As legislation continues to mandate decreases in diesel engine emissions, engine manufacturers find it necessary to more closely control fuel delivery and injection timing functions. Stanadyne plays a significant role in this effort by developing special injection pump features such as the Servo Speed Light Load Advance. This feature is designed to optimize injection timing under part load and no load conditions in order to minimize exhaust emissions and smoke levels.

This service bulletin outlines the various types of Servo Speed Light Load Advances that are used on Stanadyne D Series pumps.

Servo Speed Light Load Advance Principles of Operation
The Servo Speed Light Load Advance (SSLLA) feature has been utilized in Stanadyne D Series pumps for over 15 years but has recently undergone several redesigns to make it more manufacturable, settable, and serviceable. Figure 1 shows a schematic view of a typical SSLLA.
The SSLLA operates by using two pressure signals. First, to achieve speed advance, transfer pump pressure is used to overcome spring force and move the advance piston, thereby rotating the cam ring to advance the injection timing (Ref. Figure 2). Since transfer pressure increases and decreases in direct relationship with engine speed (ERPM), timing is advanced as speed increases (Ref. Figure 3).

Light Load Advance (LLA) is achieved by using charging pressure. This pressure, which is in the circuit between the metering valve and the pumping plungers, varies as the metering valve is rotated from full delivery to no delivery. Charging pressure is highest at wide open throttle. With respect to the schematic in Figure 1, LLA is achieved when the metering valve closes and charging pressure drops. This allows the advance piston, servo valve, speed advance spring, and LLA piston to move to the left as a unit as transfer pump pressure overcomes the LLA spring force (Ref. Fig. 2). Figure 4 shows a typical amount of additional advance provided at part load (reduced delivery) by the LLA feature.
**Original Design SSLLA**
The original design SSLLA is pictured in the exploded view in Figure 5 and the cutaway view in Figure 6.

Please note that pumps utilizing the original design SSLLA require adjusting tool, P/N 23372 to set the advance during pump calibration.

**Current Design SSLLA — Type 1**
During 1997, the first type of a newly designed SSLLA was released to production. Type 1 of the current design uses a LLA orifice screw which threads into the side of the pump housing (Reference Figure 7). This screw provides improved fuel flow control into and out of the LLA circuit. The advance pistons used with the current design SSLLA (Type 1) utilize either a reed valve or an orifice screw, as pictured in Figure 7, depending on the individual application requirements. Always refer to the individual specification for SSLLA part numbers and setting procedures. The serviceable components and torque specifications for the Type 1 current design SSLLA are shown in Figure 7.
NOTE: Some applications also use a Teflon® washer to properly position the seal between the advance plug(s) and the pump housing. Refer to the individual pump specification to determine if a Teflon® washer is used. Teflon washers are to be replaced during pump service and should not be reused.

The Type 1 current design SSLLA uses a nylon patch on the threads of both the light load and speed advance adjusting screws for retention purposes. The speed advance adjusting screw threads into the LLA piston and the LLA adjusting screw is threaded into the LLA advance plug. Service Tool 33196 is required for making advance adjustments during pump calibration as shown in Figure 8.

**Figure 7**

**Advance Adjustments on Type 1 of the Current Design SSLLA**

*Tool is used as pictured for speed advance adjustment and inverted end for end to make load advance adjustment*
Viscosity Sensitive Advance Feature
Stanadyne introduced a modified version of the current SSLLA referred to as a viscosity sensitive advance. It is designed to reduce sensitivity to fuel viscosity changes in the LLA circuit, and consists of a different LLA orifice screw and speed advance adjusting screw. Only a small number of applications require the viscosity sensitive advance and at this time there are approximately 15 pump specifications that have this feature.

The LLA orifice screw contains a flatted pin instead of an orifice to control the flow of metered fuel to the LLA piston cavity. There are three LLA orifice screw assemblies with different sized flatted pins for the viscosity sensitive advance. Part numbers are located on the head of the screw for identification purposes. The speed advance adjusting screw has an orifice located in the center of the screw. At this time there are currently two adjusting screws with different size orifices for these applications. Cutaway views of the standard (non-viscosity sensitive) and the viscosity sensitive LLA features are shown below in Figures 9a and 9b.

Current Design SSLLA — Type 2
Stanadyne has introduced a variation of the current design SSLLA to address adjustability and retention issues with the speed and LLA adjusting screws. The Type 2 or “patchless” design includes a press fit speed advance adjustment plug and a light load advance adjusting screw that uses an o-ring for retention purposes. These changes allowed for the removal of the nylon patch on the speed advance and LLA adjusting screws which contributed to the adjustability and retention issues. Other changes include a redesigned LLA orifice screw.
(Figure 9), a new LLA plug (Figure 10) and the inclusion of a filter that is incorporated in the hydraulic head (Figure 13) to prevent debris from entering the LLA orifice screw. Torque values are the same for both Type 1 and Type 2 of the current design SSLLA and are shown in Figure 7. An exploded view highlighting the unique components of the Type 2 design is shown in Figure 10.

All pump models originally released with the Type 1 SSLLA have been or are being changed to incorporate the components of the Type 2 design.

**Servicing Current Type 1 and Type 2 SSLLA’s**

When a pump is received for service with the Type 1 SSLLA, it does **not** have to be upgraded to the patchless (Type 2) advance components. However the previously used speed advance adjusting screws, light load advance pistons and light load advance adjusting screws have been superseded and will no longer be available for service. Therefore, if any of these components do require replacement during service, they will have to upgraded with the appropriate Type 2 advance component(s).
LLA pistons are now available in press fit (Type 2) versions only. Replacement LLA pistons are not equipped with a speed advance adjusting plug due to the large variety of piston and speed advance adjusting plug combinations in use. Therefore, whenever a LLA piston requires replacement, the specified speed advance adjusting plug must be ordered separately. Always refer to the individual pump specification when making service part replacements.

The following chart shows the Type 1 advance components and the Type 2 components that supersede them.

<table>
<thead>
<tr>
<th>Original Type 1</th>
<th>Superseded by Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part No.</td>
<td>Part No.</td>
</tr>
<tr>
<td>Description</td>
<td>Description</td>
</tr>
<tr>
<td>32479* Speed Advance Adjusting Screw</td>
<td>33905 Speed Advance Adjusting Plug</td>
</tr>
<tr>
<td>33941 Speed Advance Adjusting Screw</td>
<td>34244 Speed advance Adjusting Plug</td>
</tr>
<tr>
<td>33982 Speed Advance Adjusting Screw</td>
<td>34245 Speed advance Adjusting Plug</td>
</tr>
<tr>
<td>33042 LLA Adjusting Screw</td>
<td>33614 LLA Adjusting Screw</td>
</tr>
</tbody>
</table>

*Speed advance adjusting screw, P/N 32479, has been superseded by adjusting screw P/N 23201 for service. Therefore, when only a 32479 adjusting screw requires replacement, the 23201 screw should be used in its place making it unnecessary to replace the LLA piston when only the speed advance adjusting screw requires replacement.

**Press Fit Speed Advance Plug Adjustments**

Stanadyne is currently developing a new speed advance adjusting tool that will allow for adjustments of the press fit style speed advance adjusting plug while the pump is running on the test bench. Until the new speed advance adjusting tool is available, speed advance adjustments will have to be performed with the LLA piston removed from the pump.

To make speed advance adjustments, an arbor press, advance seal installation tool P/N 30847, and a LLA end plug are required. Installation and adjustments of the speed advance adjusting plug are as follows:

1) Insert the LLA piston into the LLA end plug and place on an arbor press making sure that it rests flat on the arbor plate as shown in Figure 11a.
   
   *NOTE: The polished O.D. surface of the LLA piston skirt (stem) is critical. Therefore, extreme care should be exercised when handling this component.*

2) Press the adjusting plug, with open end facing upwards, into the piston using service tool 30487 until the plug is flush to slightly below the top of the LLA piston.
3) Install the LLA piston into the pump and check for proper speed advance as indicated on the individual pump specification. If speed advance set point is high, go to step 4, if speed advance is low, go to step 5.

4) To decrease speed advance, first determine how many degrees of adjustment is required. Measure the depth of the adjusting plug prior to making adjustments. Press the adjusting plug in .022” (0.56mm) for each degree of required adjustment in the direction as shown in Figure 11a. Example: Speed advance measured at 1.25° above the specified speed advance. The adjusting plug needs to be pressed inwards .0275” (.022” x 1.25° = .0275”) (.56mm x 1.25° = .70mm).

5) To increase speed advance, place the advance piston on top of the advance plug as shown in Figure 11b. Again, first determine how many degrees of adjustment are required and then calculate the movement required to achieve the correct speed advance. Press the adjusting plug inwards (towards the top of the piston) the appropriate amount.

The final position of the speed advance adjusting plug in the LLA piston can be anywhere from flush with the top of the LLA piston to .130” (3.30mm) below the top of the LLA piston, dependent upon the application.

**LLA Adjustments**

As stated, the LLA adjusting screw has been changed from the nylon patch style (Type 1) to the O-ring retained (Type 2) adjusting screw. Since the release of the O-ring retention style adjusting screw, P/N 33614, the O-ring groove location has been moved to increase the adjustment range and to eliminate the
possibility of blocking the air bleed passageway in the LLA end plug. The LLA adjusting screw part number (33614) has not changed. As a result, when servicing pumps with the 33614 adjusting screw it is important to first identify which version adjusting screw the pump is equipped with. The O-ring groove on the original 33614 adjusting screw is located .175” (4.45mm) from the end of the screw and provides an adjustment range of .058” (1.47mm). The O-ring groove has since been relocated at .277” (7.04mm) from the end of the screw which allows for a much greater adjustment range.

LLA adjustments are made with the advance cap off and the test bench at 0000 ERPM. An 11 mm hex key (or a modified 7/16” hex key) is required to make adjustments. Following final adjustment of the LLA, the position of the LLA adjusting screw should be checked to ensure proper retention. Figures 12a and 12b show the minimum and maximum positions for both versions of the 33614 adjusting screw.

**LLA Orifice Screw Filter**

A LLA orifice screw filter has been introduced to prevent debris from entering into and possibly plugging the LLA orifice screw. To accommodate this filter, a new family of head and rotor assemblies have been released to production. The filter, P/N 24565, is located in the hydraulic head assembly as shown in Figure 13. All new pump models with SSLLA will be equipped with the new head & rotor assemblies and filter 24565. In addition, these new head & rotor assemblies and filters are being added into previously released specifications that are equipped with the SSLLA feature.

Pumps previously built without the LLA circuit filter are not to be upgraded to include this filter. However, when head & rotor replacement becomes
necessary, the current head & rotor assemblies, which are packaged with the 24565 filter, are to be used.

In order to properly seal metered fuel pressure and to seat the orifice screw filter in the hydraulic head assembly, it was necessary to release new LLA orifice screws. As a result, whenever a head & rotor is being replaced in a pump that did not originally contain a 24565 filter, the appropriate LLA orifice screw and associated seals will also have to be installed. The original and new LLA orifice screws designs are shown below in Figure 14.

There are currently four versions of the LLA orifice screw. One uses an orifice to control the metered fuel pressure signal to the LLA advance while the other three use a flatted pin. The LLA orifice screws with flatted pins are visually similar, but are differentiated by their flow rates. Part numbers are located on the hex head portion of the screw for identification.

For service, the new LLA orifice screws can be used on pumps without the 24565 filter. However, the old style orifice screws are not to be used with head & rotor assemblies that contain the 24565 filter. The following chart shows the original and the superseding LLA orifice screws part numbers. Again, always refer to the individual pump specification when making service part replacements.

<table>
<thead>
<tr>
<th>LLA Orifice Screws Used in Pumps without Filter 24565</th>
<th>LLA Orifice Screws Used in Pumps with Filter 24565</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part No.</strong></td>
<td><strong>Description (flow rate)</strong></td>
</tr>
<tr>
<td>32513</td>
<td>Orifice Type, Button Head</td>
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<tr>
<td>33988</td>
<td>Flatted Pin Type (125 ml/min)</td>
</tr>
<tr>
<td>33981</td>
<td>Flatted Pin Type (150 ml/min)</td>
</tr>
<tr>
<td>33942</td>
<td>Flatted Pin Type (250 ml/min)</td>
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<tr>
<td>Revision</td>
<td>Date</td>
</tr>
<tr>
<td>----------</td>
<td>-------</td>
</tr>
<tr>
<td>1</td>
<td>6/97</td>
</tr>
<tr>
<td>2</td>
<td>12/98</td>
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</tbody>
</table>
Stanadyne developed the cold start advance (CSA) feature to assist engine manufacturers in reducing the white exhaust smoke associated with cold temperature starting and operation of diesel engines. The white exhaust smoke is caused by unburned fuel due to an incomplete combustion process. By advancing the fuel injection timing during cold engine operation, combustion efficiency is improved and white exhaust smoke is minimized. Once the engine coolant temperature is sufficiently elevated, the injection timing and advance functionality are returned to normal operation. Stanadyne’s cold start advance mechanisms are used on servo-speed light load advance (SSLLA, Ref. S.B. 373) equipped DB2 (non-automotive) and DB4 pump models and may either be operated electronically (solenoid actuated) or manually (mechanically actuated).

**Solenoid Actuated Cold Start Advance**

The automatic operation of the solenoid actuated cold start advance provides precise cold engine injection timing control. There are several variations of solenoid hardware and operating parameters but the general operation of the solenoid actuated CSA design is consistent. A typical solenoid actuated CSA mechanism is shown in Figure 1.
During cold engine start and operation, the solenoid is energized allowing the plunger to lift off of the seat and provide fuel under transfer pump pressure to the rear of the cold start advance piston. The pressurized fuel causes the CSA piston to move the servo advance piston until the CSA piston is stopped by the retaining ring within the advance end plug. Once the engine warms, the solenoid is de-energized and the spring loaded plunger seats in the valve body. With the plunger seated the flow of fuel under transfer pump pressure is blocked and the CSA piston is pushed back into the advance end plug which allows the pumps automatic advance mechanism to return to normal operation.

Cold Start Advance Solenoid Assemblies

Since the introduction of this CSA design, Stanadyne has used two different types of CSA solenoid-valve assemblies - a rectangular type and a cylindrical type (Figure 2). The basic functionality and mounting configurations are the same. However, there are some differences between the individual components of each type which prevents parts interchangeability.

Variations of CSA assemblies include: 12 or 24 volt coils, different lengths of wire leads and different terminal connectors. In addition, there are two functionally different types of valve bodies. For identification purposes, the variants and part numbers for individual components are provided in the following tables.
Cold Start Advance Delay Feature

Some engines require retarded injection timing for starting, but once running the injection timing must be advanced to avoid the generation of white exhaust smoke. To address this operating criteria, a CSA actuation delay feature was introduced. A higher rate spring under the check valve ball (Reference Figure 1) keeps the valve from opening until the internal transfer pump pressure is sufficient enough to lift the ball off of the seat. The table below identifies the part numbers and valve body activation types of both CSA assemblies.

<table>
<thead>
<tr>
<th>Rectangular</th>
<th>Cylindrical</th>
<th>Coil Voltage</th>
<th>Connector Type</th>
<th>Wire Lead Length† (Color)</th>
<th>Reference Pump Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>33240</td>
<td>34268</td>
<td>12</td>
<td>A</td>
<td>Long (Black)</td>
<td>DB4429-5895</td>
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<tr>
<td>33285</td>
<td>34269</td>
<td>24</td>
<td>A</td>
<td>Long (Red)</td>
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</tr>
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<td>32944</td>
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<td>12</td>
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<td>Long (Black)</td>
<td>DB4429-6000</td>
</tr>
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<td>DB4429-6004</td>
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<td>DB4429-5929</td>
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<td>39500</td>
<td>—</td>
<td>12</td>
<td>D</td>
<td>Short (Black)</td>
<td>*</td>
</tr>
</tbody>
</table>

† Long = 14 inches (35 cm), Short = 7 inches (17 cm)
* Currently only used experimentally

Cold Start Advance Solenoid Supersession

Several years ago the rectangular CSA assemblies were superseded by cylindrical CSA solenoid assemblies. Since the individual components were not interchangeable, Stanadyne created a variety of cylindrical CSA solenoid kits for servicing pumps originally equipped with rectangular CSA assemblies. This supersession has now been reversed - the rectangular CSA solenoids are now

<table>
<thead>
<tr>
<th>Actuation Feature</th>
<th>Rectangular Type</th>
<th>Cylindrical Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delay</td>
<td>33191</td>
<td>34194</td>
</tr>
<tr>
<td>Non-Delay</td>
<td>33307</td>
<td>34195</td>
</tr>
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</table>
used for both production and service. Therefore, all cylindrical style CSA assemblies are superseded by equivalent rectangular solenoid assemblies. This is a running change where components for the cylindrical CSA solenoid assembly will remain available only until current stocks are depleted. Should you receive a pump that requires service of a cylindrical style CSA and the components are no longer available, refer to the following chart to determine which rectangular CSA service kit part number is applicable.

<table>
<thead>
<tr>
<th>Service Kit¹ Part Number</th>
<th>Valve Body</th>
<th>Coil Assembly</th>
<th>Service Kit² Part Number</th>
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<th>Coil Assembly</th>
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<tr>
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<td>37075</td>
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</table>

¹ Cylindrical CSA Service Kits include one of each of the following:

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>32866</td>
<td>O-Ring Seal</td>
</tr>
<tr>
<td>32955</td>
<td>Lock Nut</td>
</tr>
<tr>
<td>34267</td>
<td>Flux Washer</td>
</tr>
<tr>
<td>34505</td>
<td>Protective Sleeve</td>
</tr>
<tr>
<td>See table</td>
<td>Coil Assembly*</td>
</tr>
<tr>
<td>See table</td>
<td>Valve Body Assembly**</td>
</tr>
</tbody>
</table>

² Rectangular CSA Service Kits include one of each of the following:

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>32866</td>
<td>O-Ring Seal</td>
</tr>
<tr>
<td>32955</td>
<td>Lock Nut</td>
</tr>
<tr>
<td>See table</td>
<td>Coil Assembly</td>
</tr>
<tr>
<td>See table</td>
<td>Valve Body Assembly**</td>
</tr>
</tbody>
</table>

* Coil Housing are not available separately, only as part of the complete coil assembly.
** Valve Body Assemblies include O-ring Seal (P/N 27268)

Since some pump models may have either CSA type, service specifications include valve body and coil assembly part numbers for both rectangular and cylindrical types. The diagram in the housing group reflects one CSA type and a note identifies the part numbers of the other CSA type as shown in Figure 3.

![Figure 3](image-url)
Cold Start Advance Solenoid Assembly Installation

Valve Body Installation (Reference Figure 2)

The CSA valve body is a sealed, non-serviceable assembly that should not be disassembled. Prior to installing the valve body the coil assembly must be removed. Ensure the o-ring seals (P/N’s 27268 & 32866) are positioned on the valve body base and thread the valve body into the pump housing. To avoid damaging the valve assembly, use a 7/8 inch (22.25 mm) deep socket on the body hex and tighten the assembly to 90-110 lbf.-inch (10.2-12.4 N•m).

Coil Assembly Installation (Reference Figure 2)

Rectangular Coil Assembly:
1. Place the coil assembly onto the valve body with the wire leads facing the direction shown on the specification. Install the coil lock nut finger tight.
2. Rotate the coil assembly until it lightly contacts the hydraulic head assembly and tighten the coil lock nut to 40-50 lbf.-inch (5.1-5.6 N•m).

Cylindrical Coil Assembly:
1. Place the O-ring seal (PN 29525), flux washer (with the stepped O.D. facing away from pump housing), coil assembly and the metal coil housing onto the valve body. Install the coil lock nut finger tight.
2. Position the protective sleeve on the coil assembly with the step facing toward the pump and the flat facing the hydraulic head assembly. Slide the sleeve over the coil assembly until it bottoms.
3. Rotate the protective sleeve and coil assembly until the sleeve stops against the hydraulic head assembly (wire leads should face direction shown on the individual pump specification). Tighten the coil lock nut to 40-50 lbf.-inch (5.1-5.6 N•m).

For Iveco pump models ONLY: The head locking screws must be changed from one side to the other for ground terminal connection (Reference Figure 4).

![Figure 4](image-url)
4. Remove the ground wire clamp screw. Remove the nut, two washers and ground terminal lug from the head locking screw stud.

5. Remove both head locking screws and install them in the opposite location from their original position. Tighten each head locking screw to 180-220 lbf.-inch (20-25 N•m).

6. Place the ground terminal, flat washer and toothed washer onto the stud. Install and tighten the nut to 50-60 lbf.-inch (5.7-6.8 N•m).

Cold Start Advance Solenoid Operational Test

Operational testing of the cold start advance solenoid is performed during the Test Following Pump Service calibration routine by energizing the CSA solenoid and recording the advance movement (Reference Figure 5).

Pump models with delay type valve bodies are tested to ensure that the CSA is not active when transfer pump pressure and engine speeds are low. If the CSA is active at this check point, the transfer pump pressure may be high or the CSA solenoid assembly (valve body and/or coil assemblies) may not be functioning properly. The delay type valve bodies are tested again at a higher speed and “part load” (adjusted throttle position) to ensure CSA operation and full travel.

Certain pump models may require the use of a smaller diameter CSA piston in cases where the advance travel is insufficient at the “part load/Adjusted throttle” check point. The applicable pump models will have both standard and under-sized CSA piston part numbers listed on the specifications.

Solenoid Actuated Cold Start Advance End Plug Assemblies

The typical solenoid actuated CSA design uses a CSA piston operating within an advance end plug mounted to the side of the pump housing (Reference Figures 2 and 6). A retaining ring within the advance end plug limits piston travel. The length of the CSA piston defines the amount of timing advance when the CSA is actuated.
Early DB4 and all DB2 pump models equipped with cold start advance have a CSA end plug assembly which threads into the side of the pump housing (Figure 6). Certain DB4 pump models were later changed over to an advance end plug retained by four screws due to the high load on the cam ring and the other advance components (Figure 2). This end plug design was later incorporated into all DB4 servo-speed light load advance featured pumps.

**IMPORTANT:** When replacing a pump housing or advance components on an early DB4 pump with a threaded CSA advance end plug additional components will be necessary. Refer to the latest pump specification for correct part numbers and quantities.

**Compact Cold Start Advance**

Stanadyne introduced the “Compact” CSA design to offer engine manufactures more versatility where pump mounting clearance is an issue. The compact CSA operates in the same way as the standard CSA. However, the compact cold advance has a cup shaped cold advance piston which operates within the pump housing and incorporates a low profile advance end plug. To address additional clearance issues, some pump housings equipped with the compact CSA feature may also have CSA solenoids that are mounted on an angle.

![Diagram of CSA End Plug Assembly](image)

Early compact CSA equipped pump models were produced with a thick sleeved pump housing (Figure 7a). Later, a thin sleeved compact CSA was introduced when all SSLLA equipped pump models were standardized with a thin sleeved housing and non-plated servo-advance pistons (Reference S.B. 373).
Both the thick and thin sleeve designs function the same, both have housing advance bores that are steel sleeved and they share common CSA solenoid assemblies and servo-speed light load advance components. However, the housing assemblies, cold start advance pistons, and the CSA advance end plugs are unique to each design as shown in Figures 7a, 7b & 8.

**IMPORTANT:** When a thick sleeve housing is replaced with a thin sleeve housing, additional parts are required (advance end plug, CSA piston, advance plug screws, and associated seals). Reference the individual service specification for the specific part numbers.

All pump models originally specified with a thick sleeve CSA have been superseded by pump models with the thin sleeve CSA design. For this supersession, only the Stanadyne model/part number changed - the customer part numbers remained unchanged, as shown in the following pump model supersession tables:

### John Deere

<table>
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<tr>
<th>Original Stanadyne Model No. (Thick Sleeve)</th>
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<td>DB4327-5563</td>
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<td>DB4327-5562</td>
<td>RE 500442</td>
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<td>DB4327-5367</td>
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<td>DB4327-5583</td>
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<td>RE 502509</td>
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</tr>
<tr>
<td>DB4327-5502**</td>
<td>DB4327-5584</td>
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</tr>
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</table>

* DB4-5400 (RE 501258) was superseded by DB4-5488 (RE 502217).
** DB4-5484 (RE 502182) was superseded by DB4-5502 (RE 502509).
Cold Start Advance Assist Spring (Reference Model DB4429-6052)

Some compact CSA equipped pump models use a CSA assist spring in the CSA advance end plug and acting against the CSA piston (Figure 9). The spring pre-positions the CSA piston and the servo-advance piston in an advanced position, which provides additional timing advance to eliminate white smoke at cranking speed and while the engine speed is accelerating once started.

Cold Start Advance Ready Pumps (Reference Model DB4-5982)

A number of pump models were equipped with the standard CSA components but without a CSA solenoid assembly. These pumps are referred to as being “Cold Start Advance Ready” and have a CSA solenoid bore plug (P/N 33131) installed in place of the CSA solenoid assembly (Figure 10).

There are a small number of pump model specifications that were originally “CSA Ready” but have since been changed to include the CSA solenoid. If you should receive a pump that shows a solenoid on the service specification but the pump is not equipped with one, it should be serviced “as is”. Do not install a solenoid unless it is at the customers request, in which case all associated costs are the customers responsibility.
Mechanical Cold Start Advance
A mechanical CSA was used on early SSLLA equipped pump models, however it is no longer used in production. This feature is manually operated by rotating the face cam which contacts either a step or a pin on the end of the servo advance piston moving the advance that contacts the ramp of the face cam. An exploded view of a typical mechanical cold start advance, as well as the different piston types and lever orientations, are shown in Figure 11.

![Figure 11](image)

Technical Support Group
Product Support Department

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Changes</th>
</tr>
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<td>3</td>
<td>9/08</td>
<td>Changed solenoid supersession information. Added CSA assist spring, threaded end plug, service kit and operational testing information</td>
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<td>4</td>
<td>6/09</td>
<td>Added Iveco installation instructions</td>
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<td>5</td>
<td>02/11</td>
<td>Changed solenoid supersession information</td>
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</table>
Subject: Service Procedures and Tool Requirements for the Chevrolet 6.2 Liter V-8 Fuel Injection Pump Models

Automatic Advance Indicators 21734, 23745

The 21734 automatic advance indicator assembly (DM/DB2 Base) may be modified for use on the Chevrolet 6.2 liter V-8 fuel injection pumps by grinding away a portion of the indicator plate as shown below in Figure 1.

![Figure 1](image1.png)

Grind flush with surface of block

This is necessary because of interference between the throttle lever and the indicator during throttle lever rotation. **NOTE: Thoroughly clean the indicator after grinding.**

For those who do not wish to make this modification, a newly designed advance indicator assembly, 23745, is currently available. (Figure 2.) The new indicator allows sufficient clearance for full travel of the throttle lever, and also utilizes a new base, 23710. This new automatic advance indicator assembly may be used on all DM and DB2 pumps including the Chevrolet V-8 and Oldsmobile V-6 and V-8 models. (See also S.B. 374)
23615 Plate, Holding Fixture

Because of the unique flange configuration of the Chevrolet pump housings, a new holding fixture plate assembly has been designed, and is now available as part number 23615.

23716 Throttle Lever Gauge

To set the throttle lever of the Chevrolet V-8 pumps in the correct low idle position prior to calibration, a new throttle lever setting gauge is required. The new gauge is designed to establish a distance of 3.09 inches (78.5mm) from the pump mounting flange to the throttle connection stud. This will automatically determine the correct angular position of the throttle lever (34 degrees) as measured between the vertical centerline of the throttle shaft bushing bore, and the centerline of the throttle connection stud. To use the new 23716 gauge, lay the pump on its side with the throttle lever facing up, and back out the spring-loaded low idle screw a few turns. Install the 23716 gauge squarely to the face of the pump mounting flange. Holding the gauge firmly against the flange, turn the low idle screw inwards until the quarter inch diameter (.250 inch (6.35mm)) of the throttle connection stud makes contact with the gauge. (Figure 3.) Remove gauge from pump. The throttle lever is now set in the correct low idle position, and the pump may now be tested according to specification.
Air Timing Fixture 23715

Due to the different mounting flange and drive shaft configuration, a new air timing fixture, 23715, will be required for servicing DB2 pump models for the Chevrolet V-8 applications. (Figure 4.)

![Diagram of 23715 Air Timing Fixture]

1. To check the existing timing line, pre-set the air timing tool to the position indicated on the individual pump specification. Rotate the pump drive shaft to locate the dowel pin at the 7 o'clock position as viewed from the drive end. Install the air timing tool to the pump making certain that the dowel pin engages the hole in the tool. Connect a supply of dry, filtered air at 60 to 100 psi to the number "1" discharge fitting. The number "1" discharge fitting can be identified either by the "1" cast onto the housing adjacent to it, or by referring to the individual pump specification. Rotate the air timing tool in the direction of rotation (correct pump rotation may be determined by the directional arrow cast onto the housing next to the "1") until the cam rollers can be felt making contact with the cam ring. Repeat several times by first turning the fixture opposite the direction of rotation, followed by turning in the direction of rotation to get a positive "feel" for when the rollers first make contact with the cam ring. With the beginning of injection located, finger tighten the knurled screw on the fixture against the housing to retain the fixture in position. Check the timing mark with optical gauge 21962.

2. To re-mark an incorrectly placed timing line, remove timing fixture from pump, cover drive shaft and pilot area of pump with a clean rag to prevent entrance of filings into bearing and seal area, and file off old mark. Re-install timing fixture to pump, and replace optical gauge with scribe. Repeat procedure in Paragraph 1 for finding beginning of injection. Lock gauge to pump and tap scribe with mallet to place new timing line on pump flange.
Drive Shaft Seal Replacement (Figures 5 and 6)

NOTE: Several new parts will be needed to perform this repair. Read entire instruction before proceeding.

In the event that a Chevrolet V-8 pump is received for drive shaft seal replacement only, it is not necessary to disassemble the entire pump. The Chevrolet DB2 pump utilizes a wire ring to retain the drive shaft. This makes partial disassembly of the pump necessary in order to perform drive shaft removal. The following procedure has been developed to aid in this repair:

Disassembly

1. Mount pump in fixture 23615, and clamp fixture in vise.
2. Remove and discard vacuum module drive pin.
3. Remove three (3) governor cover hold-down screws and governor cover. (Discard governor cover gasket.)
4. Observe position of metering valve spring over the top of the guide stud. This position must be exactly duplicated during reassembly. Remove guide stud and washer. 
   NOTE: Two types of guide stud and washer combinations are in use. The current combination is a guide stud with a ¼ inch internal hex and utilizes a steel washer with trapped elastomer. This type of washer may be re-used during reassembly. The other combination has a 7/16 inch external hex and an aluminum washer. This type of washer must be replaced during reassembly. The correct guide stud and washer combination must be used to prevent fuel leakage.
5. Remove min/max governor assembly.
6. Rotate throttle lever to low idle position and scribe the throttle boss adjacent to the face cam in location shown in Figure 6.
7. Remove face cam screw.
8. Remove throttle shaft assembly.
9. Remove and discard throttle shaft seals. Leave throttle shaft spacer washer on lever end of shaft.
10. Lift out face cam and throttle shaft seal washer. (The thin Mylar washer found between the face cam and housing.)
11. Remove linkage hook and governor arm assemblies. (CAUTION: Do not disturb linkage hook adjustment.)
12. Rotate drive shaft until one of the raised portions of the retaining ring (immediately below the ball pivot stud) is accessible. Using a long, thin hook-shaped tool, such as a dental tool, or bent wire, reach into the housing through the governor arm opening, hook the ring, and pull it slightly to the rear. Grasp the ring with needle nose pliers and pull it straight up and out of the housing. Discard the ring - it cannot be used again.
13. Remove the holding fixture with pump attached from the vise to a flat surface. With the pump resting at an angle, supported by the holding fixture and the discharge fittings, rotate the drive shaft until the dowel pin is at the 7 o'clock position. Pull the drive shaft out of the pump. Remove and discard drive shaft seals. CAUTION: Do not disturb the pump while the drive shaft is removed to prevent dislocation of governing components.
14. Inspect the bearing and pilot tube areas of the pump for evidence of debris. If none is present, proceed to "Reassembly". If any debris is present, the pump will have to be completely disassembled, cleaned, and the bearing may have to be replaced. See following section, "Drive Shaft Bearing Replacement".

Reassembly

1. Install new seals on drive shaft using tool 22727. Lubricate seals by applying a liberal coating of Syn-Kut based 1241 compound (our P/N 22204) to seals before assembling to shaft and shaft to pump.
2. Install a new wire ring to the drive shaft. Spread the ring by hand only enough to slip over the end of the shaft. Slide the ring down the shaft to its groove. Do not use the 22727 drive shaft seal installing tool for this purpose as it will expand the ring excessively. Check the ring for snug fit on the shaft by rotating it in its groove.
3. Lubricate drive shaft bearing by packing with contents of grease pack 23451. With the dowel pin at the 7 o'clock position, carefully insert the complete drive shaft assembly into the housing. The wire ring will compress and pass through the pilot tube, then resume its original size inside the pump.
4. Install governor arm and linkage hook assembly.
5. Install new throttle shaft seals using tool 18338. Lubricate seals and both sides of throttle shaft spacer washer with contents of grease pack 23451.
6. Hold face cam and new Mylar washer in place and install throttle shaft assembly.
7. Install face cam screw finger tight.
8. Insert .005 inch feeler gauge between throttle shaft washer and housing. Rotate throttle shaft to low idle position and face cam to previously scribed position. (Figure 7.) While squeezing throttle lever and face cam to pinch feeler gauge, tighten face cam screw to specified torque, and remove feeler gauge. Secure screw with Loctite 290 (our P/N 21915).

- Figure 7 -

9. Install min/max governor assembly.
10. Install guide stud and appropriate washer and tighten to specified torque value.
11. Install governor cover with new gasket. Tighten three (3) governor cover screws to specified torque.
12. Install new vacuum module drive pin.

**Drive Shaft Bearing Replacement**

The Chevrolet V-8 pump drive shaft bearing must be replaced, if during inspection, metallic particles are found in the needles, or, if the race on the drive shaft is damaged or scored. The bearing need not be replaced if it is contaminated with only drive shaft seal debris. In this case, the installed bearing can be washed out with solvent, dried, and then re-packed with the contents of grease pack 23451.
To replace a bearing, the pump must first be completely disassembled. With the empty housing mounted on holding fixture 23615, extract the old bearing from the housing with Snap-On puller No. A-78 or equivalent. To install a bearing, fabricate or order bearing installation tool 23805 (Figure 8). The tool may be used in either of two ways:

1. Place pilot tube mandrel 16314 over the small diameter of tool 23805. Place pump housing on arbor press with rear of housing supported on flat surface. Place new bearing, part number first, on tool 23805. (Bearing part number must face outward following installation.) Press bearing into housing until tool bottoms.

2. Place small diameter of tool 23805 in chuck of drill press. Place pump housing on drill press table with rear of housing supported on flat surface. Place new bearing on tool, and use drill press to push bearing into housing until tool bottoms.

Never drive bearing into housing with impact, always press in with proper tool. Following installation, check needles for proper alignment and freedom of movement within the bearing cup.

**Figure 8**

**Delivery Valve Extraction**

DB2 pump models for the Chevrolet 6.2 liter engines utilize a larger (.225 inch (5.7mm)) diameter delivery valve. The spring guide diameter on these valves is also larger, precluding the use of the 13383 delivery valve extractor. Nozzle valve extractor 20147 must be used instead. The 20147 tool is part of nozzle kit 16494, or may be purchased separately.

Service Department
SUPERSEDES: S.B. 438R10 dated 9/10/07

SUBJECT: DRIVE SHAFT AND DRIVE SEAL SERVICE PROCEDURES

PUMP MODELS AFFECTED: DB4, DS AND DE

Drive Arrangement - DB4

The DB4 drive shaft is retained by an internal thrust arrangement consisting of a stationary thrust bearing, a rotating thrust washer, a spring washer, and a retaining ring as shown in Figure 1. Drive shaft sealing is accomplished by two lip type seals which are pressed into the front of the pump housing below the needle bearing. The needle bearing is engine oil lubricated and supports the drive shaft. A weep hole in the pump housing prevents fuel leakage from entering the engine and provides a means for visual leak detection.

Drive Arrangement - DE & DS

The DE and DS pump models share similar drive designs. Drive shaft sealing is accomplished by two lip type seals pressed into the front of the pump housing, as shown in Figure 2. The transfer pump assembly is driven by the drive shaft and is also the point where axial thrust is controlled. The drive shaft is supported by two bearings: an engine oil lubricated external needle bearing and also by a fuel oil lubricated internal needle bearing located within the transfer pump assembly.
IMPORTANT! Only use the seals called for on the individual service specification. Improper seal usage can lead to premature seal failure.

Fuel Side Seals

Fuel side seals in DS pump models are a dual lip type (P/N 31375) with a black metal casing that incorporates a molded polymer sealing surface on the outer case wall (Figure 3a). Pump models DE and DB4 use a Teflon® lip type fuel seal (P/N 30804). This seal has a blue sealant bonded to the outer diameter of the metal case (Figure 3b). Both fuel seals share common service procedures.

Oil Side Seals

When the DE pump model was introduced, it contained a unique oil seal (P/N 35494) which was slightly larger at the outside diameter and had an orange case. This seal was replaced in 2004 by the oil side seal (P/N 36534) which is used in all DE, DS and DB4 pump models.

To prevent seal distortion during assembly, an installation sleeve (P/N 39197 or P/N 39989) is used in conjunction with the 33421 seal and bearing installation tool. Sleeve selection is determined by the pilot length on the pump housing (Figure 4). Refer to the Seal and Bearing Installation section of this Service Bulletin for additional information on service tools and assembly procedures.

Seal Spacers

Early DB4 and DS pumps were fitted with a white polymer spacer (P/N 30445) between the fuel seal and the oil seal to prevent seal movement within the housing. In the late 1990’s, the spacer was eliminated as seal retention properties were improved.

Needle Bearings

All DS, DE, and most DB4 pump models have a housing with a standard length mounting pilot (Figure 4) and use the same needle bearing assembly. Some
DB4 pump models use a housing with an extended length pilot and a longer needle bearing (P/N 40018). The service tools are the same for both needle bearings. However, the removal procedures differ as described herein.

Removing Drive Shaft, Seals and Needle Bearing

Drive shaft removal is required to service the seals and bearings in DB4, DE and DS pump models. Complete disassembly, inspection, and assembly procedures are provided in the applicable Operation and Instruction Manual: DB4 (P/N 99689), DS (P/N 99646), and DE (P/N 99807).

The bearing and seal puller (P/N 28311), as shown in Figure 5, is used to remove both drive shaft seals, the seal spacer (if applicable) and the needle bearing. For DE and DS pump models, as well as standard length pilot DB4 pump models removal of the seals and bearing can be performed simultaneously in one operation. Those DB4 pump models with extended pilot housings require the bearing and seals to be removed in separate operations as follows:

1. Back the outer nut out to the end of the jack screw. Back the inner nut out until the jaws can be retracted. Insert tool jaws into the drive bore of the pump housing (Figure 6a), through the center of the bearing and align/center the puller base on the pilot boss of the pump housing.

2. Holding the inner nut stationary, turn the jack screw to expand the jaws. Position the puller jaws so that they are in the gap between the oil seal and the needle bearing so that the lip is in contact with the bottom of the bearing cage (Figure 6b). Do not over tighten. Remove the needle bearing by holding the jack screw stationary and tightening the outer nut.

3. Disassemble the P/N 28311 bearing and seal puller (Figure 6c). Retract the jaws, as in Step 1. Insert jaw assembly into the drive bore. Align the puller base with the pilot. Push jack screw thru the center hole and install washer and outer nut.
4. Expand the puller jaws under the seals (Figure 6d). Hold the jack screw stationary, tighten the outer nut to remove both seals (Figure 6e).

**Figure 6**

![Diagram of Seal and Bearing Installation Tool](image)

**IMPORTANT! The seals and bearing are damaged during the removal process. Never reuse seals or bearings once removed from housing.**

**Seal and Bearing Installation Tool**

The Seal and Bearing Installation Tool (P/N 33421), shown in Figure 7, is used for all DB4, DS and DE pump models to ensure correct seal positioning. Oil seal installation sleeve (P/N 39197) is used for all DS, DE and standard length piloted DB4 pump models. For the extended length pilot DB4 pump models, there is separate extension adapter for the fuel seal (P/N 38366) and an extension sleeve for the oil seal (P/N 39989).

**Figure 7**

![Image of Seal and Bearing Installation Tool](image)

**Seal and Bearing Installation**

Both seals and the needle bearing are press fit into the pump housing. Place the pump housing on an arbor press with the housing flange facing upwards. **NOTE: Ensure the housing rests flat on the arbor plate and that the seal bore of the housing is clean and dry.**
**Fuel Side Seal**

1. Place the appropriate fuel seal onto the end of the 33421 installation tool or the 38366 extension, as required. The seal case faces the tool and the open side of the seal (lip/garter spring side) faces outward.

![Figure 8](image)

**NOTE:** When installing the fuel seal, ensure the 39197 oil seal installation sleeve is removed from the 33421 seal and bearing installation tool to avoid damage to the thin lip of the sleeve.

2. Position the tool and seal above the pump housing as shown in Figure 8. Guide the tool and seal into the housing bore and press the seal down until the tool flange bottoms against the pump housing.

**Oil Side Seal**

1. Select the proper oil seal installation sleeve and insert it onto the end of the 33421 seal and bearing installation tool. Place the open side of the seal (lip/garter spring side) over the lip of the installation sleeve so that the seal sits squarely.

2. Guide the seal and tool into the pump housing as shown in Figure 9 and press the seal in until the flange on the tool bottoms against the housing.

![Figure 9](image)

**Drive Shaft Needle Bearing**

1. Remove the oil seal sleeve (P/N 39197 or 39989) from the end of the 33421 seal and bearing installation tool. Slide the bearing onto the tool in place of the sleeve with the bearing part number facing toward the tool shoulder. Guide the bearing into the housing as shown in Figure 10 and press it in until the flange on the tool bottoms against the housing.
IMPORTANT: When installed correctly, the drive shaft needle bearing will protrude approximately .045 inches (1.14 mm) from the end of the housing - this is a normal condition.

NOTE: Some DB4 pump models used on VM Motori pump applications are not equipped with a drive bearing. Reference Service Bulletin 478 for specific service and bench testing information regarding these pump models.

**Drive Shaft and Thrust Component Assembly**

There is a specific drive shaft seal protection tube used for each pump type. Figure 11 shows a typical DB4 drive shaft installation. As an assembly aid, moisten both drive shaft and seal protection tube with calibrating fluid prior to installation. Refer the respective *Operation and Instruction Manual: DB4 (P/N 99689), DS (P/N 99646), and DE (P/N 99807)* for applicable instructions and specific tooling required during drive component assembly.

IMPORTANT: Do not tilt the housing rearward (head bore down) without the head and rotor assembly installed and secured. The drive shaft and thrust components could fall out of the housing through the head bore.

**Re-use of Drive Shafts**

During normal pump operation, seal lip contact creates witness marks on the drive shaft (Figure 12). Re-using a drive shaft with new seals is an acceptable
service practice if the shaft exhibits normal wear patterns as shown in Example 1 of Figure 12. Uneven ridges and/or deep wear grooves, as shown Example 2 of Figure 12, would be a reason for drive shaft replacement.

![Figure 12](Image)

**Warranty**

If a DB4, DS, or DE pump is received for service with a customer complaint of weep hole leakage (fuel or engine oil), and it is within the Stanadyne warranty period, the pump does not have to be tested to verify the complaint (Operation Code 01A). A warranty claim may be submitted for the labor operations outlined below. **NOTE: Reference Section 4.7 of the Stanadyne Service Policies and Procedures for time allowances. The Stanadyne on-line warranty program will automatically calculate time allowances.**

**Labor Operations for DB4, DE, or DS Drive Shaft Seal Replacement**

(When customer complaint is weep hole leakage)

<table>
<thead>
<tr>
<th>Labor Operation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>06</td>
<td>Replace drive shaft seals</td>
</tr>
<tr>
<td>51, 51A, or 51B (Dependent on Model Type)</td>
<td>Install pump on test bench, calibrate and leak test.</td>
</tr>
<tr>
<td>00</td>
<td>Administrative time</td>
</tr>
</tbody>
</table>

**Technical Support Group**

Product Support Department

**Revisions**

<table>
<thead>
<tr>
<th>Revisions</th>
<th>Date</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>4/10</td>
<td>Introduced oil seal installation extension sleeve P/N 39989. Removed Loctite procedure and oil seal change history</td>
</tr>
</tbody>
</table>
Stanadyne announces a significant design change for the DB2, DM, and DB4 transfer pump components. Since S.B. 314 was published there have been several product improvements introduced for these components. In 1983, the metal filter screen was replaced by a conical, nylon filter screen which eliminated the need for the screen retaining ring and filter screen seal. The shape of this nylon filter was changed in 1987 to a cylindrical configuration. The two previous design arrangements and the newly released design are compared in Figure 1.

---

**FIGURE 1**

Diesel Systems Division, Stanadyne Automotive Corp.
92 Deerfield Road, Windsor, CT 06095, USA  Tel: (860) 525-0821; Telex: 99218; Telecopy: (860) 525-4215
The new design is the result of on-going product development and includes the following changes:

- Elimination of the transfer pump pressure plate, P/N 20523.
- Elimination of seal groove from outside diameter of transfer pump regulator assembly sleeve.
- New inlet filter screen designed to fit uniform diameter regulating sleeve.
- Chamfer added to back of transfer pump regulator assembly porting plates.
- Transfer pump end caps are redesigned inside to mate with chamfered regulator porting plate.

Transfer Pump End Cap Application Information

There are four different transfer pump end cap part numbers (due to various inlet configurations) involved in this change. The following chart lists transfer pump end cap part numbers, configurations and applications.

**Chart I**

End Cap Application Information

<table>
<thead>
<tr>
<th>End Cap P/N's</th>
<th>Inlet Configuration</th>
<th>Application Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous</td>
<td>New</td>
<td></td>
</tr>
<tr>
<td>20525</td>
<td>28980</td>
<td>1/2&quot;-20</td>
</tr>
<tr>
<td>21296</td>
<td>28981</td>
<td>7/16&quot;-24 w/inverted flare</td>
</tr>
<tr>
<td>26122</td>
<td>28982*</td>
<td>Side Inlet Hose Connector</td>
</tr>
<tr>
<td>26562</td>
<td>28983</td>
<td>12mm x 1.5</td>
</tr>
</tbody>
</table>

*This side inlet End Cap is part of assembly P/N 26127 which includes:
1 - 27607 Hex Plug Seal
1 - 26239 Hex Plug
1 - 28982 Transfer Pump End Cap
1 - 26124 Hose Connector Assembly
1 - 26125 Retaining Clip
2 - 26126 O-Ring Seal

NOTE: See service instructions for this type of End Cap Assy. on page 4.

Transfer Pump Component Replacement Information

Whenever a DB2, DB4 or DM model pump equipped with the previously used transfer pump components is received for service and the transfer pump end cap and/or regulator assembly require replacement, it will be necessary to substitute parts according to the following charts. **NOTE: When a new style end cap and regulator assembly are used to replace a previous version, the pressure plate (P/N 20523) will no longer be required and may be discarded.**
Chart II
Regulator Assembly/End Cap Replacement

<table>
<thead>
<tr>
<th>Old T.P.</th>
<th>New T.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulator P/N's</td>
<td>Regulator P/N's</td>
</tr>
<tr>
<td>19912</td>
<td>28987</td>
</tr>
<tr>
<td>21200</td>
<td>28988</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Used With</th>
<th>Used With</th>
</tr>
</thead>
<tbody>
<tr>
<td>T.P. End Caps</td>
<td>T.P. End Caps</td>
</tr>
<tr>
<td>20525</td>
<td>28980</td>
</tr>
<tr>
<td>21296</td>
<td>28981</td>
</tr>
<tr>
<td>26122</td>
<td>28982</td>
</tr>
<tr>
<td>26562</td>
<td>28983</td>
</tr>
</tbody>
</table>

Chart III
Inlet Filter Screen Replacement

<table>
<thead>
<tr>
<th>Present Filter</th>
<th>If Filter Change Only</th>
<th>If End Cap &amp; Reg. Assy. Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>P/N</td>
<td>Style</td>
<td></td>
</tr>
<tr>
<td>20527</td>
<td>metal</td>
<td>26617</td>
</tr>
<tr>
<td>23819</td>
<td>conical nylon (black)</td>
<td>&quot;</td>
</tr>
<tr>
<td>26617</td>
<td>cylindrical nylon (black)</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

Installation of New Transfer Pump Components
1. Install the 27608 transfer pump seal in the head counterbore.
2. After the transfer pump liner, blades, springs, retainers and locating ring are installed, place the inlet filter on the transfer pump regulator assembly.
3. Install the transfer pump regulator assembly with rollpin located in the rollpin hole in the head.
4. Coat the beveled surface on the inside of the transfer pump end cap (at contact point shown in Figure 3) and the end cap threads with Lubriplate #630AA grease or equivalent.

FIGURE 3
5. Assemble the end cap to the head. Apply light pressure to top of end cap and rotate counter-clockwise until a slight “click” is heard. Then turn the cap clockwise until hand tight.

6. Tighten the end cap to 360-440 lbf.-inches (40.7-49.7 N•m) using a P/N 20548 end cap socket wrench.

7. Install end cap locking plate, seal and screw (Ref. S.B. 408R1).

Assembly Instructions for Side Inlet End Cap Assemblies (End Caps 26122 & 28982)

After completing steps 1-7 above, assemble side inlet cap components as follows:

1. Position seals, 26126, into hose connector assembly and lubricate lightly with Syn-Kut lubricant, P/N 22204. Install hose connector assembly to end cap.

2. Seat retaining clip into groove in end cap.

3. Place hex plug seal, 27607, on hex plug (Refer to Figure 4). Screw hex plug into end cap and tighten to 75-100 lbf.-inches (8.5-11.3 N•m) using a 3/16 inch hex bit.
SERVICE BULLETIN

DATE: March 31, 1997

SUBJECT: PRESSURE COMPENSATING TRANSFER PUMP

A new type of transfer pump has been released for Stanadyne DB2 and DB4 "Target" Series pumps. The new transfer pump is designed to maintain its pressure curve despite variations in either inlet pressure or housing pressure. Stable, repeatable transfer pump pressure is necessary for the proper operation of Target Series features such as the low speed fuel limiter and the servo speed light load advance.

Principles of Operation
With a standard transfer pump, changes in inlet pressure result in changes in transfer pressure. This is due to the fact that leakage through the viscosity compensation orifice in the adjusting screw is directed into the inlet pressure area (Ref. Figure 1). As a result, variations in inlet pressure have a direct biasing affect on the regulating piston and cause transfer pressure to vary in direct proportion to increases or decreases in inlet pressure.

![Figure 1: Standard Transfer Pump]

With the pressure compensating transfer pump, the viscosity compensation orifice has been moved from the pressure adjusting screw to a passage in the regulator assembly (Ref. Figure 2). Now, fuel that flows through the viscosity...
compensation orifice is directed into the pump housing instead with the result that changes in inlet pressure have a minimal effect on transfer pump pressure.

![Pressure Compensating Transfer Pump Diagram](image)

**Figure 2**
Pressure Compensating Transfer Pump

With the pressure compensating transfer pump, changes in housing pressure act on the back of the regulating piston causing transfer pressure to vary directly with housing pressure. The result is that the net effective pressure acting on the pumping plungers does not vary with changes in housing pressure. *NOTE: On applications using pressure compensating transfer pumps, an engine fuel return line restriction (e.g. a pinched or plugged fuel return line) can result in excessive transfer pump pressure and possible pump damage such as a transfer pump end head and rotor seizure.*

**Other Features**
With standard transfer pumps, a "Z" slot in the face of the regulator allows pressurized fuel to flow to the regulating piston. The pressure compensating transfer pump does not use a "Z" slot in the regulator. Instead pressurized fuel flow through a series of holes in one of the rotor retainers and into the undercut area of the rotor just behind the blade slots. From here it can flow through the openings beneath the blades to reach the regulating piston bore as well as to the various passages in the hydraulic head.

In addition, a small notch has been added to the chamfered portion of the regulator assembly (as shown in Figure 3). This notch allows a small amount of the fuel from the viscosity compensation orifice to flow back to the inlet area thereby maintaining the normal amount of return oil flow.
Components
Figure 3 shows an exploded view of the pressure compensating transfer pump components. Differences between the standard and the pressure compensating transfer pump include new end caps, transfer pump regulator assemblies, rotor retainers, a different style liner locating ring and a solid pressure adjusting screw. The new transfer pump also requires new Head and Rotor assemblies with the necessary fuel flow passages.

Several variations of components exist as shown in the following charts to satisfy specific applications requirements.

Transfer Pump Regulator Assemblies
Two different regulator assemblies are used for pressure compensating transfer pumps as follows.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>32548</td>
<td>0.016 inch wide regulating slot (Slot “A”, Fig. 1) plus pressure relief slot (Slot “B”, Fig. 1)</td>
</tr>
<tr>
<td>33040</td>
<td>0.029 inch wide regulating slot (Slot “A”, Fig. 1), no pressure relief slot (Slot “B”, Fig. 1)</td>
</tr>
</tbody>
</table>
Transfer Pump End Caps

End caps for the pressure compensating transfer pump have a larger inside diameter (I.D.) in the area that fits over the liner locating ring to allow a flow path for fuel from the viscosity compensation passage in the regulator to flow to the passage in the hydraulic head leading to the vent wire bore.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Inlet Configuration</th>
<th>Supersedes Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>32636</td>
<td>12mm x 1.5 threads, plus o-ring seal chamfer for inlet fitting (Ref. Fig. 3)</td>
<td></td>
</tr>
<tr>
<td>33128</td>
<td>12mm x 1.5 threads, no o-ring chamfer for inlet fitting (Ref. Fig. 3)</td>
<td>28983</td>
</tr>
<tr>
<td>28980</td>
<td>1/2&quot; x 20 threads</td>
<td>*</td>
</tr>
<tr>
<td>28981</td>
<td>7/16&quot; x 24 threads</td>
<td>*</td>
</tr>
<tr>
<td>28982</td>
<td>7/16&quot; x 20 threads</td>
<td>*</td>
</tr>
</tbody>
</table>

![Diagram of Old and New Style Cap I.D.](image)

*NOTE: For standardization purposes, the inside diameter that fits over the liner locating ring on end caps 28980, 28981 and 28892 was increased from 1.560" (39.62mm) to 1.594" (40.48mm) without a change in part number.

CAUTION: Do not install an original style 28980, 28981, or 28982 end cap with a 1.560" inside diameter on a pump with a pressure compensating transfer pump. The lack of flow area can cause excessively high transfer pressure and possible pump damage. Always use an end cap with a 1.594 inch I.D. on models with pressure compensating transfer pumps.
Disassembly and Reassembly Procedures
Disassembly and reassembly of the pressure compensating transfer pump is the same as with the standard transfer pump with the following two exceptions.

1. The liner locating ring is a continuous band design which is removed and installed differently than the split design used with standard transfer pumps.

2. The pressure compensating transfer pump utilizes two types of rotor retainers. One is solid and one has a series of holes in it to allow fuel to flow into the pump. The one with the holes must be oriented properly to allow fuel flow. For a clockwise rotation pump the retainer with the holes is positioned at the bottom of the pump as shown in Figure 3. Similarly, the transfer pump regulator assembly has a set of holes to allow fuel flow into the transfer pump. These holes must be oriented opposite the holes in the rotor retainer. In the case of a clockwise rotating pump the holes would be at the top of the pump.

Liner Locating Ring Removal
Removal of the liner locating ring is accomplished by prying the ring off the rotor retainers using two small hex wrenches (1/8 inch or smaller) as shown in Figure 5. Two holes in the ring are provided to insert the wrenches into. NOTE: It is suggested that a new liner locating ring be used during reassembly but a used liner locating ring can be re-used as long as it is still a snug press fit on the rotor retainers.

![Figure 5]

Liner Locating Ring Orientation
Before installing a new liner locating ring it must be properly oriented with respect to the rotor retainers. See Figure 6 for proper orientation. First note that the stamped indentations are closer to one side of the ring than the other. Orient the ring so that the indentations are facing up (towards the
transfer pump end). Next orient the ring so that the holes are approximately 90 degrees from the joint where the two rotor retainers meet.

**Liner Locating Ring Installation**

![Diagram](0)

**Figure 6**

Using service tool 18330 and an arbor press as shown in Figure 7, press the liner locating ring until the tool bottoms on the face of the rotor retainers. Clean off any debris generated from pressing the ring on before proceeding with the assembly of the transfer pump.

![Diagram](0)

**Figure 7**

Technical Support Group
Product Support Department
SUBJECT: FIELD CONVERSIONS OF D SERIES PUMPS FOR OPERATION WITH EXTERNAL ELECTRONIC GOVERNORS

As you may know, Stanadyne's fuel injection pumps equipped with speed droop governors offer governor regulation of 3-5%, which is more than adequate for most close governor applications. There is, however, a small but increasing number of applications which require isochronous (zero droop) governing. Isochronous or precise governing can be attained by connecting one of several commercially available brands of external electronic governors by linkage to the shut-off lever of a Stanadyne "D" series pump equipped with either an all speed or speed droop governor.

NOTE: Never attempt to connect an external electronic governor to the throttle lever of a Stanadyne injection pump. Poor performance and/or rapid wear of pump governor components could result.

The following information has been compiled for our service network to allow for the necessary modifications required to adapt our pumps for external governor operation.

Service Kits

Two service kits are available to help facilitate these field conversions. Kit 29375, shown in Figure 1, contains the necessary components for pumps which were not equipped with a shut-off shaft assembly as part of the original equipment. Kit 29338, shown in Figure 2, contains the necessary components for pumps equipped a shut-off shaft assembly as original equipment. Refer to the individual pump specification to determine which part changes are required, and which kit, if any, is appropriate to implement this conversion. Some applications may only require a roller-type shut-off cam to complete the conversion and in such cases a service kit would not be required.

<table>
<thead>
<tr>
<th>CONTENTS OF KIT P/N 29338</th>
</tr>
</thead>
<tbody>
<tr>
<td>P/N</td>
</tr>
<tr>
<td>11582</td>
</tr>
<tr>
<td>12049</td>
</tr>
<tr>
<td>12051</td>
</tr>
<tr>
<td>12167</td>
</tr>
<tr>
<td>12173</td>
</tr>
<tr>
<td>12237</td>
</tr>
<tr>
<td>12992</td>
</tr>
<tr>
<td>12998</td>
</tr>
<tr>
<td>14408</td>
</tr>
<tr>
<td>14966</td>
</tr>
<tr>
<td>17438</td>
</tr>
<tr>
<td>27244</td>
</tr>
</tbody>
</table>

* Not Shown
Modification Procedure

Long steel throttle bushings, P/N 17776, are required for pumps operating with external governors. If you should receive a pump with the request to modify for external governor operation which does not have long throttle bushings, reference Service Bulletins 357 and 173 for removal and installation instructions.

As an added safety measure, Stanadyne recommends that our pumps be equipped with an electric shutoff solenoid (ESO) when operating with an external electronic governor. If a pump is received for this field conversion which is not equipped with an ESO, it may be upgraded to include one (reference S.B. 108R9).
The following assembly instructions contain the necessary information to convert most D series pumps with speed droop or all speed governors. However, there are some applications which may require special hardware, such as a shut-off lever with a unique bend (reference Figure 3) to avoid interference with the engine. These special cases will have to be handled on an individual basis. Not all of the listed steps are required for each modification. (Refer to the Injection Pump Operation and Instruction Manuals for additional disassembly and reassembly instructions.)

1. Remove the governor control cover and discard cover gasket.

2. Remove shut-off cam or retainer clip utilizing service tool no. 20992. (A pair of pliers may be used to grip the shut-off shaft to prevent rotation while removing the shut-off cam or retaining clip.) Remove the shut-off shaft.

   NOTE: Steps 3 (a), 3 (b) and 3 (c) are for pumps with throttle shaft assemblies located on the right-hand side of the pump, as viewed from the transfer pump end, in order to reposition the throttle lever from the right to the left side of the pump.

3. (a) Remove the throttle shaft assembly and throttle shaft lever.

   NOTE: You may occasionally receive a pump equipped with a throttle shaft assembly which cannot be repositioned from the right to the left side of the pump due to the geometry of its key slot(s). Throttle shaft assemblies which have two key slots that are symmetrical to its centerline, as shown in Figure 4, can be repositioned. If the throttle shaft assembly has only one key slot or the two key slots are not symmetrical to its centerline, replace with a 12019 throttle shaft assembly.
3. (b) Install a new 14408 Mylar washer and 17438 throttle shaft seal. Reverse positions of the high and low idle adjusting screws in the lever.

3. (c) Reinstall the throttle shaft assembly partially through its bore on the left side of the pump housing (viewed from the transfer pump end). Slide the throttle shaft lever onto the throttle shaft assembly by engaging the key in the throttle lever bore with the throttle shaft key slot which is closest to the transfer pump end of the pump. Complete the throttle shaft assembly installation with a slight rotary motion to prevent seal damage. The forked end of the throttle shaft lever must straddle the guide stud on pumps equipped with all speed governors and straddle the flats on the control rod guide bushing on pumps equipped with speed droop governors (ref. S.B. 97R2).

4. Install a 12237 shut-off shaft assembly with a new 17438 shut-off shaft seal and a 14408 Mylar washer. Check linkage gap and readjust if necessary before installing a new shut-off roller cam assembly.

5. Install a 14966 roller-type shut-off cam assembly with the straight inner edge engaging the slot in the shut-off shaft assembly. The roller cam will snap into position when installed correctly.

6. Install the 12167 shut-off shaft assembly adjusting screws and the 12173 adjusting screw locking nuts onto the shut-off shaft assembly.

7. Align the center holes of the adjustable shut-off lever and shut-off shaft assembly as shown in figure 1. Secure in position with a 12998 lever retaining screw and 11582 washer. Position the lever in the L1-L position unless otherwise indicated (ref. S.B. 164) with a 12051 lever positioning screw and a 12049 washer. Tighten the lever positioning screw to 25 - 30 lbf-in (2.8 - 3.4 N•m) and the lever retaining screw to 35 - 40 lbf-in (4.0 - 4.5 N•m).

8. Rotate the shut-off lever toward the transfer pump end and adjust the transfer pump end adjusting screw until the long leg of the roller cam is in a vertical position (there should be no contact between the linkage hook and roller cam). Rotate the lever toward the flange end and adjust the flange end adjusting screw until the long cam leg is at an angle of approximately 60 degrees from vertical. Tighten the adjusting locknuts to 35 - 40 lbf-in (4.0 - 4.5 N•m).

9. Reinstall governor control cover with a new 27244 control cover gasket. Tighten the three governor control cover screws to 35 - 45 lbf-in (4.0 - 5.1 N•m).

**Calibration Procedure**

1. Recalibrate to original pump specification.

2. Following normal pump calibration, adjust the high idle screw to obtain the specified high idle fuel delivery at 10% above the rated ERPM (adjust speed droop to minimum droop position on pumps equipped with speed droop governors). [Example: 1800 x .10 = 180 + 1800 = 1980 ERPM] This ensures that the pump's mechanical governor will not interfere with the electronic governor.
3. Check for a maximum of 4mm /stroke @ 400 ERPM and rated ERPM with the shut-off shaft assembly in the full off position. Adjust if necessary (reference step number 8 of the modification procedure).

4. Seal the shut-off shaft adjusting screws together with a 10408 sealing wire as outlined in Service Bulletin 134 following pump calibration.

**Identification**

Identify each modified pump by stamping “S.B. 462” on the nameplate below the pump model number.

**Warranty**

These conversions are to be made at the request and expense of the customer only. Stanadyne will not accept warranty claims for these modifications.

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Technical Support Group  
Product Support Department
LIMITED DISTRIBUTION — GENERAL MOTORS

SUBJECT: 1992 MODEL YEAR GM 6.2 AND 6.5 LITER DIESEL UPDATE

This bulletin outlines the new features for the DB2 pumps on 1992 GM 6.2L and 6.5L engines. Also included herein is the introduction and service instructions for the model 100 series Fuel Manager which is the fuel filtration system for all GM 6.5L diesel engines.

DB2 Pumps (6.2L and 6.5L)
The 1992 model year marks the eleventh straight year that Stanadyne has supplied DB2 pumps for the GM 6.2L diesel engine. This is also the introductory year for the GM 6.5L turbodiesel engine for which Stanadyne is proud to be the sole supplier of the fuel injection pump plus a new fuel filter system. There are nine new automotive pump models, five for the 6.2L engine and four for the 6.5L turbocharged engine, and two new 6.2L marine applications (reference P.B. 119 for applications information).

Time Trac Sensor
A new feature for all DB2 pumps on 1992 GM applications is the Time Trac Sensor. The purpose of this sensor is to provide the OEM with a more consistent method of pump-to-engine timing at their assembly plant.

The Time Trac Sensor is considered to be an “engine component” and should remain with the engine when the pump is removed for service. However, you may on occasion receive a pump for service with the Time Trac Sensor attached. If this occurs, simply remove the sensor and perform pump repairs and calibration as you normally would. Following pump service, reinstall the sensor onto the number one discharge fitting (reference Figure 1) and tighten with a 16mm crowfoot wrench to 240-290 lbf.-inch (27-33 N•m).
DB2 pumps for the 1992 6.2L applications are identical to the 1991 models except for the addition of the Time Trac Sensor. For this reason, the 1992 6.2L models have been superseded to the appropriate 1991 models for service. Supersessions are as follows:

<table>
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<th>1992 Model</th>
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<tr>
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</table>

**NOTE:** Whenever a 1992 6.2L pump is being replaced, and the Time Trac Sensor is returned with pump, the sensor must be removed from the pump and then installed on the replacement pump model. If a new Time Trac Sensor is required, it may be purchased separately under Part No. 26605.

**Min-Max Gap (6.2L Light Duty Applications)**

1992 light duty GM 6.2L applications utilize an internal idle spring on the min-max governor (ref. SB 360A). The gap between the min-max sleeve and the push rod on 1992 LD 6.2L applications has been changed from .026"-.034" to .030"-.034" (this gap change also pertains to 1991 LD models). Maintaining a gap of .030"-.034" has been shown to have a favorable effect on advance idle timing due to additional face cam lift which reduces white smoke during cold start-ups. **Note:** The min-max gap setting for 6.2L LD pump models may change due to the result of ongoing studies pertaining to the affect of this gap on pump performance. Always reference any pertinent service literature along with the latest edition of the pump model specification for up-to-date calibration information.

The min-max gap is measured with a four ounce weight (service tool 27980) placed onto the min-max sleeve as shown in Figure 2. A variety of idle spring guides are available to allow for increasing and decreasing of the gap when necessary. Refer to the pump specification for the idle spring guide part numbers.
6.5 Liter Applications

Stanadyne has introduced four new DB2 pumps for the 1992 GM 6.5L turbodiesel applications. There are two heavy duty pump models (standard and low viscosity fuel components [LVFC]) and two Super Duty pump models (standard and LVFC components). The heavy duty models are utilized in CK and P truck applications while the Super Duty models are designated for applications rated for 15,000 pound gross vehicle weight.

Although the exterior appearance of the 6.5L and 6.2L pumps are identical, there are several differences in their head and rotor assemblies. Changes to the 6.5L head and rotor assembly were necessary to accommodate a 36% increase in full load fuel delivery at rated speed. These changes include the addition of charging accumulators in the hydraulic head assembly plus the following changes to the rotor (ref. Figure 3):

- Plunger diameter increased from .290" to .310"
- Charging port angle changed from 30° to 60°
- Discharge port diameter increased by 25%
Fuel Manager (6.5L Engines Only)
Stanadyne is also pleased to be the supplier of the fuel filtration system for the 6.5L diesel engine. A top loading version of the Model 100 Series Fuel Manager (Ref. Figure 4) will be standard equipment for all 6.5L applications. This fuel manager incorporates three major components which provide several different functions. The components and their functions are as follows:

- **Element Assembly** — a two-stage element which acts as a fuel filter and a water separator.
- **Water Sensor Assembly** — a sensor which detects water in the fuel and warns the operator by activating the “WATER IN FUEL” light on the instrument panel.
- **Heater Assembly** — fuel heater which activates in cold weather to help prevent fuel waxing.

![FUEL MANAGER Diagram]

*Figure 4*
All components of the 29367 Fuel Manager are serviceable except for the header assembly (Ref. Figure 5 for part numbers and exploded view). If the header assembly requires replacement, the entire fuel manager must be replaced. Servicing instructions are as follows:

**ELEMENT REPLACEMENT**

1. Loosen fuel filler cap to release any pressure or vacuum in the fuel tank.

2. Remove element retaining nut by turning by hand in the counterclockwise direction. (If unable to turn, a strap wrench [oil filter type] may be used to “break loose” the element nut.)

3. Remove element by lifting straight up and out of the header assembly. **NOTE:** It is not necessary to drain fuel from the header assembly to change the filter element since the fuel will remain in the header assembly’s cavity.

4. Make sure the mating surface between the element assembly and the header assembly is clean before installation. Install the new element assembly by aligning the widest key slot located under the element assembly cap with the widest key in the header assembly. Push the element in a downwards direction until the mating surfaces make contact.

5. Install the element retaining nut and tighten to 115-120 lbf.-inches (13.0-13.6 N•m).

6. Bleed air from Fuel Manager as follows:
   - Connect hose to air bleed valve (located at the top of the element assembly) and place opposite end of hose into a suitable container.
   - Open air bleed valve 1/2 turn.
   - Disconnect fuel injection pump electric shutoff solenoid wire.
   - Crank engine in 10 to 15 second increments until clear fuel is observed at the air bleed hose (wait one minute between cranking intervals).
   - Close air bleed valve and tighten to 12-14 lbf.-inches (1.4-1.6 N•m).

7. Connect electric shutoff solenoid wire and reinstall fuel filler cap.

8. Start engine and allow to run for five minutes at idle. Check for fuel filter leaks.

**WATER SENSOR ASSEMBLY (On Vehicle Diagnosis)**

When the “Water In Fuel” indicator light comes on, the Fuel Manager should be purged of water as soon as possible as follows:

1. Shut engine off. Place suitable container under the water drain hose and open the remote drain valve (located near the top radiator hose at the front of the engine).
WATER SENSOR ASSEMBLY (Continued)

2. Start engine and run at idle until clear fuel is observed. “Water In Fuel” indicator light should go off. Close the water drain valve. If the “Water In Fuel” indicator light remains lit after this procedure, it will be necessary to remove the water sensor from the unit and dry off the tip as follows.

- Remove the 24322 water sensor assembly screws (Ref. Figure 5). Remove assembly and discard the 27602 seal.

- Wipe the water sensor tip clean. Reinstall the water sensor assembly (with a new 27602 seal) and tighten the 24322 screws to 15-20 lbf-inches (1.7-2.3 N·m). If the “Water In Fuel” indicator lamp remains lit, replace the water sensor assembly.

HEATER ASSEMBLY

In order to remove and diagnose the fuel heater assembly the entire Fuel Manager must be removed from the vehicle. (Reference the GM 6.5L Engine Service Manual for removal and installation instructions.)

Off Vehicle Diagnosis (room temperature 70 °F approx.)

1. Remove heater assembly from the header assembly by turning its cap nut (Ref. Figure 5) counterclockwise while lifting outwardly on the heater assembly.

2. Place the heater assembly into a freezer or an environmental control chamber to reduce the temperature of the assembly below 58 °F. (This is necessary since the thermal switch will not turn on until the temperature drops below 58 °F.)

3. (With temperature of assembly below 58 °F.) Wet the heater element with diesel fuel or calibrating fluid. Connect a variable power supply to the element’s leads (pink wire is positive, black is negative). Holding the assembly by its lead wires, switch the power supply on and adjust to 12 V D.C. Observe the heater element; it should begin to give off vapor from the heater fuel. This will indicate that the heater switch has closed and the element is heating. Switch off voltage source. CAUTION: Do not touch the element, it becomes extremely hot within seconds. Also, do not allow the heater to remain on longer than 30 seconds, or damage to the heater element may occur.

4. If heater element does not heat, replace element.

5. Install a new 28869 cap seal (Ref. Figure 5) on the heater assembly's sealing surface of the header assembly. (Make sure sealing surface is clean.)

6. Install heater assembly and tighten the cap nut to 75-80 lbf-inch (8.5-9 N·m).
EXPLoded View of the 29367 Fuel Manager

28694 Element Retaining Nut

29215 Element Assembly

27602 Water Sensor Seal

29257 Water Sensor Assembly

24322 Water Sensor Assembly Screw

28869 Heater Assembly Seal

29241 Heater Assembly

Figure 5

Technical Support Group
Product Support Department
SUBJECT: WOODWARD DYNA 70025 INTEGRATED ACTUATOR FOR STANADYNE FUEL INJECTION PUMPS

PUBLICATIONS REFERENCES: SERVICE BULLETINS 462, 509R2

The Woodward DYNA 70025 electronic governing system has been used in conjunction with Stanadyne “D” Series mechanically governed injection pumps for both production and the aftermarket since the mid-1990’s. This governing system (Reference Figure 1) is easily adapted to mechanically governed “D” Series pumps where closer governor regulation than what the mechanical governor can provide is desired.

The electronic governing system consists of a rotary actuator, which replaces the standard governor cover, plus engine mounted electronic controls. The Woodward Governor Company manufactures several variants of the DYNA 70025 pump mounted electronic actuator. However, only three are available from Stanadyne - two 12 volt actuators (internally sealed actuator shaft and non-sealed shaft versions) and one 24 volt actuator (sealed actuator shaft) version, as shown in the table in the following page.
<table>
<thead>
<tr>
<th>Stanadyne Part Number</th>
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<th>Actuator Voltage</th>
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<td>Sealed</td>
<td>Cummins</td>
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**NOTE:** The DYNA 70025 electronic governing system was originally manufactured by the Barber Colman Governor Company. Part numbers for both manufacturers are represented in the table above.

The engine controls and other actuators available from Woodward are not available from Stanadyne. Additional information on these components is available through the Woodward Governor Company, at the following address:

Woodward Governor Company  
6250 West Howard Street  
Niles, IL 60714-3433  
Phone: 1(847)967-7730  
www.woodward.com

**Governor Operation**

The actuator consists of an electric coil and a lever arm which contacts the pumps governor linkage to control engine speed. As engine speed varies with load, the electronic control unit varies the current to the pump mounted actuator which in turn repositions the linkage and metering valve.

**Testing Pumps With the DYNA 70025 Actuator**

Pumps received for service that have a DYNA 70025 Actuator installed, should be serviced as follows.

1. Compare the part number on the actuator manufacturers label to the table above to determine whether the actuator is a 12 or 24 volt model.
2. With the pump mounted on the test bench, connect the leads from your voltage supply (12 or 24 volts DC as applicable) to the two center terminal screws on the terminal strip of the actuator (Ref. Fig. 3).
3. With the pump operating and fuel flowing out the return, turn the voltage supply on. This will rotate the actuator out of contact with the linkage hook thereby allowing full wide open throttle (WOT) fuel delivery.

4. Check the pump performance per the individual specification. In order to perform the fuel delivery shutoff checks, de-energize the actuator.

**NOTE:** It will be necessary to reset the high idle settings to specification prior to checking pump performance. In addition, the low idle setting procedure stated on the individual service specification must also be carefully followed to prevent possible mechanical interference between the throttle lever fork and the actuator yoke when the throttle is in the low idle position.

![Diagram of actuator yoke and governor linkage](image)

**Figure 3**

Care must be taken when reinstalling the Barber-Colman actuator to the pump. With the mounting screws removed from the cover assembly, position and align the actuator above and to the front of the pump and align the actuator yoke with the linkage in the pump. Lower the actuator onto the pump at an angle as shown in Figure 3. With the linkage properly engaged, a slight amount of pressure will be required to align the cover holes. Reinstall the cover screws and tighten to 35-45 lbf. inches (4.0 - 5.1 N-m).

**IMPORTANT:** Once the pump is installed on the engine, it will be necessary to reset the mechanical governor cutoff speed to a level that is 12% higher than the desired operating speed controlled by the Barber-Colman actuator. This prevents the mechanical governor from interfering with the electronic governor during operation as well as providing overspeed protection.
Warranty
Stanadyne’s limited warranty applies to pumps with Woodward/Barber Colman actuators as follows:

1. All models listed below that were originally equipped with DYNC 70025 actuators - both the pump and actuator are covered by our standard terms as outlined in the Service Policies and Procedures Manual (99666) for the specific application.

2. Pump models not listed below that have had a DYNC 70025 actuator added in the field - the pump itself is covered by our standard warranty terms as outlined in the Service Policies and Procedures Manual but the DYNC 70025 actuator does not qualify for the Stanadyne warranty coverage.

3. Service Parts Warranty - All DYNC 70025 actuators sold by Stanadyne qualify for our Standard Service Parts warranty coverage of 12 months or 500 hours, whichever occurs first.

Pump Models Originally Equipped With a DYNC 70025 Actuator

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<tr>
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<td>Corrected improperly listed part numbers.</td>
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<td>4</td>
<td>10/06</td>
<td>Changed part numbers, pump model reference, and warranty information. Changed manufacturer information.</td>
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The ST-125 electronic governing system has been used in conjunction with Stanadyne “D” series pumps for a number of years in both production and the aftermarket. Recently, the Woodward Governor Company decided to discontinue the manufacture of the ST-125 electronic governor actuator. As a result, Stanadyne has introduced two conversion kits that contain Woodward DYNA 70025 type actuators for servicing pumps that require replacement of the originally fitted ST-125 actuator. 

**IMPORTANT:** Stanadyne actuator conversion kits include the parts for fuel injection pump governor conversion only. Additional engine control changes are required which are not available from Stanadyne, but must be obtained through Perkins or Woodward.

This bulletin outlines the procedures for servicing ST-125 actuator equipped pumps, actuator testing methods, actuator conversion kit contents and conversion procedures.

**Description**

The ST-125 electronic governing system includes an integrated actuator (Reference Figure 1) and a separate analog speed control. The governor uses a bi-directional actuator to rotate a roller type shutoff cam. The cam moves the governor linkage to control metering valve motion for precise fuel delivery control. The original mechanical overspeed protection and electric shut off solenoid are also retained.
Aneroid Shutoff Cam
Pump models equipped with both an ST-125 actuator and an aneroid (Reference S.B. 225) have a unique aneroid shutoff cam, as shown in Figure 2, which allows for aneroid operation independent of the governor. As with all shutoff cams, the 34361 aneroid shutoff cam is designed to be installed only once. Therefore, whenever a shutoff cam is removed from a pump it must be discarded and replaced with a new cam.

![Aneroid Shutoff Cam P/N 34361](image)

**Figure 2**

Pump Testing
Pump Test As Received and Test Following Pump Service are performed while the electronic governor actuator is rotated from its normal operating position, as shown in Figure 3. This places the roller shutoff cam in a position so it does not interfere with linkage travel.

![Remove cover screw, rotate actuator approximately 45°, and re-install cover screw](image)

**Figure 3**

1. Remove only the governor cover screw that fastens the ST-125 actuator to the governor cover.
2. Rotate the actuator approximately 45 degrees in the upwards direction. Re-install cover screw and tighten to 35-45 lbf-inch (4.0-5.1 N•m).
3. Prior to performing calibration checks, reset the high idle fuel delivery using the guide stud.
4. Remove the torque screw plug and replace it with the torque screw, nut, and seal called out on the individual service specification. This will enable fuel delivery adjustment during calibration checks.
Once pump test and calibration are complete, the actuator must be returned to its operational position.

1. Remove the governor cover screw and rotate the actuator back in the downward direction.
2. Place a 13521 washer under the actuator mounting tang (between the actuator mounting tang and the governor cover) to prevent possible governor cover interference and shaft binding.
3. Tighten the governor cover screw to 35-45 lbf-inch (4.0-5.1 N•m).

**ST-125 Actuator Testing**

The ST-125 actuator consists of two main coils and a position sensor. One coil is to rotate the actuator in one direction and the other coil is to rotate it in the opposite direction.

Functional tests of the actuator itself are limited to electrical continuity testing of the coils. The position sensor can only be accurately checked by measuring voltage output when connected to a powered ST-125 Control. Therefore, it is not practical or recommended for the Stanadyne dealer to test this circuit.

Continuity testing of the two main coils can be performed using a digital multimeter set on the 10 ohms scale. Reference Figure 4 below and the Woodward publication: “ST-125 Control System Installation and Adjustment Manual”. *NOTE: This manual was attached to the first issuance of S.B. 509. Please retain this publication and attach it to this revision.*

1. Resistance between the blue striped wire (Pin 4) and the red striped wire (Pin 5) should be between 1.5 and 2.5 ohms.
2. Resistance between the yellow striped wire (Pin 6) and the red stripped wire (Pin 5) should also be between 1.5 and 2.5 ohms.

If the coil resistance values are out of specification, the governor actuator may be replaced through actuator conversion as described in this bulletin.

![Figure 4](image-url)

**NOTE:** Actuator failures that are unrelated to the coils may not be detectable by the Stanadyne Dealer. If engine performance problems occur, which are not detected during the pump calibration checks or in coil continuity testing, the customer should be referred to the nearest Perkins dealer or Woodward Governor dealer for assistance.
Actuator Conversion (ST-125 to DYNA 70025)

Two different actuator conversion kits are available to convert ST-125 actuator equipped pumps for use with Woodward DYNA 70025 type electronic governor actuators (Reference S.B. 483). These kits contain all of the components necessary for pump conversion and are differentiated by whether the pump is equipped with an aneroid or not.

In addition to the actuator conversion, modifications are also required at the engine. None of the components for the engine modifications are available from Stanadyne. Please contact your local Perkins dealer or Woodward Governor dealer for additional information regarding these modifications. Technical assistance from the Woodward Governor Company may be also found by contacting:

Woodward Governor Company
6250 West Howard Street
Niles, IL 60714-3433
Phone: 1(847)967-7730
www.woodward.com

IMPORTANT: Should governor actuator conversion become necessary, the customer must be informed of the modification requirements for both the pump and the engine. All costs associated with this conversion are chargeable to the customer.

Several internal pump component modifications are required since the ST-125 actuators and DYNA 70025 actuators have different mounting arrangements. Therefore, it is recommended that actuator conversions be performed with the pump removed from the engine and then bench tested after conversion according to the individual superseding pump model specification (see table below) and S.B. 483.

Pump models originally equipped with ST-125 governors have been superseded to pump models equipped with the DYNA 70025 governor actuator. Pump model supersession information is listed in the table below:

<table>
<thead>
<tr>
<th>Original ST-125 Equipped Pump Model</th>
<th>Superseded by DYNA 70025 Equipped Pump Model</th>
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<tbody>
<tr>
<td>Stanadyne Part Number</td>
<td>Perkins Part Number</td>
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<tr>
<td>DB4-5198</td>
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Whenever actuator conversion is performed, the pump must be re-identified by replacing the pump name plate with one stamped with the superseding pump model number, corresponding Perkins part number, and any other remaining information from the original name plate, as shown in Figure 5.

![Figure 5](image)

When performing actuator conversions, refer to the superseding model number service specification for correct component assembly orientation and any preliminary setting requirements.

Use the Actuator Conversion Kit, P/N 38471 to convert electronic actuators on pump models not equipped with an aneroid. The contents of this kit are as follows:

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<tr>
<td>34796</td>
<td>DYNA Actuator Assembly, cover</td>
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</tbody>
</table>

Use the Actuator Conversion Kit, P/N 38470 to convert electronic actuators on pump models equipped with an aneroid. The contents of this kit are shown on the following page.
### 38470 Actuator Conversion Kit (Pump Models with Aneroid)

**To convert Pump Model 5520 to a 5990**  
**And Pump Model 5590 to a 5991**

<table>
<thead>
<tr>
<th>Part number</th>
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<tr>
<td>12165</td>
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<td>12169</td>
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<tr>
<td>17429</td>
<td>Ring, retaining</td>
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<tr>
<td>17438</td>
<td>Seal, o-ring</td>
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<td>19116</td>
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<td>27244</td>
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<td>27607</td>
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<tr>
<td>28449</td>
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<td>28627</td>
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<td>30788</td>
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<td>34796</td>
<td>DYNA Actuator Assembly, cover</td>
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</tbody>
</table>

The 38470 kit contains an aneroid bracket with a different mounting style from the original pump model. Assemble the aneroid and bracket as shown on the individual service specification and tighten the aneroid bracket mounting nut to 70-80 lbf.-inch (7.9-9.0 N•m), as shown in Figure 6.
Warranty
Stanadyne does not provide warranty coverage for the ST-125 actuator. Therefore, whenever an actuator conversion is performed as outlined in this bulletin, all costs are chargeable to the customer.

All components contained in the 38470 and 38471 Actuator Conversion Kits, including the 34796 actuator, are covered by Stanadyne’s Service Parts Warranty (1 year / 500 hours) as outlined in S.L. 301.

Technical Support Group
Product Support Department

Revision Date Changes

1 10/97 Removed reference to low idle adjustment. Revised method of rotating the roller shutoff cam out of the way during calibration. Revised Servicing and Warranty Consideration section

2 2/06 Added actuator discontinuation, washer placement, and actuator conversion information. Removed Aftermarket Considerations.
LIMITED DISTRIBUTION — PERKINS ENGINE COMPANY

SUBJECT: LOCKED DRIVE SHAFT TIMING

As a means of improving the installation timing accuracy as well as preventing unauthorized timing adjustments, Stanadyne has developed a locked drive shaft timing feature for Perkins DB4 pumps. The system consists of the following features and is pictured in Figure 1.

Pump Housing
The locked shaft timing pump housing has holes rather than the traditional "kidney" slots for the pump-to-engine mounting bolts. This is designed to prevent unauthorized pump to engine timing adjustments. The housing also has a hole in the face of the flange to accept a timing pin. A threaded hole in the neck of the housing located between the drive shaft seals serves as a drive shaft locking screw hole during the pump timing procedure.

Drive Shaft
The drive shaft used with the locked shaft timing arrangement also has no keyway on the tapered portion allowing the drive hub to be located on the shaft in any position.

Diesel Systems Division, Stanadyne Automotive Corp.
92 Deerfield Road, Windsor, CT 06095, USA Tel: (860) 525-0621; Telex: 99216; Teletype: (860) 525-4216
Drive Hub
A new drive hub with a slot designed to accept a timing pin but without a keyway on the tapered inside diameter allows accurate location of the hub on the drive shaft during the timing procedure.

Drive Hub Removal/Installation/Pump Testing
NOTE: When a pump with the locked drive shaft timing feature is received for service, *whenever possible, do not remove the hub from the drive shaft*. Pumps with the locked shaft timing feature are to be calibrated with the drive shaft hub installed. Contact the test bench manufacturer (reference S.B. 80) to acquire the correct drive adapter for these pumps. Hub removal/reinstallation should only be performed if the hub or shaft requires replacement or if the necessary pump drive adapter is unavailable.

In those cases where a drive shaft hub needs to be removed from the drive shaft, the specific reinstallation steps are covered later in this bulletin but the procedure can be summarized as follows. Accurate location of the hub on the drive shaft is achieved by locating the start of pumping on the number 1 cylinder through air timing. Then the shaft is rotated several degrees past this point in the direction of rotation (refer to the individual specification) where it is then locked in position with a locking screw. Once the shaft is located, a timing pin is used to locate the drive hub on the shaft and the hub retaining nut and washer are used to lock the hub onto the shaft in the pinned position. Finally, the drive shaft locking screw is removed and discarded. When the pump is installed on the engine, another timing pin (provided by the engine manufacturer) is again used to properly align the hub with the housing while the gear is attached to the hub.

Special Service Tools
Several special service tools are needed to service the locked shaft timing feature. A kit, P/N 33153, that contains a special pump holding fixture, a hub puller and the timing pin has been released. Serviceable components are shown in Figure 2 and the tools and remaining information in this bulletin applies only to those pumps where the hub needs to be removed.

![Diagram of Hub Components](image)
In addition to the 33153 kit, Hartridge air timing fixture, P/N 7244-27 with Stanadyne’s P/N 29711 hub and pointer kit are needed to position the drive shaft prior to hub installation. Refer to Service Bulletin 480 for additional information on Hartridge air timing tools.

The following procedures apply only in those cases where pump drive hub removal becomes necessary.

Drive Hub Removal
1. Clamp the pump holding fixture from kit 33153 in a vise with the side where the hub puller mounts facing you. Align the timing pin slot in the pump drive hub with the pin access hole in the fixture. Use the two provided 8mm hub retaining screws to attach the pump to the back side of the fixture by its drive hub. Loosen, but do not remove, the drive shaft hub locking nut with a 22mm socket (Ref. Figure 3).

![Figure 3](image)

2. Remove the pump from the fixture and remount the pump housing to the fixture using the three pump mounting screws (Ref. Figure 4).

![Figure 4](image)
3. With drive shaft hub locking nut backed off 1 turn, attach hub puller to drive hub using the two 8mm x 45mm long socket head cap screws. *NOTE:* For proper puller alignment, install one of the screws into the hole closest to the timing pin slot. Hold the puller with a 7/8" open end wrench while evenly tightening the screws until the hub releases from the tapered shaft (Ref. Figure 4). Remove puller, hub locking nut, washer, and drive hub from the drive shaft.

**Drive Hub Installation**

1. Refer to the special notes section of the individual specification to determine how many degrees past the point of plunger lockup the pump is timed to (offset angle). Mount Hartridge air timing fixture 7244-27 with the hub from kit 29711 onto the pump drive shaft and tighten the hub locking nut to 50-60 lbf-inches (5.7-6.8 Nm) as shown in Figure 5. Install the pointer from kit 29711 upside down. *NOTE: If interference between the pointer and the housing flange occurs, place a P/N 13521 governor cover washer between the pointer and the timing fixture.*

   ![Figure 5](image)

   - Hartridge Air Timing Fixture
   - Hub from 29711 hub and pointer kit
   - 50-60 lbf-inches (5.7-6.8 Nm)

2. Install a new 29011 drive shaft locking screw into the housing neck until it bottoms on the drive shaft, then back out 1 turn.

3. Connect 60 - 100 p.s.i. (414-609 Kpa) air pressure to the No.1 cylinder outlet fitting (Reference specification). Rotate drive shaft in direction of rotation to index the discharge port with the No. 1 outlet. Allow air pressure to push the plungers out to their maximum outward position. When roller lockup is achieved, loosen the timing fixture thumbscrew to unlock the outer and inner portions of the fixture. Rotate the fixture's outer portion while holding the inner portion in place until the pointer is in line with a known degree tick mark and centered over one of the pump flange "ears" as shown in Figure 6. Tighten the timing fixture thumbscrew...
to lock the fixture together. Using the pointer as a guide, place a thin reference line on the flange with a scribe.

4. Loosen the fixture’s thumbscrew and rotate outer portion of fixture in opposite direction of rotation the number of degrees as specified in the special notes section of the injection pumps specification (Reference Figure 7). Tighten the fixture’s thumbscrew to lock the inner and outer portions of the fixture together.

5. Turn off the compressed air supply. Rotate the air timing fixture and pump drive shaft in the direction of rotation until the timing pointer is realigned with the scribed mark. Tighten the 29011 drive shaft locking screw to 90 - 100 lbf-inches (10.0 - 11.3 Nm) (Ref. Figure 8).
6. Loosen the hub locking nut and remove the air timing fixture from the drive shaft. It may be necessary to use a medium size screwdriver to gently pry the fixture off the tapered drive shaft. **IMPORTANT: Prior to installing the pump drive hub, be sure both the tapered portion of the shaft and the drive hub are clean, dry and free from dirt, grease or oil for proper torque retention.**

7. Insert the timing pin into the hole in the housing. Install the drive hub onto the drive shaft aligning the slot in the hub with the timing pin. Install the hub locking nut and washer (Ref. Figure 9).

8. Align the timing pin slot in the drive hub with the pin access hole in the fixture and use the two 8mm screws provided to re-attach the pump to the back side of the pump holding fixture by its drive hub. Tighten the hub locking nut to 110-130 lbf-inches (12.4-14.7 Nm) then tighten an additional 1/4 turn (90°) (Ref. Figure 10) while monitoring the applied torque. The additional 90° turn must provide a minimum of 780 lbf-inches (65 lbf-feet) torque (88.0 Nm) on the hub locking nut. If the minimum torque requirement is not achieved, remove the hub from the drive shaft and replace it with a new, clean, dry drive hub.
9. Loosen, remove and **discard** the 29011 drive shaft locking screw and remove the timing pin from the housing. Remove pump from fixture.

**Figure 10**

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**Technical Support Group**
**Product Support Department**
SUBJECT: LOW SPEED FUEL LIMITER

As legislation continues to mandate decreases in diesel engine emissions, engine manufacturers find it necessary to more closely control fuel delivery and injection timing functions. Stanadyne plays a significant roll in this effort by developing special injection pump features such as the Low Speed Fuel Limiter. This new feature is designed to reduce wide-open throttle (WOT) fuel delivery below engine peak torque speed in order to control low speed black smoke and exhaust emissions. It is at speeds below peak torque speed (generally below 1600 ERPM) where there is insufficient air to burn the fuel normally injected. This is particularly true with turbocharged engines.

The Low Speed Fuel Limiter (LSFL) feature is located in the hydraulic head assembly and uses an adjustable orifice screw and a fuel limiter piston to restrict the flow of fuel to the metering valve at wide open throttle. Figures 1a and 1b show the locations of the adjustable orifice screw and fuel limiter piston.

![Diagram of Low Speed Fuel Limiter](image)

**Figure 1a**

**Figure 1b**

**Operation of the Low Speed Fuel Limiter**

The adjustable orifice screw and the fuel limiter piston are located in passageways that feed fuel under transfer pump pressure to the pump’s...
metering valve. At low engine speeds when transfer pump pressure is relatively low, the fuel limiter piston is seated blocking one of the two passageways leading to the metering valve. As such, the only fuel that reaches the metering valve is that which flows past the restriction created by the adjustable orifice screw. Figure 2 shows the position of the fuel limiter components during low speed operation.

As engine speed increases, transfer pump pressure also increases. The fuel limiter piston adjusting screw is set during pump calibration so the fuel limiter piston will be fully open by peak torque speed. When the fuel limiter piston is fully open, fuel flows unrestricted to the metering valve as shown in Figure 3.
Maximum (wide-open throttle) fuel delivery from peak torque speed to rated speed is then controlled by the roller to roller dimension (leaf springs) as is the case with non-fuel limiter pumps.

**Figure 4**

WOT Fuel Delivery Curves
Low Speed Fuel Limiter vs. Baseline

![Graph showing fuel delivery curves for WOT, comparing fuel limiter vs. baseline.](image)

Figure 4 compares the wide open throttle (WOT) fuel curves of a non-fuel limiter pump to a pump with the low speed fuel limiter feature. The orifice screw setting determines how much WOT fuel is trimmed back while the fuel limiter piston adjusting screw setting determines when the fuel delivery curve returns to the normal fuel curve.

**Servicing the Low Speed Fuel Limiter Feature**

The serviceable components and torque specifications for the low speed fuel limiter are shown below in Figure 5.
Fuel Limiter Adjustments
Whenever disassembly or calibration of a pump with the LSFL feature is required, the welch plugs will have to be removed in order to disassemble and inspect the LSFL components and to adjust the fuel limiter settings during pump calibration.

To remove the welch plugs, position a 1/8" punch (or equivalent) in the center of the welch plug and carefully strike the punch with a hammer until the punch pierces the welch plug. *NOTE: Use care to avoid damaging the adjustable orifice screw and fuel limiter piston adjusting screw.* Once the welch plug is pierced, use a prying motion to remove the plugs from the locknuts as shown in Figure 6.

A fuel limiter adjusting wrench, P/N 33195, is required to make fuel limiter adjustments during pump calibration. To adjust the fuel limiter, insert the 33195 tool into the locknuts and loosen the locknuts with a 3/8" wrench. While holding the locknuts in place with the 3/8" wrench, use a 1/8" hex key to set the adjustable orifice screw. Use a 5/32" hex key to set the fuel limiter piston adjusting screw as shown in figure 7. Refer to the individual specification for preliminary settings and the correct calibration sequence.
After each fuel limiter adjustment, tighten the locknuts to specification using a 3/8" crowfoot socket and the appropriate torque wrench. While holding the adjusting screw firmly in place to prevent calibration changes, tighten the locknuts using the 33195 tool to specification (refer to Figure 5).

Following pump calibration, the fuel limiter welch plugs must be installed into the adjusting screw locknuts to prevent tampering with these adjustments. Install the welch plugs into the locknuts so that the bulge in the plug is facing outwards. As shown in Figure 8, position a 3/8" dowel pin (or equivalent) in the center of the welch plug and lightly strike the dowel pin several times with a small hammer. The welch plugs are properly seated when they are flat in shape.

![Figure 8](image)

Technical Support Group
Product Support Department
SUBJECT: DISCOLORATION OF CAM ROLLERS (P/N 11141)

It has been brought to our attention that some pumps have experienced discoloration of the cam rollers. After careful analysis, Stanadyne has determined that this discoloration is most likely caused by high surface temperatures due to friction from low lubricity fuel use. The cam rollers analyzed by Stanadyne met all dimensional and surface finish requirements, even though the surface is blue-black in color as shown in Figure 1. Therefore, Stanadyne has determined that discolored cam rollers may continue to be used without effecting pump performance or durability.

![Discolored vs Normal Cam Rollers](image)

**Figure 1**

**Service**

Should you find discolored cam rollers during normal pump repair, inspect the rollers and cam follower shoes for signs of excessive abrasion. If the surface finish appears to be smooth without excessive scoring, reuse of the discolored rollers is acceptable. Since discoloration of cam rollers is a sign of low lubricity fuel usage, you should inform your customer of the benefits of using a lubricity additive such as Stanadyne’s Performance Formula®.

Technical Support Group
Product Support Department
SUBJECT: INTRODUCTION OF T2 MECHANICAL PUMP FEATURES

To assist diesel engine manufacturers in meeting government mandated Tier 2 / Stage 2 emission requirements, Stanadyne has released a new family of mechanical pumps with enhanced features. These second generation Target Featured DB2 and DB4 pumps are referred to as T2 Mechanical pumps.

The innovative changes that are used in T2 pumps include an improved servo-speed light load advance (SSLLA) mechanism, along with improved calibration techniques that allows for precise setting of the pumps advance. In addition, most T2 pumps are also equipped with a vented hydraulic rotor assembly, and a balanced metering valve. Pump models designated for diesel engines that are Tier 2/Stage 2 emission certified are identified by the “(tier 2)” designation on the service specification masthead as shown in Figure 1. Please note that specifications that are designated as Tier 2 specifications contain some or all of the features outlined in this service bulletin.

Servo-Speed Light Load Advance (SSLLA)
Stanadyne has introduced a new SSLLA design that uses a servo valve that incorporates a dampening orifice (Reference Figures 2 & 3) to lessen the affects of varying loads and pressures. The advance pistons feed hole has been relocated so that transfer pump pressure is directed to an annulus groove in the servo valve, instead of directly behind the servo valve. Therefore, transfer pump pressure must flow through the servo valves dampening orifice in the annulus groove. Transfer pump pressure that flows through this orifice, becomes the “Signal Pressure” that powers the servo valve. The dampening orifice in the servo valve removes pressure...
fluctuations that are inherent to the rotary vane type transfer pump. By removing these pressure fluctuations, a steeper and more linear speed advance curve can be achieved and the beginning and end of both speed and load advance can be precisely set during pump calibration.

Pump Calibration

The setting procedures for pumps equipped with this new type of SSLLA differs slightly from previous versions (reference SB 373). The SSLLA adjustment procedure consists of a pre-setting of the speed advance adjusting plug as stated on the individual service specification. Like other SSLLA’s, the initial light load advance (LLA) setting is adjusted using the LLA adjusting screw. Following the initial LLA setting, the LLA is checked again at a specified speed and fuel delivery. If the LLA requires further adjustment, the speed advance adjusting plug is used to “Fine Tune” the LLA set point by pressing the speed advance adjusting plug inwards or outwards to achieve the desired LLA. Service tool 34593 (reference PB 224) is required to make the final adjustment and adjustments are performed with the pump not rotating (test bench at 0 ERPM). Following adjustment, remove the 34593 tool and reinstall the advance cap prior to checking the final adjustment.
Calibrating Injectors
Stanadyne has introduced a new Calibrating Injector that is required to calibrate most T2 pumps, and also some recently released non T2 pumps. These calibrating injectors are a low dead volume type that are set at 207 bar (3000 psi) nozzle opening pressure, and are similar to the ISO 14681 standard. Stanadyne’s part number for these calibrating injector is 36950. All authorized Stanadyne service dealers must use Stanadyne Calibrating Injectors, P/N 36950, when servicing pumps that call for this part number on the individual service specification (Reference Service Letter 319). Stanadyne has found that the use of these Calibrating Injectors greatly enhances repeatability and calibration consistency.

Hydraulic Rotor Assembly
A new vent slot has been incorporated into the hydraulic rotor to reduce fluctuations in metered fuel pressure to the SSLLA circuit. The single vent slot is larger and in a different location (See Figure 4) than the two smaller vent slots traditionally used on D series rotors. This vent slot indexes with the charging ports in the hydraulic head assembly between charging events, venting any fluctuation in metered fuel pressure back to housing pressure. The vented rotor provides for a more linear advance curve (especially on 3 cylinder applications) and also provides for better light load advance consistency on pumps that are equipped with the low speed fuel limiter feature.

Metering Valve
Most T2 pumps use a balanced metering valve as shown in Figure 5, which reduces side loading of the valve. This feature allows for increased consistency of metered fuel pressure by attenuating pressure fluctuations caused by metering valve positioning resulting in additional low idle advance and improves low idle stability.
SERVICE BULLETIN

DATE: October 15, 2005

SUBJECT: STATIC TIMING PIN FEATURE

Several of Stanadyne’s engine manufacturing customers have requested a more precise static timing method when installing fuel injection pumps to their engines. In order to meet this requirement, Stanadyne has released a number of T2 featured pump models (Reference S.B. 549) which are dynamically lock shaft timed during pump production. A static timing pin design has also been incorporated into these pump models to maintain the accuracy of dynamic timing in cases where the drive shaft lock is disengaged (Reference S.B. 460) and the correct lock shaft timing angle needs to be re-established.

The timing pin design consists of a slotted rotor hub, timing lock plate, and a removable timing pin (P/N 37588) as shown in Figure 1. Once the dynamic timing angle is obtained during factory testing the drive shaft is locked, the timing pin is then indexed in the rotor hub slot and the timing lock plate is tightened in position. Due to the accuracy of factory dynamic pump timing, the timing lock plate should not be removed nor should the position of the timing lock plate be disturbed unless absolutely necessary. The 37588 timing pin is considered a mandatory auditable service tool (Reference Section 2.7.2 of the 99666 Stanadyne Policies and Procedures Manual).

Service
In most cases, the pump may be serviced without removing or altering the position of the timing lock plate. However, certain service scenarios do require timing lock plate removal. In these cases, choose the following service scenario that best fits the appropriate level of pump service being performed (Reference Figure 2).
**Scenario 1** - This procedure is used when removal of the timing lock plate is required and no major components have been changed or the roller to roller settings altered (i.e. for timing lock plate gasket replacement). This procedure involves indexing the timing pin in the rotor hub slot then locking the drive shaft in the factory established position.

1. Remove the timing lock plate plug (5/32” Hex Bit, P/N 13336 or equivalent) in the center of the timing lock plate and insert a 37588 timing pin.
2. Rotate the drive shaft until the pin indexes with the slot in the hydraulic rotor hub (Reference Figure 1) and lock the drive shaft as outlined in Service Bulletin 460.
3. Remove the two timing lock plate mounting screws (T15 Tamper Proof), the timing lock plate, and the gasket. Clean the mating surfaces.
4. Install the timing lock plate, new gasket, and both mounting screws. Index the timing pin in the rotor hub slot and tighten the two timing lock plate mounting screws to 15-20 lbf.-inches (1.7-2.3 N•m).
5. Remove the timing pin and install timing lock plate plug, tighten to 20-30 lbf.-inches (2.3-3.4 N•m).

**Scenario 2** - This procedure is used when a major component or adjustment that directly affects pump static timing has been changed (head & rotor, housing, advance piston, drive shaft or roller to roller settings). For these cases, the pump must be air timed to the housing (Reference S.B. 177) according the latest edition of the individual service specification.

1. Air time the pump according to the individual service specification and tighten the drive shaft locking screw to 105-110 lbf.-inches (11.8-12.4 N•m) (Reference S.B. 460).
2. Remove the timing lock plate plug (5/32” Hex Bit, P/N 13336 or equivalent) in the center of the timing lock plate and insert a 37588 timing pin.
3. Loosen, but do not remove, the two timing lock plate tamper resistant mounting screws (T15 Tamper Proof).
4. Move the timing lock plate up or down until the pin indexes with the slot in the hydraulic rotor hub (Reference Figure 1).

5. Tighten the two timing lock plate mounting screws to 15-20 lbf.-inches (1.7-2.3 N\text{\textperiodcentered}m).

6. Remove the timing pin and install timing lock plate plug, tighten to 20-30 lbf.-inches (2.3-3.4 N\text{\textperiodcentered}m).

Technical Support Group
Product Support Department
Many DB2 automotive pumps use a drive arrangement with three cup type seals, as shown in Figure 1. Two of the seals are identical (P/N 10453) and are black in color. One of the 10453 seals is used to prevent fuel from entering the engine's crankcase and the other is used to prevent engine oil from entering the pump. The third cup seal (P/N 21860), is red in color and was designed specifically to prevent fuel leakage during cold engine operation. This seal is positioned on the drive shaft in the seal groove between the two black drive shaft seals.

The 21860 red drive shaft seals are made from a rigid material which is not as elastic as the black drive shaft seals (P/N 10453). Because of this, special care must be taken to prevent seal damage during pump assembly.

- Ensure the correct drive shaft seal assembly tool (P/N 22727) is being used.

**NOTE:** The O.D. of the stepped shank on a DB/DC drive shaft seal assembly tool (P/N 13369) is too large and may damage the 21860 red drive shaft seal if mistakenly used during assembly.

- Closely inspect the 22727 drive shaft assembly tool for any signs of surface irregularities (nicks, burrs, raised scratches, etc.). Repair or replace the assembly tool as required.

- Use SAE 30W engine oil to generously lubricate the cup seals and the drive shaft seal assembly tool. In the past, the use of assembly lubricant (P/N 22204) was recommended for drive shaft cup seal assembly. However, recent testing has shown that by using engine oil the probability of damaging the 21860 drive shaft seal during assembly is significantly reduced.
Stanadyne's innovative mechanical pump features assist engine manufacturers in meeting emission certification requirements. Many of these features are designed for accurate and repeatable fuel injection timing (Reference S.B.'s 373, 373A & 549). Accordingly, the calibrating parameters for these pump models are very stringent with timing tolerances of +/- 0.05 engine degree. To assure our OEM customers that these exacting standards are maintained following pump repair, Stanadyne has developed an electronic advance indicator (Figure 1) for close tolerance calibration of “D” Series mechanical rotary pumps.

The contents of the 39938 Electronic Advance Indicator kit are shown in Figure 1.

As a result of the accuracy of the 39938 Electronic Advance Indicator, it is considered a required tool that supersedes the 23745 mechanical advance indicator for testing DB2, DB4 and DM pump models.
The timing requirements are not as meticulous for older pump models (D, DB and DC). Therefore, use of the EAI on these pumps is optional. The 21733 mechanical advance indicator can continue to be used when testing these pump models. **NOTE:** The cam movement sensor assembly will not fit some early D model pump housings. These pump housings have small timing window cutouts and angled walls which prevent EAI mounting.

**Assembly/Installation**

1. Attach the 22831 gasket to the cam movement sensor by threading the two mounting screws in until the gasket rests in the undercut portion of the screw shank.

   a. **For D, DB and DC pump models:** Place the 39965 spacer and the 13367 gasket (Figure 2a) over the two screws. Thread the screws into the 13367 gasket until both holes in the gasket are in the undercut on the screws.

2. As shown in Figure 2b, the cam pointer is offset from the centerline of the mounting screws. After removing the timing window cover from the pump, orient the sensor so that the pointer sits in the slot on the cam ring. The flat end of the cam movement sensor will be toward the drive end of the pump. **NOTE:** If the orientation is incorrect, the pointer may be damaged by contact with the rotor hub/governor weight retainer during pump rotation.

3. Apply enough pressure on the cam sensor assembly to overcome the spring tension on the pointer. Align the two mounting screws with the holes in the pump housing and tighten them evenly to 15-20 lbf.-in (1.5-2.5 N•m).

4. Remove the 21735 plug from the port on the sensor assembly (Figure 1). Install the tubing fitting (P/N 22035), tighten to 35-45 lbf.-in. (4.0-5.0 N•m) and connect to the pump housing pressure gauge per the test bench manufactures instruction. Both the fitting and the plug use a 27607 O-ring seal.
5. Position the 39940 EAI monitor in a viewable location. An adhesive backed magnetic strip (P/N 39943) is provided as an option for mounting the EAI monitor onto a flat steel surface (example: side of a test bench).

6. Route the wire harness (P/N 39942) carefully and connect it to the cam movement sensor and to the monitor (Figure 4).

7. Connect the power supply to a suitable power source. **NOTE:** The power supply has an automatic feature that allows either 110 volt (60 Hz.) or 220 volt (50 Hz.) operation. A power cord adapter may be required for operation outside of the continental USA (adapters are not available from Stanadyne).

**Operation**

Once the electronic advance indicator kit is assembled, touch the monitor screen anywhere to turn it on (Figure 5). **NOTE:** The monitor has a glass “touch screen” that requires ample finger pressure to make command selections.

With the pump in the static position (not rotating), press the “Zero” button to reset the advance indicator to the origin point. **NOTE:** Depending on sensor mounting
orientation and pump rotation the display may read negative (-). Additionally, due to the sensitivity of the sensor the display may fluctuate +/- 0.02 degrees. Once the pump is operating at sufficient speed, sensor fluctuations will be eliminated. To turn the monitor off, simply press the "Power Off" screen button (Figure 5).

Warranty

Each serviceable component within the 39938 Electronic Advance Indicator kit is covered by a one year limited warranty for defects in material and workmanship. If a serviceable component were to fail, submit a warranty claim only for the specific component not the entire kit. Likewise, when replacing the suspect component only order that component not the entire kit. As with all service tools, the failed component must be returned to:

Stanadyne Corporation
92 Deerfield Road
Windsor, CT 06095
Attention: Warranty Return Dept.

Consult section 4.6.4 of the Stanadyne Policies and Procedures Manual (99966) found on the Stanadyne service website for warrantable conditions pertaining to service tools.

Technical Support Group
Product Support Department

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision</th>
<th>Description</th>
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<tbody>
<tr>
<td>10/09</td>
<td>1</td>
<td>Added information about operation, mounting, housing pressure port and warranty</td>
</tr>
</tbody>
</table>
SUBJECT: ADVANCE PISTON CHANGES FOR SERVO-SPEED LIGHT LOAD ADVANCE (SSLLA)

The SSLLA design for Target featured DB2 and DB4 pump models has undergone many changes since its introduction (Reference S.B. 373). Two of the more significant changes include the introduction of non-plated advance pistons with sleeved advance bore pump housings and the separation of the advance piston power side design types.

Plated vs. Non-Plated Advance Pistons

The aluminum advance bore in the pump housing was originally sized to fit a plated advance piston. In an effort to simplify pump service, by avoiding the need for multiple oversized advance pistons and housing bore reamers, Stanadyne introduced steel sleeved advance bore pump housings and non-plated pistons. This design enhancement shifts the major wear component in the advance area from the aluminum housing bore to a non-plated steel advance piston, which improves advance consistency and pump longevity.

Advance Piston Types

The original advance piston design included provisions for both a reed valve and an orifice screw. For manufacturing purposes, the advance pistons have been separated into two types: a reed valve type and a orifice screw type (Figure 1).

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**Figure 1**

**Plated and Early Non-Plated SSLLA Pistons**
- Threaded Hole for Orifice Screw
- Threaded Hole for Reed Valve Screw
- Reed Valve Slot

**Current Non-Plated SSLLA Piston Types**
- Reed Valve
  - Non-Threaded Hole
  - Threaded Hole for Orifice Screw
- Orifice Screw
  - Part Number Locations
The following table identifies the original advance piston part numbers and the corresponding part numbers for each piston type.

NOTE: Some reed valve type pistons retained their original part numbers while all of the orifice screw type pistons received new part numbers.

<table>
<thead>
<tr>
<th>Original Plated Advance Pistons</th>
<th>Non-plated Advance Pistons</th>
<th>Reed Valve Type</th>
<th>Orifice Screw Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>(for non-sleeved pump housings)</td>
<td></td>
<td>(also early non-plated pistons with both orifice screw and reed valve provisions)</td>
<td></td>
</tr>
<tr>
<td>32519</td>
<td>33399</td>
<td>34694</td>
<td></td>
</tr>
<tr>
<td>33400</td>
<td>33400</td>
<td>34695</td>
<td></td>
</tr>
<tr>
<td>—</td>
<td>34430</td>
<td>34699</td>
<td></td>
</tr>
<tr>
<td>33674</td>
<td>33448</td>
<td>34696</td>
<td></td>
</tr>
<tr>
<td>33586</td>
<td>33586</td>
<td>33587</td>
<td></td>
</tr>
<tr>
<td>—</td>
<td>34356</td>
<td>34697</td>
<td></td>
</tr>
<tr>
<td>—</td>
<td>34366</td>
<td>34698</td>
<td></td>
</tr>
<tr>
<td>32465</td>
<td>34590</td>
<td>34700</td>
<td></td>
</tr>
<tr>
<td>32520</td>
<td>34591</td>
<td>34701</td>
<td></td>
</tr>
</tbody>
</table>

Service

The availability of non-sleeved pump housings and plated advance pistons is limited. Once supplies of these components are exhausted, pump housing or advance piston replacement will require conversion to the equivalent sleeved pump housing with a non-plated advance piston. NOTE: Some popular pump housing and advance piston combinations are available together as a service kit (Reference Service Bulletin 429).

IMPORTANT: Due to other design changes, when replacing a pump housing equipped with the SSLLA feature, some additional parts may be required (i.e. different advance end plug assembly, end plug mounting screws, seals, etc.). Carefully compare the components of the pump being serviced with the latest edition of the specification to identify any hardware differences and respective part numbers.

Technical Support Group
Product Support Department
SUBJECT: GENERAC - DB4 PUMP HOUSING REPLACEMENT

PUMP MODELS AFFECTED: DB4429-5471, DB4429-5337 & DB4627-5256

The servo-speed light load advance (SSLLA) design (Reference S.B. 373) has changed since these pump models were last manufactured. The pump housing assembly now incorporates a steel sleeved advance bore and a power side advance end plug that is bolted to the housing instead of being threaded into it, as shown in Figure 1. These changes were implemented after the affected pump models were no longer in production and subsequently they were not changed.

As a result of these design changes and others, many of the original components for the affected pump models are no longer available (e.g. Pump Housing Assemblies). However, an affected pump model with an excessively worn advance bore and/or advance piston can be repaired using the combination of components identified in this bulletin.

Service
An affected pump model that requires pump housing replacement will also need additional components for the power side of the advance mechanism (Refer to Figure 1 and the table on the following page). No hardware/parts kits have been created, so the individual parts must be obtained separately.
The original plated advance piston (P/N 32520) has no equivalent non-plated piston. Therefore, should piston replacement be required the P/N 32520 plated advance piston must be used. Extensive testing has determined that using the plated advance piston within a sleeved advance bore, although not ideal, has no detrimental effects.

The spring side end plug, light load advance piston and servo valve components can be used in the replacement housing assembly, as shown in Figure 1. For these and other components, refer to the individual service specification for the correct part numbers.

The tables below identify both the original components and the parts that replace them. An additional table is provided with the assembly torque values for your convenience.

<table>
<thead>
<tr>
<th>Original and Replacement Parts</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Original</td>
<td>Replace With:</td>
</tr>
<tr>
<td>Part Number</td>
<td>Description</td>
</tr>
<tr>
<td>33577</td>
<td>Housing (no-sleeve)</td>
</tr>
<tr>
<td>22649</td>
<td>End Plug</td>
</tr>
<tr>
<td>32740</td>
<td>Seal</td>
</tr>
<tr>
<td>32520</td>
<td>Advance Piston</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assembly Torque Values</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Part Number</td>
<td>Description</td>
</tr>
<tr>
<td>33348</td>
<td>End Plug Screws</td>
</tr>
<tr>
<td>19835</td>
<td>Reed Valve Screw</td>
</tr>
<tr>
<td>33008</td>
<td>Spring Side End Plug</td>
</tr>
<tr>
<td>35109</td>
<td>Light Load Advance End Cap</td>
</tr>
</tbody>
</table>

Technical Support Group
Product Support Department

Corrected Copy   Feb. 17, 2011   P/N for Housing changed
Mar. 13, 2012   P/N for O-ring changed
SUBJECT: HYDRAULIC ROTOR ASSEMBLIES WITH STEPPED DELIVERY VALVE STOP SCREW

PUMP MODELS AFFECTED: DB2831-5079, 5149, 6201

Inadequate delivery valve stop screw thread depth in the hydraulic rotor assemblies used in a small number of the affected pump models has caused low fuel delivery during initial pump calibration. Without the full thread depth the stop screw does not seat the delivery valve stop when tightened, causing delivery valve stop seat leakage (Reference S.B. 143B). To prevent thread interference during assembly, a special stepped delivery valve stop screw (Figure 1) has been introduced specifically for use in these rotor assemblies.

Each pump manufactured with a 23124LT screw is identified by “SB567” stamped on the nameplate in the location shown in Figure 2.

Service
If delivery valve removal is required for one of the affected pumps, both the delivery valve stop (P/N 26070) and the delivery valve stop screw (P/N 23124LT) must be replaced. When ordering a stepped delivery valve stop screw, ensure the “LT” suffix is included with the part number. The stop screw is installed in the orientation shown in Figure 1 and tightened to 85-90 lbf.-in. (9.5-10 N•m).

Technical Support Group
Product Support Department
LIMITED DISTRIBUTION — JOHN DEERE

SUBJECT: CHANGES TO ADDRESS LOW POWER

PUMP MODELS AFFECTED: DB4429-6189 (RE-548320)

Since the introduction of the above affected pump model, there have been some reports of low power issues for engines fitted on HIDROMEK applications. To address this low power issue, John Deere is requesting that the Roller to Roller (R-to-R) fuel and/or Low Speed Fuel Limiter (LSFL) setting be reset to the “Following Pump Service” section of the latest DB4-6189 pump specification (edition 4), if necessary.

Service
Should you receive a DB4-6189 pump with a complaint of low power, perform the “Test As Received” (TAR) routine. If the pump meets all of the TAR check points but if it is noted that the R-to-R check point at 1500 RPM (step 3g) is below 107 mm3, and/or the LSFL check point at 1300 RPM (step 3h) is below 105 mm3, the pump must be reset to the “Following Pump Service” routine of the specification. However, if the pump meets all of the TAR check points and also meets these two OEM requested check points (107 mm3 at step 3g and 105 mm3/st at step 3h), no further action is required and the pump can be returned to the customer.

Warranty
If the pump met all of the TAR check points of the latest test specification but the fuel did not meet the OEM calibration requirements as outlined above (1500 RPM - 107 mm3 minimum and/or 1300 RPM - 105 mm3 minimum), all costs associated to reset the pump are chargeable to the customer because this request is being made by John Deere.

For Pumps that were tested that did not meet other TAR checkpoints (not specified in this Service Bulletin) and/or were found to be out of the following fuel flow ranges,

<table>
<thead>
<tr>
<th>RPM</th>
<th>Throttle Position</th>
<th>mm3/stk.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500</td>
<td>WOT</td>
<td>105.5 - 111</td>
</tr>
<tr>
<td>1300</td>
<td>WOT</td>
<td>98 - 114.5</td>
</tr>
</tbody>
</table>

a warranty claim may be submitted for reimbursement if the pump is within the warranty period.

Technical Support Group
Product Support Department
LIMITED DISTRIBUTION — JOHN DEERE (BRAZIL ONLY)

SUBJECT: LOW POWER, SMOKE, ROUGH RUNNING, STALLING

PUMP MODELS AFFECTED:  DB4327-5986 (RE-531128)

There has been a number of performance related issues with John Deere 5075E Tractors in Brazil. The engine in those tractors was originally fitted with a DB4-5986 pump and the root cause of the performance issues are related to low engine RPM recovery and premature wear of the pump’s transfer pump components (caused by fuel with inadequate lubricity). As a result of the low RPM performance and premature wear issues, John Deere has approved the release of a new pump model, DB4-6264 (RE-560216), to replace the DB4-5986 in Brazil only. The DB4-6264 is equipped with Reduced Lubricity Fuel Components (RLFC) in the transfer pump area, a new cold start advance piston with spring assist and a change in pump calibration.

Service

Should you receive a DB4-5986 pump for service with a complaint of low power, smoke, rough running or stalling, the pump will need to be converted with the parts listed in the table below and calibrated to the latest “Pump Following Service” routine of the DB4-6264 Test Specification. Once the conversion is complete and the pump is calibrated, the pump will need to be identified accordingly. The original nameplate can be used for identification purposes as long as the original pump model number and customer part number are etched out and the new model number (DB4327-6264) and customer part number (RE-560216) are etched/stamped on the available field spaces of the plate (Reference Figure 1). The other option is to install a new service name plate, part number 36773, and transfer the serial number from the original name plate onto it and etch/stamp the new pump model number and customer part number accordingly.

<table>
<thead>
<tr>
<th>Description</th>
<th>Remove</th>
<th>Install</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotor Retainer, Transfer Pump</td>
<td>32859</td>
<td>33818</td>
</tr>
<tr>
<td>Rotor Retainer, Transfer Pump</td>
<td>19870</td>
<td>33817</td>
</tr>
<tr>
<td>Liner, Transfer Pump</td>
<td>21232</td>
<td>37447</td>
</tr>
<tr>
<td>Blade, Transfer Pump (Ref. S.B. 304)</td>
<td>34759</td>
<td>37267</td>
</tr>
<tr>
<td>Piston, Cold Advance</td>
<td>37236</td>
<td>34228</td>
</tr>
<tr>
<td>Cover, Power Side Advance</td>
<td>34805</td>
<td>39455</td>
</tr>
<tr>
<td>Spring, CSA Assist</td>
<td>-</td>
<td>39454</td>
</tr>
</tbody>
</table>
Warranty

Since this request is being made by John Deere, all costs associated to convert the pump are chargeable to the customer. Also, warranty claims should not be accepted for pumps that are found to have failed due to normal and/or premature wear and tear caused by fuel with inadequate lubricity.

Technical Support Group
Product Support Department