

Section III - Intravance Timing Device

Introduction:

The Model 100 pump is equipped with either a solid camshaft or an internal timing device with either a single or dual advance range. The maximum timing advance currently available is 20° with actual timing advance tailored to customer requirement.

The Intravance timing device is a hydraulically actuated, speed sensing camshaft that will automatically advance the injection pump to engine timing. It was designed to fill a need required by high speed, automotive diesel engines. The Intravance timing device senses engine speed and sets beginning of injection to a specified engine timing curve, responding to engine RPM only. In general, as the engine speed increases, injection timing is advanced in relation to top dead center with the intent of providing more optimum engine performance.

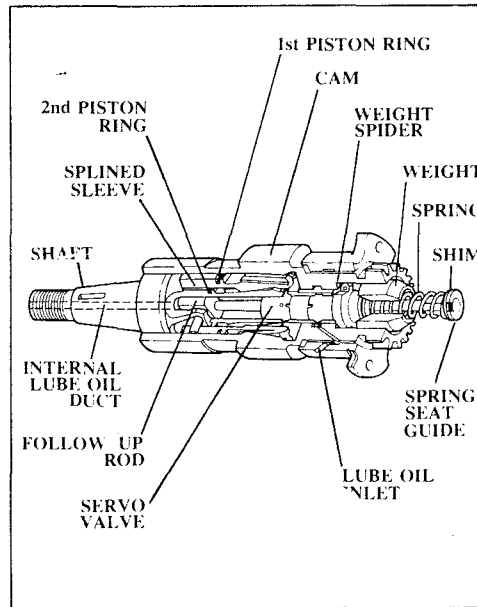


FIGURE 3-1
SECTION VIEW OF INTRAVANCE
TIMING DEVICE

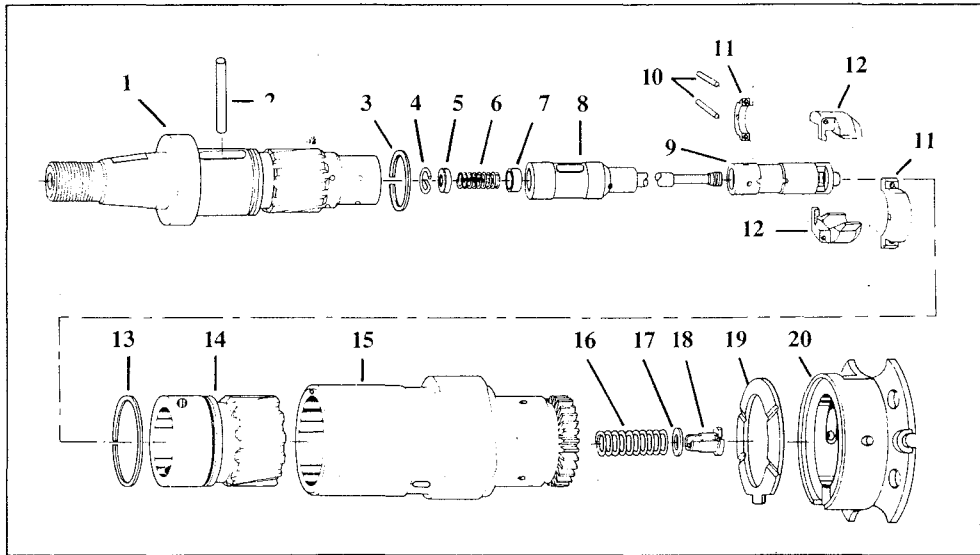


FIGURE 3-2
EXPLODED VIEW OF INTRAVANCE
TIMING DEVICE

Single Range Intravance Timing Device - Operation

Engine lube oil pressure is used to actuate the Timing Device, entering the unit through a passage in the rear bearing. Centrifugal force from the weights, in conjunction with the advance spring force, controls the change in timing throughout the advance range.

The actual sequence of events can be described as follows:

Parts List

- (1) Drive Shaft
- (2) Sleeve and Rod Pin
- (3) Piston Ring
- (4) Spring Ring
- (5) Spring Seat
- (6) Retard Spring
- (7) Retard Piston
- (8) Follow-up Rod
- (9) Control Valve
- (10) Weight Pin
- (11) Weight Spider
- (12) Weight
- (13) Piston Ring
- (14) Splined Sleeve
- (15) Cam
- (16) Advance Spring
- (17) Washer(s)
- (18) Spring Seat
- (19) Thrust Washer
- (20) Bearing Plate Assy.

As the engine speed increases, the weights shown in above diagrams swing outward thus overcoming the initial force exerted by the advance spring on the control valve.

The weight fingers, which contact the control valve, then move the valve to the right.

As a result, an oil passage is opened, allowing lube oil to enter the working chamber behind the sleeve (right end). Oil is retained in the working chamber by the two piston rings.

The pressure exerted by the oil forces the sleeve to move toward the advance position (left).

Since the sleeve, camshaft and cam incorporate helical splines, the cam is caused to rotate with respect to the driveshaft and, therefore, advance the beginning of injection.

The sleeve is connected to the follow-up rod by a cross pin. The rod is also moved to a new position as the sleeve is moved.

With the movement of the sleeve and follow-up rod toward the left, the advance spring compresses until the load in the spring equals the centrifugal force generated by the rotating weights.

At this point, the lube oil inlet is closed off by the control valve. Required pressure is then maintained at the right end of the sleeve and the unit no longer advances.

If the engine speed increases beyond the range of advance, the sleeve has traveled as far as it can and maximum advance is maintained. At this point, the weights will remain fully open since the centrifugal weight force is greater than the force developed by the compressed advance spring which has stopped compressing when the sleeve reaches maximum advance.

When decreasing speed, the action of the system is reversed; the weights lose centrifugal force and move inward and the spring again acts on the control valve.

The valve moves toward the left, closing the lube inlet passage and opening a drain passage. This allows lube oil to escape from the working chamber through the control or servo valve.

As the movement continues, the spring lengthens, reducing the load until it balances the centrifugal weight force generated at the new lower speed.

At this position, the drain land closes to maintain the required pressure at the new timing position.

Dual Range Intravance Timing Device

The dual range Intravance Timing Device functions in the same manner as described in the previous section. It includes, however, a pre-advance which is independent of the operational advance phase of operation.

The first step of advance is obtained with the use of a special follow-up rod shown in figure 3-2. The spring which is housed within the follow-up rod controls this phase of operation.

At approximately 300 RPM, the control valve is pulled toward the weight end of the Intravance, thereby starting to compress the light rate spring. The spring continues to compress until approximately 500 RPM. At this point, the spring will not compress any farther since the cross pin, which passes through the rod and compresses the spring, has contacted the opposite end of the elongated hole in the follow-up rod.

By the time the engine has started and is idling, lube oil has entered the working chamber to the right of the sleeve. Oil pressure will, at the same time, shift the sleeve, yielding an advance change equal to the number of degrees specified.

The first advance step is actually a "retard start" feature. It allows a shift in timing, during the starting cycle, to aid in engine start-up.

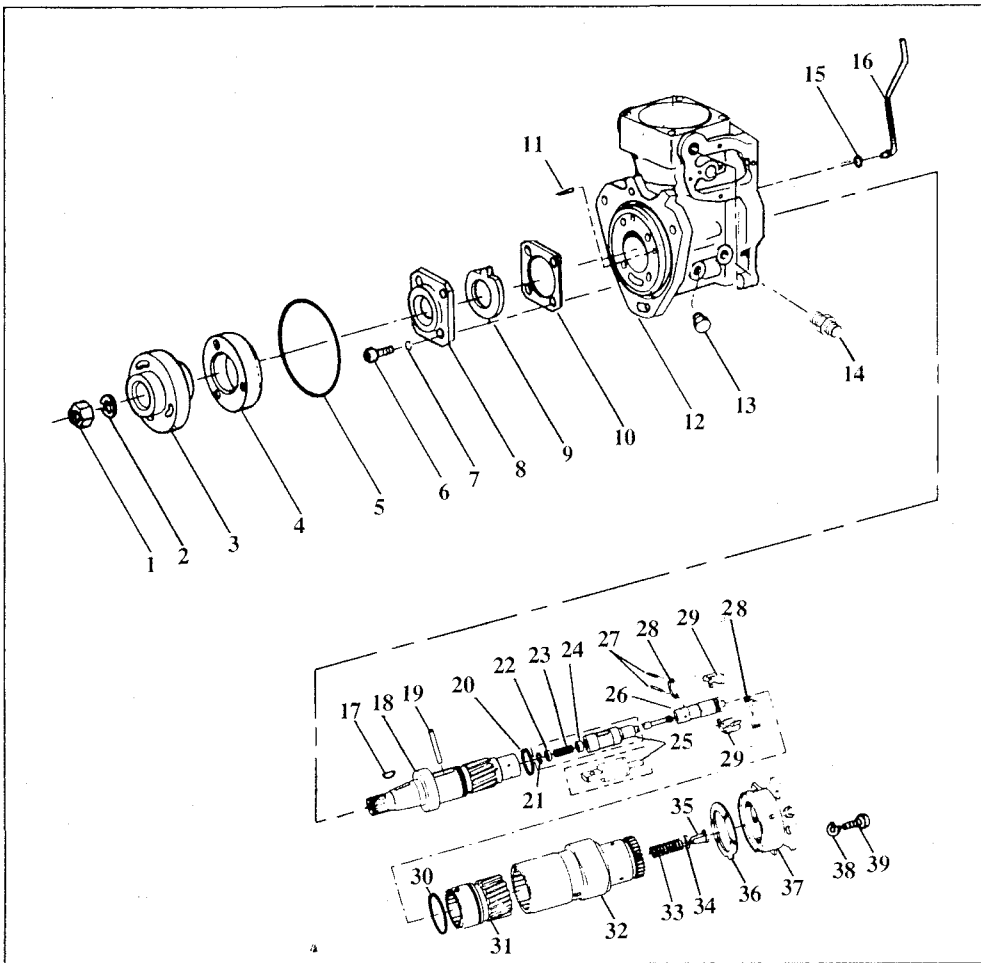


FIGURE 3-3
EXPLODED VIEW OF INTRAVANCE
TIMING DEVICE ASSEMBLY AND
RELATED COMPONENTS

Parts List

1. NUT, drive hub
2. WASHER, lock-drive hub
3. HUB, drive
4. PLATE, back-drive hub
5. GASKET, ring
6. SCREW, retainer plate (4)
7. WASHER, lock (4)
8. PLATE, retainer
9. WASHER, thrust
10. SHIMS (AR)
11. POINTER, timing
12. HOUSING, pump
13. PLUG, timing window
14. FITTING, lube inlet
15. GASKET, "o" ring-lube oil tube
16. TUBE, lube oil-excess fuel device
17. KEY, woodruff
18. SHAFT, cam
19. PIN, sleeve and rod
20. RING, piston
21. RING, spring
22. SEAT, spring
23. SPRING, retard
24. PISTON, retard
25. ROD, follow-up
26. VALVE, control
27. PIN, weight (2)
28. SPIDER, weight (2)
29. WEIGHT (2)
30. RING, piston
31. SLEEVE, spline
32. CAM
33. SPRING
34. WASHER (AR)
35. SEAT, spring
36. WASHER, thrust
37. PLATE, bearing assembly
38. WASHER, lock (4)
39. SCREW, retaining-bearing plate (4)

Caution: All work on injection equipment must be performed in the cleanest possible location. No filing, sawing or scraping should be done on the bench where repairs are made.

Note: The Timing Device can be removed with or without removal of the hydraulic head and supply pump, however, these diagrams show hydraulic head and supply pump removed.

- (1) Refer to Hydraulic Head Section I.A. (Hydraulic Head Removal) and follow steps 1-8.

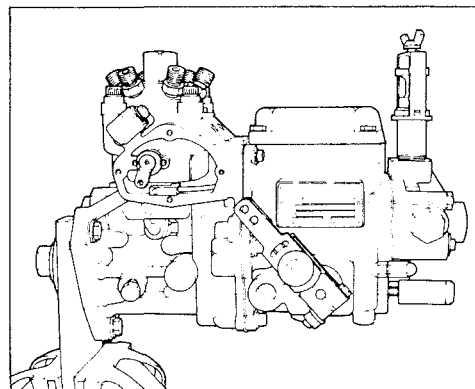


FIGURE 3-4
CONTROL ROD DISENGAGED FROM
CONTROL UNIT ASSEMBLY

- (2) Remove the four governor top cover fastening screws & remove governor cover and gasket.

A. Intravance Timing Device Removal