

- 24. Pointer, control rack
- 25. Screw, fastening
- 26. Screw, stop - control rack

APF fuel injection pumps are designed for medium and low speed applications (one per cylinder) ranging from small and medium to large stationary diesels of up to 1000 HP per cylinder. Special types have been developed for modern high compression diesels and dual fuel (diesel and natural gas) engines.

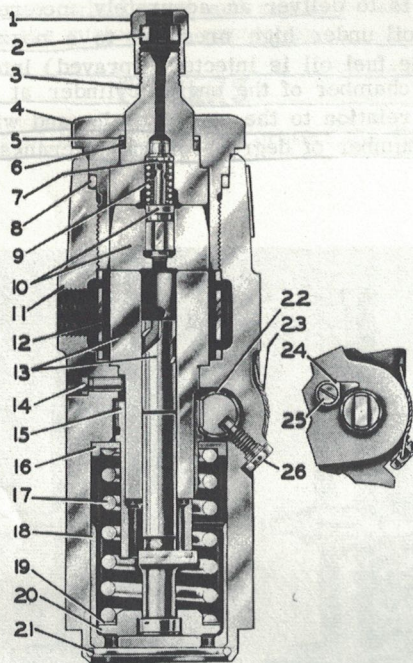


FIGURE 2-2 - Internal View Of Typical APF Fuel Injection Pump

OPERATION - The operation of American Bosch APF fuel injection pumps mainly involves five interlocking functions - the pumping action, plunger helix arrangement, metering principle, delivery valve action and the fuel delivery controls, as follows:

2.1-1 THE PLUNGER ACTION (Figure 2-3) - With the plunger at the bottom of its stroke (cam at base circle) as illustrated in "A", fuel from the pump sump flows through the barrel ports and fills the volume above the plunger. The sump fuel initially fills the vertical slots and connecting cutaway areas of the plunger.

Upward movement of the plunger seals off the barrel ports thus trapping fuel as illustrated in "B". Additional upward movement of the plunger as illustrated in "C" forces fuel through the delivery valve, high pressure tubing, nozzle and finally to the combustion chamber. Fuel delivery ceases when the plunger helix uncovers the barrel port as illustrated in "D"

- this releases the trapped fuel through the annulus in the plunger and out the barrel ports.

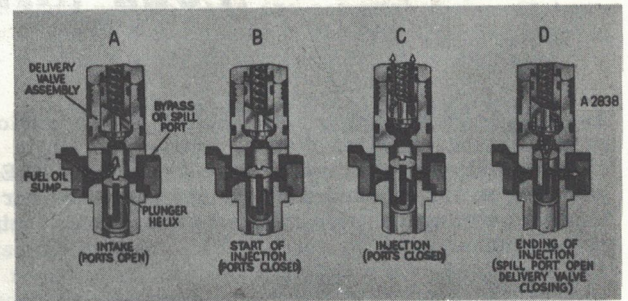


FIGURE 2-3 - Pumping Action

2.1-2 PLUNGER HELIX ARRANGEMENT (Figure 2-4)

- As illustrated in Figure 2-4, plungers for APF pumps can have various helix arrangements, and the type applied to a particular pump is dependent on the fuel delivery curve requirement specified by the engine manufacturer.

A plunger with a lower helix gives a constant beginning and a variable ending of delivery. Except when the vertical slot on the plunger lines up with the barrel port (the no-delivery position), the top edge of the plunger closes the barrel ports on the upward stroke. By-passing occurs when the helix uncovers the port.

A plunger with an upper helix gives a variable beginning and a constant ending of delivery. The time of closing the barrel ports on the upward stroke is varied by the relation of the helix to the ports and the angular position of the plunger. The end of delivery occurs when the upper edge of the vertical slot opens the ports.

A plunger with a double helix (upper and lower) gives a variable beginning and ending of delivery as both conditions depend upon the relation of the helix to the ports.

2.1-3 METERING PRINCIPLE - The amount of fuel delivered is controlled by the position of the plunger helix. When the plunger is rotated to a position as illustrated in Figure 2-5, the effective part of the stroke (that portion of the stroke from the closing of the barrel ports by the top of the plunger to the point where the edge of the helix rises above the barrel ports) is long and fuel delivery is at a maximum.

When the plunger is rotated to a position as illustrated in Figure 2-6, the effective part of the stroke is reduced since the helix will uncover the barrel ports sooner (at a lower position) - This action reduces the fuel delivery.

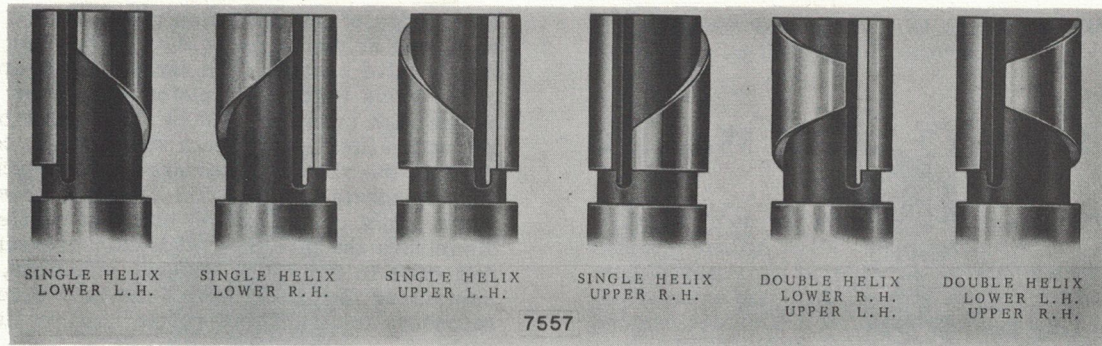


FIGURE 2-4 - Plunger Helices

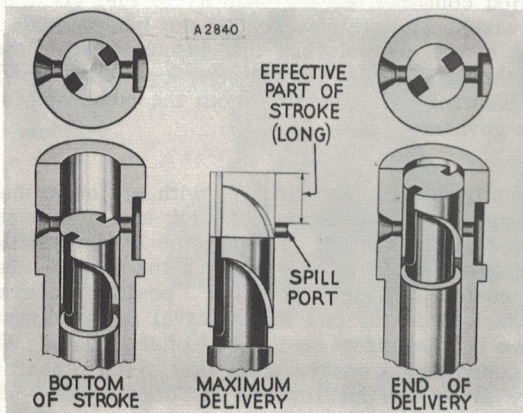


FIGURE 2-5 - Maximum Delivery

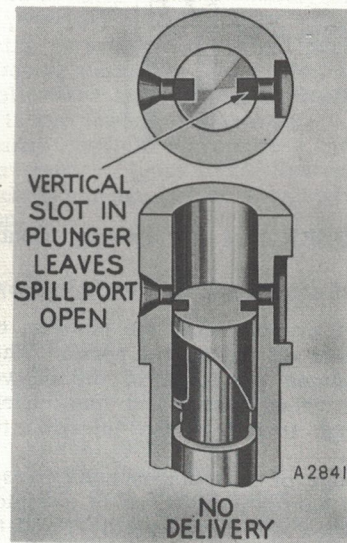


FIGURE 2-7 - No Delivery

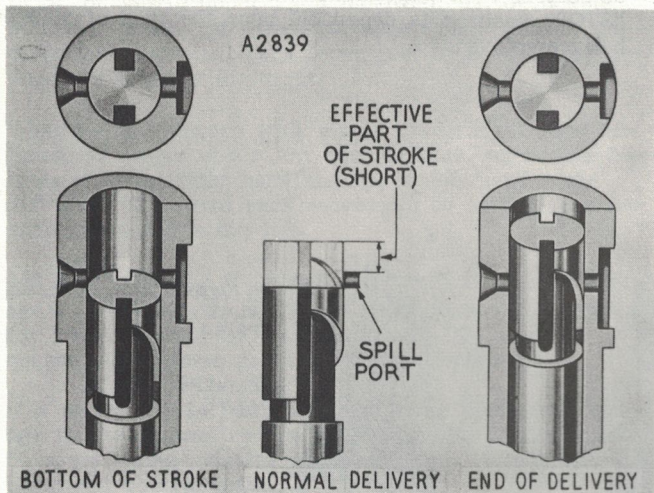


FIGURE 2-6 - Normal Delivery

When the vertical slots in the plunger are in line with one of the barrel ports, as illustrated in Figure 2-7, there is no effective stroke and, therefore, no fuel delivery.

The positioning of the plunger helix is controlled by the movement of the control rack, segment gear and control sleeve - See Figure 2-8. The lower end of the control sleeve is slotted to engage the plunger flange - and located at the upper end is the segment gear that meshes with the teeth of the control rack. Longitudinal movement of the control rack, either manually or by governor action, rotates the plunger in either direction and thus varies the quantity of fuel delivered by the pump - See Page 10.

2.1-4 DELIVERY VALVE ACTION (Figure 2-9) -
The delivery valve assembly, located directly above the plunger, assists the injection function by preventing irregular loss of fuel from the delivery to the supply side of the system between pumping strokes.

The delivery valve assembly consists of a valve with a conical seat and a valve body with corresponding mating seat. Opening pressure is controlled by the delivery valve spring that engages the top of the valve.