CERTIFICATE OF APPROVAL No 5/6B/23

This is to certify that the pattern and variants of the

Epex M7 Flowmeter

submitted by Engineering Products Pty Ltd,
418 Burnley Street,
Burnley, Victoria, 3121,

have been approved under the Weights and Measures (Patterns of Instruments) Regulations as being suitable for use for trade.

Date of Approval: 14 August 1974.

The pattern and variants are described in Technical Schedule No 5/6B/23, and in drawings and specifications lodged with the Commission.

The approval is subject to review on or after 1 September 1979.

All instruments conforming to this approval shall be marked with the approval number "NSC No 5/6B/23".

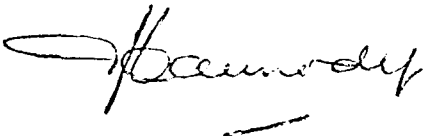
Approval is granted on condition that:

1. The flow rate be limited to a maximum of 230 litres per minute when the Liquid Controls gas separator is fitted, and to a maximum of 260 litres per minute when the Epex gas separator is fitted.

2. The pump suction operate under a positive liquid head when the Liquid Controls gas separator is fitted.

3. The liquids measured to be limited to viscosity between 1 and 5 mm^2/s only.

Signed



Executive Officer

Indexed

14/8/74

NATIONAL STANDARDS COMMISSION

TECHNICAL SCHEDULE No 5/6B/23

Pattern: Epex M7 Flowmeter

Submittor: Engineering Products Pty Ltd,
418 Burnley Street,
Burnley, Victoria, 3121.

Date of Approval: 14 August 1974

Conditions of Approval:

1. The flow rate is to be limited to a maximum of 230 litres per minute when the Liquid Controls gas separator is fitted, and to a maximum of 260 litres per minute when the Epex gas separator is fitted.

2. The pump suction is to operate under a positive liquid head when the Liquid Controls gas separator is fitted.

3. The liquids measured are to be limited to viscosities between 1 and 5 mm^2/s only. The liquid for which the flowmeter is calibrated is to be nominated on the instrument data plate.

All instruments conforming to this approval shall be marked "NSC No 5/6B/23".

Introduction:

The flowmeter (see Figures 1 and 2) is a vehicle-mounted instrument for the delivery of liquid petroleum of viscosity between 1 and 5 mm^2/s. It comprises a flooded-suction measuring system fitted with electrically operated controls to minimise the non flow-dependent error caused by hose dilation. The system ensures that the maximum difference in the liquid pressure in the hose at the beginning of a delivery and at the end of a delivery is in the order of 65 kPa (9 psi).

Referring to Figure 2:

The hose pressure at the start of a delivery will be the "no-flow" pressure

set by the spring-loaded part of the pilot-operated pump by-pass valve. * When the nozzle is opened the flow switch senses the flow of liquid and closes the solenoid-operated pilot valve which causes the pump by-pass valve to close and increase the pressure to "full-flow" pressure.

At the end of a delivery when the flow switch senses the no-flow condition, it opens the solenoid-operated pilot valve which allows the pump by-pass valve to open, dropping the pressure back to the "no-flow" pressure. The pressure in the hose simultaneously drops to the "no-flow" pressure, say, 120 kPa, or to 90 kPa (13 psi) if the pump is stopped, as liquid in the hose flows back to the supply tank through the solenoid-operated by-pass valve which is open when the hose pressure is above 90 kPa.

If prior to a delivery the nozzle has been opened, the hose pressure will have fallen to the anti-drain valve pressure, normally 55 kPa (8 psi), and similarly, if the nozzle is opened after a delivery and after the pump has stopped, the hose pressure will drop to 55 kPa. As a result the maximum variation in hose pressure which will cause the non flow-dependent error of hose dilation will be from 55 kPa to "no-flow" pressure, say, about 120 kPa (17 psi), a range of 65 kPa (9 psi).

Due to backlash in the meter and indicator the quantity of liquid indicated as moving through the meter in the forward direction when the pressure in the hose builds up to full-flow pressure at the start of a delivery will be more than the quantity subtracted from the reading when the delivery is finished and the hose pressure falls to "no-flow" pressure of 120 kPa or to 90 kPa, as appropriate, by liquid flowing back from the hose through the meter to the supply tank. This causes an additional non flow-dependent error.

Description:

The pattern (see Figures 1 and 2) is for a flowmeter to measure liquid petroleum within a viscosity range of 1 and 5 mm^2/s (heating oil).

The flowmeter comprises the following:

1. Positive displacement pump mounted on the assembly at a point

* Note: The actual pressure in any installation should be determined during the non flow-dependent error tests.

lower than the minimum height of the liquid in the supply tank. The supply pipe from the tank to the pump slopes downward to the pump.

2. Pump by-pass valve (see Figures 2 and 3) maintains "no-flow" pressure when the pilot valve is open, and "full-flow" pressure when the pilot valve closes.

3. Liquid Controls E.1-42100 gas separator (see Figure 4).

4. Liquid Controls M7 meter (see Figure 4).

5. Indicator and ticket printer (see Figures 4 and 5) which comprise a Veeder-Root Model 1558 register (UK) or 169100 or 169200 (USA) and Model KE 1630 ticket printer modified for single-handle reset by fitting a chain drive. The ticket printer has 1-litre increments and the indicator has 0,1-litre graduations; the right-hand indicator wheel has 100 graduations of which each tenth graduation is numbered from 0 to 9. The indicator and printer make an addition to the indicated quantity when the drive shaft from the meter rotates in one direction and a subtraction when rotation is in the reverse direction. During the resetting process a shutter covers the quantity-indicating wheels other than the right-hand wheel.

6. Flow-detecting non-return valve (see Figures 2 and 6). The pilot valve is closed by the flow switch only when the nozzle is open and liquid is flowing through the non-return valve.

7. Solenoid-operated by-pass valve (see Figures 2 and 6). The pressure switch closes the solenoid-operated by-pass valve when the hose pressure falls to 90 kPa (13 psi). The pressure switch controlling the operation of the solenoid-operated by-pass valve is located within a sealed enclosure (see Figure 7).

8. Hose — up to 75 metres of "1$\frac{1}{4}$-inch" bore hose mounted on a hose reel.

9. Anti-drain valve (see Figure 8) — an anti-drain valve and swivel coupling is fitted on the end of the hose. The anti-drain valve retains a pressure of not less than 55 kPa (8 psi).

10. Nozzle — any nozzle fitted with an integral anti-drain valve which retains a pressure of not less than 5 kPa (1 psi) and which is

located downstream of the main nozzle valve may be used.

11. Test button — a spring-loaded button which, when held pressed, closes the pilot valve and allows the pump pressure to build up to "full-flow" pressure is located within the sealed enclosure containing the pressure switch.

12. Marking — an instrument data plate sealed to the instrument is marked:

    (a) "approved for heating oil only"; and

    (b) "maximum length of hose x metres",

    x being the length of hose fitted at verification.

13. Sealing — the following parts of the system are sealed:

    (a) pump by-pass valve (see Figure 3);

    (b) meter (see Figure 4);

    (c) the enclosure containing the pressure switch and the test button (see Figure 7);

    (d) the flow-detecting non-return valve (see Figure 6); and

    (e) the instrument data plate.

The approval includes the following:

1. An Epex gas separator (see Figures 9 and 10) may be used, in which case the positive displacement pump may be mounted higher or lower than the minimum height of the liquid in the supply tank and the supply pipe from the tank to the pump need not slope downward to the pump. The maximum flow rate is increased to 260 litres per minute.

   The Epex gas separator is fitted with a float-operated switch which will open the pilot valve and reduce the pump pressure to "no-flow" pressure whenever air accumulates in the top of the gas separator (see Figure 11). The flow rate at no-flow pressure is less than 20% of full flow rate.

When the pump is mounted higher than the minimum height of the liquid in the supply tank, a gas-separation test valve is fitted into the pipe between the supply tank and the pump. The valve fitted is of a type that enables the quantity of air admitted to be readily controlled so as to reduce the flow rate in stages of, say, 90%, 80%, 70%, etc., of full flow rate.

The gas-separation test valve is sealed (see Figure 12).

2. When fitted with a preset stop and cut-off valve (see Figure 13), an OPW 1190 AD nozzle is used. The presetting mechanism is located between the meter and register and the shut-off valve is between the meter and the flow-detecting non-return valve.

   The OPW 1190 AD automatic hose nozzle (see Figure 14) is fitted with a dashpot which controls the closing rate of the main valve. The dashpot adjustment is sealed by a lead plug seal (see Figure 14). The nozzle may have a bent spout or a plastic guard, in which case the suffix S or G respectively is added to the name.

3. The flowmeter as a fixed installation.

4. With or without a ticket printer.

5. The flowmeter measuring kerosene or similar liquid petroleum products within a viscosity range of 1 and 5 mm^2/s. The instrument data plate will be marked specifically with the product to be used; for example:

   "approved for kerosene only".

Special Tests:

1. The instrument should be tested with the liquid for which it will be used and which is marked on the instrument data plate. The length of hose fitted during testing should not be less than the length marked on the instrument data plate.

2. Pressure Settings — a pressure gauge is inserted in the pipe between the hose and the non-return valve.

   (a) "no-flow" pressure: start the pump with the nozzle closed —

pressure gauge should indicate not less than 120 kPa (17 psi).

Note: If the "no-flow" pressure is set too high the instrument will fail the test for non flow-dependent error;

(b) pressure switch: stop the pump with the nozzle closed — the pressure gauge should indicate about 90 kPa (13 psi);

(c) anti-drain valve: with the pump stopped open the nozzle — the pressure gauge should indicate about 55 kPa (8 psi).

3. Non Flow-dependent Error

(a) Hose dilation and meter and indicator backlash — with the pump stopped and the hose unwound from the reel, open the nozzle to reduce the hose pressure to the anti-drain valve retaining pressure of about 55 kPa. Then zero the indicator, start the pump, press the test button for sufficient time to allow full-flow pressure to be attained and then release the test button. The reading remaining on the meter is the non flow-dependent error caused by hose dilation and meter and indicator backlash.

(b) Variation of quantity in nozzle — if the integral anti-drain valve in the nozzle is not fitted or is not operating, the quantity of liquid contained in the nozzle and its fittings between the external anti-drain valve and the main nozzle valve will be a non flow-dependent error.

The efficiency of the integral anti-drain valve, and the nozzle non flow-dependent error, may be determined by:

(i) starting the pump, opening and closing the main nozzle valve, stopping the pump and through a drain plug reducing the hose pressure to less than 55 kPa; and

(ii) then opening the nozzle main valve and measuring the drainings. The quantity of drainings is a non flow-dependent error.

(c) Printing error of 1 increment, that is, 1 litre; if a ticket printer is not fitted there will be an indication error of 0,1 litre.

The sum of the above non flow-dependent errors should not exceed 2,5 litres if a ticket printer is fitted, and 1,6 litres without a ticket printer.

When a ticket printer is fitted the minimum delivery for which the relative error from all sources, including the 2,5-litre non flow-dependent error, would not exceed 1,5% is 210 litres.

When a ticket printer is not fitted the minimum delivery for which the relative error from all sources, including the 1,6-litre non flow-dependent error, would not exceed 1,5% is 130 litres.

4. Gas Separation (Liquid Controls gas separator) — The effect of gas on the indication of the quantity delivered should not exceed 0,5% when the supply tank is allowed to run dry during a delivery. It will be necessary to stop the pump when the supply tank is empty, refill the supply tank and restart the pump to finish the delivery into the proving measure.

5. Gas Separation (Epex gas separator)

   (a) When the pump is mounted lower than the minimum height of liquid in the supply tank, the gas-separation test for the Liquid Controls gas separator applies.

   (b) When the pump is mounted higher than the minimum height of liquid in the supply tank, the gas-separation test valve is opened in stages so that the flow rate is reduced due to the presence of air to, say, 90%, then 80%, 70%, etc., of full flow rate.

   A separate test delivery should be made at each flow rate.

6. Dashpot Adjustment (OPW 1190 AD hose nozzle when the preset cut-off valve is fitted) — The dashpot should be adjusted so that the main nozzle valve closes more slowly than the preset cut-off valve. The hose pressure should drop to the anti-drain valve retaining pressure when the preset emergency-stop button is pressed simultaneously with the release of the main nozzle valve. A hose pressure significantly higher than the anti-drain valve pressure of about 55 kPa would indicate that the nozzle valve closed before the preset valve.

National Standards Commission

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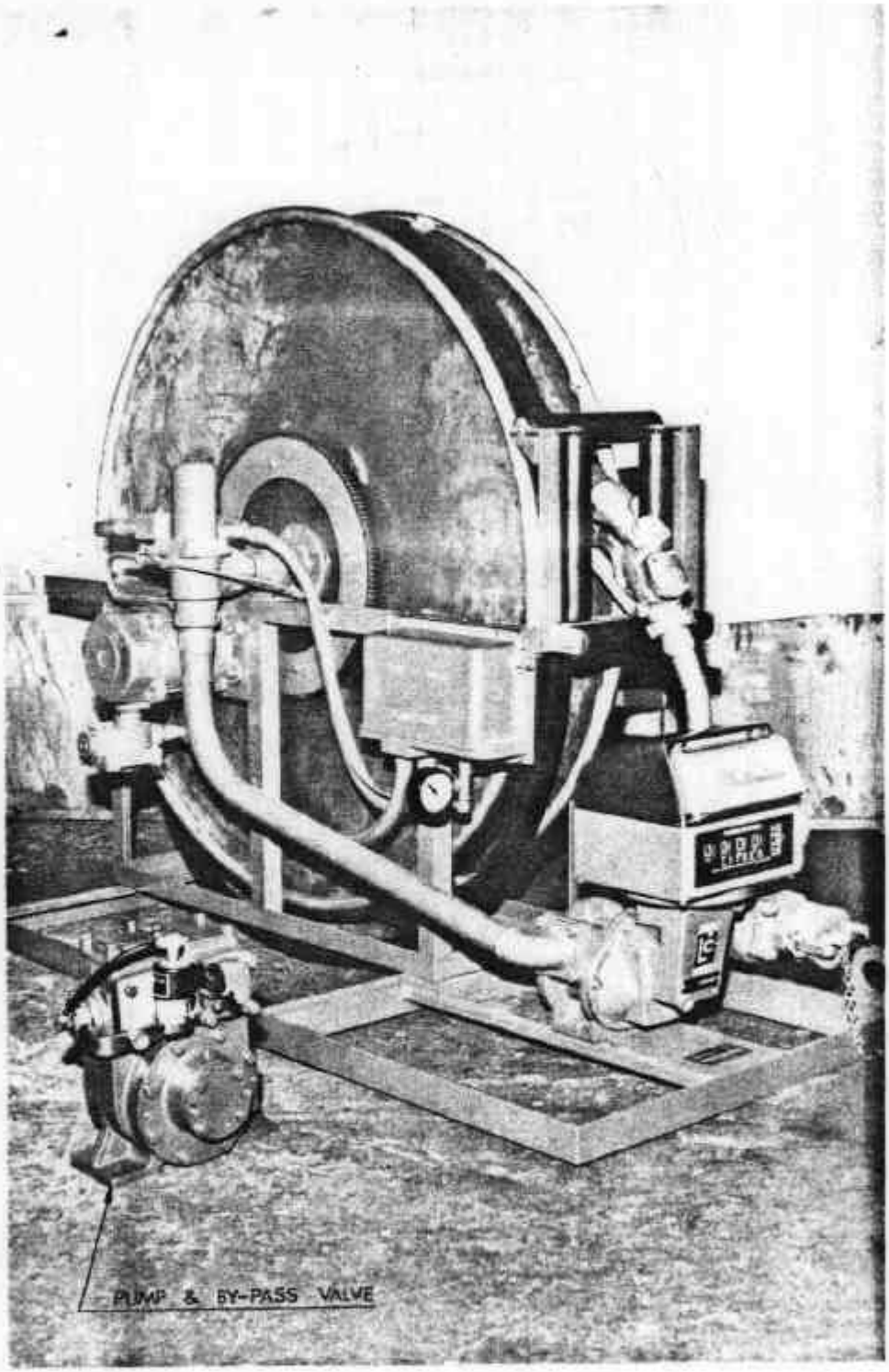
Signed

Executive Officer

FIGURE 5/6B/23 - 1



Epex M7 Flowmeter

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FIGURE 5/6B/23 - 2

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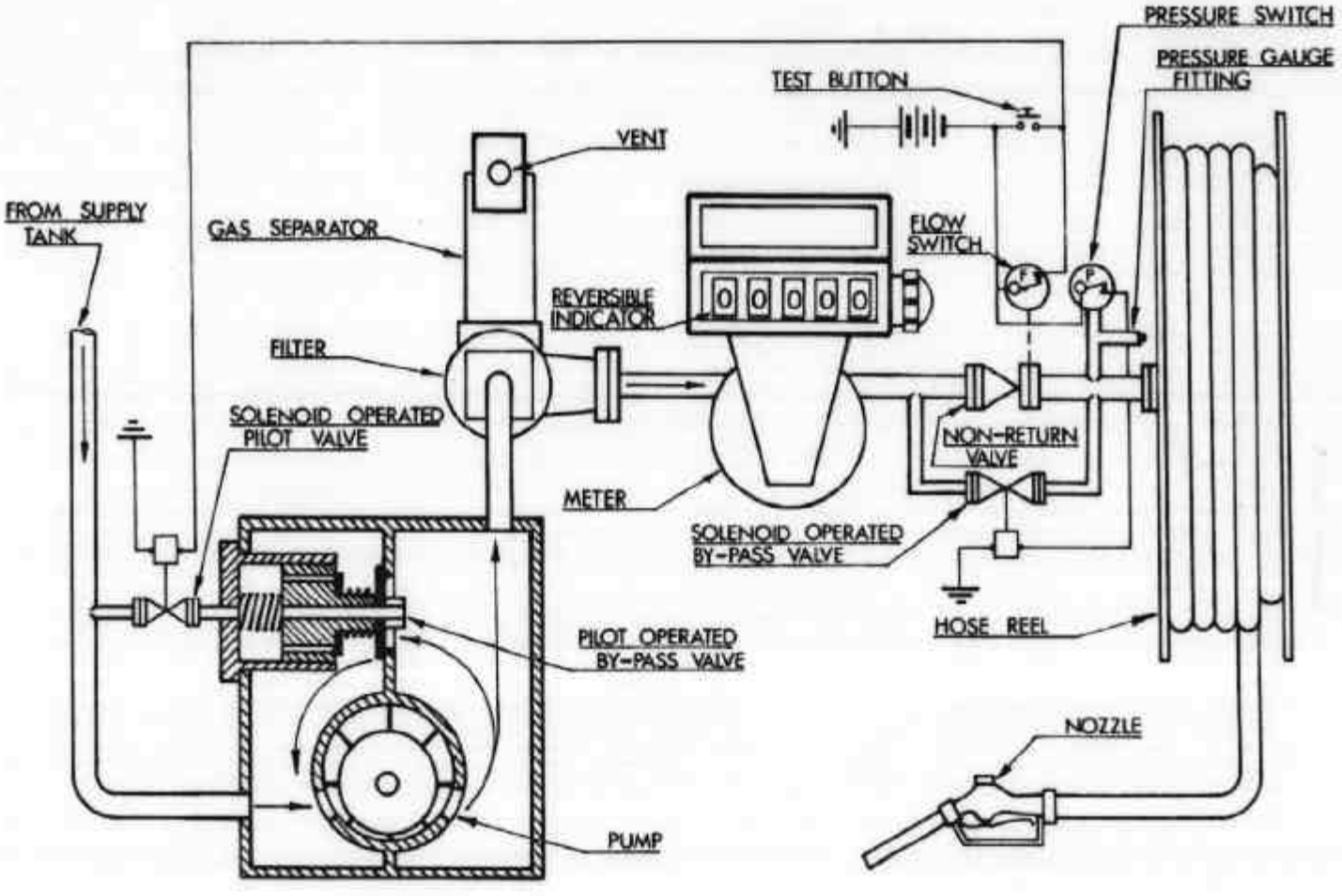
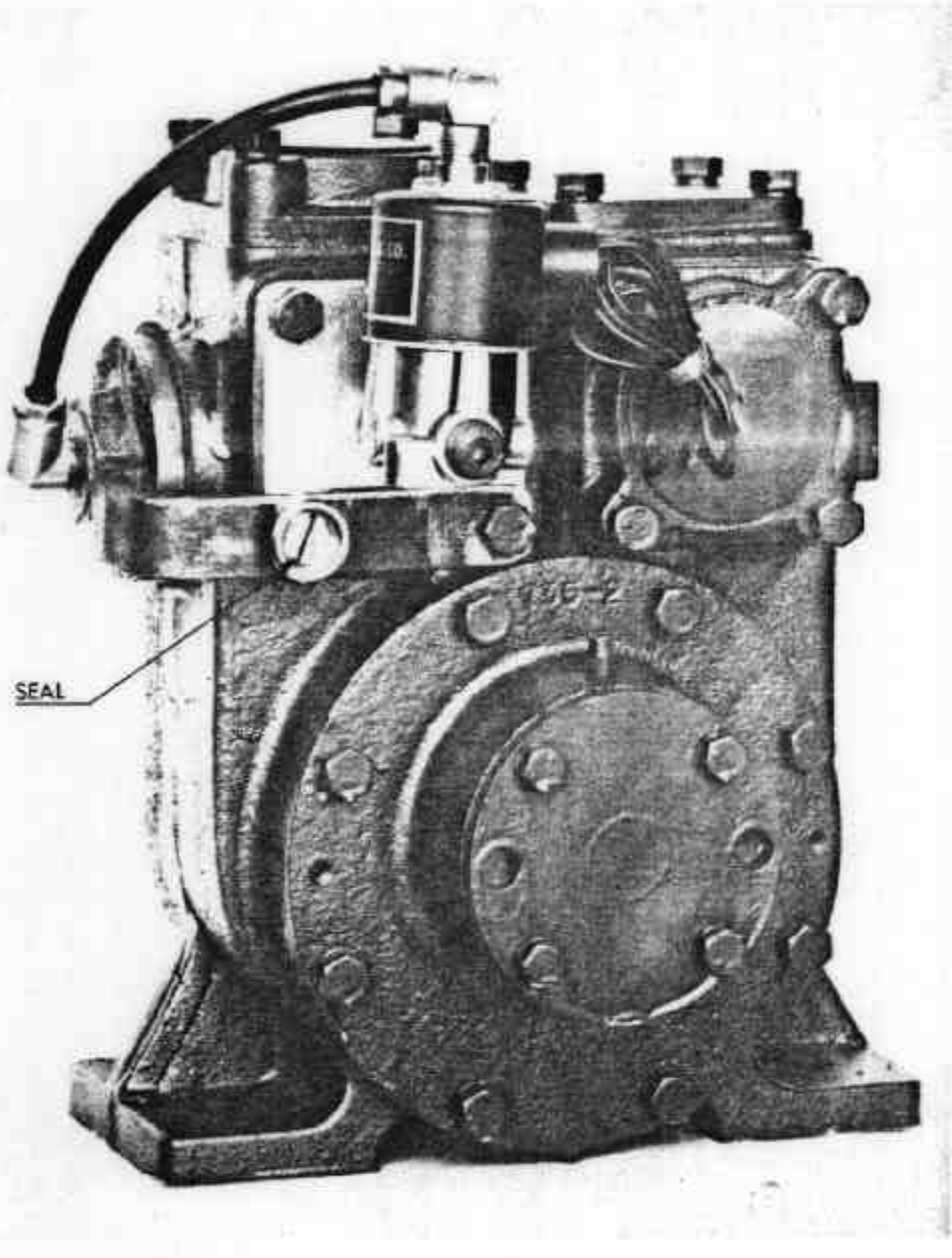


Epex M7 Flowmeter — Schematic Diagram

FIGURE 5/6B/23 - 3



Pump and By-pass Valve

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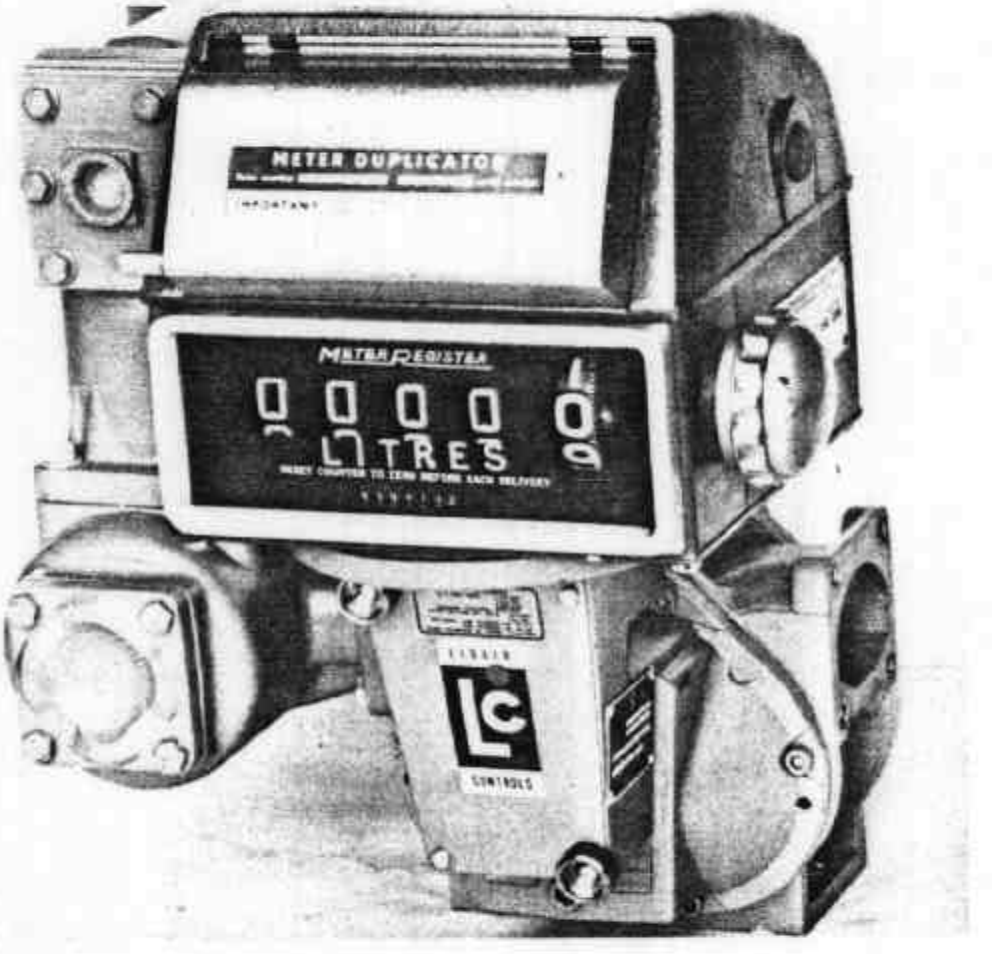
FIGURE 5/6B/23 - 4



Liquid Controls Meter, Gas Separator, Indicator and Ticket Printer
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FIGURE 5/6B/23 - 5

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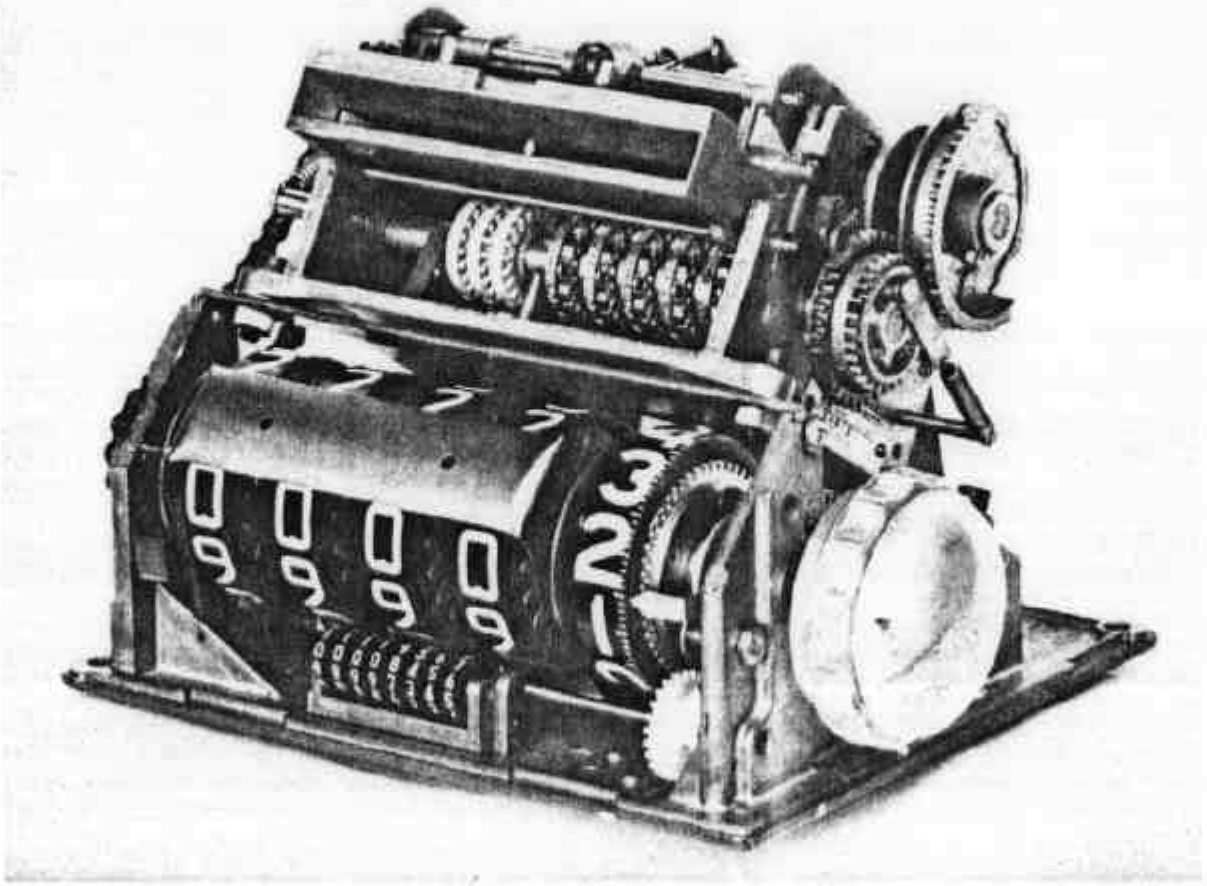
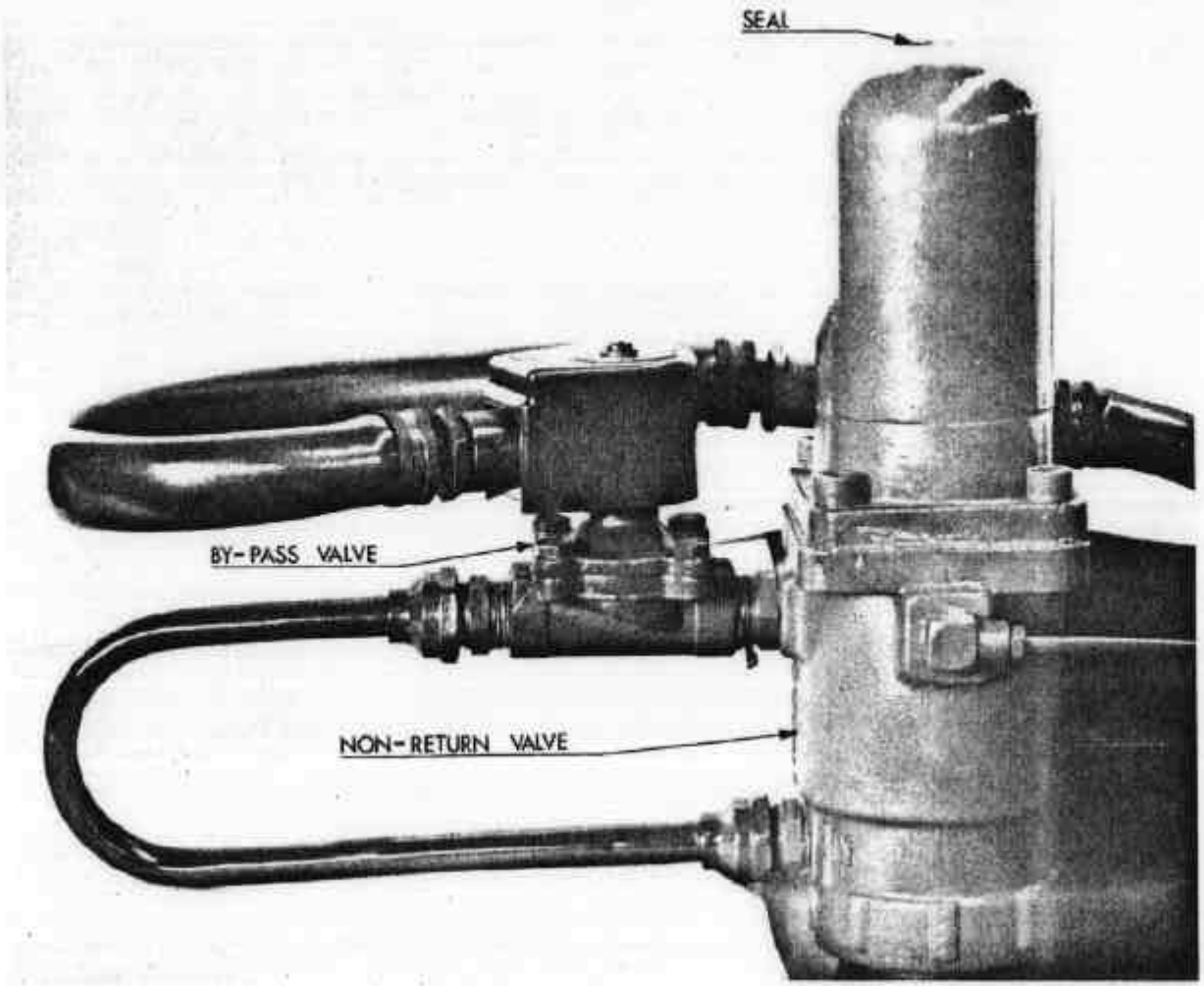


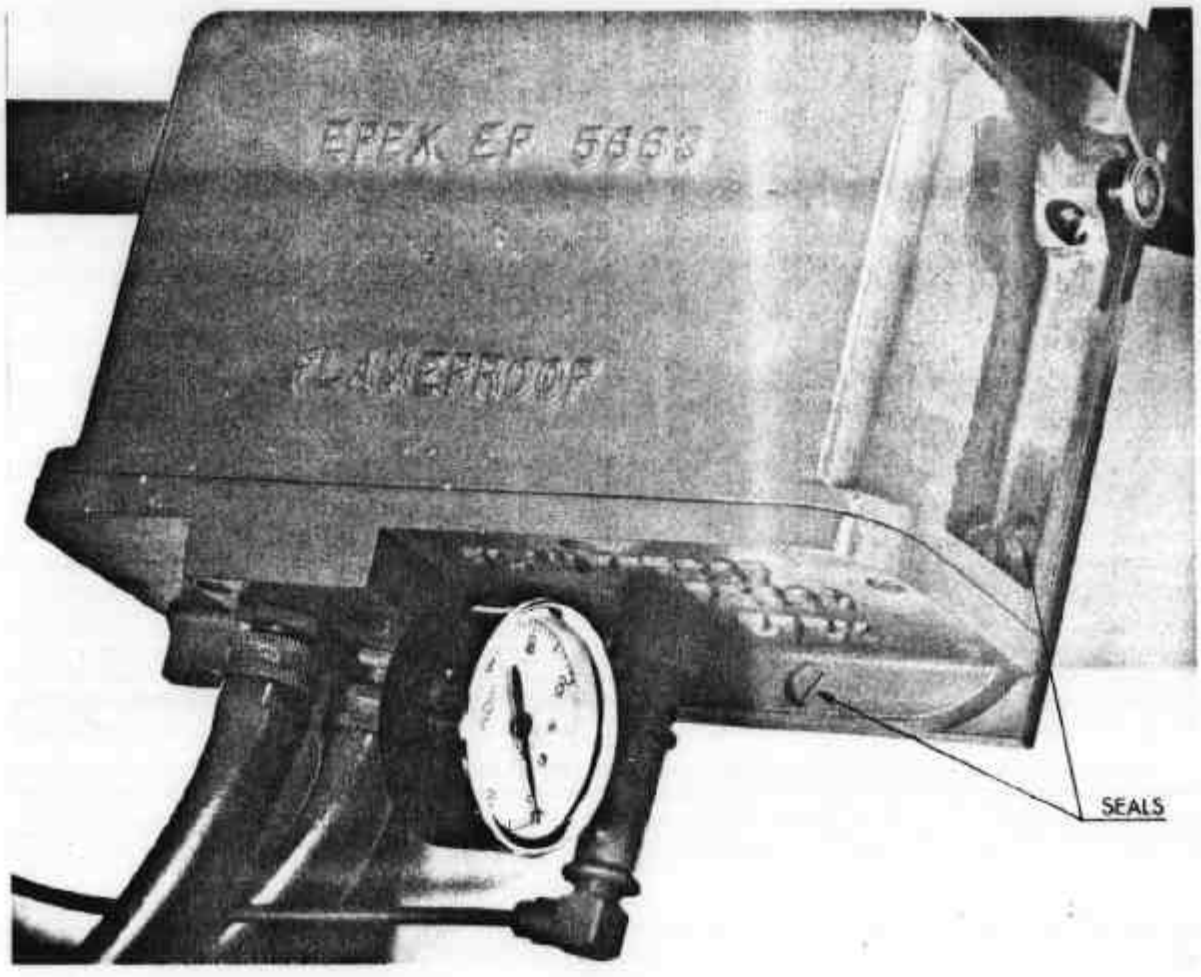
Veeder-Root Indicator and Ticket Printer (modified for single-handle reset)

FIGURE 5/6B/23 - 6



Flow-detecting Non-return Valve and Solenoid-operated By-pass Valve

FIGURE 5/6B/23 - 7



Pressure Switch Enclosure

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FIGURE 5/6B/23 - 8

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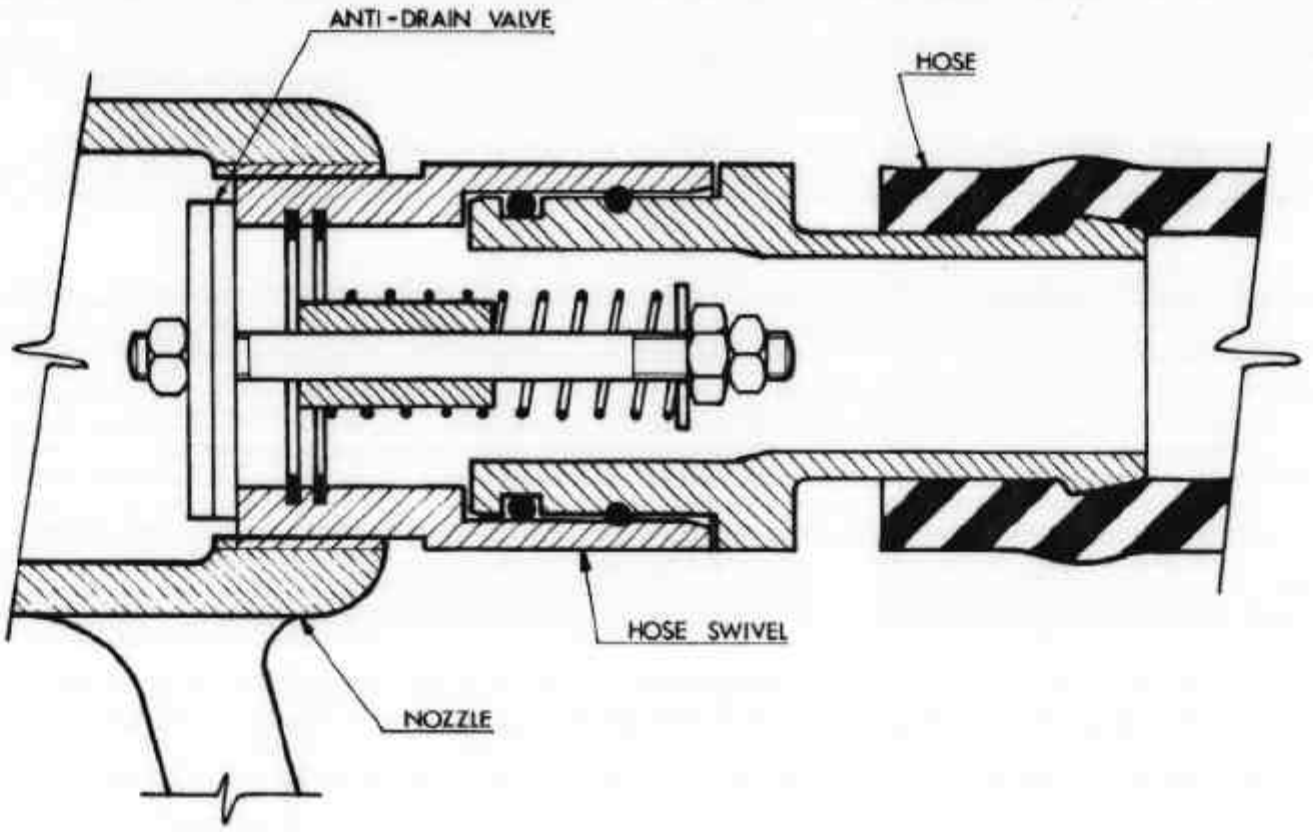

Anti-drain Valve and Swivel Coupling — Schematic Diagram

FIGURE 5/6B/23 - 9

Epex M7 Gas Separator

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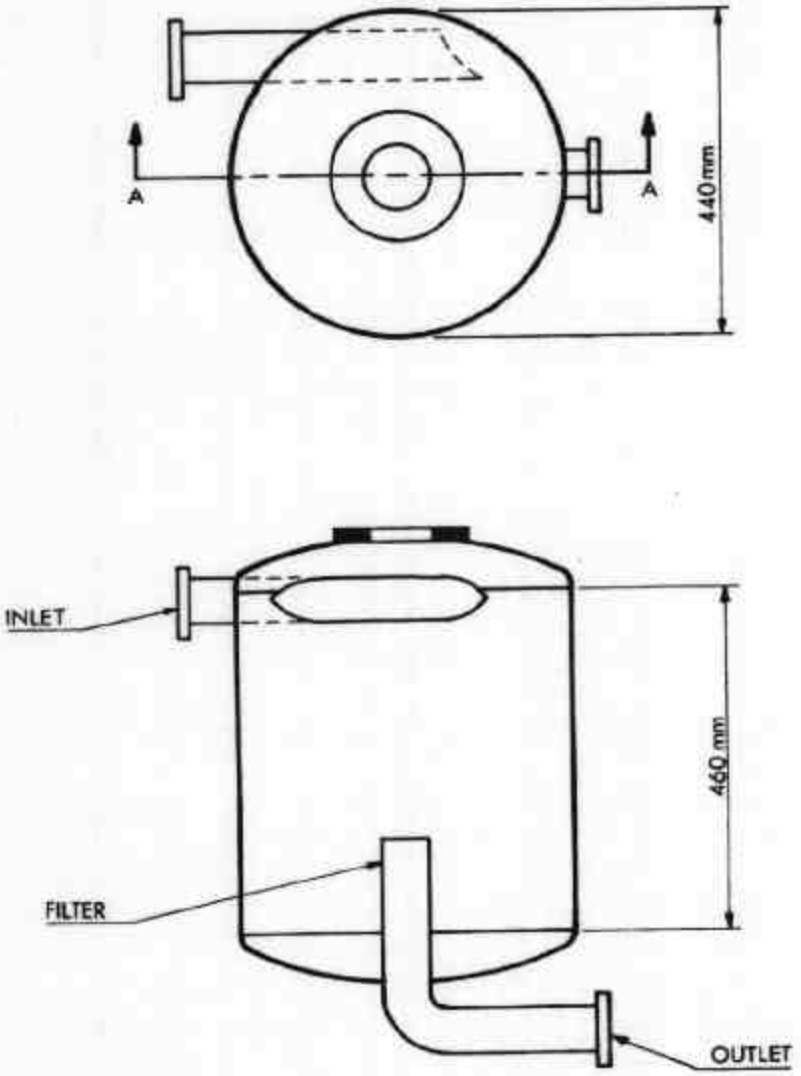
FIGURE 5/6B/23 - 10



Epex M7 Gas Separator — Schematic Diagram

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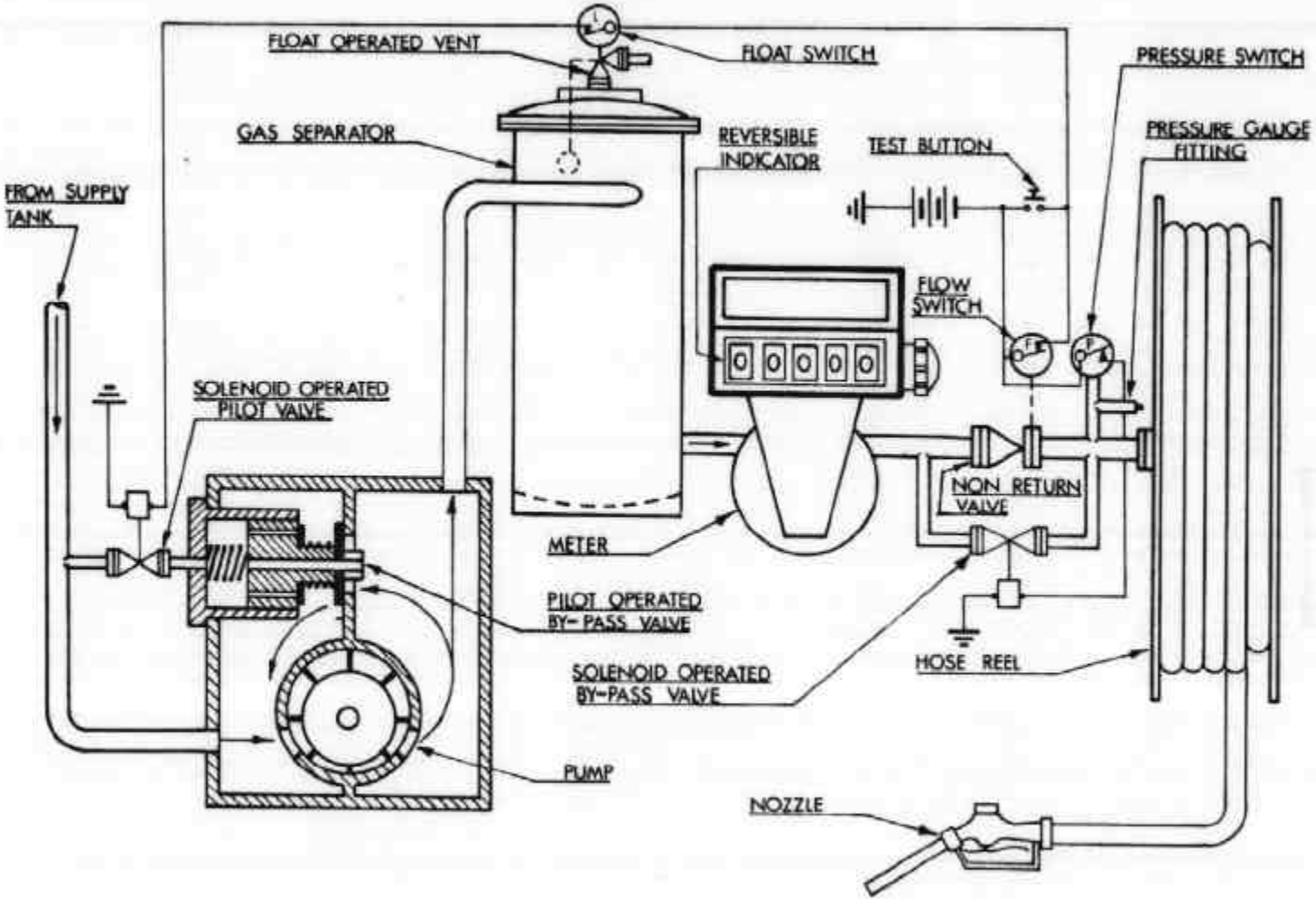
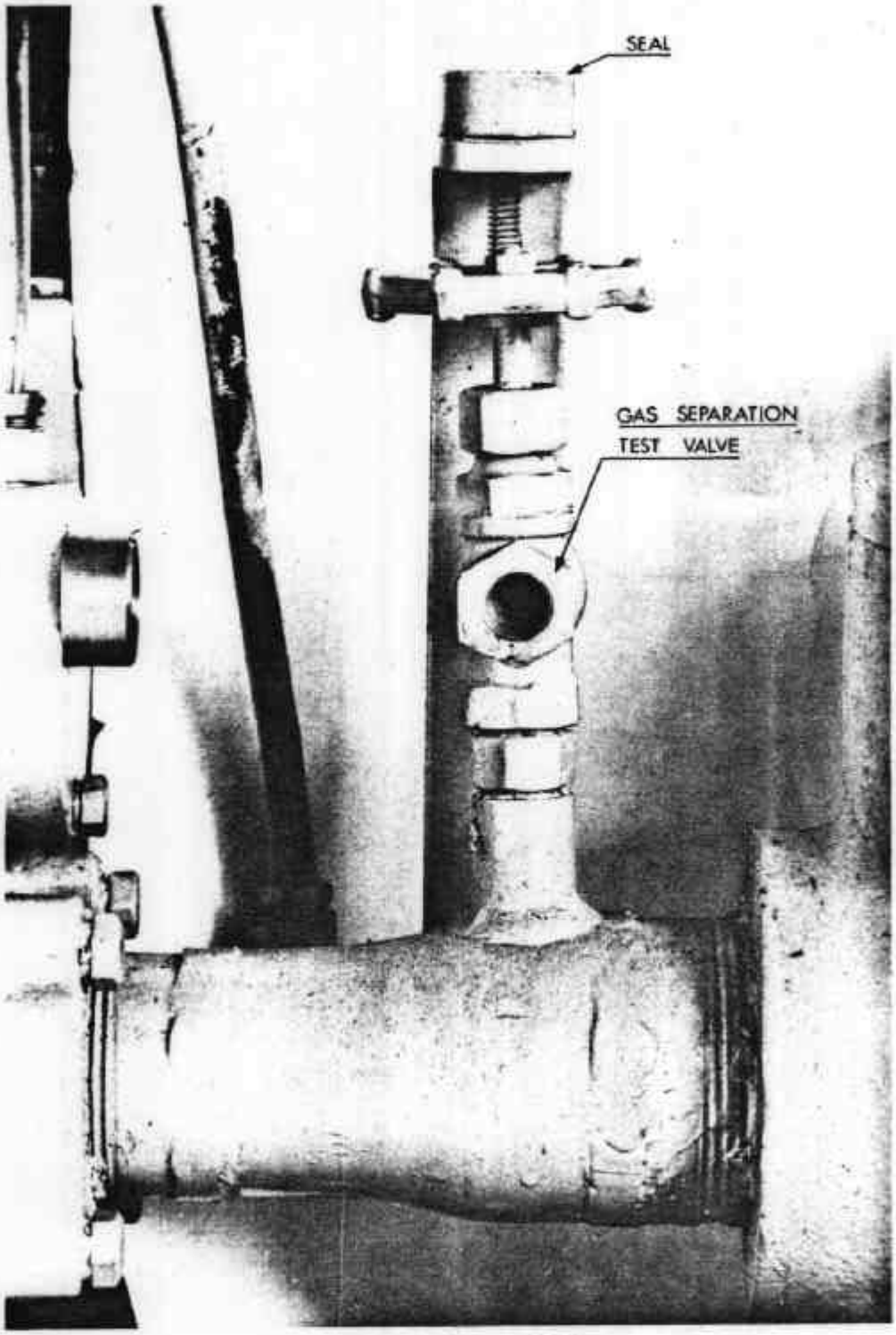
FIGURE 5/6B/23 - 11



Epex M7 Flowmeter with Epex M7 Gas Separator — Schematic Diagram

FIGURE 5/6B/23 - 12



Gas-separation Test Valve

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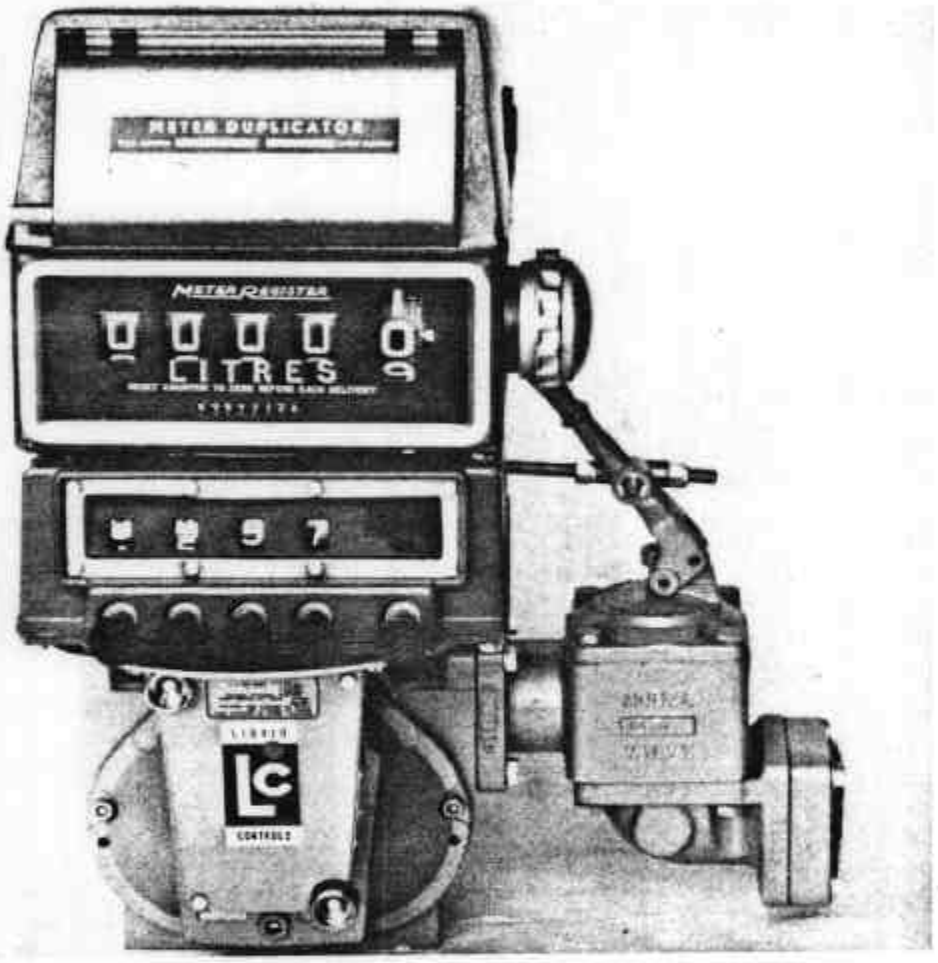
FIGURE 5/6B/23 - 13



Preset Stop and Cut-off Valve

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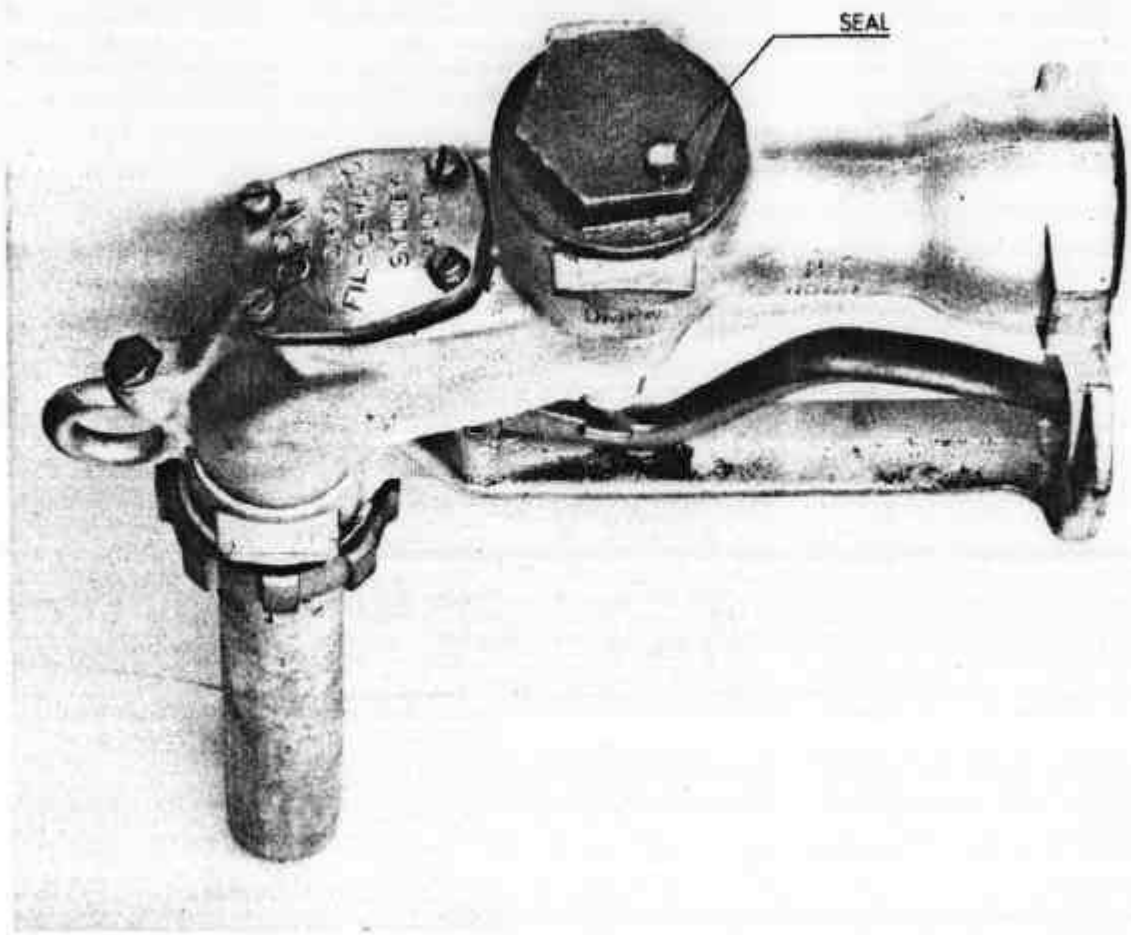
FIGURE 5/6B/23 - 14



OPW 1190 AD Automatic Hose Nozzle