



**Pursuant to section 12 of the
Weights and Measures Act 1985
Certificate No 2767/1 Revision 4**

issued by:

The National Measurement Office

In accordance with the provisions of section 12 of the Weights and Measures Act 1985, the Secretary of State for Business, Innovation & Skills has issued this UK national type-approval certificate to:

**Mechtronic Ltd
15 Lower Wortley Road
Leeds
West Yorkshire, LS12 4RY
United Kingdom**

and hereby certifies as suitable for use for trade the following pattern a vehicle-mounted liquid fuel meter measuring system:

Model designation	Mechtronic 'Maxflow 800'
Maximum rate of flow	757 litres / minute 575 litres / minute (Maxflow 400 system)
Minimum rate of flow	75 litres / minute 57 litres / minute (Maxflow 400 system)
Maximum operating pressure	8 bar
Minimum delivery	200 litres: pumped hose reel
Minimum delivery	1000 litres: pumped bulk
Liquids measured	liquids other than water of low viscosity (<20mPa.s) except liquefied gas)

The necessary data (principal characteristics, alterations, securing, functioning etc) for identification purposes and conditions (when applicable) are set out in the descriptive annex to this certificate.

Under the provisions of section 12(6) of the said Act, the validity of this certificate is limited as shown below.

Note: This certificate relates to the suitability of the equipment for use for trade only in respect of its metrological characteristics. It does not constitute or imply any guarantee as to the safety of the equipment in use for trade or otherwise.

This revision replaces previous versions of the certificate.

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**Signatory: P R Dixon
for Chief Executive**



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1 INTRODUCTION

This pattern is a meter measuring system inclusive of a product return system fitted to a road tanker for the transport and delivery of liquids with low viscosity stored at atmospheric pressure. The measuring system can be configured to give a temperature compensated delivery.

The pattern covers both Mechanical Meter Head and Electronic Meter Head systems, with variants to cover Additive Injection Systems, deliveries from a drawbar tank trailer, self loading through the meter and for the Electronic Meter only a dry-line hose reel system

It comprises a multi-compartment tank, an optional multi-compartment manifold pipe and valve system, an optional pump fitted with a pneumatic relief valve, filters, a meter, a special gas extractor, a full hose reel, a dry delivery line, selector valves and compatible ancillary equipment. Product return comprises spouts with non return valves, guard bar assembly and interlock system.

Variants comprise:

- Additive Injection System linked into the meter head.
- Metered self loading.
- Deliveries made from a drawbar tank trailer.
- Dry-line system for use with the hose reel delivery system.

The system, with variants, allows:

- (a) metered delivery by pumping (full hose)
- (b) metered delivery by pumping (dry hose)
- (c) direct delivery, with or without pumping, without passing through the meter.
- (d) unlimited product return, including transfer of product from one compartment to another.
- (e) unmetered self loading.
- (f) metered self loading
- (g) metered delivery by hose reel with additive injection

The hydraulic system is shown in Figures 1, 2, 3, 4 & 5 which is followed by a key (Figure 6).

Note: Maxflow 400 should be marked on the system plate with Certificate Number 2767.

2 MECHANICAL METER HEAD

2.1 CONSTRUCTION

2.1.1 Hydraulics

The hydraulic system is shown in Figures 1. Liquid may flow from any of the selected compartments of the cargo tank via the appropriate foot valve and manifold valve into the manifold. From there it passes through an electronically controlled special gas extractor **SgP** which is fitted within the manifold which in turn acts as the outlet from the manifold into the pump suction pipe. The liquid then passes through an optional flexible coupling or hose into a cargo pump fitted with a pneumatically operated relief valve **P**, **PRv**. From there it passes through an optional 2 way valve **R2** which allows a metered delivery or a metered bulk delivery. Metered deliveries pass through an optional filter, meter **C**, flow sensing valve **FSv**, system isolation valve **PIV**, 2 way valve which allows full hose or empty hose delivery **R3**, hose-reel **FH1**, hose and trigger nozzle **cla**.

2.1.2 Special gas extractor

Schematic shown in Figure 3. This is a form of 'special gas extractor' manufactured by Mechtronic Ltd type MF400. The MF400 consists of a housing optionally secured between two manifold valves thus forming part of the manifold pipe. The housing is closed off by a housing lid. The MF400 contains an optic detector probe, **S1**, a microprocessor controlled vent valve, **T3**, and a fitting used to connect an optional manifold balance pipe. The housing also provides for a second optic probe, **S2**, fitted into the lower part of the housing just prior to the outlet flange. Both top and bottom probes, **S1** & **S2**, are connected to the special gas extractor electronic control unit, **CU**.

The special gas extractor electronic control unit converts the signals received from the optic probes into pneumatic/electrical signals controlling the pneumatic relief valve, **PRv**, on the pump, the system isolation valve, **PIV**, and the gas extractor vent valve, **T3**.

Gas from the MF400 is vented, via a valve, controlled by the special gas extractor electronic controller, into a liquid collection tank, **T1**. The collection tank is vented to atmosphere and is fitted with a drain valve, **Dv**.

2.1.3 Meter

This is a Tuthill Transfer Systems FPP Meter Division positive displacement meter. Approved by EEC certification No UK04 2702. The pattern is a rotary positive displacement type meter with two oval gear rotors. Optionally, any suitable approved meter type may be used.

2.1.4 Meter head assembly

The meter head assembly comprises of the following Veeder-Root equipment

- | | | |
|-----|-----------------|---------|
| (a) | Counter | VR 7887 |
| (b) | Ticket printer | VR 7888 |
| (c) | Preset | VR 7889 |
| (d) | Counter/printer | VR 7890 |

2.1.5 Pump

This pattern will accept any pump fitted with a pneumatically operated relief valve capable of producing the required minimum and maximum flow rates and pressures.

2.1.6 Electronics

The special gas extractor electronic control unit houses both the electronic control module and solenoid operated pneumatic valves in the one housing. The front cover of the housing allows viewing of the status LEDs. The LEDs give the operator a real time status of the special gas extractor's optic probes and the open closed status of the special gas extractor vent valve, the pump relief valve and the system stop start valve. The software version number (1.1) is displayed through the front panel. Access to the software is limited by the control module being manufactured without a software programming interface.

2.1.7 Power supply

The special gas extractor electronic control is powered by the vehicle battery. In the event of a power failure all pneumatic valves fail in the normally closed state thus stopping the delivery. The delivery can not be restarted until power is reinstated. The special gas extractor electronic control unit is optionally switched on and off by a pressure switch connected to the power take off pneumatic engagement signal

2.2 OPERATION

The system allows pumped metered deliveries through

- a) the full hose reel
- b) empty bulk discharge hose
- c) unmetered deliveries
- d) optional, unmetered self loading.

Metered deliveries. The direction of flow is controlled by a pneumatically operated 2 way valve **R3**, directing flow to either the full hose or empty hose delivery system. Interlocks are provided to ensure that the 2 way valve **R3** if operated during a delivery will cease the delivery. After completion of an empty hose delivery the hose is cleared of product by introducing compressed air into the system from air tank **AT** via blow down valve **Bd**. Sight glass **Sg**, provides indication of an empty hose.

Unmetered deliveries. The direction of flow is controlled via a manual 2 way valve **R2** situated between the pump and meter. Movement of this valve during a metered delivery will have no effect upon the integrity of the metered delivery. Once liquid has passed the meter there are no other possible outlets other than the hose end nozzle or the empty bulk hose.

Optional self loading of the vehicle is permitted as the auxiliary suction is taken from the manifold which is situated upstream of the special gas extractor. When in self loading mode the special gas extractor is shut down thus closing the product isolation valve. No metered deliveries can be made whilst the external suction valve is open.

The pneumatic and electronic circuitry has been designed on a fail safe principle, such that in the event of pneumatic failure, disconnection or electrical failure then the system will shut down.

Metered delivery is set up by selecting the product and thus the compartment to be opened. The power take off is engaged energising the manifold control system and special gas extractor control unit. The manifold valve is then opened. The 2 way valve **R2** is set for metered delivery and then the 2 way valve **R3** is set for either full hose or empty hose delivery. If a preset delivery is required then the meter preset is set. A ticket is inserted into the meter and the meter preset valve is opened. Once the hose end nozzle is opened the delivery will commence. The special gas extractor will control the rate of flow via the pump relief valve and the product isolation valve during the delivery ensuring that no air/gas can leave the special gas extractor during the delivery. At the completion of the delivery the ticket is printed and the system shut down.

3 ELECTRONIC METER HEAD

3.1 CONSTRUCTION

3.1.1 Hydraulics

The hydraulic system is shown in Figure 2. Liquid may flow from any of the selected compartments of the cargo tank via the appropriate foot valve and manifold valve into the manifold. From there it passes through an electronically controlled special gas extractor **SgP** which is fitted within the manifold which in turn acts as the outlet from the manifold into the pump suction pipe. The liquid then passes through an optional flexible coupling into a cargo pump fitted with a pneumatically operated relief valve **P**, **PRv**. From there it passes through either **PIV1** (Hose) or **PIV2** (Bulk) which allows either a metered delivery or a metered bulk delivery. Metered deliveries pass through an optional filter, meter **C**, system isolation valve **PIV**, hose reel **FH1**, hose and trigger nozzle **cla**.

3.1.2 Special gas extractor

Schematic shown in Figure 3. This is a form of 'special gas extractor' manufactured by Mechtronic Ltd type MF400. The MF400 consists of a housing optionally secured between two manifold valves thus forming part of the manifold pipe. The housing is closed off by a housing lid. The MF400 contains an optic detector probe, **S1**, a microprocessor controlled vent valve, **T3**. The housing also provides for a second optic probe, **S2**, fitted into the lower part of the housing just prior to the outlet flange. Both top and bottom probes, **S1** & **S2**, are connected to the special gas extractor electronic control unit, **CU**.

The special gas extractor electronic control unit converts the signals received from the optic probes into pneumatic/electrical signals controlling the pneumatic relief valve, **PRv**, on the pump, the system isolation valve, **PIV1/PIV2**, and the gas extractor vent valve, **T3**.

Gas from the MF400 is vented, via a valve, controlled by the special gas extractor electronic controller, into a liquid collection tank, **T1**. The collection tank is vented to atmosphere and is fitted with a drain valve, **Dv**.

The special gas extractor control unit is fitted with a security shield (Figure 14) which prevents unauthorised access to the wiring and the removal of the unit. The countersunk screw holding the unit in place is secured by a hologram seal (Figure 10). The security number from the seal is displayed on the EMR3 display head on start up of the display (Figure 15). The security number is inputted into the display head whilst in C&C mode. Once the C&C switch is sealed (Figure 16) the number cannot be changed

3.1.3 Meter

Optionally a Tuthill Transfer Systems, FPP Meter Division, positive displacement meter. Approved by EEC certification No UK04 2702. The pattern is a rotary positive displacement type meter with two oval gear rotors. Optionally, any suitable approved meter type may be used.

3.1.4 Meter head assembly

The Electronic meter display head used in this system is the Veeder-Root EMR3. The EMR3 consists of 2 major components, the Display Head and an Interconnecting Box (IB). Approved under NMO test certificate GB-1285.

The Veeder Root EMR3 electronic display head is mounted within the Mechtronic control cabinet alongside the special gas extractor (Figure 17). Each mounted on their respective separate mounting panels. All wiring to and from the display head is protected and sealed by the NMO external seal. (Figures 13 & 14). By sealing in this manner the panels can be removed from the control cabinet for maintenance work without breaking the NMO seal.

3.1.5 Pump

This pattern will accept any pump fitted with a pneumatically operated relief valve capable of producing the required minimum and maximum flow rates and pressures.

3.1.6 Interlock

The delivery must be ended and a ticket must be printed before the next transaction can start.

3.1.7 Software

The software issue status of the EMR³ is displayed upon switch-on. Current issue status is F08. Previous versions are FB2, F04 & F07.

The software issue status of the Special Gas Extractor (1.1) is displayed through the front panel. Access to the software is limited by the control module being manufactured without a software programming interface. Software operational logic is shown in Figure 12.

3.1.8 Power supply

The special gas extractor electronic control is powered by the vehicle battery. In the event of a power failure all pneumatic valves fail in the normally closed state thus stopping the delivery. The delivery cannot be restarted until power is reinstated. The special gas extractor electronic control unit is optionally switched on and off by a pressure switch connected to the power take off pneumatic engagement signal.

3.2 OPERATION

The system allows pumped metered deliveries through:

- a) the full hose reel
- b) empty bulk discharge hose
- c) unmetered deliveries
- d) any of the above (a, b, or c) but from a drawbar trailer attached to the tank truck with liquid passing through the manifold
- e) optional, unmetered self loading.
- f) optional metered self loading (ticket printed with 'Product Transfer Delivery')

a, b) Metered deliveries. The direction of flow is controlled by a pneumatically operated valve either **PIV1** or **PIV2**, directing flow to either the full hose or empty hose delivery system. Interlocks are provided to ensure that only one valve can be open at any time during a delivery. After completion of an empty hose delivery, the hose is cleared of product by introducing compressed air into the system from air tank **AT** via blow down valve **Bd**. Sight glass **Sg**, provides indication of an empty hose.

c) Unmetered deliveries. The direction of flow is controlled via a manual 2 way valve **R2** situated between the pump and meter. Movement of this valve during a metered delivery will have no effect upon the integrity of the metered delivery. Once liquid has passes the meter there are no other possible outlets other than the hose end nozzle or the empty bulk hose.

d) Optional, deliveries as above but from a drawbar tank trailer. An additional manifold section is attached to the manifold with a piped connection leading to the rear of the tank truck. (Figure 23) An auxiliary air eliminator **AAE** is fitted into the extra manifold section to evacuate air trapped between the drawbar trailer pipe work and the manifold before the manifold is opened and a delivery started. Once the delivery is started the special gas extractor **SgP** performs its normal function.

e) Optional, non metered self loading of the vehicle is permitted through valve **R1**. The auxiliary suction is taken from the manifold which is situated upstream of the special gas extractor. When in self loading mode the special gas extractor is shut down thus closing the product isolation valve. No metered deliveries can be made whilst the external suction valve is open.

f) Optional, metered self loading (Figure 4). An additional manifold section (Figure 22) is attached to the manifold with a piped connection to an inlet connection. An additional mechanical air eliminator **AE** is fitted into the delivery pipe work before the meter. The action of selecting the self load option in the control cabinet inhibits the use of the special gas extractor and thus closes valve **T3**. The trigger nozzle **cla** is connected to a product return spout **Pt** necessitating the raising of the guard bar. At the conclusion of the self loading operation a ticket is produced which is stamped 'Product Transfer Ticket'

The pneumatic and electronic circuitry has been designed on a fail-safe principle, such that in the event of pneumatic failure, disconnection or electrical failure then the system will shut down.

4 VOLUME CONVERSION

A temperature correction algorithm is stored in the EMR³ for automatic volume correction when in the temperature correction mode. Volume conversion may be implemented using an optional temperature probe. A thermometer icon is displayed when being used in volume conversion mode.

4.1 Electronic Temperature Probe

This is a two-wire thermistor which is used as an associated measuring instrument. It is manufactured by US Sensor Corporation and has part number USP2119. The temperature sensor (figure 16) is installed in the fuel delivery pipe within one metre from the flow meter; a typical installation is shown in Figure 17.

Other temperature probes may be used in place of the above thermistor provided they meet the accuracy requirements of OIML R117 paragraph 2.7.2.

NOTE: PT100 type temperature probes will not operate with the EMR³ system.

4.2 Calibration of the temperature probe

The temperature probe is calibrated at 0°C in the C&C mode with the probe immersed in a water/ice mixture. After calibration, this setting cannot be altered without breaking the seal on the Register Head. The following procedure shall be used:

1. Fill the bottom (about 100 mm) of a 1 litre container with ice.
2. Centre the temperature probe in the container, and then put ice all around it and on top of it until the container is full.
3. Fill the container with water until it is level with the ice.
4. Verification should be performed in still air and out of direct sunlight.
5. Allow 2-5 minutes for the temperature measuring devices to stabilize.
6. Select 0°C for the CALIBRATE TEMP on the EMR³ whilst in C&C mode.
(Refer to EMR³ Set up and Operation Manual No: **577013-766** • for detailed information on using the setup menus.)

To test a probe, connect each lead to an ohmmeter and measure the resistance. At 25°C, the meter should read about 10 K ohms.

An error code E08 will be displayed if the probe wires are either shorted together or are not connected to the TP terminals in the EMR³.

4.3 Indication of measurement result

A legend is affixed adjacent to the volume indication clearly indicating that the volume dispensed is corrected to 15°C (Figure 20). The delivery ticket also indicates that the volume dispensed is corrected to 15°C.

4.4 Securing

The temperature sensor is secured to prevent removal from the fuel line. A sealing wire is threaded through a pre-drilled hole in the probe body and passed around the pipe, the wire ends are drawn taught and secured with an approved seal. The probe lead is hard wired within the EMR³ unit which is secured to prevent unauthorised entry.

5 TECHNICAL DATA

Technical data Maxflow 800		unit
Nominal bore:	30 to 100	mm
Maximum rate of flow:	757	litres / minute
Minimum rate of flow:	75	litres / minute
Maximum working pressure:	8	bar
Minimum delivery Hose:	200	litres
Minimum delivery Bulk:	1000	Litres

Technical data Maxflow 400		unit
Nominal bore:	30 to 100	mm
Maximum rate of flow:	575	litres / minute
Minimum rate of flow:	57	litres / minute
Maximum working pressure:	8	bar
Minimum delivery Hose:	200	litres
Minimum delivery Bulk:	1000	Litres

Liquids measured: liquids other than water of low viscosity (<20mPa.s) except liquefied gas)

The maximum rate of flow, however, must not be greater than the maximum rate of flow of any component of the system

6 INSCRIPTIONS

The following inscriptions are marked on a plate attached to the system :

	Maxflow 800	Maxflow 400
(1) The Certificate number:	2767/1	2767
(2) The manufacturer's name:	Mechtronic Ltd	Mechtronic Ltd
(3) The serial number:		
(4) The date of manufacture.		
(5) The manufacturer's designation.	Maxflow 800	Maxflow 400
(6) The maximum rate of flow	757 L/min	575 L/min
(7) The minimum rate of flow	75 L/min	57 L/min
(8) Minimum delivery hose	200 litres	
(9) Minimum delivery bulk	1000 litres	N/A
(10) The liquids measured:	Derv; Gas oil, Kerosene, Paraffin	
)		

7 SEALING

The following shall be sealed to prevent unauthorised adjustment or dismantling:

- the components of the meter chamber, pulser and mechanical meter head in accordance with the requirements of their relevant pattern approvals.
- the plate referred to in Section 6 shall be sealed or welded to a support of the system.
- Dry-line sealing as laid out in section 9.3

- d) The EMR³ electronic register C&C switch shall be sealed as shown in Figure 16.
- e) Hologram sealing label on Maxflow Controller facia with security number displayed on EMR3 display head upon start up. Figure 15.
- f) temperature probe if fitted as per 4.4

8 AUTHORISED ALTERNATIVES

8.1 The system as described in the descriptive annex but without the Mechtronic product return system.

8.2 The system as described in section 11 with an extra manifold section fitted into the manifold to facilitate delivery from a drawbar tank trailer.

8.3 The system as described in section 12 with an extra manifold section fitted into the manifold and an air eliminator fitted on the downstream side of the meter to facilitate metered self loading.

8.4 An additive injection system fitted into the suction side of the pump pipe work as described in section 13.

8.5 The system as described in the descriptive annex but using any suitable approved meter.

8.6 The system as described in the descriptive annex but utilizing a Dry-Line Hose delivery system as described in 9.0, used in conjunction with the Veeder-Root electronic EMR³ system.

8.7 Having a remote reading device used with the EMR³ which can be used by the operator to stop a delivery in an emergency. It displays the volume being dispensed as shown on the EMR³ but it not used for metrological purposes.

8.8 Maxflow 400 system should be marked as Certificate No 2767. The system as described in the certificate but with a maximum flow rate of 575 lpm and having no bulk dry line facility. All as described in section 14.

9 DRY-LINE SYSTEM

9.1 Introduction

The dry-line system is fitted to the standard system and interfaces with the system valve controls via the IB connecting box, printer and return guard bar status indication system. The objective of the system is to provide a dry-line delivery system that is automatic in its operation and prints an additional line on the ticket to confirm that the line is dry. In the event that the delivery is terminated as a frustrated delivery then the driver can finish the delivery as 'frustrated' by taking an option from the Dry-Line Display screen which allows the delivery to be finished with an extra line printed on the ticket stating that a credit for 'x' litres will be issued. The clearing of the line is performed by compressed air from a dedicated air reservoir. The air reservoir is fitted with pneumatic isolation valves controlling the charging and discharging of the air reservoir and a pressure sensor relaying the rate of pressure change within the reservoir to the dry-line controller. Due to this monitoring of pressure, a profile of pressure decay against time can be stored within the Dry-Line Controller for each system (necessary to take care of differing length and diameter of delivery hose), this profile is used to determine if the blow down has completed correctly. In the event that the trigger nozzle has been closed during a blow down then the decay profile will show this and an 'incomplete blow down' message will appear on the display and printing of a ticket interrupted. The delivery can only be finished once a correctly executed blow down has taken place or the 'frustrated delivery' option is taken. If a frustrated delivery has taken place then the hose is blown down back to the tank truck. This is performed by raising the product return guard bar connecting the trigger nozzle and performing a manual blow down. The raising of the guard bar and blow down are stored in the Dry-Line Controller's memory. All events within the dry-line system are stored and can be retrieved via the screen. The dry-line controller is shown in figure 21 and a schematic shown in figure 24.

9.2 Construction

9.2.1 Mechanical

The blow down system comprises of typically a 20-30 litre air reservoir fitted with pneumatic isolation valves controlling both the charging and discharging of the tank, a pressure sensor and a drain tap. The inlet valve is connected via pneumatic tubing to the truck auxiliary air supply. The outlet valve is connected to a non return valve fitted into a socket fitted into the product delivery line close to the Product Isolation Valve. Air line connection fittings are of the nut and olive type fitted with a plastic security seal. The pressure transducer is connected via cable to the blow down control cabinet.

9.2.2 Electronics

CPU unit, LCD Display unit, input switches and solenoid valves all mounted within a small cabinet with connections to 24volt power, printer through the RS485 connection within the EMR³, output relays from the EMR³ IB box and product return guard bar switch.

9.2.3 Operation

The total volume of the hose and associated product pipe work to the Product Isolation Valve **PIV** is measured and entered into the system (Figure 24). (This total volume is made up of two volumes, the first is that of the flexible hose. The hose volume is calculated by the DLC after the hose length and diameter are entered **9.4**. The second volume constitutes the fixed steel/aluminium pipe work taken from the **PIV** to the end of the hose reel hub. This volume is either calculated by measuring the length and diameter of the pipe or measured by the tank builder by filling the pipe then releasing the contents into a container which is then subsequently measured).

This total volume is used to notify the customer how much credit is required following a frustrated delivery. Following tests, the pressure requirement for the blow down air reservoir is determined and entered into the system. Once the system variables have been inputted the system is ready for use.

The Dry Line Controller (DLC) is switched into run mode after receiving a signal from the EMR³ to open the PIV and pressurize the pneumatic relief valve. The DLC will check the air reservoir for pressure, fill to the required level if required, then send the signal down to the PIV and pump relief valve to start the delivery. If the signal from the EMR³ is switched off by either the system pre-set, the remote stop button is pushed or the emergency stop is activated then the DLC will immediately shut the PIV and open the relief valve then open the output valve from the air reservoir and blow down the hose. Once the blow down is complete the DLC will recharge the reservoir and wait for the start signal from the EMR³. If the finish button is pressed then the EMR³ will finish the delivery and print the ticket. The DLC monitors the print instruction from the EMR³ and waits for the ticket print to end, it then sends an additional line confirming blow down complete to the printer. When printing is complete the DLC sends a finish command to the EMR³ which then waits for the signal from the printer that the ticket has been removed. In the case of a frustrated delivery then the finish button is pressed on the EMR³ which prints a ticket. The DLC again waits for the print to finish and adds a line stating that a credit is required for the undelivered quantity. To clear the line of product the driver accesses the manual blow down option from the screen, connects the nozzle to the product return spout and starts the blow down.

9.2.4 Security Features

9.2.4.1 A delivery cannot take place unless the blow down air reservoir is fully charged.

9.2.4.2 A delivery cannot take place until a ticket has been produced from the previous delivery thus confirming a correct or frustrated delivery.

9.2.4.3 A ticket cannot be produced unless a blow down complies with the parameters held within the DLC. The system will allow for multiple blow down attempts.

9.2.4.4 A historical log is made of every event. This can be recalled via the DLC screen.

9.2.4.5 If the blow down is incomplete then the ticket is printed 'blow down incomplete xx litres to be credited'.

9.2.4.6 If the trigger nozzle is closed during a delivery then the blowdown will fail. If the driver returns any product to the truck then the act of raising the product return guard bar initiates the printing of the ticket as described above.

9.2.4.7 If the nozzle is partially closed to slow down the flow during blowing down procedure then the blow down will time out.

9.3 Security Sealing

The pneumatic fittings securing the pneumatic tube between the Pneumatic Isolation Valve (out) and the non return valve fitted to the product pipe work shall be sealed using Mechtronic seals.

9.4 Checking the Dry-line parameters

The dry line parameters can be checked via the System Info screen:

- To access that screen, make sure that Dryline is on the main menu.
- Use the arrow keys to select "System Info" and then press OK.
- The hose length and internal diameter will be displayed on the screen in the format 'XXXft x YYYY"', where XXX is the hose length, in feet and YYYY is the hose internal diameter, in inches. For example: 100ft x 1.25" = 100ft hose with an ID of 1.25in. Press OK to return to the main screen.

The parameters are protected by a password that is held by Mechtronic. Once the hose length or diameter is altered the system then recalculates the volume. The volume cannot be changed any other way.

10 PRODUCT RETURN

The system is designed to allow product to be returned to a compartment to permit the changeover of product following the completion of a delivery, but to inhibit product return until the ticket from that delivery has been withdrawn.

10.1 Construction

10.1.1 Hydraulics

The system is shown in Figures 1 and 2, which is accompanied by a key in Figure 7. A general view is shown in Figure 9.

10.2 Operation - mechanical meter head

10.2.1 Normal delivery

At the start of a delivery when the ticket is inserted and the printer handle is operated, the ticket is positioned by a slider and locked in place by a retaining pin that passes through a punched hole in the ticket. Closing the slide blocks the pneumatic signal to the product isolation valve **PIV** (Figure 1) rendering it closed. With the product return guard bar in its closed position a cam within the product return arm operates pneumatic valve **GbV** (Figure 1) sending a pneumatic signal to the product isolation valve thus opening the valve. Delivery is carried out normally. On completion, the printer handle is operated to print and releases the ticket.

10.2.2 Product return

For product changeover, the mechanical catch holding the product return bar in its closed position is released and the product return guard bar raised, the wet-hose nozzle is then connected to the product transfer spout, which incorporates a non-return valve. Once raised, the pneumatic valve **GbV** actuated by the product return arm cam shuts off the pneumatic signal to the product isolation valve **PIV** rendering the valve closed. If a ticket is still in the printer then the printer handle is operated to print and release the ticket from the previous delivery. This opens **PrV** and sends a pneumatic signal to the product isolation valve **PIV** thus opening the valve. The quantity of product to be returned is entered on the pre-set device and pumping is started.

When the product return is complete, the meter pre-set shuts off product flow and the hose-end nozzle is manually closed. The blowdown valve **Bd** is manually opened. This allows compressed air from the air tank **AT** to purge product from the bottom-loading pipework from **Pt** back into the compartment. Duration is approximately 2-5 seconds. The hose end nozzle is then removed from the product return spout, the product return guard bar lowered into its rest position which then deactivates the product return system.

10.3 Operation - electronic meter head

10.3.1 Normal delivery

The product return guard bar is in the down position giving a normal delivery signal to the EMR3 display head. In this position the delivery takes place as laid out on the delivery instructions secured to the inside of the control cabinet door. If the product return guard bar is lifted whilst in a normal delivery situation the system will terminate the delivery and print a ticket. To resume the delivery the guard bar must be returned to its down position and a new delivery started.

10.3.2 Product return

For product changeover, the product return guard bar is raised, the wet-hose nozzle is then connected to the product transfer spout, which incorporates a non-return valve. Once the guard bar is raised, a signal is given to the EMR3 display head that a product transfer delivery is to take place. The quantity of product to be returned is entered on the pre-set device and pumping is started.

When the product return is complete, the meter pre-set shuts off product flow and the hose-end nozzle is manually closed. The blow down valve **Bd** is manually opened. This allows compressed air from the air tank **AT** to purge product from the bottom-loading pipe work from **Pt** back into the compartment. Duration is approximately 2-5 seconds. The hose end nozzle is then removed from the product return spout, the product return guard bar lowered into its rest position which then deactivates the product return system.

10.4 Security features and interlocks

10.4.1 If, during a normal delivery, the product return guard bar is raised, the delivery is immediately terminated and a ticket must be printed before another delivery can be started.

10.4.2 If a ticket is inserted into the mechanical printer during the product return operation, the pneumatic signal from **PrV** to the product isolation valve **PIV** will be lost . This will close the product isolation valve **PrV** and product transfer will cease.

10.4.3 Product cannot be diverted into a compartment via a product transfer connector during a normal delivery because the raising of the product return guard bar causes the delivery to be terminated.

11 DELIVERIES MADE FROM A DRAWBAR TANK TRAILER

The system is designed to allow an option of metered deliveries to be made from a drawbar tank trailer. The system uses an additional manifold section **AMv** (Figure 23) without an API adaptor or product return facility. The operation of opening the valve is controlled by the standard controls within the control cabinet. In essence it deals with the drawbar as though it were another compartment. To cater for the expulsion of air in the fixed pipe work on the truck and that trapped in the flexible hose between the drawbar tank API and tank truck auxiliary suction coupling, an auxiliary air eliminator **AAE** is fitted into the additional manifold section. The fitting of this valve expels the majority of trapped air before the special gas extractor, thus reducing the time before a delivery can commence.

11.1 Construction

11.1.1 Hydraulics

The system is shown in Figure 4 which is accompanied by a key in Fig7.

11.2 Operation

Connection is made from the drawbar tank trailer API to the auxiliary suction connection on the tank truck **C4**. The foot valve on the drawbar is opened, product flows through the pipe work and displaces any residual air out of the auxiliary air eliminator **AAE**. The delivery is then made using the same procedure as though it was from a compartment on the tank truck.

12 METERED SELF LOADING

The system is designed to allow an option of metered self loading for stock reconciliation purposes. When self loading has taken place the ticket produced will be marked 'Product Transfer Ticket'.

12.1 Construction

12.1.1 Hydraulics

The system is shown in Figure 5 which is accompanied by a key in Figure 7.

12.2 Operation

Connection is made from a third part tank to connection **C4** via a flexible hose. The load position is selected in the control cabinet which opens the auxiliary manifold valve **AMv** (Figure 22) and switches off the Special Gas Extractor thus ensuring valve **T3** is closed. The product return guard bar is raised and the hose end nozzle attached to a product return spout. The nozzle is opened and the meter set to deliver either a preset or unlimited delivery. The transfer of product from the 3rd party tank into the tank truck takes place. Any air that is displaced during the transfer is eliminated by the mechanical secondary air eliminator. At the conclusion of loading a ticket is produced showing the amount loaded and stamped 'Product Transfer Ticket'.

13 ADDITIVE INJECTION

The system is designed to allow an option of additive to be injected into the product being delivered. In some instances it will be a single additive system and in others it will be a multiple injection system. Each system although packaged in the one housing is a complete stand alone and separate system. The amount of additive injected into the product can range from 200 mltrs/1000 ltrs to 500mltrs/1000 ltrs and therefore has no detrimental effect on the product characteristics that could influence the calibration setting of the truck meter.

13.1 Construction

13.1.1 Each additive injection system consists of a holding tank, nominally 20 ltrs, a solenoid driven diaphragm pump energised by the pulse output of the EMR3, a flow switch and an injector fitting incorporating a non return valve with a pressure setting of 300 mbar.

The additive injection system will only operate with a preset delivery. The delivered amount must be known in order that the number of injection pulses can be calculated. A flow sensing switch is fitted into each delivery line and monitors the amount of strokes and hence the volume of additive injected. The flow switch pulses are read by the additive microcontroller and compared against the pump strokes. If 3 pump strokes are made without any corresponding strokes received from the flow switch then the delivery is stopped. This guarantees that the customer receives product and additive in the correct proportions.

The system is connected into the meter system as per figure 2.

13.2 Operation

Operation of the system is completely automatic. Once the driver has selected a product that requires additive from the product list held in the EMR3 head, he will continue to complete the delivery in the normal way. The system will shut down if pulses are not received from the flow switch and therefore deliveries cannot take place if the additive tank is empty. The 300 mbar check valves ensure that no additive can be dragged into the suction line during the delivery of non additive products.

14 MAXFLOW 400 SYSTEM - CERTIFICATE 2767

As described in the certificate but with the following differences:

14.1 The meter is changed from a 3" to a 2" model with a maximum flow rate of 575 lpm.

14.2 The system only employs a hose reel pumped delivery system. Metered bulk is not available. The system is shown in Figure 6 which is accompanied by a key in Figure 7

14.3 The system plate is changed to reflect the differing flow rate and Certificate number of 2767.

15 RECOMMENDED TESTS

15.1 The meter measuring system shall be tested at a minimum of two substantially different rates of flow between the maximum and minimum rates of flow.

15.2 The meter measuring system shall be tested by a minimum of three repeat runs at each rate of flow. Each run shall have a minimum duration of one minute.

15.3 Due regard shall be paid to the viscosity of the liquid used for the verification tests to ensure that the permitted limits of error are not likely to be exceeded when other liquids which the system is intended to measure are metered.

15.4 If the optional self loading connection is present, then whilst in normal metered delivery mode activate the valve R1. The system must shut down.

15.5 Verify that the interlocks of Section 8.3 operate as described.

15.6 Verify the software issue status as detailed in Section 3.1.8

16 TWO METERED WETLINE SYSTEM with one line having minimum delivery of 10 LITRES* limited to vehicles with registrations L8 WTL AND L9 WTL

As described in the certificate but with the following differences:

16.1 The following air eliminator to be used in place of special gas extractor:

Manufacturer	Model designation	EEC pattern approval number
Liquid Controls (Alpeco)	Series A 8100	UK81 1783

16.2 System has two metered wet line discharge paths in place of one wet line and one dry Line/blow down.

16.2.1 One of the wet lines will be through a 20' x 1³/₈" hose, max flow rate 400LPM and minimum delivery of 250 litres. (Figure 25).

16.2.2 The other wet line will be through a 100' x 1" hose, max flow 80LPM, with a minimum delivery of 10 litres*

***NOTE: DELIVERIES BELOW 100 LITRES ARE OUSIDE THE SCOPE OF THIS APPROVAL.**

16.2.3 This system is restricted to two vehicles only. Vehicle registrations as above.

ISSUE NO.	DATE	DESCRIPTION
2767/1	11 April 2006	Type examination certificate first issued.
2767/1 Revision 1	18 August 2009	Section 3.3 replaced with full description in paragraphs 3.3.1 to 3.3.10. Section 6 - Sealing points d) and e) added. Section 8.3 deleted (replaced by section 3.3.4) and subsequent sections renumbered.
2767/1 Revision 2	25 August 2010	Section 7.5 added, Dry-Line Hose delivery system used in conjunction with the Veeder-Root electronic EMR ³ . Change of minimum delivery of 200 litres for pumped hose reel – Front page and sections 4 and 5. Section 7.6 added, remote device
2767/1 Revision 3	10 July 2012	Sections 7.5.4.5, 7.5.4.6, 7.5.4.7 and 7.5.6 added. Dryline system security descriptions. Section 10 added, Two Metered Wetline System with one line having a Minimum Delivery of 10 Litres - limited to Vehicles with Registrations L8 WTL and L9 WTL
2767/1 Revision 4	30 July 2012	Entire Certificate Edited and sections and figures renumbered, to include consolidation of Certificate 2767 (Maxflow 400) and new and existing configurations as listed below: Front Page MaxFlow 400 added Section 1 - New configurations and Maxflow 400 added. Section 2 Now describes Mechanical Head configuration only. Section 3 Describes Electronic Head configuration. EMR3 certificate number updated to GB-1285. Remote installation of EMR3 added. Section 5 and 6 Include Maxflow 400 Section 7 – Sealing EMR3 updated, sealing of EMR3 direct to meter removed. Section 8 – all alternatives listed. Section 9.2.3 description of calculation of Dry-Line pipe-work volume added. New configurations:- Section 11 - Deliveries made from A Drawbar Trailer Section 12 – Metered Self Loading Section 13 – Additive Injection Section 14 – Maxflow 400 description

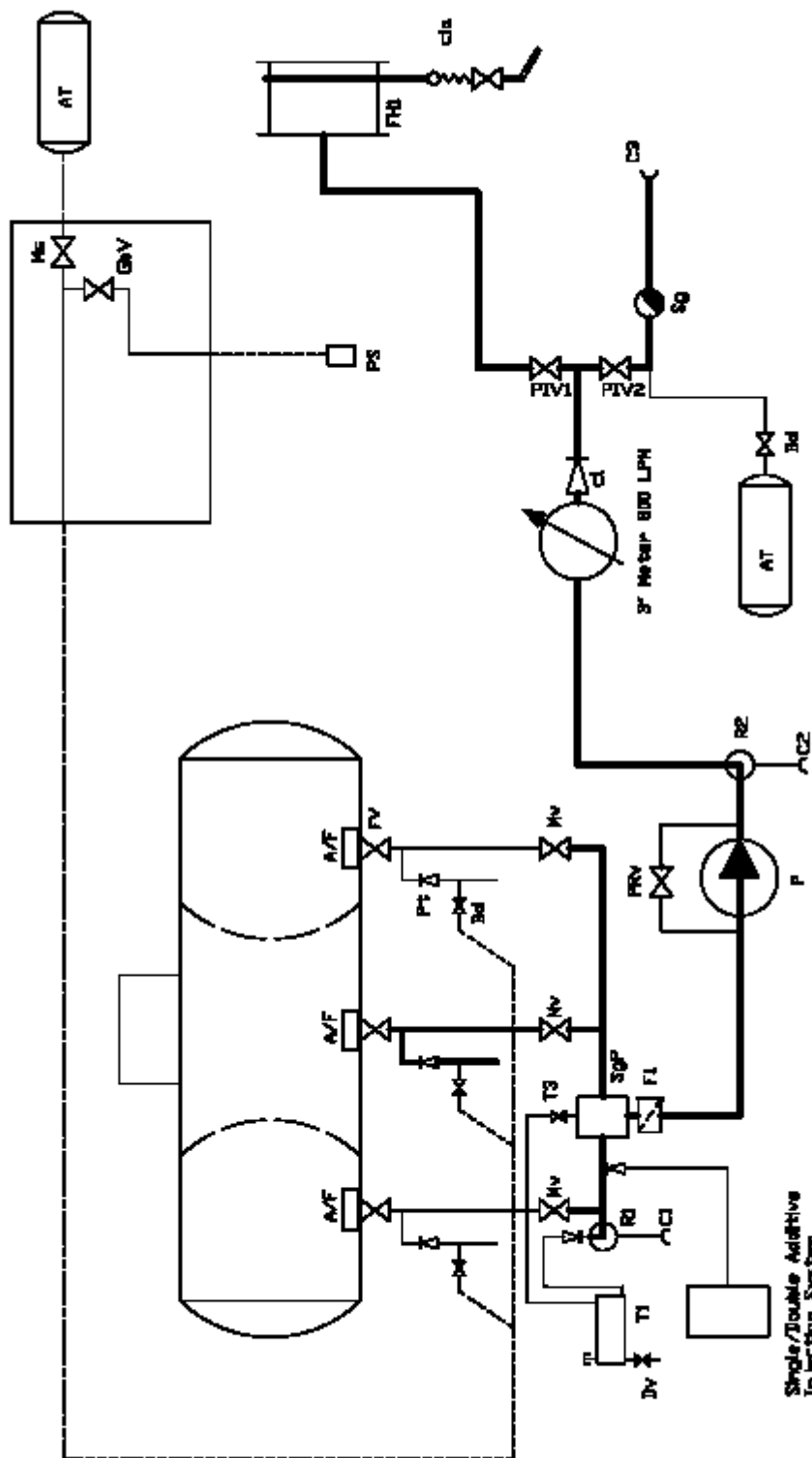


Figure 2 Hydraulic diagram - electronic meter head - EMR3 showing optional additive injection system.

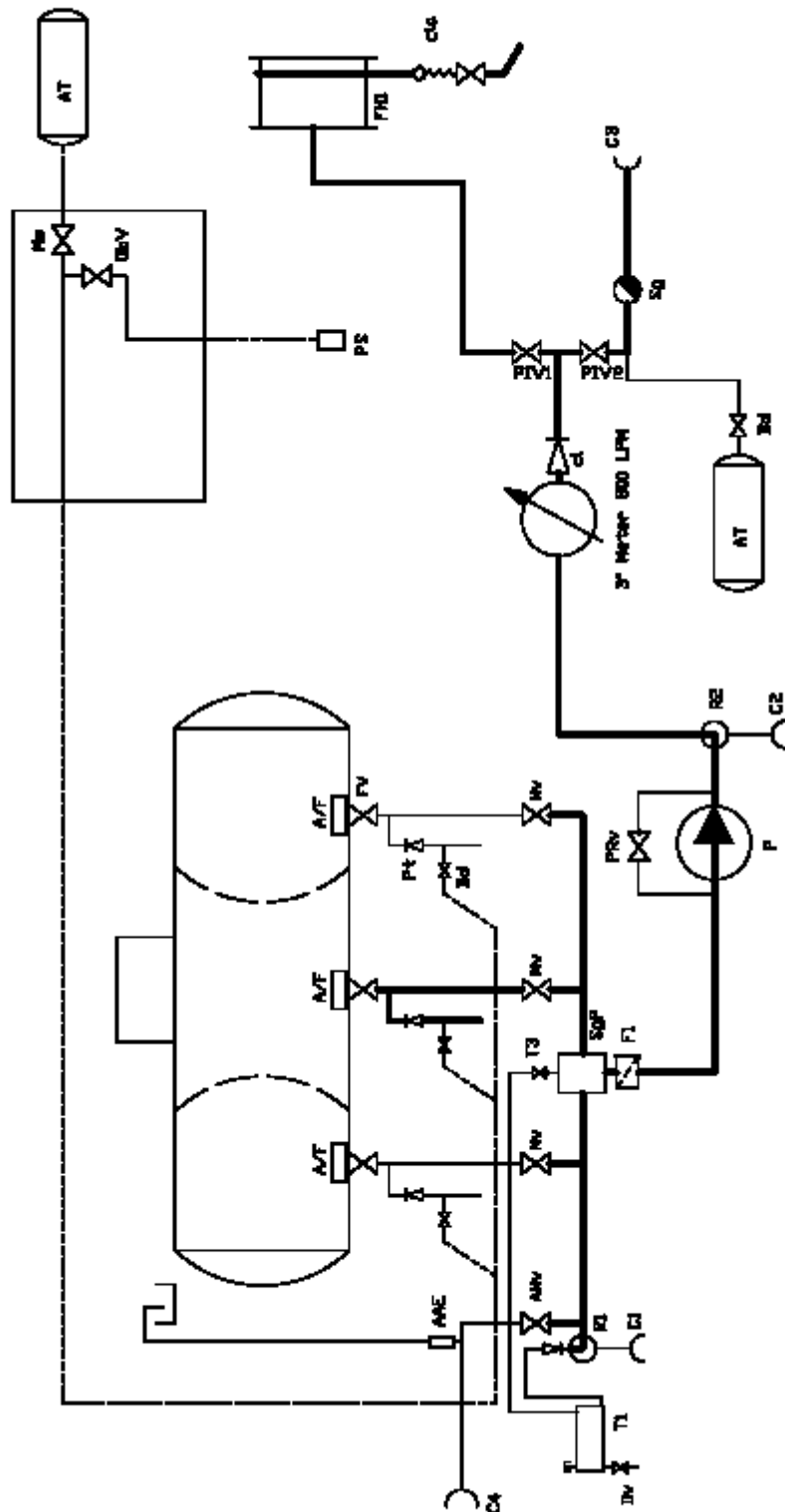


Figure 3 Hydraulic diagram - electronic meter head - EMR3 showing optional suction for drawbar tank trailer.

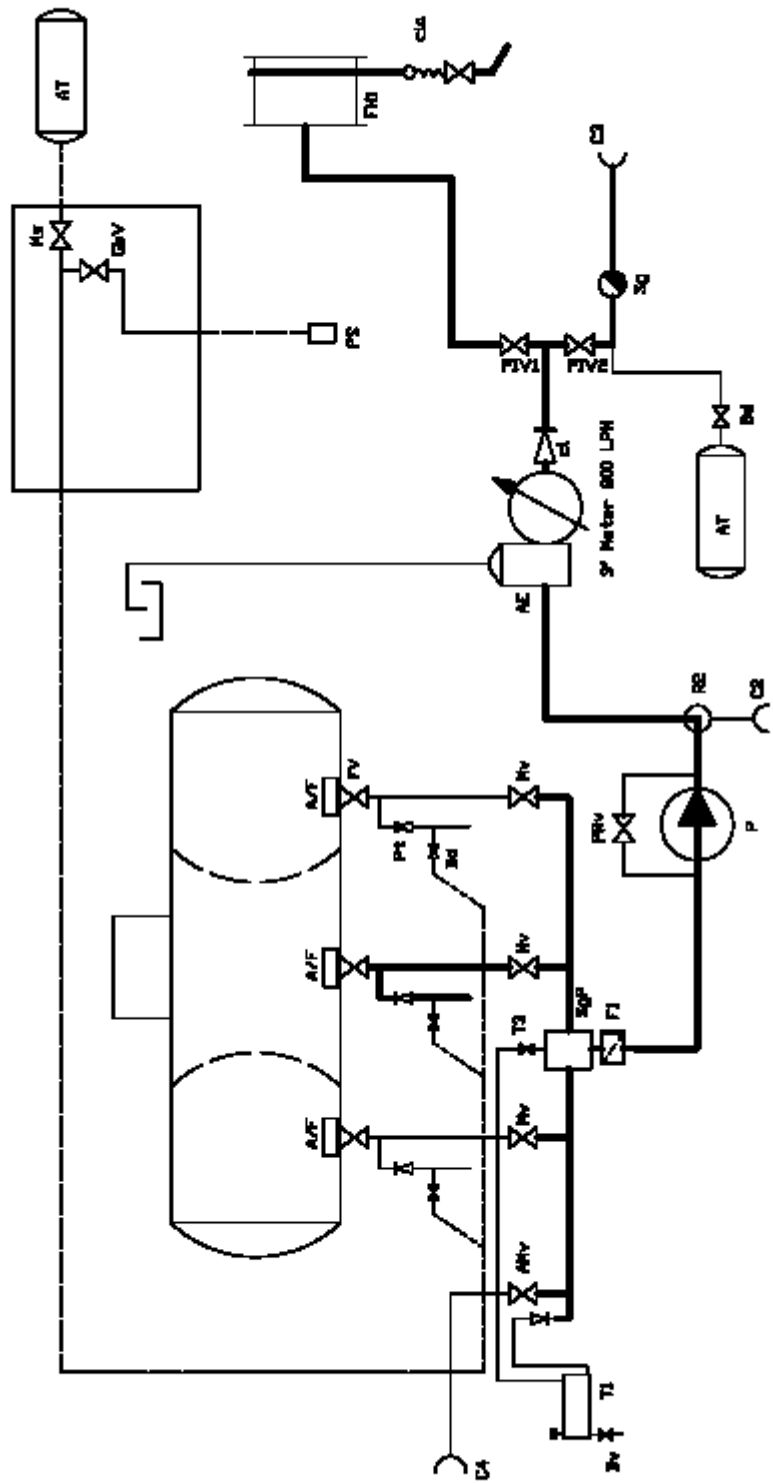
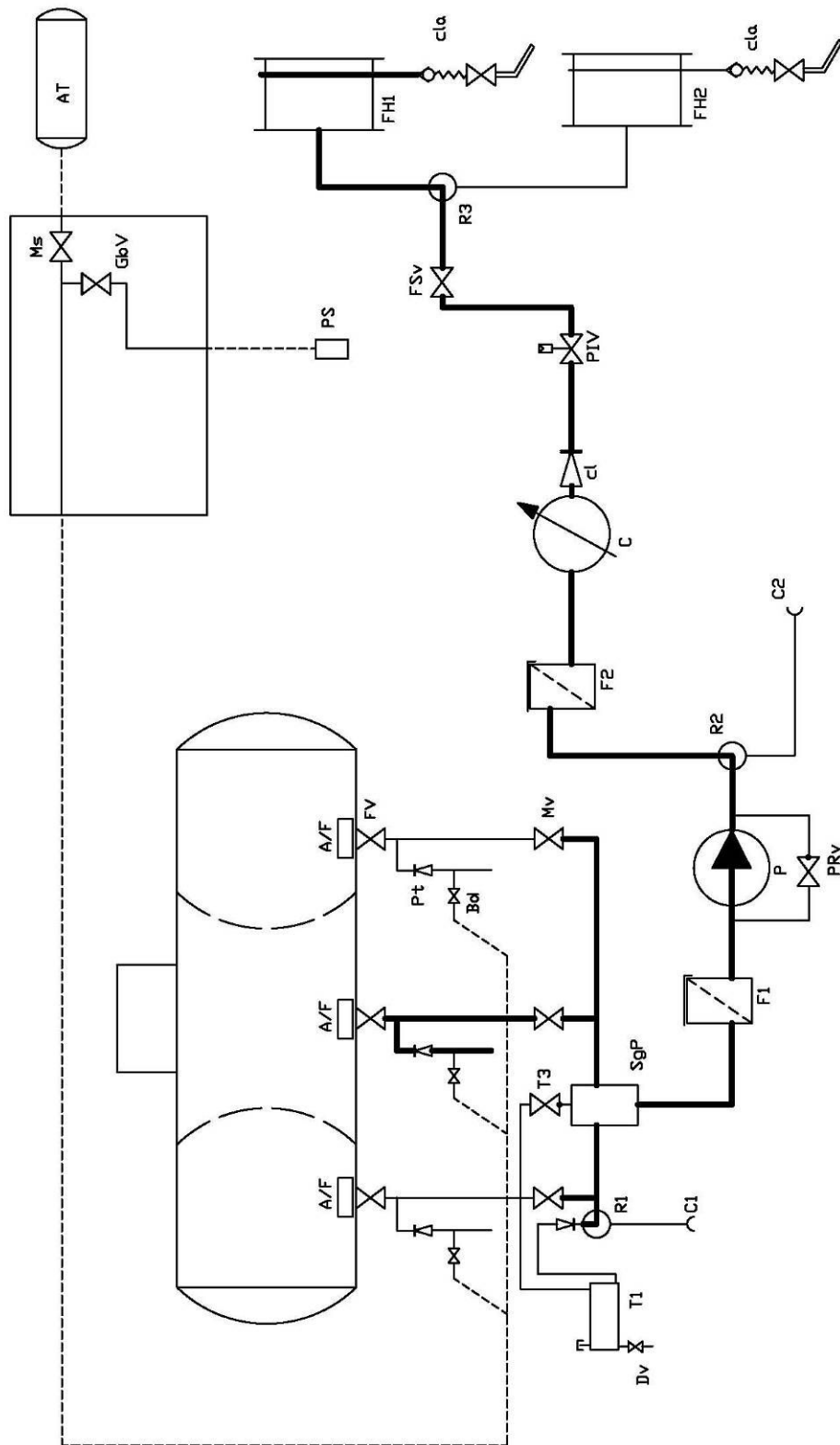
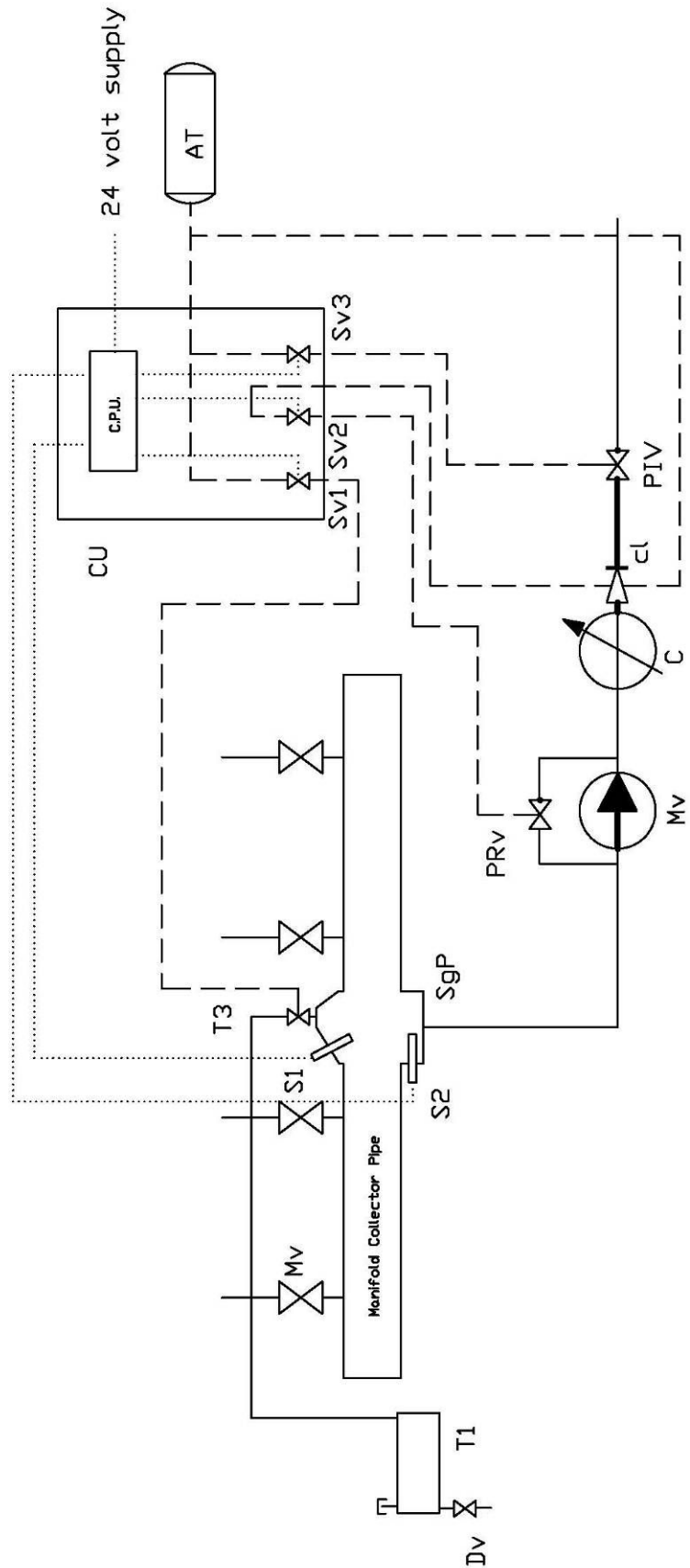


Figure 4 Hydraulic diagram - electronic meter head - EMR3 showing optional self load using product return and secondary air eliminator.



**Figure 5 Maxflow 400 Hydraulic diagram - electronic meter head - EMR3
Alternatives shown in Figures 3 & 4 apply**



**Figure 6 Schematic diagram of special gas extractor components
Read in conjunction with Figures 1, 2, 3, 4 & 5**

A/F	Anti-swirl device
Mv	Manifold valve. Transfer of liquid between compartments is prevented by the use of double acting cylinders ensuring all valves are power closed with the exception of the open valve and control cabinet interlock mechanisms
AMv	Auxiliary manifold valve fitted into manifold for allowing additional suction from either drawbar tank trailer or external 3rd part tank. The manifold section is not fitted with an API adaptor or product return facilities.
FV	Compartment foot valve
P	Pump fitted with pneumatically operated relief valve
PRv	Pneumatically operated pump relief valve
R1	Optional valve for auxiliary suction. Interlocks are provided to ensure that PIV remains closed and a metered delivery can not take place
R2	Optional valve for pumped unmetred delivery. Where this is fitted for trade use, the compartments have dipstick measuring systems which are subject to national regulations
R3	2 way valve for selection of full hose or empty hose delivery or 2nd hose with MF400
F1	Optional suction line filter
F2	Pressure side filter
SgP	Special gas extractor fitted into manifold forming part of manifold pipe.
Vv	Valve fitted to special gas extractor for release of air/gas controlled by the special gas extractor control unit
T₁	Liquid collection tank which incorporates a vent valve and a drain valve (Dv)
C	Meter.
V_m	Operating valve which may be connected to the pre-setting mechanism of the meter
PIV/1/2	Product isolation valve. Controlled by the EMR3, product return system, Interlocks on R1 and Special gas extractor control unit.
FSv	Flow sensing valve.
FH1/2	Full hose and hose reel
Sg	Sight Glass
cl	Optional non return valve. Can be replaced with flow sensing valve
cla	Trigger nozzle and spout incorporating a valve to prevent the hose from emptying
At	Auxiliary air tank.
Bd	Blow down valve
Ms	Master control switch
PrV	Printer tray valve
GbV	Guard bar valve
ORV	'OR' gate logic valve
PIV	Product isolation valve
Pt	Product transfer spout non return valve.
C1	External suction connection. Interlocked with PIV to remain closed when C1 open
C2	Non metered pumped discharge connection
C3	Empty hose discharge connection
C4	Auxiliary suction connection
PS	Pressure switch
CU	Special Gas Extractor Control Unit
S1	Top optic detector probe
S2	Bottom optic detector probe
Sv1	Solenoid operated pneumatic valve controlling gas extractor vent valve T3
Sv2	Solenoid operated pneumatic valve controlling pump pneumatic relief valve PRv
Sv3	Solenoid operated pneumatic valve controlling product isolation valve PIV
T3	Special gas extractor vent valve
AE	Secondary air eliminator (only used for metered self loading)
AAE	Auxiliary air eliminator (typical 1"BSP size)

Figure 7 Key to hydraulic diagrams Figures 1, 2, 3, 4 & 5

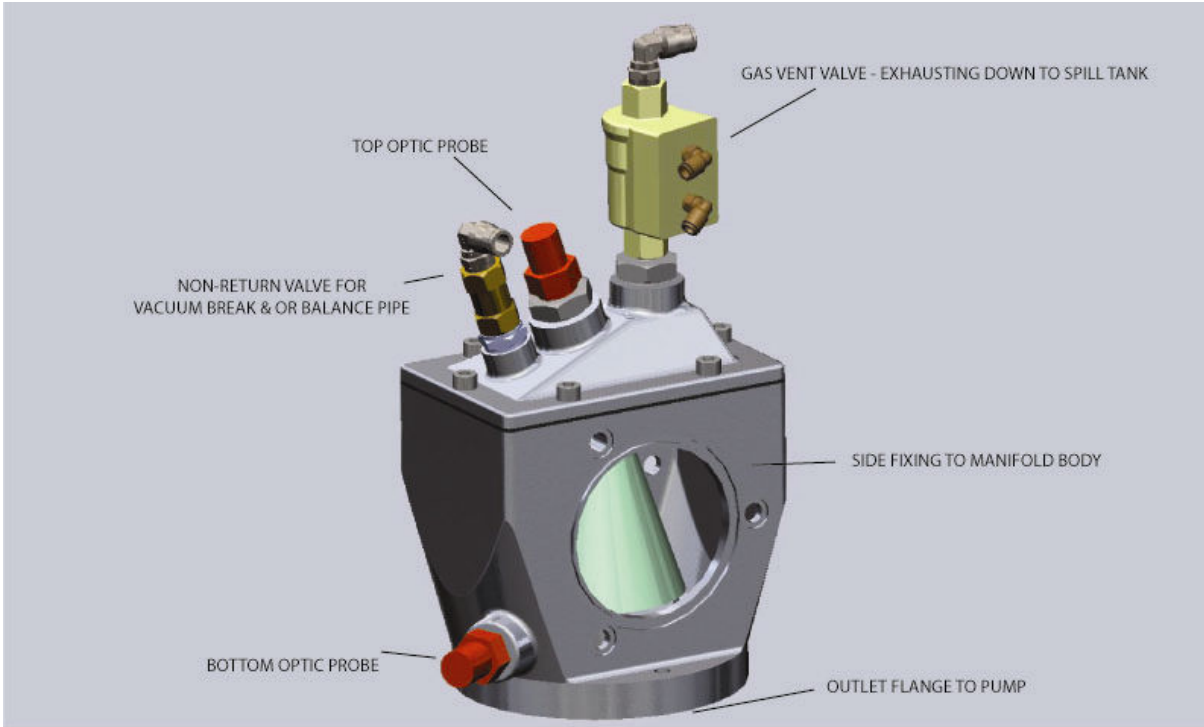


Figure 8 Typical view of special gas extractor

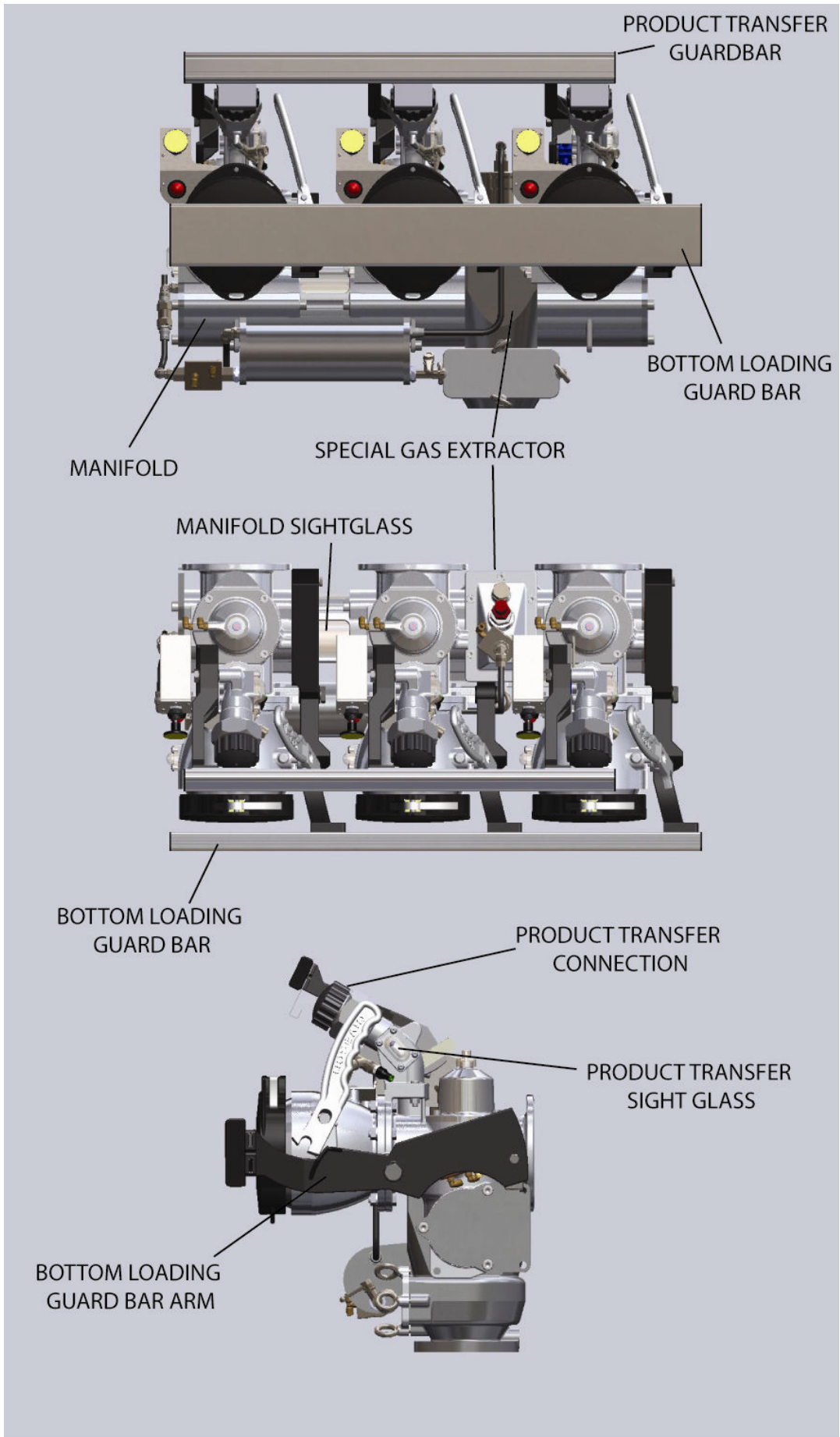


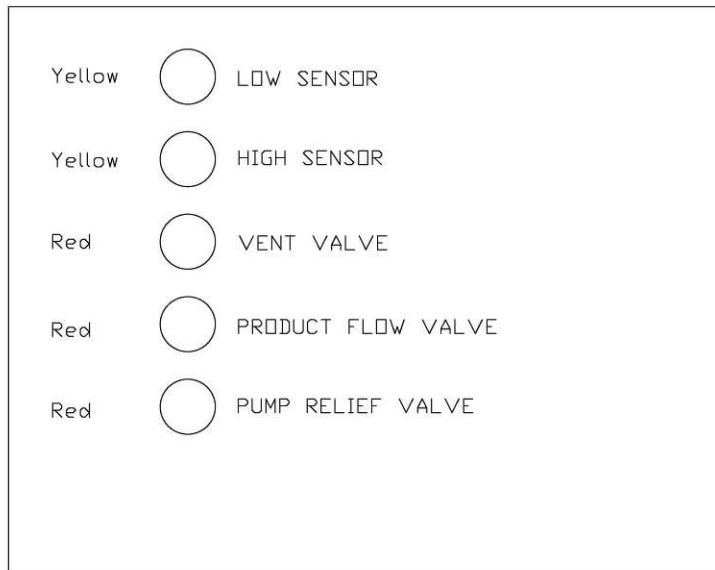
Figure 9 Manifold and product return assembly



Figure10
Typical view of special gas extractor control unit (electronic) showing
hologram seal on Maxflow controller



Figure 11
Typical view of special gas extractor control unit (mechanical)



Special gas extractor LED display logic:

- | | | |
|-----|--------------------------|---|
| (1) | Low sensor flashing | Low sensor dry. |
| (2) | High sensor flashing | High sensor dry. |
| (3) | Vent valve unlit | Vent valve is open. |
| (4) | Vent valve lit | Vent valve closed. |
| (5) | Pump relief valve unlit | Pump relief valve on stand by pressure. Low flow. |
| (6) | Pump relief valve lit | Pump relief valve on full pressure. High flow. |
| (7) | Product flow valve unlit | PIV closed. |
| (8) | Product flow valve lit | PIV open. |
-
- | | | |
|-----|--|---|
| (1) | Both yellow LEDs flashing. | <i>Manifold in dry state. Vent valve open (no flow).</i> |
| (2) | Low sensor lit. High sensor flashing. | <i>Manifold filling. Vent valve open (no flow).</i> |
| (3) | Both yellow LEDs lit. | <i>Manifold full. Vent valve open (no flow).</i> |
| (4) | Both yellow LEDs lit. Vent valve lit. | <i>Manifold full. Vent valve shut (no flow).</i> |
| | System now waits for 10 seconds before next stage. | |
| (5) | Both yellow LEDs lit. Vent valve lit and product flow valve lit. | <i>Manifold full. Vent valve shut, product isolation valve open (slow flow)</i> |
| | System now waits for 5 seconds before next stage. | |
| (6) | All LEDs lit. | <i>Manifold full. Vent valve shut, product isolation open, pump relief valve energised (full flow).</i> |
| (7) | Low sensor lit. High sensor flashing. Product Flow valve lit. | <i>Vent valve unlit. Pump relief valve unlit.</i> |
| | <i>Gas in manifold. Vent valve open, pump relief valve de-energised (slow flow).</i> | |

Figure 12 Typical view of special gas extractor LED display and logic

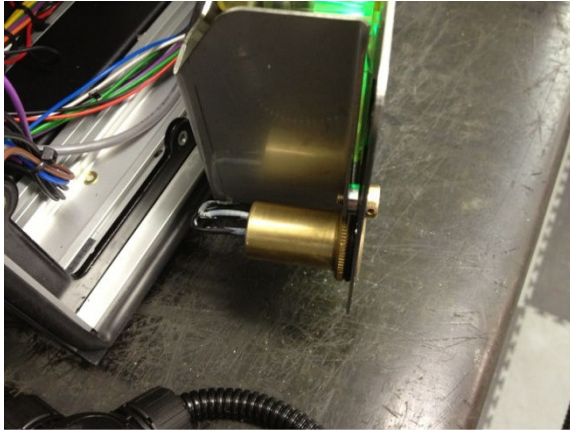


Figure 13 EMR³ display head cover sealing arrangement.

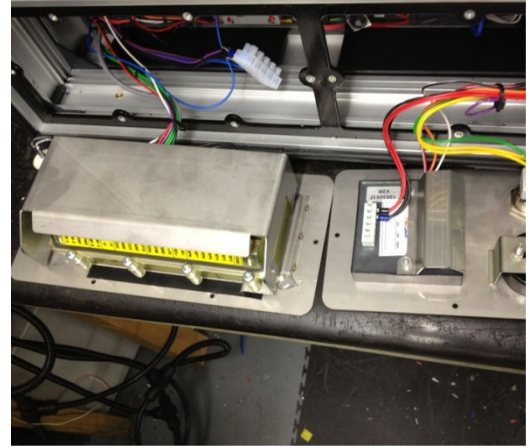


Figure 14 Sealing covers on display head and Maxflow controller



Figure 15 Hologram sealing number shown on display head



Figure 16 EMR³ register head sealing



Figure 17 Typical view of display head and Maxflow controller mounted in control cabinet



Figure 18 Temperature probe & thermowell

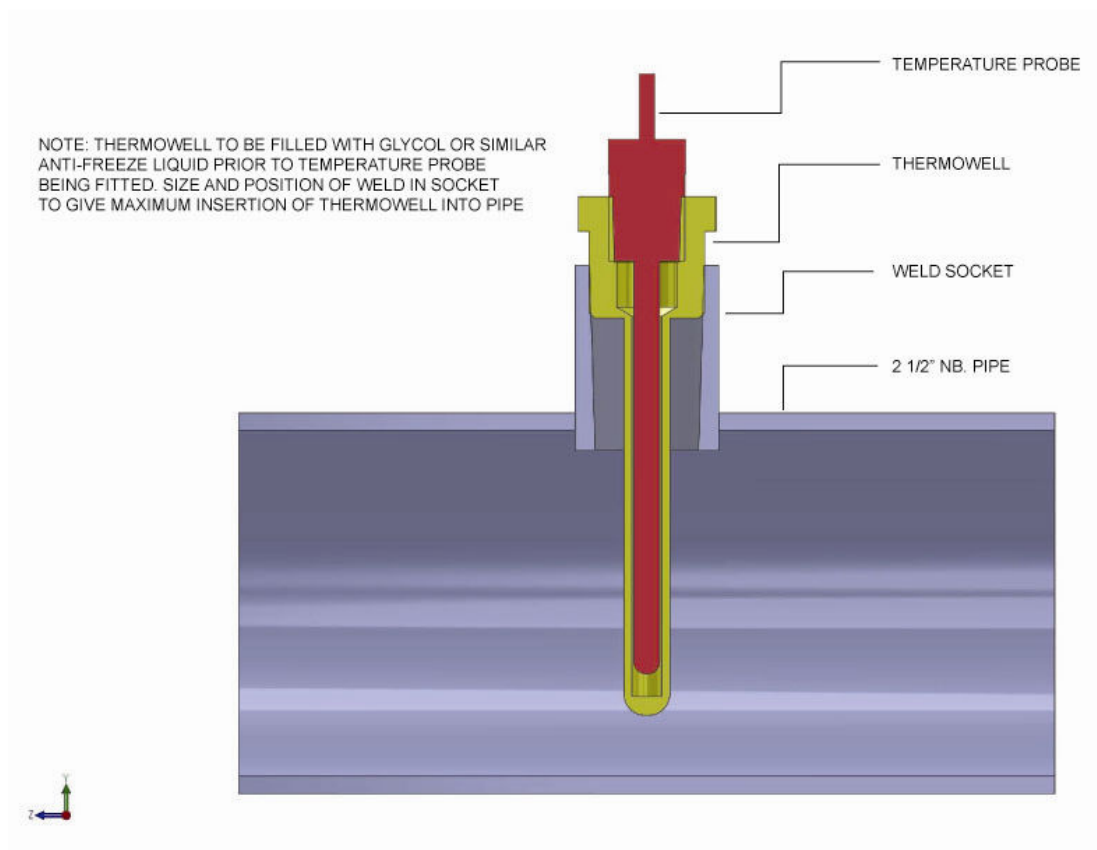


Figure 19 Typical temperature probe & thermowell installation



Figure 20 Typical legend showing temperature correction



Figure 21 Dry-Line Controller



Figure 22 Auxiliary manifold section for loading operation



Figure 23 Auxiliary manifold section for drawbar tank trailer operation showing auxiliary air eliminator

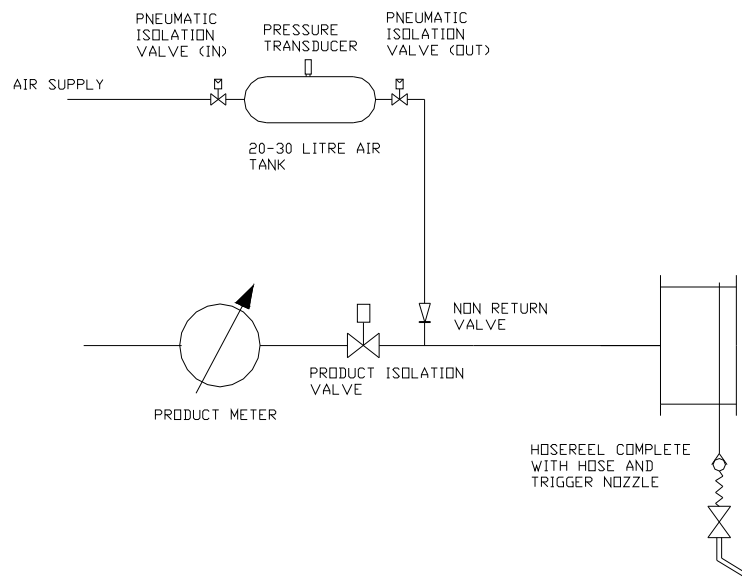


Figure 24 Dry-Line Schematic

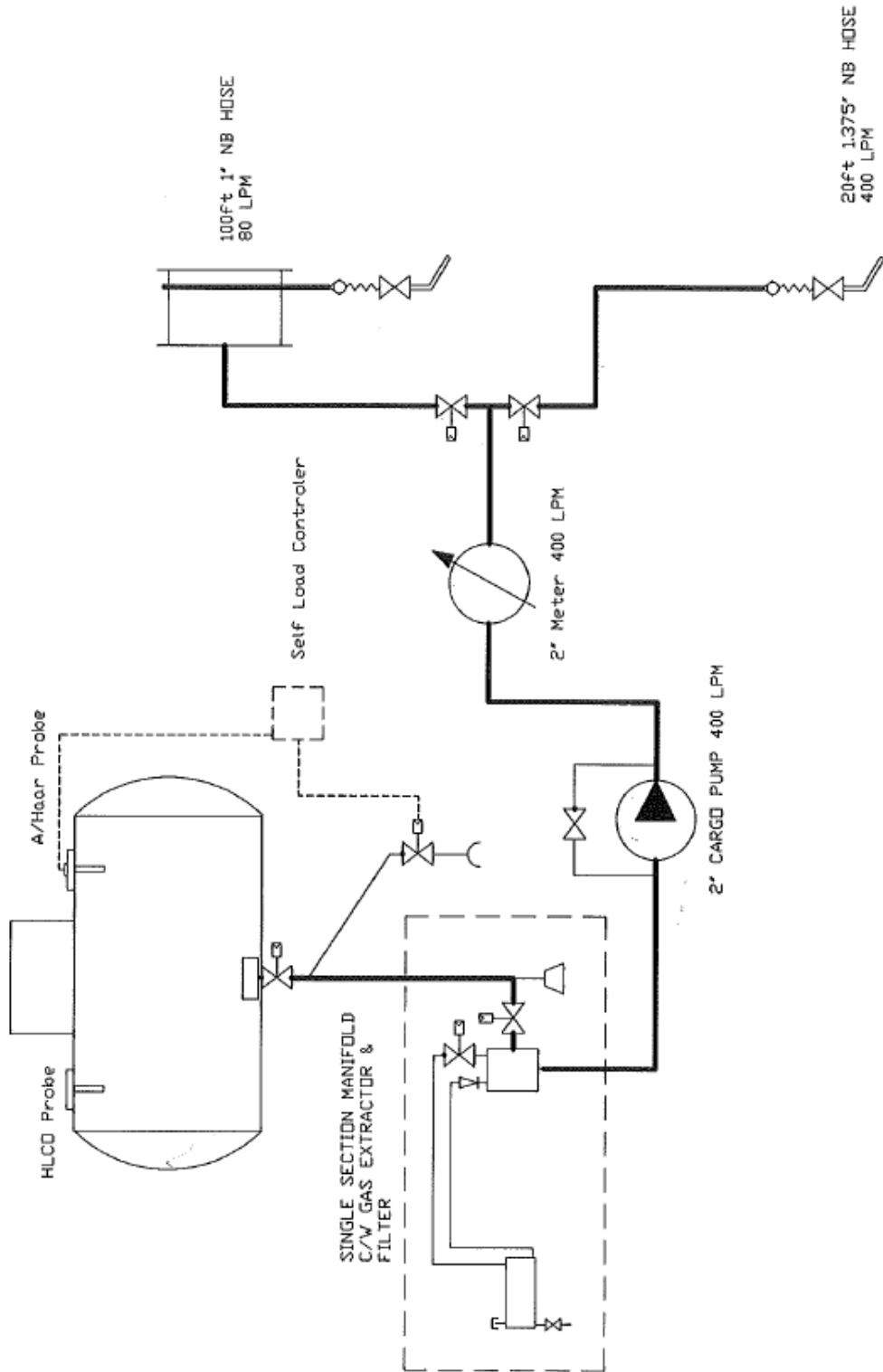


Figure 25 Schematic of Two Metered Wetline System with one line having minimum delivery of 10 Litres

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