(2536) III(5)a

Department for Innovation, Universities & Skills

Certificate
Pursuant to section 12 of the Weights and Measures Act 1985

Certification No 2536 Revision 1

Valid Until 26 October 2016

In accordance with the provisions of section 12 of the Weights and Measures Act 1985, the Secretary of State for Trade and Industry hereby certifies as suitable for use for trade a pattern of a liquid flowmeter as described in the descriptive annex to this Certificate, and having the following characteristics:-

DISPENSER: *Dresser Wayne 10000 Series dispenser as described in the descriptive annex.*

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

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.

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CERTIFICATION NO 2536 REVISION 1

Descriptive Annex

1 INTRODUCTION

This pattern of an electrically driven flow meter comprises a dispensing unit operating in attended stand-alone mode. It is manufactured by Dresser Wayne and is designated the 10000 Series. Each dispensing unit is double-sided serving up to four grades of fuel on each side via eight metering systems. The transaction data for each side is shown on the display and computing head. The dispenser can indicate up to 9999.99 litres giving an indication every 0.01 litres or 0.001 litres in calibration mode. The price-to-pay indication indicates up to £9999.99 in intervals of £0.01. The unit price increments every 0.1 pence per litre up to a maximum of 999.9 pence per litre.

Up to four unit prices may be shown on each side of the dispenser. Any of the four grades of fuel can be delivered from each side of the dispenser. Only one nozzle per side can be used at any one time.

This pattern is suitable for liquids other than water of low viscosity (<20mPa.s) except liquefied gases. This includes ethanol blends up to 100% ethanol

2 CONSTRUCTION

2.1 Mechanical (Figure 1)

The dispensing unit consists of three major components, the hydraulics enclosure, support column and the support gantry. The electronic computing and display head is attached to the support column. Structural assemblies are constructed in mild steel while panel work is of fibreglass.

Access to the hydraulics is made by unlocking the hydraulic enclosure panels.

2.2 Hydraulics (Figure 2)

The hydraulic unit is designated a Global Hydraulic Module and comprises a motor driven pumping unit, with integral air separator, feeding two meters, with associated non-return and pressure relief valves. The meter output pipes are routed via solenoid valves up the column to the hose support gantry. There can be up to four such hydraulic arrangements per dispenser.

Alternatively the fuel supplied to the dispenser unit by a submersible turbine pump (STP), in which case motors, pumping units and air separators are not fitted. A check valve is fitted at each of the meters in the dispensing unit and a solenoid valve is fitted. The storage tanks from which the STP delivers the product shall be equipped with a level detection device. The level detection device is connected to the system to prevent the pumping unit from operating when a low level is detected.

2.2.1 Combined pump and air separator

The pumping unit is belt driven from an electric motor and has an integral air separator. It is manufactured by Wayne and is designated type 1-48018. The maximum flow rate through the

pump and air separator is 80 L/min. The maximum delivery rate is up to 80 L/min at each nozzle.

Fuel is drawn in via the inlet and passes through the strainer into the rotary pump. A by-pass valve circulates liquid returning at a predetermined pressure to the pump inlet. Fuel passes through the air separator where any air present is allowed to pass to the float chamber. The float chamber houses a float operated valve that permits excess liquid to be returned to the suction side of the pump, air is vented from the float chamber to the atmosphere via an overflow protection valve.

2.2.2 Duplex meter (Figure 3)

There are two meters within the one casting, each of which is of the two piston horizontally opposed positive displacement type. It is manufactured by Wayne and is designated type 1-49015. The body of the meter is made from aluminium alloy and the cylinders have stainless steel liners. Liquid enters the meter from the pump or pressure line via a check valve and filter. The passage of the liquid through the meter displaces the pistons and rotates the meter output shaft. On this shaft, and within the meter housing, is attached a disc containing a set of magnets. These magnets, when the disc is rotated, influence a set of sensors in the encoder. The meter shaft rotates twice for every litre of fuel delivered. Calibration of the meter is carried out electronically.

2.2.3 Pipework

A pipe from each meter is routed via a solenoid valve to the pump column and then to the hose support arm. Each pipe is fixed to this arm and to its respective hose, the hose terminating in a nozzle. Nozzles are stowed in holsters along the sides of the hydraulics enclosure.

2.2.4 Solenoid valve

A solenoid valve is fitted on the discharge port of each meter. When energised the valve allows full flow of the liquid.

2.2.5 Nozzles

The following nozzles may be used:

Manufacturer	Model/Description	Type
Elaflex	ZVA 4.4R for use with unleaded petrol	Automatic Shut-off
Elaflex	ZVA 4.4 for use with leaded petrol and diesel	Automatic Shut-off
Elaflex	ZVA 25.41 high flow nozzle for diesel	Automatic Shut-off
Elaflex	ZVA Slimline Drip Stop nozzle Minimum Delivery 5 litres. (A legend indicating a 5 litre minimum delivery will be marked on the spout of the nozzle, this marking overrides that marked on the dispenser).	Automatic Shut-off
Elaflex	ZVA Slimline 2	Automatic Shut-off

Elaflex	ZVA X204 GRV3G for use with unleaded petrol	Vapour Recovery
Elaflex	ZVA X204 GRV3R-BL for use with leaded petrol	Vapour Recovery
Elaflex	ZVA X204M GRVP	Vapour Recovery
Elaflex	ZVA Slimline 2 GR	Vapour Recovery
Husky	Type 'X' series, single and double poppet designs. Optional accessories including swivel joints, sight glass option, and alternative spouts and splash guards which may be fitted as required.	Automatic Shut-off
Goodyear	GTR 50 for flowrates up to 50 litres /minute	Automatic Shut-off
Goodyear	GTR 80 for flowrates up to 80 litres /minute	Automatic Shut-off
Goodyear	GTR 120 for flowrates up to 120 litres /minute	Automatic Shut-off
Goodyear	GTR 50 VR	Vapour Recovery
OPW	11 VAIE-0035 for use with unleaded petrol	Vapour Recovery
OPW	11 VAIE-0037 for use with leaded petrol	Vapour Recovery
OPW	12 EN (may be fitted with different sizes of spout depending on the product type)	Automatic Shut-off
OPW	12 EN V (may be fitted with different sizes of spout depending on the product type)	Vapour Recovery

2.2.6 Hoses

The following hoses may be used:

Manufacturer	Model	Maximum length (Metres)
Elaflex, Germany	Conti – Slimline 25 Low temperature	6
Elaflex, Germany	Conti – Slimline 21 Low temperature	10
Elaflex, Germany	Conti – Slimline 16 Low temperature	13
Elaflex, Germany	Conti – Slimline 21 MPD	7
Good Year, USA	EN1360 TYPE 3 25mm 16 BAR M 1Q00 0310	15
Good Year, USA	EN1360 TYPE 3 16mm 16 BAR M 1Q99 0749	15
Good Year, USA	¾"Hardwall Petrol Hose	15

2.3 Electrical

2.3.1 Motor

The motors that drive the rotary pumps are single-phase or 3 phase, 1 HP rated.

2.4 Electronics

2.4.1 Pulser (Figure 4)

The Wayne Integrated pulser (WIP) contains the electronics of two conventional pulsers. It is fitted to the top casting of the Wayne Duplex meter. It is marked with the drawing number 165575, or intrinsically safe version 165560 (WM001682-0001). There is also a batch code

marked on it. There are two output signals from each half of the pulser, one the phase signal, the other quadrature; all four edges per cycle of the signals are counted.

On the inside of each meter, and located within the fluid, is a magnetic disc of 52 poles which is turned by the meter shaft. As the disc turns the changes in magnetic flux are detected by Hall-effect sensors fitted on the inside of the pulser housing and converted into pulses. These pulses are stored in the pulser until a predetermined volume is reached, then, that volume will be transmitted to the pump computer. This volume is added to the sale total stored within the pulser, and added to the non-resettable total also within the pulser at the end of the sale. The pulser nominally outputs 250 pulses per revolution of the output shaft, corresponding to 500 pulses per litre. This equates to 2 ml per pulse. As there is no facility for mechanically adjusting the meter, the calibration is done electrically. To calibrate the pulser, a magnet has to be removed from the pulser enclosure via a hinged cover. The magnets are situated in the pulser housing and are removed by first removing the seal and then opening the door thus exposing the magnet. A test measure is then taken and the magnet is returned to its normal position.

2.4.2 **Indicating device and calculator**.

2.4.2.1 Display head (Figure 5)

The display head is supported from the column and contains the electronic computer, displays, power supply and motor switching circuits known as the 9000 MK3 electronics package. These are all housed in a fibreglass enclosure with a window in each side. Illumination is by fluorescent tube.

2.4.2.2 Computer board

This board contains central processor unit (CPU), all the input/output ports and the dispenser memory. It is marked with the word 'PROCESSOR' and either the number 61/76402 or 61/53159 is marked on a label. The memory is retained if there is a power failure by means of a battery back-up facility.

2.4.2.3 Display board

The dispensing unit contains two display boards, one on each side of the computing and display head. The words 'DISPLAY BOARD' are etched into the copper. The part numbers are either 61/53222, 61/53225, 61/53231, 61/53232 or 61/53161 depending on hose, configuration or display requirements. The board contains liquid crystal display elements to display price-to-pay (6 digit), volume (6 digit), pence per litre (4 digit).

Displays and legends

The legends and displays on the computing and display head are shown in Figure 5 and set out in table below:

Legend	Associated display	Approximate height
THIS SALE £	XXXX.XX	13 mm 16 mm
MINIMUM DELIVERY 2 LITRES		5 mm
LITRES	XXXX.XX	13 mm 16 mm
PENCE PER LITRE	XXX.X	5 mm 12 mm
DRESSER WAYNE		3.5 mm

There are displays on both sides of the display head. Indications of price-to-pay, volume and unit price are arranged one below the other and are of the 7-segment liquid crystal type. There may be up to four unit prices displayed which will be identified by colour coding and/or a written description of the grade adjacent to the unit price window. The same colour coding/written description will identify the nozzle holster and may also identify the hose and nozzle boot. Providing there is no sale in operation and a nozzle is removed then all the displays will show all '8's. all 'blanks', all 'zeros' then '0.00'. The unit price windows then all go blank except the grade selected and the sale can commence. Once the nozzle is replaced, after 5 to 8 seconds all the unit prices are restored.

2.6 Sealing

2.6.1 Meter and pulser (Figures 3 and 4)

Each pulser is sealed to the meter body by passing a wire through a hole in each pulser door and an adjacent hole in the meter casting then into the seals. The meter is sealed by sealing wire being passed through two screws on a cylinder head, then through two screws on the adjacent cylinder head, then into a hole in the dispenser frame (previously described as motor chassis) and then into a seal. The same is done on the other face except the sealing wire is not passed through the dispenser frame again.

2.6.2 Alternative meter sealing.

Having the sealing arrangements as described above but omitting the sealing wire between the meters and the dispenser frame.

3 OPERATION

3.1 Operating sequence

At the start of the transaction, the dispenser displays the previous sale. The operator removes the nozzle corresponding to the grade required on the side of the dispenser at which he is standing. The displays show all ‘8’s, all ‘blanks’, all ‘zeros’ then ‘0.00’. The unit price corresponding to the nozzle removed is displayed, the other unit prices will blank, and the

appropriate motor is started permitting a delivery to commence.

A second nozzle may be used on the other side of the dispensing unit.

At the end of the delivery the nozzle is replaced in the nozzle holster and the pump motor stops.

3.2 Controls and features

On the underside of the computing and display head are two groups of switches and the Electro-mechanical totes if fitted. They are exposed when the door underneath the pump display head is removed. The group of two rocker switches situated towards the centre are for isolating the mains and data lines and are only to be operated only during periodic insulation testing.

The other group, a rocker switch and two momentary action push-button switches labelled ‘A’ and ‘B’, may be replaced by a plug in unit containing these switches. They are used to control or allow access to the following:

a) The setting of pump parameters
b) Clearing of totals
c) Entry to pump diagnostics
d) Setting of pump number, hose grade numbers
e) Attendant/self service modes
f) Setting unit prices (attendant mode only)
g) Dispensed volume limits, per hose
h) Whilst the momentary action push-button marked ‘A’ is pressed and held during a delivery the dispenser enters calibration mode and a third decimal place (one thousandth of a litre) is shown on the volume display. On releasing of this button the volume display returns to two decimal places.
i) Pressing and holding button ‘A’ when the nozzles are stowed shows rolling digits.
j) Pressing and holding button 'B' during a delivery causes the flow rate for that product to be shown on the unit price display

3.3 Interlocks and security features

a) No price changes can take place during a delivery or until 5 seconds after the nozzle has been replaced.
b) A transaction cannot be initiated when the dispenser is in the price setting mode or until a delay of 5 seconds has elapsed after a new unit price has been set at the kiosk.
c) A maximum volume limit can be set between 10 and 990 Litres for each hose.
d) A maximum money limit can be set between 10 and 990.

e) A maximum duration of sale between 1 and 30 minutes.

f) An anti-fraud timer, set between 0.5 min and 5 min checks that if the pump motor is running, the pulses is giving an output. The motor will be stopped if there are no output pulses from the pulses in the set time.

g) If the electronics or software detect a significant fault then the pump will stop. If there are three consecutive significant faults then the pump will not be allowed to start.

h) There is a 30 seconds delay between a post payment sale and the next sale on that pump.

i) Only one nozzle per side may be used at any one time.

j) A new sale cannot be started until a guard time of at least 5 seconds has elapsed since the previous sale.

4 AUTHORISED ALTERNATIVES

4.1 Alternative Enclosure Arrangements

4.1.1 Having the dispensing unit, described in the certificate up to a maximum of eight, hose(s) and associated nozzle(s). The hose arrangement may be with an equal or unequal number of hoses on each side.

4.1.2 Having nozzles and displays fitted to one side of the dispenser only, in which case the appropriate meters, encoders and valves are removed from the unit and that side of the display case is blanked.

4.1.3 Having only the selected unit price display on the dial face. In this case only the unit price pertaining to the nozzle selected will be shown. The unit price will also be marked for each product near to the nozzle holster from which it will be dispensed.

4.1.4 The volume, price, and unit price displays may be illuminated from the front or rear.

4.2 Alternative Dispenser Styles

4.2.1 Apollo dispenser. (Figure 6)

4.2.1.1 Having the dispenser electronics enclosure, nozzle holsters and hoses mounted on the forecourt canopy stanchion, this dispenser configuration is named ‘Apollo’. The hydraulic components are of the submersible turbine pump design as described in section 2.2 above, with the remaining hydraulic and vapour recovery components placed below forecourt level at the base of the column. The existing hydraulic enclosure is not required and is not included in this configuration.

4.2.1.2 Construction

A metal framework is clamped to the canopy stanchion. To this framework, at opposite sides of the column, is fixed the side panels with nozzle holsters and hose handling. At the front face of the framework, at a height of 1.5metres (approx.) is fitted the display head. A filler section covers the back face of the column.

The hydraulic components are housed in a plastic container that is placed in a covered pit at the base of the canopy stanchion and below forecourt level. Pipework and cabling between the column and the hydraulics are routed via ducts. Flexible hose is used within the panels between the hose coupling positioned at the base of the column (Figure 7) and the top of the column, and between the top of the column and the nozzle. The following types of hose may only be used.

Goodyear Hardwall Petrol Hose Type 3
Elaflex Conti-Slimline 21MPD Type 1

NOTE: The total length of flexible hose between the hose coupling and the nozzle shall not exceed 7 metres.

4.2.2 Additional LPG grade

Having Liquid Petroleum Gas (LPG) nozzles fitted on either side of the dispenser as shown in Figure 8. These nozzles are stowed on an extended column fixed to the existing column that supports the display head enclosure. The LPG hydraulic components are housed adjacent to this extended dispenser column.

Note: The LPG hydraulics are not prescribed under the Liquid Fuel and Lubricants Regulations.

4.2.3 Dresser Wayne 9000 MK2 Enclosure to allow connection to Integrated Payment Terminal (Figure 9)

The head assembly is housed within the 9000 MK2 enclosure described in certification 2176 using suitable brackets and fixings. Use of this housing enables the fitting of the Integrated Payment Terminal (IPT) as described in certification 2176/54.

4.2.3 High flow rate selection - Qmax is 80 L/min

Having a push button switch fitted to the dispenser near the dial face. When the switch is pressed, and the dispenser enabled, the high flow rate of that product is selected and remains selected until the nozzle is replaced. The dispenser will have up to 8 hoses, two of which will be dual speed dispensing diesel. The nozzle on the dual speed diesel hose will be the Elaflex ZVA 4.4 automatic shut-off nozzle but is supplied from a large bore pipe and hose. The maximum flow rate through the pump and air separator is 80 L/min. The maximum delivery rate is up to 80 L/min at each nozzle.

4.2.4 Addition of Wayne-Trac post payment system via the Wayne kiosk system 45 (Figure 10)

4.2.4.1 Description

Having the Wayne-Trac post payment system fitted to the dispenser via the Wayne kiosk system 45. The system operation is controlled by wireless radio frequency communication between the dispenser and a hand held transponder.

4.2.4.2 Construction

The Wayne-Trac sensing units are contained in an extended display enclosure and adjacent to the displays, one on each side. On each unit there are areas marked `PLACE KEYTAG HERE' and `START FUELLING' or similar. A printer situated within the display head will print a receipt on demand. (Figure 11)

4.2.4.3 Operation

The customer approaches the pump and places the tag close to the area marked `PLACE KEYTAG HERE'. An area above lights up indicating `START FUELLING'. The customer then removes the nozzle and takes fuel. During the early stages of the delivery the authenticity of the tag and credit availability is checked, if verified the sale continues, if not, the sale is stopped. Once the customer completes the sale, the customer is free to leave. The sales data is then stored locally for forwarding to the credit centre later or transferred on completion of the sale.

4.2.4.4 Conditions

The Wayne Trac post payment system is for use by registered customers only.

The `tag validity computer' and the Solus Marketer 2000 must be connected to an APC Back-UPS 600 or to an equivalent or better uninterruptible power supply (UPS).

4.2.4.5 Authorised Alternatives

4.2.4.5.1 Having the single coloured instruction area replaced by an instruction area having up to three colours with instructions on each coloured section of the area (Figure 12).

4.2.4.5.2 With the `tag validity computer' disconnected from the pump communication lines. In this case the validity check will be done remotely via the point of sale terminal and pump controller which must be connected to the UPS as required at Section 4.2.

4.2.4.5.3 Having traffic light indicator prompts (Figure 13) and the Solus Marketer units replaced by a Meggitt 'Fast' PC. The customer approaches the pump and places the tag close to the area marked "PLACE TAG HERE". The area lights change from amber to green indicating the customer can start fuelling.

4.3 Harmony Dispenser

4.3.1 Having the dispenser electronics enclosure, nozzle holsters and hoses mounted on the forecourt canopy stanchion, this dispenser configuration is named ‘Harmony’. The hydraulic components are below ground as described in section 2.2 with the remaining hydraulic (and optionally vapour recovery) components placed below forecourt level at the base of the column. The aboveground hydraulic enclosure is not required and is not included in this configuration. A schematic view of the dispenser (illustrating the belowground hydraulic components) is shown in Figure 14.

5 ALTERNATIVE CALCULATORS

5.1 Dresser Wayne IGEM calculator

5.1.1 Electronics

The calculator comprises of the following components: -

5.1.1.1 Power supply unit (Figure 15)
Identification No: S8PS-05024CD

This is manufactured by Omron and is a switch mode type rated at 24Vdc 50 Watt (100 Watt optional). The following alternatives may also be used:

Manufacturer	**Part Number**
APS	APS65ID-S240025
APS	RL0211E15-24A
Channel Well	UAS150B

5.1.1.2 Power distribution board (Figure 16)

Identification No: 61-53193/01

This board contains the relays for controlling up to four pump motors and a vapour recovery motor and isolation relays for the data and audio signal lines. It also has connectors for distributing power to optional equipment.

5.1.1.3 Standard Display boards (Figure 17)

Identification No: 168830 (3 unit price displays)
Identification No: 168855 (4 unit price displays)

The dispenser display head contains two display boards, one on each side having 7-segment liquid crystal displays (LCD) for price to pay and volume (6-digits of 25.4mm height), and unit price (4-digit of 12mm height). The boards may optionally have 3 or 4 unit price displays.

Alternative Display Boards:

The iGem electronics can be fitted with alternative display boards as listed in the table below:

Display Board Description	Manufacturer	Part Number
Double Row, 1 Unit Price	NOTE Lund AB	WM010887-0001
Double Row, 2 Unit Prices	NOTE Lund AB	WM010888-0001
Double Row, 3 Unit Prices	NOTE Lund AB	WM010887-0002
Double Row, 4 Unit Prices	NOTE Lund AB	WM010888-0002

5.1.1.4 Pump Computer module (Figure 18)

Identification No: 168862

This board assembly's function is to control the operation of the dispenser including communication with the self-service system.

5.1.1.5 ISB board (Figure 19)

Identification No: 165561

This is an interface board connected between the pulser and the pump computer board and is an intrinsically safe barrier. Alternatively ISB board, pattern designation 173950 (WM002450) may be used.

5.1.2 Communication protocol

5.1.2.1 Communication to the self-service system may be current loop or RS485 or IFSF-LON.

5.1.2.2 An optional 'wireless' communication interface for data collection purposes may be connected. By using standard off the shelf components, an 802.11b wireless 2.4GHz Ethernet network to provide a link between the pump and kiosk that gathers pump diagnostics and performance indications.

5.1.3 Display head

The display head has an access panel that is secured with a lock. Behind this panel are two isolation switches, a download socket and a switch to enable an infrared remote control device (Figure 20).

5.1.4 Dispenser configuration

The two isolation switches isolate the mains and data lines and are only used periodically by authorised engineers for maintenance purposes and configuration of the dispenser. The down load socket is for the connection of diagnostic equipment and for down loading the dispenser software. The infrared switch enables the dispenser to be programmed from an infrared remote control.

5.1.5 Software

The legal metrology part of the software has its own checksum. The checksum number is 0bE5 and can be displayed on the volume display by pressing the CRC button on the computer board or operating the IR enable switch where fitted.

5.1.6 Recommended Tests

Check that the correct checksum number is generated and can be displayed on the volume display.

6 ALTERNATIVE METERS

6.1 Meter type 'X-Flo'

6.1.1 X-Flo modules

6.1.1.1 There are two versions of the X-Flo module; suction unit and remote unit. The remote unit is used when fuel is supplied to the dispenser by a submersible turbine pump (STP) while the suction unit is used when the dispenser incorporates the motor and pump. The remote and suction units are shown in Figures 21 and 22 respectively. The pump cover, remote inlet and the dome cover are different on the two versions.

6.1.1.2 The meter housing consists of two independent metering units, with the two sides designated Side A and Side B. The meter can be Single (Side A or Side B) or Duplex. The X-Flo meter has an approved flowrate range of 3 - 80 litres/min, and a minimum measured quantity of 2 litres.

6.1.1.3 In each meter, one pair of spindles is provided, thus giving two pairs per meter housing. The pair of spindles consists of one long (male) and one short (female) spindle. The female spindle has three entrances while the male spindle only has two. This allows the transfer of fuel through the meter housing. Each revolution gives 1.1 cl, thus there are approximately 88 revolutions per litre. The longer spindle is provided with a stud which incorporates a magnetic ring. The ring is magnetised with 3 north pole faces and 3 south pole faces evenly distributed along the outer circumference.

6.1.2 Pulse transmitter

6.1.2.1 The pulser is a type X-WIP (Wayne WM011529-0001) which is mounted on the dome cover of the meter. A circuit board is equipped with one dual Hall-effect sensor for each measuring element. This board is placed outside the rotating spindle housing so that the dual Hall-efect sensors sense the rotation of the measuring element. When the measuring element rotates a change corresponding to 0.19 cl can be registered.

6.1.2.2 A microprocessor on the circuit board reads the changes from the dual sensor and calculates the volume through the meter elements. The microprocessor communicates with the pump CPU to calculate the measured volume and to facilitate troubleshooting and diagnostics.

6.1.3 Calibration

6.1.3.1 There are two calibration switches on the printed circuit board of the pulser that are used to set the pulser processor into the calibration mode.

6.1.3.2 Next to the calibration switches described above are two magnets, one for each meter element. To calibrate the pulser the appropriate magnet is moved away from the calibration switches. The magnet is located behind a cover which is opened to reveal the magnet. The microprocessor detects that the magnet has been removed and resets itself in calibration mode. In calibration mode a characteristic curve is downloaded to the meter. A test measure is taken and the magnet is returned to its normal position.

6.1.4 Securing (Figure 44)

6.1.4.1 The meter is sealed by running a sealing wire through one screw between the dome cover and the meter housing and one screw between the pump cover and the meter housing.

6.1.4.2 The support plate on the pump cover is sealed by running a sealing wire through one screw in the support plate and one screw between the pump cover and the meter.

6.1.4.3 The X-WIP calibration covers are sealed by running a sealing wire through the sealing hole in each calibration cover and the corresponding sealing hole in the dome cover and around the X-WIP back to the hole in the dome cover.

6.1.4.4 Alternative sealing method (Figure 45)

The sealing point on the screw between the pump cover and the meter housing is omitted. Instead the sealing wire on the screw holding the dome cover and the meter housing is passed through a screw on the pump cover. This allows the meter housing to be separated from the pumping unit in order to replace the filter.

6.1.5 Conditions

The X-Flo Meter and X-WIP pulser may only be used in instruments utilising compatible iGem electronics.

7 STAGE II VAPOUR RECOVERY

The following stage II vapour recovery devices may be installed on the dispenser:

7.1 Wayne 'Burkert' assisted vapour recovery system with or without Vapour Gate System

7.1.1 Description

The Wayne 'Burkert' assisted vapour recovery system is shown in Figure 24 with the Vapour Gate Meter. A vacuum pump supplies vapour recovery for each grade of fuel. In one dispenser there may be grades with or without vapour recovery. The rate of vapour recovery is controlled by independent electronics that adjusts, using a pulse drive output, the vapour flow according to the fluid flow. Vapour recovery continues for a short period after the nozzle has been stowed.

7.1.2 Construction

The existing hose is replaced by a co-axial hose with the vapour line converted at the upper flexible to affixed connection to small bore copper pipe. This pipe is taken via a proportional control valve to an independent electrically driven vacuum pump. The nozzle is replaced with a nozzle having a vapour annulus and an additional mechanism connected to the fluid flow valve that shuts the vapour line at the same time as the fluid flow. Recovered vapour is returned to the supply tank independent of the dispenser hydraulics. The following components are used in the Burkert vapour recovery system:

a)	Hose:	Elaflex Conti Slimline 21 or Goodyear Vapour Assist hose manufactured to DIN 2824, EN1360:1996
b)	Vapour recovery nozzles:	Any compatible vapour recovery nozzle
c)	Motor:	Elnor type BA240CP11-AR-R or BAI75EII AR
d)	Vacuum pump types:	Gardner Denver Thomas types 8014-5.0, or 8014-6.0. Or Dürr types MEX 0831-10, MEX 0831-11 or MEX 0544. Or ASF Thomas TFK 3G/4L. Or Fenner G56-1001
e)	Proportional valve:	Burkert types 6022, 2832-A-04.5-EF-MS-GM82-024/DC-07*-PD36*MA01
f)	Control board:	Burkert 147911 or Compact vapour recovery controller, type 1094: Burkert 131561 (Figure 23)
g)	Break coupling:	Elaflex CSB 21

Parts c, d, and e are situated in the hydraulics enclosure and part f is situated in the display head.

7.1.3 Vapour Gate System

The meter measures the gas volume that passes through the vapour recovery system. The meter is an oscillating type of gas meter, a small amount of gas passes through the meter and is made to oscillate as it passes a thin heated platinum wire. This creates a frequency that is proportional to the gas flow. The ISB/interface transforms this frequency to pulses that iGEM calculate in to a volume. A ratio, referred later to as A/L, is calculated by dividing the amount of gas volume recovered with the amount of liquid dispensed. This ratio is allowed to be $0.85 \geq A/L \geq 1.15$, otherwise the filling is considered as erroneous.

A second path can be installed between the nozzle/nozzles and the VR meter that is controlled by an on/off valve. During normal circumstances this valve will be closed. Every filling is evaluated by iGEM and if fillings start to be out of the normal characteristics, according to certain parameters, the system will perform a self check just after the filling has ended. IGEM simulates a short filling during the self check and the on/off valve is opened to obtain a known and controlled pressure. If the A/L value from the self check is a certain amount higher than the A/L value from the filling, iGEM will consider the filling erroneous even if the measured A/L value is within range. This test is used to detect if any of the nozzles has a jammed suction path in the vapour channels.

If the system has ten fillings on the same side out of range, ten unapproved self checks on the same nozzle or a combination of both, it will start a timer, if after 168 hours has elapsed it will close down the side until the error is reset.

7.2 Nuovo Pignone assisted vapour recovery system RV-01 - open frame version and explosion proof version

7.2.1 Description

The vapour control electronics detect pulses from one of the pulsers the vapour pump is turned on and the relevant voltage is supplied to the vapour control valve, controlling the rate of vapour extraction. These electronics and valves are common to each system. A schematic of the system is shown in Figure 28.

Vapour recovery may be supplied for each grade of fuel. The existing hose is replaced by a co-axial hose with the vapour line converted to small steel or plastic pipe at the connection to fixed pipe. The nozzle is replaced by a vapour recovery nozzle that incorporates an annulus vapour duct. Recovered vapour is returned to the supply tank independent of the dispenser hydraulics via a non-return valve.

7.2.2 Construction

The gas outlet of the air separation unit must not be connected to the vapour recovery system.

The vapour recovery module used may be one of two types, an open frame version (Figure 25) for installation in non-explosive areas, or an explosion proof version (Figure 26) for use in explosive areas. Both versions may be connected to the pulse output from the pulser via a junction box or to a pulser output from a magnetic encoder (Figure 27) mounted on the meter shaft.

This approval does not permit the connection of the vapour recovery module directly to the calculator.

The vapour recovery system comprises of the following main components:

Manufacturer	**Description**	**Model No:**
Nuovo Pignone	vapour recovery control module Open frame version Explosion proof version	 TSO91033-34 TSO91030-31
Nuovo Pignone	Power supply board	TSO31086
Nuovo Pignone	magnetic encoder	SWITCH MZ94
Nuovo Pignone	vacuum pump motor (filter on suction side as an option)	NFB459001061 (or similar model)
Elaflex	vapour recovery nozzle with integrated vapour on/off valve (for each vapour recovery hose)	ZVA 200 GRV3 ZVA 200 GR

Any of the following models of coaxial hose may be used for each petroleum product (not diesel)

Manufacturer	Model	Maximum length (without hose reel) Metres	Maximum length (with hose reel) Metres
ITR Italy	Carbopress D 31/21 13/8	6.18	12.36
Elaflex, Germany	Conti Elaflex C 21	4.41	8.82

7.3 CleanAir AS type CA40/80 Vapour Recovery System

Having the dispensers as described in the Certificate but having fitted, the CleanAir AS vapour recovery system. The system is described as follows.

7.3.1 Description

The CleanAir CA40/80 is a vapour recovery system which may be fitted to existing dispensers, or may be fitted as an alternative to previously fitted vapour recovery systems. A diagram of the CleanAir system is shown in Figure 30.

7.3.2 Construction

The CleanAir vapour recovery system employs an electrically driven vacuum pump situated within a separate enclosure adjacent to the dispenser (Figure 29).

7.3.2.1 Hydraulics

The CleanAir vapour recovery system is connected to the dispenser by two 10mm pipes, one for vapour input and other for liquid return. Electrical interface is accomplished via a separate connection. The vapour line is connected to pipe work within the dispenser which connects, via a manifold, to each coaxial hose and vapour recovery nozzle. The liquid return line returns condensed liquid to the pump inlet.

7.3.2.2 Electrical

Electrical interface within the dispenser will be as described in the certification for vapour recovery systems. Electrical power is supplied via the associated dispenser. The vacuum pump is controlled from the dispenser electronics. When fuel for any product connected to the vapour recovery system starts to flow, the vapour recovery pump is switched on. It will remain on until the nozzle is re-hung and after a pre-determined delay will switch off.

7.3.2.3 Electronics

Electronics is as described within the certification for vapour recovery systems.

7.3.2.4 Nozzles

Any compatible vapour recovery nozzle as described within the certification .

8 VOLUME CONVERSION DEVICES

8.1 TVC volume conversion device (Temperature compensation device)

8.1.1 System Description

The TVC is a conversion device for use with two meters, intended for correcting volumes of fuel as if dispensed at 15°C. The temperature compensation function is added by connecting the TVC unit between the pulse output of the dispenser pulser and dispenser calculator. The TVC provides a pulse output stream corrected for temperature by monitoring the temperature of the fluid passing through the meter. The pulse output is no longer a fixed number of pulses per rotation of the meter output shaft, but adjusts the volume of fuel as if it is dispensed at 15°C. The TVC unit is shown in figure 31.

The conversion calculation for a certain density of fuel is determined by the selection of a suitable density block (module) as shown in figure 33. The density block contains the calculations as specified in the ASTM manual D1250-80, table 4. The density blocks are identified as follows:

Module identification	Density range in kg/m3
B1	720 - 730
B2	730 - 740
B3	740 - 750
B4	750 - 760
B5	760 - 770
B6	770 - 780
D1	810 - 820
D2	820 - 830
D3	830 - 840
D4	850 - 860

8.1.2 Construction

8.1.2.1 TVC unit

The TVC circuit board is housed in a secure box which prevents unauthorised access to the calibration button and the power supply, data link, temperature sensor, density block and pulser connections. The box has a clear lid to allow inspection of the density block.

Optionally an LCD display (figure 32) may be installed which allows access to the following data by pressing the scroll button:

- Fixed Density
- Temperature (Actual temperature from liquid)
- Uncompensated volume 1(last delivery, 2 digits behind the comma)
- Uncompensated volume 2(last delivery, 2 digits behind the comma)
- When test button is pressed, display shows “bypass”
- Display shows “ERROR” when the TVC is defective or errors occur

8.1.2.2 Temperature sensor

A temperature sensor manufactured by E. Meurs BV and designated LM335 is connected to the TVC unit. The temperature sensor (figure 34) is installed in the fuel delivery pipe within one metre from the flow meter; a typical installation is shown in figure 35.

8.1.2.3 Software

An infrared port in the TVC unit allows the reading of data and performing the calibration via an infra red reader connected to a portable PC running the Windows based software 'Fuel Monitor', produced by E. Meurs BV. A typical data display is shown in figure 38

The software version number is: V1.01 and can be accessed with the 'Fuel Monitor' software, or by viewing the LCD screen in the TVC unit where fitted.

8.1.2.4 Indication of measurement result

A legend shall be affixed adjacent to the volume indication clearly indicating that the volume dispensed is corrected to 15 °C.

8.1.3 Adjustments

Adjustments to the calibration and temperature compensation of the TVC unit may be made using a PC having an infra red link and running 'Fuel Monitor' software or using the scroll buttons if the TVC unit has an LCD display.

8.1.4 Sealing

8.1.4.1 The TVC unit is sealed as shown in figure 36.

8.1.4.2 The temperature sensor is secured to prevent removal from the T-connector and the T-connector from the fuel pipe by routing a sealing wire through the sensor and around the pipe connection (figure 37).

8.1.6 Recommended tests

Check that the correct software version is installed in the TVC unit

8.2 Dresser Wayne ATC (Automatic Temperature Compensation)

8.2.1 System Description

The ATC system compensates for temperature effects on the measured volume, thus the temperature compensated volume correspond to the product volume at 15 ºC. The volume conversion factor, VCF, which is the quotient between the uncompensated and the compensated volume is calculated, and used to do the compensation.

The VCF is based on three quantities; product type; product density; and product temperature. Product type and product density are entered in the ATC setup and the system reads the momentary product temperature and calculates the VCF. The compensated volume is used for the normal transaction data i.e. showed on the display. Both net volumes (compensated) and gross volumes (uncompensated) are saved in the pump computer.

8.2.2 Construction and Installation (Figure 39)

The ATC system is consists of:

A Temperature module
Up to ten temperature probes (depending on pump model)
An ISB with integrated TTL/CAN converter. (Figure 40)

The system is interfaced to iGem via the CAN-Bus connector, J13 on the iGem board. The specific components and part numbers are shown in the following table:

Part	Part Number	Quantity	Location
ATC dome cover	WM019762 or WM020020	1 per meter hydraulics	Mounted on the meter hydraulics
Temperature probes	WM019643	1 to 10 depending on pump model	ATC dome cover
Temperature Module(composed of several subparts)	WM017626-0001	1	Mounted on the electrical junction box support.
ISB with integrated TTL/CAN converter	WM019881-0001	1	Mounted in the electronic head
Cable interconnecting ISB and TM(2x3circuits)	WM019837-0001	1	
Cable interconnecting iGem to the ISB	WM019845-0001	1	

8.2.2.1 Temperature probes (Figure 41)

One or two temperature probes are mounted per dome cover depending on the pump model (single or double side). If one temperature probe is installed, a blind plug is fitted in the other probe thread. The temperature probes are connected to the connectors on the temperature module board (numbered J2 to J11).

8.2.3 Sealing

8.2.3.1 The Temperature Module (TM)

The sheet metal cover, covering the TM prevents access to the temperature probe connectors. It also prevents access to the switch, which enables access to ATC set up mode. This cover is sealed by a sealing thread, see figure 42.

8.2.3.2 Temperature Probes

The temperature probes are sealed pair wise by a sealing thread, see figure 43. If the pump is

single sided the probe is sealed in the blind plug.

8.2.4 Conditions

For dispensers providing temperature compensation, the primary indicator (dispenser display) shall clearly indicate that the volume dispensed is corrected to 15 °C.

9 RECOMMENDED TESTS

The following tests may be performed in addition to those specified in Regulations in order following to determine conformity with the approved pattern.

9.1 Check the accuracy of measurement and computation at dispenser, both at current unit price and near maximum authorised unit price using the volume indicated for test purposes.

9.2 Check that unit price changes are inhibited when a sale is in progress.

9.3 Check that a second transaction cannot be initiated until a guard time of at least five seconds has elapsed after the completion of the first transaction.

9.4 Check that all '8's blanks, and all '0's appear on the dispenser display at the start of a sale.

9.5 Check that it is not possible to authorise more than one nozzle on one side at any time.

9.6 Check that when in calibration mode. releasing of button 'A' causes the volume display to revert to two decimal places.

10 ILLUSTRATIONS

10 TEST CERTIFICATE HISTORY

ISSUE NO.	DATE	DESCRIPTION
2536	21 November 2001	Certificate first issued.
2536 Revision 1	5 December 2008	- Amendments 1 to 14 Consolidated in to certificate. - Ethanol suitability added to Section 1. - Section 2.2.5, Elaflex ZVA Slimline 2 models added. - Section 6.1.4 Figure 44 added - Section 6.1.4.1 added: alternative sealing arrangement - Section 5.1.3 added: Vapour Gate System for Burkert Stage II Vapour Recovery System. - Section 8.2 added: Dresser Wayne ATC.

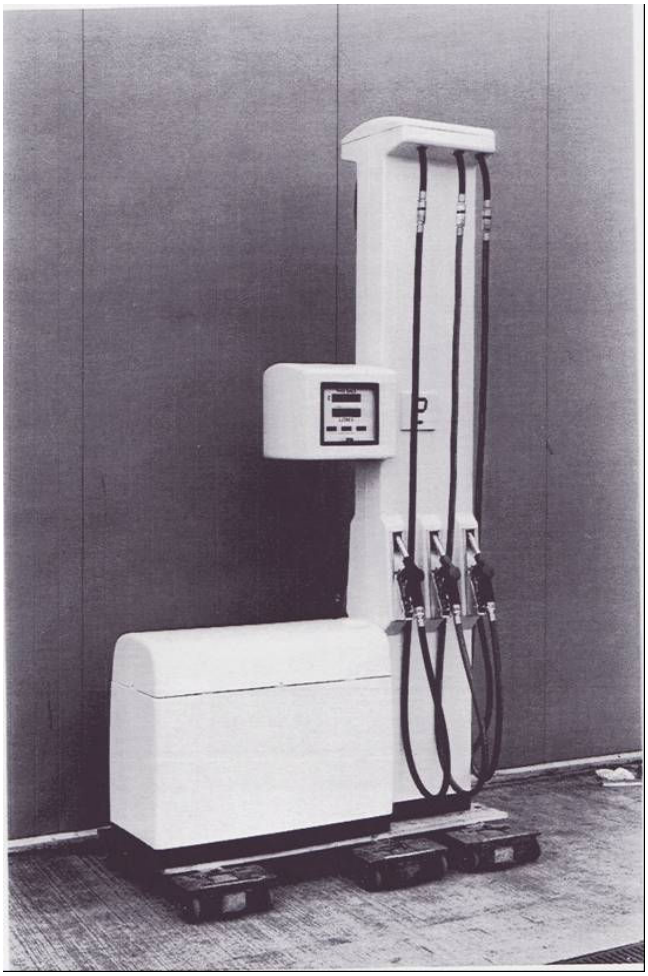


Figure 1 1000 Series Dispenser

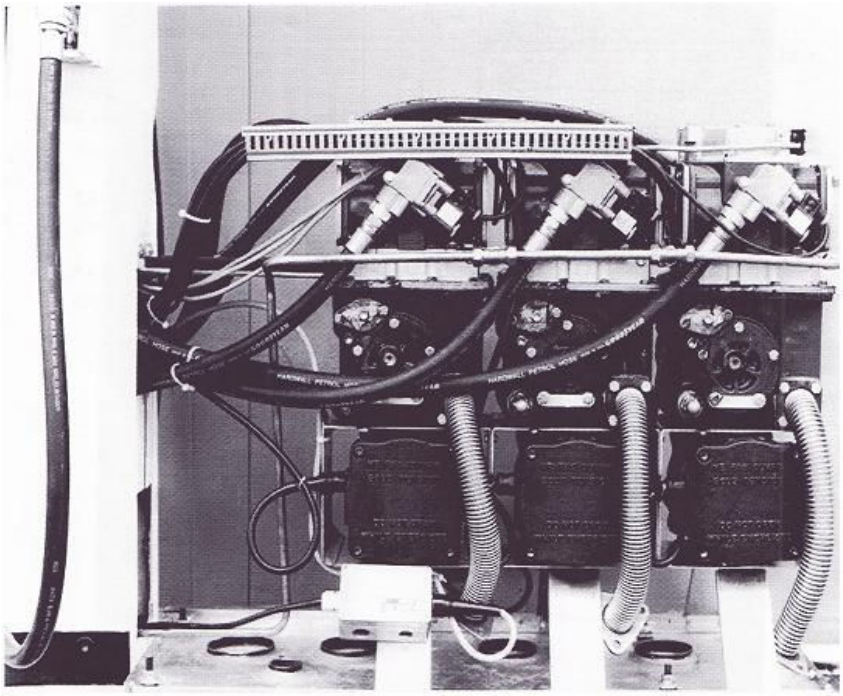


Figure 2 1000 Series Hydraulics

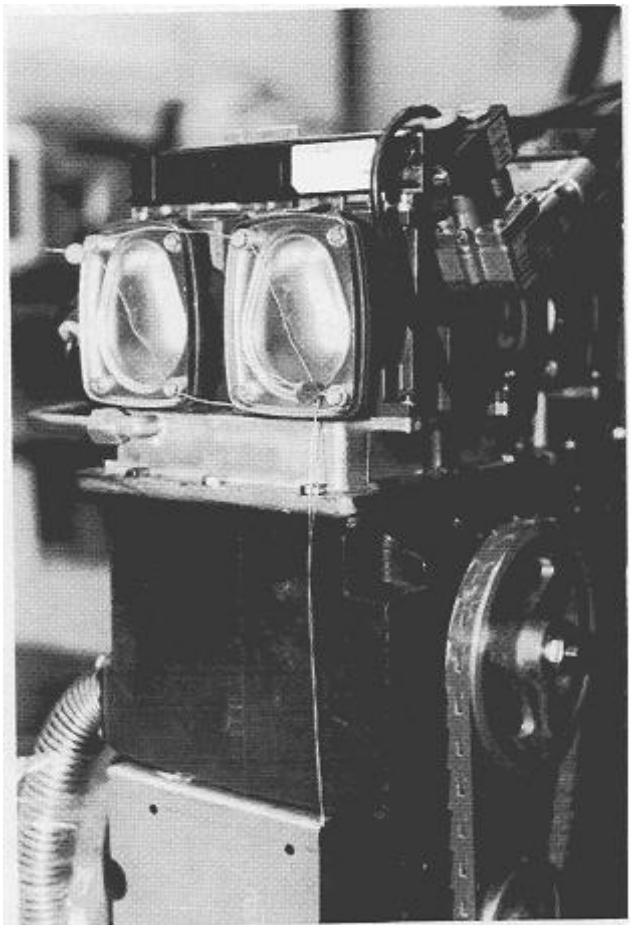


Figure 3 Wayne Global Hydraulic Module (GHM) — includes sealing

Figure 4 Sealing of Wayne Integrated Pulser (WIP)

Figure 5 Displays and Legends

Figure 6 Apollo dispenser

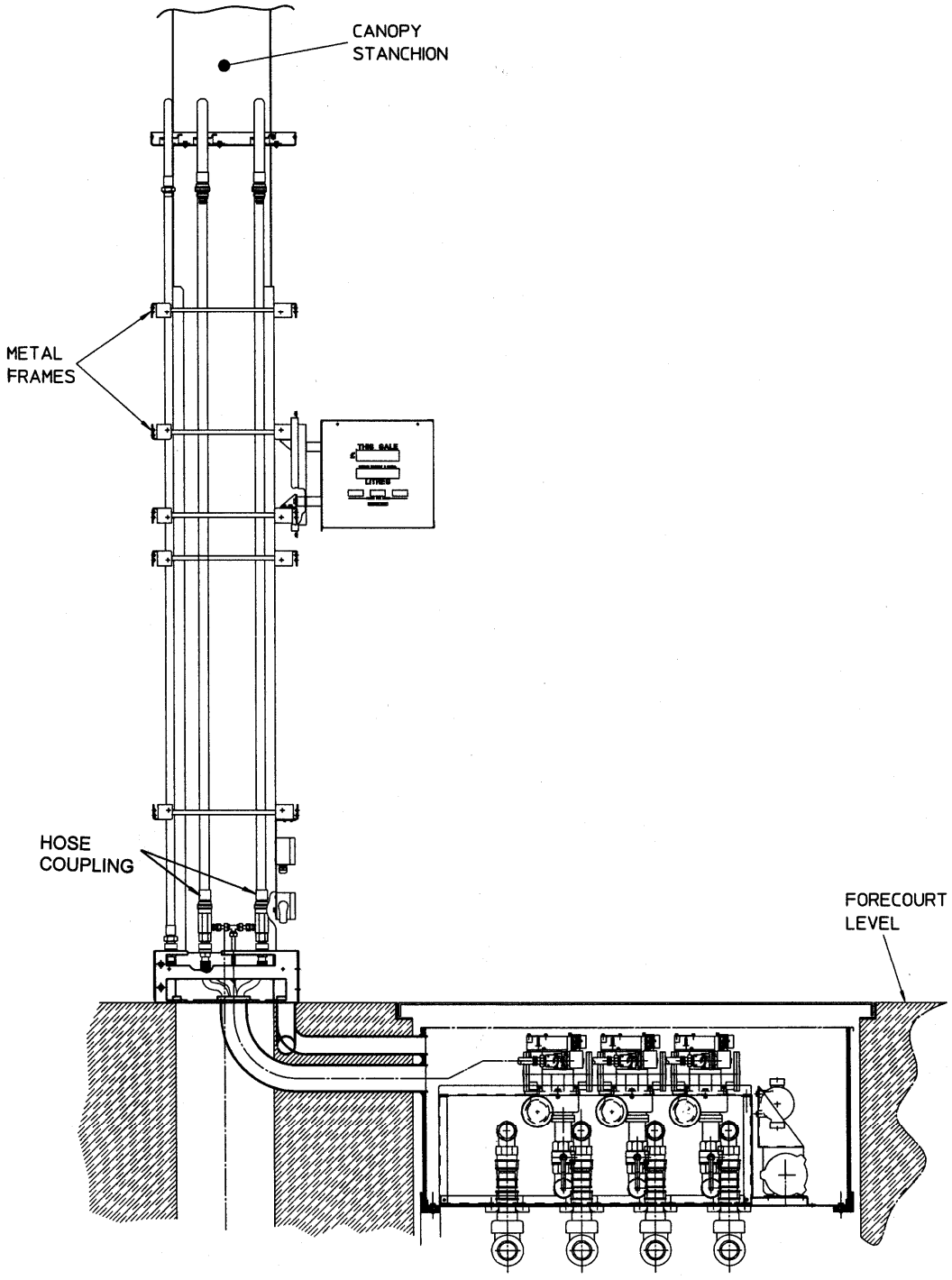


Figure 7 Schematic of Apollo dispenser

Figure 8 Dresser Wayne Harmony Dispenser with additional LPG nozzles

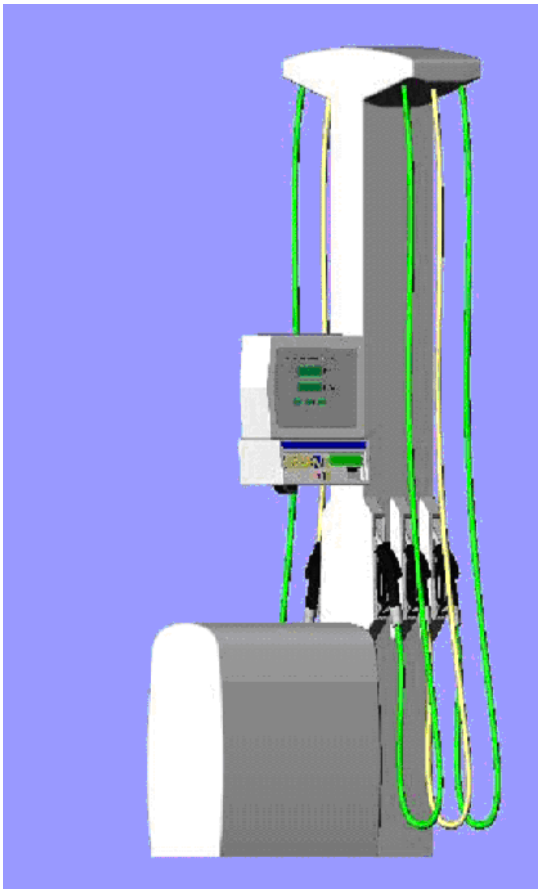


Figure 9 Dresser Wayne 9000 MK2 head enclosure with IPT

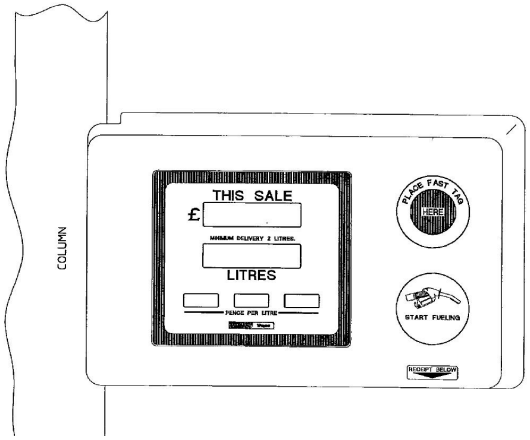


Figure 10
Dispenser head with Wayne-Trac post payment system

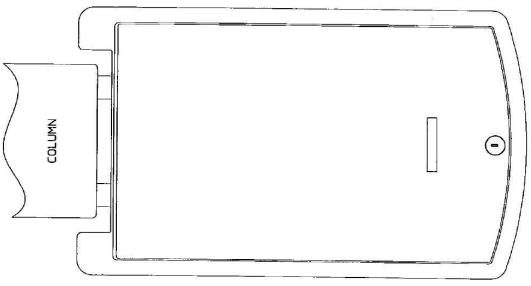


Figure 11
Wayne-Trac system - View on underside of head showing receipt slot

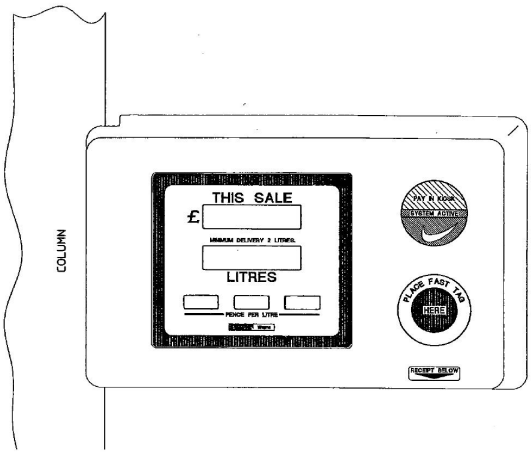


Figure 12
Wayne-Trac system with alternative three colour instruction area

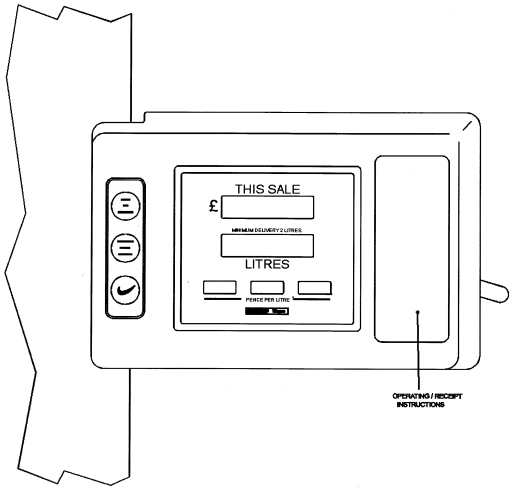


Figure 13
Wayne-Trac system with traffic light customer indicator prompts

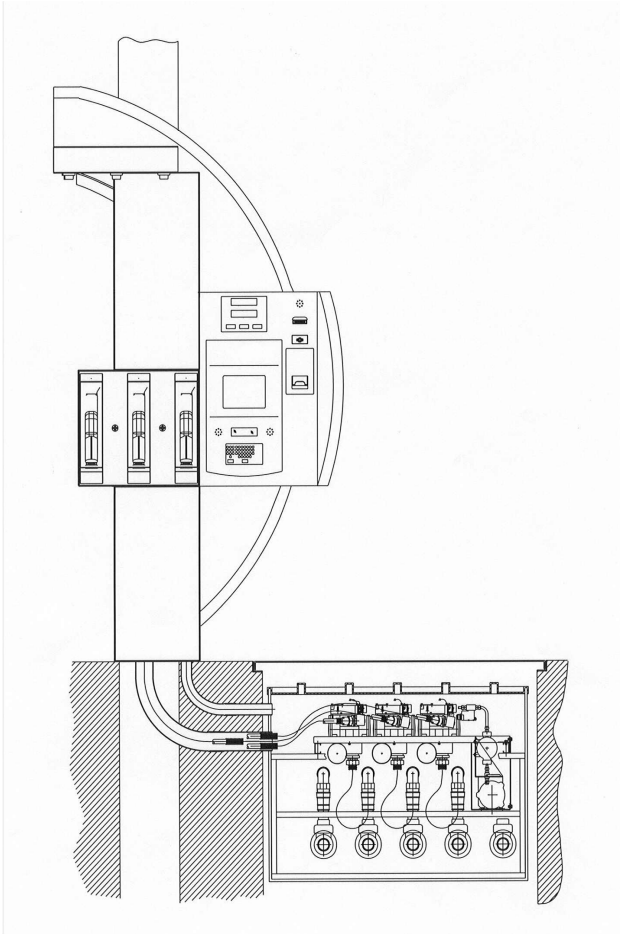


Figure 14 Schematic of Harmony dispenser with cut-away view showing below-ground hydraulics

Figure 15
IGEM - Power supply unit

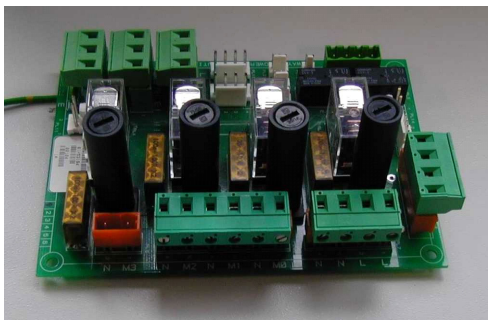


Figure 16
IGEM - Power distribution board

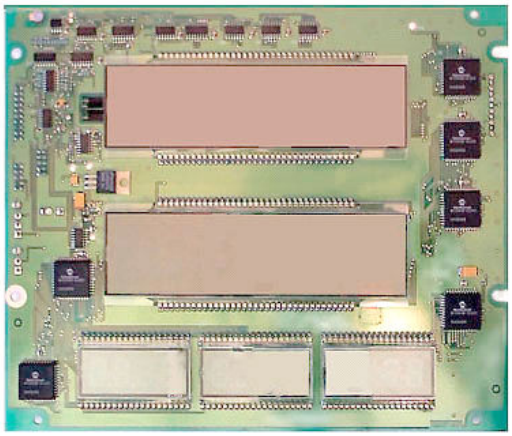


Figure 17
IGEM - Display board (3 unit price display)

Figure 18
IGEM - Pump Computer module

Figure 19
IGEM - ISB board

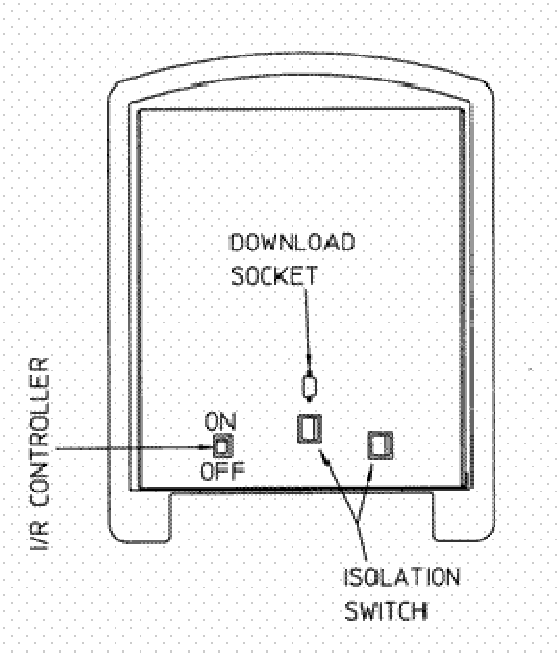


Figure 20
IGEM - Typical configuration panel

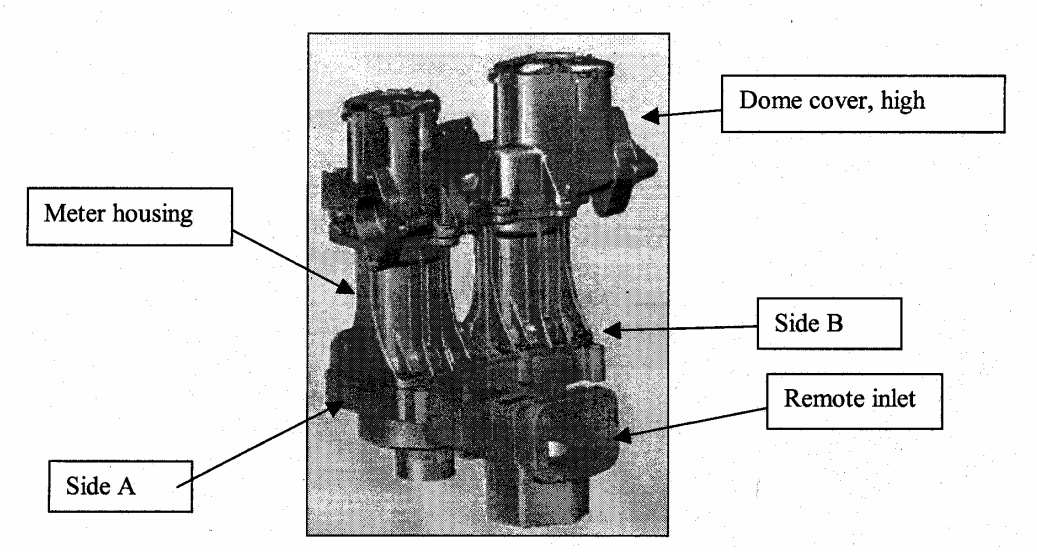


Figure 21 X-Flo Remote unit

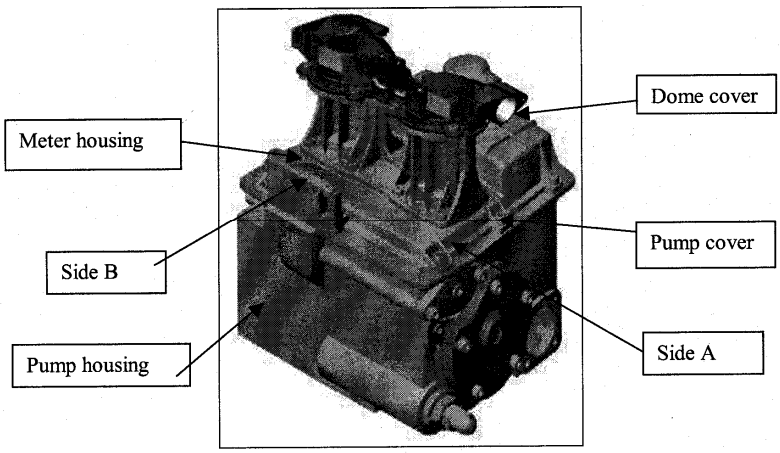


Figure 22 X-Flo Suction Unit

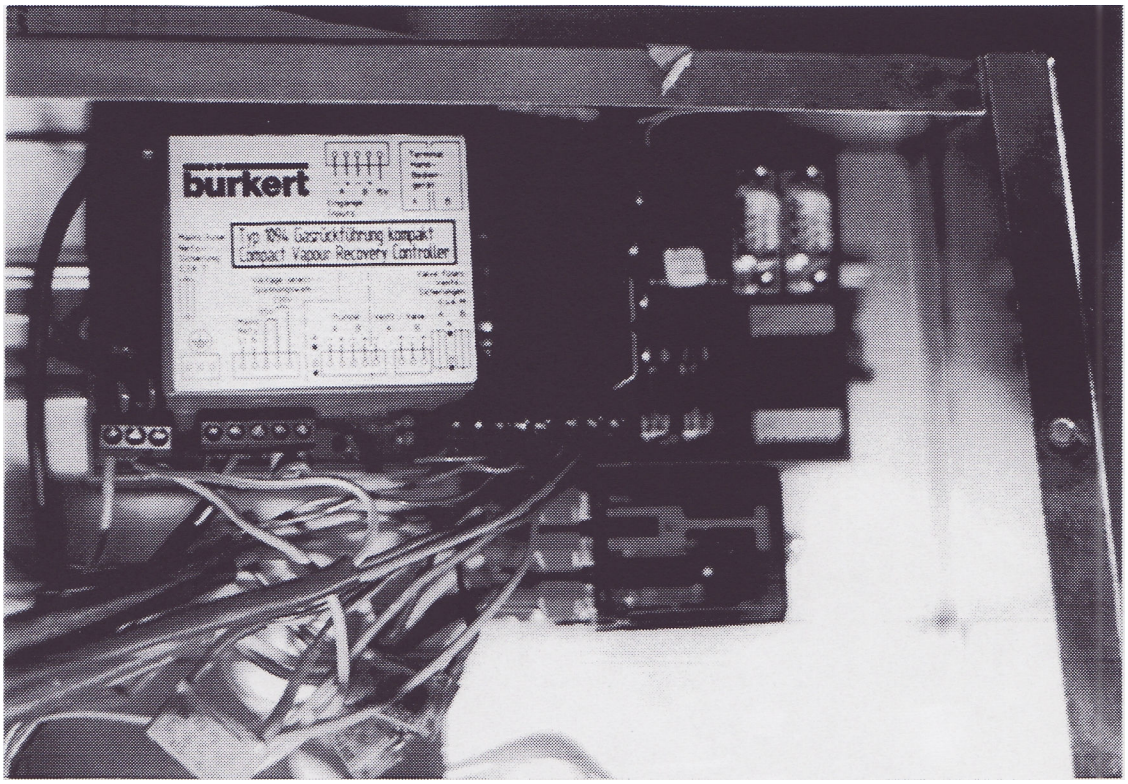


Figure 23 Burkert Assisted Vapour Recovery Control Unit

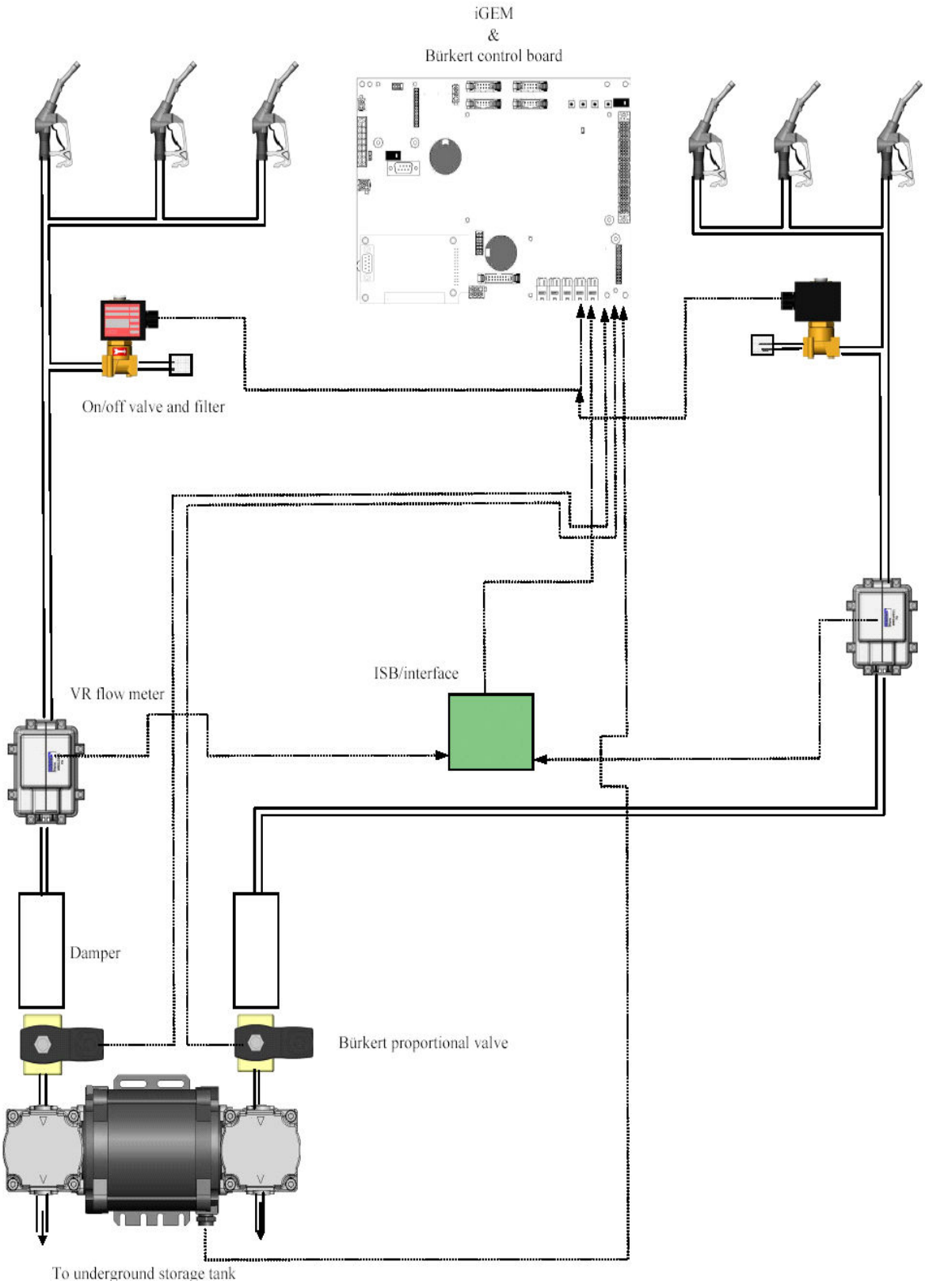


Figure 24.. Wayne 'Burkert' assisted vapour recovery system with Vapour Gate Meter

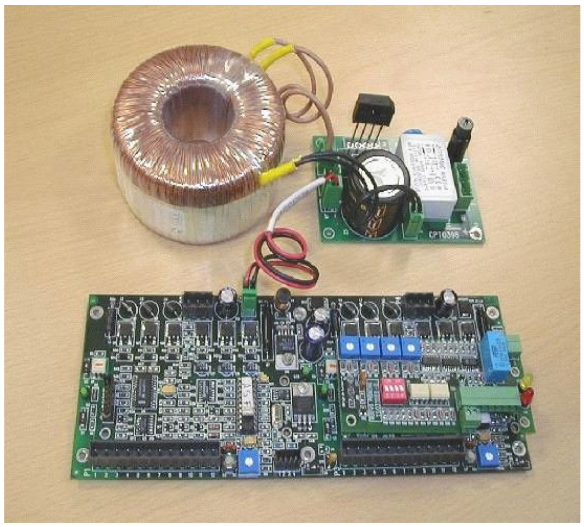


Figure 25
Nuovo Pignone Vapour recovery module (open frame version) with associated power supplyboard

Figure 26
Nuovo Pignone Vapour recovery module (explosion proof version)

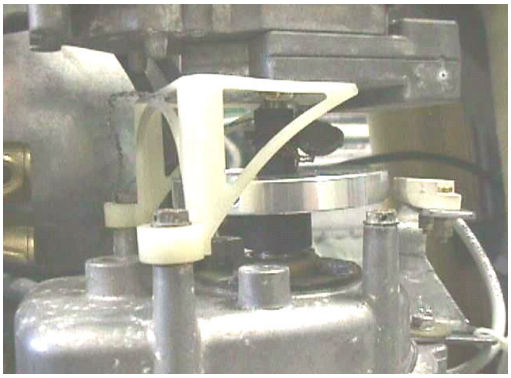
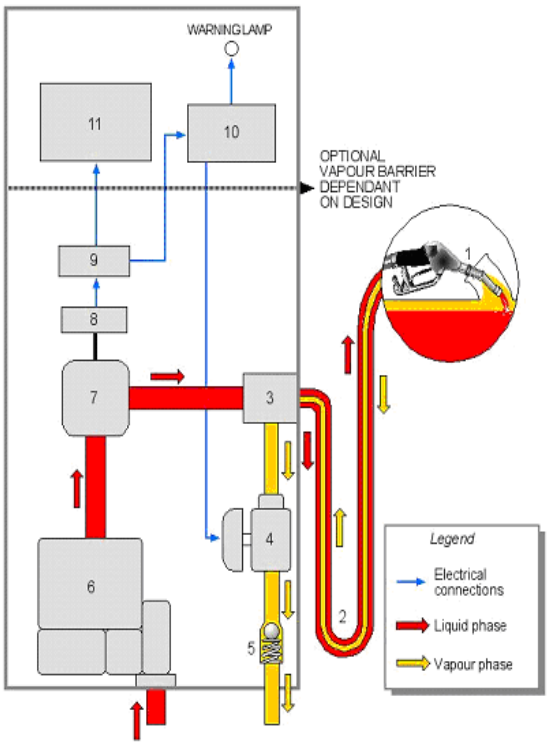


Figure 27
Nuovo Pignone - Magnetic encoder fitted between meter and pulser



COMPONENTS			
1	Nozzle	7	Meter
2	Coaxial hose	8	Pulser
3	Splitter	9	Junction box
4	VR-Pump	10	VR-Pump control module
5	Non-return valve	11	Head control board
6	Pumping unit		

Figure 28
Schematic of Nuovo Pignone vapour recovery system

Figure 29 CleanAir vapour recovery unit

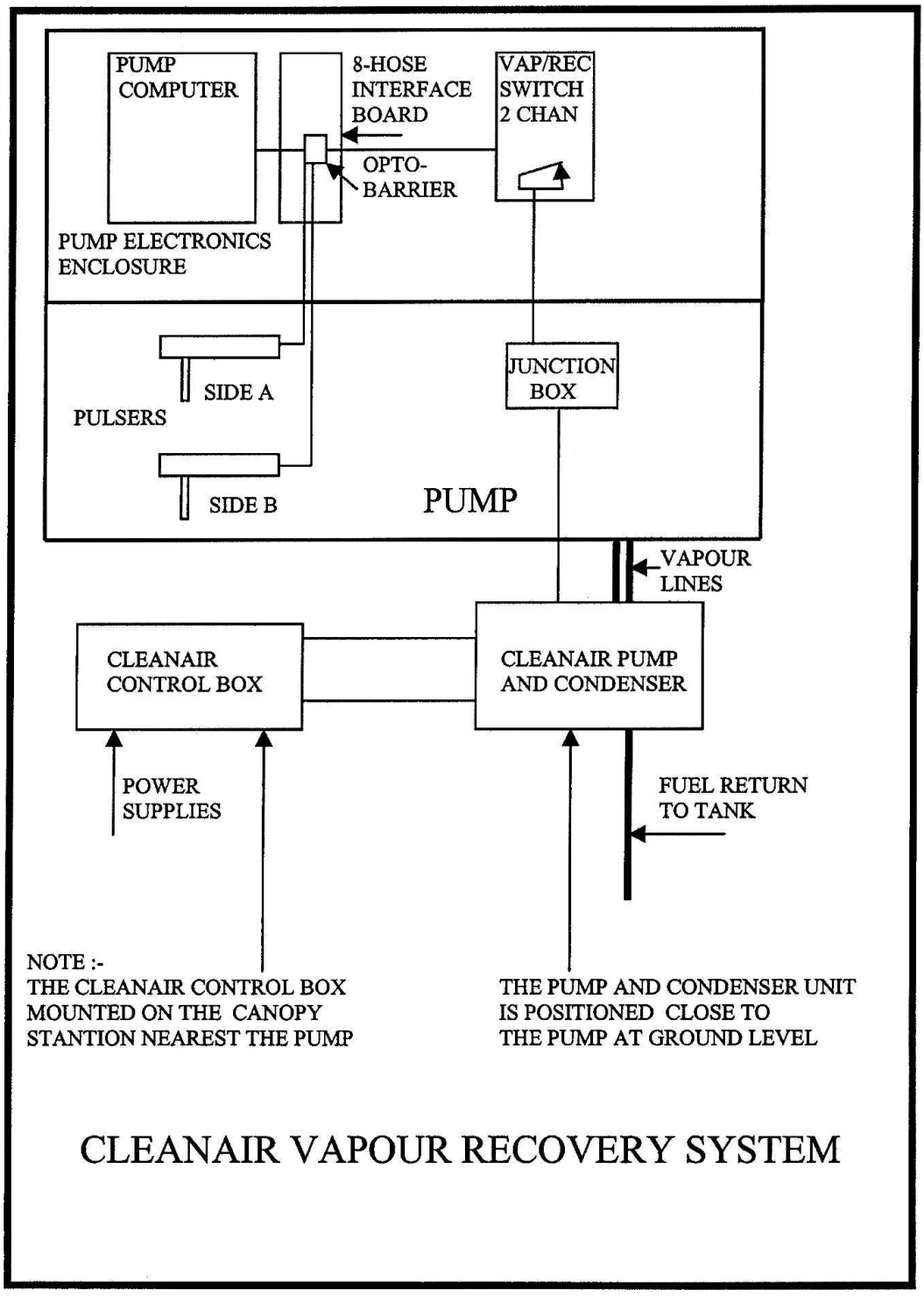
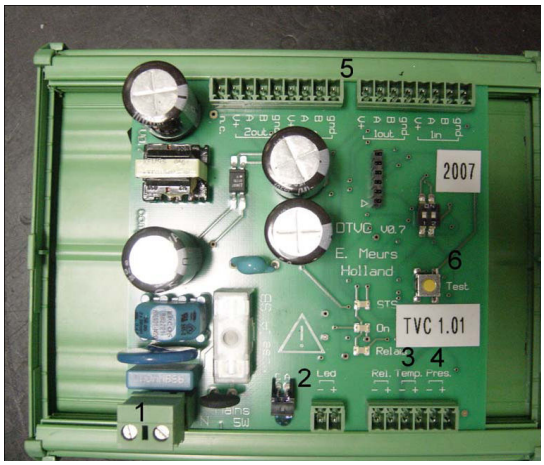
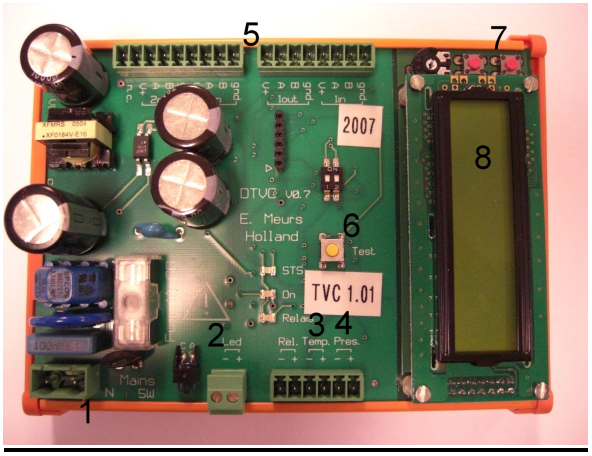


Figure 30 Functional diagram of CleanAir vapour recovery unit



1 Power Supply connection 230V
2 Infrared Port for Data communication
3 Temperature sensor connection
4 Density block connection
5 Pulser channel connection
6 Calibration button TVC system on/off

Figure 31 TVC unit without LCD display



1 Power Supply connection 230V
2 Infrared Port for Data communication
3 Temperature sensor connection
4 Density block connection
5 Pulser channel connection and Calculator connection
6 Calibration button TVC system on/off
7 Scroll function for display information
8 Display

Figure 32 TVC unit with LCD display

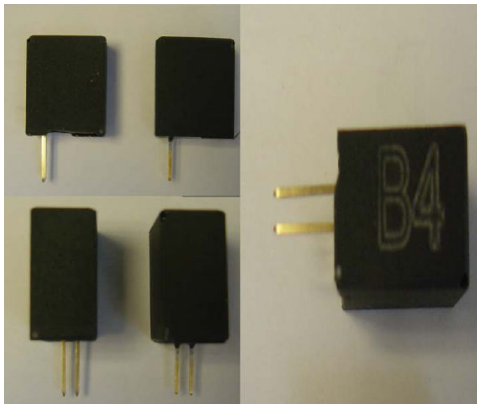


Figure 33 Density blocks

Figure 34 Temperature sensor: LM335

Figure 35 Typical installation of temperature sensor

Figure 36 TVC unit sealing arrangement

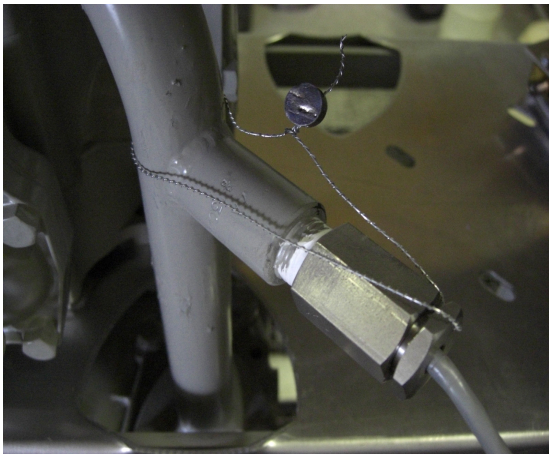


Figure 37 Typical installation of temperature sensor and sealing arrangement

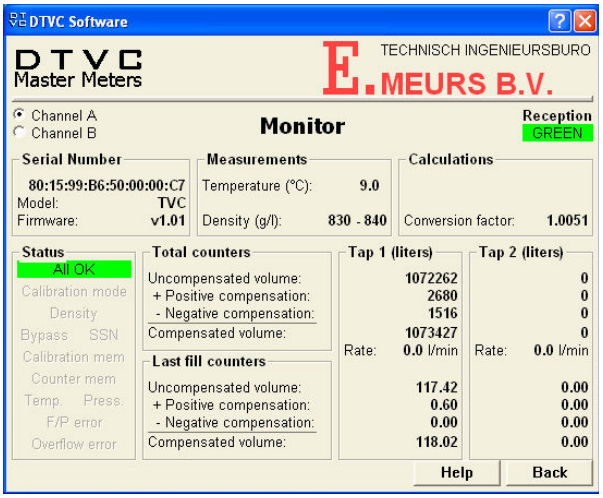


Figure 38 Typical display of measurement data using 'Fuel Monitor' software

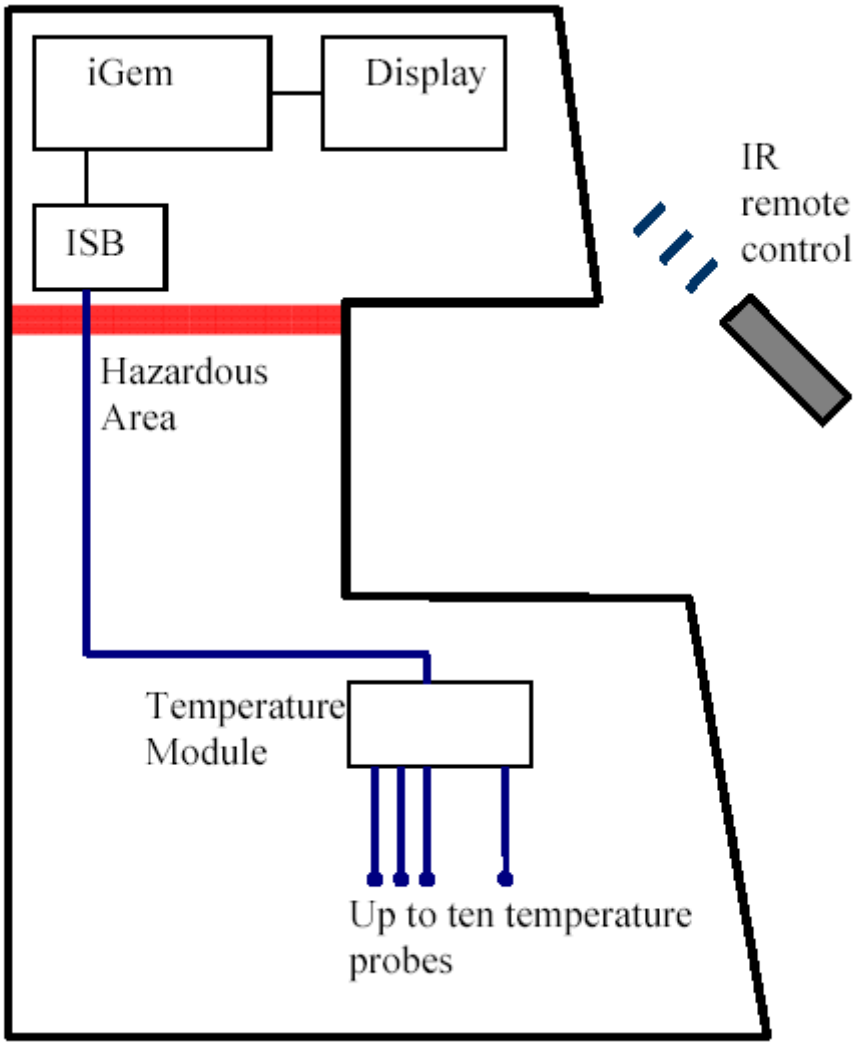


Figure 39 Dresser Wayne ATC – Component Overview

Figure 40
Dresser Wayne ATC – **ISB mounted in electronic head**

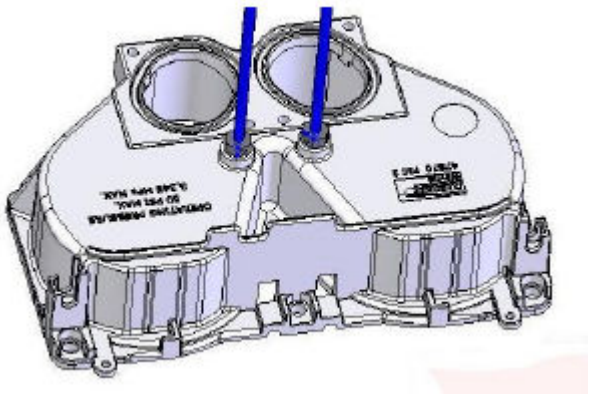


Figure 41
Dresser Wayne ATC – Probes mounted in dome cover

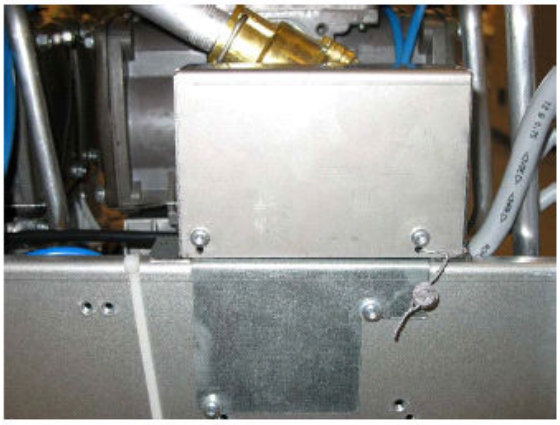


Figure 42
Dresser Wayne ATC – Sealing – TM module

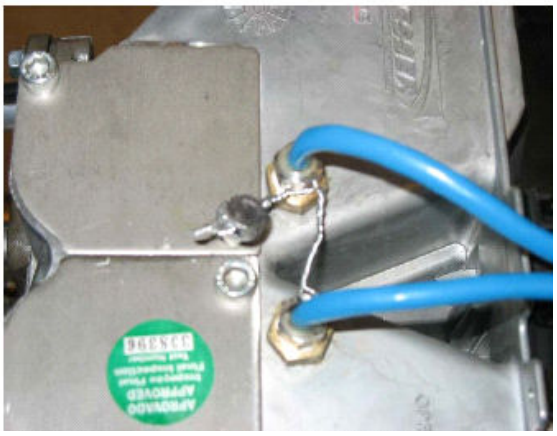


Figure 43
Dresser Wayne ATC – Sealing – Temperature probes

Figure 44 X-Flo sealing arrangements

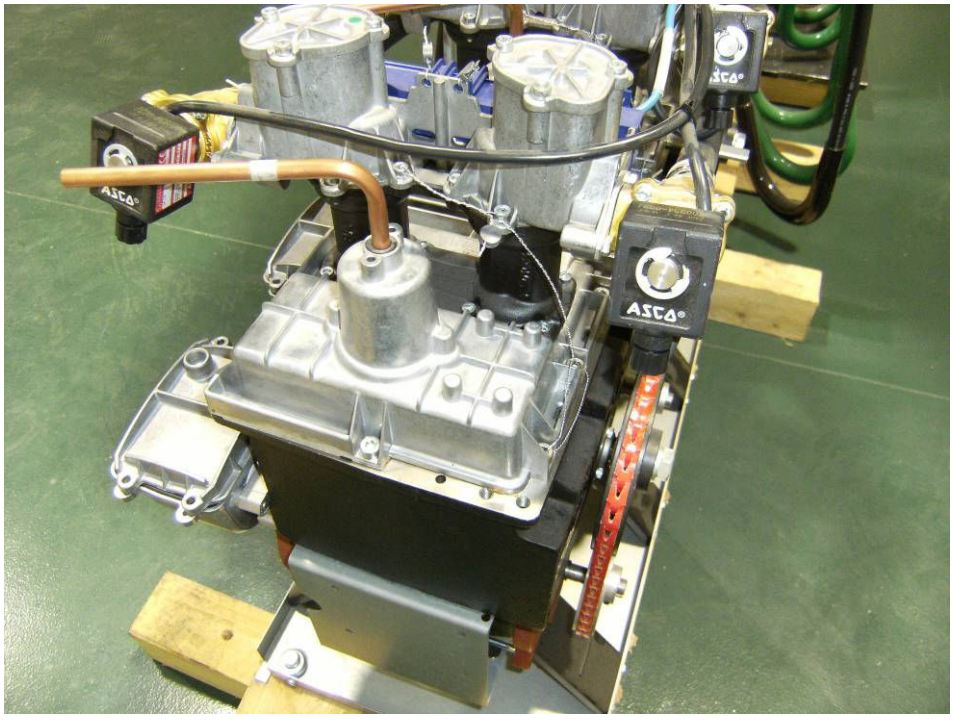


Figure 45 Alternative X-Flo sealing arrangements

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