

640

OILCON[®] MARK 6M

According MEPC 108 (49)

Oil Discharge Monitoring and Control System

Valid for Oilcon[®] Mark 6M (serial numbers from 091201M)

1 flowmeter configuration



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1. PREFACE

1.1 GENERAL

This manual contains instructions for installation, operation and maintenance (IOM) of the Oil Discharge Monitoring and Control system.

For IOM information of associated equipment supplied by VAF Instruments, refer to the separate manual supplied with those products.

This manual contains important information for the installer, the operator and for your maintenance department.



To ensure safe and correct installation and operation, read this manual completely before installing the equipment and starting operations.

For any additional information contact:

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1.2 SYMBOLS

The following symbols are used to call attention to specific types of information.



A warning to use caution! In some instances, personal injury or damage to the Oil Discharge Monitoring and Control system may result if these instructions are not followed properly.



An explanation or information of interest.

1.3 COPYRIGHT

This Technical Manual is copyrighted with all rights reserved.

While every precaution has been taken in the preparation of this manual, no responsibility for errors or omissions is assumed. Neither is any liability assumed for damages resulting from the use of the information contained herein. Specifications can be changed without notice.

Oilcon® is a registered trademark of VAF Instruments B.V.

2. INSTALLATION

2.1 INTRODUCTION

This specification sets out the requirements for the installation, operation and maintenance of an Oilcon® Oil Discharge Monitoring & Control System on board a typical tanker. It should be studied carefully before actually commencing any operation or work.

For the purpose of installation the system can be divided into four categories;

1. Pump room equipment and related deck ancillaries (hazardous area)
2. Bulkhead penetrations.
3. Engine room equipment * (non-hazardous area)
4. Control room equipment ** (non-hazardous area)

The exact location of the separate elements within these categories will vary from ship to ship but the specific location of some units relative to others is important.

In addition to safety precautions which must always be strictly observed for work in hazardous spaces, installation undertaken at sea, with the ship underway, require additional precautions.

* It is recognised that for some vessels the pump room and engine room are not adjacent. If this is the case, it will be necessary to mount the electrical equipment in some other suitable non-hazardous space adjacent to the pump room.

** Again, some vessels may not have a cargo control room. If this is the case, some other convenient area must be identified, such as the navigation bridge, the engine room or the accommodation area.



ANY COMPONENTS MOUNTED ON OPEN DECK OR IN AREAS LIKELY TO ENCOUNTER TEMPERATURE AT OR BELOW FREEZING SHOULD BE PROTECTED ACCORDINGLY AGAINST FREEZING.

2.2 UTILITIES

For operation of the Oil Discharge Monitoring & Control System the following utilities are required:

2.2.1 Fresh water supply

An un-interrupted supply of fresh water free of any contamination is important for a correct operation of the Oil Discharge Monitoring & Control System, as the freshwater is used to keep the pipework and the windows of the detection cell clean and to perform a Zero check prior to operation of the system.

Fresh water supply conditions:

nominal inlet pressure	: 1.5 bar	(150kPa.)
maximum inlet pressure	: 6 bar	(600kPa)
average consumption	: 0.13 l/min	
maximum consumption	: 8 l/min, during FLUSH	
temperature	: 10 °C - 65 °C	

2.2.2 Air supply

For a trouble free and satisfactory operation of the pneumatic components in the Oil Discharge Monitoring & Control System a supply of clean, dry air at a constant pressure is essential.

Air supply conditions:

- valve control	4.0 bar nom. 7 bar max.	(400kPa nom, 700kPa max)
- window wash pump	5.0 bar nom. 7 bar max.	(500kPa nom, 700kPa max)
- average consumption	6 l/min	
- maximum consumption	50 l/min	

2.2.3 Electrical supply

Main Control Unit	115/230 VAC 50/60 Hz, 0,5 Amp
Emergency supply	24 VDC, 1 Amp
Electro Pneumatic Unit	115/230 VAC, 50/60 Hz, 0,5 Amp
Sample pump motor	440 VAC, 60 Hz, 1.3 kW, 2.5 Amp or 380 VAC, 50 Hz, 1.1 kW, 2.6 Amp

2.3 PIPEWORK GENERAL

All pipework for water services should be of a suitable material and capable of withstanding working pressures of up to 16 bar. The pipework has been standardised at 15mm O/D with a minimum wall thickness of 1 mm. For example:

(ASTM B111-69 alloy 706 - or BS 378/2871 type CN 102-0).

Air signal pipework should be copper, and generally be 6 mm O/D x 4 mm I/D.

The exception in this sizing is the air supply for the window wash pump mounted on the skid, and shown as V12. These lines are 8 mm O/D x 6 mm I/D. (ASTM B75-68 alloy 122 - or BS 2871/1971 type C106-0).

Pipework must be clean and oil-free prior to fitting and care must be taken to ensure all joints are leak tight. Failure to ensure this will adversely affect system function, particularly if air leakage is evident on pump suction lines. Ideally all joints should be made using brazed couplings. If piping is being installed during a sea passage then compression fittings may be used. These couplings should be of a salt water resistant material, and the use of stainless steel compression rings may be necessary if a non-flared tube end technique is used to make the joints. Mild steel couplings must not be used. Pipework must be adequately clipped and supported, and shall not impose any strain or force on equipment, e.g. pump or skid assembly. Pipework must also be protected in exposed situations. In those cases where the water discharge from the ballast skid is taken to a slop tank, if the ship has an inert gas system, a loop-seal arrangement must be fitted in the discharge line to prevent contamination being forced back down the line. Also measurements must be taken to prevent the discharge from free-falling into the tank. This is usually achieved by diverting the flow against the bulkhead of the tank.



CAUTION:

Before the system is put into operation or tested all pipework shall be flushed and cleared from dirt or foreign matter.

Reference drawings;

Schematic installation diagram Oilcon® Monitor System Mk6	0806-8035
Bulkhead penetrations and piping diagram Oilcon® Monitor System Mk6	0806-8064
Dimensional drawing & parts list Skid Oilcon® Monitor System Mk6	0806-1280

2.3.1 Sample pump units

The sample pump unit comprises a pump, bulkhead mounting flange with integral gas-tight shaft seal and a flange mounted motor. For this purpose a hole of diameter 290 mm is to be made in the bulkhead wall. The pump unit shall be fitted to the bulkhead utilising the welding ring as supplied with the pump. This ring shall be welded to the bulkhead wall. For the location of this hole verify with the pump dimensional drawing that there will be no obstacles, and that the pump unit can be accessed for maintenance. Maintain sufficient free space around the motor for free air circulation to cool the motor. If possible, the unit should be located below all proposed sampling points and as central to these locations as possible. Care should be taken to ensure that under all operational circumstances a zero or positive pressure is present at the suction side of the pump.

The joints of the suction line must be air-tight, otherwise air leakage will occur causing reduced pumping and monitoring performance. If air leakage is considerable, the pump may fail to prime or pump at all.

It will be observed that a length restriction has been placed on the sample pipes (refer to section 2.7.4 pipe work response time calculation). This is for two reasons:

- a) To ensure that the total response time of the system is less than 40 sec., as required by the legislation. In fact, since the instrument response time is less than 5 seconds and the sample velocity in the specified pipework is 0.9 m/s, there is some margin here.
- b) To ensure that the sample pump is not faced with excessive negative suction pressure due to high pipe losses.

2.3.2 Installation of pump



WARNING:

In the case of an installation at sea, where the pump room constitutes a hazardous area, precautions for hot work as laid down by the owner must be strictly observed.

At the selected location a hole of diameter 290mm is to be made in the bulkhead wall. The installer should note that in some circumstance it may be necessary to construct a 'top-hat' device, to artificially extend the pump room/engine room bulkhead around the pump/motor assembly while the hole is being cut and the mounting flange fitted.

Weld-on the welding ring; make sure that the bolt holes are in X-position. These holes are not to be in +-position!

The gasket shall be placed in between the pump main plate and the welded ring.

For easy installation do not fit the oil reservoir yet.

Before connecting the system piping to the pump, the unit is to be securely fastened to the bulkhead. Long or heavy piping sections shall not be supported from the pump but by separate supports.

ALIGNMENT: No inspection or corrections to pump/motor alignment are necessary.

Install the oil reservoir and top up the reservoir with the supplied oil.



WARNING:

The oil reservoir shall always be sufficiently filled with oil, as the proper functioning of the gas seal located in the centre of the pump main plate relies on the presence of oil, for lubricating, sealing and cooling purposes.

2.3.3 Electrical installation pump

Verify the power supply, this is to match the data as shown on the electric motor nameplate. Earthen is to be carried out utilizing the earthen bolt located inside the terminal box, this before the motor is connected to the mains.

2.3.4 First start



CAUTION:

UNDER NO CIRCUMSTANCES MUST THE PUMP BE RUN WITHOUT LIQUID. THE PUMP CASING MUST BE FILLED WITH LIQUID FIRST OTHERWISE THE PUMP WILL SEIZE AND DAMAGE WILL OCCUR.

a) SELF-PRIMING

The pump will not function or prime until the casing is filled with liquid. Make sure any discharge valve is opened before starting, enabling air to be released. Running the pump with zero capacity will cause excessive system pressure; heat generated in the pump and may overload the electric motor. Make sure any system valve should be fully opened when the pump is being started or stopped.

b) DIRECTION OF ROTATION

This can be seen or checked from the motor side only. Make sure that all piping is installed, and the pump is filled with water. Switch-on the pump unit for a short moment only! Look at the motor fan and notice the direction in which the fan spins. This must be **clockwise**, when looking from the back cover of the motor. An arrow also indicates correct direction of rotation. If direction of rotation is wrong, interchange any of two line wires of the power cable in the terminal box.

Reference drawings:

Schematic inst. diagram Oilcon® Monitor System Mark 6	0806-8035
Sample pump/motor dimensions	0806-1076
B'hd penetrations & piping diagram Oilcon® Monitor System Mark6	0806-8064
Electrical interconnection diagram Oilcon® Monitor System Mark6M	0806-2046

2.3.5 Skid

The skid is normally located in the pump room and is mounted on the pump room/engine room bulkhead. The unit should be positioned above the sample pump, but should be kept below the level of the sampling probe points wherever possible. This is to ensure full pipework and provision of adequate suction pressure for the pump.

The skid is provided with four mounting points, drilled to accept 12 mm bolts.

A sample should be fitted between the pump discharge and the skid to facilitate the taking of grab samples for analysis.

Reference drawings:

Schematic installation diagram Oilcon® Monitor System Mark 6	0806-8035
Assembly drawing Oilcon® Monitor System Mark6M	0806-1280
Bulkhead penetration and piping diagram Oilcon® Monitor System Mark6	0806-8064

2.3.6 Sampling probess



WARNING:

In the case of an installation at sea safety precautions must be observed while drilling operations take place. In the case where welding is not permitted a saddle clamp arrangement can be utilised. This type of probe arrangement should only be viewed as temporary and arrangements should be made to weld the probe in place at the next opportunity.

Two sample points are supplied with the monitor, for location at the selected points on the relevant overboard discharge lines and contains the following:

- a pneumatic operated valve for selection of the sample point;
- a sample probe to take the sample from the discharge line.

Each probe is supplied with a compression fitting which can be welded to the pipeline. Each probe is supplied with a hand valve.

Positioning of the sample probe within the pipeline is most important. To prevent excessive quantities of air being drawn into the sample pump, the probe should ideally be mounted in a rising vertical pipe section. This will ensure that -provide water is being pumped - the main pipe is always filled. Where it is not possible to mount into a vertical pipe then a horizontal section may be used and the probe located as shown in drawing 0806-1265-4. VAF Instruments recommend that whenever possible the sample probe be installed on the upstream side of the orifice plate.

In any case the probe should be located upstream of any diverting line to the slop tank.

The important points to note are as follows:

- a) The probe enters from the underside of the pipe.
- b) The probe is mounted a small distance into the pipe. This ensures a representative sample and reduces the possibility of picking up 'sludge' deposited in the pipe.
- c) The probe end is located in the lower section of the pipe, partly to increase the possibility of obtaining an air-free sample and partly to reduce the obstruction in the pipe.
- d) The sample valve is mounted in the correct orientation. (Air inlet port uppermost)
- e) The sample valve inlet and outlet ports are correctly mounted.

Reference drawings:

Schematic installation diagram Oilcon® Monitor System Mark6	0806-8035-3
Sampling probe installation	0806-1265-4
Dimensional drawing. Sample V/V Oilcon® Monitor System Mark6	0806-1077-4

2.3.7 Orifice plate

GENERAL INFORMATION

The orifice plate is a square-edged, concentric bore type, manufactured in stainless steel. It is designed to be clamped between two flanges, within the PCD of the flange bolts. Working pressure is up to 24 bar and working temperature is up to 290 degrees Celsius. Width is 3 mm on this vessels line size. In such cases where a bevel is machined on the bore of the plate, the side with the bevel on should be facing downstream when installed.

INSTALLATION OF FLOW SENSOR

The single most important consideration, when installing an orifice plate type flowmeter is the amount of straight pipe available on each side of the orifice plate. It is appreciated that long lengths of straight pipe are not common in the average pump room, but it is essential that the flow through the orifice plate is not turbulent. The only way to achieve this is, have a long smooth approach to the orifice plate. The minimum recommended length of straight pipe upstream of the plate is 10 pipe diameters and downstream of the plate, is 5 diameters. Within these distances there should be no bends or obstructions such as valves. The effect of reducing these distances is to considerably reduce the accuracy of the flow metering system.

The accuracy of the flowmeter is limited to +/- 10 % and this is easily achieved at high flow rates. However, at low flow rates, an orifice plate type flowmeter rapidly becomes inaccurate such that the accuracy limit of +/- 10 % is reached at about 1/10th of the maximum flow. If the orifice plate is not installed with adequate lengths of straight pipe, the effect is to reduce the effective measuring range of the flowmeter and to produce a widely fluctuating signal.

The orifice plate should be mounted in such a position so as to ensure a full pipe at all times, which is usually best achieved in a vertical pipe. The pipeline downstream of the sensor must be arranged to ensure that no siphoning effect is possible. To prevent siphoning in horizontal installations, the discharge line must rise by at least 1`xpipe diameter above horizontal centre line. The rise should be so arranged that it is located at least 5x pipe diameters after orifice plate. It must be stressed that if above installation requirements cannot be met, VAF Instruments should be consulted for advice. VAF Instruments cannot held be responsible for any flow metering system installed incorrectly or without due consultation.

The orifice plate is installed between the flanges using jointing material of 1.5mm thickness. Two pressure tapping holes are required, one each side of the orifice plate. For pipelines larger than 25mm diameter, it is advisable to weld a threaded boss to the pipeline. For lines less than 25 mm diameter the pipe itself can be drilled and tapped. In both cases, the hole must be threaded for ¼" BSP. The boss upstream of the orifice plate must be sited 1 pipe diameter from the centre-line of the plate. The boss downstream of the orifice plate must be sited ½ pipe diameter from the centre-line of the plate. In the case of a vertically rising line, the bosses can be sited at any position on the circumference of the pipe. In a horizontal line, the bosses must be sited on the horizontal centre-line of the pipe.

Reference drawings:

Schematic installation diagram Oilcon® Monitor system Mark 6	0806-8035-3
Installation flowmeter Oilcon® Monitor System Mark6	0806-8016-3
Dim. drawing ball valve flowmeter kit Oilcon® Monitor System Mark6	0806-1041-4

2.3.8 d.P. transmitter

The electronic differential pressure transmitter is a two-wire transmitter which converts the differential pressure developed by the flow sensor into a 4-20mA signal.

Select a location for the transmitter that is close to the flow sensor, not exceeding 16 metres and where the ambient temperature will not exceed 90 degrees Celsius nor be less than -40 degrees Celsius. The location should be as free from vibration as possible.

The transmitter must be mounted so that the measuring element is vertical. A mounting bracket and U-bolt is supplied to mount the instrument on and is suitable for either pipe or surface mounting. For pipe mounting, the bracket accepts from 30mm up to 60 mm diameter pipe and can be positioned on a horizontal or vertical pipe.

The differential pressure sensing lines from the flow sensor are coupled to the transmitter's 3-way manifold using 1/4" NPT/10 mm couplings which are supplied.

The 3-way manifold contains isolating valves and an equalizing valve.

The pressure sensing lines must be routed with a minimum gradient of 1 in 10 fall after an initial fall from the pressure tapping points of 300 mm. The lines should be adequately clipped. Two isolating valves are supplied; one end threaded 1/4" BSP for connection to the pipe.

DP/i transmitters these items of equipment are certified as  II 1 G EEx ia IIC T4 or T5.

Reminder :

"EEx" equipment in compliance with European standards for potentially explosive atmospheres,

"ia" equipment in compliance with specific building rules for intrinsically safe equipment,

"C" equipment for use with gas of the subdivision C.

"T4" Temp ambient -40°C to +80°C equipment whose surface temperature does not exceed 135°C when used in an ambient temperature less than 80°C.

The equipment is suitable for areas classified as Zone 0 (area in which an explosive atmosphere is present continuously or during long periods) **AND** Zone 1 (area in which an explosive atmosphere is likely to occur in normal operating conditions).

Note:

In hazardous zones with explosion proof requirements the covers must be tightened with at least 7 turns. In hazardous zones with intrinsically safe or non-incendive requirements, the circuit entity parameters and applicable installation procedures must be observed. Cable access to wiring connections is obtained by one of the two cable conduit outlets. Conduit threads should be sealed by means of code approved sealing methods. The unused outlet connection should be plugged accordingly. Refer to section 2.4.3 of this section for further information.

Reference drawings:

Schematic installation diagram Oilcon® Monitor System Mark6	0806-8035
Bulkhead penetration and piping diagram Oilcon® Monitor System Mark6	0806-8064
Electrical interconnection diagram Oilcon® Monitor System Mark6M	0806-2046
Dimensional drawing dP Transmitter	0899-1092
Connection diagram dP Transmitter type FUJI	0810-2007
Control drawing Oilcon® Monitor System Mark6M	0806-0006

2.4 BULKHEAD PENETRATIONS GENERAL

Great attention has been paid, during the design of the Oilcon[®] monitor, to minimise the number of bulkhead penetrations which must be made and to make the total installation as simple and as straightforward as possible.

Nevertheless, there remain two sets of penetrations which must be made.

2.4.1 Sample pump

The requirements for mounting this pump have been detailed in Section 2.3.1 of this manual.

2.4.2 Air pipelines

The recommended method for making these penetrations is, using a proprietary transit system, for which approvals have been obtained such as the Multi Cable Transit system.

It is anticipated that the penetrations will usually be made with standard 6 mm and 10 mm pipe provided with a pipe connector at each side.

When the Oilcon[®] installation is required to be proven with oil injection, a commissioning engineer must make connections to the air supply line V11, on both sides of the bulkhead. The installers are therefore requested: To make at least the V11 bulkhead penetration using a 6 mm pipe connector, one on each side of the bulkhead penetration. Note that these components are outside VAF Instrument's normal scope of supply.

Reference drawings:

Schematic installation diagram Oilcon [®] Monitor system Mark6	0806-8035
Multi cable transit Oilcon [®] Monitor System Mark6	0806-8066
Bulkhead penetration and piping diagram Oilcon [®] Monitor System Mark6	0806-8064
Parts list Air supply unit Oilcon [®] Monitor System Mark6	0899-1258

2.4.3 I/S communication cable

For general information, the communication cable between the Electro Pneumatic Unit and the skid has a nominal 0.5mm² diameter, 7 cores of 2 twisted pairs with an overall screen. (EG Helkama RFE-HF60V).

The communication cable makes use of the same cable transit system as is used for the air pipelines to ease installation of the system.



BEFORE OPERATION

It is vital to ensure that the equipment supplied exactly meets your needs and that it is certified for a safe use in your expected operating conditions. For the components such as the measurement cell and EPU items of equipment are certified.

See section 6 for certification standards.

All circuits are connected to the energy limiting circuits within the EPU. These circuits limit the voltage by means redundant zener diodes, all connected to the same earth connection. The current is limited by means of resistors. Each circuit is thermally protected by means of a fuse.

The ratings of the circuits to the measurement cell is such that even in case of an total short circuit of all the circuits together, the energy within that short is still within non-ignitive intrinsically safe energy levels (including a safety factor of 1,5) The additional position detection circuits are separated from the circuits to the measurement cell. The EPU contains two other energy limited circuits for connection to the approved dP/I sensors. These circuits are separated from the aforementioned circuits.

WIRING PROCEDURE

Before making wiring work, be sure to turn OFF the main power, cables, cable glands and plugs certified in accordance with the considered zone must be used.

More, whatever the protection mode, only use plugs or cable glands with a protection degree of at least IP 65

- be sure that the cable diameter complies with the selected cable gland,
- tight the cable gland in accordance with supplier's instructions,
- never forget to mount the covers and tighten then correctly.

REPLACEMENT PARTS

The replacement of components can only be done by a person trained to act on equipment intended for use in potentially explosive atmospheres.

Spare parts must only be genuine parts supplied by VAF Instruments.

During installation there is no need to operate the system and thus to switch the Electro Pneumatic Unit on.

Reference drawings:

Schematic installation diagram Oilcon® Monitor system Mark6	0806-8035
Multi cable transit Oilcon® Monitor System Mark6	0806-8066
Bulkhead penetration and piping diagram Oilcon® Monitor System Mark6	0806-8064
Control drawing Oilcon® Monitor System Mark6M	0806-0006

2.5 ELECTRICAL INSTALLATION GENERAL



ALL CABLES MUST BE OF SUITABLE TYPE FOR THE PURPOSE INTENDED.

All cables should be run on cable trays and should be secured to the tray by clips which will not damage the cable sheathing. Metal clips are not recommended, unless coated with a suitable buffer material such as nylon or PVC.

All screened cables should be run on a separate cable tray, if possible.

Under all circumstances screened cables must be kept segregated from AC power cables, at a minimum distance of 0.5 metres.

All cables passing through bulkheads should be led through an approved gas-tight bulkhead penetration/gland.

To avoid signal fouling due to electro magnetic induction, all braided copper screens on the screened cables should be connected at one end only, in the engine room. All exposed braids should be suitably trimmed and finished so that all braids end inside the cable gland, and no braids should enter into the cabinet.



- Make sure the temperature rating of the cables connected to the EPU should at least be 70 °C.
- The supply cables connected to the EPU should be secured in such a way that no connection can be made with the signal cables.
- For correct installation a suitable isolation switch shall be installed in the supply line as near as possible to the equipment. Maximum fuse current 16A.

Cable terminations for individual conductors should be finished with a pin terminal crimped on the conductor.

Cables are not supplied by VAF Instruments, unless specifically ordered.

2.5.1 Electro pneumatic unit (EPU)



ALL WIRING CONNECTED TO EPU FROM THE HAZARDOUS ZONE MUST BE CONNECTED IN ACCORDANCE WITH DRAWING 0806-0006 IN ORDER TO ENSURE INTRINSICALLY SAFE CIRCUITS REMAIN SAFE.

The Electro Pneumatic Unit is of sheet steel construction, it is mounted onto a steel frame which carries the pneumatic section of the assembly. It is normally situated in the engine room on the engine room/pump room bulkhead, opposite the skid mounted in the pump room.

This unit has both electrical and pneumatic connections, the electrical cables being run through the base of the cabinet to internal connectors. Suitable cable glands are provided for in the base of the cabinet.

The pneumatic connections are located in the right hand side of the cabinet mounting plate and are suitable for 6 mm o.d. and 10 mm o.d. pipe.

Mounting is by means of six holes drilled to accept 8 mm bolts.

Should the mounting side selected be subject to excessive vibration, anti-vibration pads or stiffeners should be installed to reduce this to an acceptable level.

2.5.2 Starter box

The starter box is used to switch and control the electrical supply to the sample pump motor and contains a relay and thermal relay to protect the pump for overheating. It may be mounted to any suitable location adjacent to the Electro Pneumatic Unit or pump motor. The unit is mounted by four holes which accept 4 mm bolts.

Reference drawings:

Schematic installation diagram Oilcon® Monitor System Mark6	0806-8035
Dimensional drawing motor starter box	0806-1075
Assembly drawing Electro-pneumatic unit	0806-1283
Electrical interconnection diagram Oilcon® Monitor System Mark6M	0806-2046
Bulkhead penetration and piping diagram Oilcon® Monitor System Mark6	0806-8064
Connection diagram motor starter box	0806-2032
Control drawing Oilcon® Monitor System Mark6M	0806-0006

2.6 CONTROL ROOM EQUIPMENT – MAIN CONTROL UNIT (MCU)

This unit is normally mounted in the cargo control room and may be fitted into an appropriate space in one of the cargo control consoles, or wall mounted via a suitable wall mount box. The Main Control Unit is suitable for mounting into a 19" rack system.

SPEED INPUT

1. The Main Control Unit is designed to accept a GPS NMEA 0183 input, baud rate: 4800, data bits: 8, parity: none, stop bits: 1.



Important:

The latitude/longitude position command to be set with four (4) digits behind comma.

The following NMEA0183 position messages can be accepted by the Main Control Unit:

- RMC (Recommended Minimum Specific GNSS Data)
- GLL (Geographic Position- Latitude/Longitude)
- GGA (Global Position System Fix Data)

The following NMEA0183 speed message can be accepted by the Main Control Unit:

- VTG (Course over ground and ground speed)

2. The Main Control Unit is designed to accept a voltage free pulse signal from the ships log or a similar device.

Input pulses can be either 100, 200 or 400 pulses/N.mile.

OVERBOARD VALVE CONTROL

The overboard valve is controlled by the MCU. To achieve this, the MCU is provided with a double pole switchover relay contact (discharge control relay) to control the discharge valve operation.

The valve feedback signal must be connected to the appropriate input terminal at the back of the MCU. In case of system failure the Auto/Man relay contact can be used to override the MCU command, to switchover to manual operation. The relay contact is controlled by the key switch on front of the MCU.

Reference drawings:

Dimensional drawing Main Control Unit

0806-1278

Electrical interconnection diagram Oilcon® Monitor System Mark6M

0806-2046

2.7 INSTALLATION CHECKLIST

2.7.1 General installation checks

1. Is pipework of correct materials and dimensions?
2. Is pipework adequately supported?
3. Does the max distance from furthest sample probe to skid give a system response time of less than 40 seconds?
4. Is pipework free from leaks?
5. Is sample discharge line to slop tank so arranged as to prevent free-fall into the tank?
6. Is loop-seal (or non-return valve) of adequate height installed in sample discharge line to slop tank?
7. Is sample pump installed in such a position as to have a positive pressure on the suction side of the pump at all times?
8. Is relative position of sample pump to skid satisfactory?
9. Is relative position of skid to Electro Pneumatic Unit satisfactory?
10. Are sample probes adequately supported and fitted with a manual stop valve as well as the pneumatic select valve?
11. Are sample probes located in a vertical section of pipe with the flow upwards or in a horizontal section of pipe with the probe entering from the underside?
12. Are all discharges fitted with a sample probe?
13. Is the positioning of each sample probe at a location upstream of any recirculation line to the slop tank?
14. Is sample probe inserted a distance of 1/4 of the pipe diameter and is probe correctly angled in the direction of the flow?
15. Is capacity of fresh water supply adequate?
16. Is fresh water tank (if installed) made from non-corrosive material of adequate strength?
17. Is fresh water tank (if installed) located a minimum of 6 metres above skid?
18. Is fresh water tank (if installed) fitted with an automatic filling valve of adequate size?
19. Are Electro Pneumatic Unit and starter box mounted correctly?
20. Are all electrical cables supported adequately?
21. Are all signal cables segregated from AC power cables by at least 0.5 metres?
22. Are all cables terminated correctly?
23. Is Main Control Unit mounted correctly?
24. Are all bulkhead penetrations gastight and of a type approved by the Administration?
25. If starting interlock is required, has method been approved by the classification society?

2.7.2 Check of Flowmeter and automatic control

1. Does the flowmeter orifice plate have required minimum 10x pipe diameter upstream and 5x pipe diameter downstream and has it been installed upstream of any re-circulating line to the slop tank?
2. Is the orifice plate located in a vertical section of the pipe with an upwards flow?
3. If the orifice plate is located in a horizontal section of pipe, have measures been taken to ensure that the pipe will always be full of water, will not be subjected to syphoning and will ensure sufficient back-pressure across the orifice?
4. Is positioning of orifice plate pressure tapping correct at 1x pipe diameter upstream and 1/2x pipe diameter downstream of orifice plate?
5. Do the pressure sensing lines from the orifice plate pressure tapping fall continuously to the differential pressure transmitter?
6. Is automatic control of overboard discharge valve(s) and recirculation valve(s) installed correctly?
7. Are manual stop valves fitted as required?

2.7.3 Starting interlock and/or overboard valve control

IMO Resolution MEPC 108 (49) entitled:

"Guidelines and specifications for Oil Discharge Monitoring & Control Systems for tankers"

Oil tankers of 150 gross tonnage and above shall be fitted with an oil discharge monitoring control system approved by the Administration and designed and installed in compliance with the Guidelines and Specifications for Oil discharge Monitoring and Control Systems for Oil Tankers adopted by the Organization.

System should record and display the necessary information:

Input information:	Ships position (GPS) Ship speed Overboard discharge valve position Oil content ppm Flowrate discharge Time and date Starting interlock
Output information:	Time and date (UTC) Ships position (GPS) Auto/manual mode Status of operational mode Instantaneous oil content (ppm) Flowrate of discharge (T/h) Ships speed (kts) Instantaneous rate of discharge of oil (l/Nm) Total quantity of oil discharged (l) Status of discharge Sample point selected Type of oil

The data is displayed on a LCD display and also printed on paper at selectable intervals (max. 10min).

Due to the wide variety of starting interlock and overboard discharge control circuits VAF Instruments can only give a general concept of how they can be achieved. Firstly: the IMO description of each version and then an interpretation of the system layout using the Oilcon[®] Oil Discharge Monitoring & Control System.

i) Discharge valve control

The definition of an overboard discharge control is given in paragraph 3.3 of the Annex to IMO Resolution MEPC 108 (49) and is as follows:

"An overboard discharge control is a device which automatically initiates the sequence to stop the overboard discharge of the effluent in alarm conditions and prevents the discharge throughout the period the alarm condition prevails. The device may be arranged to close the overboard valves or to stop the relevant pumps, as appropriate."

ii) Starting interlock

The definition of a starting interlock is given in paragraph 3.4 of the Annex to IMO Resolution MEPC 108 (49) and is as follows:

"A starting interlock is a facility which prevents the initiation of the opening of the discharge valve or the operation of other equivalent arrangements before the monitoring system is fully operational when use of the monitoring system is required by the Convention."

By its very nature Overboard Discharge Control can be considered a starting interlock, if the overboard valves are controlled from the Main Control Unit. They will only receive a signal to open for discharge when all the input parameters are correct.

If so connected as to stop the discharge by use of stopping the relevant pumps, this is not deemed a starting interlock. In this instance a starting interlock could be typically a valve spindle brake.

For an example of an overboard control circuit by use of interlocking overboard and slop tank return valves see drawing 0806-5019-4. This also incorporates a starting interlock.

VAF Instruments advise that prior consultation is made with the classification society surveyor in each case to ensure that the arrangement will be acceptable both as to the operation and with regard to safety.

2.7.4 Pipework response time

MARPOL regulations require that taking into consideration the length of sampling piping, the overall response time is as short as possible, and in any case not more than 40 seconds.

It is therefore necessary to place a restriction on the length of sample pipe from the probe to the detector cell.

The maximum length of sample pipe permissible can be calculated as follows:

Total response time	$T1 = 40 \text{ sec (max)}$
Monitor response time	$T2 = 4 \text{ seconds}$
Sample response time	$T3 = T1 - T2 = 36 \text{ sec}$

Maximum length of sample pipe (in this example sample pipe O.D. 15 mm, thickness of pipe 1mm):

$$L_{\text{Max}} = \frac{T3 \times Q}{A \times 60 \times 60}$$

where : T3 = Sample response time (sec)
Q = Sample flowrate (m³/h)
A = Internal area of sample pipe (m²)

Since internal area of pipe = $1.33 \times 10^{-4} \text{ m}^2$
And the sample flowrate = 0.5 m³/h

Therefore:

$$L_{\text{Max}} = \frac{36 \times 0.5}{1.33 \times 10^{-4} \times 60 \times 60}$$

$$L_{\text{Max}} = 37.5 \text{ m}$$

2.7.5 Final check

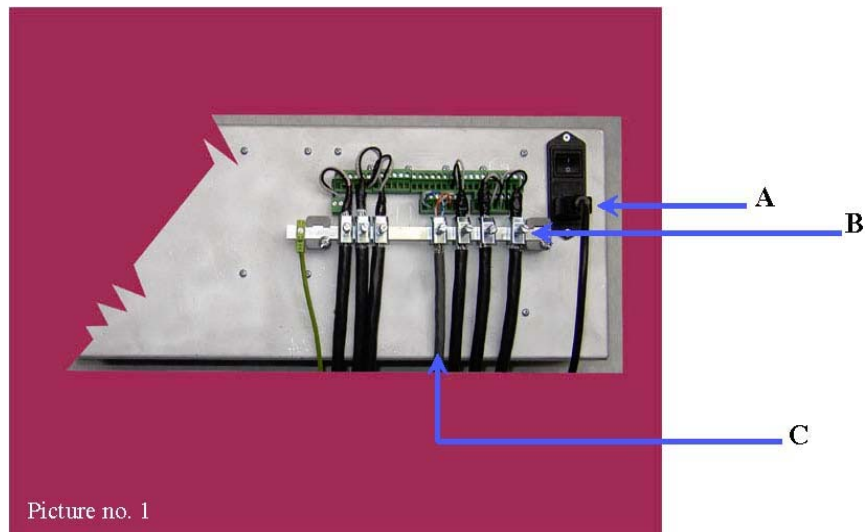
Has completed system been inspected as a whole with regard to safety?

2.8 OVERVIEW INSTALLATION CHECK

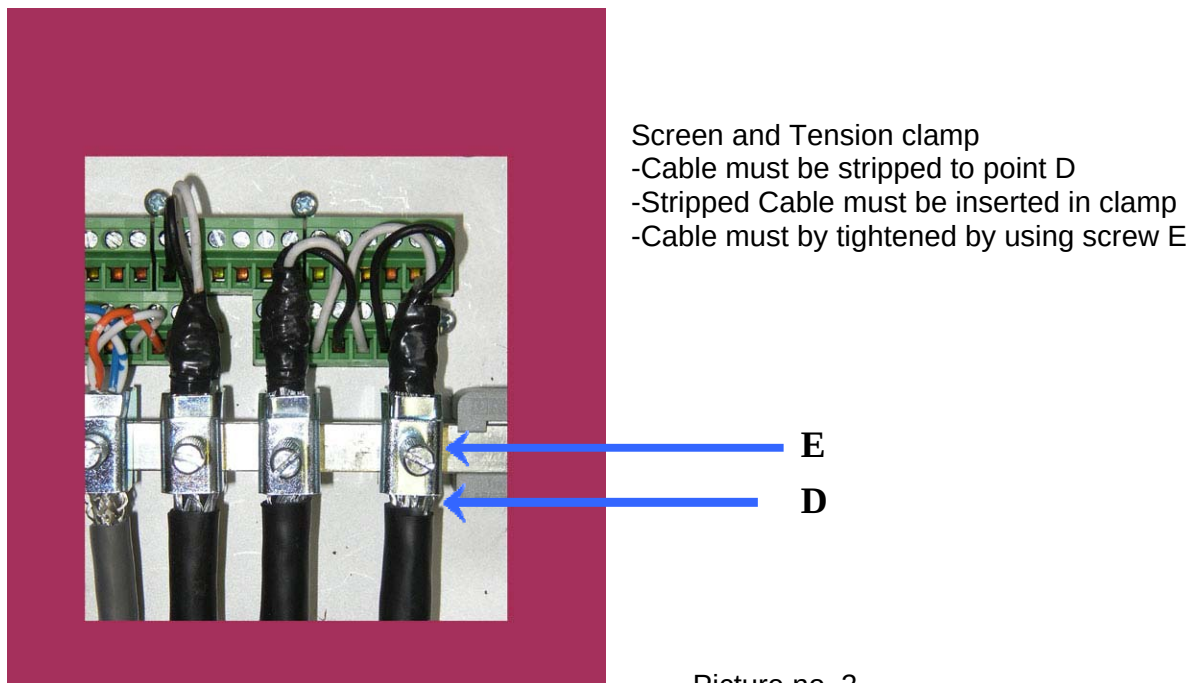
Cabel connection Main Control Unit

Ref. VAF Instruments drawings

- 0806-2047
- 0806-2046

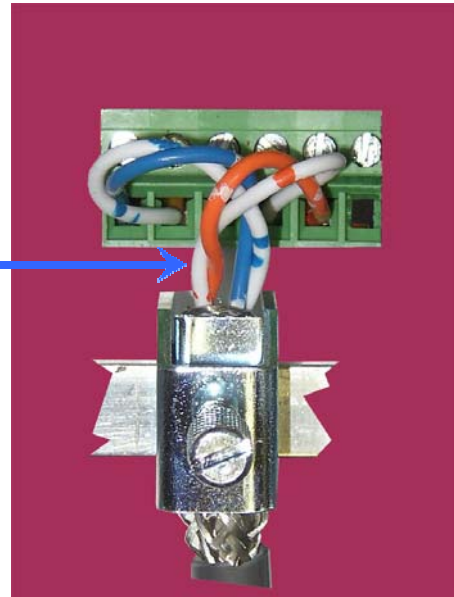


- A. Main Power Supply Connection. Cable supplied by VAF Instruments.
B. Screen and Tension Clamp (see Picture no. 2)
C. Communication cable. (see Picture no. 3)



F

F. Communication Cable Connection MCU and EPU
Cable specifications
2x2x0,5 mm² (2x2 individual screened)



Picture no. 3

Cable Connection Electric Pneumatic Unit
Ref.: VAF Drawing
-0806-2046
-0806-0006



Picture no. 4

G

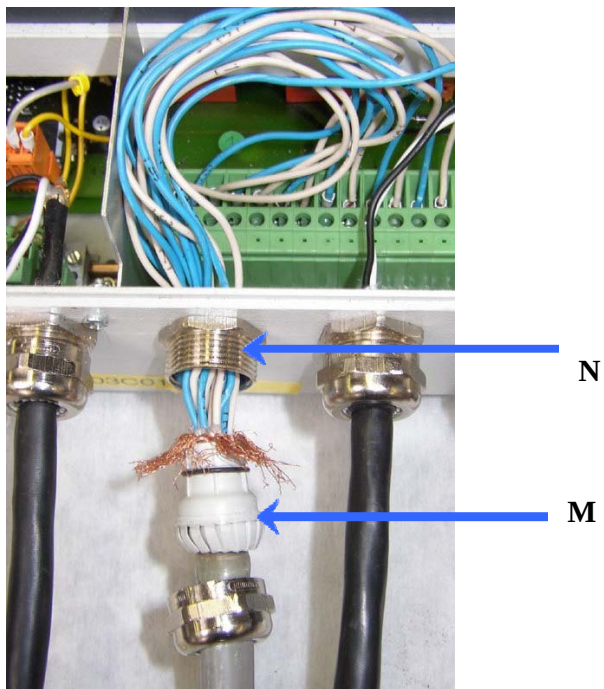
H

I

J

K

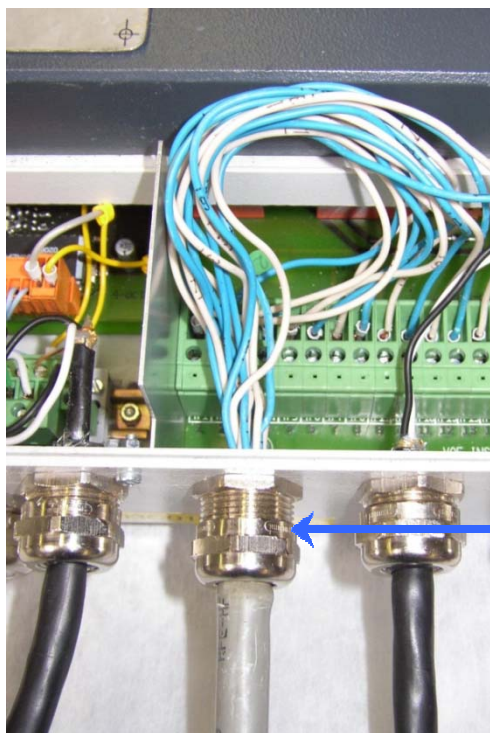
G. Power supply cable	IC-07
H. Communication cable	IC-03
I. Starter Box Sample Pump cable	IC-06
J. Connection cable EPU->Skid	IC-02
K. Overboard Flowmeter	IC-04 (if applicable)



Picture no. 5



Picture no. 6



Picture no. 7

All cable connections to EPU and
Connection Box Skid

-Strip Cable

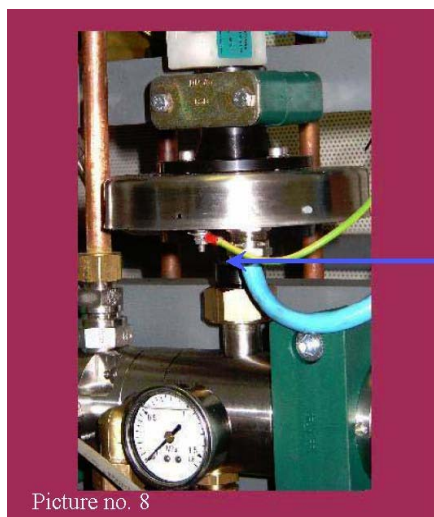
- Guide stripped cable through synthetic insert M

- Fold screen back over synthetic insert M

- Insert synthetic M in cable gland N

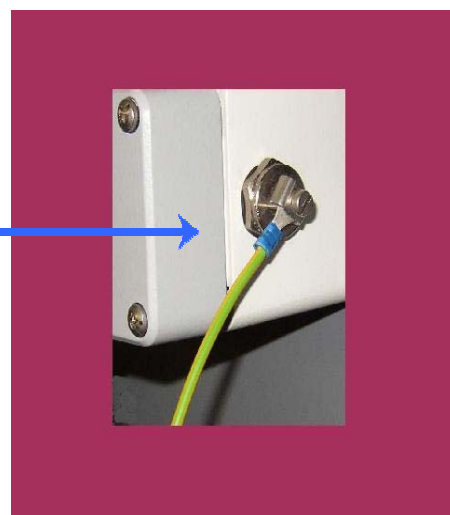
- Tighten gland nut O

O



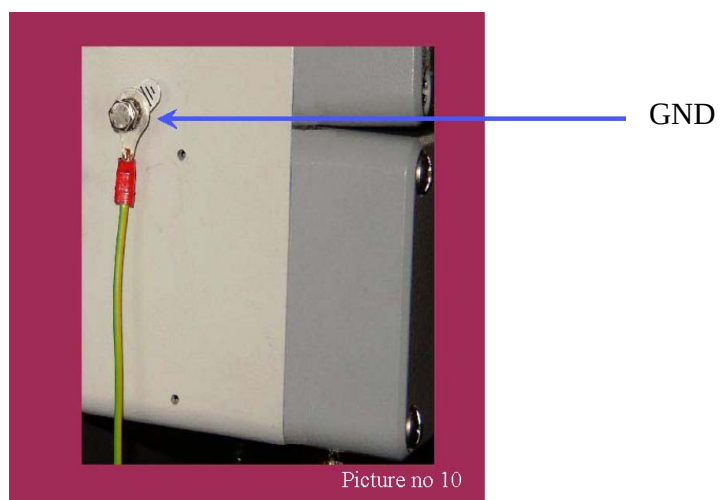
Picture no. 8

Picture no. 8



Picture no. 9

Picture no. 8 and 9: Intrinsically safe Ground points, measurement cell and EPU
Refer to drawing 0806-0006



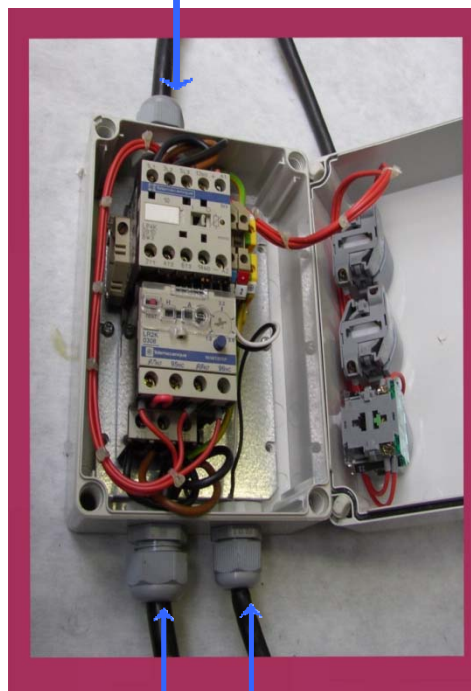
Picture no 10

Picture no. 10: Single phase Power supply ground EPU



Picture no.11

Picture no. 11



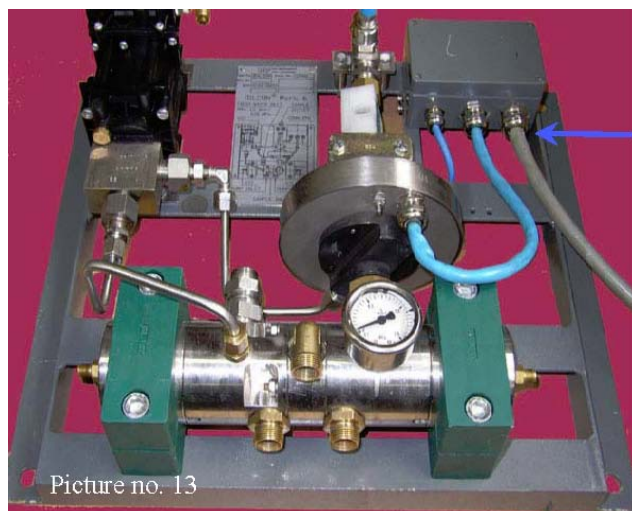
R

S

Picture no. 12

- P. Power Supply Sample Pump to Starter Box
- Q. Power Supply Sample Pump from Starter Box
- R. Power Supply Sample Pump
- S. 24VDC Start signal
- T. Connection Cable EPU->Skid
(Cable Item T must be installed according instructions page 3)

- IC-08
- IC-09
- IC-09
- IC-06 (see picture no. 4 Item I)
- IC-02 (see picture no. 4 Item J)

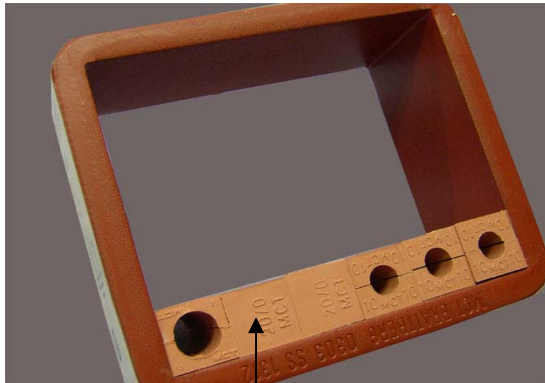


Picture no. 13

Picture no. 13

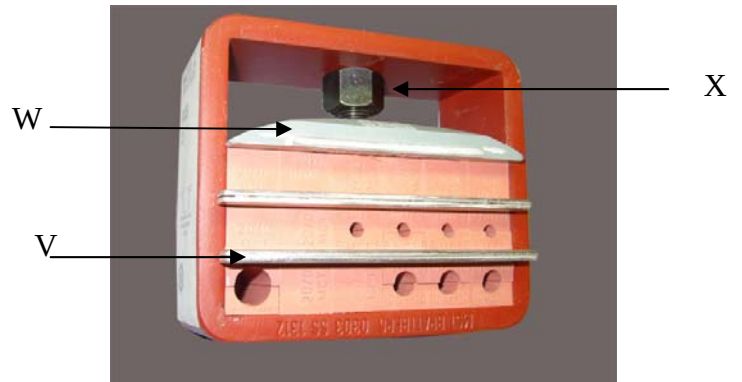
Multi Cable Transit (Bulkhead Penetration)

Ref.: VAF Drawing -0806-8066



Picture no. 14

U

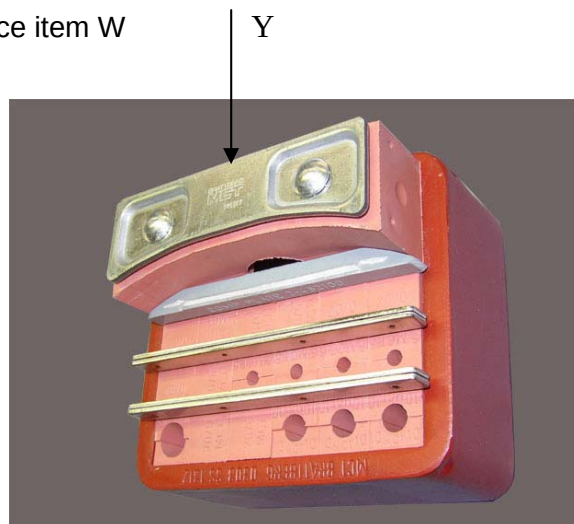


Picture no. 15

Installation MCT

- Place insert blocs U
- Place cables and air pipes in accordance with size of insert blocs
- Place metal plates V -Place next line of insert blocs
- When all blocs and cables are installed place item W
- Tighten Nut X
- Insert item Y and tighten nuts.

Picture no. 16



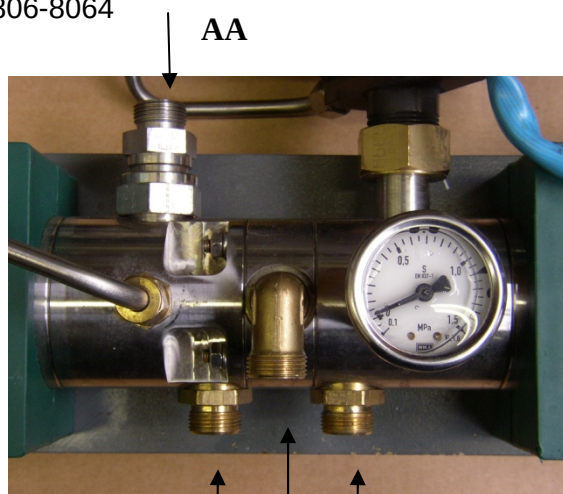
Water and Airline connections Skid

Ref.: VAF Instruments drawings

-0806-1280

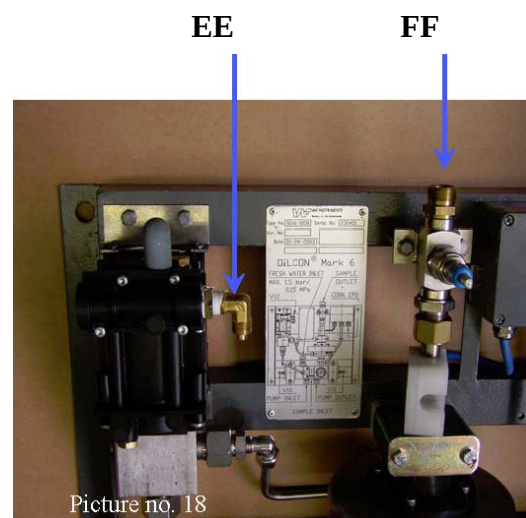
-0806-1283

-0806-8064



Picture no. 17

BB CC DD



Picture no. 18

Picture no. 18

AA Fresh water Inlet

BB Sample Pump Inlet

CC Sample Inlet from Sample Valve

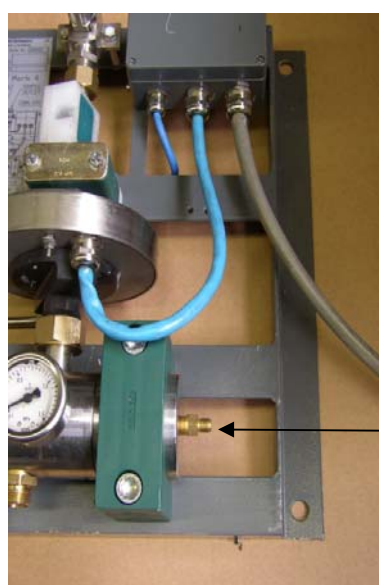
DD Sample Pump Outlet

EE Airline from solenoid V12

FF Sample Outlet to Slop Tank

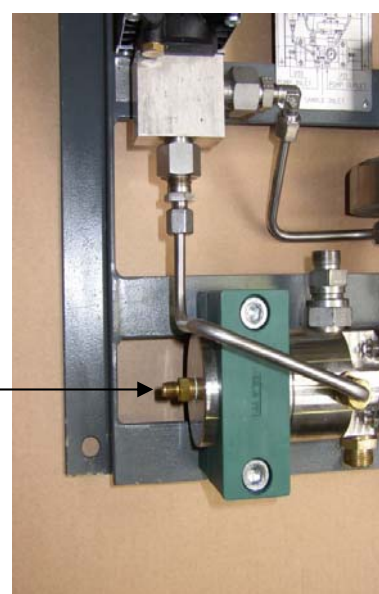
GG Airline from solenoid V11

HH Airline from solenoid



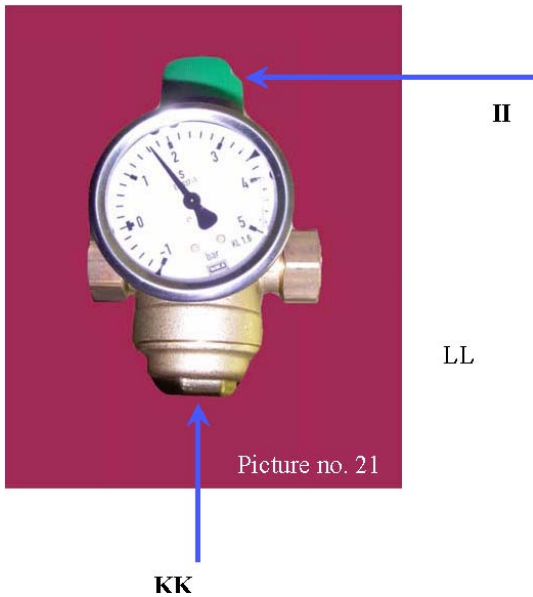
Picture no. 19

HH GG



Picture no. 20

System settings.

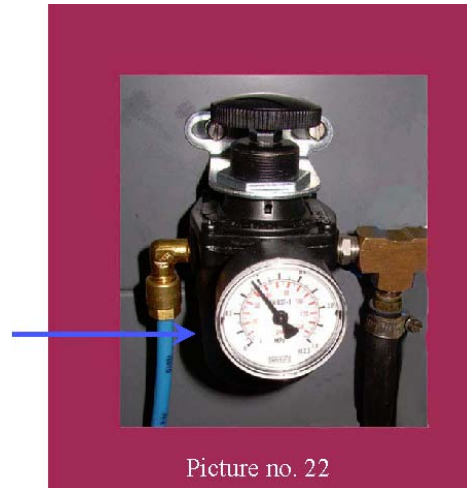


Picture no. 21

Fresh water regulator

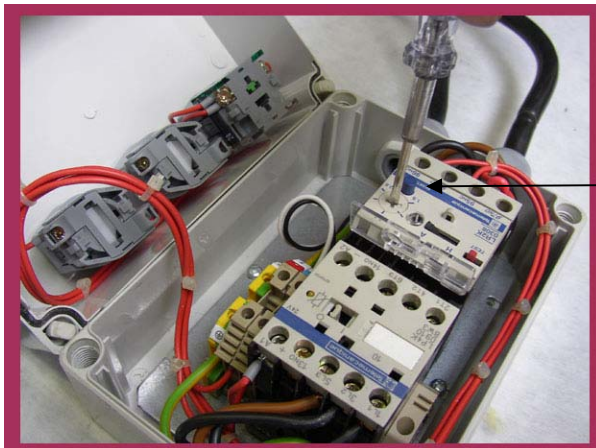
II Water pressure set knob set
pressure to 1,5 bar

KK Fresh water filter



Picture no. 22

LL Set pressure to 4 bar minimum



Picture no. 23 Starter Box

MM. Trip level setting

3. SYSTEM CONFIGURATION

In order to configure the Oilcon[®] Mark 6 MCU to the ships specific requirements it is necessary to enter the configuration mode of the unit.

Prior to entering this mode the operator must familiarise themselves with the system and also the following information the majority of which can be located on the vessels IOPP certificate:

1. Ships Deadweight
2. Status of ship
3. How many sampling points are fitted on the vessel and the denomination of each
4. Max range of flowmeters (if fitted)
5. Pulses per nautical mile, Ships speed log input (if fitted), Ships GPS

To enter the configuration mode follow the steps below:

- Switch on power to the MCU (AC and DC) and EPU
- The system will be in the stand by mode
- Press change to enter the extended set up mode, Enter password: 729

1

Max. flow Flowmeter 1 at 20mA: 0 T/h Range 1..32000 T/hr Press 'CHANGE' or 'ENTER'	<i>Value to be entered in '0' area is the maximum flow of the overboard discharge flow connected to the Oil discharge monitoring and control system, if fitted.</i>
--	---

Action : "CHANGE"

2

Max. flow Flowmeter 1 at 20mA: _ T/h Range 1..32000 T/hr Type 'NUMBER' and press 'ENTER'	<i>Having pressed 'CHANGE' the value in the t/h field is cleared. Now the numeric value must be entered. If a value of 40000 is entered</i>
--	---

Action : Type in 40000 and "ENTER"

3

Max. flow Flowmeter 1 at 20mA: 40000 T/h Range 1..32000 T/h Press 'CHANGE' or 'ENTER'	<i>This value is over max permissible value. A lower value must be entered.</i>
---	---

Action : "ENTER"

4

Max. flow Flowmeter 1 at 20mA: 40000 T/h WARNING: Input out of range ! Press 'CLEAR'	<i>This action empties the data field</i>
--	---

Action : "CLEAR"

5

Max. flow Flowmeter 1 at 20mA: _ T/h Range 1..32000 T/hr Type 'NUMBER and press 'ENTER'	<i>Incorrect value is now cleared. Value entered is max flow of overboard discharge flow through the flow metering unit No1 connected to the Oil discharge monitoring and control system. If a value of 3500 is entered for example. Now correct value has been entered you can proceed to next input parameter field.</i>
---	--

Action: Type in value 3500 and "ENTER"

6

Max. flow Flowmeter 1 at 20mA: 3500 T/h Range 1..32000 T/hr Type 'CHANGE' or 'ENTER'	<i>Value is now entered; proceed to next input parameter field.</i>
--	---

Action : "ENTER"

7

Max. flow Flowmeter 1 at 20mA: 3500 T/h Range 1..32000 T/hr Type 'CHANGE' or 'ENTER'	<i>Confirmation of data, if correct proceeds to next input parameter field.</i>
--	---

Action : "ENTER"

8

Max. flow Flowmeter 2 at 20mA: 0 T/h	
--------------------------------------	--

Action : "ENTER"

9

K-factor skid Flowmeter THIS FACTOR MAY NOT BE CHANGED Type 'ENTER'	<i>This is the k-factor of the flow meter (flow sensor) installed in the skid. This factor is normally factory set and is mentioned on tag plate of flow meter (flow sensor).</i>
---	---

Action : "ENTER"

10

Separated or combined flow measurement for overboard / slop discharge Separated ="0"	<i>This function makes it able to combine two flow meters, if fitted. The system will choose correct flow metering system based on current flow rate. See drawing 0806-8064 for configuring of combined or separated system.</i>
---	--

Action : "ENTER"

11

K-factor measurement cell THIS FACTOR MAY NOT BE CHANGED Type 'CHANGE' or 'ENTER'	<i>This is the k-factor of the measurement cell installed in the skid. This factor is factory set.</i>
---	--

Action : "ENTER"

12

K-factor of Ships log: 200 p/nm Range 1..400 pulses/nm Type 'CHANGE' or 'ENTER'	<i>Value entered is the input in pulses/nautical mile from vessels speed log (if installed). Normal values are either 100, 200 or 400. Actions "CLEAR", "CHANGE" and "ENTER" function the same as above steps. Here a value of 200 is entered. If correct value has been entered you can proceed to next input parameter field.</i>
---	---

Action : "ENTER"

13

Total Ships volume: XXXX kTon Range 1..6000 kTon Press 'CHANGE' or 'ENTER'	<i>Value to be entered in 'xxxx' area is the ships deadweight in kilo tons. In other words if deadweight is 45,000 tons then a value of 45 must be entered in this area.</i>
--	--

Action: 'ENTER'

14

New or Old ship: X New ship = 0 Old ship = 1 Press 'CHANGE' or 'ENTER'	<i>Value to be entered in 'x' area is either 1 or 0 based upon IOPP certificate Item 1.7</i>
---	--

Action: 'ENTER'

15

Number of Sample Points: X Range 1 ..6 Press 'CHANGE' or 'ENTER'	<i>Value to be entered in 'x' area is based upon number of sampling points installed on this particular vessel</i>
--	--

Action: 'ENTER'

16

Name of Sample Points #1: X 1..port high 3..port low 5..stripping 2..stbd high 4..stbd low 6..clean ballast Press 'CHANGE' or 'ENTER'	<i>Value to be entered in 'x' area is based upon name or nomination of each particular sample point number. Eg if "Sample point No1" is monitoring stbd high discharge then value 2 must be entered.</i>
--	--

Action: 'ENTER'

NOTE:

For Clean/Segregated ballast operation, the system must be configured such that the highest numeric sample point available on the system (2 or 6 depending upon type of system delivered) must have the name clean ballast entered in the next step.

Name of Sample Points #2: X 1..port high 3..port low 5..stripping 2..stbd high 4..stbd low 6..clean ballast Press 'CHANGE' or 'ENTER'	<i>Value to be entered in 'x' area is based upon name or nomination of each particular sample point number. E.g. if "Sample point No2" is monitoring stripping line discharge then value 5 must be entered.</i> <i>(See note above for clean/segregated ballast)</i>
--	--

18

Name of Sample Points #3: X 1..port high 3..port low 5..stripping 2..stbd high 4..stbd low 6..clean ballast Press 'CHANGE' or 'ENTER'	<i>Value to be entered in 'x' area is based upon name or nomination of each particular sample point number. E.g. if "Sample point No3" is monitoring port high discharge then value 1 must be entered...and so on</i>
--	---

Repeat step 15 for all 6 sample point options. The Software of the unit is capable of driving up to six sample points, but the hardware may not be configured for six valves. No value needs to be entered in this case

The highest available sample point installed must be called "CLEAN BALLAST" for the unit to enable the 15ppm* alarm monitoring capability.

15/7/02 18:12 MODE
STANDBY
"Oilcon[®]" Oil discharge monitor
VAF INSTRUMENTS
Setup: ">" V/V com: C pos: C

During forward flush or sample, by pressing the scroll button, the MCU will display the flow rate of flush or sample water passing through the skid. By adjusting the needle valve on the outlet side of the measurement cell, the flow rate can be adjusted. Nominal flow should be between 450 and 550 litres per hour. The “No-Flow” alarm is activated at flows less than 240 litres per hour.

35

4. DETAILS OF MAJOR COMPONENTS OF THE SYSTEM

4.1 INTRODUCTION GENERAL

The Oil Discharge Monitoring & Control System is used for monitoring and controlling the discharge of dirty ballast water overboard. The system comprises the following main components:

- Oilcon® Oil Discharge Monitor;
- Flow meter system.

The purpose of the Oil Discharge Monitor is to calculate and record:

- the instantaneous rate of discharge of oil, in litres per nautical mile;
- the total quantity of oil discharge into the sea on each voyage;
- and also to control the ship's overboard discharge system as necessary to reduce the possibility of discharging excessively oily water.

This section of the manual contains important and essential instructions for handling, operation and maintenance of the Oilcon® Oil Discharge Monitor & Control System. It should be studied carefully before actually commencing any operation or work.

For installation details or ships particulars please refer to other relevant sections within this manual.

4.2 SAFETY ASPECTS

We have ensured in so far as reasonable practical that the equipment has been designed and constructed to be safe and without risk to health when properly used. Provided that the recommendations contained in this manual are carefully adhered to, we can not foresee circumstances where the equipment will present a health or safety hazard.

- Make sure that all safety requirements are met before starting any maintenance work.
- Use adequate personal protection where necessary.
- Use adequate tools to perform the work.
- Do not assemble or disassemble electrical equipment or remove or install printed circuit boards with power switched ON.
- Handle printed circuit boards with CMOS components according the correct procedures for such components to prevent any damage due to electrostatic discharges.
- Use cleaning solvents in a well ventilated place. Avoid breathing fumes. Keep away from open fire. Do not use solvents on plastic components/parts.

4.3 GENERAL INFORMATION

4.3.1 Technical specification

4.3.1.1 *General*

Range:	0 - 1000 ppm
Type of oils:	in accordance with type approval certificate
Accuracy:	in accordance with IMO Resolution MEPC 108 (49), the system response is within the accuracy specified.
Response time:	less than 20 seconds, in accordance with IMO Resolution MEPC 108 (49)
Zero noise:	less than 2 ppm
Response to oils:	in accordance with IMO Resolution MEPC 108 (49), the system response is within the accuracy specified.
Sensitivity to solids:	in accordance with IMO Resolution MEPC 108 (49), the system response is within the accuracy specified.
Fouling:	in accordance with IMO Resolution MEPC 108 (49)
Alarm adjustment:	0 - 1000 ppm.
Sample points:	2 standard, (option 6 maximum)

4.3.1.2 *Main control unit (MCU)*

Electrical supply:	115/230 VAC 50/60 Hz
Emergency supply:	24VDC, 1A
Power consumption:	20 Watt

Input signals

GPS:	GPS NMEA 0183, Baud rate: 4800, Data bits: 8, Parity: none, Stop bits: 1
Ships log:	100, 200, or 400 p/nm, rating 5 mA
Discharge feedback:	nc contact, rating 2.2 mA

Output signals

Discharge control:	no/nc contact, rating 250 VAC - 5 A or 30 VDC - 5 A
Auto/Man control:	no/nc contact, rating 250 VAC - 5 A or 30 VDC - 5 A
External alarm:	no/nc contact, rating 250 VAC - 5 A or 30 VDC - 5 A
Segregated ballast alarm:	no/nc contact, rating 250 VAC - 5 A or 30 VDC - 5 A
Ambient temperature:	-20...+55°C
Humidity range:	0-95% RH
Mounting:	Panel mounting, see drawing 0806-1278 for dimensions
Wiring supply:	IEC Socket with 3 core (0.75mm ²) PVC cable
Wiring output	0.2 – 2.5 mm ²
Wiring input:	0.2 – 2.5 mm ²
Installation category:	II
Pollution degree :	I acc. to IEC 664
Ventilation requirements:	no special requirements

4.3.1.3 *Electro pneumatic unit*

Electrical supply:	115/230 VAC 50/60 Hz
Power consumption:	60 Watt
Air supply:	4 .. 7 bar, dry clean air {400kPa... 700kPa} max. consumption 50 l/min average consumption 6 l/min

Output signals

Communication:	RS422/485 to MCU
Pump start/stop signal:	24 Vdc, ..mA to Sample pump Starter relay
Pneumatic supply:	4 bar to SKID and Sample valve
Ambient temperature:	-20...+55°C
Humidity range:	0-95% RH
Protection class:	IP 65
Mounting:	Wall mounting, see drawing 0806-1282 for dimensions

Cable connections

	See drawing 0806-2037-4 for options
Power supply:	M20 x 1,5 cable dia. 6-12 mm standard
Communication to MCU:	M20 x 1,5 cable dia. 6-12 mm standard
Pump start/stop:	M20 x 1,5 cable dia. 6-12 mm standard & M20 x 1,5 cable dia. 10-14 mm
Flow meter	M20 x 1,5 cable dia. 6-12 mm standard
Skid:	M20 x 1,5 cable dia. 10-14 mm standard
Wiring supply:	0.2 – 2.5 mm ²
Wiring output:	0.2 – 2.5 mm ²
Wiring input:	0.5 – 4 mm ²
Installation category:	II
Pollution degree	II acc. To IEC 664
Ventilation requirements:	no special requirements

4.3.1.4 Skid

Sample flow rate:	between 450 and 550 l/h
Sample inlet pressure:	3 bar (nom), 6 bar (max) {300kPa nom, 600kPa max}
Water temperature range:	10 °C - 65°C, in accordance with IMO Resolution MEPC 108 (49)
Fresh water supply:	6 bar (max), 3 bar (nom) {300kPa nom, 600kPa max} max. consumption 8 l/min average consumption 0.13 l/min
Ambient temperature:	-20...+55°C
Humidity range:	0-95% RH
Protection class:	IP 65
Mounting:	Wall mounting, see drawing 0806-1280 for dimensions

Connections

Fresh water and sample water:	15mm tube coupling
Air to valves:	6 mm tube coupling
Air to pneumatic pump:	8 mm tube coupling
Cable to EPU:	M20 x 1,5 cable dia. 10-14 mm
Wiring:	0.2 – 2.5 mm ²

4.3.1.5 Sample pumps

Electrical supply:	3 phase 380-420 VAC, 50Hz, 3 phase 440-480 VAC, 60 Hz
Power consumption:	1300 Watt
Isolation class:	F, IEC 34-1
Protection class:	IP 55
Mounting:	Wall mounting, see drawing 0806-1076 for dimensions

Connections

Sample water:	15mm tube coupling
Cable:	M20 x 1,5 cable dia. 10-14 mm
Wiring:	0.2 – 2.5 mm ²

4.3.2 Reference table of products which may be measured

CRUDE OILS, "BLACK AND WHITE" PRODUCTS, OIL-LIKE-NOXIOUS LIQUID SUBSTANCES DESCRIBED IN MARPOL ANNEX II

Range number	Chemical	Range number	Chemical
0	Marine Destilate Fuel oil	20	Hexene
1	Category 1 crude oil	21	iso-Octane (all isomers)
2	Category 2 crude oil	22	Methylcyclohexane
3	Category 3 crude oil	23	Nonane
4	Category 4 crude oil	24	Paraffine
5	Category 5 crude oil	25	Pentane
6	Category 6 crude oil	26	Pentene
7	Automotive Gasoline	27	Toluene
8	Kerosine	28	TetraHydroNaphtalene
9	Cyclohexane	29	Xylene (all isomers)
10	Cyclohexene		
11	Cyclopentane		
12	Cyclopentene		
13	p-Cymene		
14	Diethylbenzene		
15	Dipentene		
16	Dodecane		
17	Ethylbenzene		
18	Ethylcyclohexane		
19	Hexane		

4.4 SYSTEM DESCRIPTION

4.4.1 Oilcon® Oil Discharge Monitoring and Control System

The Oilcon® Oil Discharge Monitoring & Control System continuously samples the ballast water being discharged overboard and measures the oil content and controls the discharge of the ballast water and plays therefore, a central role in the Oil Discharge Monitor & Control System.

A schematic arrangement of the entire Oil Discharge Monitoring & Control System is shown in drawing 0806-8035-3.

The Oilcon® Oil Discharge Monitor comprises the elements labelled as: Skid, Electro Pneumatic Unit (EPU), Starter box, Sample pump and Main Control Unit (MCU).

4.4.1.1 *Main Control Unit (MCU)*

See drawing. 0806-1278-3

The Main Control Unit is the central part of the Oil Discharge Monitoring & Control System and is designed for mounting in the cargo control console (19' rack). Its function is to compute and record:

- the instantaneous rate of discharged oil, in litres per nautical mile;
- the total quantity of oil discharged into the sea on each voyage;
- to control the ships overboard discharge system.

It receives the following input signals:

- ships GPS input
- ships speed in knots;
- overboard valve position;
- oil content of ballast water in ppm; *
- rate of discharge of ballast water in tonnes per hour. *

Inputs marked * are received from the Electro Pneumatic Unit via a serial data link.

The MCU processes these inputs and records and displays all the necessary information:

- | | |
|--|---|
| - time and date (UTC) | (29/10/95 12:15); |
| - position GPS | (N 53 deg 21.209 min.) (E 007 deg 10.485 min.) |
| - auto/manual mode | (CONC ppm A/M); |
| - status of operational mode | (MODE SAMPLE); |
| - instantaneous oil content | (CONC ppm); |
| - rate of discharge | (FLOW T/h); |
| - ships speed | (SPEED kts); |
| - instantaneous rate of discharge of oil | (DISCH l/Nm); |
| - total quantity of oil discharged | (TOT.OIL l); |
| - status of discharge | (V/V COM:C POS:C); |
| - sampling point selected | (SAMP.PNT 1); |
| - type of oil | (OIL: 12). |

The data is displayed on a LCD display and is also printed on paper at 10 min. intervals. Control of the MCU is through a keyboard. The MCU also displays a number of pages with information according to the operator's instructions. The various pages are designed to help the operator to control the Oil Discharge Monitoring & Control System and to give a wide range of information.

4.4.1.2 Electro Pneumatic Unit (EPU)

See drawing. 0806-1283

The Electro Pneumatic Unit (EPU) contains the control electronics and the solenoid valves to switch the pneumatic signals. It also contains the zener barriers for the input signals from the flowmeter(s), flow switch and measurement cell. There is a single electronic card installed, and a power supply in the cover of the upper section of the cabinet.

The EPU is designed for mounting in the engine room opposite the Skid on the engine room/pump room bulkhead or in another suitable location.

4.4.1.3 I/S communication cable

The engine room mounted EPU is connected to the pump room mounted detector cell located within the Skid Assembly via an intrinsically Safe communication cable. The cable carries the following signals from the skid:

- a) Oil content signals generated by the detector cell.
- b) Flow rate of sample water
- c) LED feedback signal

4.4.1.4 Starter box

See drawing. 0806-1075-4

The control of the Sample pump motor is from the EPU via the Starter box. This unit contains a relay to switch the 3-phase supply to the pump motor and a thermal trip to protect the pump motor. It also has a main switch to isolate the pump motor from the 3-phase supply in case of maintenance. Location for the Starter box is the engine room in the convenience of the Sample pump motor.

4.4.1.5 Pump/motor assembly

See drawing. 0806-1260-3, 0806-1076-3

The Pump/Motor assembly comprises a high-shear vortex pump, a gas tight bulkhead seal and a motor. The pump provides a degree of sample water conditioning as the shearing effect tends to produce droplets of oil of roughly similar size. The pump has a mechanical seal to provide sealing on the shaft. This shaft fits directly on the motor shaft and is inter-connected by a lantern ring. The shaft passes through a bulkhead seal, which consists of a number of rubber lip-seals which are oil lubricated to form a gas tight seal. The motor is directly bolted to the bulkhead seal. The motor is suitable for 380 V or 440 V at 50 Hz or 60 Hz, runs at 2850 or 3420 rpm respectively and is constructed to IP55 and isolation Class F, IEC 34-1.

4.4.1.6 Skid assembly

See drawing. 0806-1280-3

The Skid Assembly contains the necessary items to handle the sampled ballast water and to measure the oil content. In the Skid Assembly there is a pneumatically operated shuttle valve, (4) and a window wash pump (1).

The shuttle valve selects between fresh water, forward or backward flush and sample water.

Also contained within the Skid Assembly is the detector cell which contains the electronic sensing system to determine oil content. On the left hand side of the Skid Assembly is the Window Wash pump (1). This is a pneumatically operated pump which provides a 10 to 1 pressure boost to the window flushing water. Also included in the Skid Assembly is a flow setting valve (3), which sets a back pressure on the Sample pump and a magnetic flow sensor (2) to determine flow through the Skid assembly.

The Skid Assembly is normally mounted in the pump room opposite the EPU on the engine room side of the bulkhead.

4.4.1.7 Flowmeter system

The flow metering system is shown in drawing. 0806-8016-3

The flow of water through the orifice plate causes a pressure difference across the plate. This differential pressure is converted into a mA signal and transmitted to the EPU by the dP/I transmitter.

The manifold valve block fitted to the differential pressure transmitter, has three shut-off valves. The two outer valves are for blocking off the pressure sensing lines from the sensor. The centre valve serves as equalizing valve to balance the pressure at both sides of the transmitter.

See drawing 0806-8038 for configuring of combined or separated system.

4.4.1.8 Sample probe valve assembly

See drawings 0806-1265-4, 0806-1077-4 and 0806-1268-4

For taking a representative sample of the ballast water to measure the oil level content a sample probe valve assembly is provided for. It comprises:

- a probe, for penetration in the selected discharge line;
- a gate valve, for manual closure upon completion of monitoring;
- a pneumatic valve, for remote selection of the discharge line, so the line can be changed whilst the monitor is in operation.

4.4.2 Principle of operation

The measurement technique used in the Oilcon[®] Oil Discharge Monitoring & Control System is based on scattered light. The sample of discharge water passes through a detector cell while light enters and leaves the measurement area of the cell. The sample flow is at right angles to the optical path. When no particles or oil droplets are present in the water, light can pass straight through the cell (Direct beam). When oil is present in the form of a homogeneous mixture, light is scattered at different angles (Scatter beam). The intensity of scattered light at a specific angle depends on the density of oil droplets and upon their particle size relative to the wavelength of radiation. The intensity of light of the direct beam decreases logarithmically with increasing oil concentration, while the scatter beam increases linearly but passes through a maximum before decreasing logarithmically, see drawing. 0806-1622. The maximum occurs because of the increase in attenuation blocking out the scattered light at high concentrations. The variation of light refraction by oil droplets only is quite different to that refracted when solid contaminants are also present and this fact can be used to obtain an accurate indication of oil content whilst disregarding solid particles up to a point.

The light source used in the Oilcon[®] Oil Discharge Monitoring & Control System is a near infra red diode which is operated in the pulsed mode so that the average power dissipation is very low, although the intensity is high. The light signal is processed and transmitted along a communication cable from the detector cell to the EPU where the three detection signals are used to compute the oil concentration levels present in the sample passing through the detector cell.

The response in the optical detection is instantaneous and most of the delays when reading oil levels lie in the sampling pipework. High velocity, short sampling length and minimum pipework bends give fast response times. During periods of inactivity the pipework may become fouled and when the system is started up, erroneous readings could occur as oil is stripped from the pipework. Automatic sequential control of forward and backward flushing at start up and shut down of the monitor prevents erroneous readings and keeps the sampling lines clean. This also ensures reliable start up, minimises system deterioration and ensures that the pipework is left in clean condition prior to the next use of the monitor. At the end of the start up flushing cycle a system zero check is performed, this automatic zero setting compensates for any small deposits on the cell windows. The window wash pump cleans the cell windows at regular intervals.

All operating controls and system alarms are situated on the MCU. Manual system flush and window wash controls are available to make these two operations possible at any time. With the exception of selecting the sample point and the oil type, the system works automatically once sampling has been initiated. The oil level together with the discharge flow rate and ships speed are input to the MCU to give a permanent record of oil discharged overboard. Both calibration alarms and operational alarms are provided and the alarm philosophy employed follows normal marine practice. When a fault occurs, both audible and visual alarms are activated. The audible alarm can be silenced by fault acceptance but the visual alarm cannot be extinguished. It is only after the fault has been rectified that the visual alarm is extinguished. Should a second alarm occur during this sequence, both audible and the visual alarms would be reactivated.

4.4.3 Sampling system arrangements

A suggested installation configuration of the Oil Discharge Monitoring & Control System is given in drawing. 0806-8035-3. Up to 6 sampling points can be catered for, although most ships will have much less than this. The total number of valves that are contained in the system is depending on the particular configuration on the ship.

The sample point is selected from the MCU in the Ships Cargo Control Room; this causes the selected valve to open. When the system is in Sample mode, water is drawn from the sample point by the sample pump, passed through the detector cell and then discharged to the slop tank or discharged overboard, depending on the installation.

The accuracy of the monitor is improved by the use of a flushing sequence before sampling commences, at intervals during sampling and when the system is shut down after use. All the flushing sequences are carried out automatically by the system. The flushing sequences serve three purposes: - to clean the pipework; - to keep the detector cell windows clean, which keeps the optical path un-obscured and to perform a zero check every time a flush sequence is activated. The flushing sequences can be operated manually from the MCU, if required.

The Skid Assembly, see drawing. 0806-1280-3, contains a pneumatically operated shuttle valve, which facilitates the forward flush and backward flush. During the automatic flushing sequences on start up, and on shut down, the valve activates to flush all the pipework using the fresh water supply and sequentially selects between backward and forward flush. When the manual flush is operated, valve activates to allow fresh water into the system and an additional zero check is performed.

Every three minutes during sampling, an automatic cleaning of the windows in the detector cell is carried out. A pneumatic pump mounted in the Skid Assembly supplies high pressure fresh water which is sprayed across each window. It will be noticed that the window wash sequence is indicated on the MCU by "*MODE SAMPLE WW*".

The use of fresh water for these sequences means that it is important, for correct operation of the Oil Discharge Monitoring & Control System, that an un-interrupted supply of fresh water is available. The fresh water used must be free of any contaminants.

The typical installation in drawing 0806-8035-3 shows a number of manual valves. These are used for isolation of the system for maintenance purposes. The valves are:

- a) fresh water pressure reducing / isolator valve;
- b) sample discharge valve skid;
- d) isolation valve to slop tank
* YARD SUPPLY* (usually a non-return valve as the slop tank will have pressure due to Inert Gas system);
- e) sample grab cock mounted on the sample pump discharge.
- f) injection point (for onboard calibration by Approved Service Engineer)

Note:

There is an unmarked valve inside the Skid Assembly on the outlet side of the measurement cell.. This valve is used to provide back pressure for the sample pump. If the valve is open fully, there will be little or no back pressure on the pump, so the pump could cavitate and this would cause erroneous reading of oil content. The correct setting for the valve is almost closed; in this position the pump discharge will be in the region of 450 -550 litres per hour. The flow can be checked by pressing "SCROLL" on the MCU during either forward flush or sample modes which will then temporarily display the flow rate. A precise setting of the valve is not necessary.

4.4.4 System operations

Operation of the Oil Discharge Monitoring & Control System is controlled from, and recorded by the MCU.

A diagrammatic representation of the control panel of the MCU, as fitted in the Cargo Control Room, is given in drawing. 0806-1278-3. The MCU control panel contains the following:

(i) **LCD Display**

- acts as the major interface between machine and operator, and displays all relevant information;

dd/mm/yy	hh:mm	SAMP.PNT 1	MODE SAMPLE
CONC	ppm	M DISCH	l/nm
FLOW	T/h	M TOT.OIL	I
SPEED	kts	M V/V	COM:C POS:C OIL:1

(ii) **Control switch**

- "Off" - the display is blanked and the MCU goes to a quiescent state where the only active electronic circuit is the battery backed clock/calendar;

Note: do not attempt to service the equipment in this mode, see Maintenance section 4.7;

- "Control Unit" – (CTRL) in this position the MCU is in the normal operational mode, automatically controlling the ballast discharge system if automatic control is fitted;

- "Console" – (CNSL) in this position the MCU is in normal operational mode but manual control of the ballast discharge system is provided from the cargo console;

(iii) **Keyboard**

- the operator can communicate with the equipment by using the keyboard. All inputs from the keyboard are displayed on the LCD display. The keys are as follows;

- | | |
|------------------|---|
| - [WINDOW WASH] | initiate a manual Window Wash; |
| - [FLUSH] | initiate a manual Flush and calibration check; |
| - [STOP MONITOR] | stop operation; |
| - [ALARM RESET] | silences the audible alarm and displays the cause of the alarm situation; |
| - [SCROLL] | display the next page; |
| - [CHANGE] | change a system setting; |
| - [CLEAR] | clear the value of a display setting; |
| - [ENTER] | enter a system setting; |
| - [>] | select Set Up when in Standby mode, or select Sample when in Idle mode; |
| - [?] | enter the Help mode; |
| - [DARK] | reduces the brightness of display back-lighting |
| - [BRIGHT] | increases the brightness of display back-lighting |
- the numeric key's are used to enter the numeric values for the system settings.

(iv) **Printer**

Note:

According to the Regulations a printed record of the entire ballast water discharge operation must be kept on board the vessel for at least 3 years.

The printer in the MCU provides a printout at the following intervals;

- at the start and at the end of the de-ballasting operation;
- at ten minutes intervals (or less, if set by the operator);
- at the occurrence of any alarm;
- if automatic or manual mode is selected;
- any fault of out of range inputs from the transducers;
- if any of the system settings is changed;
- if the front panel key-switch is operated;
- if the discharge rate changes by more than 10 l/nm.
- if an alarm situation is cleared

During normal operation, the data printed will be shown on the display. Each time a printout takes place an appropriate message is printed at the top of the printout to explain why the printout has occurred. The message takes the form;

During normal operation, the data printed will be shown on the display. Each time a printout takes place an appropriate message is printed at the top of the printout to explain why the printout occurred. The messages can take any of the following forms;

- | | |
|--------------------------|------------------------------|
| - ALARM PRINTOUT: | - DISCHARGE RATE INCREASING: |
| - TIME INTERVAL REPORT : | - CONTROL MODE REPORT : |
| - CONSOLE MODE REPORT : | - MANUAL TO AUTO CHANGE : |
| - MANUAL DATA ENTERED : | - OIL TYPE CHANGE : |
| - DISCHARGE VALVE OPEN : | - DISCHARGE VALVE CLOSED : |
| - DISCHARGE PROHIBITED: | |

Examples of printouts:

Printout generated at the end of SET UP mode;

CONTROL MODE REPORT	
04/05/02 12:50 UTC	
N053 DEG 21.090 MIN	
E007 DEG 10.485 MIN	
A OIL CONTENT:	0 PPM
A SHIP SPEED:	11 KNOTS
A FLOW RATE:	123 T/HR
DISCHARGE RATE:	0 L/NM
OIL DISCHARGED:	22 L
SAMPLE VALVE NO.:	
OIL TYPE:	1
COMMAND:	CLOSED
STATUS :	CLOSED

DATA ENTRY PARAMETERS	
PRINT INTERVAL:	10 MINS
DISCHARGE LIMIT:	30 L/NM
TOTAL OIL LIMIT:	850 L
SAMPLE VALVE NO.:	1
RESET DISCHARGE:	NO
DISCHARGE PROHIBITED	

Printout generated during normal operation;

TIME INTERVAL REPORT	
04/05/02 13:15 UTC	
N053 DEG 21.090 MIN	
E007 DEG 10.485 MIN	
A OIL CONTENT:	188 PPM
A SHIP SPEED:	11 KNOTS
A FLOW RATE:	375 T/HR
DISCHARGE RATE:	6 L/NM
OIL DISCHARGED:	22 L
SAMPLE VALVE NO.:	1
OIL TYPE:	1
COMMAND:	OPEN
STATUS:	OPEN

Printout generated in case of an alarm for example an oil level alarm.

ALARM PRINTOUT	
04/05/02 13:45 UTC	
N053 DEG 21.090 MIN	
E007 DEG 10.485 MIN	
A OIL CONTENT:	940 PPM
A SHIP SPEED:	11 KNOTS
A FLOW RATE:	375 T/HR
DISCHARGE RATE:	32 L/NM
OIL DISCHARGED:	39 L
SAMPLE VALVE NO.:	1
OIL TYPE:	1
COMMAND:	CLOSED
STATUS:	CLOSED
THE FOLLOWING ALARMS	
HAVE OCCURRED:	DISCHARGE RATE OVER SET LEVEL.

Printout generated in case of an alarm situation being cleared.

ALARM PRINTOUT

04/05/02 13:02 UTC

N053 DEG 21.090 MIN

E007 DEG 10.485 MIN

A OIL CONTENT: 902 PPM

A SHIP SPEED: 11 KNOTS

A FLOW RATE: 175 T/HR

DISCHARGE RATE: 14 L/NM

OIL DISCHARGED: 40 L

SAMPLE VALVE NO.: 1

OIL TYPE: 1

COMMAND: OPEN

STATUS: OPEN

THE FOLLOWING ALARMS HAVE

BEEN CLEARED: OIL CONTENT OVER SET LEVEL.

Printout generated at end of SET UP mode for a clean ballast discharge.

CONTROL MODE REPORT

05/05/02 12:50 UTC

N053 DEG 21.090 MIN

E007 DEG 10.485 MIN

A OIL CONTENT: 0 PPM

A SHIP SPEED: -- KNOTS

A FLOW RATE: --- T/HR

CLEAN BALLAST DISCHARGE

SAMPLE VALVE NO.: 2 # (or 6 see Section 3, items 15, 16)

OIL TYPE: 1

COMMAND: CLOSED

STATUS: CLOSED

DATA ENTRY PARAMETERS

PRINT INTERVAL: 10 MINS

DISCHARGE LIMIT: 30 L/NM

TOTAL OIL LIMIT: 850 L

SAMPLE VALVE NO: 2 #

RESET DISCHARGE: NO

DISCHARGE PROHIBITED

Printout generated during normal clean ballast discharge operation;

```
TIME INTERVAL REPORT
04/05/02      13:15 UTC
N053 DEG 21.090 MIN
E007 DEG 10.485 MIN
A OIL CONTENT:          10 PPM
A SHIP SPEED:           -- KNOTS
A FLOW RATE:            --- T/HR
CLEAN BALLAST DISCHARGE
SAMPLE VALVE NO.:       2 #
OIL TYPE:               1
COMMAND:                OPEN
STATUS:                 OPEN
```

Printout generated during alarm of clean ballast discharge operation;

```
TIME INTERVAL REPORT
04/05/02      13:15 UTC
N053 DEG 21.090 MIN
E007 DEG 10.485 MIN
A OIL CONTENT:          20 PPM
A SHIP SPEED:           -- KNOTS
A FLOW RATE:            --- T/HR
CLEAN BALLAST DISCHARGE
SAMPLE VALVE NO.:       2 #
OIL TYPE:               1
COMMAND:                CLOSED
STATUS:                 CLOSED
THE FOLLOWING ALARMS
HAVE OCCURED:           OIL CONTENT OVER SET LEVEL.
```

: Valve number will either be 2 or 6 depending upon system configuration, 2 or max. 6 sample valve version.

4.4.4.1 *System over-rides*

The MCU provides a number of output signals to allow flexible means of controlling the ballast water discharge system. Two outputs are under the direct control of the MCU and these are used to automatically control the discharge system -to stop the discharge when the alarm points are reached and to permit discharge when the discharge rate of oil is within limits. Over-riding of the MCU should only be considered if the MCU itself has failed or if special circumstances prevail.

There may be occasions when it is imperative to over-ride the control signal from the MCU to the ballast discharge system, if automatic control is fitted. The control switch on the MCU front panel has a position marked 'Console' with the switch in this position the automatic control is over-ridden, which means that the control of the valves, pumps ect. in the ballast discharge system has reverted to the cargo control room console. In the position marked 'Control Unit', control of the ballast discharge system is entirely from the MCU. The fact that the switch has been operated will be printed on the printer.

4.4.4.2 *Transducer over-ride*

On occasions, one of the three transducers in the system (Oil discharge Monitoring & Control System, ship's log or discharge flow meter) may be defective. For this situation, the input of these transducers can be changed from Auto to Manual. This can be done by entering the Set Up mode or the Extra Set Up mode and selecting the required input signal. The input mode is indicated alongside the input by 'A' for automatic and by 'M' for manual. The mode can be changed by pressing [CHANGE]. In manual mode the value for that input must be entered with the numeric key's. Any of the 3 inputs and any combination of these inputs can be set to manual. Any change of mode from automatic to manual or vice-versa will be recorded on the printer.

4.4.4.3 *Discharge control*

The main purpose of the MCU is to control the discharge of ballast water overboard. The MCU controls an internal relay which, when suitably connected, can be used to open or close an overboard valve, or start and stop a cargo pump. The specific installation on any ship may vary.

The position of this internal relay is shown on the display on 'V/V COM:' and is either 'O' (open) or 'C' (closed). The relay will be closed when;

- the Oil Discharge Monitor is switched off, or is self-flushing;
- when the discharge rate exceeds 30 l/nm;
- when the Total Oil discharged exceeds 1/30,000 of the last cargo carried;
- should there be any other alarm displayed on the MCU.

When the monitor has completed the Flush cycle and has switched to sample, there will be a 10 second delay before 'V/V COM:' changes to open. If the discharge is being restarted after an alarm condition, then there will be a 2 minute delay after the alarm has been cleared before the 'V/V COM:' changes to 'O'(open).

4.4.4.4 Discharge control answer-back

It is necessary for the MCU to know if the command output has been obeyed correctly. Hence, an input is provided to signal the 'status' of the discharge control system. The input could be, for example, from a micro switch on the overboard valve. The answer-back is shown on the display as 'POS:' and status is shown as 'O' (open) or 'C' (closed).

If the MCU is in 'Control' mode and the command and status indications do not agree, after 2 minutes, the 'status' indication will flash "ERROR" to indicate a fault. The overboard valve command will then be 'CLOSE'.

The Discharge Rate and Total Oil Discharged calculations are performed once the status is open. This means that if the overboard valve is opened even when the command signal is to close the valve, then the normal calculation will be carried out and the amount of oil discharged will be recorded.

4.5 OPERATION

4.5.1 Operation instructions



CAUTION:

No adjustments should be made to the electronic units prior to operation. Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.



NOTE CAREFULLY:

On this system the screen will not acknowledge any change of input data until the printer has printed the last input information.

4.5.1.1 *Modes of operation*

The MCU has several modes of operation which are; Standby, Set up, Flush, Idle, Sample, Automatic Window Wash, Manual Window Wash, Manual Flush, Shutdown, Extra Set up, Clean Ballast Discharge, Help and Configuration. These modes are either selected automatically or by the operator via the keyboard.

4.5.1.2 *Standby modes*

The Standby mode is automatically selected after switching 'ON' (Key switch to "Control" [CTRL] position) the system and is also automatically entered after performing the Shutdown flush sequence or when in Set Up mode [STOP MONITOR] is pressed. In Standby mode the system is waiting for manual input from the operator which can be:

- a) press [>], to enter the Set Up mode and start operation;
- b) press [SCROLL], to select the Self-test mode;
- c) switching 'OFF' to stop operation.

4.5.1.3 *Set up mode*

The Set Up mode is used to set up the system before a discharge run can take place. The settings which can be selected are:

- a) Time and date;
- b) Discharge rate;
- c) Total Oil limit;
- d) Reset Total Oil;
- e) Sample point selection;
- f) Oil type selection;
- g) Oil concentration alarm;
- h) Printer interval time;
- i) Ships speed input mode (auto/man);
- j) Discharge flow rate input mode (auto/man);
- k) Oil content input mode (auto/man).
- l) Selection of ships speed (using GPS/Speed log)

These settings are displayed sequentially and can be selected by pressing [ENTER]. In the display is indicated which keyboard actions can be executed to change or input the correct value for that setting. Once the Set Up is completed, which is indicated in the display, there are three possible actions:

- a) press [>], to check the Set Up settings;
- b) press [ENTER], to initiate the Flush mode and continue operation;
- c) press [STOP MONITOR], to stop operation and return to Standby mode.

4.5.1.4 Flush mode

The Flush mode is used to clean the system prior to sampling and to check the condition of the detector cell and the system. This mode consists of a 2 minute Backward flush, a 2 minute Forward flush and calibration. If no failures are detected the system will select the Idle mode after completion of the flush.

4.5.1.5 Idle mode

From this point there are four possible keyboard actions:

- a) press [>], to select the Sample mode and continue operation;
- b) press [STOP MONITOR], to initiate the Shutdown flush and return the system to Standby mode;
- c) press [CHANGE], to enter the Extra Set Up mode to change the system settings;
- d) press [SCROLL], to select the Self test mode.

4.5.1.6 Sample mode

In this operational mode the overboard discharge of ballast water is continuously monitored for oil content and the discharge rate is controlled. If an alarm situation occurs the ballast water will automatically be diverted from overboard to the slop tank to prevent any oil contamination. During the sample mode an automatic Window Wash takes place every 3 minutes to keep the detector cell in an optimal condition. There are four possible keyboard actions during the Sample mode.

- a) press [WINDOW WASH], to initiate a Manual Window Wash;
- b) press [FLUSH], to initiate a Manual Flush and calibration check. However during Manual Flush the ballast water is diverted to the slop tank instead of discharged overboard;
- c) press [STOP MONITOR], to return to Idle mode;
- d) press [SCROLL], to select the Self test mode.

4.5.1.7 Shutdown modes

The shutdown mode is used to clean the piping of the Oil Discharge Monitoring & Control System prior to a final stop of operation, thus leaving the system in a clean condition for the next discharge run. The Shut down mode is entered when in Idle mode [STOP MONITOR] is pressed. In this mode a 2 minute Backward and 2 minute forward flush are performed.

4.5.1.8 *Extra set up mode*

This mode can only be entered when in Idle mode [CHANGE] is pressed. In this mode the following system settings can be changed;

- a) Sample point selection;
- b) Oil type selection;
- c) Discharge rate;
- d) Oil concentration alarm;
- e) Ships speed input mode (auto/manual);
- f) Discharge flow rate input mode (auto/manual);
- g) Oil content input mode (auto/manual);

These settings can be selected by pressing [ENTER] and will be displayed sequentially.

The system will automatically return to Idle mode when [ENTER] is pressed after the last setting selection or 15 seconds after the last keyboard action.

4.5.1.9 *Clean ballast discharge*

This mode can be entered by selecting during set-up the highest numerical sample point available on the system. The operator enters the sample point as the highest numerical one available on the system. The system then switches automatically over to CLEAN BALLAST DISCHARGE mode.

In this mode the ships speed and overboard discharge flow input parameters are not computed, and only the oil content is registered. The maximum oil content permissible in this mode is 15ppm*.

4.5.1.10 *Help mode*

The Help mode can be entered by pressing [?] and give additional information about system operation and operational actions which can be taken if an alarm situation occurs.

To return to the normal operational mode press [CLEAR].

4.5.1.11 *Configuration mode*

The Configuration mode is used to set up the system during installation and this should only be done by a trained service engineer.

* for special software versions this might be 20ppm or 30ppm

4.5.2 Operation instruction

4.5.2.1 *Start-up – Dirty ballast discharge*

Note:

The Oil Discharge Monitoring & Control System must be operated as directed under the regulations given in Marpol 73/78, to prevent discharge of oil-contaminated water overboard. Where instructions in this manual may apparently conflict with the Marpol requirements, then at all times the Marpol regulations must be favoured.



CAUTION:

UNDER NO CIRCUMSTANCES MUST THE PUMP BE RUN WITHOUT LIQUID. THE PUMP CASING MUST BE FILLED WITH LIQUID FIRST OTHERWISE THE PUMP WILL SEIZE AND DAMAGE WILL OCCUR.

Before operating the system ensure that the following conditions are met:

- a) control air supply is on;
- b) fresh water supply is on;
- c) electrical supplies are on;
- d) MCU is switched on;
- e) EPU is switched on;
- f) starter box is switched on;
- g) all manual valves in the system are open;
- h) cargo pump is on stand by;
- i) check if sufficient paper is available in printer.

* Switch on Main Control Unit (MCU) to 'Control Unit'.
Display of MCU indicates 'MODE STANDBY'.

* Press [>].
Time and date is displayed.
If correct, proceed with the next step.
If not correct, press [CHANGE] and follow the actions as indicated in the display.

* Press [ENTER].
Discharge rate is displayed.
If correct, proceed with the next step.
If not correct, press [CHANGE] and follow the actions as indicated in the display.

* Press [ENTER]
Total oil limit is displayed.
If correct, proceed with the next step.
If not correct, press [CHANGE] and follow actions as indicated in the display.

* Press [ENTER]
"Reset Oil Total?" is displayed.
If not, proceed with the next step.
If yes, press [CHANGE] and follow the actions as indicated in the display.
WARNING: It is only permissible to reset the Total Oil discharged at the start of a new ballast voyage.

- * Press [ENTER]
 Sample point selection is displayed.
 If correct sample point, proceed with next step.
 If not correct, press [CHANGE] and follow the actions as indicated in the display.

- * Press [ENTER]
 Oil type selection is displayed.
 If correct oil type, proceed with the next step.
 If not correct, press [CHANGE] and follow the actions as indicated in the display.

- * Press [ENTER]
 Oil concentration alarm setting is displayed.
 If alarm setting is correct, proceed with the next step.
 If not correct, press [CHANGE] and follow the actions as indicated in the display.

- * Press [ENTER]
 Printer interval time is displayed.
 If correct interval time, proceed with the next step.
 If not correct, press [CHANGE] and follow the actions as indicated in the display.
 WARNING: according to regulations the maximum printing interval is 10 minutes.

- * Press [ENTER]
 Ships speed input mode (Auto/Manual) is displayed.
 If correct input mode, proceed with the next step.
 If not correct, press [CHANGE] and follow the actions as indicated in the display.

- * Press [ENTER]
 Discharge flow rate input mode (Auto/Manual) is displayed.
 If correct input mode, proceed with the next step.
 If not correct, press [CHANGE] and follow the actions as indicated in the display.

- * Press [ENTER]
 Oil content input mode (Auto/Manual) is displayed.
 If correct input mode, proceed with the next step.
 If not correct, press [CHANGE] and follow the actions as indicated in the display.

- * Press [ENTER]
 Input mode for source of ship speed is displayed.
 (Using ships log speed / Using GPS speed)
 If correct, proceed with next step.
 If not correct, press [CHANGE] and follow the actions as indicated in the display.

- Note:
 The use of GPS for ships speed requires an approved type of GPS.

- * Press [ENTER]
 The SET-UP sequence is now completed.
 To continue monitoring, proceed with the next step.
 To check SET-UP of the system, press [>].
 To stop monitoring and go into STANDBY, press [STOP MONITOR].

* Press [ENTER]

The FLUSH mode is entered. {WHICH IS DISPLAYED ONCE PRINTER HAS FINISHED PRINT-OUT}

Display indicates "MODE FLUSH BF"/"CALIBRATION.....wait 4 minutes".

The Flush/Sample selection valve (V10), in the skid, opens to select clean water.

The back flush valve (V11) opens.

The selected sample valve opens.

The sample pump starts.

After 2 minutes of back flush, the forward flush starts and a window wash is performed.

Display changes from "MODE FLUSH BF" to "MODE FLUSH FF"

The back flush valve (V11) closes.

Window Wash pump (V12) operates for 3 seconds ("MODE FLUSH WW").

After 2 minutes of forward flush, the system changes to IDLE mode.

Display changes to "MODE IDLE"

Flush/Sample selection valve (V10) closes.

Sample pump stops.

* Start the CARGO PUMP on idle speed.

* Press [>], to continue monitoring and to enter the SAMPLE mode.

Display changes to "MODE SAMPLE"

Sample pump starts.

dd/mm/yy	hh:mm	SAMP.PNT 1	MODE SAMPLE
CONC	ppm	A DISCH	l/nm
FLOW	T/h	A TOT.OIL	I
SPEED	cts	A V/V COM:C	POS:C OIL:1

The monitor is now sampling from the selected sample point and will supply a read-out of the measured oil content level. Provided no alarms are activated and after a short delay, 20 sec. or 2 min. after an alarm situation is cleared, the overboard valve command will change to 'OPEN'. This is indicated in the display by; " V/V COM: O".

The overboard discharge will then automatically be diverted overboard.

* Increase the speed of the cargo pump.

Watch the discharge rate indicated "DISCH" on the MCU, it will increase as the speed of the cargo pump is increased.

Note:

If the discharge rate approaches the maximum permissible (i.e. 30 l/nm), it can be reduced by slowing down the cargo pump.

The system is now operating fully automatically. If any of the permitted limits are exceeded or if any other alarms are activated, an alarm will be given, the ballast will be diverted to the slop tank and the printer will record.

When the Oil Discharge Monitoring & Control System is running normally, the oil content will be displayed. At regular intervals a record of the monitor status is printed, which will build up to give a complete printed record of the ballast discharge. Whenever there is a discharge overboard the Total Oil Discharged will be incremented.

Every 3 minutes the window wash will operate automatically. This is indicated in the display by *"MODE SAMPLE WW"*. During the operation extra manual window flushing can be carried out, if required by pressing [WINDOW WASH].

If it is suspected that the detector cell is particularly dirty, extra cleaning can be carried out by pressing [FLUSH]. It should be noted however, that this will cause the discharge overboard to be stopped automatically. The monitor will not be measuring the discharge overboard whilst flushing.

4.5.2.2 Shutdown

To stop operation the following steps should be performed;

- * Stop cargo pumps.

- * Press [STOP MONITOR]

 - Display changes from *"MODE SAMPLE"* to *"MODE IDLE"*

 - The overboard valve command changes from *"V/V COM: O"* to *"V/V COM: C"*.

 - The sample pump stops.

- * Press [STOP MONITOR]

The SHUTDOWN mode is started. This is an automatic flush sequence to clear the pipework of oil contaminated water, leaving the monitor clean for the next time it is used.

 - Display indicates *"MODE SHUTD BF"*

 - The Flush/Sample selection valve (V10) opens to select clean water.

 - The back flush valve (V11) opens.

 - The selected sample valve opens.

 - The Sample pump starts.

After 2 minutes of back flush the system changes to the forward flush mode

 - Display indicates *"MODE SHUTD FF"*

 - The back flush valve (V11) closes.

 - The Window Wash pump (V12) operates for 3 seconds. (*"MODE SHUTD WW"*).

After 2 minutes of forward flush the system changes to STANDBY mode

Display indicates "*MODE STANDBY*".

All valves are closed.

The sample pump is stopped.

* Switch the MCU to "OFF".

The system is now shut off. All manual valves in the system may be closed and all auxiliaries may be shut off. The only active electronics will be the clock/calendar and the overboard valve position control. If for any reasons there is a change in the overboard valve position from CLOSE to OPEN or vice versa, a printout is made to record the event.

4.5.3 Miscellaneous

This section is to describe the problems that may be encountered during operation, and the suggested reasons.

4.5.3.1 *Oil content reading higher than expected*

During a normal discharge run of ballast water the ppm reading should be around 50 to 150 ppm assuming that sufficient time has been left to allow the oil to settle out in the tank.

The reading should be steady for most of the duration of discharge. If the reading is varying rapidly with large excursions, it is likely that air is being entrained into the ballast water. This could be due to a partly filled overboard line, a cavitating cargo pump or a low suction pressure on the monitor sample pump casing causing air to enter the pump.

If the ppm reading is consistently high press [FLUSH]. This will cause the monitor to run on fresh water for a short time. The ppm reading should therefore go down to zero.

Note:

Operation of the [FLUSH] key will signal the MCU to stop the discharge overboard, since the monitor is no longer sampling the ballast water.

Once the calibration check is completed the monitor will return to sampling the ballast water. If reading returns to it's previous level, then it is sure that the reading is accurate.

If there is any further doubt, the only solution is to stop the monitor and restart it again thereby forcing it to complete a full flushing cycle.

4.5.3.2 *Oil level alarm*

During a normal ballast discharge, the ppm reading should be quite low probably in the region of between 50 and 150 ppm, as the main bulk of the ballast tank is decanted. During this time, the rate of discharge in litres per nautical mile as calculated by the MCU, will also be steady and remain within the permitted limits. Obviously, as the level in the tank falls, there comes a time when the reading on the monitor will start to rise, as oil is stripped from the layer on the surface. It is difficult to predict at what depth of water this will occur due to a number of reasons:

- how long the tank had been left to settle;
- whether or not heating has been applied;
- whether conditions during discharge;
- type of oil being carried.

However, it is true to say that the entraining of oil into the tank suction occurs when an appreciable level of separated water remains in the tank. The oil is pulled down from the oil-water interface due to swirling in tanks, powerful cross currents between the frames and wier-ing over frames. This is all caused by a high rate of pumping. To reduce this effect and to allow a greater quantity of water to be pumped out, the rate of pumping must be reduced. This will have the effect of reducing the amount of oil entrained, and the ppm reading should therefore fall.

In this way, the monitor can be used as an accurate means of sensing the oil-water interface and ensuring that the maximum amount of water is discharged. If the 'oil level' alarm should sound, reduce the pumping rate until the ppm reading falls and becomes steady. After a time the reading will rise again. Reduce the pumping rate further to let the ppm reading fall again. Repeat this cycle until the pumping reaches the oil-water interface at which time the ppm reading will rise rapidly and go over scale. The discharge will now be complete. Considerably more water will have been discharged using this technique, although it will have increased the time taken to discharge the ballast water.

4.5.4 Alarms

Note:

At all times the Oil Discharge Monitoring & Control System must be operated as directed by MARPOL 73/78 to prevent discharge of oil contaminated water overboard.

There are necessarily a number of alarm conditions in the MCU. Irrespective of what caused the alarm, the result is the same. The letters '*ERR*' or '*FLT*' will appear on the display alongside whatever caused the alarm. Also an internal buzzer will sound. A control signal will be sent to stop the ballast water discharge.

Should any alarm occur during normal operation, press [ALARM RESET]. This will silence the audible alarm. The display will give a message about the cause of the alarm. Pressing [?] will give a help text about the cause of the alarm and actions that can be taken to correct the situation. To return to normal display press [CLEAR].

However the fault must be cleared before any discharge of ballast can take place.

4.5.4.1 *No air*

If for any reason there is no air supply to the Oil Discharge Monitoring & Control System the NO AIR alarm is activated.

The alarm is indicated alongside the oil concentration indication; '*CONC ERR ppm*'

The system will then return to Standby mode. Consult the Help mode of the MCU or Fault Finding Section 4.6. of this manual, for corrective actions.

4.5.4.2 No flow

If for any reason there is no flow through the Oil Discharge Monitoring & Control System the NO FLOW alarm is activated. The alarm is indicated alongside the oil concentration indication; '*CONC ERR ppm*'. The Sample pump will be stopped automatically to prevent any damage to the pump or motor. If in Flush or Shutdown mode the system will return to Standby mode. When in Sample mode the system will go to the Idle mode. Consult the Help mode of the MCU or Fault Finding Section 4.6, of this manual, for corrective actions.

4.5.4.3 Zero error

During the calibration check of the Oil Discharge Monitoring & Control System, during Flush or Manual Flush mode, the ZERO ERROR alarm can be activated if the flushing water is dirty, oily or if it contains air. The alarm is indicated alongside the oil concentration indication; '*CONC ERR ppm*'.

The system will go to Idle mode and from there only the Shutdown mode can be selected, to resume operation after the fault is cleared. Thus a restart is made from Standby. Consult the Help mode of the MCU or Fault Finding Section 4.6. of this manual, for corrective actions.

4.5.4.4 Path dirty

During the calibration check of the Oil Discharge Monitoring & Control System the PATH DIRTY alarm can be activated if the optical path between the laser transmitter and the direct receiver is obscured.

The alarm is indicated alongside the oil concentration indication; '*CONC ERR ppm*'.

The system will go to Idle mode and from there only the Shutdown mode can be selected, to resume operation after the fault is cleared. Thus a restart is made from Standby. Consult the Help mode of the MCU or Fault Finding Section 4.6, of this manual, for corrective actions.

4.5.4.5 Power/communication failure

If during operation of the Oil Discharge Monitoring & Control System a fault develops in the communication link between the MCU and the EPU or a power failure condition occurs, then the POWER/COMMUNICATION FAILURE alarm is activated. The alarm is indicated alongside the oil concentration indication; '*CONC ERR ppm*'.

The system will go to the Shutdown mode followed by Standby. However during such a situation the emergency power supply will take over, thus no data will be lost. Consult the Help mode of the MCU or Fault Finding Section 4.6. of this manual, for corrective actions.

4.5.4.6 Watchdog

If during operation a fault condition occurs in the program of the Oil Discharge Monitoring & Control System the WATCHDOG is activated. The alarm is indicated alongside the oil concentration indication; '*CONC ERR ppm*'. The system will go to Set-up page in Standby mode. Consult the Help mode of the MCU or Fault Finding Section 4.6. of this manual, for corrective actions.

4.5.4.7 Led monitor error

If an optical LED failure is detected during operation of the Oil Discharge Monitoring & Control System the LED MONITOR ERROR alarm is activated. The alarm is indicated alongside the oil concentration indication; '*CONC ERR ppm*'. Consult the Help mode of the MCU or Fault Finding Section 4.6 of this manual, for corrective actions.

4.5.4.8 Flow overrange

If during operation of the Oil Discharge Monitoring & Control System an over-range fault is detected in the flowmeter signal the FLOW OVERRANGE alarm is activated. The alarm is indicated alongside the discharge flow rate; 'FLOW FLT T/H'. Consult the Help mode of the MCU or Fault Finding Section 4.6 of this manual for corrective actions.

4.5.4.9 Flow underrange

If during operation of the Oil Discharge Monitoring & Control System an under-range fault is detected in the flowmeter signal the FLOW UNDERRANGE alarm is activated. The alarm is indicated alongside the discharge flow rate; 'FLOW ERR T/H'. Consult the Help mode of the MCU or Fault Finding Section 4.6 of this manual, for corrective actions.

4.5.4.10 Overboard arrangement failure

The OVERBOARD ARRANGEMENT FAILURE is activated if during operation of the Oil Discharge Monitoring & Control System, in 'Control' mode, a mismatch is detected between the overboard valve command and the overboard valve position indication. The alarm is indicated by a flashing 'ERROR' alongside the overboard valve command; 'V/V COM:C ERROR'. Consult the Help mode of the MCU or Fault Finding Section 4.6 of this manual, for corrective actions.

4.5.4.11 Printer failure

The PRINTER FAILURE alarm is activated if during operation of the Oil Discharge Monitoring & Control System a fault is detected in the printer. The alarm is indicated on the top line of the display by a flashing message 'PRINTER FAILURE'. Consult the Help mode of the MCU or Fault Finding Section 4.6 of this manual, for corrective actions.

4.5.4.12 Discharge ratio

If during operation of the Oil Discharge Monitoring & Control System the rate of discharge exceeds 30 l/nm the DISCHARGE RATIO alarm is activated. The alarm is indicated alongside the discharge ratio; 'DISCH. FLT l/nm'. The system will continue operation in the Sample mode, although the ballast water discharge will be stopped.

According to the Regulations the maximum discharge rate is 30 litres/nautical mile and the discharge rate alarm level is set to this limit, but may be set to a lower figure, if required. This can be done on SET Up page 2. If this limit is exceeded, the discharge of ballast water will be stopped automatically and will only be permitted if the oil discharge rate is

4.5.4.13 Total discharged oil limit

If the total discharge oil limit exceeds 1/30,000 of the last cargo carried, the TOTAL DISCHARGED OIL LIMIT alarm is activated. The alarm is indicated alongside the total oil indication; 'TOT.OIL FLT l'.

The limit is normally set by the operator and is calculated as:

- 1/30,000 of the last cargo carried (for new ships); or
- 1/15,000 of the last cargo (for existing ships).

The result, in litres, is entered on SET UP page 3. If this limit is exceeded, no further discharge of ballast water can take place on that particular voyage.

The TOTAL OIL DISCHARGED can only be reset at the start of a new ballast voyage. (i.e. after a cargo has been carried and the vessel is again ballasted). A printed record is made when the total oil limit is reset.

4.5.4.14 Bad shut-down

If during the previous usage of the system the unit was shut-down in an incorrect manner, (i.e. without going through shut-down flush procedure) then this message will appear briefly on the display at the next start up. No print-out will be made, but this will be logged within the systems own internal data-logger.

4.5.5 System failures

IMPORTANT

On any failure of the system the discharge should be stopped and the failure should be noted in the Oil Records Book. A manually operated alternative system shall be provided and may be used in the event of such a failure, but the defective unit must be made operable before the tanker commences its next ballast voyage, unless it is proceeding to a repair yard.

4.5.5.1 Auto/manual operation

In the occasion of a failure of one of the three transducers in the system (Oil Discharge Monitoring & Control System, ships log or discharge flowmeter) the input of these transducers can be changed from Auto to Manual. This can be done by following the next instructions:

1. operate the MCU till the system is in SET Up mode or the EXTRA SET UP mode;
2. press [ENTER];
3. select the appropriate input (Ships speed, Discharge flowrate, Oil content), by pressing [ENTER];
4. press [CHANGE] to change from automatic to manual or vice versa;
Automatic input is indicated by 'A', manual input by 'M'.
5. enter the value for that input with the numeric key's;
6. press [ENTER];
7. operate the system till back in IDLE mode.

4.5.5.2 Flowmeter

In the event of failure of the discharge flow metering system, the flow rate should be estimated by the best means available and entered into the MCU manually as described above.

The flowrate can be estimated by:

1. cargo pump characteristic curves, a copy of which should be included in this manual;
2. in the case of reciprocating pumps, the flow rate can be calculated by multiplying the number of strokes per minute x the number of cylinders x the volume per cylinder;
3. alternatively, the flow rate can be calculated by taking ullage readings from the tank being discharged at various intervals and using the ullage tables to calculate the flow rate.

4.5.5.3 Ship's speed indicator

In the event of failure of the ship's speed indicating device the speed should be estimated by the best means available and entered into the MCU manually as described in Section 4.5.5.1.

The speed can be estimated by:

1. the ship's speed log;
2. the main engine r.p.m;
3. from the charted ship's positions.

4.5.5.4 Oil Discharge Monitoring & Control System

In the event of failure of the Oil Discharge Monitoring & Control System the oil content should be estimated by the best means available and entered into the MCU manually as described in Section 4.5.5.1.

The oil content in ppm cannot be estimated accurately other than with sophisticated test equipment. However, the following, if all used together, would give a rough indication of oil content.

1. visual observation of the surface of the water around the ship;
2. the use of an interface detector in the tank being discharged;
3. the use of a part flow system where fitted.

4.5.5.5 Main Control Unit (MCU)

In the event of failure of the MCU, the following should be carried out;

1. discharge rate calculated by the following formula:

$$R = \frac{C \times Q}{V \times 1000}$$

Where R= Discharge rate in litres per nautical mile
 C= Oil content in ppm
 Q= Flow rate in cubic metres per hour
 V= Ship's speed in knots

2. discharge total can be calculated by the following formula:

$$OD = R \times V \times T$$

Where OD= Oil discharged in litres
 R= Discharge rate in litres per nautical mile
 V= Ship's speed in knots
 T= Discharge time in hours

3. discharge control can be carried out by manual operation of valves and pumps. This can also be done in the event of failure of the discharge valve actuating circuits or cargo pump trips.
4. manual recording of all data, calculations, times and operations in the Oil Records Book.

4.6 FAULT FINDING

4.6.1 Introduction fault finding guide

The first requirement when attempting to find a fault in the system, is to ensure that the monitor is correctly set up to run. A large number of service problems can be directly related to a simple mechanical fault, that appears to cause a large number of seemingly un-related problems. It is essential to check before delving too deeply, that all hand-valves in the system are open; that the fresh water supply is available and clean and free of any contaminants; that the air supply to the EPU is on; that electrical supply to the pump is on; and that the electrical supply to the MCU and EPU is on.

It is also important to note that most service problems are mechanical faults and not electronic faults. On the whole, electronic systems are much more reliable than the mechanical components attached to them. However, when a fault occurs, the tendency is to distrust the electronic systems and hunt for faults in the electronic part, discounting the mechanical parts. This tendency should be reversed.

The emphasis in this fault-finding guide and the following 'Repair' section is on mechanical repair and overhaul. Indications are given to assist in electronic repairs, but it is expected that most fault will be rectified by complete board replacement, rather than component replacement. Therefore, it is indicated which board is likely to be the source of the particular problem.

4.6.2 Safety

If any work is carried out on the monitor, the following precautions should be taken before any work is commenced:

1. make sure that all safety requirements are met before starting any work;
2. use adequate personnel protection where necessary;
3. use adequate tools to perform the work;
4. Before starting the system, check that fresh water, air and electrical supplies are all on and that manual valves are open.
5. CAUTION: The printed circuit boards have CMOS components which may be damaged by electrostatic discharges. Observe correct procedures for handling CMOS components. It is also recommended to store the circuit boards in electrostatic proof cases.

4.6.3 Fault finding guide

The structure of the following fault-finding guide is that the correct functioning path is on the left of the page; the section of the manual for the fault-finding is indicated on the right of the page. To use the guide, start at the beginning and take the monitor through the outlined operating procedure, checking that the monitor operates correctly at each point. Should the monitor not operate as specified, refer to the right side of the page and turn to that section of the manual or refer directly to the fault as indicated on the MCU.

If the fault can not be rectified from this guide, then contact VAF Instruments to request specialist assistance. Quote the serial number of the monitor and explain up to which section in this guide the monitor worked correctly.

CORRECT PATH	IF FAULTY
1 Switch on MCU to 'Control Unit'. Display of MCU indicates 'MODE STANDBY'	Refer to Section 4.6.6
2 Press [>] The SET-UP mode is entered. Operate MCU till the SET-Up mode is completed, By pressing [ENTER]. Select the appropriate sample point and oil type.	Refer to Section 4.6.5
3 Press [ENTER] The FLUSH mode is entered. The display indicates: "MODE FLUSH/BF"/"CALIBRATION ...wait 4 minutes."	Refer to Section 4.6.5
4 Air is supplied to the solenoid valves in the EPU Solenoid V10, and the selected sample valve are energised	Refer to Section 4.6.8
5 The pneumatic shuttle valve on the Skid Assembly activates V10 together with the selected sample valve in the pump room are opened.	Refer to Section 4.6.9
6 The lamp 'Running' on the Starter Box lights up. The sample pump starts.	Refer to Section 4.6.11.1
The monitor is now in the BACKFLUSH MODE. Fresh water is being pumped from the fresh water inlet, through the sample pump, through the detector cell and via V11 discharged through the sample inlet port of the skid back to the sample probe selected.	Refer to Section 4.6.11.2

- | | | |
|----|--|---------------------------|
| 7 | <p>After approximately 2 minutes the FORWARD FLUSH mode is entered and a window wash is performed for 3 sec.</p> <p>The display of the MCU indicates:
"MODE FLUSH FF"/"MODE FLUSH WW"</p> | Refer to Section 4.6.5 |
| 8 | <p>In the EPU solenoids V11 is energized
V12 is energised for 3 sec.</p> | Refer to Section 4.6.8 |
| 9 | <p>The window wash pump on the Skid Assembly operates for a few strokes.</p> | Refer to Section 4.6.10 |
| 10 | <p>The pneumatic valve V11 on the Skid Assembly is now open.</p> <p>The monitor is now in the FORWARD FLUSH MODE.
Clean water is pumped from the fresh water inlet through the sample pump, detector cell and then discharge through the sample outlet port into the sloptank/disch line.</p> | Refer to Section 4.6.9 |
| 11 | <p>The No Flow alarm is now enabled. Any problem with the fresh water supply will be highlighted at this point.</p> | Refer to Section 4.6.11.2 |
| 12 | <p>At this point the calibration is checked.
Since the monitor is operating on fresh water, the ZERO ERROR alarm will be activated, if there is any contamination.</p> | Refer to Section 4.6.4.1 |
| 13 | <p>If the windows in the detector cell on the Skid Assembly are dirty the 'PATH DIRTY' alarm will be activated.</p> | Refer to Section 4.6.4.2 |
| 14 | <p>At the end of the flush cycle the sample pump will stop and V10 is released. The display of the MCU indicates "MODE IDLE".</p> | Refer to Section 4.6.5 |
| 15 | <p>In the EPU all the solenoids including the selected sample point are de-activated.</p> <p>The green lamp 'Running' on the Starter Box will go out.
The sample pump will stop.</p> | Refer to Section 4.6.8 |
| 16 | <p>All the pneumatic valves in the system are now in their de-energised position</p> <p>The system is now in IDLE mode. If required a self test can be performed at this point. This can be done by pressing [SCROLL] and following the actions as indicated on the display of the MCU.
During the selftest the display should indicate 500 ppm, the audio alarm should sound and a printer test is performed.</p> | Refer to Section 4.6.9 |

- | | | |
|----|---|-------------------------|
| 17 | To select SAMPLE mode press [>]
The display of the MCU indicates "MODE SAMPLE"
The green lamp 'Running' on the Starter Box will light.
V11 and the selected sample valve are energised.
The Sample pump starts running again. | Refer to Section 4.6.11 |
| 18 | The monitor is now in sample mode and no alarms are activated. | Refer to Section 4.6.5 |
| 19 | After 3 minutes the window wash pump will operate for 3 seconds.
The window wash solenoid V12 in the EPU is activated.
This action is repeated every 3 minutes. | Refer to Section 4.6.10 |

4.6.4 Calibration alarms

4.6.4.1 *Zero error alarm*

Probable causes:

1. **Sample pump cavitating.**

- Check pressure gauge settings on the Skid Assembly, for correct settings see Section 4.6.11.2
- If necessary consult Section 4.6.11.2

2. **Flushing water contaminated.**

- Check flushing water for oil, dirt or if it contains air.
 - Check fresh water tank, if installed.
- Drain the tank and refill, if necessary.

3. **Excessive oil left in monitor.**

- Check sample outlet of monitor.
- Flush the monitor again till the 'Zero Error' alarms clears.
It is advisable to let the monitor complete the flush cycle each time.
This will give the maximum amount of flushing.

4. **Transmitter error.**

- Check cables from measurement cell to junction box – on skid.
 - Check cables from junction box on skid to EPU terminal strip.
- If the alarm persists, then it is likely that the cell is faulty and will require replacement.

Note:

See Section 4.7.4 for the replacement of the measurement cell assembly.

4.6.4.2 *Path dirty alarm*

Probable causes:

1. **Windows of detector cell dirty.**

Operate the window wash pump a few times by pressing [WINDOW WASH] during the flush cycle.

This should clean the windows sufficiently to cancel the alarm.

If the alarm persists it is necessary to clean the windows in the measurement cell manually.

Remove the top cover clean the windows as described in Section 4.7.4.

2. **Excessive oil in detector cell, 'Zero Error' alarm also activated.**

- Check sample outlet of monitor.

Flush the monitor again till the 'Zero Error' alarms clears.

It is advisable to let the monitor complete the flush cycle each time.

This will give the maximum amount of flushing.

3. **Transmitter error.**

- Check cables from measurement cell to junction box – on skid.

- Check cables from junction box on skid to EPU terminal strip.

If the alarm persists, then it is likely that the cell is faulty and will require replacement.

- Consult Section 4.6.5.5.

Note:

See Section 4.7.4 for the replacement of the measurement cell assembly.

4.6.5 System alarms

4.6.5.1 *No air*

Consult Section 4.6.7 & 4.6.8.

4.6.5.2 *No flow*

Consult Section 4.6.11.2.

4.6.5.3 *Power failures*

Consult Section 4.6.6

4.6.5.4 *Communication failure*

Probable cause:

1. **Communication link not correct.**

- Check power to EPU.

- Check communication link between the MCU and EPU.

Check with voltmeter on connector X9, terminal 1, 2, 3 and 4 in MCU or connector X1, terminal 5, 6, 8 and 9 in EPU for data transmission.

Term.1/2 or 5/6 for data transmission from MCU

Term.3/4 or 8/9 for data transmission from EPU

If alarm is persistent contact VAF Instruments

4.6.5.5 *Led feedback error*

Probable cause:

1. **Transmitter error.**

- Check cables from measurement cell to junction box – on skid.
- Check cables from junction box on skid to EPU terminal strip.

If the alarm persists, then it is likely that the cell is faulty and will require replacement.

Note: See Section 4.7.4 for the replacement of the measurement cell assembly.

4.6.5.6 *Flow overrange failure*

Probable causes:

1. **Overboard discharge flow rate to high.**

- Check overboard discharge flow rate and reduce if necessary.

2. **Flowmeter not functioning correct.**

- Check the connections of the related flowmeter.
- Check calibration of the related flowmeter.

Also consult Section 4.6.12.

4.6.5.7 *Flow underrange failure*

Probable causes:

1. **Flowmeter not functioning correct.**

- Check the connections of the related flowmeter.
- Check calibration of the related flowmeter.

Also consult Section 4.6.12.

4.6.5.8 *Overboard arrangement failure*

Probable causes:

1. **No power supply.**

- Check power supply to overboard valve actuator.
- Check signal connections between MCU and valve actuator.

2. **No air supply.**

- Check air supply to overboard valve actuator.
- Check signal connections between MCU and valve actuator.

3. **Feedback switch failure.**

- Check functioning of feedback switch.
- Check connections between MCU and feedback switch.

4. **Overboard valve failure.**

- Check functioning of overboard valve.

4.6.5.9 *Printer failure*

Probable causes:

1. **No paper.**

- Check paper and paper feed of printer.

To replace the paper roll consult Section 4.7.3.1

Note:

Make sure that the insert in the paper roll is of plastic material and not of cardboard, as this will pick-up moisture and therefore might expand, which can cause a printer failure.

2. Electric connections.

- Check connections to printer.

4.6.5.10 Discharge rate failure

Probable cause:

1. Discharge rate to high.

- Check overboard discharge rate and reduce to clear the alarm.
See also Section 4.5.4.12.

4.6.5.11 Total discharge oil limit alarm

Probable cause:

1. Maximum oil limit is reached.

- STOP the discharge operation immediately.
See also Section 4.5.4.13.

Note:

The maximum amount of oil for this voyage is discharged. the Total Oil may only be reset at the start of a new ballast voyage.

4.6.6 Power supply problems**4.6.6.1 MCU**

(i) SYMPTOM: POWER FAILURE

Probable causes:

1. Single phase power failure.

- Check that the isolator for the single phase supply is ON.
- Check the switch at the back of the MCU is ON.
- Check the fuse in the power socket on the rear of the MCU, fuse 1 AF (fast).

2. Emergency power failure.

- Check that the emergency power is switched on.
- Check the fuse on the back panel of the MCU, fuse 1 AF (fast).

4.6.6.2 Electro Pneumatic Unit

(i) SYMPTOM: POWER FAILURE

Probable causes:

1. Single phase power failure.

- Check that the isolator for the single phase supply is ON.
- Check the fuse inside the cover of the EPU, fuse 1 AF (fast).

2. Power supply unit failure.

- Check power supply unit in EPU.
- Check fuse of power supply unit in EPU.

Note:

To check fuse, remove front panel from EPU. The fuse is located on the back face of the front panel. If still causing problems the power supply should be replaced with a spare one and shipped back for repair.

4.6.7 Air supply problems

(i) SYMPTOM: AIR SUPPLY FAILURE

Probable causes:

1. No air supply.

- Check air supply to EPU, normally set to 4.0 bar. (400kPa)
- Check ship's control air supply.
- Check connections for leakage.

2. Pressure sensor failure.

- Check connections to pressure sensor on solenoid valve block on EPU Assembly.
- Check functioning of pressure sensor with Digital Voltmeter for open/closed circuit function

(ii) SYMPTOM: WATER FOUND IN MONITORS AIR SYSTEM

Probable causes:

1. Water in air supply unit housing.

- Check air supply unit regulator and drain if necessary.

If a great deal of water is found then the filters in the regulators need to be replaced.

2. Malfunction in ship's control air system.

- Check compressors.
- Check air dryers.

4.6.8 Solenoid valve problems

(i) SYMPTOM: VALVE NOT WORKING

Probable causes:

1. No air supply.

- Check air supply unit regulator, normally set to 4.0 bar. (400kPa)
- Check ship's control air system.
- Check connections for leakage.

2. 24 V power supply failure.

- Check 24 V power supply.
- Check fuse of power supply.
- Check connections to solenoid valve.

3. Solenoid valve actuator not functioning.

- Check solenoid valve connections.
- Change plug on faulty solenoid, for the plug from a solenoid that is known to be working.
- Replace if necessary



WARNING:

ALWAYS turn the power off FIRST before removing any solenoid plug.

4. Solenoid air valve not working.

- Check the air valve for dirt, water or other contamination.
- Replace if necessary.

4.6.9 Pneumatic valve problems

For repair procedures of the pneumatic valves see Section 4.7.6.

(i) SYMPTOM: VALVE NOT FUNCTIONING

Probable cause:

1. No air supply

- Check air supply unit regulator in air supply line to valve, normally set to 4.0 bar (400kPa)
- Check air connections for leakage.
- Check ship's control air system.
- Check functioning of solenoid valve. See Section 4.6.8.

2. Pneumatic valve failure

- Check actuator housing for leakage.

(ii) SYMPTOM: VALVE GLAND LEAKAGE

Probable cause:

1. Worn packings

Damaged or worn packings or damage of valve gland.

Replacement packings are required. Unit should be returned to a qualified service centre for repair.

ii) SYMPTOM: VALVE LEAKAGE

Probable cause:

1. Leakage between valve plug and seat

Damaged or worn valve seat and plug.

Replacement valve seat and plug are required.

Unit should be returned to a qualified service centre for repair

4.6.10 Window wash pump problems

For disassembly and re-assembly procedures of window wash pump see Section 4.7.5.

(i) SYMPTOM: PUMP NOT WORKING

Probable causes:

1. Air supply failure

- Check air supply to solenoid V12 in EPU, should be at least 5 bar. (500kPa)
- Check air supply to regulator/lubricator, setting should be 5 bar. (500kPa)
- Check functioning of solenoid V12 in EPU.

2. Air cycle valve failure.

- Check sleeve and cycling spool (under cap of muffler) for contamination.
Replace if necessary.

3. Electric circuit failure.

- Check power supply in EPU.
- Check connection to solenoid V12 in EPU.
- Check operation of solenoid V12. Replace if necessary.
- Check connection between MCU and EPU.

(ii) SYMPTOM: PUMP CYCLES WITHOUT PUMPING OR DOES NOT STALL

Probable causes:

1. No water supply.

- Check water supply to pump.

2. Check valves not seating or leak in system.

- Inspect inlet check valve.
- Inspect outlet check valve.

(iii) SYMPTOM: FALSE CYCLE

Probable cause:

1. Leakage from pilot exhaust (top centre of cap).

- Check air section seal. Replace if necessary.

(iv) SYMPTOM: FLUID APPEARS AT MUFFLER

Probable cause:

1. High pressure seal leakage.

- Check high pressure seal. Replace if necessary.

4.6.11 Sample pump problems

4.6.11.1 *Electrical problems*

(i) SYMPTOM: PUMP RUNNING BUT GREEN INDICATOR ON STARTER BOX OFF

Probable cause:

1. Indicator failure.

- Check power supply to indicator lamp.
- Check indicator lamp.

(ii) SYMPTOM: PUMP SHOULD BE RUNNING BUT IS OFF

Probable causes:

1. 3-phase supply failure.

- Check if 3-phase supply is switched on.
- Check fuses of 3 phase supply.

2. Thermal trip of pump.

- Check terminal trip on pump contactor in Starter Box. Red light is ON.
Reset if necessary.

Note:

If the motor repeatedly trips out on thermal trip, check the motor and pump for binding or blockages etc. Do not force the motor to run.

3. Pump contactor failure

- Check the power on the contactor terminals (1,2), should be 24 VDC. Check also for correct polarity.
- Check 24 VDC power supply in EPU.
- Check connections between Starter box and EPU.

4.6.11.2 *Pump related problems*

Note:

Normal operating conditions during forward flush and in sample are:

- pump discharge 5 to 8 bar. (500 to 800kPa)
 - pump suction 0 to 1 bar. (0 to 100kPa)
- (Pressures may vary from one installation to another).

(i) SYMPTOM: NO FLOW

Probable causes:

1. No fresh water supply. (low discharge pressure < 2 bar during flushing) (< 200kPa during flushing)

- Check fresh water supply to monitor. Pressure should be at least 1,5 bar. (220kPa)
- Check manual valves in fresh water inlet line.

2. No sample water supply.

(low discharge pressure < 2 bar during sampling)) (< 200kPa during flushing)

- Check if cargo/stripping pump is on.
- Check if discharge line is filled with water.
- Check if manual valve of sample probe is open.
- Check if pneumatic valve in sample line is open.
- Check if manual valve in sample inlet of the Skid Assembly is open.

3. Blockage in outlet line. (high discharge pressure > 10 bar)) (>1000kPa)

- Check that manual valve in sample outlet of the Skid Assembly is open.
- Check that the manual valve on the discharge to the slop tank is open.

4. Flowrate through monitor too low.

- Check flowrate through monitor.
- Press "SCROLL" during either forward flush or sample and ensure flow is between 450 -550 l/hour
- Flow rate can be adjusted by needle valve on outlet of measurement cell.

Note:

During commissioning the flowrate through the monitor is set to between 450 and 550 l/hour.

5. Malfunction of flowsensor.

- Check electrical connections on flowsensor
- Check connections between flowsensor and EPU.
- Check function of flowsensor.

Nnote:

That during BACKFLUSH, the 'NO FLOW' alarm is inhibited. The flow alarm comes into operation at the start of the FORWARD FLUSH cycle.

4.6.12 Differential pressure transmitter problems**Note:**

For disassemble and re-assemble instructions consult Section 4.7.9

(i) SYMPTOM: NO LINE CURRENT

Probable causes:

1. Transmitter connections.

- Check wiring polarity and continuity.
- Check for shorts or ground loops.
- Check if power supply connector is connected to main board.

2. Power supply.

- Check power supply output. The voltage must be between 12 and 45 VDC at transmitter terminals.

3. Electronic circuit failure.

- Check the main board for defect by replacing it with a spare one.

(ii) SYMPTOM: Current of 21.0 mA or 3.9 mA

Probable causes:

1. Pressure tap (piping).

- Verify if blocking valves are fully open.
- Check for gas in liquid lines.
- Check the specific gravity of process fluid.
- Check process flanges for sediments.
- Check the pressure connection.
- Check if bypass valve is closed.
- Check if pressure applied is not over upper limit of DPT range.

2. Sensor to main circuit connection.

- Check connection (male and female connectors).

3. Electronic circuit failure.

- Check the sensor circuit for damage by replacing it with a spare one.
- Replace sensor.

(iii) SYMPTOM: INCORRECT OUTPUT

Probable causes:

1. Transmitter connections.

- Check power supply voltage
- Check for intermittent short circuits, open circuits and grounding problems.

2. Noise measurement fluid.

- Adjust damping.

3. Pressure tap.

- Check for gas in liquid lines.
- Check the integrity of the circuit by replacing it with a spare one.

4. Calibration.

- Check calibration of DPT

4.6.13 Fault finding form

The fault finding form is made in case the fault finding guide does not result in a proper working of the system. This form should be filled in and returned to VAF Instruments Service department. The form is included in this technical manual 640M and also available on enclosed CD-rom.

OIL DISCHARGE MONITORING & CONTROL SYSTEM

FAULT FINDING FORM

Fault Finding Aid Checklist Oilcon[®] Mark 6M

Serial number MCU :
(Open printer hatch, s/n can be found on right side 6 digits)

Serial number EPU :
(Stamped on EEXiA type plate at left side of EPU 6 digits)

At the DATA ENTRY PARAMETERS printout you'll find the K-Factor parameters:

Skid K-Factor : P/L

Cel K-Factor :

The following steps have to be followed in order for VAF Instruments BV to determine if the ODM system is having a malfunction. If during the complete procedure an alarm is triggered, push the Alarm rest button and write down the Alarm.

Step	Description	Action
1.	Switch Off the MCU, key switch in the Off position, Main switch on the Back of the MCU switched to Off. 24VDC Back-up Supply switched Off	
2.	Wait for 30 seconds	
3.	Make sure the EPU in the engine Room is switched On	
4.	Switch On the Main switch on the Back of the MCU	
5.	Switch the key switch of the MCU to Control Mode	
6.	Wait for 1 minute and write down any alarm which comes up. Acknowledge the Alarm by pressing "Alarm Reset" wait again for one minute. (Inform us if any alarm comes up.)	
7.	Go through the set-up of the MCU and write down the input parameters.	
8.	Date and Time.	
9.	Discharge Rate	Set to: 30 l/nm

- | | | | |
|-----|--|------------|-----------------------|
| 10. | Total Oil Limit | Write down | |
| 11. | Reset Total Oil | Set to: | Yes |
| 12. | Sample Point | Write down | |
| 13. | Oil Type | Write down | |
| 14. | Pre. Al. Oil Conc. | Set to: | 1000 PPM |
| 15. | Printing Interval | Set to: | 10 min |
| 16. | Ship Speed Input (set to auto) | | |
| 17. | Flow Rate Input (set to auto) | | |
| 18. | Oil Content (set to auto) | | |
| 19. | Source for ships speed (GPS/Speed log) | Set to: | Using ships log speed |
| 20. | Press Enter to go in Flush | | |
| 21. | Check if the pump is running now. | | |
| 22. | Wait until system comes in Idle Mode | | |
| 23. | Push Scroll Button
Active alarms will be shown | Write down | |
| 24. | Push Scroll Button
Active errors will be shown | Write down | |
| 25. | Push Scroll Button
Internal Flowmeter will be shown | Ignore | |
| 26. | Push Scroll Button
System test will appear on screen | | |
| 27. | Push Change Button
System test will be activated on the print out the character test will be printed and a log file of the 40 last alarms and errors will be printed. Write down or copy these last alarms. | | |
| 28. | After print out the MCU will go back to Idle Mode | | |
| 29. | Push Stop Monitor | | |
| 30. | System will go to Stand-by | | |
| 31. | Switch Key switch to Off | | |

List of alarms which were triggered during the above procedure:

:
:
:
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4.7 MAINTENANCE

4.7.1 Maintenance general

The Oil Discharge Monitor & Control System is an assembly of components forming a complete system. It comprises a mix of pneumatic, electronic and mechanical components. Once a control system is functioning correctly there is no test, or tests, which can be applied to guarantee successful operation for a stated period of time; random failure of components can occur and such random failures can never be forecast. In consequence, satisfactory operation, in the way the system was designed to operate, is the only test to apply. This involves frequent operation of the monitor, especially if the monitor is shut down for long periods. A test run, once a month, will ensure that the monitor will work correctly when it is required.

Dirt, corrosion, and, to a lesser extent, wear are the enemies of control. This means that clean conditions must be maintained in the area of the monitoring equipment.

Pneumatic and hydraulic components require little maintenance. The various moving parts in the system should be free from friction and in good working order. Oil should not be applied to pneumatic components. Connections should be tight; loose connections not only waste air but produce unsatisfactory operation and performance.

One of the greatest problems with pneumatic systems is the maintaining of a supply of clean , dry air at a constant pressure. Moisture, oil or foreign particles carried into the system from the air supply will cause problems. Pneumatic valves and controllers operating with clean dry air require virtually no maintenance.

SAFETY

If any work is carried out on the monitor, the following precautions should be taken before any work is commenced:

1. Make sure that all safety requirements are met before starting any maintenance work;
2. Make sure that all equipment is isolated from the electrical supplies;
3. Make sure that the equipment is isolated from the water supply;
4. Make sure that the equipment is isolated from the air supply;
5. Use adequate personnel protection where necessary;
6. Use adequate tools to perform the work;
7. Thoroughly clean the outside of all fittings, pipes and components, and surrounding structure before any work commences;
8. Then pipe lines are disconnected fit dust caps to pipes and unions, mask any exposed surfaces and make certain that foreign matter cannot enter the system;
9. If flushing pipes, use a clean inert solvent, from a clean container;
10. Use cleaning solvent in a well ventilated place. Avoid breathing fumes. Keep away from open fire.

4.7.2 Routine maintenance

There is little routine maintenance that can be carried out on the Oil Discharge Monitoring & Control System. The major requirement is to ensure that the lubricator in the system is kept topped up and a regular check of the air regulator housings for excess water.

4.7.2.1 *Air regulators*

For correct and fault free functioning of pneumatic components it is advised to regularly check and drain the regulator housing of excess water. If a great deal of water is found the filter in the regulator house should be replaced. Also a check should then be performed on the ship's control air system, compressors, air-dryers etc.

4.7.2.2 *Pump/motor lubricator*

Proper functioning of the gas seal located in the centre of the pump main plate relies on the presence of oil, for lubricating, sealing and cooling purposes.

The oil reservoir shall always be sufficiently filled with oil. It can easily be filled by opening the spring-loaded cap on top, and pouring the oil in.

There is no need to disassemble any part of the support assembly.

For lubricating oil we recommend to use a light-duty type of machine oil, or Automatic Transmission Fluid.

The viscosity of the oil can be within the range of:

- 20....100 cSt
- 20....100 cPs
- 100...500 SSU
- 3.....14° Engler

Suggested products are:

- AGIP OSO 22 or 32	AGIP ATF 2D
- Castrol MLV30	
- Castrol Highspin AWH-M68	
- Elf Olma DS 46	Elf Transomatic
- Elf Hydrelf DS 46	
- Esso Teresso 32 or 46	Esso ATF-D
- Esso Nuto-H 32 or 46	
- Kroon Carsinus U68	Kroon Almurool
- Kroon Abacod MEP 68	
- Kroon Perlus AF	
- Pennzoil AW Hydraulic 22 or 32	Pennzoil ATF
- Pennzoil Pennzgear 150 or 220	
- Shell Tellus 22 or 37	Shell Donax TA
- Total Azolla ZS 32	Total Fluide ATX
- Total Preslia 32	
- Texaco ISO VG 32 or 68	Texaco Texamatic 4261

Biodegradable:

- Castrol Carelube SES32



WARNING:

ATF-types of oil are not to be mixed with general machine oil.

4.7.3 Printer

The only routine maintenance required to the MCU is to ensure that there is an adequate supply of paper in the printer before starting a ballast discharge operation.

Note:

Ensure printer head mechanism is clean.



CAUTION:

Never let the printer work without printing paper as this will damage the printing mechanism.

4.7.3.1 *Loading paper*

1. Unscrew the two knurled thumb-screws on the front panel and allow the front panel to drop down on its hinges.
2. Slide the take-up spindle from rear of the front panel by sliding off the free end. Slide the roll of paper off the spindle and retain it on board.
3. Remove the rear paper feed spindle from the holder by pushing it out of the retaining clips and discharge the empty spool. Slide the new roll of paper on the spindle.
4. Replace the feed spindle in the front retaining clips and ensure it locates securely. Feed the paper through the printer using the red paper feed button located on the left hand side of the printer module. Then feed the paper through the lower aperture in the front panel. (See Drawing. 0806-8041).
5. Feed the paper back through the upper aperture in the front panel and onto the take up spindle. Replace the paper retaining spindle, and ensure that the pins on the take-up spindle mesh correctly with the cutouts on the spindle. The paper can now be tightened by turning the take-up spindle.
6. Lift the front panel back into position and tighten up the thumb-screws.

Note:

One roll of paper will provide approximately 50 hours of normal use.

4.7.4 Detector cell

Drawing 0806-1279-4 shows the detector cell and will help to visualize the following.

Make sure that the Electro Pneumatic Unit is switched off.

Note:

The internal parts of the detector cell have been chemically treated. It is important to ensure that the coating remains intact and that no bare metal has been exposed.

4.7.4.1 *Cleaning the detector cell windows*

1. This is not normally required but in cases where repeated failure of the system to qualify occurs, the following cleaning procedure can be undertaken.
2. Relieve any pressure from the cell body. Remove the upper pipe clamp above the cell.
3. Remove the flow regulator mounting bolts.
4. Unscrew the upper coupling on flow sensor.
5. Unscrew the four upper hex drive bolts.
6. Remove the upper connection piece of the measurement cell and slide out to the front of the skid assembly.
7. The inner parts of the cell can now be cleaned by using the cleansing brush (Part number 0609-0290) provided.
8. Re-assembly of the cell is the reverse procedure, taking care that the O-ring is properly seated.

4.7.4.2 *Removing the detector cell*

1. The detector cell only requires removal for complete unit replacement.
2. Proceed as for cleaning the window bolts, until step 6.
3. The centre section of the detector cell can now be removed.
4. The detector cell centre section must be removed and replaced with the attached cable. As such the Connection box must be opened and the cable gland loosened and terminals undone. The detector cell and cable can now be removed and replaced.

4.7.4.3 *Re-mounting the detector cell*

1. Ensure the lower O-ring is properly seated.
2. Slide the new centre section of the detector cell into place.
3. Slide the upper section of the cell into place. Line up the holes.
4. Insert the four hex drive bolts and tighten.
5. Re-connect the upper pipework connection.
6. Tighten pipe clamp and mounting bolts for flow sensor.

4.7.5 Window wash pump

Note:

When the pump is disassembled for repairs, all matched parts should be handled carefully to avoid damage to lapped or honed surfaces.



WARNING:

Use cleaning solvent in a well ventilated place. Avoid breathing of fumes. Keep away from open fire.

Drawing 0871-1212 shows the window wash pump and will help to visualize the following:

4.7.5.1 Disassembling the window wash pump

1. Isolate the pump and relieve any pressure from the pump.
2. Remove the pump from the Skid assembly to a clean and well lit work place, after first disconnecting the two water pipe lines and the air supply line.

4.7.5.2 Air side problems

1. In the eventuality of an air drive malfunction the spool guide (8) and pilot valves (17) should be replaced. Inspect this first and replace if necessary prior to retesting before further disassembly of air drive. Spool guide (8) is most easily removed by removing the four star drive screws and carefully removing, behind the spool guide is a small sliding port valve. Care should be taken to ensure the sliding port valve is replaced with the hollow side toward the body of the unit. The spool guide is included in spare parts kit 0390-1202.
2. Secondly on the air drive side are the replacements of pilot valves (17). These two units should be replaced as a pair, and form part of the Window wash pump maintenance kit (part number 0390-1202)

4.7.5.3 Water side problems

1. The inlet and outlet couplings are provided with non-return valves. Should a leakage occur on the water side replacement of the O-rings (45) should be carried out. Remove inlet or outlet gland completely and remove O-ring from inner part. Replace with new. The O-rings are part of the window wash maintenance kit 0390-1202.
2. If water is leaking from the wet side to the air side then the back up ring (33) should be replaced. To perform this, first undo four star screws (29). Remove upper body (1). Remove Air piston (23). Place lower assembly into a bench vice. With a 36mm box spanner remove cap nut (40). The O-ring(32 and back-up ring (33) are now visible and can be replaced with reserve from window wash pump spare parts kit 0390-1202.

4.7.5.4 Re-assembling the window wash pump

1. Before starting re-assembly operations, wash all metallic parts thoroughly in solvent.
2. The air piston, air barrel, cycling valve and sleeve should be lubricated on assembly with lubricant provided in the spare parts kit.
3. Re-insert air piston.
4. Replace body onto lower pump body, taking care to ensure O-ring (28) sits well and is not "pinched".
5. Replace the pump into the Skid Assembly and connect the water and air service pipes.

4.7.6 Skid shuttle valve

No maintenance on this unit is envisioned. Should the unit fail to operate, a replacement unit should be installed. If any water leakage through the end cap bleed holes is detected, the assembly should be delivered to a qualified VAF Instruments service point for overhaul.

4.7.7 2-Way pneumatic valve(s)

No maintenance on this unit is envisioned. Should the unit fail to operate, a replacement unit should be installed. If any water leakage through the end cap bleed holes is detected, the assembly should be delivered to a qualified VAF Instruments service point for overhaul.

4.7.8 Sample pump



WARNING:

The following point must be considered before commencing work to the unit.

- stop the pump;
- isolated the electric motor from the mains supply;
- isolated the pump from the water supply and relieve any pressure on the pump.

Drawing. 0806-1260-3 shows the pump/motor and will help to visualize the following:

4.7.8.1 *Mechanical shaft seal*

This sealing device requires no maintenance or adjustment. When a new seal is being run in, small leakage may occur momentarily.

If any water leakage occurs, this will drip out of the 2mm. keyway at the bottom side of the pump casing, visible from the pump room side.

4.7.8.2 *Disassembling the pump/motor*

1. Drain the pump and piping. On the pump casing a drain plug is provided. If repair to the impeller or rotating part of the mechanical seal is required, the piping can remain in place. Otherwise, remove the suction and discharge piping from the pump.
2. Remove the eight nuts (7) and washers (38) from the pump cover.
3. Remove the cover (5) from the pump casing, preferably utilising the two off jacking screws size M6. Be careful not to damage the set of packing rings (4).
4. If only the impeller (10) is to be changed out, pull it out of the casing. If it sticks, gently use two snap grips and apply little force evenly. Be careful not to be injured by the sharp impeller vanes, and also not to damage the impeller. The keyway for the impeller is glued in place in the factory and should not be disturbed.
5. For access to the mechanical seal (9), the coupling (14) is to be removed. For this purpose, the impeller can be left in place and be blocked with a tool having a soft end. Be careful not to be injured by the sharp impeller vanes, and also not to damage the impeller. Loosen the hexagon socket head cap screw (12) of the coupling (14). Then remove the impeller, and the bolt (12) with the o-ring (13).
6. Pull the coupling from the motor shaft. For this purpose a M16 thread is provided, enabling use of a bolt as pull handle. Be careful as the rotating part of the mechanical seal (9) will come off with the shaft sleeve. Prevent the seal part from striking the pump casing when it comes off. Do not damage the sealing ring and store it in a clean cloth at a safe place.

7. For further disassembly remove the three hexagon socket head bolts (16) from the flange (22). Pull the pump casing (2) with fitting ring (22) from the main plate. Care should be taken for the stationary ring of the mechanical seal, this will come off together with the pump casing. This ring should not strike the shaft, otherwise it may be damaged. Be aware that the key (31) should be kept in place.

Note:

The gas tight seal will be compromised if the following steps are taken. Ensure replacement parts are to hand.



WARNING:

Gas tight integrity of the bulkhead will be shortly compromised. Ensure all safety regulations are followed and blanking plates are available if the repair of the unit is expected to take any length of time.

8. If deemed necessary the rings forming the gas seal can be removed. Remove the oil reservoir on engine room side of bulkhead. Pull out the first oil seal (25), the lantern ring (26) and the second oil ring. The oil seals will certainly be damaged and need to be replaced.
9. Clean the oil that will come out of the oil seal chamber.
10. Clean all components and store these at a safe place.
11. Now the electric motor (32) can be removed from the flange (22). Remove the bolts and washers (23, 24) from the motor flange. Pull the motor from its fitting.
12. Seal the hole of the motor shaft using f.i. tape or a plug diameter 30 mm. Protect the sleeve on the motor shaft from damage. If a new motor is being installed the bushing (27) is supplied fitted to the original VAF Instruments spare part.

4.7.8.3 Re-assembling the pump/motor

Have all parts cleaned and be free of burrs. Have new gaskets, oil and if required oil seals available.

1. If the electric motor was removed or replaced, inspect the surface of the bushing (27) for scratches. If the surface is damaged, then complete original VAF Instruments motor and bushing will need to be replaced, as this item is critical for the gas tight seal.
2. If the oil seals (26) were removed, install these now, together with lantern ring (25). Take care not to damage the oil seals. If the oil seals (26) are still in place, make sure that these are not damaged during re-installation. Ensure the lubricating oil channel is clean. Smear a small amount of oil over the seals. Install the electric motor (32). The terminal box should preferably be located at the top.
3. Smear some oil on the pump house (2) face. Mount the pump house (2) on the pump face (22) with the three Hex Socket head drive screws (16). Use water and soap on the mechanical seal (9) and press this into the pump house over the slightly prominent motor drive shaft.
4. Insert the woodruff key (11) into the coupling (14) with Loctite Retainer 542. Mount the coupling (14) with attention to the mechanical seal onto the motor shaft. (The sleeve should slip easily onto the shaft). Care is to be taken to ensure the keyway in the coupling mates with the drive pin (31) in the motor shaft.

5. Install the impeller (10) onto the shaft, taking care to line the keyway up with the woodruff key (11). The impeller should fit readily onto the shaft. There is no difference between frontside or backside. However, when re-fitting the same impeller it is preferable to adhere to the original position.
6. Place the casing cover (5) on the pump casing (2), with a new O-ring gasket (8). Re-use all of the shims (4). If a shim gets damaged it must be replaced with a new one of exact the same thickness, otherwise pump performance will be affected or the pump may even jam. Gently tighten all cover nuts (7).
7. Check that the pump rotates freely by hand. This can be done at the cooling fan of the electric motor.
8. Check the oil level in the reservoir (38), if required refill.



CAUTION:

UNDER NO CIRCUMSTANCES MUST THE PUMP BE RUN WITHOUT LIQUID. THE PUMP CASING MUST BE FILLED WITH LIQUID FIRST.

OTHERWISE THE PUMP WILL SEIZE AND DAMAGE WILL OCCUR.

9. Re-connect the suction and discharge piping to the pump casing. Re-install the drain and vent plugs after filling the pump casing and suction line with water.
10. Re-connect the pumpmotor to the mains supply. Make sure that all piping is installed, and the pump is filled with water. Make sure any discharge valve is opened before starting, enabling air to be released.

Check the direction of rotation by switching on the pumpmotor for a short moment only ! Look at the motor fan and notice the direction in which the fan spins. This must be **CLOCKWISE** when looking from the back cover of the motor. An arrow also indicates correct direction of rotation. If direction of rotation is wrong, interchange any of two line wires of the power cable in the terminal box. Switch off the electrical supply first !

4.7.9 Differential pressure transmitter

4.7.9.1 *Zero output check of DPT*

1. Open equalising valve of DPT.
2. The FLOW indication on the MCU should now read zero. If reading is not zero, adjust zero point at DPT, in accordance with section 4.7.9.2, until reading is zero.
3. Close equalising valve of DPT.

4.7.9.2 *Zero adjustment of DPT*

1. Keep the transmitter energised for at least 10 minutes.
2. Remove cover from electronics housing of DPT.
3. Check that 'MODE' switch is at 'O' (refer to the illustrations in drawing 0899-1249-3).
4. Apply the lower value pressure.
5. Wait for the pressure to stabilise.

6. Slide away 'ZERO' cover on electronics housing and adjust zero point by turning adjustment screw as shown in drawing 0899-1249-3.
7. Set 'MODE' switch to '2'.

Note:

When a digital voltmeter is used you will find an example of wiring (connected to CK- and CK+ on the terminal block) with the illustrations. Lower pressure value should then correspond with an output of 4 mA.



Caution:

After adjustment of the transmitter, it should be kept energised for about 10 seconds.

4.7.9.3 *Span adjustment of DPT*

1. Unscrew cover from electronics section of DPT and read calibration data plate affixed to inside of cover.
2. Connect a suitable pressure gauge and air supply to "+" side of DPT. Make sure that "-" side vents to atmosphere.
3. Connect suitable digital voltmeter (refer to the illustrations in drawing 0899-1249-3).
4. Set 'MODE' switch to '1' (see illustrations).
5. Apply pressure shown as "upper calibration value" on calibration data plate of the DPT.
6. Wait for the pressure to stabilise.
7. Observe mA signal output. If reading is not in accordance with the upper limit of the DPT the output current can be adjusted using the zero/span screw.
8. Repeat steps 1, 2 and 3 of paragraph 4.7.9.1 to check that the zero point has not drifted.
9. Set 'MODE' switch to '2'.
10. Remove air tools and voltmeter. Close covers. Ensure that the sealing ring is installed otherwise the transmitter is not in accordance with IP67.



Caution:

After adjustment of the transmitter, it should be kept energised for about 10 seconds.



Warning:

In hazardous zones with explosion proof requirements the cover must be tightened at least 7 turns.

4.7.9.4 *Disassembling the DPT*



Warning:

Use cleaning solvent in a well ventilated place. Avoid breathing of fumes. Keep away from open fire.



Warning:

DO NOT DISASSEMBLE WITH POWER ON

In drawing 0899-1249-3 you will find illustrations with an exploded view of the DPT which will help to visualize the following:

1. In order to have access to the sensor (B105) for cleaning purposes, the transmitter should be removed from its process connections. The transmitter should be isolated from the process by means of manifolds or valves and must be vented from any remaining pressure prior to removing.
2. Remove the DPT to a clean and well lit work place.
3. The flange nuts (B-14) may now be loosened crosswise, one at a time. After removing bolts and flanges (B-9), the isolating diaphragms will be easily accessible for cleaning.
4. Cleaning should be done carefully in order to avoid damaging of the delicate isolating diaphragms. Use of a soft cloth and a non-acid solution is recommended.
5. The oscillating circuit is a part of the sensor and replacement of one implies replacing the other.
6. To remove the sensor from the electronics housing, the electrical connections (in the field terminal side) and the main board connector must be disconnected.
7. Loosen the hex screw (A-31A) and carefully unscrew the electronics housing from the sensor, observing that the flat cable is not excessively twisted.



Caution:

Do not rotate the electronics housing more than 180° without disconnecting the electronic circuit from the sensor and from the power supply.

4.7.9.5 *Electronic circuit*

1. To remove the circuit board (A-6) loosen the two screws that anchor the board.



Caution:

The board has CMOS components which may be damaged by electrostatic discharges. Observe correct procedures for handling CMOS components. It is also recommended to store the circuit boards in electrostatic-proof cases.

2. Pull the main board out of the housing and disconnect the power supply and the sensor connectors.

4.7.9.6 *Re-assembling the DPT*



Warning:

Do not assemble with power on.

(i) **Sensor**

1. When mounting the sensor (B105), it is recommended to make use of a new set of gaskets (B-8) compatible with the process fluid. The bolts, nuts, flanges and other parts should be inspected for corrosion or other eventual damage. Damaged parts should be replaced.
2. Gaskets should be lightly lubricated with silicone oil before they are fitted into their recesses. The flanges should then be positioned in order to press them in place. With the flanges holding the O-rings in place, insert the four bolts and tighten the nuts (B-14) finger-tight, making sure the flanges remain parallel all the time.

- Tighten one nut till the flange seats.
 - Tighten the nut diagonally across with a torque of approximately 25 Nm (20 ft.lbs).
 - Tighten the first nut with the same torque.
 - Verify the flange alignment.
 - Check torque on the four bolts.
3. The fitting of the sensor must be done with the main board out of the electronic housing. Mount the sensor to the housing turning clockwise until it stops. Then turn it counter-clockwise until it faces the protective cover (A-1) parallel to the process flange. Tighten the hex screw (A-31A) to lock the housing to the sensor.

(ii) Electronic Circuit

1. Plug sensor connector and power supply connector to main board.
2. Anchor the main board with its screws.
3. After tightening the protective cover (A-1), mounting procedure is complete. The DPT is ready to be energized and tested. It is recommended to open the DPT pressure valves to atmosphere and adjust the TRIM.



Warning:

In hazardous zones with explosion proof requirements the cover must be tightened with at least 7 turns.

4.7.10 Spare parts

4.7.10.1 *Standard spares*

Standard spare parts supplied with every Oil Discharge Monitoring & Control System delivery:

Description	Stock number	Quantity
Standard spare parts OIL DISCHARGE MONITOR system	0390-1194	
comprising:		
Printer paper		10
Bulkhead seal lubricant		500ml
O-ring I/D 53,70 x 1,78 mm		2
Fuse 500 mA (slow)		2
Fuse 630 mA (slow)		2
Cleansing brush		1
Printer ribbon		4

4.7.10.2 *Servicing spares*

When ordering spares, **always refer to the Oil Discharge Monitoring & Control System's serial number** and list required spares indicating:

1. stock number;
2. quantity required;
3. description of kit.

We recommend to stock the following spares:

Description	Stock number	Quantity
Sample pump – Impeller replacement kit	0390-1210	
(See drawing 0806-1260)		
comprising:		
Impeller (10)		1
Sample pump maintenance kit (0390-1182):		
Mechanical seal (9)		1
O-ring (8)		1
O-ring (13)		1
Oil sealing (25)		2
Shim (set) (4)		1

Description	Stock number	Quantity
Sample pump electric motor kit (See drawing 0806-1260) comprising:	0390-1209	
Electric motor (32)		1
Key (31)		1
Bushing (27)		1
Window wash maintenance kit (See drawing 0871-1212) comprising:	0390-1202	
Pilot valve complete (17)		2
Back up ring (33)		1
O-ring (45)		2
Printer Kit comprising:	0390-1212	
Printer paper		10
Printer ribbon		5
Electrical items spares kit comprising:	0390-1211	
LED Green (starter box)		2
LED Red (starter box)		2
Fuses 500mA Slow (EPU & MCU)		2
Fuses 630mA Slow (EPU & MCU)		2

5. TEST AND CHECK-OUT PROCEDURE

RECOMMENDED TEST PROCEDURE

Before test is carried out the person in charge should familiarise himself/herself with the operation of the system and ensure the following conditions are met:



CAUTION:

UNDER NO CIRCUMSTANCES MUST THE PUMP BE RUN WITHOUT LIQUID. THE PUMP CASING MUST BE FILLED WITH LIQUID FIRST OTHERWISE THE PUMP WILL SEIZE AND DAMAGE WILL OCCUR.

- a) control air supply is on;
- b) fresh water supply is on;
- c) electrical supplies are on;
- d) Main Control Unit is switched on;
- e) Electro Pneumatic Unit is switched on;
- f) starter box is switched on;
- g) all manual valves in the system are open;
- h) cargo pump is on stand by;
- i) check if sufficient paper is available in printer.

Proceed as follows:

1. Switch MCU to "Control Unit" position.
2. Press [>], to enter SET UP mode.
3. Press [ENTER] till 'Total Oil Limit' is displayed.
4. Press [CHANGE] and enter Total Oil limit of 40 L.
5. Press [ENTER] to display 'Reset Oil Total ?'
6. Press [CHANGE] and [CLEAR] to reset Oil Total to zero.
7. Press [ENTER] till 'Ships speed input' is selected. Change to manual mode and enter Ship's speed of 15 knots.
8. Press [ENTER] till 'Flow rate input' is selected. Change to manual and enter flow rate of 1000 T/h.
9. Press [ENTER] till 'Oil content input' is selected. Change to manual and enter oil content of 400 ppm.

10. Press [ENTER] till end of SET UP mode is reached.
11. Press [ENTER] the system will go to IDLE mode.
12. Press [>] to start the SAMPLE mode.
13. Check the display of the MCU for correct information.
dd/mm/yy hh:mm SAMP.PNT 1 MODE SAMPLE
CONC 400 ppm M DISCH 0 l/nm
FLOW 1000 T/h M TOT.OIL I
SPEED 15 kts M V/V COM:C POS:C OIL:1
14. After approximately 2 minutes, the signal to open the overboard valve and to shut the slop tank valve will be given. Which is indicated on the display as follows:
dd/mm/yy hh:mm SAMP.PNT 1 MODE SAMPLE
CONC 400 ppm M DISCH 27 l/nm
FLOW 1000 T/h M TOT.OIL xx I
SPEED 15 kts M V/V COM:O POS:O OIL:1
15. In the case of this vessel check that the valves have in fact operated. On the display of the MCU this is indicated by the change of POS: from 'C' to 'O'.
16. Press [STOP MONITOR]. the system will return to IDLE mode and the signal to close the overboard valve and open the slop tank valve will be given.
dd/mm/yy hh:mm SAMP.PNT 1 MODE **IDLE**
CONC 400 ppm M DISCH 27 l/nm
FLOW 1000 T/h M TOT.OIL I
SPEED 15 kts M V/V COM:C POS:C OIL:1
17. In the case of this vessel check that the valves have in fact operated.
18. Select EXTRA SET UP mode by pressing [CHANGE].
19. Press [ENTER] till 'Flow rate input' is selected. Change flow rate to 2000 T/h.
20. Wait till system is back in IDLE mode. (15 seconds after last keyboard action).
21. Select Sample mode by pressing [>].
22. Check the display of the MCU for correct information.
dd/mm/yy hh:mm SAMP.PNT 1 MODE SAMPLE
CONC 400 ppm M DISCH Flt l/nm
FLOW 2000 T/h M TOT.OIL I
SPEED 15 kts M V/V COM:C POS:C OIL:1

23. After approximately 2 minutes the overboard discharge valve signal will not change from close to open.

24. Press [STOP MONITOR] to select IDLE mode again.

25. Select EXTRA SET UP mode by pressing [CHANGE].

26. Press [ENTER] till 'Flow rate input' is selected. Change flow rate to 1000 T/h.

27. Wait till system is back in IDLE mode. (15 seconds after last keyboard action).

28. Select Sample mode by pressing [>].

29. Check the display of the MCU for correct information.

dd/mm/yy hh:mm SAMP.PNT 1 MODE SAMPLE

CONC 400 ppm M DISCH 0 l/nm

FLOW 1000 T/h M TOT.OIL I

SPEED 15 kts M V/V COM:C POS:C OIL:1

30. After approximately 2 minutes, the signal to open the overboard valve and to shut the slop tank valve will be given. Which is indicated on the display as follows:

dd/mm/yy hh:mm SAMP.PNT 1 MODE SAMPLE

CONC 400 ppm M DISCH 0 l/nm

FLOW 1000 T/h M TOT.OIL I

SPEED 15 kts M V/V COM:O POS: O OIL:1

31. In the case of this vessel check that the valves have in fact operated. On the display of the MCU this is indicated by the change of POS: from 'C' to 'O'.

32. The discharged oil indicated on the display by 'TOT.OIL' will increase. Allow the oil discharge to increase till it reaches 40 l, at which time the signal will be given to close the overboard valve and to open the slop tank valve.

33. Check that the valves have in fact operated.

34. Press [STOP MONITOR] to select IDLE mode.

35. Press [STOP MONITOR] to select SHUTDOWN mode.

The system is now STANDBY mode.

36. Press [>] to select SET UP mode.

37. Press [ENTER] till 'Reset Oil Total ?' is displayed.

38. Press [ENTER].

39. Press [ENTER] till 'Ship's speed input' is selected. Change to auto mode.

40. Press [ENTER] till 'Flow rate input' is selected. Change to auto mode.

41. Press [ENTER] till 'Oil content input' is selected. Change to auto mode.

42. Press [ENTER] till 'Using GPS speed / Using ship's log speed' is reached and select 'Using ship's log speed'.

43. Press [ENTER] till end of SET UP mode is reached.

44. Press [ENTER] to start FLUSH mode.
45. Wait till the system has completed the flushing cycle and is back in IDLE mode.
46. Check the display of the MCU for correct information.
47. Start the cargo pump. NOTE: the MCU will divert the flow into the slop tank.
48. Press [>] to start sampling. Check that the ppm indication on the MCU is changing.
49. Press [STOP MONITOR] to select IDLE mode.
50. Press [CHANGE] to select EXTRA SET UP mode.
51. Press [CHANGE] and select the next sample point.
52. Wait 15 seconds till the system is back in IDLE mode again.
53. Press [>] to start sampling.
 - Check that the correct sample point is indicated on the MCU.
 - Check that the correct sample probe is selected.
54. Repeat step 48 to 52 for each sample point.
55. Press [STOP MONITOR] to select IDLE mode.
56. Press [CHANGE] to select EXTRA SET UP mode.
57. Press [ENTER] till 'Oil Type' selection is displayed and select the next oil type.
58. Wait 15 seconds till the system is back in IDLE mode again.
59. Check if correct Oil type is indicated on MCU.
60. Repeat step 56 to 58 for each oil type.
61. Press [>] to select the SAMPLE mode.
62. Press [WINDOW WASH].

The display will indicate "MW" alongside "SAMPLE MODE". The window wash pump should operate for a few seconds.
63. Press [FLUSH].

The display will indicate "MF" alongside "SAMPLE MODE".

 - Check that fresh water valve (V10) opens for approximately 2 minutes.
 - Check that Oil content indication on MCU reads zero.
64. Test the NO FLOW alarm by manually shutting the sample inlet valve on the Skid Assembly.
 - Check that sample pump is stopped after approximately 2 minutes
 - Re-open sample inlet valve after test.
65. Check that the ship's speed, flow rate and oil content are all displayed on the MCU and wait for the overboard discharge valve to open. Regulate cargo pump speed and back pressure to obtain a flow rate equivalent to approx. 50 % of the rated capacity of the flowmeter. Check the accuracy of the flowmeter against ullage readings or cargo pump characteristic curves.

66. Test under-range alarm by reduce of flow. Overboard valve shut and recirculating valve will go open. Increase discharge flow and press "alarm reset". Press "stop reset".
67. Press [SCROLL] to select TEST mode.
- Follow instructions as indicated on the display of MCU to perform a self test of the system
- . - Display should indicate 500 ppm
 - The audio alarm should sound.
 - The printer should perform a print test.
68. Press [CLEAR] or wait for 15 seconds to return to SAMPLE mode.
69. Press [STOP MONITOR] to select IDLE mode.
70. Turn the keyswitch on the MCU to 'CONSOLE' position and check the manual control of the overboard discharge valve and sloptank valve from the cargo control console.
71. Turn the keyswitch on the MCU to 'CONTROL UNIT' and check that the manual control of both overboard discharge valve and slop tank valve from the cargo control console is not possible.
72. Press [STOP MONITOR] to select SHUTDOWN mode.
- Check operation of SHUTDOWN flushing cycle as follows:
- Fresh water valve (V10) and back flush valve (V11) opens.
 - Sample pump runs.- After 2 minutes (V11) should close.
 - The window wash pump will operate for a few seconds
 - . - After a further 2 minutes valve (V10) will close and the pump stops.
- The system is now in a STANDBY mode.
73. Inspect the system for evidence of any leaks.

6. CERTIFICATES OF CONFORMITY AND CERTIFICATES OF APPROVAL

6.1 CERTIFICATES OF CONFORMITY

Certificate:	Type:	For:
Det Norske Veritas	EC type examination certificate	Oil Discharge system OILCON Mark 6M
KEMA	EC type examination certificate	Interface and Detector cell
KEMA	EC declaration of conformity	Oil Discharge Monitoring and Control System Oilcon Mark 6M
PTB	EC type examination certificate	Inductive sensor (skid flowmeter)
KEMA	EC type examination certificate	dP transmitter (overboard discharge flowmeter)



DET NORSKE VERITAS

EC TYPE-EXAMINATION CERTIFICATE

Application of: Council Directive 96/98/EC of 20 December 1996 on Marine Equipment as amended by directive 2008/67/EC, issued as "Forskrift om Skipsutstyr" by the Norwegian Maritime Directorate. This Certificate is issued by Det Norske Veritas under the authority of the Government of the Kingdom of Norway.

CERTIFICATE NO. **MED-B-5937**

This is to certify that the
Oil discharge monitoring and control system for an oil tanker

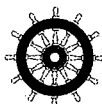
with type designation(s)
Oil Discharge system OILCON® Mark 6M

Manufacturer
VAF instruments BV
DORDRECHT, Netherlands

is found to comply with the requirements in the following Regulations/Standards:
Annex A.1, item No. A.1/2.5 and Annex B, Module B in the Directive. Marpol 73/78 as amended, Annex I Regulation 31 and
IMO Res. MEPC.108(49)

Further details of the equipment and conditions for certification are given overleaf.

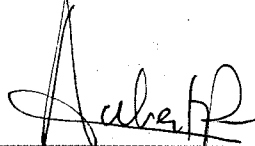
Høvik, 2010-03-02
for Det Norske Veritas AS



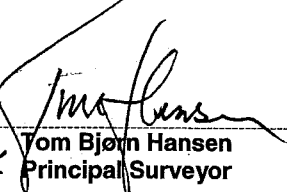
Notified Body No.: **0575**

DNV local office:
Rotterdam

This Certificate is valid until
2015-03-02


Eivind Mykland
Head of Department




Tom Bjørn Hansen
Principal Surveyor



The Certificate is subject to terms and conditions overleaf. Any significant changes in design or construction of the product, or amendments to the Directive or Standards referenced above may render this Certificate invalid. The product liability rests with the manufacturer or his representative in accordance with Council Directive 96/98/EC, as amended. The Mark of Conformity may only be affixed to the product and a Declaration of Conformity may only be issued when the production/product assessment module referred to in the council directive, is fully complied with.



Certificate No.: MED-B-5937
Item No.: A.1/2.5
Job Id.: 344.1-002437-1

Product description

Main components of The OILCON system Mark 6M Oil Discharge Monitoring & Control System:

Main Control Unit	dP/I Transmitter
Skid containing the measuring cell	Electro Pneumatic Unit
Sampling Pump	Pressure regulating valve
Starter box	Automatically controlled valves.
Sample Valves	Orifice plate
Sample Probe	

The equipment is designed and tested to meet the requirements of the IMO Resolution MEPC.108(49).

Application/Limitation

This EC Type Examination covers system design principle and installation on board with regards to fire and explosion hazard, as well as performance. Arrangement drawing and certificate for intrinsically safe equipment is to be submitted for each installation. Inspection of intrinsically safety is to be carried out upon installation on board.

The oil content meter is tested and approved according to IMO Res. MEPC.108(49).

for:

- Crude oils
- "Black" and "white" products

Type Examination documentation

General document;

Installation and Operating Manual 640 Oilcon® Mark 6M – Publ. No.TIB-640-GB-1204

Drwg.No.;	Rev.;	Title;
0806-0005-3	C	Control Drawing for Mark 6 Oil Discharge Monitor
0806-0005-4	C	Notes Control Drawing for Mark 6 Oil Discharge Monitor
0806-1041-4	G	Dimensional Drwg. Ball Valve Flowmeter Kit, Ballast Monitor
0806-1075-4	B	Dimensional Drwg. Motor Starter Box, Ballast Monitor
0806-1076-3	D	Dimensional Drwg. Sample Pump Motor
0806-1077-4	B	Dimensional Drwg. Sample Valve
0806-1260-3	C	Assembly Drwg. Sample Pump
0806-1260-4	H	Parts List Sample Pump
0806-1280-3	B	Dim. Drwg. + Parts List Ballast Skid
0806-1282-3	A	Dim. Drwg. + Parts List EPU, 1-2 Sample Valves
0806-1278-3	C	Dim. Drwg. + Parts List Main Control Unit
0806-1265-4	C	Parts List Sampling Probe Pipe Conn. Ø15 mm
0806-1267-4	E	Parts List Motor Starter Box
0806-1268-4	B	Parts List Isolating Valve Ø15 mm
0806-1272-4	A	Basic Spare Parts Kit
0806-1279-4	C	Parts List Detector Cell
0806-1621-4	A	Grab Cock and Injection Point
0806-1622-4	10/02	Light Scatter Cell
0806-2032-4	04/03	Connection Diagram Motor Starter Box
0806-2037-4	B	Connection Diagram, Cable Specification
0806-2036-3	C	Electric Connection Diagram
0806-5019-4	C	Schematic Diagram Overboard Valve Control
0806-5021-3	B	Schematic Diagram Ballast Monitor
0806-8016-3	J	Installation Flowmeter
0806-8023-3	A	Installation Requirements F.W. Supply Line
0806-8035-3	D	Schematic Installation Diagram
0806-8037-4	B	Multi Cable Transit
0806-8038-3	E	Bulkhead Penetration and Piping Diagram (sh.1 of 3)
0806-8038-3	D	Bulkhead Penetration and Piping Diagram (sh.2 of 3)
0806-8038-4	C	Bulkhead Penetration and Piping Diagram (sh.3 of 3)
0806-8039-4	A	Schematic Pipe Arrangement





Certificate No.: MED-B-5937
Item No.: A.1/2.5
Job Id.: 344.1-002437-1

0806-8040-4	A	Cable Termination Instruction
0806-8041-4	A	Instruction Paper Path Printer
0806-8042-4	B	Control Panel MCU
0810-2007-4	D	Connection Diagram dP/I Transmitter Type FUJI
0871-1212-3	12/02	Assembly Drwg. Window Wash Pump (sh.1 of 2)
0871-1212-4	12/02	Parts List Window Wash Pump (sh.2 of 2)
0899-1092	F	Dim. Drwg. dP/I Transmitter FUJI Flow Meter Kit
0899-1249	H	Parts List FUJI dP/I Transmitter Flow Meter Kit
0899-1256-3	C	Parts List Pressure Reducing Valve Fresh Water
0899-1258-3	D	Parts List air Supply Units
0610-0030	10/09	dP/I Transmitter FUJI
0610-0031	10/09	dP/I Transmitter FUJI

Tests carried out

Tested in accordance with the requirements of the specification contained in Part 1 of the Annex to the Guidelines and Specification contained in IMO Resolution MEPC.108(49);

-Institut Fresenius AG, Cert.No. 104_254598, dated Dec.20, 2004, Certificate of Type Approval for Oil Content Meters intended for Monitoring the Discharge of Oil-Contaminated Water from Cargo Tank Areas of Oil Tankers.

Tested in accordance with the requirements of the specification contained in Part 2 of the Annex to the Guidelines and Specification contained in IMO Resolution A.586 (14);

Vibration-, inclination-, humidity-, dry heat-, cold- and EMC-tests;

-Test Programme No.01-09-2001 Rev.D w/ Summary of results

-Dijkstra Advies, Research & EMC Consultancy B.V. (DARE), Report No. 03C00259RPT01, Electromagnetic Compatibility Test Report

-TNO Building and Construction Research, TNO Report No.2003-CMC-R008, Vibration Test of 'Oilcon Mark 6'.

-KEMA Quality B.V., EC-Type Examination Certificate No. KEMA 03ATEX1187 X w/Amendment 1, for Oil Discharge Monitor type Oilcon Mark 6

-Cosmos Corporation, Test Report No. E89244, dt. Dec.18, 2008, EMC Test Report for Differential Pressure Transmitter.

Marking of product

For traceability to this type approval, each unit is to be marked with;

-Manufacturer's name or trade mark

-Type designation

-Serial No.

-Mark of Conformity



Mark of Conformity

The manufacturer is allowed to affix the Mark of Conformity according to Article 11 in the Council Directive 96/98/EC on Marine Equipment and shall issue a Declaration of Conformity, only when the module D or E or F of Annex B in the same directive is fully complied with.

Module D: The quality system for production and testing shall be approved by the Notified Body.

Module E: The quality system for inspection and testing shall be approved by the Notified Body.

Module F: Compliance of the products to type as described in this EC Type-Examination Certificate must be verified by the Notified Body who also shall issue a Certificate of Conformity.

This certificate replaces previous EC type-Examination Certificate No. MED-B-2814.

(1) **EC-TYPE EXAMINATION CERTIFICATE**

(2) **Equipment and protective systems intended for use in potentially explosive atmospheres - Directive 94/9/EC**

(3) EC-Type Examination Certificate Number: **KEMA 03ATEX1187 X** Issue Number: **2**

(4) Equipment: **Oil Discharge Monitor Type Oilcon Mark 6M**

(5) Manufacturer: **VAF Instruments B.V..**

(6) Address: **Vierlinghstraat 24, 3316 EL Dordrecht, The Netherlands**

(7) This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) KEMA Quality B.V., notified body number 0344 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the directive.

The examination and test results are recorded in confidential test report number 211995100.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 60079-0 : 2006

EN 60079-11 : 2006

EN 60079-26 : 2007

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-Type Examination Certificate relates only to the design, examination and tests of the specified equipment according to the Directive 94/9/EC. Further requirements of the directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the equipment shall include the following:



II (1) G [Ex ia] IIB
II 1 G Ex ia IIB T4

This certificate is issued on February 19, 2009 and, as far as applicable, shall be revised before the date of cessation of presumption of conformity of (one of) the standards mentioned above as communicated in the Official Journal of the European Union.

KEMA Quality B.V.



T. Pijpker
Certification Manager



(13) **SCHEDULE**

(14) **to EC-Type Examination Certificate KEMA 03ATEX1187 X** Issue No. 2

(15) **Description**

Oil Discharge Monitor Type Oilcon Mark 6M with Detector cell is used for on-line monitoring of discharge water during deballasting operations. The monitor provides intrinsically safe circuits for the measurement of the process flow and for the detection of oil in the ballast water with the necessary intrinsically safe Detection cell. The monitor provides control and output signals to several components of the monitoring system.

The Detector cell is provided with a permanently connected cable.

Ambient temperature range -40 °C to +60 °C.

Electrical data

Non-intrinsically safe circuits

Supply:	115 V ac or 230 V ac, 0,5 W
Control circuits (relays):	24 V dc, max. 10 W
Communication circuits (e.g. RS 422):	19 V dc, 20 mW
	$U_m = 250$ V ac

Intrinsically safe circuits

Flow sensor input (terminals 13 and 14):
in type of protection intrinsic safety Ex ia IIB, with the following maximum values:
 $U_o = 14$ V; $I_o = 20$ mA; $P_o = 70$ mW; $C_o = 4,6$ μ F; $L_o = 350$ mH.

Pressure sensor inputs (terminals 15, 16 and 17, 18):
in type of protection intrinsic safety Ex ia IIB, with the following maximum values:
 $U_o = 21$ V; $I_o = 82$ mA; $P_o = 430$ mW; $C_o = 1,23$ μ F; $L_o = 20$ mH.

Detector input (terminals 1 ... 12):
in type of protection intrinsic safety Ex ia IIB, only for connection to the intrinsically safe Detector cell, via a cable with following maximum values:
 $C_c = 0,2$ μ F; $L_c = 0,1$ mH; $L_c/R_c = 46$ μ H/ Ω .

From the safety point of view, the intrinsically safe circuits shall be considered to be connected to earth. The circuits of the Detector cell withstand a test voltage of at least 500 V during 1 minute with respect to the enclosure.

Installation instructions

The manual provided with the equipment shall be followed in detail to assure safe operation.

(16) **Test Report**

KEMA No. 211995100.

(13) **SCHEDULE**

(14) **to EC-Type Examination Certificate KEMA 03ATEX1187 X** Issue No. 2

(17) **Special conditions for safe use**

The Discharge monitor shall be connected to the potential equalising system, using the dedicated earth terminal, taking into account the local installation code of practice.

The intrinsically safe detector circuits, if connected in a junction box, shall be connected such, that the separation between these circuits and all other circuits present, meets the requirements of the applicable installation standards. The junction box shall be suitable for the environmental conditions in order to assure the integrity of the separations.

For ambient temperature range and electrical data, refer to (15).

(18) **Essential Health and Safety Requirements**

Covered by the standards listed at (9).

(19) **Test documentation**

As listed in Test Report No. 211995100.

AMENDMENT 1

to EC-Type Examination Certificate KEMA 03ATEX1187 X

Manufacturer: **VAF Instruments B.V.**

Address: **Vierlingstraat 24, 3316 EL Dordrecht, The Netherlands**

Description

In future the Oil Discharge Monitor type Oilcon Mark 6 may also be constructed in accordance with the documentation listed below.

The marking of the equipment shall include the following:

-  II (1) G [EEx ia] IIB (interface)
 II 1 G EEx ia IIB T4 (detector cell)

Electrical data

Intrinsically safe circuits:

Flow detection circuit in type of explosion protection intrinsic safety EEx ia IIB,
(terminals 13/14) with the following maximum values:

U_o	=	14	V
I_o	=	20	mA
P_o	=	70	mW
C_o	=	4,6	μ F
L_o	=	350	mH

Differential Pressure sensing
circuits (terminals 15/16 and 17/18)

in type of explosion protection intrinsic safety EEx ia IIB,
with the following maximum values (for each circuit):

U_o	=	21	V
I_o	=	82	mA
P_o	=	0,43	W
C_o	=	1,23	μ F
L_o	=	20	mH

Detector Cell circuit.....
(terminals 1 ... 12)

in type of explosion protection intrinsic safety EEx ia IIB,
only for connection to the interface via an interconnecting
cable with the following maximum values:

Cable Capacitance	:	0,2	μ F
Cable Inductance	:	0,1	mH
Cable L/R ratio	:	46	μ H/m

From the safety point of view the intrinsically safe circuits of the interface are connected to earth.
The circuits of the detector cell have a dielectric strength of at least 500 Vac with respect to its enclosure.

All other data remain unchanged.

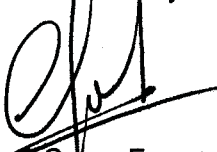
AMENDMENT 1

to EC-Type Examination Certificate KEMA 03ATEX1187 X

Test documentation

		<u>dated</u>
Drawing Number	<i>Interface</i>	
	0397-0345-3	)
	0397-0345-4	)
	0399-0382-3 (2 sheets)	) 20.09.2004
	0497-0261-3, Rev. A (4 sheets)	)
	0412-0887-4, Rev. C	)
	0997-3167-3	)
	0412-0914-4, Rev. A	)
	0806-0005-3, Rev. B	) 11.10.2004
	0806-0005-4, Rev. C	)
	0806-2036-3, Rev. A	13.10.2004
	<i>Detector cell</i>	
	0301-0589-3 (2 sheets)	)
	0497-0263-3 (4 sheets)	) 20.09.2004
	0412-0915-4, Rev. A	11.10.2004
	0806-1279-4, Rev. A	)
	0397-0346-3, Rev. A	) 13.10.2004
	0397-0346-4, Rev. B	)
	0997-3168-3, Rev. B	)

Arnhem, 17 November 2004
KEMA Quality B.V.



C.G. van Es
Certification Manager

EC DECLARATION OF CONFORMITY FOR EQUIPMENT and PROTECTIVE SYSTEMS
for use in explosive atmospheres
(Directive 94/9/EC)

Manufacturer : **VAF Instruments BV**
Addres : **Amstelwijckweg 21**
3316 BB Dordrecht (NLD)

Notified Body : **KEMA Quality B.V. (0344)**
Utrechtseweg 310
6812 AR ARNHEM
The Netherlands

Herewith declares that

Oil Discharge Monitor Type OILCON Mark6M

which consists of Electric Pneumatic Unit 0399-0383
and Detector Cell 0301-0589

- is in conformity with the provisions of the following EC directives:

EN 60079-0 : 2006 , EN 60079-11 : 2006 , EN 60079-20 : 2007

Marking:

 II (1) G [Ex ia] IIB KEMA 03ATEX1187X

 II 1 G Ex ia IIB T4 KEMA 03ATEX1187X

 (interface)

 (detector cell)

DORDRECHT,

7-4-2010


M. van Beveren, Quality Manager



EC-TYPE-EXAMINATION CERTIFICATE

(Translation)

- (2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**
- (3) EC-type-examination Certificate Number:



PTB 00 ATEX 2048 X

- (4) Equipment: Cylindrical inductive sensors, types NC... and NJ...
- (5) Manufacturer: Pepperl + Fuchs GmbH
- (6) Address: D-68307 Mannheim
- (7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.
- (8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.
- The examination and test results are recorded in the confidential report PTB Ex 00-29206.
- (9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:
- EN 50014:1997** **EN 50020:1994**
- (10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.
- (11) This EC-type-examination Certificate relates only to the design and construction of the specified equipment in accordance with Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and supply of this equipment.
- (12) The marking of the equipment shall include the following:



II 2 G EEx ia IIC T6

Zertifizierungsstelle Explosionsschutz
By order:

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor



Braunschweig, September 26, 2000

(13)

SCHEDULE

(14)

EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2048 X

(15) Description of equipment

The cylindrical inductive sensors, types NC... and NJ...are used to convert displacements into electrical signals.

The cylindrical inductive sensors may be operated with intrinsically safe circuits certified for categories and explosion groups [EEx ia] IIC or IIB resp. [EEx ib] IIC or IIB. The category as well as the explosion group of the intrinsically safe cylindrical inductive sensors depends on the connected supplying intrinsically safe circuit.

Electrical data

Evaluation and

supply circuit.....type of protection Intrinsic Safety EEx ia IIC/IIB
resp. EEx ib IIC/IIB
only for connection to certified intrinsically safe circuits
maximum values:

type 1	type 2	type 3	type 4
$U_i = 16 \text{ V}$	$U_i = 16 \text{ V}$	$U_i = 16 \text{ V}$	$U_i = 16 \text{ V}$
$I_i = 25 \text{ mA}$	$I_i = 25 \text{ mA}$	$I_i = 52 \text{ mA}$	$I_i = 76 \text{ mA}$
$P_i = 34 \text{ mW}$	$P_i = 64 \text{ mW}$	$P_i = 169 \text{ mW}$	$P_i = 242 \text{ mW}$

The assignment of the type of the connected circuit to the maximum permissible ambient temperature and the temperature class as well as the effective internal reactances for the individual types of cylindrical inductive sensors is shown in the following table:

types	C _i [nF]	L _i [μH]	type 1			type 2			type 3			type 4		
			maximum permissible ambient temperature in °C for application in temperature class											
			T6	T5	T4-T1	T6	T5	T4-T1	T6	T5	T4-T1	T6	T5	T4-T1
NCB1,5...M...N0...	90	100	74	89	100	69	84	100	51	66	85	39	54	67
NCB2-12GK...-N0...	90	100	73	88	100	69	84	100	51	66	80	39	54	61
NCB2-12GM...-N0...	90	100	76	91	100	73	88	100	62	77	81	54	63	63
NCN4-12GK...-N0...	95	100	73	88	100	69	84	100	51	66	80	39	54	61
NCN4-12GM...-N0...	95	100	76	91	100	73	88	100	62	77	81	54	63	63
NCB5-18GK...-N0...	95	100	73	88	100	69	84	100	51	66	80	39	54	61
NCB5-18GM...-N0...	95	100	76	91	100	73	88	100	62	77	81	54	63	63
NCN8-18GK...-N0...	95	100	73	88	100	69	84	100	51	66	80	39	54	61
NCN8-18GM...-N0...	95	100	76	91	100	73	88	100	62	77	81	54	63	63
NCB10-30GK...-N0...	105	100	73	88	100	69	84	100	51	66	80	39	54	61
NCB10-30GM...-N0...	105	100	76	91	100	73	88	100	62	77	81	54	63	63
NCN15-30GK...-N0...	110	100	73	88	100	69	84	100	51	66	80	39	54	61
NCN15-30GM...-N0...	110	100	76	91	100	73	88	100	62	77	81	54	63	63
NJ 0,2-10GM-N...	20	50	73	88	100	68	83	100	49	64	67	36	42	42
NJ 0,8-4,5-N...	30	50	73	88	100	68	83	100	49	64	67	36	42	42
NJ 0,8-5GM-N...	30	50	73	88	100	68	83	100	49	64	67	36	42	42
NJ 1,5-6,5...-N...	30	50	73	88	100	68	83	100	49	64	67	36	42	42
NJ 1,5-10GM-N-Y...	20	50	73	88	100	68	83	100	49	64	67	36	42	42
NJ 1,5-8GM-N...	30	50	73	88	100	68	83	100	49	64	67	36	42	42
NJ 1,5-8-N...	20	50	73	88	100	68	83	100	49	64	67	36	42	42
NJ 1,5-18GM-N-D...	50	60	76	91	100	73	88	100	62	77	81	54	63	63
NJ 2-11-N...	45	50	73	88	100	66	81	100	45	60	89	30	45	74
NJ 2-11-N-G...	30	50	76	91	100	73	88	100	62	77	81	54	63	63
NJ 2-12GK-N...	45	50	73	88	100	69	84	100	51	66	80	39	54	61
NJ 2-12GM-N...	30	50	76	91	100	73	88	100	62	77	81	54	63	63
NJ 2-14GM-N...	30	50	76	91	100	73	88	100	62	77	81	54	63	63
NJ 2,5-14GM-N...	30	50	76	91	100	73	88	100	62	77	81	54	63	63
NJ 4-12GK-N...	45	50	73	88	100	69	84	100	51	66	80	39	54	61
NJ 4-14GK-N...	45	50	73	88	100	69	84	100	51	66	80	39	54	61
NJ 4-12GM-N...	45	50	73	88	100	68	83	100	49	64	67	36	42	42
NJ 4-30GM-N-200...	70	100	73	88	100	66	81	100	45	60	89	30	45	74
NJ 5-10-11-N...	70	100	73	88	100	66	81	100	45	60	78	30	45	57
NJ 5-11-N...	45	50	72	87	100	65	80	100	42	57	82	26	41	63
NJ 5-18GK-N...	70	50	73	88	100	69	84	100	51	66	80	39	54	61
NJ 5-18GM-N...	70	50	76	91	100	73	88	100	62	77	81	54	63	63
NJ 6-22-N...	130	100	73	88	100	69	84	100	51	66	80	39	54	61
NJ 8-18GK-N...	70	50	73	88	100	69	84	100	51	66	80	39	54	61

			type 1			type 2			type 3			type 4		
<u>types</u>	C _i	L _i	maximum permissible ambient temperature in °C for application in temperature class											
	[nF]	[μH]	T6	T5	T4-T1	T6	T5	T4-T1	T6	T5	T4-T1	T6	T5	T4-T1
NJ 8-18GM-N...	70	50	76	91	100	73	88	100	62	77	81	54	63	63
NJ 10-22-N...	130	100	73	88	100	69	84	100	51	66	80	39	54	61
NJ 10-30GK...-N...	140	100	73	88	100	69	84	100	51	66	80	39	54	61
NJ 10-30GM-N...	140	100	76	91	100	73	88	100	62	77	81	54	63	63
NJ 15-30GK...-N...	140	100	73	88	100	69	84	100	51	66	80	39	54	61
NJ 15-30GM-N...	140	100	76	91	100	73	88	100	62	77	81	54	63	63
NJ 25-50-N...	150	140	73	88	100	69	84	100	51	66	80	39	54	61
NJ 20-40-N...	140	140	73	88	100	69	84	100	51	66	80	39	54	61

(16) Test report PTB Ex 00-29206

(17) Special conditions for safe use

1. For the application within a temperature range of -60 °C to -20 °C the cylindrical inductive sensors, types NC... and NJ... must be protected against damage due to impact by mounting into an additional housing.
2. The connection facilities of the cylindrical inductive sensors, types NC... and NJ... shall be installed as such that at least a degree of protection of IP20 according to IEC-publication 60529:1989 is met.
3. The assignment of the type of the connected circuit to the maximum permissible ambient temperature and the temperature class as well as the effective internal reactances for the individual types of cylindrical inductive sensors is shown in the table given under item (15) of this EC-type-examination certificate.
4. Inadmissible electrostatic charge of parts of the metal housing has to be avoided for the following types of cylindrical inductive sensors. Dangerous electrostatic charges of parts of the metal housing can be avoided by grounding of these parts whereas very small parts of the metal housing (e.g. screws) don't need to be grounded:

NCB1,5...M...N0...
NCB2-12GM...-N0...
NCN4-12GM...-N0...
NCB5-18GM...-N0...
NCN8-18GM...-N0...

NJ 1,5-6,5...-N...
NJ 1,5-10GM-N-Y...
NJ 1,5-8GM-N...
NJ 1,5-8-N...
NJ 1,5-18GM-N-D...

NJ 4-30GM-N-200...
NJ 5-11-N-545...
NJ 5-11-N-G...
NJ 5-18GM-N...
NJ 6-22-N-G...

NCB10-30GM..-N0...

NCN15-30GM...-N0...

NJ 0,2-10GM-N...

NJ 0,8-4,5-N...

NJ 0,8-5GM-N...

NJ 2-11-N-G...

NJ 2-12GM-N...

NJ 2-14GM-N...

NJ 2,5-14GM-N...

NJ 4-12GM-N...

NJ 8-18GM-N...

NJ 10-22-N-G...

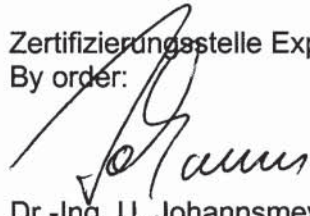
NJ 10-30GM-N...

(18) Essential health and safety requirements

Met by the standards mentioned above

Zertifizierungsstelle Explosionsschutz

By order:



Dr.-Ing. U. Johannsmeyer
Regierungsdirektor



Braunschweig, September 26, 2000

(1) EC-TYPE EXAMINATION CERTIFICATE

(2) **Equipment and protective systems intended for use in potentially explosive atmospheres - Directive 94/9/EC**

(3) EC-Type Examination Certificate Number: **KEMA 08ATEX0120 X** Issue Number: 1

(4) Equipment: **Electronic Pressure Transmitters Type FCX-AIII or FCX-AII**

(5) Manufacturer: **Fuji Electric Systems Co., Ltd.**

(6) Address: **1, Fuji-machi, Hino-City, Tokyo 191-8502, Japan**

(7) This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) KEMA Quality B.V., notified body number 0344 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the directive.

The examination and test results are recorded in confidential test report number 211848100.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 60079-0 : 2006

EN 60079-11 : 2007

EN 60079-26 : 2007

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-Type Examination Certificate relates only to the design, examination and tests of the specified equipment according to the Directive 94/9/EC. Further requirements of the directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

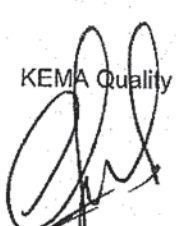
(12) The marking of the equipment shall include the following:



II 1 G Ex ia IIC T4 or T5

This certificate is issued on July 31, 2008 and, as far as applicable, shall be revised before the date of cessation of presumption of conformity of (one of) the standards mentioned above as communicated in the Official Journal of the European Union.

KEMA Quality B.V.


C.G. van Es
Certification Manager

Page 1/2



* Integral publication of this certificate and adjoining reports is allowed. This Certificate may only be reproduced in its entirety and without any change.

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T +31 26 3 56 20 00 F +31 26 3 52 58 00 customer@kema.com www.kema.com Registered Arnhem 09085396

Experience you can trust.

(13) **SCHEDULE**

(14) **to EC-Type Examination Certificate KEMA 08ATEX0120 X** Issue No. 1

(15) **Description**

Electronic Pressure Transmitters Type FCX-AIII or FCX-AII are used to measure the differential, absolute or relative pressure of a liquid or a gas. The measurement signal is converted into an electrical signal.

Optionally, the transmitter is provided with a digital or analog indicator and/or with overvoltage protection.

Ambient temperature range: -40 °C to +70 °C for T4;
-40 °C to +50 °C for T5.

Electrical data

Supply and output circuit (terminals supply + and -):
in type of protection intrinsic safety Ex ia IIC, only for connection to a certified intrinsically safe circuit, with following maximum values:

$U_i = 28 \text{ V}$; $I_i = 94,3 \text{ mA}$; $P_i = 0,66 \text{ W}$; $C_i = 26 \text{ nF}$ (36 nF with overvoltage protection);
 $L_i = 0,6 \text{ mH}$ (0,7 mH with analog indicator).

Installation instructions

The installation instructions as provided by the manufacturer shall be followed in detail in order to assure proper and safe functioning of the equipment, taking into account the local installation rules.

(16) **Test Report**

KEMA No. 211848100 .

(17) **Special conditions for safe use**

Models of the Pressure Transmitter that include the optional Overvoltage Protection do not assure the electrical insulation of minimum 500 Vac between the input circuitry and enclosure. From a safety point of view, the intrinsically safe supply and output circuit shall be considered to be earthed.

Because the transmitter enclosure is made of aluminium alloy, if the transmitter is installed in an explosive atmosphere requiring the use of apparatus of equipment category 1 G, it shall be installed such that even in the event of rare incidents, ignition sources due to impact and friction sparks are excluded.

(18) **Essential Health and Safety Requirements**

Covered by the standards listed at (9).

(19) **Test documentation**

As listed in Test Report No. 211848100.

6.2 CERTIFICATES OF APPROVAL

ABS	Certificate of Design Assessment	Oil Discharge Monitoring and Control System Oilcon Mark 6M
ABS	Certificate of Manufacturing Assessment	Oil Discharge Monitoring and Control System Oilcon Mark 6M
ABS	Certificate of Type Approval	Oil Discharge Monitoring and Control System Oilcon Mark 6M
CCS	Certificate of Type Approval	Oil Discharge Monitoring and Control System Oilcon Mark 6M
NKK	Certificate of Type Approval	Oil Discharge Monitoring and Control System Oilcon Mark 6M
RMRS (Russian Maritime Register of Shipping)	Certificate of Type Approval	Oil Discharge Monitoring and Control System Oilcon Mark 6M
USCG (United States Coast Guard)	Certificate of Type Approval	Oil Discharge Monitoring and Control System Oilcon Mark 6M
KR (Korean Register)	Certificate of Type Approval	Oil Discharge Monitoring and Control System Oilcon Mark 6M
Canada	Certificate of Type Approval	Oil Discharge Monitoring and Control System Oilcon Mark 6M



Most recent copies of above mentioned certificates of approval are available on our web-site www.vaf.nl.

7. MAINTENANCE RECORD SHEETS

(For details of routine maintenance refer to Section 4.7.1 of this manual)

Date	Nature of repair/maintenance	Equipment	Parts used	Further action required	Signature

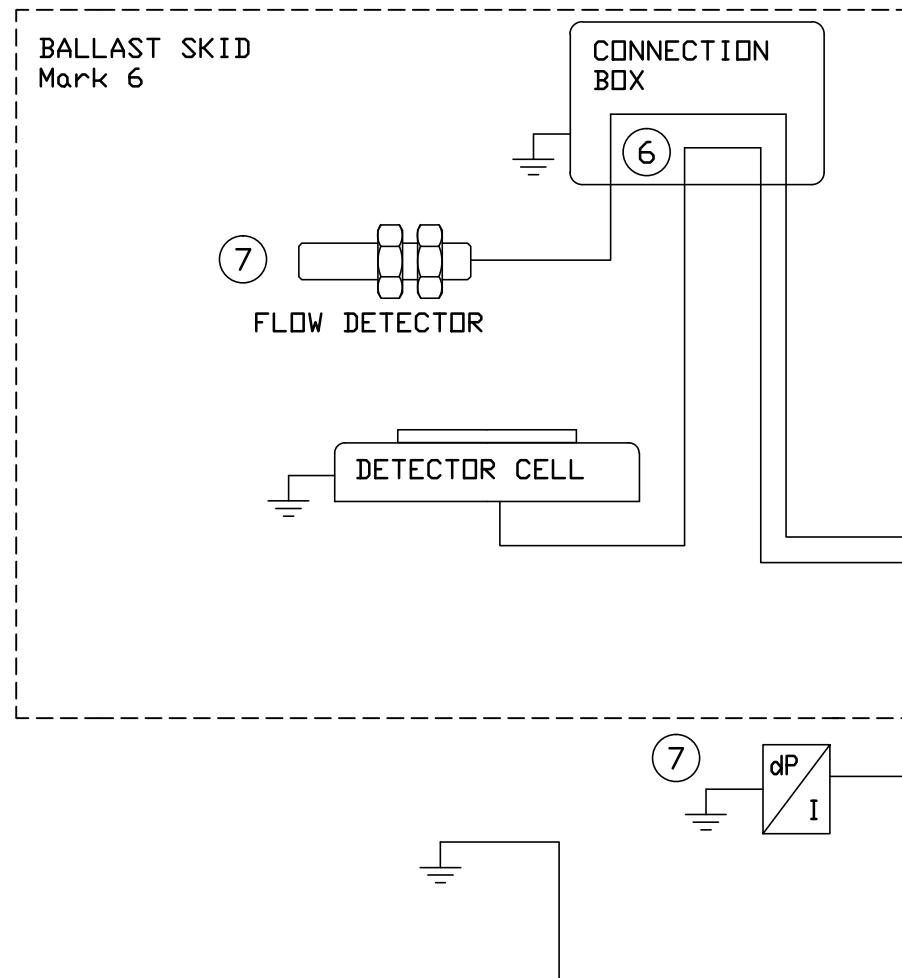
Date	Nature of repair/maintenance	Equipment	Parts used	Further action required	Signature

Date	Nature of repair/maintenance	Equipment	Parts used	Further action required	Signature

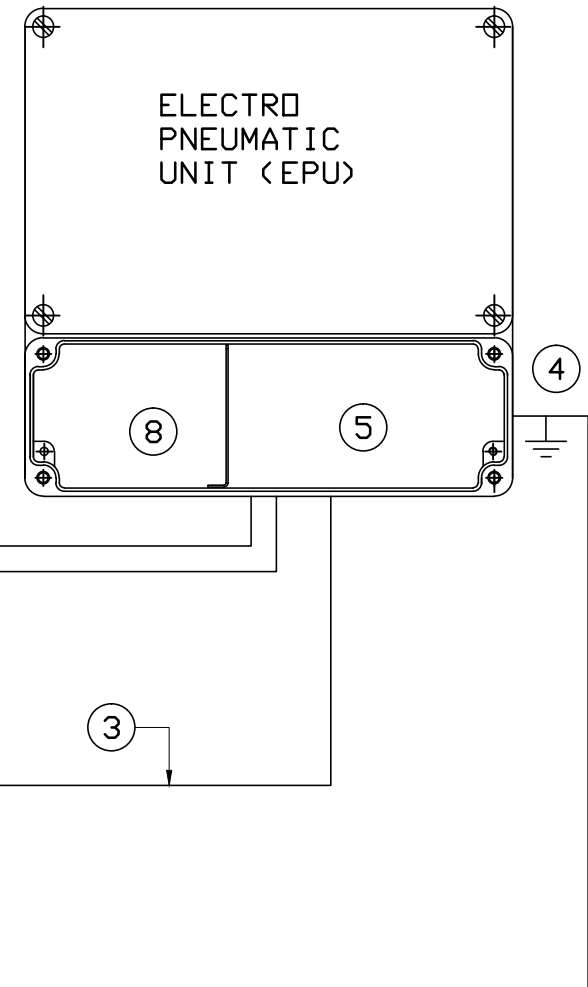
8. DRAWINGS

Description:	Drawing number:
(drawings Mark 6)	
Control drawing	0806-0006
Ball valve flow meter kit	0806-1041
Motor starter box - dimensions	0806-1075
Sample pump/motor - dimensions	0806-1076
Sample valve	0806-1077
Sample pump/motor - part list	0806-1260
Sampling probe	0806-1265
Motor starter box - part list	0806-1267
Isolating valve - parts list	0806-1268
Basic spare parts kit	0806-1272
Main control unit	0806-1278
Measurement cell	0806-1279
Skid ballast monitor	0806-1280
Electro pneumatic unit	0806-1283
Grab cock and injection point	0806-1621
Light scatter cell	0806-1622
Connection diagram motor starter box	0806-2032
Electrical connection diagram	0806-2046
Connection diagram with cable gland sizes	0806-2047
Logic diagram overboard valve control	0806-5019
Schematic diagram	0806-5021
Installation flowmeter	0806-8016
ABS Installation req's fresh water supply line Ballast Monitor	0806-8023
Schematic Installation diagram Ballast Monitor	0806-8035
Schematic pipe arrangement skid	0806-8039
Cable termination instruction	0806-8040
Paper path printer	0806-8041
Front panel MCU	0806-8042
Bulkhead penetration and piping diagram	0806-8064
Multi cable transit box	0806-8066
Connection diagram dP/I transmitter type Fuji	0810-2007
Part list window wash pump	0871-1212
Dimensional drawing dP/I transmitter with bracket	0899-1092
Parts list dP/I transmitter	0899-1249
Pressure reducing valve	0899-1256
Air supply units	0899-1258

HAZARDOUS (CLASSIFIED) LOCATION.
CLASS I, DIVISION 1, GROUP C AND D



NON-HAZARDOUS LOCATION



SHEET 1 OF 2

FOR NOTES SEE DRAWING 0806-0006-4 SHEET 2 OF 2

		DATE	08-12-10	 VAF INSTRUMENTS Dordrecht, The Netherlands	DIMENSIONS IN mm 	REV.
		DRAWN	FV			No.
		CHECKED	WR			
		MATERIAL				
		SEMI MAT.				
		CONTROL DRAWING FOR Mk6M OIL DISCHARGE MONITOR			0806-0006-3	
		PART OF				
No.	DESCRIPTION	DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.		
REVISIONS						

Notes:

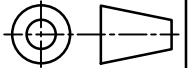
1. Total maximum cable parameters in the circuit to sensor belonging to the Electro Pneumatic Unit:
Lo/Ro=46 μ H/0hm
2. Maximum entity parameters to intrinsically safe flow detector:
Voc = 14 V
Isc = 20 mA
Po = 69 mW
Ca = 4.6 μ F
La = 350 mH
3. Maximum entity parameters to intrinsically safe differential pressure sensor:
Voc = 21 V
Isc = 82 mA
Po = 0.43 W
Ca = 1.23 μ F
La = 20 mH
4. Connect P.E. connection of barrier circuit to the P.E. system within the potentially explosive atmosphere per National Electrical Code NFPA 70, Article 504.
5. Connect the circuits to the terminations as shown in the instruction manual.
6. Terminate the two circuits in the junction box with an increased protection suitable is its environment, but at leased IP54 / NEMA 4.
Keep the terminals of the sensor circuits and the flow detector circuit at least 6 mm (0.25 inch) apart from each other.
7. Connect only approved intrinsically safe apparatus which complies with the following:
The entity concept allows interconnection of intrinsically safe apparatus with the Electro Pneumatic Unit when approved values of Voc, Isc and Pmax of the Electro Pneumatic Unit are less than or equal to Vmax, Imax and Pi of the approved intrinsically safe apparatus and the approved values of Ca and La of the Electro Pneumatic Unit are greater the Ci and Li of the approved intrinsically safe apparatus, including the capacitance and inductance of the interconnecting cable.
8. Connect only non-intrinsically safe circuits with Um = 250 Vrms maximum.
9. The installation shall be in accordance with the National Electrical Code NFPA 70, Article 504 and ANSI/ISA-RP-12.6.
10. Ambient temperature range -40°C ... +60°C (-40°F ... +140°F).

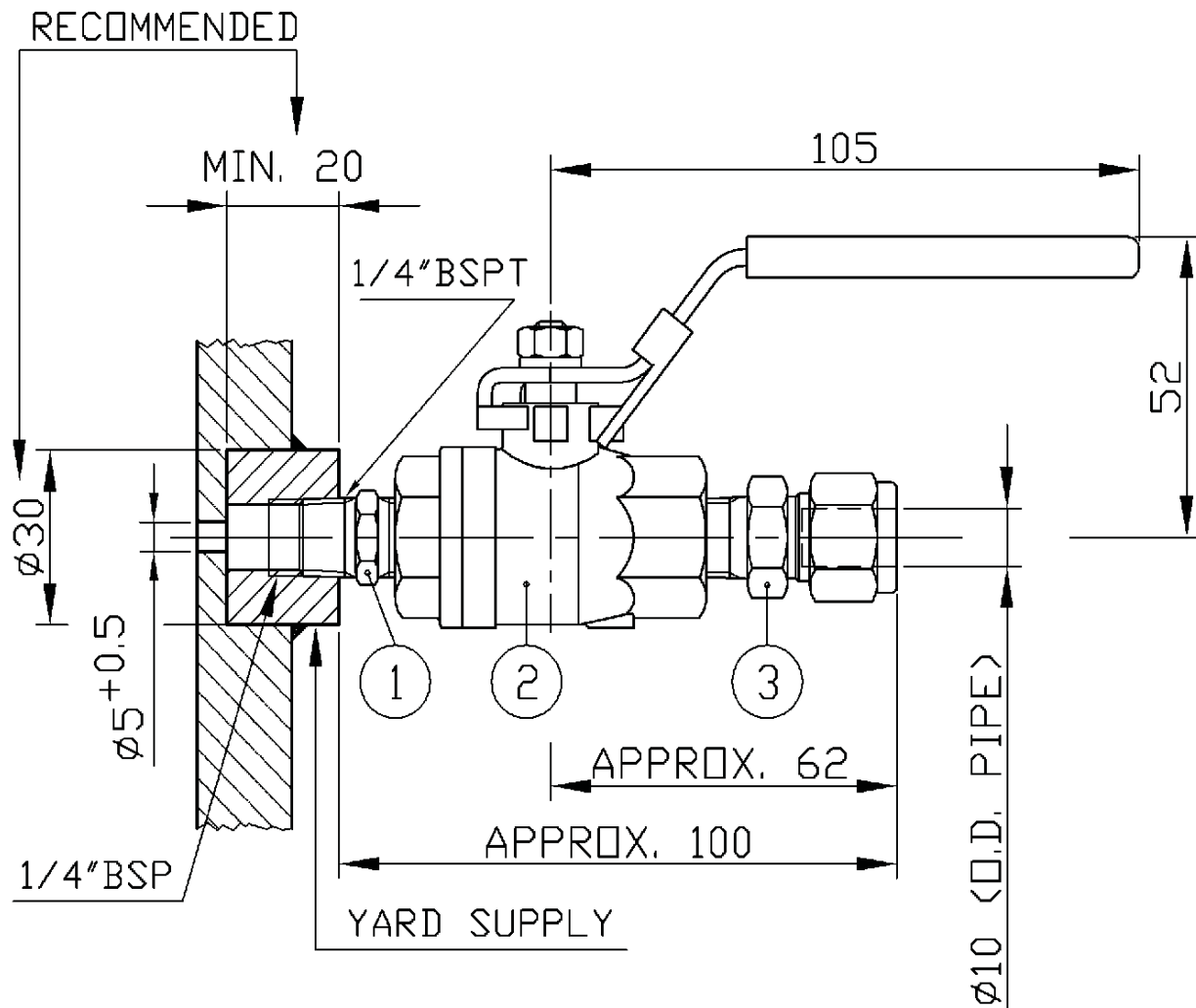
11. WARNING:

SUBSTITUTION OF COMPONENTS MAY IMPAIR THE INTRINSIC SAFETY.

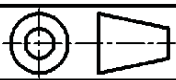
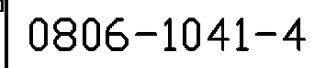
FOR LOCATION SEE DRAWING 0806-0006-3 SHEET 1 OF 2

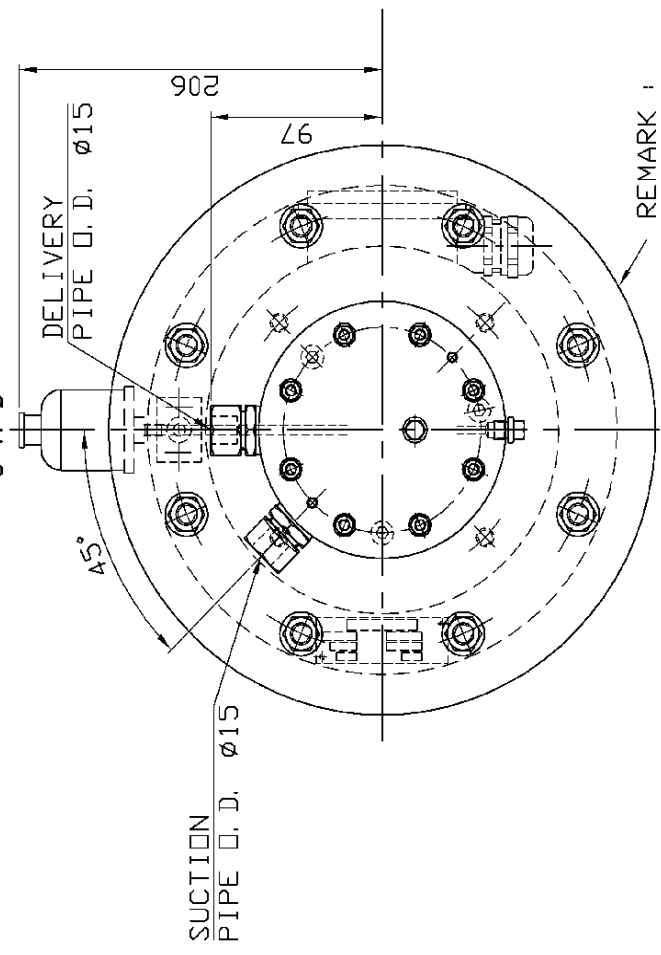
SHEET 2 OF 2

			DATE	08-12-10		VAF INSTRUMENTS Dordrecht, The Netherlands		
			DRAWN	FV				
			CHECKED	WR				
			MATERIAL			DIMENSIONS IN mm	REV. No.	
			SEMI MAT.					
			NOTES CONTROL DRW. FOR Mk6 OIL DISCHARGE MONITOR				0806-0006-4	-
-	-	-				PART OF		
No.	DESCRIPTION	DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.				
REVISIONS								



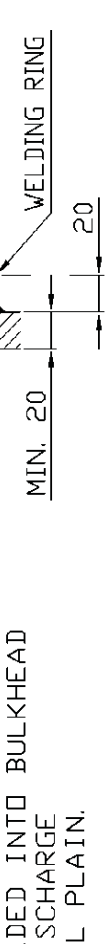
ITEM No.	PART NUMBER	QTY	PART NAME	MATERIAL
1	0621-0243	1	NIPPLE, 2 x 1/4" BSPT MALE	AISI 316
2	0622-0029	1	BALL VALVE, 2 x 1/4" BSP FEMALE	AISI 316
3	0621-0244	1	MALE CONNECTOR, 1/4" BSPT x 10mm	AISI 316

				DATE	31-03-1994		VAF INSTRUMENTS		
				DRAWN	A.v.Nies				
G	PART NR.'S ADDED	24-02-04	BV	CHECKED	BV		Dordrecht, The Netherlands		
F	BALL VALVE CHANGED	17-06-03	BV	MATERIAL :			25 mm	REV.	
E	TABLE CHANGED	16-04-03	BV	SEMI MAT. :			DIMENSIONS IN mm	No.	
D	REDRAWN IN AutoCAD	08-01-02	JS	DIMENSIONAL DRAWING			A	B	C
C	TABLE ADDED	23-10-96	NH	BALL VALVE			D	E	F
B	CONSTRUCTION CHANGED	10-09-96	NH	FLOWMETER KIT			G		
A	DIMENSIONS CHANGED	03-01-95	MS	BALLAST MONITOR			PART OF 0399-0282		
No.	DESCRIPTION		DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.				
REVISIONS									

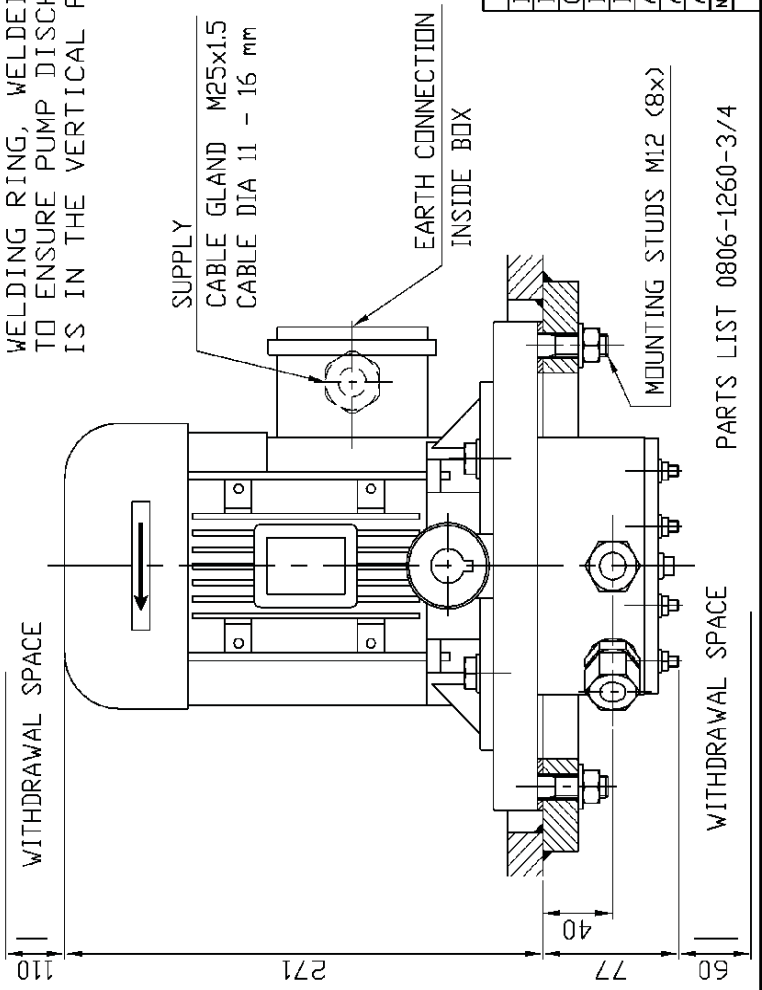


REMARK :

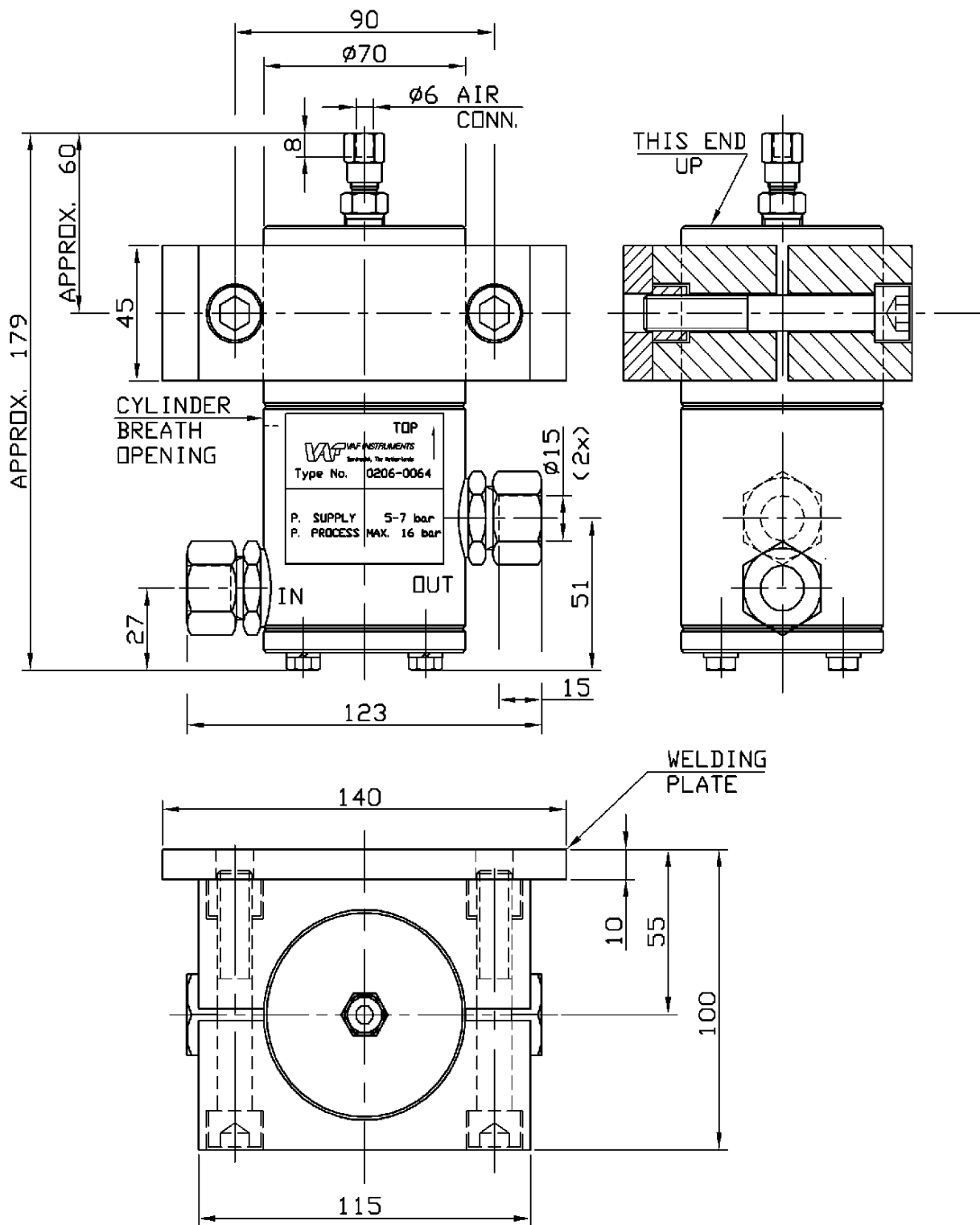
WELDING RING, WELDED INTO BULKHEAD TO ENSURE PUMP DISCHARGE IS IN THE VERTICAL PLAIN.

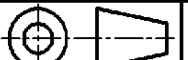


LOCATION : PUMP ROOM / ENGINE ROOM BULKHEAD
WEIGHT : 30 kg
RATED CAPACITY : 500 l/h
HEAD AT RATED CAPACITY : 0.6 MPa (< 6 bar)
HEAD AT 150% OF RATED CAPACITY : 0.3 MPa (< 3 bar)
SHUT OFF HEAD : 1.0 MPa (< 10 bar)
MOTOR TYPE : ELSTO
VOLTS : 380/440 VAC, 3 ph, 50/60 Hz
kW : 1.1 ... 1.3
R. P. M. : 2850/3420
CURRENT RATING : MAX. 2.6A
INSULATION : CL. F, IEC 34-1
PROTECTION CLASS : IP 55

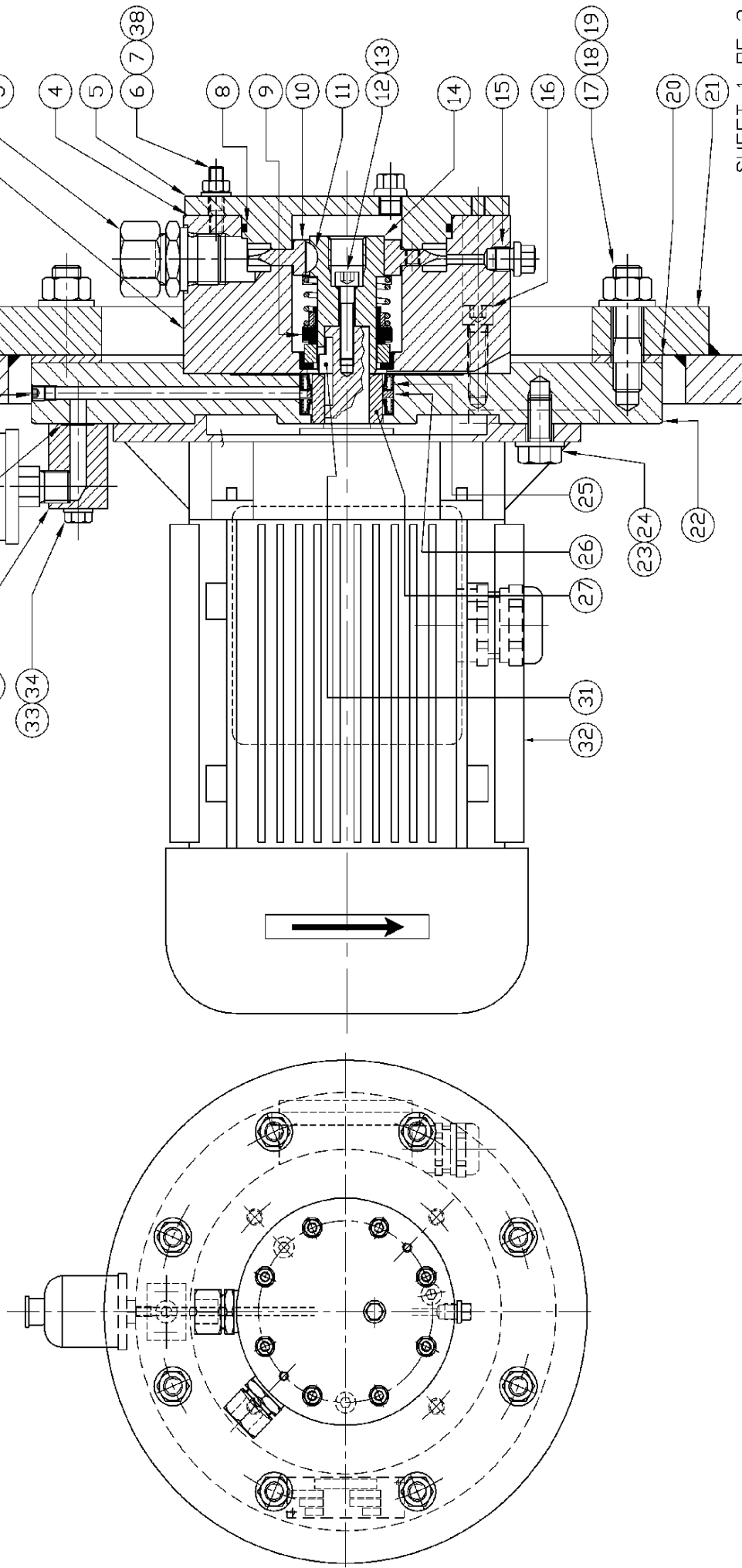


DATE				25-10-2001				VAF INSTRUMENTS			
D				PUMPFLANGE Ø266				Dordrecht, The Netherlands			
D				WAS Ø270				REV. No.			
C				10206-0059 ADDED				DIMENSIONS IN mm			
B				MOTOR CHANGED				0806-1076-3			
B				271 WAS 253				PART OF 0206-0059			
A				MOTOR CHANGED				THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS			
A				CURRENT RATING				IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM OR ITS CONTENTS			
A				WAS MAX. 4.3A				DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.			
No.				DESCRIPTION				REVISIONS			
				DATE							



				DATE	28-10-2002	 VAF INSTRUMENTS Dordrecht, The Netherlands	 50 mm DIMENSIONS IN mm	REV. No.	A	B
				DRAWN	B. T.					
				CHECKED	BV					
				MATERIAL						
				SEMI MAT.						
B	100 WAS 110	30-06-04	MM	DIMENSIONAL DRAWING SAMPLE VALVE Mark 6			0806-1077-4			
A	LENGTH WELDING	23-07-03	BV							
A	PLATE 140 WAS 115									
No.	DESCRIPTION	DATE	PAR	PART OF 0206-0064						
REVISIONS				THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.						

SCALE
100 mm



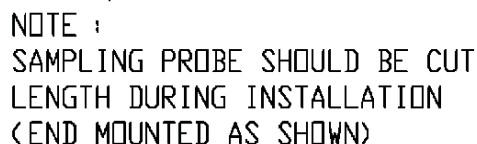
SHEET 1 OF 2

DATE: 26-10-2001		DRAWN: B. Vos		CHECKED: J. V.		REV.:		No.	
C: CONN. BOX CHANGED		16-04-03 BV		MATERIAL: 1		125 mm		DIMENSIONS IN mm	
B: MOTOR CHANGED		14-08-02 BV		SEMI MAT. 1		0806-1260-3		PART OF 0206-0059	
B ITEM 28, 29 AND 30 DELETED		13-03-02 BV		ASSEMBLY DRAWING		Mark 6		THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS	
A ITEM 12, 13 AND 14 CHANGED				SAMPLE PUMP				IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS	
A ITEM 38 ADDED				BALLAST MONITOR				DIVULGED TO A THIRD PARTY WITHOUT WRITTEN AUTHORIZATION.	
A: MOTOR CHANGED									
No.		DESCRIPTION		DATE		PAR		REVISIONS	

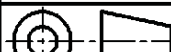
DIMENSIONAL DRAWING 0806-1076-3
FOR PARTS LIST SEE DRAWING 0806-1260-4 SHEET 2 OF 2

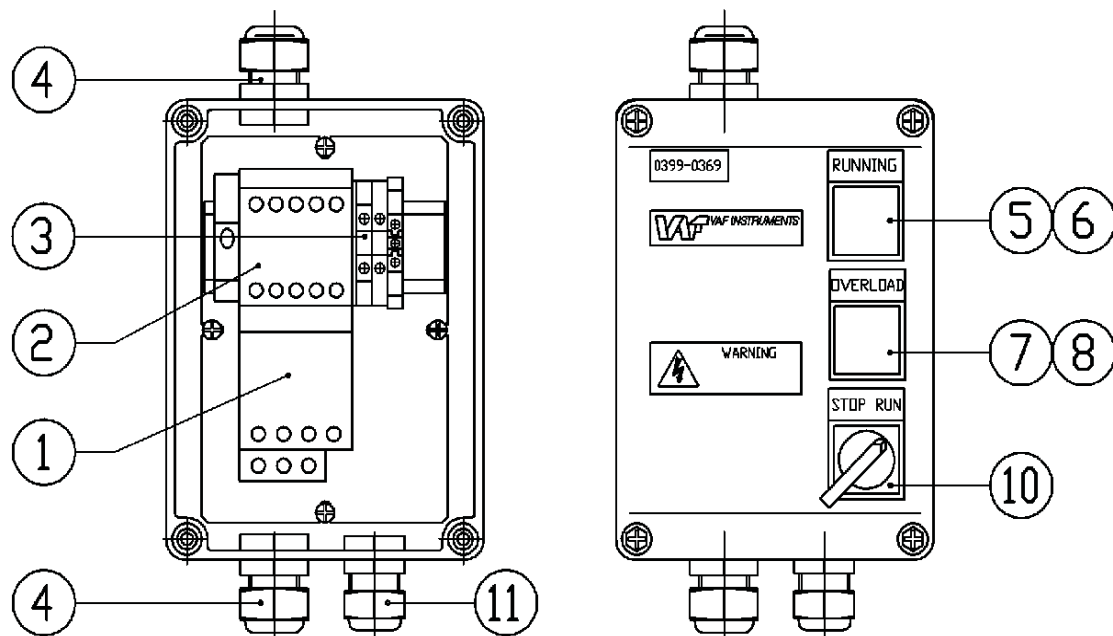
ITEM No.	PART NUMBER	QTY	PART NAME	MATERIAL
1	0731-0606	1	SCREW, M6 x 6 mm	STEEL 45H
2	0401-0780	1	HOUSING, Ø140 x 65 mm	BRONZE
3	0621-0141	2	MALE CONNECTOR 1/2" BSP Ø15 mm	SoMs59/AISI 316
4	0431-0053	1	SET PACKING RINGS Ø140 x Ø90 mm THICKNESS 2x 50, 2x 100 AND 1x 190 micrometer	MELINEX
5	0402-0611	1	COVER, Ø139 x 22 mm	BRONZE
6	1735-0620	8	STUD, M6 x 20 mm, DIN 939	AISI 316
7	1734-0600	8	HEXAGON NUT, M6, (L TOTAL 27.5 mm) DIN 934	AISI 316
8	0630-3152	1	O-RING, ID 82.22 x Ø2.62 mm	VITON
9	0634-0017	1	MECHANICAL SEAL, Ø40 x Ø25 x Lo 70 mm	CARBON/CERAMIC
10	0479-0008	1	IMPELLER, Ø85 x 15 mm	MONEL
11	1744-0005	1	WOODRUFF KEY, 4 x 5 mm, DIN 6888	AISI 316
12	1728-0630	1	HEX. SOCKET HEAD CAP SCREW, M6x30 mm, DIN 912	AISI 316
13	0630-6020	1	O-RING, ID 6 x Ø1 mm	VITON
14	0415-0102	1	COUPLING, Ø32 x 56.5 mm	BRONZE
15	1726-1013	2	PLUG 1/8" BSP, DIN 910	AISI 316
16	1728-0830	3	HEX. SOCKET HEAD CAP SCREW, M8x30 mm, DIN 912	AISI 316
17	0799-0070	8	STUD, M12 x 40 mm, (L TOTAL 55mm) DIN 939	STEEL 8.8
18	0716-1200	8	WASHER, Ø24 x Ø13 x 2.5 mm, DIN 125	STEEL
19	0734-1200	8	HEXAGON NUT, M12, DIN 934	STEEL 8
20	0431-0052	1	PACKING, Ø266 x Ø210 x 3 mm	NON ASBESTOS
21	0411-0272	1	WELDING RING, Ø310 x Ø210 x 20 mm	STEEL
22	0414-0138	1	FLANGE, Ø266 x 25 mm	STEEL
23	0733-1020	4	HEXAGON SCREW, M10 x 20 mm, DIN 933	STEEL 8.8
24	0716-1000	4	WASHER, Ø20 x Ø10.5 x 2 mm, DIN 125	STEEL
25	0634-0016	2	OIL SEALING, Ø40 x Ø30 x 7 mm	NITRILE
26	0411-0273	1	LANTERN RING, Ø40 x Ø31 x 3 mm	STEEL
27	0499-0718	1	BUSHING, Ø30 x Ø19 x 20 mm	STEEL, HRD
31	0479-0007	1	KEY, 6 x 6 x 15 mm	STEEL, HRD
32	0672-0044	1	ELECTROMOTOR 380/440VAC, 3ph, 50/60Hz	
33	0732-0645	2	HEXAGON BOLT, M6 x 45 mm, DIN 931	STEEL 8.8
34	0716-0600	2	WASHER, Ø12 x Ø6.4 x 1.6 mm, DIN 125	STEEL
35	0440-0005	1	BLOCK, 35 x 35 x 25 mm	STEEL
36	0630-6013	1	O-RING, ID 12 x Ø1 mm	VITON
37	0609-0257	1	OIL RESERVOIR	POLYCARBONAAT
38	1716-0600	8	WASHER, Ø12.5 x Ø6.4 x 1.6 mm, DIN 125	AISI 316

ITEMS 4, 8, 9, 12, 13, 14 AND 25 (2x) ARE INCLUDED IN
SAMPLE PUMP SPARE PARTS KIT 0390-1182



ITEM NR.	PART NUMBER	QTY	PART NAME	MATERIAL
1	0621-0141	1	MALE CONNECTOR 1/2" BSPxø15mm	SoMs58/AISI 316
2	0622-0032	1	GATE VALVE 2x 1/2" BSP FEMALE	AISI 316
3	0621-0297	1	MALE CONNECTOR 1/2" BSPxø15mm	AISI 316
4	0442-0149	1	TUBE ø15x1.5 L=500mm	AISI 316
5	0499-0683	1	WELDING CONNECTOR PIPE ø15mm	AISI 316

				DRAWN : B. Vos	 VAF INSTRUMENTS Dordrecht, The Netherlands				
				DATE : 11-01-2002					
				CHECKED : <i>W</i>					
				MATERIAL :					
				SEMI MAT. :	DIMENSIONS IN mm		REV. No.		
				PARTS LIST SAMPLING PROBE PIPE CONN. $\varnothing$ 15mm			A	B	C
C	PARTNR. 'S ADDED	26-09-03	BV				0806-1265-4		
B	TABLE CHANGED	16-04-03	BV	PART OF 0399-0373PH					
A	0621-0297 ADDED	15-01-03	BV				BALLAST MONITOR Mk6		
No.	DESCRIPTION	DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS					
REVISIONS				IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS					
				DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.					

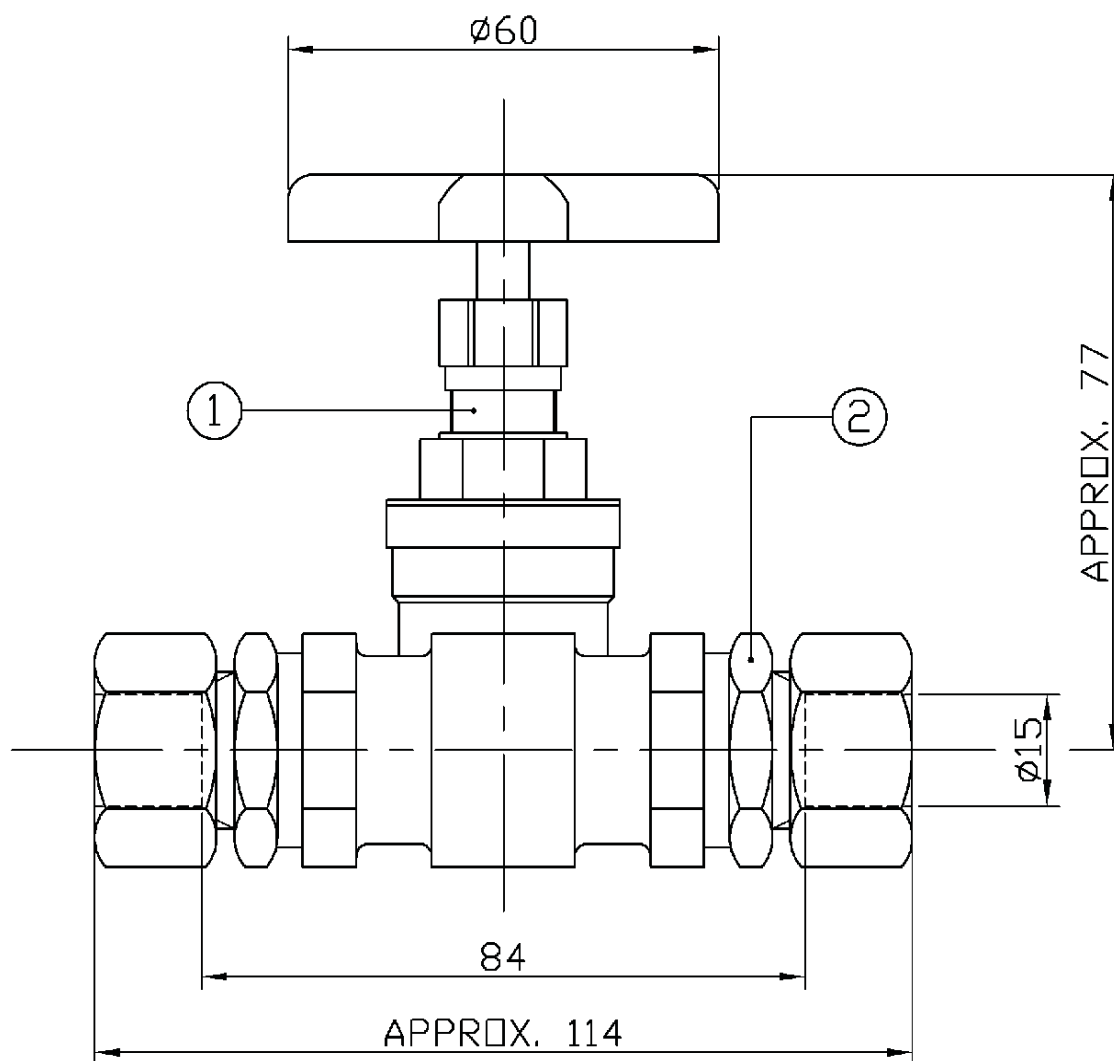


ITEM NR.	PART NUMBER	QTY	PART NAME
1	0652-1045	1	THERMAL RELAY 1.8 - 2.6 A
2	0652-1044	1	MAGNET RELAY 24VDC
3	0646-3039	2	TERMINAL
	0646-3033	1	ENDSTOP
	0646-3040	1	ENDPLATE
4	0646-1296	2	CABLE GLAND M20x1.5 FOR CABLE Ø10-14
	0646-1328	2	NUT CABLE GLAND M20x1.5
	0630-6019	2	O-RING ID 17 x Ø2, VITON
5	0644-2051	1	LED, GREEN, 24V
6	0647-0047	1	BULBHOLDER GREEN
7	0644-2050	1	LED, RED, 24V
8	0647-0044	1	BULBHOLDER RED
10	0645-0532	1	SWITCH INCLUDING CONTACT BLOCK
11	0646-1295	1	CABLE GLAND M20x1.5 FOR CABLE Ø 6-12
	0646-1328	1	NUT CABLE GLAND M20x1.5
	0630-6019	1	O-RING ID 17 x Ø2, VITON

ITEMS 5 AND 7 ARE INCLUDED IN
ELECTRIC SPARE PARTS KIT FOR Mk6 0390-1211

DIMENSIONAL DRAWING 0806-1075-4
CONNECTION DIAGRAM 0806-2032-4

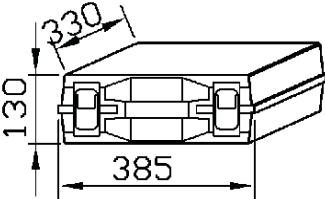
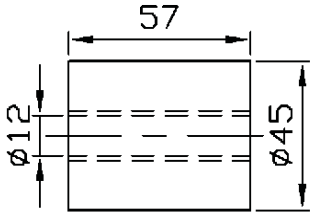
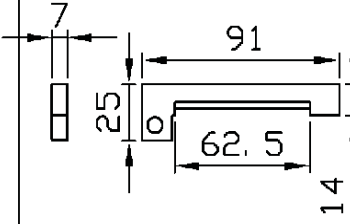
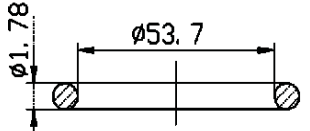
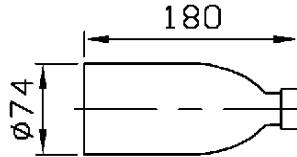
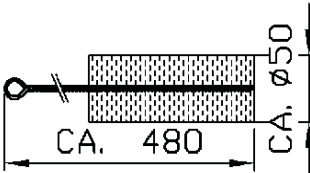
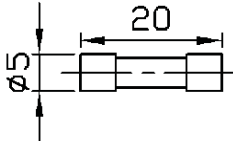
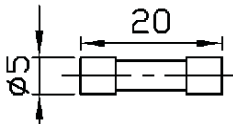
				DATE	18-01-2002	 VAF INSTRUMENTS					
E	PART NR. ITEM 3...8	24-02-04	MM	DRAWN	M vd Sluijs						
E	AND ITEM 11 ADDED			CHECKED	BV	Dordrecht, The Netherlands					
D	ITEMNR. 9 DELETED	25-09-03	BV	MATERIAL				50 mm	REV.		
D	ITEMNR. 10 WAS ONLY SWITCH			SEMI MAT.		DIMENSIONS IN mm			No.		
C	0806-2032-4 WAS	06-05-03	BV	PARTS LIST MOTOR STARTER BOX BALLAST MONITOR Mark 6			0806-1267-4		A	B	C
C	0806-2019-4								D	E	
B	SPARE KIT 0390-1211	16-04-03	BV	PART OF 0399-0369							
B	ADDED										
No.	DESCRIPTION	DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.							
REVISIONS											



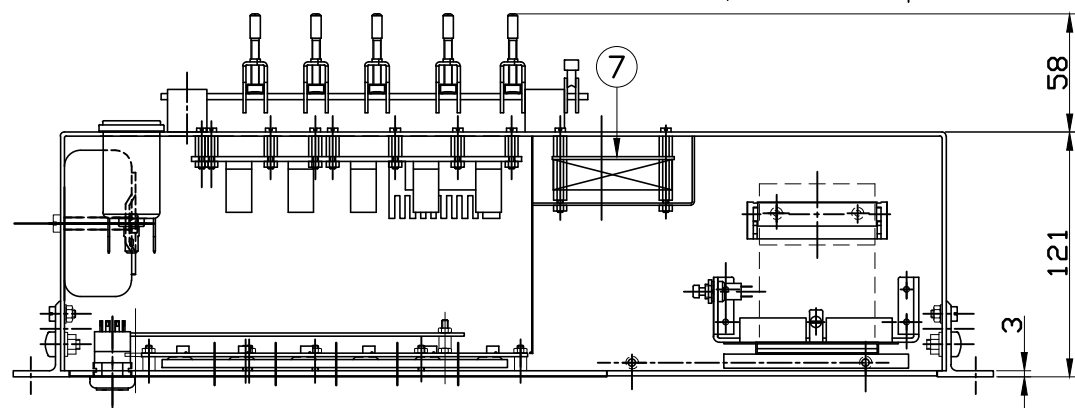
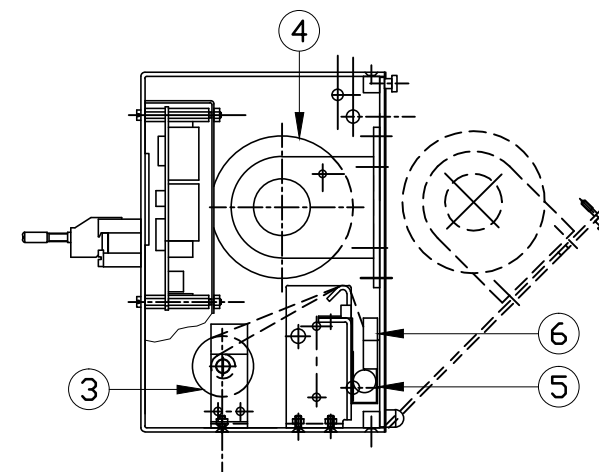
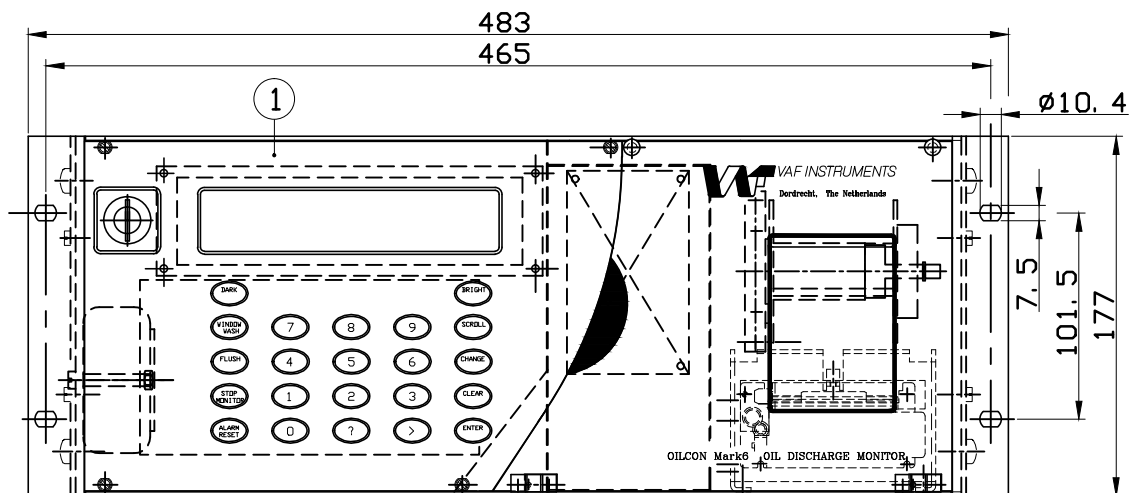
ITEM No.	PART NUMBER	QTY	PART NAME	MATERIAL
1	0622-0035	1	SLIDING VALVE, 2x 1/2" BSP FEMALE	BRASS
2	0621-0141	2	MALE CONNECTOR 1/2" BSP x Ø15 mm	SoMs/ AISI316

				DATE	08-01-2002		VAF INSTRUMENTS				
				DRAWN	J.SMAAL						
				CHECKED	BV						
				MATERIAL					25 mm	REV.	No.
				SEMI MAT.		DIMENSIONS IN mm					
				PARTS LIST ISOLATING VALVE ø15 BALLAST MONITOR Mark 6			0806-1268-4			A	B
B	PART NR.'S ADDED	24-02-04	BV								
A	TABLE CHANGED	16-04-03	BV								
No.	DESCRIPTION	DATE	PAR	PART OF 0399-0371							
REVISIONS				THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.							

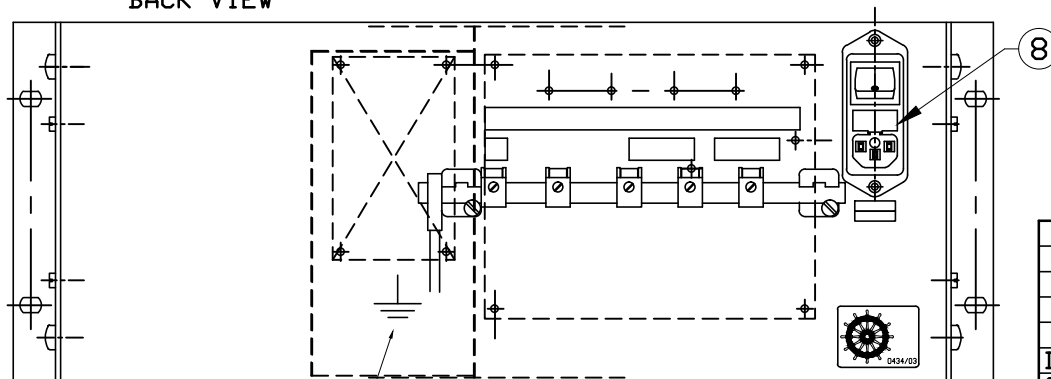
DESIGNING CAD ENGINEERING

ITEM No.	NAME AND No. SPARE PART	SKETCH SPARE PART DIMENSIONS mm	MATERIAL	SUPPLY		PARTS LIST	
				WORKING	SPARE	ITEM No.	DRAW. No.
(1)	BOX SPARE PARTS 0499-0531		SYNTHETIC		1		
(2)	PAPER ROLL		PAPER	1	10	3	MAIN CONTROL UNIT 0806-1264-3
(3)	PRINTER RIBBON			1	4	6	MAIN CONTROL UNIT 0806-1264-3
(4)	O-RING 0630-3034		VITON	2	2	1	DETECTOR CELL BALLAST SKID 0806-1271-4
(5)	BOTTLE WITH 0.5 LITRE OIL		HYDRAULIC OIL		1		SAMPLE PUMP 0806-1260-3
(6)	CLEANING BRUSH				1		DETECTOR CELL BALLAST SKID 0806-1271-4
(7)	FUSE 630mA SLOW			1	2	2	ELECTRO PNEUMATIC UNIT 0806-1263-3
(8)	FUSE 500mA SLOW			2	2	8	MAIN CONTROL UNIT 0806-1264-3

				DATE : 05-06-2003		 VAF INSTRUMENTS Dordrecht, The Netherlands	
				DRAWN : M. MOM			
				CHECKED : BV			
				MATERIAL :			
				SEMI MAT. :		REV. No.	
				BASIC SPARE PARTS KIT BALLAST MONITOR Mark 6 0390-1194		0806-1272-4	
						A	
A ITEM (7)		19-06-03		BV			
A WAS FUSE 1A						PART OF	
No.	DESCRIPTION	DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS. IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.			
REVISIONS							



BACK VIEW



EARTH
CONNECTION

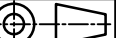
ITEM NR.	PART NUMBER	QTY	PART NAME
1	0357-0020	1	ASSY KEYBOARD PANEL INCLUDING PCB PROCESSOR
3	0690-1014	1	PAPER ROLL
4	0390-1214	1	PAPERTRANSPORT MOTOR + CABLE
5	0390-1215	1	PRINTER + CABLE
6	0690-1012	1	PRINTER RIBBON
7	0690-1013	1	PRINTER DRIVER BOARD
8	0647-2003	2	FUSE, ACC. IEC 127, PART 2 500mA SLOW, Ø5x20mm

ITEM 8 (2x) INCLUDED IN ELECTRIC KIT FOR Mk6 0390-1211

SPARE PARTS KIT FOR PRINTER 0390-1212 COMPRISES:
ITEM 3 (10x) AND ITEM 6 (5x)

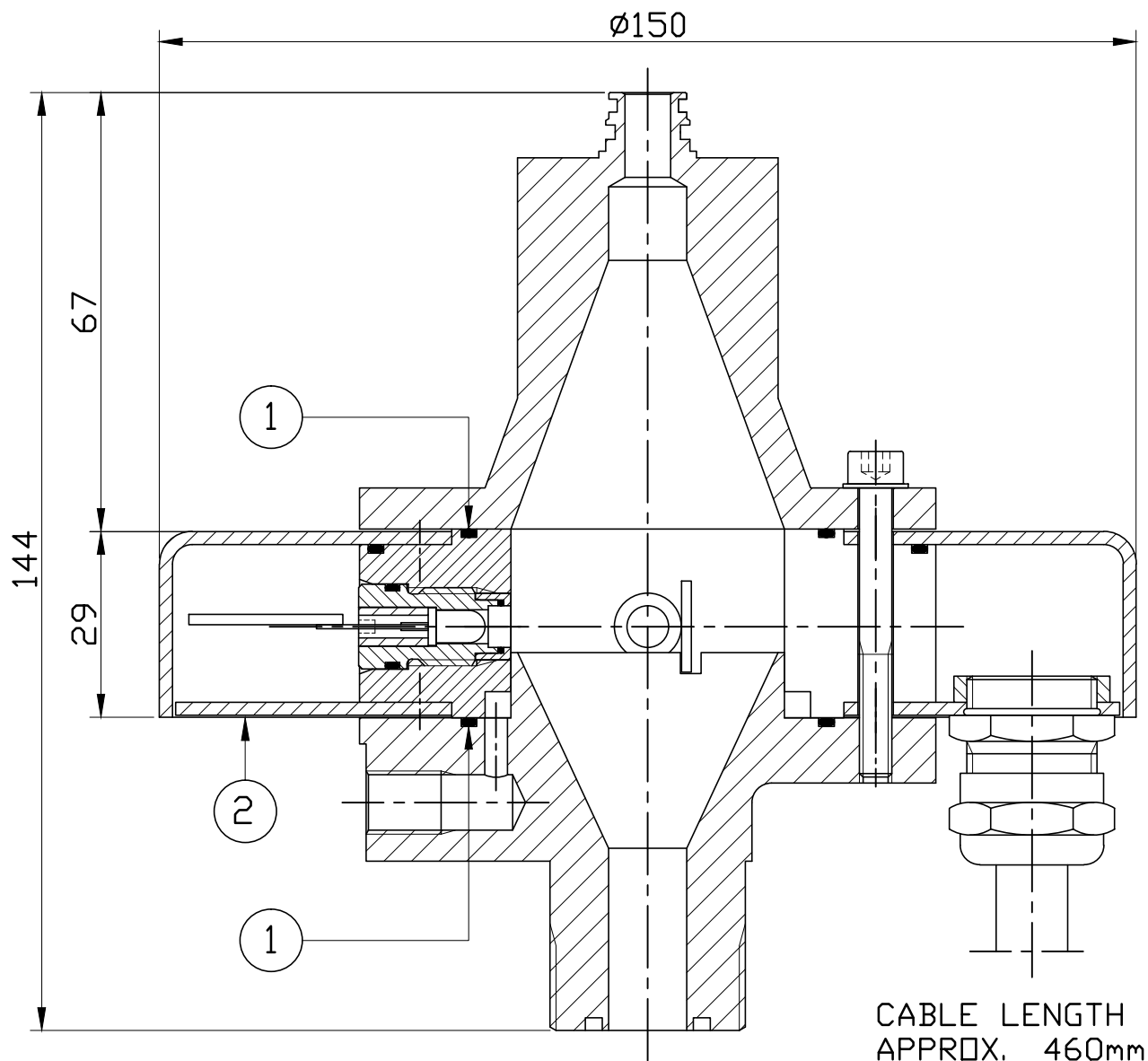
PANEL CUTOUT 454 x 178 mm

ELECTRICAL CONNECTION DIAGRAM 0806-2046-3

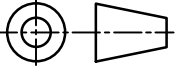
				DATE	27-08-2004		VAF INSTRUMENTS			
				DRAWN	M. MOM		Dordrecht, The Netherlands			
				CHECKED				50 mm	REV.	
				MATERIAL				DIMENSIONS IN mm	No.	
				SEMI MAT.						
D	REF. DRW 0806-2046 WAS-2036	10-01-11	WR	DIMENSIONAL DRAWING AND PARTS LIST MAIN CONTROL UNIT Mk6M			0806-1278-3	A	B	C
C	ITEM 2 0397-0339 DEL'D	14-11-06	WR					D		
B	0690-1014 WAS 0609-	27-10-05	WR							
A	0397-0339 WAS -0337	06-01-05	MM							
No.	DESCRIPTION	DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.						
REVISIONS										

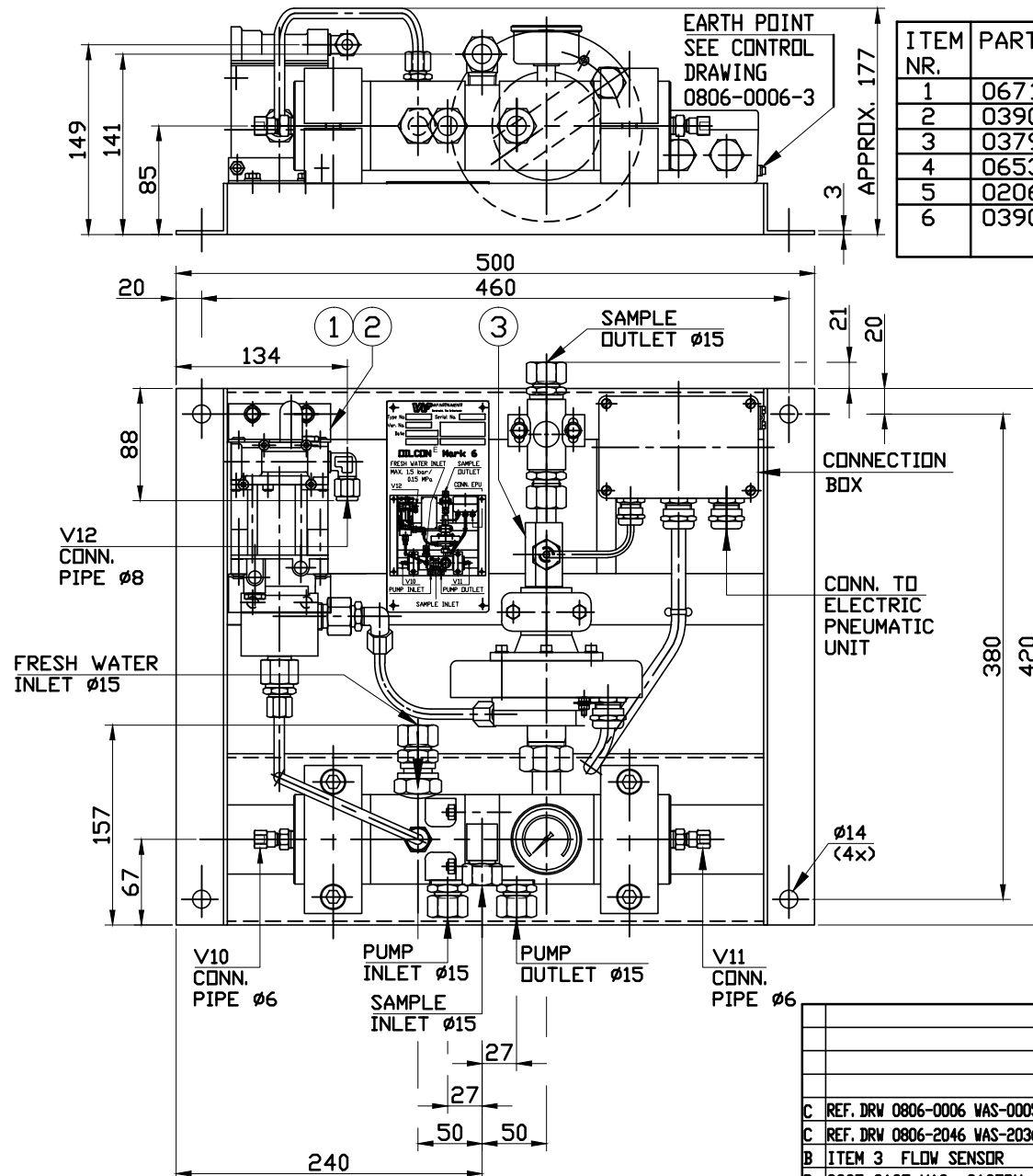
ITEM NR.	PART NUMBER	QTY	PART NAME	MATERIAL
1	0630-3034	2	O-RING ID 53.70xØ1.78mm	VITON
2	0301-0589	1	DETECTOR CELL INCLUDING CABLE	

ITEM 1 (2x) AND ITEM 2 (1x) ARE INCLUDED IN SPARE PARTS KIT :
DETECTOR CELL ATEX/UL 0390-1233

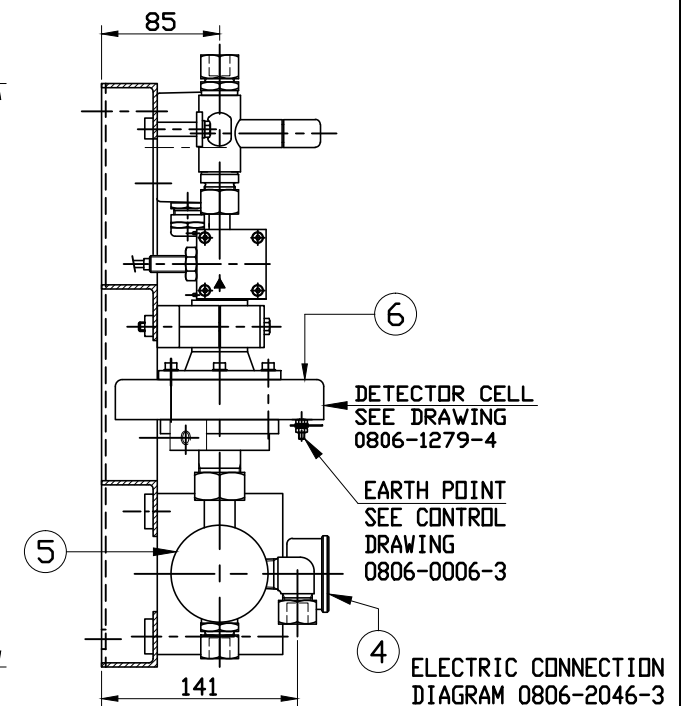


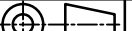
ELECTRIC CONNECTION DIAGRAM 0806-2046-3

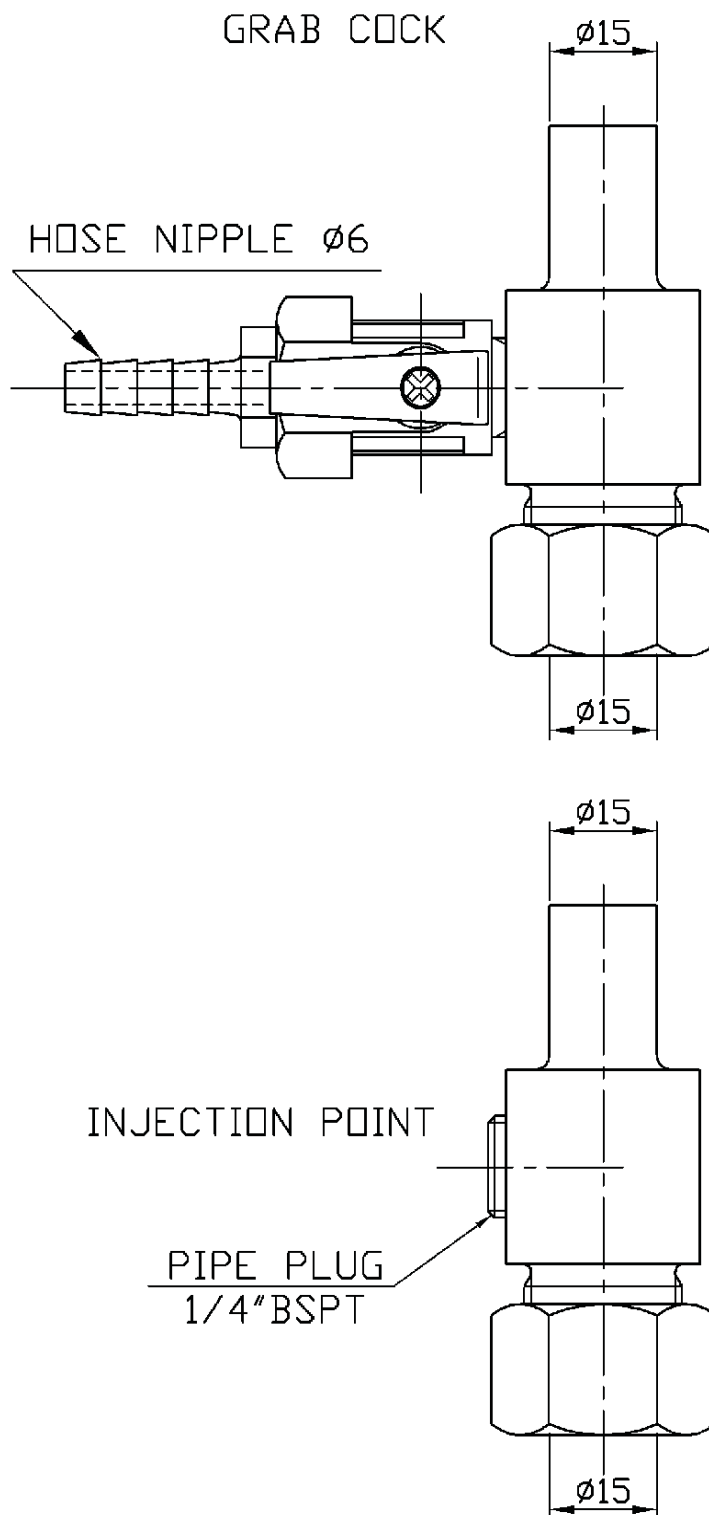
				DATE	17-09-2004	 VAF INSTRUMENTS Dordrecht, The Netherlands  25 mm DIMENSIONS IN mm REV. No. A B C D				
				DRAWN	M.MOM					
				CHECKED						
				MATERIAL						
D	REF.DRW 0806-2046 WAS-2036	10-01-11	WR	SEMI MAT.						
C	BOLT CHANGED	12-04-05	MM	PARTS LIST DETECTOR CELL Mark 6M  0806-1279-4 PART OF 0390-1233						
B	0390-1233 was -1192	14-12-04	WR							
B	0301-0589 was -0589PH									
A	0806-2036 was 2030	12-10-04	WR							
No.	DESCRIPTION	DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.						
REVISIONS										

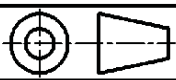


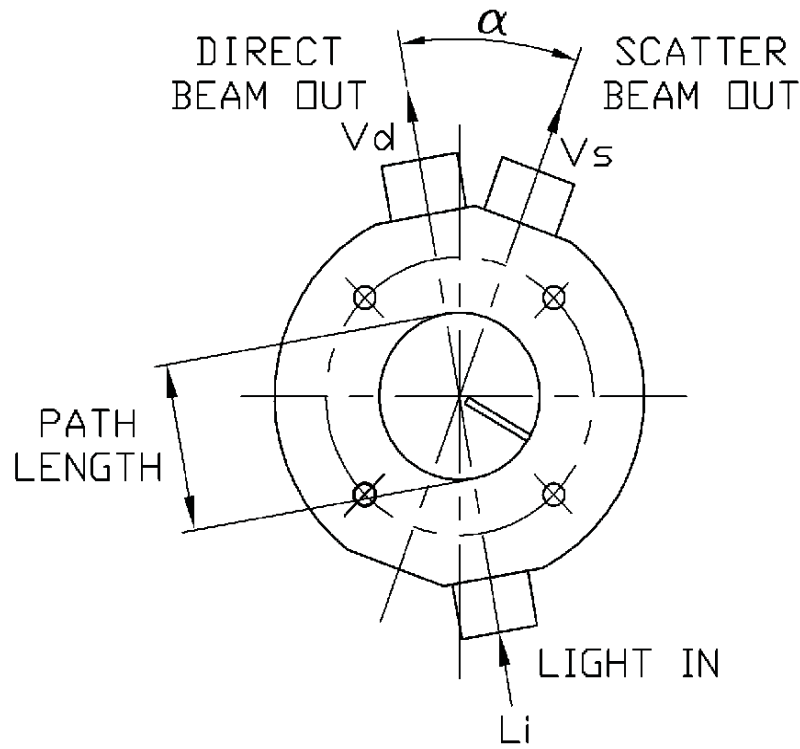
ITEM NR.	PART NUMBER	QTY	PART NAME
1	0671-0025	1	WINDOW WASHPUMP
2	0390-1202	1	SPARE PARTS WINDOW WASHPUMP
3	0379-0125	1	FLOW SENSOR INCLUDING CABLE
4	0653-0067	1	PRESSURE GAUGE ø55, 0-1.6MPa
5	0206-0063	1	SHUTTLE VALVE
6	0390-1233	1	DETECTOR CELL INCLUDING CABLE AND O-RINGS



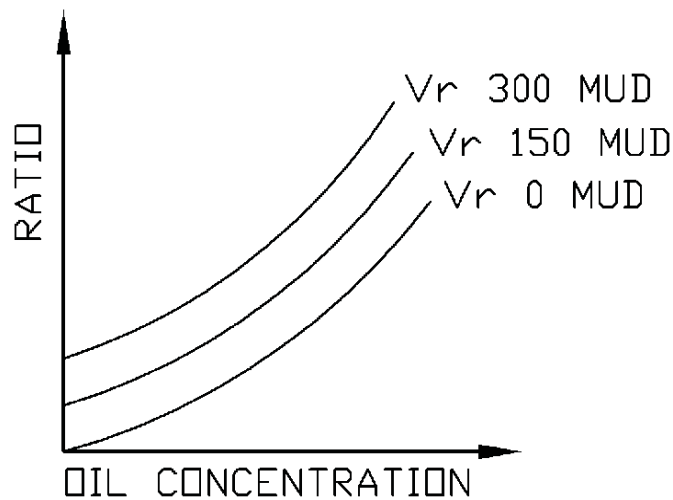
				DATE	20-09-2004	 VAF INSTRUMENTS Dordrecht, The Netherlands			
				DRAWN	M.MOM				
				CHECKED					
				MATERIAL					
C	REF. DRW 0806-0006 WAS-0005	10-01-11	WR	SEMI MAT.		50 mm DIMENSIONS IN mm	REV. No.		
C	REF. DRW 0806-2046 WAS-2036			DIM. DRAWING + PARTS LIST BALLAST SKID Mk6M			A	B	C
B	ITEM 3 FLOW SENSOR	31-05-05	WR						
B	0397-0125 WAS -0125PH								
A	0390-1233 WAS -1192	14-12-04	WR						
No.	DESCRIPTION	DATE	PAR	PART OF 0206-0080					
REVISIONS				THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.					



				DATE	02-04-2002	 VAF INSTRUMENTS Dordrecht, The Netherlands	 25 mm DIMENSIONS IN mm	REV. No.	A		
				DRAWN	B.Vos						
				CHECKED	JV						
				MATERIAL							
				SEMI MAT.							
				GRAB COCK AND INJECTION POINT							
				BALLAST MONITOR							
				Mark 6							
A	0379-0118/0119	09-04-03	BV								
A	ADDED										
PART OF 0379-0118/0119											
No.	DESCRIPTION	DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.							
REVISIONS											



LIGHT SCATTER IN MEASUREMENT CELL

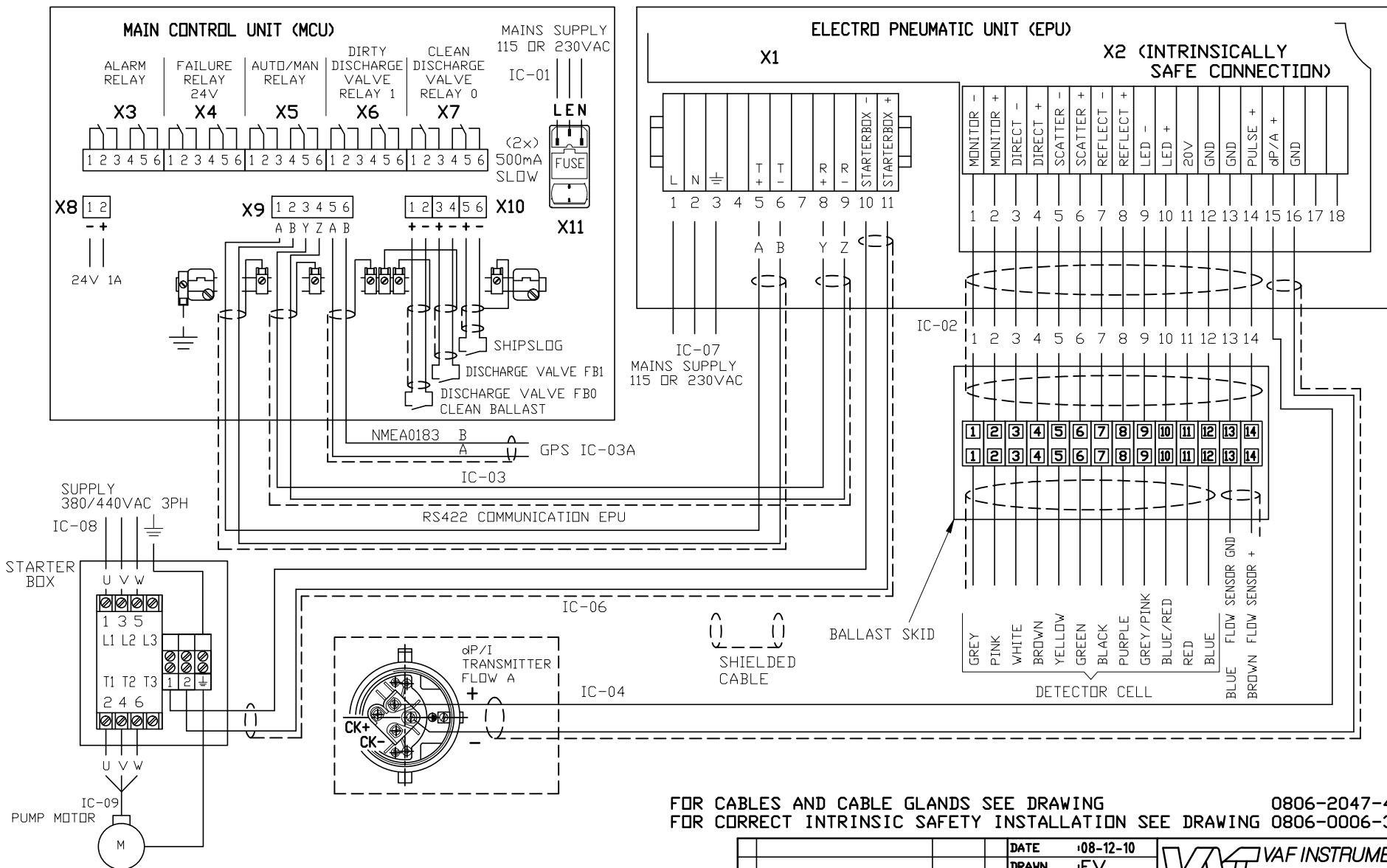


VARIATION OF LIGHT OUTPUT WITH OIL AND MUD CONCENTRATION

			DATE : 25-10-2002	 VAF INSTRUMENTS Dordrecht, The Netherlands		
			DRAWN : M.MOM			
			CHECKED : BV			
			MATERIAL :			
			SEMI MAT. :	 	REV. No.	
			LIGHT SCATTER CELL BALLAST MONITOR Mk6		0806-1622-4	
					PART OF	
No.	DESCRIPTION	DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.		



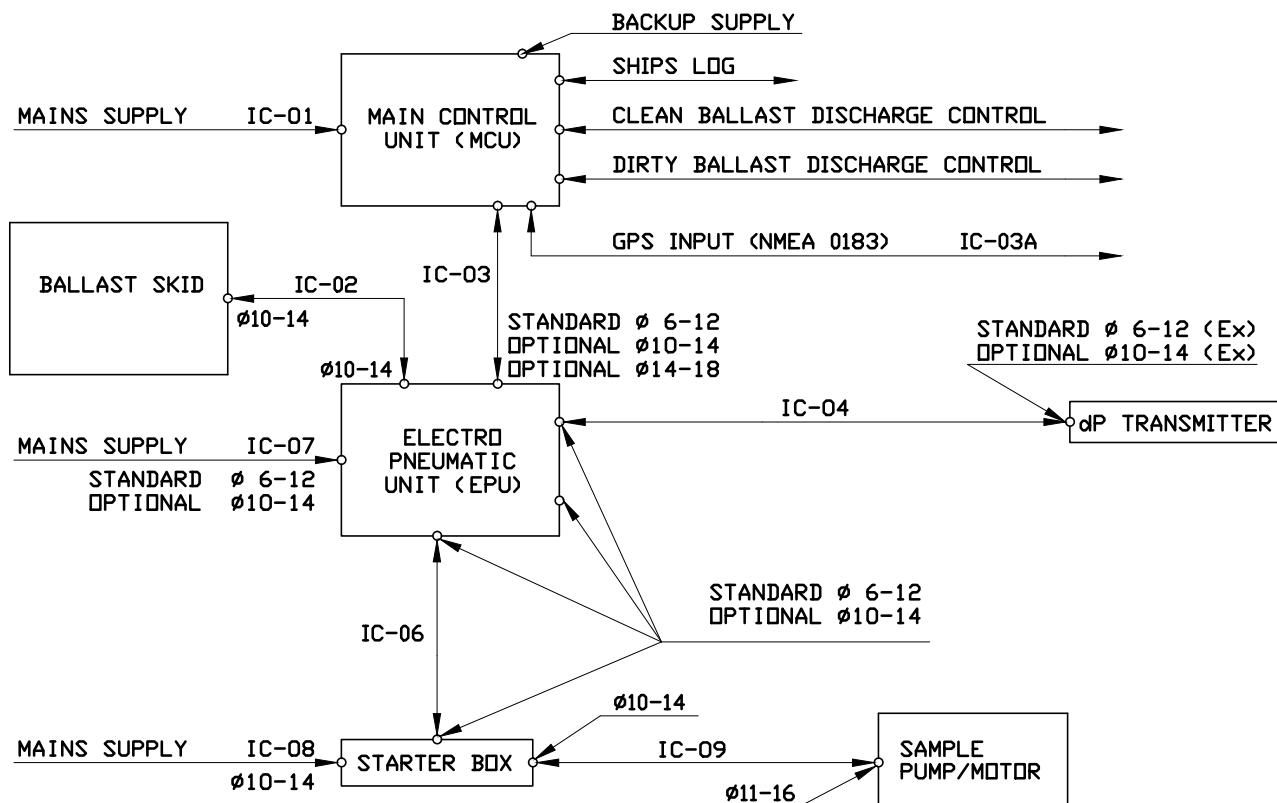
				DATE : 25-04-2003	 VAF INSTRUMENTS Dordrecht, The Netherlands	
				DRAWN : B.T.		
				CHECKED : BV		
				MATERIAL :		
				SEMI MAT. :		
				CONNECTION DIAGRAM MOTOR STARTER BOX Mk6	0806-2032-4	REV. No.
No.	DESCRIPTION	DATE	PART	PART OF 0399-0369		
REVISIONS				THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.		



ITEMS MARKED [] ARE OPTIONAL

FOR CABLES AND CABLE GLANDS SEE DRAWING 0806-2047-4
FOR CORRECT INTRINSIC SAFETY INSTALLATION SEE DRAWING 0806-0006-3/4

				DATE	08-12-10	 VAF INSTRUMENTS Dordrecht, The Netherlands	REV. No.
				DRAWN	FV		
				CHECKED	WR		
				MATERIAL			
				SEMI MAT.		 0806-2046-3 PART OF	
				ELECTR. CONNECTION DIAGRAM			
				BALLAST MONITOR Mk6M			
				MEPC 108(49)			
-	-	-		THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.			
No.	DESCRIPTION	DATE	PAR				
REVISIONS							



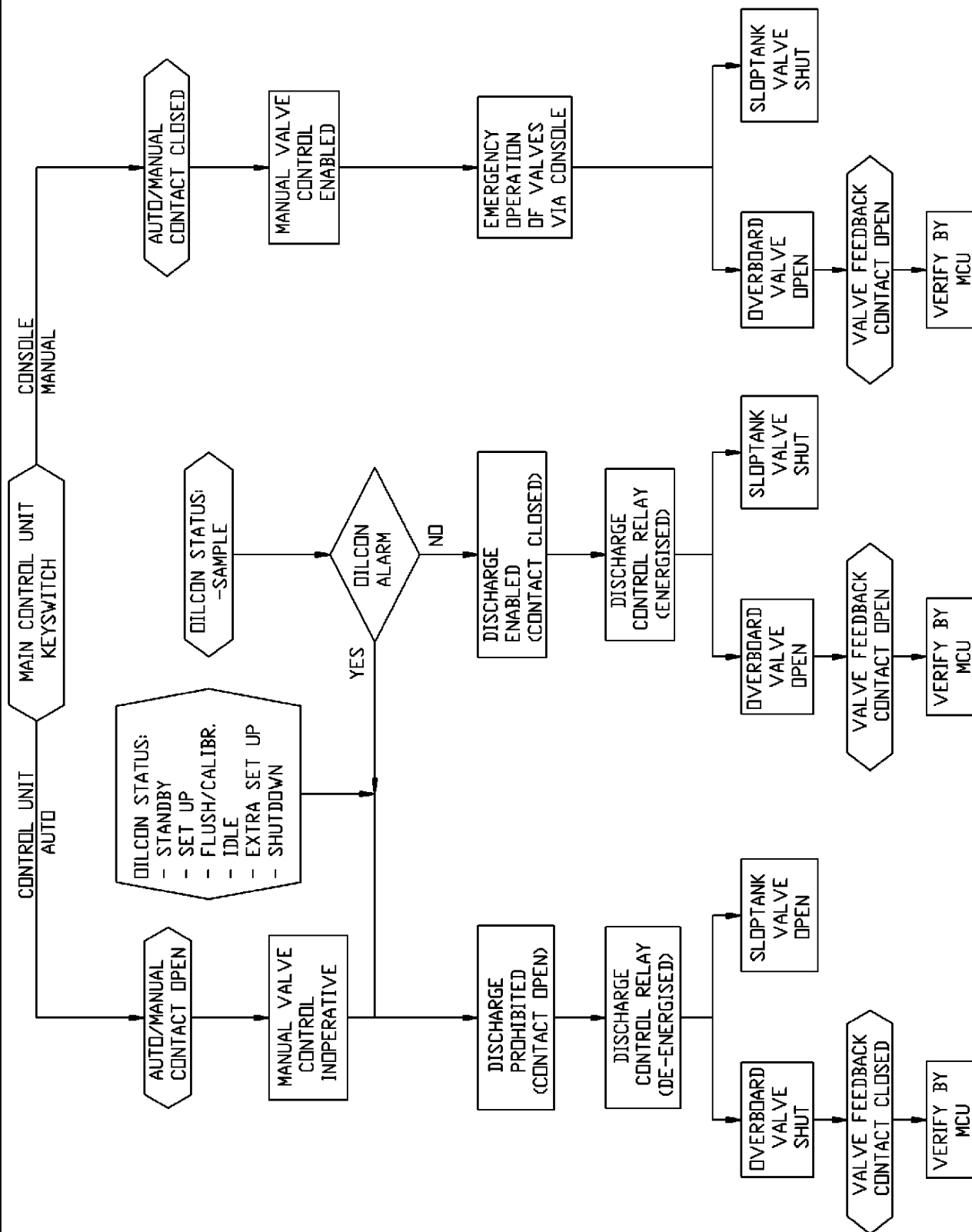
CABLE SPECIFICATION

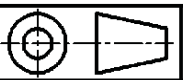
No. OF CORES/SIZE

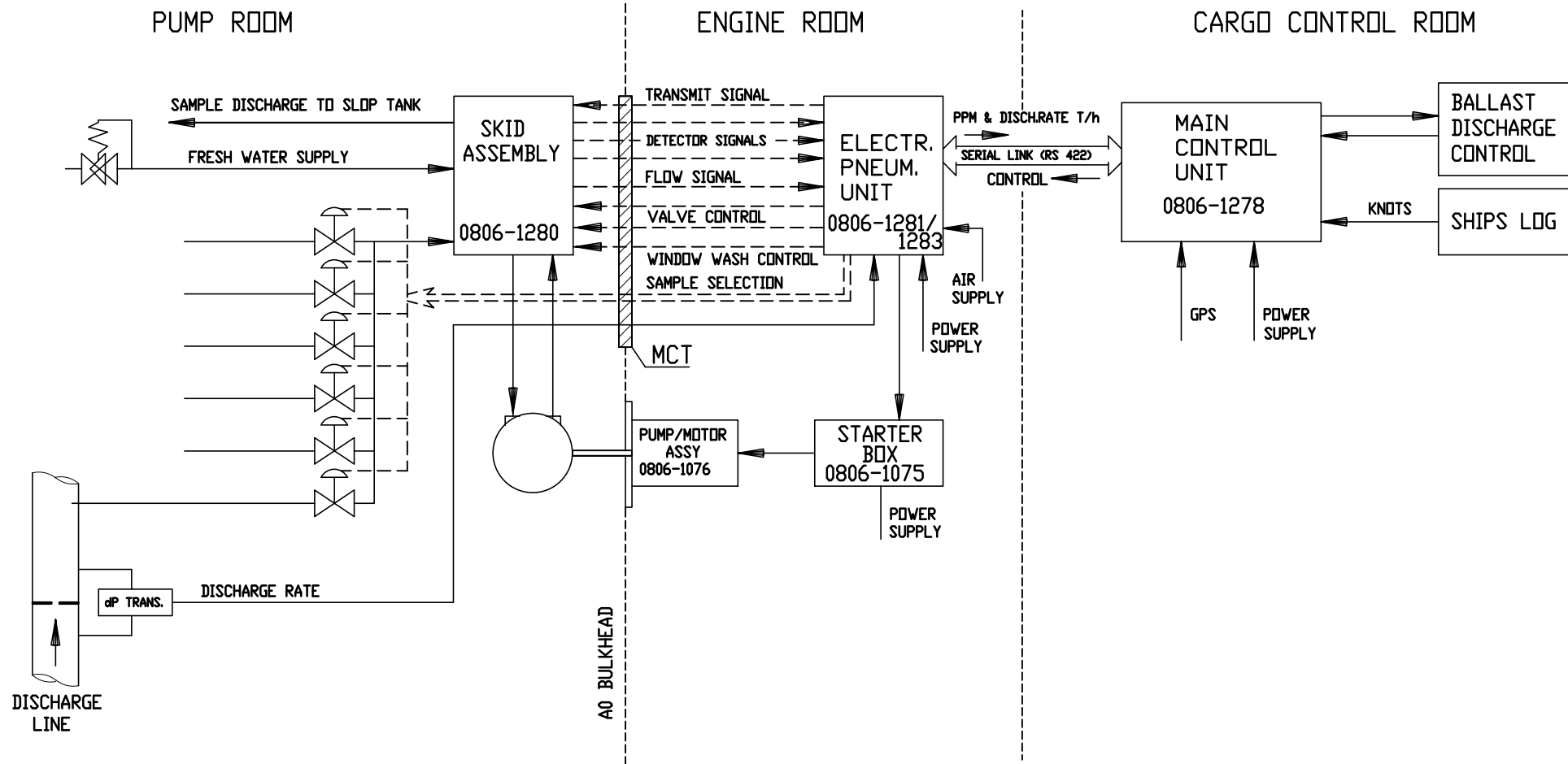
IC-01:	3x0.75	mm ²	
IC-02:	7x2x0.5	mm ²	(7x2 TWISTED PAIR OVERALL BRAIDED SCREENED E. G. HELKAMA RFE-HF60V) VAF Nr. R60-60-231
IC-03:	2x2x0.5	mm ²	(2x2 PAIR INDIVIDUAL SCREENED E. G. BELDEN 9842) VAF Nr. R60-60-229
IC-03A:	2x0.5	mm ²	(ONE PAIR SCREENED CABLE) ACC. SPEC. 0960-0679-4
IC-04:	2x0.5	mm ²	(2 TWISTED PAIR OVERALL BRAIDED SCREENED)
IC-06:	2x0.5	mm ²	E. G. JOBARCOFLEX IKPPDV-af) VAF Nr. R60-60-224 (ONE PAIR SCREENED CABLE)
IC-07:	3x0.75	mm ²	
IC-08:	4x2.5	mm ²	
IC-09:	4x2.5	mm ²	

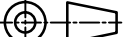
USE APPROVED FLAME RETARDING CABLE
IF WIRES ARE LED THROUGH THE BULKHEAD (MCT)

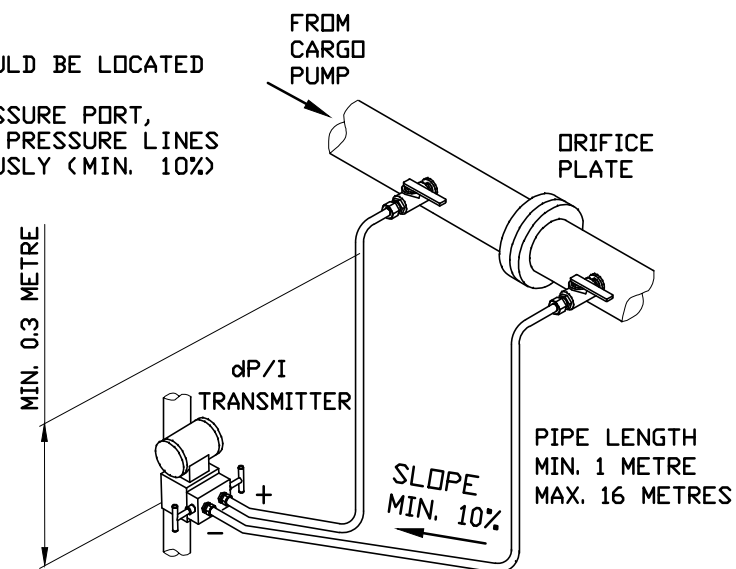
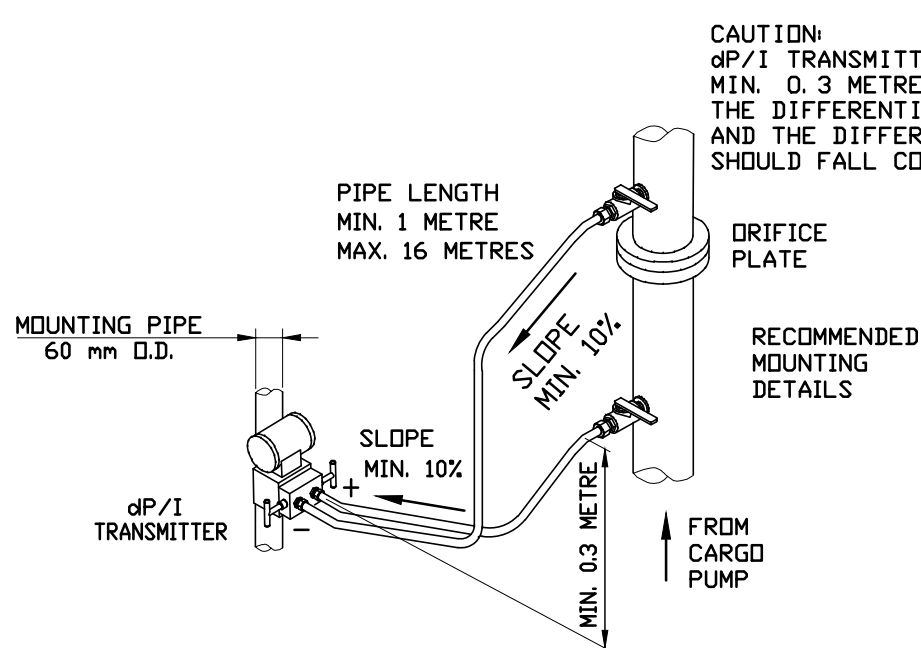
			DATE	08-12-10	 VAF INSTRUMENTS Dordrecht, The Netherlands	
			DRAWN	FV		
			CHECKED	WR		
			MATERIAL			
			SEMI MAT.		DIMENSIONS IN mm	
			CONNECTION DIAGRAM OILCON Mark 6 CABLE SPECIFICATION MEPC 108(49)			REV. No.
						-
-	-	-				0806-2047-4
						PART OF DRW.
No.	DESCRIPTION	DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.		
REVISIONS						



				DATE : 10-07-1995	 VAF INSTRUMENTS Dordrecht, The Netherlands	REV. No. <table><tr><td>A</td><td>B</td><td>C</td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr></table>			A	B	C						
A	B	C															
				DRAWN : AVO													
				CHECKED : BV													
				MATERIAL :		0806-5019-4											
				SEMI MAT. :													
C	Mark 6 ADDED	07-01-02	JS	SCHEMATIC DIAGRAM OVERBOARD VALVE CONTROL BALLAST MONITOR Mark 5/6		PART OF											
B	REDRAWN IN AUTOCAD	02-11-01	BV														
A	VALVE FEEDBACK CONTACT	23-07-97	JV														
B	CLOSED WAS OPEN, OPEN WAS CLOSED																
No.	DESCRIPTION	DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.													
REVISIONS																	



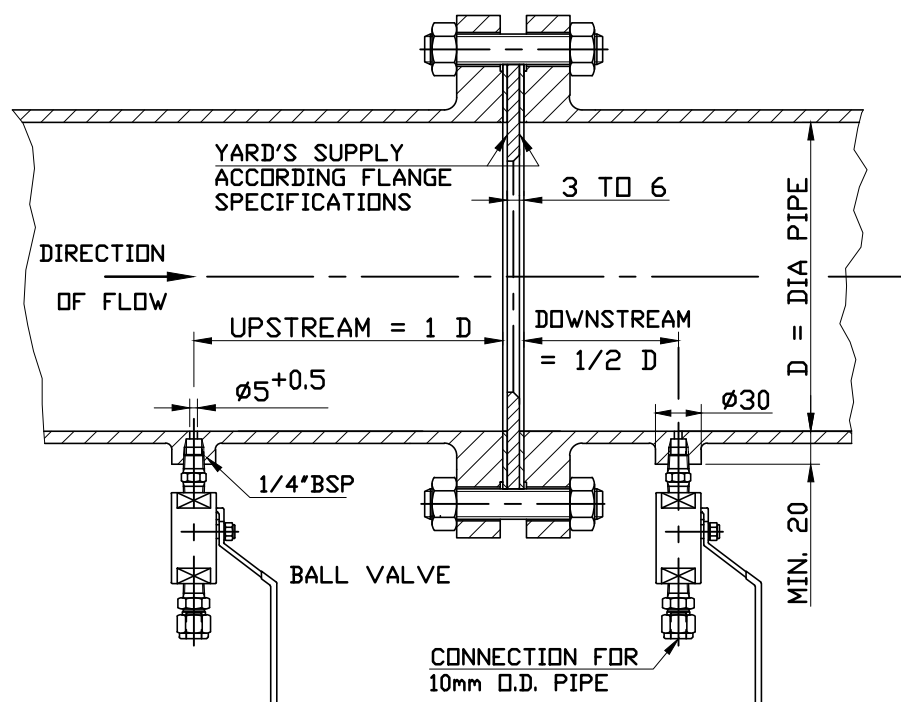
				DATE	31-10-2001		VAF INSTRUMENTS Dordrecht, The Netherlands				REV. No.	A B C	
				DRAWN	B.Vos								
				CHECKED									
				MATERIAL									
				SEMI MAT.									
C	REF.DRW 0806-1283 WAS-01282	10-01-11	WR	SCHEMATIC DIAGRAM DILCON BALLAST MONITOR Mark 6M						0806-5021-3		PART OF	
B	REF DRAW NUMBERS CHANGED	12-04-05	WR										
B	GPS INPUT ADDED												
A	RS 422 WAS RS 442	16-04-03	BV										
No.	DESCRIPTION	DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.									
REVISIONS													



THE MINIMUM RECOMMENDED LENGTH OF STRAIGHT PIPE UPSTREAM OF THE DRIFICE PLATE IS 10 PIPE DIAMETERS AND DOWNSTREAM OF THE DRIFICE PLATE IS 5 DIAMETERS.

WHEN DRILLING AND TAPPING PRESSURE HOLES ALL BURRS AND PROJECTIONS MUST BE REMOVED FROM THE MAIN AND FROM THE PRESSURE HOLES.

ELECTRICAL CONNECTION DIAGRAM Mark 5 0806-2018-3
Mark 6 0806-2030-3
Mark 6M 0806-2046-3



		DATE	25-01-1995	 VAF INSTRUMENTS Dordrecht, The Netherlands	
		DRAWN	P. Stefess		
		CHECKED			
K	Mk6M 0806-2046was-2036	10-01-11	VR	MATERIAL	
J	Mk6M 0806-2036 ADDED	12-04-05	MM	SEMI MAT.	
H	HORIZONTAL POSITION	16-04-03	BV	INSTALLATION	
H	OF BALL VALVES ON RIGHT			FLOWMETER	
H	SIDE OF DRAWING WAS	VERTICAL		BALLAST MONITOR	
G	Mark 6 ADDED	17-01-02	JS	Mark 5/6	
No.	DESCRIPTION	DATE	PAR	PART OF	
REVISIONS				0806-8016-3 DEF GHJ K	

THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS. IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.

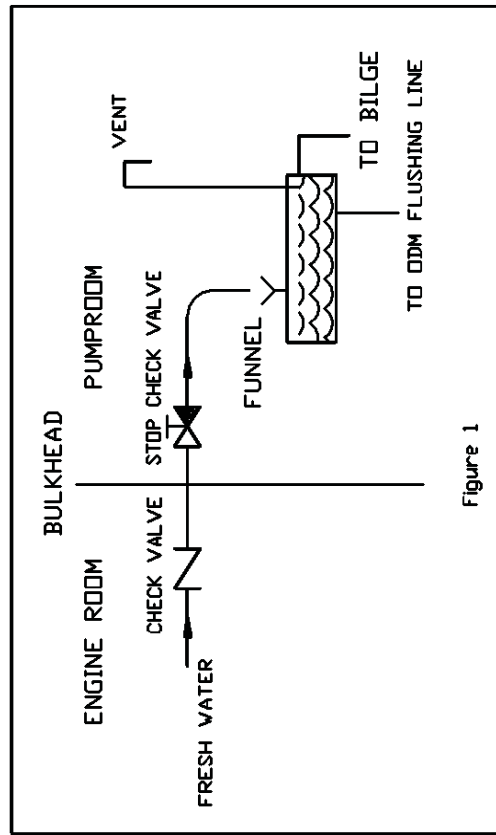


Figure 1

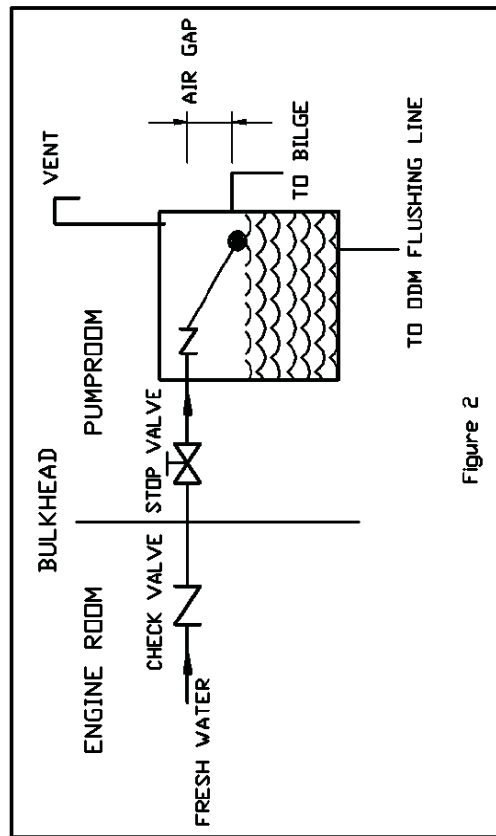


Figure 2

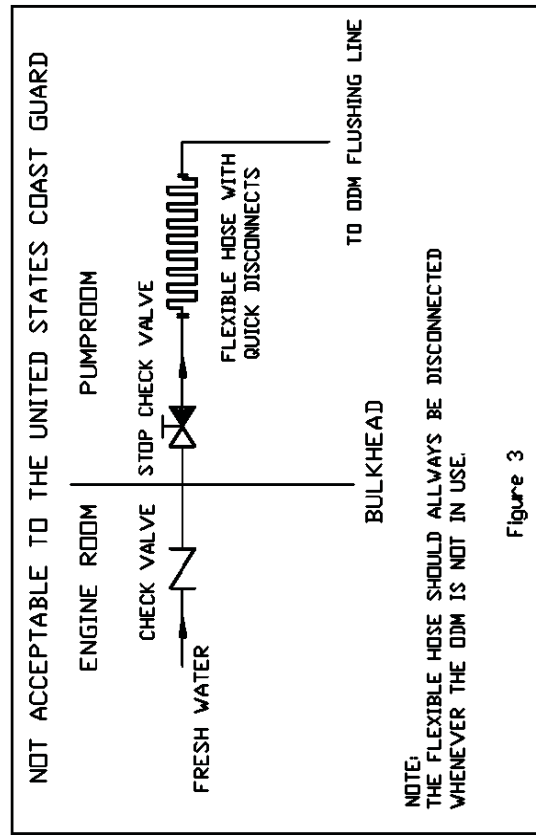
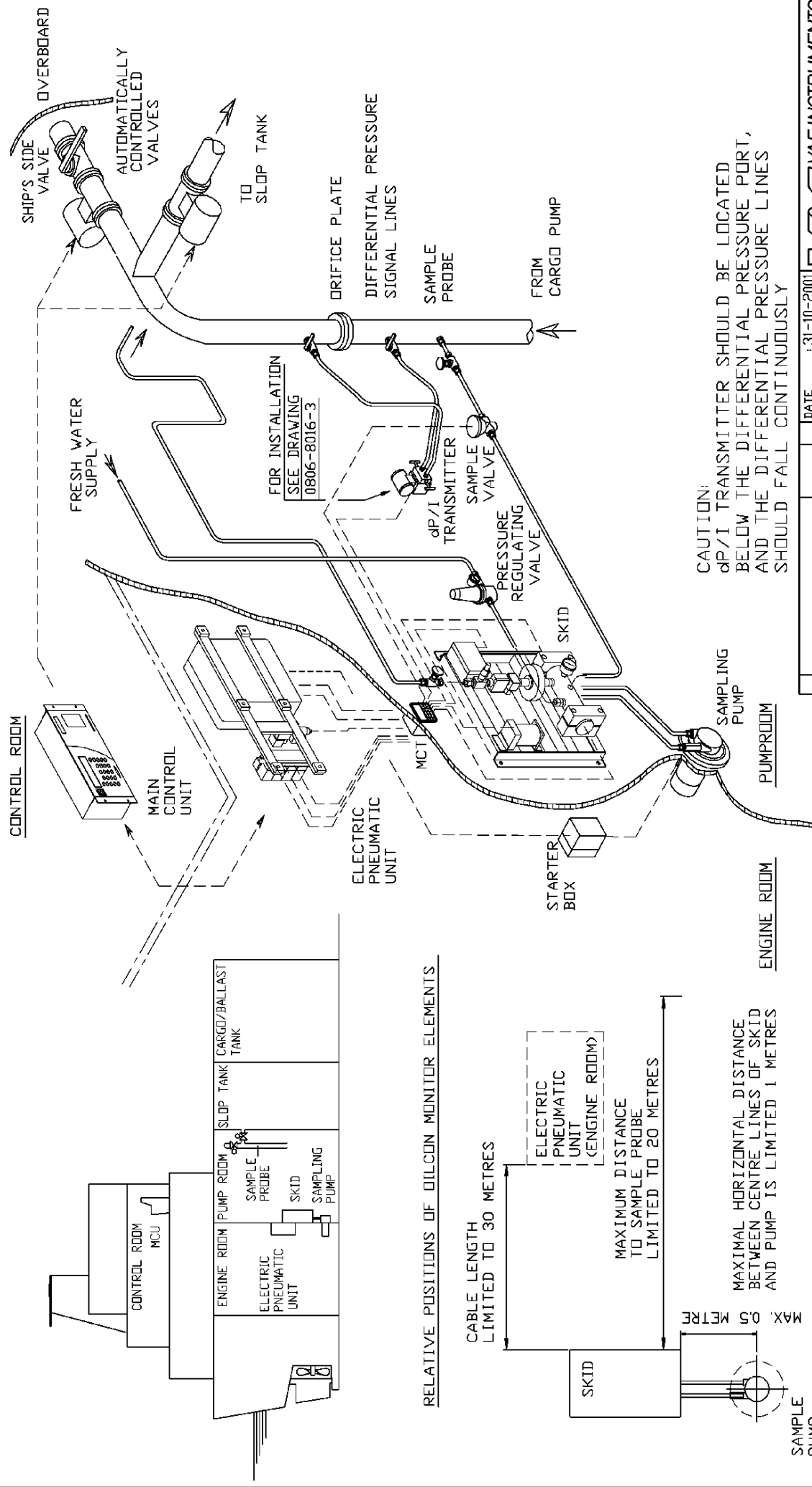


Figure 3

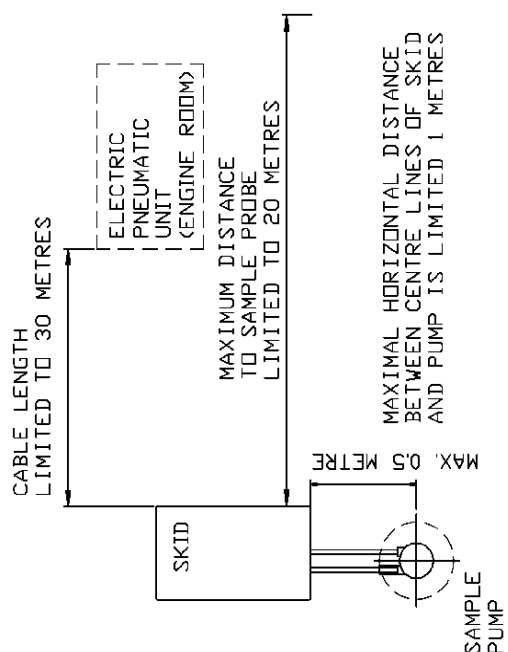
EXPLANATION

THE OIL CONTENT MONITOR IS CONSIDERED TO BE PART OF THE CARGO OIL SYSTEM. ACCORDINGLY 4/6.7.1 OF THE RULES IS APPLICABLE. THE ILLUSTRATIONS SHOW THE ACCEPTABLE MEANS FOR PROVIDING FRESH WATER FOR FLUSHING OF THE OIL CONTENT MONITOR AND THE PROBES.

[illegible]

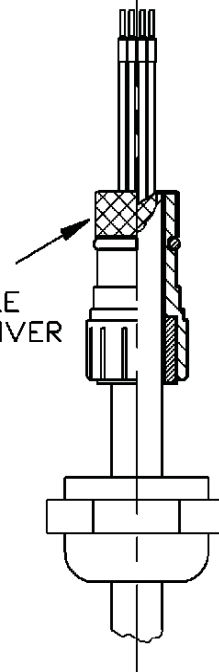
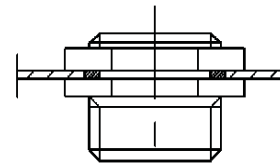
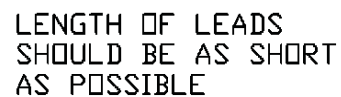
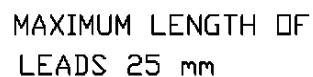


RELATIVE POSITIONS OF OILCON MONITOR ELEMENTS



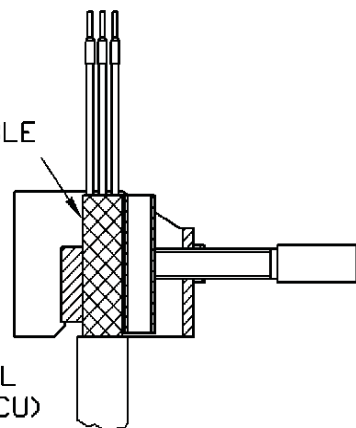
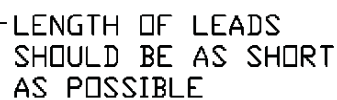
CAUTION:
dP/I TRANSMITTER SHOULD BE LOCATED
BELOW THE DIFFERENTIAL PRESSURE PORT,
AND THE DIFFERENTIAL PRESSURE LINES
SHOULD FALL CONTINUOUSLY

DATE		31-10-2001	VAF INSTRUMENTS	
DRAWN		B.Vos	Dordrecht, The Netherlands	
CHECKED			REV. No.	
MATERIAL			A/B	
SEMI MAT.			0806-8035-3	
B PIPING TO SLOP		07-01-03 BV	PART OF	
B TANK CHANGED			SCHEMATIC INSTALLATION	
A LIMITED TO		02-06-02 BV	DIAGRAM OILCON MONITOR	
A 30 METRES WAS 50 METRES			SYSTEM WITH 1x dP-I	
No.			TRANSMITTER Mark 6	
DESCRIPTION			THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS	
REVISIONS			IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS	
			DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.	



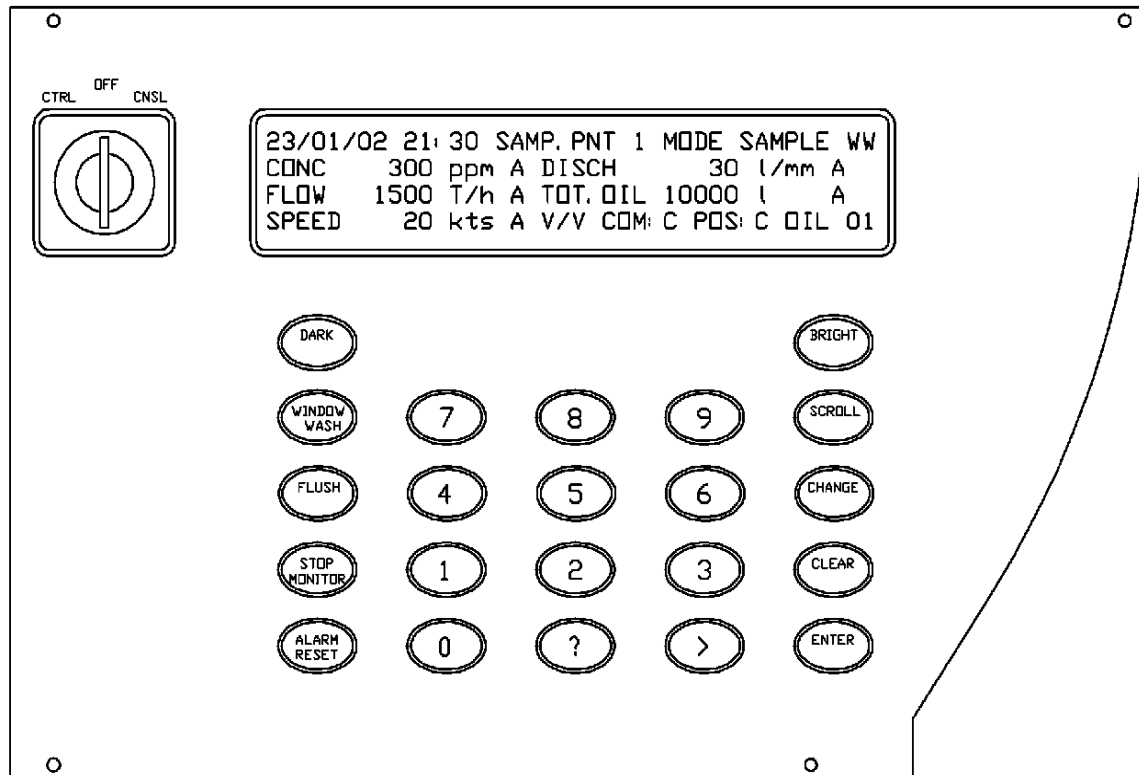
SCREEN OF CABLE
FOULDED BACK OVER
TOP OF INSERT

NOTE:
NO LOOSE SCREENING SHOULD ENTER
THE ELECTR. PNEUM. UNIT (EPU),
TO PREVENT INTRODUCTION OF NOISE.



EARTH CONNECTION RAIL MAIN CONTROL UNIT (MCU)

			DATE	07-01-2002	 VAF INSTRUMENTS Dordrecht, The Netherlands			REV.	
			DRAWN	J.SMAAL				No.	
			CHECKED	BV					
			MATERIAL						
			SEMI MAT.		 				
			CABLE TERMINATION INSTRUCTION			0806-8040-4		A	
			BALLAST MONITOR						
A	CABLE TERMINATION	25-02-03	BV	Mark 6					
A	MCU ADDED						PART OF		
No.	DESCRIPTION	DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.					
REVISIONS									



				DATE	18-01-2002	 VAF INSTRUMENTS Dordrecht, The Netherlands			
				DRAWN	B.Vos				
				CHECKED	BV				
				MATERIAL					
				SEMI MAT.		 	25 mm	REV.	
						DIMENSIONS IN mm		No.	
B	LOWER EDGE ON	22-10-03	BV	CONTROL PANEL MCU BALLAST MONITOR Mark 6			0806-8042-4	A	B
B	RIGHT SIDE CHANGED								
A	TEXT CTRL, OFF AND	15-05-02	BV						
A	CNSL ADDED								
No.	DESCRIPTION	DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.					
REVISIONS									

DRAWN	Regeer	 VAF INSTRUMENTS Dordrecht, The Netherlands		
DATE	29-11-2010			
CHECKED				
MATERIAL				
SEMI MAT.		 	DIMENSIONS IN mm	REV. No.
BULKHEAD PENETRATION AND PIPING DIAGRAM Mark 6		0806-8064-3		-
		PART OF		
THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.				

NOTES:

1. ALL DIMENSIONS ARE MILLIMETERS.
PIPE SIZES ARE O. D.
2. ALL PNEUMATIC PIPES, MATERIAL COPPER
ALL WATERSERVICE PIPES, OF A SUITABLE MATERIAL.
3. ALL 6mm AND 8mm FITTINGS ON SKID AND
ELECTRIC PNEUMATIC UNIT ARE SUPPLIED.
ALSO ONE 6mm FITTING FOR SAMPLE VALVE.
4. OTHER PIPE FITTINGS ARE SUPPLIED AS FOLLOWS :
 -PUMP SUCTIONS AND DELIVERY (2x)
 -SKID CONNECTIONS FOR PUMP (2x)
 -MANUAL ISOLATING VALVE ON SKID (1x)
 -PNEUMATIC SAMPLE VALVE (2 PER VALVE)
 -INJECTION POINT (1x)
 -GRAB COCK (1x)
5. SHIP'S CONTROL AIR SUPPLY TO BE CLEAN, DRY AIR,
MIN. PRESSURE 0.6MPa (6 bar), MAX. PRESSURE 1.5MPa (15 bar).
CONSUMPTION 50 L/min. AVERAGE CONSUMPTION 6 L/min.
6. SHIPS FRESH WATER SUPPLY TO BE FREE OF ANY CONTAMINANTS
MAX. PRESS. 0.6MPa (6 bar) NOM. PRESS. 0.3MPa (3 bar).
MAX. CONSUMPTION 8 L/min. (DURING FLUSH)
AVERAGE CONSUMPTION 0.25 L/min.
7. ALL PIPEWORK IS YARD SUPPLY.
8. ITEMS MARKED ARE YARD SUPPLY.
9. INSTALLATION PLACE OF FLOWMETER(S) AND SAMPLE POINT(S)
MUST ALWAYS BE ARRANGED TO AVOID SYPHONING.

FOR PIPING DIAGRAM WITH:

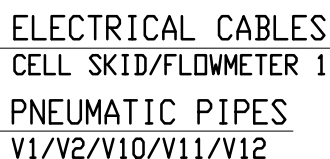
1 OR 2 SAMPLE VALVES 0806-8064-3 SHEET 1 OF 3 + SHEET 2 OF 3

3 TO 6 SAMPLE VALVES 0806-8065-3

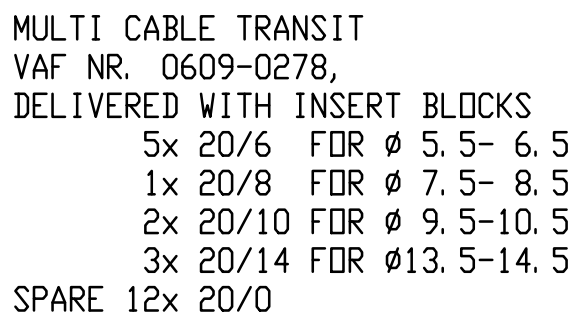
0806-8064-3 SHEET 2 OF 3

SHEET 3 OF 3

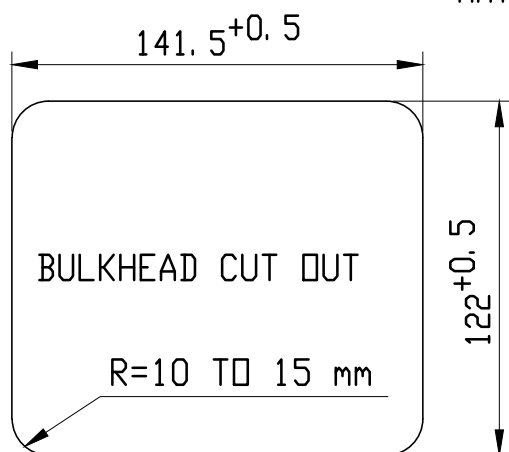
				DRAWN : Regeer	 VAF INSTRUMENTS Dordrecht, The Netherlands			
				DATE : 29-11-2010				
				CHECKED :				
				MATERIAL :				
				SEMI MAT.:			REV. No.	
				BULKHEAD PENETRATION AND PIPING DIAGRAM Mark 6M	0806-8064-4	-		
-	-	-						
No.	DESCRIPTION	DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.				
REVISIONS								



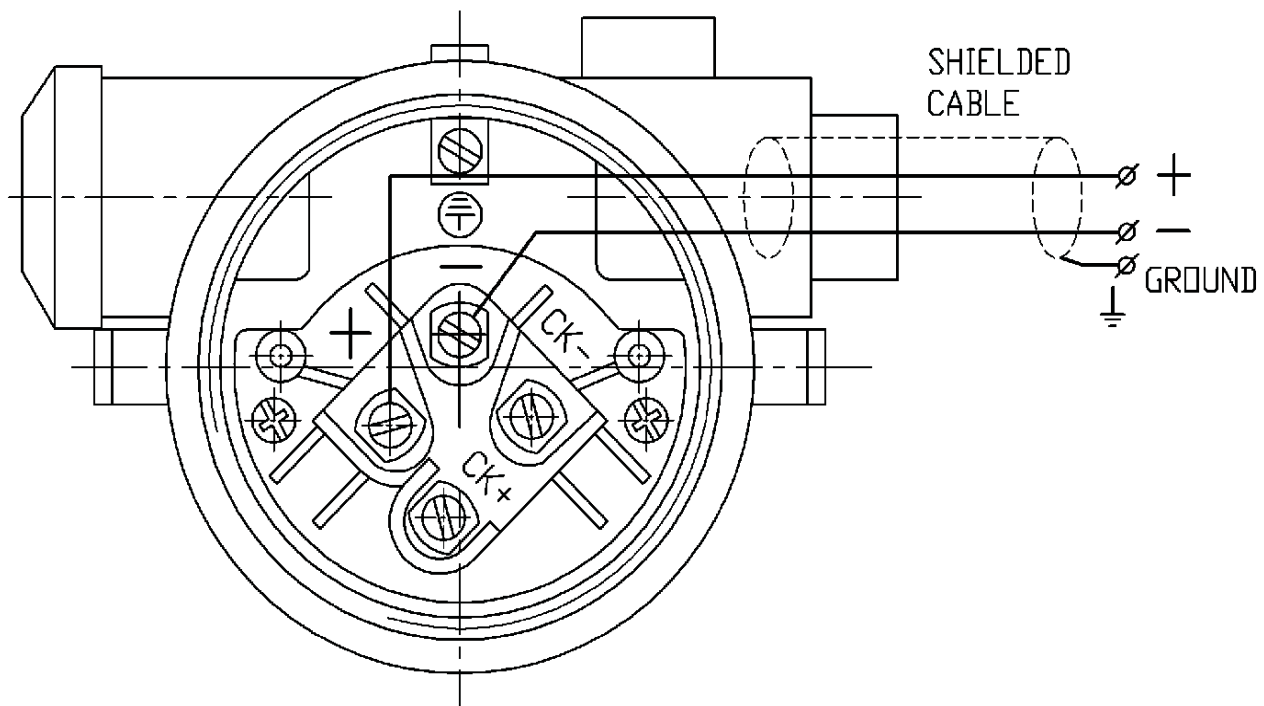
SEE INSTALLATION DRAWING
0806-8038-3



MATERIAL: FRAME, PAINTED STEEL
PLATES, GALVANIZED STEEL
INSERT BLOCKS AND PACKING, LYCRON



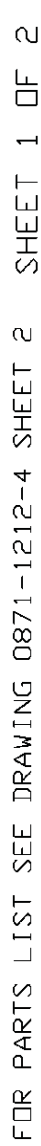
				DATE	08-12-10	 VAF INSTRUMENTS Dordrecht, The Netherlands		50 mm DIMENSIONS IN mm	REV. No.	-		
				DRAWN	FV							
				CHECKED	WR							
				MATERIAL	SEE DRAW.							
				SEMI MAT.								
				MULTI CABLE TRANSIT BALLAST MONITOR Mark 6			0806-8066-4			-		
-	-		-							PART OF		
No.	DESCRIPTION			DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.						
REVISIONS												



VISCOTHERM BALLAST MONITOR
Mark 5/6

DIMENSIONAL DRAWING 0899-1141-3 0899-1092-3
PARTS LIST 0899-1239-3 0899-1249-3

				DATE : 20-08-1992	 VAF INSTRUMENTS Dordrecht, The Netherlands				
				DRAWN : N.Hatunic					
				CHECKED : BV					
				MATERIAL :		  25 mm DIMENSIONS IN mm	REV. No.		
D	Mark 6 ADDED	07-01-02	JS	SEMI MAT. :					
C	REDRAWN IN AUTOCAD	18-09-00	BV	CONNECTION DIAGRAM dP/I TRANSMITTER TYPE FUJI	0810-2007-4	A	B	C	
B	BALLAST MON. ADDED	26-08-97	BV			D			
A	INSIDE TRANSMITTER	28-06-96	NH						
A	CHANGED								
No.	DESCRIPTION	DATE	PAR	PART OF					
REVISIONS				THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.					

[illegible]

ITEM No.		QTY	PART NAME
1		1	CYLINDER WITH TOP CAP COMPLETE
7		1	O-RING
8		1	SPOOL GUIDE
13		2	EJOT PT-SCREW
16		2	MOUNTING BRACKET
17		2	PILOT VALVE COMPLETE
22		1	PLUNGER
23		1	AIR PISTON
24		1	DOUBLE GROOVE RING
25		1	O-RING
26		1	BOTTOM CAP COMPLETE
28		1	O-RING
29		4	EJOT PT-SCREW
30		1	PUMPHEAD
31		1	O-RING
32		1	SEAL
33		1	BACK UP RING
34		1	PACKING RING
35		1	O-RING
36		1	GLIDE RING
37		1	O-RING
38		1	WASHER
39		1	LOCK NUT
40		1	CAP NUT
41		1	INLET GLAND
42		2	BALL
43		1	SPRING
44		2	BALL BRACKET
45		2	O-RING
46		1	OUTLET GLAND
48		1	SPRING

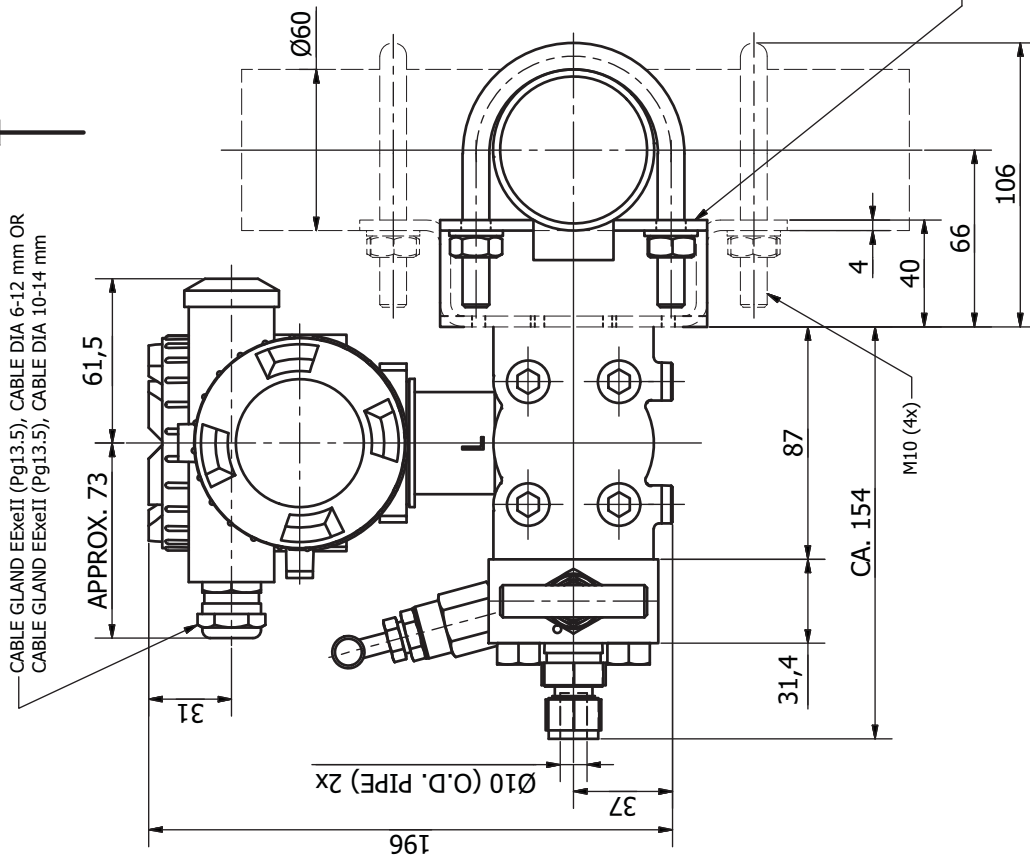
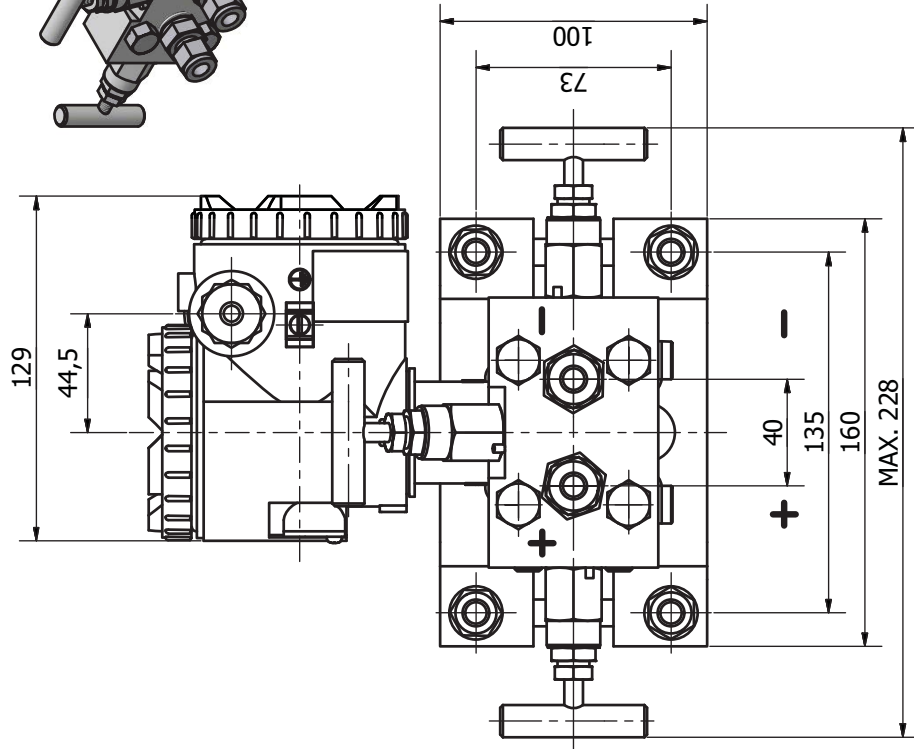
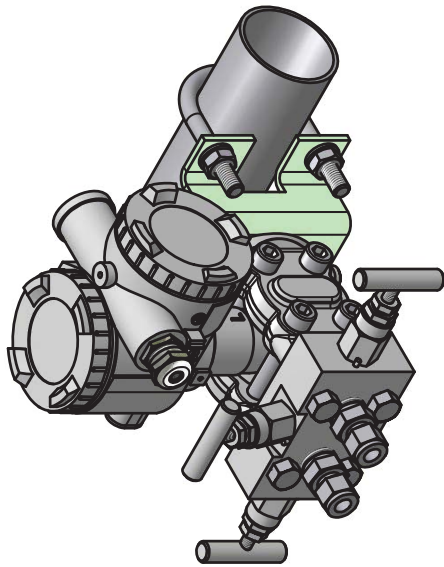
ITEMS 8, 17 (2x), 32, 33, 45 (2x) AND 1 TUBE OF LUBRICANT
ARE INCLUDED IN WINDOW WASHPUMP SPARE PARTS KIT 0390-1202

ASSEMBLY DRAWING 0871-1212-3 SHEET 1 OF 2

SHEET 2 OF 2

			DATE : 02-12-2002	 VAF INSTRUMENTS Dordrecht, The Netherlands		REV. No.
			DRAWN : M.MOM			
			CHECKED : BV			
			MATERIAL :			
			SEMI MAT. :			
				PARTS LIST WINDOW WASH PUMP Mk6	0871-1212-4	PART OF 0671-0025
No.	DESCRIPTION	DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.		
REVISIONS						

RECOMMENDED: VERTICAL DIRECTION FOR MOUNTING



0899-1249 PARTS LIST dP/I TRANSMITTER
PROTECTION CLASS IP 67

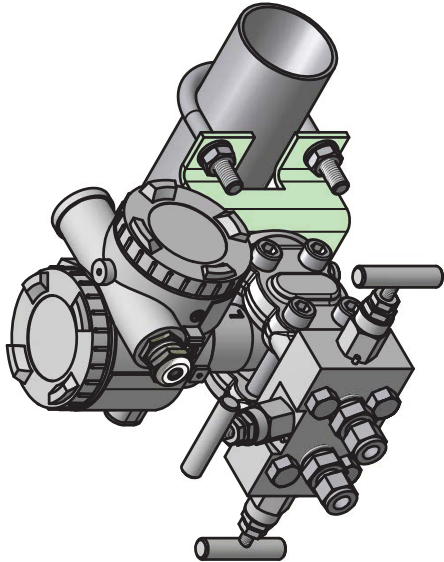
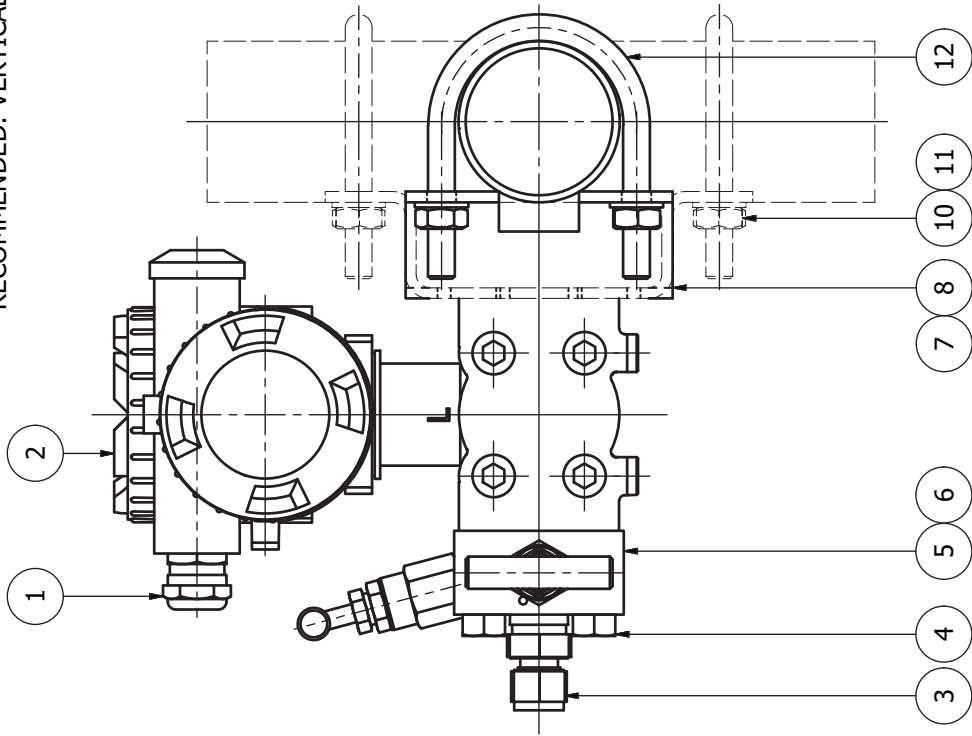
0810-2007 EXTERNAL CONNECTION DIAGRAM

+ AND - CONNECTIONS PIPE DIA OUTSIDE 10mm

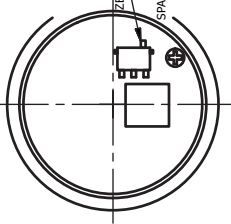
BRACKET FOR HORIZONTAL OR
VERTICAL PIPE MOUNTING

DATE	:26-05-97	DATE	5-11-09	FV
DRAWN	:P.Stefles	TRANSMITTER GEWIJZIGD EN	5-11-09	FV
CHECKED	:WR	DIV MATEN HIERDOOR AANGEPAST	08-04-03	MM
MATERIAL	:	MANIFOLD GEWIJZIGD	18-01-02	JS
SEM MAT	:	CABLE GLAND ADDED	Mark 6 ADDED	PAR
DIMENSIONS IN mm	25 mm	MANIFOLD CHANGED	DESCRIPTION	REVISION
DIMENSIONAL DRAWING				
dP/I TRANSMITTER FUJI				
FLOW METER KIT				
0899-1092				
F				
PART OF: 0399-0318/0319				
THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS				
IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS				
DIVULGED TO A THIRD PARTY PRIOR WRITTEN AUTHORIZATION.				

RECOMMENDED: VERTICAL DIRECTION FOR MOUNTING



VIEW ON PCB
LOCATED INSIDE TRANSMITTER



SET SWITCH TO
"ZERO" FOR ZERO
CALIBRATION

dp/I TRANSMITTER COMPLETE:

0399-0318 STANDARD, MEASURE SPAN 13 TO 130 kPa.
0399-0319 SPECIAL, MEASURE SPAN 50 TO 500 kPa.

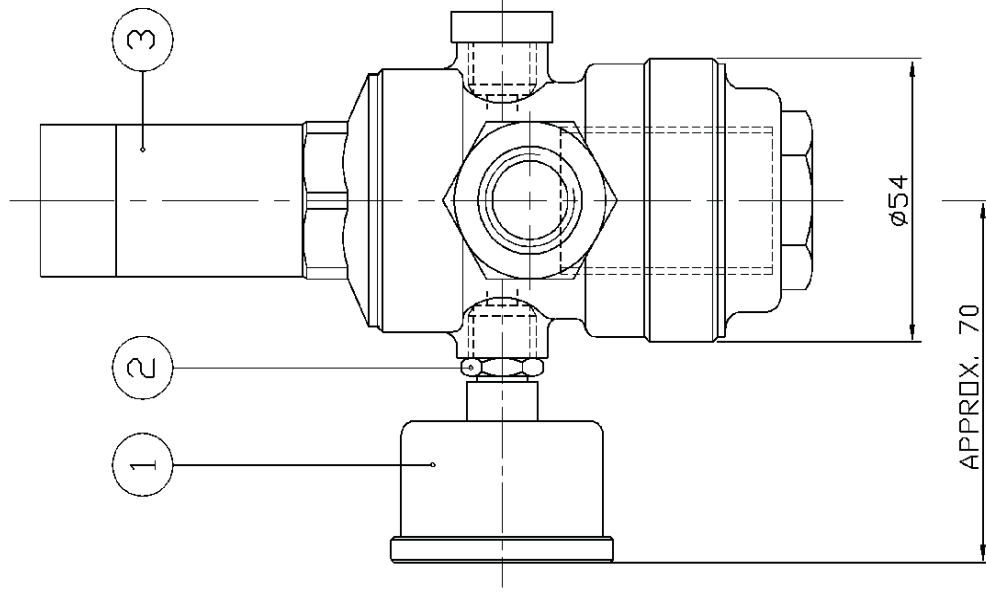
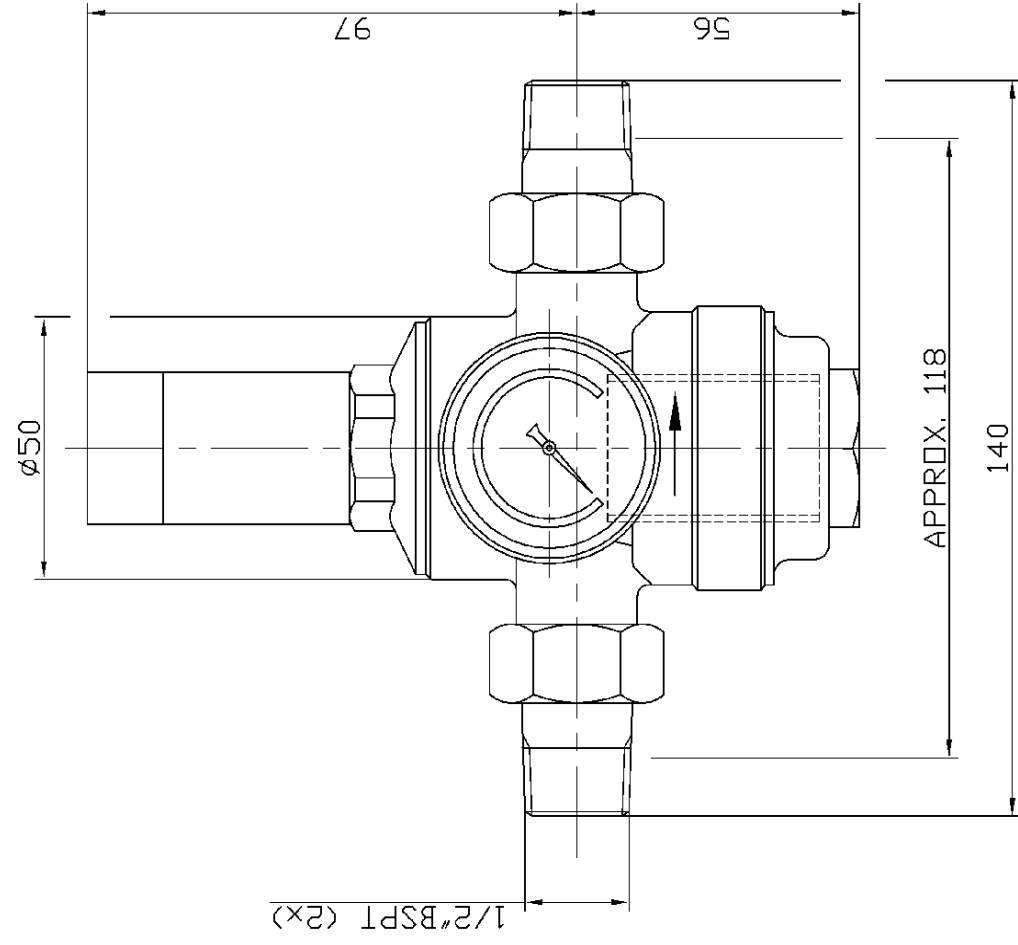
KIT FOR PIPE MOUNTING:

0319-0018 INCLUDE ITEM; 7, 8, 9, 10, 11 AND 12

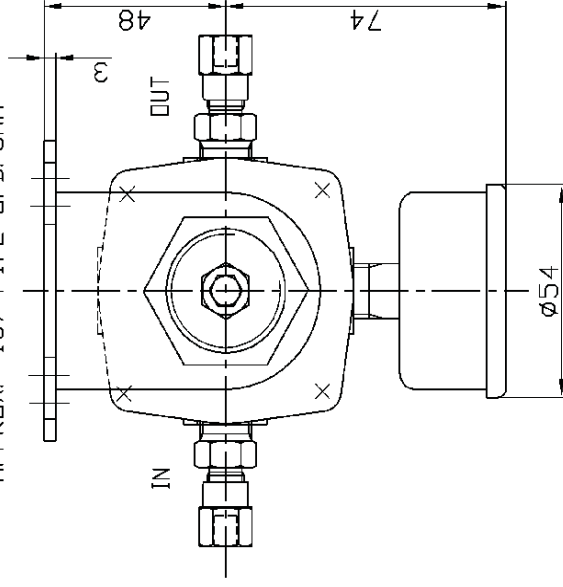
0810-2007 EXTERNAL CONNECTION DIAGRAM
0899-1092 DIMENSIONAL DRAWING

ITEM No.	PART NUMBER	QTY	PART NAME	MATERIAL
1		1	CABLE GLAND EExeII	BRASS
	0646-1269		CABLE DIA. 6-12mm	
	0646-1277		CABLE DIA. 10-14mm	
2		1	dp/I TRANSMITTER	ALSI 316
	0610-0031		STANDARD, MEASURE SPAN 13 TO 130 kPa	AND
	0610-0030		SPECIAL, MEASURE SPAN 13 TO 130 kPa	ALUMINIUM
3	0621-0245	2	MALE CONNECTOR 1/2"NPT x 10 mm	ALSI 316
4	1629-1145	4	SCREW, HEX. HEAD, 7/16"x20 UNF L=1.75"	STEEL 8.8
5	0675-0103	1	MANIFOLD INCLUDING ITEM No. 4 AND 6	ALSI 316
6	V010-0026	2	GASKET 024 x 018 x 3 mm	TEFLON
7	1629-1119	4	SCREW, HEX. HEAD, 7/16"x20 UNF L=0.75"	STEEL 8.8
8	0716-1100	4	WASHER, PLAIN, 7/16" (M11)	DIN 125
9	0419-0049	1	BRACKET	STEEL
10	0734-1000	4	NUT, HEX., M10	STEEL
11	0716-1000	4	WASHER, PLAIN, M10	STEEL 8
12	0609-0238	2	U-BOLT FOR 2"PIPE	DIN 125
				STEEL

DATE : 26-05-97		DRAWN : P. Stiefes		CHECKED : WR		MATERIAL :		SEMI MAT. :		REV. No.	
H		TRANSMITTER GEWIJZIGD		05-11-09		FV					
H		0610-0031 WAS -0026, -0030 WAS -0027									
G		INSTR. SWITCH ADDED		06-06-05		WR					
F		PART Nr.'S ADDED		24-02-04		BV					
E		TABLE CHANGED		16-04-03		BV					
D		MANIFOLD CHANGED		08-04-03		BV					
REV		DESCRIPTION		DATE		PAR					

[illegible]

ITEM No.	PART NUMBER	QTY	PART NAME	MATERIAL
1	0653-0066	1	PRESSURE GAUGE, RANGE 0-1 MPa	STAINLESS STEEL
2	0621-0247	1	NIPPLE 1/4" BSP MALE x 1/8" BSP FEMALE	BRASS
3	0675-0346	1	PRESSURE REDUCING VALVE 1/2" BSP MALE	BRASS



WINDOW WASH PUMP SUPPLY UNIT 0399-0368 <COUPLINGS 8 mm>

D	PART NR.'S ADDED	B4-02-04	BV	DRAWN	: J.SMAAL	 VAF INSTRUMENTS Dordrecht, The Netherlands
C	ITEM NR. 2	WAS	BV	DATE	: 07-01-2002	
C	0670-0006	(0-0.45 MPa)		CHECKED	: B/	
C	FOR WINDOW	WASH PUMP		MATERIAL	:	
B	TABLE CHANGED	16-04-03	BV	SEMI MAT.	:	
A	AIR SUPPLY UNIT	19-06-02	BV		:	
A	WAS 0399-0280				:	
A	AIRFILTER-REGULATOR				:	
A	0670-0007	ADDED			:	
No.	DESCRIPTION	DATE	PART	PARTS LIST AIR SUPPLY UNITS BALLAST MONITOR Mark 6 PART OF		 DIMENSIONS IN mm  REV. NO.
				0899-1258-3 A B C D		
REVISIONS				THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS TRANSMITTED IN ANY MANNER, WITHOUT PRIOR WRITTEN AUTHORIZATION		

9. COMMISSIONING CHECKLIST

Order number: _____

Hull number: _____

Serial number: _____

Shipsname: _____

Check that the following operations have been carried out correctly.

PIPE WORKS

	Yes	No
• Adequate supported	☐	☐
• All pipe works free of leaks	☐	☐
• Correct materials and dimensions used	☐	☐
• Sample discharge line to slop tank prevented from free-fall	☐	☐
• Loop seal/non return valve in sample discharge line to slop tank	☐	☐
• Maximum Distance from sample probe to skid less then 26 meters	☐	☐

WATER INSTALLATION

• Fresh water tank (if installed) made of non-corrosive material and adequate strength	☐	☐
• Fresh water tank (if installed) located at least 10 meters above the skid	☐	☐
• Capacity of fresh water tank (if installed) at least 200 litre	☐	☐
• Lid placed on top of fresh water tank (if installed)	☐	☐
• Air vent placed on top of fresh water tank (if installed)	☐	☐
• Is capacity of fresh water using pressure regulating valve at least 1.5. bar	☐	☐
• Flowrate of Skid set to 500 litre per hour	☐	☐

AIR INSTALLATION

• Air supply set to 4 bar minimum	☐	☐
• Air filter regulators placed correctly	☐	☐
• Air lines connected correctly to valves	☐	☐
• Air lines connected correctly to E.P.U	☐	☐
• Air supply to window wash pump set to 4.0 bar	☐	☐

ELECTRO-PNEUMATIC UNIT AND STARTER BOX

• Electro-Pneumatic Unit and starter box mounted correctly	☐	☐
• All electrical cables supported adequately an of correct (recommended) type	☐	☐
• All signal cables segregated from A.C. power cables by least 0.5 meters	☐	☐
• All cables terminated correctly and placed in correct slots	☐	☐
• Is oil reservoir of sample pump filled with lubricator	☐	☐
• Earth cables installed conform drawings 0806-0005-3 and 0806-0005-4	☐	☐
• Cable between Skid Junction Box and electro-pneumatic unit delivered by VAF	☐	☐
• Cable length between Skid Junction Box and electro-pneumatic unit		
☐ 10 meters ☐ 20 meters ☐ 30 meters		

Order number: _____

Page 2 of 2

M.C.U.

	Yes	No
• M.C.U. mounted correctly and adequately supported	☐	☐
• All electrical cables supported adequately	☐	☐
• All cables terminated correctly and placed in correct slots	☐	☐
• Communication cable made out of 1 (one) piece of cable	☐	☐
• Communication cable of correct and recommended type (drawing: 0806-2029-4)	☐	☐

SKID

• Positive pressure on suction side of sample pump at all times	☐	☐
• Position of sample pump to skid correct	☐	☐
• Position of skid to electro-pneumatic unit correct	☐	☐
• Grab cock and injection point installed	☐	☐
• Bulkhead penetration gas tight and of an approved type	☐	☐
• All discharges lines fitted with sample probes	☐	☐
• Sample probes adequately supported with manual stop and pneumatic select valves	☐	☐
• Sample probes inserted ¼ of pipe diameter and correctly angled in flow direction	☐	☐
• Sample probe in vertical section of pipe with flow upwards or in horizontal section of pipe with probe entering from the underside	☐	☐
• Is the position of each sample probe at a location upstream of any re-circulate line to the slop tank	☐	☐

FLOWMETER AND OVERBOARD VALVE

• Orifice plate 10x pipe diameter upstream and 5x pipe diameter downstream	☐	☐
• Orifice plate installed upstream of any re-circulating line to the slop tank	☐	☐
• Orifice plate located in vertical pipe with upstream flow	☐	☐
• When orifice plate is located in horizontal pipe always full of water	☐	☐
• Pressure tapping at 1x pipe diameter upstream and ½x pipe diameter downstream	☐	☐
• Process lines of pressure tapping fall continuously to the D.P. transmitter with a minimum fall of 300 mm	☐	☐
• Automatic control of overboard and re-circulating valve installed correctly	☐	☐
• Answer back signal of overboard valves installed correctly	☐	☐
• Manual stop valves fitted as required	☐	☐

VAF Instruments BV and it's world wide representatives can not be held responsible for the installation and connection of Explosion Protective Systems.

Date: ____ - ____ - ____

Commissioning
Engineer

Shipyard

Order number: _____

	<u>OPERATION</u>		
	Yes	No	N.A.
• No flow alarm tested	☐	☐	
• No paper alarm tested	☐	☐	
• 30 l/NM exceeding test	☐	☐	
• Power failure alarm tested	☐	☐	
• Communication alarm tested	☐	☐	
• Total discharge oil limit tested	☐	☐	
• No air alarm tested and set to 4 bar	☐	☐	
• Global Position System input tested	☐	☐	
• Oil injected and checked readings on M.C.U.	☐	☐	
• Operation of external relays tested	☐	☐	
• Ships speed input tested	☐	☐	☐
• Operation of auto/man relays tested	☐	☐	☐
• Operation of 24V backup failure relays tested	☐	☐	☐
• Dirty Ballast overboard arrangement and re-circulation valve tested	☐	☐	☐
• Clean Ballast overboard arrangement and re-circulation valve tested	☐	☐	☐
• Operation of Flowmeters tested with cargo pumps (reading within 10% accuracy)	☐	☐	☐
• Flowmeter no. 1 underrange alarm tested (if applicable)	☐	☐	☐
• Flowmeter no. 1 overrange alarm tested (if applicable)	☐	☐	☐
• Flowmeter no. 1 abnormal alarm tested (if applicable)	☐	☐	☐
• Flowmeter no. 2 underrange alarm tested (if applicable)	☐	☐	☐
• Flowmeter no. 2 overrange alarm tested (if applicable)	☐	☐	☐
• Flowmeter no. 2 abnormal alarm tested (if applicable)	☐	☐	☐

Date: ____ - ____ - ____

Commissioning
Engineer

Classification

Shipyard

Owner

Order number: _____

CONFIGURATION DATA

- Maximum capacity of Flowmeter 1 m³ per hour (T/hr)
- Maximum capacity of Flowmeter 2 m³ per hour (T/hr)
- Separate Flowmeter System ☐
- Combined Flowmeter System ☐
- K-factor ships log pulses per Nautical Mile
- Ships volume kilo Ton
- New ship ☐
- Old ship ☐
- Number of sample points
- Name of sample point 1
- Name of sample point 2
- Name of sample point 3
- Name of sample point 4
- Name of sample point 5
- Name of sample point 6
- Pressure of discharge side of sample point Bar
- Software version MCU (see printout)
- Software version EPU (see printout)
- Serial number MCU
- Serial number EPU
- Serial number Skid
- K-Factor Cell (see Data Parameter printout MCU)
- K-Factor Flowmeter (see Data Parameter printout MCU)

GENERAL

- | | Yes | No |
|--|--------------------------|--------------------------|
| • Shown system to classification society | ☐ | ☐ |
| • Shown system to owner and/or shipyard | ☐ | ☐ |
| • Relevant instruction manuals present with customer | ☐ | ☐ |
| • Final function check of installation complete | ☐ | ☐ |
| • All four (4) pages commissioning checklist present | ☐ | ☐ |
| • Name of ship owner | | |
| • Name of shipyard | | |
| • Name of classification society | | |

Date: _____ - _____ - _____

Commissioning Engineer

10. WARRANTY CONDITIONS

1. Without prejudice to the restrictions stated hereinafter, the contractor guarantees both the soundness of the product delivered by him and the quality of the material used and/or delivered for it, insofar as this concerns faults in the product delivered which do not become apparent during inspection or transfer test, which the principal shall demonstrate to have arisen within 12 months from delivery in accordance with subarticle 1A exclusively or predominantly as a direct consequence of unsoundness of the construction used by the contractor or as a consequence of faulty finishing or the use of poor materials.
 - 1A. The product shall be deemed to have been delivered when it is ready for inspection (if inspection at the premises of the contractor has been agreed) and otherwise when it is ready for shipment.
2. Articles 1 and 1a shall equally apply to faults which do not become apparent during inspection or transfer test which are caused exclusively or predominantly by unsound assembly/installation by the contractor. If assembly/installation is carried out by the contractor, the guarantee period intended in article 1 shall last 12 months from the day on which assembly/installation is completed by the contractor, with the understanding that in this case the guarantee period shall end not later than 18 months after delivery in accordance with the terms of subarticle 1A.
3. Defects covered by the guarantee intended under articles 1, 1a and 2 shall be remedied by the contractor by repair or replacement of the faulty component either on or off the premises of the contractor, or by shipment of a replacement component, this remaining at the discretion of the contractor. Subarticle 3A shall equally apply if repair or replacement takes place at the site where the product has been assembled/installed. All costs accruing above the single obligation described in the first sentence, such as are not restricted to shipment costs, travelling and accommodation costs or disassembly or assembly costs insofar as they are not covered by the agreement, shall be paid by the principal.
 - 3A. If repair or replacement takes place at the site where the product has been assembled/installed, the principal shall ensure, at his own expense and risk, that:
 - a. the employees of the contractor shall be able to commence their work as soon as they have arrived at the erection site and continue to do so during normal working hours, and moreover, if the contractor deems it necessary, outside the normal working hours, with the proviso that the contractor informs the principal of this in good time;
 - b. suitable accommodation and/or all facilities required in accordance with government regulations, the agreement and common usage, shall be available for the employees of the contractor;
 - c. the access roads to the erection site shall be suitable for the transport required;
 - d. the allocated site shall be suitable for storage and assembly;
 - e. the necessary lockable storage sites for materials, tools and other goods shall be available;
 - f. the necessary and usual auxiliary workmen, auxiliary machines, auxiliary tools, materials and working materials (including process liquids, oils and greases, cleaning and other minor materials, gas, water, electricity, steam, compressed air, heating, lighting, etc.) and the measurement and testing equipment usual for in the business operations of the principal, shall be available at the correct place and at the disposal of the contractor at the correct time and without charge;

- g. all necessary safety and precautionary measures shall have been taken and adhered to, and all measures shall have been taken and adhered to necessary to observe the applicable government regulations in the context of assembly/installation;
 - h. the products shipped shall be available at the correct site at the commencement of and during assembly.
4. Defects not covered by the guarantee are those which occur partially or wholly as a result of:
 - A. non-observance of the operation and maintenance instructions or other than foreseeable normal usage;
 - B. normal wear and tear;
 - C. assembly/installation by third parties, including the principal;
 - D. the application of any government regulation regarding the nature or quality of the material used;
 - E. materials or goods used in consultation with the principal;
 - F. materials or goods provided by the principal to the contractor for processing;
 - G. materials, goods, working methods and constructions insofar as are applied at the express instruction of the principal, and materials or goods supplied by or on behalf of the principal.
 - H. components obtained from third parties by the contractor insofar as that party has given no guarantee to the contractor.
 5. If the principal fails to fulfil any obligation properly or on time ensuing from the agreement concluded between the principal and the contractor or any agreement connected to it, the contractor shall not be bound by any of these agreements to any guarantee regardless of how it is referred to. If, without previous written approval from the contractor, the principal commences disassembly, repair or other work on the product or allows it to be commenced, then every agreement with regard to guarantee shall be void
 6. Claims regarding defects must be submitted in writing as quickly as possible and not later than 14 days after the discovery of such. All claims against the contractor regarding faults shall be void if this term is exceeded. Claims pertaining to the guarantee must be submitted within one year of the valid complaint on penalty of invalidity.
 7. If the contractor replaces components/products under the terms of his guarantee obligations, the replaced components/products shall become the property of the contractor.
 8. Unless otherwise agreed, a guarantee on repair or overhaul work carried out by the contractor or other services shall only be given on the correctness of the manner in which the commissioned work is carried out, this for a period of 6 months. This guarantee only covers the single obligation of the contractor to carry out the work concerned once again in the event of unsound work. In this case, subarticle 3A shall apply equally.
 9. No guarantee shall be given regarded the inspection conducted, advice given and similar matters.
 10. Alleged failure to comply with his guarantee commitments on the part of the contractor shall not absolve the principal from his obligations ensuing from any agreement concluded with the contractor.
 11. No guarantee shall be given on products which form a part of, or on work and services on, goods older than 8 years.

Revision 1106:
Section 4.6.5 System alarms:
Terminal codes corrected

Revision 0107:
Section 6 Certificates of approval and certificates of conformity:
Certificate Canada added

Revision 0507:
Section 6 Certificates of approval and certificates of conformity:
Certificate United States Coast Guard renewed

Revision 0807:
Revised Marpol Annex II

Revision 0907:
Section 4.6.10 and Commission checklist: air pressure corrected

Revision 1207:
Section 6 ABS Certificate of Type Approval added
ABS Certificate of Manufacturing Assessment renewed

Revision 1207(2):
Section 2.6 GPS input command corrected

Revision 0908:
Selection for GPS or Ships log for ships speed added.
Chapter 6:
EC declaration of conformity for equipment and protective systems certificate added.

Revision 0109:
Chapter 9:
Commission checklist corrected.

Revision 0409:
Section 6:
CCS certificate of type approval renewed.

Revision 1009
Section 6:
EC declaration of conformity for equipment and protective systems
and KEMA EC-type examination certificate renewed.

Revision 1209
Section 6 and 8:
DP/I transmitter changed for part number, dimensional drawings and certificate

Revision 0310
Section 4.7.10.2:Electrical items spares kit corrected
Section 6: DNV EC Type-Examination Certificate renewed

Revision 0410
Section 6:
ABS Product Type Approval certificate renewed.

Revision 0510:
Section 3 (page 35) and 4.5.1.9
Note for special software versions added

Revision 0610:
Section 6: RMRS
Russian Maritime Register of Shipping certificate renewed

Revision 0710:
Section 6:
Certificates of approval are available on our web-site and
EC declaration of conformity for equipment and protective systems renewed.

Revision 1010:
Section 3; point 17 Level of "No flow alarm" corrected.
Section 5; point 14 and 16: New software; modified calculation of whole numbers

Revision 0111:
System modification led to use of one (1) flow meter kit for overboard discharge calculation:
Section 2.8, Section 3: point 8 and 10 modified

Section 8:
Drawings 0806-0005 replaced by 0806-0006
 0806-1282 0806-1283
 0806-2036 0806-2046
 0806-2037 0806-2047
 0806-8037 0806-8066
 0806-8038 0806-8064

Relevant drawings modified.

Revision 0711:
House style change

Revision 1111:
Section 4.7.1. Cleaning requirements adjusted

Revision 0613:
Small changes in chapter 4.7.10.1 standard spare parts Oil Discharge Monitor System

Revision 0214:
Chapter 4.7.2.2 and chapter 4.7.10.2 corrected

VAF

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