ASAMS

ASAMS SYSTEM 3

UNDERWATER MAGNETIC PARTICLE INSPECTION UNIT

INSTRUCTIONS FOR USE

ISSUE 6 – February 2005

ASAMS Limited, Marine Building, Owen Road, Harfreys Industrial Estate, GREAT YARMOUTH, Norfolk NR31 0NA (Page 1 of 28)
Telephone: +44 (0) 1493 653535 Fax: + 44 (0) 1493 653536 Email: sales@asams.co.uk Web: www.asams.co.uk VAT No: 521 2585 70
Registered Office: Surrey Chambers, Surrey Street, LOWESTOFT, Suffolk NR32 1LJ. Registered In England No: 2322620

CONTENTS

SECTION 1 - INTRODUCTION

UNDERWATER MAGNETIC PARTICLE UNIT

This unit was developed by OIS Engineering and is now manufactured and supported by ASAMS. It provides a flexible, compact alternative to other systems. Emphasis has been placed on retaining weight and size to a minimum whilst achieving high performance and flexibility. Safety was the prime consideration and its specifications with regard to safety are in excess of recommendations.

The unit provides the diver with all facilities necessary to undertake the most critical type of magnetic particle inspection.

Dimensions

Surface Unit	48cms x 25cms x 25cms
Submersible Unit	26cms diameter, 45cms height
Ultraviolet Lamp	12cms diameter, 21cms long
Isolation Transformer Unit	30cms x 30cms x 50cms in height

Weights

	In Air	In Sea Water (approx.)
Surface Unit	35.5kgs	
Submersible Unit	56.8kgs	26kgs
Ultraviolet Lamp	3.5kgs	½kg
Isolation Transformer	61.0kgs	

Depth Rating

Submersible Unit - 600 ft in seawater - oil filled pressure balanced housing.

Ultraviolet lamp - 600ft in sea water. Each lamp hydrostatically tested and certified. Special lamps can be provided for depths in excess of 600ft.

Technical Data

Electrical Supply - 200 - 250V AC single phase 30 amp to 380 - 440V AC 3 phase.

Transformer Output -1500 amp AC or DC, 5-volt open circuit output infinitely variable.

Ultraviolet Lamp - Light intensity in excess of current recommendations. The lamp is capable of long periods of continuous operation without overheating.

OPERATION

1. Methods of Magnetisation

   The following methods are available: -

   a) **Prods**
   Hand held two piece separable unit with adjustable prod spacing facility (recommended spacing 8"). Lead, copper or alloy tips may be fitted.

   b) **Cable**
   Coil or parallel conductor technique. A continuous loop of cable may be supplied with quick fit connections and clamps to enable the technique to be applied easily underwater.

   c) **Electromagnetic Yoke**
   Electromagnetic yoke with articulating legs to ensure good contact with test surface. HWDC operation developing 22.7 kilos pull. FWDC in excess of this.

2. Fluid Dispensing System

   A constantly agitated pre-mix is contained in an external reservoir. The fluid is delivered to the hand held u/v lamp by a small diameter hose at 25 psi above ambient water pressure. Capacity of the reservoir is equivalent to approximately 10 litres of "ready to use" mix. External reservoir is easily replaced underwater.

3. The unit may be used to demagnetise as required.

SURFACE CONTROL UNIT

Controls and Indicators - (See Figure 1)

Mains I/P Lamp - Illuminated when supply is connected to the control unit.

I/P Voltage Selector - Can be adjusted for 120V-220V 220V 240Vac input and is fitted with 5A anti surge fuse in the primary unit for the u/v supply.

Mains Supply Circuit Breaker - 30A circuit breaker supplying mains to the 30A contactor.

Test - Test facility for checking the earth leakage trip sensor, adjusted to operate at 20mA.

Magnetising Current ON/'OFF Switch - Switches in 30A contactor and supply mains to the subsea transformer. Switch illuminates when on.

Magnetising Current O/P Lamp - Will illuminate when 30A contactor is energised.

Remote Control - A facility to remotely control the magnetising current.

Meter - Indicates input mains current drawn when using loop (0-40 amps), and loop current (0-1500A).

U/V Lamp and Pump Circuit Breaker - 5A circuit breaker supplying mains to transformer TI .

Test - Test facility for checking the earth leakage trip sensor, adjusted at 20mA.

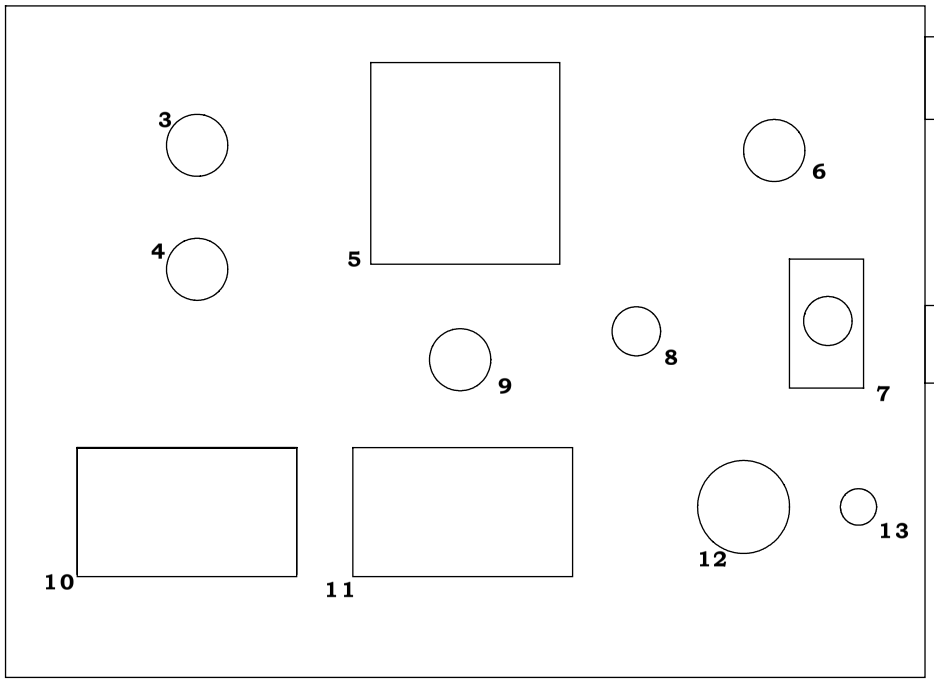
U/V Lamp - Illuminates when u/v circuit breaker is operated.

IN/OUT Demag Control - Energises 30A contactor and switching in triac for demagnetising facility.

Output Control - Controls output current from 0A to 1500A (clockwise).

Mains Input Plug - 3 pin chassis mounted plug.

Umbilical Socket - 4 pin chassis mounted socket.



1. Umbilical Connector
2. Mains Input Connector
3. Mains Input Lamp
4. Input Selector 5A Fuse (U/V Lamp)
5. Magnetising Amps K.A. Metre
6. Magnetising Current Output Lamp
7. Remote Control Socket
8. Push Button On/Off Magnetising Current
9. U/V Lamp
10. Mains Supply ELBC
11. U/V Lamp Supply ELBC
12. Demag - Output Control
13. Demag - Output Control In/Out

OIS System 3 Figure 1
REF No. 539m

MPI CONTROL UNIT PANEL LAYOUT

DRN BY: S.V.N
11.11.99

ASAMS Limited, Marine Building, Owen Road, Harfreys Industrial Estate, GREAT YARMOUTH, Norfolk NR31 0NA (Page 6 of 28)
Telephone: +44 (0) 1493 653535 Fax: + 44 (0) 1493 655555 Email: asams@asams.co.uk Web: www.asams.co.uk VAT No: 521 2585 70
Registered Office: Surrey Chambers, Surrey Street, LOWESTOFT, Suffolk NR32 1LJ. Registered In England No: 2322620

SUBSEA UNIT LAYOUT - (See Figure 2)

AC, HWDC and Common Penetrator - Screw on brass terminals giving AC output (connecting AC and common) half wave DC (connecting HWDC and common) and full wave DC for yoke using bridge connector.

Control Unit Connector - Underwater 4-pin plug (chassis mounting) which connects to the umbilical supply from the surface unit.

U/V Lamp Connector - Underwater 4 pin socket (chassis mounting) which supplies the u/v lamp.

MPI Fluid Pump - Circulates MPI fluid through the ink reservoir. A take off point dispenses the fluid by hose to the u/v lamp.

Topping Up Points - Two topping up points are situated either side of the lid to enable the unit to be filled completely with dewatering fluid.

Lifting Eye - Used when transporting subsea unit from deck to seabed.

Handrail - To enable easy manoeuvring on the seabed, also houses the ink reservoir system.

SAFETY FEATURES

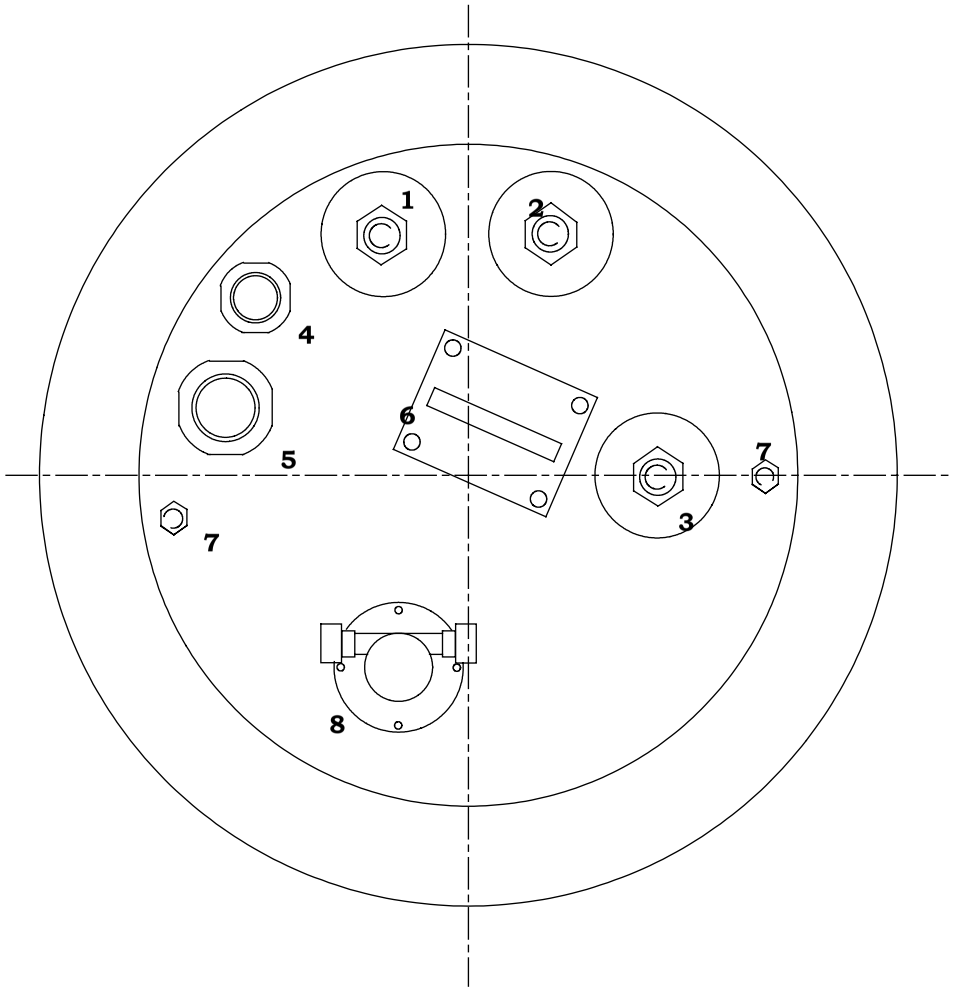
a) A separate mains isolation transformer with a centre tap is an additional item recommended by DNV.

b) Earth leakage sensors fitted to both supplies operating at 20mA.

ACCESSORIES

Fluid dispensing system may be fitted to the prod handle or electromagnet if required.

The OIS MPI system was developed to meet the full requirements of Lloyds Register of Shipping and Det Norske Veritas.



1. AC Penetrator
2. HWDC Penetrator
3. Common Penetrator
4. U/V Lamp Connector
5. Control Unit Connector
6. Lifting Eye
7. Topping Up Points
8. MPI Fluid Pump

OIS System 3 Figure 2
REF No. 539M

MPI SUBSEA UNIT PANEL LAYOUT

DRN BY: S.V.N
11.11.99

ASAMS Limited, Marine Building, Owen Road, Harfreys Industrial Estate, GREAT YARMOUTH, Norfolk NR31 0NA (Page 8 of 28)
Telephone: +44 (0) 1493 653535 Fax: + 44 (0) 1493 655555 Electronic Copy Seen Original Web: www.asams.co.uk VAT No: 521 2585 70
Registered Office: Surrey Chambers, Surrey Street, LOWESTOFT, Suffolk NR32 1LJ. Registered In England No: 2322620

SECTION 2 - OPERATING PRINCIPLES

OIS SYSTEM 3 MPI UNIT

OPERATING PRINCIPLES (See Figure 3)

Supply

200 volts to 250 volts AC single phase 30A can either be plugged directly into the Surface Control Unit or via the Isolation Transformer (see operating instructions and diagram 5a). 380 volts to 440 volts AC three phase can be supplied via the Isolation Transformer (see operating instructions and diagram 5b).

Control Unit (See Figure 4)

The mains input to the control unit via a 3 pin Plessey connector splits 3 ways:-

a) MPI circuitry
b) Black light and pump circuitry
c) Current control board circuitry.

a) MPI Circuitry

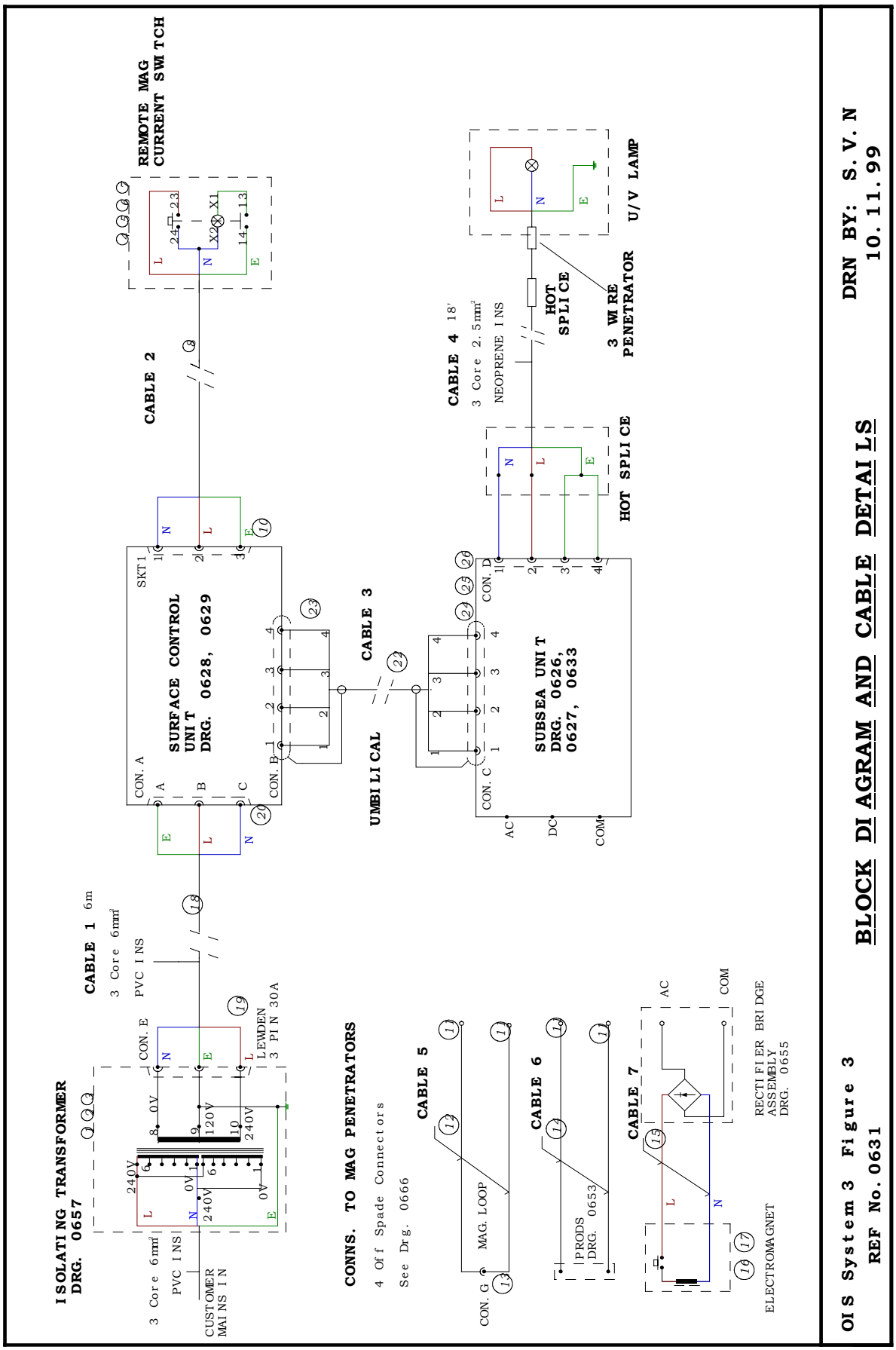
When the supply is connected to the control unit LTI (red lamp) is illuminated. It is then passed through the earth leakage sensor, which is set to operate at 20mA. The ammeter indicates current drawn from the subsea transformer. RL2 is energised by operating PB1 (MPI operate switch) which is self latching and illuminated. Socket SK1 is in parallel with PB1 for use with a remote switch. LT2 (amber) will also be illuminated. With current controller 'OFF' the supply is fed out of unit on connector B pins 2 and 3.

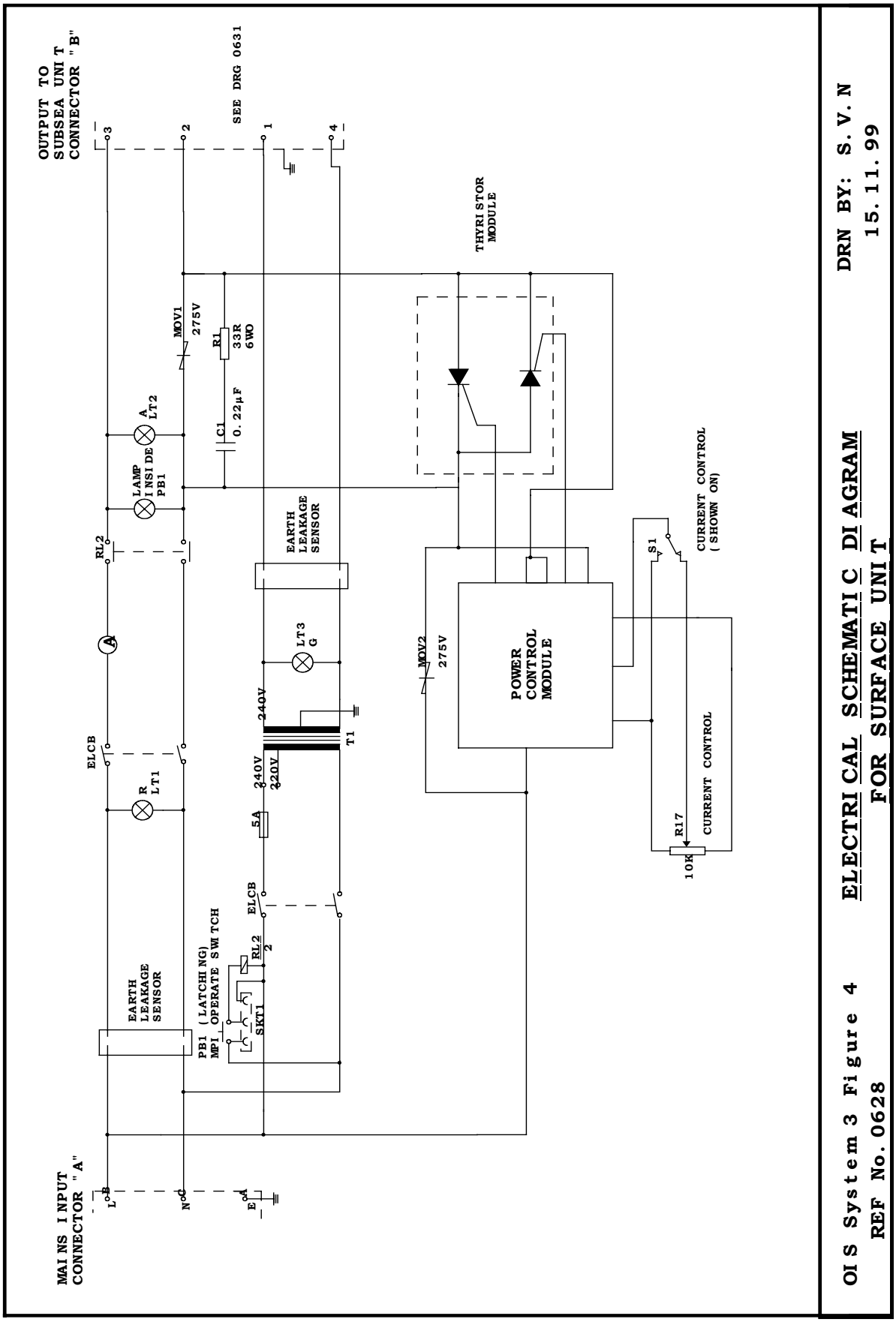
b) Black Light and Pump Circuitry

Supply brought through to the tapped transformer TI via the earth leakage circuit breaker and a 5A anti surge fuse. The tapping can be set to either 240V or 220V AC giving flexibility to the black light output. The secondary of TI is centre tapped to earth to reduce effective line voltage for safety reasons. The earth leakage sensor is set to operate at 20mA and the output goes out on pins 1 and 4 of connector 'B'. When the circuit breaker is energised LT3 (green lamp) is illuminated.

c) Current Control Circuitry

Magnetising current can be varied from zero to maximum delivery (dependable on number of turns in the magnetising coil) by adjustment of the current control potentiometer (clockwise for increased current). This potentiometer adjusts the control voltage to the power control module, which in turn adjusts the phase angle of the trigger pulse to the thyristor module.





SUBSEA UNIT (See Figure 5)

The submersible unit is housed in a pressure-balanced container. A diaphragm is mounted in the base of the unit to compensate for variations in pressure. The housing is completely filled with a high grade dewatering fluid.

Two connectors are fitted onto the top of the submersible unit. Firstly a four pin male receptacle which brings the umbilical supply in, and secondly, a four pin EO connector which supplies power to the ultraviolet lamp.

The MPI input supply is connected directly to the primary of the 1500 amp transformer, the secondary is brought out of the unit via 3 brass conductor/penetrators. The HWDC supply is via 3 x 500 amp diodes in parallel.

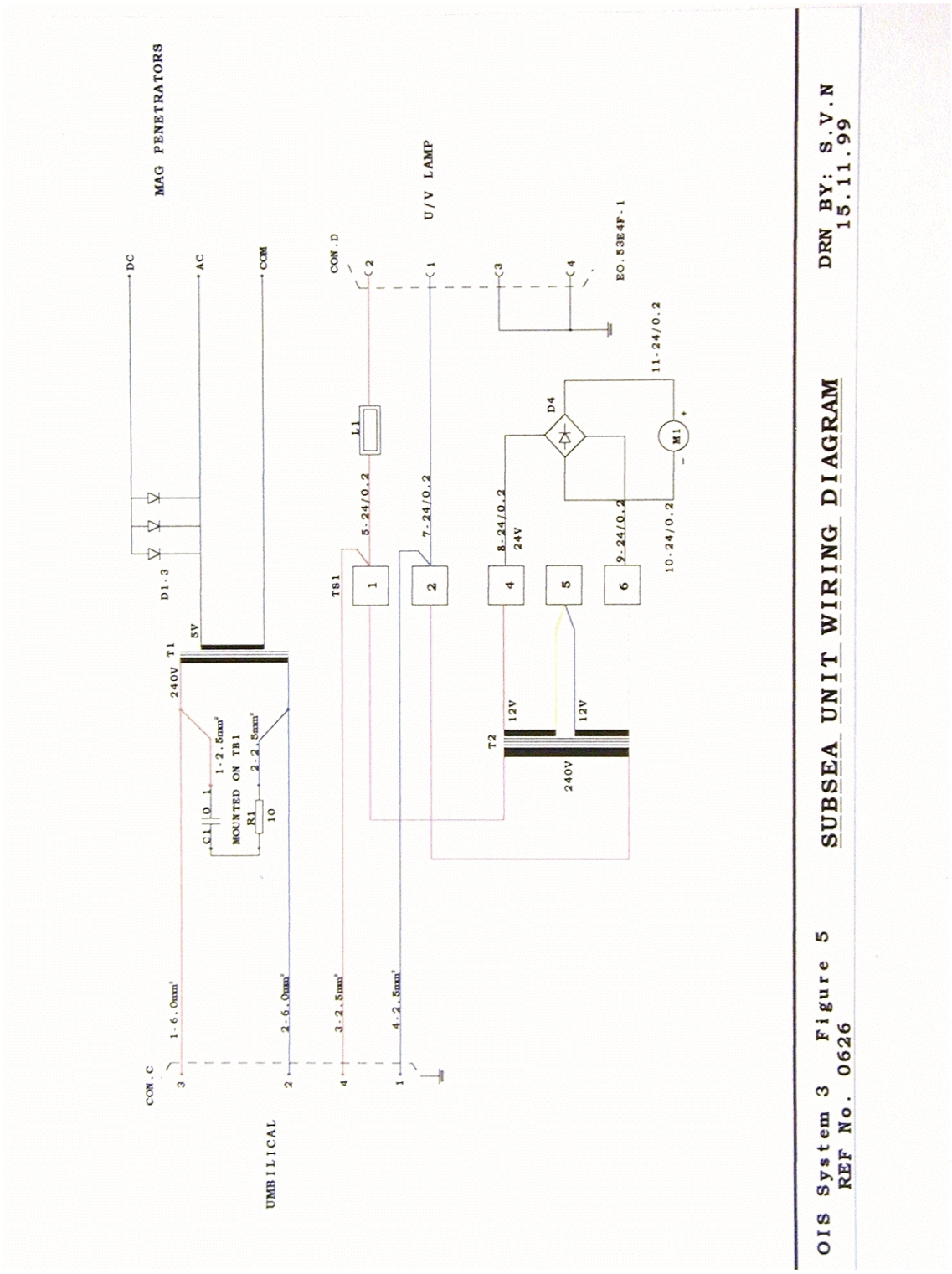
The umbilical connector also brings in the isolated mains supply to operate the U/V lamp via a HPMV choke and provides primary power for T2, the secondary of T2 provides 0, 12 and 24V DC supplies via a bridge rectifier to operate the agitation and dispensing motor/pump which runs continuously.

Umbilical Cable

This is a five-conductor steel wire armoured electromechanical cable. The braid acts as the earth line and cable restrainer. A 'Chinese finger' is fitted to the subsea end and attached to the lifting eye to take the strain off the connector.

BRIEF TECHNICAL DATA

Magnetising Prods	1500 amps AC or DC. 8" - 12" spacing of electrodes with lead or copper tips, variable output, open circuit voltage of 5 volts.
Coil or Cable	42.5ft continuous loop, 1000 amps AC or DC 5 volts. Duty cycle continuously rated.
Electromagnet	Articulated 5V DC [HWDC or FWDC].
Ultraviolet Lamp	With fluorescent dispensing nozzle and switch. 200V x 100 watt lamp. Output at 0.5 metre in excess of 250 lux.
Fluid Dispensing System	Delivery at 25 psi above ambient. Capacity 10 litres of mixed fluid. Container easily replaced underwater.



SECTION 3 - OPERATING INSTRUCTIONS

SUPPLIES

1. Single Phase Operation (Figure 6a)
   The two primary windings are paralleled together to give the required input, ranging from 210 VAC to 240 VAC. Figure 6a shows the connections for 240 VAC; link 1 to 1, and 6 to 6, and connect input between 5 and 2.

2. Three Phase Operation (Figure 6b)
   In situations where no neutral exists and a 3-phase supply is used the two primary windings are wired in series to give the required input ranging from 480VAC to 380VAC. Figure 6b shows the connections for 440 VAC using two of the three-phase supply. Link 1 and 6 and connect input between 4 and 1. The dotted line shows connections for 380 VAC. Link 1 and 4, and connect input between 4 and 3.

   Note: Different link combinations can be used for different supply inputs.

   Secondary 240VAC with a centre tap to earth (through connector 7) as in Figure 6 is the normal configuration for the output.

PREPARATION OF INKS

Ink reservoir holds approximately 10 litres of ink. Prepare ink according to manufacturers instructions. For the most critical inspection use fine particle fluorescent inks.

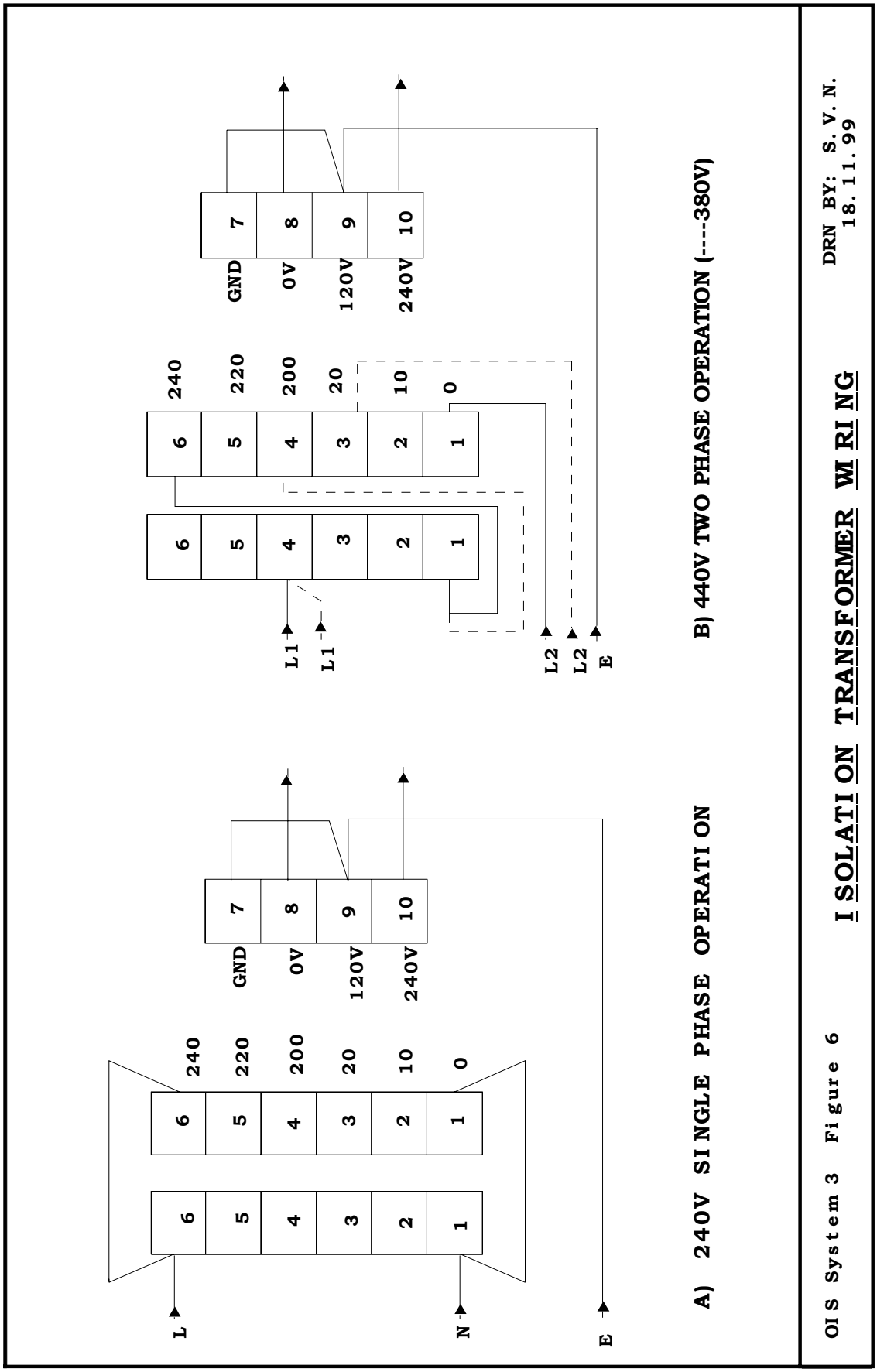
UMBILICAL CONNECTIONS

Connect mains umbilical to submersible unit. The connector should be sprayed with silicone grease every second connection. Twist the connector until locating pins align and screw down firmly. Do not force or over-tighten connector.

Connect the light umbilical to the submersible unit. The EO connector should be lubricated with silicone grease on every application. Connect quick release fluid supply. Check that this connector is secure.

After positioning submersible unit as close as possible to the weld to be inspected, connect the umbilical to the surface control supply unit. **NB**: The surface unit may be stood on its side to prevent damage to the unit and kept dry. Electrical trips should be accessible to controller and output meter clearly visible. Connect remote MPI magnetisation button if required.

Ensure that the trips are in the off position (off is in downward position). Connect mains supply as above. Mains input light should now be on. For supplies other than 240 volts or when used on DNV certified inspections a mains isolation transformer must be used.



DRN BY: S.V.N.
18.11.99

ISOLATION TRANSFORMER WIRING

OIS System 3 Figure 6

METHOD OF MAGNETISATION

After selecting method of magnetisation to be used, i.e. prods, electromagnet or mag loop, connect one terminal to the required AC or DC penetrator on the top of the submersible unit and the other to the common penetrator. Note: the terminals should be secure but not over-tightened. Either lead terminal may be used for common. In the case of the closed mag loop it is often easier to "rig" the cable as required before connecting the second terminal.

Connect ink reservoir and shake to agitate particles. Ink reservoir to be placed on the tope of the submersible unit and the ink agitation hoses connected. These hoses are inter-changeable but when connecting ensure that the outlet connector is terminated first. Agitation in the ink reservoir should be clearly visible.

Depress the ink button on the U/V Lamp until the ink fluid is emitted from the line to ensure that all the air locks are removed.

Perform the MPI examination. See notes on Magnetic Particle Inspection.
Note 1: Ink reservoir may be changed out easily. Magnetising power is switched on at surface on request from the diver. Magnetising currents switched on by switch on surface unit or remote control.
Note 2: The 100 watt ultraviolet bulb features a mercury vapour arc lamp which can be tripped out in certain positions in the magnetic field. In the event the lamp goes out, remove from the vicinity of the coil, prods etc., and leave to stand for 5 minutes. Do not use lamp for extended periods out of water. Do not place in cold water after extended period switched on the surface.

ALTERNATIVE DEPLOYMENT

The unit may be made neutrally buoyant using a buoyancy collar and gas supplied by divers pneumo. Float the submersible into location. It is possible to make all connections underwater. Ensure there is no power on the umbilical (both electrical trips should be in down position) before connection., Connect ink reservoir as above. Depress trigger until ink is emitted.

On completion of inspection recover MPI submersible unit. On surface disconnect ink reservoir and place fluid hoses into a bucket of fresh water. With agitation supply on (5 amp electrical trip) the system will flush through itself. Depress trigger until fresh water is emitted from lamp so that the ink umbilical is cleaned. Switch off all power. Clean and silicone spray connectors. Silicone spray the sliding prods and adjustable poles on the electromagnet if used. Replaced prod tips if required. Replenish ink reservoir as required. Always shake reservoir before connection to submersible unit.

Note: It is essential that after several dives the dewatering fluid level should be checked and if necessary topped up.

SECTION 4 - BASIC NOTES ON MAGNETIC PARTICLE INSPECTION

NOTE: This method detects surface-breaking defects in ferromagnetic materials only.

CLEANING

Prior to any form of magnetic particle inspection the material must be cleaned to bare metal. Needle guns must not be used. Hydrojets or wire brushes are often acceptable but for the best finish use some form of grit injection system. For weld inspection, area at least 4" either side of any weld should be cleaned as specified in procedure.

Then perform a visual inspection of the weld using a powerful white light.

SELECTION OF INK TYPE

Only fluorescent ink suitable for water dilution should be used. The ink reservoir holds 10 litres of ready mix and should be mixed according to manufacturer's instructions or according to certifying authority's procedure. For the most critical form of MPI a fine particle fluorescent magnetic ink should be used. It may be necessary to change the ink for better results with photography.

METHOD OF MAGNETISATION

Will normally be specified by certifying authority's procedure.

There are three basic methods, the advantages of each are explained below. Note the unit may be used with ultraviolet light or ink in conjunction with a permanent magnet but the magnetisation achieved by this method may well be unacceptable. The magnetisation will depend on several variables, e.g. strength of magnet, contact between magnet and metal surface, cleanliness of surface, permeability of material.

MAGNETISATION BY ELECTROMAGNET

Connect the electromagnet to the submersible unit using terminal block between AC and common. [Can be fitted either way round]- **do not over tighten!**. Leads are interchangeable. Select maximum output on surface control box. This gives full wave rectified DC.

Adjust pole pieces to suit configuration to give maximum contact. Pole piece ends must be at right angle to material surface i.e.: (See Figure 7a).

The electromagnet must be energised on the surface either on the control unit or remote lead. Select maximum output (triac switch on OFF position). The magnetising output will show a low amperage, this is normal.

The magnetising force occurring directly between the poles. The fluorescent ink must be applied while the electromagnet is in the correct position and the magnetising current ON.
Note:The interpretation must only be made between the poles and defects located transverse to this field will be preferentially located. i.e.: (see Figure 7b).

The optimum position for location of the defect is with the defect perpendicular to the field. However, it is possible to locate defects with the field angled up to 45° from the normal.

Thus using only an electromagnet the electromagnet must be positioned twice at each point on the weld or material surface to cover all possible orientations of defects (See Figure 7c).

MAGNETISATION BY PRODS

Ensure new lead prod tips are used. Under no circumstances use worn tips when it is possible that contact might be made between brass prod and metal.

Connect prods to submersible unit, either lead to common terminal and second lead to AC or DC terminal. DO NOT OVERTIGHTEN:

Adjust prod spacing as required. Report prod spacing to surface. Surface should select triac current on and vary output to 100 amps/inch. AC, 120 amps/inch DC. Magnetising current is switched on by surface at request of diver.

The diver applies the prods to area to be tested and when correct positioning is achieved, current is read on surface output meter and diver will feel a "buzz" from the prods. While the current is flowing the ink must be applied and inspection with the ultraviolet light made. It may be found advantageous to add buoyancy in the prod leads - e.g. with trawl floats. Even so, this technique is extremely difficult for single diver operation and two-diver operation with the first diver applying the prods while second diver applies the ink and inspects, is preferable.

As current flows between the prods a field is produced at right angles which will preferentially show defects perpendicular to the field (See Figure 8a).

As for electromagnet, the prods must be used in 2 positions at each point of inspection. Interpretation should only be made between the prod tips.

Two fields must be produced at right angles to ensure that defects in all possible orientations are located.

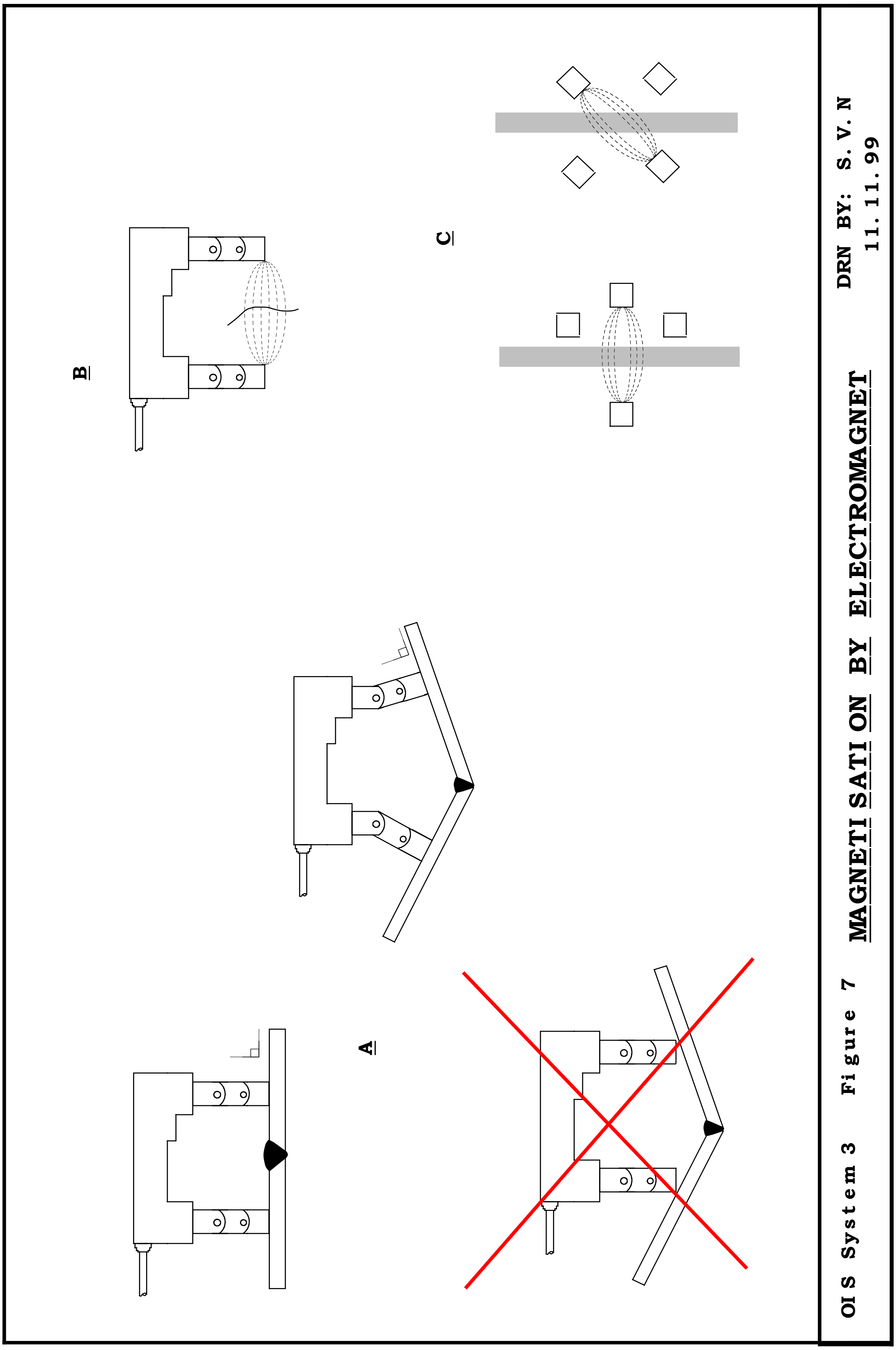
Advantages

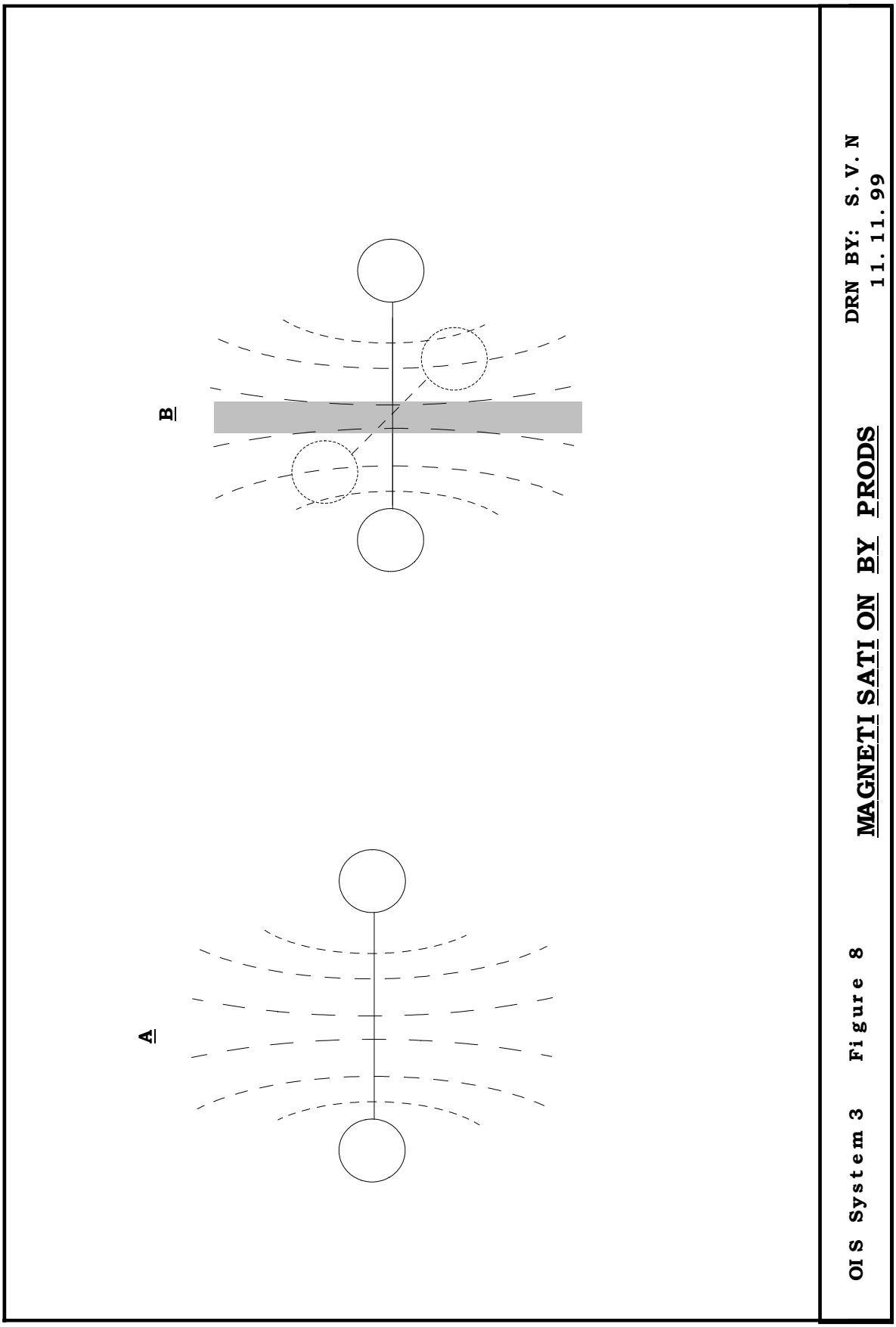
With a given current flow a known magnetisation force is produced. This is the only method where a guaranteed magnetising force is produced.

Disadvantages

Very difficult for single diver operation, surface must be very clean to enable good prod contact. Prod tips must be renewed regularly. Poor prod contact may result in localised heating of the surface, which may result in 'Star' cracking.

ASAMS





MAGNETISATION BY CLOSED LOOP

A procedure must be set up for each weld inspection. The standard is a 14.5 metre cable, which may be coil, or parallel conductor wrapped as standard, but different cable lengths for specific applications may be produced.

The diver connects one end of the loop onto the common terminal - DO NOT OVERTIGHTEN! The coil or parallel conductor is then wrapped around the workpiece and the other end secured to AC or DC terminal.

Using a reducing AC field it is possible to demagnetise. (See figures 9a and b)
Or split coil - parallel conductor. (See figures 9c, d and e).
All the techniques will indicate a longitudinal weld defects preferentially.

An individual procedure must be proposed for each inspection taking into account workpiece size, configuration etc.

The coil may be held in position with small horseshoe magnets which will have negligible effect on the field produced. The aim is to get the coil in as close as possible contact with the parent metal. For parallel conduction the ideal is a set spacing between the conductors.

Although this technique will take time to set up properly, once set up the inspection will proceed rapidly. While the coil is energised the diver applies the ink and inspects with the ultraviolet light. If several similar butts are to be inspected it may be advantageous to consider the use of a "JIG", i.e. (see Figure 9f).

The diver fits the jig then connects the leads from the submersible unit.

Note: the technique only magnetises in one direction, looking for longitudinal defects. One should then use prods or electromagnet to detect any transverse defects.

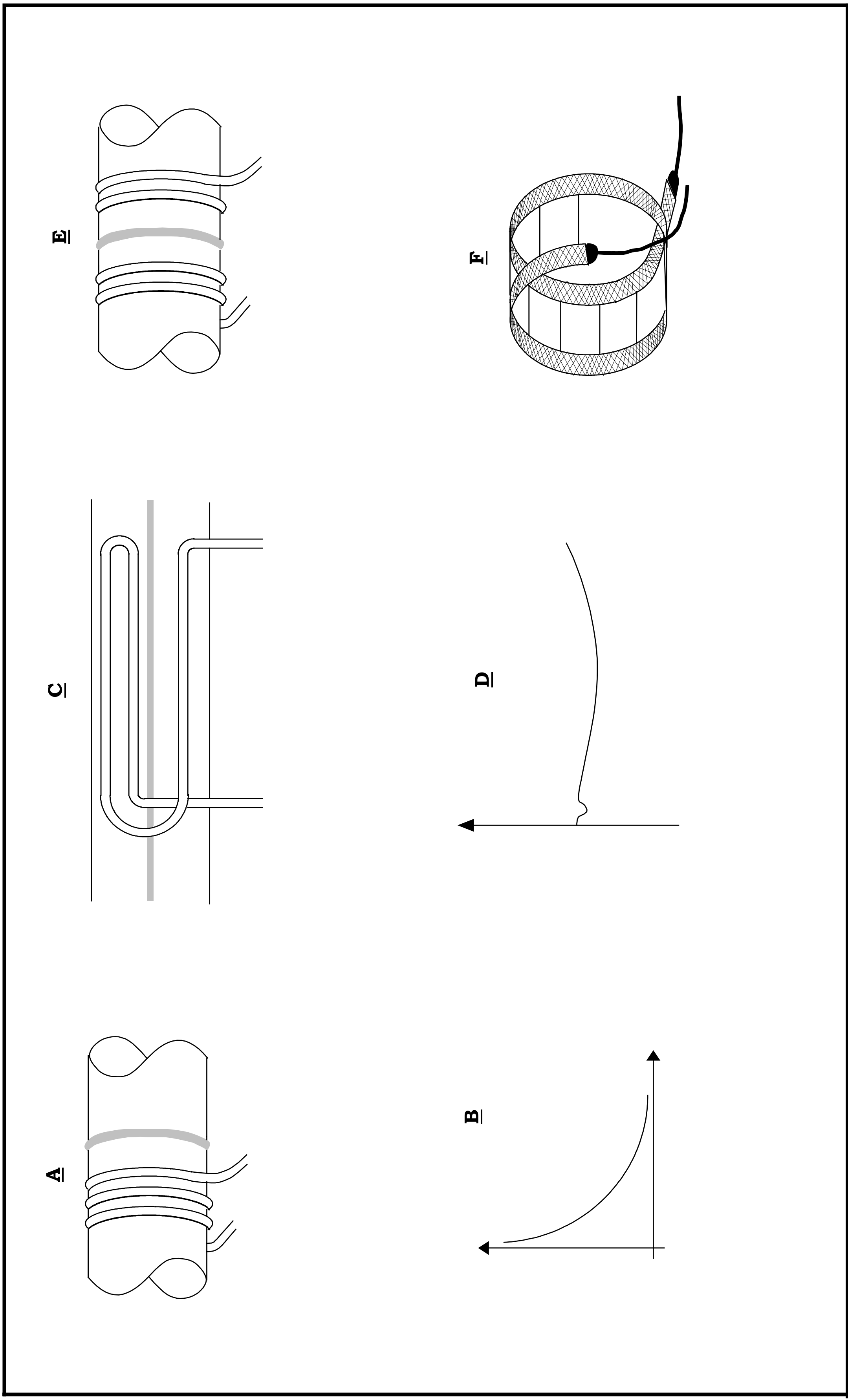
Advantages
Very good technique for detecting longitudinal defects. Once set up inspection is relatively easy for diver.

Disadvantages
Takes time to set up, only good for longitudinal defects, procedure must be written for each separate inspection. No guaranteed magnetising force. Magnetising force will depend on correct application of coil.

USE OF FLUX INDICATORS

There are a few flux indicators available, the most widely used being the Burmah Castrol type.

Their use is to be recommended as an indication of magnetising force only. They were developed for surface use and their use underwater should be as a guide only and strict adherence to the manufacturer's instructions is necessary.



OIS System 3 Figure 9 **MAGNETISATION BY CLOSED LOOP** DRN BY: S.V.N 11.11.99

SECTION 5 - A. FAULT FINDING

Fault Description	Diagnosis
1. Either or both circuit breaker tripping out.	(a) Damaged/flooded umbilical causing imbalance supply lines to earth. (b) Sea water ingressed subsea unit.
2. Main contactors energises and O/P lamp illuminated but no current being drawn	(a) Bad contact between prod tips and working surface. (b) Faulty subsea transformer by prods.(check terminal voltage 5VAC or 5VHWDC on penetrators).
3. Intermittent U/V lamp.	(a) Intermittent U/V lamp umbilical (b) Faulty U/V lamp penetrator or EO connector. (c) Faulty U/V lamp.
4. No U/V lamp and pump, green light not illuminated	(a) 5A fuse blown on surface unit. (b) 5A ELCB faulty switch mechanism
5. No ink dispensing and agitation	(a) Pump motor shaft seized in housing lid. (b) Ingress of salt water into subsea unit (c) Rubber pump impellor stripped
6. U/V lamp goes out when operating near the mag loop.	(a) lamp possibly too close to working area - field from loop interrupting U/V lamp.
7. No magnetising from yoke.	(a) Switch on yoke faulty. (b) No output from subsea unit (c) Open circuit supply cable from subsea unit to yoke.
8. Low output from mag loop - AC surface or DC	(a) Check mains supply to unit and check tapping on isolation transformer. (b) Check loop connectors and penetrators on subsea unit for corrosion.
9. Poor flow of ink to dispensing nozzle	(a) Impellor faulty in pump. (b) Blocked nozzle or valve on U/V lamp.

Fault Description	Diagnosis
10. U/V lamp and pump circuit breaker tripping out	(a) Flooded lamp housing (b) Short circuit in:- (i) U/V lamp umbilical (ii) U/V lamp penetrator (iii) Subsea penetrator
11. Lamp fails to strike and/or relays chatter in surface unit.	(a) Low input supply, check voltage to isolation transformer and adjust tappings as necessary.

SECTION 5B - USEFUL ADDITIONAL INFORMATION

1. It is essential to avoid 'pitting' on the main umbilical connectors and their mating plugs and sockets. This is achieved by:-

   (a) Not making and breaking connections while the main power is on.
   (b) Ensuring the connections are good.

2. The subsea unit is designed to be lifted (either by umbilical or restrainer) ONLY by the central lifting lug on the subsea lid.

SECTION 6 - MPI COMPONENT AND SPARES LIST

ASAMS LTD

SYSTEM 3 MPI UNIT SPARES LIST

A - SURFACE UNIT

Item	Description
M101	Lifting Handle
M102	Mains Transformer
M103	Bulkhead Receptacle - Umbilical
M104	Mains Input Receptacle
M105	Meter
M106	Contactor
M107	Switch
M108	Mag. Current Switch - Complete
M109	Indicator Lamp - State Colour
M110	30 amp Breaker (ELCB)
M111	10 amp Breaker (ELCB)
M113	3 pin Receptacle - RCU
M114	3 pin Plug - RCU
M115	Demag Control Knob
M116	Fuse Holder
M117	Potentiometer
M118	Surface Remote Control Unit
M119	Mains Lead
M120	Current Control Board
M121	Surface Stainless Box
M122	Surface Unit Lid
M123	Surface Unit Lid
M124	Surface Unit catch
M125	Pack 10A 1.25” Fuses
M126	Mains Input Connector
M127	Mains Input Connector Assembly Kit
M128	Lewden Plug
M129	Adaptor Plate Kit [for use with M110, M111 on pre ‘91 units]
M130	Earth Leakage Sensor

B - SUBSEA UNIT

Item	Description
M201	Mains Transformer
M202	24 volt Toroidal Transformer
M203	G9M4 Motor
M204	EO Connector [UV supply]
M205	Umbilical Bulkhead Connector
M206	Penetrator Nut Cover
M207	Motor Seal
M208	Choke
M209	3/16" 'O' Ring
M210	Check Valve
M211	Prod Tip - Pair
M212	Check Valve [UV Lamp]
M213	Pump Housing
M214	SK92 Pump Spares Kit [old type]
M215	Mag Loop Spade Ends - Pair
M216	Mag Loop In-Line Connector
M217	Bridge Rectifier
M218	Ink Hose - Suction
M219	Ink Hose - Discharge
M220	Subsea Housing
M221	Subsea Housing Lid
M222	Tubular Protection Rail
M223	Diaphragm Mat
M224	Diaphragm Retainer Ring
M225	Penetrator - Complete
M226	SK374 Pump Spares Kit [new type]
M227	Subsea Pot Oil - 5LT Drum
M228	Pump Spacer

C - MKII UV LAMP

Item	Description
M301	Woods Filter
M302	'O' Ring Kit No1
M303	'O' Ring Kit No2
M304	'O' Ring Kit No3
M305	No Longer Available - see M311
M306	No Longer Available - see M311
M307	Pressure Valve
M308	Ink Dispensing Nozzle
M309	UV Bulb 240v 100watt [lamps up to UVL145]
M309N	UV Bulb 240v 100watt [lamps UVL146N onwards]
M310	UV Bulb Holder [lamps up to UVL145]
M310N	UV Bulb Holder [lamps UVL146N onwards]
M311	UV Lamp Electrical Supply Lead
M312	UV Lamp Ink Hose
M313	Nylon Face Plate
M314	Aluminium Lens Support Plate
M315	Brass Hose Tail - RB16
M316	Hose Connector
M317	UV Lamp Springs

D - INK RESERVOIR

Item	Description
M601	Ink Bag
M602	3/8" Check Valve Assembly

E - UMBILICAL

Item	Description
M701	Umbilical cable
M702	Litton Surface Connector
M703	Connector
M704	Bell Housing
M705	'Chinese Finger'
M706	3/8" Shackle

F - ISOLATION TRANSFORMER

Item	Description
M801	Isolation Transformer Bulkhead Connector

ASAMS LIMITED

SYSTEM 3 MPI UNIT - COMPONENT LIST

Item	Description
M100	Surface Unit - Complete
M200	Subsea Unit - Complete
M300	Underwater UV Lamp - Complete
M400	Magnetising Cable Loop
M500	Magnetising Prods
M600	Ink Reservoir - Complete
M700	Umbilical Cable - 200M
M750	Umbilical Cable - 300M
M800	Isolation Transformer
M900	Surface Remote Control Unit
M1000	Electromagnetic Yoke