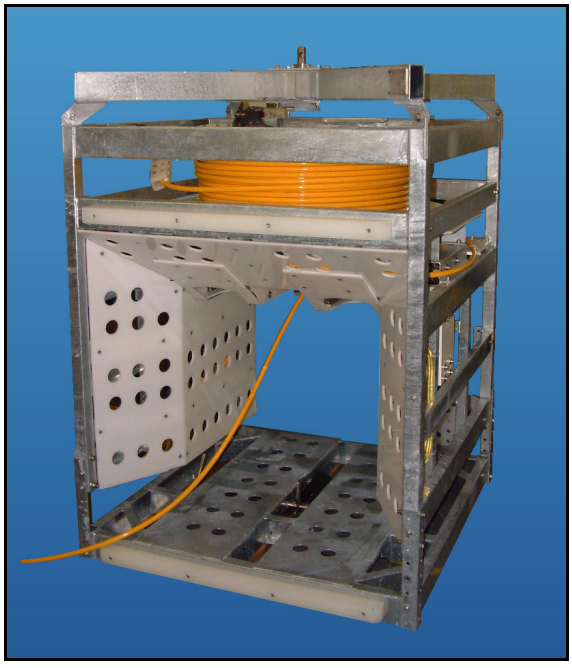
Seaeye Tether Management System Type TMS2T

Technical Manual



System Tiger 880

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WARNING

System Compatibility Issues

SAAB SEAEYE Systems utilise major assemblies that may appear, on casual external examination, to be generic items common to all systems in the modern SAAB SEAEYE fleet.

However, the use of increasingly complex technology and the frequent implementation of customer-requested system-specific modifications above baseline specifications may result in a Health and Safety Risk to personnel and damage to equipment and material should such modified equipment be substituted between systems.

CONSEQUENTLY, SEAEYE TECHNICAL DIRECTORATE ADVISE THAT SERIAL NUMBERED MAJOR ASSEMBLIES SUPPLIED WITH A VEHICLE SYSTEM SHOULD AT ALL TIMES REMAIN WITH THAT SYSTEM.

SAAB SEAEYE ARE UNABLE TO ACCEPT RESPONSIBILITY OR LIABILITY FOR EQUIPMENT IF THIS IS NOT OBSERVED.

Should major assemblies (e.g. SI-SCU, SI-PSUs, Junction Boxes, Umbilicals, Software etc) from one system be utilised (as spares provisions or as repair-by-replacement items in the field) on another system, Health and Safety risks to personnel and risks of damage to equipment and material exist.

Operators possessing SAAB SEAEYE ROV Systems who wish to interchange major assemblies between one system and another do so at their own risk. Where any doubt exists as to the compatibility of major assemblies between one system build and another, SAAB SEAEYE may be contacted for advice prior to attempting such operational interchange.

Saab Seaeye Ltd. 20 Brunel Way, Segensworth East, Fareham, Hampshire, PO15 5SD, England

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In respect of the Electromagnetic Compatibility Directive 89/336/EEC, attention is drawn to the following:

- The SEAEYE TMS system 'as delivered' complies with the essential protection requirements of the EMC Directive 89/336/EEC.
- In order to ensure that the SEAEYE TMS system complies with the Directive when installed for operational use, the installation instructions contained within this Technical Manual must be adhered to and the surface equipment installed within the screened enclosures with which they were supplied.
- The end user of (or authority responsible for) the installation of the SEAEYE TMS system becomes responsible for the complete installation's compliance with the Directive, particularly under the following circumstances:
  - additional equipments are used in conjunction with the system (unless they are supplied by SAAB SEAEYE LTD), or
  - modifications are made to the system (or part thereof), or
  - surface equipment is removed from its 'as-built' enclosures for subsequent installation in third-party racks or consoles.
- During Maintenance Procedures, when the system is operated outside its normal operating environment and/or screened enclosures are opened for access, the equipment may emit, or be susceptible to, electromagnetic interference (EMI). The equipment should be sited away from safety critical, essential communication, or navigation systems during such activities. It is advisable to site the surface equipment away from critical electronic systems at all times.
- It is recommended that electrical power for the SEAEYE TMS system is provided using a dedicated supply which is not also used to power safety critical, essential communication, or navigation equipment.
- Any questions in respect of the Compliance of any SAAB SEAEYE LTD equipment with the EMC Directive, or any field reports of EMC related faults, should be addressed to the Engineering Director at SAAB SEAEYE LTD.

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PREFACE

The purpose of this Technical Manual is to provide the Tether Management System (TMS) maintainer/operator with concise information and instructions on the operating, technical and maintenance aspects of the Tether Management System (TMS). The book is written for a maintainer/ operator with a reasonable understanding of electrical and mechanical principles and a sound understanding of safe working practices. It is recommended that on receipt of the TMS that the handbooks are read in their entirety prior to assembly, installation and first operational use. If a specialist understanding of the technical and maintenance aspects of the system is required a training course can be provided by Saab Seaeye Ltd.

The Technical Manual consists of the following:

System Overview - Provides a general description of the main units as an introduction to the system, the TMS system technical specification and any related information.

Operating Information - Provides a description of unit controls and indicators for easy reference. Instructions on how to assemble, install, configure and operate the system.

Functional Description - Provides functional descriptions and block diagrams of the power distribution, video and control systems.

Maintenance Information - Provides maintenance instructions on how to remove, dismantle, assemble and refit the major units, procedures and diagnostics.

Parts Lists - Provides the TMS system parts lists.

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ISSUE STATUS AND AMMENDMENTS

ISSUE STATUS	PAGES AFFECTED	DATE OF CHANGE	REASON FOR CHANGE

Table. 1 Manuual Issue Status

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WARRANTY STATEMENT

Products sold by SAAB SEAEYE LIMITED (hereafter referred to as SEAEYE) are guaranteed to the **original** purchaser as follows:

Subject to the exceptions and upon the conditions stated hereafter, SEAEYE agrees to correct, either by way of repair, or at SEAEYE's sole discretion, by way of replacement, any defect of material or workmanship which develops as follows:

- SEAEYE Tether Management System : 12 months,
- SEAEYE SM4 Bailing Motor : 24 months,
- SEAEYE parts returned on completion of Repair : 3 months,

from dispatch of the product to the **original** purchaser by SEAEYE or it's authorised representative, provided that the investigation and factory inspection by SEAEYE disclose that such defect developed under normal and proper use and not due to fair wear and tear or misuse by the user for its intended purpose. Repair or replacement are the exclusive remedies under this guarantee, and further provided that the guarantee granted hereby shall not include parts, materials, or spare parts that SEAEYE considers as expendables under normal operating conditions.

The exceptions and conditions mentioned above are as follows:

a SEAEYE make no guarantee concerning components or accessories that are not of it's own manufacture. All goods sold and manufactured by other manufacturers are sold subject to the manufacturer's guarantee, which shall be assigned to the purchaser or authorised representative. SEAEYE in so far as it is appointed by the agents of a manufacturer to carry out repair work under such guarantees will, where it considers it appropriate, carry out the necessary repair work on terms agreed by SEAEYE and purchaser or authorized representative having regard to the liability of the manufacturer under it's guarantee. Notwithstanding anything in this paragraph, any goods sold but not manufactured by SEAEYE are not supplied with any warranty whether express or implied and warranty imposed by common law or statute including the warranty of merchantable quality and the implied warranty of fitness for a particular purpose contained in the UK Sales of Goods Act 1979 Section 14 is expressly excluded although SEAEYE undertakes to take reasonable care in supplying suitable goods and giving particulars of performance.

b SEAEYE shall be released from all obligations under its guarantee in the events that repairs or modifications are made by persons other than its own authorised service personnel or trained and authorized representative, unless such repairs or modifications by others are made with prior written consent by a Director of SEAEYE. In the event of a failure, and the purchaser or agent authorized by the purchaser or the operator fails to take prompt and reasonable action to prevent further damage, SEAEYE will not accept any responsibility for consequent damage. "Normal and Proper use" of a product includes without limitation performing routine preventative maintenance in accordance with the appropriate instructions within the appropriate service and/or maintenance manual.

c SEAEYE products, systems and parts are Ex-works at the company's UK site. SEAEYE is not responsible for carriage/shipment/duty/taxes/insurance or any other costs for any product, system or part either dispatched to or from the company's UK site.

d There are no guarantees which extend beyond those expressly provided for herein and the aforesaid guarantee and SEAEYE's obligations and liabilities there under are in lieu of, and the customer waives, all other guarantees, express or implied, and all other liabilities therefore arising by law or otherwise, including without limitation any implied guarantee of merchantability or fitness for a particular purpose, and all obligations and liabilities with respect to loss of use, revenue or profit, or indirect, consequential or incidental damages of any kind and from manufacture, sale, handling, shipment, repair, maintenance or replacement of said products.

e Representations and warranties made by any person, including dealers and representatives of SEAEYE that are inconsistent or in conflict with the terms of this guarantee (including but not limited to the limitations of the liability of SEAEYE as set forth previously), shall not be binding upon SEAEYE unless reduced to writing and approved by an officer of SEAEYE.

f SEAEYE's liability arising from the sale or use of a product sold by SEAEYE shall be limited to SEAEYE's cost of correcting defects, as provided herein, or the total cost of such product as shown on the purchase order pursuant to which it was purchased, whichever is less. All such liabilities will terminate upon expiration of the guarantee period.

g This guarantee shall be provided for and governed by the prevailing laws of England.

General Information

Specifications: SEAEYE reserves the right to change specifications at any time without due notice and without incurring any obligation to incorporate any new features in any of it's previous products, whether or not they have been sold.

Damage in Shipment: Each new product is carefully examined and checked prior to dispatch from SEAEYE's premises. It should be carefully examined and operationally tested on receipt by the receiving party. If the product is damaged in any way, then a claim should be lodged with the carrier. New or repaired product that has been damaged in transit should not be returned to SEAEYE without first obtaining specific shipping instructions from SEAEYE.

Repairs: If any fault develops, the following steps should be taken:

- Notify SEAEYE and give full details of the difficulty. Include in this notification the model type and its serial number. On receipt of this information SEAEYE may elect to either issue service instructions or provide full shipping data for the return of the equipment.
- After shipping instructions are supplied, forward the product(s) prepaid and repairs will be estimated and the client informed prior to any repairs to the fault(s) being carried out.
- The client may then issue SEAEYE an approved purchase order to cover the costs of the repair, if the fault has been caused by misuse or is not under guarantee.

Notes to Readers

Warnings, Cautions and Notes

Throughout this Publication warnings and notes are used to direct the readers attention to specific information.

A **WARNING** is used to alert the reader to operational or maintenance activities that may, under certain circumstances, represent a threat to safety and health. A warning precedes the paragraph or procedure which gives rise to such a threat.

A **Caution** is used to alert the reader to operational or maintenance activities which, may under certain circumstances, cause damage to equipment and/or material. A caution precedes the paragraph or procedure to which it refers.

A **Note** contains information of a specific or general nature and is printed immediately after the paragraph to which it refers.

The following symbols are used through this document:

WARNING – Risk of Personal Injury

WARNING – Take precautions against Static Electricity

WARNING – Risk of Electric Shock

WARNING – Heavy Object

WARNING – Moving Parts

WARNING – Chemical Hazard

CAUTION – Wear Protective Equipment

List of abbreviations

A	Ampere
AC	Alternating Current
ADC	Analogue to Digital Converter
CCD	Charge-coupled Device
CPU	Central Processing Unit
DAC	Digital to Analogue Converter
DC	Direct Current
Deg.	Degree(s)
EPOD	Electronics Pod
FET	Field Effect Transistor
Fig.	Figure
HCU	Hand Control Unit
Hz	Hertz
IGFET	Insulated Gate Field Effect Transistor
I/O	Input/Output
JB	Junction Box
Kbd	Kilo baud
LIM	Line Insulation Monitor
SM4	Thrusters
MCB	Mains Circuit Breaker
MFIO	Multi-function Input/Output
NAV	Navigation Unit
PCB	Printed Circuit Board
PDU	Power Distribution Unit
PSU	Power Supply Unit
PWM	Pulse Width Modulated
ROV	Remotely Operated Vehicle
SCR	Silicon-Controlled Rectifier
SIT	Silicon-Intensifier Target
STU	Surface Transformer Unit
SU	Surface Unit
TMS	Tether Management System
Toggle	Change to one of two states. Hardware or Software
VAC	Volts AC
VDC	Volts DC
W	Watts

WARNINGS

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMS SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

POSSIBILITY OF DAMAGE TO EQUIPMENT. UNDER NO CIRCUMSTANCES IS THE TMS EPOD TO BE ASSEMBLED WITHOUT ANTI-EXTRUSION RINGS.

POSSIBLE DANGER TO PERSONNEL AND DAMAGE TO EQUIPMENT. THE ELECTRONICS POD WEIGHS APPROXIMATELY 33 KG, AND CARE SHOULD THEREFORE BE TAKEN WHEN LIFTING THE POD FOR SLINGING PURPOSES.

DANGER TO PERSONNEL AND EQUIPMENT. THE BAILING MOTOR MAY OPERATE WITHOUT WARNING WHEN THE SYSTEM DC SUPPLY IS ENERGISED. ENSURE THAT THE TMS IS CLEAR OF ANY OBSTRUCTION AND PERSONNEL PRIOR TO ENERGISING THE DC SUPPLY.

DANGER TO PERSONNEL AND EQUIPMENT. LIM'S (LINE INSULATION MONITOR) DO NOT FUNCTION AS PERSONAL SAFETY PROTECTION DEVICES. A LIM MONITORS THE STATUS OF THE SYSTEM AND WARNS OF A POTENTIAL FAULT, THE LIM CAN CUT SUPPLY FEED TO HELP PROTECT PERSONAL AND EQUIPMENT, BUT THE REACTION TIME OF THE LIM IS GENERALLY TOO SLOW TO PREVENT ELECTRICAL SHOCK.

Cautions

Danger of damage to PCBs. Do not remove or replace PCBs unless the supply is switched off. PCBs must be handled in accordance with electrostatic discharge handling procedures. Damage to PCBs could affect the safe operation of the equipment.

Danger of damage to equipment. When checking connections, care is to be taken not to slacken them, otherwise their watertight integrity may be breached.

Danger of damage to equipment. When using an insulation meter, ensure that the cable under test is disconnected at both ends.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

Danger of damage to lights. Do not operate the TMS light for longer than ten seconds in air.

Possibility of damage to equipment. Ensure all vent plugs are securely fitted and shut prior to immersing the TMS.

Possibility of damage to equipment. Ensure that the Surface Power Supply Unit (PSU) transformer tappings correspond to the external input power supply.

ENGINEERING ADVICE NOTES (EANs)

The purpose of an engineering advice note is to bring to the operator/maintainer's attention any safety, maintenance or operational related information that may present a threat to health or cause damage to equipment and are to be used in conjunction with the manual.

Any relevant EANs raised after the publication of this handbook will be issued by letter and are to be inserted into this manual.

IMPORTANT ADVICE NOTICE
ADDITIONAL RECOMMENDATIONS

The following recommendations and instructions have resulted from observations and reports experienced by operators in the field:

- Do not subject the TMS or associated equipment to shock or impact; do not drop, or allow objects to impact the equipment.
- To prevent damage to or unnecessary stress on chassis components, always use the lifting point(s) factory fitted to TMS launch-systems.
- Operating a TMS in close proximity to pile drivers will subject the vehicle to high levels of shock and pressure. This may well result in destruction of lamp unit filaments due to severe vibration. Over-pressure created by underwater equipment such as pile drivers or explosive processes may exceed the TMS's proof-pressure test certificate, resulting in damage to seals and enclosures and subsequent flooding.
- Do not remove electrical components, equipment or PCB's while the system is electrically live.
- Permitting bailing motors or TMS lamps to operate in air for periods in excess of that described in the Technical Manual may cause irreparable damage. Observe the cautions obtained in the relevant sections of the Technical Manual.
- Equipment should not be left exposed to direct sunlight as extreme temperatures can damage the electronic components.
- Equipment should not be left exposed to freezing conditions. Provide suitable covers or stow in a protected area.
- Do not disassemble equipment, particularly thrusters beyond the level described in the maintenance section.
- Do not attempt to increase the performance of the bailing motors by subjecting them to voltages in excess of specified levels. Ensure that the SPSU is set up and compensated correctly for the umbilical being used.
- System modifications carried out by customers or operators will not appear in either the Technical Manual or associated Wiring Diagrams Manual or in amendments issued by Seaeye.
- Ensure that all surface and subsea connectors are securely mated. Subsea neoprene connectors must be totally dry, clean and their end faces lightly coated with silicone grease before mating.
- It is usually necessary to carry out a complete Configuration procedure if PCB's and items of control equipment have been removed or replaced in the system.
- Conducting pre and post-operational checks reduces operational downtime.
- Check for the security of fasteners, fixtures and fittings prior to and on completion of operational use.

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CHAPTER 1

SYSTEM OVERVIEW

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1. SYSTEM OVERVIEW

This Chapter provides a general description of the main units as an introduction to the Tether Management System (TMS) Type TMS2T, the technical specification and any related information.

1.1 The Tether Management System

The purpose of the sub-sea TMS equipment is to afford protection to the Remotely Operated Vehicle (ROV) during both launch and recover situations in adverse sea states. The TMS is capable of operation in winds of Beaufort 6. An armoured lift cable provides the means for raising or lowering the launch system, and also provides electrical connections between the surface and sub-sea equipment. The lower end of the lift cable is terminated at the EPOD via a bullet arrangement. This bullet is secured to a single point lifting fitted on top of the launch system structure. When the TMS is lifted by the launching system (LARS or Winch), the bullet engages into a latch lock and sheave arrangement which is suspended from the LARS or Winch arm.

The TMS launch system may be deployed up to 1100 m from the customer's winch/Launch System. The ROV may be deployed up to 140 m (dependent on the length of the tether cable) from the launch system by means of a neutrally buoyant tether connecting the ROV to the launch system. This tether is spooled onto a fixed bobbin, located in the top section of the TMS and, unlike the main lift cable, is un-armoured. (The vehicle tether is not required to be subjected to heavy loads). The vehicle tether is bailed in and out by means of a motorised bailing system.

1.2 Power Supply Unit

The Power Supply Unit (PSU) Type 9PSU-2, provides the power supplies required by the ROV system and incorporates a series of protection devices, interlocks and a cooling fan. The PSU, when switched on, initialises internal AC and DC supplies that are only distributed when they are remotely operated from the Surface Unit. The PSU requires a customer supplied power input of 220 VAC through to 475 VAC, selectable via internal links.

Detailed information can be found in the ROV Technical Manual Book Two Chapter 1 that contains a full description and circuit diagrams.

Figure. 1.1 Power Supply Unit

1.3 Surface Unit

The Surface Unit (SU) Type 10PDU-1 provides the switching and distribution of the PSU supplies and is the main interface for the TMS and ROV system surface units. Functions include:

- AC and DC supply switching and distribution.
- DC Current and voltage indication.
- Control of video and video overlay.
- A keypad for setting up system configuration.
- Plugs and sockets for system connection.
- TMS control systems.

Detailed information can be found in the ROV Technical Manual Book Two Chapter 2 that contains a full description and circuit diagrams.

Figure. 1.2 Surface Unit

1.4 Hand Control Unit

The Hand Control Unit (HCU) Type HC(D)/5 provides the interface between the operator and vehicle by a series of switches and controls. The HCU controls the following:

- ROV functions.
- TMS Bailing IN/OUT.

Detailed information can be found in the ROV Technical Manual Book Two Chapter 3 that contains a full description and circuit diagrams.

Figure. 1.3 Hand Control Unit

1.4.1 Bailing Foot Operated Switch Unit

The Seaeye Bailing Foot Switch Unit provides the interface between the operator and TMS Bailing system by a series of foot controlled switches. The unit controls the TMS bailing In/ Out.

Figure. 1.4 TMS Foot Switches

1.5 SML Telemetry Monitor Unit

The Telemetry Monitor Unit and associated software is dual purpose; designed to monitor system telemetry as an aid to fault diagnosis and to transmit environmental data to external navigational/survey equipment. Extracted data from the telemetry is converted by the Data Converter from RS485 into RS232 format and received by an IBM compatible PC (not supplied) for subsequent display using the software provided. Environmental data from the PC can be transmitted via PC COM port 2 to external equipment for processing.

Figure. 1.5 Telemetry Monitor Unit

1.6 Umbilical and Tether

The TMS2T is designed to be used with the Seaeye Tiger ROV No. 880. This system uses the Type ADU3 main lift cable that consists of a multi-cored cable and used to route the following between the LARS and the TMS:

- TMS and Vehicle DC power.
- TMS and Vehicle AC power.
- Video signals.
- TMS and Vehicle telemetry.
- Sonar data.
- Auxiliary power and telemetry signals.
- Earths.

The ADU3 consists of the following cores:

- One fibre optic element with four G50/125/250µm.
- Three Twisted Pair 0.56 mm² cables with copper braid and foil wrapping.
- Three Twisted Pair Quad 0.56 mm² cables with drain wire, foil screen and PE jacket.
- Six cores 0.56 mm² cable with PE insulation.
- Drain wire and foil screen.
- Sixteen cores 3 mm² cables with XLPE insulation.
- Sixteen drain wires.
- TPE jacket.
- Two layers of galvanised steel wires.

The Tiger ROV tether is a multi-cored polyurethane tether cable used as the electrical communicating medium between the TMS and the vehicle. The tether is used for the following:

- DC power distribution.
- Vehicle AC power distribution.
- Video signals.
- Vehicle telemetry.
- Sonar data.
- Auxiliary supplies and telemetry signals.
- Earths.

1.7 Tether Management System

The TMS consists of a sub-sea deployment system and surface control equipment. The surface control equipment is integrated with the ROV Surface Unit to provide the means of communicating and controlling the operation of the TMS.

The main lift cable acts as the electrical interface between the surface electronics (Surface Unit) and the TMS electronics. The TMS has the advantage of incorporating a bailing arm system eliminating the need for sub-sea slip-rings.

The TMS2T system consists of the following major units:

- Surface Unit electronics (incorporated into the ROV Surface Control Unit).
- TMS cage (TMS2T).
- Tether.

The rectangular shaped launch frame, manufactured in three sections, is fabricated from steel sections which after drilling for fixing holes is hot dipped galvanised and painted, using two pack marine grade paint. The forward face of the frame is open, providing access to a polypropylene and D-rubber lined vehicle bay in which the ROV locates.

Every launch frame and lifting spider is subjected to a load test, and certified to a safe working load of 1000 kgs. The lifting spider is bolted to the launch frame with grade A4 stainless steel M14 bolts and Nyloc nuts. The lifting pin/boss are so designed to limit rotation of the launch system. The TMS cage consists of the following assemblies and components:

- TMS electronics pod.
- Hydrostatic release assembly.
- Tether bailing system.
- Lifting assembly.
- Pressure compensation system.
- Bail count sensor.
- SM4M bailing motor.
- Seaeye Mini Colour Camera Type P00864C-PF.

- Seaeye Lamp Unit Type P00357-M

The TMS primary drive is a type SM4M DC brushless motor, driving a roller chain sprocket through a reduction gearbox. The sprocket is mounted to the gearbox output shaft using a friction clutch arrangement. This clutch is to protect the system should any malfunction cause the tether bailing mechanism to stall.

The gearbox sprocket drives the primary chain, which directly drives a sheave wheel and a toothed-belt pulley.

The vehicle tether is gripped by the sheave wheel and the back surface of a driven toothed belt tensioned against the sheave wheel. This ensures enough friction between the sheave and tether to prevent any slip during bailing in or bailing out.

The sheave wheel is mounted directly to a one-way hub, through which another sprocket is mounted with a friction clutch. During the bailing in operation this sprocket drives the secondary chain directly driving a sprocket fixed to the bailing arm assembly. The friction clutch on the one-way hub is to set the tension of the tether windings on the bobbin. There must be some degree of constant slip to keep the tether taught and the windings even, allowing for the different length or tether wrapped by each turn of the bailing arm dependant on the diameter of the bobbin, which is affected by the quantity or tether already wound off the bobbin.

During the bailing out operation the hub can spin freely, allowing the sheave wheel to drive the tether, but no drive is transmitted to the bailing arm. The movement of the bailing arm is now driven by the action of the tether unwinding and pulling it around.

The uniform layering of the tether is achieved via another system of rollers and sprockets. One revolution of the bailing arm results in the rise or fall of the tether guide by an amount slightly greater than the tether diameter.

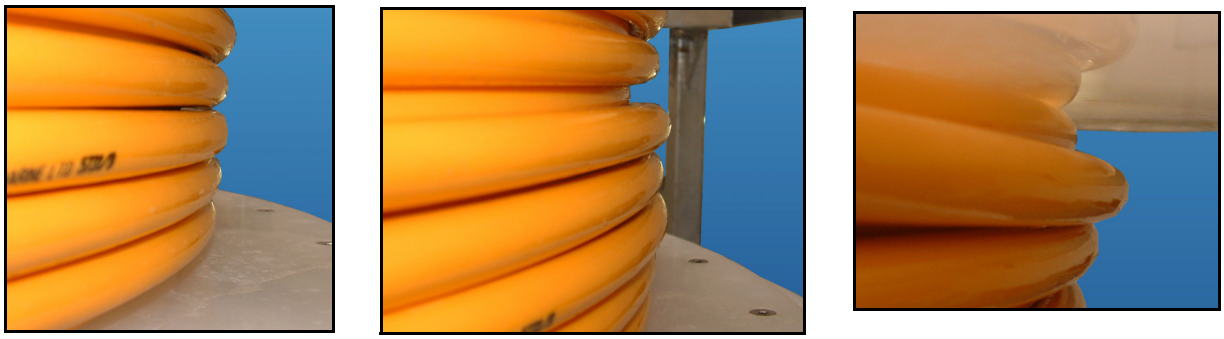

Figure. 1.6 Tether Shown Wound Correctly, Too Loose and Too Tight

A system of free running rollers guide the tether along a pre-determined route between the static bobbin and the vehicle bay.

1.7.1 Hydrostatic Release Assembly

The hydrostatic release assembly comprises of a Hydrostatic Locking Unit fitted at the bottom of the vehicle load compartment that releases the vehicle after the TMS2T has moved through the splash zone by approximately 10 to 15 metres.

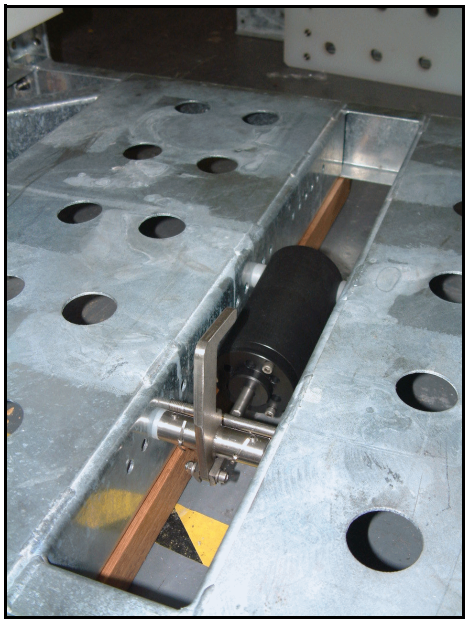

Figure. 1.7 Hydrostatic Release Assembly

1.7.2 Bailing Motor

The TMS uses a DC brushless bailing motor Type SM4M for driving the bailing system. The bailing motor drives a roller chain sprocket through a reduction gearbox.

Figure. 1.8 Bailing Motor

1.7.3 Idler Hub

The idler hub is powered directly from the primary chain. The output from the idler hub is transmitted via a slipping clutch, to protect the tensioned drive belt in the event that the drive belt becomes fouled. The pressure of the drive belt forcing the tether into contact with the powered sheave wheel ensures that when bailing is required, the tether is forced out of or onto the fixed bobbin as required. Free running guide rollers are fitted in the launch system frame to direct the vehicle tether along a pre-determined route between the static bobbin and the launch system vehicle bay.

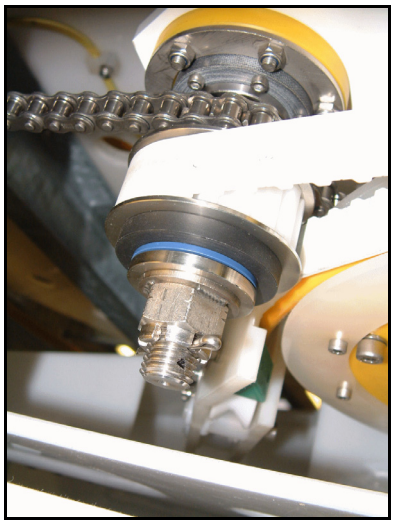

Figure. 1.9 Idler Hub

1.7.4 Drive Hub

Mounted on the Sheave Wheel is a one-way drive hub. Located in the upper part of the launch frame, the centrally located motorised bailing arm is free running as the vehicle tether is drawn from the bobbin and driven out of the TMS launch system vehicle bay by the powered sheave wheel and drive belt assembly when bailing out. During bailing in however, the arm is driven by a chain and sprocket assembly coupled to the powered sheave wheel via the drive hub which has a slipping clutch. This clutch transmits the tether drive to the bailing arm and provides slippage and speed differential, required to compensate for varying bobbin diameter as more or less tether is added to the bobbin, thus maintaining the tension of the wraps on the bobbin.

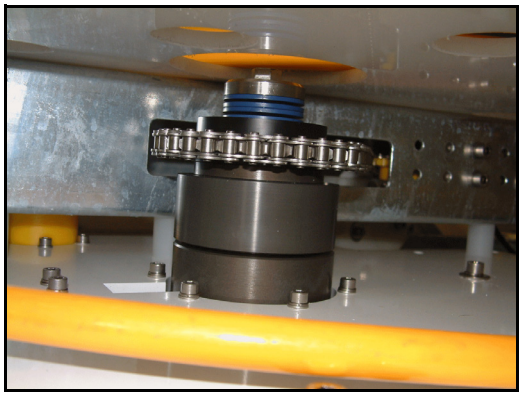

Figure. 1.10 Drive Hub

Wrapping is achieved by utilizing a driven tether guide situated at the end of the bailing arms. At each revolution of the bailing arm, the guide rises (or falls) by 20mm, which results in uniform wrapping of the tether.

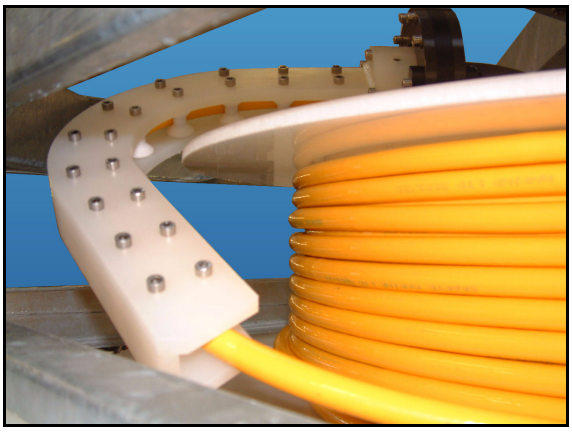

Figure. 1.11 Level Winder

1.7.5 Bail Sensor and Magnet

A sensor fixed to the TMS frame detects the passing of two magnets located on the tether bail arm. The sensor is connected to the Surface Unit, which maintains a count of the number of magnetic passes. Each count equates to approximately 1 metre of deployed tether. The bail count is displayed as Video Overlay on the system video monitor.

Figure. 1.12 Magnet and Bail Sensor

1.7.6 Electronics Pod

The TMS has an electronics pod, Type TMSEPM-2B, which is manufactured from high-grade carbon fibre, and provides the housing for the TMS electronics.

Figure. 1.13 TMS EPOD

1.7.7 Pressure compensation

The TMS is fitted with a ½ pint oil Compensation Unit for TMS oil filled unit oil compensation. The pressure compensation Unit is fitted to the upper side of the vehicle bay with each unit connected via individual line shut-off valves.

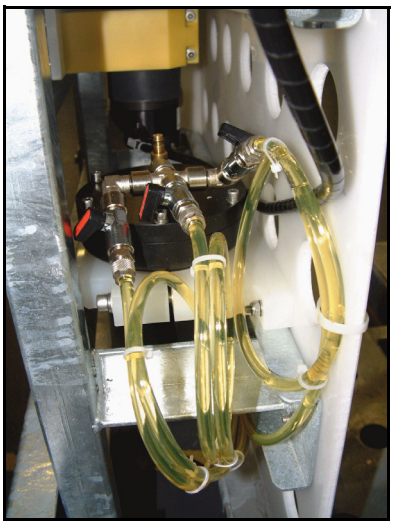

Figure. 1.14 Junction Box Pressure Compensator

1.8 Seaeye LAmp Unit Type P00357-M

The TMS2T has an individual 75 W lamp assembly Type P00357-M fitted at the rear of the TMS to illuminate the vehicle when entering and exiting the garage. The light has smooth intensity control from fully OFF to fully ON and has rugged construction.

Figure. 1.15 Lamp Unit P00357-M

1.8.1 Specifications

Power	150W
Voltage	250VDC
OPerating Depth	3000m
Weight	
In Air	0.88Kg
In Seawater	0.43kg
Connector	3way connector, 2x Power, 1x Earth

Table 1.1 Lamp Unit Specifications

The following items are all oil filled and remotely fitted with pressure compensation using Shell Tellus38 oil or equivalent oil grade (32 - 38):

- Reduction Gearbox.
- Bailing Arm Hub.
- Power Sheave Hub.

1.9 System Specification

Overall height	1600 mm (to centre of lifting eye)
Overall length	1200 mm
Overall width	1200 mm
Weight (including tether, pod)	487 kg
Bare Weight	387 kg
Safe Working Load	2040 kg
Max. Operational depth	1000 m

Table 1.2 System Specifications

1.10 Associated Documentation

The following documentation is also supplied with the TMS2T:

- TMS records.
- QA documentation.
- ROV Technical Manuals

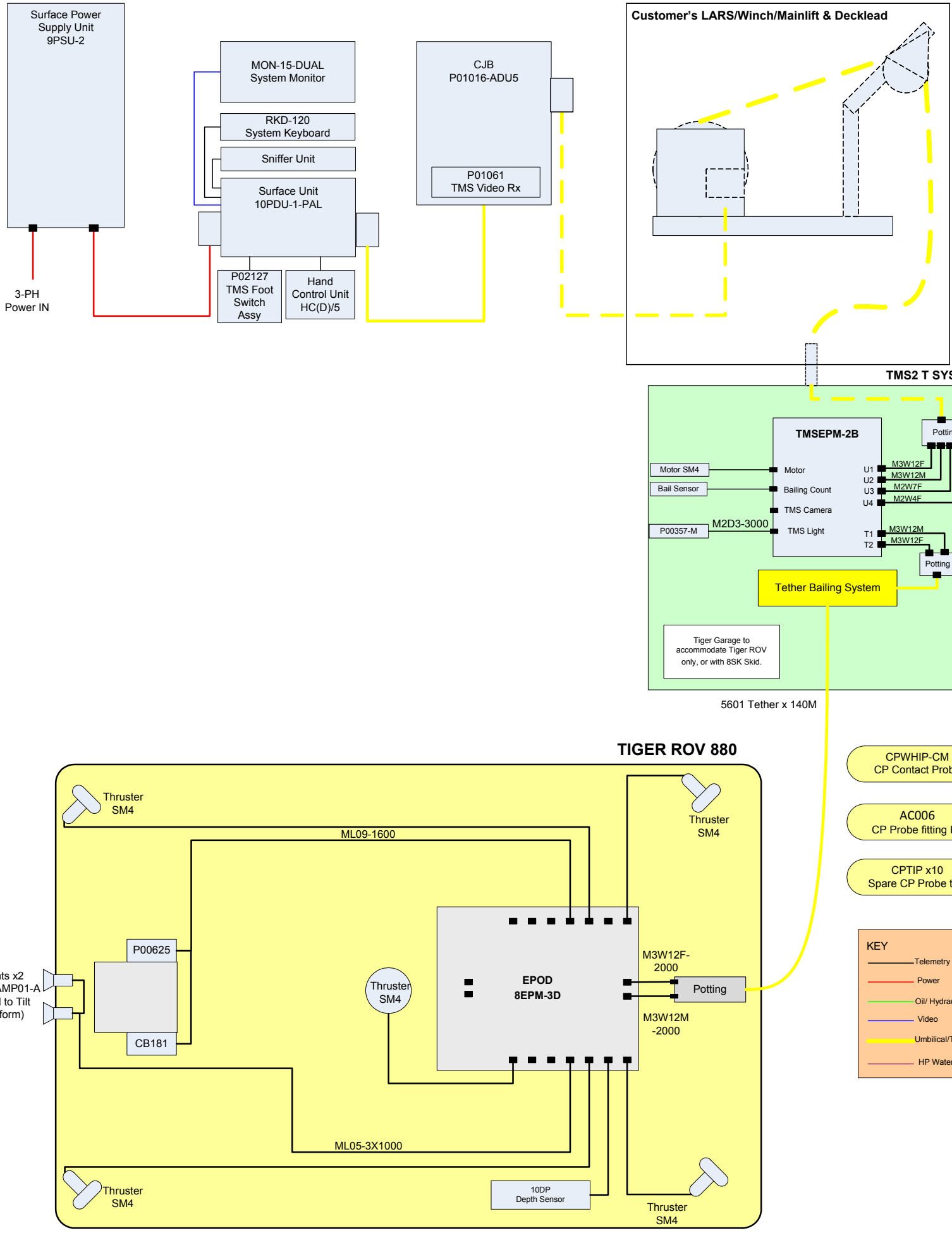

Figure. 1.16 TMS2T Tiger 880 System Configuration

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CHAPTER 2

CONTROLS AND

INDICATORS

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2. CONTROLS AND INDICATORS

This Chapter provides a description of TMS2T System controls and indicators for easy reference.

2.1 Introduction

The controls and indicators for the TMS are located on the front panels of the Power Supply Unit (PSU), Surface Unit (SU) and Hand Control Unit (HCU). Their functions are listed in the following tables and their location identified on the switch and indicator layout diagrams. Detailed information for all switch and indicator functions are contained in the ROV technical manuals. The following descriptions include those controls and indicators applicable to the TMS

2.2 PSU Controls and Indicators

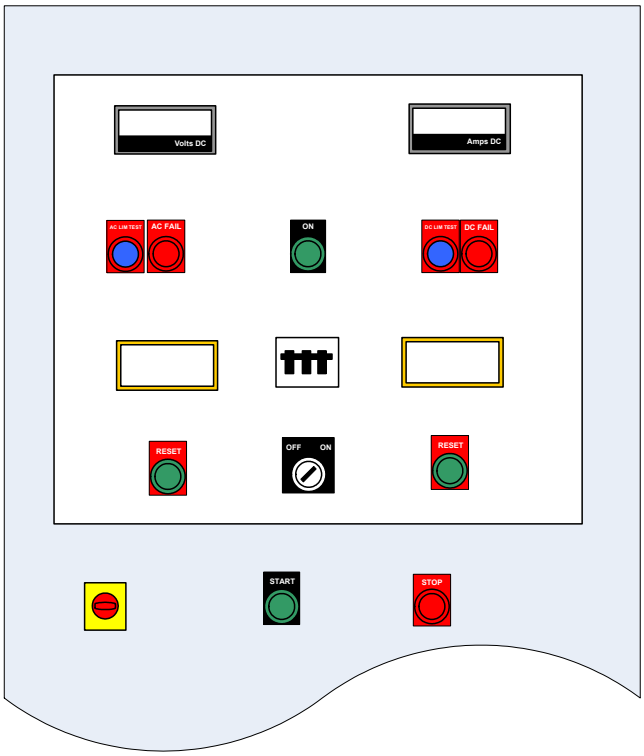

Figure. 2.1 PSU Front Panel

CONTROL/INDICATOR	FUNCTION
Mains Isolator rotary switch	When set to ON (clockwise), applies the external three phase power supply to the PSU. The switch is mechanically disabled when the PSU door is open.
AC circuit breaker	When set to ON (up), AC supplies are made available for routing to the PSU output when the SU AC SURFACE switch is made. Provides over-current protection for the input supply.

Table 2.1 PSU Controls and Indications

CONTROL/INDICATOR	FUNCTION
ON indicator	Illuminates GREEN when AC power is available.
AC Line Insulation Monitor (LIM)	Trips the subsea AC supplies when a line-line or line-earth fault condition is detected by the LIM across the AC power conductors when below the resistance setting of that LIM.
AC FAIL indicator	Illuminates RED when a fault condition has been detected by the LIM circuits, shutting down the subsea AC supply. NOTE. The AC FAIL indicator illuminates when the SU VEHICLE AC switch is OFF.
AC LIM TEST press button switch	When operated, tests for correct functionality of the AC LIM.
AC RESET press button switch	When operated the Subsea AC supplies are reset and extinguishes the AC FAIL indicator (provided no AC earth fault condition exists).
Key-operated switch	When set to ON (clockwise), allows the START switch to be made (the key cannot be removed in this position). When set to OFF (anticlockwise), the switch acts as an interlock for the START switch (in this position the key can be removed for safety reasons preventing the START switch from being operated).
START press button switch	When operated in conjunction with the Key-operated switch energises the PSU DC supplies. NOTE. DC supplies are distributed when the SU MASTER DC switch is selected to ON.
STOP press button switch	When operated de-energises the PSU DC supplies.
DC Line Insulation Monitor (LIM)	Trips the DC supplies when a line-line or line-earth fault condition is detected by the LIM across the DC power conductors when below the resistance setting of that LIM.
DC FAIL indicator	Illuminates RED when a fault condition has been detected by the LIM circuits, shutting down the DC supply. NOTE. The DC FAIL indicator illuminates when the SU MASTER DC switch is OFF.
DC LIM TEST press button switch	When operated, tests for correct functionality of the DC LIM.
DC RESET press button switch	When operated the DC supplies are reset and extinguishes the DC FAIL indicator (provided no DC earth fault condition exists).
DC Voltmeter	Provides a digital readout of the DC voltage.
DC Ammeter	Provides a digital readout of the DC current drawn by the system.

Table 2.1 PSU Controls and Indications (Continued)

2.3 SU Controls and Indicators

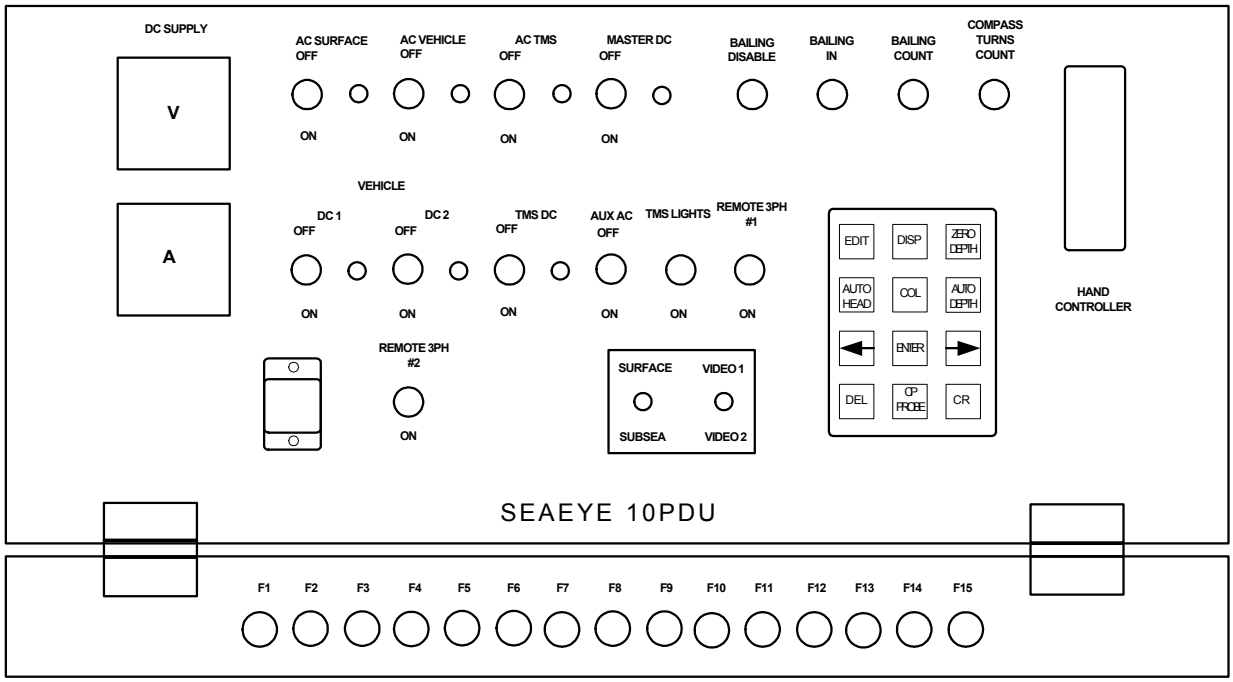

Figure. 2.2 Surface Unit Front Panel

CONTROL/INDICATOR	FUNCTION
AC SURFACE toggle switch	Routes the PSU Auxiliary AC output to the SU when set to ON (down).
AC SURFACE indicator LED	Illuminates RED when AC SURFACE switch is set to ON.
AC TMS toggle switch	When set to ON (down), supplies the TMS with AC (provided the AC SURFACE switch is set to ON).
AC TMS indicator LED	Illuminates RED when AC TMS switch is set to ON.
MASTER DC toggle switch	Acts as a remote switch for the PSU DC supplies. When set to ON (down), routes DC to the SU for distribution.
VEHICLE DC1, VEHICLE DC2 & TMS DC toggle switches	When set to ON (down), applies DC to the ROV and TMS. The switches must be pre-selected prior to operating the MASTER DC switch. Their function provides DC redundancy to prevent a single DC failure affecting the other DC paths.
DC Indicator LEDs	Illuminate RED when the DC switches are to ON.
DC Voltmeter	Provides an analogue readout of system DC voltage.
DC Ammeter	Provides an analogue readout of current drawn by the system.

Table 2.2 Surface Unit Controls and Indications

CONTROL/INDICATOR	FUNCTION
Surface Unit Keypad	Provides operator interface with the SU CPU. Full keypad functions are detailed in Chapter 4.
BAILING DISABLE/ENABLE toggle switch	When set to DISABLE (up), disables the TMS bailing motor preventing inadvertent tether bailing. When set to ENABLE (down), enables the TMS bailing motor control.
BAILING IN/OUT centre biased three position toggle switch	When set to the BAIL IN position (up), the bailing motor bails in the tether. When set to BAIL OUT (down), the bailing motor bails out the tether.
BAILING COUNT RESET push button switch	When operated, resets the bailing arm turns counter to zero (displayed on the system monitor).
TMS LIGHTS toggle switch	When set to ON (down), lights are switched on at full brilliance. When set to OFF (up), lights are off.

Table 2.2 Surface Unit Controls and Indications (Continued)

2.4 HCU Controls and Indicators

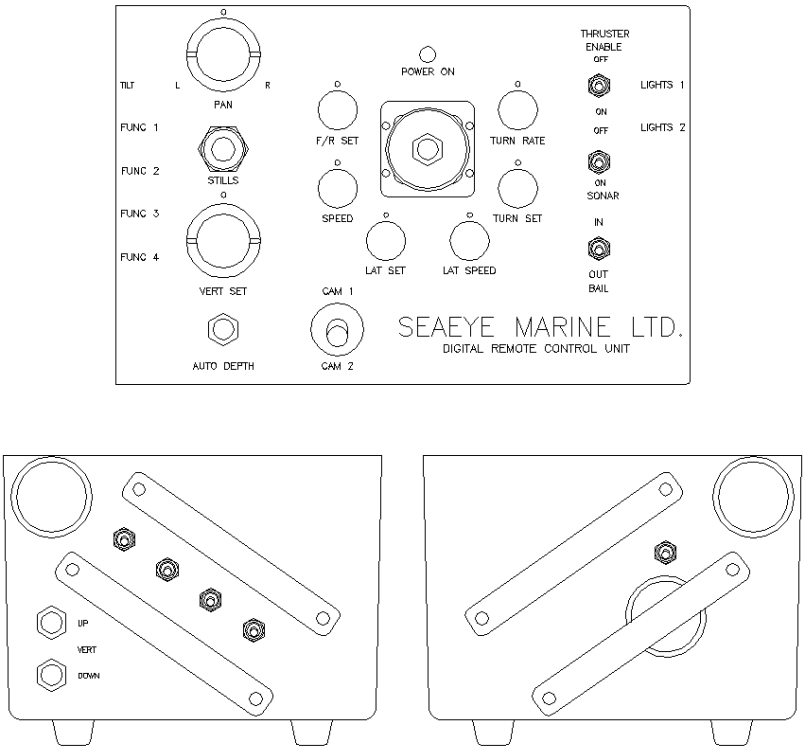

Figure. 2.3 Hand Control Unit Front Panel

CONTROL/INDICATOR	FUNCTION
BAILING IN/OUT centre biased three position toggle switch	When set to the BAIL IN position (up), the bailing motor bails in the tether. When set to BAIL OUT (down), the bailing motor bails out the tether.

Table 2.3 HCU Controls and Indications

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CHAPTER 3

ASSEMBLY AND

INSTALLATION

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3. ASSEMBLY AND INSTALLATION

This Chapter details the instructions for receipt and installation of the TMS2T system. On completion of installation a series of installation tests are carried out prior to the vehicles first operational dive. The installation tests ensure that the system is working correctly and allows the operator to become familiar with the units and controls.

3.1 Introduction

The system (Fig. 3.3) has been set up for the equipment supplied, however after repair or maintenance the system may require setting up, compensating or reconfiguring. The installation and installation tests are to be carried out whenever the system is relocated or the input supply changed.

Before and after the TMS is immersed, the **Pre and Post Operational Checks** (Task 1 and 2, Chapter 7) are to be carried out and considered **MANDATORY**. The Pre Operational checks ensure that before diving, the vehicle is ready in all respects to dive. The Post Operational Checks are designed to detect any defects or damage that may have been incurred during operational use, allowing the operator to rectify them and ensuring the vehicle can be stored operational and ready for its next dive. Fig. 3.4 provides a flow chart of the installation process.

3.2 Adverse Effects of Extreme Climactic Conditions

Saab Seaeye Ltd. Technical Department advises that extremes of temperature and climate can adversely affect the performance of all systems in the Seaeye Fleets. In some cases, extreme climatic conditions can cause irreparable damage to sensitive electronic components.

At particular risk is the subsea equipment (ROV, TMS, etc) and black anodised enclosures, which if left exposed to direct sunlight (especially in equatorial latitudes and the tropics) may experience destructive temperatures. Similarly, equipment left exposed in Polar Regions will suffer performance degradation and/or irreparable damage. Operators should also be aware of the risk of condensation when moving equipment from cold areas into warmer locations.

Operators are therefore advised to provide adequate protection against extremes of climate. When equipment is to be left exposed to direct sunlight, shade is to be provided (by means of tarpaulin covers or shelters, for example) and consideration should be given to frequent temperature monitoring and the provision of artificial cooling if necessary. In freezing conditions, subsea equipment is to be protected from direct exposure and if possible stowed “indoors”.

CAUTION.

Reparable damage can occur to equipment exposed to extremes of climate. Do not expose to direct sunlight for prolonged periods. Do not expose to freezing conditions for prolonged periods. If equipment is to be stowed exposed to the elements, always provide adequate covering/shelter/shade.

3.2.1 Receipt

Unpack the system in a dry clean environment and check the contents and serial numbers against the delivery note. Should any discrepancy be noted, contact SAAB SEAEYE LTD. immediately.

Prior to dispatch a stringent Quality Control Inspection is carried out. A copy is contained with the vehicles record document, however it is recommended that the contents be examined for any damage that may have occurred during transit. Refer to the Warranty information contained in the preliminary pages of this handbook.

It is recommended that all packaging and packing cases be retained for subsequent storage, transportation or return-to-works.

3.3 Installation

Prior to system connection a series of tests are required to ensure the input supply is correctly earthed and the AC input voltages are correct for system operation. At the earliest opportunity after the installation checks, the Subsea AC and DC power supplies are to be checked for correct compensation (Chapter 7).

CAUTION.

Danger of damage to equipment. If installing in extreme heat conditions, remove the vent plugs from the electronics pods to prevent excessive pressure build up.

The surface equipment is to be set up in the area the system is to be operated, in a dry and clean environment.

1. Position the Power Supply Unit, Surface Unit, equipment racks and monitor(s) on a stable, clean and dry platform.
2. Check all leads and cables for damage and bent pins.
3. Confirm the external electrical supply to be used with the system is disconnected and isolated.
4. Connect the following cables and leads to their respective units taking care not to damage their pins (Fig. 3.1):
   - Power in cable.
   - Keyboard.
   - HCU lead.
   - Monitor power and video leads.
   - Cabin JB Power supplies.
5. Visually examine the TMS to ensure all equipment is secure and undamaged.
6. Visually examine TMS lamp and ensure lamp cover is undamaged.
7. Visually examine the TMS camera, remove the camera lens cover and ensure lens is clean.

NOTE.

All connectors must be dry and their threadforms lightly lubricated with silicone grease before connecting.

All open-ended cables, when terminated, are to be checked for continuity and isolation prior to powering up the system. Testing should be carried out from the SU connector to the TMS end of main lift cable.

8. Connect the un-terminated end of the deck lead and main lift cable to the fixed junction box and slip ring unit of the LARS using the relevant WDM wiring diagram and the umbilical data section of the ROV Technical manual.

9. Connect the deck lead plug assembly to the umbilical socket located on the front panel of the Surface Unit.

3.3.1 TMS Main Lift Cable Fitment

Fit the main lift cable to the TMS as follows:

1. Feed the main lift cable through the TMS top assembly central lift point until the bullet assembly is located adjacent to the central lift point.
2. Continue the route the main lift cable by looping it around the inside of the TMS frame so that the end termination can be fitted to the EPOD. When routing the cable around the inside of the TMS, locate the cable into the 'C' sections to provide as much protection as possible.
3. Connect the main lift cable to the EPOD.

Figure. 3.1 EPOD Connection

4. Secure the main lift cable to suitable points around the TMS frame and the bullet cable guide ensuring that there is enough 'slack' in the cable to prevent any stress points.
5. Connect the ROV Tether to the TMS EPOD.
6. Connect the Tether to the ROV EPOD as detailed in the ROV technical manual.
7. Visually inspect the TMS and ensure all mounted equipment is secure and undamaged.
8. Ensure that the correct garage extensions are used for the Tiger with or without the tooling skid. If necessary interchange the TMS setup as required.

3.4 Installation Tests

3.4.1 Initial Preparation

Set the following unit switch and control settings:

HCU

☐ LIGHTS 1 and LIGHTS 2 controls	Fully anticlockwise
☐ VERTICAL SET control	Centre position
☐ F/R SET control	Centre position
☐ SPEED control	Centre position
☐ LAT SET control	Centre position
☐ LAT SPEED	Centre position
☐ TURN SET control	Centre position
☐ TURN RATE control	Centre position
☐ THRUSTER ENABLE switch	Set to OFF
☐ SONAR switch	Set to OFF
☐ CAM switch	Set to CAM 1
☐ TILT control	Centre position
☐ PAN control	Centre position
☐ Joystick	Operate in all axes and ensure joystick returns to the centre position on release

SU

☐ ROV MASTER DC switch	Set to OFF
☐ AC VEHICLE switch	Set to OFF
☐ AC SURFACE switch	Set to OFF
☐ AC TMS switch	Set to OFF
☐ VIDEO switch	Set to SURFACE
☐ BAILING DISABLE/ENABLE	Set to DISABLE

3.4.2 Powering Up

Connect and switch on the external power supply.

Set the following unit switch and control settings:

PSU

☐ Mains Isolator	Set to ON
☐ AC circuit breaker	Set to ON
☐ Key-operated switch	Set to ON
☐ START switch	Operate

SU

☐ AC SURFACE switch	Set to ON

☐	AC SURFACE indicator	Confirm illuminated

3.4.3 Installation System Tests

NOTE.

The system is supplied fully configured, however, if any equipment (PCBs, tilt motors etc.) has been changed from the factory-supplied condition it is necessary to carry out a full system configuration as detailed in Chapter 4.

Confirm the system monitor displays video overlay and prompts:

"DO YOU WISH TO CONFIGURE THE SYSTEM?"

☐	At the SU keypad	Respond NO
☐	HCU POWER indicator	Confirm illuminated

Remove the vehicle camera lens cap(s).

Set the following unit switch and control settings:

SU

☐	AC VEHICLE switch	Set to ON
☐	AC VEHICLE indicator	Confirm illuminated
☐	AC TMS switch	Set to ON
☐	AC TMS indicator	Confirm illuminated
☐	VIDEO switch	Set to SUBSEA

Confirm the system monitor displays images received from the camera with video overlay (OVERLAY socket) and without overlay (DIRECT VIDEO socket).

If additional cameras are fitted to the vehicle, confirm all camera images can be displayed, including the camera fitted to the TMS.

Set the following unit and control settings:

WARNING.

DANGER TO PERSONNEL AND EQUIPMENT. THRUSTER MOTORS MAY OPERATE WITHOUT WARNING WHEN THE SYSTEM DC SUPPLY IS ENERGISED. ENSURE THAT THE VEHICLE IS CLEAR OF ANY OBSTRUCTION AND PERSONNEL PRIOR TO ENERGISING THE DC SUPPLY

SU

☐	DC1 and DC2 switches	Set to ON
☐	TMS DC switch	Set to ON
☐	MASTER DC switch	Set to ON
☐	DC indicators	Confirm illuminated

HCU

☐	TILT control	Operate over full range and confirm vehicle camera platform rotates through its full range and its movement is unobstructed.

CAUTION.

POSSIBLE DAMAGE TO THRUSTER MOTOR. THRUSTERS MUST NOT BE OPERATED FOR LONGER THAN ONE MINUTE IN AIR OR MOTOR V-SEAL DAMAGE MAY OCCUR.

HCU

☐ THRUSTER ENABLE switch	Set to ON
☐ F/R SET, LATERAL SET	Adjust until horizontal and TURN SET controls thrusters are stationary
☐ VERTICAL SET control	Adjust until vertical thrusters are stationary

CAUTION.

Possible damage to lamps. Vehicle lamps must not be operated for longer than 10 seconds in air.

☐ LIGHTS 1	Operate and confirm lamps illuminate

HCU

☐ JOYSTICK	Operate in all axes and confirm thrusters respond to joystick demand
☐ THRUSTER ENABLE switch	Set to OFF
☐ JOYSTICK	Operate in all axes and confirm thrusters do not operate to joystick demand

The following tests require the vehicle to be suspended. Care must be taken when swinging the vehicle to prevent damage from surrounding structures.

NOTE.

When carrying out the compass swing check, the compass reading may be incorrect if the vehicle is surrounded by metal structures.

Slowly rotate the suspended vehicle and confirm that the compass rose responds to vehicle movement.

Confirm depth and CP (if fitted) indication is displayed as overlay on the system monitor.

Set the following unit switch and control settings:

WARNING.

DANGER TO PERSONNEL AND EQUIPMENT. THRUSTER MOTORS MAY OPERATE WITHOUT WARNING WHEN THE SYSTEM DC SUPPLY IS ENERGISED. ENSURE THAT THE VEHICLE IS CLEAR OF ANY OBSTRUCTION AND PERSONNEL PRIOR TO ENERGISING THE DC SUPPLY.

HCU and SU Keypad

☐ THRUSTER ENABLE switch	Set to ON
☐ AUTO HEADING switch	Operate and confirm “A” is displayed in the compass data area as overlay on the system monitor.

☐ Vehicle	Rotate the vehicle and ensure the thrusters oppose rotation.
☐ AUTO HEADING switch	Operate and confirm the "A" is no longer displayed
☐ AUTO DEPTH switch	Operate and confirm "A" is displayed in the depth data area as overlay on the system monitor. Operate the switch again and confirm the "A" is no longer displayed

Repeat the auto heading and depth test using the surface unit keypad.

Taking care to avoid contact with the thruster motors, jerk the suspended vehicle and confirm the gyro responds by operating the thrusters momentarily.

Set the following unit switch setting:

HCU

☐ THRUSTER ENABLE switch	Set to OFF

Test all other fitted equipment, sonars, manipulators, cutting tools etc., as detailed in the manufacturer's handbook.

SU

☐ BAILING ENABLE switch	Set to ENABLE
☐ BAILING switch	Set to OUT. Bail out the tether to allow the ROV to be manually moved out of the TMS structure with three meters of slack.
☐ BAILING switch	Set to IN. Carefully bail in the ROV.

HCU

☐ BAILING switch	Set to OUT. Bail out the tether to allow the ROV to be manually moved out of the TMS structure with three meters of slack.
☐ BAILING switch	Set to IN. Carefully bail in the ROV.

Bailing Foot Switches

☐ BAILING OUT switch	Press. Bail out the tether to allow the ROV to be manually moved out of the TMS structure with three meters of slack.
☐ BAILING IN switch	Press. Carefully bail in the ROV.

SU

☐ BAILING ENABLE switch	Set to DISABLE
☐ TMS LIGHT switch	Operate and confirm lamp illuminates

3.4.4 Powering Down

Set the following unit switch and control settings:

SU

- ☐ MASTER DC switch — Set to OFF
- ☐ MASTER DC indicator — Confirm extinguished
- ☐ VEHICLE DC switches — Set to OFF
- ☐ VEHICLE DC indicators — Confirm extinguished
- ☐ TMS DC switch — Set to OFF
- ☐ TMS DC indicator — Confirm extinguished
- ☐ AC VEHICLE switch — Set to OFF
- ☐ AC VEHICLE indicator — Confirm extinguished
- ☐ AC TMS switch — Set to OFF
- ☐ AC TMS indicator — Confirm extinguished
- ☐ AC SURFACE switch — Set to OFF
- ☐ AC indicator — Confirm extinguished

PSU

- ☐ STOP switch — Operate
- ☐ Mains Isolator — Set to OFF

Switch off and isolate the external power supply.

Lower the vehicle and replace the vehicle lens cap(s).

CHAPTER 4

SYSTEM FUNCTIONAL DESCRIPTION

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4. SYSTEM FUNCTIONAL DESCRIPTIONS

This chapter, with the aid of block diagrams, describes the various functions of the TMS2T system.

4.1 Introduction

The descriptions include units that form part of the ROV system that are required for the operation of the TMS. The functional descriptions can be divided into the following:

- Power distribution.
- TMS Control and sensor functions.
- Video distribution.

4.2 Power Distribution

TMS power distribution can be divided into AC and DC functions. Surface AC (240VAC) is used in the Surface Unit to control the various relays and switching functions and to produce the low voltage DC supplies for all of the system control electronics. Subsea AC (240 VAC) is used to supply the subsea power supplies used by the TMS.

DC (250 VDC) derived from the external power supply is required to supply the bail motor and lamp assembly.

4.2.1 Line Insulation Monitors

4.2.2 The Isolated Power Supplies, and Line Insulation Monitoring on Seaeye ROV systems.

All Seaeye ROV systems utilise isolated power supplies which may be AC, DC or both. A Power Distribution Unit (PDU) will provide these isolated power supplies; this may be an integral part of the surface equipment, or a separate unit. The isolated power is then distributed via the umbilical (or main-lift and tether) to the ROV, TMS and any additional tooling etc.

Providing an isolated supply removes the supplies' relationship to earth (vessel, structures, etc), and greatly reduces the risk of electrical shock. This method provides a safe system under normal conditions, as with a single fault no current will flow to earth.

If the supply becomes connected to earth, either directly or indirectly through a resistive path due to a fault or failure within the system, then the system becomes potentially unsafe if a second fault is introduced. Seaeye systems use Line Insulation Monitoring (LIM) devices to continuously monitor the resistance between the power conductors and earth, giving warning of potential faults. LIMs on Seaeye ROV systems typically provide both Off-line and On-line monitoring; this means that the systems continuously monitor the insulation resistance regardless of the ROV power being on or off. The LIM will disable the supply when the line insulation resistance falls below a set alarm level. This disable function may be directly operated from the LIM contacts or through the system's control software.

The use of ungrounded isolated power supplies and a LIM is in accordance with recommendations for acceptable practice in the IMCA Code of Practice for the Safe Use of Electricity Under Water AODC 035 (September 1985).

DANGER TO PERSONNEL AND EQUIPMENT. IT IS IMPORTANT TO NOTE THAT LIM'S DO NOT FUNCTION AS PERSONAL SAFETY PROTECTION DEVICES. A LIM MONITORS THE STATUS OF THE SYSTEM AND WARNS OF A POTENTIAL FAULT, THE LIM CAN CUT SUPPLY FEED TO HELP PROTECT PERSONAL AND EQUIPMENT, BUT THE REACTION TIME OF THE LIM IS GENERALLY TOO SLOW TO PREVENT ELECTRICAL SHOCK.

NOTE.The LIM does NOT negate the requirement to check the condition of all equipment before use and the carrying out of regular maintenance to ensure safe operation of the system.

Definition:

Line Insulation Monitoring (LIM) - also known as Ground Fault Monitor or Insulation Resistance Monitor. These devices monitor the condition of a system's power to earth insulation. The output may be in the form of a meter reading, an alarm, contactors or any combination of these. AC and DC Line Insulation Monitors (LIM) monitor the AC and DC power supply lines. If the insulation resistance of a power line to earth falls below the threshold set on the LIM, the supply is automatically cut off and either or both the AC and DC O/P Earth Fail lamps illuminate. If an insulation problem is detected by the AC LIM, an internal relay trips disabling BOTH AC and DC circuits. A fault detected on the DC power lines will ONLY disable the DC circuits.

4.2.3 AC System

When the PSU main isolator and AC CIRCUIT breakers are switched on, two phases from the 3-phase input are fed to a single phase transformer, stepped down and made available for switching by the Surface Unit AC SURFACE remote switch, to provide AC supplies for all electronics within the Surface Unit.

A second output from the single-phase transformer is stepped down and switched by the Surface Unit to provide both the TMS and ROV AC supplies.

The AC TMS switch, located on the Surface Unit, energises a relay which routes the AC supply via the Winch and main lift cable to the TMS EPOD.

The AC Line Insulation monitor (LIM) monitors the AC power supply lines. If the insulation resistance of an AC line to earth falls below the threshold set on the LIM, the AC supply is automatically isolated.

The 240 VAC is fed via the U3 connector to the TMS EPOD PSU1 via Filter X1. PSU1 provides the supplies 24 VDC for the Light FET Suppressor and Thruster Ref PCB (6062P), Line Video Driver PCB1, TMS camera bulkhead connector and Thruster Control PCB (6034P). PSU1 also feeds a 12 VDC supply to the IC1 which provides a +5V output to the PCB backplane.

ROV 240 VAC is routed from U1 connector through the TMS EPOD to T1 connector for ROV AC supplies and routed to the TMS PSU2 via filter X4. PSU2 provides a 24 VDC supply for the Fibre Optic Multiplexer which routes the ROV video signals to the surface via fibre optic connection.

4.2.4 DC System

When the PSU main isolator is switched to on and the START button operated, the DC circuits are energised and made available for switching by the Surface Unit remote switches, AC SURFACE and DC MASTER. The 3 phase input to the PSU is routed to a 3 phase transformer, rectified, smoothed and switched by the Surface Unit to provide TMS DC.

Before the DC circuits can be energised, the MASTER DC switch must be switched on. Depending on the DC front panel switch positions, the relevant DC enable control signal energises its associated relay and applies DC to the TMS. The required DC1, DC2 and TMS DC switches must be made prior to switching on the DC MASTER switch which once operated provides a hold-on circuit to prevent further DC switching.

The DC Line Insulation Monitor (LIM) monitors the DC power supply lines. If the insulation resistance of a DC line to earth falls below the threshold set on the LIM, the DC supply is automatically isolated.

The DC1 and DC2 supplies are routed to the TMS EPOD via connector U1. TMS DC is routed from the EPOD bulkhead connector U3 to the Fuse and Filter PCB (6056P) to supply the bailing motor and to the Light FET Suppressor and Thruster Ref PCB (6062P) to supply the TMS light.

Relays RL3 (DC1) and RL2 (DC2) within the TMS EPOD interlink with relay RL1 (TMS DC) to provide current sharing for the umbilical conductors for vehicle DC1± and DC2± and TMS DC±.

4.3 TMS Control and Sensor Functions

The TMS telemetry system uses a half duplex RS485 communication link. All control and sensor data is transmitted between the surface and subsea CPU PCBs (6047P) over a single screen twisted pair. Control data is transmitted by the surface CPU every 80 mS. The subsea CPU only transmits data on reception of a valid data string from the surface.

All control and sensor functions are controlled by two TMS CPUs, the surface CPU located in the Surface Unit and the subsea CPU located in the TMS EPOD. The TMS control system can be split into control and sensor functions as follows:

- Control function, TMS Light and the Bailing Motor.
- Sensor functions, the Bailing Counter and the TMS electronics pod leak detection.

NOTE.

The ROV Tiger system and TMS CPU PCBs are identical with the exception of their fitted software is identified for surface use and subsea use.

4.3.1 Bail Motor Control

The Bail IN/OUT switches, located on the HCU, the TMS Bailing Foot Switches and on the front panel of the Surface Unit, are effectively wired in parallel so that either can be used to control the TMS bailing system. They are interfaced to the Surface TMS CPU PCB via the Switch Adaptor PCB. A Bail Enable switch on the front panel of the Surface Unit provides protection against inadvertent bailing operation. With the TMS Enable switch set to 'ON', the bail demand is transmitted over the RS485 telemetry link to the subsea TMS CPU PCB (6047P). The Thruster Control PCB (6034P) converts the digital bail demand into the analogue direction and speed signals required by the bail motor (± 24 V on the direction control lines and 0 V on the speed control line to give full motor speed, 10 V on the speed line for motor stop).

4.3.2 Bail Arm Counter

A sensor fixed to the TMS frame detects the passing of two magnets located on the tether bail arm. The sensor is connected via a backplane to the CPU PCB (6047P), which maintains a count of the number of magnetic passes. Each count equates to approximately 1 meter of deployed tether. The bail count is transmitted to the Surface CPU where it is retransmitted over a RS485 connection via the Expansion I/O PCB to the Video Overlay PCB for display on the system video monitor.

Operation of the Counter Reset switch, located on the Surface Unit, is detected by the TMS Switch Adaptor PCB and signals the Surface CPU that the switch has been activated. The reset data is transmitted to the Subsea TMS CPU 6047P via the RS485 telemetry link to reset the counter in the CPU to zero. The data is then transmitted to the Surface CPU to the Video Overlay PCB for subsequent display as video overlay data on the system monitor.

4.3.3 Light Control

The TMS Lights switch, located on the SU is used to control the TMS lighting. The switch is interfaced to the Surface TMS CPU PCB (6047P) via the Switch Adaptor PCB (6052AP). With the TMS Light switch set to 'ON', the light demand is transmitted over the RS485 telemetry link to the sub-sea TMS CPU PCB (6047P). After processing by the TMS CPU the data is passed to the Thruster Control PCB (6034P), where it is converted into a PWM signal to control the Light FET Suppressor and Thruster Ref PCB (6062P).

4.3.4 Leak Detection

Two probes are connected to the Leak Detection PCB 6068P. If water is detected, or if the probes become disconnected, a leak signal is transmitted to the Surface CPU. A warning is then transmitted, via the RS 232 link to the Video Overlay PCB to be displayed on the system monitor.

4.4 Video

In the TMS pod, composite video from the TMS camera is routed to the Video Line Driver PCB (6071ASP) for transmission to the surface via twisted pair cable. At the surface the video signal is routed to the Video RX Module P01061 located in the Cabin Junction Box for display on a video monitor.Output is by way of BNC on the side of the Cabin Junction Box.

In the TMS pod, video from the ROV camera 1 and camera 2 is routed from T2 tether bulkhead connector straight through to umbilical bulkhead output U2 and continues via deck lead and CJB to the surface control unit T.P Video Module. Camera choice is determined by Video switch on the front of the SCU.

4.5 Mechanical Operation

The TMS operates as a bailing arm system, where the tether is wound onto a drum using a bailing arm. The arm is driven by a series of belts and chains by the bailing motor. As the bailing arm rotates around the drum, it winds the tether cable on or off the drum. This enables the ROV to be deployed from its garage under its own power or pulled back into the garage using the tether as the pulling force.

A series of adjusters and tension springs ensure that the chain and belt tensions are maintained.

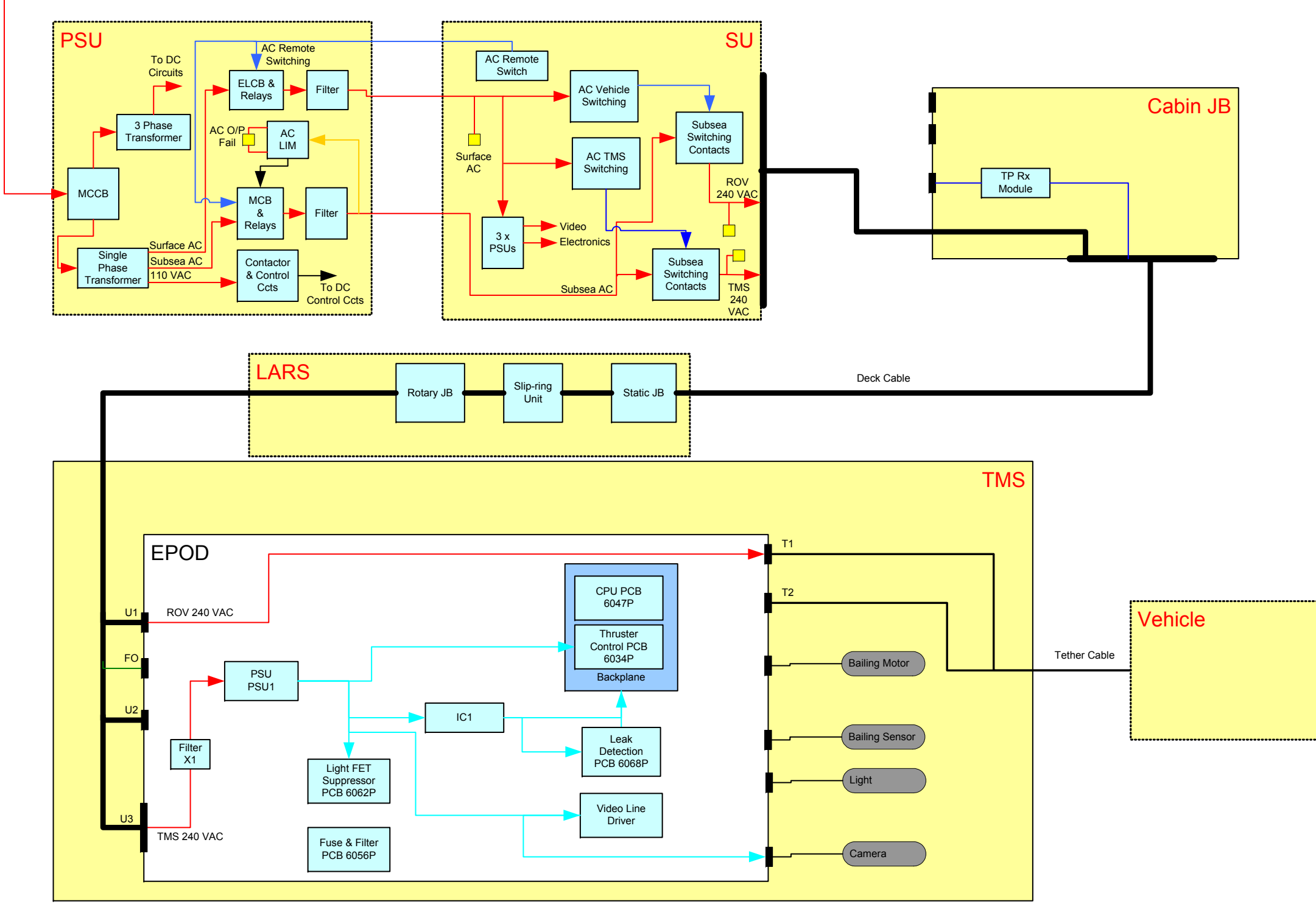


Figure. 4.1 AC Power Distribution

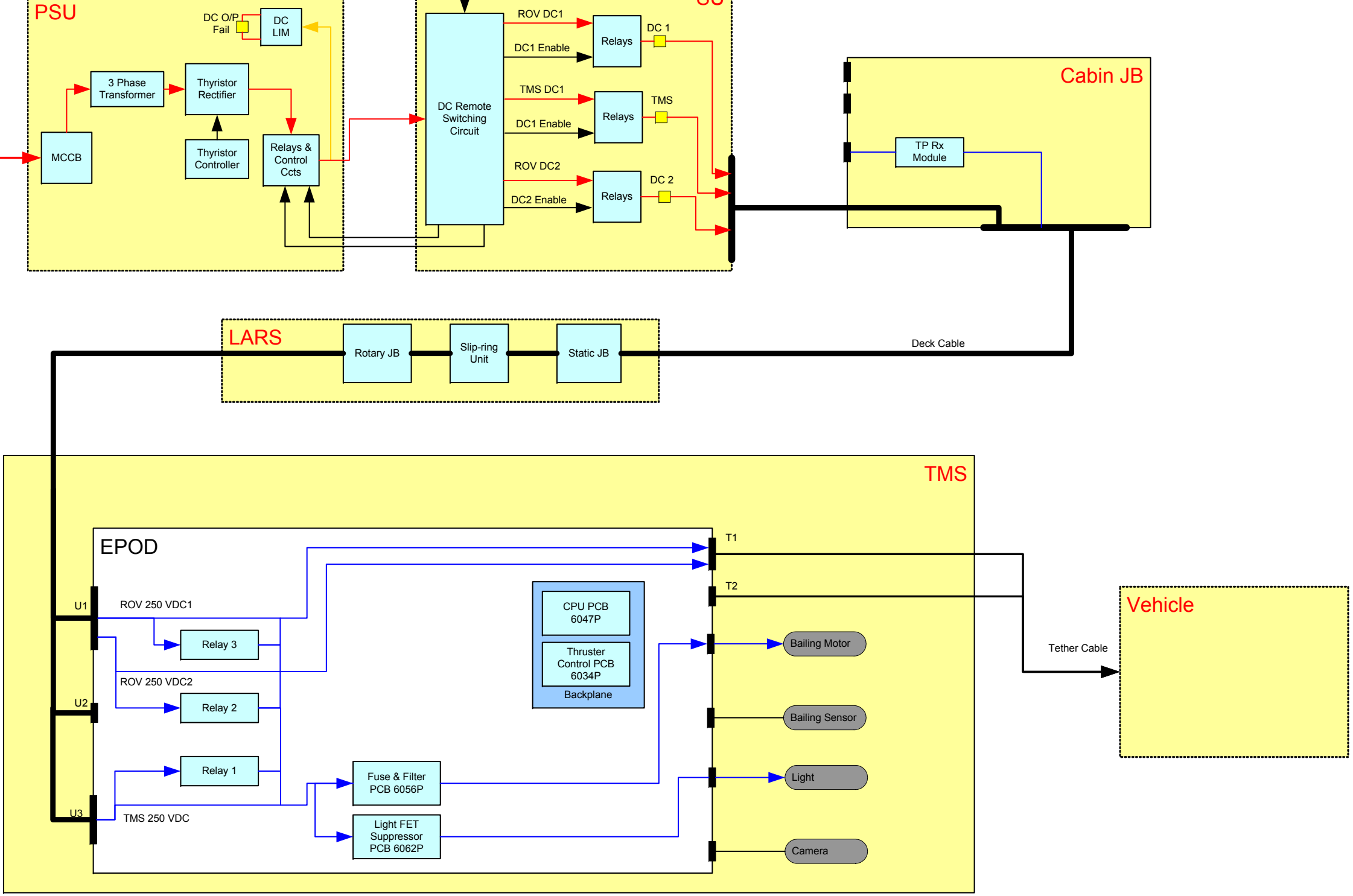
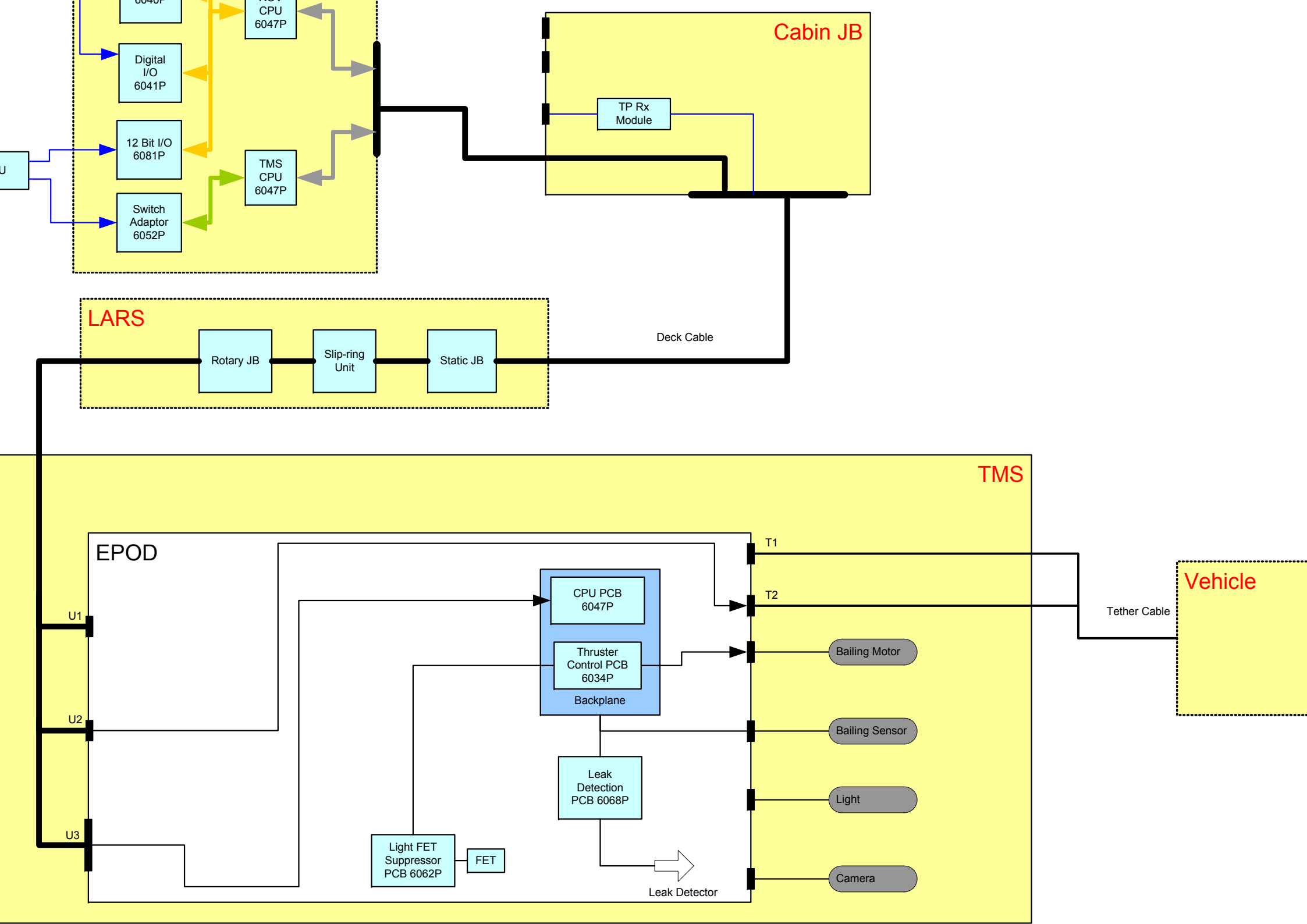
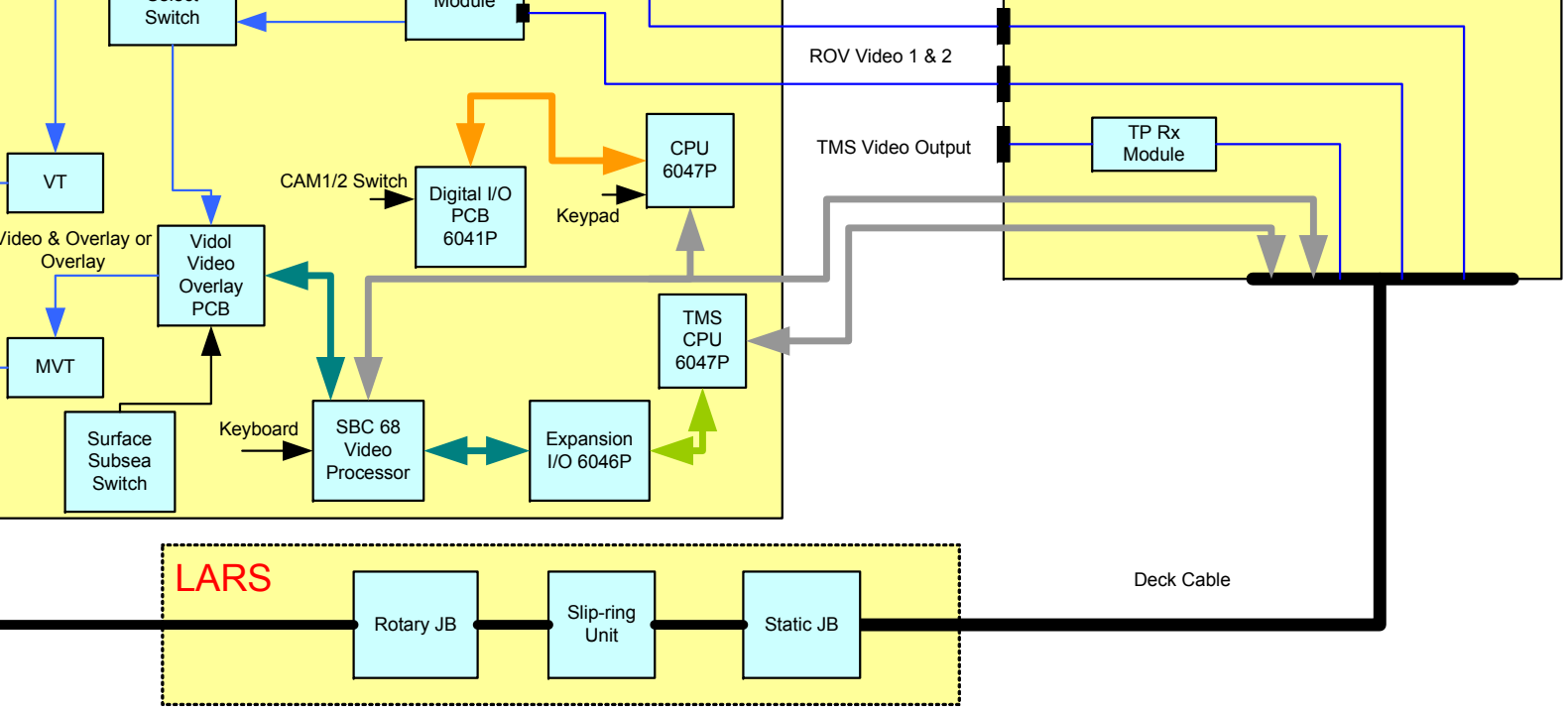
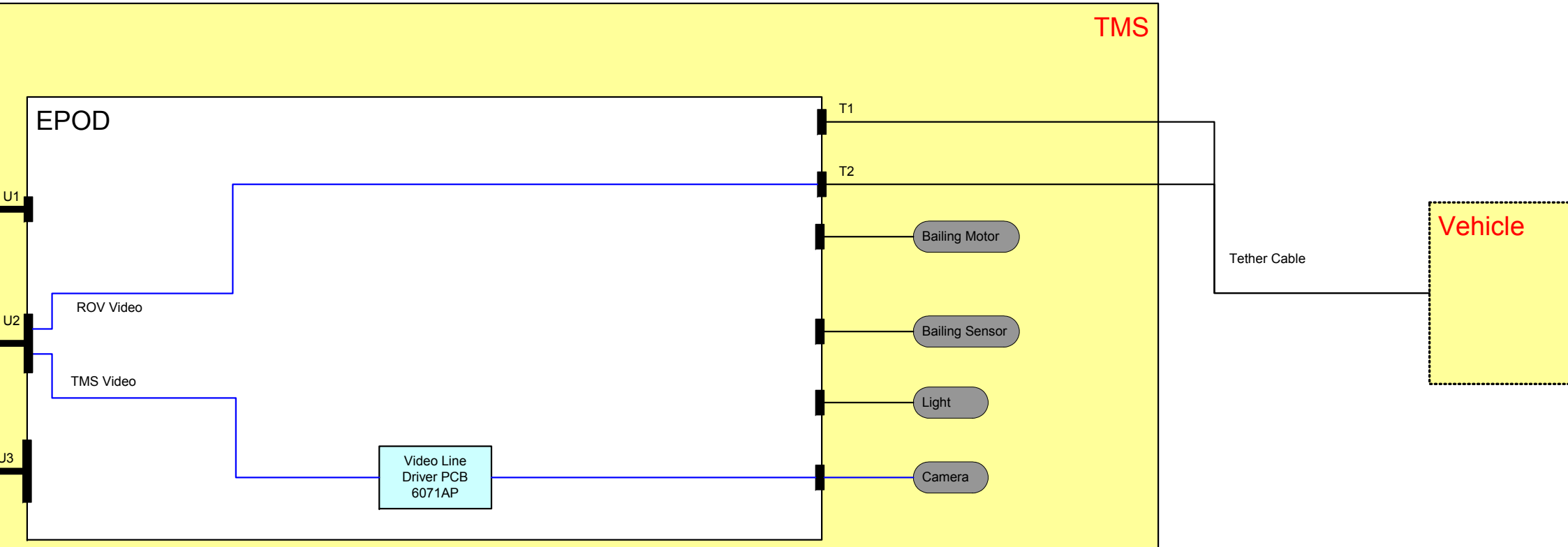


Figure. 4.2 DC Power Distribution


Digital I/O 6041P
12 Bit I/O 6081P
Switch Adaptor 6052P
TMS CPU 6047P
Cabin JB
TP Rx Module
LARS
Rotary JB
Slip-ring Unit
Static JB
Deck Cable
TMS
EPOD
U1
U2
U3
CPU PCB 6047P
Thruster Control PCB 6034P
Backplane
Leak Detection PCB 6068P
Light FET Suppressor PCB 6062P
FET
Leak Detector
T1
T2
Bailing Motor
Bailing Sensor
Light
Camera
Tether Cable
Vehicle


Switch
Module
ROV Video 1 & 2
TMS Video Output
TP Rx Module
VT
CAM1/2 Switch
Digital I/O PCB 6041P
CPU 6047P
Keypad
Video & Overlay or Overlay
Vidol Video Overlay PCB
TMS CPU 6047P
MVT
Surface Subsea Switch
Keyboard
SBC 68 Video Processor
Expansion I/O 6046P
LARS
Rotary JB
Slip-ring Unit
Static JB
Deck Cable


TMS
EPOD
U1
U2
U3
ROV Video
TMS Video
Video Line Driver PCB 6071AP
T1
T2
Bailing Motor
Bailing Sensor
Light
Camera
Tether Cable
Vehicle

CHAPTER 5

TMS EPOD FUNCTIONAL DESCRIPTION

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5. TMS EPOD FUNCTIONAL DESCRIPTIONS

This chapter describes the various functions of the TMS2T system Electronics Pod (EPOD) Type TMSEPM-2B.

5.1 Introduction

The TMS EPOD consists of a hard anodised aluminium cylinder housing and end-plate. The end-plate accommodates bulkhead penetrators, which provide the termination for all TMS subsea electrical connectors.

The housing contains an aluminium rectangular electronic chassis used as a card rack to hold the EPOD PCBs. Each PCB is connected to a backplane via Eurocard edge connectors.

The end-plate is sealed to the cylinder with O-seals and is held in place by four M5 screws. A bleed screw is fitted to allow the internal pressure to equalise when opening or closing the EPOD.

Figure. 5.1 Electronics Pod TMSEPM-2D

The power, control and TMS functions are communicated from the surface through the Winch/LARS and main lift cable to the TMS EPOD bulkhead connectors and distributed within the EPOD for power distribution and processing.

5.2 TMS Power Supplies

The supplies used by the TMS EPOD can be split into AC and low power DC used for EPOD electronics and high power DC used to operate the bailing motor and light. Power supplies are routed from the surface via the Winch and main lift cable to the EPOD penetrator, U3.

5.2.1 AC and Low Power DC

TMS 240 VAC from the SU is routed to Power Supply Unit PSU1 via fuses F1 & F2 (T500 mA), Filter X1 and connector U3 pins 4 & 6. PSU1 produces a regulated output of 24 VDC (12-0-12 VDC) to supply the following:

- 24 VDC to Thruster Control PCB (6034P).
- 24 VDC to Light FET Suppressor PCB (6062P).
- 24 VDC to TMS Camera connector pins 3 and 1.
- 12 VDC to Line Video Driver PCB1.
- +5 VDC via regulator IC1 to Leak Detector PCB (6068P).
- +5 VDC to the Bail Count connector pin 1.
- +5 VDC via regulator IC1 to the backplane.

ROV 240 VAC from the SU is routed directly through the EPOD from U1 pins 9 & 10 to the T1 bulkhead connector pins 9 & 10. ROV 240 VAC is also routed to Power Supply Unit PSU2 via fuses F3 & F4 (T500 mA) and Filter X4. PSU2 produces a regulated output of 24 VDC to supply the Fibre Optic Multiplexer.

5.2.2 TMS High Power DC

TMS DC is applied to bulkhead connector U3 pins 1 (TMS DC-) and 3 (TMS DC+). This is routed to the Fuse & Filter PCB (6056P) pins 2a, 2c, and to pins 4a, 4c via PCB internal links (DC+ IN) and pins 30a, 30c, and to pins 32a, 32c via PCB internal links (DC- IN). The Fuse & Filter PCB provides a DC channel output routing DC± to the bailing motor bulkhead penetrator, DC- pin 1 and DC+ pin 3.

The TMS DC is also routed to the Light FET Suppressor PCB (6062P) SKT1. The PCB provides DC to the TMS light penetrator pins 1 (DC+) and 2 (DC-) via TB4 terminals 11 and 12.

ROV DC1± and DC2± enter the EPOD on U1 and are integrated with TMS DC to reduce the voltage drop over the main lift cable by power sharing. TMS DC±, DC1± and DC2± each have a relay across their supply lines to provide isolation in the event of a defect on one of the other DC± lines. Absence of DC power on any line stops it's associated relay from energising, preventing the good DC lines integrating with the defective DC line.

Relay RL1 controls the TMS DC, relay RL2 controls the ROV DC2 and relay RL3 controls the ROV DC1 circuits.

5.3 TMS Control Electronics

TMS Telemetry data is transmitted and received through the Winch/LARS and main lift cable and processed by the TMS CPU (6047P). The information is used by the PCBs, which provide the interface for the TMS functions. Additional PCBs, connected to the CPU PCB via the passive backplane, provide the interfaces to the TMS motor, Light, Leak Detector and Bail sensor.

5.3.1 Bailing Motor Control

Bailing motor demands from the surface are transmitted to the Thruster Control PCB (6034P) via the backplane under control of the TMS CPU (6047P). The thruster control PCB has four channels of which only one is used to control the bailing motor with a speed and direction signal.

The speed signal to the Thruster Control PCB is a digital signal, which is converted into a TTL 50 Hz base frequency pulse width modulated (PWM) signal whose duty cycle is proportional to the required speed. For example, a 100% duty cycle represents a continuous 0 V signal causing the motor to run at full speed. The speed signal is fed to the bailing motor via the bulkhead connector pin 5.

NOTE.

The bailing motor speed does not need to be varied; the TMS software sets the speed to full speed when TMS bailing is demanded.

Direction is controlled by a 24 VDC signal (derived from PSU1), DIR+ & DIR-, the polarity of which decides bailing motor direction. The 24 VDC is routed to the motor via the Bailing Motor bulkhead, pins 4 & 6 providing a supply to the motor electronics as well as direction.

NOTE.

The Thruster Control PCB link settings must be correctly set as described below.

5.3.2 Thruster Control PCB Link Setting

The Thruster Control PCB (6034P) has link settings that are adjusted to configure the system to the number of thrusters used. The PCB can provide signals to control up to four motors. The TMS system uses one motor (bailing motor) and the PCB link (LK3) is set to position 1 as shown by Fig. 5.2.

NOTE.

All other links are to remain in the factory set condition.

When exchanging 6034P PCBs ensure the link position is correct and the PCB is correctly populated.

Bailing Motor	Thruster card No1 LK3 link position
1	Position 1

Table. 5.1 Thruster Card Link Configuration

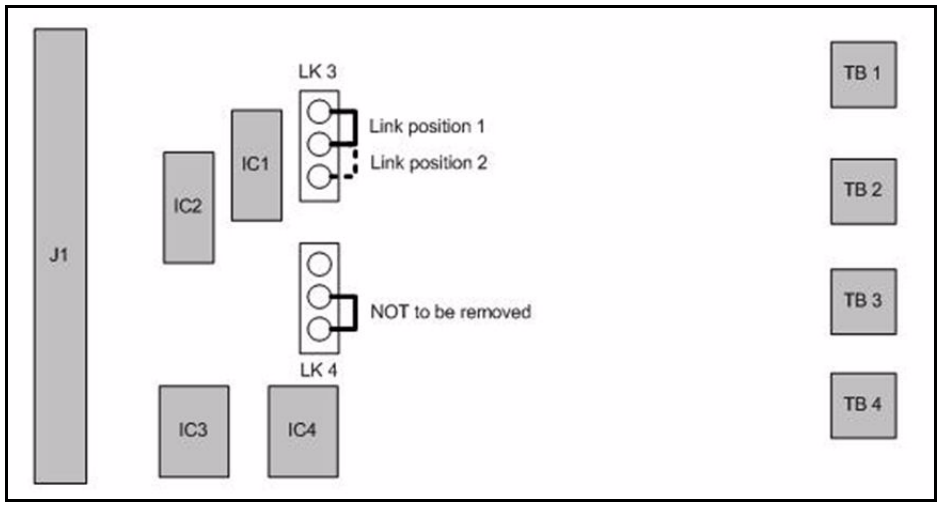


Figure. 5.2 Thruster Control PCB Link Setting

5.3.3 Lights Control

The TMS has one lighting channel, TMS LIGHT, which can be switched under control from the Surface Unit.

Light demand from the surface is an 8-bit digital signal decoded from the RS485 telemetry link by the CPU and input to the Thruster Control PCB (6034P) to convert the digital signal into a 2 KHz pulse width modulated signal (PWM) to produce a 100% duty cycle for full brilliance (250 VDC) or 0% duty cycle for the lamps to be off (no voltage). The PWM signal is routed to the Light FET Suppressor PCB (6062P) SKT2 pins 3 & 4, which turns the MOSFET on and off at 2kHz. The DC is output from the Light FET Suppressor PCB (6062P) on SKT1 and routed to the lights penetrator, TMS Lights.

5.3.4 Leak Detection

The leak detection circuit consists of a water probe connected to Leak Detector PCB (6068P), SKT5 pins 1 & 2. The PCB monitors the resistance of the probe and when it becomes wet, a fault is detected by the PCB. The fault condition is read by the TMS CPU and transmitted to the surface as a warning for display on the system monitor.

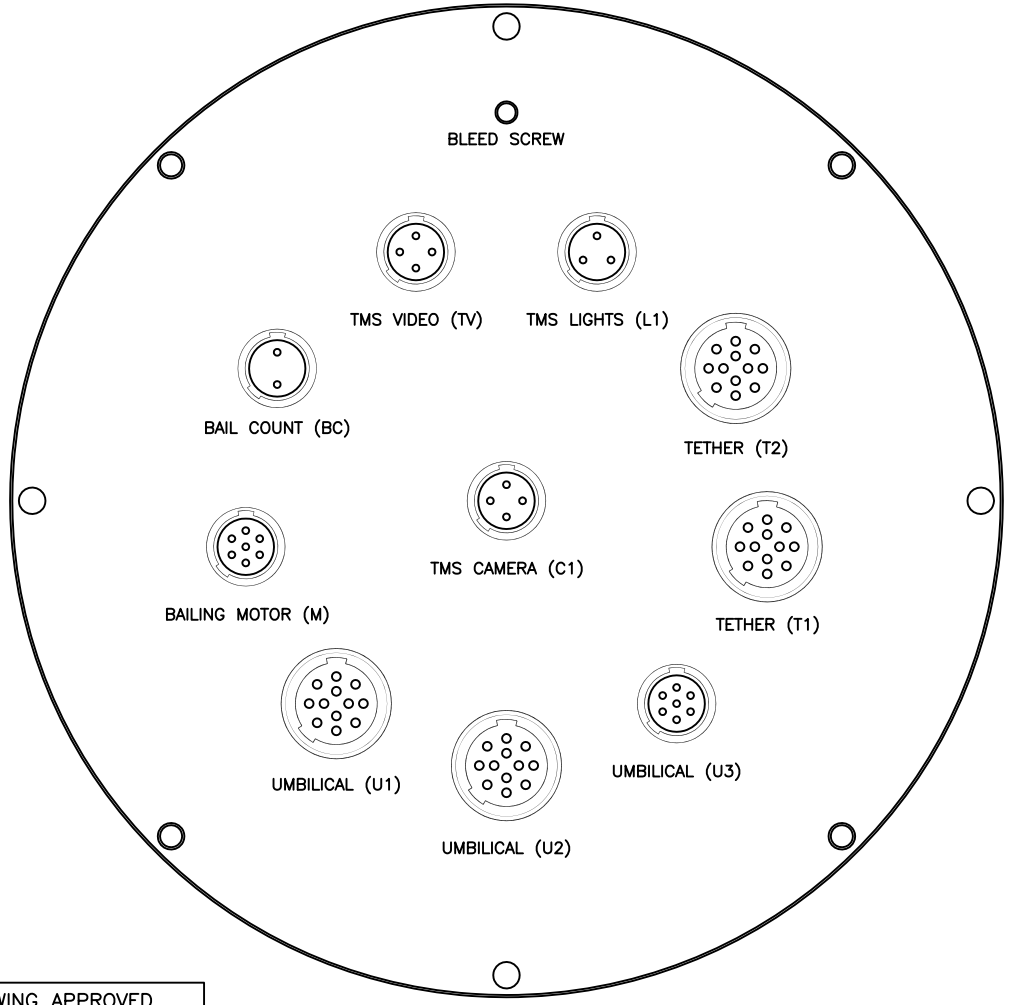
5.3.5 Bailing Count

Bail count data from the bail arm sensor is routed to the backplane via the Bailing Count bulkhead penetrator, pins 1 & 2. The sensor data is interfaced by the backplane to the TMS CPU where it is processed.

5.4 Video

In the TMS pod, composite video from the TMS camera pins 2 & 4 is routed to the Video Line Driver PCB (6071ASP) SKT 4 for transmission to the surface via twisted pair cable. At the surface the video signal is routed to the Video RX Module P01061 located in the Cabin Junction Box for display on a video monitor.Output is by way of BNC on the side of the Cabin Junction Box.

In the TMS pod, video from the ROV camera 1 and camera 2 is routed from T2 tether bulkhead connector straight through to umbilical bulkhead output U2 and continues via deck lead and CJB to the surface control unit T.P Video Module. Camera choice is determined by Video switch on the front of the SCU.



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2	M	1	BULKHEAD SIZE2 7WAY FEMALE 5/8 THREAD	M2BH7F
3	U1, T2	2	BULKHEAD SIZE3 12WAY MALE 5/8 THREAD	M3BH12M
4	U2, T1	2	BULKHEAD SIZE3 12WAY FEMALE 5/8 THREAD	M3BH12F
5	U3	1	BULKHEAD SIZE2 7WAY MALE 5/8 THREAD	M2BH7M
6	BC	1	BULKHEAD SIZE2 2WAY FEMALE 5/8 THREAD	M2BH2F
7	L1	1	BULKHEAD SIZE2 3WAY FEMALE 5/8 THREAD	M2BH3F
8	C1	1	BULKHEAD SIZE2 4WAY FEMALE 5/8 THREAD	M2BH4F
9	–	1	BLEED SCREW M5	Y18–S11–A6

ALL CONNECTORS & BUNGS ARE TO BE FITTED
WITH INSULATING WASHERS – REF. DWG. EP084

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1	First Issue		8/2/05	N/A

Seaeye

Seaeye Marine Ltd.
Seaeye House
Lower Quay Road
Fareham
Hampshire
PO16 0RQ
England
Tel: +44 (0)1329 289000

TITLE
TMSEPM–2b TETHER MANAGEMENT SYSTEM
EPOD WITH TMS CAMERA & LIGHTS
BULKHEAD LAYOUT

SHEET 1 OF 1

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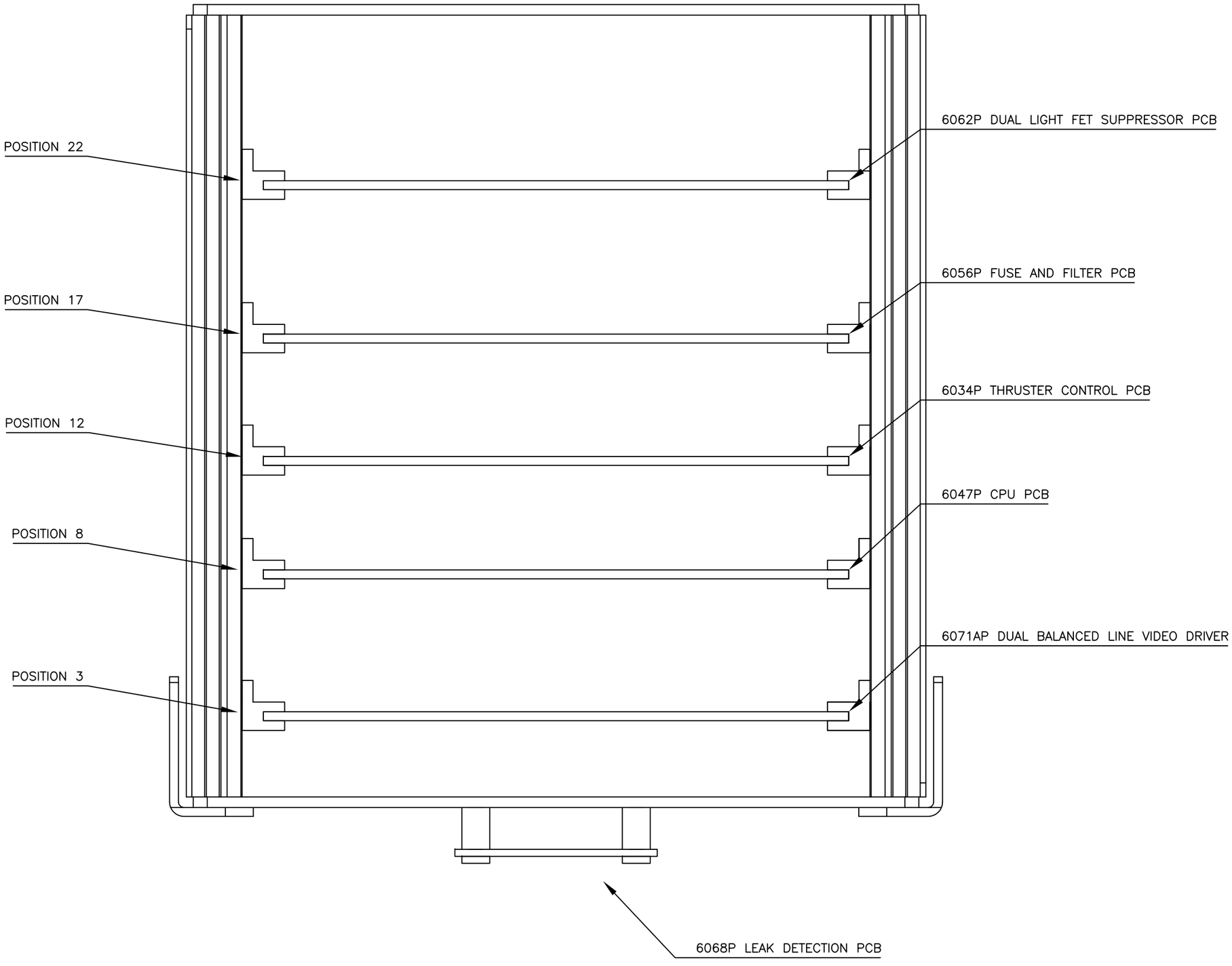
D. Waite	CGP	8/2/05

DWG.No. S04376 Rev. 2 Sht. 1



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2	COMPONENTE LAYOUT CORRECTED	GA	26/10/07	ECR1512-JFP
1	FIRST ISSUE		25/10/07	

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TITLE
TMSEPM-2B
TETHER MANAGEMENT SYSTEM
TMS POD CARD RACK CARD
POSITIONS
SHEET 1 OF 1

DRAWN	APPROVED	DATE
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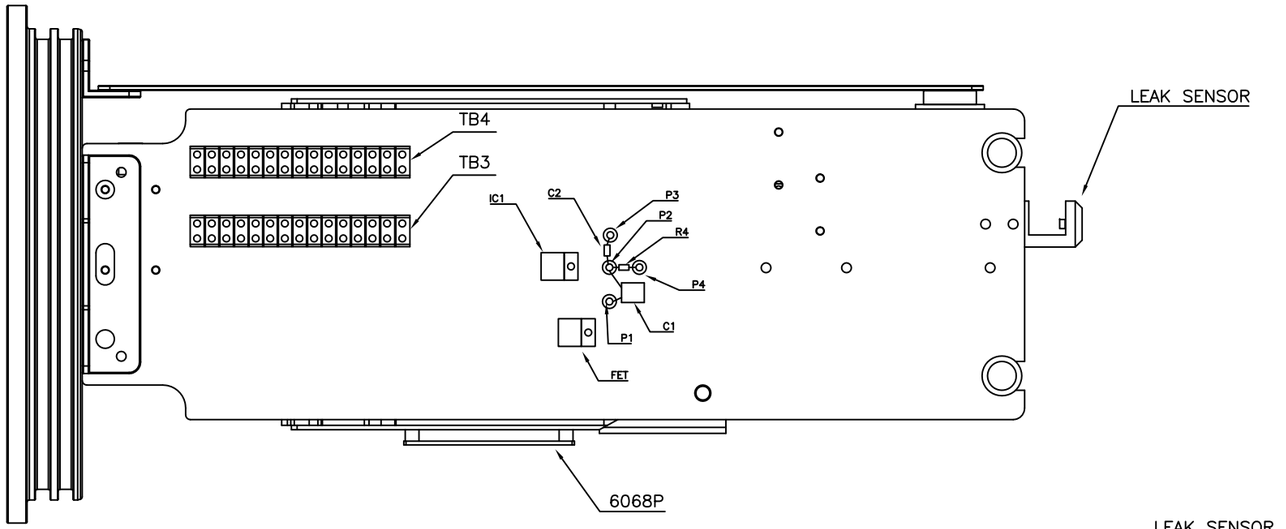

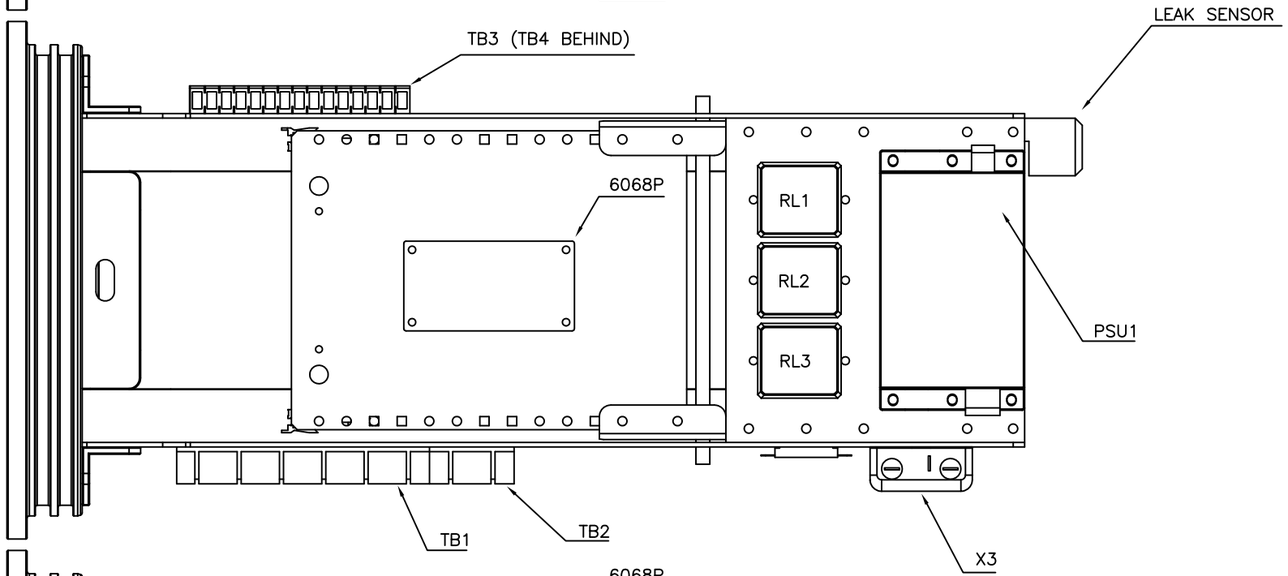

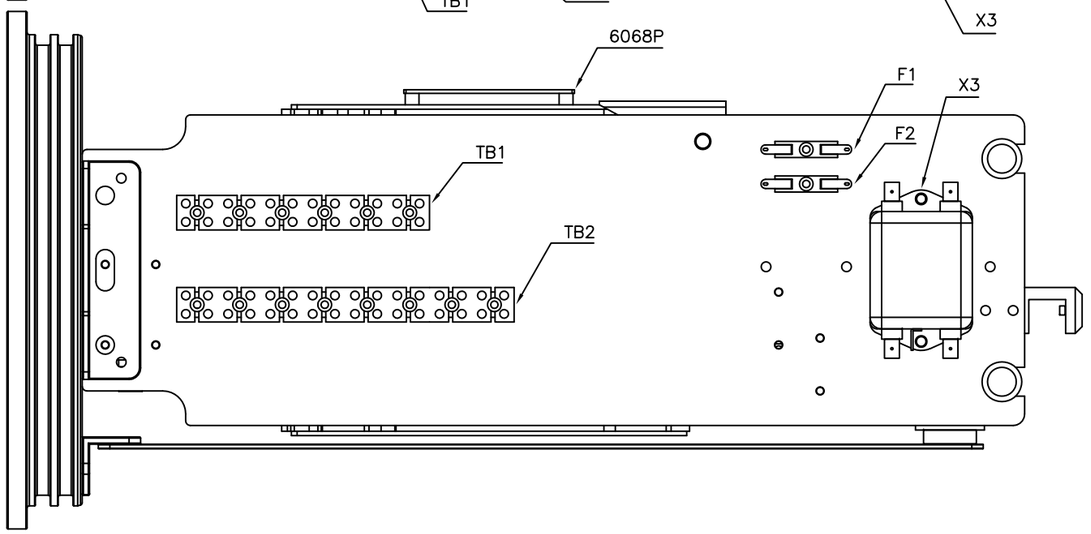

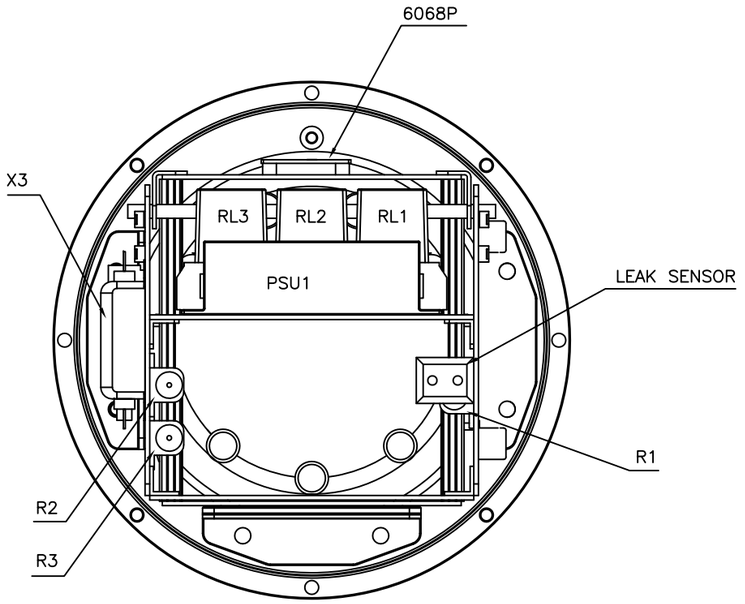

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TETHER MANAGEMENT SYSTEM
COMPONENT GENERAL ARRANGEMENT

SHEET 1 OF 1

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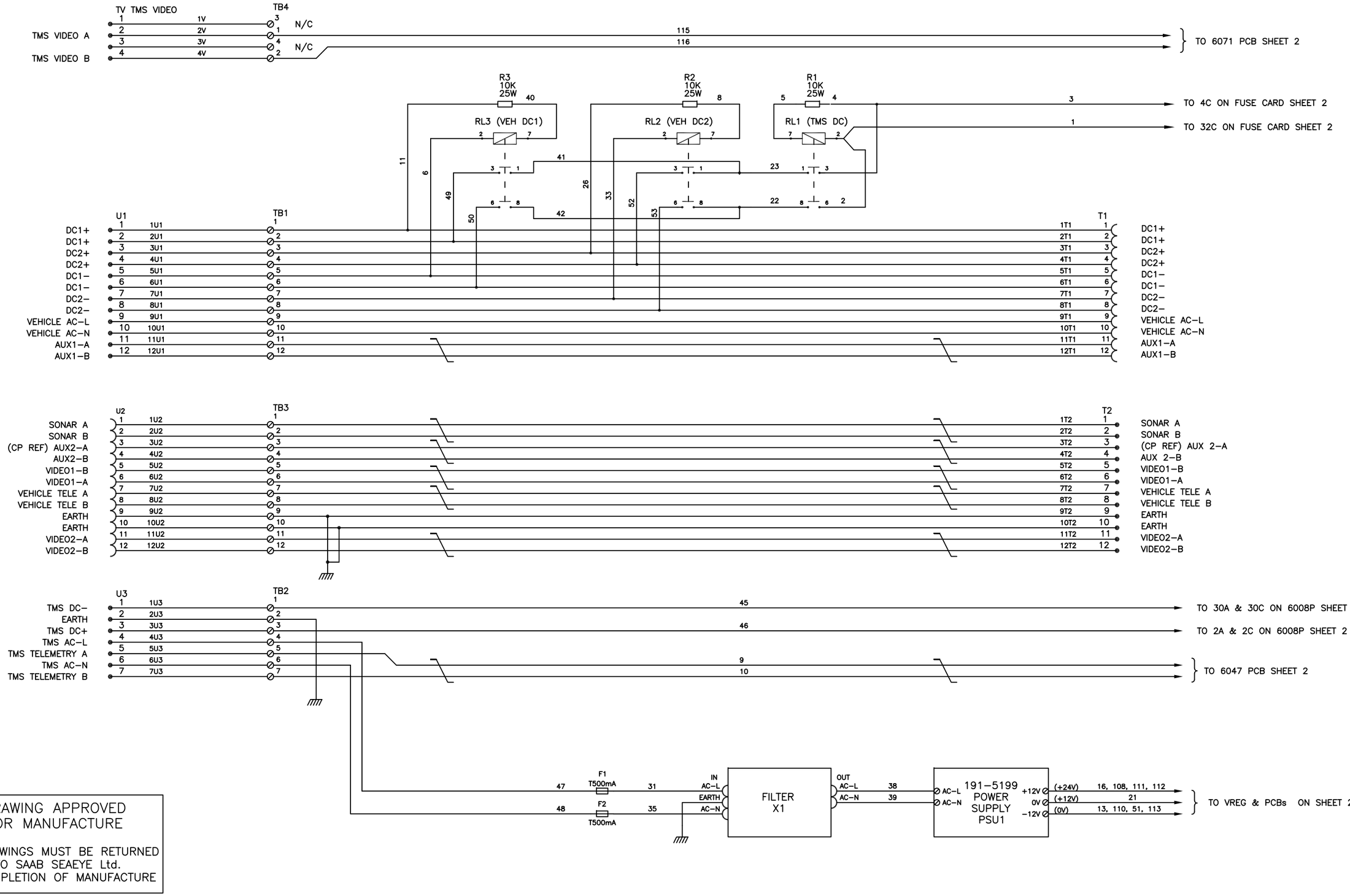

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2	DETAIL CORECTIONS OF DRG. ERRORS	GA	25/10/07	ECR1512-JFP
1	First Issue		23/2/05	N/A

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PO15 5SD
United Kingdom
Tel: +44 (0)1489 898000

TITLE
TMSEPM−2b TETHER MANAGEMENT SYSTEM
EPOD WITH TMS CAMERA & LIGHTS;
RELAY AND ELECTRONICS PSU
WIRING DIAGRAM
SHEET 1 OF 2

DRAWN	APPROVED	DATE
D. Waite	AW	23/2/05

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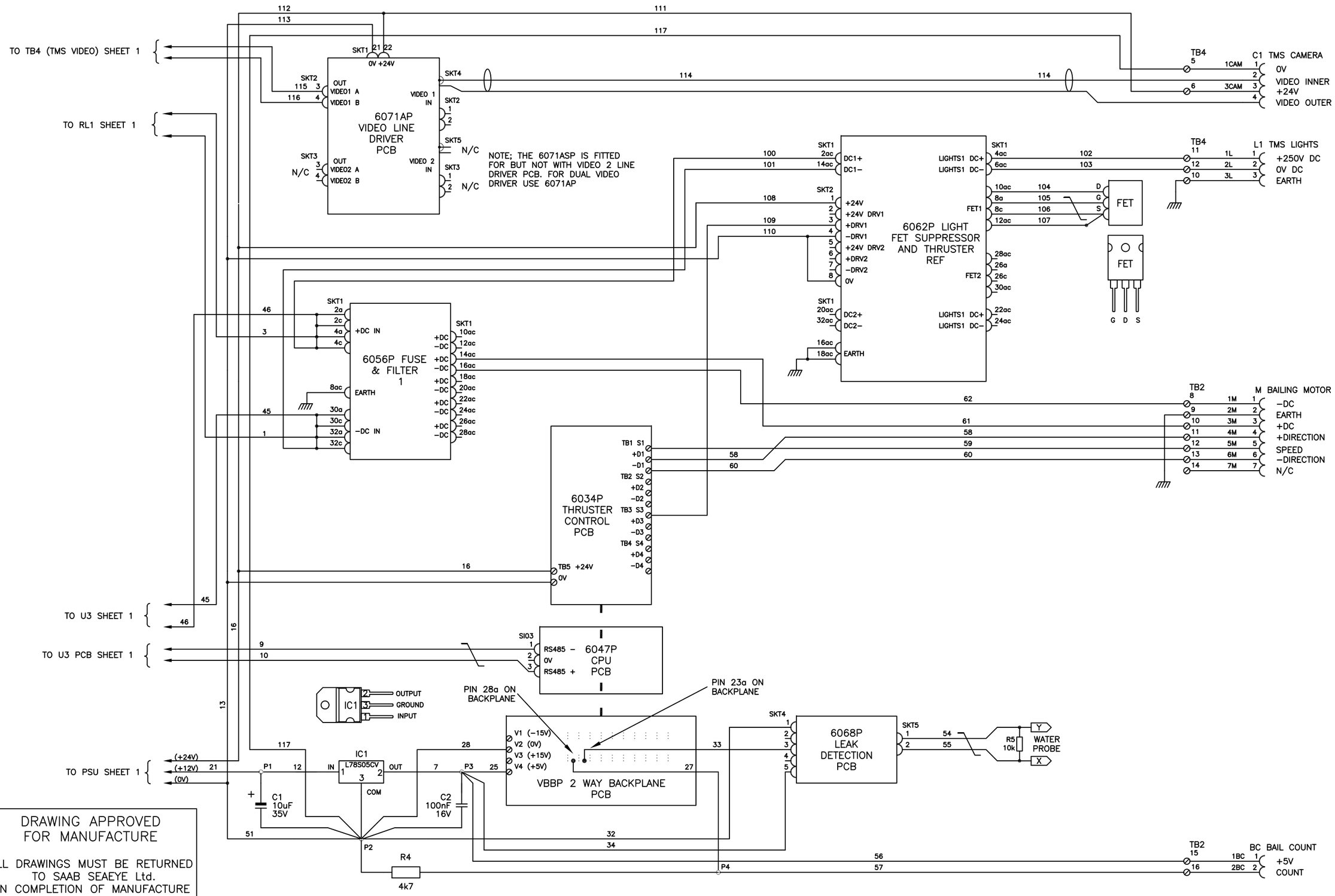

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3	6056P REPLACES 6008P	AJS	19/05/08	ECR1748-JFP
2	DETAIL CORRECTION OF DRG. ERRORS	GA	25.10/07	ECR1512-JFP
1	First Issue		23/2/05	N/A

Seaeye

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United Kingdom
Tel: +44 (0)1489 898000

TITLE

TMSEPM–2b TETHER MANAGEMENT SYSTEM EPOD WITH TMS CAMERA & LIGHTS; BACKPLANE, PCB & WATER PROBE WIRING DIAGRAM
SHEET 2 OF 2

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D. Waite	AW	23/2/05

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CHAPTER 6

CORRECTIVE

MAINTENANCE

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6. CORRECTIVE MAINTENANCE

This Chapter contains the approved procedures for removal, dismantling, assembling and refitting of equipment necessary for the correct maintenance of the TMS2T system.

6.1 Introduction

Where access to equipment and lowest replaceable units is straightforward, it is considered unnecessary to give instructions on dismantling and assembling.

6.1.1 Safety Precautions

Lethal voltages are present in all of the units and can be present in cable connections between units and junction boxes. Maintenance can involve contact with substances harmful to health. Before any work is carried out, involving internal access to the units, junction boxes or cable connections, the following warnings and cautions are to be observed.

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMS SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

POSSIBILITY OF DAMAGE TO EQUIPMENT. UNDER NO CIRCUMSTANCES IS THE TMS EPOD TO BE ASSEMBLED WITHOUT ANTI-EXTRUSION RINGS.

POSSIBLE DANGER TO PERSONNEL AND DAMAGE TO EQUIPMENT. THE ELECTRONICS POD WEIGHS APPROXIMATELY 16 KG AND CARE SHOULD THEREFORE BE TAKEN WHEN LIFTING THE POD FOR SLINGING PURPOSES.

DANGER TO PERSONNEL AND EQUIPMENT. THE BAILING MOTOR MAY OPERATE WITHOUT WARNING WHEN THE SYSTEM DC SUPPLY IS ENERGISED. ENSURE THAT THE TMS IS CLEAR OF ANY OBSTRUCTION AND PERSONNEL PRIOR TO ENERGISING THE DC SUPPLY.

CAUTIONS.

Danger of damage to PCBs. Do not remove or replace PCBs unless the supply is switched off. PCBs must be handled in accordance with electrostatic discharge handling procedures. Damage to PCBs could affect the safe operation of the equipment.

Danger of damage to equipment. When checking connections, care is to be taken not to slacken them, otherwise their watertight integrity may be breached.

Danger of damage to equipment. When using an insulation meter, ensure that the cable under test is disconnected at both ends.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

Danger of damage to light. Do not operate the TMS light for longer than ten seconds in air.

Possibility of damage to equipment. Ensure all vent plugs are securely fitted and shut prior to immersing the TMS.

Possibility of damage to equipment. Ensure that the Surface Power Supply Unit (PSU) transformer tappings correspond to the external input power supply.

6.1.2 Tools Required

The various maintenance procedures detailed in this handbook call for various standard and specialist tools. Not all tools are required for all procedures and the following list is not exhaustive, however it is strongly recommended that the special to type tools required for the more involved procedures be used. The following tools may be required:

- Flat bladed screwdrivers (common sizes).
- Open ended or ring spanners (common sizes).
- Socket set.
- Pliers, flat nosed.
- Hex keys (common sizes).
- Torque wrench (to achieve 2.8 kg. / m).
- Rubber mallet.

6.1.3 Parts Required

It is recommended that a supply of spare parts is always available and ready for use, especially O-rings. The following parts may be required:

- Stainless steel plain M8 nut.
- M8 and M16 Nylok nuts.

- Loctite 222, 641 and 480.
- Silicone grease (Molycote MS111 or similar).
- Cleaning fluid (Amberklene or similar).
- Oil container suitable for collecting oil.
- Bailing Motor V-seals (Part No VASEAL0012).
- Bailing Motor Diaphragm (Part No TH066).
- Bailing Motor Shaft Seals (Part No TH111).
- Bailing Motor Nose Cone O-ring (Part No 200-138).
- Bailing Motor Shaft Seal Platform (Part No TH112).
- TMS EPOD lid O-ring (Part No 200-366).
- M2 Metal Shell connector O-rings (Part Nos 200-014)
- M3 Metal Shell connector O-rings (Part Nos 200-019).
- Lamp O-rings (Part No 206-345 and 200-320).
- Lamp (Part NoJD150W/M2E11).
- Lamp fuse (Part No FF1A 20 mm ceramic).

6.2 Electrical Connectors and Seals

Where electrical connectors have been disconnected, before reconnecting the plugs and bulkhead connectors are to be examined for damage to the threadforms, O-rings, lead and pins and any dirt removed. Cleaning should only be with Amberklene and the plug and socket assembly thoroughly dried and threads and O-rings lightly coated with silicone grease before reconnecting.

It is advised where maintenance has disturbed units fitted with O-rings that the O-ring be discarded and replaced with a new one. Where this is not possible, the seal and O-ring groove should be cleaned and inspected for damage. O-rings are to be lightly coated with silicone grease prior to unit assembly.

The TMS system electronic pod is designed to operate at full diving depth and is fitted with anti-extrusion rings. The O-ring grooves on the pod have been designed to accommodate both an O-ring and an anti extrusion ring to prevent O-ring failure. It is therefore essential that the pod is assembled with the anti-extrusion ring fitted to the inboard side of the O-ring.

6.3 Vehicle Electronic Pods

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMS SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

CAUTIONS.

Danger of damage to PCBs. Do not remove or replace PCBs unless the supply is switched off. PCBs must be handled in accordance with electrostatic discharge handling procedures. Damage to PCBs could affect the safe operation of the equipment.

Danger of damage to equipment. When checking connections, care is to be taken not to slacken them, otherwise their watertight integrity may be breached.

Danger of damage to equipment. When using an insulation meter, ensure that the cable under test is disconnected at both ends.

6.3.1 Removal

Proceed as follows:

1. Disconnect the Electronics Pod (EPOD) electrical connections from the end-plate.

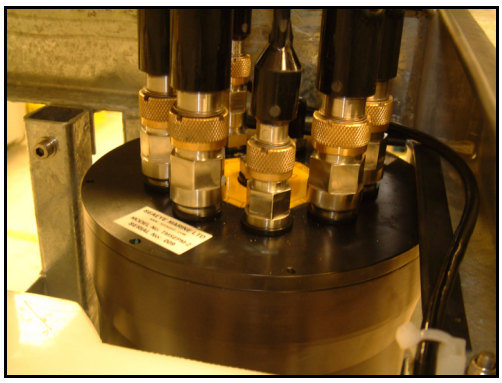

Figure. 6.1 EPOD Connections

2. Remove the bolts securing the TMS rear cross member bar. Remove the cross member bar.

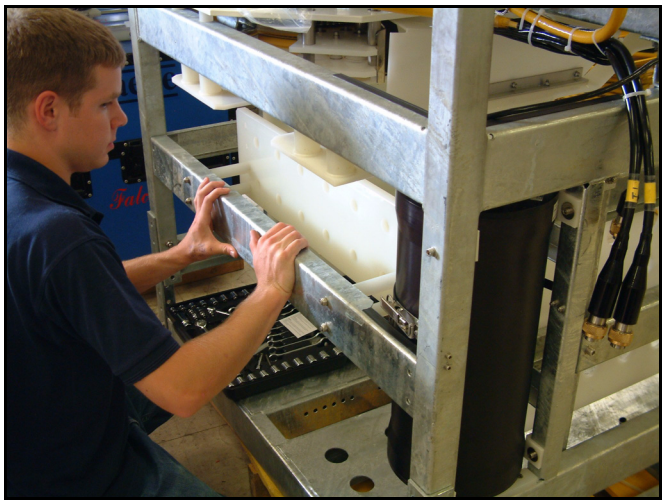

Figure. 6.2 TMS Rear Crossbar Removal

3. Remove the circlip securing the pod-securing bracket. Loosen the electronics pod-securing bracket to allow removal of the EPOD.

Figure. 6.3 EPOD Securing Bracket Removal

4. Lift the pod through the rear of the TMS structure taking care not to damage the EPOD.

Figure. 6.4 EPOD Removal

6.3.2 Dismantling

Proceed as follows:

1. Position the EPOD vertically on a stable platform.
2. Remove and retain the vent plug from the EPOD end-plate.
3. Press down on the end-plate and pull the nylon lock-wire free and retain.
4. Pull apart the end-plate from the EPOD.
5. Withdraw the end-plate and chassis from the EPOD housing.

6.3.3 Assembling

Proceed as follows:

1. Using a non-metallic tool prise off the O-seal from the end-plate.
2. Discard the O-seal.
3. Clean the end-plate O-seal groove and the EPOD O-seal face.
4. Sparingly lubricate the new O-seal with silicone grease.
5. Fit the O-seal to the end-plate groove.
6. Lower the end-plate and chassis into the EPOD housing ensuring it is seated correctly and taking care not to damage wires or O-seal.
7. Press down on the end-plate and feed the nylon lock-wire into the recess until the other end emerges and both ends are equal in length.
8. Replace the vent screw.

6.3.4 Refitting

Proceed as follows:

1. Guide the EPOD into the securing bracket in the TMS structure.
2. Locate the pod so that it sits on its platform stand with the two location bolts on the bottom of the pod on either side of the platform.
3. Secure the pod to the TMS with the securing bracket. Locate and fit the bracket securing pin.
4. Locate the TMS rear cross member bar and secure using the removed bolts.
5. Check connectors are clean and dry and lubricate the threads of both bulkhead connectors and plugs with Acua-Shield.
6. Reconnect all electrical connections securely to the EPOD end-plate.
7. Carry out a functional test of all TMS and ROV systems.

6.4 Metal Shell Connector O-Ring Replacement

WARNINGS.

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DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMS SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

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POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

CAUTIONS.

Danger of damage to PCBs. Do not remove or replace PCBs unless the supply is switched off. PCBs must be handled in accordance with electrostatic discharge handling procedures. Damage to PCBs could affect the safe operation of the equipment.

Danger of damage to equipment. When checking connections, care is to be taken not to slacken them, otherwise their watertight integrity may be breached.

Danger of damage to equipment. When using an insulation meter, ensure that the cable under test is disconnected at both ends.

Proceed as follows:

1. Using a small screwdriver, open the spiralux washer and slide along the connector body towards the plug moulding.
2. Pull back the nut towards the plug moulding, remove and discard the O-rings.
3. Clean the O-ring grooves, connector body and nut with Amberklene.
4. Lightly lubricate two new O-rings and fit into the connector body O-ring grooves.
5. Slide the nut along the connector body past the spiralux groove.
6. Using a small screwdriver, slide the spiralux washer along the connector body until it locates into its groove.
7. Functionally check all systems.

6.5 Mechanical Re-termination of Armoured Cables

The following procedure describes the method for the recovery of a mechanical termination and re-termination of a cable fitted with the Scorpion Oceanics Ltd. termination.

6.5.1 Recovery of Mechanical Termination from Cable

Carry out the following procedure:

1. Unscrew the spring bend strain relief from the termination and slide the spring along the cable.
2. Bind or tape the cable armour adjacent to the termination.
3. Cut through the armoured cable with an angle grinder adjacent to the termination.
4. Cut through the inner cable tail at the universal coupling side of the termination.
5. Drill, chisel or burn out the potting materials and scrap the cable from the termination armour body.
6. Thoroughly clean out the bore of the armoured body.

6.5.2 Mechanical Re-termination of the Cable

Proceed as follows:

1. Mark the cable at a point allowing the required length of inner cable tail.
2. Slide the spring bend strain relief along the cable and beyond this termination point.
3. Slide the mechanical termination along the cable and beyond the termination point.
4. Tightly bind the cable with thin cord over approximately 20 mm length at the termination point.
5. Cut through the outer layer of the cable armour with an angle grinder at approximately 110 mm from the binding at the free cable tail side. (Take care to not generate excessive heat or the cable inner sheath may melt). Remove the loose armour wire strands.
6. Cut half way through the inner layer cable armour with an angle grinder at the same point on the cable. (Take care to not generate excessive heat or the cable inner sheath

may melt). Snap off and remove the loose armour wire stands. Do not cut all the way through the inner layer of armour or damage may be caused to the cable inner sheath.

7. Slightly splay out (to a maximum of 10 degrees from the cable axis) and separate the 110 mm wire tails.
8. Thoroughly degrease the 110 mm wire tails with a brush and clean solvent.
9. Slide the termination armour body over the wire tails such that the wire ends are at the widest part of the conical bore of the termination and the binding in the narrow parallel part.
10. Apply mastic at the external interface of the armoured cable and termination.
11. Fit a 'Jubilee' clip on the cable at this interface to stop the termination from sliding along the cable.
12. Support the assembly vertically with the wide end of the conical bore uppermost and the cable exit central at each end.
13. Thoroughly mix a 250 cc Wirelock kit and pour into the conical bore of the termination to the widest point of the bore. Allow to cure. (Use Wirelock in accordance with the manufacturer's instructions).
14. Thoroughly mix a small amount of polyurethane customer and fill the remaining bore with polyurethane. Allow to cure. (Use the polyurethane in accordance with the manufacturer's instructions.
15. After the resins have cured, remove the supporting 'Jubilee' clip and mastic.
16. Screw the spring band strain relief back on to the termination.

NOTE.

Operators may find the recovery of the termination components and re-termination easier if the universal coupling is dis-assembled. If this method is adopted, then the following should be noted:

- Refit the screws using Loctite 242E retainer (or equivalent).
- Renew the internal circlips.
- Peen over the universal coupling pin bore outer ends.

Use appropriate safety equipment whilst using the tools and resins etc.

Proof loading of the assembly prior to use in service is recommended.

6.6 Bailing Motor

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMS SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

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POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

DANGER TO PERSONNEL AND EQUIPMENT. THE BAILING MOTOR MAY OPERATE WITHOUT WARNING WHEN THE SYSTEM DC SUPPLY IS ENERGISED. ENSURE THAT THE TMS IS CLEAR OF ANY OBSTRUCTION AND PERSONNEL PRIOR TO ENERGISING THE DC SUPPLY.

CAUTIONS.

Danger of damage to PCBs. Do not remove or replace PCBs unless the supply is switched off. PCBs must be handled in accordance with electrostatic discharge handling procedures. Damage to PCBs could affect the safe operation of the equipment.

Danger of damage to equipment. When checking connections, care is to be taken not to slacken them, otherwise their watertight integrity may be breached.

Danger of damage to equipment. When using an insulation meter, ensure that the cable under test is disconnected at both ends.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

6.6.1 Removal

Proceed as follows:

1. Disconnect the motor connector from the EPOD end-plate.
2. Support the Bailing motor and loosen the two hex socket bolts on the motor securing clamp assembly.
3. Lower the motor from the bracket and withdraw from the TMS structure ensuring the blue drive collar-meshing wheel is retained.

6.6.2 Dismantling

Proceed as follows:

1. Using a soft jawed vice secure the drive collar and remove the nyloc nut and washer from the shaft. Retain the washer and discard the nut.
2. Loosen the drive collar grub-screw sufficiently to clear the drive collar boss and remove and retain the drive collar sheath.
3. Fit the puller tools legs under the drive collar boss and screw down on the jacking screw until it engages the end of the motor shaft.
4. Continue to tighten the jacking screw until the drive collar boss breaks free of the motor shaft.

NOTE.

Dismantling the bailing motor beyond the maintenance described within the handbooks will invalidate the warranty. If in any doubt consult SAAB SEAEYE LTD. prior to any further dismantling of the Bailing Motor.

6.6.3 Assembling

Proceed as follows:

1. Refit the drive collar boss to the motor shaft. With minimum force gently tap the collar onto the shaft taper with a rubber mallet.
2. Refit the drive collar sheath and tighten the grub-screw onto the drive collar boss.
3. Using a soft jawed vice secure the drive collar, fit the M8 plain nut and tighten until the drive collar boss has fully located onto the taper shaft.
4. Remove the M8 plain nut.
5. Fit the washer and new M8 nyloc nut and tighten with a torque wrench to 27 Nm/ 2.8kgm/ 20lb ft.
6. Clean the motor plug with Amberklene then lubricate thread forms with silicone grease.

6.6.4 Refitting

Proceed as follows:

1. Fit the blue collar meshing wheel onto the motor drive collar and locate the motor up into the securing clamp assembly and tighten in place.
2. Reconnect the motor connector to the EPOD end-plate.
3. Check the TMS bailing system for correct operation.

6.7 Bailing Motor V-Seal Replacement

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

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DANGER TO PERSONNEL AND EQUIPMENT. THE BAILING MOTOR MAY OPERATE WITHOUT WARNING WHEN THE SYSTEM DC SUPPLY IS ENERGISED. ENSURE THAT THE TMS IS CLEAR OF ANY OBSTRUCTION AND PERSONNEL PRIOR TO ENERGISING THE DC SUPPLY.

CAUTIONS.

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Danger of damage to equipment. When checking connections, care is to be taken not to slacken them, otherwise their watertight integrity may be breached.

Danger of damage to equipment. When using an insulation meter, ensure that the cable under test is disconnected at both ends.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

Proceed as follows:

1. Remove the motor from the TMS.
2. Dismantle the motor.
3. Support the motor in a vertical attitude shaft uppermost.
4. Gently remove the V-Seal from the nose cone and discard.
5. Lubricate the motor shaft with silicone grease.
6. Fit a new V-seal to motor shaft.

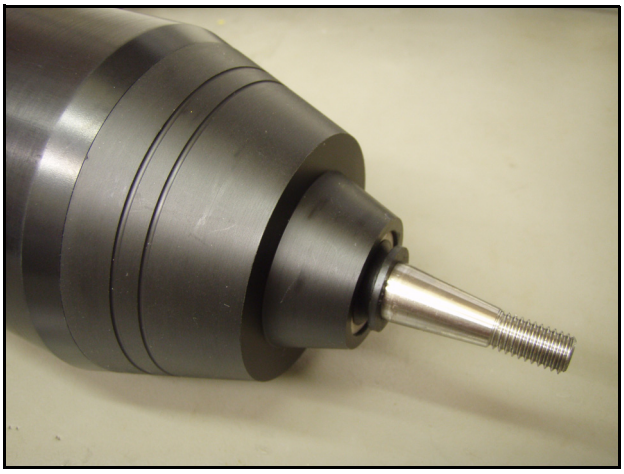

Figure. 6.5 V-Seal Fitment

7. Assemble the motor.
8. Carry out an oil level check.
9. Refit the motor.

6.8 Bailing Motor Shaft Seal Replacement

WARNINGS.

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Danger of damage to equipment. When using an insulation meter, ensure that the cable under test is disconnected at both ends.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

Proceed as follows:

1. Remove motor from the TMS.
2. Dismantle the motor.
3. Thoroughly clean the motor exterior with Amberklene.
4. Position a container under the motor to collect the oil.
5. Remove and retain the fill and vent screws from the motor and drain the oil.
6. Gently remove the V-Seal from the nose cone and discard.
7. Unscrew the motor nose cone by hand. If removal proves difficult apply heat from a heat gun until the nose cone is hand hot and gently tap away the nose cone using a wooden dowel.
8. Remove and discard the nose cone O-ring.
9. Carefully remove the ceramic seal and discard.
10. Carefully remove the shaft seal assembly and discard.
11. Thoroughly clean the nose cone and shaft with Amberklene.
12. Lubricate the new ceramic seal with clean water with 50% washing-up liquid.

13. Using the seal insertion tool (Part No TH111-2) press the seal assembly onto the nose cone.

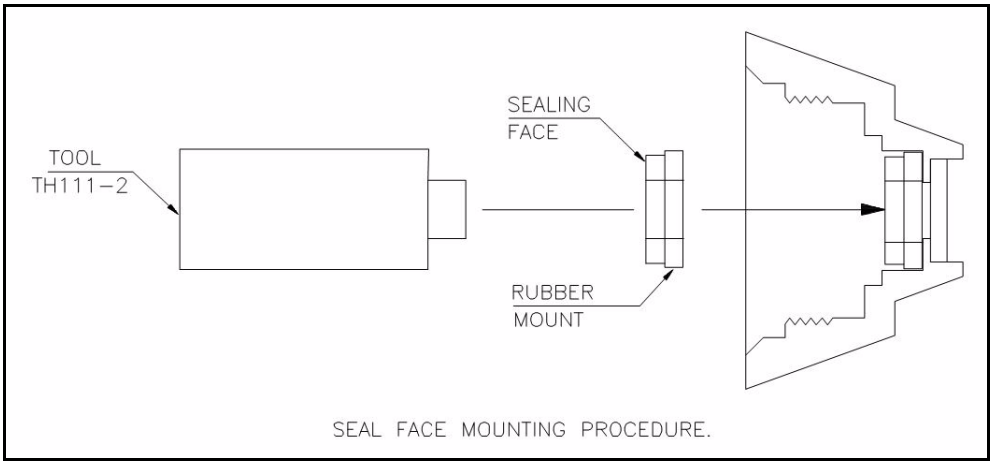

Figure. 6.6 Seal Face Mounting Procedure

Figure. 6.7 Ceramic Seal with Insertion Tools

14. Using the gauge tool (Part No TH111-3) rotate the nose cone looking for any high points. Firmly press down on the tool to remove high points and ensure the seal is fitted squarely onto the nose cone.

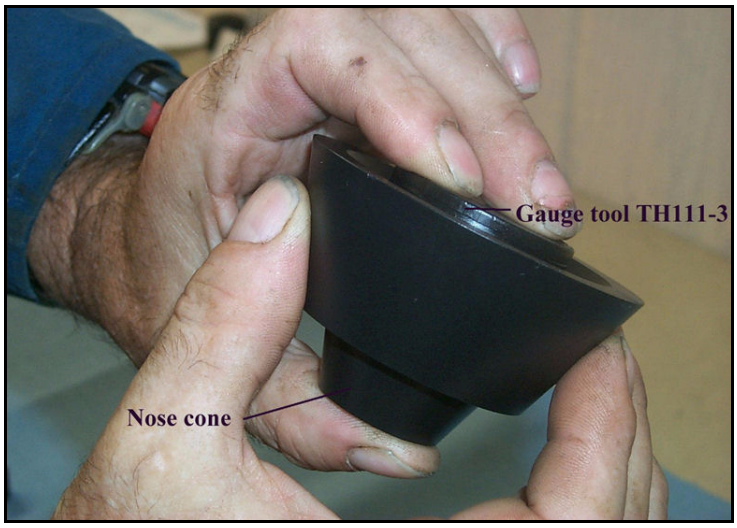

Figure. 6.8 Nose Cone Seal Fitting

15. Loosen the shaft seal M4 grubscrew and lightly coat the shaft seal M4 grubscrew with Loctite 641.
16. Lubricate the inside of the shaft seal with a mixture of water and 50% washing-up liquid. Fit the seal platform onto the motor's shaft with the large diameter end of the seal platform facing end of the shaft.
17. Position the seal platform level with the top rim of the motor's body using a fitting tool. Tighten the grubscrew sufficient to grip the shaft but allow the seal platform to slide with the application of slight pressure.

Figure. 6.9 Shaft Seal Fitting

18. Fit the 3mm shaft seal fitting tool (Part No TH111-1) onto the shaft and resting on the seal platform.

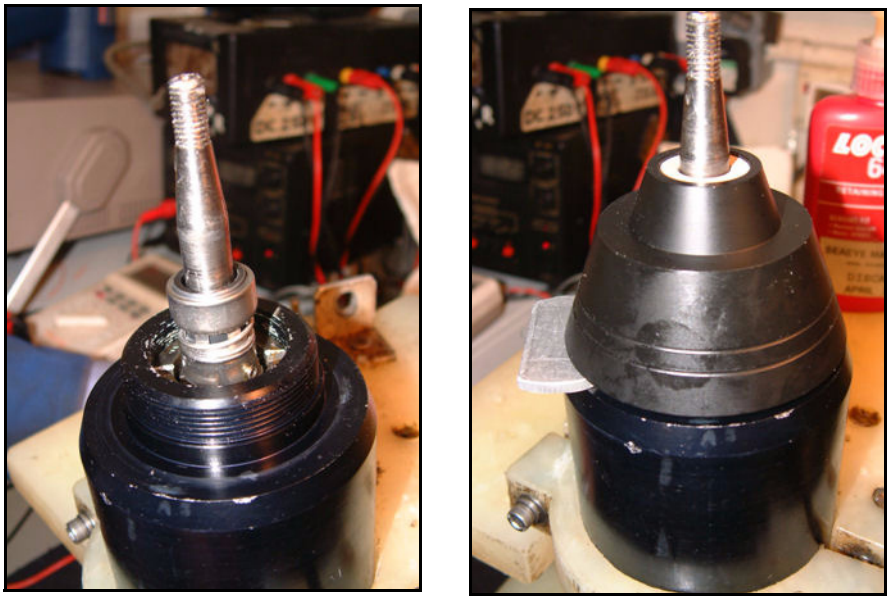

Figure. 6.10 Shaft Seal and 3mm Fitting tool

19. Fit the nose cone onto the shaft and screw down carefully to seat the seal platform at the correct position.
20. Carefully remove the nose cone.
21. Carefully remove the shaft seal-fitting tool without disturbing the seal platform.
22. Note the marking on the ceramic seal. This should be marked around ¾ of the seal face. If not, reposition the shaft seal until the marking is correct. Tighten the grubscrew fully.

Figure. 6.11 Detail Showing 'Clean' Ceramic Seal and 'Marked' Ceramic Seal

23. Clean and dry thoroughly the faces of the shaft seal and nose cone ceramic seals.

NOTE.

It is essential that all traces of oil and contaminates are removed from the shaft and ceramic seal faces and surfaces are perfectly dry.

24. Lubricate the nose cone O-ring with silicone grease.
25. Refit the nose cone.
26. Leave the motor undisturbed for a minimum of 30 minutes to permit the loctite to cure.
27. Fit a new V-Seal.
28. Assemble the motor.
29. Carry out oil level check.
30. Run the motor for 10 minutes to run in the surfaces of the shaft seal and ceramic seal faces.

CAUTION.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

31. Refit the motor.

6.9 Bailing Motor Diaphragm Replacement

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

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CAUTIONS.

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Danger of damage to equipment. When checking connections, care is to be taken not to slacken them, otherwise their watertight integrity may be breached.

Danger of damage to equipment. When using an insulation meter, ensure that the cable under test is disconnected at both ends.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

Proceed as follows:

1. Remove motor from the TMS.
2. Thoroughly clean the motor exterior with Amberklene.
3. Position a container under the motor to collect the oil.
4. Remove the fill and vent screws from the motor and drain the oil.
5. Remove and retain the four hex screws securing the motor's top hat to the motor body.
6. Remove the top hat together with the diaphragm return spring.
7. Remove and discard the diaphragm.
8. Thoroughly clean the diaphragm housing.
9. Fit a new diaphragm ensuring the O-ring is correctly seated.
10. Fit the diaphragm return spring in position on the diaphragm.
11. Fit the top hat and secure with the four hex screws using Loctite 222.
12. Carry out oil fill check.
13. Refit the motor.

6.10 Motor Insulation Testing

WARNINGS.

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DANGER TO PERSONNEL AND EQUIPMENT. THE BAILING MOTOR MAY OPERATE WITHOUT WARNING WHEN THE SYSTEM DC SUPPLY IS ENERGISED. ENSURE THAT THE TMS IS CLEAR OF ANY OBSTRUCTION AND PERSONNEL PRIOR TO ENERGISING THE DC SUPPLY.

CAUTIONS.

Danger of damage to PCBs. Do not remove or replace PCBs unless the supply is switched off. PCBs must be handled in accordance with electrostatic discharge handling procedures. Damage to PCBs could affect the safe operation of the equipment.

Danger of damage to equipment. When checking connections, care is to be taken not to slacken them, otherwise their watertight integrity may be breached.

Danger of damage to equipment. When using an insulation meter, ensure that the cable under test is disconnected at both ends.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

Damage may occur if the motor insulation test is not carried out correctly.

Proceed as follows:

1. Connect the insulation tester.
2. The motor can be insulation tested as follows.
   - Earth to DC.
   - Earth to Electronics.
   - Electronics to DC.
3. Reading is to be greater than 200 Mohms.

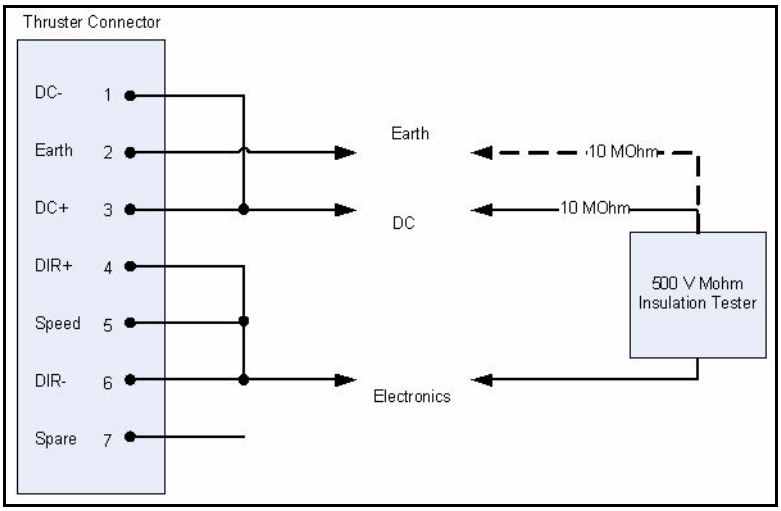

Figure. 6.12 Motor Insulation Test Setup

NOTE.

Electronic lines must be kept bonded for insulation tests. Damage may occur to electronics if the lines are separated and tested individually.

6.11 Sheave Wheel Belt Replacement

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMSV SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

6.11.1 Removal

Proceed as follows:

1. Slacken off the spring adjusting bolt.

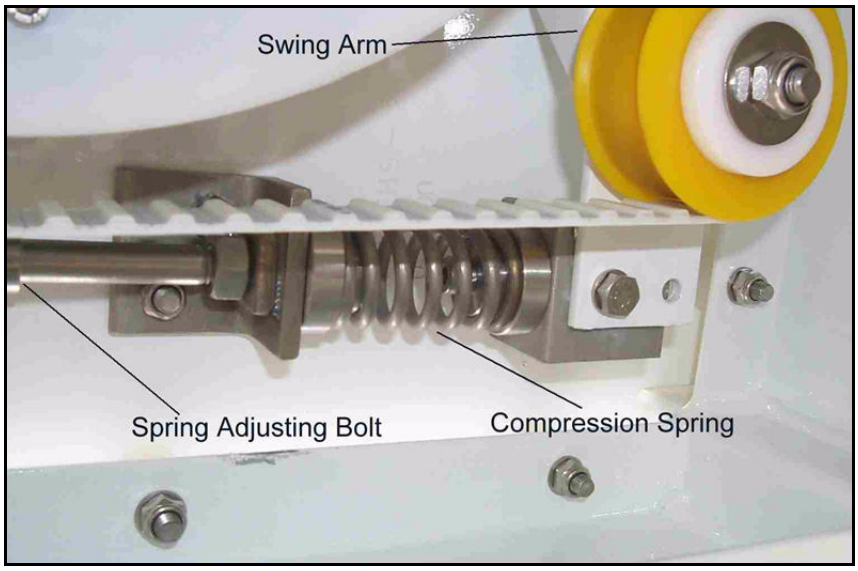

Figure. 6.13 Sheave Wheel Belt Compression Spring

2. Disengage the compression spring and pull rearwards.
3. Move the Swing arm to slacken the Sheave Wheel belt.

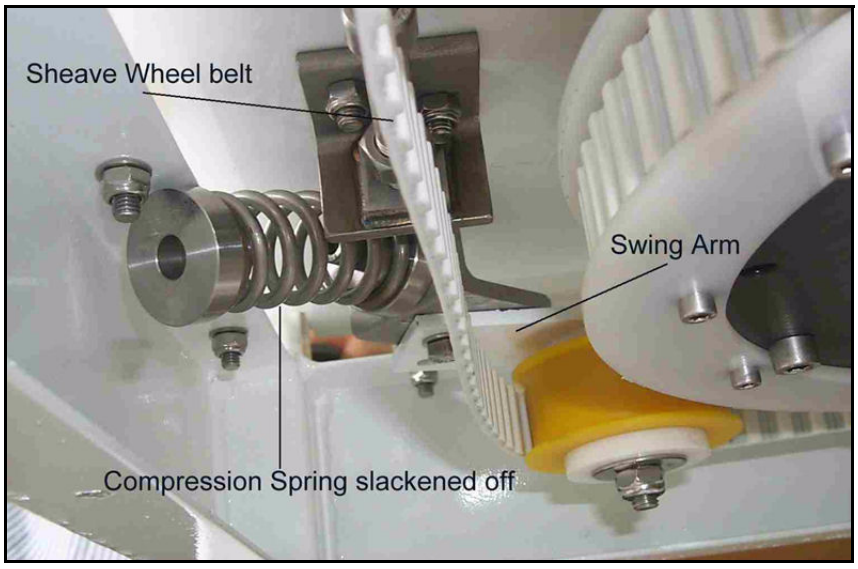

Figure. 6.14 Sheave Wheel Belt Slackened Off for Removal

Remove one screw from the idler bracket and swing the idler bracket to the side to provide clearance for the belt removal.

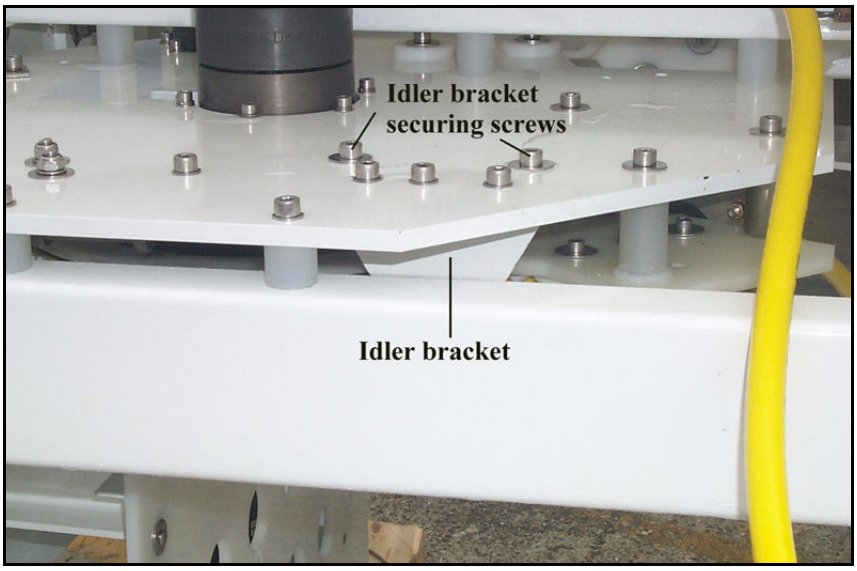

Figure. 6.15 Idler Bracket

4. Remove the Sheave Wheel belt.

6.11.2 Replacement

Proceed as follows:

1. Fit the Sheave Wheel belt.
2. Swing the idler bracket into place and secure with the screw.
3. Move the swing arm into place.
4. Engage the compression spring into the compression spring bracket.
5. Replace the spring adjusting bolt and screw finger tight.
6. Carry out the belt adjustment.
7. Carry out a functional test of the bailing system.

6.12 Primary Drive Chain Replacement

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMSV SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

6.12.1 Removal

Proceed as follows:

1. Loosen the two in-number hex screws.

Figure. 6.16 Primary Drive Chain Tensioner Securing Screws

2. Move the chain tensioner to slacken off the chain.

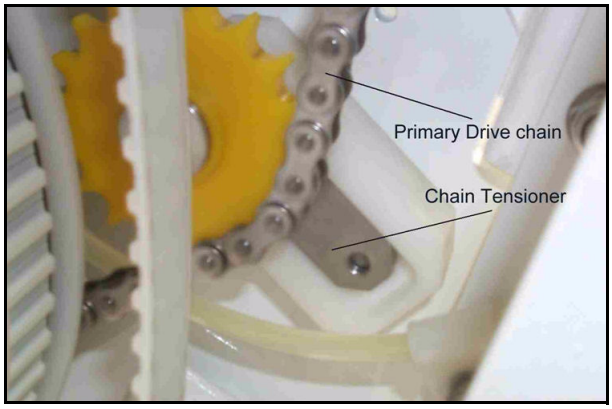

Figure. 6.17 Primary Chain Tensioner

3. Locate the chain link connector on the drive chain and remove.
4. Remove the chain from the sprockets.

6.12.2 Refitting

NOTE.

When replacing the Primary Drive chain, the chain must be kept level when passing round the Idler hub, Sheave Wheel and Reduction gearbox

Proceed as follows:

1. Carefully feed the chain through the assemblies and fit correctly on the sprockets.
2. Replace the chain link connector.
3. Carry out the chain adjustment as detailed in Chapter 7.
4. Functionally check the bailing system.

6.13 Secondary Drive Chain Replacement

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMSV SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

6.13.1 Removal

Proceed as follows:

1. Loosen the four screws on the bailing arm chain adjuster.

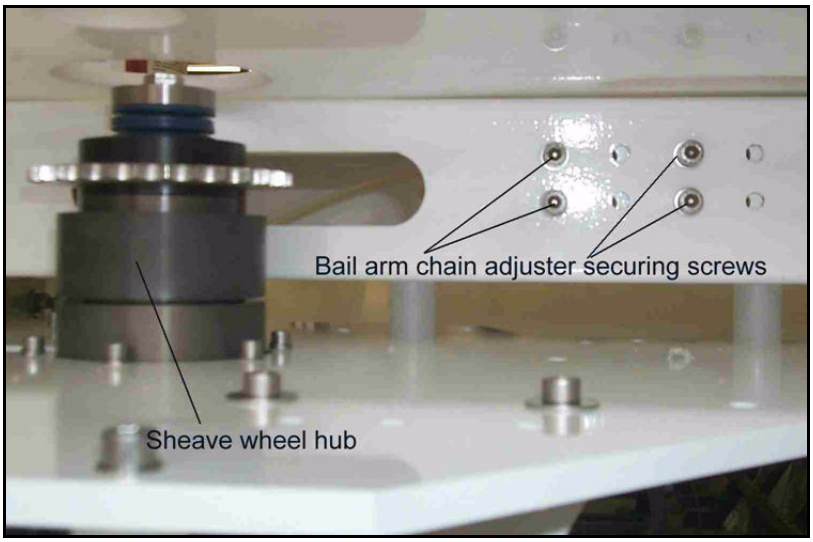

Figure. 6.18 Bail Arm Adjuster Securing Screws

2. Locate the chain link connector on the secondary drive chain and remove.
3. Remove the chain.

6.13.2 Refitting

Proceed as follows:

1. Carefully feed the chain through the assemblies and the sprockets.
2. Replace the chain link connector.
3. Carry out the secondary drive chain adjustment.
4. Carry out a functional test of the bailing system.

6.14 Belville Springs Replacement

Belville springs are to be changed on signs of corrosion and excessive wear. If the springs are over tightened, flattened or assembled incorrectly irreparable damage is possible. Belville springs can be found on the following:

- Sheave Wheel.
- Reduction gearbox.
- Idler hub.

6.14.1 Sheave Wheel Belville Springs Replacement

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMSV SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

6.14.2 Removal

Proceed as follows:

1. Remove the tension off the Belville springs by slackening the tension-adjusting bolt.

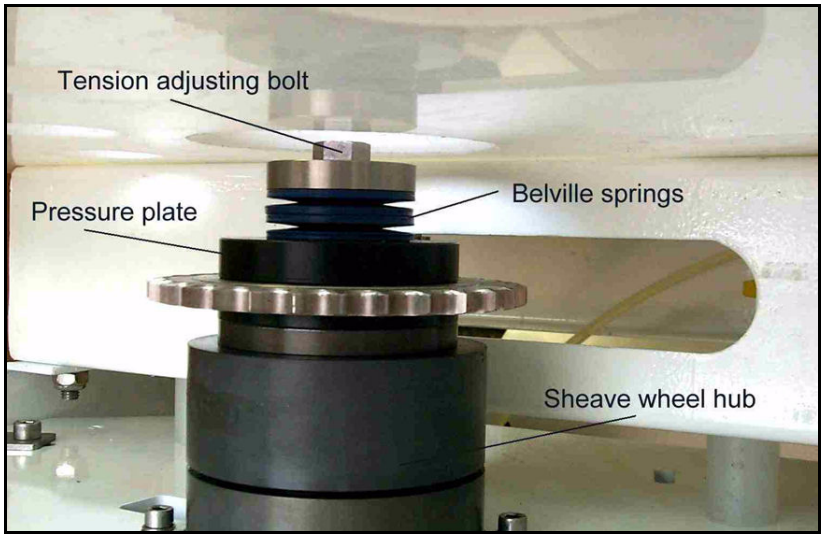

Figure. 6.19 Sheave Wheel Assembly

2. Continue to unscrew the bolt, remove bolt and washer and retain.
3. Remove the pressure plate.
4. Remove and discard the four Belville springs.

6.14.3 Replacement

Proceed as follows:

WARNING.

POSSIBLE DAMAGE TO EQUIPMENT. INCORRECT ASSEMBLY OF THE BELVILLE SPRINGS CAN CAUSE IRREPARABLE DAMAGE

1. Locate the four Belville springs onto the power sheave end cap shaft ensuring they are in the correct order.

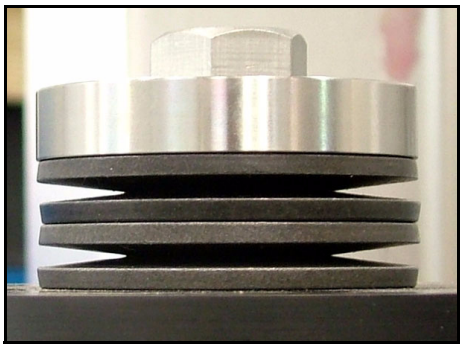

Figure. 6.20 Belville Spring Stack Order

2. Replace the pressure plate.
3. Locate the adjusting bolt and washer into the bore of the pressure plate and screw finger tight.
4. Carry out bailing arm adjustment as detailed in Chapter 7.
5. Functionally check the bailing system.

6.14.4 Reduction Gearbox Belville Springs Replacement

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMSV SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

Proceed as follows:

WARNING.

POSSIBLE DAMAGE TO EQUIPMENT. INCORRECT ASSEMBLY OF THE BELVILLE SPRINGS CAN CAUSE IRREPARABLE DAMAGE

1. Remove the split pin from the castle nut.
2. Unscrew and remove the castle nut.

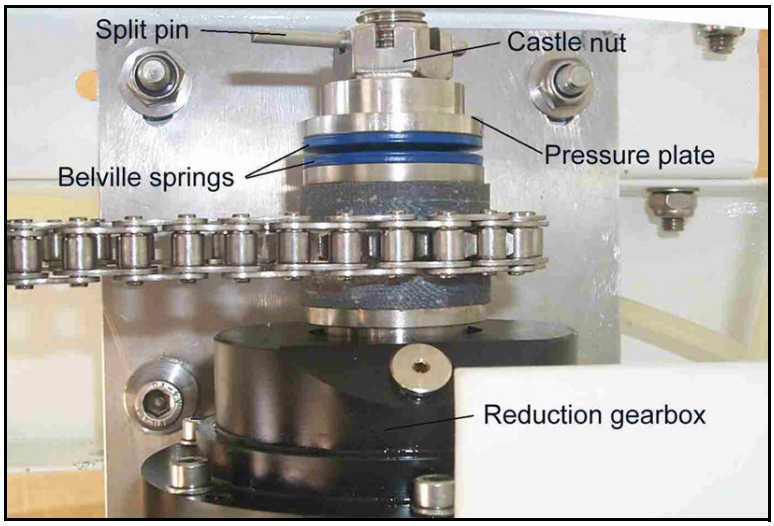

Figure. 6.21 Reduction Gearbox Belville Springs

3. Remove the pressure plate.
4. Remove the two Belville Springs.

6.14.5 Replacement

Proceed as follows:

1. Locate the two Belville springs onto the reduction gearbox shaft ensuring they are in the correct order.
2. Replace the pressure plate.
3. Screw the castle nut onto the reduction gearbox shaft.
4. Carry out the reduction gearbox tension adjustment as detailed in Chapter 7.
5. Replace the split pin.
6. Carry out a functional check of the bailing system.

6.14.6 Idler Hub Belville Spring Replacement

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMSV SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

6.14.7 Removal

Proceed as follows:

1. Remove the split pin from the castle nut.
2. Unscrew and remove the castle nut.

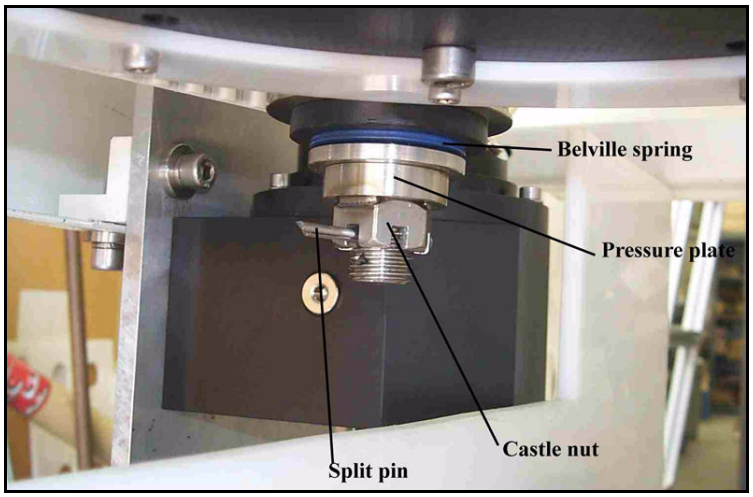

Figure. 6.22 Idler Hub Belville Spring

3. Remove the pressure plate.
4. Remove the Belville spring.

6.14.8 Replacement

Proceed as follows:

1. Locate the Belville spring onto the idler hub shaft.
2. Replace the pressure plate.
3. Screw the castle nut onto the idler hub shaft.
4. Using a torque wrench, torque the castle nut to 9.8 Nm (1 kg fm) and fit the split to closest hole to the torque setting.
5. Carry out a functional check of the bailing system.

6.15 Tether Removal and Replacement

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMSV SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

6.15.1 Removal

Proceed as follows:

1. Maintain a constant supply of freshwater over the TMS tether and bailing system.
2. Bail out the tether until no wraps are left on the bobbin.
3. Switch off all power and disconnect the mains supply.
4. Remove one half of the exit point doughnut.
5. Remove the horizontal cable guide lower plate.

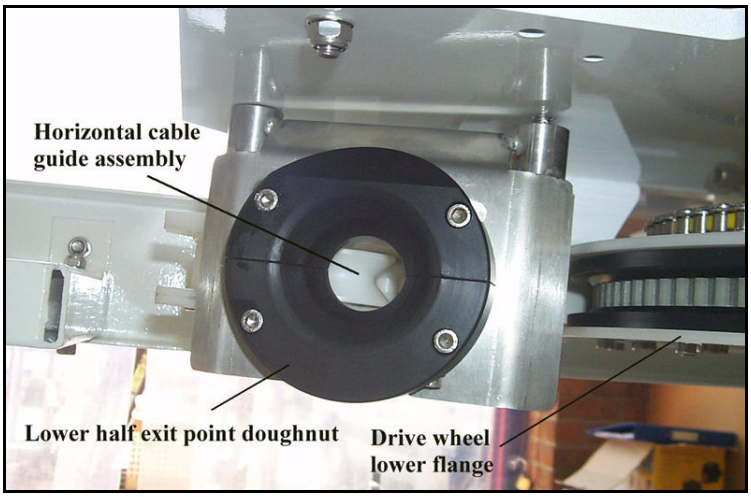

Figure. 6.23 Exit Point Doughnut

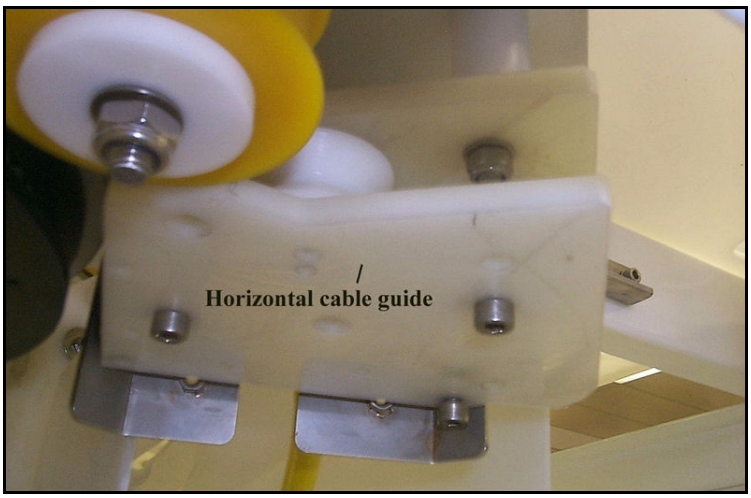

Figure. 6.24 Horizontal Cable Guide

6. Slacken off the spring adjusting bolt.

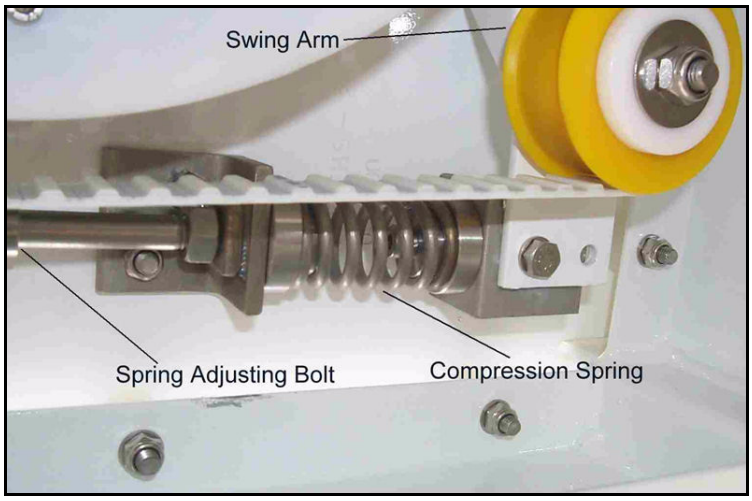

Figure. 6.25 Sheave Wheel Belt

7. Disengage the compression spring and pull rearwards.
8. Move the Swing arm to slacken the Sheave Wheel belt.

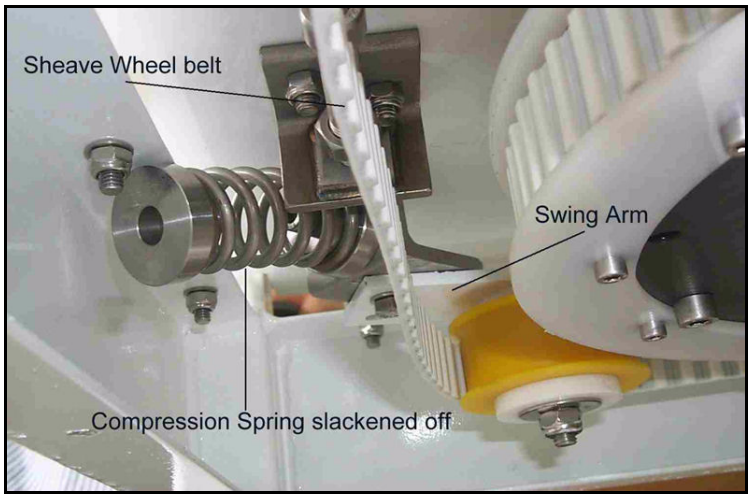

Figure. 6.26 Sheave Wheel Belt Slackened Off for Removal

9. Remove one screw from the idler bracket and swing the idler bracket to the side to provide clearance for belt removal.

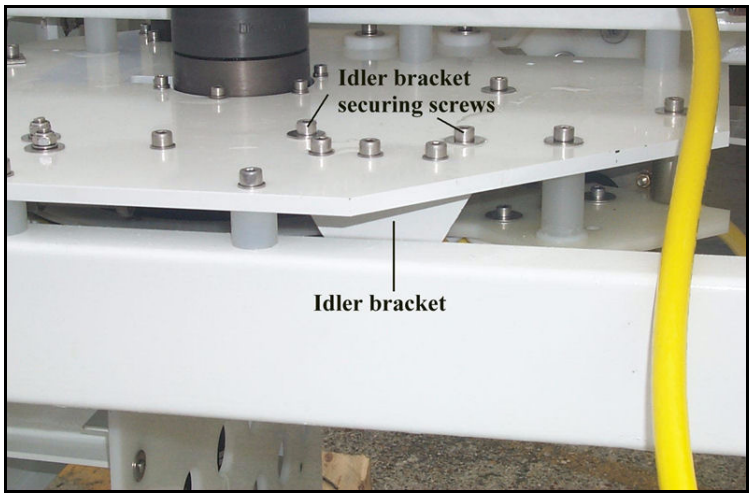

Figure. 6.27 Idler Bracket

10. Remove the sheave wheel belt.
11. Remove the main drive wheel lower flange.
12. Slacken the two bolts securing the vertical cable guide to the mounting plate and move it towards the hub centre to gain access.

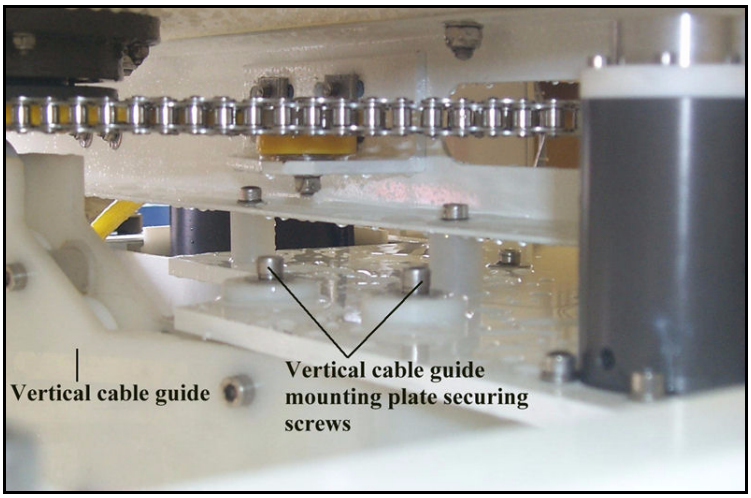

Figure. 6.28 Vertical Cable Guide Securing Screws

13. Remove the vertical cable guide front plate.

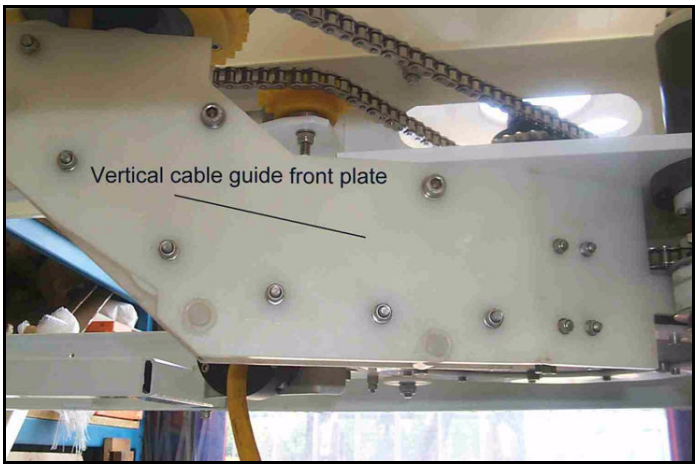

Figure. 6.29 Vertical Cable Guide

14. Remove the Vee guide roller from the horizontal cable guide.

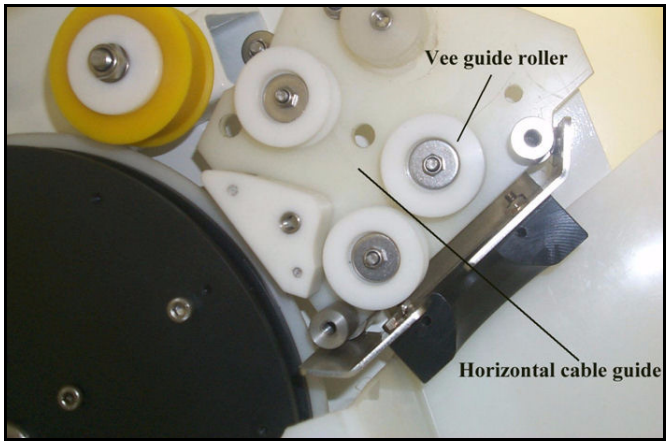

Figure. 6.30 Vee Guide Roller

15. Remove the Kellams grip.

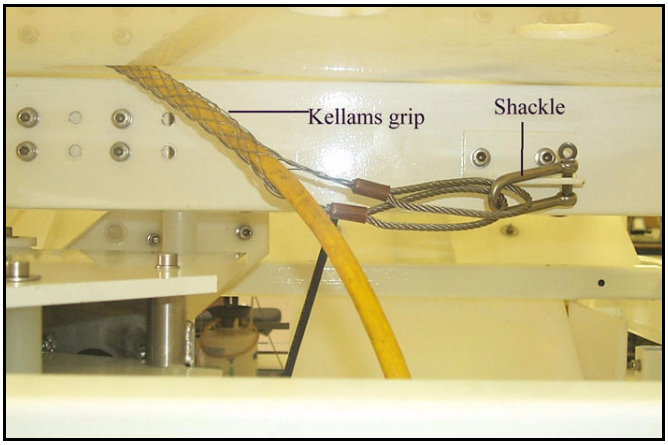

Figure. 6.31 Kellams Grip

Figure. 6.32 Kellams Grip

16. Remove all the tether tyraps securing the tether to the TMS frame. Note the tether cable routing to assist with refitment.
17. Carefully withdraw the remainder of tether.

6.15.2 Tether Loading Procedure

Proceed as follows:

1. Commence loading the tether at the split doughnut, through the horizontal cable guide, around the sheave wheel and through the vertical guide assembly.
2. To facilitate tether loading, the bailing arm duct can be unbolted from the bailing arm hub by removing 3 hex screws.

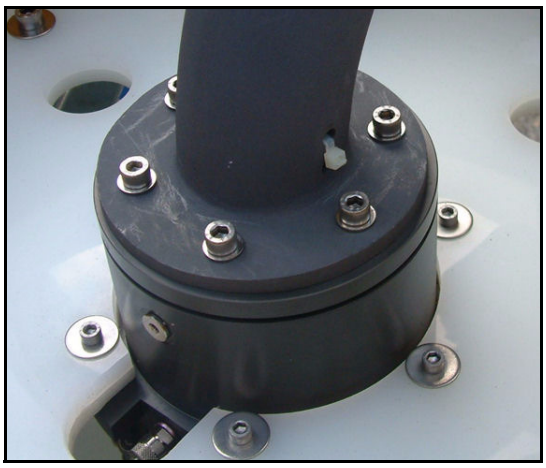

Figure. 6.33 Bailing Arm Hub Assembly

3. If the tether being loaded is un-terminated omit steps 4 to 7.
4. Remove the 12 screws from the bailing arm swivel joint assembly back plate.

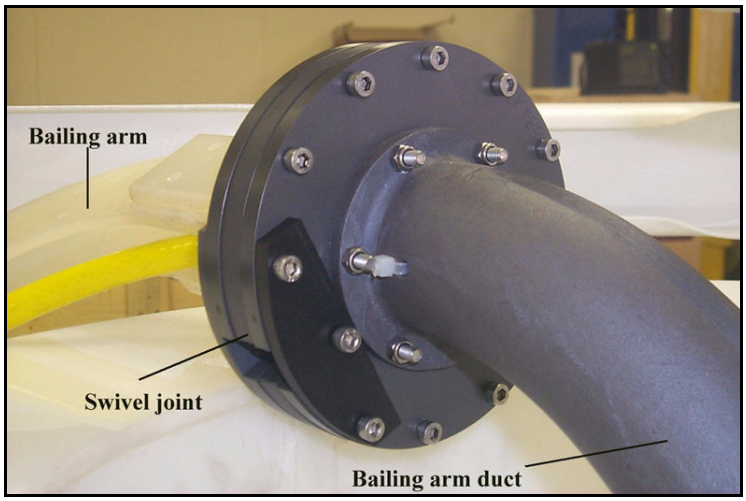

Figure. 6.34 Swivel Joint

5. Separate the swivel joint plates and remove the spacer by gently tapping the spindle from the swivel joint centre plate.
6. Remove the 10 Vee guide rollers from the bailing arm.
7. Remove the helical coil from the bailing arm duct.
8. Continue to feed the tether through the bailing arm hub, bailing arm duct, bailing arm and through the uprights of the bobbin and out through the hole in the flange plate.

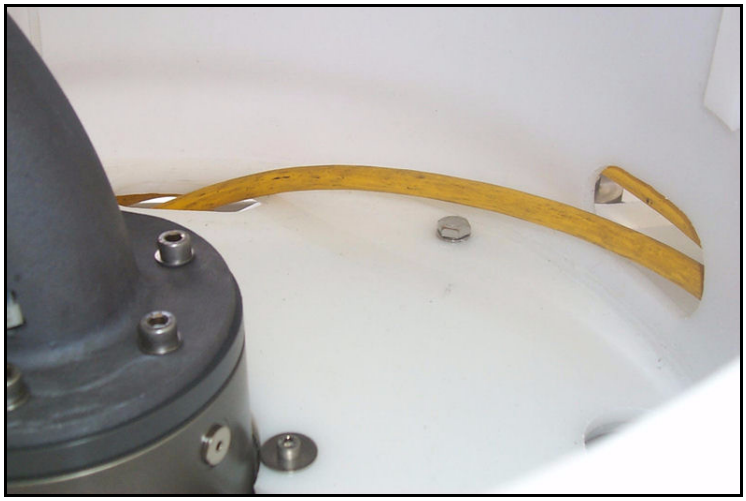

Figure. 6.35 Tether Bobbin Entry and Exit Routes

9. For a terminated tether, reassemble the swivel joint and bailing arm and refit the helical coil into the bailing arm duct.
10. Replace the Vee guide roller and fit the plate to the horizontal cable guide.
11. Replace the vertical cable guide front plate.
12. Secure the vertical cable guide to the mounting plate ensuring the tether enters the bailing arm hub at it's centre.
13. Replace the main drive wheel lower flange.
14. Fit the idler bracket into place and secure with screws.

15. Replace the sheave wheel belt and secure the swing arm in place.
16. Replace the exit point doughnut.
17. Engage the compression spring into the compression spring bracket.
18. Replace the Kellams grip.
19. Carry out sheave wheel belt, reduction gearbox and bailing arm tension adjustments.
20. Reconnect the tether to the vehicle.
21. Maintain a constant supply of freshwater over the TMS tether and bailing system.
22. Bail in the tether ensuring the wraps on the bobbin are even.

NOTE.

During bailing in, it may be necessary to further adjust the bailing arm tension to ensure the wraps are not too tight or too loose (refer to Chapter 7).

23. Carry out a functional test of the bailing system.
24. Carry out a functional test of the ROV systems.

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CHAPTER 7

MAINTENANCE TASKS

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7. MAINTENANCE TASKS

This Chapter contains the approved methods by which the maintenance tasks listed in Table 7.1 are carried out.

7.1 Introduction

For safety of personnel and protection of equipment the removal, dismantling, assembling and refitting of equipment must be performed in accordance with the corrective maintenance procedures as detailed in Chapter 6.

7.1.1 Safety Precautions

Lethal voltages are present in all of the units and can be present in cable connections between units and junction boxes. Maintenance tasks can involve contact with substances harmful to health. Before any work is carried out, involving internal access to the units, junction boxes or cable connections, the following warnings and cautions are to be observed.

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMS SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

POSSIBILITY OF DAMAGE TO EQUIPMENT. UNDER NO CIRCUMSTANCES IS THE TMS EPOD TO BE ASSEMBLED WITHOUT AN ANTI-EXTRUSION RING.

POSSIBLE DANGER TO PERSONNEL AND DAMAGE TO EQUIPMENT. THE ELECTRONICS POD WEIGHS APPROXIMATELY 16 KG AND CARE SHOULD THEREFORE BE TAKEN WHEN LIFTING THE POD FOR SLINGING PURPOSES.

DANGER TO PERSONNEL AND EQUIPMENT. THE BAILING MOTOR MAY OPERATE WITHOUT WARNING WHEN THE SYSTEM DC SUPPLY IS ENERGISED. ENSURE THAT THE TMS IS CLEAR OF ANY OBSTRUCTION AND PERSONNEL PRIOR TO ENERGISING THE DC SUPPLY.

CAUTIONS.

Danger of damage to PCBs. Do not remove or replace PCBs unless the supply is switched off. PCBs must be handled in accordance with electrostatic discharge handling procedures. Damage to PCBs could affect the safe operation of the equipment.

Danger of damage to equipment. When checking connections, care is to be taken not to slacken them, otherwise their watertight integrity may be breached.

Danger of damage to equipment. When using an insulation meter, ensure that the cable under test is disconnected at both ends.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

Danger of damage to light. Do not operate the TMS light for longer than ten seconds in air.

Possibility of damage to equipment. Ensure all vent plugs are securely fitted and shut prior to immersing the TMS.

Possibility of damage to equipment. Ensure that the Surface Power Supply Unit (PSU) transformer tappings correspond to the external input power supply.

Task No	Task	Period
1	Pre-operational Tests	Pre-flight
2	Post-operational Tests	Post-flight
3	Reduction Gearbox Clutch Adjustment	Post installation Tether replacement Reduction gearbox replacement Belville stack replacement
4	Bailing Arm Clutch Adjustment	Post installation Tether/idler hub replacement Bailing wrap tension problems Belville stack replacement
5	Sheave Wheel Belt Adjustment	Belt replacement Belt slip

Table. 7.1 Maintenance Tasks

Task No	Task	Period
6	Primary Chain Adjustment	Chain replacement
7	Secondary Drive Chain Adjustment	Chain replacement
8	Tether Inspection	3 monthly
9	Equipment Vent Plug Removal	Prior to air transportation Exposure to direct sunlight Prolonged storage in high temperatures
10	Bailing Motor Oil Level Check and Replenishment	Pre-flight
11	Bailing Motor Shaft Rotation	Monthly
12	Finish Restoration	When necessary to carry out repairs
13	TMS Oil Compensation System Oil Check and Replenishment	Pre and post flight
14	Video Compensation Adjustments	Change of umbilical length Change of umbilical Change of camera Change of Line Video Driver PCB
15	Fibre Optic Attenuation	Loss of video Poor video image

Table. 7.1 Maintenance Tasks (Continued)

TASK 1
PRE-OPERATIONAL CHECKS

Frequency of Task

Pre-flight.

Introduction

These checks ensure that the equipment is fully functional, secure and in good working order prior to each operational use. It is recommended that a copy of the check list be used prior to each dive and signed and witnessed by a supervisor.

Tools Required

No tools are required.:

Parts Required

No parts are required.

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMS SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

POSSIBILITY OF DAMAGE TO EQUIPMENT. UNDER NO CIRCUMSTANCES IS THE TMS EPOD TO BE ASSEMBLED WITHOUT AN ANTI-EXTRUSION RING.

POSSIBLE DANGER TO PERSONNEL AND DAMAGE TO EQUIPMENT. THE ELECTRONICS POD WEIGHS APPROXIMATELY 16 KG AND CARE SHOULD THEREFORE BE TAKEN WHEN LIFTING THE POD FOR SLINGING PURPOSES.

DANGER TO PERSONNEL AND EQUIPMENT. THE BAILING MOTOR MAY OPERATE WITHOUT WARNING WHEN THE SYSTEM DC SUPPLY IS ENERGISED. ENSURE THAT THE TMS IS CLEAR OF ANY OBSTRUCTION AND PERSONNEL PRIOR TO ENERGISING THE DC SUPPLY.

CAUTIONS.

Danger of damage to PCBs. Do not remove or replace PCBs unless the supply is switched off. PCBs must be handled in accordance with electrostatic discharge handling procedures. Damage to PCBs could affect the safe operation of the equipment.

Danger of damage to equipment. When checking connections, care is to be taken not to slacken them, otherwise their watertight integrity may be breached.

Danger of damage to equipment. When using an insulation meter, ensure that the cable under test is disconnected at both ends.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

Danger of damage to light. Do not operate the TMS light for longer than ten seconds in air.

Possibility of damage to equipment. Ensure all vent plugs are securely fitted and shut prior to immersing the TMS.

Possibility of damage to equipment. Ensure that the Surface Power Supply Unit (PSU) transformer tappings correspond to the external input power supply.

Procedure

Proceed in accordance with Pre-Operational checklist.

TASK 1 - CHECK SHEET

Pre-Operational Checks			
SWITCH OFF ALL SUPPLIES TO THE PSU AND CHECK ALL INDICATORS ARE EXTINGUISHED			
Vehicle Checks			
Carry out the Pre-Dive vehicle checks in accordance with the ROV Technical manual Book 1 Chapter 7 Task 1 Check Sheet			
TMS Checks			
Check Bailing Motor and compensating system oil levels as detailed in the respective tasks in this chapter			
Check the light assembly for damage			
Remove the camera lens cover and clean the lens			
Check **ALL** connectors are properly mated, sleeved and all cables secure and clear of all moving parts			
Confirm all equipment is correctly fitted and secure			
Ensure correct garage extension mounting is fitted for type of ROV installed (with or without Tooling Skid)			
Confirm vent plug is correctly **FITTED AND SECURE**			
TMS Pre-Dive Checks			
Power the system in accordance with the ROV Technical Manual Book 1 and carry out the following switch settings			
SCU and HCU	BAILING DISABLE/ENABLE switch	Set to ENABLE	
	BAILING IN/OUT switches (SCU, HCU and Foot switches)	Operate and ensure that the TMS bails out and in	
	BAILING DISABLE/ENABLE switch	Set to DISABLE	
	CAMERA (if fitted)	Ensure video image is displayed on the monitor	
	LIGHT (if fitted)	TMS Light switch operate and ensure light illuminates	
WARNING. POSSIBLE DAMAGE TO LAMP. THE TMS LAMP MUST NOT BE OPERATED FOR LONGER THAN 10 SECONDS IN AIR			
WARNING. POSSIBLE DAMAGE TO MOTOR V SEAL. DO NOT OPERATE BAILING MOTOR FOR LONGER THAN ONE MINUTE IN AIR			

Table. 7.2 Pre-Operational Checks

Pilot/Operator (sign and print)---------- Date----------

Authorised to dive? YES/NO

Supervisor (sign and print)---------- Date----------

TASK 2
POST-OPERATIONAL CHECKS

Frequency of Task

Post-flight

Introduction

These checks ensure that any damage that may have occurred during operational use can be repaired and any defects rectified before storage or subsequent operations.

Tools Required

No special tools required.

Parts Required

No parts are required.

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMS SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

POSSIBILITY OF DAMAGE TO EQUIPMENT. UNDER NO CIRCUMSTANCES IS THE TMS EPOD TO BE ASSEMBLED WITHOUT AN ANTI-EXTRUSION RING.

POSSIBLE DANGER TO PERSONNEL AND DAMAGE TO EQUIPMENT. THE ELECTRONICS POD WEIGHS APPROXIMATELY 16 KG AND CARE SHOULD THEREFORE BE TAKEN WHEN LIFTING THE POD FOR SLINGING PURPOSES.

DANGER TO PERSONNEL AND EQUIPMENT. THE BAILING MOTOR MAY OPERATE WITHOUT WARNING WHEN THE SYSTEM DC SUPPLY IS ENERGISED. ENSURE THAT THE TMS IS CLEAR OF ANY OBSTRUCTION AND PERSONNEL PRIOR TO ENERGISING THE DC SUPPLY.

CAUTIONS.

Danger of damage to PCBs. Do not remove or replace PCBs unless the supply is switched off. PCBs must be handled in accordance with electrostatic discharge handling procedures. Damage to PCBs could affect the safe operation of the equipment.

Danger of damage to equipment. When checking connections, care is to be taken not to slacken them, otherwise their watertight integrity may be breached.

Danger of damage to equipment. When using an insulation meter, ensure that the cable under test is disconnected at both ends.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

Danger of damage to light. Do not operate the TMS light for longer than ten seconds in air.

Possibility of damage to equipment. Ensure all vent plugs are securely fitted and shut prior to immersing the TMS.

Possibility of damage to equipment. Ensure that the Surface Power Supply Unit (PSU) transformer tappings correspond to the external input power supply.

Procedure

Proceed in accordance with Post-Operational checklist.

TASK 2 - CHECK SHEET

Post Operational Checks	
⚠ SWITCH OFF ALL SUPPLIES TO THE PSU AND CHECK ALL INDICATORS ARE EXTINGUISHED	
Vehicle Checks	
Carry out the Post-Dive Vehicle Checks in accordance with the ROV Technical manual Book 1 Chapter 7 Task 2 Check Sheet	
TMS Checks	
Check Bailing Motor and compensating system oil levels as detailed in the respective tasks in this chapter	
Check the lamp assembly for damage	
Clean the camera lens and refit the cover	
Check **ALL** connectors are properly mated, sleeved and all cables secure and clear of all moving parts	
Check **ALL** connectors are properly mated, sleeved and all cables secure and clear of all moving parts	
Confirm vent plug is correctly **FITTED AND SECURE**	
Remove any debris from structures	
TMS Storage Checks	
Ensure stored away from direct sunlight and water ingress	
If exposed to high temperatures or for air transportation remove vent plugs and store in plastic bags taped in a prominent position for later use	
Fit dust caps where applicable	

Table. 7.3 Post-Operational Checks

Pilot/Operator (sign and print)---------- Date----------

Authorised to Stow? YES/NO

Supervisor (sign and print)---------- Date----------

TASK 3
REDUCTION GEARBOX CLUTCH ADJUSTMENT

Frequency of Task

To be carried out in the following circumstances:

- Post installation.
- Tether replacement.
- Reduction gearbox replacement.
- Belville stack replacement.

Introduction

This adjustment ensures that the clutch slips at between 30 and 40 kg. The reduction gearbox clutch protects the motor, gearbox and drive chain in the event of vehicle or tether fouling. It is therefore essential in the interests of safety and system longevity **NOT** to over tension the Belville springs. It is advisable to have at least three persons in attendance for this maintenance of which one person has the sole responsibility of operating the bail control.

Tools Required

The following tools may be required:

- Open ended spanners (common sizes).
- Hex keys.
- Spring balance (to measure 40 kg.).
- Strop.

Parts Required

The following parts may be required:

- Supply of freshwater.

Procedure

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMS SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

CAUTION.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

Proceed as follows:

1. Ensure that no person is performing maintenance work on the system or system cabling.
2. Maintain a constant supply of fresh water on the bailing motor, bailing system and tether cable.
3. Bail out the tether to allow the vehicle to be manually moved out of the TMS structure with approximately 5 metres of slack.
4. Ensure the SURFACE UNIT TMS BAIL ENABLE switch is to OFF.
5. Attach a Kellams grip to the tether approximately two metres from the vehicle. Connect the spring balance between the Kellams grip and a strop such that bailing in will put tension on the spring balance.
6. Taking care, hold the strop in preparation to slip the clutch by pulling back on the tether when bailing in.
7. Put the SURFACE UNIT TMS BAIL ENABLE switch to ON.
8. Bail in the tether and by pulling back on the strop observe the spring balance tension as the reduction gearbox clutch slips.
9. Adjust the reduction gearbox castle nut to set a tension of between 30 and 40 kg.

NOTE.

When tensioning, ensure that the Belville spring stack is not flattened.

It is essential that a constant stream of water is maintained on the tether, bailing system and bailing motor to ensure the correct bailing arm tension is set.

10. Put the SURFACE UNIT TMS BAIL ENABLE switch to OFF.
11. Remove the spring balance, strop and Kellams grip.
12. Bail out the tether until all slack is removed, then bail in the tether and garage the vehicle.

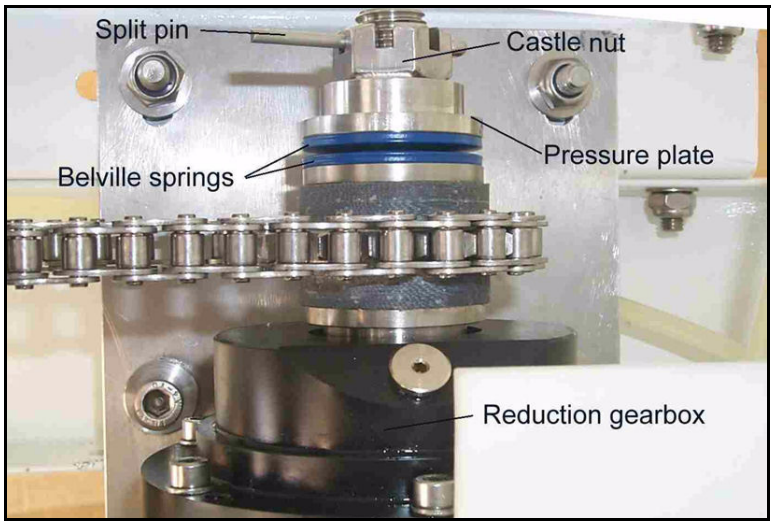


Figure. 7.1 Reduction Gearbox Clutch Adjustment

13. Check that the bailing system operates correctly.

TASK 4
BAILING ARM ADJUSTMENT

Frequency of Task

To be carried out in the following circumstances:

- Post installation.
- Tether replacement.
- Idler Hub replacement.
- Bailing wrap tension problems.
- Belville stack replacement.

Introduction

This adjustment ensures that the clutch slips at between 8 and 10 kg. The clutch provides the slip and speed differential between maximum and minimum diameters of the tether on the bobbin. Under tension will cause the wraps to fall on the bobbin and too much tension will put undue stress on the tether cable.

Tools Required

The following tools may be required:

- Open ended spanners (common sizes).
- Hex keys.
- Spring balance (to measure 10 kg.).

Parts Required

The following parts may be required:

- Supply of freshwater.

Procedure

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMS SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

CAUTION.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

Danger of damage to equipment. Cease bailing immediately if the spring balance indicates a tension greater than 15 kg.

1. Ensure that no person is performing maintenance work on the system or system cabling.
2. Maintain a constant supply of fresh water on the bailing motor, bailing system and tether cable.
3. Bail out the tether to allow the vehicle to be manually moved out of the TMS structure with 3 metres of slack.
4. Ensure the SURFACE UNIT TMS BAIL ENABLE switch is to OFF.
5. Connect one end of the spring balance to the bailing arm and the other to the TMS structure such that “bailing in” will “pull” the spring balance. Confirm spring balance reads 0 kg.
6. Put the SURFACE UNIT TMS BAIL ENABLE switch to ON.
7. Bail in the tether briefly observing the spring balance tension.
8. Note the reading and stop bailing in.
9. Bail out the tether to remove the slack created on the bobbin.

NOTE.

The tension is set between 8 and 10 kg to ensure that the wraps on the bobbin are evenly wound such that the wraps remain in place without falling down but not over tensioned as to cause tether damage.

When tensioning, ensure that the Belville spring stack is not flattened.

It is essential that a constant stream of water is maintained on the tether, bailing system and bailing motor to ensure the correct bailing arm tension is set.

10. Adjust the tension-adjusting bolt to achieve a tension between 8 and 10 kg.

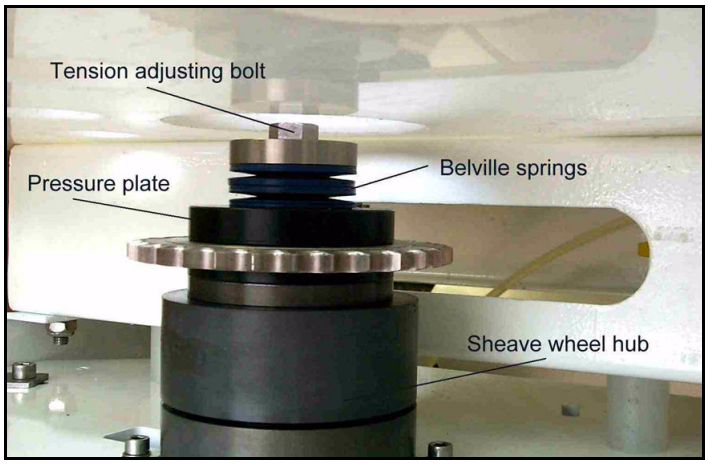


Figure. 7.2 Bailing Arm Tension Adjustment

11. Repeat paragraphs (7) to (10) until the correct tension is set.
12. Remove the spring balance.
13. Bail out the tether until all slack is removed then bail in the tether and garage the vehicle.
14. Select the Surface Unit TMS BAIL ENABLE switch to DISABLE.

TASK 5
SHEAVE WHEEL BELT ADJUSTMENT

Frequency of Task

To be carried out in the following circumstances:

- Belt replacement.
- Belt slip.

Introduction

This adjustment ensures that the Sheave wheel belt is set to the correct tension to prevent belt slip.

Tools Required

The following tools may be required:

- Hex key set.
- Open ended spanners (common sizes).

Parts Required

No parts required.

Procedure

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMS SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

CAUTION.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

Proceed as follows:

1. Locate the spring adjusting bolt.

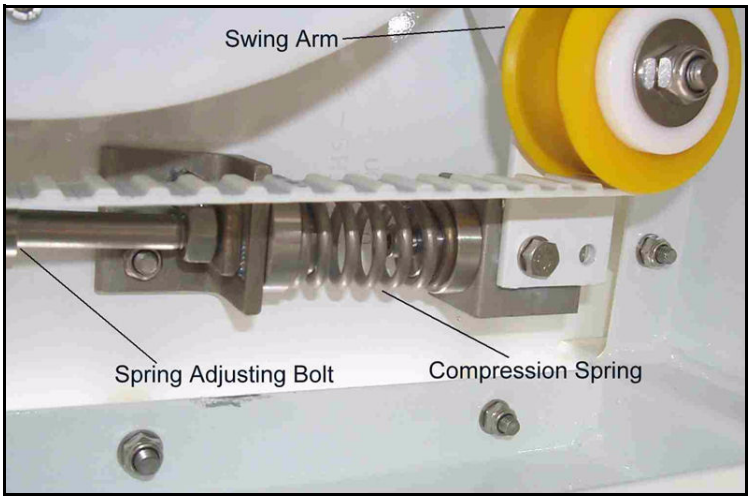


Figure. 7.3 Sheave Wheel Belt Spring Adjusting Bolt

2. Carefully tighten the spring adjusting bolt to set a belt tension such that the belt can be turned through 90°.

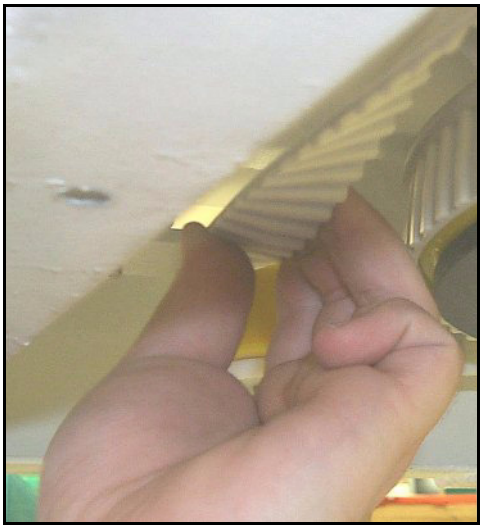


Figure. 7.4 Sheave Wheel Belt Tension

TASK 6
PRIMARY CHAIN ADJUSTMENT

Frequency of Task

To be carried out in the following circumstances:

- Chain replacement.
- As required.

Introduction

This task describes the routine required to adjust the primary chain tension.

Tools Required

The following tools may be required:

- Hex key set.
- Open ended spanners (common sizes).

Parts Required

No parts are required.

Procedure

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMS SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

CAUTION.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

Proceed as follows:

1. Loosen the chain tensioner hex headed screws.

Figure. 7.5 Chain Tensioner Securing Screws

2. Carefully turn the Bailing motor and gearbox coupling by hand to remove slack from the chain between the sheave wheel and the idler hub and between the gearbox and the idler hub.
3. Adjust the chain tensioner to provide approximately 6 mm of slack in the primary chain.

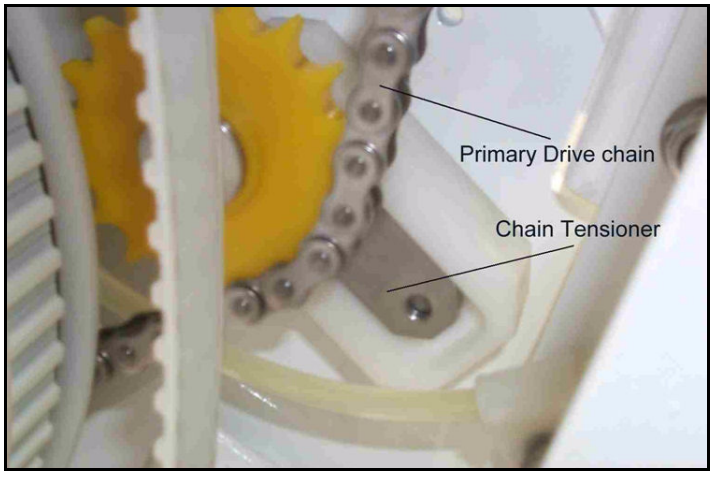


Figure. 7.6 Primary Chain Tensioner

4. Tighten the chain tensioner hex headed screws.

TASK 7
SECONDARY DRIVE CHAIN ADJUSTMENT

Frequency of Task

To be carried out in the following circumstances:

- Chain replacement.
- As required.

Introduction

This task describes the routine required to adjust the secondary drive chain.

Tools Required

The following tools may be required:

- Hex key set.
- Open ended spanners (common sizes).

Parts Required

No parts are required.

Procedure

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMS SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

CAUTION.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

Proceed as follows:

1. Loosen the four screws on the bailing arm chain adjuster.

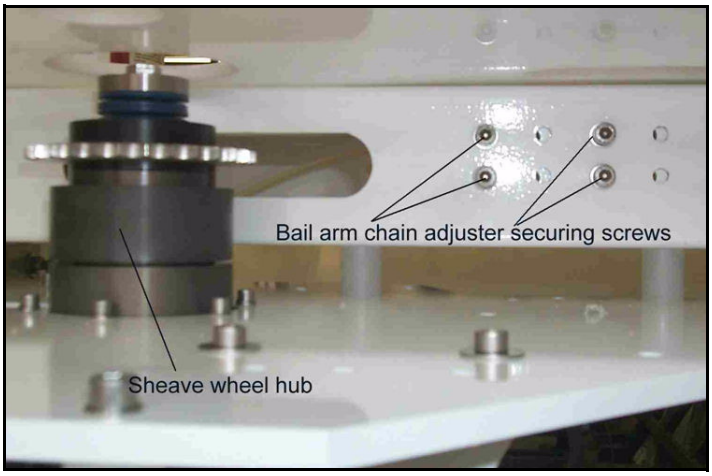


Figure. 7.7 Bail Arm Adjuster Securing Screws

2. Adjust the bailing arm adjuster to provide approximately 6 mm of slack in the secondary drive chain.

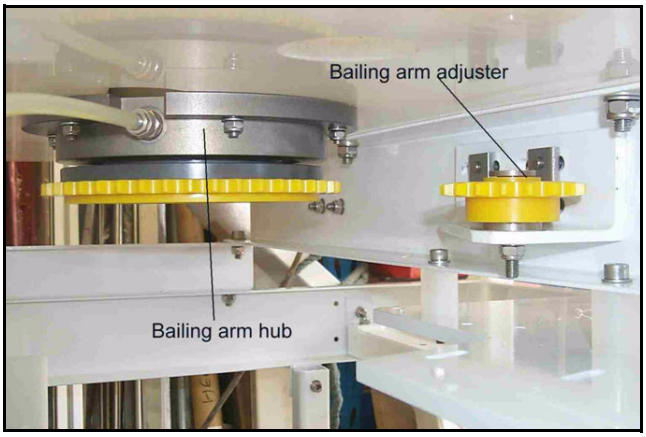


Figure. 7.8 Bailing Arm Adjustment

3. Secure the four in-number hex screws.

TASK 8
TETHER INSPECTION

Frequency of task

To be carried out in the following circumstances:

- 3 monthly.

Introduction

During operational use it is possible for a natural occurrence of tether twisting to become evident from a visual examination, as a result of the TMS bailing mechanism. It is recommended that the following procedure be carried out at 3 monthly intervals.

Tools Required

The following tools may be required:

- Open ended spanners (common sizes).
- Hex keys.

Parts Required

The following parts may be required:

- Supply of freshwater and pressure hose.

Procedure

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMS SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

CAUTION.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

Proceed as follows:

1. Ensure that no person is performing maintenance work on the system or system cabling.

NOTE.

During bailing in and out the tether and bailing mechanism should be maintained wet either by seawater or freshwater pressure hose.

2. Bail out the full length of tether and lay out on the deck.
3. Slowly bail in untwisting the tether as required.
4. The tether should be inspected as it is bailed in for any cuts or abrasions.
5. When bailing is complete secure the system.

TASK 9
EQUIPMENT VENT PLUG REMOVAL

Frequency of Task

To be carried out in the following circumstances:

- Prior to air transportation.
- When exposed to direct sunlight and extreme temperatures.

Introduction

This task is to prevent excessive pressure build up within the electronics unit.

Tools Required

No tools are required.

Parts Required

No parts are required.

Procedure

Proceed as follows:

1. Remove the vent plug.
2. Clean and dry the vent plug and lightly coat with silicone grease.
3. Place the vent plug in a plastic bag adjacent to electronics unit for subsequent replacement.
4. Cover the unit vent plug hole with tape to protect the unit from dirt ensuring the tape does not provide an air tight seal.

TASK 10
BAILING MOTOR OIL LEVEL CHECK AND REPLENISHMENT

Frequency of Task

- Pre and Post-flight.

Introduction

The purpose of this check is to ensure that the thruster motor oil level is correct prior to operational use and details the procedure on how to replenish the oil if required.

NOTE.

If frequent topping up is required an investigation is required to ascertain the possibility of damage to the thruster motor.

Tools Required

The following tools may be required:

- Torque wrench (to achieve 27 N m/20ft.lbf/2.8kg m).
- Hex key set.
- Diaphragm puller tool (Part no TH110).
- Seaeye Fillkit (Part No P00514).
- Clean container for oil.

Parts Required

The following parts may be required:

- Mobilect 35 – SM4/M.

Oil Level Check Procedure

WARNING.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

DANGER TO PERSONNEL AND EQUIPMENT. THE BAILING MOTOR MAY OPERATE WITHOUT WARNING WHEN THE SYSTEM DC SUPPLY IS ENERGISED. ENSURE THAT THE TMS IS CLEAR OF ANY OBSTRUCTION AND PERSONNEL PRIOR TO ENERGISING THE DC SUPPLY.

CAUTION.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

Proceed as follows:

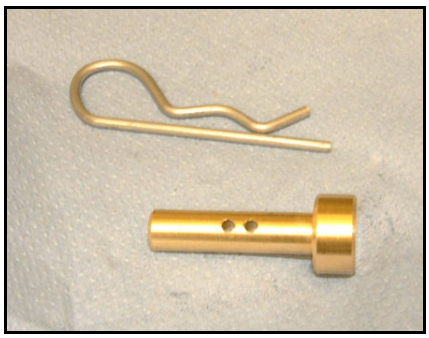


Figure. 7.9 Diaphragm Puller Tool

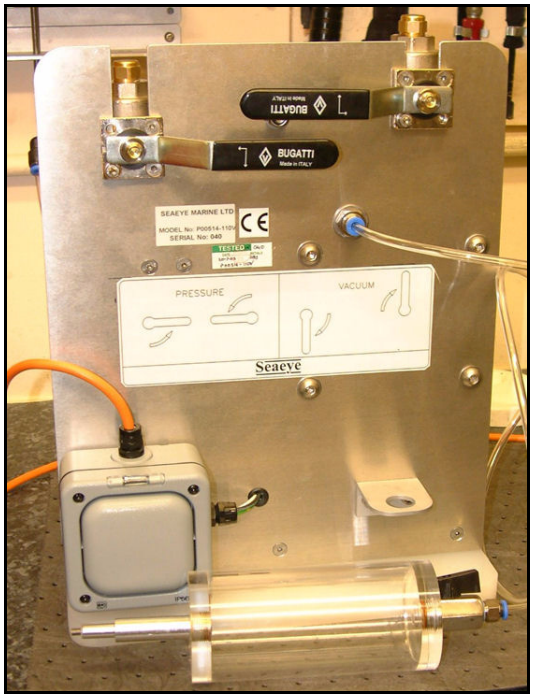


Figure. 7.10 Oil Fill Kit P00514

1. Visually examine the motor, motor cable gland and cable, and chassis vicinity for signs of oil leakage.
2. Using the Diaphragm Puller Tool, screw into the motor diaphragm and ensure that the top of the diaphragm cover is between the drilled holes on the tool.

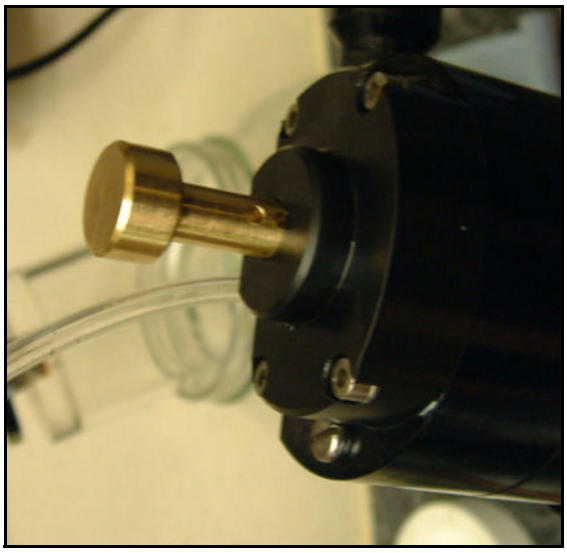


Figure. 7.11 Diaphragm Puller Tool Indication Hole

If the holes are not visible, carry out the oil replenishment procedure.

NOTE.

If frequent topping up is required, an investigation is required to ascertain the possibility of damage to the motor.

Oil replenishment procedure

Proceed as follows:

1. Remove the required motor as detailed in Chapter 6.
2. Position the motor vertically using a mounting base.
3. Insert the Diaphragm puller tool into the motor end cap and screw onto diaphragm-threaded stud.

Figure. 7.12 Diaphragm Puller Tool

4. Holding the motor securely, pull upward on the puller tool until the locking pin hole is visible above the end cap and insert locking pin. If necessary, loosen the motor fill screw to release the pressure taking care that the oil pressure does not cause the oil to be released through the fill screw hole. Release the puller tool.

Figure. 7.13 Diaphragm Tool Pin Insertion

5. Carefully fully remove the motor fill screw and retain. Replace the O-ring.

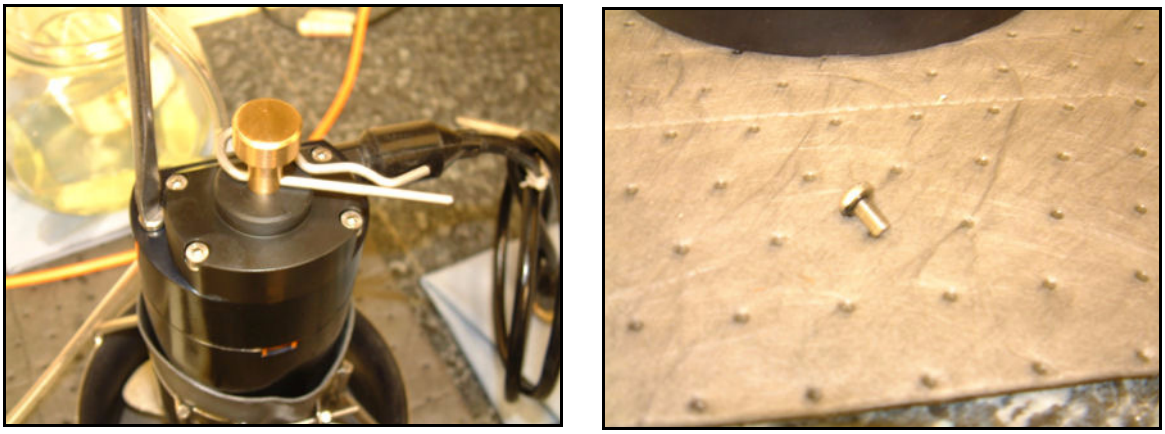
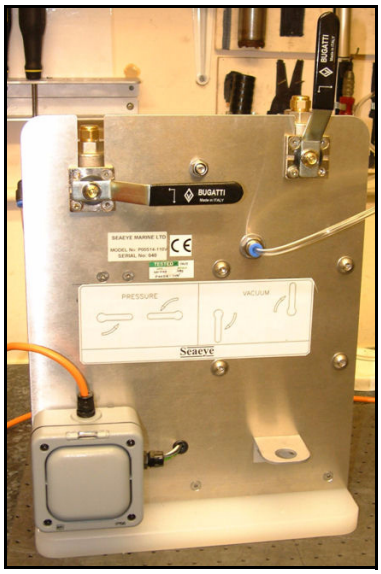


Figure. 7.14 Vent Screw

6. Ensure the Fillkit kit reservoir is clean and empty and the power switch is set to OFF.



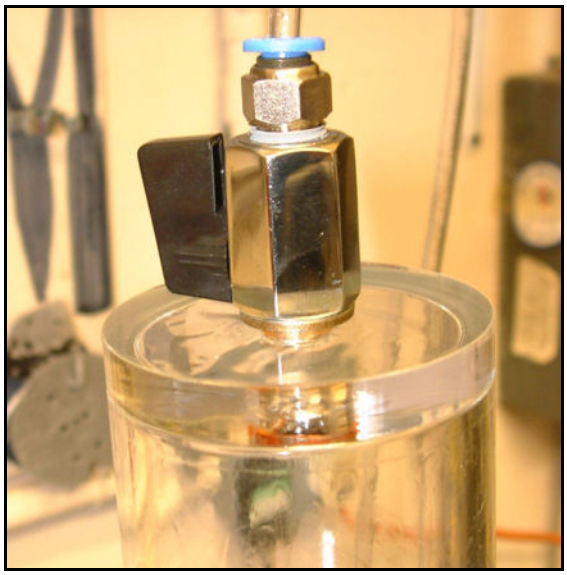


Figure. 7.15 Oil Fill Kit Valve Positions

7. Confirm the following:
   - Vacuum Valve – vertical position.
   - Pressure Valve – horizontal position.
   - Reservoir Valve – vertical position
8. Place the reservoir end in the container of the motor oil.
9. Switch on the Fillkit.
10. Slowly move the pressure valve towards the vertical position and confirm oil is being drawn from the reservoir.
11. When the reservoir is three quarters full, return the pressure valve to the horizontal position.
12. Move the reservoir valve to the horizontal position and switch off the Fillkit.
13. Connect the reservoir to the motor fill screw orifice. Position the motor so that it is approximately at a 45 degree angle with the motor fill screw orifice at the 'upper' position.
14. Move the reservoir valve to the vertical position.
15. Remove the diaphragm puller tool locking pin.
16. Switch on the Fillkit. Slowly move the vacuum valve and observe that the diaphragm puller tool rises as the oil is pumped into the motor. Ensure that the diaphragm puller tool does not reach the fully upper position while carrying out the 'oil fill' operation. When the diaphragm puller moves towards the upper position, close the vacuum valve and open the pressure valve to expel air from the motor. Ensure that the diaphragm puller tool does not reach the fully lower position while carrying out the 'cycling' operation.
17. Slowly continue to 'cycle' the vacuum and pressure valves up and down and observe that the diaphragm puller tool rises and falls. Ensure that the diaphragm puller tool does not reach the fully upper or lower position while carrying out the 'cycling' operation.

18. Observe that the air is expelled from the motor diaphragm through the oil reservoir.
19. When all air has been expelled, position the pressure and vacuum valves in the off position.
20. Fit the locking pin through the diaphragm lower locating pin hole.
21. Switch off the Fillkit.
22. Move the vacuum valve and reservoir valve to the vertical position.
23. The diaphragm puller tool will fall to the locking pin level.
24. Remove the Fillkit reservoir from the motor.
25. Refit the motor fill screw.
26. Clean the motor of any oil spillage.
27. Remove the locking pin and observe the puller tool pinholes and ensure that at least one of the holes remain visible. This indicates that the motor is completely filled with oil and purged of air. Should the tool “sink” into the motor end cap repeat the fill procedure.
28. Remove the diaphragm puller tool.
29. Visually examine the motor for signs of oil leaks.
30. Sparingly lubricate the motor connector threadforms with silicone grease.
31. Refit the motor to the TMS.

TASK 11
BAILING MOTOR SHAFT ROTATION

Frequency of Task

Monthly.

Introduction

This task prevents the shaft seal and ceramic seal surfaces seizing when the motors are not being used for prolonged periods. This maintenance includes motors fitted and motors held in stores.

Tools Required

No tools are required.

Parts Required

No parts required.

Procedure

WARNING.

DANGER TO PERSONNEL AND EQUIPMENT. THE BAILING MOTOR MAY OPERATE WITHOUT WARNING WHEN THE SYSTEM DC SUPPLY IS ENERGISED. ENSURE THAT THE TMS IS CLEAR OF ANY OBSTRUCTION AND PERSONNEL PRIOR TO ENERGISING THE DC SUPPLY.

CAUTION.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

Proceed as follows:

- Rotate all motor shafts through several revolutions.

TASK 12
FINISH RESTORATION

Frequency of Task

To be carried out in the following circumstances:

- Whenever necessary to carry out minor repairs.

Introduction

This task details the procedures on how to carry out minor damage repairs to TMS anodised enclosures. In the event of major damage contact SAAB SEAEYE LTD. for advice.

Tools Required

The following tools may be required:

- P1000 wet and dry.
- Lint free cloth.

Parts Required

The following parts may be required:

- Black Humbrol paint.
- Amberklene.

Anodised Enclosure Repair Procedure

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMS SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

Proceed as follows:

1. Remove the damaged anodised enclosure from the TMS.
2. Clean the damaged area with lint free cloth soaked in Amberklene.
3. Dress the damaged area using the P1000 wet and dry.
4. Apply black Humbrol paint to the damaged area, allow to dry and apply a second coat if required.
5. Refit the anodised enclosure to the TMS.

TASK 13
TMS OIL COMPENSATING SYSTEM OIL LEVEL CHECK

Frequency of Task

To be carried out in the following circumstances:

- Pre flight.
- Post flight.

Introduction

The oil level check should be carried out before and after each operational use and the compensator topped up with oil as necessary. If regular oil topping up is needed an investigation into the possibility of an oil leak is required.

Tools Required

The following tools may be required:

- Hex keys.
- Open ended spanners (common sizes).
- Foot pump.

Parts Required

The following parts may be required:

- Shell Tellus38 oil – used for the TMS gearboxes and mechanical parts.

Procedure

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMS SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

Proceed as follows:

1. Inspect the area around the compensator, hoses, hose connections, sheave wheel hub, bailing arm hub and reduction gearbox for any evidence of oil leaks.
2. Locate the compensator that connects to the gerarboxes, connect a 1/4” BSP female QC (Quick Connect) fitting to the fill point and drain a sample of oil. Check for water contamination.

Figure. 7.16 Oil Compensating System

3. Fill the hand pump with fresh oil.
4. Connect the hand pump to the compensator QC fill point.
5. Open the required bleed screw and operate the pump until oil purges from the bleed screw and all air is dispelled.
6. Shut the bleed screw.

WARNING.

WARNING. POSSIBLE DAMAGE TO EQUIPMENT. OVER PRESSURISATION WILL CAUSE OIL TO LEAK PASS THE SEALS.

7. Continue to carefully operate the hand pump until the compensator indicator rod extends to 50mm showing that the compensator is full. Do not fill beyond this mark. This provides 0.5 bar compensation.
8. Disconnect the hand pump from the 1/4” BSP QC fitting and refit the QC cap.

TASK 14
VIDEO COMPENSATION ADJUSTMENTS

Frequency of Task

Video adjustments are be carried out in the following instances:

- Significant changes to the umbilical or tether length.
- Change of umbilical or tether.
- Change of camera.
- Change of video driver.

Introduction

The purpose of this Task is to pre-emphasise the video signal to compensate for signal loss due to the length of the umbilical and tether. The video system installed can be Fibre Optic, co-axial or a twisted pair depending on customer requirements. Fibre Optic systems require no compensation. With the co-axial video system the Video Amp PCB (6032P), fitted to Seaeye cameras, is adjusted for video compensation, however, with a twisted pair video system the 6032P PCB is factory set for zero compensation and the Line Video PCB adjusted for cable length. The PCB's are factory set to match the length of cable supplied, however, in the event of significant changes to the umbilical/tether length video compensation adjustment is necessary. The adjustments are made by setting up the sync pulse and by selecting DIL switches mounted on the PCB's proportional to the length of cable. The PCB's can accommodate umbilical lengths of 0 to 800 meters in 200 metre increments.

NOTE.

This procedure is for fitted Seaeye cameras. For other cameras such as the Kongsberg cameras fitted to some ROVs, the video compensation procedure may be different. Contact Saab Seaeye Ltd for video compensation instructions.

Tools and Test Equipment Required

The following tools and test equipment may be required:

- Tuning tool.
- Oscilloscope.

Parts Required

The following parts may be required:

- BNC T-piece.
- Test Lead Kit (Part No.P01835).

WARNING.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE ROV SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE ROV SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

CAUTION.

Danger of damage to PCBs. Do not remove or replace PCBs unless the supply is switched off. PCBs must be handled in accordance with electrostatic discharge handling procedures. Damage to PCBs could affect the safe operation of the equipment.

Twisted Pair Video Compensation Procedure

Proceed as follows:

1. Ensure the TMS system is switched off at all units i.e. SU and the external power supply.
2. Ensure that no person is performing maintenance work on the system or cabling.
3. Disconnect the external power supply to the PSU.
4. Remove the camera unit from the TMS.
5. Remove the vent plug from the camera enclosure.
6. Remove the nylon lockwire from between the camera body and end-cap and carefully withdraw the end-plate.
7. Ensure the Video camera VIDEO/AMP PCB (6032P) DIL switches are to off for zero compensation.
8. Connect the oscilloscope to the output of the camera
9. Connect the PSU external power supply and switch on.
10. Set the following unit switch positions:
    - Set the PSU Mains Isolator to ON.
    - Set the PSU AC circuit breaker to ON.
    - Set the SU AC SURFACE switch to ON.
11. Adjust RV1 on the 6032P PCB to give a 300mv sync pulse.

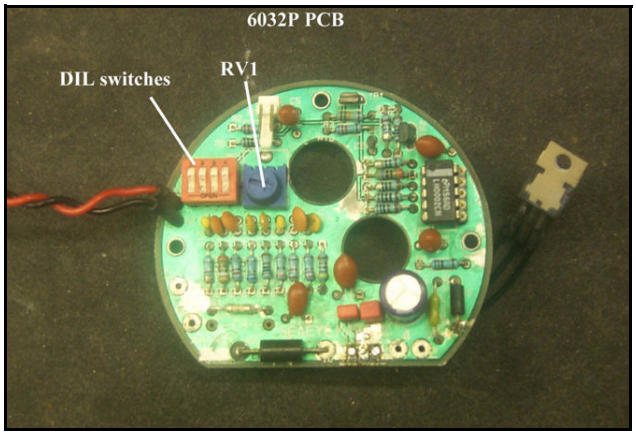


Figure. 7.17 6032 PCB

12. Set the oscilloscope and connect to the Balanced line video receiver PCB (located in the SU) as follows:
    - Dual Trace.
    - V/cm 200 mV.
    - Timebase 10 ìS.
    - TV line triggering.
    - Channel 1 to video A.
    - Channel 2 to video B (inverted).
    - Common grounds to GND.

NOTE.

If a monitor is not connected a 75-ohm load resistor must be wired to the video output.

13. Adjust RV1, Line Video Driver PCB (located in the EPOD), for maximum signal.

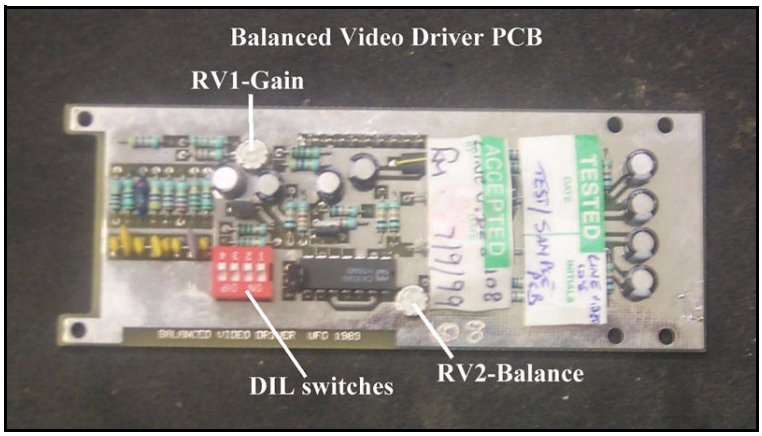


Figure. 7.18 EPOD Balanced Line Driver PCB

14. Set the oscilloscope to ADD ensuring channel 2 is inverted.
15. Adjust the Balance RV2 for minimum signal.
16. Set the oscilloscope to single trace and observe the video output from the surface unit.

17. Locate the four DIL switches on the Line Driver PCB and make only one at a time until the sync pulse is clearly defined with square edges. The DIL switches represent the following approximate lengths:
    - DIL 1 = 200m.
    - DIL 2 = 400m.
    - DIL 3 = 600m.
    - DIL 4 = 800m.

NOTE.

Only one DIL switch should be made at any one time.

18. The Video Receiver Amp in the surface unit can be adjusted to add further high frequency gain as follows.
19. Gain access to the Balanced Line Video Receiver PCB located in the Cabin Junction Box.
20. Connect the oscilloscope to DIRECT VIDEO on the surface unit front panel.
21. Ensure all DIL switches are in the OFF position.

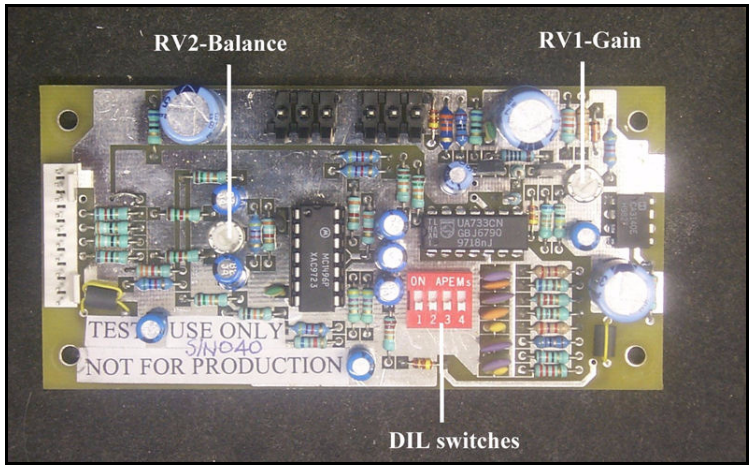


Figure. 7.19 Surface Unit Balanced Line Receiver

22. Adjust the BALANCE potentiometer RV1 to its mid position (on the centre line of the PCB).
23. Adjust the GAIN potentiometer, VR2 to produce a video signal amplitude of 1 V peak to peak (from the bottom of the sync pulse to peak white).
24. Set the following unit switch positions.
    - Set the SU AC SURFACE switch to OFF.
    - Set the AC circuit breaker to OFF.
    - Set the Mains Isolator to OFF.
25. Disconnect test leads and equipment.
26. Reassemble the CJB and camera unit and refit to the TMS.
27. .

CHAPTER 8

DIAGNOSTIC

MAINTENANCE

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8. DIAGNOSTIC MAINTENANCE

This Chapter provides diagnostic flow charts to help the maintainer arrive at the possible defective area.

8.1 Introduction

The main fault detection tool for Saab Seaeye systems is the SML Telemetry Monitor Unit (Sniffer), however, with a sound understanding of the system, and by a series of deductions and use of lamps and indicators visible to the maintainer faults can be localised and rectified.

The TMS Fault diagnosis flow chart provides a series of decision boxes and prompts to lead the maintainer to the possible defective area. Where more than one possible solution is listed, the solution should be tried in the order given. The chart is by no means exhaustive and should be used in conjunction with the drawings within this handbook.

Table 1 where possible lists all foreseeable faults and details the measures that can be taken to investigate and/or remedy them. The fault diagnosis chart should be used in conjunction with the wiring diagrams and the TMS technical manuals.

With all PCB based systems a possible defective PCB can be simply rectified by reseating it and/or cleaning the edge connections.

Figure. 8.1 SML Telemetry Monitor Unit

8.1.1 Safety Precautions

Lethal voltages are present in all of the units and can be present in cable connections between units and junction boxes. Diagnostic maintenance can involve contact with substances harmful to health. Before any diagnostic work is carried out, involving internal access to the units, junction boxes or cable connections, the following warnings and cautions are to be observed.

WARNINGS.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMS SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT. BEFORE SWITCHING ON THE TMS SYSTEM, ENSURE THAT THE SYSTEM IS FULLY ASSEMBLED AND OPERABLE AND NO MAINTENANCE ACTIVITY IS IN OPERATION.

POSSIBILITY OF TOXIC HAZARDS. DURING MAINTENANCE OR REPAIR IT IS POSSIBLE TO COME INTO CONTACT WITH SUBSTANCES HARMFUL TO HEALTH. PRIOR TO ALL MAINTENANCE OR REPAIR TASKS ENSURE THAT THE RELEVANT DATA HAZARD SHEETS AND LOCAL COSHH PROCEDURES HAVE BEEN READ AND UNDERSTOOD.

POSSIBILITY OF DAMAGE TO EQUIPMENT. UNDER NO CIRCUMSTANCES IS THE TMS EPOD TO BE ASSEMBLED WITHOUT ANTI-EXTRUSION RINGS.

POSSIBLE DANGER TO PERSONNEL AND DAMAGE TO EQUIPMENT. THE ELECTRONICS POD WEIGHS APPROXIMATELY 16 KG AND CARE SHOULD THEREFORE BE TAKEN WHEN LIFTING THE POD FOR SLINGING PURPOSES.

DANGER TO PERSONNEL AND EQUIPMENT. THE BAILING MOTOR MAY OPERATE WITHOUT WARNING WHEN THE SYSTEM DC SUPPLY IS ENERGISED. ENSURE THAT THE TMS IS CLEAR OF ANY OBSTRUCTION AND PERSONNEL PRIOR TO ENERGISING THE DC SUPPLY.

CAUTIONS.

Danger of damage to PCBs. Do not remove or replace PCBs unless the supply is switched off. PCBs must be handled in accordance with electrostatic discharge handling procedures. Damage to PCBs could affect the safe operation of the equipment.

Danger of damage to equipment. When checking connections, care is to be taken not to slacken them, otherwise their watertight integrity may be breached.

Danger of damage to equipment. When using an insulation meter, ensure that the cable under test is disconnected at both ends.

Danger of damage to Bailing Motor. Do not operate the Bailing Motor in air for longer than one minute.

Danger of damage to light. Do not operate the TMS light for longer than ten seconds in air.

Possibility of damage to equipment. Ensure all vent plugs are securely fitted and shut prior to immersing the TMS.

Possibility of damage to equipment. Ensure that the Surface Power Supply Unit (PSU) transformer tappings correspond to the external input power supply.

8.2 SML Unit Telemetry System

The Telemetry Monitor Unit and associated software is dual purpose; designed to monitor system telemetry as an aid to fault diagnosis and to transmit environmental data to external navigational/survey equipment. Extracted data from the telemetry is converted by the Data Converter from RS485 into RS232 format and received by an IBM compatible PC (not supplied) for subsequent display using the software provided. Environmental data from the PC can be transmitted via PC COM port 2 to external equipment for processing.

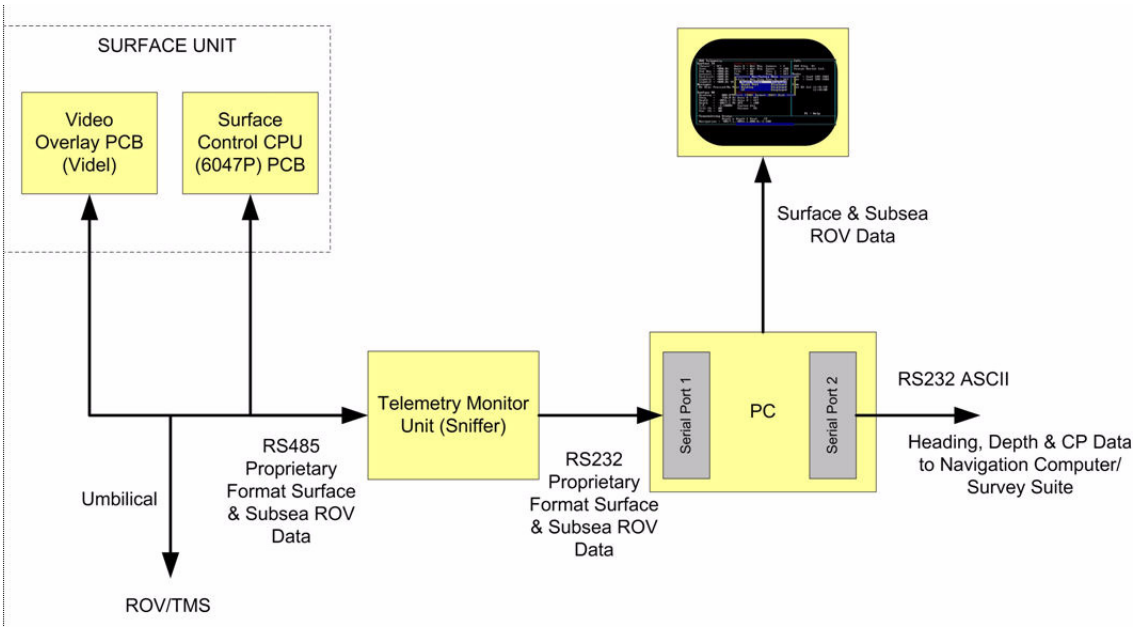

Figure. 8.2 Functional Block Diagram of Data Export Diagnostic System

8.2.1 General Description

The Data Converter is a self contained, impact- resistant plastic unit that requires either a 120 or 240 VAC external power supply or a 9 VDC battery fitted within a battery compartment at the rear of the unit. The front and rear panels contain the following:

- PC connector socket
- BAT/AC selection switch
- COMMS input socket
- Red power indicator
- Mains input socket
- ON/OFF switch

- ROV/TMS telemetry switch
- Battery compartment

8.2.2 Hardware Installation

Connect the system as follows:

1. Ensure the supply is disconnected from the rear of the Data Converter.

WARNING.

DANGER OF FATAL ELECTRIC SHOCK. BEFORE REMOVING OR OBTAINING INTERNAL ACCESS TO THE EQUIPMENT, ISOLATE ALL THE UNITS POWER SUPPLIES.

DANGER OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL. WHEN THE SUPPLY CANNOT BE DISCONNECTED, FUNCTIONAL TESTING, MAINTENANCE AND REPAIR OF THE TMS SYSTEM IS TO BE UNDERTAKEN ONLY BY PERSONS FULLY AWARE OF THE DANGERS INVOLVED AND HAVE TAKEN ADEQUATE PRECAUTIONS.

2. Ensure the voltage setting in the unit corresponds to the Sniffer unit input supply as detailed in Fig. 8.3.

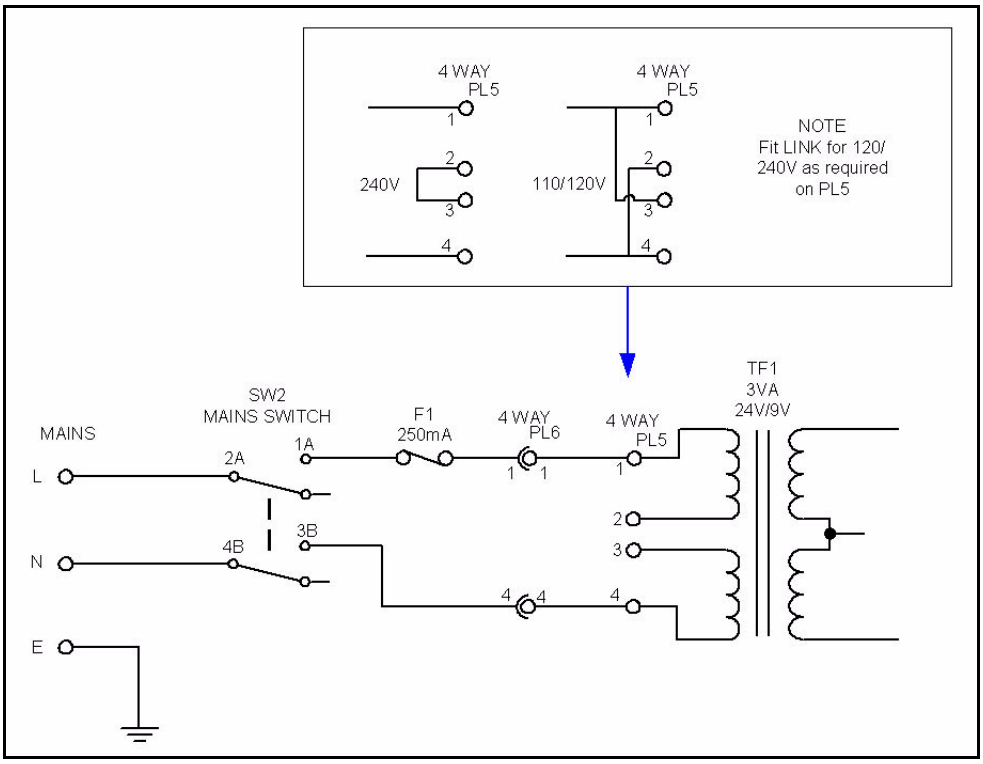

Figure. 8.3 SML Unit Input Power Supply Link Setting

3. Connect the lead from the Data Converter PC connector to COM port 1 of the PC.
4. The orange and yellow twisted pair lead can be connected in one of two ways depending on the ROV system as follows:

- **New Systems** - Connect the orange and yellow twisted pair lead from the Data Converter COM connector to the 15 way D connector on the rear of the Surface unit.
- **Older Systems** - Disconnect the telemetry lead from the CPU PCB (6047P) and connect the supplied 3 way Molex "T" adaptor. Connect the telemetry lead and orange and yellow twisted pair lead to the "T" adaptor.

5. Connect the external power supply.
6. Set the rear switch to I (ON) position and confirm the front panel led illuminates.

8.2.3 Software Installation

Software supplied on the disk includes vehicle and TMS programs and can be run on virtually any IBM compatible PC. Vehicle software can be run through either a DOS window or from DOS. The TMS program can only be run from DOS.

NOTE.

The software does not have to be installed and can be run from A drive.

8.2.4 TMS Software Installation

The program can be run by entering "A:\TMSVIEW1\TMSVIEW1.exe" from DOS at the DOS prompt. Instructions can be found on the readme file on the disk.

The viewer display has two panels. The upper panel displays data flowing from Surface to Subsea and the lower panel displays data flowing from Subsea to Surface.

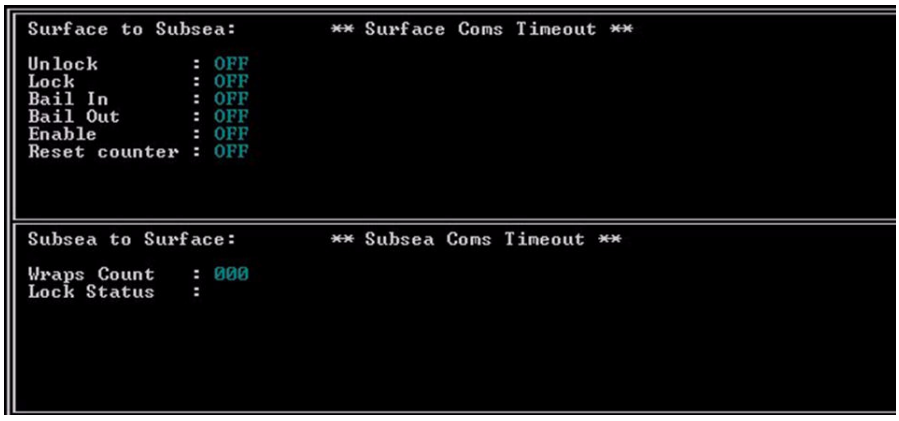

Figure. 8.4 TMS Viewer Display

8.2.5 Viewer Error Messages

The following table is a list of possible error messages that can be displayed on the viewer.

Error Message	Meaning
Surface Comms Timeout	Displayed in the upper panel. Indicates that the viewer is not receiving communications from the surface CPU
Subsea Comms Timeout	Displayed in the lower panel. Indicates that the viewer is not receiving communications from the Subsea CPU. This message also occurs during a system configuration procedure

Table. 8.1 Viewer Error Messages

Error Message	Meaning
Heading=Error I	Indicates that the subsea system is not receiving data from the compass
Heading=Error A	Indicates that the subsea system is receiving from the compass but the messages received are not recognised as being valid
Freq=Error and Depth=Error	If either of these messages are displayed then the output of the depth sensor is either not being received by the subsea system or is out of range

Table. 8.1 Viewer Error Messages (Continued)

8.2.6 Parts Supplied

Table 8.2 lists the parts supplied with the Data Converter.

PART	Quantity
SML232/RS485 Data Converter	1
25 way to 9 way RS232 lead	1
13 way Molex “T” adaptor lead	1
Telemetry patch leads	2
3.5” floppy disk	1
Power lead	1

Table. 8.2 Parts Supplied

8.3 TMS Fault Diagnosis

FAULT SYMPTOM	PROBABLE CAUSE	REPAIR ACTION
Bailing Motor does not respond to demand	No DC supply	Test DC supply and umbilical connections
	Defective Bailing motor	Replace
	ENABLING BAILING switch set to "DISABLE"	Set to ENABLE
	TMS DC switch not pre-selected "ON"	Switch OFF DC MASTER switch, re-select TMS DC and switch ON DC MASTER
	6008P/6034P fuse ruptured	Replace
	Incorrect switch settings	Correct
	Defective PCB's: 6034P 6008P 6052P	Replace
	DC control relays	Replace
	PSU's	Replace
	HCU/SU/TMS Control Box switches	Replace
Bailing Motor responds but tether does not bail in or out	Sheave wheel belt slack	Re-tension
	Sheave wheel belt broken	Replace
	Tether/drive fouled	Clear fouling
Bailing Motor responds but tether does not bail in or out	Drive clutches slip	Carry out adjustments
	Drive Motor coupling broken or not engaging gearbox	Investigate and replace
	Drive chains broken	Replace
	Gearbox seized or broken	Replace/repair

Table. 8.3 TMS Fault Diagnosis

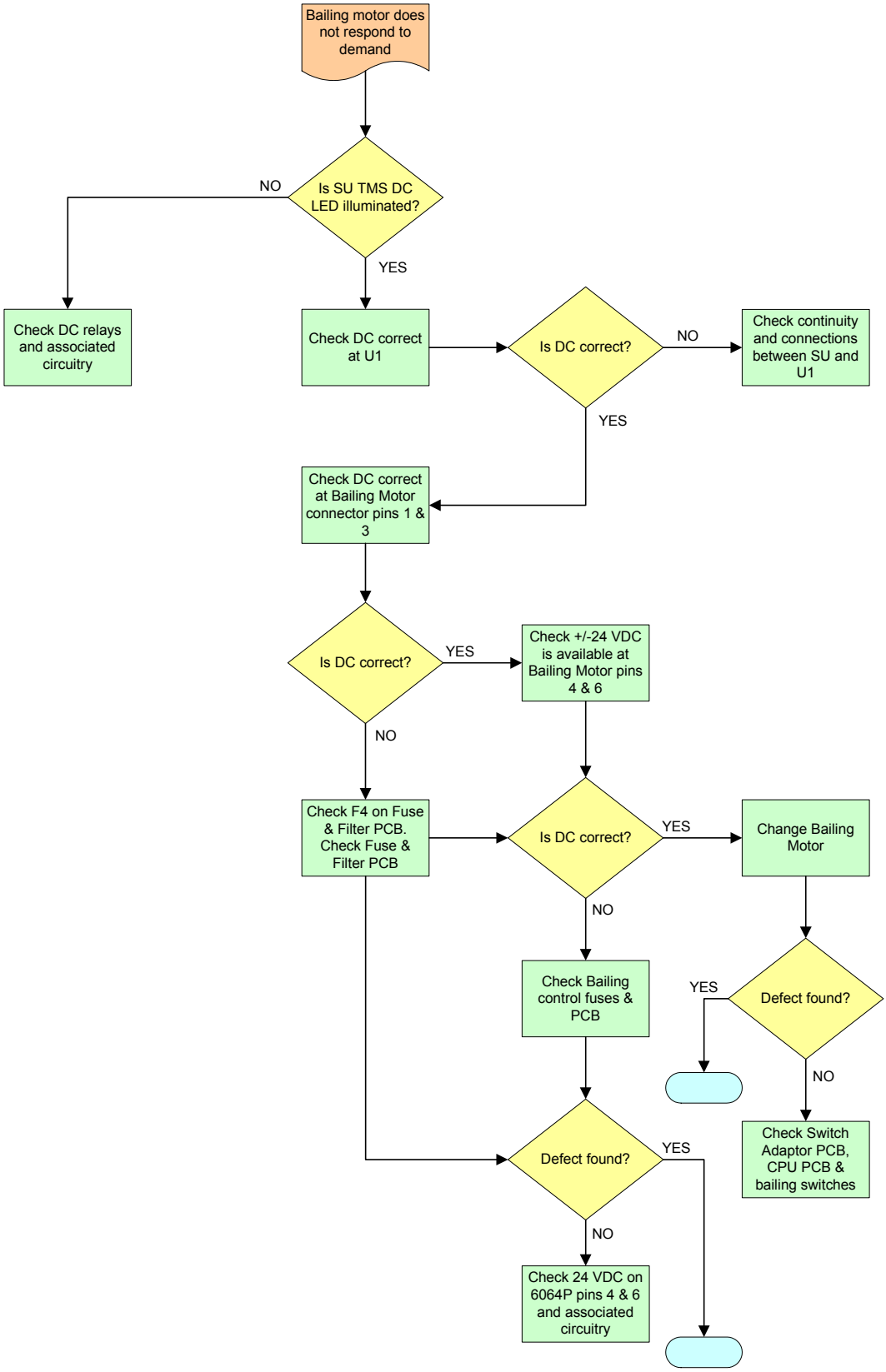

Figure. 8.5 Bailing Fault Diagnosis

CHAPTER 9

PARTS

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9. PARTS

This chapter provides the TMS2T system parts list.

9.1 TMS2 System Parts List

Part	Description	Qty
TMSCAGE02A-T	TMS ADJUSTABLE FRAME TYPE 2A TIGER	1
SM4M	THRUSTER C/W METAL SHELL WHIP	1
TMSENSOR/2M-2000	TMS SENSOR - 730-830 + M2W2M-2000	1
301-520	ENCAPSULATED MAGNET	2
M2X7F-1500	METAL SHELL 7 WAY MALE TO INLINE 7 WAY	1
PH1TA	SHACKLE 1 TON SWL	1
P01805-RAW	TMS2 BAIL SENSOR MAGNET BRACKET	2
P02127	TMS DUAL FOOTSWITCH ASSEMBLY	1
6047P	PCB CENTRAL PROCESSING UNIT (CPU)	1
6052AP	PCB TMS SWITCH ADAPTOR	1
6046P	EXPANSION I/O CARD	1
TMSSWT	TMS SOFTWARE TOP	1
OROKO RUNNER	OROKO(SUB TEAK)	4
P01885	10DP/2 MOUNT SADDLE	1
TMSEPM-2D	TMS EPOD FO C/W LIGHT AND CAMERA	1
VOLAYSW	VIDEO OVERLAY SOFTWARE	1
MANUAL-TMS2 T-880	TIGER TYPE 2 TMS MANUAL 880	1
MANUAL-TMS2 T-CD-880	TIGER TYPE 2 TMS MANUAL 880	1

Table. 9.1 TMS2 Parts List

9.2 TMS2T Component Parts List

Part No	Drg. No	Description	Qty
Drawing 030 Bailing Arm Housing Assembly			
N/A	N/A	Seal kit, universal	1
DK072	030/031	Spiral (anti friction)	1

Table. 9.2 TMS2T Parts List

Part No	Drg. No	Description	Qty
DK081	030/031	Bailing arm duct casting	1
DK091	030	Bailing arm housing inner	1
DK092	030	Bailing arm housing inner end cap	1
DK093	030	Bailing arm bearing spacer tube	1
DK101	030	Bailing arm housing outer	1
DK166	030	44T sprocket	1
DK217	030	V-seal	1
DK218	030	Bearing	2
DK219	030	Circlip	3
DK220		Circlip	1
DK221		V seal	1
DK222	030	O-ring	1
DK234	030/054	1/8 BSP plug	4
DK249	030	1/8 BSP taper plug	1
	030	M8 x 18 Socket Head Screw	6
	030	M6 x 30 Socket Head Screw	8
	030	M6 x 16 Socket Head Screw	6
Drawing 031 Bailing Arm Swivel Joint Assembly			
DK072	030/031	Spiral (anti friction)	1
DK081	030/031	Bailing arm duct casting	1
DK126	031	Swivel centre	1
DK127	031	Outer ring	1
DK128	031	Back plate	1
DK129	031	Front plate	1
DK130	031	Stop plate	2
DK135	031	Ball bearing spigot	5
DK136	031	19mm ball bearing	5
DK137	031	Vee guide roller 25mm (bail arm)	25
DK138	031	Vee guide roller spindle	2

Table. 9.2 TMS2T Parts List (Continued)

Part No	Drg. No	Description	Qty
DK511	031	Bailing arm swivel joint assembly comprising: 127, 128, 129, 130x2, 126, 135x5, 136x5, 138x2, 137x5, 341, M6x60 cp hdx3, M6x50 cp hd x 9	1
DK512	031	Bailing arm assembly comprising: 340, 137x10, M6x50 cp hdx10, M6x25 cp hdx6	1
	031	M6 x 20 Socket Head Screw	6
	031	M8 x 10 Grub Screw	4
	031	M6 x 50 Socket Head Screw	9
	031	M6 x 60 Socket Head Screw	3
	031	M6 x 25 Socket Head Screw	6
	031	M6 x 55 Socket Head Screw	10
Drawing 032 Power Sheave Drive Hub			
DK102	032	Power sheave hub Superseded by DK626	1
DK103	032	Power sheave clutch bearing housing Superseded by DK630	1
DK104	032	Power sheave clutch end cap	1
DK105	032	Power sheave hub end cap	1
DK106	032	Power sheave shaft and spacer	1
DK107	032	Carrier plate	1
DK109	032	Friction disc Superseded by DK631	1
DK110	032/054	Thrust washer	2
DK154	032	Flange plate	2
DK155	032	Sheave wheel disc top	1
DK156	032	Sheave wheel disc lower	1
DK164	032	60T sprocket	1
DK165	032	25T sprocket (Superseded by DK707)	1
DK200	032	O-ring	1
DK201	032	O-ring	1
DK202	032	Circlip	2
DK203	032	Bearing	1
DK204	032	Circlip	2

Table. 9.2 TMS2T Parts List (Continued)

Part No	Drg. No	Description	Qty
DK205	032	V seal	1
DK206	032	FDN 30CFR OBSOLETE	1
DK209	032	O-ring	1
DK210	032/054	Belville spring	7
DK211	032/054	8mm 1/8 BSP	1
DK213	032	6mm x 6mm x 15mm key	1
DK214	032	6mm x 6mm x 10mm key	1
DK215	032	Power sheave drive disc – 16mm tether	1
DK215A	032	Power sheave drive disc – 17.5 mm tether	1
DK216	032	6mm x 6mm x 14mm key	1
DK224	032	Taperlock OBSOLETE	1
DK225	032	6mm x 6mm x 22mm key	1
DK237	032	Bearing	1
DK238	032	Circlip	1
DK239	032	Snap ring	1
DK252	032	Bearing	2
DK305	032	Locking washer	1
DK508-2	032	Power sheave hub main assembly comprising: 105, 201, 200, 202x3, 238, 237, 204x2, 203, 234, 211, 102, 216, 106, 213	1
DK509-2	032	Power sheave one-way hub assembly comprising: 265, 630,261, 263, 209, 104, 214, 275, 276	1
DK626	032	Replacement for DK102 Power sheave hub	1
DK630	032	Replacement for DK103 Power sheave clutch bearing housing	1
DK631	032	Replacement for DK109 Friction disc	2
	032	M5 x 12 CSK Screw	12
	032	M8 x 30 Socket Head Screw	6
	032	M8 x 60 Socket Head Screw	6
	032	M8 x 25 Socket Head Screw	1
	032	M10 x 40 Socket Head Screw	1

Table. 9.2 TMS2T Parts List (Continued)

Part No	Drg. No	Description	Qty
	032	M6 x 20 CSK Screw	6
	032	M5 Grub Screw	1
Drawing 034 Belt & Primary Chain Drive Tension Assembly			
DK117	034/049/049-1	Power sheave mounting plate	1
DK122	034/049	Belt tension	1
DK124	034/049	Idler bracket	1
DK160	034/049	18T sprocket idler	2
DK161	034/054	Timing pulley	3
DK162	034/054	Timing pulley flanges	6
DK167	034	Compression spring bracket	1
DK168	034	Compression spring pivot bracket	1
DK169	034	Spring location bush	1
DK170	034/049	Spring pusher	1
DK171	034/049	Pivot bush	2
DK172	034/049	Chain idler spigot	2
DK173	034/049	Spacer	4
DK174	034/049	25mm spigot	2
DK176	034/049	Primary drive chain idler body	1
DK176A	034/049	Clamp plate	1
DK226	034	Compression spring	1
DK232	034/054	18T sprocket idler OBSOLETE (Superseded by DK160)	2
DK233	034	Timing belt Top exit Umbilical Configuration	1
DK255	034	Timing belt Rear exit Umbilical Configuration	1
DK502	034	Belt tension swing arm assembly comprising: 122, 171 x 2, 168, 172 x 2, 174, 161, 162 x 2, 168,169, M8 x 40 skt cp hd, M10 x 70 hex, M12 x 60 hex	1
DK503	034	Belt idler assembly comprising: 124, 173 x 2, 161, 162 x 2, M10 x 70 hex, M8 x 30 skt cp (2 off)	1
DK504	034	Belt tension compression spring assembly comprising: 169, 170, 226	1
	034	M10 x 70 Socket Head Screw	2

Table. 9.2 TMS2T Parts List (Continued)

Part No	Drg. No	Description	Qty
	034	M8 x 40 Socket Head Screw	4
	034	M12 x 60 Socket Head Screw	1
Drawing 045 Hydrostatic Release Mechanism			
DK195	045	Cylinder body	1
DK196	045	End cap	1
DK197	045	Piston rod	1
DK198	045	Piston	1
DK199	045	Rod end	1
DK241	045	1/8 BSP Hex plug	1
DK248	045	O-ring	1
DK254	045	Return spring	1
DK300	045	Locking hook	1
DK302	045	Spacer	2
DK514	045	Hydrostatic release mechanism comprising: 195, 196, 197, 198, 199, 300, 241, M19x120 hex x 3, M5x20 cp hd x 3, M6x40 cp hd	1
	045	M10 x 120 Hex Head Screw	3
	045	M5 x 20 Socket Head Screw	1
	045	M6 x 40 Socket Head Screw	1
Drawing 049 Sheave Wheel Guide Assembly			
DK117	049	Power sheave mounting plate	1
DK122	034/049	Belt tension	1
DK124	034/049	Idler bracket	1
DK132	050/049	Vertical side plate inner	1
DK134	049/050	Vee guide rollers 50mm	26
DK160	034/049	18T sprocket idler	2
DK167	034/049	Compression spring bracket	1
DK168	034/049	Compression spring pivot bracket	1
DK169	034/049	Spring location bush	1
DK170	034/049	Spring pusher	1

Table. 9.2 TMS2T Parts List (Continued)

Part No	Drg. No	Description	Qty
DK171	034/049	Pivot bush	2
DK172	034/049	Chain idler spigot	2
DK173	034/049	Spacer	4
DK174	034/049	25mm spigot	2
DK176	034/049	Primary drive chain idler body	1
DK176A	034/049	Clamp plate	1
DK226	034/049	Compression spring	1
DK233	034/049	Timing belt	1
DK250	049	Primary drive chain 54in.	1
DK306	049	Attachment pillars outside frame	5
	049	M12 x 60 Hex Head Screw	1
049-1 Belt Tension Assembly			
DK117	049/049-1	Power sheave mounting plate	1
DK122	034/049/049-1	Belt tension	1
DK124	034/049/049-1	Idler bracket	1
DK122	034/049/049-1	Belt tension	1
DK161	034/054/049-1	Timing pulley	3
DK162	034/054/049-1	Timing pulley flanges	6
DK167	034/049-1	Compression spring bracket	1
DK168	034/049-1	Compression spring pivot bracket	1
DK169	034/049-1	Spring location bush	1
DK170	034/049/049-1	Spring pusher	1
DK171	034/049/049-1	Pivot bush	2
DK172	034/049/049-1	Chain idler spigot	2
DK173	034/049/049-1	Spacer	4
DK174	034/049/049-1	25mm spigot	2
DK226	034/049-1	Compression spring	1
DK306	049-1	Attachment pillars outside frame	5
DK506	054/049-1	Gearbox output drive components comprising: 315, 112 x 2, 232A, 320, 210x2, 111	1

Table. 9.2 TMS2T Parts List (Continued)

Part No	Drg. No	Description	Qty
	049	M12 x 60 Hex Head Screw	1
Drawing 050 Assembly of Cable Guides			
DK132	050	Vertical side plate inner	1
DK132A	050	Vertical side plate outer	1
DK134	049/050	Vee guide rollers 50mm	26
DK183	050	Horizontal side plate	1
DK183A	050	Horizontal side plate	1
Drawing 054 Idler Hub & Gearbox Extension Assembly			
DK110	032/054	Thrust washer	2
DK111	054	Adjusting nut	2
DK161	034/054	Timing pulley	3
DK162	034/054	Timing pulley flanges	6
DK178	054	Idler hub OBSOLETE	1
DK179	054	Idler hub end cap OBSOLETE	1
DK180	054	Idler hub shaft OBSOLETE	1
DK181	054	Friction disc plain outer OBSOLETE	1
DK181A	054	Bearing spacer	1
DK182	054	Friction disc keywayed inner	1
DK207	054	Bearing 6004 OBSOLETE	2
DK210	032/054	Belville spring	7
DK211	032/054	8mm 1/8 BSP	1
DK212	054	6mm x 6mm x 20mm key	1
DK228	054	Coupling assembly	2
DK229	054	V seal	1
DK230	054	O-ring	1
DK231	054	C clip 7100-025	1
DK232	034/054	18T sprocket idler OBSOLETE (Superseded by DK160)	2
DK232A	054/034	18T stainless steel 316 sprocket	1
DK234	030/054	1/8 BSP plug	4
DK235	054	14T stainless sprocket	1

Table. 9.2 TMS2T Parts List (Continued)

Part No	Drg. No	Description	Qty
DK241	045	1/8 BSP Hex plug	1
DK243	054	Oil seal	1
DK244	054	O-ring	1
DK245	054	Oil seal	1
DK249	030/054	1/8 BSP taper plug	1
DK253	054	¼ BSP – 8mm elbow fitting	1
DK308	054	Gearbox housing	1
DK309	054	Gear box end cap	1
DK314	054	Output shaft	1
DK315	054	Output shaft thrust washer	1
DK316	054	Input shaft adaptor MK.1 (OBSOLETE)	1
DK317	054	Belville spring carrier	1
DK318	054	Washer	1
DK319	054	Washer	1
DK320	054	Anti-rotation thrust washer	1
DK505	054	Reduction gearbox assembly comprising: 308, 309, 314, 243, 245, 318 stainless steel fittings	1
DK506	054	Gearbox output drive components comprising: 315, 112 x 2, 232A, 320, 210x2, 111	1
DK507	054	Gearbox input drive elements comprising: 228x2, 246, 312	1
	054	M4 X 20 Socket head screw	1
	054	6 x 6 x18 key	1
	054	3.5 dia Roll Pin	4
	054	M6 x 50 Socket Head Screw	1
	054	4.0 Split Pin	
Drawing 067 Idler Hub Assembly			
DK510-2	067	Idler hub assembly comprising: 691, 693x2, 690, 692, 163A, 182, 181	1
DK110	032/054	Thrust washer	2
DK111	054/067	Adjusting nut	1

Table. 9.2 TMS2T Parts List (Continued)

Part No	Drg. No	Description	Qty
DK161	034/054/067	Timing pulley	1
DK162	034/054/067	Timing pulley flanges	2
DK163A	067	Sprocket	
DK181	054/067	Friction disc plain outer OBSOLETE	1
DK210	032/054/067	Belville spring	7
DK690	067	Idler hub	1
DK691	067	Idler hub shaft	1
DK692	067	Idler hub lock collar	1
DK693	067	Idler hub BR6	2

Table. 9.2 TMS2T Parts List (Continued)

9.3 Mechanical Drawings

Table 9.3 lists the mechanical drawings for the TMS2T system.

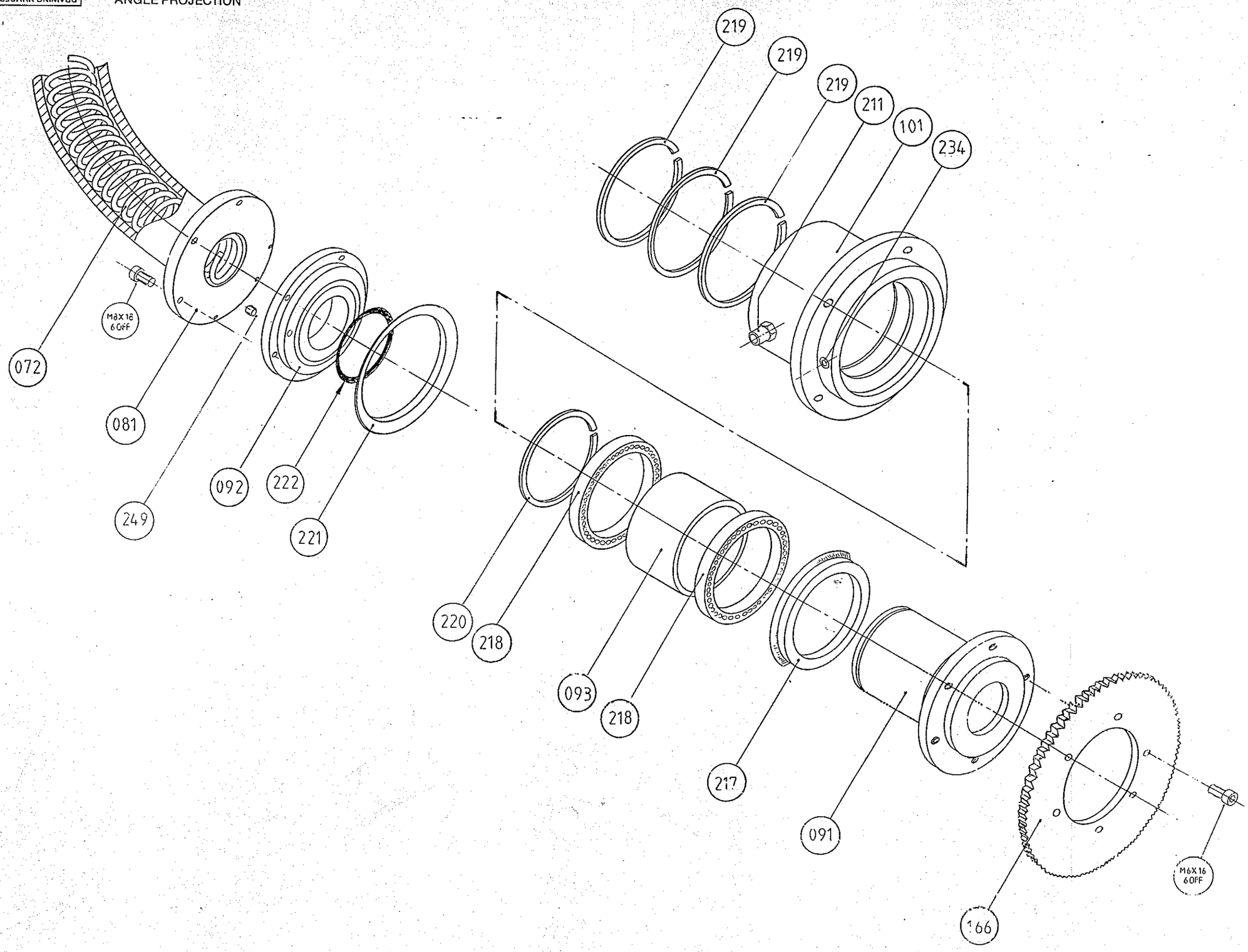
Drawing No.	Mechanical Drawings
030	Bailing Arm Housing Assembly
031	Bailing Arm Swivel Joint Assembly
032	Power Sheave Drive Hub
034	Belt & Primary Chain Drive Tension Assembly
045	Hydrostatic Release Mechanism
049	Sheave Wheel Guide Assembly
049-1	Belt Tension Assembly
050	Assembly of Cable Guides
054	Idler Hub & Gearbox Extension Assembly
067	Idler Hub Assembly

Table. 9.3 List of Mechanical Drawings

1	2	3	4	5	6	7	8	9	10	11

DRAWING NUMBER 030

ANGLE PROJECTION



ISSUE	DATE	MOD No.	ISSUE	DATE	MOD No.

WDS1

MATERIAL

FINISH

TOLERANCES – UNLESS STATED
UNIT ± 0·
·0 ± 0·
·00 ± 0·
·000 ± 0·

DIMENSIONS IN

NOTES

SCALE: 1-2

DRAWN BY:

DATE 6-12-93

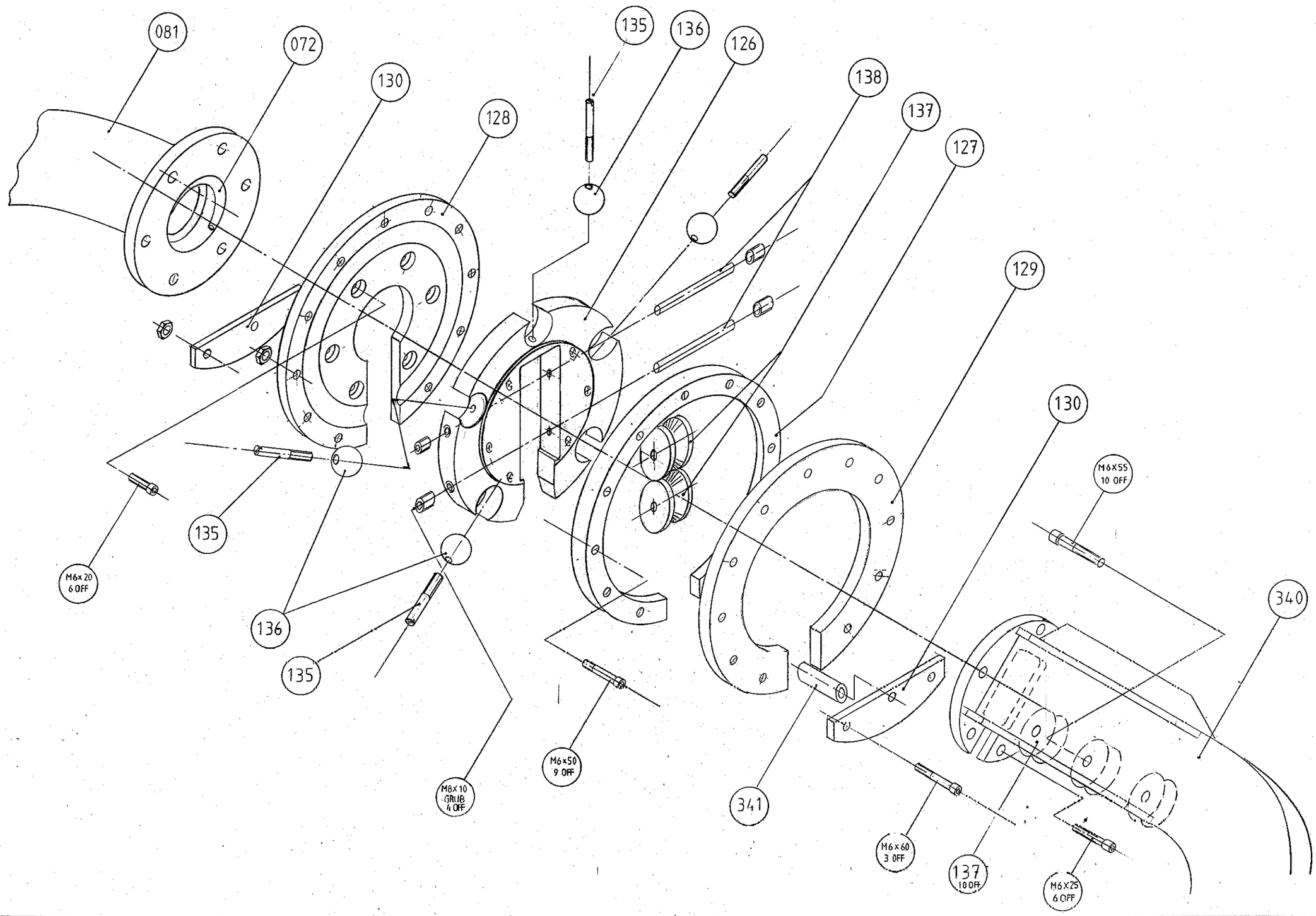
D.K. ENGINEERING SERVICES

TITLE BAILING ARM HOUSING ASSY

DRAWING NUMBER 030

DRAWING NUMBER 031 -3

ANGLE PROJECTION



ISSUE	DATE	MOD No.	ISSUE	DATE	MOD No.
.1	8.92				

MATERIAL

FINISH

TOLERANCES – UNLESS STATED
UNIT ± 0·
·0 ± 0·
·00 ± 0·
·000 ± 0·

DIMENSIONS IN

NOTES

SCALE 1/1

DRAWN BY DKD

DATE 15·12·89

TITLE: BAILING ARM SWIVEL JOINT ASSY

DRAWING NUMBER: 031

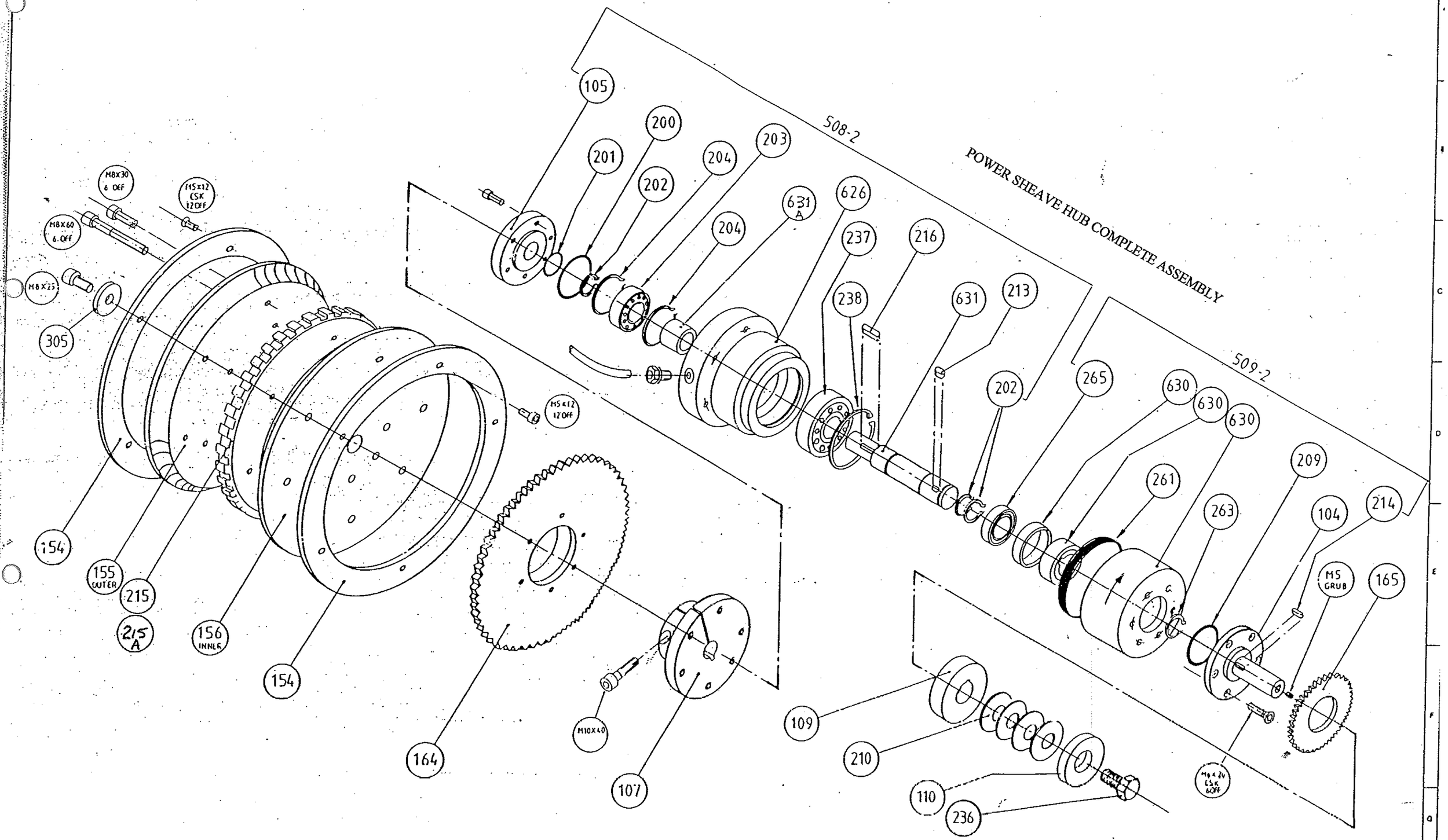
ISS: 3

WD61 WOKING BYELINE "ENGINEERING"

A1

DRAWING NUMBER 032-2

ANGLE PROJECTION



ISSUE	DATE	MOD No	ISSUE	DATE	MOD No
1-1	15-5-97				

MATERIAL

FINISH

TOLERANCES – UNLESS STATED
UNIT ± 0
0 ± 0
·00 ± 0
·000 ± 0
DIMENSIONS IN

NOTES

SCALE 1-2

DRN DD 15-5-97

D.H. ENGINEERING SERVICES

TITLE POWER SHEAVE DRIVE HUB TYPE 2 TMS

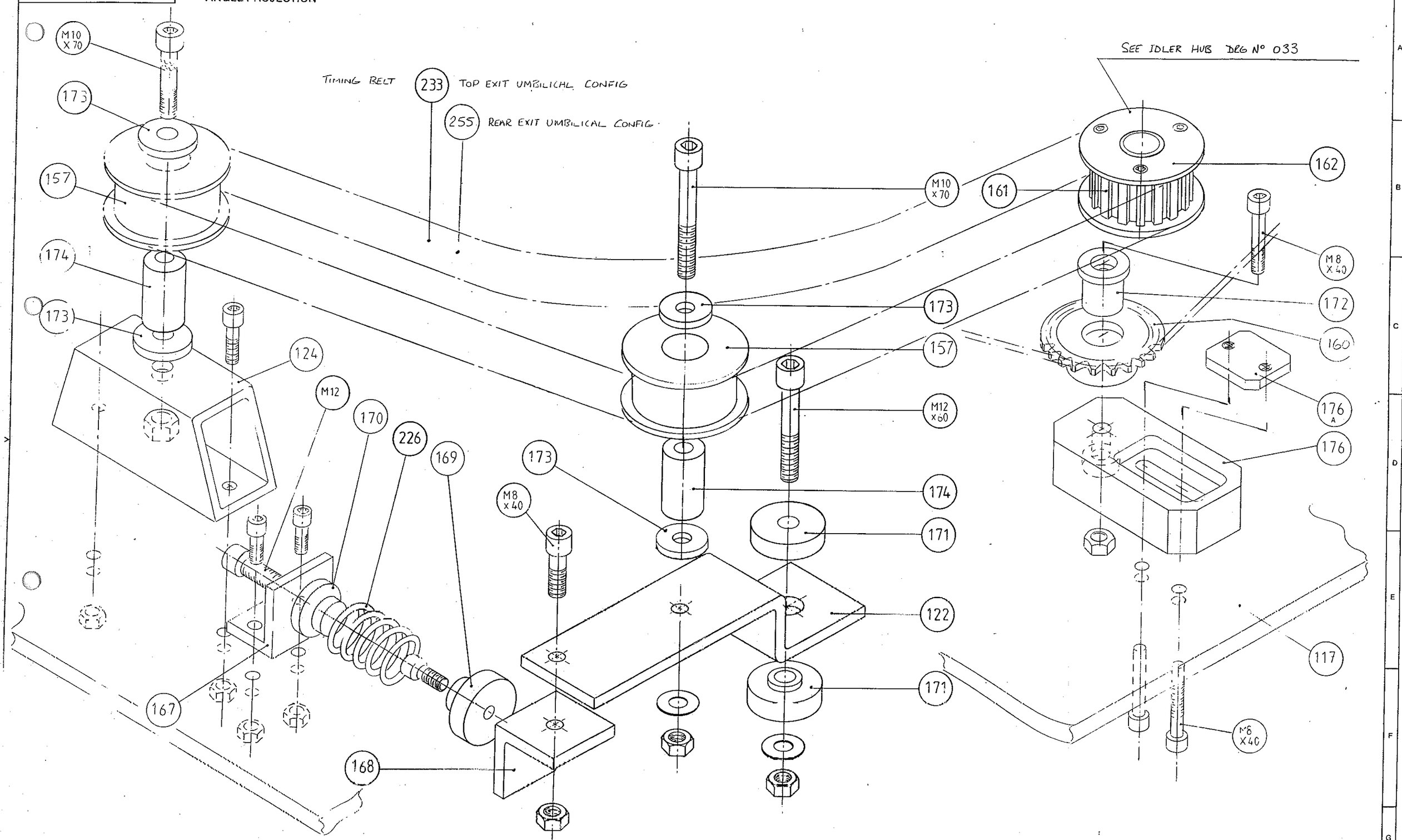
DRAWING NUMBER 032

ISS. 2

A1

DRAWING NUMBER 034 4

ANGLE PROJECTION



ISSUE	DATE	MOD No.	ISSUE	DATE	MOD No.
2	1.93				
3	2.11.93	SERVICE HOLE			
4	10.11.93				

D61 WORKING OVELVE "ENGINEERING"

MATERIAL

FINISH

TOLERANCES – UNLESS STATED
UNIT ± 0·
·0 ± 0·
00 ± 0
·000 ± 0·

DIMENSIONS IN

NOTES

SCALE: 1-1

DRAWN BY D.D

DATE 2-2-93

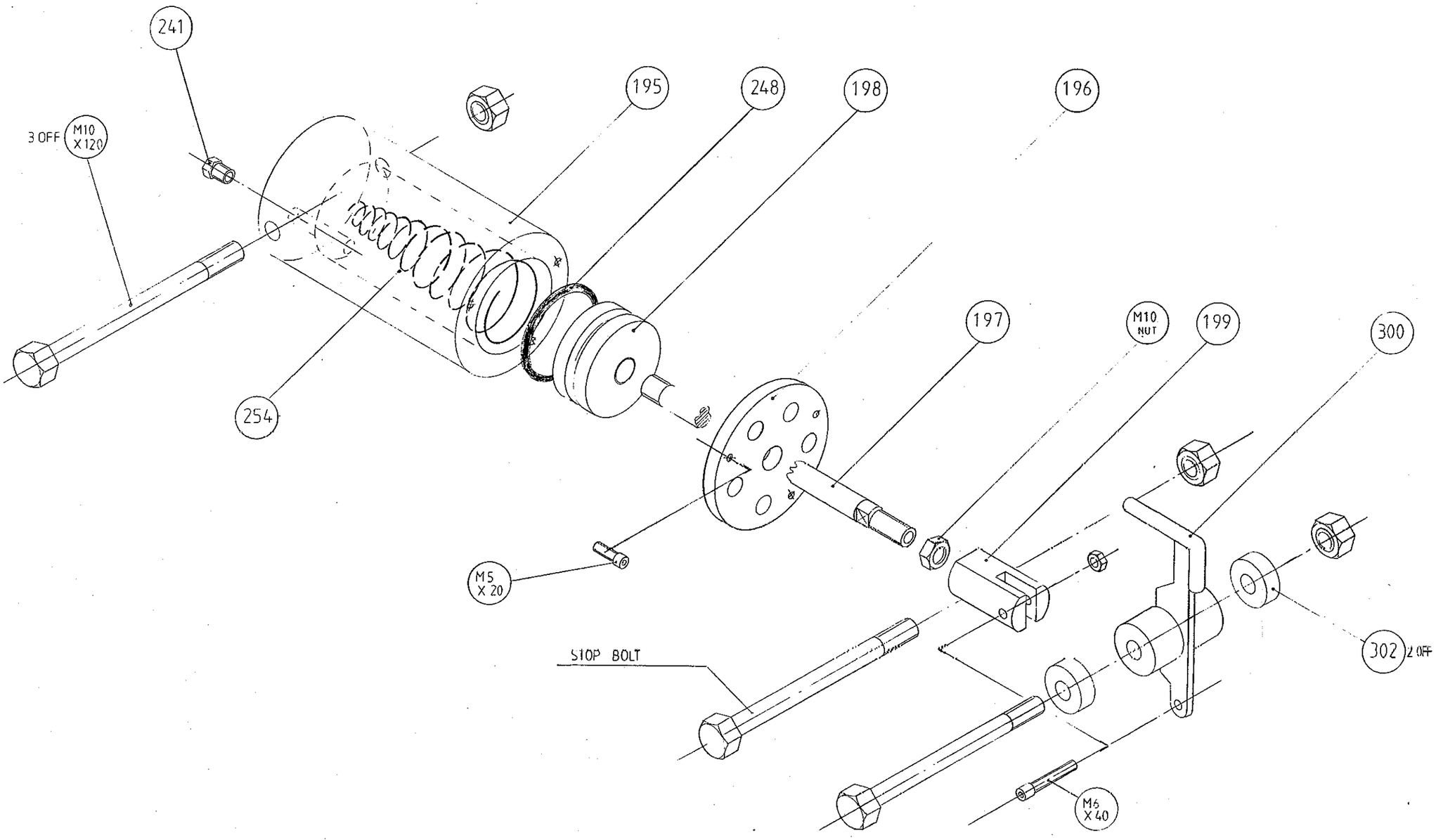
TITLE BELT & PRIMARY CHAIN DRIVE TENSION ASSY.

DRAWING NUMBER 034

ISS 4

DRAWING NUMBER 045

ANGLE PROJECTION



ISSUE	DATE	MOD No.	ISSUE	DATE	MOD No.
2	12 92	ISO DRG.			

MATERIAL

FINISH

TOLERANCES UNLESS STATED
UNIT ± 0·
·0 ± 0·
·00 ± 0·
·000 ± 0·

DIMENSIONS IN

NOTES

SCALE

DRAWN BY DS

DATE 12.92

TITLE HYDROSTATIC RELEASE MECHINISM

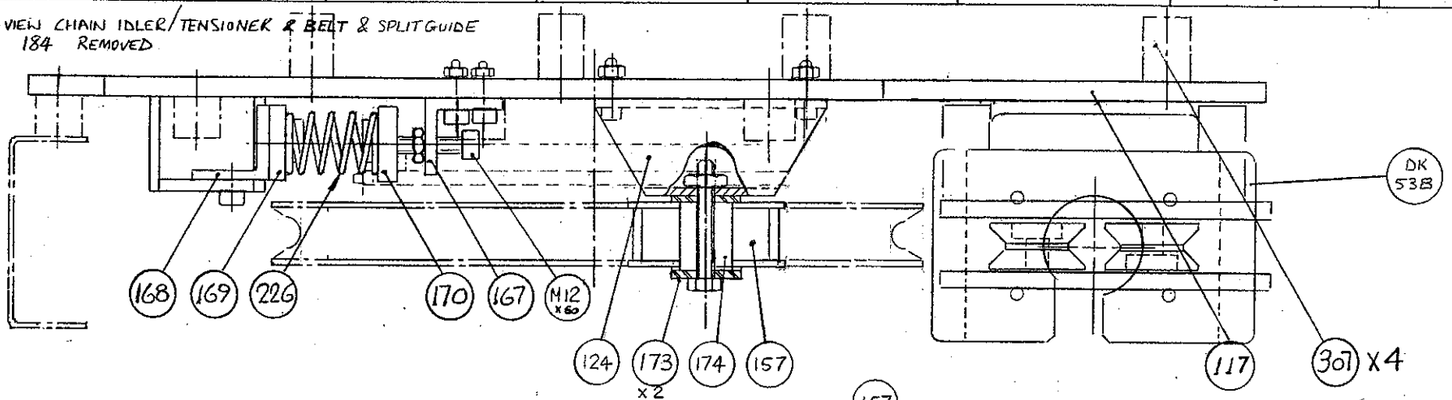
DRAWING NUMBER 045

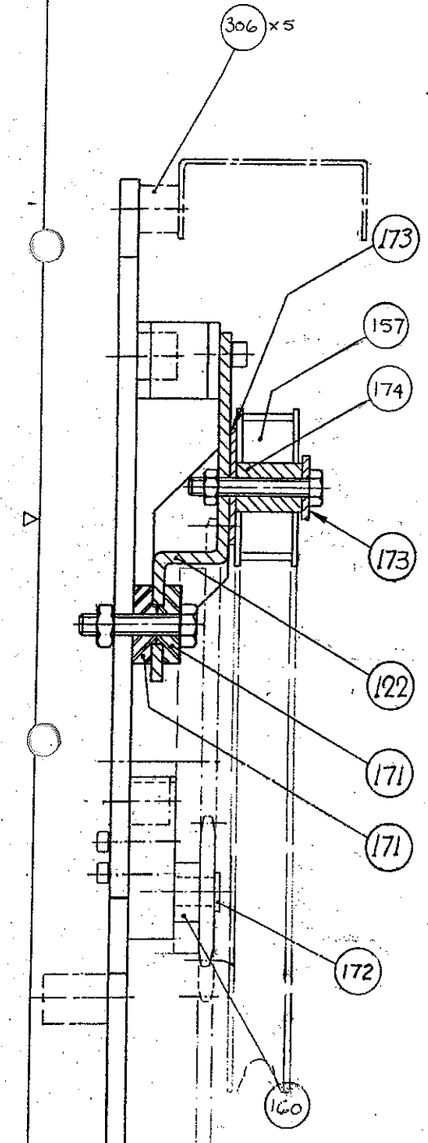
ISS 2

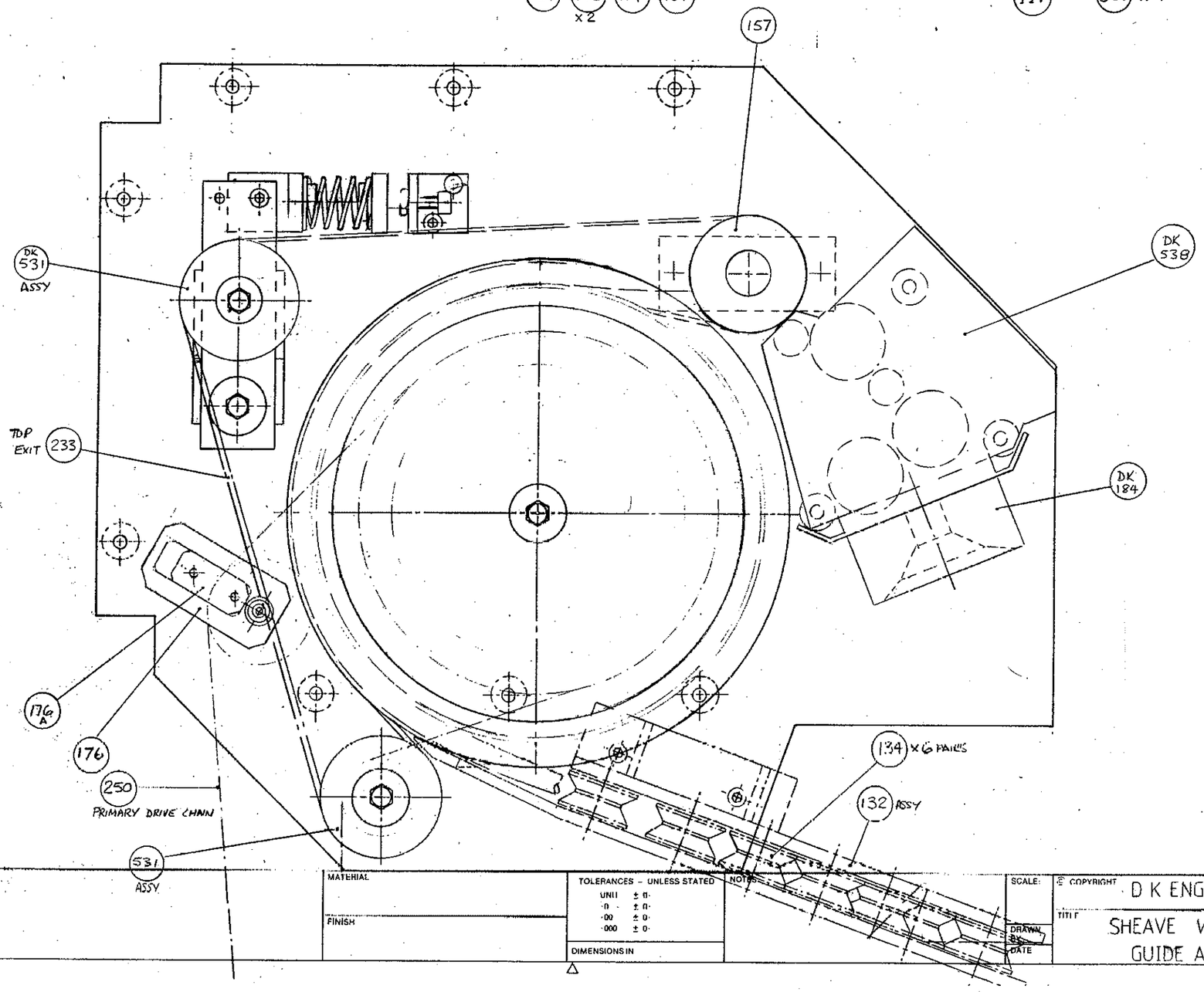
DRAWING NUMBER 049-4

ANGLE PROJECTION

SIDE VIEW CHAIN IDLER/TENSIONER & BELT & SPLIT GUIDE 184 REMOVED







ISSUE	DATE	MOD No	ISSUE	DATE	MOD No.
3	11-98				
4	01-02	538			

MATERIAL

FINISH

TOLERANCES – UNLESS STATED
UNIT ± 1
.0 ± 0
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DIMENSIONS IN

NOTES

SCALE:

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DATE

 D K ENGINEERING SERVICES

TITLE SHEAVE WHEEL/UMBICAL GUIDE ASSY

DRAWING NUMBER 049

ISS 4

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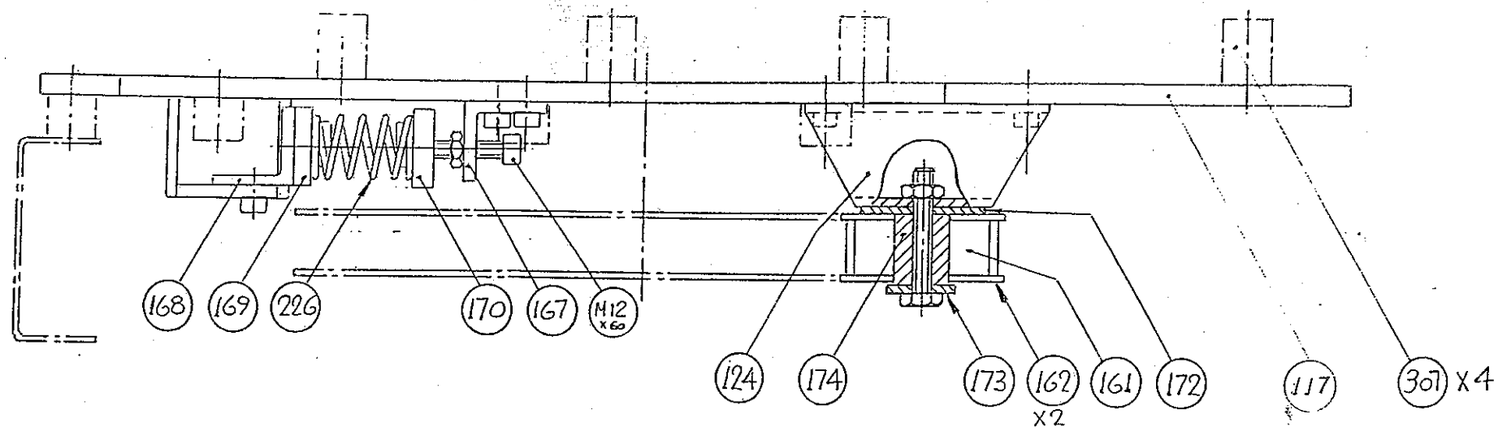
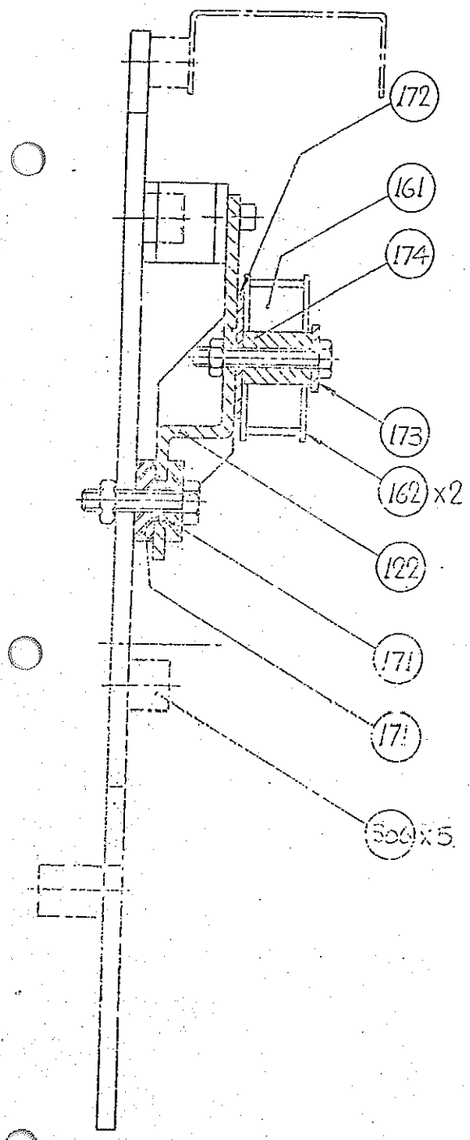
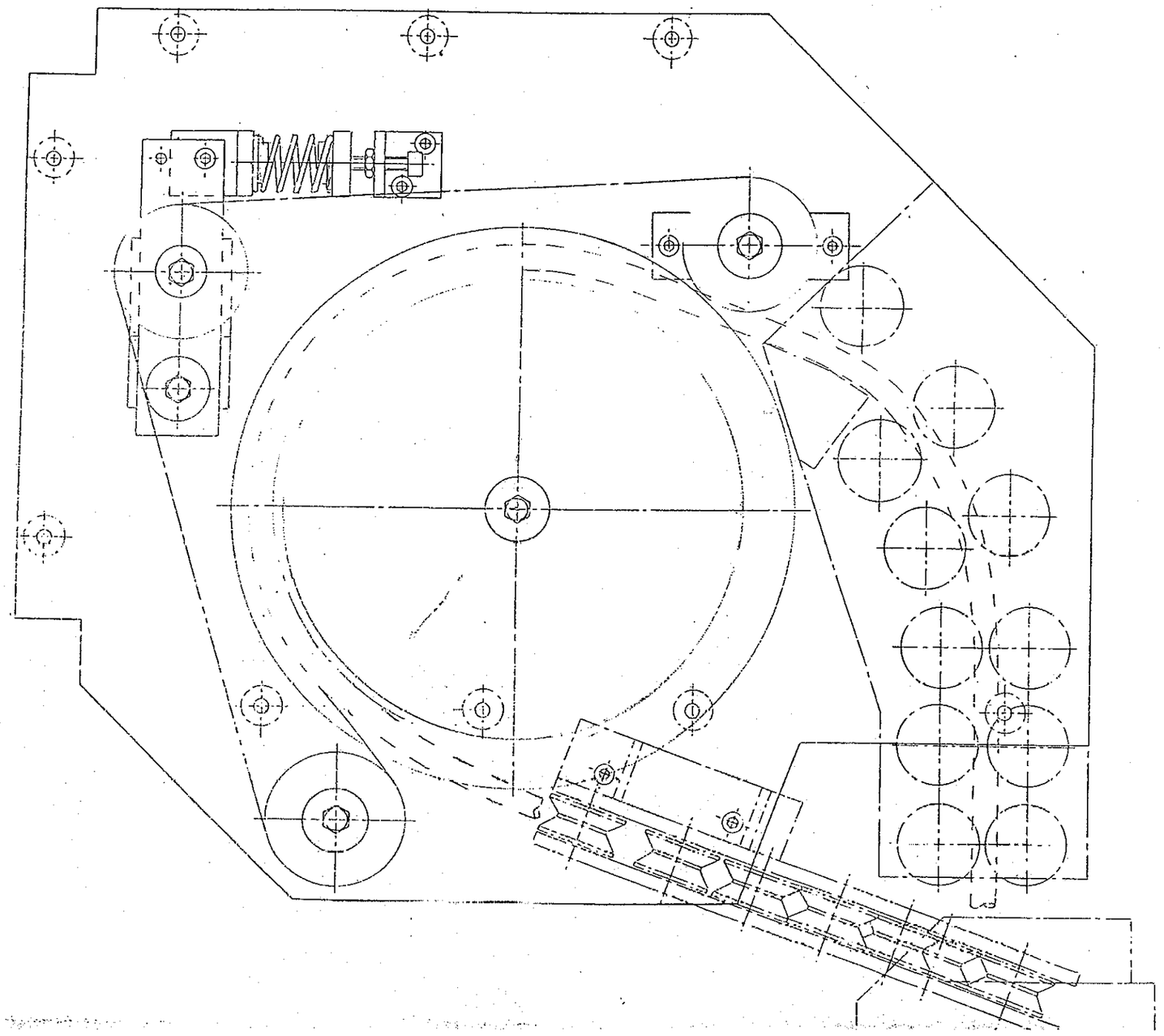






BELT TENSION ASSY.

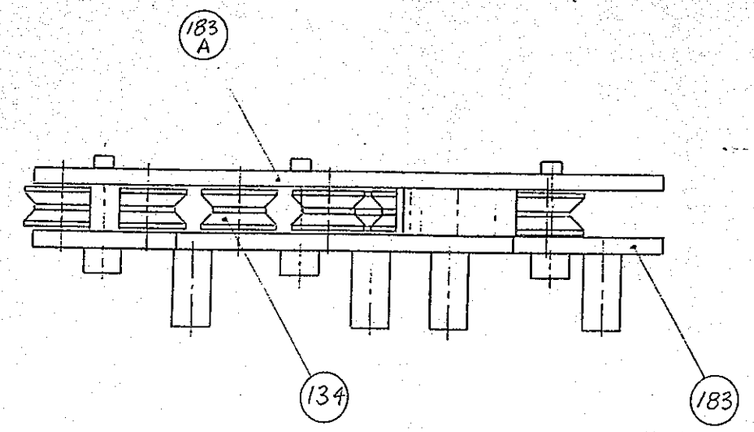
DRG Nº 049 – 1

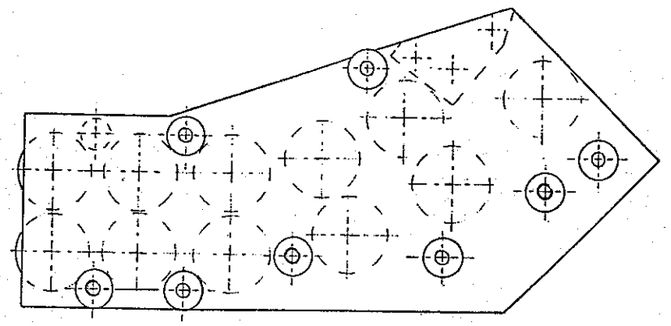
PART OF

DO NOT SCALE

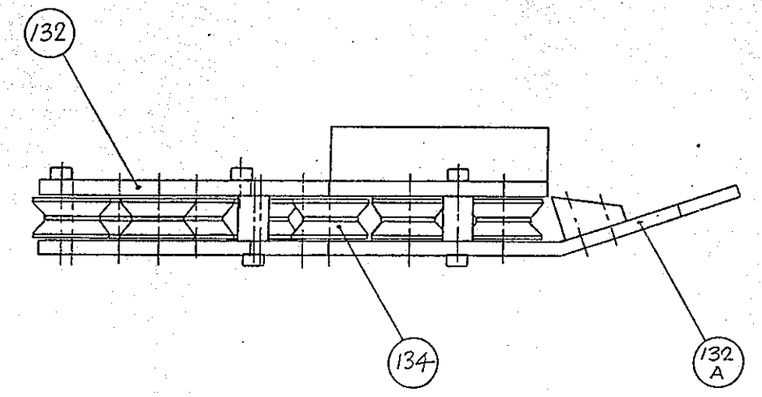
SHEET OF

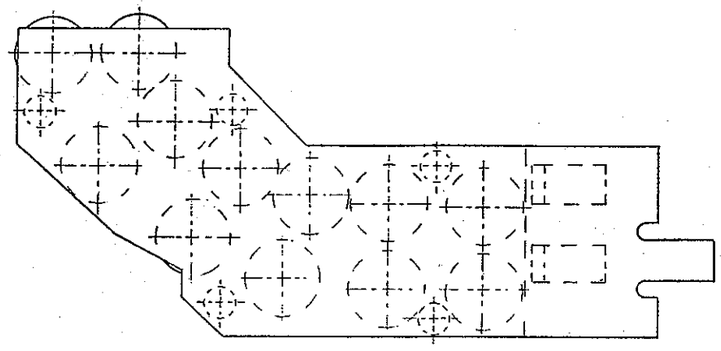
DRG. No. 050





HORIZONTAL CABLE GUIDE





VERICAL CABLE GUIDE

ISSUE	DESCRIPTION	APPD.	DATE

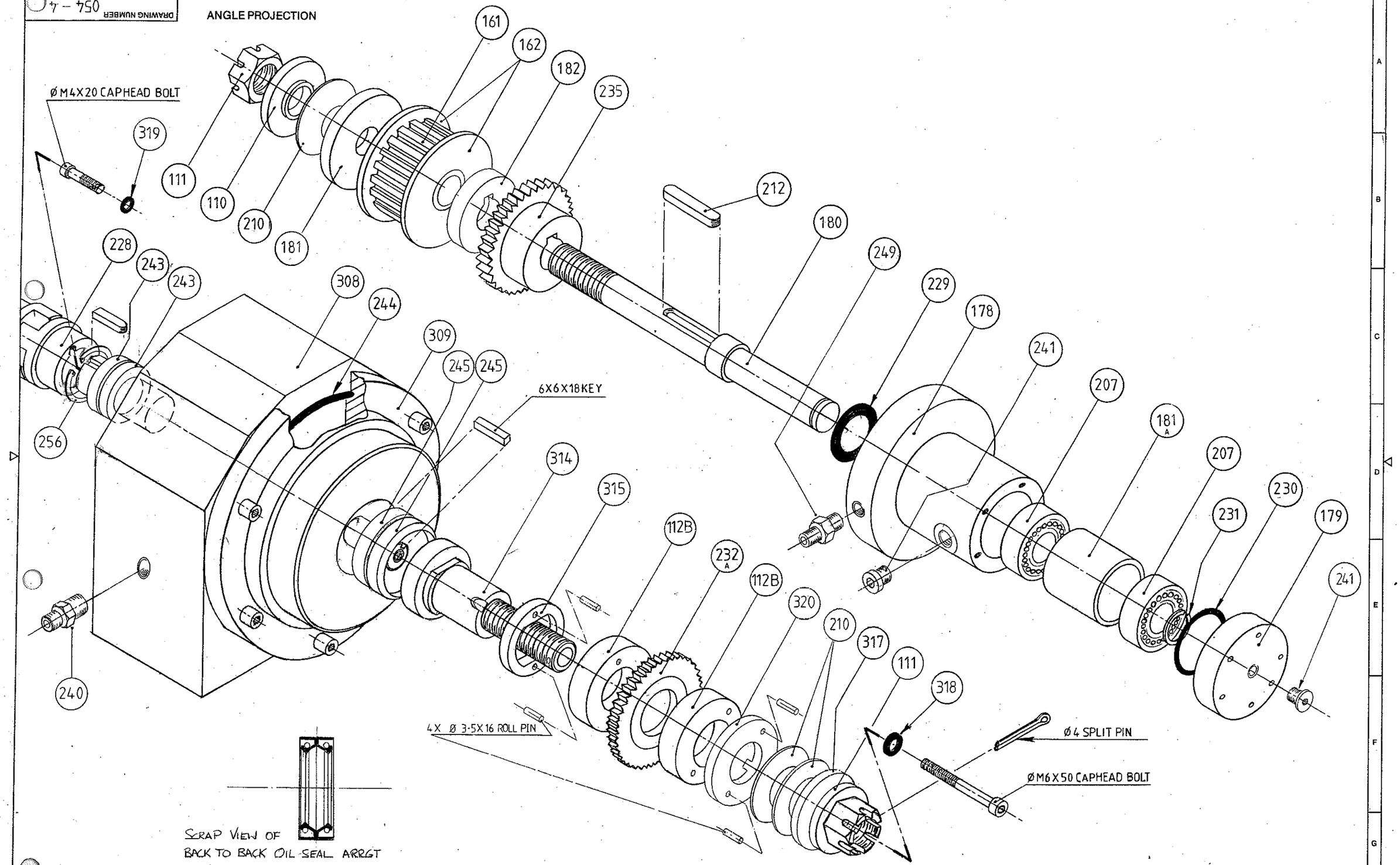
TITLE: ASSY OF CABLE GUIDES

DRAWN	TRACED	CHECKED	APPROVED	DATE	SCALE
T.A.				FEB 92.	1-2

DRAWING No. 050.

DRAWING NUMBER 054 - 4

ANGLE PROJECTION



SCRAP VIEW OF
BACK TO BACK OIL SEAL ARRGT

ISSUE	DATE	MOD No.	ISSUE	DATE	MOD No.
	22-5-92				
3	8-5-92	314/315 320/112B			
4	2-94	245/243x2			

MATERIAL

FINISH

TOLERANCES – UNLESS STATED
UNIT ±0·
·0 ±0·
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DIMENSIONS IN

NOTES

SCALE: 1-1

DRAWN BY DD

DATE 22-5-92

TITLE IDLER HUB & GEARBOX EXTENSION. ASSY

DRAWING NUMBER 054

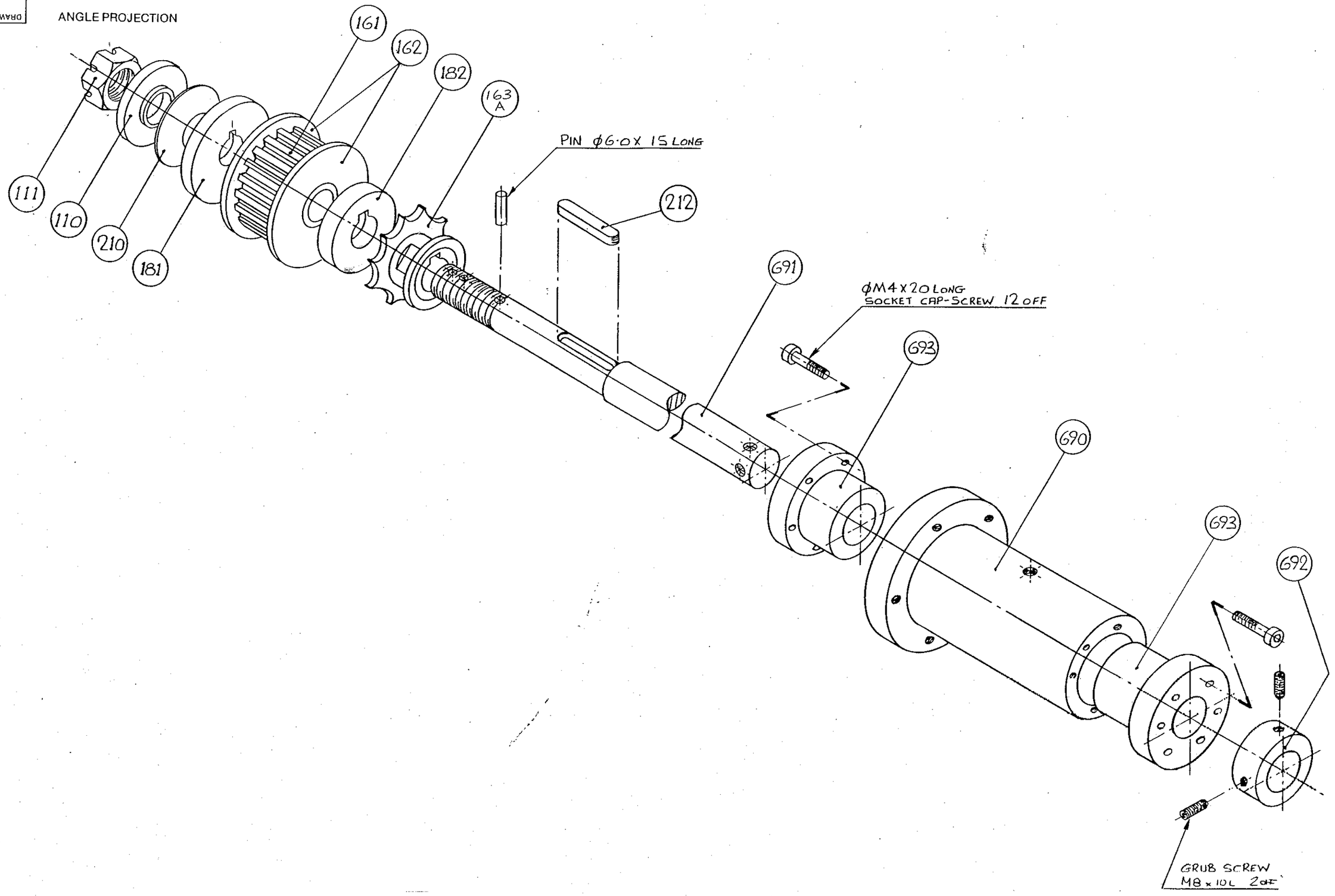
ISS 4

WD61 WORKING DYELINE "ENGINEERING"

594 X 841mm A1

DRAWING NUMBER 067

ANGLE PROJECTION



ISSUE	DATE	MOD No.	ISSUE	DATE	MOD No.
1	19-6-98				

MATERIAL

FINISH

TOLERANCES – UNLESS STATED

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0	± 0
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·000	± 0·

DIMENSIONS IN

NOTES
FITTED TO TMS 027 SUPERCEDES DK 510 DIRECT REPLACEMENT

SCALE: 1-1

DRAWN BY TA

DATE 19-6-98

TITLE IDLER HUB ASSEMBLY DK 510-2

DRAWING NUMBER 067

ISS 5

594 X 841mm A1

CHAPTER 10

PCB MODULES

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10. PCB MODULES

This Chapter describes the TMS2T Electronics Pod (EPOD) Type TMSEPM-2B PCBs. The chapter also contains the respective diagrams.

10.1 TMSEPM-2B PCBs

PCB Drawings		
Drawing No	**Description**	**PCB**
S0302311	Thruster Control Circuit Diagram	6034P
S0302312	Thruster Control Circuit Diagram	6034P
S0302313	Thruster Control Circuit Diagram	6034P
S0303121	CPU Component Layout	6047P
S0303122	CPU Circuit Diagram	6047P
S0303123	CPU Circuit Diagram	6047P
S0303114	CPU Circuit Diagram	6047P
S0007251	Fuse & Filter PCB Circuit Diagram	6056P
S0146821	Dual Light FET Suppressor Component Layout	6062P
S0146611	Dual Light FET Suppressor Component Circuit Diagram	6062P
S0253011	Leak/Vacuum Input Component Layout	6068P
S0051531	Leak/Vacuum Input Circuit Diagram	6068P
S0061631	Line Video Driver PCB Circuit Diagram	6071AP

Table. 10.1 TMS EPOD PCBs

10.2 Thruster Control PCB (Part No. 6034P)

10.2.1 Function

The Thruster Control PCB provides the electronics power supply, speed and direction controls for up to four thruster motors.

10.2.2 Technical Description

The outputs are isolated from the control electronics to prevent a fault on the load affecting the rest of the system.

- **Speed** - Two counter/timer IC's each produce a TTL pulse width modulated (50Hz) signal for two thrusters. The signal is amplified and converted from TTL to +12 V (10-12V) for output to the thrusters. The speed is referenced to the 0 Volt direction line. Fuses protect against excess load on each speed output and a zener diode connected across the signals output provides over-voltage protection.

- **Direction** - Thruster direction is controlled by two digital bits per thruster. The four pairs of bits are simultaneously latched and used by a direction control circuit to produce TTL signal outputs. The outputs are used by a differential driver circuit to provide the required thruster direction as follows:
  - DIR+ High & DIR- Low give clockwise direction.
  - DIR+ Low & DIR- High give anticlockwise direction.

The direction voltage range is 21-24 VDC.

Fuses protect each direction output and a zener diode provides over-voltage protection.

10.2.3 Fuses

Direction and speed fuses F1 to F12 – wire ended 250 mA.

24 VDC input supply fuse, F13 – wire ended 1.5 A.

10.2.4 Link Settings

The PCB has links, which are adjusted according to the type of system fitted Link settings can be found in the electronic pod descriptions found in this handbook.

Function		Pin No
Inputs		
+24 VDC supply		TB5-1
0 VDC		TB5-2
Outputs		
Channel 1	Speed	TB1-3
	DIR+	TB1-2
	DIR-	TB1-1
Channel 2	Speed	TB2-3
	DIR+	TB2-2
	DIR-	TB2-1
Channel 3	Speed	TB3-3
	DIR+	TB3-2
	DIR-	TB3-1
Channel 4	Speed	TB4-3
	DIR+	TB4-2
	DIR-	TB4-1

Table. 10.2 PCB 6034P Inputs and Outputs

10.3 CPU PCB (Part No. 6047P)

10.3.1 Function

The CPU PCB is firmware driven and controls, communicates and processes system data.

10.3.2 Technical Description

The CPU PCB is based on a 16-bit Intel microcontroller. In conjunction with the non-volatile RAM and the isolated RS485 serial port, this PCB meets the processing and communication requirements of the Seaeye systems. The program and operating system for the CPU are specific to the installed system and contained on the EPROM mounted on the PCB.

10.3.3 Software Reset

A red reset button located on the PCB, when operated, restarts the operational software.

Function	Pin No
Inputs	
-15 VDC	CN1-1a, b & c
0 VDC	CN1-2a, b & c
+5 VDC	CN1-31a, b & c
+15 VDC	CN1-32a, b & c
Telemetry	
Telemetry A	S103-1
Telemetry B	S103-2
Common	S103-3

Table. 10.3 PCB 6047P Inputs and Telemetry

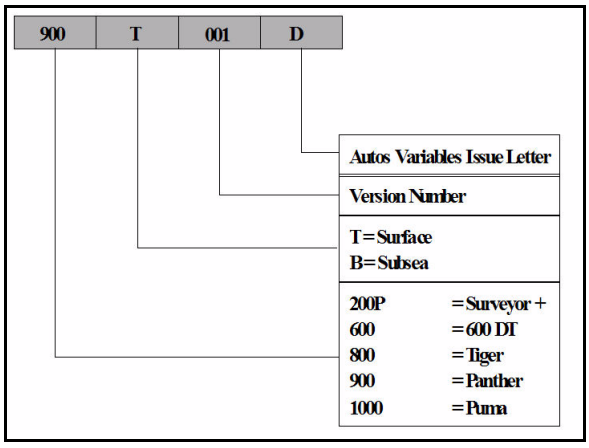

Figure. 10.1 Software Identification

10.4 Fuse and Filter PCB (Part No. 6056P)

CAUTION.

Danger of damage to equipment. PCB 6056P is not compatible with PCB 6008P.

10.4.1 Function

The Fuse and Filter PCB is responsible for protecting the vehicle's DC supply.

10.4.2 Technical Description

The PCB provides outputs for up to five loads. A fuse is fitted on the positive and negative of each channel. A short circuit causing a fuse to rupture on any one of the loads prevents the other channels being affected by the defect.

Capacitors and filter networks provide noise filtering and supply smoothing. A Tranzorb zener diode protects upstream circuits from high voltage spikes that may be generated by the loads.

10.4.3 Fuses

Fuses F1 to F5 – 20mm x 5mm T5A.

Function	Pin No
Inputs	
DC HT +	2a, 2c, 4a, 4c
DC HT -	30a, 30c, 32a, 32c
Outputs	
Channel 1 - DC HT +	14a, 14c
Channel 1 - DC HT -	16a, 16c
Channel 2 - DC HT +	18a, 18c
Channel 2 - DC HT -	20a, 20c
Channel 3 - DC HT +	22a, 22c
Channel 3 - DC HT -	24a, 24c
Channel 4 - DC HT +	26a, 26c
Channel 4 - DC HT -	28a, 28c
Channel 5 - DC HT +	10a, 10c
Channel 5 - DC HT -	12a, 12c

Table. 10.4 PCB 6056P Inputs and Outputs

10.5 Dual FET Light Suppressor PCB (Part No. 6062P)

10.5.1 Function

The Dual Light Suppressor PCB controls two independent lighting channels and can be either switched on or off or dimmed by a control signal at the PCB input.

10.5.2 Technical Description

The PCB electronics are supplied with 24 VDC applied to PL2. Each lighting channel can be driven by either a 10 or a 24 VDC signal, which is used to control two independent isolated DC supplies. The PCB is used in conjunction with two external, (one per channel), chassis mounted IGFET's used to provide the current switching for each lighting channel. TH1 and TH2 reduce the initial current flow due to the cold resistance of the lamps at switch on.

10.5.3 Fuses

Each DC channel is protected by two fuses:

- DC1± F1 & F2 – T5A – 20mm x 5mm.
- DC2± F3 & F4 – T5A – 20mm x 5mm.

Function	Pin No
Inputs	
+DC 1 Supply	PL1-2a & c
- DC 1 Supply	PL1-14a & c
+ DC 2 Supply	PL1-20a & c
- DC 2 Supply	PL1-32a & c
0 VDC Supply	PL2-8
+24 VDC Supply	PL2-1
+24 VDC Drive Signal 1	PL2-2
+10 VDC Drive Signal 1	PL2-3
Drive Input 1 common	PL2-4
+24 VDC Drive Signal 2	PL2-5
+10 VDC Drive Signal 2	PL2-6
Drive Input 2 Common	PL2-7
0 V DC Supply	PL2-8
Outputs	
Lights 1 positive supply	PL1-4a & c

Table. 10.5 PCB 6062P Inputs and Outputs

Function	Pin No
Lights 1 negative supply	PL1-6a & c
Lights 2 positive supply	PL1-22a & c
Lights 2 negative supply	PL1-24a & c

Table. 10.5 PCB 6062P Inputs and Outputs (Continued)

10.6 Leak Detection PCB (Part No. 6068P)

10.6.1 Function

The Leak Detection PCB is an environmental device using a water leak sensor to monitor the watertight integrity of electronics pod.

10.6.2 Technical Description

The PCB contains an isolation interface and a leak detector, which works in conjunction with a water sensing probe.

Water Leak detection

This circuit monitors the resistance of the detector probe connected to PL5. If a nominal dry value is measured, the green 'dry' LED on the 6068 is lit and logic 1 is set on PL4-3. If the probe becomes wet (red 'wet' LED is lit) or becomes open-circuited (amber 'open' LED is lit) then logic 1 is set on PL4-3 signalling a fault condition

Function	Pin No
Inputs	
Leak Detector Probe	PL5-1
Leak Detector Probe	PL5-2
Outputs	
+5 VDC Supply	PL4-5
0 VDC Supply	PL4-1
Sensors	
Leak sensor: 1=Dry; 0=Wet/ open	PL4-2
Vacuum monitor	PL4-3

Table. 10.6 PCB 6068P Inputs, Outputs and Sensors

10.7 Balanced Line Video Driver PCB (Part No. LINEVIDEO)

10.7.1 Function

The Balanced Line Video Driver PCB converts a single unbalanced video signal into a balanced video signal for the transmission of video over a twisted pair cable.

10.7.2 Technical Description

The PCB consists of circuitry to boost the video signal to compensate for attenuation due to the length of cable the signal is transmitted over. The PCB compensation circuit overcomes the losses by pre-emphasising the signal thereby reducing distortion and maintaining picture quality and amplitude adjustment overcomes resistive losses in the cables.

10.7.3 Video Adjustments

Procedures on how to pre-emphasise the video signal and adjust the signal amplitude are detailed in the maintenance section of the Technical Handbook (Maintenance Tasks). The maintenance must be carried out in the following instances:

On initial installation if the tether/umbilical has not been supplied with the system:

- Change of umbilical or tether.
- Significant changes to the tether or umbilical length.
- Change of camera.

Function	Pin No
Inputs	
Unbalanced Video	CN6-1
Unbalanced Video return	CN6-2
+12 VDC Power supply	CN6-5
0 VDC Power Supply	CN6-6, 3 & 2
Outputs	
Balanced Video A	CN6-9
Balanced Video B	CN6-10

Table. 10.7 PCB LINEVIDEO Inputs and Outputs

Document Number: TMS2T System 880 Issue original

Saab Seaeye Ltd

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United Kingdom

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Fax
+44 (0) 1489 898001

Internet Address
www.seaeye.com
E-mail
rovs@seaeye.com

Registered in
England & Wales
No 02022671

VAT No
566 6513 17

NOTE: All supplies from this point onwards MUST be isolated.

** NOTE: WHEN TLP2630 USED IN PLACE OF HCPL2630 THE RESISTOR VALUES MARKED ** SHOULD BE FITTED

+5V C20 0.1uF C21 0.1uF

IC2 74LS138 A8 A9 A10 G1 G2A G2B A B C Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7 ALNK1 ALNK2 ALNK3

(C16) A12 IC1F 74LS04 LK3 LK4 (C15) A11 IC1D

Y0 (A4) Y1 (A5) Y2 (A6) Y3 (A7) Y4 (A8) Y5 (A9) Y6 (A10) Y7 (A11)

D0-D7 (C29-C22) /RD (A13) /WR (A14) A0-A1 (C4-C5)

C15 0.1uF IC3 8254 CLK0 GO OUT0 CLK1 G1 OUT1 CLK2 G2 OUT2 CS RD WR A0 A1 R2 10K LNK1

C16 0.1uF IC7 N/C OUTPUT 1MHz OSC

C17 0.1uF IC4 8254 R3 10K LNK2

C18 0.1uF IC5 74ALS574 DIRECTION CONTROL CNTRL1+ CNTRL1- CNTRL2+ CNTRL2- CNTRL3+ CNTRL3- CNTRL4+ CNTRL4-

IC6A 74LS32

R73 10K C19 0.1uF IC6 74ALS32

ISO +5V C14 0.1uF IC9B HCPL2630 **TLP2630 SIL5 470R SIL6 2K2 **10K J11

IC14B LM324 F2 250mA BZX85C33 ZD10 THRUST2 TB2 (S2) R9 130K R10 91K

ISO +5V IC9A HCPL2630 **TLP2630 SIL5 470R SIL6 2K2 **10K J10

IC14C LM324 F3 250mA BZX85C33 ZD11 THRUST3 TB3 (S3) R16 130K R17 91K

ISO +5V C13 0.1uF IC8B HCPL2630 **TLP2630 SIL5 470R SIL6 2K2 **10K J12

IC14A LM324 F1 250mA BZX85C33 ZD9 THRUST1 TB1 (S1) R22 130K R23 91K

ISO +5V IC8A HCPL2630 **TLP2630 SIL5 470R SIL6 2K2 **10K J13

IC14D LM324 F4 250mA BZX85C33 ZD12 THRUST4 TB4 (S4) R29 130K R30 91K

NOTE: SEE SHEET 2

ISO +15V C22 0.1uF

+24V IN TB5(1) F13 1.5A R92 1R2 0.5W R91 15R 2.5W IC21 L78M15CV VI GND VO ISO +15V R81 12R 2.5W R82 12R 2.5W IC23 L309H ISO +5V

0V IN TB5(2) ZD13 SA24 C26 1uF Tant C23 0.1uF C27 1uF Tant C25 0.1uF C24 1uF Tant ISO GND

ISS	DESCRIPTION	CHECKED	DATE	REF
1	First Issue as CI drawing		28/1/03	N/A

Seaeye

Seaeye Marine Ltd.
Seaeye House
Lower Quay Road
Fareham
Hampshire
PO16 0RQ
England
Tel: +44 (0)1329 289000

TITLE
6034P THRUSTER DRIVE PCB
SPEED CONTROL
CIRCUIT DIAGRAM

SHEET 1 OF 3

DRAWN	APPROVED	DATE
D. Waite		28/1/03

DWG.No. S03023 Rev. 1 Sht. 1

Note: All CNTRL Signals from IC5 Sheet 1.

Note: All supplies from here onwards MUST be ISOLATED.

** NOTE: WHEN TLP2630 USED IN PLACE OF HCPL2630 THE RESISTOR VALUES MARKED ** SHOULD BE FITTED

CNTRL1+ / SIL2 470R / IC15A HCPL2630 **TLP2630 / SIL1 470R **10K / J22 n/c / IC22A / R79 4K7 **10K / F5 250mA BZX85C33 ZD5 / DIR1 / TB1 (D1+)

CNTRL1- / SIL2 470R / IC15B HCPL2630 **TLP2630 / SIL1 470R **10K / L293B / F6 250mA BZX85C33 ZD6 / DIR1/ / TB1 (D1-) / J23 n/c

CNTRL2+ / SIL2 470R / IC16A HCPL2630 **TLP2630 / C10 .01uF / SIL1 470R **10K / J24 n/c / IC22B / R80 4K7 **10K / F7 250mA BZX85C33 ZD8 / DIR2 / TB2 (D2+)

CNTRL2- / SIL2 470R / IC16B HCPL2630 **TLP2630 / SIL1 470R **10K / L293B / F8 250mA BZX85C33 ZD7 / DIR2/ / TB2 (D2-) / J25 n/c

CNTRL3+ / SIL3 470R / IC17A HCPL2630 **TLP2630 / C11 .01uF / SIL1 470R **10K / J14 n/c / IC20A / R75 4K7 **10K / F9 250mA BZX85C33 ZD1 / DIR3 / TB3 (D3+)

CNTRL3- / SIL3 470R / IC17B HCPL2630 **TLP2630 / SIL1 470R **10K / L293B / F10 250mA BZX85C33 ZD2 / DIR3/ / TB3 (D3-) / J15 n/c

CNTRL4+ / SIL3 470R / IC18A HCPL2630 **TLP2630 / .01uF / SIL1 470R **10K / J16 n/c / IC20B / R76 4K7 **10K / F11 250mA BZX85C33 ZD4 / DIR4 / TB4 (D4+)

CNTRL4- / SIL3 470R / IC18B HCPL2630 **TLP2630 / SIL1 470R **10K / L293B / F12 250mA BZX85C33 ZD3 / DIR4/ / TB4 (D4-) / J17 n/c

Note: All supplies from here onwards MUST be ISOLATED.

ISS	DESCRIPTION	CHECKED	DATE	REF
1	First Issue as CI drawing		28/1/03	N/A

Seaeye

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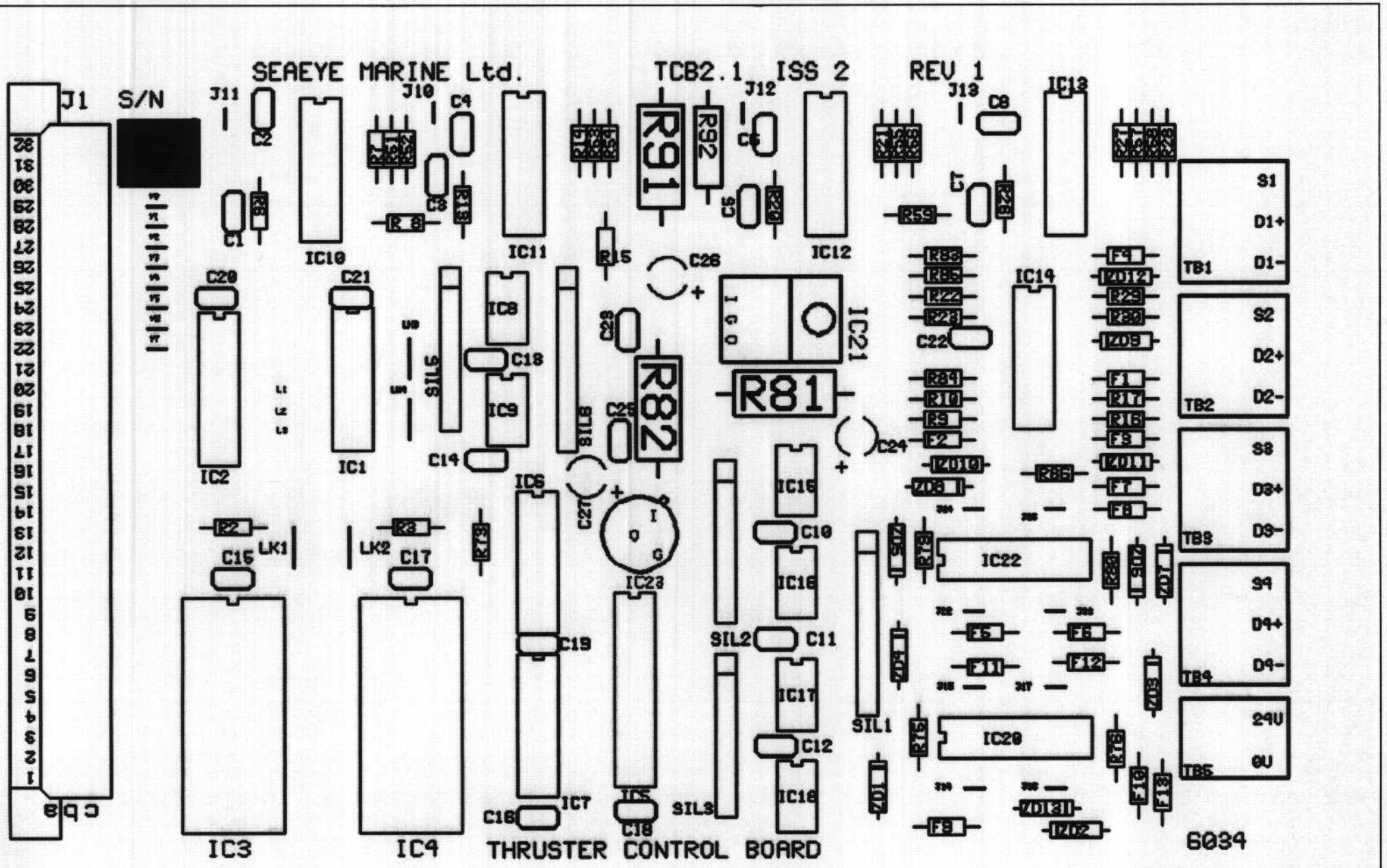
TITLE
6034P THRUSTER DRIVE PCB
DIRECTION CONTROL
CIRCUIT DIAGRAM

SHEET 2 OF 3

DRAWN	APPROVED	DATE
D. Waite		28/1/03

DWG.No. S03023 Rev. 1 Sht. 2



ISS	DESCRIPTION	CHECKED	DATE	REF
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Seaeye

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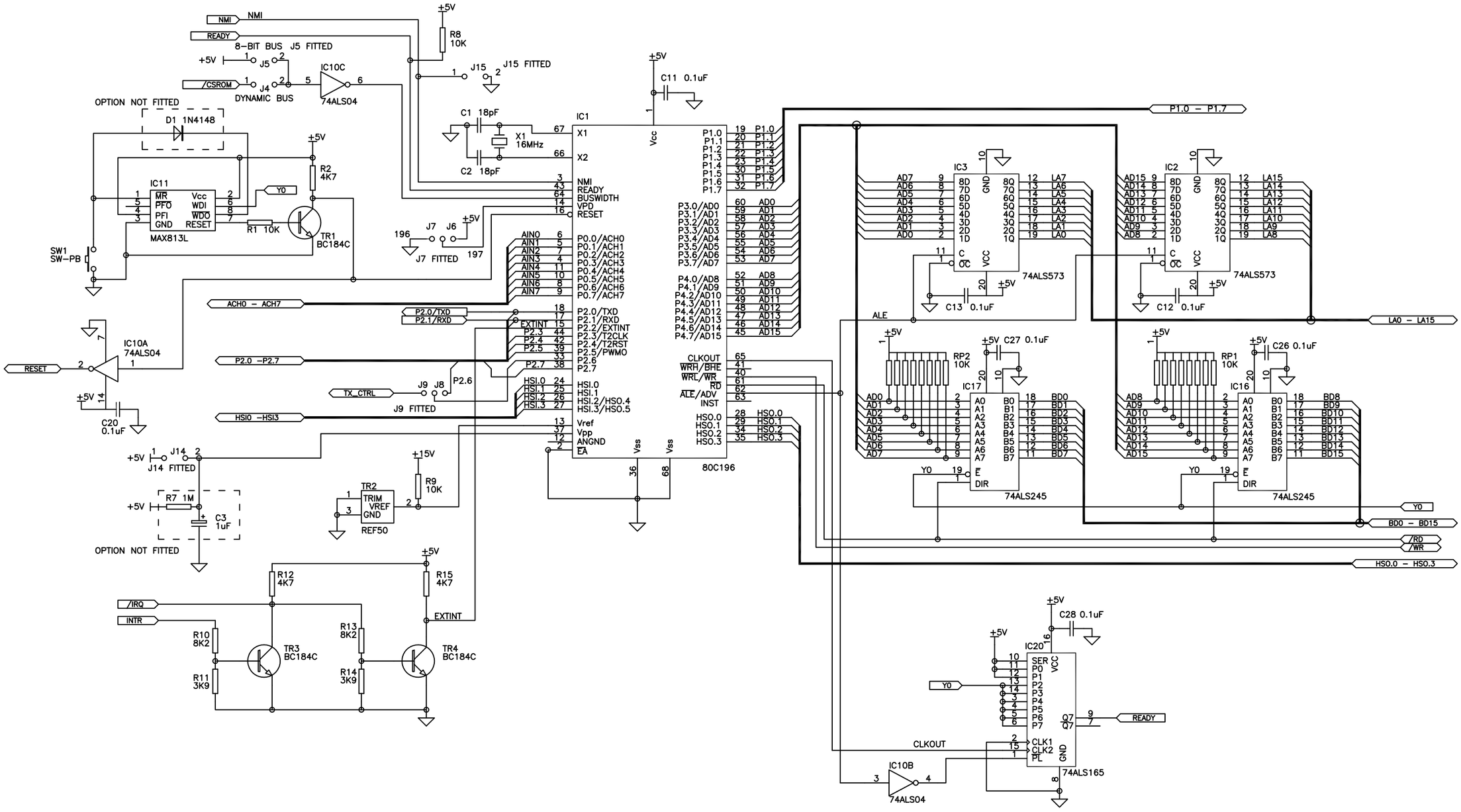
TITLE
6034P THRUSTER DRIVE PCB
COMPONENT LAYOUT
SHEET 3 OF 3

DRAWN	APPROVED	DATE
D. Waite		31/1/03

DWG.No. S03023 Rev. 1 Sht. 3



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ON COMPLETION OF MANUFACTURE

ISS	DESCRIPTION	CHECKED	DATE	REF
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1	First Issue as CI drawing		29/1/03	N/A

Seaeye

Seaeye Marine Ltd.
Seaeye House
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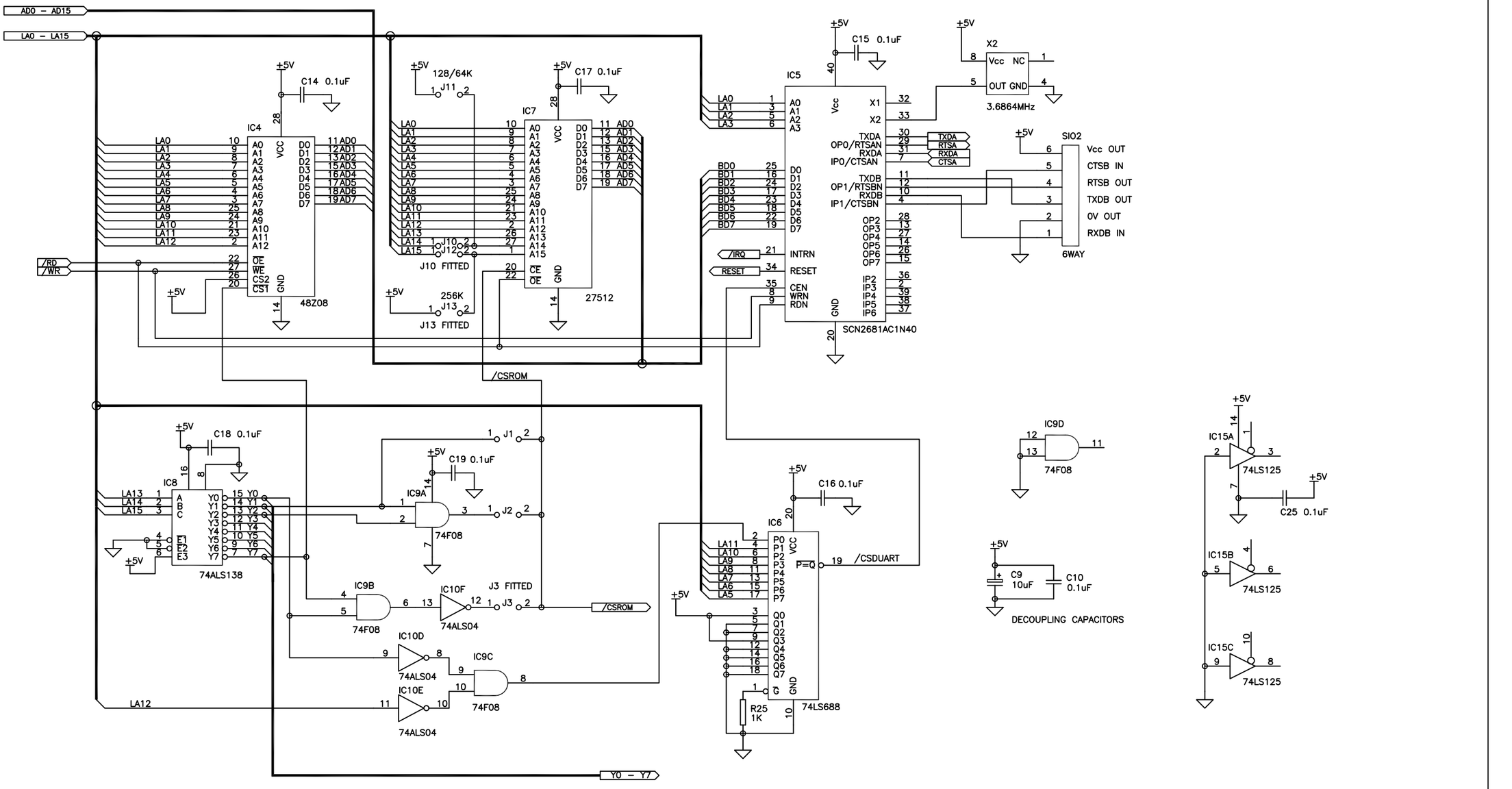
England
Tel: +44 (0)1329 289000

TITLE
6047P CPU PCB WITH DUART
CPU AND BI–DIRECTIONAL BUS CONTROL
CIRCUIT DIAGRAM

SHEET 1 OF 4

DRAWN	APPROVED	DATE
D. Waite	JMR	29/1/03

DWG.No.	Rev.	Sht.
S03031	2	1



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ALL DRAWINGS MUST BE RETURNED
TO SEAEYE MARINE Ltd.
ON COMPLETION OF MANUFACTURE

ISS	DESCRIPTION	CHECKED	DATE	REF
2	Jumpers J10 & 15 shown 'FITTED'		28/10/05	DCR883-DW
1	First Issue		29/1/03	N/A

Seaeye

Seaeye Marine Ltd.
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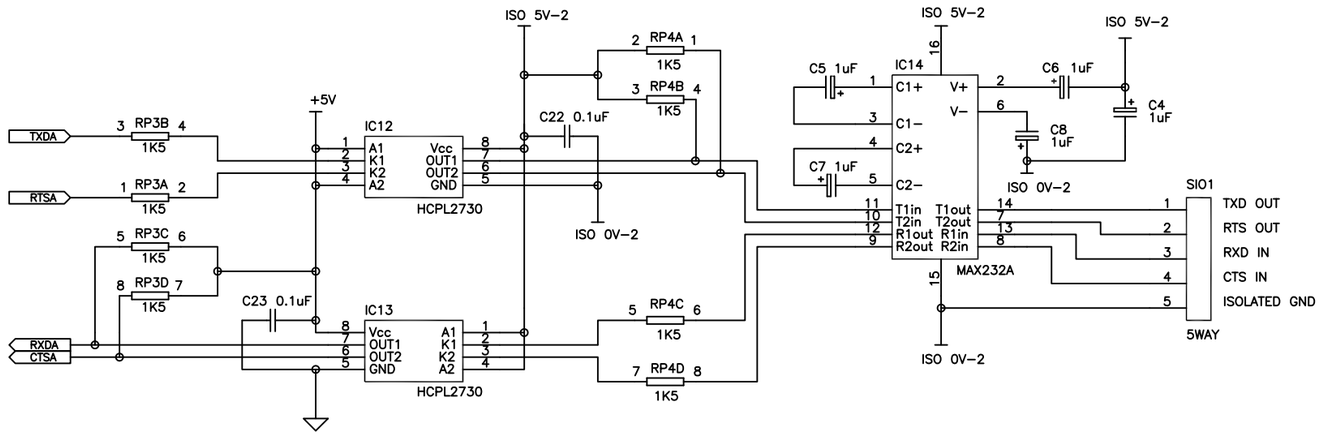
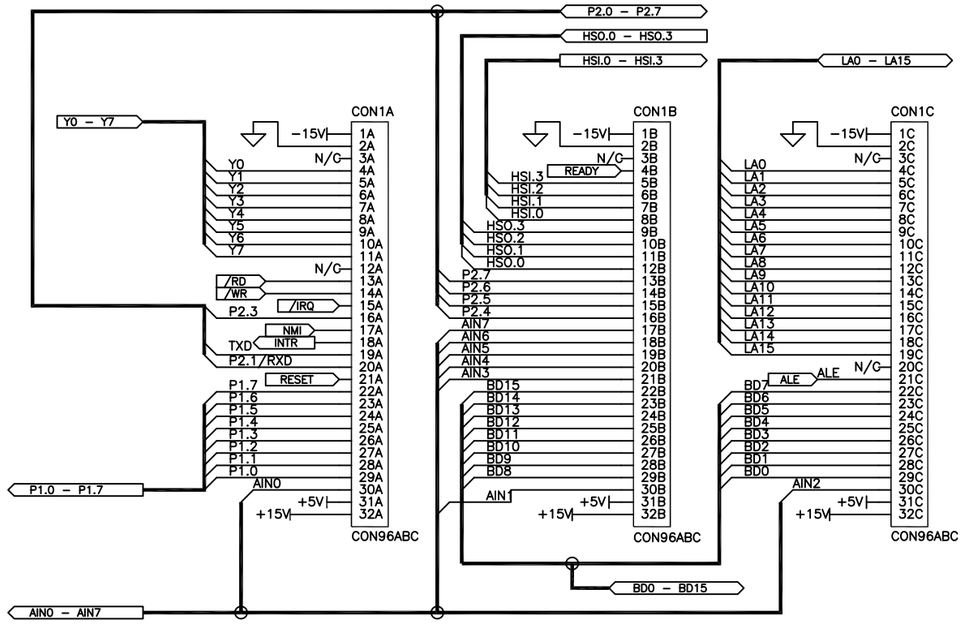
TITLE
6047P CPU PCB WITH DUART
MEMORY DUART AND ADDRESS DECODING
CIRCUIT DIAGRAM

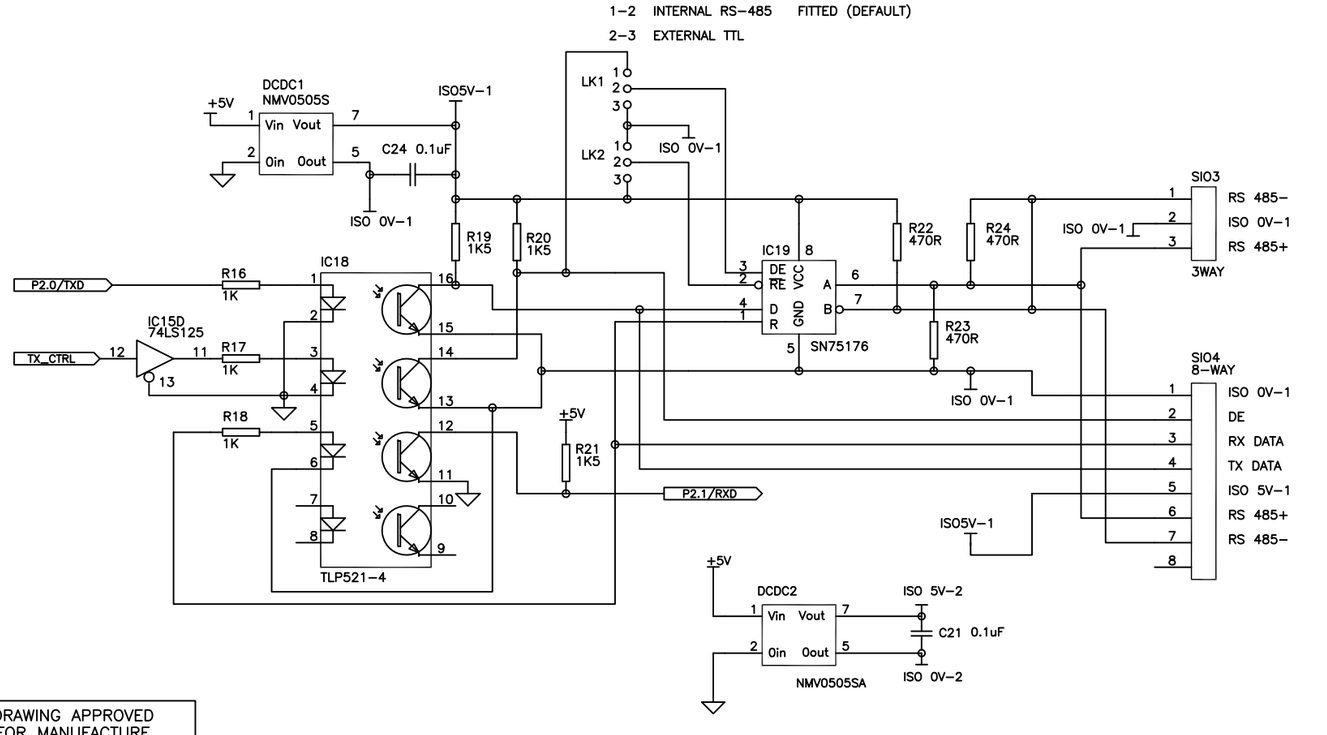
SHEET 2 OF 4

DRAWN	APPROVED	DATE
D. Waite	JMR	29/1/03

DWG.No. S03031 | Rev. 2 | Sht. 2







JUMPERS	
J1	
J2	
J3	FITTED
J4	
J5	FITTED
J6	
J7	FITTED
J8	
J9	FITTED
J10	FITTED
J11	
J12	FITTED
J13	FITTED
J14	FITTED
J15	FITTED

LINK 1	
1–2	FITTED
2–3	

LINK 2	
1–2	FITTED
2–3	

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ISS	DESCRIPTION	CHECKED	DATE	REF
2	LK1 & LK2 links, Jumper & Link table added		28/10/05	DCR883-DW
1	First Issue		29/1/03	N/A

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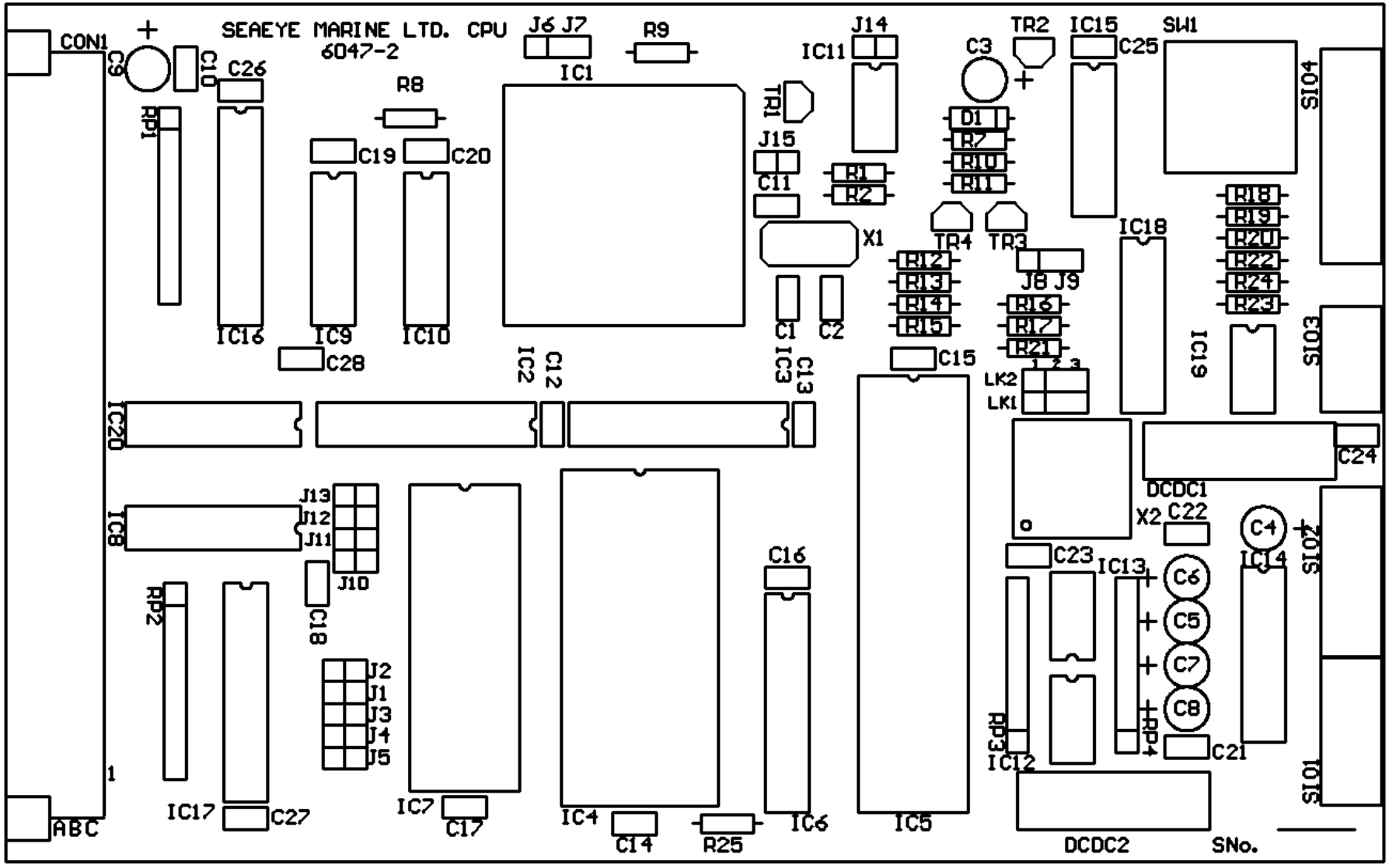
TITLE
6047P CPU PCB WITH DUART
BUS CONNECTOR AND COMMUNICATONS
CIRCUIT DIAGRAM

SHEET 3 OF 4

DRAWN	APPROVED	DATE
D. Waite	JMR	29/1/03

DWG.No. S03031 | Rev. 2 | Sht. 3



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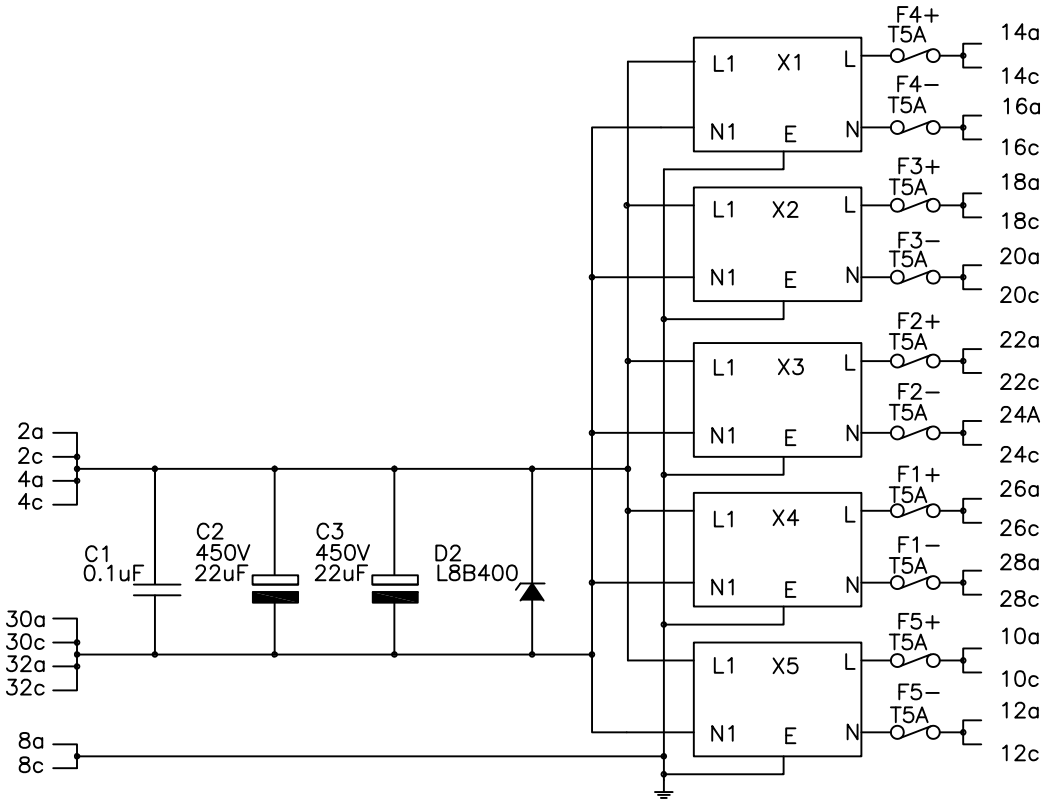
TITLE
6047P CPU PCB WITH DUART
COMPONENT LAYOUT

SHEET 4 OF 4

DRAWN	APPROVED	DATE
D. Waite	JMR	29/1/03

DWG.No. S03031 | Rev. 1 | Sht. 4



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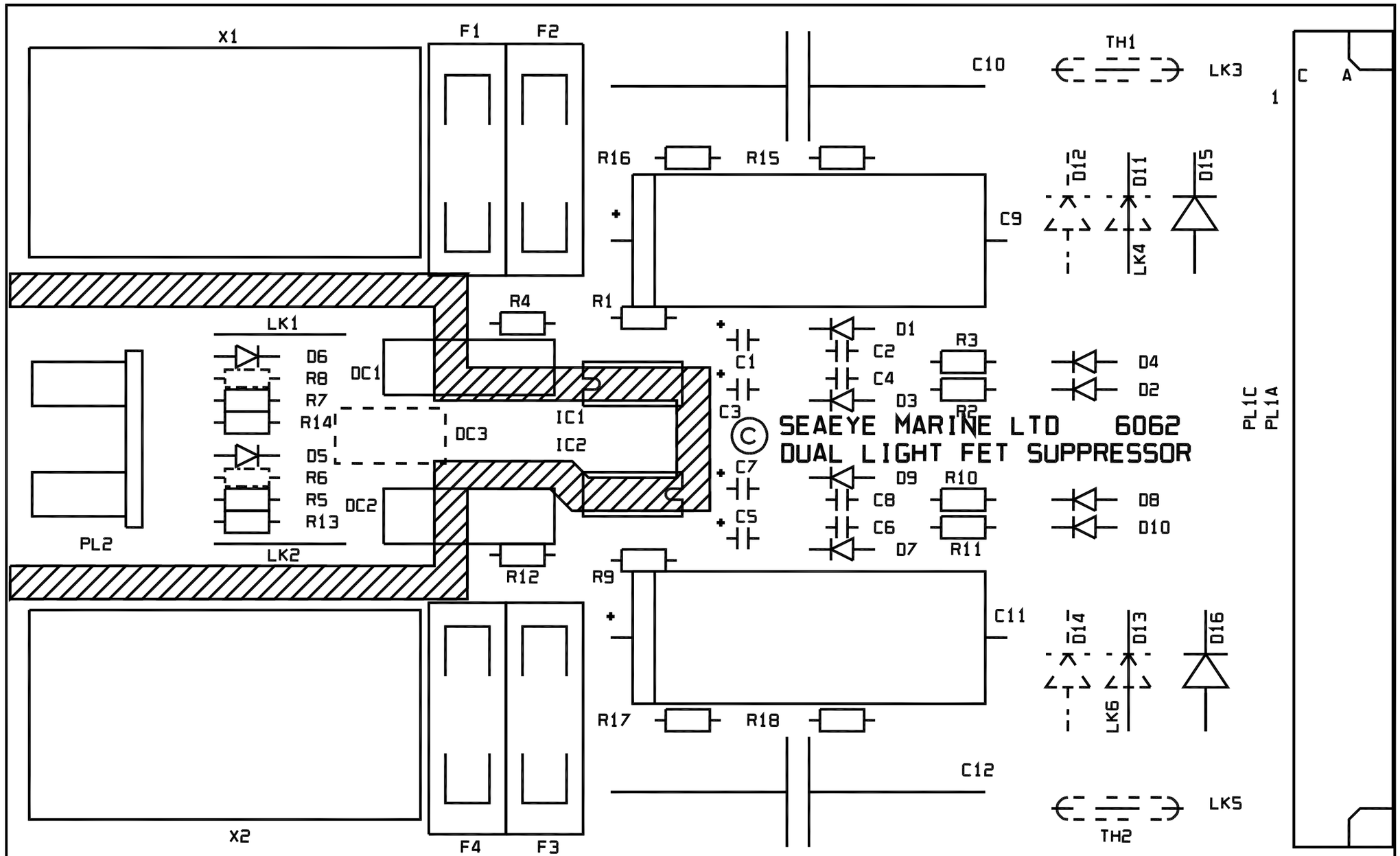
ISS	DESCRIPTION	APPD	DATE	REF
5	THRUSTER CARD TABLE REMOVED		6.MAR.00	DCR0425
4	6 THRUSTER DETAILS ADDED		21.JAN.98	ESS
3	MODIFIED TO INCLUDE 10 THRUSTER VARIANT		12.FEB.97	ESS/DCR0223
2	C2 & FUSE TYPES CHANGED C3 ADDED		13/06/95	

TITLE
6056P FUSE & FILTER PCB
CIRCUIT DIAGRAM

SHEET 1 OF 1

DRAWN	APPROVED	DATE
I.KING	JMR	13/06/95

DWG.No. S0007251



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2	REDRAWN		26/03/02	DCR0532/CGP

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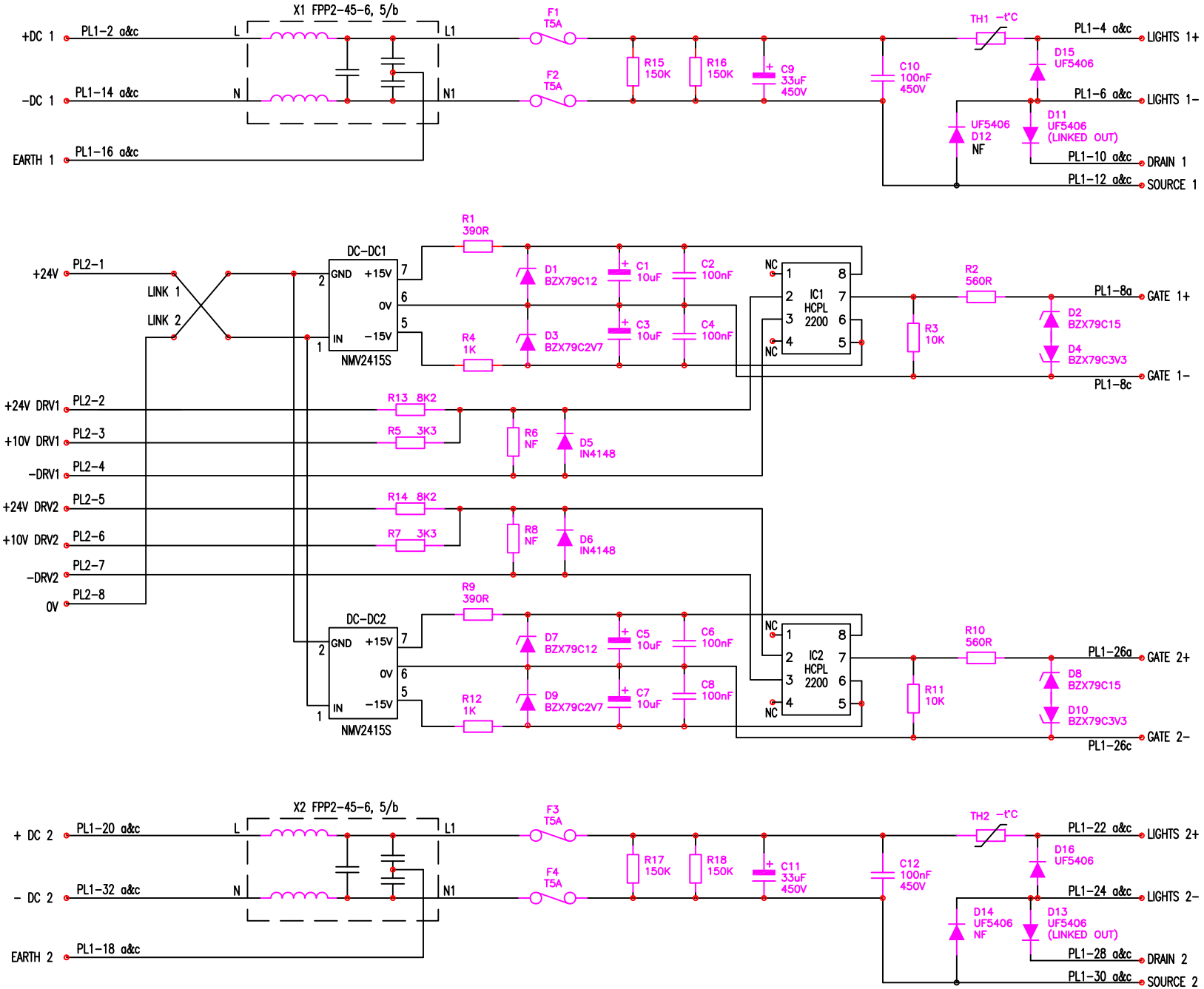
TITLE
6062P LIGHT FET SUPPRESSOR PCB
COMPONENT LAYOUT DIAGRAM

SHEET 1 OF 1

DRAWN	APPROVED	DATE
C.G.PETTIT	JMR	26/03/02

DWG.No. S01468 | Rev. 2 | Sht. 1



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ISS	DESCRIPTION	APPD	DATE	REF
1	FIRST ISSUE DERIVED FROM S0044321		27.AUG.99	

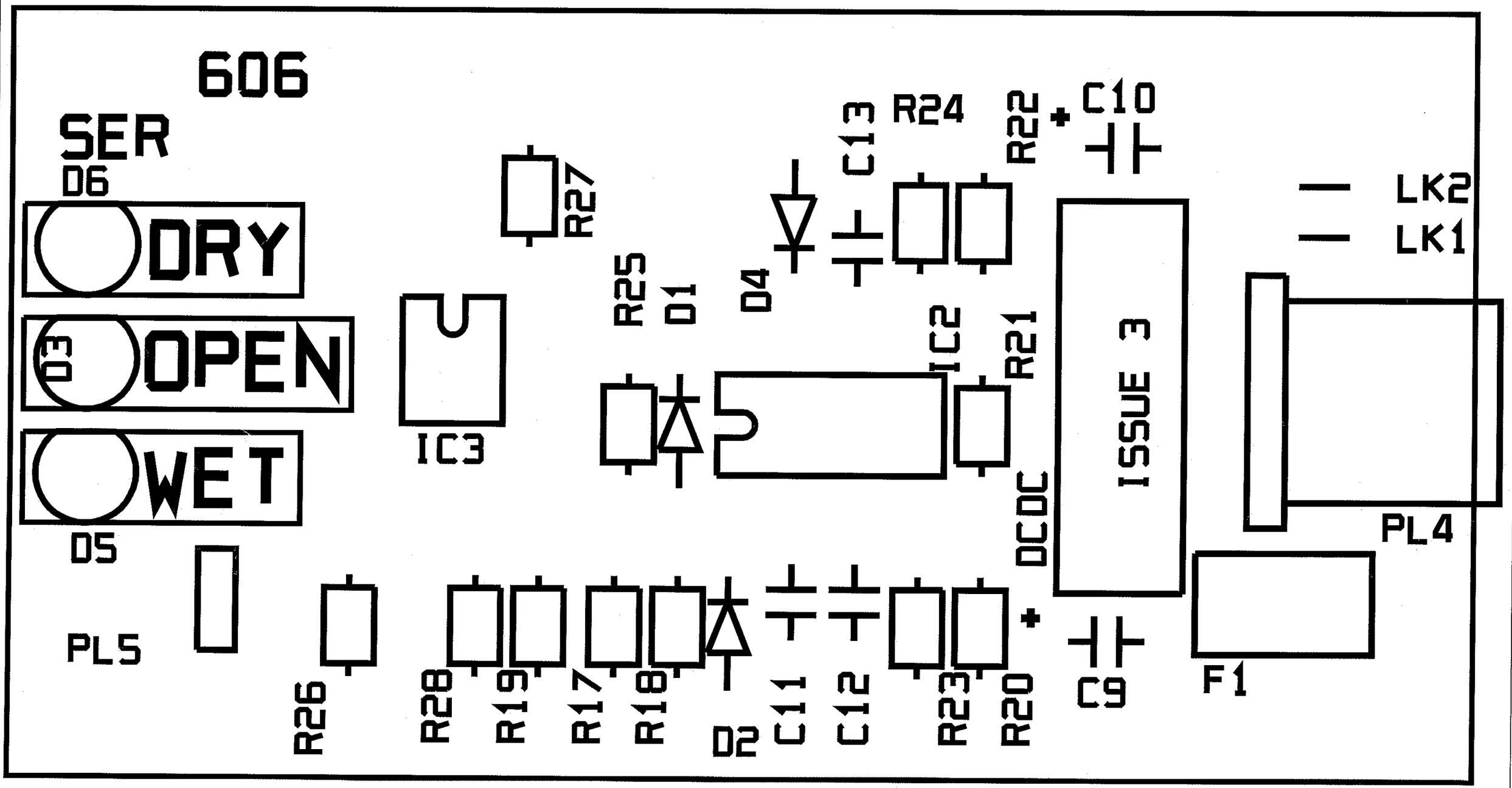
TITLE
6062P
DUAL LIGHT FET SUPPRESSOR PCB

SHEET 1 OF 1

DRAWN	APPROVED	DATE
JW	JMR	27.AUG.99

DWG.No. S0146611

DWG.No. S0146611



ISS	DESCRIPTION	APPD	DATE	REF
1	FIRST ISSUE		30/01/02	

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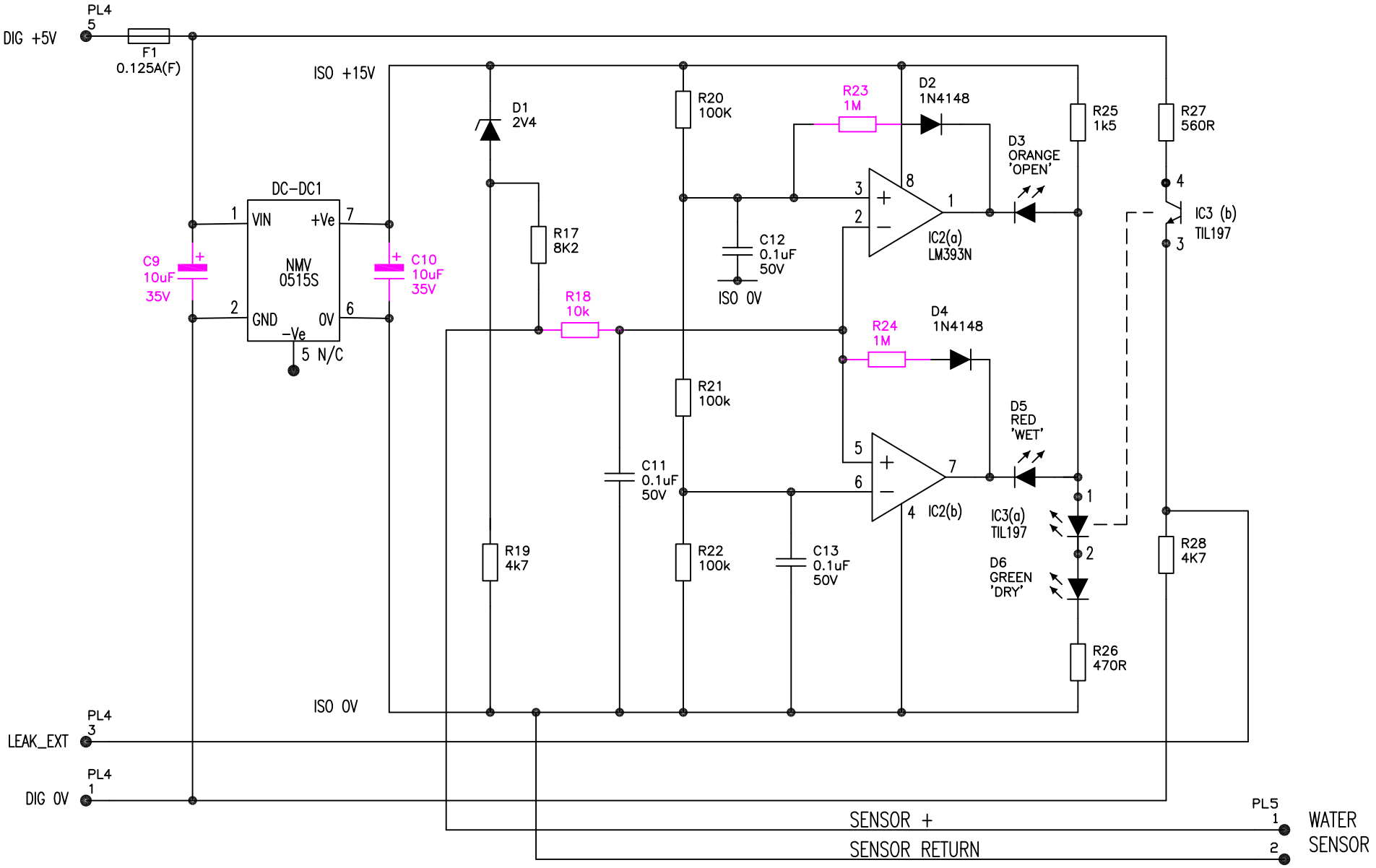
TITLE
6068P LEAK DETECTION PCB
(STAND ALONE)
COMPONENT LAYOUT

SHEET 1 OF 1

DRAWN	APPROVED	DATE
C.G.PETTIT		30/01/02

DWG.No. S02530 | Rev. 1 | Sht. 1



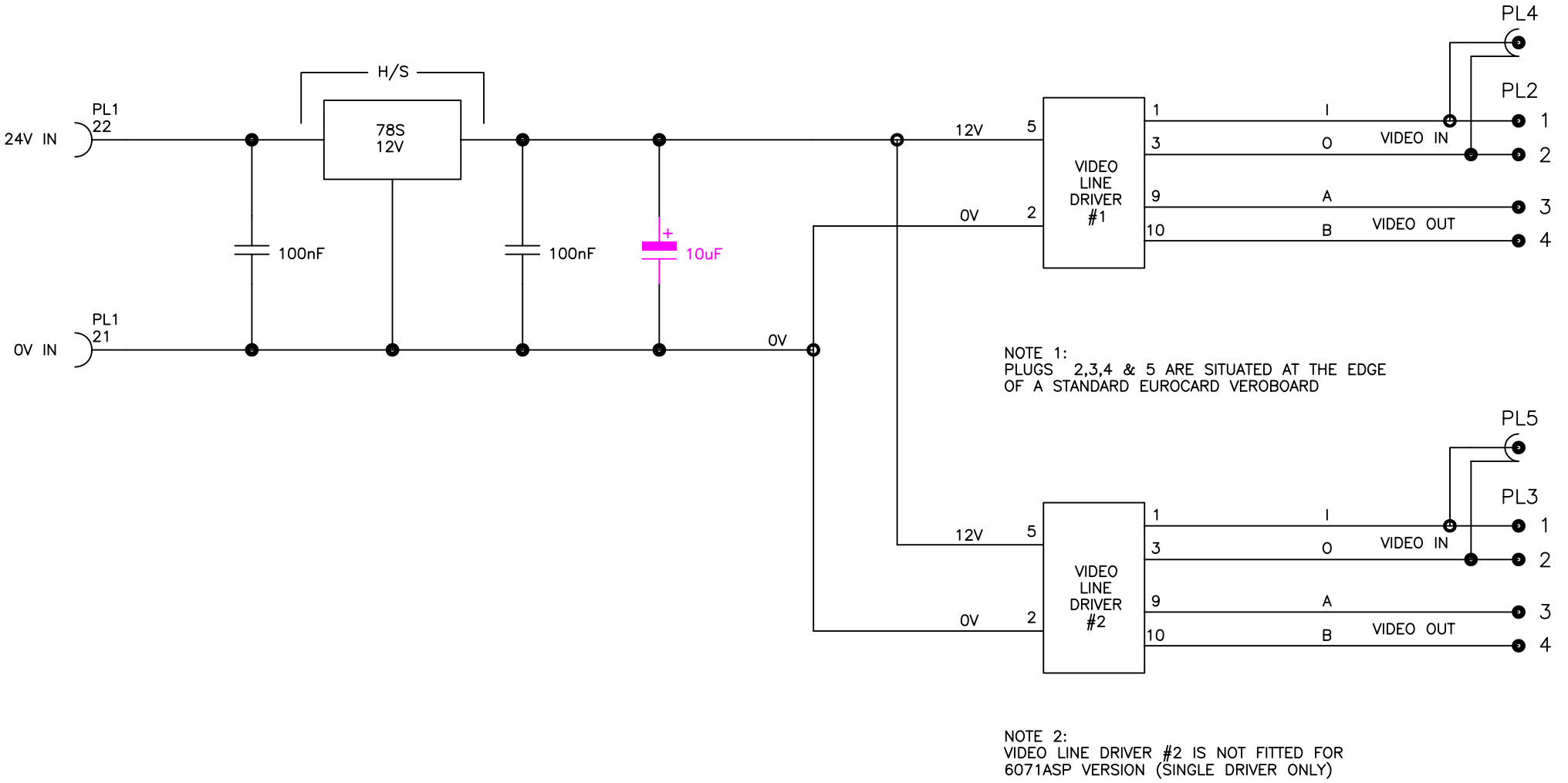
DWG.No. S0051531

ISS	DESCRIPTION	APPD	DATE	REF
3	COMPONENT CHANGES		22.SEP.98	DCR321/ESS
2	COMPONENT CHANGES/RAISE TO MKII		28.SEP.97	ECR226/ESS
1	FIRST DRAUGHT		8.AUG.97	

TITLE
6068P
LEAK DETECTOR PCB (STANDALONE)
SHEET 1 OF 1

DRAWN	APPROVED	DATE
ESS		8.AUG.97

DWG.No. S0051531



NOTE 1:
PLUGS 2,3,4 & 5 ARE SITUATED AT THE EDGE OF A STANDARD EUROCARD VEROBOARD

NOTE 2:
VIDEO LINE DRIVER #2 IS NOT FITTED FOR 6071ASP VERSION (SINGLE DRIVER ONLY)

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ISS	DESCRIPTION	APPD	DATE	REF.
3	NOTE FOR 6071ASP ADDED		19-04-01	ECR545-LAH
2	MINOR CORRECTIONS + PL4 & PL5		22-05-00	L.A.H.
1	FIRST ISSUE		28.OCT.97	

TITLE
DIGITAL SYSTEMS
6071A CIRCUIT DIAGRAM

SHEET 1 OF 1

DRAWN	APPROVED	DATE
ESS	JMR	28.OCT.97

DWG.No. S00616

DWG.No. S00616

CHAPTER 11

UMBILICAL, TETHER AND CABLE WHIPS

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11. UMBILICAL, TETHER AND CABLE WHIPS

11.1 Maintenance of Cables

11.1.1 Steel Armoured Umbilical Cables

Preventative maintenance improves the lifetime of steel armoured cables without an outer sheath. This applies to both storage and operation. Keeping the steel wires lubricated at all times could double the steel wire lifetime, compared to steel wires not lubricated at all.

Rust, water and oxidized compounds must be removed prior to lubrication. Depending on climate and utilization, cable lubrication is likely to be required several times a year. Salt water and tropical climate constitute the worst conditions for corrosion. It is also generally recommended to always clean/stray the cable with fresh water prior to storage.

Suitable lubricants include:

- Shell ROV cable grease.
- 'Tuff coat' grease.

11.1.2 Plastic Coated Umbilical Cables

Plastic materials commonly used in ROV cables should not be exposed to solvents for prolonged periods of time. However, the use of solvents for cleaning is frequently required, for example in conjunction with termination work.

Solvents that can be regarded as safe at the indicated temperatures are details as follows. Maximum exposure time is ½ hour at elevated temperatures, 1 hour at room temperatures. Other safety measures, such as breathing precautions and flammability must be adhered to when using solvents.

- Course removal: White Spirit (Best at maximum 40 °C).
- Finish: Isopropanole or Genklene or Triclorethane.

11.2 ADU3 Main Lift Cable

The TMS uses the Type ADU3 main lift cable that consists of a multi-cored cable and used to route the following between the LARS and the TMS:

- TMS and Vehicle DC power.
- TMS and Vehicle AC power.
- Video signals.
- TMS and Vehicle telemetry.
- Sonar data.
- Auxiliary power and telemetry signals.
- Earths.

The TMS system also uses the Type ADU3 deck cable that consists of a multi-cored cable and is used to route the power and telemetry from the Cabin Junction Box to the LARS.

The ADU3 consists of the following cores:

- One fibre optic element with four G50/125/250µm.

- Three Twisted Pair 0.56 mm² cables with copper braid and foil wrapping.
- Three Twisted Pair Quad 0.56 mm² cables with drain wire, foil screen and PE jacket.
- Six cores 0.56 mm² cable with PE insulation.
- Drain wire and foil screen.
- Sixteen cores 3 mm² cables with XLPE insulation.
- Sixteen drain wires.
- TPE jacket.
- Two layers of galvanised steel wires.

11.3 Tether Type 5601

The Tether Type 5601 is a multi-cored armoured cable filled with cable filling compound and used to route the following:

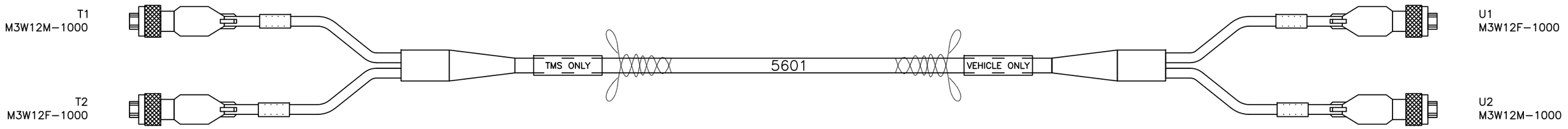
- Vehicle DC power.
- Vehicle AC power.
- Video Signals.
- Vehicle telemetry.
- Sonar data.
- Aux.
- Earths.

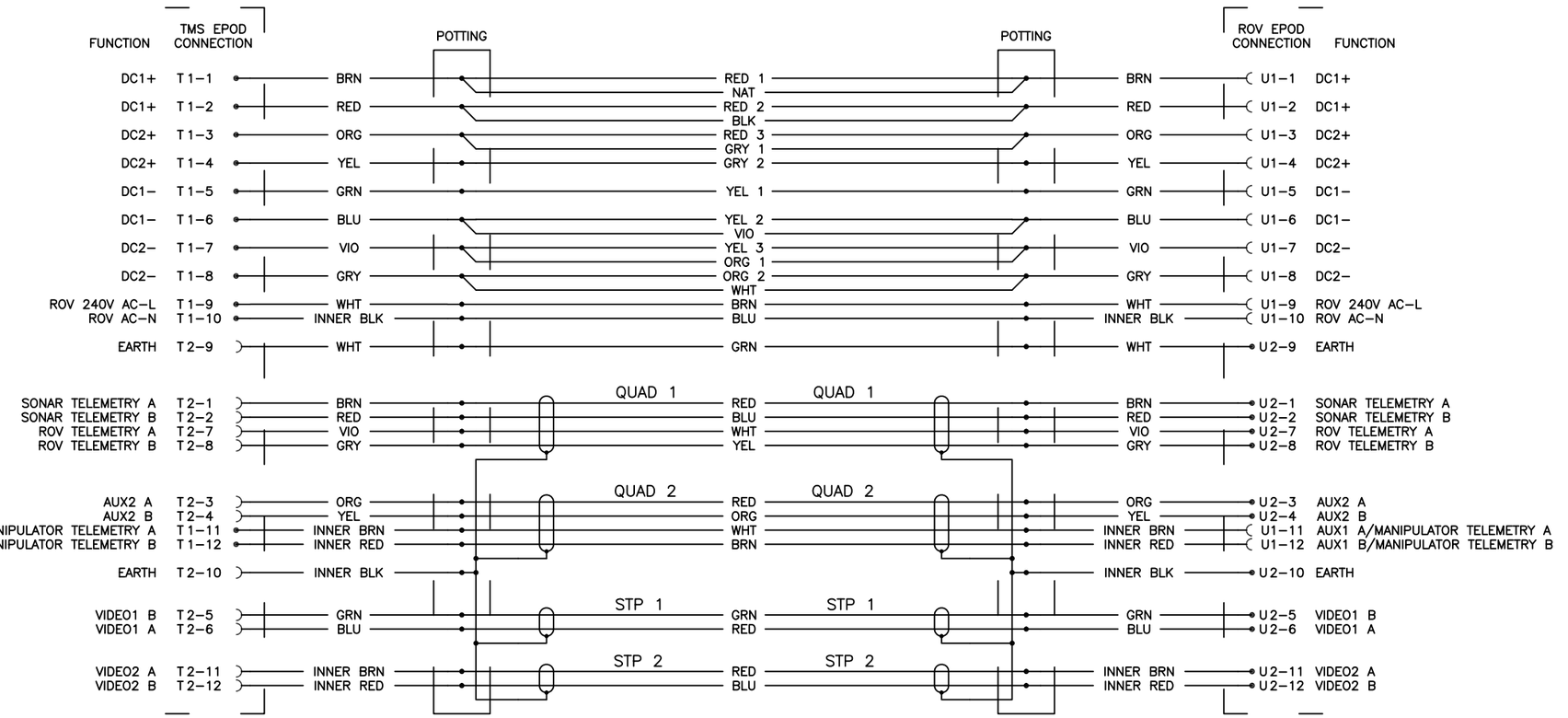
The umbilical is composed of the following cores

- Two Twisted pairs, 0.22 mm² with 0.20 mm² drains.
- Two quads, 0.22 mm² with 0.20 mm² drains.
- 17 conductors 0.62 mm², 500 volt service.
- Drain wire.
- Four cores 0.22 mm².
- High lubricity PU outer jacket.

11.4 Cable Whips and Connectors

Cable whips and connectors used on the TMS are shown in the circuit diagrams included at the end of this chapter.





NOTES

1. ALL UMBILICAL QUAD & STP SCREEN WIRES ARE TERMINATED IN T2–10 AND U2–10.

2. ALL WHIP DRAIN WIRES ARE CONNECTED TO THEIR RESPECTIVE METAL SHELLS AND TERMINATED IN T2–9 OR U2–9 AS APPROPRIATE.

3. CHECK O RINGS ARE CORRECTLY FITTED TO ALL WHIPS.

4. CONNECTORS TO BE IDENTED U1/T1, U2/T2, ETC.
THE TETHER IS TO BE LABELLED 'TMS ONLY' AT THE T1/T2 END AND 'VEHICLE ONLY' AT THE U1/U2 END

UNUSED CONDUCTORS

INTERSTICES RED
INTERSTICES WHT
INTERSTICES YEL
INTERSTICES ORG

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ISS	DESCRIPTION	CHECKED	DATE	REF
5	TAIL COLOURS CORRECTED	RAL	28/08/07	ECR1702–RAL
4	Pins rearranged for core consistency		06/09/06	ECR1163–LM
3	Revised notes & cable grip etc.redrawn		31/8/05	DCR877–DW
2	Title ammendment		23/4/03	DCR688–AP

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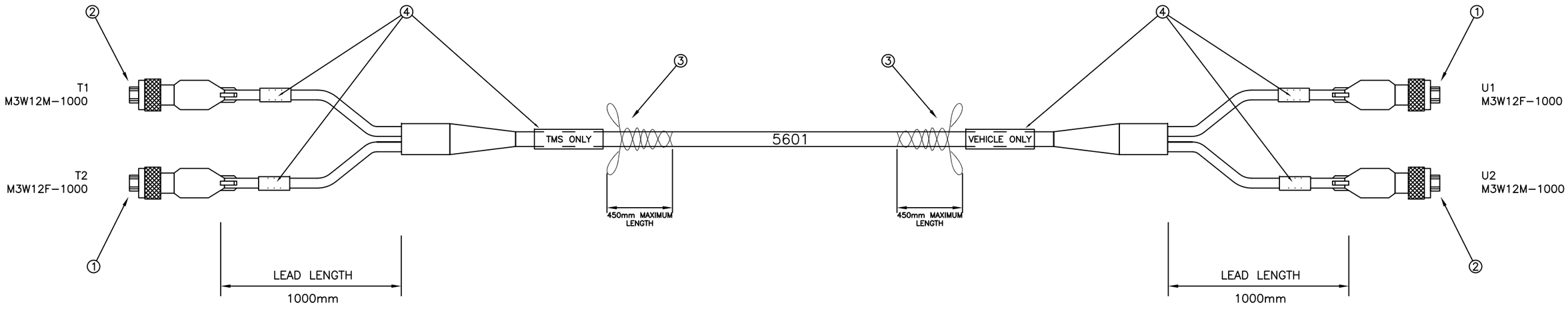
TITLE
TIGER METAL SHELL TETHER WITH DUAL TP USING 5601
WIRING DIAGRAM

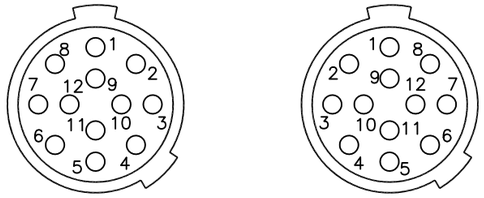
SHEET 1 OF 2

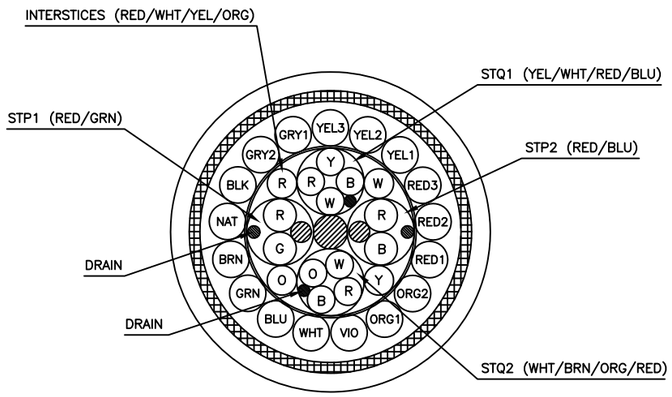
DRAWN	APPROVED	DATE
D. Waite	AW	15/2/02

DWG.No. S02576 Rev. 5 Sht. 1

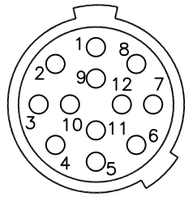
PART NO			
ITEM	QTY	DESCRIPTION	PART NO
1	2	WHIP, SIZE 3, 12 WAY, FEMALE 1000 mm	M3W12F-1000
2	2	WHIP, SIZE 3, 12 WAY, MALE 1000 mm	M3W12M-1000
3	2	CABLE GRIP	CG05
4	SET	WATER PROOF LABELS	SEE NOTES ON SHEET1

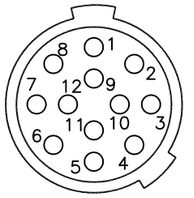






5601 CABLE





PIN	FUNCTION	PIN	FUNCTION
T1-1	DC+	T2-1	SONAR A
T1-2	DC+	T2-2	SONAR B
T1-3	DC+	T2-3	AUX2 A (CP REFERENCE)
T1-4	DC+	T2-4	AUX2 B
T1-5	DC-	T2-5	VIDEO1 B
T1-6	DC-	T2-6	VIDEO1 A
T1-7	DC-	T2-7	ROV TELEMETRY A
T1-8	DC-	T2-8	ROV TELEMETRY B
T1-9	ROV 240V AC-L	T2-9	EARTH
T1-10	ROV AC-N	T2-10	EARTH (SIGNAL)
T1-11	AUX1 A/MANIPULATOR TELEMETRY A	T2-11	VIDEO2 A
T1-12	AUX1 B/MANIPULATOR TELEMETRY B	T2-12	VIDEO2 B

PIN	FUNCTION	PIN	FUNCTION
U1-1	DC+	U2-1	SONAR A
U1-2	DC+	U2-2	SONAR B
U1-3	DC+	U2-3	AUX2 A (CP REFERENCE)
U1-4	DC+	U2-4	AUX2 B
U1-5	DC-	U2-5	VIDEO1 B
U1-6	DC-	U2-6	VIDEO1 A
U1-7	DC-	U2-7	ROV TELEMETRY A
U1-8	DC-	U2-8	ROV TELEMETRY B
U1-9	ROV 240V AC-L	U2-9	EARTH
U1-10	ROV AC-N	U2-10	EARTH (SIGNAL)
U1-11	AUX1 A/MANIPULATOR TELEMETRY A	U2-11	VIDEO2 A
U1-12	AUX1 B/MANIPULATOR TELEMETRY B	U2-12	VIDEO2 B

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4	Pins rearranged for core consistency		06/09/06	ECR1163-LM
3	Revised notes & cable grip etc.redrawn		31/8/05	DCR877-DW
2	Title ammendment		23/4/03	DCR688-AP

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TITLE
TIGER METAL SHELL TETHER WITH DUAL TP
USING 5601
PARTS & CABLE DETAILS

SHEET 2 OF 2

DRAWN	APPROVED	DATE
D. Waite	AW	15/2/02

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