

CABLE ENGINEERING TEST SPECIFICATION

MARS CTA (Cable termination assembly)

<u>Diffusion/Mises à jour (voir ci-joint)</u>			
<u>Edition</u>	1		
<u>Rédacteur</u> L P M	Date 4 L WEENS		
<u>Vérificateur</u> DTCSM	Date JL.LANG Ph. DUPIRE		
<u>Approbateur</u> Responsable Qualité	Date Y.DEMARET		

EDITION SUCCESSIVES

CONSTITUTION DU DOSSIER – MODIFICATIONS

ED.	DATE	MODIFICATIONS	MOTIF DES MISES A JOUR
Draft a	23 /05/ 04	Creation	
Draft b	22 /08/ 04	First revision	integration of revise ODI test boxes
Issue 1	25/10/04	First controlled issuing	Integration of last CTA ETS inputs

S O M M A I R E

- **System Description P. 4**
 - 1) MARS PROJECT GENERAL DESCRIPTION.
 - 2) MARS CTA ALCATEL CONTRACT
 - 3) CTA GENERAL DESCRIPTION..... P. 5
 - 4) ODI WET MAT SUBASSEMBLIES PARTS (Optical and electrical)
 - 5) CTA SEA CASE ASSEMBLING PART (Greenwich)..... P .6
 - 6) CABLE TAILS (Calais)
 - 7) CTA CABLE COUPLING AND REMOTE SEA EARTH (Calais).....P .7
 - 8) SUBMARINE CABLE JOINT TO THE OALC4 LINE CABLEP . 7
- **Fibre colour mapping and wires identification ...P. 8**
- **Optical and Electrical specification & testP. 8**
- **FAT & CTA transportation (on frame).....P .10**

Attachments

- ODI wet mate assembly part diagram
- ODI optical test box drawing
- ODI electrical test box drawing
- OALC7 SAH cable technical spec
-

The MARS housed cable termination Assembly (CTA) is based upon qualified repeater, branching units , cable termination with remote sea earth and submarine cable product.

The purpose of this Engineering test specification cable is to define the performance test limits of the Assembled MARS CTA after cable termination assembling in our ASN Calais site.

This document complete the MARS CTA engineering test specification 29DDE00800AA of Greenwich defining the test specification of the assembled CTA sea case to the ODI wet mat units.

Note : The OALC7 SAH cable tails were manufactured in Calais following our internal ASN specification « Spécification Liaison » (in French).

The Factory acceptance processes are defined in the Factory CTA ACCEPTANCE AND RELEASE PROCEDURE (CARP).

Referenced documents

- 29C QD00 800 AAA : MARS ODI Optical wet mate harness specification
- 29C QD00 800 BAA : MARS ODI Electrical wet mate harness specification
- 29D DE00 800 AAA : MARS ETS (Engineering Technical Specification)

- CARP 141-1 : MARS CTA Acceptance and Release Procedure
- SPL 141-1 : MARS CTA OALC7 SAH Cable Tails specification
- H360 G1 –1 remote sea earth termination assembling procedure list

- 8CM 00002 0100 PS GE : ASN Cable Type identification
- 8CM01 0420 200 PSGE-A ASN cable product spec
- B009D6G Corning Single Mode Fibre for Submarine Cables Ref. LEA Type NZDSF
- B009D7C Corning Single Mode Fibre for Submarine Cables Ref. RS Type NZDSF
- B009D5D Corning Single Mode Fibre for Submarine Cables Ref. LS Type NZDSF
- B009B2A Sumitomo Single Mode Fibre for Submarine Cables Ref. PSC Type NDSF

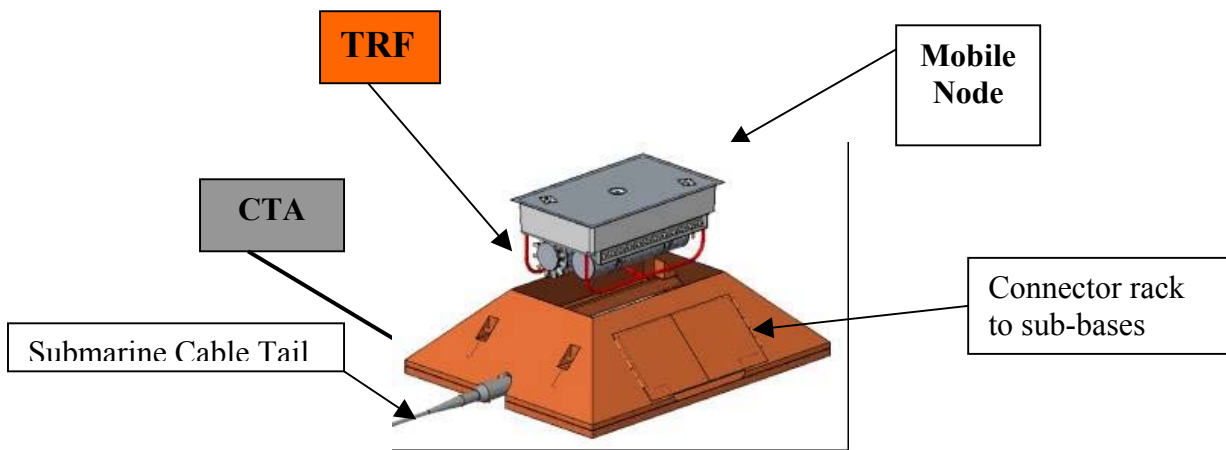
System Description

1) MARS PROJECT GENERAL DESCRIPTION

The MARS Project concern the installation at about 1000 m depth of a submarine Base in Monterey Bay. This Base will be an Optical and electrical interconnection system able to link different sub-bases equipped with different submerged Scientific test equipment directly to the terrestrial station through a submarine cable of about 50/60 km. From this land station through Internet the different research labs implied in the MARS project would be able to collect continuous information of their submerged test sets.

The Base is composed of 2 parts:

- A mobile node handled by ROV integrating the different interconnections with the sub-bases through optical and electrical wet mate connections
- A fix base (TRF) equipped with a connectors racks on which the node will connect the sub bases. The rack is directly connected by 2 Optical & electrical wet mat harness to the CTA fixed on the TRF and jointed to the submarine cable .



Mars project Customer : MBARI (Monterey Bay Aquarium Research Institut)

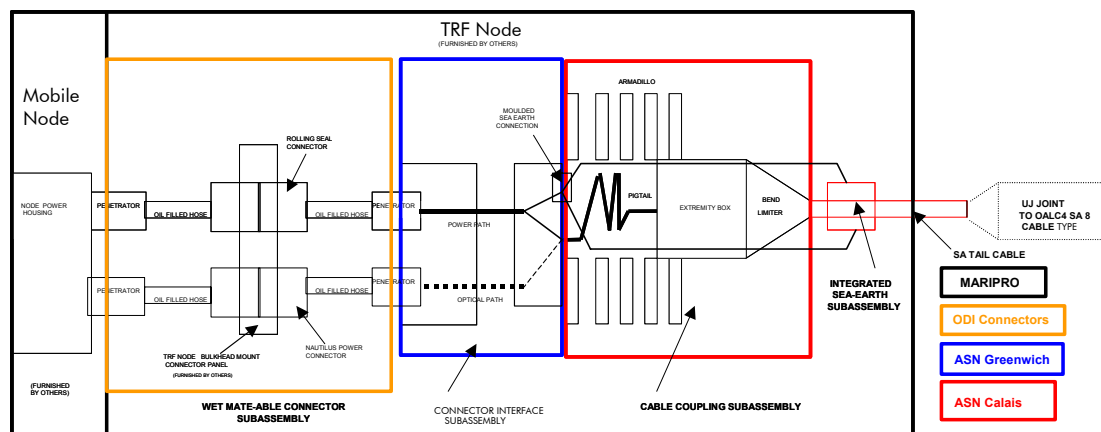
ASN Project Team : Project manager : Lionel Weens
Technical managers : I Watson- F Tortey
Product manager : G Waterworth

2) MARS CTA ALCATEL CONTRACT

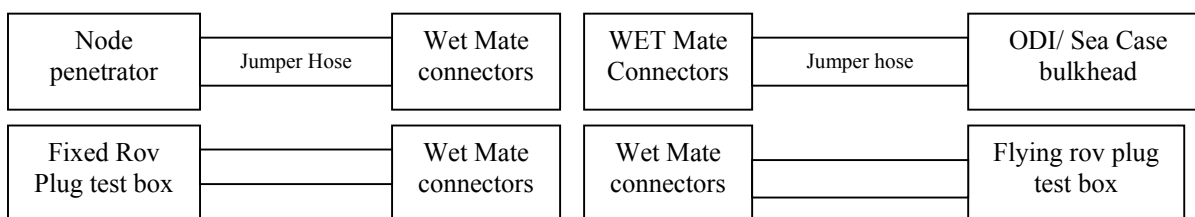
The contract concern the **SUPPLY of 2 CTAs (1 line + 1 Spare) as following :**

- Supply by ODI of 2 electrical and 2 optical wet mate subassemblies (link the node to the CTA sea case) with intermediates connectors (for the TRF connector Rack).
- Supply by ODI of 2 electrical and 2 optical "Test boxes" mountain on connectors for test.
- ODI wet mate parts and test boxes Factory acceptance with MBARI.(mid sept 04)
- Supply by Greenwich of an adapted sea case interface between the ODI wet mat subassemblies and the submarine cable termination.
- Assembling of the ODI wet mat subassemblies (test box on connectors to CTA sea cases)
- Supply of 2 cable tails (2X 80m) and 2 BU couplers with a remote sea earth
- Assembling/coupling and testing of the cable tails to the CTA sea cases.
- Assembled CTA (test boxes to cable tails) Factory acceptance by MBARI (mid Nov 04).
- Supply of an adapted frame (for 2CTAs) and transport to California.

3) CTA GENERAL DESCRIPTION



- 4) ODI WET MAT SUBASSEMBLIES PARTS (Optical and electrical)



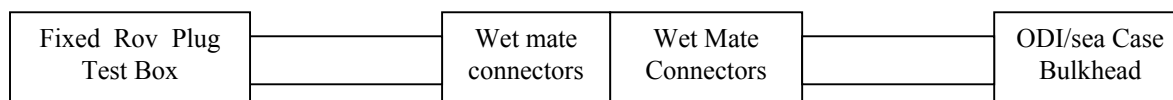
ODI supply :

- 2 optical wet mate sub-assembled (node to Sea case)
- 2 electrical wet mate sub-assembled (node to Sea case)
- 2 optical wet mate fixed rov plug test boxes on connector
- 2 electrical wet mate fixed rov plug test boxes on connector
- 2 optical wet mate Flying rov plug test boxes on connector
- 2 electrical wet mate flying rov plug test boxes on connector

Note 1 : All the optical and electrical paths (mixing line and spare wet mate assembled parts and test boxes through the wet mate connectors) will be tested in ODI.

Note 2 : the wet mate subassemblies parts will be splitted in 2 separates deliveries:

- 1) The wet parts from The ROV penetrator to the Connector connected to the flying ROV test boxes will be delivered directly to MARIPRO to be assembled to the mobile Node .
- 2) The wet parts from The ODI /sea case bulkhead penetrator to the Connector connected to the fixed ROV test boxes will be delivered to Greenwich to be assembled to the CTA sea case as following:



The optical fixed ROV Plug test boxes will be fitted with 8 fibres looped 2 by 2 in the Hermetic optical test box mountain on the optical wet mate connector.
The electrical fixed ROV Plug test boxes will be fitted with 2 insulated wire pigtail coiled inside the test box jointed to the electrical wet mate connector.

- 5) CTA SEA CASE ASSEMBLING PART (Greenwich)

Refer to the ETS for MARS CTA ref 29D DE008 00 AAA

The CTA's that leave the Greenwich repeater factory prior termination are coded 29E CT00 800 AAA and Will be engraved MARS/CTA 001 and MARS/CTA/002

Sea case Cable termination:

- The 8 PSC fibres, which complied with the standard colour scheme of the composite gland, will be accessible through the sea case pigtail.
- The 2 electrical connections will be accessible through the sea earth gland and the sea case pigtail.

Sea case Wet mate termination:

- A test box on the optical connector with the 8 fibres looped 2 by 2 inside the hermetic box will terminate The ODI optical extremities.
- A test boxes with 2 insulated wire tails coiled inside the test box and accessible for test will terminate the ODI electrical extremities.



6) **CABLE TAILS (Calais)**

For the purpose of this MARS project to comply with the selected remote sea earth design qualification, it was necessary to use an OALC7 SAH cable tail as defined .

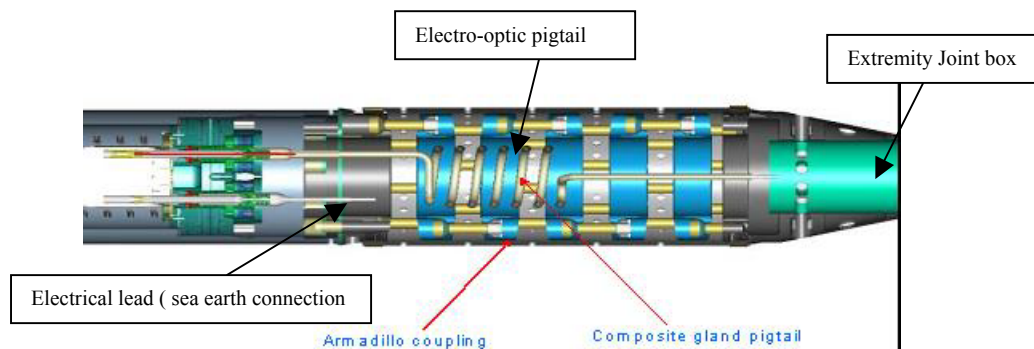
- The OALC7 cable available for the MARS project was a cable length of 5 km produced for some cable/fibres qualification tests containing the max acceptable fibre count of 16 fibres and with the 3 different fibre types commonly used in our cable systems ; 4 LEA fibres, 4 LS-RS fibres, 4 LS fibres and completed by 4 filler fibres.
- 300 meters of this cable section was cut and armoured in SAH to provide 3 cable tails of 80 meters (2 for Mars + 1 spare)
- Based on the cable test results, 8 fibres (on the 12 measurable fibres) were selected to be used for the MARS project, the target was to use the best fibre type already used in our cable and compatible for splicing to the LS submarine cable fibre and to the PSC fibres of the CTA sea case (identical to the existing BU or repeater coupling/splicing processes).
- Following the final cable testing of the 300meters cable length, A MARS project CTA Tail CARs (Cable acceptance report) was issued which include all optical and electrical test results.

7) CTA CABLE COUPLING AND REMOTE SEA EARTH (Calais)

For the purpose of this MARS project the connection with the submarine cable will be performed using Alcatel existing BU cable termination coupling and the remote sea earth system.

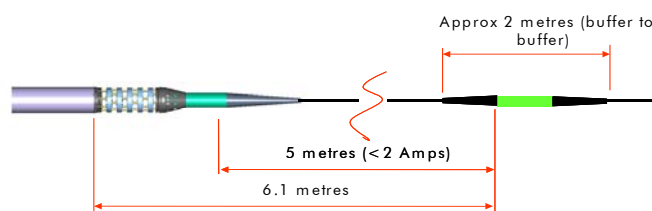
CTA sea case coupler :

- the fibres connection between the CTA sea case and the cable tail will be performed by fibre splicing in the extremity joint box of the coupler
- this extremity box will be over moulded to insure the electrical insulation of the box and of the internal electrical conductor and HV tested
- the direct electrical power supplied to the base from the land station will be connected to the CTA sea case through the electrical conductor of the pigtail with a return current conductor through the remote sea earth.



Remote Sea earth (electrical return current):

- the electrode similar to the one used for the BU will be installed at about 5 metres from the CTA coupler and will be connected to the sea earth gland of the CTA.



8) SUBMARINE CABLE JOINT TO THE OALC4 LINE CABLE (installation) :

- A cable joint will be performed on board the ship prior installation of the Base to insure all the optical, electrical and mechanical continuity of the CTA fixed on the TRF base and the submarine OALC4 line cable.
- This joint will be performed between the 80 m of the CTA OALC7 cable tail and the OALC4 cable extremity using the UJ (universal jointing) technology.
- The 8 selected fibres of the cable tail will be spliced with the 8 LS fibres of the line cable.(splices are fullycompatible)
- The cable joint box and its insulated sheath will insure the mechanical and electrical continuity between the tail cable and the line cable .

Fibre colour mapping and wires identification

Fibre identification (ODI connector code ref versus cable fibre colour code) :

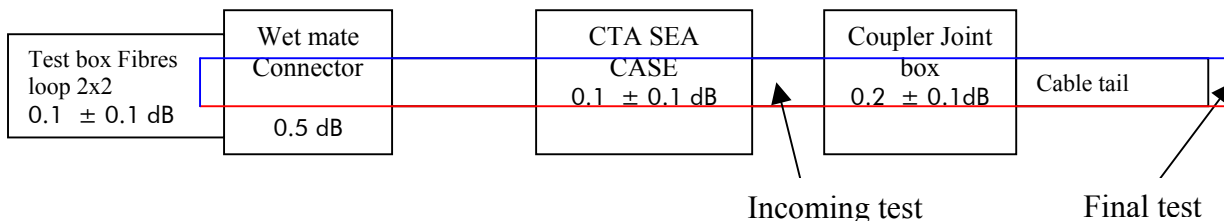
ROV test Box & connector	Sea case ODI Bulkhead	Sea case Cable Bulkhead	OALC7 cable tail	OALC4 line cable
SMF 28	SMF 28	PSCF	RS/LEA/LS	LS (S9 Portland)
Code ref	Code ref	Fibre colour	Fibre colour	Fibre colour
1	1	Black	Black (LEA)	Black
2	2	Yellow	Yellow (LEA)	Yellow
3	3	Red	Red (RS)	Red
4	4	Brown	Red 1 ring (RS)	Brown
5	5	Blue	Blue 1 ring (RS)	Blue
6	6	Orange	Orange 1 ring (RS)	Orange
7	7	Green	Turquoise LS	Green
8	8	Pink	Pink (LS)	Pink

Electrical wire identification :

	Connection description	Test connector or node penetrator	ODI Bulkhead penetrator	CTA Bulkhead penetrators	OALC7 cable tail	OALC4 line cable
Wire ref					Coupler joint	Cable Joint box
1	10 KV (DC) Live feed	Red or (white +red marking)	red	White +Red marking	inner conductor	inner conductor
2	System ground	White	White	White	Sea earth electrode	Sea return earth

Optical and electrical specification & test

1) OPTICAL SPECIFICATION AND TEST



Fibre optics are suitable for use across the ITU 692 c band covering the transmission window of 1534-1568 nm as well as 1510 nm. Wavelength adopted for all optical tests is to be 1550nm. End to End (node penetrator to cable tail extremity) , total insertion loss is to be less than or equal to 1dB at 1550 nm including :

- 0.5 dB /fibre path for the wet mate connectors (matched), or 0.75dB for unmatched ones
- (0.1 ± 0.1) dB /fibre path dB for the penetrator
- (0.2 ± 0.1) dB/fibre path for the Coupler splice (LS/RS/LEA to PSC fibre)

Optical test will be done through the test box , fibre looped by pair in the test box as following

Pair	Test box Fibres	CTA Bulkhead colour	Cable colours
Pair 1	fibre 1+ fibre 2	black & yellow	black & yellow
Pair 2	fibre 3+ fibre 4	Red- & Brown	Red- & Red 1 ring
Pair 3	fibre 5+ fibre 6	blue & Orange	blue 1 ring & Orange
Pair 4	fibre 7+ fibre 8	green & pink	Turquoise & pink

Incoming test (on both CTA+ loop back test boxes):

to check the fibre loss of each fibre pair (shall be as defined in the ETS)

≤ **1.4 dB for matched connector and loop back box**

or ≤ **1.9 dB for unmatched connector and loop back box**

note 1 : measured value must be equivalent to Greenwich FAT measurement ± 0.2 dB

final test (on both CTA+cable termination + connection to test boxes):

to check the fibre loss of each fibre pair(shall be as defined in the ETS +2 EB splices)

≤ **1.8 dB for matched connector and loop back box**

or ≤ **2.3 dB for unmatched connector and loop back box**

note 2: measured value must be equivalent to the Calais incoming test value + (0.4 ± 0.2) dB

2) ELECTRICAL SPECIFICATION AND TEST

The nominal line current for the CTA is 1A.

the maximum current is 2 Amp. No minimum current is defined.

The electrical resistance of the live feed conductor and of the earth return conductor will be measured at the CTA incoming test between the test box and the glands of the CTA sea case cable extremity , after cable coupling equivalent test will be performed between the test box and the central member of the cable for wire 1 and the electrode connection for wire 2.

Continuity of the conductors shall be :

≤ 1.8 Ohms for the live conductor path

≤ 2.2 Ohms for the system ground path

The CTA shall operate at 10 000 volts DC .

- In Greenwich, connector interface and housing of both ODI and CTA sea case bulkhead assemblies shall be tested at 13 000 Volts DC for 30 minutes in each polarity. The leakage current will be monitored throughout the test and recorded every 5s, the measured leakage current must be less than or equal to $1.15 \mu A$.
- In Calais, an HV test of 45 000 volts during 5 minutes shall be performed to check the integrity of the extremity box moulding.

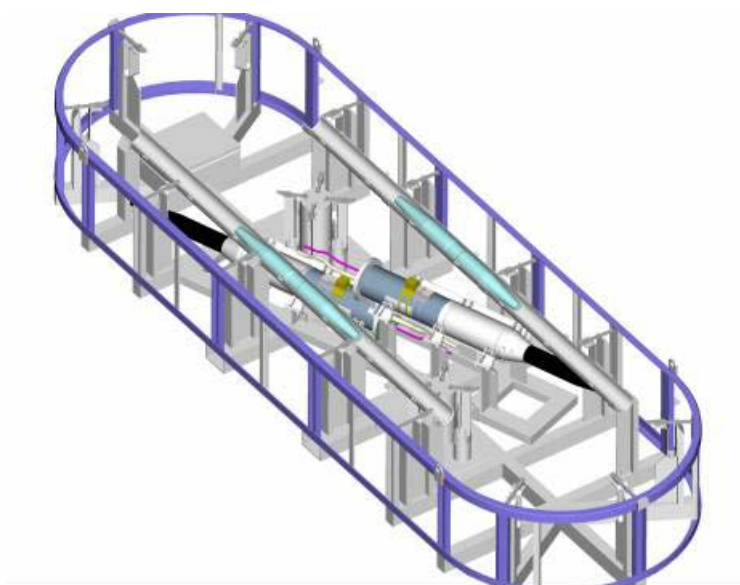
FAT & CTA transportation (on frame)

Requirement	Value
Number of CTA's to be housed	2
CTA shock isolation level	< 40g 6ms ½ sine during normal handling
Min cable bend radius OAL C7-SAH	0.9m (no twist)/1.5m (1 turn per loop if coiled)
Frame to be existing BU handling frame	29T JG00 301 ABL
Cable tail length to be housed	80m OAL C7 –SAH per CTA
Number of sea earth electrodes to be housed	2
Max hose length to be housed	2 x 14m per CTA
Min hose bend radius	75mm for optical penetrator/connector and 125mm for HV penetrator/connector
Wet mate connectors to be housed mated	No. Node module half of connector harnesses may be de mated and transported separately.

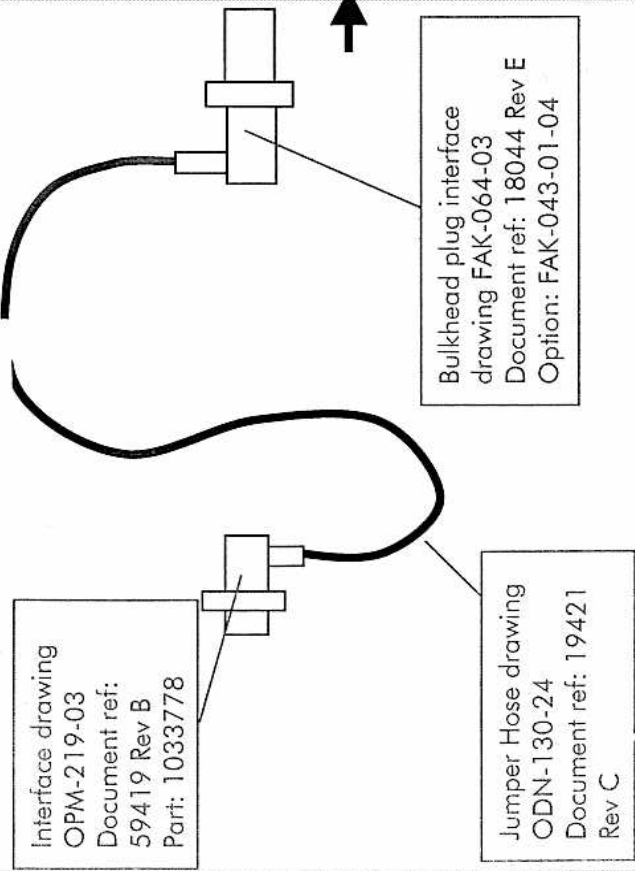
On the 2 Final CTAs assembly (1 line + 1spare) including the last operation of assembling coupler and remote sea earth, the Customer will perform FAT as defined in the CARP :

- Optical test (cut off attenuation measurement) will be performed on the 8 bare fibres of the OALC7 SAH cable following our ASN test procedure (2 by 2).
- Ohm resistance of the electrical conductors will be measured between the test box and the cable extremity and electrode following our ASN test procedure.
- HV insulation test at 45 KV DC will be performed during coupling process on the moulded extremity box following our ASN test procedure.

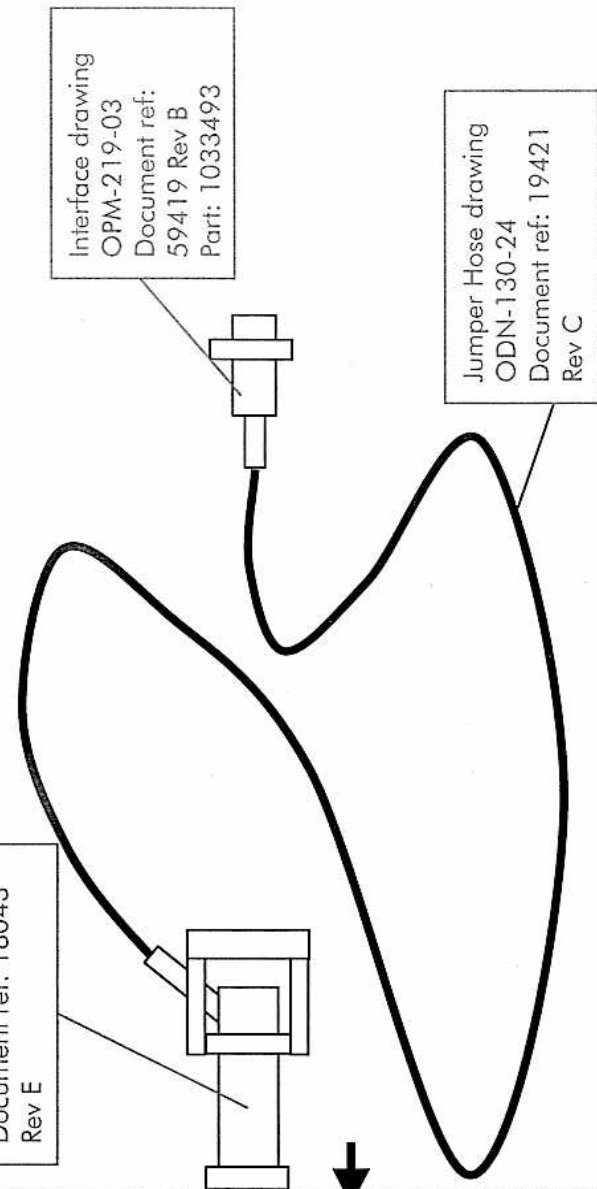
On completion of the 2 CTAs acceptance, each cable extremity /fibres will be protected inside a transportation box and the 2 CTAs with the ODI connectors and the cable tail and electrode will be stored inside the adapted frame as following:



Fixed bulkhead plug harness
OPM-195-01 (Doc ref: 59006 Rev P0) Part
No: 1033240

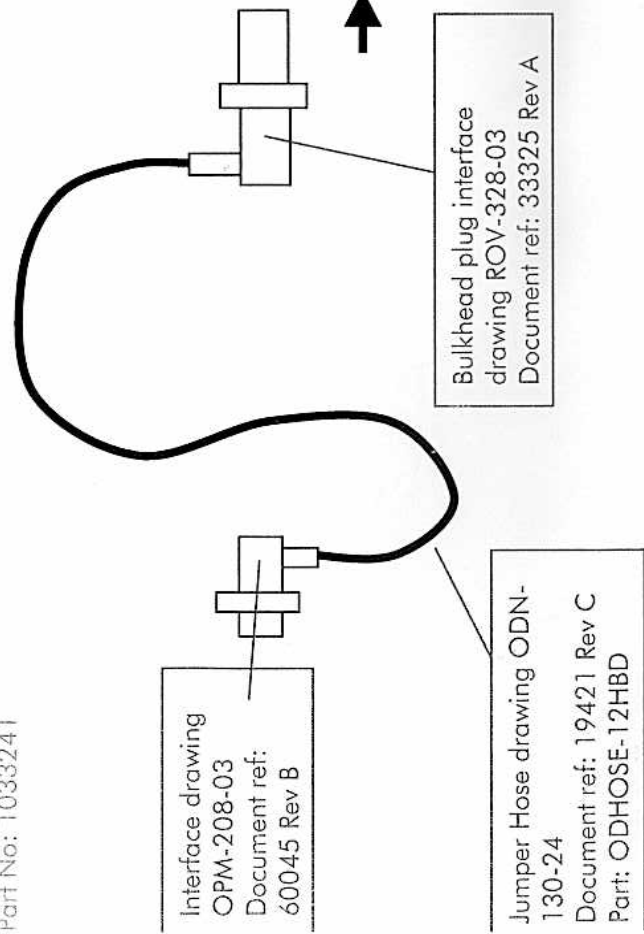


Receptacle interface
drawing FAK-049-03
Document ref: 18043
Rev E

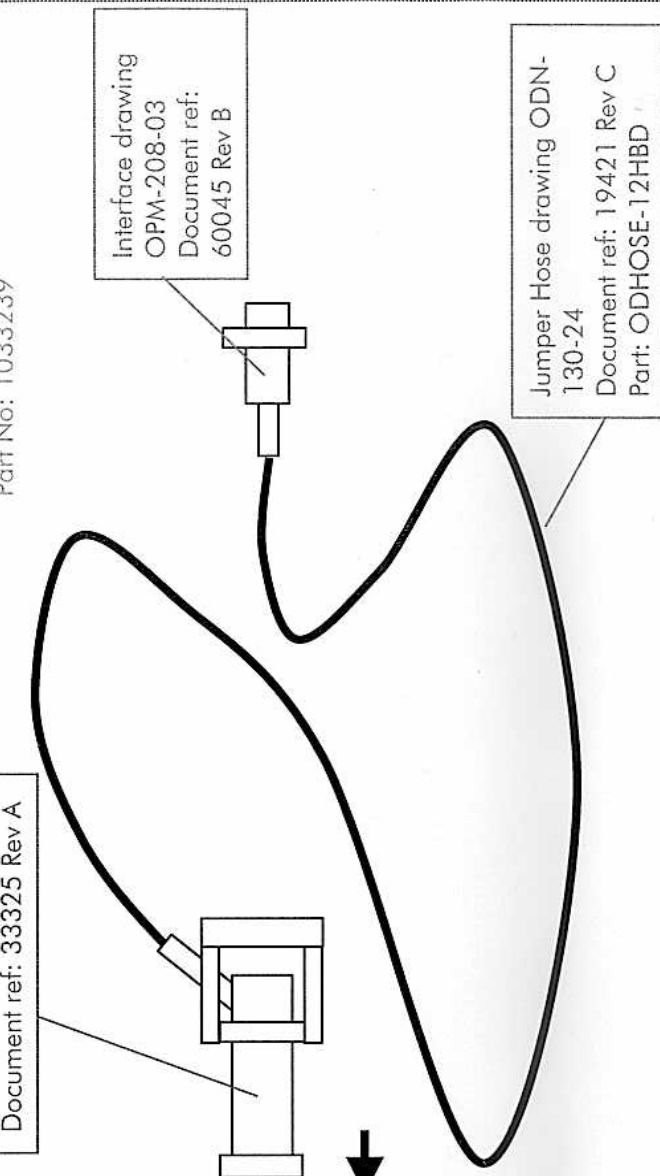


Flying ROV receptacle harness
OPM-193-01 (Doc ref: 58801 Rev P0)
Part No: 1033238

HV fixed bulkhead plug harness
OPM-196-01 (Doc ref: 59007 Rev P0)
Part No: 1033241



Receptacle interface
drawing ROV-328-03
Document ref: 33325 Rev A

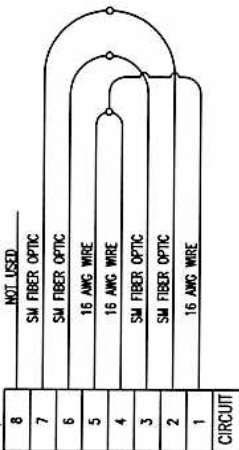


Flying HV ROV receptacle harness
OPM-194-01 (Doc ref: 59002 Rev P0)
Part No: 1033239

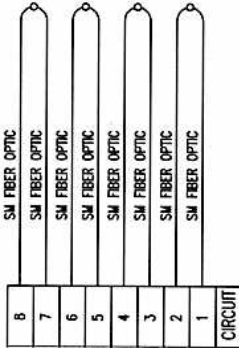
NOTES:

- DO NOT SCALE FROM DRAWING.
- FOR CONNECTOR OUTLINE INTERFACE DIMENSIONS, SEE DRAWING 18044 (PAK-064-03).
- ENGRAVE THE FOLLOWING APPROX WHERE SHOWN PER 10632 (SOP-015-39):

-1 PART
 OOI S/N _____
 KOP P/N 15-000686-74
 OCEAN DESIGN INC.
 S/N _____



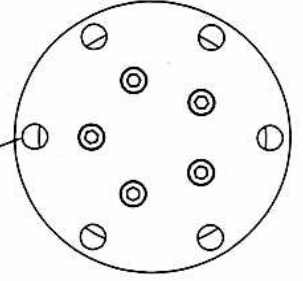
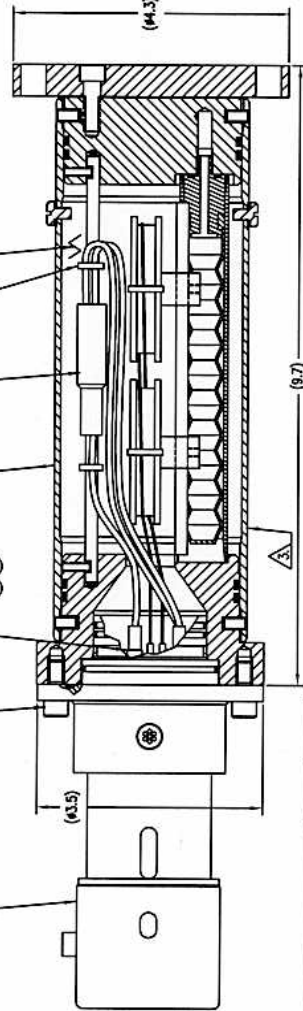
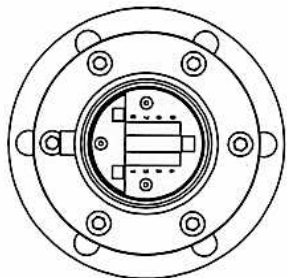
10065669 (-1) CIRCUIT CONFIGURATION



1029909 (-2) CIRCUIT CONFIGURATION

REVISION	DESCRIPTION	DATE	APPROVED
A	INITIAL ISSUE	11/19/99	DRH
B	ECO B8204, REVERSE MOUNTING HOLE DIA.	12/8/99	TOHH
C	ECO M1056 CHNG ITEM 3 FROM 3/4 TO 5/8	11/20/00	DRH
D	CO4404	6-19-01	HEP
E	C05382 ADD -2 PART	5/19/03	DRH

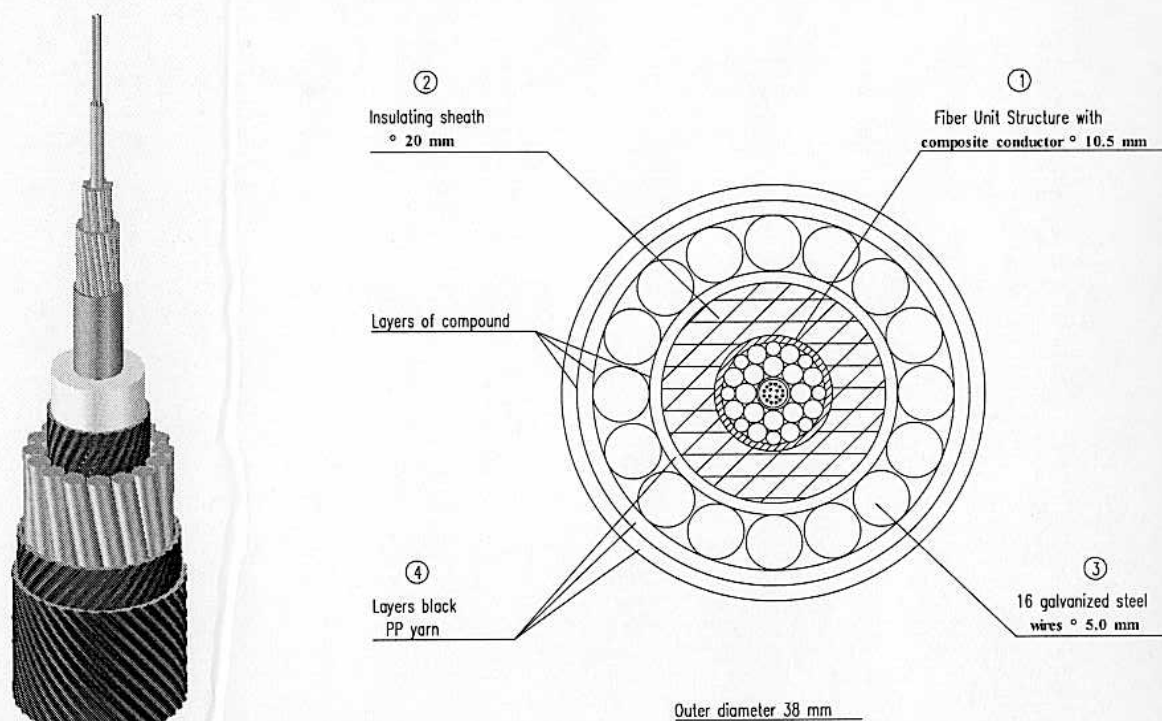
6X #0.391 THRU,
EQUALLY SPACED ON #3.625 BC



ITEM	PART #	REF. PART #	DESCRIPTION	MATERIAL	-1 QTY	-2 QTY
15	1013269	PLT2M-C0	PANOUT CABLE TIE WRAP	B.O.F.	4	8
14	1007498	FIB-219-04-1	OPTICAL SPLICE STRAIN RELIEF BOOT	FLUOROSILICONE RUBBER	4	8
13	1010914	MNH-1-40-C	OPTICAL FUSION SPLICE	B.O.F.	2	4
12	1000072	001803-10066-00	SMF 8.3/125/250 NATURAL	B.O.F.	4 X A/R	8 X A/R
11	1007427	FIB-119-04-7	BOOT SEAL	00 1037 RUBBER	3	N/A
10	1000727	4402211-15-9	RATCHEM 16 AWG WIRE	B.O.F.	3 X A/R	N/A
9	1007350	FIB-081-01	PLUG DUMMY STEM ASSEMBLY	VARIOUS	1	N/A
8	1007395	FIB-115-01	PLUS ELECTRICAL STEM ASSEMBLY	VARIOUS	3	N/A
7	1007391	FIB-075-01	PLUS OPTICAL STEM ASSEMBLY	VARIOUS	4	8
6	1012776	OHM-022-04-2	Y SPLICE BOOT SEAL	00 1037 RUBBER	1	N/A
5	1008139	GRF-660-04-4	SPLICE SOLDER POT	GOLD PLATED BRASS	1	N/A
4	1004367	DC 200-10063	DOW CORNING SILICONE OIL	B.O.F.	A/R	A/R
3	1000147	1/4-20 UNC-2A X 5/8"	SOCKET HEAD CAP SCREW	TITANIUM COMAL PURE GR. 2	6	6
2	1006570	FAK-081-01	TEST JUNCTION BOX, HYBRID, PROF	VARIOUS (TITANIUM SHELL)	1	1
1	1006510	FAK-045-01-3	ROY HYBRID PLUS, TYPE II ASSEMBLY	VARIOUS (TITANIUM SHELL)	1	1

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 APPROVAL TO ISSUE: N/A DATE: 9/24/06

OCEAN DESIGN, INC.
 5 INVENTOR WAY, DUNN ROCKY, TN 38174 USA
 TITLE: ROY HYBRID BUILDUP PLUS, TYPE II
 ROY BACK TEST CONNECTOR
 CA DRAWING WITH PARTS LIST
 CONTRACT NO.
 DATE: 11/19/99
 DRAWN BY: KBB
 CHECKED BY: KBB
 APPROVED BY: KBB
 SIZE: D CASE CODE: 0VVB88
 SCALE: FULL
 SHEET: 1 OF 1
 REV: E

Figure 4 : Single Armoured Heavy Cable (SAH)

CHARACTERISTICS	UNIT	TYPE 50
Core cable diameter	mm	20
First lay steel wire diameter	mm	5.0
Number of steel wires in the first lay (LH)		16
Pitch	mm	530
Outer diameter	mm	38
Weight in air	kg/m	3.7
Weight in water	kg/m	2.5
Storage factor	m ³ /km	1.4
PERFORMANCE	UNIT	TYPE 50
Cable breaking load (CBL)	kN	450
Permanent tension acceptable (NPTS)	kN	100
Operating tension acceptable (NOTS)	kN	200
Short term tension acceptable (1h) (NTTS)	kN	300
Modulus	km	> 18
Hydrodynamic constant	deg.Knots	84
Crush resistance	kN	40
Impact resistance	J	400
Pressure resistance	MPa	100