

# NMFSS portable CTD winch & rope capabilities for metal free sampling

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NOC

## PORTABLE METAL FREE WINCH SYSTEMS

### **Requirement:**

Provide a clean, 'metal free' CTD deployment winch & rope capability to support our science programmes.

### **Proposal:**

Two portable deployment winches using synthetic electro-mechanical rope designed to minimise contamination (Fe and other) to the rope & CTD/sensor deployment frame.

### **Capability:**

NERC operates two different systems:

1. Lebus electro-hydraulic direct pull containerised winch with NEXANS 18.5mm Aramid rope.
2. Rolls Royce electric direct pull containerised winch with Cortland 15.25mm Vectran braided rope.

## PORTABLE METAL FREE WINCH SYSTEMS

### Portable – Direct pull – Easy to transport

- Deployment systems should support metal free sampling as best as possible.
- Deployment systems should be portable for installation on NERC and OFEG ships
- We specified a direct pull winch to operate in conjunction with a jacketed synthetic electro-mechanical cable.

*The decision to go for a direct pull winch was partly driven by budget, to make the system 'simple' and 'easy to maintain at sea', and to provide a full 20 foot containerised system for transport.*

- The winch(s) to be fully enclosed to be protected from the elements, but with effective access for operation and maintenance.
- The systems must be capable of being transported by road, rail or sea freight as a standard 20 foot ISO CSC plated load.

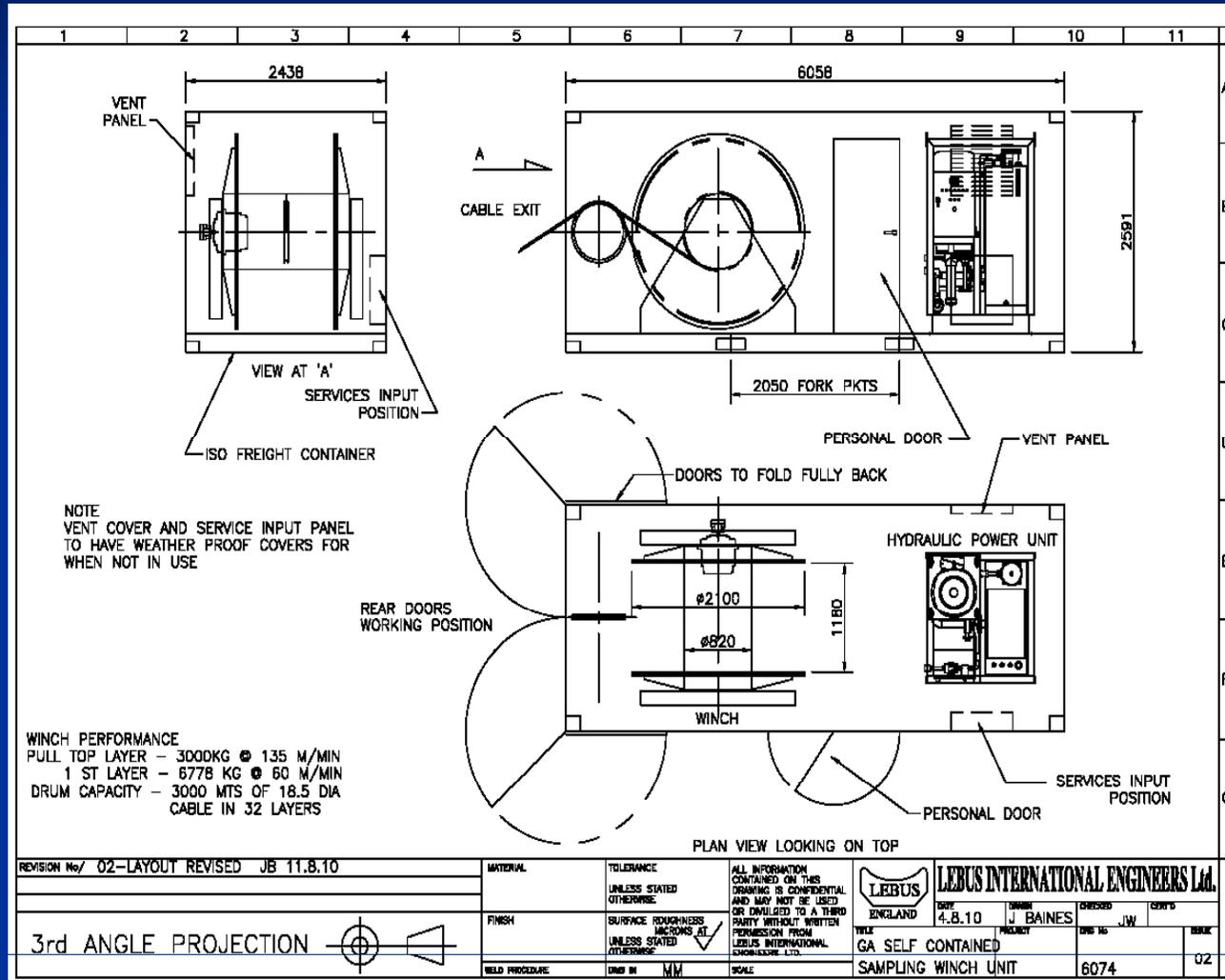
## PORTABLE METAL FREE WINCH SYSTEMS

### Which rope?

- We specified electrical conductors only and not fibre optic.
- We identified 3 potential synthetic rope suppliers:  
Cortland (USA)   Cousin Trestec (France)   NEXANs (Norway)
- We have previous bad experience from Cortland which influenced our thinking
- The Cousin Trestec rope option was outside our budget
- The NEXANs option had some track record with IMR and NIOZ and was in budget!
- The NEXANs rope was chosen for the portable RRS James Cook winch and a Cortland rope was chosen for the RRS Discovery winch system.

*We considered the rope as the major risk factor in both projects!*

# Lebus International Metal free winch system – Outline design



**Direct pull winch**

**Electro-hydraulic drive**

**Simple, reliable scroll system**

**3T line pull with full drum**

**1.0 ms-1 line speed at drum**

**Grooved Lebus drum shells**

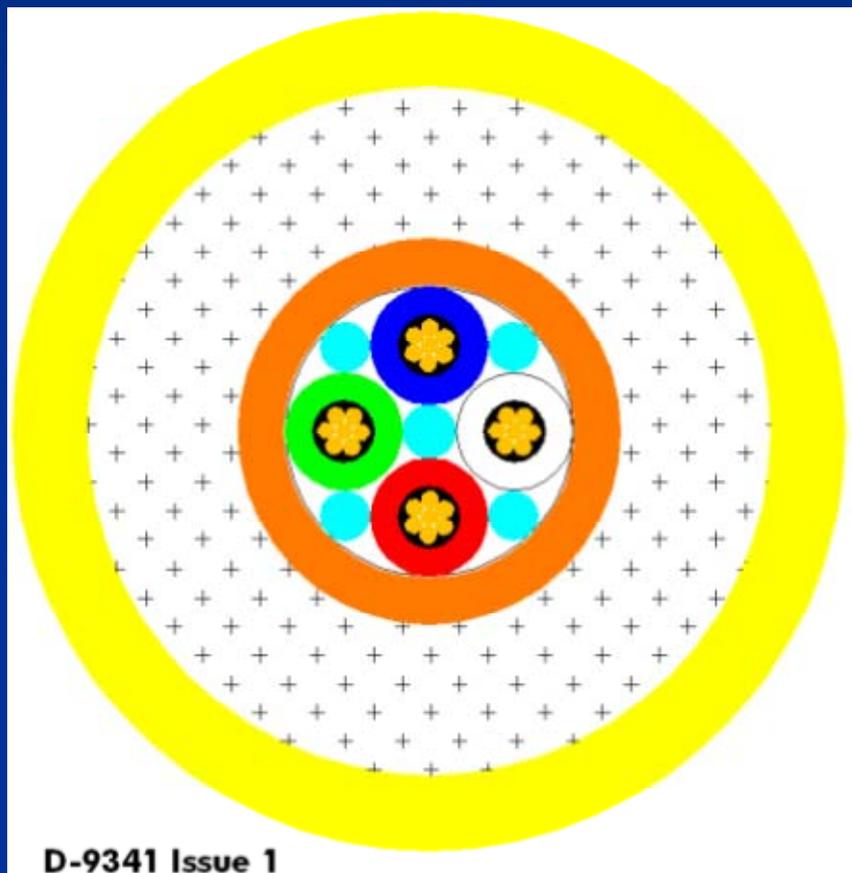
**All surfaces in contact with the rope to be coated in non-metallic material**

**CCTV cameras for drum and wire run**

**20ft ISO box dimensions**



Aramid armoured CTD instrument cable.



Length = 8000m

4 off Cu Conductor, 0.82mm<sup>2</sup>,  
7x0.39mm, 3.3kV

Outer diameter = 18.5mm

Bend diameter = 750mm

Weight in air = 310kg/km

Weight in water = 40kg/km

Breaking strength = 130kN

Safe working load = 22kN

# Lebus electro-hydraulic direct pull containerised winch with NEXANS 18.5mm Aramid rope.



20 foot containerised winch located on RRS  
Discovery hanger top.

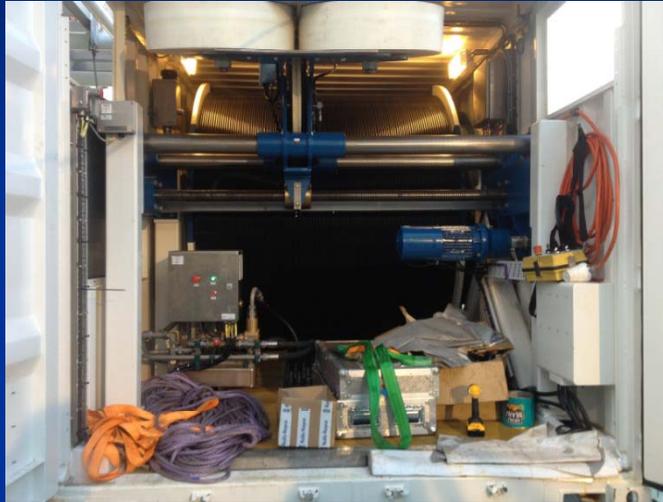


Portable clean CTD block.  
Sheave made of Nylotron.

Portable control console with 50m cable  
with plug both ends for installation  
inside ships laboratories as required..



## Rolls Royce electro direct pull containerised winch with Cortland Vectran braided rope.



Containerised direct pull winch.

Top centre shows the spooling with the drum recessed into the container.

The electric drive units are located in a separate section at the rear of the container

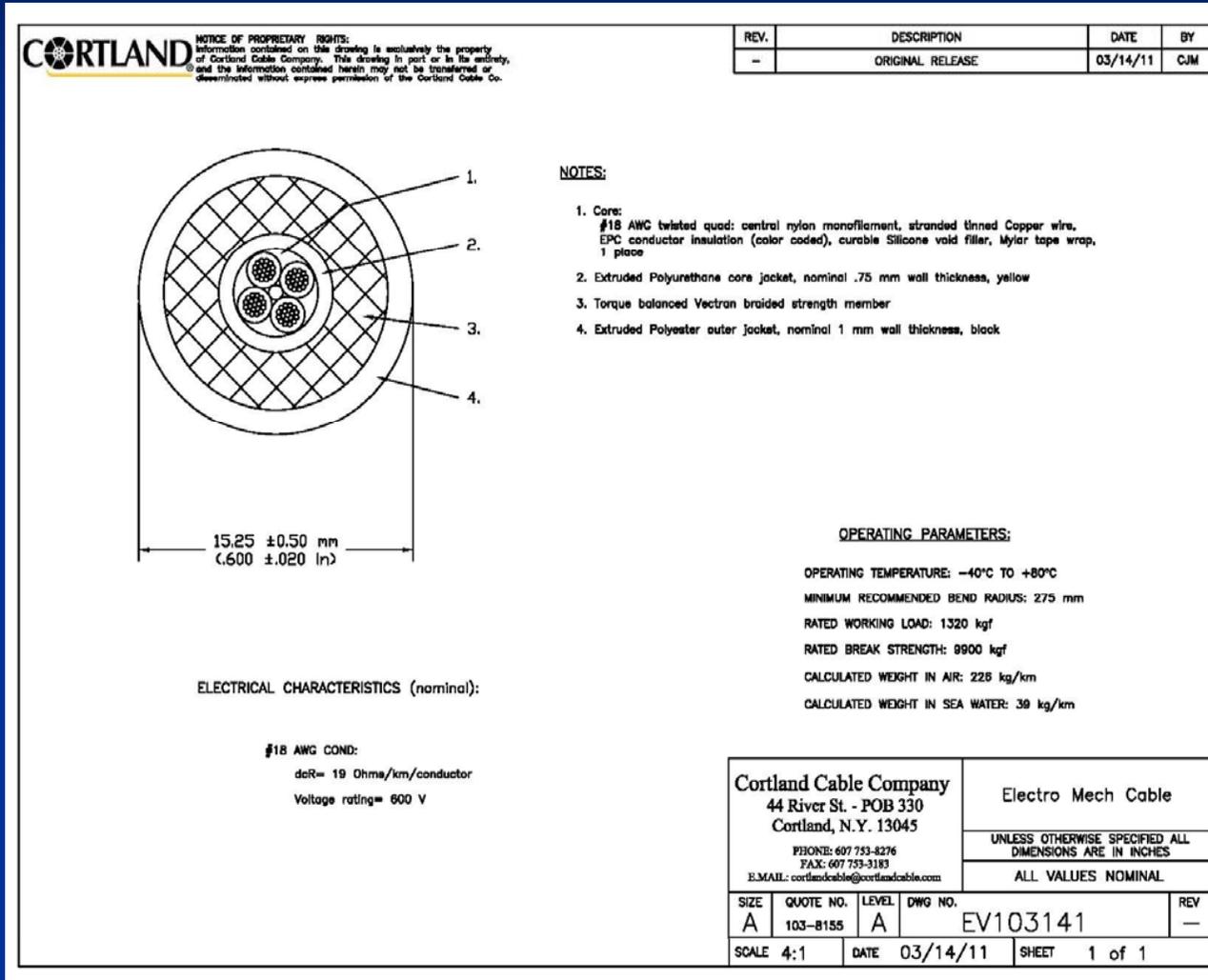


Right hand side view showing the 4 electric motors located inside the drum driving the slew ring.



# Rope specification

## Cortland rope specification:



## Cortland specification:

Length = 10000m

4 off Cu Conductor, 18AWG,  
Voltage rating = 600V

Outer diameter = 15.25mm

Bend radius = 275mm

Weight in air = 225kg/km

Weight in water = 30kg/km

Breaking strength = 9900kgf

Safe working load = 1320kgf

Operating temp =  
-40degC/+80degC

## Winch specification

Data	Value
<b>Calculation basis</b>	DNV "Standard for certification No. 2.22 - Lifting Appliances", 2011 NS 3472
<b>Safe working load</b>	4 Te (inner to mid layer) 3.7 Te (outer layer)
<b>Dynamic load</b> Dynamic amplification factor Maximum dynamic load	1.3 5.2 Te (inner to mid layer) 4.8 Te (outer layer)
<b>Brake</b> Minimum brake load	7.2 Te (inner to mid layer) 6.7 Te (outer layer)
<b>Speed</b> Launch and recovery Active heave compensation	2.0 m/s (4 Te – inner to mid layer) 2.4 m/s (1.3 Te, all layers)
<b>AHC capacity</b> Peak to peak vessel motion	6 m @ 8 s (1.3 Te, all layers)
<b>Range</b> Winch	8000 m (15.25 mm wire)
<b>Peak power consumption</b>	140 kW
<b>Certification</b>	None

## RRS Discovery clean CTD rope sheave run



Left hand side view showing the rope run from the container over the Nylatron sheaves for deployment over the starboard forward deployment system.

Right hand side view showing the rope run from the container over the Nylatron sheaves for deployment over the starboard forward deployment system.



RRS Discovery clean CTD rope sheave run over forward starboard deployment system



## RRS Discovery clean CTD rope sheave run over forward starboard deployment system



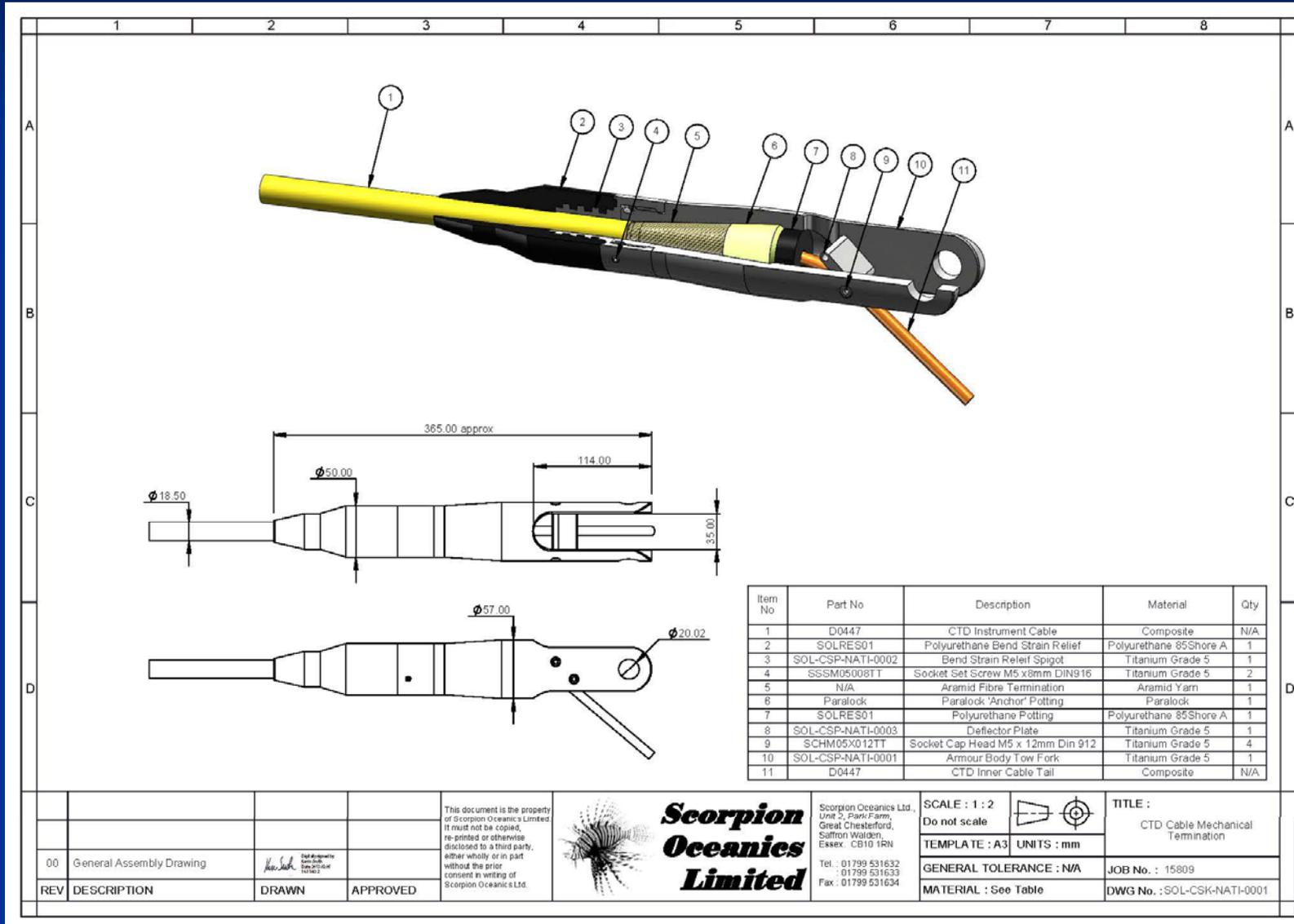
Left hand side view showing the rope run from the container over the Nylatron sheaves for deployment over the starboard Aft beam deployment system.

Right hand side view showing the rope run along the starboard beam deployment system. The picture shows the synthetic core rope rigged...the clean rope sheave can be seen top, middle right of the picture.



# Termination

## ■ Scorpion



00	General Assembly Drawing	<i>[Signature]</i>	
REV	DESCRIPTION	DRAWN	APPROVED

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SCALE : 1 : 2  
Do not scale  
TEMPLATE : A3 UNITS : mm  
GENERAL TOLERANCE : N/A  
MATERIAL : See Table

TITLE :  
CTD Cable Mechanical Termination  
JOB No. : 15809  
DWG No. : SOL-CSK-NATI-0001

# Operation to date

- **Rolls Royce winch system:**

- 1) Winch and rope trialled in September 2013
- 2) Winch and rope worked very well;
  - 1) Rope consistently deployed to 4000m with no spooling problems.
  - 2) Winch run up to 120m/sec
  - 3) Winch has heave compensation but test not completed due to faulty MRU
  - 4) Further trials planned for January 2014

- **Lebus winch system:**

- 1) Winch and rope trialled in 2012.
- 2) The winch suffered a gearbox/brake assembly failure with 1400m of rope deployed!
- 3) Winch returned to Lebus for repair
- 4) Awaiting follow up trials in January 2014

*OFEG-TECH partners welcome to join trials in January 2014 if interested!*

## What next!

- The NERC, NIOZ and GEOMAR all now plan to operate clean CTD winch systems.
- We are all adopting different approaches to the winch design and rope specifications.
- It would be useful to continue to exchange information of the use and operation of these systems (ropes in particular) to continue to develop our knowledge and experience with these ropes.

*OFEG-TECH partners welcome to join the RRS Discovery winch trials in January 2014 if interested!*