



MacArtney renewable energy presentation

12 TSS 350 (120V)
11 TSS 440 (120V)
10 rtd Diver
9 Laser Z
8 Sonarline 1500
7

World wide sales and service support



- **Group headquarters**
Esbjerg, Denmark
- **Subsidiaries and sales offices**
15 locations in Europe, North America, Asia and Oceania
- **Sales representatives**
26 locations around the world

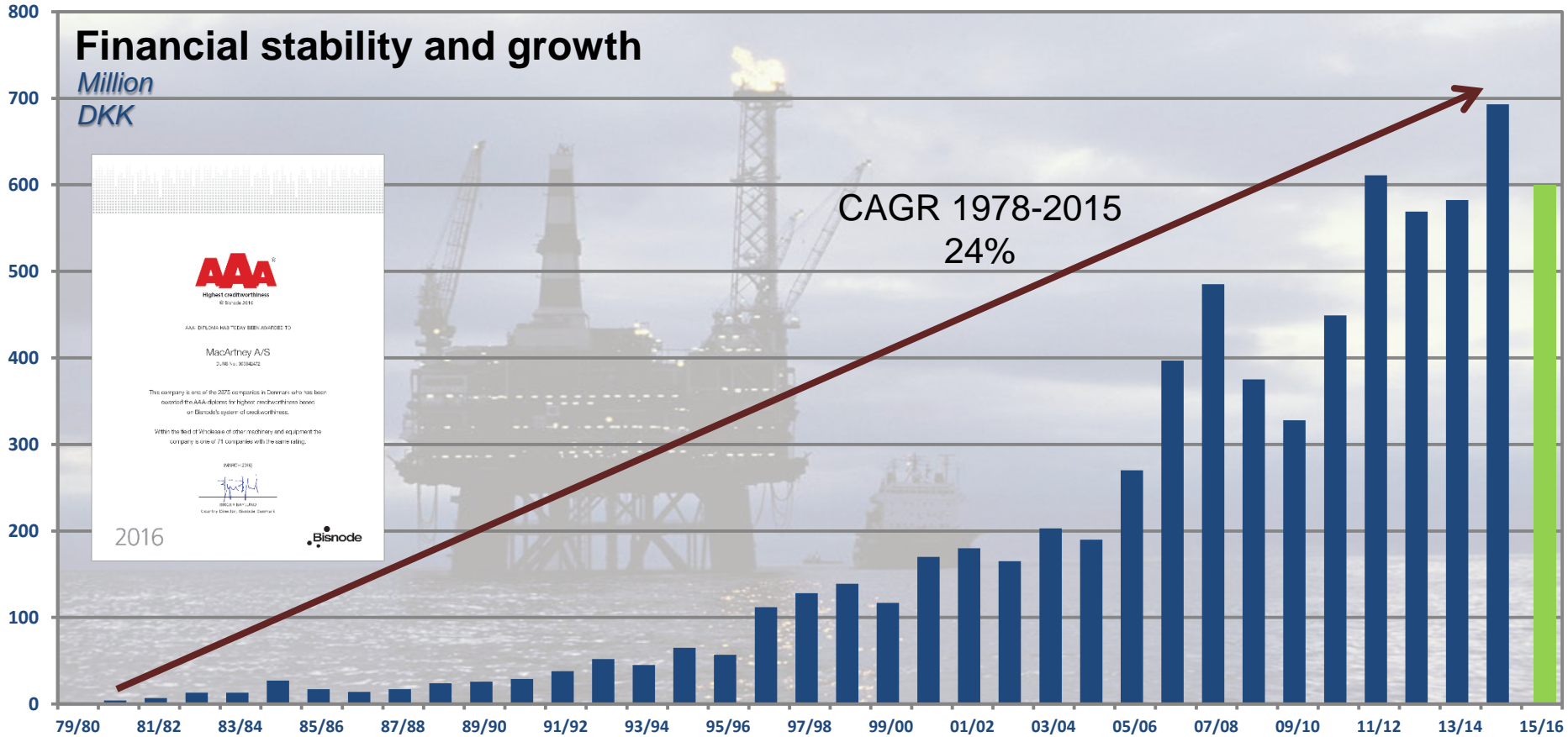
Founded in 1978 by Martin and Winnie MacArtney

~ 300 employees in group companies

~ 200 employees in associated companies

Financial stability and growth

Million
DKK



AAA
Highest creditworthiness

AAA DIPLOMA HAS RECENTLY BEEN AWARDED TO

MacArtney A/S
2-16 N. 3034672

This company is one of the 2025 companies in Denmark who has been awarded the AAAA diploma for highest creditworthiness based on Bisnode's system of creditworthiness.

With the field of Wholesale of other machinery and equipment the company is one of 71 companies with the same rating.

2016

Bisnode

Quality assurance: ISO 9001:2008

DNV-GL

DNV-GL

MANAGEMENT SYSTEM CERTIFICATE

Certificate No: 05512-1999-AC-EDN-02654
 Official certification date: 22 September, 2002
 Valid: 12 January, 2015 - 11 January, 2019

This is to certify that the management system of

MacArtney A/S
 Gl. Guldagervej 48, Hjørtning, DK-6710, Esbjerg V, Denmark
 and the sites as mentioned in the appendix accompanying this certificate

has been found to conform to the Quality Management System standard:
DS/EN ISO 9001:2008

This certificate is valid for the following scope:
**Design, sale, production, project management and service of underwater
 equipment and underwater related equipment**

Certificate No: 05512-1999-AC-EDN-02654
 Place and date: Helsinki, 12 January, 2016

Appendix to Certificate

MacArtney A/S
 Locations included in the certification are as follows:

Site Name	Site Address	Site Scope
MacArtney A/S (Esbjerg)	Gl. Guldagervej 48, Hjørtning, DK-6710, Esbjerg V, Denmark	Design, sale, production, project management and service of underwater equipment and underwater related equipment
MacArtney AS	Fall-Båveien 34, NO-4033 Stavanger, Norway	Sale, production and service of underwater equipment and underwater related equipment
MacArtney Inc.	2901 West Sam Houston, Parkway North, Ste D-200, Houston, TX, US-77004, USA	Sale, production and service of underwater equipment and underwater related equipment
MacArtney UK Ltd.	MacArtney UK Ltd., Howemoss Avenue, Kintyre Industrial Estate, Dyce, Aberdeen, GB-AB21 0EP, United Kingdom	Sale, production and service of underwater equipment and underwater related equipment

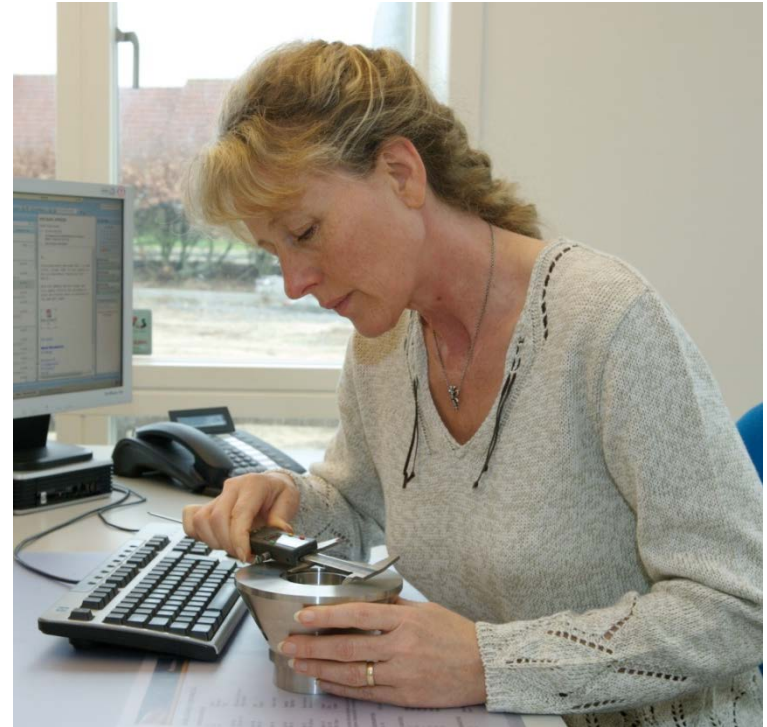
Made in Finland
 Helsinki, 12 January, 2016



For the issuing office:
 DNV-GL - Business Assurance
 Tuborg Parkvej 8, 2., DK-2800, Hellerup,
 Denmark
 Jesper Schulte
 Management Representative

Use of full name of third party as set out in the Certification Agreement may imply this Certificate is valid.
 05512-1999-AC-EDN-02654. This is a free document and may not be copied, scanned, or otherwise reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage and retrieval system, without permission in writing from DNV-GL. For more information, please contact DNV-GL, 2800 Hellerup, Denmark, Tel: +45 76 16 46 00.
 http://www.dnv-gl.com

Use of full name of certificate holder as set out in the Certification Agreement may imply this Certificate is valid.
 05512-1999-AC-EDN-02654. This is a free document and may not be copied, scanned, or otherwise reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage and retrieval system, without permission in writing from DNV-GL. For more information, please contact DNV-GL, 2800 Hellerup, Denmark, Tel: +45 76 16 46 00.
 http://www.dnv-gl.com



DS/OHSAS 18001:2008

DNV-GL

MANAGEMENT SYSTEM CERTIFICATE

Certificate No: 14EIS-0214-AIS-001-DANAK Date of certification date: 23 January, 2014 Valid: 12 January, 2015 - 31 January, 2019

This is to certify that the management system of

MacArtney A/S
Gl. Guldagervej 48, Hjerling, DK-6710, Esbjerg V, Denmark,
P-number: 1.002.688.549

has been found to conform to the Management System standard:
**DS/OHSAS 18001:2008 including
Bekendtgørelse nr. 1191 af 09.10.2013**

This certificate is valid for the following scope:
**Design, sale, production, project management and service of underwater
equipment and underwater related equipment**

Made in the date:
Hellerup, 12 January, 2014



For the issuing office:
DNV GL - Business Assurance
Tuborg Parkvej 6, 2., DK-2900, Hellerup,
Denmark

Jesper Schultz
Jesper Schultz
Management Representative

Use of this certificate or its content in any form in the context of a project may imply the certificate holder's responsibility for the project. For more information, please contact DNV GL, Tuborg Parkvej 6, 2., DK-2900 Hellerup, Denmark, Tel. +45 33 45 45 45. www.dnvgl.com



MacArtney is a system solution provider - We design, manufacture, sell and service



Connectivity
Underwater connectivity solutions
- connectors, cables and terminations



Winch and handling systems
Winch and handling systems
- winches, A-frames and rotary products



Telemetry
Underwater telemetry systems
- multiplexers and electronics



Remote technology
Remote technology systems
- ROTVs and ROVs



Instruments
Underwater instrumentation systems and products
- sonars, sensors and cameras



Engineering
And we provide system integration of all of the above...

Our industries



Oil and gas

ROVs, seismic and CSEM survey, cable/pipeline surveys, drill support, construction, IRM, decommissioning



Civil engineering

Dredging, telecommunications, ship building, tunnel inspection, dams/structures and inspection



Ocean science

Universities and research institutes, aquaculture, climate change studies, environmental authorities, coast and port authorities, waterways authorities



Renewable energy

Tidal and current energy providers, wave energy providers, hydro power, offshore wind



Defence

Hydrography, harbour surveillance, coastal and fisheries inspection, submarines, MCM



Diving

Inshore diving, offshore diving, MCM, diver training schools, hyperbaric treatment

MacArtney brands



SubConn®



OptoLink



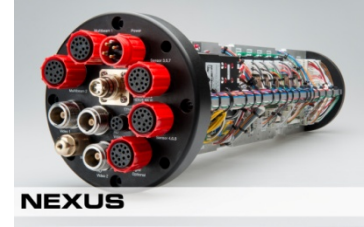
TrustLink



CORMAC



MERMAC



NEXUS



FOCUS-2



TRIAXUS



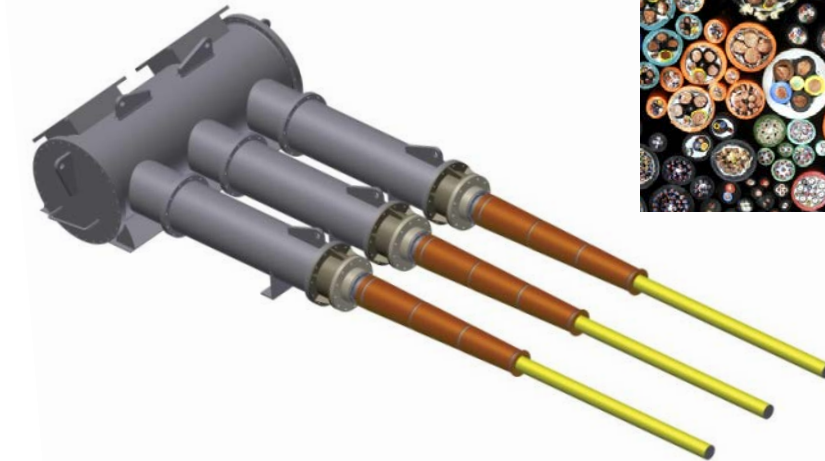
LUXUS

Renewable energy

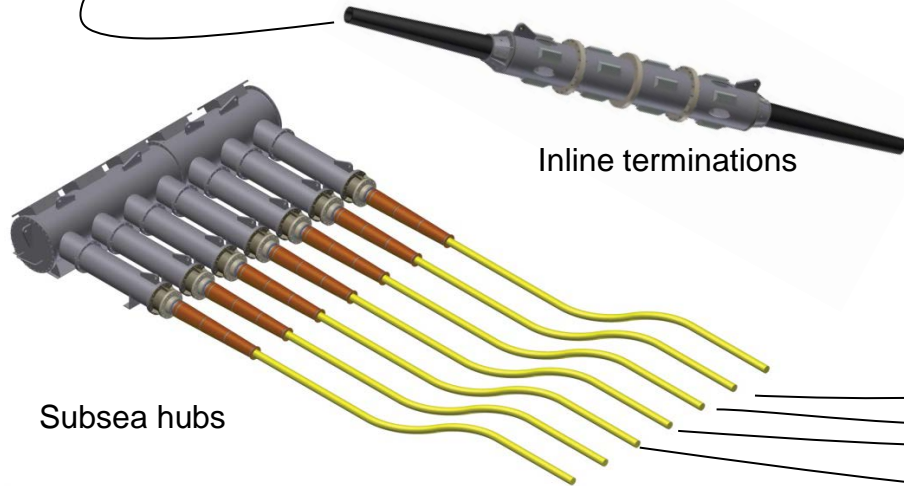


Renewable energy - disciplines

- Subsea hubs
- Engineering
- Cables and cable protection equipment
- Terminations
- Connectors
- Construction and design



Renewable energy - infrastructure



Floating wind turbines



Courtesy of OPT

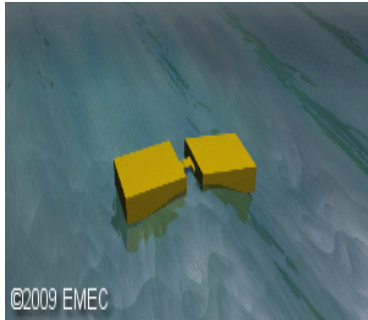
Wave energy converters



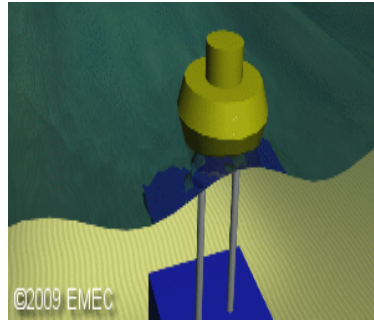
Courtesy of ANDRITZ

Tidal energy converters

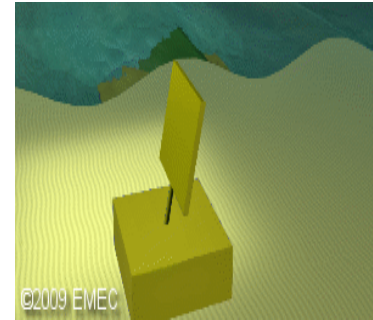
Wave energy converters



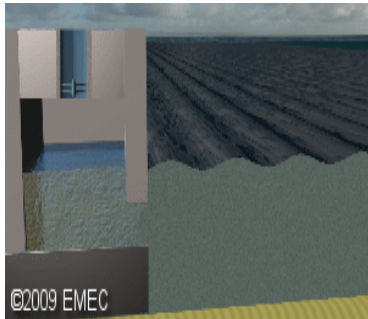
Attenuator



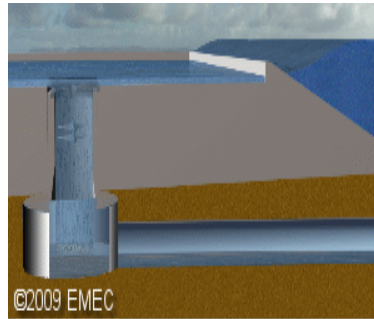
Point absorber



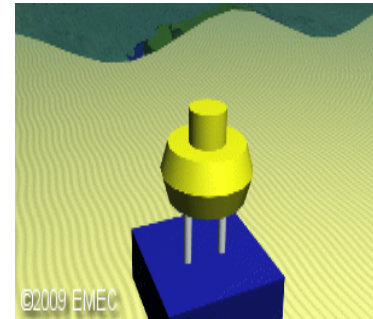
Oscillating wave surge converter



Oscillating water column

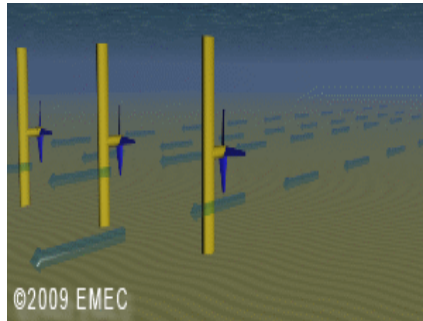


Overtopping device

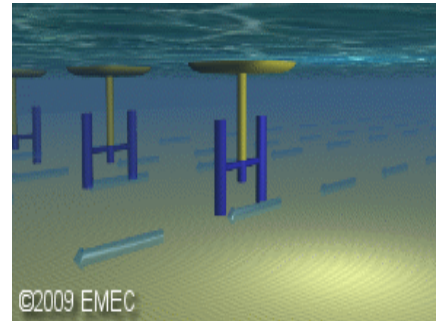


Submerged pressure differential

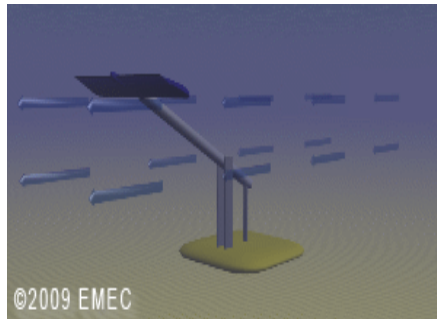
Tidal energy converters



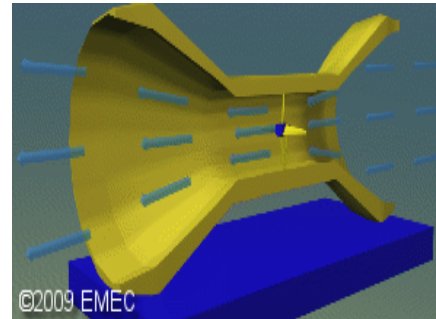
Horizontal axis turbine



Vertical axis turbine



Oscillating hydrofoil



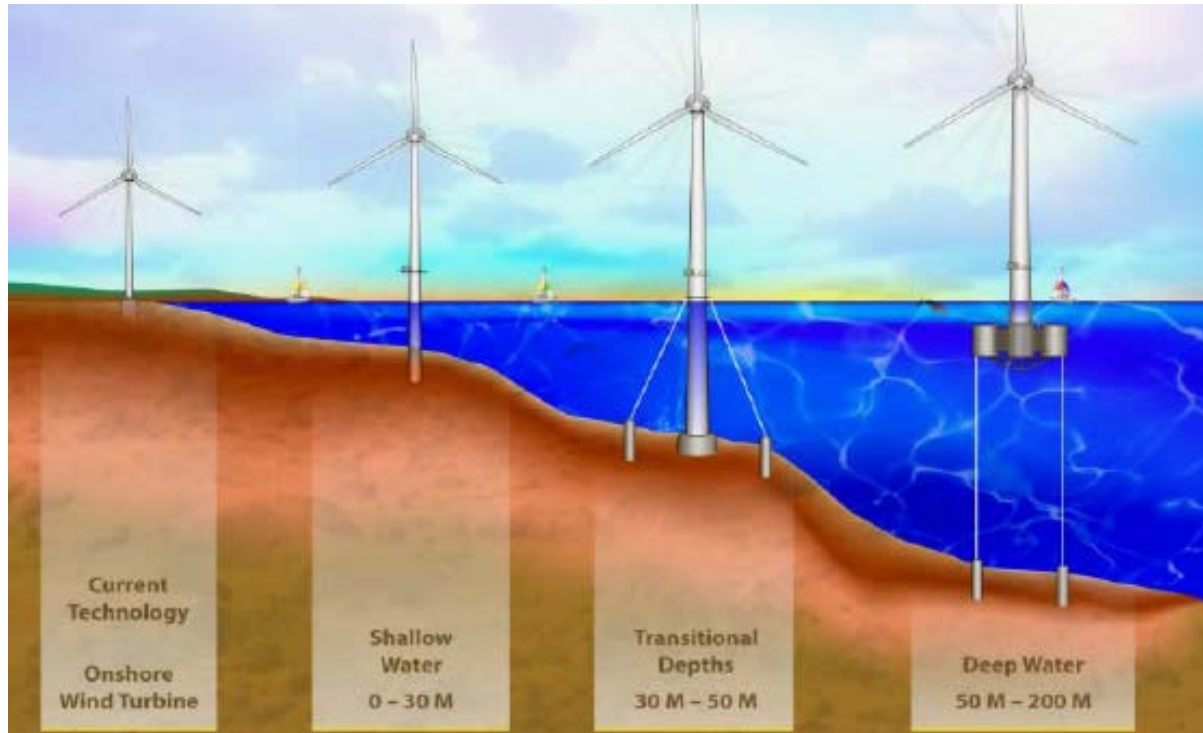
Venturi effect

Offshore wind energy converters

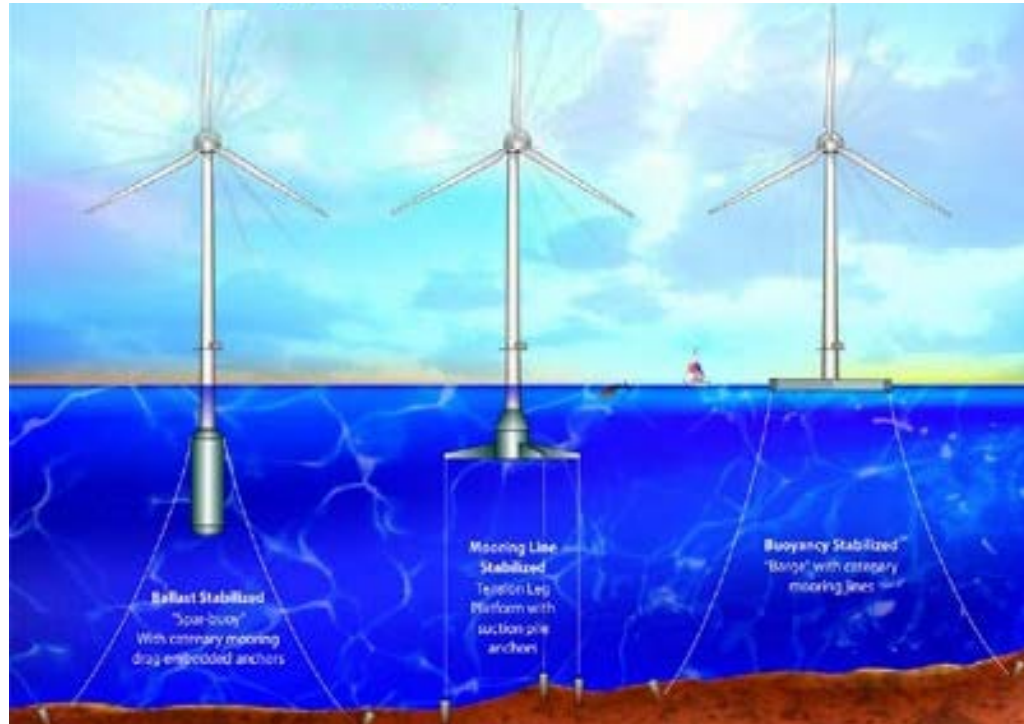
Which techniques are under development?



Deep water wind turbine development

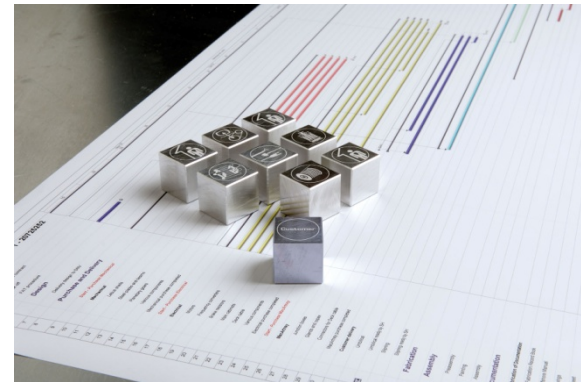


Floating wind turbine concepts



Components and services

- Feasibility studies, project management, facilitating tests and trials if required
- Control and instrumentation systems to be integrated with client SCADA systems
- Multiplexer, data-logging (Mac-Log), data storage/retrieval equipment
- Rotary products for turbine axis and vertical power swivels
- Various sensor systems including ADCP, pressure-, proximity-, vibration- cameras and strain gauge sensors for structural strain measurement

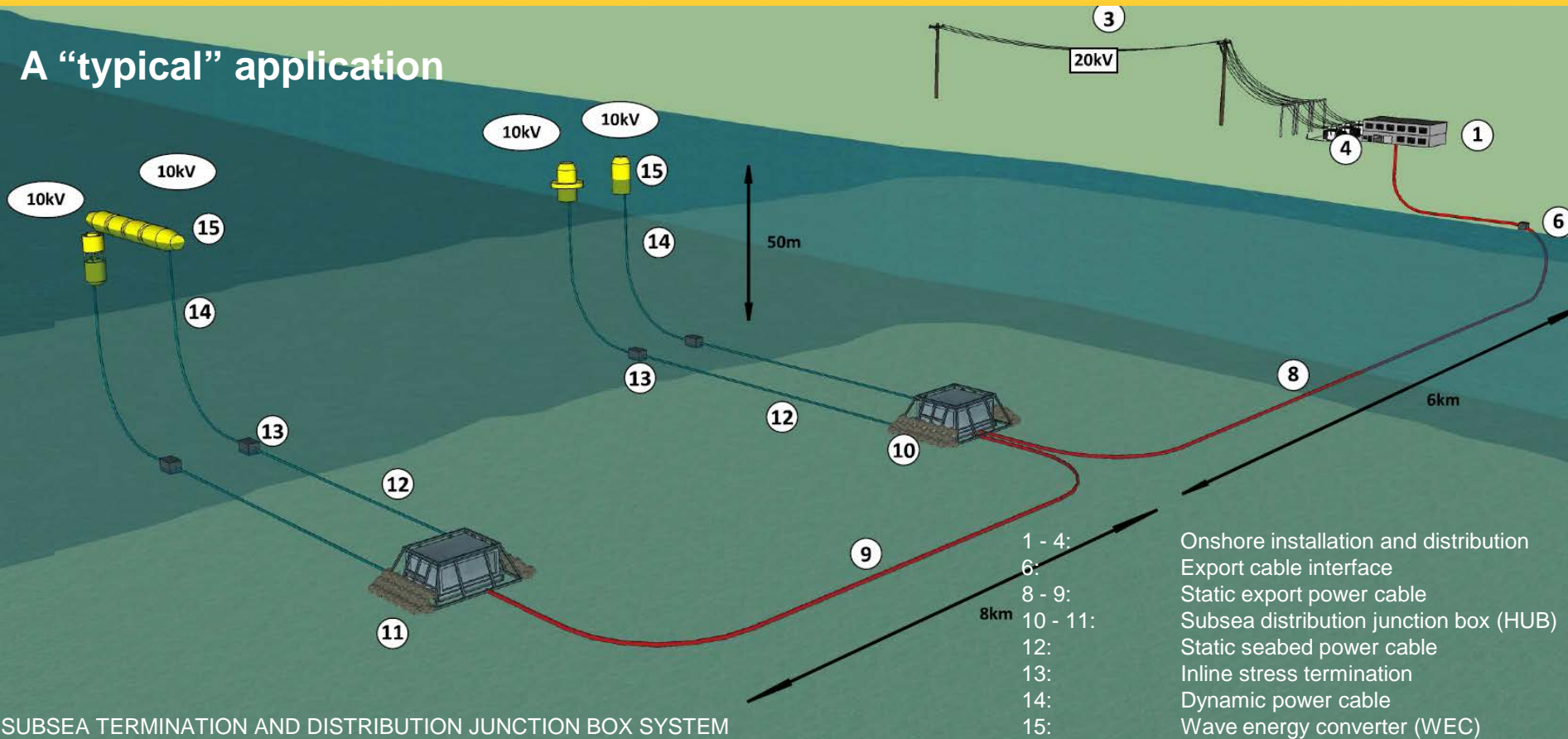


Components and services

- Special junction boxes (dry or pressure compensated)
- LV/MV/FO penetrators
- Static and dynamic LV/MV/FO cables and umbilicals
- LV/MV/FO dry- and wet-mate connector and stab plate solutions
- OptoLink fibre optic connectors and harness cables
- SubConn® connectors and harness cables
- Cable protecting equipment including bend limiting and restrictor devices
- Interconnectivity systems including special cable terminations and IL connectors and hubs or UTUs



A "typical" application



- 1 - 4: Onshore installation and distribution
- 6: Export cable interface
- 8 - 9: Static export power cable
- 10 - 11: Subsea distribution junction box (HUB)
- 12: Static seabed power cable
- 13: Inline stress termination
- 14: Dynamic power cable
- 15: Wave energy converter (WEC)

SUBSEA TERMINATION AND DISTRIBUTION JUNCTION BOX SYSTEM

Renewable energy application



Export Cable

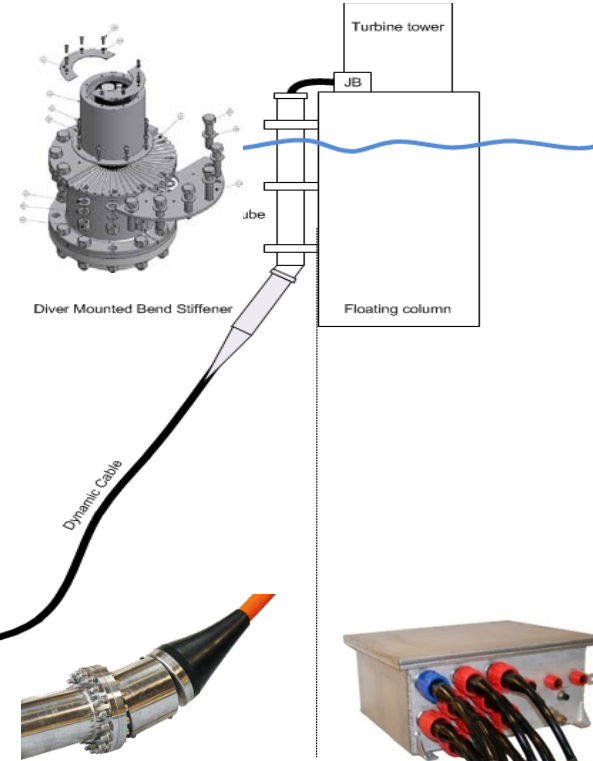
Inline stress termination



Mechanical protection



Buoyant modules

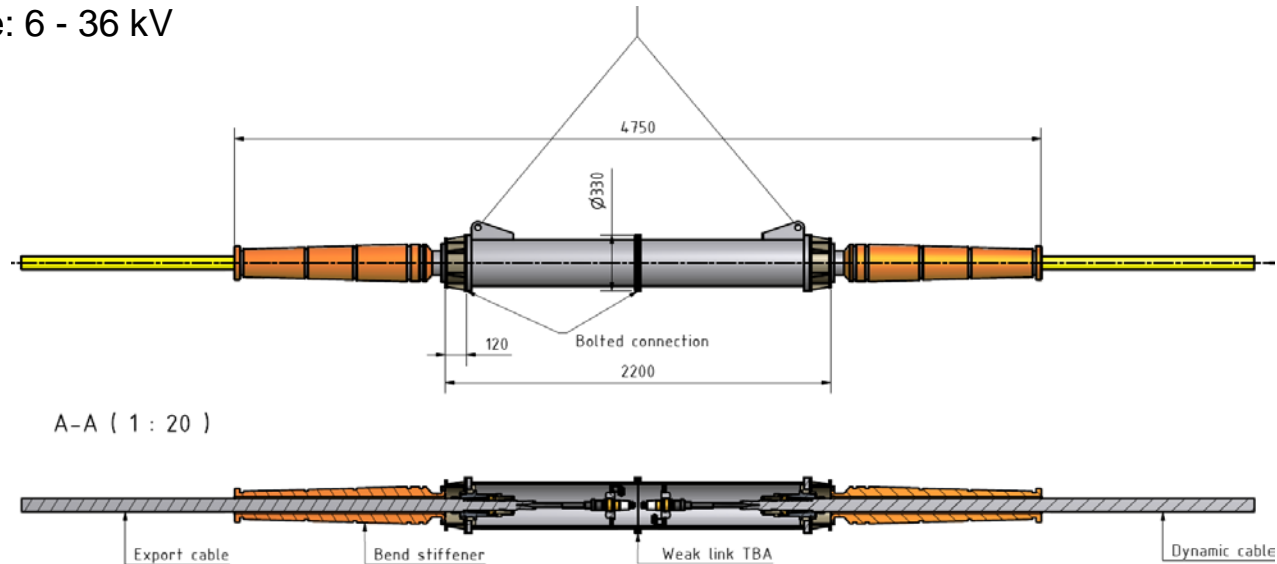


Bend stiffener

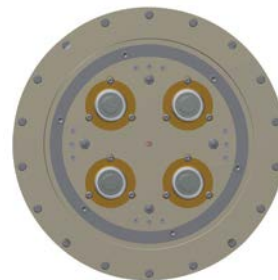
Junction box

MacArtney Inline Termination

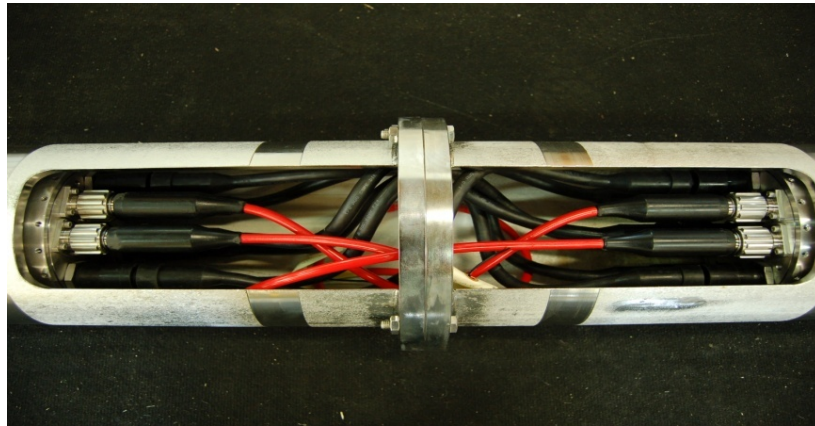
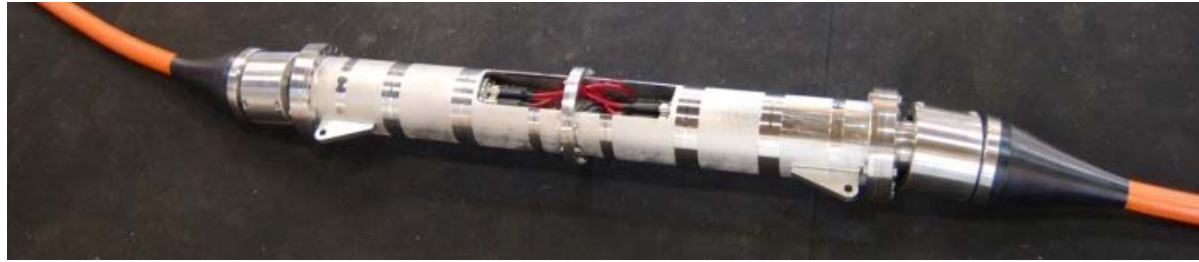
- Standard working voltage range: 6 - 36 kV
- Up to 1250 A
- Conductor range: 35 - 630 mm²
- Total estimated weight: 480 kg
- Working depth: 100 m
- AISI 316 housing material (other materials available)



MacArtney Inline Termination for EDF at the Paimpol-Bréhat offshore tidal farm

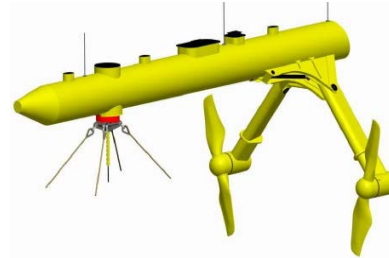


Example of termination work



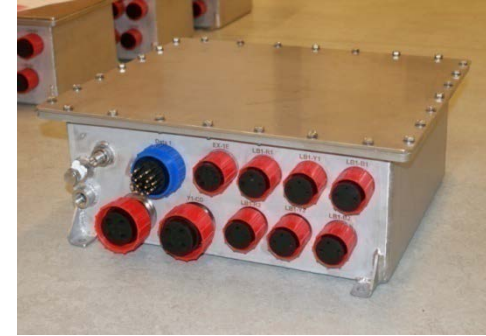
Another example

Scotrenewables SRTT250

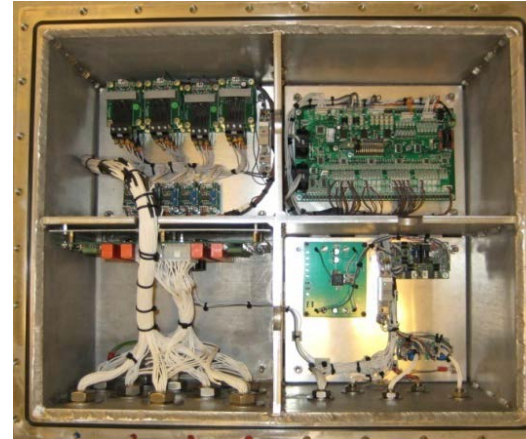


Examples of junction boxes

- For coils, sensor, data logging and various instrumentation
- Pressure compensated junction boxes
- Alternatively 1 Atm junction boxes

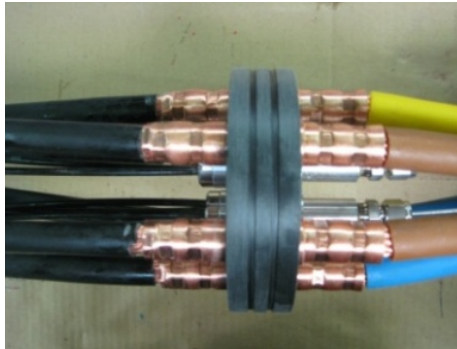
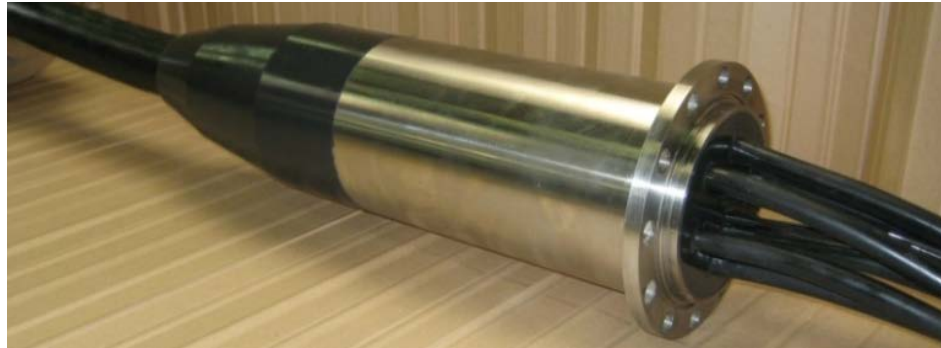
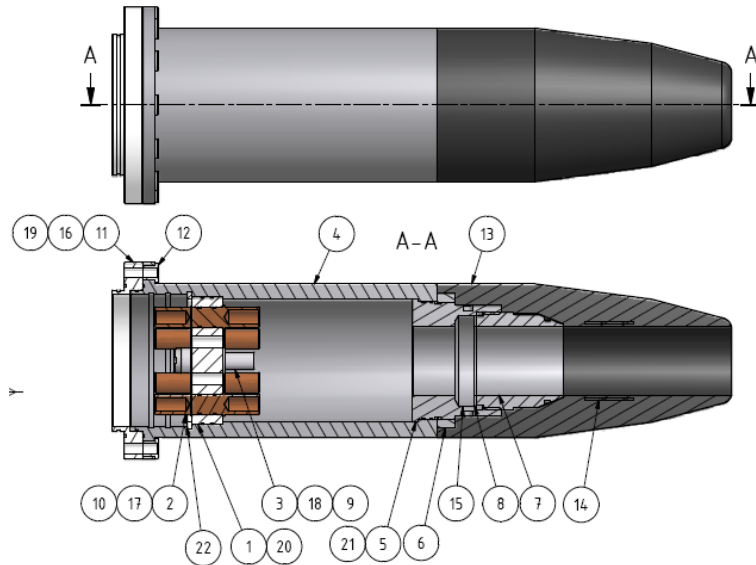


OpenHydro's installation
at the EMEC site, UK



Example of a MV and FO penetrator

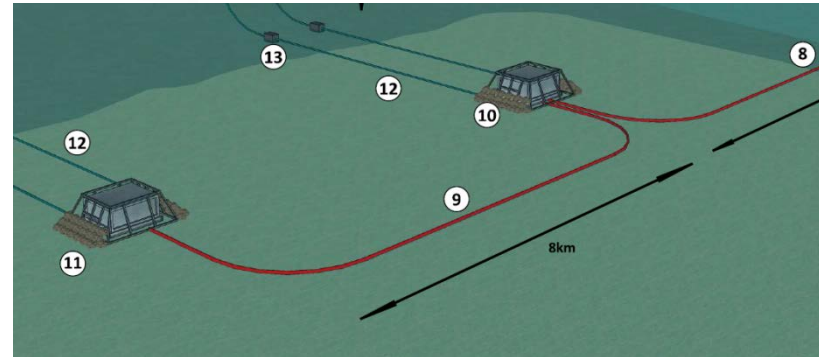
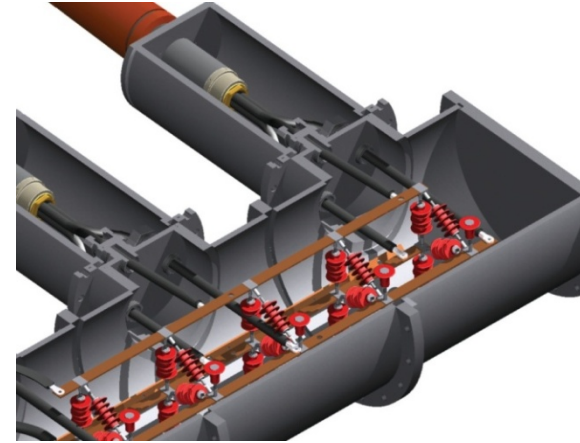
Drawing of SS water blocked penetrator
(fibre optics and power)



Concept

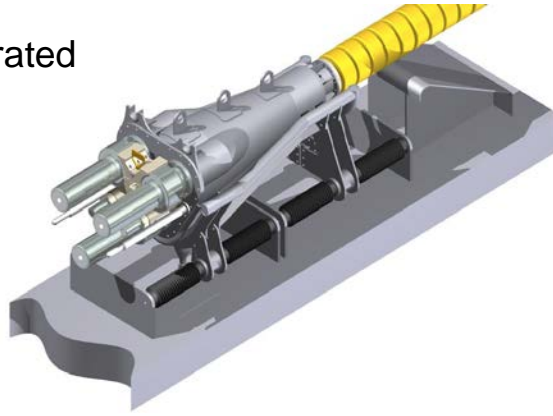
Examples of MacArtney MV Hubs

- Standard working voltage range: 6 - 36 kV
- Up to 1250 A
- Conductor range: 35 - 630 mm²
- Total estimated weight: 480 kg
- Working depth: 100 m
- AISI 316 housing material (other materials available)



Contract awarded (2010)

- 18 month project
- Costing £1.1m
- Led by MacArtney
- 11 kV AC wet mate connector
- Tested and demonstrated under workshop and real-sea conditions

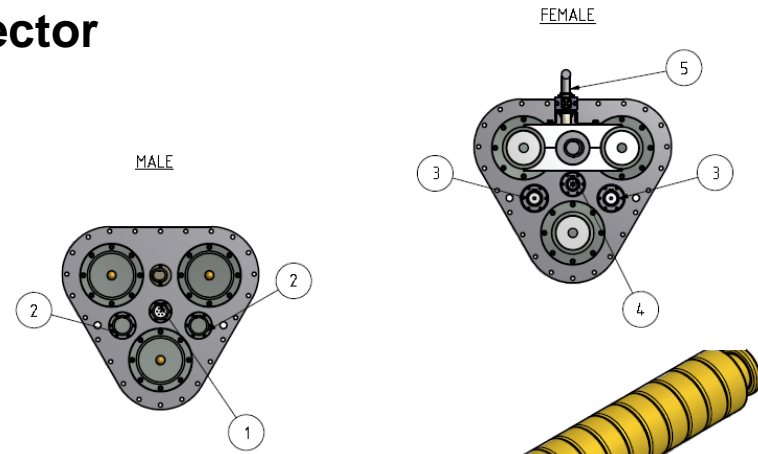
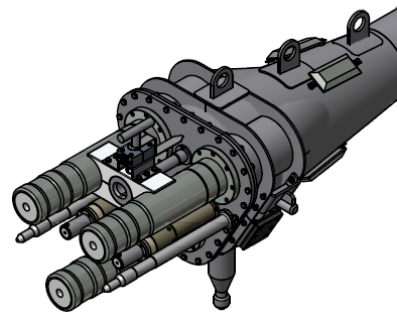


MacArtney 11 kV (7.6 MW) Wet Mate Connector



MacArtney 11 kV/400A (7.6 MW) Wet Mate Connector

- Weight in air: 1060 kg
- Weight in water: 730 kg
- Depth rating: 100 m
- PWR Uo/U/Um: 6/10/12 kVA (13 of)
- PWR max current: 400 A
- Signal Umax: 700 VDC (15 of)
- Signal max current: 30 A
- F/O: Single/multimode (8 of)
- No. of matings: 15 between oil change/ 30 between refurbishment



Global presence - local support



Service and support facilities

- Sales support (all MacArtney products)
- Advanced workshop
- Fibre optic workshop and testing
- Electronics workshop and testing
- Moulding and termination facility
- ROV/ROTV workshop
- Side scan sonar maintenance and repair facility
- Winch and handling system maintenance and repair facility
- Pressure testing facilities (100, 300, 400, 650 and 800 bar)
- Cable spooling and testing facility
- Pull/stress test facility (40 ton)
- Test pool (8x3x3 metres)
- Sensor calibration facility
- Corrosion and debonding test facilities
- Standing stock of cables and connectors (SubConn, OptoLink, MacAPI,....)
- Field installation and engineering support
- Engineering and project management
- 24/7 emergency support
- Access to global MacArtney support network
- Extensive equipment rental pool

World wide sales and service support



Thank you for your attention

For further information

Please visit:

www.macartney.com

Or contact us at:

info@macartney.com