—东方·脐带缆—
ORIENT UMBILICAL SYSTEMS

宁波东方电缆股份有限公司
NINGBO ORIENT WIRES & CABLES CO.,LTD.
中国·宁波海缆研究院
CHINA · NINGBO SUBSEA CABLE INSTITUTE
联合出品

中国·宁波 NINGBO · CHINA
电话（TEL）：0086-574-86188391
传真（FAX）：0086-574-86188390
Http：//www.orientcable.com
E-mail：orient@orientgroup.com
服务热线（HOTLINE）：800 8574 528

ESPERA AWARD ENERGY Co.
Tehran / Iran
(TEL) : 0098-21-22817769
(FAX) : 0098-21-22649396
Http: //www.espersaco.com
E-mail: info@espersaco.com

Espersa Award Energy

RIENT 东方电缆 ORIENT CABLE

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企业简介
Introduction to the Company

宁波东方电缆股份有限公司座落于浙江省宁波市，位于中国大陆海岸线中段，经济发达的长江三角洲南翼，毗邻上海、杭州，具有得天独厚深水良港的北仑。

公司是国家级高新技术企业、国家创新型试点企业。我们致力于电力、建筑、通信、石化、轨道交通、风力发电、核能、海洋油气勘采、海洋军事等领域的光、电、复合缆的设计、研发，制造，安装和技术支持。承担了建国以来行业内唯一的国家科技支撑计划项目和国家863计划项目，并牵头起草了海底电缆国家标准，是国内唯一掌握海洋脐带缆的设计分析并能进行自主生产的企业。

公司拥有500kV及以下交流海缆、陆缆，±300kV及以下直流海缆、陆缆的系统研发生产能力，并涉及海底光电复合缆，海底光缆，智能电网用光复电缆，核电缆，通信电缆，控制电缆，电线，综合布线，架空导线等一系列产品；同时提供海洋工程用线缆的客户定制化服务（如：脐带缆等）；并通过了ISO三大体系认证，拥有挪威船级社DNV认证证书。

公司以“自主创新、精益管理、优化资源、科学发展”为指导思想，依托承担国家科技支撑计划项目“220kV及以下光电复合海底电缆、海底交联电缆及生产装备开发”、863计划项目“水下生产系统脐带缆”关键技术研究和牵头起草国家海底电缆标准的有力契机，以海缆研究院为龙头，以院士工作站为载体，以标准为策略，逐步建立了竞争情报体系、应用研发体系和动态管理体系，为中国海缆第一品牌的地位不动摇奠定了扎实基础。

展望未来，公司将持之以恒地肩负起“提供畅通的连接”这一伟大使命，积极把握时代发展脉搏，创新思维发展，全力实现“拥有自主知识产权，具备世界先进水平，具有国际核心竞争力的现代企业”的宏伟愿景。

Ningbo Orient Wires & Cables Co., Ltd is located in Ningbo city, Zhejiang province, middle of China coastline and southern of developed Yangtze River delta. She owns the unique deep-water port of Beilun and is very close to Shanghai and Hangzhou.

The company is a state-level high-tech and state innovative experimental enterprise. We are committed to the electricity, construction, communication, petrochemicals, Metro transportation, wind energy, nuclear energy, offshore oil and gas exploration, marine military fields, electricity and composite cable design, research & development, manufacture, installation and technical support. It has undertaken the State Science and Technology Supporting Plan projects and State Project of the 863 plan since the founding of PRC, it also takes the leader in drafting national standards for submarine cable, also is the only domestic self-production enterprise to master the design and analysis of marine umbilical cable.

The company has the research and development capacity of 500 kV and below AC submarine cable, land cable, ± 300 kV and below DC cable, land cable system and involve submarine optical composite cable, submarine optical cable, cable restoration of intelligent grid, nuclear cable, communication cable, controlling cable, wire, comprehensive wiring, overhead wires and a series of other products. At the same time it can provide Marine Engineering with cable services (such as umbilical cable etc); The company has passed through the ISO three system certification, DNV certificate of Det Norske Veritas

The company adopts the " Independent innovation, Precise Management:, Optimize Resources, Scientific Development " as the guiding ideology. We undertake the National Science and Technology Plan projects (220 kV and below photoelectric composite submarine cables, submarine XLPE Cables and production equipment development) and the project of the 863 Plan (submarine production system of umbilical cable). We are the leader in drafting the National Submarine Power Cable standard. We own the Ningbo Submarine Cable Institute as the academician workstation. We have established a whole competitive intelligent system. R&D system. We are becoming the first class manufacturer in China's Submarine Cable Industry.

The company will continue to persist the great mission of " providing the *smooth* connection " to the customer world widely.

宁波东方成功研制出
应用于南海1500米水深的脐带缆

Ningbo Orient has successfully produced
an umbilical applied to the 1500 m water depth in South China Sea

• 863计划专家研讨会
863 high-tech project charrette

宁波东方联合中海油研究总院、大连理工大学、上海交通大学等多家知名院校机构成功开发出应用于海洋深水油气田开发采集设备用的关键传输产品–水下生产系统脐带缆

通过水下生产系统脐带缆关键技术863课题研究，突破海洋深水水下生产系统脐带缆国产化关键技术，初步具备海洋深水水下生产系统脐带缆设计、制造和测试能力，开发脐带缆设计分析的软件，研制了一条适合南海环境条件、水深1500米水下生产系统脐带缆，建立了具有自主知识产权水下生产系统脐带缆设计，制造及测试技术和方法，全面带动和促进国内相关学科及行业的技术提升和发展，为我国南海油气资源勘探和开发提供技术储备与支持。

Ningbo Orient with some well-known institutions, such as CNOOC Research Institute, Dalian University of Technology and Shanghai Jiao Tong University, has successfully produced the umbilical for subsea production system which is the key transmission product of development and acquisition equipment for oil and gas fields in deep water.

By researching the 863 program of the key technology of underwater umbilical cable production system, Orient has broken through in the key technology of localizing the production system of umbilical and had the ability of designing, manufacture and testing the umbilical.

东方脐带缆系统
ORIENT UMBILICAL SYSTEMS

脐带缆被广泛应用于海洋油气田以及海洋矿藏资源的开发、海洋勘探、水下机器人（ROV）和各种海工设备之间的电力信号连接。脐带缆主要有液压管线，电力单元和光纤单元组成。它的设计要在兼顾电、通信、液压等功能的同时满足各种复杂海况的动态响应要求。

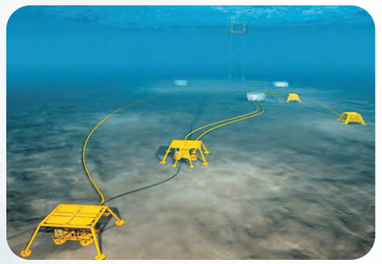
Umbilical are widely used in the ocean industry for exploration and recovery of petroleum and mineral resources, remote operated vehicle(ROV) and a variety of marine devices for electrical, hydraulic power and signal connecting.

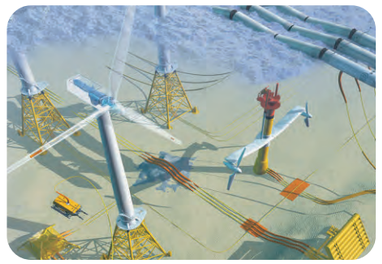
东方是国内领先的脐带缆供应商和脐带缆系统方案解决者，同时也是国内唯一一家掌握海洋动态设计分析能力的企业。以下为东方能为您的工程应用提供产品的领域介绍：

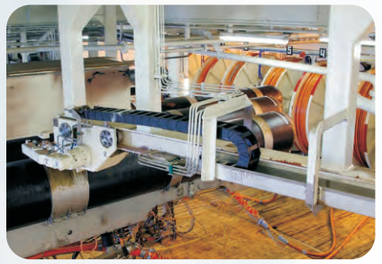
- **应用于深海和边际油气开采中水下生产系统的控制。**
- **应用于油气开采中FPSO和浮式平台与井口平台间的电力传输。**
- **应用于海洋勘探中的高压气体传输和信号采集。**
- **应用于ROV的信号和电力连接。**
- **应用于浮式风力发电和潮汐发电的电力输送。**
- **应用于特殊海洋工程装备的电力和信号等连接。如海底挖沟机、海底干式焊接仓。**

The main application field of ORIENT umbilical:

- As control line for the subsea production system.
- As power and signal connecting line between FPSO(Floating platform) and wellhead platform
- As high-pressure air transmission line for Air Gun and Signal collection line.
- As power transmission and signal connecting line for ROV.
- As power transmission line for wind power ,tidal power and other renewable power.
- As electrical and signal connecting line between a variety of marine devices, such as subsea trencher.





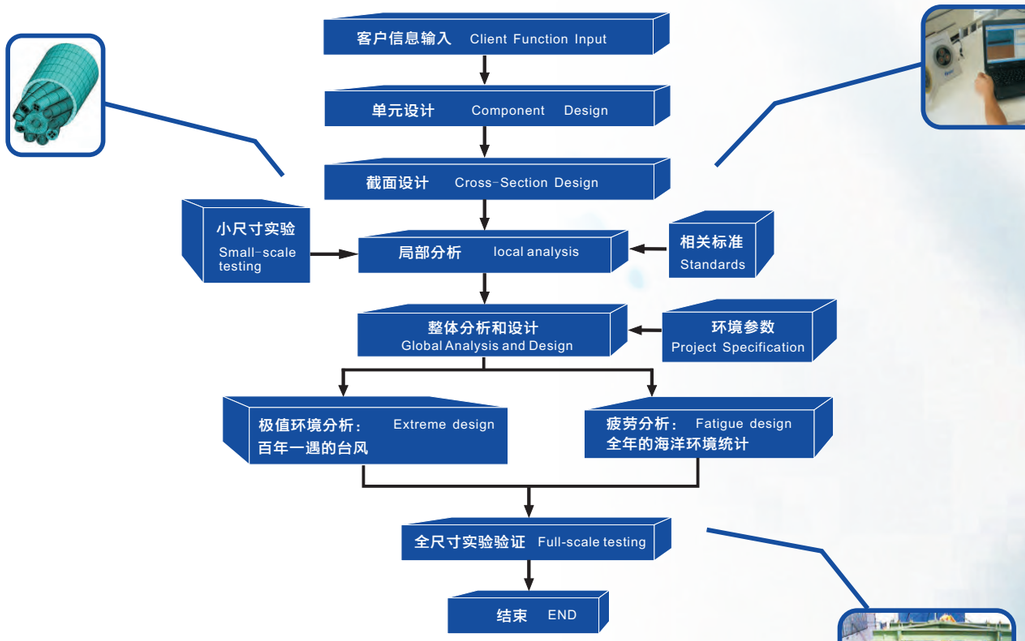


国际化、客户化的设计
Classic Design

每一根东方脐带缆都是按照客户要求并通过分析手段，由东方的海洋研发中心“海缆研究”完成设计研发的。东方脐带缆设计所参照的主要规范为：ISO13628-5,API-17E ,DNV-OS-F101，DNV-OS-F201, DNV-OSS-302，DNV-RP-F109，DNV-RP-F203，DNV-RP-F204及根据多年的工程经验和实践制定的东方企业规范等。

All the Orient umbilical are customization designed. Our main reference standard are: ISO13628-5,API-17E ,DNV-OS-F101，DNV-OS-F201, DNV-OSS-302，DNV-RP-F109，DNV-RP-F203，DNV-RP-F204.

脐带缆主要设计流程如图所示：Design of umbilical



东方具备一流的脐带缆分析设计能力技术水平：

- 拥有Orcaflex、AQWA等水动力分析软件，能对柔性管线结构及互相连接的浮体进行多体水动力耦合分析；
- 同时拥有ANSYS、ABAQUSE等结构有限元方针软件以及CABLECAD等脐带缆二维和三维结构专用分析软件，为设计出满足客户需求的产品提供了保障。
- 拥有高速计算中心，为疲劳等大计算量分析提供了高效的硬件解决方案。
- 与中海油研究总院、Marintek、大连理工大学、上海交通大学、Houston-Offshore等进行广泛合作，并提供持续的技术支持。

Analysis and design capability of Orient:
Software: Orcaflex、AQWA、ANSYS、ABAQUSE、CABLECA.
Partners: R&D of CNOOC, MARINTEK, Dalian University of Technology, Shanghai Jiao Tong University, Houston-Offshore.

先进的、专业的脐带缆制造装备

Advanced and professional equipment for manufacturing umbilical cables

东方拥有一套包括大型立式成缆机、铠装钢丝机、连续挤出装备及在线监测系统等在内的高自动化专用设备。这些都为客户提供优质可靠的产品提供了保证。

ORIENT Group has a series of highly automated equipments, including the vertical type cabling machine, the wire armoring machine, the extrusion equipment and on–line monitoring systems. These professional equipments guarantee that we can provide reliable

具有牵引力监控自动调整功能的大型多层次成缆设备能实现30个以上单元一次性同时成缆，并对成缆单元放线张力及总成缆张力进行实时监控，并自动调整各单元放线角度，有效保证软管/不锈钢单元成缆时的形变控制。

Our large multiple-layer cabling machine, equipped with tractive-force monitoring and automatic adjustment system, can lay up as many as 30 units simultaneously and meanwhile monitor the tensioning stringing of the cabling unit as well as the total cabling tension. It can also adjust the stringing angle of each unit, guaranteeing that the deformation of the hose/stainless steel unit is under control.

具有预张力可控和预扭功能的铠装机，有效解决因脐带缆生产过程中铠装排列和预张力不均而引起的钢丝受载时应力分布不问题。同时可使静态与动态双重功能的保护结构应用在东方的产品中。

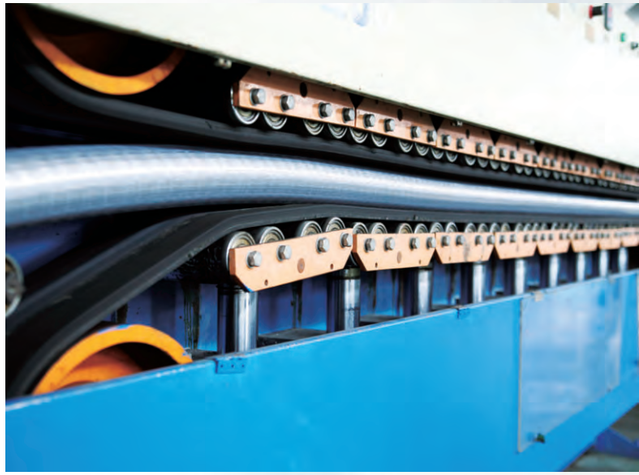
Our armoring machine can control the pretension and has the ability to pre-twist, solving the problem that during the umbilical cable production the distribution of stress on loaded steel wire is not uniform due to the nonuniformity of the pretension. At the meantime, the protection structure with both static and dynamic functions can be used in the products of ORIENT.

立式成缆机
vertical type cabling machine

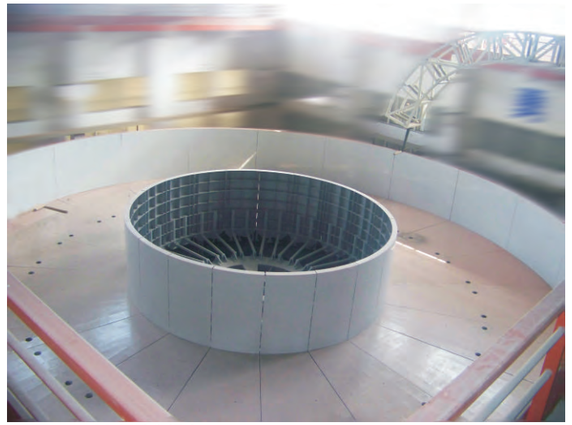
钢丝铠装设备
Steel Wire Armoring

可连续挤塑水冷型的挤塑系统，可满足最大250mm直径的护套挤出。并根据客户要求满足多种色彩（黑/黄/橙/红），多种材料(HDPE/TPU/PVC)的要求。

The plastic extruding system can satisfy continuous extruding and the maximum OD is 250mm. Variety colors (black / yellow / orange / red) and materials (HDPE / TPU / PVC) can be selected in accordance with customer's requirements.



200型挤护套设备
Type 200 Sheath Extruder



20米托盘设备
20m Carrousel

智能化的自动旋转收线装置直径达到了30m，可一次承重2000T以上，可满足90%以上海上油气田开发中需要用到的产品。

The diameter of our intelligent auto-rotating take-up device is 30m. The device can bear as much as 200T at a single device, which covers the needs of more than 90% of products used in offshore oil-gas field development.

智能的输送系统和深水码头，有效解决了超距离的脐带缆成品的装运及运输问题，避免脐带缆在运送过程中的二次损伤。

The intelligent delivering system and the deep-water wharf, efficiently solve the problem of long-distance shipping and transportation of our umbilical cables, avoiding secondary damage during delivering.

深水码头
Umbilical Sea Terminal

全方位、系统性的脐带缆测试设备

Test equipment to meet complete umbilical qualifications/verification requirements

东方拥有全套脐带缆测试解决方案和设备，依据ISO 13628–5进行严格测试，与挪威MARINTEK、大连理工大学、上海交通大学等机构院校开展合作，进行脐带缆单元及系统全面测试验证工作。脐带缆的组成单元复杂多样，其测试过程和项目也颇为复杂，东方依据标准要求，形成系统性的测试流程，从电、光和管等单元到最终的成品都需要经过严格的测试。

Orient has a full set of solutions and equipment for testing the umbilical cable. And the umbilical cable is strictly tested in accordance with ISO 13628-5. Orient also cooperates with some colleges and institutions, such as MARINTEK of Norwegian, Dalian University of Technology, Shanghai Jiao Tong University, testing the umbilical cable unit and the comprehensive system. As the unit which constitutes the umbilical cable is complex and diverse, the testing process and projects are quite complex. According to standards, Orient develops a systematic testing process. From the unit, such as electricity, light and tube, to the final product are all need to go through rigorous testing.

单元测试/Unit Testing

电单元：与一般海缆类似主要为直流电阻测试、绝缘电阻测、耐高压直流测试、电容电感阻抗测量、串音测试、时域反射测试（TDR）等。

光纤单元：水密性、光时域反射等。

软管：主要包括为检测软管抗内压能力的爆破试验、检测软管保压能力的试验压力/压力衰减测试、检测软管输送介质能力的流量试验、检测软管内壁清洁度的液体清洁度测试。

钢管：主要包括为检测钢管抗内压能力的爆破试验、检测钢管焊接工艺的无损检测、检查钢管介质输送能力的流量试验以及检查钢管内壁清洁度的液体清洁度测试。

All the electricity, light, steel tube elements are strictly tested according to ISO 13628-5 both before the production and during the production process.

系统测试/System test

拉伸测试：通过测试可得脐带缆成品的拉伸刚度和拉伸强度。其中的拉伸强度主要为验证脐带缆的抗拉能力；而拉伸刚度作为评价脐带缆力学性能的一个重要指标，同时也是整体分析的关键输入参数。

弯曲刚度测试：弯曲刚度类似于拉伸刚度为评价脐带缆力学性能的一个重要指标，脐带缆整体分析的关键输入参数。通过测试，验证其是否符合计算值。只有这样才能保证脐带缆水动力整体分析的准确性。

横向抗压测试：为确保脐带缆在储存、运输和敷设过牵引时抵御侧向压力的能力，需进行横向抗压测试

疲劳试验：疲劳测试可分为模拟敷设的低频疲劳和模拟在位运行的“高频”疲劳。其中后者试验周期高达数月，是对脐带缆性能严苛的检测。

The tensile test, bending stiffness test and lateral compression test are all carried out . Finally, the fatigue test is also carried out . Fatigue test can be divided into low-frequency fatigue for simulation installation and 'high frequency' fatigue for simulation in-place operation. And the latter one which may last several months is the stringent testing for the performance of the umbilical cable.

▲ 拉伸测试
Tensile Test

▼ 密封测试
Pressure Leak Test

▲ 交流耐压测试
AC Voltage Test

➤ 疲劳测试
Fatigue Test

Subsea Production System Umbilical

背景 / Background

水下生产系统用脐带缆分为钢管脐带缆和软管脐带缆，主要作用是为水下生产系统提供电气液压动力、化学注入通道，同时为上部模块控制信号以及水下生产系统提供数据传输通道。

The subsea production system umbilical includes steel tube umbilical and hose umbilical. The primary function of a subsea umbilical is to provide a control and supply link between top side vessels / platforms, to subsea oil and gas equipment, or subsea links between equipment.

主要挑战 / The main challenges

●钢管脐带缆在位运行时钢管单元会因为滑动摩擦和反复弯曲而产生疲劳问题，降低脐带缆使用寿命。

●钢管脐带缆在生产过程中由于要经过反复挤压、拉伸、弯曲等变形过程，容易造成塑性应变累积，降低其使用寿命。

●随着应用水深不断增加，对脐带缆提出更高的抗压溃等强度要求。同时也对脐带缆的抗拉强度、抗拉刚度、径向收缩等截面结构设计问题带来了新的挑战。

●脐带缆要求大长度联系生产，并保证无中间接头。这就对脐带缆生产、储存、运输和安装都提出了新的挑战。

●随着管单元压力等级的不断提高，对脐带缆所用钢管和软管所用材料强度、抗腐蚀和抗渗透性提出更高的要求。

● A dynamic umbilical is used to link a floating top-side vessel to subsea equipment and is designed to withstand high pressure fluid containment and a high tensile load with fluctuations generated by the vessel motion causing fatigue mechanisms. slip-stick friction behavior and repeated bending will serious affect the life of the umbilical.

● The umbilical steel tubes will be subject to large stress / strain reversals during fabrication and installation.

● We need innovative materials to meet the increasing strength and corrosion prevention requirements.

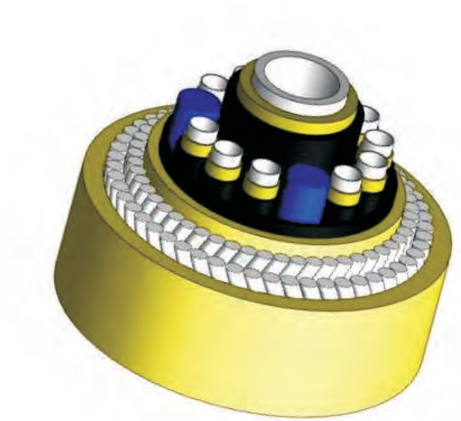
东方解决方案 / Orient solution

●通过反复分析、优化脐带缆截面设计，提出创新性的非紧压型脐带缆截面结构。在保证径向刚度的同时，降低单元间的挤压和摩擦，从而避免脐带缆因滑动摩擦而造成疲劳失效。

● Through optimize umbilical cross-section design, Orient propose innovative, non-compacted type umbilical cross-section structure. Which can ensure the radial stiffness, at the same time reduce the friction and bending stress of the tube. At last, solve the fatigue problem.

●东方脐带缆采用凯夫拉编织软管、超双相不锈钢管、纵向防水及抗水树的电单元及应用于海底环境的光缆单元等构件并配备了防腐和耐摩擦，耐紫外光的保护系统，解决了海洋环境中的应用状况。

● We use the high performance Materials, such as Kevlar Reinforced hose and Superduplex stainless steel tube to take up the challenges.



●根据工程经验，东方的工程师建议软管脐带缆应用于300m水深以下的环境中；在超过500m水深的海域，使用钢管脐带缆代替软管脐带缆，同时通过结合截面设计和水动力分析，优化截面结构，提高抗拉强度（可达到100吨），优化弯曲刚度最终脐带缆能满足1500m以下水深的应用。

●东方具有钢管连续焊接技术，世界领先的多单元成缆设备（高达38m）、智能收线托盘和深水码头。这些都为大长度脐带缆联系生产提供了有效保障。

● We have the advanced highly automated facility in the word, which can minimize accumulated plastic strain during production process

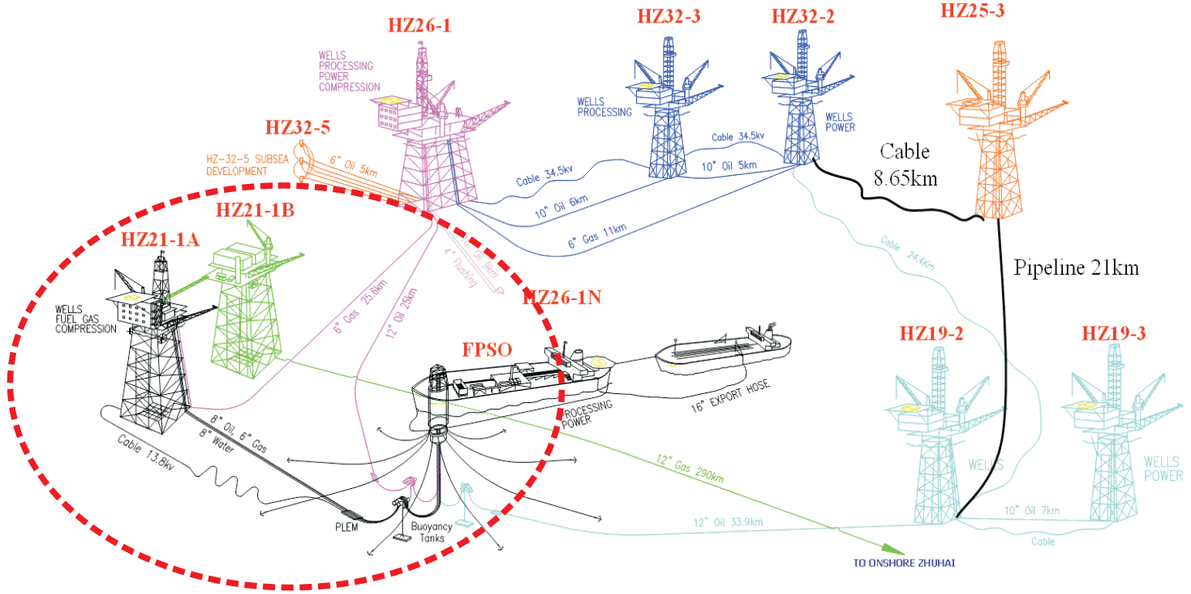
Dynamic Umbilical

背景 /Background

● 该动态脐带缆主要用于连接海上浮式平台、FPSO和进口平台之间的电力以及信号连接、海上浮式风力发电设备的电力输送。一般分为动态和静态部分。所有的动态脐带缆产品都需通过客户化设计与制造以适应动态应用的挑战。

● 该系列产品还可以应用于任何需要进行动态环境使用的工程或者装备上。（如代替柴油发油改用岸电供应的海底矿产挖掘作业船的电力传输，海洋浮式设备之间的电力连接等）

● The dynamic umbilical can used as power and signal connecting line between FPSO/Floating platform and wellhead platform, power transmission line for wind power , tidal power and other renewable power. The umbilical can generally be divided into dynamic and static parts.



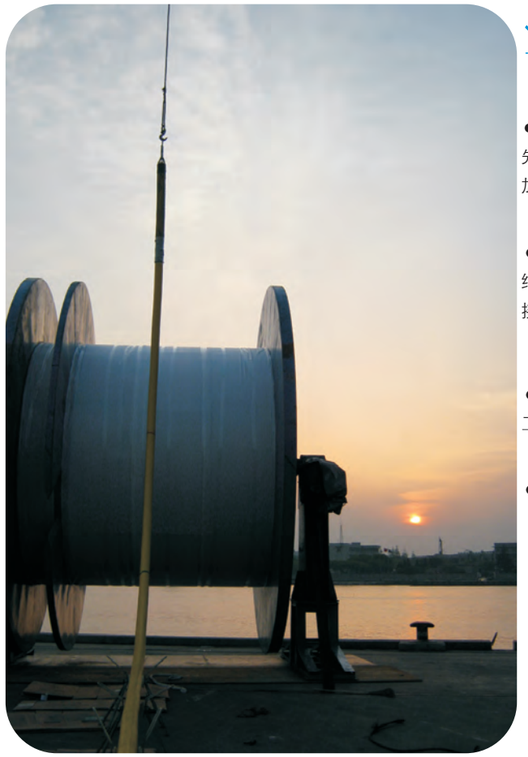
红色圆圈标注区为本公司产品在实际领域的应用
The red mark is the application area of our umbilical

主要挑战 / The main challenges

● 动态脐带缆在位运行时，铠装钢丝和铜芯等金属单元会因为反复弯曲而产生疲劳问题，而铠装钢丝作为主要承受拉伸荷载的单元，在弯曲和拉伸荷载的共同作用下，更易产生疲劳失效和极限过载失效

● 动态脐带缆一般分为静态段和动态段，两段间的硬性连接将对动态缆的存储、安装造成不利影响。这也是动态缆制造的难点之一。

● The main challenges of the dynamic umbilical are steel armor fatigue and the connection between the static and dynamic part.



东方解决方案 / Orient solution

● 采用紧压细铜丝绞合结构，避免铜芯因弯曲应力过大而产生疲劳失效。使用先进具有预张力可调和带预扭的钢丝铠装机和高强度钢丝，有效保证钢丝缠绕加工成型时结构均匀，使其在位运行时受载平均，避免了应力集中。

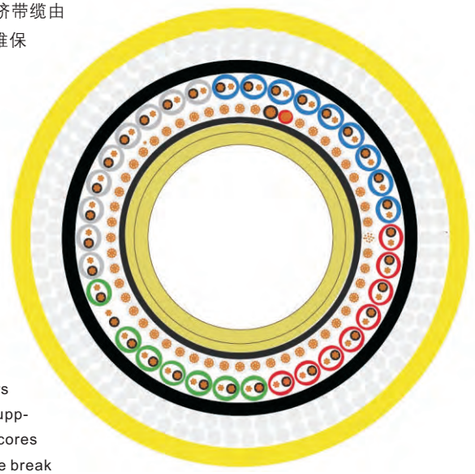
● 东方根据动力脐带缆分为动静态两段的特点，提出了创新性的柔性连接接头结构方案。避免了因安装硬性接头而产生的存储和安装问题，并有效保障了连接处的强度和密封性。

● 东方产品解决了通讯，电力，监测等多功能单元的复合技术，为用户节约了工程设计时间并有效降低工程费用。

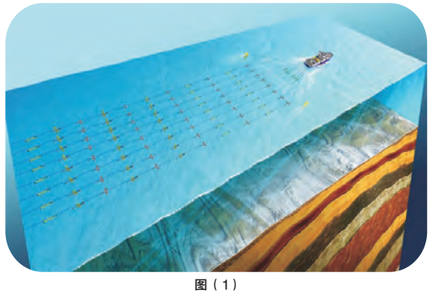
● We take advantage of the innovative umbilical cross-section structure and high strength steel armor to avoid the fatigue causing problem. We also innovatively apply the flexible connecting to solve the static and dynamic jointing problem.

Airgun Umbilical

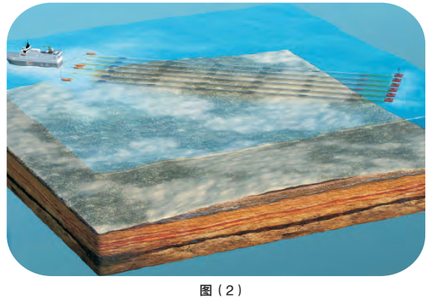
东方可提供用于海洋石油地震勘探系统的气枪脐带缆。通常，气枪脐带缆由输气软管及各种用途的光缆与电缆组成，用铠装钢丝编织层或高强度纤维保护层进行充分的保护，使气枪缆有着优异的抗拉强度，确保其有足够的拖曳负载的能力，准确可靠地传输光，电，气等信号或介质。东方的各种不同孔径的高压软管，耐压等级有3000psi、2000psi及以下，另有44~122芯的双绞或四绞数据线，以控制气枪的开合，两层钢丝铠装承重，可承受达60吨的破断拉力，最外层护套可选用多种材料，起防水及保护作用。



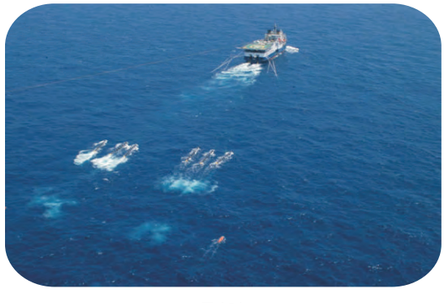
Orient provides the airgun umbilical for used in both towed and bottom laid seismic systems. Typically airgun umbilical comprises a central pneumatic hose or multi-hose with power and signal elements laid up over it, other like grouped electrical and/or fiber optic components can be added. The airgun umbilical uses steel armoured or aramid fiber strength layers to protect inner components form tow loadings. Orient umbilical hose can be supplied with different sizes and the hose work pressure is up to 3000PSI.44 to 122 cores of pairs/quads cable can be added to control of firing and other equipments. The break tension strength of double steel wire armours can be reached to 60t. Various type of material can be selected as water-proof and protection components.



图（1）

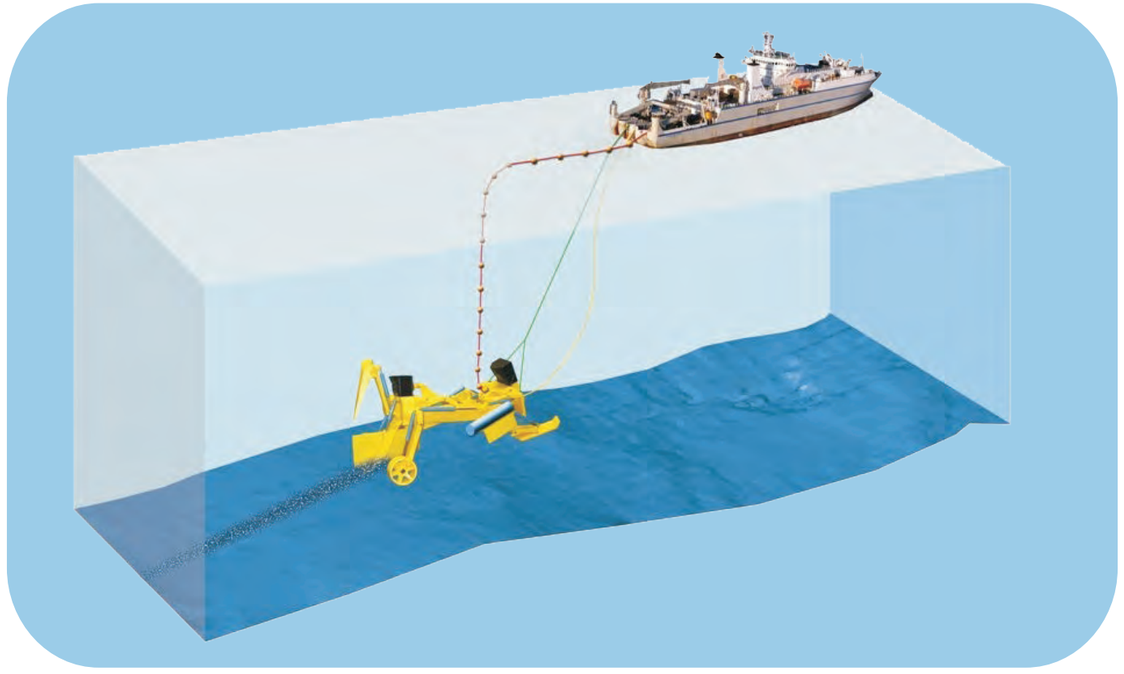


图（2）



图（3）

Customized Umbilical



适用于海底挖沟、海底打捞、海底采矿、海洋勘探等海洋工程中设备的连接，包含电力、信号传输以及管道等各种所需单元，专为海底特殊工作环境设计。可根据客户的特殊要求进行设计和制造。

东方的产品设计具有结构稳定、性能优良的电磁兼容设计，确保电缆具有良好的信号传输质量；护套材料采用耐水性能优异的热塑性弹性体材料，机械强度高，耐磨性好，电缆的水密封性能优异；电缆具有高可靠性和耐用性；电缆的钢丝铠装层多为扭矩平衡设计，不易发生扭转。

Orient designs and manufactures subsea umbilical used for subsea equipments, such as crawler, trencher, plough, etc. This product is especially suitable for subsea working condition. All design and manufacture will be according to custom's request.

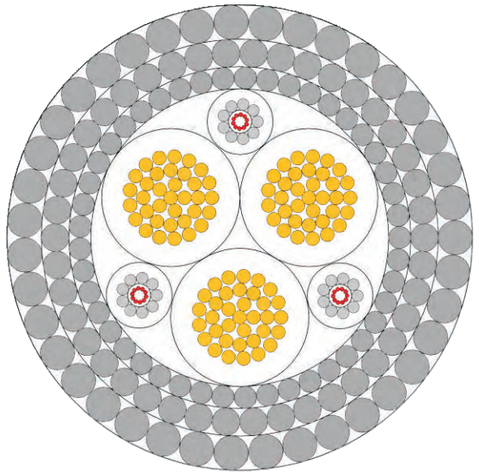
Orient design offer excellent structure stability and EMC performance; thermoplastic elastomer water-tight sheath provide highly mechanical strength and abrasive resistance; highly durability and reliability; Torque balanced steel wire armour design.

ROV Umbilical

为水下机器人等潜水设备提供机械承重、传输动力及控制信号，具有优良的动态柔韧性和紧凑的单元组成设计，满足反复收放要求，可根据客户的不同要求设计单元组成，外层采用多层高强度钢丝、kevlar纤维铠装承重，稳定性和安全性高。

Orient offers a full range of customizing umbilical cables providing the power, signal, and mechanical link between a surface vessel and submarine vehicle, such as ROV. Our designs offer the most compact electrical and fiber optic assembly diameter, highly flexibility and can be strengthened with either high strength synthetic fibers or multi-wire armoring layers to support the weight of the associated ROV, package, handling forces, vessel motion, and tidal forces.

These variants can be produced in long continuous lengths.



Subsea Tow Umbilical

东方提供的拖曳脐带缆拥有优异的抗拉强度，有效提高拖拉荷载等级，针对海洋应用进行特殊设计，拥有最小的直径与重量。其包含各种用途的光纤与电缆，用铠装钢丝编织层或凯夫拉保护层进行充分的保护，确保内部功能单元的安全，并为客户提供特殊终端的定制和严格的最终产品测试。

Orient designs and manufactures small size and light weight to umbilical systems especially for submarine uses. Tow umbilical normally contains Electrical, fiber optic, and steel or synthetic strength members to provide highly mechanical strength. We also provide special termination according to custom's requirements. The final product will be fully tested under the strict standard.

Parameters and form

东方的工程师建议客户提供以下参数，以便我们的设计团队为您量身定制一条适合工程应用的脐带缆.

The follow table is the information we need to design a suitable umbilical, please kindly provide these information to us when you have a request.

电力单元/ Power					
导体截面 Power core Size		导体数量 Core Qty		地线或屏蔽 Earth core or braided screen	
电压等级 Volt rating		载流量 Current rating		外护套材料 Preferred sheath material	
使用温度范围 Temperature range		工作温度 Operational temperature		峰值温度 Peak temperature	
纤维编织材料 Strength braid (if need)		最大允许外径 Max. cable O.D.		终端接头要求 Likely cable connector type	
其它特殊性能要求 Special performance characteristics		特殊测试要求 Special testing requirements			
信号单元 /Signal					
导体截面 Power core Size		导体数量 Core Qty		地线或屏蔽 Earth core or braided screen	
线芯类别（对绞、四线、单线） Grouping(pairs, quads, single cores)			屏蔽类型 Screen type		
使用温度范围 Temperature range		工作温度 Operational temperature		峰值温度 Peak temperature	
纤维编织材料 Strength braid (if need)		最大允许外径 Max. cable O.D.		终端接头要求 Likely cable connector type	
光纤单元 /Optical fiber					
光纤类别 Optical fiber type		光纤芯数 Fiber core qty		最大允许外径 Max. cable O.D.	
脐带缆 /Umbilical Overall–assembly					
重量允许范围 Umbilical weight range		允许外径范围 umbilical O.D. range		阻燃要求 Standard or flame retardant	
铠装材料 Preferred strength member type		铠装层数 Armour layers		浮力系数 Buoy factor	
最小弯曲半径 Minimum bending radius		抗拉强度 Working tension strength		产品长度 Umbilical length	
您的其他要求 Other requirements					

工程案例

Engineering Case

◀ 钢管脐带缆项目：

东方设计并生产了一条适用于南海1500m水深的钢管脐带缆。主要技术指标为:脐带缆截面包括3根4芯6mm2电单元，6根直径12.7mm不锈钢管单元和1根12芯单模光纤单元的水下生产系统脐带缆。使用温度为:-15℃~ +40℃，设计寿命为20年。

The umbilical includes three 4-pin 6mm2, voltage 600V power cable; six 12.7mm ID stainless steel pipe, pressure rating 345Bar; fiber optic cables: six optical fiber; optical wavelength 1310nm; ambient temperature: -15℃ ~ +40℃; design life : 20 years.

◀ 动态脐带缆项目：

东方设计、制造并提供了一条3km长，8.7/15kV 3×185mm2用于连接南海发现FPSO和HZ25-3/1井口平台的动态脐带缆。动态脐带缆的动态部分采取lazy-s线性敷设，并平行于连接进口平台和FPSO的生产柔性立管。柔性立管和脐带缆同时通过一个用锚链连接于海底的中水浮筒。整个脐带缆系统同时包括位于FPSO旋转塔锚固处的防弯器和用于动力脐带缆动态部分海底固定的夹具。动力脐带缆的静态端通过J型管固定与进口平台上。

Orient designed, manufactured and supplied a 3km, 8.7/15kV 3×185 dynamic power umbilical. The dynamic section of the umbilical is installed in a lazy-s configuration alongside flexible risers which transfer product from the Well Head Platform to the FPSO. The risers and umbilical then pass over a buoyed mid water arch (MWA) which is tethered to the sea bed. The configuration also includes dynamic bending stiffeners at the FPSO turret J-tube hang off and a hold-back structure at the seabed where the static umbilical section begins. The umbilical static section is installed in a J-tube at the WHP.

◀ 印尼BLT项目：

东方为印尼BLT公司设计提供了一根用于FPSO和进口平台之间作为动力和信号连接的光电复合动力脐带缆。脐带缆规格为3×(3 Core – 1 AWG)+ 1×(4 Core – 500 MCM)+1×24FO。设计抗拉强度为40吨，使用寿命为25年。

Orient designed, manufactured and supplied a 3×(3 Core – 1 AWG)+ 1×(4 Core – 500 MCM)+1×24FO power umbilical for power and signal link between the FPSO and the wellhead platform for BLT company.

▶ 其他项目：
Other projects:

- ▶ 物探船用气枪缆项目 (图1)
  Airgun umbilical project
- ▶ 客户定制脐带缆项目 (图2)
  Customized umbilical project
- ▶ 海底挖沟机脐带缆项目 (图3)
  Subsea trencher umbilical project
- ▶ 动态脐带缆项目 (图4)
  Dynamic umbilical project
- ▶ 电力及通信复合动态缆项目 (图5)
  Dynamic umbilical project
- ▶ 软管脐带缆项目 (图6图7)
  Thermoplastic hose umbilical project
- ▶ 印尼动态脐带缆项目 (图8)
  Indonesia dynamic umbilical project

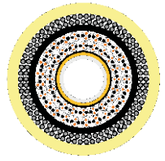


图 (1)


图 (2)


图 (3)


图 (4)

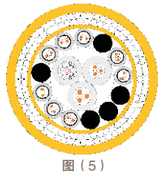


图 (5)


图 (6)

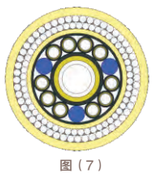


图 (7)


图 (8)

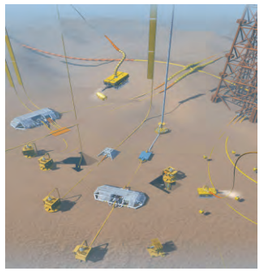
脐带缆系统附件

Umbilical System Accessories

随着我国对能源需求的不断增大，从海洋中提取油气资源的力度也在不断加强。而在能源开采与输运的过程中，脐带缆以其易弯曲、防腐蚀、方便铺设与回收、可设计性强等优势得到了越来越广泛的应用。特别是在海洋石油开发的应用中，脐带缆的应用逐渐成为一种趋势。而其配套的各种附件也成为必不可少的装备。

东方通过不断的技术交流和创新，已与国际专业的附件生产厂商取得了合作。针对不同海域环境和不同种类的脐带缆，东方将为您提供更好更专业的附件设计及配套选型。

Umbilical accessories are indispensable components in the umbilical system. According to the specific marine environment and the type of the umbilical, ORIENT will provide you with better accessory design and matching selections.



➡ A 脐带缆集成终端接头（UTH）
Umbilical Termination Heads (UTH)

在脐带缆的使用中，其端部都要与其他设备构件相连接，如脐带缆上部与FPSO单点以及脐带缆的下部与海底管汇基盘(PLEM)的连接、脐带缆上部与动力设备以及脐带缆下部与水下机器人（ROV）或拖曳声呐等拖曳设备的连接。

在这些连接的地方，往往会出现管道、控制线路及光信号线路的数量过大且集中等现象，特别是在动态脐带缆应用中，连接处又发生疲劳失效的可能，会给脐带缆的使用性能造成严重损害，导致生产效率的大大下降。

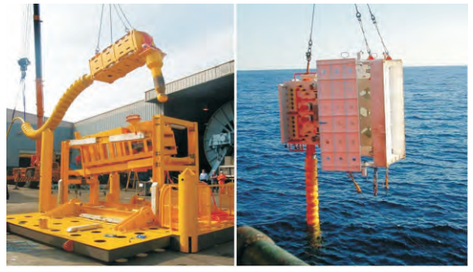
所以，在这些连接处要安装使用系统集成终端接头，承载脐带缆的绝大部分拉力，防止事故的发生，并将各个光电液压单元的接头，集成总装到一个终端上面，以方便脐带缆统一的连接到水下生产系统设备上，保证其安全稳定的运行。作为脐带缆不可或缺的辅助构件在实际生产工作中发挥着重要作用。

特点：316L不锈钢或钛合金等金属材料制作专用的防水耐压抗腐蚀壳体；根据不同脐带缆规格进行针对性设计；确保安装使用时方便可靠；专业的结构设计，确保使用的稳定性，并承受恶劣的海洋环境中。

应用领域：水下生产系统、ROV系统、拖曳设备系统、水下摄像头和水下灯、地震气枪和OBC系统、海洋学的仪器、滑环等.

Umbilical termination heads are mainly used in the connection of the upper-part of the umbilical and the single-point of FPSO, the connection of the lower section of the umbilical and PLEM, the connection of the upper part of the umbilical and the power equipment and the connection of the lower section of the umbilical and ROV (or towing equipments such as towed sonar).

Application fields: Underwater production systems, ROV systems, towing equipment systems, underwater cameras and lamps, seismic airguns and OBC systems, instruments and slip rings in Oceanography, etc



B 脐带缆单元连接器
Connectors for units in the umbilical

此类产品用于确保脐带缆内部各个单元能可靠的与设备连接，保持各个电单元、气、液压单元、光单元的传输畅通.

Such products are used to ensure that each unit in the umbilical are link with other devices firmly, and keep the transmission of each electrical unit, gas, hydraulic unit and optical unit unimpeded.

①电单元连接器
Connectors for electrical units

水下电单元连接器是指能够在水环境中安全可靠工作的电气连接器。是商业和军事领域水下设备水下连接器不可缺少的连接系统，它是接通信号和电流的嫁接桥梁，也就是电缆和水下设备联通的接口，要承受海洋全海域高压，高温，耐腐蚀考验。未来，在海洋工程技术领域，随着商业和军事工程对水下电子设备的需要日益增多，促进了水下连接器的发展。

关键及挑战：深水高压环境下的电气性能、海水环境中的防腐性

应对方案：根据脐带缆内部电单元的不同的芯数及电压配套专用的水下电单元连接器，满足其性能指标；针对深水环境及电气性能要求，进行针对的结构设计，同时满足电气性能、防水密封性及高压力海洋环境，满足2000米水深环境使用；使用316L不锈钢或钛合金制作接头外部壳体，防止恶劣的海洋环境对水下电单元连接器的腐蚀。

应用领域：水下生产系统、ROV系统、水下摄像头和水下灯、地震气枪和OBC系统、海洋学的仪器、滑环等.

Underwater connectors for electrical units are referred to electrical connectors that can work safely and reliably in watery environments.

Application fields: Underwater production systems, ROV systems, underwater cameras and lamps, seismic air-guns and OBC systems, instruments and slip rings in Oceanography, etc.

②液压管单元连接器
Connectors for Hydraulic pipe units

液压管端或管接头通常由他们所连接的设备的油口所决定，并且设备的产地对管接头的型式有很大的影响。虽然已经对连接件的型式作过标准化和优化的工作，但是仍然存在各种不同的连接系统。为保证系统长期无泄漏的运行，在系统设计中应考虑到液压单元接头的类型或密封的型式。

关键及挑战：深水环境下的密封性、耐高压性、海水环境中的防腐性.

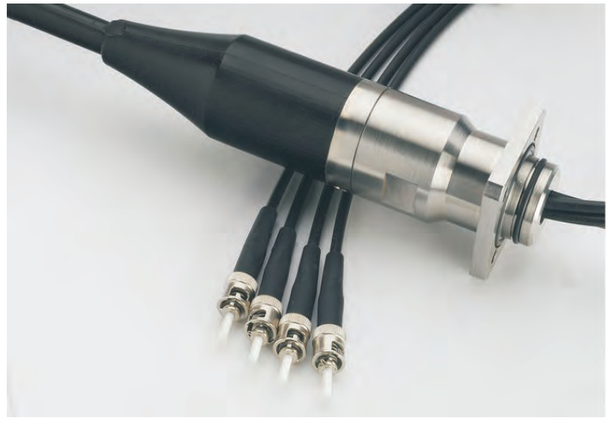
应对方案：根据脐带缆内部液压单元的不同要求配套专用的液压管单元连接器，满足其性能指标；使用316L不锈钢或钛合金制作接头外部壳体，防止恶劣的海洋环境对水下液压管单元连接器的腐蚀.

应用领域：水下生产系统、海洋工程应用.

Hydraulic pipe or fitting is usually determined by the oil port of the device and the origin place of the equipment has greatly influence on the fitting type. Although the standardization and optimization work has been carried on the connector type, there are still different connection systems. The design should consider the type of hydraulic connector or sealed mode to ensure the long-term and no leak operation.

Application: Submarine production system, offshore engineering application

③光纤单元连接器
Connectors for optical fiber unit



在实际应用中，光纤的信号传输是否通畅将起到很关键的作用，特别在ROV的应用中ROV水下拍摄到的画面需要实时的反馈到控制室里。因此水下的光单元连接器是商业和工业领域水下设备水下连接器中不可缺少的连接系统之一。

关键及挑战：深水环境下的密封性、耐高压性、海水环境中的防腐性。

应对方案：根据脐带缆内部光单元的芯数要求配套专用的连接器，采用扩展光型连接技术，与其它公司采用的对接型连接技术相比，这种新型的连接技术更加适应了海洋恶劣环境应用要求，简化了维护保养工作，有效降低了因纤芯对接磨损而引起的光纤传输故障，有力提高了连接器的插拔次数；使用316L不锈钢或钛合金制作接头外部壳体，防止恶劣的海洋环境对水下电单元连接器的腐蚀。

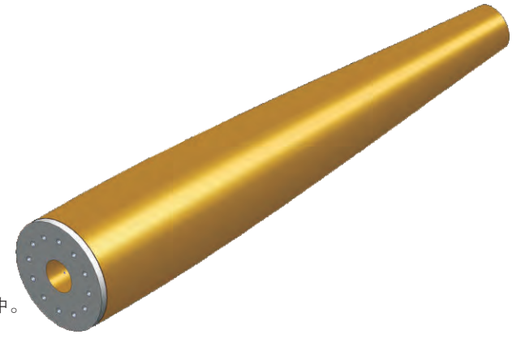
应用领域：ROV、ROTV（水下拖体）和UUV系统、视频和数据光电转换器、海底埋缆机、声学传输、常用的水下光纤组合、水下光纤通信等。

Use of the system is in principle unlimited with respect to water depth and design lifetime, submerged in seawater, is 25 years. The termination is completely oil filled and pressure and temperature compensated within wide ranges through Anguila hoses. The termination may be a stand-alone unit or integrated in the umbilical head.

All our fiber optic contacts are machine polished to provide the best insertion loss and return loss. Connectors can be terminated to cables and oil -filled assemblies according to customer's requirements.

C 附属配件
Accessories

①弯曲加强器
Bending stiffener

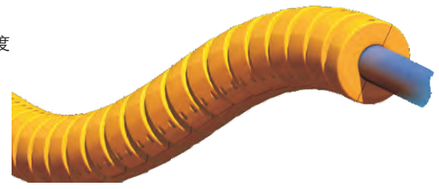


通常脐带缆都连接于硬性结构物上，如立管基座和浮式采油船的转塔等。由于恶劣的海洋环境和管线负载等情况引起管线在固定端不停运动，此时很容易造成管线疲劳和破损。在管线端头应用弯曲加强器从而保护管线的最小弯曲半径。

应用领域：海底动态使用状态、水下机器人连接处等动态海洋环境中。

Dynamic flexible risers, power cables and umbilicals may be connected to a rigid structure such as a subsea riser base or the turret exit of a floating production vessel. The presence of environmental loads subsequently causes the riser to flex about this fixed location. This movement, in combination with large axial loads may cause damage to the riser structure due to overbending and fatigue. These produces individually designed integral bending stiffeners for rigid riser end fittings. These conically shaped polyurethane mouldings add local stiffness to a riser, flowline, cable or umbilical to limit bending stresses and curvature to acceptable levels. Each bending stiffener is designed individually to protect the riser minimum bend radius (MBR) under the defined tension and angle combinations, meeting the loadcases (tension vs angle) of each application, and are specified as either dynamic or static depending on their intended use.

② 弯度限定器
Bending Restrictor



可将浮力块嵌入轭圈内部，直接安装于ROV或挖沟犁控制脐带缆末端，配合弯度加强器保护脐带缆最小弯曲半径并保持脐带缆平顺形状。

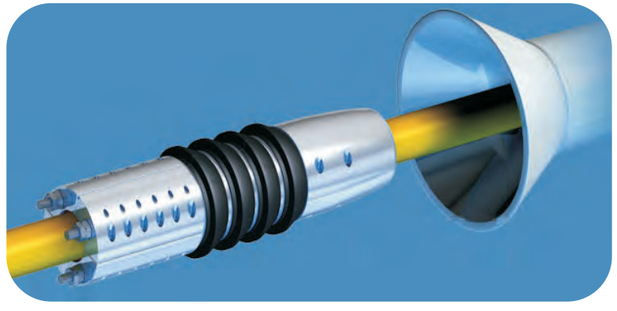
应用领域：水下生产系统模块连接处、海底动态环境等。

Flexible pipes, flowlines, power cables and umbilicals are usually connected to a rigid-structure such as a subsea riser base, PLEM or wellhead. To prevent these pipes from ove-rbending at the interface between flexible and rigid structures, Bending Restrictors are often installed on the pipe.A Bending Restrictor as it is more commonly known is specifically used where static (or quasi static) loads act on a pipe, rather than dynamic loads when a Bending Stiffener would be more suited.

③ J形管密封
J–Tube Seal

用于海洋采油平台的J形管与柔性海底输油管道连接处的密封，具有防腐性能。产品有无潜安装和潜水员协助安装两种。

A J-tube seal is designed to act as a seal and as a corrosion inhibitor between an umbilic al/flexible riser and a J-tube or I-tube on offshore platforms



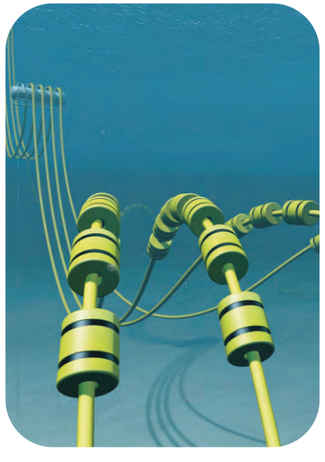
应用领域：海洋采油平台J形管或I形管末端。

④ 模块式浮筒
Distributed Buoyancy Modules

应用于浅水/深水区浮式结构物的安全系泊。通常由系泊链、绳索和浮体单元组成。可满足油轮、浮式采油船、半潜式钻井平台和其他深水平台等的系泊要求。

应用领域：浅水或深水区域浮式结构物得安全系泊。

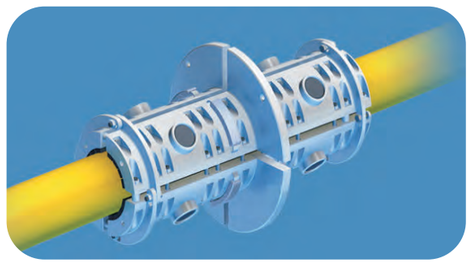
In floating production scenarios, flexible risers, cables and umbilicals are often required to be held subsea in geometric configurations other than what would form naturally under the riser self weight (catenary). To maintain these configurations buoyancy is used and one method is to attached discreet buoyancy to the outside of the riser. These units are commonly called Distributed Buoyancy Modules (DBMs).



⑤ 脐带缆夹具
Clamp

此类设计的夹具，用于脐带缆或软管的连接。特别是应用于软装在中水浮筒上或者海底回转式连接的固定。

These fully engineered clamps are for attaching to umbilicals / flexible pipes. Typically used in riser applications as an anchor device where the riser lies over a mid-water arch or as a tether point for tieback situations.



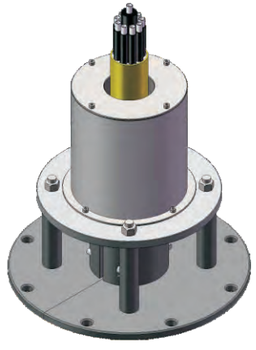
应用领域：中水浮拱、海底回转式连接的固定。

⑥ 脐带缆锚固装置
Hang– off

此类产品的特点在于机械性固定脐带缆或海底电缆的铠装层，确保负载通过脐带缆结构被安全承载。同时配置有海上防腐阳极保护系统，以免对平台等海洋装备产生腐蚀破坏。

应用领域：海洋采油平台端脐带缆等的安装固定。

Mechanically fixed the umbilicals armoring to ensure that through umbilicals structure is safe load carrying capacity.



⑦ 脐带缆盘具及收放线系统
Umbilical Reels

根据不同规格的脐带缆进行单独设计，符合每条脐带缆自身饿到最小弯曲半径，适用于脐带缆的收放线，以便于脐带缆在运输过程中不受到损伤。同时可应用在海洋敷设安装上进行直接施工，从而节约工程施工时间并降低周转次数。

应用领域：脐带缆的收放线、运输及敷设。

Radoil reels are built and tested to be very sturdy and durable. Upon customer request our reels can be operated locally, from a remote control panel or both.

工程技术服务

Engineering Services

东方专业的工程服务团队能够为客户第一时间提供技术支持和安装、维修等服务。这些领域主要包括脐带缆缆产品和系统和风力发电等新能源高压电缆等。东方工程服务队已经成功走出中国，在印尼等东南亚国家为客户提供了高效可靠的脐带缆系统的安装和技术服务。

我们能为您提供的服务：

- 产品系统安装服务
- 售后技术指导服务
- 系统技术培训服务
- 现场维修服务
- ……

The professional engineering services team of Orient could provide technical support and installation, maintenance and other services to the customers at first time. These areas mainly include the cable products and systems of umbilical cable and some high-voltage cables for new energy, such as wind power. The engineering services team of Orient has successfully come out of China, and provides efficient and reliable installation and technical services of umbilical cable system to the customers in Indonesia and other countries at Southeast Asian.

The services we could provide to you:

- installation services of product and system
- technical guidance services after sales
- training services of system technology
- repair services on-site
- ……

地理位置

Company Location