



天津海油工程技术有限公司  
PETRO-OFFSHORE ENGINEERING CO., LTD.

# 近距离管道的集束浮拖安装方案

---安哥拉海底管线项目实例



Surface Tow Method for Installing Bundled Submarine Pipeline  
Implemented at Sonangol Oil Berth Project

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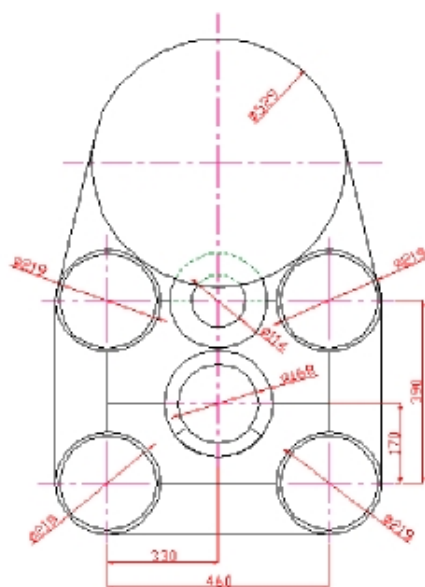
## 安哥拉海底管线项目实例

本工程是安哥拉国家石油公司油码头项目中海底管线及平台工艺管线部分。共有4根 $\Phi 219$ 的管线，其中3根分别用来输送汽油、柴油、航空煤油，另外一根备用，1根 $\Phi 168$ 的淡水管线、1根 $\Phi 63$ 的备用水管和1根 $\Phi 114$ 的光电复合缆。针对现有码头油轮频繁靠泊的情况，POE采用了创新的多管捆绑设计、浮拖、管束经过入水桥由拖轮牵引下水、海面立管连接及两端分别下沉就位的方案成功安装。每根海管长600多米，水深13米，埋设前水深16-18米。POE负责工程的设计、采办、施工、安装以及清管试压工作。整个项目完成了45份项目文件，其中包括：9个项目管理文件，7个设计规格书，6个设计计算书，32个建造、安装、调试程序以及所需要的图纸、采办料单等，所有文件顺利通过英国咨工的审查。整个项目在较短的时间内采办了材料、设备、机具等600余种。焊接一次合格率近100%。本工程于2008年2月完工，2008年6月份正式通油使用，并得到业主的高度评价。

### Surface Tow Method for Installing Bundled Submarine Pipeline

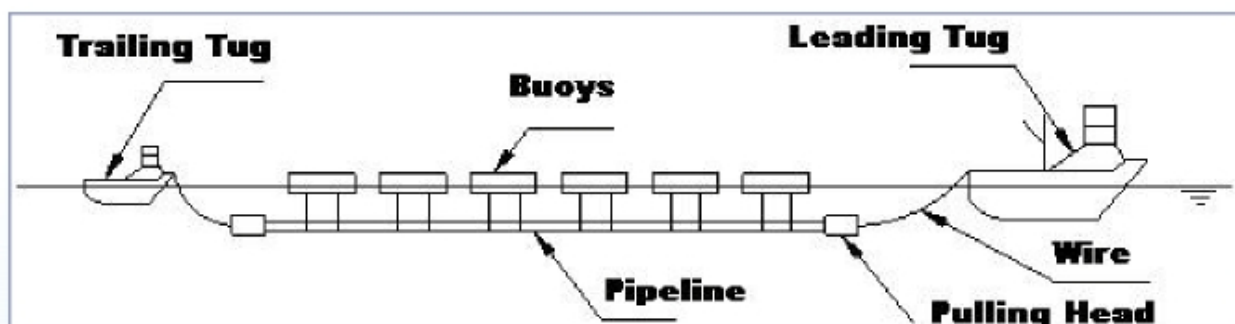
#### Implemented at Sonangol Oil Berth Project

Sonangol Oil Berth Facility is located in Luanda, Republic of Angola. POE's scope of work included engineering, procurement, construction, installation and commissioning including pigging and hydrotesting of submarine pipelines and platform process piping. The project has four  $\Phi 219$  product pipelines for gasoline, diesel, jet fuel and a future, respectively. It also includes one  $\Phi 168$  pipeline for fresh water, one  $\Phi 63$  backup water pipeline and one  $\Phi 114$  communication and power cable. Each pipeline is 600m long and water depth is 13m. The pipeline bundle is buried at about 4 meters to avoid future dredging damage. In order to minimize the interferences with the oil shuttle tankers that frequently berth the quay side that the submarine pipelines are to land, POE proposed innovative bundling design for the project. The project achieved a series of key engineering milestones: chute bridge launch, surface tow, riser surface tie-in and lowering two ends separately. Project team completed 45 major project documents, including 9 project management documents, 7 design specifications, 6 design calculation reports, and 32 various procedures covering construction, installation and commissioning. All the documents have been certified by 3rd party verification agency, Scott Wilson, a specialized consulting firm from UK. The project procured more than 600 items of materials, equipment and tools. The first time passing rate for welding is near 100%. This project was completed in February, 2008 and put to use in June, 2008.



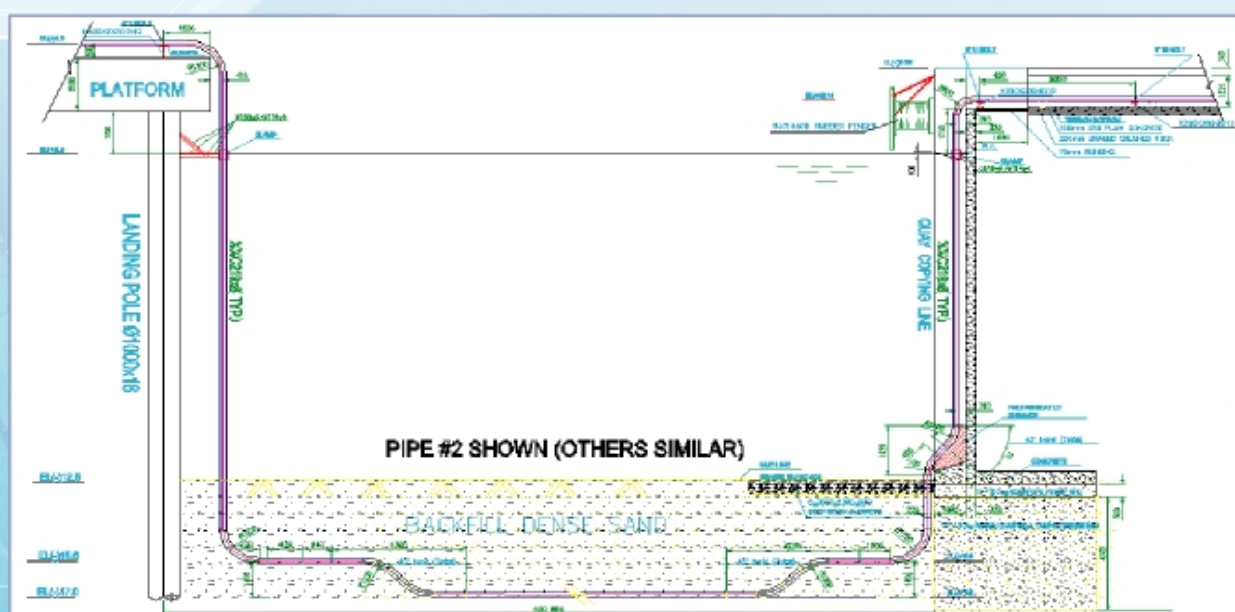
安哥拉海管绑扎图

Angola Submarine Pipeline Bundle



安哥拉海管浮拖法铺设示意图

Illustration of Sonangol Submarine Pipeline Surface Tow Method



工程截面图  
Profile

安哥拉项目组由项目经理、工程师、焊工、无损检验人员和当地工人组成，共计投入约80人，所有的工程师在海洋工程设计、建造和安装方面都有丰富的实战经验。全部的焊工都有DNV颁发的焊工资格证书。下面是工程现场各个阶段的照片。

Our project team consists of project manager, engineers, welders, NDT inspectors and local workers, about 80 people altogether. Our engineers have rich experiences in offshore engineering design, construction and installation. All the welders in this project have extensive experiences in oil and gas industries and had been certified by Det Norske Veritas (DnV) before they were mobilized to the site. The following are photos of every process on site.



## 安哥拉海底管线项目实例



绑扎好的管线和浮筒  
Pipeline Bundle and Buoys



绑扎好的管线和浮筒  
Pipeline Bundle and Buoys



POE员工和当地工人在场地  
POE staff and local workers on site



预制场地  
POE Pre-Fabrication Yard



管线下水  
Launch out



浮拖法铺设  
Surface Tow





舷吊  
Davit lift



立管连接  
Riser Tie-in



立管连接  
Riser Tie-in



立管保护架  
Riser Guard



清管试压  
Pigging and Hydro test



POE人员现场合影  
Group photo of POE staff on site



## 安哥拉海底管线项目实例



海底电缆海上铺设现场  
Laying submarine cable



平台工艺管线组装  
Assembling platform process piping



平台消防系统试验  
Testing fire system of platform



海洋平台输油轮停靠使用  
Oil tanker docking

此项目共投入16个集装箱的材料与机具，其中包括发电机、空压机、制氮机、各种电焊机、喷砂机、起重机、铲车等。下面是主要的设备和机具。

All the tools and materials were shipped from China in 16 containers. The major equipment used includes generators, air compressors, Nitrogen generator, welding machines, sand blasters, cranes, forklifts, and so on. The following are main equipments and facilities.





Argon-arc welding machine  
(WSM-315)  
1



Argon-arc /manual welding machine  
(ZX7-400ST)  
5



Manual welding machine  
(ZX7-400)  
4



CO2 electric welding machine  
(TKIII-500)  
2



AC arc welding machine  
(BX1-500) 2



Magnetic pipe gas  
cutting machine (G2-11)  
3



Pigging and Hydro  
test equipment  
1 set



Pipe grabbing forklift



Total Station Instrument  
(NTS662)  
1



Transit instrument (DT-02)  
1



Level instrument (NL32A)  
1



Shanghai diesel generator  
(300KW/150KW)  
2



Cummins generator  
(150KW)  
1



bathometer



MT machine  
(Parker DA400S-AB)  
1



RT machine  
XXG-2505  
2



UT machine  
CUD2080  
1



Nitrogen maker



G40250 卧式管锯床  
G40250 Horizontal Band Saw  
构造: 电动机、高压油泵、手动送料

Steel pipe sawing machine