

Catalogue

1、 OVERVIEW	6
2、 GENERAL REGULATION	7
2.2 GENERAL DESCRIPTION.....	7
2.2.1 <i>Principal dimesion</i>	7
2.2.2 <i>purpose</i>	7
2.2.3 <i>General Arrangement</i>	8
2.2.4 <i>Operating facilities</i>	9
2.3 SCOPE OF WORK OF THE BUILDER.....	9
2.3.1 <i>obtain licence</i>	9
2.4 DESIGN CONDITION.....	11
2.4.1 <i>Operation mode</i>	11
2.4.2 <i>Operation region</i>	12
2.4.3 <i>Water depth</i>	12
2.4.4 <i>Environmental conditions</i>	12
2.4.5 <i>Design temperature and humidity</i>	13
2.4.6 <i>Noise limited</i>	14
2.4.7 <i>Vibration</i>	14
2.4.8 <i>Tank volume</i>	15
2.5 SHIP’S CLASSIFICATION, CODE, STANDARD, REGULATION	15
2.5.1 <i>Ship’s classification</i>	15
2.5.2 <i>Code and rules</i>	15
2.5.3 <i>Ship flag</i>	17
2.5.4 <i>Register</i>	17
4、 OUTFITTING PARTS	17
4.1 SAILING ANCHOR EQUIPMENT	17
4.1.1 <i>Anchor</i>	17
4.1.2 <i>Anchor chain and accessories</i>	17
4.1.3 <i>Windlass</i>	17
4.1.4 <i>Chain stopper</i>	18
4.1.5 <i>Hawse pipe</i>	18
4.1.6 <i>Hawse pipe bolster</i>	18

Main technical specifications of pipe laying vessel

4.1.7 Chain locker.....	18
4.1.8 Hawse pipe	19
4.1.9 Abandon anchor equipment.....	19
4.2 MOORING EQUIPMENT.....	19
4.2.1 Mooring rope	19
4.2.2 200kN double drum hydraulic mooring winch	19
4.2.3 150kN hydraulic mooring winch.....	19
4.2.4 Central hydraulic pump station.....	19
4.2.5 Mooring bollard.....	20
4.2.6 Mooring hole and mooring guide device	20
4.2.7 Horn single roller cable guide device	20
4.2.8 Fender	20
4.2.9 Work boat.....	20
4.3 TOWING EQUIPMENT	21
4.3.1 Towing condition.....	21
4.3.2 Towing eyeplate ,towing cable hole and towing-with bollard.....	21
4.3.3 Towing riggings.....	21
4.3.4 Recovery cable winch.....	21
4.4 WORKING ANCHOR EQUIPMENT	21
4.4.1 Working windlass equipped requirements	21
4.4.2 Work anchor.....	22
4.4.3 Anchor cable	22
4.4.4 Positioning winch for Pipelaying.....	22
4.4.5 Guide device for anchor cable.....	23
4.4.6 Anchor rack	23
4.4.7 Anchor buoy and cable for anchor head.....	23
5、 CABIN PARTS.....	24
5.1 CABIN DESIGN GUIDELINES.....	24
5.2 CABIN CATEGORY.....	25
5.3 ROOM LAYOUT.....	25
5.3.1 Basic configuration of accommodation cabin.....	25
5.3.2 Furniture configuration.....	26
6、 TURBINE PARTS	28
6.1 OVERVIEW.....	28
6.2 ELECTRICAL POWER GENERATOR SYSTEM	28

<u>Main technical specifications of pipe laying vessel</u>	
6.2.1 Overview.....	28
6.2.2 Main diesel generator set	29
6.2.3 Emergency generating set	30
7、 ELECTRICAL PARTS.....	32
7.1 GENERAL PRINCIPLES	32
7.1.1 general rule.....	32
7.1.2 Electric braking	32
7.4 SWITCH PANEL.....	33
7.4.1 General rules	33
7.4.2 690V power distribution panel	35
7.4.3 400V low voltage switchboard.....	36
7.4.4 Emergency switchboard.....	36
7.4.5 Pipe laying switchboard.....	37
9、 PIPE LAYING SYSTEM.....	38
9.1 OVERVIEW	38
9.2 MAIN DESIGN PARAMETERS	40
9.3 PIPES LOADING AND UNLOADING	40
9.4 PIPE STORAGE	41
9.5 TRANSPORT ROLLER SYSTEM	42
9.6 PIPE END CLEANING ,GRINDING AND WELDING SYSTEM.....	43
9.7 CENTERING EQUIPMENT (THIRD PART EQUIPMENT).....	45
9.8 INSPECTION SYSTEM.....	45
9.9 TENSIONER AND A/R WINCH.....	46
9.10 COATING SYSTEM.....	47
9.11 CRANE SYSTEM	47
9.12 STINGER.....	49
9.13 STATION,ACCESS AND PLATFORM.....	50
9.14 OTHER AUXILIARY SYSTEMS	51
10、 HEAVY MARINE ENGINEERING CRANE.....	53
10.1 OVERVIEW	53
10.2 DESIGN CAPACITY	53
10.3 MAIN PARAMETER.....	55
10.4 SUITABILITY AND UTILIZATION GRADE	56
10.5 SERVICES SCOPE OF THE BUILDER	56

Main technical specifications of pipe laying vessel

11.1 OVERVIEW58

11.2 MAIN TECHNICAL PARAMETER58

11.3 SYSTEM COMPOSITION.....59

11.4 SWITCH BETWEEN BURIED PIPE AND BURIED CABLE59

12、 SATURATED DIVING OPERATIONS (OPTIONAL).....61

12.1 OVERVIEW61

12.2 MAIN TECHNICAL INDEXES.....61

12.3 MAIN COMPONENT EQUIPMENT61

1、OVERVIEW

This ship is a non-self-propelled pipe-laying crane, with the functions of single-node pipeline laying, double-node pipeline laying, lifting, ditching, saturation diving and life support.

The vessel maximum working depth for laying submarine pipelines is 350 m. An S-type pipe-laying operation line is set in the middle of the main deck, pipeline storage area is set on the two sides of the main deck, helicopter landing platform is set at the bow, fixed stinger is set at the stern, a total of 12 points anchor positioning system is set throughout the ship.

An ocean engineering heavy crane with a lifting capacity of 500 tons (full rotary) is set at the stern of the ship to meet the requirements of pipe loading and unloading, stern stinger lifting and installation, and to carry out small module lifting, stand pipe installation and Marine pipe repair and other operations.

◦

The main function of this ship is not only s-type pipe laying, but also can complete the following work: it can operate in water depth of 200 meters with towed jet type , plough type submarine pipe/cable trench digger. Meet layout and installation requirements for container-mounted saturation diving systems in depths < 300 m;The total staffs is 238, including 42 crew members and 196 workers.The total staffs can be expanded to 314 as needed.

The ship's pipe-laying and crane operations are mainly in the offshore waters of China, as well as in southeast Asia, the Gulf, Australia and the coastal waters of Africa

The purpose of this specification is to describe the design and technical requirements of the vessel to meet the requirements of construction, assembly, testing and delivery.

In case of any inconsistency between the contents of this specification, the descriptions in each professional chapter shall prevail

2、 GENERAL REGULATION

2.2 GENERAL DESCRIPTION

2.2.1 Principal dimesion

overall length:	~172.50 m
Long line between :	168.00 m
Molded breadth:	35.00 m
Molded depth:	12.50m
Working draft:	7.00-8.00 m
scantling draft:	8.50 m
Full displacement:	~ 38 000 t

2.2.2 purpose

The vessel is a non-self-propelled piper-laying vessel, equipped with 2 150T tensioners and 1 300T A&R winch, capable of laying submarine oil and gas pipelines at a maximum working depth of 350 meters. The minimum operating water depth is 8 m and the laying pipe diameter is 4" -60 "(including coating).

The vessel will also be able to do lifting operation in ocean engineering, the stern is equipped with a lifting capacity of 500 tons of x 40 meters, 350 tons of x 55 meters full slewing crane, its hoisting capacity can meet the vessel loading and unloading pipe , stern pipe bracket frame lifting and installation, also can carry out small module lifting, stand pipe installation and Marine pipe repair etc. operations.

After installing ditching equipment, this vessel can realize ditching operation in 200m depth.

The vessel's deck has an operation zone for saturation diving, which can be installed on the starboard side of the main deck with a 9-person container saturation diving system. The maximum operating depth is 300 meters

The cabin has 4 single suites, 26 single rooms, 46 double rooms, 29 four rooms, and equipped with office, conference room, clinic, dining room and entertainment room and other supporting accommodation, the total number of 238 people, including 42 crew, operation staff 196 people. It can also be used as a life support vessel, and the

Main technical specifications of pipe laying vessel

total size can be expanded to 314 people as required. On the top deck of the living quarters, there is a helicopter platform, which can handle Sikorsky S61N helicopters.

2.2.3 General Arrangement

Main deck is above BL 12.50 m , a crane pedestal at the main deck stern. In the middle of the main deck is a pipe-laying line with welding equipment, NDT equipment, coating equipment and other auxiliary equipment , such as pipe handling equipment with lateral rollers and pipe cutting/beveling machines. An A&R winch is equipped at the bow cabin

There are six superstructure decks A, B, C, D, E and F above the main bow deck, which are equipped with living quarters, offices, conference rooms and central control rooms etc. for crew and construction staff.

A Deck is provided with changing rooms, public toilets, construction staff rest rooms and laundry rooms

B deck is equipped with 3 rooms for 4 people (12 people), emergency generator room, duty room, clinic, kitchen, dining room, public toilet and air conditioner room etc..

C deck is equipped with 26 rooms for 4 people (104 people) and 14 double rooms (28 people), laundry & drying room, public toilet and air conditioner room etc..

D deck is equipped with 31 double rooms (62 people) and 4 single rooms (4 people), meeting-room ,office,laundry & drying room, public toilet and air conditioner room etc..

E deck is equipped with 1 double rooms (2 people) , 22 single rooms (22 people) and 4 single room with offices(2 people), meeting-room,office,laundry&drying room, public toilet and air conditioner room etc..

F Deck is equipped with central control room, radio room, electrical storage room and public toilet, etc

A helicopter boarding room and battery room are arranged at the top of F deck, and a helicopter deck that can at least meet the requirements of Sikorsky S61-N helicopter is arranged at the front end.

Below the main deck, two longitudinal, fore and aft bulkheads and six transverse bulkheads divide the hull into watertight compartments.

Both sides of the hull are mainly set as side ballast tanks, which can be used as dynamic ballast leveling system when the crane is working.Maintain working draft while laying pipe.

The compartments between the two longitudinal bulkheads, from bow to stern, shall be provided with the following mechanical and service compartments: A&R winch compartment, positioning winch compartment, engine room, auxiliary equipment compartment, storeroom, etc.

The double bottom is 2.00 meters high, and pipe tunnels is arranged on both sides of the double bottom.

The fuel oil tank is arranged between the longitudinal bulkheads and the fresh water tank is arranged on the two sides.

In order to reduce the amplitude of ship roll, a passive controllable water tank system is set on the two sides of the middle deck.

2.2.4 Operating facilities

The vessel in the central main deck has a s-shaped pipe-laying operation system, the system including pipe transportation, storage and internal transportation equipment, automatic welding equipment, nondestructive inspection and repair equipment, centring device, tensioner and A&R winch, coating equipment and stationary stinger, satisfy the single nodal and the double nodal pipelay.

The main deck can store about 4,000 tons of pipes. The loading, unloading and movement of the pipe will be accomplished by the main crane, two handling cranes, rollers and conveyors

The stern is equipped with Marine engineering heavy crane, the crane full swing lifting capacity of 500 tons x40 meters, 350 tons x55 meters, driving mode for electric drive.

After installing ditching equipment, this ship can realize ditching operation in 200m water depth.

The ship's deck have a area for saturation diving, which can be carried out after setting up a 9-person container saturation diving system on the starboard side of the main deck. The maximum operating water depth is 300 meters.

2.3 Scope of work of the builder

2.3.1 obtain licence

The Builder shall construct the vessel according to the specifications or drawings and shall obtain the approval of classification society for design, calculations and technology.

The Builder shall bear all costs for construction inspection and approval.

The Builder shall provide such certificates and test reports as may be required by the Classification society and other necessary documents.

Certificates to be obtained including but not limited to:

Classification Society certificate:

1. Special Purpose Ship safety certificate
2. Ship classification certificate
3. International Oil Pollution Prevention Certificate
4. International Certificate for prevention of Domestic Sewage Pollution ,
Certificate for Prevention of Garbage pollution
5. Helicopter platform approval certificate
6. International tonnage Certificate
7. International Load Line certificate
8. Class survey certificate for hull ,engine and electrical equipment
9. Radio safety certificate
10. Equipment safety certificate
11. No asbestos certification
12. Certificate of inspection and test for lifting equipment, including small
hook lifting personnel certificate
13. Lifting equipment inspection and test report, ship lifting equipment
survey record
14. Certificate of Life Saving Fire Fighting Equipment and Fire Detection
System.
15. Stability manual approved by the classification society and the relevant
authorities of the flag-flying country
16. Ship Hygiene Control Exemption Certificate/Ship Hygiene Control
Certificate
17. IAPP certificate
18. Satellite TELEVISION reception license
19. On-demand equipped with SOLAS training manuals

20. Lifting Mechanism certificate

21. Drag the certificates

22. All equipment certificates required by classification society for Marine products inspection and certification

As per request, the Builder shall provide the following certificates and documents

- When hand over vessel to owner , the builder will proved Ship building certificate , certificate of quality guarantee and declaration of no mortgage.
- Handover Protocol of vessel
- Fire Protection System Certificate
- Fire control chart, including type and location of fire protection equipment, escape route and life saving equipment
- Crane certificate, including lifting test report and lifting curve (including lifting capacity table) ,moving parts certificate
- Pressure vessel and piping inspection certificate
- Noise vibration test report
- Drinking water certificate
- Vessel's Provisional Nationality Certificate

In addition, the builder shall assist the shipowner in handling the nationality certificate of the ship, ownership certificate and other certificates.

2.4 Design condition

2.4.1 Operation mode

The vessel is designed for the following operating conditions:

- Single node pipeline laying operation;
- Double node pipeline laying operation;
- lifting operation;
- Ditching operation;
- Saturation diving operation;
- Life support.

2.4.2 Operation region

The operation region of this ship is the offshore waters of China, southeast Asia, gulf, Australia and Africa, etc.

2.4.3 Water depth

The maximum operating water depth for pipe laying is 350 m (20" pipes) and the minimum operating water depth is 8m;

The maximum operating water depth of ditching is 200 m;

The maximum operating water depth of saturated diving is 300 m.

2.4.4 Environmental conditions

Pipe laying operation condition:

The ship can be operated under the following environmental conditions:

- wind speed $V_w = 13.8$ [m/s]
- Significant wave height $H_s = 2.0$ [m]
- Wave period (crest) $T_p = 6.0- 12.0$ [s]
- Water flow speed $V_c = 2.0$ [kn]
- Wave type Jonswap
- Wind direction $0^\circ-360^\circ$.

Pipe laying in standby condition:

- wind speed $V_w = 22.7$ [m/s]
- Significant wave height $H_s = 4.0$ [m]
- Water flow speed $V_c = 3.0$ [kn]

Survival condition (Stinger retracted and rising above water):

- Wind speed $V_w = 26.4$ [m/s]
- Significant wave height $H_s = 8.0$ [m]
- Wave period (crest) $T_p = 11.0- 15.0$ [s]
- Water flow speed $V_c = 3.0$ [kn]
- Wave type Jonswap

-
- Wind direction 150°-210°。

Lifting condition:

The ship can operate under the following environmental conditions:

- Wind speed $V_w = 13.8$ [m/s]
- Significant wave height $H_s = 2.0$ [m]
- Wave period (crest) $T_p = 6.0-12.0$ [s]
- Water flow speed $V_c = 2.0$ [kn]
- Wave type Jonswap
- Wind direction 0°-360°。

During lifting mode, the ship's longitudinal and transverse angle is limited to meet with the operating conditions of the crane (details see 10.2).

Vessel towing condition:

This vessel, reinforced with bulkhead and keeping a 2m stern rake, can be towed and dispatched in unlimited zone under the following environmental conditions:

- Wind speed $V_w = 20$ [m/s]
- Significant wave height $H_s = 5.0$ [m]

2.4.5 Design temperature and humidity

The following temperature conditions will be considered in the design:

Maximum ambient temperature:	+45 °C
Maximum relative humidity:	90%
Minimum ambient temperature:	-15 °C
Maximum sea water temperature:	+32 °C
Minimum sea water temperature:	-2 °C

living quarter HVAC system will be designed according to the following conditions:

Summer conditions:

- Ambient temperature 45°C@ 70% RH
- Temperature remains 27°C@ 50% RH

Winter conditions

- Ambient temperature -15°C
- Temperature remains 20°C @ 40% RH

The supply of fresh air can be $\geq 28.8\text{m}^3/\text{h}$

2.4.6 Noise limited

The Builder shall, in accordance with IMO A.468(XII) decision on ship noise levels, minimize noise to the lowest decibels during equipment installation and sound insulation design.

The decibel level of noise in various working and living spaces should not exceed the following limits:

Workshop and storeroom:	85 dBA
Kitchen:	75 dBA
Control room and office:	65 dBA
Accommodation area and medical room:	60 dBA
Changing rooms laundry and toilets:	75 dBA
Dining room and fitness recreation room:	65 dBA
Meeting rooms and rest areas:	65 dBA

Note: The noise decibel level of the corridor as a whole should not be 5 dBA higher than the noise limit of adjacent rooms.

2.4.7 Vibration

The vibration of the ship shall conform to ISO/6954 Guidelines for vibration evaluation of merchant Ships. The measurement condition: Operation for ship moving positioning.

Measuring points and requirements are agreed upon by both parties.

If vibration exceeds the requirements of ISO/6954, the Builder shall, at its own expense, take measures to reduce vibration to meet the requirements.

The hull vibration survey report shall be submitted by the builder to the shipowner at delivery.

2.4.8 Tank volume

The stock of consumables (excluding pipeline storage) should be sufficient to sustain 238 people for 45 days of self sustaining operation (vegetable is for 30 days).

Tank volume:

Water ballast tank:	~13,000m ³
Fuel tank:	~2,400 m ³
Diesel tank:	~800 m ³
Fresh water tank:	~1,700 m ³
Anti-rolling water tank:	~3,000 m ³

At least 4,000 tons of pipes and other pipe-laying consumable can be stored on the main deck.

2.5 Ship's classification, code, standard, regulation

2.5.1 Ship's classification

All engineering drawings and specifications shall conform to the current version of codes, standards and regulations referred to in this chapter.

Construction of the ship , its machinery, equipment and outfitting parts will be carried out under the supervision of CCS , and obtain class symbols including:

- ★CSA, Pipe Layer, Floating Crane, Ice Class B, Helicopter Facilities,
Crew Accommodation

All pipe-laying equipment, including the stinger and stinger control system, will be designed in accordance with applicable code ,standards and regulations.

2.5.2 Code and rules

The vessel is designed according to, but not limited to, the following code,rules and code requirements.

- 1) CCS "Steel sea-going Ship Classification Code" 2012 edition;
- 2) CCS "Materilas and weld Code" 2012 edition;
- 3) Technical Regulations for Statutory Inspection of Ships and Marine Installations, PRC 2008 edition;
- 4) International Load Line Convention, 1966, and Protocol, 1988;

-
- 5) "China Shipbuilding Quality Standard " 2005 edition
 - 6) International Tonnage Measurement Convention 1967/1969 and its amendments;
 - 7) International Regulations for Collision Avoidance of Seagoing Vessels 1972 and their amendments;
 - 8) 1974 International Convention for the Safety of Life at Sea (SOLAS), and the 1978 Protocol with all amendments ;
 - 9) Convention on the International Prevention of Pollution of Ships (MARPOL) 73/78, and amendments;
 - 10) IMO Safety Code for Special Purpose Ships 2008 (SPS 2008);
 - 11) IMO Noise Control Regulation A.468-XII;
 - 12) IMO MSC.267(85) Complete stability rule;
 - 13) International Electrotechnical Commission (IEC) Code for electrical Installation of Ships;
 - 14) International Telecommunication Radio Code 1973/1976 and 1982, including GMDSS- Radio Communication Code);
 - 15) Regulations on the Operation of civil Helicopter platforms at Sea;
 - 16) CAP437;
 - 17) DNV-OS-F101 Code for Subsea Piping Systems 2000;
 - 18) Sea towage guide;
 - 19) Ship's standard and national standard;
 - 20) CCS code for Ships and Marine Lifting Installations;
 - 21) Technical rules for statutory inspection of lifting equipment;
 - 22) Maritime Labour Convention 2006;
 - 23) Hong Kong International Convention on Safe and Environmentally for Ship Dismantling 2009;

2.5.3 Ship flag

This ship flies Hong Kong flag

2.5.4 Register

Registration formalities. All necessary assistance provided by the Builder to the owner to minimize the net tonnage and gross tonnage of the registered tonnage, including deduction of the permanent ballast tank. The temporary nationality certificate , all other certificate for the trial voyage shall be the responsibility of the builder.

4、 OUTFITTING PARTS

4.1 Sailing anchor equipment

One set of sailing anchor equipment is set on the port and starboard sides of the bow B deck, each set of equipment includes anchor, anchor chain , chain stopper, hawse pipe, bolster and one set single-side hydraulic anchor lifting and mooring machine

4.1.1 Anchor

Specification: AC-14, high holding power anchor (balance type), weight 7425kg/pcs
quantity: 2pcs;

4.1.2 Anchor chain and accessories

Anchor Chain: diameter ϕ 78mm, grade AM3 welding anchor chain with stop-needle , total length is 660m(24 sections), port side anchor chains are 12 sections, starboard side anchor chain are 12 sections. And equip tools for dismantling anchor chain, the anchor chain have been marks.

4.1.3 Windlass

Two sets single-side hydraulic machines of windlass and mooring composition (one left and one right), each windlass is equipped with one sprocket, one mooring drum and one auxiliary drum.

Main technical parameter of single-side hydraulic machines of windlass and mooring composition is as below:

(1) Windlass part:

Anchor chain : grade AM3, ϕ 78mm;

Nominal speed of anchor lifting: $\geq 9\text{m/min}$;
work load: $\geq 290\text{kN}$;
over load: $\geq 435\text{ kN}$;
support load: $\geq 2025\text{kN}$ 。

(2) Mooring part:

Synthetic fiber rope diameter : $\phi 72\text{mm}$;
Drum work load: $\geq 200\text{ kN}$;
Mooring rope speed: $\geq 15\text{m/min}$;
Rope capacity: 200m ;

(3) Aux. drum :

Drum tensile load: 150kN ;
Mooring rope speed: $\geq 15\text{m/min}$;

4.1.4 Chain stopper

At the front of the windlass, at the exit of each hawse pipe deck, there are 1 roller switch blade chain stopper (total 2 pcs in whole vessel) . they equipped with bronze bearings, butter nozzles and stainless steel pins.

4.1.5 Hawse pipe

Two hawse tubes with sufficient slope to allow anchor to slide down freely by gravity , hawse pipe shall be equiped an anchor chain flushing pipe system and a storm cover at the outlet of hawse tube deck.

4.1.6 Hawse pipe bolster

A cast steel bolster is arranged at the outlet of the outer plate of each hawse pipe.

4.1.7 Chain locker

There shall be two independent chain lockers below the bow B deck tank, each of which shall have sufficient capacity for convenient chain storage. Steel grates shall be provided at the bottom of the chain lockers, and a watertight manhole cover shall be equipped on the bulkhead for access. Steel ladder shall be provided below the manhole cover for personnel to ascend and descend for the chain lockers, and pumping and flushing piping shall be equipped.

4.1.8 Hawse pipe

There is one chain pipe above each chain locker, and there are two chain pipes with steel cover at the head of the whole ship.

4.1.9 Abandon anchor equipment

Each chain locker shall be equipped with 1 watertight abandon anchor equipment, it total 2 pcs in the whole ship.

4.2 Mooring equipment

4.2.1 Mooring rope

The ship is equipped with 10 pcs $\phi 72$ mm eight strands of polypropylene filament ropes, each of which is 200 m long.

4.2.2 200kN double drum hydraulic mooring winch

The ship is equipped with two 200 kN double drum hydraulic mooring winch, and set at stern of main deck, one left and one right.

Main technical parameter of the 200kN double drum hydraulic mooring winch:

Work drum: mooring rope diameter	$\phi 72$ mm (pp filament rope)
Drum quantity:	2
Mooring speed:	15 m/min。
Mooring work load:	200kN;
Aux.drums: Mooring work load:	150kN;
Mooring speed:	15 m/min。

4.2.3 150kN hydraulic mooring winch

This ship is equipped with 4 150kN hydraulic mooring winches, 2 sets each side of the main deck amidships.

Main technical parameter of the 150kN double drum hydraulic mooring winch

mooring rope diameter:	$\phi 72$ mm (pp filament rope)
Mooring work load:	150kN;
Mooring speed:	15 m/min

4.2.4 Central hydraulic pump station

There is a central hydraulic pump station which is the hydraulic source for two hydraulic windlass in the fore part, one hydraulic towline retrieving cable winch, two

double drum hydraulic mooring winches in the aft part, four hydraulic mooring winches in the amidships.

The central hydraulic pump station is composed of 4 oil pump units, of which 3 oil pump units (the other one is reserved) can drive 2 hydraulic mooring winches, 1 double drum mooring winch and 1 sailing windlass simultaneously (full load), or 2 sailing windlass simultaneously (full load).

Hydraulic pump station adopts medium pressure hydraulic equipment ,valve parts and pipe system, electric power is A.C.380V,50Hz.

4.2.5 Mooring bollard

A sufficient number of welded double bollards shall be provided on the port and starboard sides of the main deck and the bow of B deck for mooring and offshore operation. Each bollards shall be provided with eyeplates of sufficient strength and tie up auxiliary ropes for bollard.

4.2.6 Mooring hole and mooring guide device

Mooring lines are led out of the ship by way of moring holes or mooring guide device arranged on the side. The ship is provided with a sufficient number of mooring holes and mooring guide device of various forms.

4.2.7 Horn single roller cable guide device

Set up enough horn single roller cable guide devices for mooring

4.2.8 Fender

The port and starboard sides of the hull are equipped with D-type polyurethane fenders to prevent the hull from being damaged by barges and other vessels approaching. The fenders are installed on the steel brackets at the side of the hull. The diameter of fenders is about 300mm, and the total length of fenders is ~300m.

4.2.9 Work boat

The vessel is equipped with a fiberglass work boat, about 10 persons, speed of no less than 6 knots, equipped with rubber fender;The Builder shall manufacture suitable pedestals for storage, fixation and hoisting, and shall provide a fabric cover for water, moisture and sun during storage at the top of the pipelay firing line.

4.3 Towing equipment

4.3.1 Towing condition

The towing equipment is configured with a towing speed of 9kN in still water

4.3.2 Towing eyeplate ,towing cable hole and towing-with bollard

On both sides of the bow of deck B, two tow eye plates and tow rope holes are provided, one drag bollard is arranged at the center line of the hull in the front part of deck B, and the tow rope guide holes are provided.

4.3.3 Towing riggings

The ship shall be equipped with the relevant towing equipment according to the legal inspection technical rules of CCS for maritime towing, including but not limited to one set of dragon-wire, which consists of two dragon-wire chain ,triangle plate ,short cable ,connecting shackle and recovery cable.

4.3.4 Recovery cable winch

A recovery cable winch is provided on deck B of the vessel. The recovery cable can be easily retracted and released by connecting the guiding pulley mounted under the bow recovery frame with the triangle plate.

Main technical parameters of hydraulic towing cable recovery winch are as follows:

Work load:	200kN;
Work speed:	12m/min;
Brakeage:	600kN;
Steel rope:	Φ 32mm;
Drum cable capacity:	200m;

4.4 Working anchor equipment

4.4.1 Working windlass equipped requirements

The ship is equipped with working anchor equipment according to 12 point anchor positioning.

The working anchor winch is arranged in the winch cabin under the main deck. The fore and aft working anchor cables are led to the main deck through the guide pulley, and then out of the ship through the guide pulley and the side rotating cable guide device, and connected with the working anchor.

The bow has 6 working anchors stored on the anchor rack in the bow and the rest on the main deck or on top of the pipelay firing line.

4.4.2 Work anchor

Set 12 STEVPRIS type ocean engineering high holding power anchor, each weighing 10000kg.

4.4.3 Anchor cable

The working anchor cable is galvanized steel wire rope, length 2500m, diameter 76mm, breaking force is about 3800 kN, a total of 12 cables, each cable is equipped with the corresponding connecting device, each cable includes: short chain (length about 10m) ,clip (about 3 pcs) , ring (1 pcs) and other connecting device, all equipment should have CCS certificate.

4.4.4 Positioning winch for Pipelaying

The ship is equipped with electric variable frequency pipe laying positioning winches with damped brakes. The 12 winches can be controlled at the side of the winches or centrally in the central control room.

The main technical parameters of the pipe laying positioning winch are as follows:

Steel wire rope:	φ 76mm;
Winch load:	1100kN; (mid layer)
Winch speed:	(When the load is 1100 kN);
The main brake supports the load:	3800KN (the 3 rd layer on the drum)
Rope capacity:	2500m;

Corollary equipment:

- 12 machine side control boxes;
- 1 set of cab console;
- 4 transformers;
- 12 sets of windlass control cabinet;
- 4 sets of inverter control cabinet;
- 4 cooling units;
- 4 sets of water cooling system;
- 12 brake resistance coolers;
- Twelve hydraulic pump stations;

-
- 12 sets of anchor line flushing equipment;
 - 12 sets of mechanical cable arrangement;

4.4.5 Guide device for anchor cable

Rotating guide device for cable:	2 pcs;
Horizontal guide pulley:	4 pcs;
Vertical guide pulley:	28pcs;

The specific number and type of guide pulley are determined according to the relevant layout of detailed design.

4.4.6 Anchor rack

The anchor rack is arranged at the bow for storing the working anchor at the bow, and the anchor rack is provided with steel grating treads and ladders.

4.4.7 Anchor buoy and cable for anchor head

The ship is equipped with 12 anchor buoys suitable for working in a water depth of 350 meters, 12 pcs cable for anchor head , short chains (about 10 meters in length) ring and all the connecting accessories. The anchor buoy, which shall have sufficient buoyancy. The ship adopts a subdivision design and is equipped with fillers to increase the anti-sinking performance.

5、 CABIN PARTS

5.1 Cabin design guidelines

The fire-resistant integrity of the interior of the vessel meets the requirements of the International Convention for the Safety of Life at Sea (SOLAS) 1974 and the amendments thereto. All equipment and materials shall be prohibited from containing asbestos.

All the materials, outfitting and equipment installed in the residential area are Marine products, which have the required Marine certificates and meet the environmental protection standards.

All details of furniture arrangement, material ,decoration, installation etc. must be approved in writing by shipowner before ordering.

Samples of materials together with description of quality, style and colour shall be submitted to owner approval prior to ordering. Samples of furniture and cabin equipment should be approved by shipowner before ordering

Cabin furniture is made by the professional manufacturer and approved by owner, these fixed way with the wall lining, deckhead , board according to Marine practice, or according to professional furniture factory to recommend the best way. The furniture base materials use a multilayer, surface for fireproof board, furniture surface, and other wood surface shall not be made using nitrocellulose tinter for base paint. Single room equips with high quality furniture

The dimensions of all furniture shall be as per cabin layout plan, the appearance of furniture shall be approved by owner. The mattresses of living quarters shall be spring mattresses made by professional manufacturer, and the sofas shall be of high quality cloth with armrests (except for designated leather sofas) and all shall be approved by owner.

All furniture,decoration, beds and bedding are of high quality Marine standard flame retardant and, unless otherwise specified, the furnished and equipment of the kitchen, laundry, cutlery, dishes, dressing rooms and other damp areas are stainless steel.

Adequate TV, Lan and light sockets shall be provided in all cabin ,offices and living rooms

Final quantity details material color decoration etc. should be confirmed by shipowner before ordering the following instructions are preliminary configuration only.

5.2 Cabin category

location	Describe
living location	Single apartment, Single room, double room, four people room
Public location	Medical room, helicopter boarding room ,office, Reference room, meeting room, big dining room, small dining room, construction staff rest room , Client office.
Control location	Central control room, radio room, batter room, emergency generator room, CO2 room, engine control room, fire control room, Centralized control room for watertight doors
walkway	Inside walkway, stairway , escape exit
Sanitary location	sanitary unit, public toilet, bath room/toilet
Service location	Kitchen, laundry/dry cloth room, dressing room, tea room, laundry room for construction crew
Food location	Fish storeroom, meat storeroom, High temperature storeroom, provision store
Machine location	Air condition machine room, fan room of engine room, fan room fo aux.equipment, Oil purifier chamber, A/R winch cabin, transformer room, engine room, aux.equipment cabin, winch cabin
Working location	Electrical control room, duty room, mechanical repair room, welding equipment repair room/welding materials room
Store location	Store room , electrical store room, bedding room, warehouse

5.3 Room layout

5.3.1 Basic configuration of accommodation cabin

Grade	room	Bed size	Bath room
Senior leader	Single apartment (office+bedroom)	2000×1000	Sanitary unit (shower)
leader	single room	2000×1000	Sanitary unit (shower)
	double room	2000×1000	Sanitary unit (shower)
Common crew	four people room	2000×1000(bunk bed)	Sanitary unit (shower)

	medical room	2000x900	Sanitary unit (bath tub)
--	--------------	----------	--------------------------

5.3.2 Furniture configuration

Cabin	furniture (each room)
Single apartment	Office: L type writing desk×1, Premium leather swivel armchair with×1, Long leather sofa×1, Sofa chair×2, tea table×1, advanced combined cabinet×1, book cabinet×1,side cabinet×1, Refrigerator (with cabinet)×1, 32 inch Samsung LCD TV×1, Miniature audio equipment×1, Household drinking water machine×1. Bedroom: bed×1, bedside table×1, soft sofa×1, double door wardrobe×1, Safe Deposit Box×1 (Captain only), table light×1
Single room	bed×1, double door wardrobe×1, writing desk×1, swivel armchair×1, side cabinet×1, book cabinet×1, Sofa×1, tea table×1, 32 inch Samsung LCD TV×1, Miniature audio equipment×1, table light×1
Double room	bed×2, four door wardrobe×2, writing desk×1, swivel armchair×1, fold chair×2, bedside cabinet×1, side cabinet×1, book cabinet×2
Four room	bunk bed×2, four door wardrobe×2, writing desk×1, swivel armchair×1, fold chair×2, bedside cabinet×1, side cabinet×1, book cabinet×2
Medical room	Steel bed for diagnosis and treatment×1, writing desk×1, swivel armchair×1, chair with back×1, medicine cabinet×1, medical refrigerator×1, disinfection cabinet×1, stretcher×1, washbasin×1, special-purpose lamp×1, double door wardrobe×1
boarding room for pilot	Waiting chair×10, TV×1, side cabinet×1, body scale×1.
office	L type writing desk×10, swivel armchair×2, fold chair×2, file cabinet×1, side cabinet×1.
Reference room	file cabinet(steel)×2, data table×1, chair with back×4
Large meeting room	Meeting table×1, Premium leather armchair×30, combined cabinet×1, 56 inch Samsung TV×1, sound equipment×1, water(hot and cool) dispenser ×1, refrigerator×1, white board×1, fixed projector and curtain.
Small meeting room	Meeting table×1, Premium leather armchair×10, combined cabinet×1, 32 inch Samsung TV×1, sound equipment×1, water(hot and cool) dispenser ×1, white board×1

Cabin	furniture (each room)
Large dining room	refectory table×25, bench×50, SS worktable×1, SS Monocular washing pool ×1, 56 inch Samsung TV×2, large sound equipment×1, table with keeping warm (5 slots) ×1, water boiler by electric×1, dispenser of cool drinking water×1, ice maker ×1, cold cabinet for store drinks×1, juicer×1, coffee maker×1, toaster×2.
small dining room	round table×3, bench×30, SS worktable×1, SS Monocular washing pool ×1, 32 inch Samsung TV×1, sound equipment×1, table with keeping warm (5 slots) ×1, water(hot and cool)dispenser ×1, refrigerator×1, coffee maker×1, toaster×1.
Central control room	liftable and fixed swivel chair×4, Premium leather armchair×4, flag box×1, plotting table×1, sundries cabinet×6, telescope box×2, key box×1, water(hot and cool) dispenser ×1
Radio room	Radio table×1, swivel armchair×2, file cabinet×2, fold chair×4, bookshelf×1,sofa×1,tea table×1
Boiled water room	water boiler by electric×2, water(cool) dispenser ×1, SS Monocular washing pool ×1, SS worktable×1

Note:

- (1) The arrangement of furniture can be adjusted according to the actual situation of the cabin layout, and the final plan is determined by the owner.
- (2) The ship is equipped with two digital cameras and one digital video camera.
- (3) In addition, there are two portable projectors and moving curtains for the meeting room.
- (4) Each room is equipped with garbage cans;Rooms without water dispensers are equipped with thermos and supports.

6、 TURBINE PARTS

6.1 Overview

In order to meet the requirements of the ship's electrical load under various working conditions, the ship is equipped with 4 ~2200kW main generator sets and 1 ~350kW emergency generator set. In addition, the ship is equipped with 2 oil-fired steam auxiliary boilers with steam capacity of ~4000kg/h to provide heating for the oil-water tank, the oil-fired equipment , the hot water tank, other heat required.

To meet the requirements of pollution prevention, the ship is equipped with 1 oil sewage treatment unit, 1 (2 sets) domestic sewage treatment unit, 1 oil skimmer and 1 incinerator.

Fuel requirements: Main diesel generator set, oil boiler, fuel oil (HFO)3500 seconds (equivalent to 380cst /50°C), 0#/-10# diesel oil (MDO) and ultra-low sulfur oil (sulfur content less than 0.1% m/m MGO); Incinerator, emergency/parking diesel generator set :0#/-10# diesel (MDO)

There is a centralized control room in the engine room, which can monitor the mechanical and electrical equipment.

6.2 Electrical power generator system

6.2.1 Overview

Four main generator sets are arranged in the engine room to provide 690V 50Hz power supply. The operation status of the generator set can be monitored in the central control room. The diesel generator set can run in parallel, start up or stop by generator side or remote control, and single generator set can be auto start or stop according to the load on the grid.

Under full load pipe-laying condition, all 4 diesel generator sets work to provide power to the grid. In the conventional pipe-laying condition , the lifting condition , and dispatching condition, the 3 diesel generator sets will be used respectively. When berthed, the vessel may be powered by a main generator or shore-powered for lighting and living facilities. When berthed in EU ports or US California ports for more than 2 hours, the diesel engine of the generator set shall be fueled with ultra-low sulfur oil.

Another emergency generator set is arranged in the emergency generator room. When the main switchboard loses power, the emergency generator should be able to start and supply power to the emergency switchboard within 45s.

6.2.2 Main diesel generator set

4 generator sets, installed on the common base, compressed air starting, dismounting parts and side instrument panel , generator control unit and other auxiliary equipment must be equipped with complete, the diesel generator set must meet MARPOL Convention TierII emission standard requirements, with NOx emission certificate.

The parameters of the main generator set are as follows:

Diesel engine

quantity	4 sets
rate power:	~2310kW, continue power
rotated speed:	750rpm medium speed diesel engine
Fuel:	HFO,MDO and ultra-low sulfur oil

Main accessories of diesel engine (dismounting parts)

Unit common base (elastic), governor, turning gear of E-power ,supercharger(with water flush device), dual fuel filter (injection pump), fuel leak detection device, fuel oil inlet port, fuel oil return port, lubricating oil pump , lubricating oil filter, oil cooler , lubricating oil temperature regulator, lub oil low level detection device, import and export interfaces of sump oil purifier, Electric lubricating oil supply pump , pipe expansion bend , soft pipe joints, expansion joint of the supercharger exhaust , silencer , fresh water cooling pump (high temperature and low temperature) , charge air one and times cooler , regulator of cooling water temperature , inlet and outlet machine interface of cooling fresh water , compressed air inlet port, concentration alarm of crankcase oil mist, etc.

4 diesel engines with high temperature fresh water and low temperature fresh water spare pump (2 sets), lubricating oil spare pump(2sets).

generator

Quantity:	4sets
Rate power:	~2200 kW
Power factor:	0.8
Voltage:	690V

frequency:	50 Hz
rotate speed:	750 rpm
insulation grade:	H/F
ambient temperature:	-15° C ~ 45° C
character:	S1 continuous output
type of cool:	air-water
level of protection:	IP 44
excitation:	Brushless,self-exciting
heater for prevent moisture:	220V, 1P

winding temperature detector: 2 × 3 PT100 temperature sensor

Common accessory of generator set (dismounting parts)

All kinds of sensors signal ,cable junction box, all kinds of modules, pre-supplied with oil pump ,pre-heating unit and other electrical control boxes, will be equippe with two sliding bearings at the these front and rear respectively.

6.2.3 Emergency generating set

Configure of the emergency generator set as follows:

Diesle engine

quantity:	1set
Power:	~410 kW
rotate speed:	1500 rpm
fuel:	MDO

The emergency generator set shall include the following components:

- cooling water tank
- Automatic start/stop control panel
- oil tray
- running relay

-
- solenoid valve for stop
 -) starting system (24V battery and compressed air)
 - battery set
 - recharger
 - Low pressure alarm touch point of lubricating oil
 - High temperature alarm touch point of lubricating oil

Generator:

The generator is brushless, air-cooled and has a silicon steel salient rotor

quantity:	1set
rate power :	~350 kW
power factor:	0.8
voltage:	400 V
frequency:	50 Hz
rotate speed:	1,500 rpm
insulation grade:	F grade
character:	continue output
type of cool:	air
level of protection:	IP 23
excitation:	Brushless
heater for prevent moisture:	230V ,1P

7、 ELECTRICAL PARTS

7.1 general principles

7.1.1 general rule

All electrical equipment shall meet Marine conditions and obtain CCS approval certificate.

All generators and motors on this ship are made of ABB ,Siemens products.

During the construction period, the Builder shall reasonably arrange the loading time of all electrical equipment, especially large electrical equipment, and ensure that the equipment is protected from dust, water, fire, oil, man-made damage or other damage.

The builder's electrical installation process (including wiring handling for installation of cable laying equipment, etc.) shall be submitted to the owner for approval prior to construction.

Analog boards for power system single line diagram summaries shall be provided and installed in the machine control room and distribution room.

7.1.2 Electric braking

describe	Voltage/V	frequency /Hz	phase	number of cores
Main generator	AC 690	50	3	3
emergency generator	AC 400	50	3	3
Crane	AC 690	50	3	3
mooring winch	AC 690	50	3	3
Tensioner and AR winch	AC 690	50	3	3
Ballast pump motor	AC 380	50	3	3
Normal and emergency lighting	AC 220	50	1	2

temporary and emergency lighting	DC 24V			2
Kitchen equipment	AC 380/220	50	3	3/2
General electric equipment	AC 380V	50	3	3
communication and navigation equipment	AC 220V/ DC24V	50/	1/	2/2
automatic system	AC220V/DC24V	50/	1/	2/2

7.4 Switch panel

7.4.1 General rules

The ship's switchboard consists of 690V switchboard, 400V switchboard, 400V emergency switchboard, 400V pipe-laying switchboard, etc.

a) Construction

- — installation way Floor type (shock-proof measures should be taken)
- — installation location Power distribution room, minitor room for engine room, emergency generator room, and power distribution room for pipe laying, etc
- — protection level: IP22
- — maintenance: maintenance in front panle or at both side of panel
- — shell:
 - faceplate: 2mm cold rolling plate
 - frame: assemliie type
 - front: door
 - side: Fixed plate with heat dissipation hole

behind:	Door with heat dissipation hole
bottom:	open
handrail:	front and behind
door ground:	installation
lifting device:	installation
base:	channel steel
absorbing rubber:	need

Main cable color code: A phase ---green, B phase—yellow, C-phase---brown

materials: Copper (tin plating)

— — Switchboard lighting: AC 220V(except for the eyebrow lamp, door controlled lighting shall be installed inside the main facilities panel) , All power distribution panels shall be equipped with appropriate sized insulating rubber pads, insulating gloves and rescue rods.

b) cable inlet: bottom

Note: Connect all external feeder cables except the generator to the reserved terminal block of the power distribution board.

c) Distribution panel composition:

690V distribution panel There are 4 main generator sets and load screens, total 17 panels

400V 配电板: Main transformer control panel 2 panels

400V distribution panel AC 380V/220V load panel

group starter screen , total 17 panels

400V emergency switchboard: 4 panels

400V pipe-laying switchboard: 8 panels

d) Each generator panel instrument, indicator light and control equipment.

— — Measuring meter

690V Distribution Board Settings:

Double needle voltmeter ,ammeter ,double needle frequency meter, power meter, synchronous meter, operation cycle counter will be set on the engine

screen.

Double needle voltmeter, double needle frequency meter ,operation cycle counter and synchronous meter , power grid insulation monitor are set on the parallel vehicle panel.

The 690V switchboard has the functions of remote start and stop generator set, automatic combination, automatic load distribution, automatic classification unloading, inverse power protection, automatic disassembly and other automatic power stations. Meanwhile, it should also have the corresponding manual function.

400V power distribution panel settings:

voltmeter

amperemeter

frequency meter

wattmeter

Synchrometer (for synchro switchboard only)

power factor meter

Power grid insulation monitor

— — Indicator light: sets according to buyer's requirements and design requirements

— —Control and selection switches: sets according to buyer's requirements and design requirements

The bus-bars of the distribution board are equipped with segmented circuit breakers.

7.4.2 690V power distribution panel

Rated voltage /V	3P 690
Rated current /A	5000
Quantity/ switchboard	17
Among them: main generator switchboard	4 drawer type
total switchboard	1 drawer type

Crane switchboard	2
winch switchboard	4
Main transformer switchboard	2
Pipelaying transformer switchboard	2
Tensioner switchboard	2

7.4.3 400V low voltage switchboard

Rated voltage /V	3P 400
Rated current /A	5000

Quantity/ switchboard	17
-----------------------	----

Among them: Main transformer switchboard	2 drawer type
phase switchboard	1 drawer type
380V load switchboard	6
220V load switchboard	2
Combination starter panel	6 (~72 units)

7.4.4 Emergency switchboard

The emergency switchboard can supply power to the emergency load. After the emergency generator is automatically started, the automatic closing device will detect the voltage and frequency and send out the closing signal. The switch of the emergency switchboard will be automatically closed to connect the emergency power supply.

Rated voltage /V	3P 400, 3P 230
Rated current /A	800
Rated breaking capacity /kA	25
Quantity/ switchboard	4
Among them: Emergency generator switchboard	1
380V load switchboard	1
Combination starter switchboard	1 (~12 units)
220V load switchboard	1

7.4.5 Pipe laying switchboard

Rated voltage /V 3P 400

Rated current /A 2500

Quantity/ switchboard 8

Among them: Piping transformer switchboard 2 drawer type

 phase switchboard 1 drawer type

 load switchboard 3

 Combination starter switchboard 2 (~24 units)

9、 PIPE LAYING SYSTEM

9.1 overview

A pipelay line lengthwise extending to the aft fixed stinger of the main deck centre, Laying pipeline is suitable for laying single nodal pipe and double nodal pipe, this ship does not consider prefabricated double nodal pipe on board, only consider laying prefabricated double nodal pipe.

Pipe yards are provided on both sides of the main deck. The yard is equipped with pipe cranes and main cranes for hoisting and lightening pipes.

The vessel can lay 20 "pipe. The maximum depth of laying pipe is 350 meters, and the minimum depth is 8 meters.

The pipe laying speed of this ship can meet the operation speed of about 5km/d for laying 24 "pipe diameter and 20.6mm wall thickness single layer insulation cement counterweight double nodal pipe in 300m water depth.

This text describes the main equipment and main operation process in the pipe laying operation system. The Builder shall satisfy all mentioned functions. In order to achieve the normal operation of the whole system, the Builder shall complete all work including the main system and all auxiliary systems. In view of the complexity of the pipe-laying system, this specification only describes its main functions. Even if the equipment is not explicitly mentioned in this specification, if it is necessary to realize the function of the system, the Builder shall be responsible for completing it. All equipment shall be supplied by the Builder unless otherwise specified. The Builder shall provide interface, installation, commissioning and other services related to the OFE equipment and third party equipment.

In order to successfully complete pipeline laying, the main system of pipe laying operation line of pipe laying ship includes but is not limited to the following contents.

- Line loading and unloading (including pipe crane and main crane);
- Pipe storage (including: wooden deck, support column, guide column and buffer column);
- Transferring roller and an aligning system;
- Pipe end cleaning, processing and welding system (including: Pipe end cleaning, heating, beveling, demagnetization, automatic welding, protective

gas distribution system, mobile platform, welding material storage and drying, welding equipment repair).

- A pipe aligning system (including a aligning device, a winch that pulls the aligning device)
- Working air distribution system
- Welding inspection system
- Tensioner and A/R winch system
- Anticorrosion and coating auxiliary system
- Crane system
- Stinger system
- Workstations, accessway and platforms
- Anticorrosion and coating equipment
- Working rooms: stinger operation room, transfer roller operation room, welding equipment maintenance room/welding material warehouse and other operating rooms which have air conditioning, adequate steel office furniture, shelves, etc.
- Other auxiliary systems, including
 - Illumination
 - Accessway for emergency escape
 - Fire fighting equipment
 - Video monitoring
 - Radio
 - Distribution box, power socket
 - Common compressed air
 - Welding equipment rack

-
- Ventilation equipment
 - Drinking water
 - Fresh water cooling, sea water cooling
 - Eye washing machine
 - Operation status indicator and alarm system

9.2 Main design parameters

- Pipe diameter range (including outer diameter of coating) 4'~60'
- Pipe diameter range (outer diameter of steel pipe) 4'~48'
- Enlarged outer dimensions due to anodes and anti-buckling devices 1'
- Length of single nodal pipe (normal) 12.1m
- Length tolerance of single nodal pipe ± 0.1m
- Max. weight of single nodal pipe 25MT
- Length of single nodal pipe (normal) 24.4 m
- Length tolerance of single nodal pipe ± 0.1m
- Max. weight of single nodal pipe 40MT
- Outer coating of pipe body: concrete;Coal tar enamel;Polyethylene; Epoxy or other type of pipe corrosion resistant coating.

9.3 Pipes loading and unloading

During pipe laying, pipes will be supplied by transport vessel. When weather conditions permit, the transport vessel will use the main crane and pipe handling crane to unload pipe from the transport vessel to the storage area or directly to the transfer roller.

The ship is equipped with two pipe cranes, one for each port and starboard side pipe stacking area. The main functions of the pipe crane include:

- The pipe is hoisted from barge to the pipe-laying vessel and placed in the designated pipe-storage area;
- Loading the pipe from the designated area to the transfer roller;

-
- Lifting of personnel on and off ship;
 - Lifting of spare parts and materials from other ships.

Crane capacity (under full rotation condition):

main hook 40m working radius ≥ 25 MT

 25m working radius ≥ 40 MT

 Min.working radius ≤ 9 m

hooklet: ≥ 10 MT

The builder shall be responsible for the installation, connection and debugging of the equipment, and shall provide the crane pedestal, handrails, railing bracket, cables, oil products related to the crane, etc., as well as all materials such as oil materials, shackles and heavy objects used for debugging.

9.4 Pipe storage

Wooden deck: Pipeline storage areas are arranged on the port and starboard sides of the main deck, with a total area of about 1000 square meters, on either side of the main operation line. Wood decks are used in the two storage areas. The specific requirements of wood decks are shown in the outfitting design drawings.

Support pillars: storage area left and right sides of the support column, column over deck surface is not less than 3 meters high, and protection for pipe, in all environmental conditions, including downtime and standby, pillar strength must meet the 4 layer x24 "with 120 mm thick cement counterweight tube storage requirements, so it should fully consider the influence of ship motion on the support column. Set polyurethane coating or thick rubber pad on the side of the column against the pipe to avoid damage to the pipe.

Guide column: guide column shall be installed at least along every 3 longitudinal conveyors to assist the crane to place single/double nodal pipe on the longitudinal conveyer line. Each column shall be covered with thick rubber pad or rubber tire to avoid damage to the pipe.

Buffer column: the front end and rear end of the longitudinal conveyor on deck are equipped with end buffer column, in order to prevent single or double nodal pipe rolling off from the longitudinal conveyor. The buffer surface is provided with a thick rubber pad to prevent damage to the pipe and pipe coating.

All columns shall be designed to be removable and pedestals shall be provided

on the main deck , the pedestal height should be as low as possible, using bolts to connect the base to the column.

9.5 Transport roller system

The transport roller system includes the following equipment:

- 51 longitudinal transmission machines
- 8 sets of fixed transverse beam
- 3 sets of transverse conveying devices
- 6 sets of transverse trolley
- 1 set of centring station
 - ✧ 1 set of freestyle supporting roller
 - ✧ 6 fixed pipe section support rollers
 - ✧ 4 adjustable A&R winch wire rope supports rollers
 - ✧ 2 adjustable supporting rollers
 - ✧ 1 stern supporting roller
 - ✧ 1 set of control system (remote control and local control)
 - ✧ 1 set of power unit

The role of the transmission roller is to carry out longitudinal and transverse transportation of the pipe, the pipe is lifted to the longitudinal transmission roller by the pipe loading and unloading crane, and the column and anti-collision device are designed on the side of the roller, these assist pipe to fall in place . Pipes enter the preparation area and finish the beveling treatment on the transverse transmission device. Pipe preheating and degaussing can be carried out during the beveling processing area or the head transverse area, and enter the centering station to complete the centering work through a group of centering devices.

In construction of single nodal pipe, tensioner is set behind seven workstations, including five welding stations, 1 pipe cleaning station, an inspection/repair station. Pipe butt-welding by five welding stations (including automatic welding equipment welding), start welds polishing & cleaning ,cooling at the No.6 station , then automatically AUT nondestructive inspection at the No.7 station , also a repair station at he No.7 station.

In construction of double nodal pipe, tensioner is set behind 4 workstations, including 3 welding stations, 1 pipe cleaning station, an inspection/repair station. Double donal pipe butt-welding by 3 welding stations (including automatic welding equipment welding), start welds polishing &cleaning ,cooling at the No.4 station , then automatically AUT nondestructive inspection at the No.4 station , also a repair station at the No.4 station.

Each roller set in front of the tensioner can be composed of 8 to 10 rollers, and each roller behind the tensioner has an adjustable track support and is installed on the hull deck

The builder shall be responsible for the installation, connection and debugging of the equipment, and shall provide the roller supporting hull base (drawings provided by the supplier), the connection pipes between the roller units (stainless steel material: 316L), pipe coupling and flange joints, connection accessories, cables, etc., as well as all materials used for debugging such as oil materials and pipes.

9.6 Pipe end cleaning ,grinding and welding system

Pipe end cleaning: Before the beveling of the pipe ends, the construction personnel will use hand pneumatic tools or hand electric tools to clean the pipe ends (manual tools are provided by the ship owner). For this purpose, the builder shall arrange and install compressed air and power supply.

The main equipment of the welding system on the pipe laying operation line includes:

- 2 sets of pipe surface treatment (groove processing machine, third party equipment) system
- 2 sets of pipe preheating and degaussing systems
- One induction preheating open ring (the first welding station)
- 1 set of welding repair station
- 5 sets of fully automatic external welding stations
- Welding control and recording system

The Builder shall be responsible for the installation, connection and debugging of

the equipment, and shall provide equipment such as cable ,hydraulic pipelines and pipe accessory, support ,welding mobile platform required , as well as welding materials and auxiliary materials used for debugging. The Builder shall be responsible for installing and arranging power and air sources for normal operation of the equipment

The Builder shall be equipped with a complete auxiliary welding system including:

a. 1 set of welding protection gas distribution system:

The Builder shall provide a protective gas distribution system with external connections, the CO₂ or argon /CO₂ shielding gas to be distributed from the storage compartment closely adjacent to the main line. And connect to each welding station of the pipe-laying line ,the exact location of storage compartment shall be determined by the detailed design and final deck arrangement. The gas distribution system consists of stainless steel pipes that supply all welding and repair stations on the main line.

The manifold can be 80 bar of pressure. There is a main adjusting valve at the junction to the manifold, in order to reduce the pressure (about 125bar) from the storage bottle. The adjusting valve must supply more than 1000 CFH (30 m³/hr) .The manifold with two CO₂/ Argon /CO₂ valves are connected to each welding station, bleeder valves are installed at each end of the collection pipe to the nitrogen cleaning unit, and heating pressure regulating valve directly connected to the valve, it can also be used to mix CO₂ with argon gas, these gas are in cylinders of approximately 125 bar. The preceding data is for reference only. For details, refer to the confirmation documents provided by the equipment manufacturer.

b. 5 Sets of automatic welding welding mobile platform track and supporting devices.

Since the sea pipe will have a small range of longitudinal movement during welding, mobile platform, track and supporting devices are set up to ensure that welding equipment and operators are always relatively stable with the pipe in the welding process.

Each unit shall consist of rails, pulleys, platforms, jacks, etc. The Builder shall also be responsible for installing and arranging compressed air or hydraulic systems for normal use of the equipment.

c. Pipe heated gas cylinder storage rack

Unless specifically requested by the tube heater manufacturer, the pipe heaters

shall be installed in front of the welding station. The pipe heating requires gas, so the builder shall install a gas cylinder rack in the pipe heating area and the gas pipe system shall extend to the anticorrosive station.

d. Welding material warehouse

The welding material warehouse is located near the welding station outside the pipe laying operation line, with a door to facilitate the transfer of welding materials. The warehouse equips welding rod oven, rack, air condition and other welding materials. Its size is determined according to the detailed design drawings.

In addition, attention should be paid:

All welding stations shall minimize the exposure of adjacent workers to welding arc light.

The paint color of the equipment near the welding station is dull color, non-smooth color.

Provide good ventilation to eliminate welding smoke and exhaust gases.

9.7 Centering equipment (third part equipment)

The function of centering equipment is to align the unwelded pipe with the welded sea pipe end for welding work. It is mainly composed of centering roller, centering device, traction winch and centering control room, etc. Centering roller is a part of the transmission roller, which is not described here

The internal centering device will be supplied by the owner, and install after ship construction completement. The builder shall provide the power and air source necessary for the operation of the equipment.

Two traction winches are set in the front of the operation line, and the builder shall provide the centring traction winches and their attached pulley wire ropes, etc. The winches are driven by pneumatic force, one of which has a capacity of about 8T and the other 3T.

The Builder shall provide one centering control room, and centering console equipped with adequate steel furniture, 1 fixed VHF, air conditioning, onboard telephone, acoustic telephone, etc.

9.8 Inspection system

The pipelay line is equipped with two sets of NDT inspection equipment (AUT). The NDT equipment includes sensor, display, printer and data storage function. The

NDT equipment includes probe, data reading, data processing, data storage ,display, printer and computer.

AUT work room is located on the outside of pipe-laying operation line and near the inspection/repair station. The operation room has a 200 x 200 holes on the operation line side , and will be equipped with network cable interface, independent regulated voltage power, one air conditioner with dehumidification function, a closed-circuit television monitoring system that can monitor the operation, in-ship telephone and one set of steel office desk and chair.

The Builder shall provide a water supply and recovery system for the NDT process. The NDT system shall cool the pipe nodes first and use water to direct ultrasonic pulses into the material. The pipe surface shall be cooled below 100°C.

The cooling water flow required by the operation line is 150[L/min], and the cooling water for each 2min cycle is seawater, which should be provided to the front of the NDT station. The supply and recovery of seawater can be carried out in the same pipeline system and equipped with fresh water flushing pipeline system

The water used for ultrasonic inspection should be fresh water, which can be recovered from under the pipe. Fresh water is recyclable, and the flow rate required by each NDT station is 30[L/min].

9.9 Tensioner and A/R winch

The tensioner is used to clamp the pipe during normal pipeline laying, and the A/R winch is used for pipe collection and pipe abandonment.

The laying pipeline is equipped with two sets of combined 150 t tensioner:

Tensioner Qty.:	2sets
Rated tension (unit set)	150t
Pipe diameter range (total outer diameter including coating) :	4" to 60"
Driving type:	Frequency conversion motor

A 300T A/R winch shall be installed at the front of the pipe-laying operation line, including:

- Winch
- 1 set of vertical guiding measuring pulley
- steel wire rope storage reel

Rated tension (unit set)	300t
Rope capacity of drum:	1200m

Diameter of steel wire rop : ~110mm

Driving type: Frequency conversion motor

Tensioner and A&R winch equipment also includes variable frequency power unit ,1 set of remote control equipment and crawler pad, cushion block spare parts, etc.

A 5T wire rope traction winch and pulley guide device are arranged at the stern near the stinger, it be used to pull the wire rope of A/R winch.

The Builder shall be responsible for the installation, connection and commissioning of the equipment and provide A&R steel wire rope and equipment base, power cables , communication control cables, compressed air ,pipes and accessories, and other auxiliary items needed for debugging test.

9.10 Coating system

There are two sets of coating stations on the pipelaying line, which are used for anticorrosion and insulation of offshore pipeline joints. Each set of coating system equipment includes:

- Power steel brush
- High-pressure foam machines
- Joint mould
- Blasting derusting and recovery device
- Medium frequency induction heating device

The coating equipment shall be provided by the owner when pipe-laying, and the Builder shall provide appropriate distribution power box, compressed air couples and other utility connections at the coating station, as well as gas couples for heating the heat-shrinkable anticorrosion belt.

The Builder shall provide a water supply and recovery system for the painting process. Cooling pipe joint are required at each coating station, and the cooling water flow is 150[L/min]. The cooling water is seawater and can flow into the sea automatically if there are no obstacles.

9.11 Crane system

The crane system of the operation line is arranged above the main deck, and abover the roller transmission system in the closed operation line, corresponding to the roller transmission system, which is mainly used for pipeline transmission when

the local roller system cannot complete pipeline transmission, to ensure the continuity of pipe laying

The pipe can be transported longitudinally to pipe preparation area by the closed crane system in the operation line, and then transverse to the other side of the pipe preparation area, and then longitudinally to in front of the tensioner.

The crane system of the main operating line is disconnected above the first tensioner, and after passing the second tensioner, the crane system continues to the stern.

The crane system is equipped with 6 sets of 20-ton rated load electric hoists, which are used for transmitting the repairing pipes of the operation line. The electric hoists are respectively arranged above the longitudinal transmission line and the main operation line.

Among them, 1 set for port side longitudinal and 1 set starbord side, 1 set for the central area of main operation line, 1 set for welding station 1 and 2, 1 set for welding station 3, 4 and 5, 1 set for AUT and repair station, 1 set for coating station and stern transmission roller. A&R winch cabin is equipped with one set of electric hoist with rated load of 5 tons it be used for hoisting of A&R winch equipment maintenance. The protection grade of the electrical equipment of the pipe-laying operation line is IP56, and the protection grade of the A&R winch cabin is IP44.

All crane layout should fully consider equipment weight of the engineering work area and the lifting area of repairing equipment.

The power cable of electric crane adopts tension drum form

Electric crane uses wireless remote control, and each driving has its own independent code, to avoid wrong action when different driving at the same time.

Power crane should have adequate protection measures, including hook head limit switch , limit switch at rail end , hook head mechanical buffer limit and rail end buffer limit.

Power and control cables should use special crane cable for drum.

The protection level of crane power equipment used for pipe-laying operation line and open deck is IP56, and the protection level of driving electrical equipment used for cabin is IP56. The ship provides a single power supply, it is 400V 3P 50Hz.

Conspicuous SWL signs and numbers should be displayed on the crane and track.

9.12 stinger

A fixed stinger is provided in the middle of the stern, it prevent excessive bending of the pipeline when it is lowered from the stern.

Fixed stinger includes A-frame, stinger, hydraulic latch device of connecting stinger to hull, roller installed on stinger , monitoring & measurement system of stanger state and components, all provided by the builder.

The pulley block is installed on the top of the A-frame to lift and lower the stinger. The length of the A-frame is about 30m.

Stinger is a truss structure. The main structure adopts Q460 low-alloy high-strength steel pipe, the stinger total length is about 79m, which is divided into two part. The length of the first part stinger is about 43.6m, and the distance between stern hinge points is 16.8m. The second part stinger is about 35.6m. they are articulated between the two part of the stinger by connecting the short joint, which is used to adjust the connection angle. The stinger is hinged on the stern, and the position is adjusted by lifting or lowering the A frame by the winch, in order to adjust the inlet curvature radius of the laying pipe

Other equipment provided by the Builder mainly includes:

- The connection structure between stinger and hull requires high local strength.
- A - frame base for fixed stinger.
- Lifting system and control equipment of fixed stinger: fixed stinger is lifted and fixed by two 60t constant tension winch and pulley block installed on the crane cylinder, and provides the operation and maintenance platform of the winch. Constant tension winch for electric drive (if the use of hydraulic, hydraulic pump station with control system is required to provide), set up a special drive and control system for the winch control, in order to realize the fixed stinger hoisting and fixed, Each winch set two sets of brake devices, a set of in the high speed end, a set of at the low speed end, the each set brake ia above averaging

1.5 times the rated torque.

- Locking device of fixed stinger hinge point: each stinger hinge point is equipped with a set of hydraulic cylinder locking and hydraulic control device.
- Stinger roller device: a total of 11 groups of roller devices are configured on the stinger to support the vertical load of the pipe. The roller level can be adjusted through the disassembly of bolts or pins. The roller group at the rear of the stinger, including the diagonal inclined guide roller, load measuring roller and the transverse guide roller etc., it can support the maximum load of 50T.
- Stinger control room: The stinger control room is arranged at the stern, CCTV signal is used to monitor the operation process of stinger installation and disconnection, control and state monitoring of fixed stinger winch, and underwater monitoring of the working state of the rear roller of stinger; Monitoring the load of the rear roller of the stinger; Monitoring the working water depth of the rear roller of the stinger The relative angle and depth of the stinger show , the control room of the stinger is arranged at the stern, which is conducive to control field of vision of the stinger , and can be simultaneously transmitted to the pipe-laying console.
- Access for maintenance: the access is set for equipment installation and maintenance of stinger, the aisle frame is made of steel structure, the plastic steel grating is set on the topside.

9.13 station, access and platform

All welding station areas located on the main work line shall be provided with floors of appropriate height, determined according to the detailed design drawings, to ensure walk smoothly in work line area. As required, some areas shall be made of

checkered steel plate, others shall be made of galvanized grating , and these can be detachable

The floor is flat

The floor of painting station shall be galvanized grating, and have channel to allow spills for paint and water.

The floor of the welding station in main operation line covers the overall width of the tunnel to ensure good access and support for welders.

9.14 Other auxiliary systems

9.13.1 compressed air

The Builder shall provide a compressed air distribution system. Compressed air shall be distributed from the central compressed air supply station to each applying equipment, including to the pipe surface processor, centering station, welding station, NDT station, coating station, pipe cleaning station, cooling stations or repair stations are supplied air. In addition, at each station, the distribution system is equipped with at least two quick connections , it is supplying air for small machinery and temporary use.

9.13.2 power socket

The Builder shall provide power and control cable for the installation and connection of all equipment. In addition to the main power supply, at least two 220[V]380[V] sockets shall be installed in the vicinity of the pipe surface processor ,the central station,welding station, NDT station, coating station , pipe cleaner or maintenance station. The sockets for the supply of power to the low-power equipment shall be provided with dust covers when not in use

9.13.3 Alarm & monitoring system

The design of the alarm and monitoring system shall be based on the PLC control system which are produced by Siemens or ABB.

The ship's electrical management system shall be connected with the pipe-laying control system , and to control the electrical load, e.g. to stop all operations in case of loss of power or abnormal conditions.

The Builder shall provide an audible and visual alarm system.

Each workstation is equipped with an audible and visual alarm system. This alarm status is used to give a signal allowing the pipe to move when the pipe joint has completed the welding ,NDT ,repair and coating process.

The alarm signals of all welding stations on the main operating line are directly transmitted to the central console of pipe-laying wheel house.

Each welding /NDT/ repair/coating station on the main line has red and green indicator lights and a button to transmit the signal to the control room.

The central console is provided with a panel that can display the status of each workstation on the main operation line; Red light during welding /NDT/ repair/painting operations , green light when the workstation is ready to move the pipe joint after these operations finishing.

When all the workstations in the control room show green light, the overall green signal light will automatically light up and the operator can press the central switch to trigger the audible and visual alarm of each workstation, and then switch each workstation to the red light state.

The main operation center of controlling pipe-laying operation is the cab pipe-laying central console, including at least the following functions:

- The aforementioned audible and visual alarm system.
- State monitors from all tensioner,A&R Winch,alignment station,welding station,NDT station,coating station and the last group of the stinger roller .
- Displays are using for wind speed and direction,longitudinal trim, athwartships trim and draft depth.
- Remote control device for tensioner and A&R winch
- Two-way communication is with local control of all tensioner and A&R Winch, centring station ,welding station ,NDT station , office and coating station.

The pipe-laying CCTV system shall be connected with the whole ship's CCTV system, and the pipe-laying operation status can be monitored at the cab.

9.13.4 Lighting,broadcast, ventilation, emergency access, fire control system, eye syringe and other auxiliary system equipment shall be ready.

9.13.5 Hydraulic equipment requirements;

All cylinder seals are imported;Stainless steel X22CrNi17 or equal.

The hydraulic pipes in the cabin are carbon steel (ST37.4/ST52.4), the hydraulic pipes of outside the cabin and on the main deck are precision stainless steel pipes (316, containing 2~3%Mo), and the protective cover is installed. All the penetrating piece exposed outside the deck are stainless steel (316L). The hydraulic joints exposed

outside the deck and the tightening bolts are made of high strength carbon steel

The hydraulic penetrating piece exposed outside the deck are stainless steel , it can be used carbon steel if heavy type is used.

Hydraulic pipeline connection type: pipe outer diameter $\leq \Phi 42\text{mm}$,the standard joint with imported brand extrusion molding joint;The outer diameter of the pipe is $> \Phi 42\text{mm}$. its connection type are stainless steel flanges .

10、 HEAVY MARINE ENGINEERING CRANE

10.1 Overview

Aft of the ship, there is a 500 t(full rotary) mast type Marine engineering crane, which is electrically driven and powered by the ship's main power station. The crane is used for hoisting and installation of large offshore equipment and stinger. The secondary hook is used for transferring ditches and pipes from barge, and loading and unloading on the longitudinal transmission line.

All electric winches motors of the crane adopt AC frequency conversion control, motor,frequency converters and transformers, etc. are Siemens or ABB products, frequency converters are AFE type , the crane electrical system THD is <5%.

10.2 Design capacity

Main hook full rotation mode (Condition I):

Safe working load of 500 MT full rotation

The maximum single amplitude of the crane transverse swing is 1.5 degree , the period is 8 seconds.

The maximum single amplitude of the crane longitudinal swing is 1.2 degree , the period is 8 seconds.

Maximum single amplitude of ship heave of 0.5 m

Maximum heeling angle of ship is 3.5 degree

Maximum trim angle of ship is 3.0 degree

The maximum allowable angle of intersection between load line and boom plane is 3.5 degree , it also includes ship heeling and transverse rolling.

The maximum allowable angle of intersection between load line and boom plane

is 3.5 degree , it also includes ship trim and longitudinal rolling.

Wind force and wind factor according to classification society requirements

Dynamic load (including self weight and lifting load) coefficient is 1.10.

Main hook full rotation mode (Condition II):

Safe working load of 350 MT full rotation;

The maximum single amplitude of the crane transverse swing is 1.5 degree , the period is 8 seconds;

The maximum single amplitude of the crane longitudinal swing is 1.2 degree , the period is 8 seconds.

Maximum single amplitude of ship heave of 0.5 m

Maximum heeling angle of ship is 3.5 degree

Maximum trim angle of ship is 3.0 degree

The maximum allowable angle of intersection between load line and boom plane is 3.5 degree , it also includes ship heeling and transverse rolling.

The maximum allowable angle of intersection between load line and boom plane is 3.5 degree , it also includes ship trim and longitudinal rolling.

Wind force and wind factor according to classification society requirements

Dynamic load (including self weight and lifting load) coefficient is 1.10.

Secondry hook full rotation mode (Condition III):

Secondry safe working load of 50 MT full rotation,working radius 70m.

The maximum single amplitude of the crane transverse swing is 3.5 degree.

The maximum single amplitude of the crane longitudinal swing is 2 degree.

Maximum single amplitude of ship heave of 0.5 m

Maximum heeling angle of ship is 5 degree

Maximum trim angle of ship is 3.5 degree

The maximum allowable angle of intersection between load line and boom plane is 5 degree , it also includes ship heeling and transverse rolling.

The maximum allowable angle of intersection between load line and boom plane is 5 degree , it also includes ship trim and longitudinal rolling.

Wind force and wind factor according to classification society requirements

Dynamic load (including self weight and lifting load) coefficient is 1.10.

The state in which the crane stops working , boom on the bracket and the hook head pulley is placed on the deck (condition IV):

Wind force and wind factor according to classification society requirements

10.3 main parameter

When the main hook is in full rotation operation, the lifting ,amplitude, rotation can be working at some time when reducing the load , these parameter of various working conditions are as follows:

main hook is in full rotation operation:

Safety load X work radius	500mt@40m(crane stern boot outreach>37m)
	450mt@45m(crane stern boot outreach>42m)
	400mt@50m(crane stern boot outreach>47m)
	350mt@55m(crane stern boot outreach>52m)

Lifting height above main deck at minimum working radius >75 m

Lifting speed under maximum working load 0—4m/min

Lifting speed under partial load 0—8m/min

Secondary hook:

Safety load X work radius 50mt@ >70 m

Lifting height above main deck at minimum working radius >85 m

Maximum entry water depth of hook head/work load 200m/50mt

Lifting speed under maximum working load 0—12m/min

Rigging hook(between main hook to secondary hook):

Safety work load 15mt

Lifting speed under maximum working load 0-40m/min

Maximum entry water depth of hook head/work load 200m/15mt

rotating mechanism:

Rotating speed under partial load	0-0.3r/min
Rotating speed under safty work load	0-0.15r/min

Boom luffing:

Boom from horizontal position to minimum operating radius (partial load) about 12 minutes

Winch for stability lift goods:

Max. safty work load:	20t
Full-load speed	0-15m/min
No-load speed	0-30m/min

Winch for stability lift hook:

Max. safty work load:	20t
Speed	0-30m/min

10.4 Suitability and utilization grade

The crane and its components are designed in accordance with the requirements of FEM 1.001 and CCS rule. The following are the crane and its mechanism groups and utilization grades

main crane	A3 (U3 & Q2)
main lifting	M4(L3 & T3)
seacondary lifting	M5(L3 & T4)
small hook lifting	M7 (L3 & T6)
rotation mechanism	M5 (L2 & T5)
luffing mechanism	M5 (L2 & T5)

10.5 Services scope of the Builder

Services scope of the Builder as follow:

The crane pedestal is on the deck of the ship, the design dividing line between the crane pedestal and the hull is BL13500mm (1000mm above the main deck). The manufacturing dividing line between the crane pedestal and the crane is BL 20500mm (8000mm above the main deck), and the part below the dividing line is processed, manufactured and installed by the builder. The builder shall do a good job of welding the

welding surface of the crane barrel base;

The turntable (track surface) shall be processed by the supplier, and the on-site welding between the cylindrical base and the turntable shall be conducted by the builder. All the above shall be accepted and approved by the crane supplier

Crane pedestal peripheral viaduct step bridge/platform processing ,fabrication and installation

Processing, fabrication and installation of timber covered jib supports on main deck (design drawings provided by crane supplier) and sea-going/towing fixtures, including service platform for maintenance of jib top mechanism.

Processing, fabrication and installation of hook basket and hook head service platform for maintenance.

Processing, fabrication and installation of handrails around crane pedestal above main deck.

Provide all electrical equipment and connecting cables from the main power station switchboard to the crane electric slip ring, and be responsible for connecting work. This part of the design drawings are provided by the crane supplier.

- The Builder is responsible for providing the sling and test blocks for the crane load test.

11、 DITCHING OPERATION (OPTIONAL)

11.1 Overview

The vessel can reserve the function of ditching operation, and the stern heavy crane can be used for the lifting operation of ditching machine inside and outside board. The vessel can reserve the corresponding transformation space according to the different function of ditching operation.

According to the different seabed soil, can use plough type burying machine or towing jet type submarine buried pipe/cable trench digging machine (below call trench digger) for work. The jet trench digging machine is suitable for soil shear strength of 0-80kpa soil construction, plough trench digging machine is suitable for soil shear strength of 0-180kpa soil construction. Trench digger is an important equipment for laying submarine oil & gas pipelines/cables. Its working process is as follows: The trench digger is dragged forward by the traction mother ship and guided by the plough or jet pipe to break the soil layers on both sides of the submarine pipeline;

The submarine oil & gas pipeline/cable falls to the bottom of the trench by self-gravity, and the oil & gas pipeline/cable trench will be backfilled naturally.

Trench digger is the ship's main equipment of submarine pipe/cable burying. The plough trench digger and the jet submarine pipe/cable trench digger are not working at the same time, using the same storage pedestal, arranged in the ship's pipes storage area.

11.2 Main technical parameter

Main technical parameter of trench digger :

Max.operation water depth: 200m

work capacity: bury pipe and cable

bury depth: 0~2.5m

adapting to the pipe diameter: 4" ~ 46"

adapting to the soil: Ooze, sand ,clay and gravel

digging trench speed: 30kPa@2m@200m/h

[30kPa@2.5m@150m/h](#)

80kPa@ 2m@50m/h

11.3 System composition

Plough trench digger consists of two parts: balance carrier, multi-knife plow. The balance carrier, which is mainly composed of frame, skid, sea cable channel, buried depth device with adjusting & controlling, towing conversion device, signal cable input and fastening device, status condition monitoring equipment and other parts, it located in the front of the burying machine. The skid of the balance carrier is located on both sides of the carrier, which is symmetrical. It is welded into a strip shape by the steel plate, and the front end is upturned. The frame is on the top side of skid, and welded it with skid together.

The digger system of towed jetting submarine buried pipe/cable trench includes five parts: the trench digger body, power and signal transmission umbilical cord cable, umbilical cord cable conveying system, water surface monitoring unit and towing equipment. The trench digger body includes skid, frame structure, buried pipe slipper, buried cable slipper, submersible pump, hydraulic system, instrument barrel, all kinds of sensors, sonar and lighting, etc.

Power and signal transmission umbilical cord cable include: high voltage power cable, low voltage power cable, coaxial cable and multi-stranded wire.

The umbilical cord cable conveyor system includes: umbilical cord cable winch, cable feeder, deck cable guide bracket.;

Water surface monitoring unit includes: power station, integrated monitoring navigation system, etc.

Sensor: touch sensor, depth gauge, oil pressure sensor, shoe angle sensor tension sensor, etc.

Umbilical cord cable: transmission motor power, monitoring system for power, water and sensor signals and communication data.

Towing equipment: towing cable winch, etc.

11.4 Switch between buried pipe and buried cable

Trench digger body equipped with buoyancy bucket, can work in two states: buried pipe state and buried cable state.

In the buried pipe state, only the buried pipe slipper and guide slipper should be retained. The buried cable slipper, bell mouth, corresponding hydraulic cylinder and hose should be removed, the buried cable outlet pipe should be blocked with flange, and the centering device should be installed on the bearing house of the buried cable slipper shaft. There are two centralizing devices. The centralizing device installed on

the inside of the frame . The hydraulic cylinder of the bell mouth are common, and the interface is consistent. The valve on the water pump outlet pipe and leading to the buried pipe slipper is in the open position. The buoyancy bucket must be sealed with a cap to keep water out to reduce the weight of the trencher.

In buried cable state, buried cable slipper (including bell mouth), buried pipe slipper ,guide slipper are on correct position, the inlet and outlet of the buoyancy bucket are in the open. The valve leading to the buried pipe slipper on the water pump outlet pipe is in the closed state.

12、 SATURATED DIVING OPERATIONS (OPTIONAL)

12.1 Overview

This vessel can reserve the function of saturated diving operation. When saturated diving operation is required, part of the support on the storage area should be removed to provide an area of about 600m² for the arrangement of saturated diving equipment. The fresh water, diesel oil and other backup power, communication etc. interfaces required by saturated diving should be considered during the construction of the vessel.

The vessel is considering reserving a 9-person saturated diving system --maximum working depth of 300 meters. It is equipped with a 9-person living cabin, including 6 people in the main cabin, 3 people in the auxiliary cabin, 3 people in the diving bell, 9 people in the high-pressure rescue cabin and other equipment, so that 3 divers can carry out diving operations at the same time.

12.2 mian technical indexes

Working wind speed	≤grade 4
Working water speed	≤1m/s(2kn)
Maximum depth of saturation diving operation	300m
Maximum touring diving depth	340m
Rated saturation staff	9 people
Accommodation cabin (2 sets) , Transition cabin (2 sets)	
Max.work pressure	3.0Mpa
Duration under maximum pressure	≤30 day and night

diving bell

Max.outside pressure	3.4MPa
Max.inside pressure	3.0MPa
Rated staff member	3 persons
Emergency support time	≤12 Hrs.

12. 3 Main component equipment

(1) diving bell

Max. population capacity	3 people
--------------------------	----------

(2) Saturated pressurized cabin

Rated main cabin staff	6 persons
Rated secondary cabin staff	3 persons
Rated high pressure rescue cabin staff	9 persons

(3) Lifts and move device of diving bell

(4) lifts and move device of diving bell Mooring ballast.

(5) heave compensator

(6) Mechanical retracting device for umbilical cord cable

(7) Diving bell console

(8) Saturated pressurized cabin control console

(9) Cabin loading and decompression system

(10) Environmental control system

(11) Gas analysis and oxygen supply system

(12) sanitation system

(13) Air supply and emergency air supply system of diving bell

(14) Respiratory gas recovery system

(15) Seawater heating system

(16) Hydraulic system

(17) TV monitoring ,communication , sound and light signal alarm system

(18) Integrated monitoring system

(19) Supply and distribution system