

Modification introduction

- The purpose of modification: by installed the propulsion device and the dynamic positioning control system to make the ship have the dynamic positioning function, and obtain class DP2 according to class .
- The top construction is located in the bow position, the main deck area after top construction is operation deck, covered with pipe laying operation equipment and cranes. The space below the main deck is covered with 12 wireropes positioning system, auxiliary equipments, fresh water tanks, fuel tanks, ballast tanks and other cabins.
- According to the above situation, Scheme 1 is introduced herein:
1641kWx12sets of deck type combined thruster are installed on the main deck, which is driven by the diesel engine installed in the separate container with high integrated and easy installation.
The port side&starboard side of the main deck will be widened by extended outboard direct in order to protect the thruster from damage when transport ship is capable of mooring alongside.

Deck-mounted mechanical propulsion introduction

- Deck combination rudder paddle, as shown in the below picture, the diesel engine is installed inside of container. Besides the diesel engine body, also including the coupling device, steering mechanism, water cooler, fuel cabinet, ventilation, local control, lighting, fire fighting, other equipments and accessories are integrated into the container. The application of deck combined thruster has been used widely in shipmarket, and it is widely used in the modification of domestic cable laying ships to add DP function for non-self propelling cable laying ships.

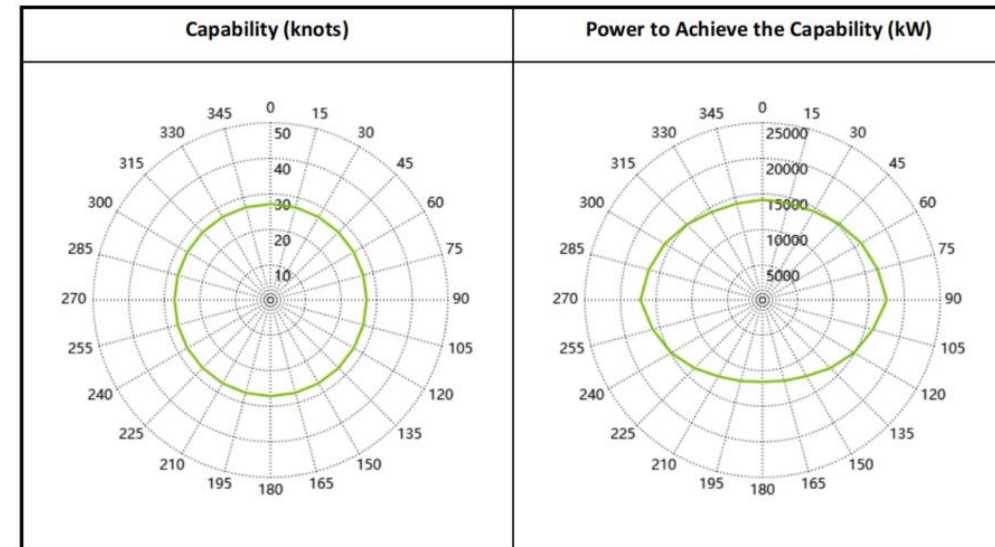
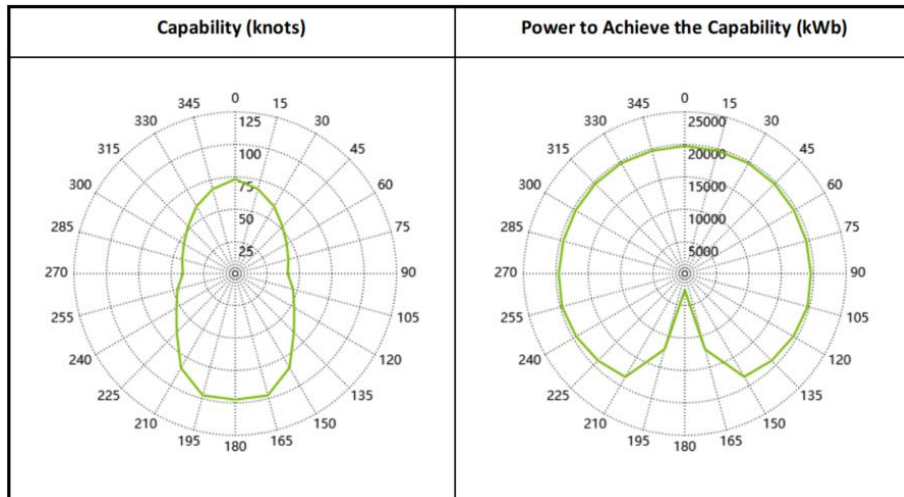


Dynamic positioning capability analysis

- The calculation software "VESPA" of the dynamic positioning manufacturer GE is used to carry out the dynamic positioning capability analysis to determine the power of the deck combination rudder paddle.
- Dynamic positioning ability analysis environmental conditions: 27 kn wind, 2m wave, 2 kn current, 225T pipe tension.
- After calculation, the scheme of 12x1641kW deck combined rudderpropellers is recommended. The analysis results of DP2 dynamic positioning capability are as follows (Note, DP capability analysis assumes that external forces such as wind, wave and current act on the ship from the same direction, which rarely occurs in reality; GE DP capability analysis software has 10% margin):

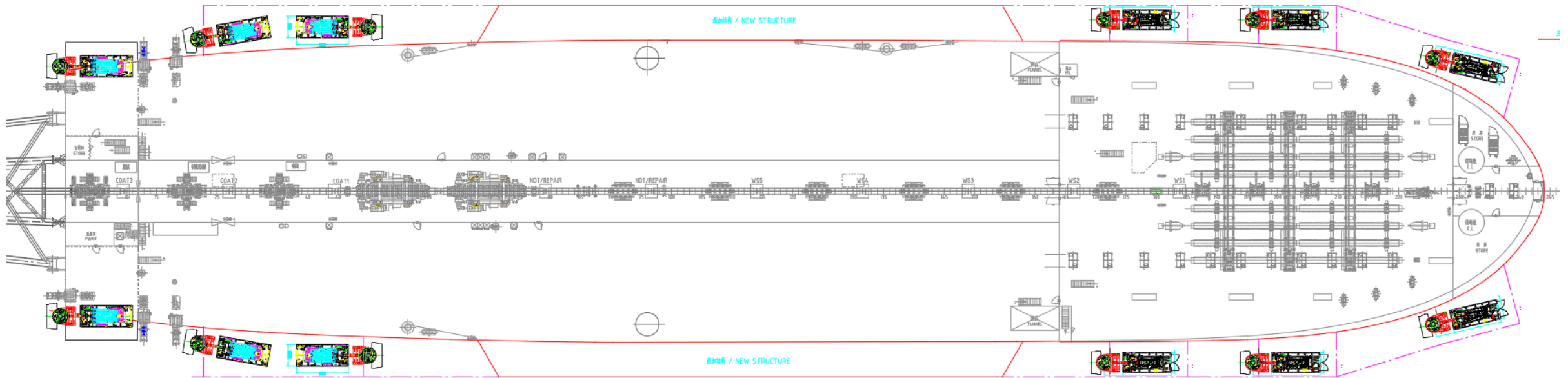
➤ Full mode (All thrusters work normally, the outermost ring is 0~360 degrees Angle value, 0 degrees for the bow, 180 degrees for the stern; The number of the inner ring is the wind speed, the unit is knot)

➤ Single point failure mode (most serious single point failure, loss of 1 set of stern paddle)

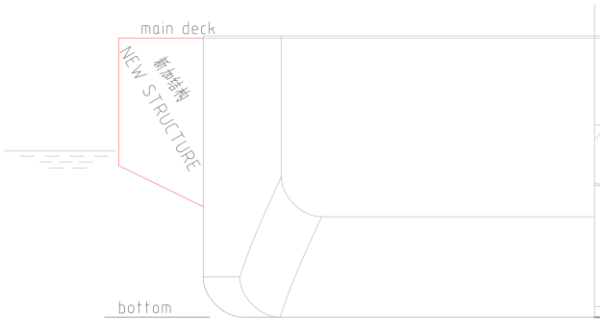
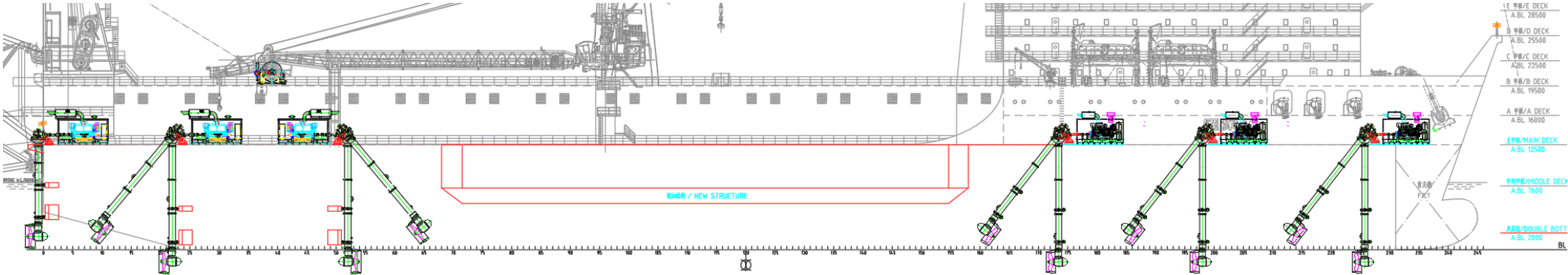


Deck-mounted mechanical propulsion introduction

- As shown in the figure below, 12 Rudderpropellers are arranged on both sides of the main deck. The Rudderpropellers extend out of the bottom of the ship. In shallow water or docking, the Rudderpropellers can be be lifting up above ship bottom.



Deck-mounted mechanical propulsion introduction



Modification cost&period estimate

equipment	Manufacturer / Origin	quantity (set)	total(RMB, ten thousand Yuan)	date of delivery	remarks
Deck combination rudderpropeller	Domestic well-known brands, dutchthrustleader, Su Chuan, South Gaojing, etc	12	3640	7months(Cummins) 8.5 months(CAT)	Including rudderpropeller and container, without diesel engine
DP2 system	GE/ Britain	1	380	7 months	
desil engine	Cummins (chongqing)	12	2028	3.5 months	K50,1641KW@2000RPM
	CAT(tianjin)	12	5160	6.5 months	CAT 3516C-1640KW/1600RPM
Hull plate、 Pipe material、 Pipe fittings&valves, MSB etc.	Domestic well-known		4200	3 months	
Design and class review				3 months	
Shipyard Construction before in dock				2months	
Shipyard Construction In Dock and Sea trial, Delivery etc.				2 months	
total				10248(Cummins) 13380 months(CAT)	9months(Cummins) 10.5 months(CAT)

Modification work contents

The expected modifications works will include the following contents:

- Modification design, drawing review and inspection.
- combined rudderpropellers installation, including displacement of the original equipment in the installation area, installation of the base on the deck, strengthening of the base area structure, addition of auxiliary structure on the outboard, etc.
- Prefabrication and installation of new structural sections on the side.
- wheel house modification, including the addition of rearcontrol console, DP system control and display equipment on the rearcontrol console, and rudderpropellers and desiel engines remote control system, and DP system sensor installation at the top of the wheel house.
- Distribution board modification, including the bus switch needs to be added to make two busbars; power supply for new equipment such as seawater cooling pump, fuel pump, DP system, etc.
- New equipment such as seawater cooling pump, fuel pump and other equipment installation.
- The increase of pipelines is mainly to provide cooling seawater for the diesel engine and rudderpropellers , and to add fuel for the fuel tank in the container.
- Cable laying, distribution board for seawater cooling pump, fuel pump, rudder steering (if required), DP system and other power supply cables, DP system internal connection cable, DP and propeller remote control system connection cable, etc.

The above only lists the items roughly included in the modification project, the accurate material quantity and labor, as well as the shipyard related costs need to be estimated by the shipyard.

Equipment introduction-DP

GE

The Dynamic Positioning (DP) dynamic positioning system

- GE provides complete DP1, DP2, and DP3 system protocol
- The independent joint lever provides automatic heading and automatic positioning functions

- 45 years of experience in dynamic positioning systems
- The first DP system was provided in 1971, and it continued to improve and innovate for several decades afterwards
- More than 1,000 DPs have been provided so far



Equipment introduction-desil engine

Cummins K50

CONFIGURATION: V-16 CYLINDER, 4-STROKE DIESEL

BORE & STROKE: 159X159 MM

RATED POWER: 1641kW

RATED ENGINE SPEED: 2000rpm

LxWxH(mm) :3129*1563*2259

WEIGHT(kg):5724



- High power, small size, light weight, ensure that the deck combined rudderpropeller occupies less deck area, and fewer hull structure changes are strengthened;
- Cummins' proprietary MCRS electronically controlled fuel system ensures the excellent dynamic response capacity of the engine and better meet the needs of ship DP operations;
- Excellent starting performance, without pre-lubrication pump continuous work, from starting to stable speed can add the load is not more than 5 seconds;

Equipment introduction-desil engine

CAT 3516C

CONFIGURATION: V-16 CYLINDER, 4-STROKE DIESEL

BORE & STROKE: 170X190 MM

RATED POWER: 1640kW

RATED ENGINE SPEED: 1600rpm

LxWxH(mm) : 3637*1967*2037

WEIGHT(kg):7964

- The engine is manufactured, assembled and tested at the CAT tianjin plant;



Equipment introduction-rudderpropeller

Dutch thrustleader TLAT2200DM



Thruster System Data 推进器数据	
Thruster Component 推进器类别	Description 描述
Thruster brand 推进器品牌	Dutch thrustleader 荷兰达器
Thruster model 推进器型号	TLAT2200DM
Drive Type 驱动形式	Diesel Engine 柴油机驱动
Thruster input power 输入功率	1641kW
Nominal input speed 输入转速	2000 rpm (t.b.d)
Propeller speed 螺旋桨转速	314rpm (t.b.d)
Propeller type 螺旋桨形式	4 blades / Ni-Al Bronze / Fixed Pitch 4叶/镍铝青铜/定居桨
Propeller diameter 螺旋桨直径	Ø 2200 mm (tbd)
Rated bollard pull 额定系柱拖力	279KN
Propeller rotation direction 螺旋桨旋转方向	Left (as looked from the stem) 外旋
Duty cycle 工作制	S1-continuous duty operation 连续工作制
Steering type 转舵形式	Hydraulic motor drive slewing gear 液压马达驱动回转支撑转舵
Steering speed 转舵速度	about 180°/15s

