

CCS OIL TANKER SERVICE MANUAL

CCS
CHINA CLASSIFICATION SOCIETY
中 国 船 级 社

Overview

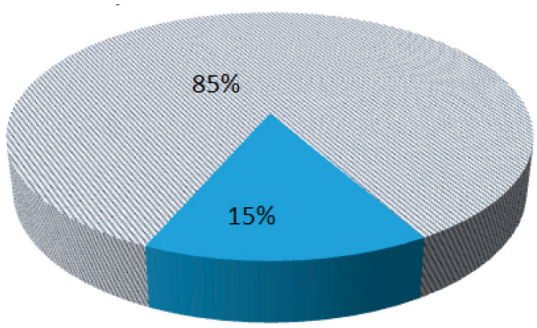
By sticking to the policy of "building first-class international classification society with own characteristics and with technology as the foundation and credibility as the cornerstone", CCS improves continuously its image and value in the oil tanker sector through advanced technology and quality service and is widely and highly recognized by the industry.

CCS classed oil tankers cover all types from VLCC, Suezmax, Aframax, Panamax to Handy size, as well as product carriers of LR1, LR2 and MR, integrated and independent petroleum asphalt tankers. CCS provides the clients with technical services such as upgrading of CSR ship types, Anti-sediment design, solutions to emission control, intelligentization, vibration and noise evaluation, shafting vibration and alignment, ship's energy efficiency, etc.

By committing to the mission of "safety, environmental protection and creating value for clients and society" and based on over 120 offices established across the globe, CCS provides the ship owner with 7X24 hours of survey and technical support services. Relying on its highly efficient service system structure, CCS continuously provides comprehensive support for conducting survey activities, safeguarding ship safety and emergency response to accidents. CCS has continuously achieved outstanding performance in three main MoUs and witnessed healthy and steady increase of its fleet size

Performance (classed fleet)

Since 2000 CCS has completed classification construction survey and certification of more than 9 0 VLCC newbuildings, accounting for 15% of the ships engaged in international voyages. CCS-classed VLCCs are remarkably new, with the average ship age at 7 years.



Pie chart showing the percentage of VLCCs engaged in international voyages

In addition, there are 25 CCS classed Aframax oil tankers engaged in international voyages. In the future, it is estimated that CCS will have newbuilding order for at least 14 VLCCs.



308,000 DWT VLCC (NEW CAESAR)



308,000 DWT VLCC (YUAN QIU HU)



318,000 DWT VLCC (NEW TRIUMPH)



COSCO Shipping 114,000 DWT Aframax oil tanker



308,000 DWT Intelligent VLCC （NEW VISION）



308,000 DWT Wind Sail VLCC (NEW VITALITY)

Ship type categorization and characteristics

Oil tanker: according to MARPOL, oil tanker means a ship constructed or adapted primarily to carry oil in bulk in its cargo spaces and includes combination carriers, when carrying a cargo or part cargo of oil in bulk.

◆ Crude oil tankers are divided into the following types by deadweight:

- ULCC deadweight over 320,000 ton
- VLCC deadweight 200,000 ton - 320,000 ton
- Suezmax deadweight 120,000 ton - 200,000 ton
- Aframax deadweight 80,000 ton - 120,000 ton
- Panamax deadweight 60,000 ton - 80,000 ton

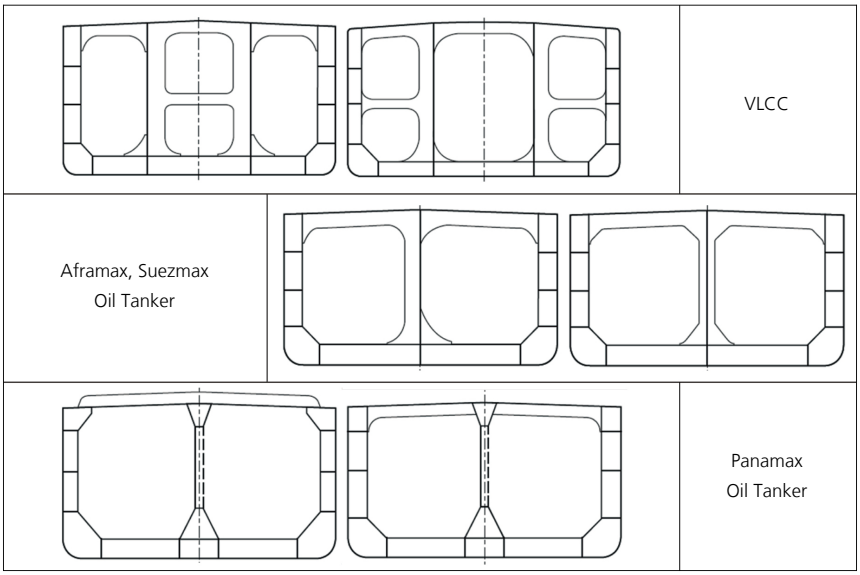
◆ Product oil tankers are divided into the following types by voyage distance:

- LR2 long distance, deadweight 100,000 ton - 120,000 ton
- LR1 long distance, deadweight 50,000 ton - 100,000 ton
- MR intermediate distance, deadweight 30,000 ton - 50,000 ton

◆ Typical transverse sections of oil tankers share the following features:

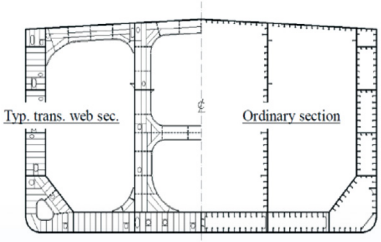
- Cargo oil tanks are enveloped by double bottom, double hull, deck and cofferdam (if any).
- The double bottom, double hull, deck and longitudinal bulkheads are generally longitudinally framed.
- Hull structure outside the cargo tank region is longitudinally or transversely framed.

Typical transverse sections of oil tankers of different deadweight are as follows.



◆ Typical transverse sections of a VLCC have the following characteristics:

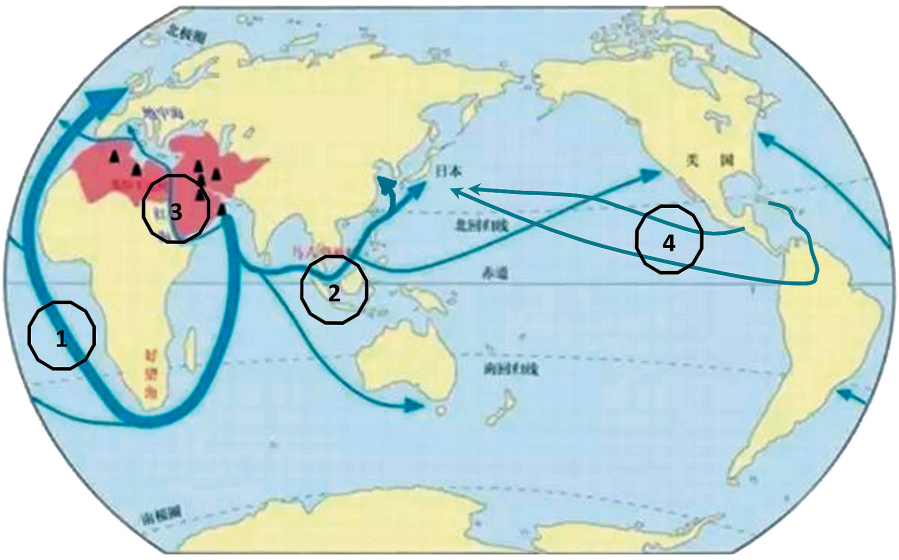
- A VLCC is normally provided with two longitudinal oil-tight bulkheads.
- The shell envelope, inner side, deck and longitudinal bulkhead are longitudinally framed. The spacing of longitudinals is generally 0.85m~0.9m and the spacing of web frames is generally 5.0m~6.2m. Double bottom floor, hopper tank diaphragm, double side diaphragm, deck transverse and vertical girder on longitudinal bulkheads are in the same plane and form into one ring system.
- Horizontal crossties are normally fitted at the mid-span of vertical girders on longitudinal bulkheads. Horizontal crossties are arranged between vertical girders on longitudinal bulkheads in the center cargo tank or between inner side and vertical girders on longitudinal bulkheads in the side cargo tank.



Main routes and ports

There are four major oil transportation routes in the world.

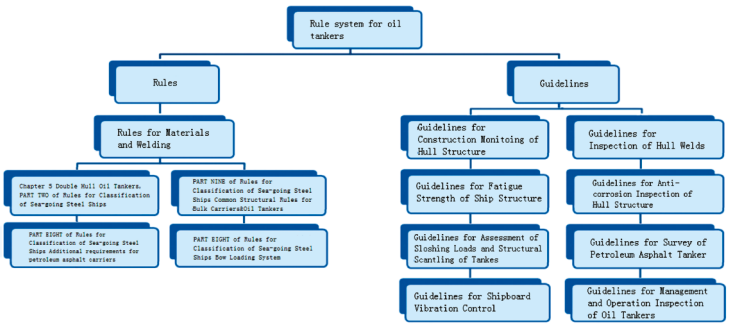
① Persian Gulf -- West Europe and North America route: The main oil supply route to West Europe and North America oil consumption areas; the maximum annual volume was up to 600 million tons, transported by VLCCs primarily. It starts from the Persian Gulf, go through the Mozambique Channel, and around the Cape of Good Hope route.
② Persian Gulf - East Asia route: The main oil supply route to East Asia, the annual volume is more than 100 million tons. It starts from the Persian Gulf, and goes through the Lombok Strait and Makassar Strait by VLCCs or through the Strait of Malacca to the east of Asia by Suezmax oil tankers with a shorter voyage.
③ Persian Gulf - West Europe route: The oil supply route to West Europe, partly transports to North America by tankers within 150,000 tons deadweight. It starts from the Persian Gulf through the Suez Canal, the Mediterranean and the strait of Gibraltar to West Europe and North America.
④ Mexico-East Asia routes: The main oil supply routes to East Asia, one is through the Panama Canal, across the Pacific Ocean to the east of Asia, by Panamax oil tankers, while the other starts from the west coast of Mexico, along the North Pacific Ocean to the east of Asia.



The world's major oil tanker ports are concentrated on the starting points and destinations of oil shipping routes - the Persian Gulf, Mexico, West Europe, North America and East Asia, including but not limited to: Zirku Island, Ras Tanura, Basrah, Das Island, Rotterdam, Singapore, Qingdao, Lanshan, Zhoushan, Dalian, Kiire, Mizushima.

Rules system

Thanks to the experience in oil tanker classification survey accumulated in the past decades, CCS has established a complete technical requirements system for oil tankers.



Characters of classification and class notations

CCS typical characters of classification and class notations are as follows:

★ CSA Oil Tanker; Double Hull; F.P.≤60°; CSR; PSPC(B,C); Emergency Towing Arrangements; Loading Computer(S,I,D); Equipped with Single Point Mooring Connecting Installation; ESP; In-Water Survey; CM; i-Ship(N, M,Est,C,I)

★ CSM AUT-0; IGS; COW; VCS; SCM; PMS; G-ECO(CDx, BWM(T); G-EP(GPR)

Class notation	Description	Remarks
Oil Tanker	Ships carrying crude oil or oil products, note to be added according to flash point of oil carried: ① flash point above 60℃: F.P. >60℃ ② flash point up to 60℃: F.P. ≤60℃	For ships with distance between two hulls in compliance with the Rules, single deck and small-size hatches, carrying crude oil or oil products, the notation "Double Hull" may be added, i.e. Oil Tanker, Double Hull.
CSR	For ships designed and constructed in accordance with Common Structural Rules.	
COMPASS	For ships the design of which has been checked using CCS COMPASS-Structure software, one or more of the following suffixes R, D and F are to be added. Meanings of the suffixes are as follows: R: for ships the check of which against rules has been performed using COMPASS-Structure; D: for ships of which hull structure direct calculations have been performed using COMPASS-Structure; F: for ships of which hull structure fatigue strength assessment has been performed using COMPASS-Structure.	Such notation is necessary for CSR ships.

Class notation	Description	Remarks
Emergency Towing Arrangements	Tankers provided with emergency towing arrangements are to be assigned this notation.	This notation is necessary for tankers with deadweight of 20,000 t and above.
Equipped with Single Point Mooring Connecting Installation	Ships equipped with single point mooring connecting installation according to relevant requirements are to be assigned the notation.	This notation is necessary for oil tankers loading/unloading at single point mooring ports and for obtaining approval from major oil companies. Mooring Equipment Guidelines of OCIMF are to be complied with.
Loading Computer	Ships provided with approved loading computers are to be assigned this notation, with one or more of suffixes OA, S, I and D being added thereafter. Meanings of the suffixes are as follows: OA: Capable of calculating optimal trim curve in each loading condition and creating optimal energy-saving loading plan by automatic optimization; S: Capable of calculating and checking hull strength under various loading conditions; I: Capable of calculating and checking intact stability; D: Capable of calculating and checking damage stability.	Note: OA, S, I and D can operate both separately and together.
Bow Loading System	Ships provided with bow loading systems are to be assigned this notation.	
PSPC	Ships of which specific spaces comply with IMO Performance Standard for Protective Coatings may be assigned this notation, with one or more of suffixes B,C, D and V being added thereafter. Meanings of the suffixes are as follows: B: protective coatings applied in dedicated seawater ballast tanks of all types of ships; C: protective coatings applied in cargo oil tank spaces of crude oil tankers; D: protective coatings applied in double-side skin spaces; V: protective coatings applied in void spaces of bulk carriers and oil tankers.	B, C, D and V can operate both separately and together
CM	Ships for which the Construction Monitor of structural precision at critical locations of hull (including alignment, fitting-up, edge treatment and technological standards) is in accordance with an approved plan.	For tankers and bulk carriers subject to SOLAS Chapter II-1 Part A-1 Regulation 3-10 (Goal-based ship construction standards for bulk carriers and oil tankers) this class notation is necessary.
In-Water Survey	For ships suitable for in-water surveys, this notation may be assigned.	
ESP	For oil tankers subject to Enhanced Survey Programme, this notation is to be added after type notation.	
AUT-0	Main propulsion machinery remotely controlled from BCS, machinery space including center control station periodically unattended.	

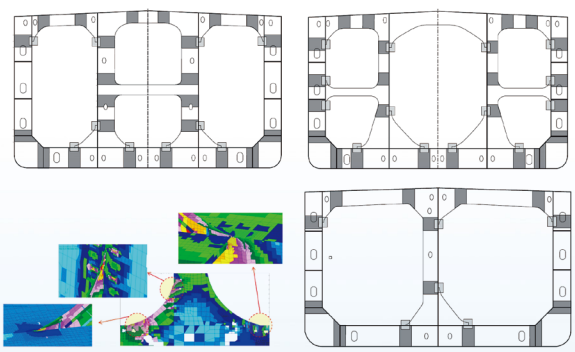
Class notation	Description	Remarks
IGS	This notation may be added for ships fitted with Inert Gas System.	
COW	This notation may be added for ships fitted with Crude Oil Washing system.	
SCM	This notation may be assigned to oil-lubricated or water-lubricated propeller shafts fitted with approved shaft seals.	
G-ECO(X)	Ecological protection notation for green eco-ships. Where it is necessary to indicate further the level of ecological protection, "X" is used to represent the sub-elements as follows: CDx-- CO_2 emission design index, where "x" represents the percentage ratio of the ship's Attained EEDI value lower than the reference line value for that ship; COM-- CO_2 emission operation management; BWM(T)-- ballast water treatment; BWM(Es)-- ballast water sequential method; BWM(Ef)-- ballast water flow-through method; BWM(Ed)-- ballast water dilution method; BWM(O)-- other management method of ballast water; BIO-- biofouling management; VIBx-- comfort onboard (vibration), where x is 1 or 2 or 3, and 3 means the highest grade; NOIx-- comfort onboard (compartment noise), where x is 1 or 2 or 3, and 3 means the highest grade; CLx-- comfort onboard (indoor climate), where x is 1 or 2 or 3, and 3 means the highest grade; UW-- underwater noise; RN-- ambient noise.	
G-EP(X)	Environmental protection notation for green eco-ships.Where it is necessary to indicate further the level of environmental protection, "X" is used to represent the sub-elements as follows: OILx-- control of discharge of oil pollutants, where x is 1 or 2; EAL-- environmental acceptable lubricants; IBTS-- integrated bilge water treatment system; NLSx-- control of discharge of noxious liquid substances, where x is 1 or 2; SC-- control of discharge of sewage; GWC-- control of discharge of grey water; RC-- control of discharge of garbage; NECx-- control of NOx emission, where x is 1 or 2; SEC-- control of SOx emission; VCS/VCS-T-- VOC emission control; RSCx-- control of refrigeration system; INC-- emission control of incineration operation on board; BC20, BC70-- emission control of black carbon; AFS/AFS +-- anti-fouling systems; GPR/GPR+-- green passport; GPR(EU)/GPR(EU)+ -- green passport (EU)	
EOM	Capable of monitoring ship's operation in real time and supporting decision on operational energy efficiency management and optimization by collecting operational parameters of ship's energy-consuming equipment and navigational equipment and synchronizing with shore-based equipment.	

Class notation	Description
i-ship	Intelligent ship is the development trend of the shipping industry. Intelligent ships are to be assigned with this notation with one or more of suffixes Ai, Ri, Nx, Hx, Mx, Ex, Cx and I being added thereafter: Ai-functional notation for autonomous operation; Ri– functional notation for remote control; Nx– functional notation for intelligent navigation; Hx – functional notation for intelligent hull; Mx – functional notation for intelligent machinery; Ex – functional notation for intelligent energy efficiency management; Cx – functional notation for intelligent cargo management; I – functional notation for intelligent integration platform; i – numbers such as 1, 2, 3, indicating the scope and degree of remote control and autonomous operation; x – additional notation for optional function
DFDR	A ship assigned with the class notation of DFDR may has one or more suffix(es) of XN. The intention of XN is as follows: H: the hull structures have been strengthened in accordance with the relevant requirements of natural gas fuel powered ships T: the natural gas fuel containment system (bunkers/fuel tanks) and its supporting members have been installed M: the main engine installed in ship's construction is a dual fuel engine m: main engine installed in ship's construction may be converted to a dual fuel engine in future A: the auxiliary engine installed in ship's construction is a dual fuel engine a: the auxiliary engine installed in ship's construction may be converted to a dual fuel engine in future B: the boiler installed in ship's construction is a dual fuel boiler P: the arrangement in ship's construction has been considered the approaching installation of natural gas fuel supply system and related to, including the arrangement of piping, bunkering station, compressor room, gas valve unit,fire-fighting system, etc. E: the power distribution system has been reserved for the equipment related to natural gas fuel powered system in ship's construction D: the gas dangerous zones have been taken into consideration in ship's construction
ERS	Upon prior ERS agreement between the owner and CCS and an electronic database for stability and structural strength of a ship, CCS will in case of emergency of the ship, e.g. collision at sea, grounding, oil spillage, etc. and at request of the owner, initiate an emergency response procedure to provide calculation and analysis for damage stability, structural strength and spillage, giving technical support to the ship in getting out of danger and recommendations to the owner/master in making final decision.

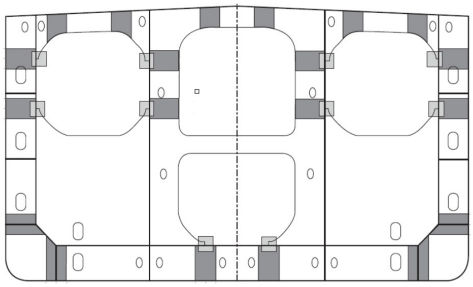
Key technologies

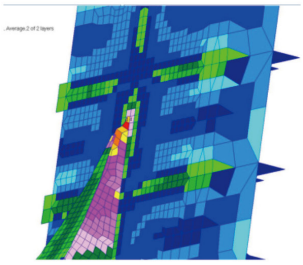
◆ Critical structural areas

(1) Web frames: upper and lower hopper knuckle joint, bracket toes of deck transverses, bracket toes of vertical girders, ends of the crossties.

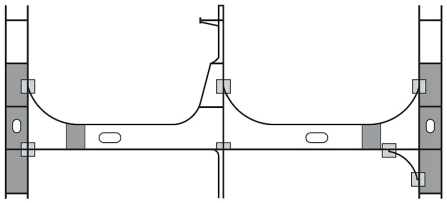


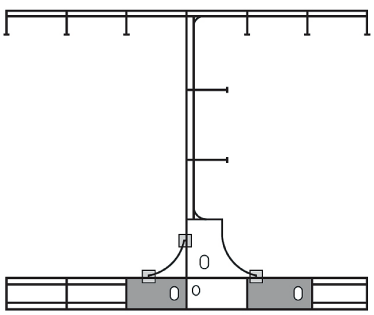
(2) Swash bulkhead: upper and lower hopper knuckle joint, bracket toes of deck transverses, bracket toes of vertical girders, bracket toes of Swash bulkhead.

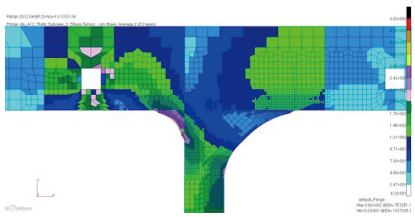


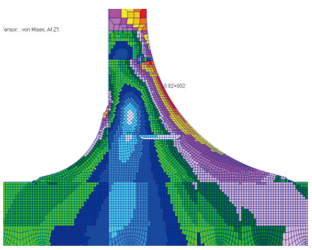


(3) Transverse plane bulkhead: bracket toes of horizontal girders, crossings of transverse/longitudinal bulkheads, bracket toes of vertical girders of transverse bulkheads.

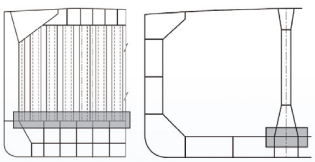


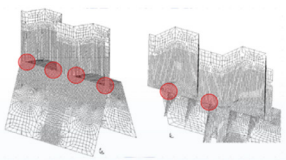


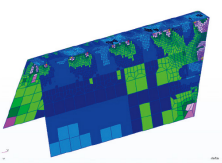


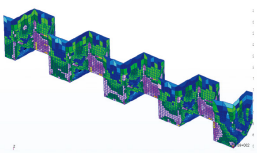


(4) Corrugated bulkhead: lower end of corrugation, crossings of lower stools/inner bottom plates/longitudinal girders.









◆ Structural arrangement and node optimization

By means of research on structural design of real ship and analysis of damage cases, CCS provides structural arrangement and node optimization plan for main ship types and has successfully provided the technical service of "structural arrangement and node optimization" to series of VLCC, VLOC and large container ship projects, helping shipyards and ship owners save cost and increase competitiveness.

Optimization of longitudinal spacing

➢ Arrangement requirements for PMA is that longitudinal spacing is to be within 800~942 mm.

➢Differences in weight of longitudinal member with different longitudinal spacing

Plan	Longitudinal spacing(mm)	Weight of longitudinal member
A	850	100%
B	900	101.69%
C	950	101.83%

Analysis:

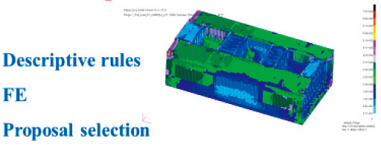
Theoretically speaking, there are no final conclusions: optimization of relatively small longitudinal spacing is based on engineering experience. In fact, longitudinal spacing is to match frame spacing and longitudinal strength margin of the ship.

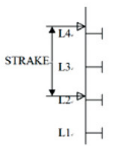
Refined design

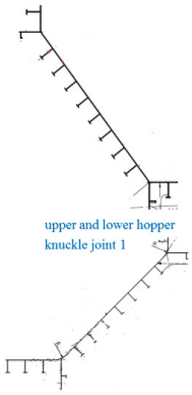
Descriptive rules

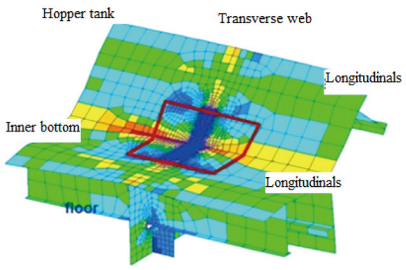
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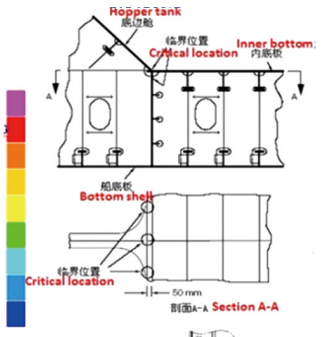
Proposal selection



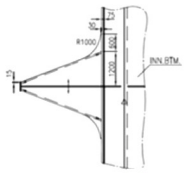


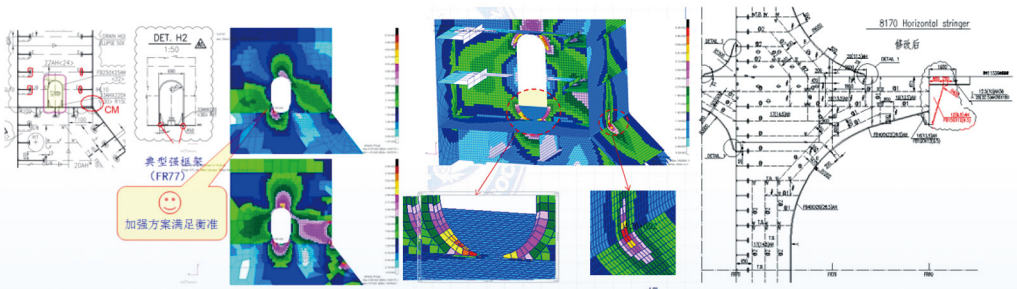






To improve the fatigue strength and rigidity of inner bottom knuckle

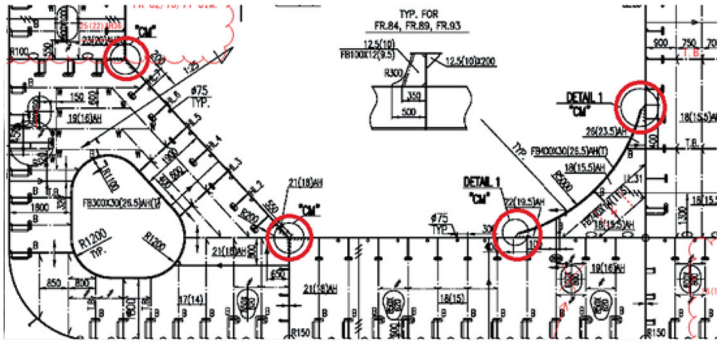




◆ Construction Monitoring of Hull Structures (CM)

VLCC is more than 300 m in length. As a result, quliaty requirements during the construction stage is particularly important. When a ship applies for CM notation, the hull structures will be monitored by CCS surveyers throughout the ship's lifecycle, i.e. in the design, construction and operation stages. The structural precision of critical areas in the ship's structure is controlled by CMP, greatly increases the operation reliablity of hull structures for the ship's life.

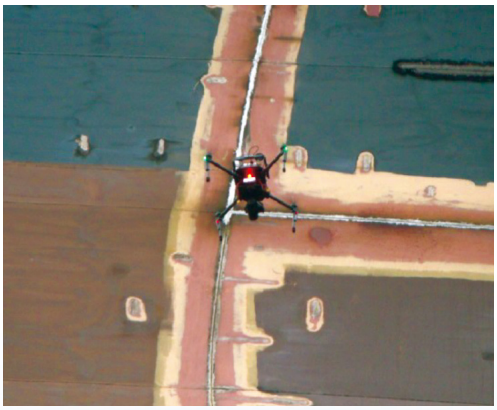




◆ Survey by means of unmanned aerial vehicle (UAV)

During ship surveys, UAVs may be used by CCS to take close-up photos, scanning hull structures automatically or by manual control. In this way, defect screening can be achieved through image recognition technology. UAV can be used as an alternative or supplementary way for survey of those hull structures that are not easy to be accessed or in areas of poor visibility, thus helping to improve survey quality and efficiency, increase survey safety and reduce cost.

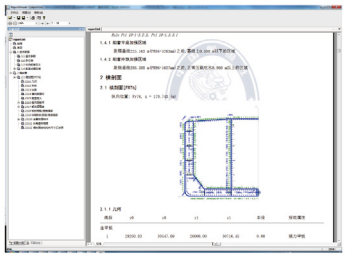


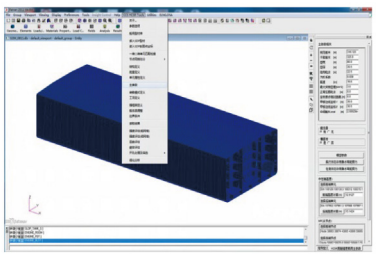


Hotspot technologies

◆ IACS Common Structural Rules for Bulk Carriers & Oil Tankers

CCS has always been dedicated to guiding and helping shipyards and designers to implement the new rules more efficiently. CCS is the first classification society to issue CSR calculation software, which is efficient, stable, integrated, accurate and user-friendly.





◆ Anti-sediment designs

According to the daily information feebacks of ships in operation: when oil tankers unload oil in ports heavy in mud and sand, siginificant sediment deposition occurs in double bottom ballast tanks, affecting survey and operation safety.

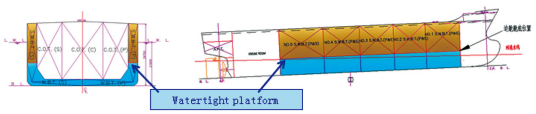
CCS Anti-sediment design is an effective measure for reducing mud and sand deposition. Daily operation of anti-sediment VLCCs shows that mud and sand deposition in double bottom ballast tanks is reduced significantly.

Sediment in real ship



Plan I Illustration of anti-sediment plan using separted ballast tanks

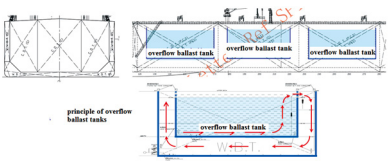
Separated ballast tanks



Explanation: Separated ballast tanks are used to reduce the use of double bottom ballast tank.
Detailed structure:
A watertight platform is provided at the upper hopper knuckle joint to separate the ballast tank into wing ballast tank and double bottom ballast tank. When the ship sails from ports heavy in mud and sand, the Captain use all wing ballast tanks + minimum number of double bottom ballast tanks, provided that the requirements for strength, floatation condition, visibility are met. When the ship has left the area heavy in mud and sand, the Captain ballast the rest of the ballast tanks to satisfy the needs of sailing in full speed. Wing ballast tanks have no structural members on the bottom, making sediment unlikely deposit and easily cleaned.

Plan II Illustration of anti-sediment plan for ballast tanks using overflow method

Ballast tanks using overflow method



Explanation: Overflow ballast tanks are used so that ballast water with relatively little sediment flows into the double bottom ballast tanks.
Detailed structure:
The concept of "smaller tank inside bigger tank" is introduced. An overflow ballast tank with the lower part closed is segregated from the existing L-shaped big ballast tank. In the sedimentation tank, the upper parts of the fore and aft bulkheads are fitted with tank top overflow opening. When the ship sails from ports heavy in mud and sand, ballast water is first pumped into the overflow ballast tank to facilitate sedimentation. When the overflow ballast tank is full, relatively cleaner sea water will flow into the big double bottom ballast tank connected to the double side ballast tank through the overflow opening. This arrangement not only makes mud and sand deposit as much as possible in the overflow tank which is relatively easy to clean, but also keeps the original L-shaped watertight division onboard.

◆ SOx & NOx emission control

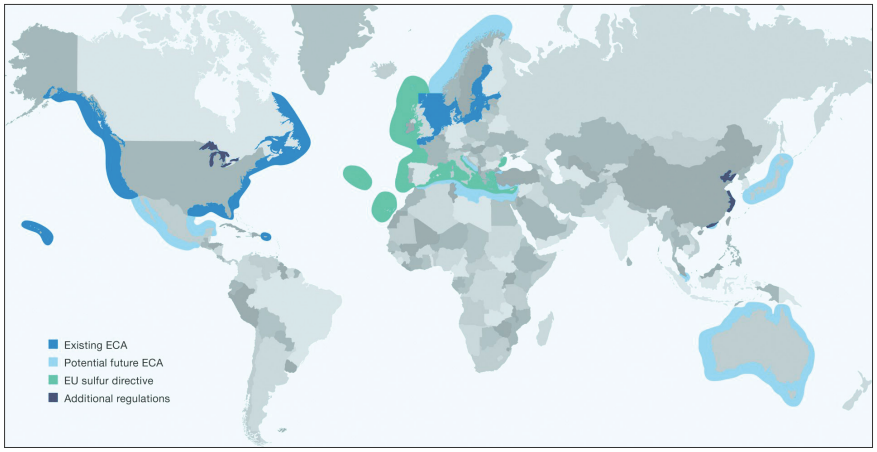
In recent years, international conventions and related countries and regions have more and more strict requirements for air pollution emission control from ships. CCS has always been committed to research on various technologies and methods to effectively reduce SOx/NOx emission from ships. CCS provides clients with single or combined emission control solutions and economical analysis based on ship types and navigation routes.

◎ **Currently, with regard to SOx emission requirements, the following may be adopted:**

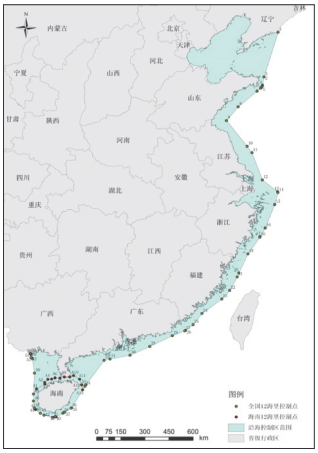
- Low-sulphur fuel oil;
- Dual-fuel power system;
- Exhaust gas cleaning (EGC) system.

◎ **With regard to NOx Tier III requirements, the following may be adopted:**

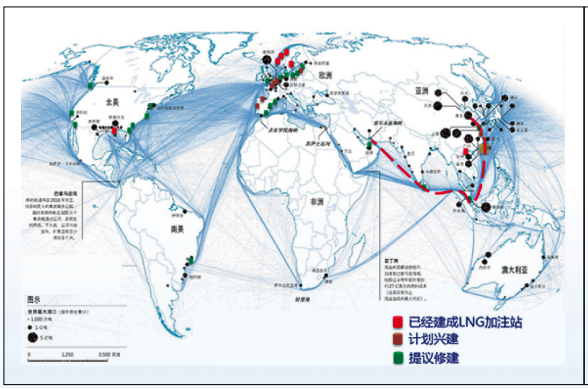
- Low-pressure dual-fuel power system;
- Exhaust post-processing SCR system;
- Exhaust recycling EGR system.



a) Global emission control areas



b) China's emission control area



Typical VLCC route: China-Middle East

China——the Strait of Malacca——Middle East

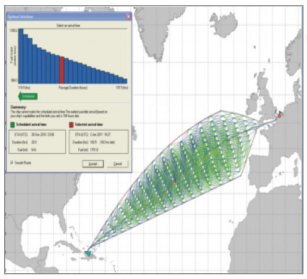
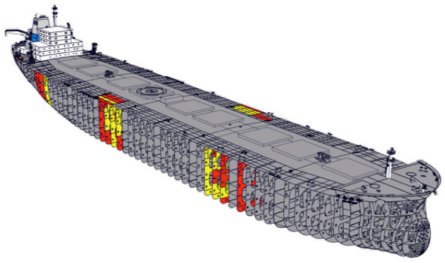
Voyage distance 6,000 nautical miles

VLCC: SCR system is recommended, which is equivalent to EGR system in terms of economy.

When space is sufficient, SCR system, which is more mature in technology, has more advantages.

◆ Intelligentization

CCS can provide ship owners with intelligent technology application service in 8 aspects: intelligent liquid cargo management, route optimization, full life cycle management of structures, condition montoring and assisted decision-making of engine room equipment, montoring and assisted decision-making of energy efficiency parameters, speed optimization, best trimming stowage, and intelligent integrated platform.


◆ Vibration and noise evaluation

Excessive ship vibration and noise will adversely affect the comfort of crew or passengers, cause local structural fatigue damage, cause mechanical equipment failure, and reduce the reliability of ship operation. CCS has a complete system of rules and standards for shipboard vibration and noise control, and provides optional comfort class notation.

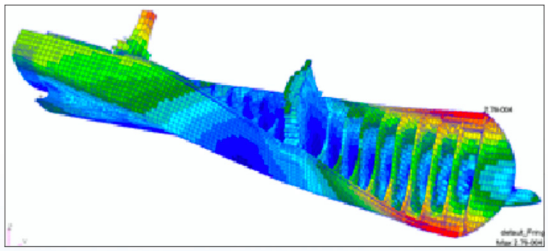
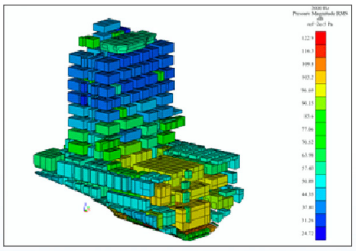
CCS can provide the following technical services:

(1) Hull vibration and compartment noise assessment;

(2) Real ship measurement of hull vibration and compartment noise;

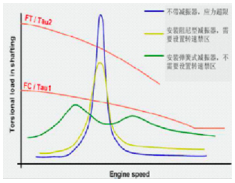
(3) Solutions for harmful vibration and noise on board;

(4) Cooperative development of ships with vibration and noise comfort.


◆ Shafting vibration and alignment

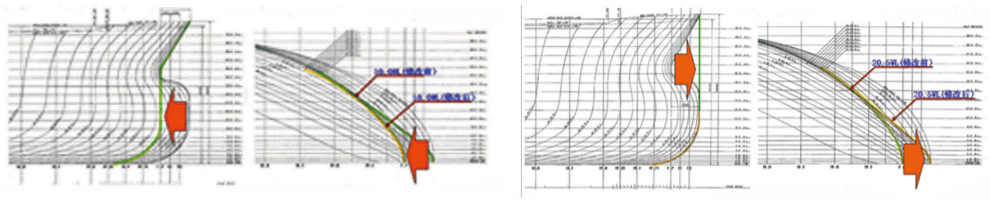


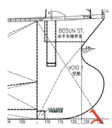
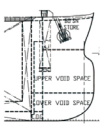
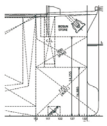
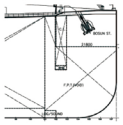


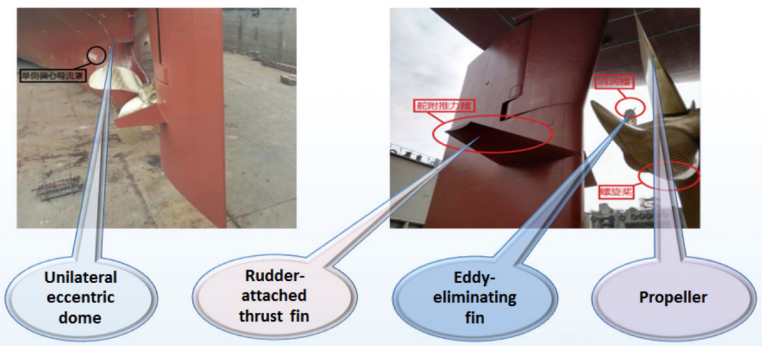
Through the analysis and evaluation of shafting vibration and alignment characteristics, CCS can provide technical support for shafting design, component arrangement and alignment construction process scheme, and effectively avoid excessive vibration of ship propulsion system and fatigue damage of shafting components, bearing overheating caused by alignment process and design. This service can provide customers with shafting vibration and alignment (design scheme, condition) evaluation, shafting vibration and alignment design (design scheme, equipment selection) and other services, and assist shipyards/ shipowners to implement shafting vibration fault analysis and provide solutions.

◆ Application of Energy Efficiency Technology on Ships

Due to the double pressure of environmental protection and operational cost, the shipbuilding and shipping industries has focused attention on ship’s energy saving and emission reduction. CCS can provide technical service such as resistance reduction technology (including line optimization, air lubrication, application of low-resistance coating), efficient propulsion system, energy-saving installations, light weight control, optimization of machinery and electrical installations and systems, best trimming, new energy technology (including wind energy), and intelligent on-line energy management system according to the ship type, logistics and route characteristics, based on reliable experience, scientific tests and numerical calculations.



 The traditional bulbous bow design mainly focuses on the fast performance at designed draught.	 The short bulbous bow design increases deadweight, comprehensively reduces resistance, controls wave’s bending moment and decreases green water in the bow area.
 Improved vertical bow design solves issues brought by the vertical bow design such as green water. Without increasing the overall length, the design of the low bulb ensures the distance of the anti-collision bulkhead.	 The vertical bow design increases deadweight, comprehensively reduces resistance, and improves propulsion efficiency when combined with type G main engine and large-diameter propeller.



◆ EEDI main engine minimum propulsion power

As Resolution MEPC.262(68) adjusted the calculation methods for the minimum propulsion power of the main engine, when estimated according to the amended Level 1 method, the installed power needs to be increased; when Level 2 method is used to calculate the minimum propulsion power of the main engine, it is possible to reduce power and oil consumption of the main engine: (take a VLCC as an example)

Pie chart showing the percentage of VLCCs engaged in international voyages

Indicator	Existing ship type	New ship type
Main engine power (SMCR)	25360kW	24720kW/20020kW
Speed	15.6kn	~15kn/14.5kn
Main engine daily oil consumption (15% Sea Margin)	~90t	↓↓ ~80t/70t

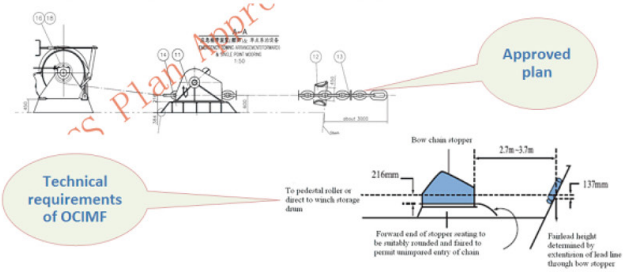
Please pay attention to:

- Calculation reliability of testing method using wave to increase resistance for the minimum propulsion power of the main engine (difference between the calculation results and actual voyage);
- Maneuvering safety of the ship under actual adverse weather conditions.

◆ Survey for compliance with OCIMF requirements

Industry organizations such as CDI, OCIMF devote themselves to improving safety of oil tankers and chemical tankers and protecting environment, always focus on ship's hardware and equipment configuration, and have respective complicated inspection requirements. CCS can provide oil tankers with technical value-added services of audit survey required by these organizations with owner's authorization.

Emergency towing and single-point mooring equipment



According to the provisions of paragraph 4.7.7 of Guidelines for Implementation of the Requirements for Construction and Equipment of Tankers by Oil Industry Organization, single-point mooring equipment is to be arranged in a straight line as far as possible, and the front end of bow chain stopper foundation is to permit unimpaired entry of chain.

Provision of oil blocking flat bar on upper deck

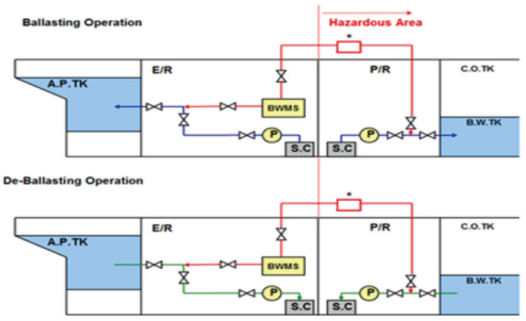


According to the requirements of SOLAS Reg. II-2/4.5.1.6, a permanent continuous coaming of a height at least 300 mm, extending from side to side, is to be provided on upper deck to keep deck spills away from the accommodation and service areas. The OCIMF also has relevant provisions. For example, Exxon Mobil requires that for oil tankers and dangerous chemical tankers over 100000 DWT, the continuous coaming at the edge of bow deck is to be at least 250 mm in height, transit gradually to aft end of cargo tank and connect with transverse coaming at aft end of which the height is 400 mm.

◆ BWM Convention

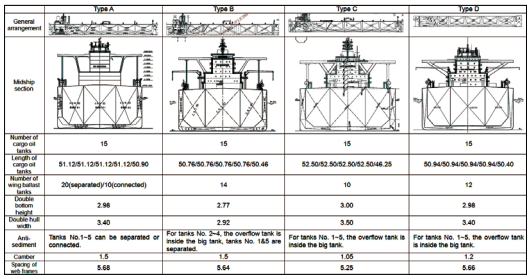
The BWM Convention entered into force on 8th Sept. 2017. See the table below for the date of mandatory implementation for D2 standard. CCS can provide recommendations on the type selection, installation and survey timing of BWMS as well as strategies based on ship type, ballast demand and navigation route. For BWMS installed on cargo tankers, two points are to be noted: ① isolation arrangement is to be located on the open deck within the hazardous area; ② ballast water from hazardous area is not to be discharged into the safe area.

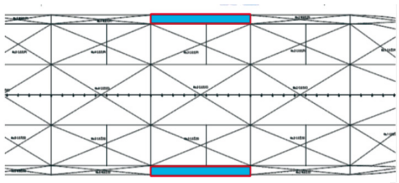
Date of construction	Ballast water capacity (m^3)	Date of mandatory implementation for D2 standard (installing BWMS)
8 Sept. 2017 or after	all	At ship delivery
Prior to 8 Sept. 2017	all	For existing ships that have completed IOPP renewal survey on or after 8 Sept. 2014 but before 8 Sept. 2017, at the first IOPP renewal survey on or after 8 Sept. 2017
		For existing ships that have completed IOPP renewal survey on or after 8 Sept. 2017 but before 8 Sept. 2019, at the first IOPP renewal survey on or after 8 Sept. 2019
		For existing ships that will have IOPP renewal survey on or after 2019, at the first IOPP renewal survey on or after 2019
		For existing ships to which IOPP survey is not applicable, at a date determined by the Administration but not later than 8 Sept. 2024



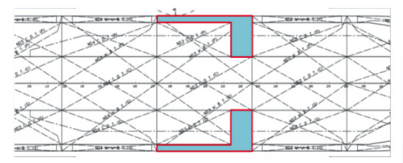
Recommended ship types

Recently, there are 4 preferred ship types for VLCCs which have considered for Anti-sediment design, structural arrangement optimization and comply with requirements of applicable conventions and rules. They are categorized as Type A, B, C and D based on different tank arrangement.





General arrangement of cargo oil tanks and wing ballast tanks for types A, C, D



Arrangement of cargo oil tanks and wing ballast tanks for type B

1) Cargo oil tanks

① For types A, B, C of 308,000 deadweight tonnage, the capacity of cargo oil tanks is over 345,700m^3; for type D of 318,000 deadweight tonnage, the capacity of cargo oil tanks is largest, reaching 358,600 m^3.

② For types A, C, D, the cargo oil tank arrangement is same: 5 cargo tank areas along the ship length and 3 along the ship breadth. The cargo oil tank arrangement for type B is slightly different.

2) Wing ballast tanks

① For double hull wing ballast tanks of VLCCs, the tank width is generally 2.9m, and the double bottom height is generally 2.8m.

② For types A, B, C, 5 ballast tank areas are arranged along the ship length; watertight transverse bulkheads of ballast tanks are in the same frame as those of cargo tanks.

③ For type B, in order to control the maximum hogging as well as the sagging bending moment and lightship, part of the midship cargo tank areas is set as ballast tanks to increase ballast water in the midship area, to decrease the hogging bending moment in the ballast condition and sagging bending moment in the fully loaded condition.

CCS ship type service:

◆ Joint development of ship type

Joint development of ship type is accomplished in cooperation with the shipyard or designer. By making use of CCS advantage in marine knowledge and technology, including comprehensive information such as route, port and channels and by means of advanced technical rules, economic analysis, and structural and performance calculation analysis, effective technical solutions are provided in order to jointly develope top quality ship types.

◆ Optimization and upgrading of ship type

Reliable structural optimization and upgrading solutions are provided by means of scientifically reasonable quantitative and qualitative research and analysis based on current characteristics of ship type, so as to provide strong support for ship type upgrading, making the ship safer, more environmentally friendly, more economical and more efficient.

◆ Approval of ship type

With compliance evaluation been carried out on ship types submitted by shipyards and designers in accordance with the agreed rules and conventions, ship type approval certificate will be issued to lay the foundation for plan approval and ship type promotion in the future.

◆ Recommendation of ship type

Excellent and reliable ship type is recommended to industry in accordance with the basic needs of the clients and based on CCS ship type performance accumulation and advantage in technical experience, covering principle particulars, structural arrangement, and model selection of main engine, energy efficiency indicator, emission scheme and intelligentizing scheme.

◆ Technical training of clients

Based on the needs of the clients, CCS can provide comprehensive and customized technical training service related to rules, software and technical solutions.

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APR, 2023