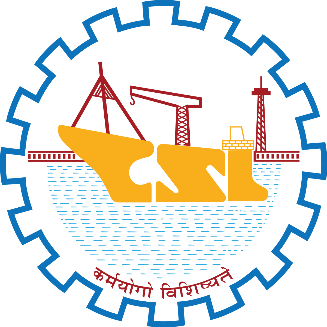
SUMMER INTERNSHIP REPORT



AT COCHIN SHIPYARD LTD.



INDIAN MARITIME UNIVERSITY

VIZAG CAMPUS

SUBMITTED TO: COCHIN SHIPYARD

SUBMITTED BY: TAMOGHNO BANERJEE

BATCH: 2018-2022

DATE: 21/09/2021

**CERTIFICATE**

This is to certify that **Mr. Tamoghno Banerjee** student of Indian Maritime University Visakhapatnam campus has successfully completed his **“Summer Internship of 2 weeks”** at Cochin Shipyard.

|  |
| --- |
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**Cochin Shipyard Mr. Tamoghno Banerjee**

**Day 1:**

**About CSL**

Cochin Shipyard was incorporated in the year 1972 as a fully owned Govt. of India company. It is one of the leading shipbuilders over the last 45 years. In the last three decades, the company has emerged as a forerunner in the Indian Shipbuilding & Ship repair industry. CSL has secured shipbuilding orders from internationally renowned companies from Europe & Middle East and is nominated to build the country’s first indigenous Air Defense Ship.

It is the largest shipyard in terms of deck capacity. Training also takes place here, DGS-approved marine engineering training. They are also partnered with SMSSC of GOI. They have an in-house lab facility accredited by NABL. Only qualified yard in India to build LNG carriers.

* CSL Shipbuilding Docks

1) 255 x 43 x 9M at Kochi

2) 310 x 75/60 x 13M at Kochi (under construction)

3) Slipways:

i) 96 x 22M at Mangalore

ii) 90 x 20M at Kolkata (2 are under construction)

* CSL Ship Repair Docks:

1) 270 x 45 x 12M at Kochi

2) 300 x 30 x 9M at Mumbai

3) 172 x 23 x 8M at Kolkata (2)

4) 88 x 20 x 7M at Port Blair

5) 68 x 20 x 5M at Port Blair

6) Shiplift: 6000T (130 x 25M) at Kochi (under construction)

7) Slipways: 35MT x 250MT at Port Blair (5)

* Collaborative Approach:

1) Partnership with FINCANTIERI(Defense), IHC, ROLLS-ROYCE Marine, AKAR YARDS, GTR Campbell, Samsung heavy industry (LNG carriers), etc.

2) CSL has developed a strong connection with European companies’ like VARD, masterly, ASKO, KONGSBERG, etc.

3) CSL has 35 shipbuilding projects with the Norwegian Business group.

4) presently, they are associated with the construction of aircraft carriers, passenger vessels, and ASKO autobarge.

* Design Capabilities

CSL is one of the shipyards that have the best-in-class design capabilities for

vessels.

Software’s like NAPA, NavCad, Nauticus Hull, 3D Max, Mars, Open foam,

Autocad, IR-HULL, Tribon, etc. are used in CSL.

**Day 2: Inclining Experiment**

* Inclining Experiment is an experiment performed to determine the Lightship Weight and Centre of Gravity (COG) of the ship i.e. LWT, LCG, TCG, VCG.
* It is conducted when ship’s construction is almost complete. All items which are not part of the ship’s lightship weight must be removed. Under the Guidance – IMO Intact Stability Code 2008 – Part B, Chapter 8, IMO Intact Stability Code 2008
* To be dispended from an inclining test, the deviation of lightship mass is not to exceed,
* For L < 50 m: 2% of the lightship mass of the lead ship or as given in the information on stability;
* For L > 160 m: 1% of the lightship mass of the lead ship or as given in the information on stability;
* For intermediate lengths between 50 & 160 m values are obtained by linear interpolation,
* The Deviation of the lightship’s longitudinal center of gravity (LCG) referred to L should not be greater than 0.5% of the lightship’s LCG of the lead ship.
* Where any alterations are made to a ship so as to materially affect the stability, the ship should be re-inclined.
* At periodic intervals not exceeding five years, a lightship survey should be carried out on all passenger ships to verify any changes in lightship displacement and longitudinal center of gravity. The ship should be re-inclined whenever, in comparison with the approved stability information, a deviation from the lightship displacement exceeding 2% or a deviation of the longitudinal center of gravity exceeding 1% of L is found or anticipated.

**Experimental Setup**

* Lightship Condition – Ship should be as complete as possible at the time of the Inclining test.
* Preferably, all tanks should be empty and clean or completely full. The number of slack tanks should be kept on an absolute minimum.
* Decks should be free of water. Water trapped on deck may shift and pocket in a fashion similar to liquids in a tank. Any rain, snow or ice accumulated on the ship should be removed prior to the test.
* The ship should be moored in a quiet, sheltered area free from extraneous forces such as propeller wash from passing vessels, or sudden discharges from shore side pumps. The ship should be moored in a manner to allow unrestricted heeling.
* The tide conditions and the trim of the ship during the test should be considered.
* Prior to the test, the depth of water should be measured and recorded in as many locations as are necessary to ensure that the ship will not contact the bottom.
* The specific gravity of water should be accurately recorded.
* The ship should be as upright as possible; with inclining weights in the initial position, up to one – half degree of list is acceptable.
* The total weight used should be sufficient to provide a minimum inclination of one degree and a maximum of four degrees of heel to each side.
* The use of three pendulums is recommended but a minimum of two should be used to allow identification of bad readings at any one pendulum station. They should each be located in an area protected from the wind.
* Approved Inclining Procedure should be available.
* A small boat should be arranged for easy recording of drafts and freeboard.

**Location of Inclining Weights and Pendulum**

To conduct inclining experiment min. of four number of weights are required and the experiment is carried out with 8 no. of weight shifts. The weight shift sequence is mentioned in the table given below.

|  |  |  |
| --- | --- | --- |
| Weight Shifts | Port Side | Stbd Side |
| 0 | W2,W4 | W1,W3 |
| 1 | W4 | W1,W2,W3 |
| 2 | -- | W1,W2,W3,W4 |
| 3 | W1 | W2,W3,W4 |
| 4 | W1,W3 | W2,W4 |
| 5 | W1,W2,W3 | W4 |
| 6 | W1,W2,W3,W4 | -- |
| 7 | W2,W3,W4 | W1 |
| 8 | W2,W4 | W1,W3 |

Minimum two pendulums are used placed at the fore and aft of the ship. Piano wire is used as the string of the pendulum. The length of the string can be about 3 m. The weight is put in a trough filled with oil to dampen the oscillation and get correct readings during the experiment. A meter scale is attached to the trough to get the readings.

Figure Below shows the concrete block (weight) used to heel the vessel. The condition being the blocks are to be placed on the bulkheads or deep members to avoid any damage to the vessel.

Shifting of the Inclining weights

The figure below shows the movement of the pendulum with every shift.

Experiment Includes:

* Onboard survey of tanks, additional / missing items, Fuel oil, Lube Oil.
* Recording of Draft.
* Collection of water samples.
* Pendulum Stations – fwd & aft
* Shifting of weights.
* Recording deflections.
* Assessing Accuracy of Readings.

Calculations:

* Hydrostatic Tables
* Displacement from draft readings and density of sea water.
* LCG from trim
* TCG from list
* VCG from weight shifts

Determination of VCG:

GM = (w x d) / (Displacement \* Tan ϴ)

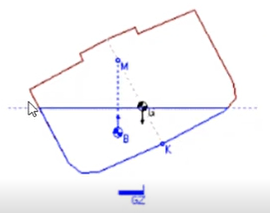
Where, w – inclining weight

d – weight shifting distance

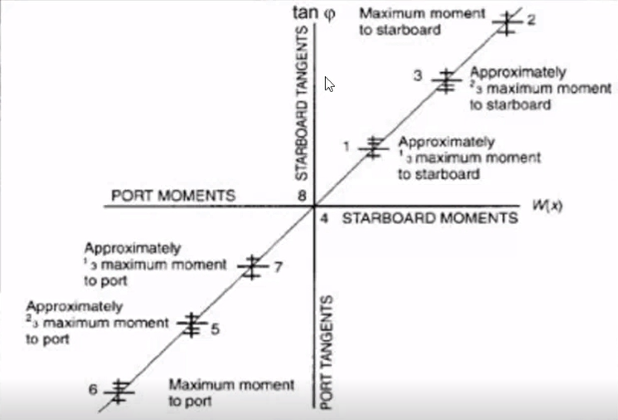
ϴ - angle of deflection

KM – From Hydrostatics table

VCG = KM – GM



Inclining Test Plot:



The plot obtained should be a straight line. It indicates that the experiment is conducted correctly.

Some of the plots indicating errors are shown below:

Inclining Experiment Report:

* Approval of Inclining Experiment Report
* Updating the Stability Booklet
* Approval of Final Stability Booklet

**Model Testing of Ships:**

* Model tests are performed to evaluate ship resistance, propulsion, maneuvering, seakeeping etc. for various hull forms.
* Model testing offers the most comprehensive assessment of power requirements for a new ship in calm water conditions.
* Traditional ship model tests provide still more accurate predictions of ship performance than existing computational fluid dynamics (CFD) methods can deliver.
* Test methodology, post-test analyses and extrapolation to full-scale are guided by International Towing Tank Conference (ITTC).

Major Model Testing Facilities around the world are shown below:

Major Testing facilities in India are shown below:

**Model Specification:**

Model Size

* Model is a linearly scaled down replica of the full scale ship.
* Model to be as large as possible to minimize viscosity scale effects.
* Generally, size of a stock propeller is to be taken into consideration when the scale for a ship model is selected.

Materials Used

* Wood + Wax
* High density closed cell foam
* Fibre Reinforced Plastic

Ship Model:

Stage 1: Manufacturing of Ship Hull Models

Phase 1: Bottom Cutting

5 – axis CNC machine is used for cutting the wooden planks.

Phase 2: Waterline Cutting

3 – axis CNC milling machine is used for this purpose.

Phase 3: Waterlines gluing

Phase 4: Preparation for milling

Hull Model Milling

Phase 5: Hull Surface Finishing

Phase 6: Marking Lines on the Hull

Towing Tank – Applications

* Resistance Tests
* Self-Propulsion Tests
* Open Water Testing of Propellers
* Cavitation Tunnel Tests
* Maneuvering Tests
* Seakeeping Tests

Towing Tank Arrangement

Streamline Tests are conducted paint is applied on various positions on the hull. As the model is towed the movement of the paint help us understand the movement of waves near the hull.

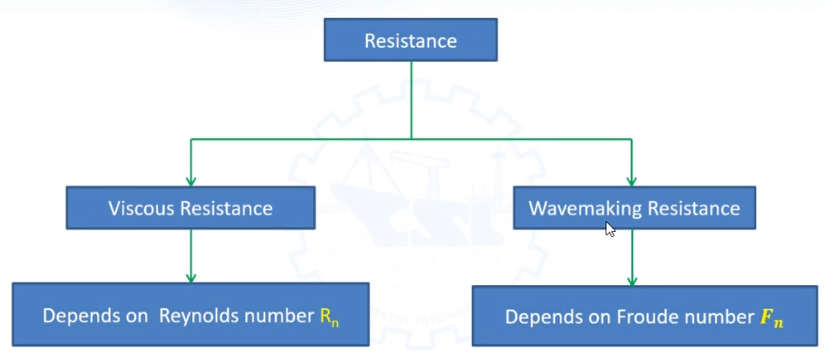
With a 3D model machine the appendages are made for resistance tests.

3D wake tests are conducted and the results are recorded.

Resistance Tests:

The main objective is to determine resistance data for the model, at any desired speed in Calm water condition and extrapolation to estimate Ship resistance.

Components of Ship Resistance are shown in the figure below:



Resistance Extrapolation Method:

Rs = RWs + RFs + Rallowance

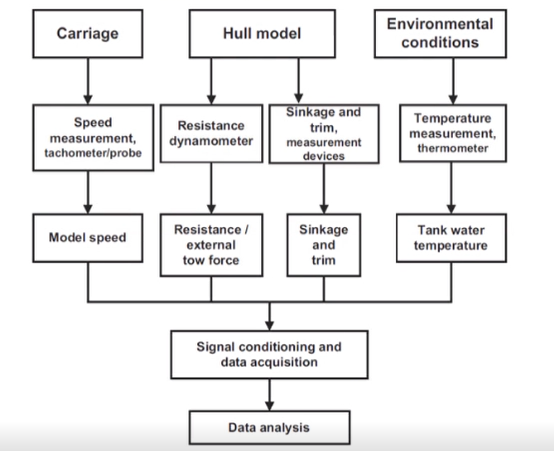
Rs – Resistance of the ship

RWs – Wavemaking Resistance of Ship

RFs – Frictional Resistance of ship estimated based on Grigson’s friction line (ITTC 2002)

Rallowance – The Resistance component supposed to allow for hull roughness, appendages on the ship but not present in the model experiment, still air drag of the ship.

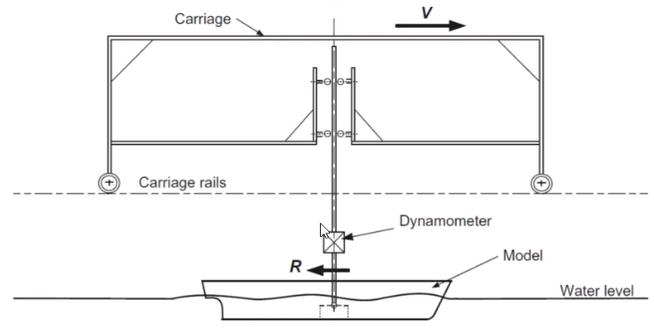
RWs = RWm \* λ3 \* (ρs / ρm)



Procedure

* Model is towed at speeds giving the same Froude number as for the full – scale ship.
* Model resistance and its speed through the water are simultaneously measured for each run.
* The running attitude of the model, i.e. sinkage fore and aft or the running trim and sinkage are also measured.

Arrangement of Towing Carriage



**Self – Propulsion Tests**

Objective:

To determine the power requirements, but also to supply wake and thrust deduction, one other input data (such as the wake field in the propeller plane) for the propeller design.

Procedure:

* In the self-propulsion test, the model is towed at speeds giving the same Froude number as for the full-scale ship.
* Model is mounted on the carriage similar to a conventional calm water test. However, a propulsion system is also added.
* During the test, propeller thrust, torque and rate of propeller rotation are measured.
* In many cases, stock propellers are used which are selected in view of the similarity in diameter, pitch and blade area to full-scale propeller.

Measured Parameters

* Torque Q
* Thrust T
* RPM
* Model Speed
* Sinkage fore and aft

Propeller Rotation Direction – Optimization

Energy Saving Devices – Optimization

Model tests are carried out to determine the optimum parameters of carious energy saving devices at the design conditions of the vessel.

Rudder Angle – Optimization

**Propeller Open Water Test**

|  |  |
| --- | --- |
| Objective:  In reality, propeller operates in the highly non uniform ship wake. However, a standard propeller test is performed in uniform flow yielding the open-water characteristics:   * Thrust coefficient, * Torque coefficient and * Propeller efficiency   Measured Parameters   * Torque Q * Thrust T * Rate of Revolutions n * Speed V |  |

**Cavitation Test for Propellers**

|  |  |
| --- | --- |
| Objective  Investigation of:   * Cavitation induced erosion of propeller blades. * Effect of cavitation on propulsion efficiency. * Vibrations and noise.   Test Types   * Cavitation Observation * Pressure Pulses * Noise measurements   Cavitation erosion |  |

Measured Parameters

* Propeller RPM
* Thrust
* Torque
* Static tunnel pressure
* Tunnel water speed
* Measurement of propeller noise; Using hydrophones

**Day 3: Hull Structural Design**

The flowchart given below shows the design process in a shipyard.

Hull Structure Design, Accommodation Outfit Design, Electrical Outfit Design, Hull Outfit Design and Machinery Outfit Design are the 5 Major Design Departments at CSL.

Hull Structural Design Process Flow

* Key Plans and their Scrutiny
* Detailed Design – TRIBON Modelling
* Preparation of Various Production Drawings

Scrutiny of Key Plans

CSL Comments

* Key Plans will be checked on the basis of design principles and production feasibility.
* Comments will be passed on to designer.

Owner Comments

* Key Plans will be sent to the owner for owner’s correspondence and concurrence.
* Suggestions from owner will be handed out to designer for incorporation.

Class Comments

* Key Plans will be studied by class and scrutinized w.r.t class rules.
* Comments will be sent to designer for incorporating in next revision.

Class Approved Drawings

* Final class approved drawings will be cross-checked with the model for updating them.

Key Plans

List of Important Key Plans for HSD

|  |  |
| --- | --- |
| Mould Line Drawing | Fore end and Aft end structure |
| General Arrangement | Superstructure and Deckhouse Construction |
| Capacity Plan | Transverse Bulkheads |
| Midship Section | Bulwark Construction |
| Profile and Deck | Funnel and Engine room casing |
| Shell Expansion | Major Machinery Foundations |
| Engine Room Construction | Welding Table |
| Frame Sections below Main Deck | Arrangements of manholes and vertical ladders / doors and windows |

Flysheets: Minor revision(s) in main drawings which can be submitted as a standalone drawing for class approval before the final key-plans have been made ready or for any urgent approvals. These will later be merged / incorporated in the final key plan.

Welding Table

The type of weld and its thickness is written in this table.

A welding table for bottom shell is given below:

Major Check Points in Key Plans

* Accessibility to different tanks
* Adherence to class rules
* Missing details of plates and stiffeners
* Missing end connection details
* Continuity issues
* Scantlings mismatch
* Mismatch between key plans
* Production feasibility
* Welding details
* Compliance with general arrangement and tank plan
* Compliance with yard’s hull construction standards
* Fouling of members with erection seams and butts

**Tribon Modelling**

The plans and the inputs required to make a Tribon Model are given below.

* Block Division Plan
* Structural Key Plans
* Capacity Plan
* Manhole and door arrangement
* Inputs from outfit design team

Block Division Plan

Root Concept: Integrated Hull Construction, Outfitting and Painting (IHOP)

Factors Affecting Block Division Plan

* Dimensions of skids at various workstations
* Crane capacity at various workstations
* Painting booth dimensions
* Lifting feasibility
* Position of critical equipments like Main Engine, Bow thrusters
* Blocks with sensitive alignment items like wheel house windows
* Plate size available with yard (optimization to reduce scrap generation)

Fig: Block Division Plan

The whole ship is divided into various blocks and it makes it easy for us to know which type of plating to be used where.

The Figures below show the Tribon Model of a vessel.

|  |  |
| --- | --- |
|  |  |
|  |  |

**Production Drawings**

With a Tribon Model we can generate various plans and tables such as

* Yard Plan
* Nesting
* Stiff List
* Piece Table
* Bending Templates
* Jig Plan
* Lifting Plan

It can be concluded from the above figure that more accuracy in modeling leads to more accuracy in production drawings which finally leads to Lesser time to prepare finalized production drawings.

**Yard Plan**

It is used to make it clear at which section what type of plating, stiffeners, bracket is used and their dimensions. Figure below shows a section in yard plan

**Shell Expansion Plan**

This is a ship's plan giving details of Shell plating. It is a two dimensional drawing of a three dimensional surface of the ship's hull form. It is developed from the ship's line plan with the contour lines erected straight on the base line representing the ship's length. Figure below shows a Shell Expansion Plan

**Nesting**

Nesting refers to the process of laying out cutting patterns to minimize the raw material waste. Figure below shows nesting.

**Stiff List**

It shows the arc, length, radius and angle of the plates. Figure below shows a stiff list.

End Cut details for bulb and L-bars is given below

**Piece Table**

It indicates the Part name, Length, Dimension, Thickness, Grade, Weight, Quantity, Piece, Nesting number etc. of various members. piece Table is shown below

Jig Plan

A Jig Plan is made to place the Jigs at the exact location while building the structure of the vessel. A Jig Plan is shown below

**Day 4: Hull Outfit Design**

Takes care of anything coming on the deck, outside accommodation and outside the machinery space or engine room e.g.

* Steering Gear and Rudder
* Heli Decks and accessories
* Ballast System
* Fire Fighting System
* Air Vent System
* Tank Testing Plan
* LSA and FCP
* Paint Scheme
* Anode Arrangement

Main Functions

* Equipment / Machinery procurement
* Functional Design
* Anchoring and mooring arrangement-mock up
* Ramp design and arrangement for ro-ro ferries
* Anode arrangement
* Manhole Positioning
* Drain Plug Positioning
* LSA and FCP
* 3D Modelling in CAD
* Tribon- migrating to Catia based ‘3D-experience’
* Equipment modeling
* Pipe and vent ducts routing
* Production drawing generation
* Arrangement and layout drawings
* Installation drawings
* Pipe drawings
* Interaction with Class, Flag authorities and ship owner
* Compliance with building specification and owner requirement
* Rule compliance
* Rule interpretation
* Drawing submission and approval
* Comment closure

**Anchor Windlass**

A windlass is a machine used on ships that is used to let-out and heave-up equipment such as a ship's anchor or a fishing trawl.

Figure below shows an Anchor Windlass on board a vessel.

Choosing Anchor, Chain and Mooring Items

* Equipment Number calculation based on class rules
* Part 3 Chapter 15, Section 3, 3.1
* Profile area of above water line
* Breadth of ship
* Height of ship above water line
* Displacement

**Life Boats**

|  |  |
| --- | --- |
| Lifeboats are basically small boats that are kept aboard a ship to carry out emergency abandonment, in case of mishaps such as man overboard, ship accidents, etc. occur. They primarily function as a device for swift and effective evacuation of people in distress from the ship and then aid them to a safe location. |  |

**Inflatable Life Rafts**

|  |  |
| --- | --- |
| An inflatable life raft is a lightweight buoyant platform, designed in the likeness of a small boat in structure. It is carried within water vessels such as yachts and ships during sea travel for the purpose of evacuating the members on board in the event of an emergency. |  |

Choosing life boats

Regulation – Chapter III, Section II, Regulation 21 of SOLAS

* Passenger ships on international voyage- to have life boats to accommodate at least 50% of the total people onboard on each side of the ship.
* Or a combination of boats for 37.5% of passengers on each side and life rafts for the remaining passengers.
* Life rafts to accommodate at least 25% of the total persons on board

**Day 5: Hull Outfit Design**

Tribon Model for a complete vessel

The main topics included

* Bollards, Chocks, Capstan foundation
* Bollards: A bollard is a sturdy, short, vertical post. The term originally referred to a post on a ship or quay used principally for mooring boats.
* Chock: A guide for a mooring line, or steel towing wire which enables the line to pass through a ship bulwark or other barrier.
* Anchor Pocket / Rack detail:  A recess in the bow plating large enough to accommodate the anchor so that there is no projection outside of shell plating.
* Anchor Winch and Chain Stopper Foundation
* Anchor winch: A machine used on ships that is used to let-out and heave-up equipment such as a ship's anchor or a fishing trawl.
* Chain Stopper: A fitting used to secure the anchor chain when riding at anchor, thereby relieving the strain on the windlass, and also for securing the anchor in the housed position in the hawse pipe.
* Emergency Towing Arrangement: The emergency towing arrangements should be so designed as to facilitate salvage and emergency towing operations on tankers primarily to reduce the risk of pollution.
* Safety Plan (FCP and LSA):
* Fire control plan provides all the information about ship's firefighting systems, fire alarms, escape routes, types of bulkhead etc.
* Life-saving appliances are those appliances that protect human life at sea. The devices are documented as part of the [International Convention for the Safety of Life at Sea](https://en.wikipedia.org/wiki/SOLAS_Convention), or SOLAS Convention.
* Ramp Arrangement and details (Aft)
* Air vent system: The functions of venting are to relieve pressure and prevent the formation of a vacuum where pressure differential could impair the structure of the tank.
* Sounding Piping System: Sound pipe- A pipe which leads down to almost the bottom of a tank to enable the depth of liquid to be measured by a sounding tape. A striking pad must be located on the tank bottom beneath the pipe.
* Fire Main system: The fire main is a system consisting of sea inlet(s), suction piping, fire pumps and a distributed piping system supplying fire hydrants, hoses and nozzles located throughout the vessel.
* Manholes Position Key Plan
* Portable Flush Panel Details
* Ladder Arrangement (Inclined and Vertical)
* Anchor and Mooring Arrangement
* Ramp Arrangement and details (Aft)
* Drain Plug Arrangement
* Freeboard Mark and Draught Marks
* Ship Name and Owner’s Logo with Cargo Deck Markings
* Deck Cargo Stowage and Securing Arrangement

Some of the Valves and Fittings used on board the vessel is mentioned below:

**Day 6: Machinery Outfit Design**

Machinery Outfit Design consists of design and integration of machinery space, preparation of layout for engine room and other auxiliary machine spaces, selection of main and auxiliary equipment, preparation of key plans for main and auxiliary machinery system and detailed engineering and production drawings.

Key inputs of Machinery Outfit Design (MOD) are build specification and general arrangement plan. Build Specification is a signed document between the ship owner and the builder. Things getting on board, such as, hull material, machinery, accommodation etc., are specified here. It is one of the most important parts as the design department is concerned. Key activities include procurement which involves preparation of technical specification for each equipment, preparation of technical specification for pipes and fitting, recommending technically suitable equipment for the purchase department to proceed, purchase order technical specification and approval of maker’s drawings. Key plans include preparation of ER layout, piping diagram, calculations etc., key plan approval by class and owner, detailed engineering using TRIBON software, model completion check and interference check before extracting production drawing and preparation of test and trial procedure.

Purchase technical specification includes all the general accessories for main engines. Once they are received, technical evaluation is done and technical evaluation report is done. Then commercial evaluation is done. It involves the pricing part and payment terms.

**Main machinery:**

Main machinery in a ship is involved in propulsion or it is the propeller. In the main engine, the power is transmitted through the gearbox to a shaft, which drives the propeller. It includes bearings to support propeller shafting.

**Auxiliary machinery:**

It is the machinery other than which is involved in propulsion. They are selected depending upon the size, type of the vessel etc. Auxiliary machinery includes auxiliary boilers, economizers, pumps, purifiers, air compressors, heat exchangers, bilge separator, incinerator etc.

The type, Number and Capacities of Auxiliary Machinery often depend on

* The Main Machinery
* Capacity / Size of the vessel
* Governing rules and regulations
* Owner requirements
* Statutory requirements

DG Sets:

* DG Sets are used to generate electric power needed for the ship.
* A ship will have two or more DG sets. Usually tankers have 3 to 4.
* DG set capacities are specified in KW or KVA
* DG sets usually run at about 70% of their rated load
* Fuel for DG sets – HSD in small vessels – MDO and HFO in larger vessels.
* The prime mover and the alternator are coupled usually through a flexible coupling.
* In larger DG sets, the alternator bearings are lubricated by the prime mover lube oil.

Auxiliary Boiler:

* Auxiliary Boilers are used to generate steam for the ship.
* The ship requires steam for
* Running team turbines
* Heating of Cargo oil and fuel
* Tank cleaning and washing operations

Economizer: This equipment as the name implies “economizes” the waste heat of the main engine to produce steam.

Pumps:

Pumps are used for a variety of purposes on board a ship

The following types of pumps are commonly used

* Centrifugal pumps
* Screw pumps
* Gear pumps
* Reciprocating pumps

A tanker has more than 50 pumps required for its routine operation.

Centrifugal Pumps:

Some of the common applications of centrifugal pumps in a tanker are:

* Cooling sea water pump
* Jacket cooling fresh water pump
* Feed pump
* Auxiliary Feed pump
* Boiler water circulating pump etc.

Screw Pumps:

Some of the common applications of Screw pumps in a tanker are:

* Lubricating Oil Pump
* Cross Head lubricating oil pump
* Fuel Oil burning pump

Reciprocating Pumps:

Some of the common applications of Screw pumps in a tanker are:

* Bilge Pump
* Bilge Separator Pump
* Sludge Pump
* Emergency fire pump

Oil Purifiers: Purifiers are equipments which purify the fuel oil and lube oil used on the ship.

Air Compressors: Air Compressors supply the requirement of compressed air on board the ship. For starting the main and auxiliary engines i.e. 30 bar.

Heat Exchangers: Required for heating of fuel, lube oil and feed water on the ship. Steam or hot water is the heating medium.

Bilge Separator: The bilge separator separates the water and oil.

Incinerator: It is used for disposing of oil and solid wastes on board the ship.

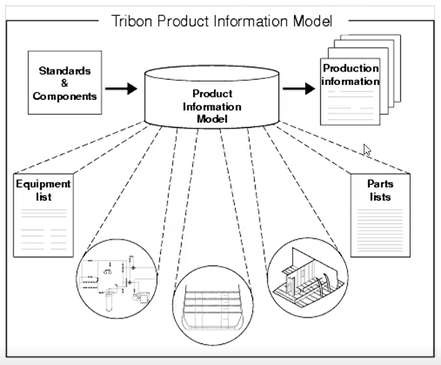
Technical Purchase specifications

* The specifications have to be detailed and clear.
* There should be no scope for misinterpretation.
* It should take care of all operating requirements.
* It should satisfy all rules and regulations.
* It should specify all instrumentation required on the equipment.
* It should include operating conditions like ambient temperature, pressure of operation, duration of operation etc.
* It should include accessories and tools for operation and maintenance.
* It should specify the warranty requirements and supplier’s obligations like installation supervision etc.
* It should include all necessary spares for a period as required by owner and classification society.

**Day 7: Machinery Outfit Design**

Product Information Model

A comprehensive “Ship Database” containing all information about a specific project.



Handing over Manuals / Certificates / As built drawings.

* Preparation of as built drawing after vessel completion.
* Consolidation of test and trial documents and prepare trial reports.
* Consolidation of Equipment manuals, Spare parts manual/list, certificates.
* Handing over all these to Owner during the delivery of vessel.

Detailed Engineering.

Basic design drawings / Equipment data leads to 3D Modelling which leads to Production Drawings.

The ultimate aim is to provide safe and ergonomic designs in compliance with the requirements of Classification Societies and other Statutory Bodies.

It is shown in the flow chart below

**Outfitting Methods**

A shipbuilding system which organizes outfitting work by zone and stage into on-unit, on-block and on-board work.

|  |  |
| --- | --- |
| On-unit: On-unit outfitting refers to a zone where outfitting work is performed as module independent of the hull structure. |  |
| On-block: Refers to a zone where outfit work is carried out on a structural assembly (semi-block, block or ground block). |  |

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| On-board: Refers to a zone on the ship where outfit assembly is performed (Hull erection stage or post launch stage). |  |

**Day 8: Electrical Outfit Design**

Procedure for Electrical Outfit Design

Major Electrical Systems onboard ship

* Electrical Power System
* Lighting System
* Internal & External Communication System
* Navigation System
* Control and Monitoring
* Fire Detection and Alarm System

Generally used voltages onboard ships

* High Voltage 6.6 KV, 3.3 KV ETC @60/50 HZ – Generated as DG O/P Voltages
* 415V AC System @60/50 HZ – Generated as DG O/P Voltages
* 230V AC System @60/50 HZ – Stepped down using transformers
* 24V DC System – Generated through batteries, inverters ETC
* Special Purpose Voltages 115V AC, 28V DC ETC

Typical Single line diagram – Power

Major Power System components

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| 6.6 KV HV main switch board | 440V/230V Transformer |
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**Communication Systems**

Internal Communication

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| Public Address and General Alarm System: The Public Address & General Alarm Systems (PAGA) is a communication system that integrates both (General Alarm) and Public Address Broadcasting to form a complete Communication, Emergency and Evacuation System. |  |

* Auto Telephone System: Auto Telephone System is an electronic telephone switchboard with reliability and durability to meet various needs occurring inside or outside the ship. It operates with the interface between the central exchange unit, which is a micro-computer controlled system, and telecommunication equipment.
* Sound Powered Telephone: A sound-powered telephone is a communication device that allows users to talk to each other with the use of a handset, similar to a conventional telephone, but without the use of external power.

External Communication

GMSS – Global Maritime Distress and Safety System

It is the Internationally agreed- upon set of safety procedures, types of equipment and communication protocols used to increase safety and make it easier to rescue all distressed, boats and aircrafts.

GMDSS consists of

Digital Selective Calling (DSC) – A standard for sending pre-defined digital messages from ship to ship, ship to shore and shore to ship. Based on VHF, MF and HF Maritime Radio Communication.

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| VHF Radio Telephone | MF/HF Radio Equipment |
| Emergency Position Indicator Radio Beacon (EPIRB) – Automated identification and locator device for search and rescue operations. | SART – Search and Rescue Transponder - A manual deployment survivor location device intended for use on life-rafts or survival crafts. |
| Navtex – An International Automated service for delivery of navigational and meteorological warnings, forecasts and urgent maritime safety information to ships. | Inmarsat C – A Global Mobile Satellite Communication system providing two-way data and messaging. |

**Day 9: Electrical Outfit Design**

Navigation System

The art and science of determining the position of a ship and guiding it to a specific destination. Various equipments involved includes.

Major Navigation system equipments

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| RADAR (Radio Detection and Ranging)   * Used to detect other ships and land obstacles, to provide bearing and distance for collision avoidance and navigation at sea * X Band Radar - 10GHZ and S Band Radar – 3 GHZ   The X – Band, being of higher frequency is used for a sharper image and better resolution whereas the S – Band is used especially when in rain or fog as well as for identification and tracking. |  |
| ECIDS (Electronic chart display and information system)  It is a geographic information system used for nautical navigation as an alternative to paper nautical charts. |  |
| Magnetic Compass  Magnetic Compass is a primary means of navigation as a direction indicating device of a ship. It is the ships standard compass. It is fitted above the bridge on the monkey island at the centerline of the ship. |  |
| Gyro Compass  Used to find the true north – electrically powered. |  |

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| AIS – Automatic Identification System  Providing position, identification and other information of the ship to other ships and to coastal authorities automatically |  |
| Echo Sounder  Used to determine the depth of water by transmitting acoustic waves into water. |  |
| Doppler Log  Ship speed measuring device |  |
| DGPS- Differential Global Positioning system for locating the position |  |
| Autopilot  A system which can maintain a vessel on a predetermined (set) course without the need for human intervention. |  |

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| VDR – Voyage Data Recorder  Maintains a store of information, in a secure and retrievable form, concerning the position, movement, physical status, command and control of a vessel over the period leading up to and following an incident. |  |
| Anemometer – Provides the wind speed and direction system |  |
| BNWAS – Bridge Navigational Watch Alarm System  It is an Automatic system which sounds an alarm if the watch officer on the bridge of a ship falls asleep, becomes otherwise incapacitated or is absent for too long a time. |  |

**Day 10: Accommodation Outfit Design**

Design of entire gamut of accommodation works covering Insulation, flooring, doors, windows, side scuttles, furniture, wall and ceiling panels, wet units, galley and laundry equipments, HVAC systems, sanitary supply and discharge systems, cold and cold rooms, provision plants, refrigeration systems, wheelhouse window flushing and wiping systems, provision lifts, passenger lifts.

Accommodation Spaces As per SOLAS:

Accommodation spaces are those spaces used for public spaces, corridors, lavatories, cabins, offices, hospitals, cinemas, game and hobby rooms, barber shops, pantries containing no cooking appliances and similar spaces.

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“A” Class Divisions:

"A" class divisions are those divisions formed by bulkheads and decks which comply with the following criteria:

* They are constructed of steel or other equivalent material;
* They are suitably stiffened;
* They are insulated with approved non-combustible materials such that the average temperature of the unexposed side will not rise more than 140°C above the original temperature, nor will the temperature, at any one point, including any joint, rise more than 180°C above the original temperature, within the time listed below:

Class "A-60" 60 min

Class "A-30" 30 min

Class "A-15" 15 min

Class “A- 0” 0 min

* They are so constructed as to be capable of preventing the passage of smoke and flame to the end of the fire test.

“B” Class Divisions:

“B” Class Divisions are those divisions formed by bulkheads, decks, ceilings or linings which comply with the following criteria:

* They are constructed of approved non – combustible materials and all materials used in the construction and erection of “B” class divisions are non – combustible, with the exception that combustible veneers may be permitted provided they meet other appropriate requirements of this chapter.
* They have an insulation value such that the average temperature of the unexposed side will not rise more than 140-degree C above the original temperature, nor will the temperature at any one point, including any joint, rise more than 225-degree C above the temperature, within the time listed below:

Class “B – 15” 15 min

Class “B – 0” 0 min

* They are so constructed as to be capable as to be capable of preventing the passage of flame to the end of the first half hour of the standard fire test.

**Day 11: Accommodation Outfit Design**

Types of Paneling

* Standard Panel - The basic system provides an attractive, affordable and efficient solution for conventional bulkheads. The system can contribute to the quality of life at sea while meeting structural, Safety and budget considerations.
* Light weight panel - Often recommended for saving weight applications, the HT Panel System is also often used for low weight and high-traffic areas where style, economy, and good insulation values are important.
* Conduit panel - Dropping power and communications-neatly and simply from up there to down hero that's what Prearranged Conduits are all about. Whatever kind of power or communications wiring you need Conduit Size 100x23.5mm
* High noise reduction panel - C50D Panel System is an economical solution in commercial, special and passenger vessels. Panel systems can be designed for new construction, renovations, or retrofit projects where a reduction of intrusive noise or reverberation time is required.

Types of ceiling

* Removable ceiling - Concealed Snap-in Panels, with a continuous bead on sides, specifically manufactured and snapped into the ceiling panel itself. Snap-in panels present a clean look offering upward accessibility, superior noise reduction and sound transmission properties.
* Self-suspended ceiling - Fire class: Continues B-0, Sound reduction index: 48dB.
* Gap ceiling - A linear metal ceiling system consisting of precision, factory detailed metal pedals attached to a concealed carrier suspended from the structure above.
* Lay in ceiling - Fire class: Continues B-15, 30, Sound reduction index: 50dB.

Types of Flooring

* Vinyl Floor
* Tiling
* Raised Floor - A raised floor is a construction model in which an elevated floor is built above a building's original concrete slab surface.
* Floating Floor - The subfloor is installed so that the floor is separate from the steel deck and separate from the walls. The floating application of the floor ensures ultimate noise reduction and offers a high level of comfort for the crew on board.

Galley

* Every ship to which these rules apply, shall be provided with a galley for the preparation of food for the crew, unless the circumstances are such that no members of the crew are required to mess on board.
* The galley shall be situated as near as may be to the mess rooms provided for the crew and any necessary equipment shall be provided to enable food to be served in the mess rooms under all weather conditions.
* There shall be no direct opening between the galley and any sleeping.
* The cooking appliances in the galley shall be arranged in a manner which will facilitate the cleaning of the galley. All cupboards and dressers in the galley shall be made of material which is impervious to dirt and moisture and can easily be kept clean.

Cool and Cold Rooms

* In every ship, means shall be provided to store perishable provision.
* In ships of 3000 tons or over, refrigerated cold rooms of adequate capacity shall be provided for this purpose.
* In ships of under 3000 ton refrigerators or box freezers may be located in a dry provision room or galley or any other suitable place close to the galley.
* Access to every cold store room shall be obtained from a passageway, galley or from another store room.
* The store room or other space in which the refrigerating machinery is situated shall be so constructed as to be gastight where it abuts upon other parts of the crew accommodation and shall be adequately ventilated by at least two ventilators to the open air, one of which shall be fitted with an exhaust fan and shall have its inlet near the bottom of the room or space.
* Access to such store room or space shall wherever practicable, be by means of a hinged door from an open deck.

Dry Provision Room

* In every ship to which these rules apply, no being in a ship in which each member of the crew provides his own food, one or more store rooms shall be provided for the storage of dry provisions for the crew.
* Such rooms shall be fitted with sufficient shelving, cupboards and bins having regard to the maximum period likely to elapse between successive replenishments of stores and to the maximum number of persons for whom food is to be served.
* Every dry provision store room shall be enclosed by bulkheads constructed of steel or other suitable material. Access to every dry provision store room shall be obtained from a passageway, galley, pantry or another store room, or from a position on an open deck with, in so far as is reasonable and practicable in the circumstances, shall be a protected position.
* Every dry provision store room shall be so situated, constructed and ventilated as to avoid deterioration of the stores through heat, draught, condensation or infestation by insects or vermin.
* Without prejudice to the generality of the foregoing sub-rule no dry provision store room shall be situated over a boiler room or any other space in which heat is generated, or shall adjoin a galley or machinery casing unless the dry provision room is adequately emulated. No part of a dry provision store room shall be used for the storage of bedding or textiles

**Conclusion**

The Online training enhanced my field knowledge. Most importantly, I am oriented to the Industrial scenario and its many challenged and subtleties. The smooth functioning of an industry depends to a large extent on the mutual cooperation among its different wings.

Nevertheless, I did enjoy the training to the fullest and I am very sure that this training will help me in the future endeavors.