

Design For Production Workshop



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on

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Update

Category B Data

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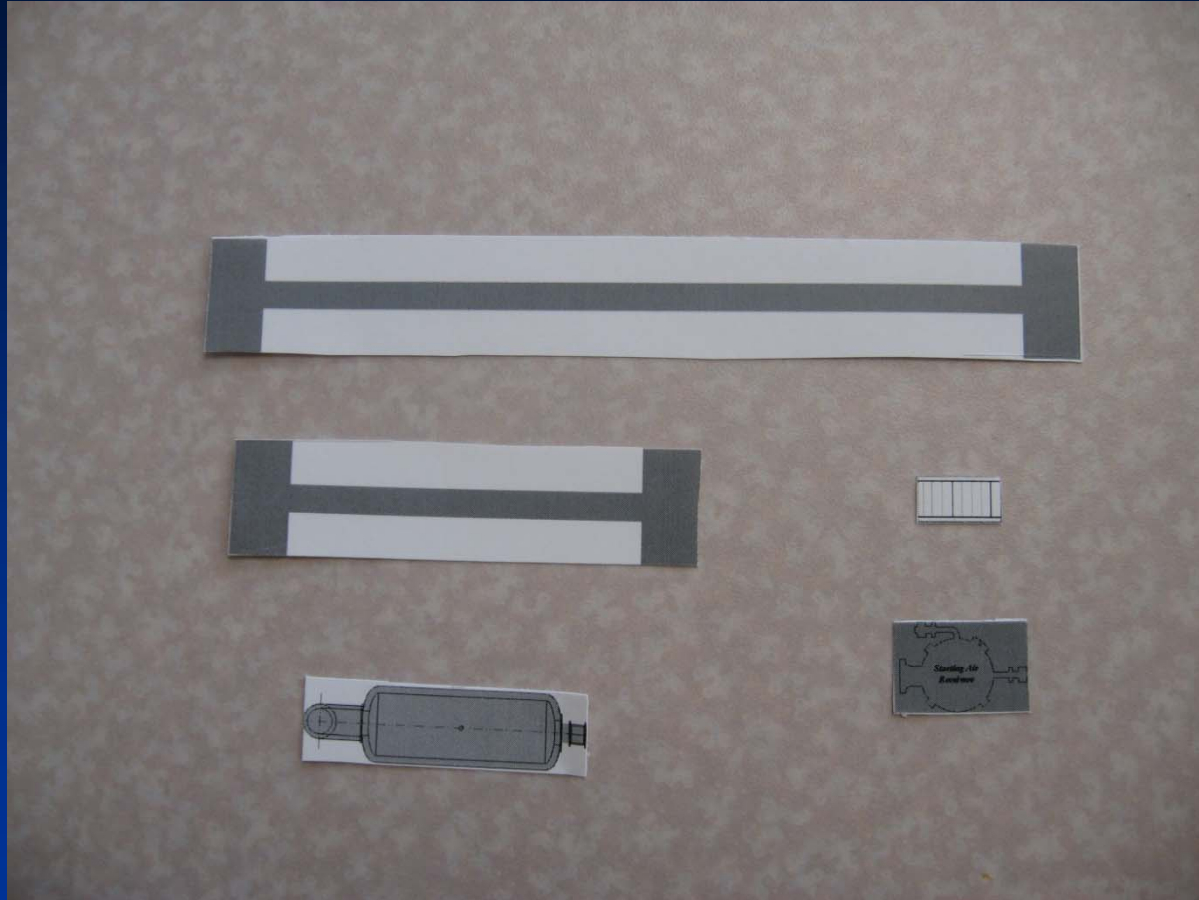
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Changes to Engine Room Exercise Based on Results of Initial Offering



1. Each deck layout template has main engines, gears and shafts.
2. Each deck layout template has diesel generators.
3. Control room is placed.
4. Plastic cutouts are available for all auxiliary equipment to be placed.
5. Major activities will be to:
 1. Place auxiliary equipment
 2. Run walkways (service routes)
 3. Verify access between levels.
 4. Minimize the length of the Auxiliary Machinery Space.
 5. Identify modules shapes and weights and check to see if they match the given facility limitations.

Plastic Cutouts



Module Weight and Size Check



Description	Weight Check	Module shop door width Check	Workstation length Check	Workstation width Check
Module 1	39.24	4	1	4
Module 2	37.68	9	4	9
Module 3	6.17	12	12	4
Module 4	6.36	10	10	2
Module 5	1.40	33	22	33
Module 6	1.86	5	5	5
Module 7	2.35	7	6	7
Module 8	4.40	9	7	9
Module 9	1.02	12	1	12
Module 10	1.01	6	6	3

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Training Exercise 2 Engine Room

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General Sequence for Developing the Layout



1. Start with each deck layout template as there are crossovers between each level.
2. Place walkways associated with the main propulsion equipment.
3. Place walkways associated with the power generation equipment.
4. Place walkways associated with the main control room.
5. Place the lube oil purifying equipment with associated walkways etc.
6. Place the remaining secondary equipment.
7. Place the remaining walkways and check the access between the levels.
8. Identify the outline of the deck openings in both machinery spaces.
9. Minimize the length of the Auxiliary Machinery Space.
10. Identify modules shapes and weights and check to see if they match the given facility limitations.

Templates Required for the Training Exercise



Base Templates

- Base Template - Lower level x 1
- Base Template - Middle level x 1
- Base Template - Upper level x 1

Functional Templates

- Walkways x 1 set of strips
- Exhaust systems: Main Engine x 2 and Diesel Generator x 4 sets
- Ladders x 3 - between the lower and middle deck levels

Main Equipment Templates

- Main Engines x 2 – for each deck level (already located)
- Gearboxes x 2 – for each deck level (already located)
- Stern Gear x 2 – for each deck level (already located)
- Main Control Room x 1 - one each for the middle and upper levels (already located)
- Diesel Generators x 4 - one set per deck level (already located)
- Lub. Oil Purifiers x 2

Templates Required for the Training Exercise



Secondary Equipment Templates

- Pumps
- Compressed Air Panels
- Coolers
- Local Control positions
- Hydraulic Power Packs
- Fresh Water Generators
- Air Panels
- Pneumatic Supply Frame
- Starting Air Receivers
- Fresh Water Hydrophone Tank
- Starting Air Compressors

Assumptions



Assumptions

- Ship breadth fixed
- Two machinery spaces to be arranged (Main Engine Room and Auxiliary Machinery Space)
- Transverse bulkhead locations fixed
- Built-in tank location and size fixed
- The longitudinal spacing is set to 0.5m
- The transverse spacing is set to 1.0m
- The transverse numbering is from left to right starting at 0.
- The longitudinal numbering is from the center line outboard, starting at 0, positive to port negative to starboard.
- Shaft line locations are fixed
- Structural sections are fixed 900mm for shell, all other structure 400mm
- All the equipment is chosen (parts library available and restricted)
- Walkways limited to 1m width
- Control room footprint is fixed

General Layout Rules



Layout rules

- Align structure to grid to simplify the structural connections of the module support structure.
- Align equipment to grid, unless driven by local rules.
- Create straight access routes.
- Create straight service routes to minimize pipe bends.

Structural Boundary Rules



Lower Level

- Side shell structure to be aligned inboard of longitudinal buttocks 22/-22
- Aft Engine Room bulkhead to align with frame space 0, with sections on the forward side
- Forward Engine Room bulkhead to align with frame space 22, with sections on the forward side
- Forward Auxiliary Machinery Space bulkhead to align with frame space 40, with sections on the forward side.
- Aft tanks P/S aligned aft bulkhead and side shell frames 0 to 7 and inboard to buttocks 16/-16
- Mid tanks P/S aligned Forward Engine Room bulkhead and side shell frames 22 to 28 and inboard to buttocks 15/-15
- Forward tanks P/S aligned Forward Engine Room bulkhead and side shell frames 34 to 40 and inboard to buttocks 15/-15

Structural Boundary Rules



Middle Level

- Side shell structure as per lower level
- Aft Engine Room bulkhead as per lower level
- Forward Engine Room bulkhead as per lower level
- Forward Auxiliary Machinery Space bulkhead as per lower level
- Forward tanks P/S as per lower level

Upper Level

- Side shell structure as per lower level
- Aft Engine Room bulkhead as per lower level
- Forward Engine Room bulkhead as per lower level
- Forward Auxiliary Machinery Space bulkhead as per lower level
- Forward tanks P/S as per lower level
- Uptake casings external footprint fixed between frames 13 to 28 and from buttocks 11/-11 to 19/-19

Main Propulsion Equipment Rules



The following are the steps to fixing the position of the primary propulsion equipment in the engine room (already located).

Fixing the position of the Stern Gear

- Assume the position of each propeller shaft is 4.3 m off center line
- Align stern gear with center line of propeller and moulded position of aft bulkhead.

Note: The length of the stern gear shaft can increase anything up to one frame space to allow the gear box to be aligned with the structure below.

Aligning the Gearbox to the Stern Gear

- Align the output shaft line and rearward face of the gear box with the forward face of the Stern Gear.
- Also align the gear box with the structure below.

Note: The transverse position of the gear box can be 0.5 times the spacing of the longitudinals and up to one frame space to allow the gear box to be aligned with the structure below.

Main Propulsion Equipment Rules - Continued



Aligning the Main Engine to the Gearbox

- Align the output shaft line and rearward face of the Main Engine with the forward face of the Gear Box.
- Also align the Main Engine with the structure below.

Note: The transverse movement of the main engine can be 0.5 times the spacing of the longitudinals and up to one frame space to allow the main engine to be aligned with the structure below.

Fixing the position of the Main Engine Exhaust

- Align the exhaust pipe transversely with the Main Engine Exhaust unit.
- The exhaust uptake must run clear of the structure in the Uptake Casing.

Main Propulsion Equipment Rules - Continued



Adding access space around the Propulsion Equipment

- Add walkways as per the walkways and service routing rules.

Fixing the position of the Local Control Positions

- Locate each local control position (LCP) between the Main Engines and aft of the Main Control Room but as close as practical for quick access.
- Minimum space between LCP's and Main Engines is one walkway width.
- It is allowable to have doors open across walkway but is not the preferred solution.
- Add the access walkways between and around each LCP.

Modularization / Pre-Outfitting Rules

- The Main Propulsion Equipment will be separately lifted into the Main Engine Room at the onboard outfitting stage.

Power Generator Equipment Rules



The following are the steps to fixing the position of the Power Generation Equipment in the Auxiliary Machinery Space.

Note: Assume the machinery control room is at the aft end of the compartment but on Middle Level.

Fixing the position of the Diesel Generator Sets (already located)

- Locate the diesel generators in the forward end of the auxiliary machinery room.
- Align the forward ends of all generators to the structure below.
- Diesel generator cannot be located closer together than one walkway width.
- Add the access walkways between and around each generator.

Fixing the position of the Local Control Positions

- Place each local control position (LCP) aft of its diesel generator set and in front of the Main Control Room.
- Minimum space between LCP's and diesel generator set is one walkway width.
- It is allowable to have doors open across walkway but is not the preferred solution.
- Add the access walkways between and around each LCP.

Power Generator Equipment Rules - Continued



Exhaust System Rules

- The exhaust system for the Diesel Generator Sets must be routed to the uptake casings without clashing with any other object.
- The exhaust uptake must run clear of the structure in the Uptake Casing.

Modularization / Pre-Outfitting Rules

- The Diesel Generator Sets will be separately lifted into the Auxiliary Machinery Space at the onboard outfitting stage.

Main Control Room Rules



The following are the steps to fixing the position of Main Control Room

Fixing the position of the Main Control Room (already located)

- The control room is located in the auxiliary machinery space on the middle deck level.
- Align the control room with the bulkhead on frame 22 and the Center Line.

Modularization / Pre-Outfitting Rules

- The Control Room will be modularized and will be separately lifted into the Auxiliary Machinery Space as part of the block assembly process.

Lube Oil Purification Equipment Rules



The following are the steps to fixing the position of the Lube Oil Purification Equipment located in the Auxiliary Machinery Space.

Fixing the position of the Lube Oil Purification Equipment

- Assume the purification equipment is in a separately enclosed compartment under the machinery control room in the aft end of the auxiliary machinery space.
- Place the two Lube Oil Purifier units centrally in the lube oil compartment with a walkway between and around each unit.
- Assume the bulkheads of the control room and lube oil purifier room are continuous.

Modularization / Pre-Outfitting Rules

- The Lube Oil Purification equipment will be modularized and will be installed prior to landing the middle level structure.



Secondary Equipment Rules

The following are the steps to fixing the secondary equipment throughout both machinery spaces

Pumps - Firemain, Bilge and Bilge and Ballast

- The pumps requiring sea water must be located as close as practical to the Sea Inlets.
- The maximum number of pumps requiring sea water that can be located together is two to provide redundancy in case of damage.
- Four of these pumps are located in pairs centrally in the Engine Room on top of the Sea Inlet and Crossover Pipes.
- Four of these pumps are located in pairs in the Auxiliary Machinery Room as far aft as possible and to the sides of the Lube Oil Purifier Room.
- Add the access walkways around three sides of each Pump.

Compressed Air Panels

- The panels are located on the Middle level in the Engine Room.
- Assume the panels are located at the forward end of the Engine Room, positioned adjacent to the shell P&S.
- Add the access walkways in front of each panel.

Overspeed Air Panels

- The panels are located on the Middle level in the Engine Room.
- Assume the panels are located at the forward end of the Engine Room, positioned on the forward bulkhead as far outboard as possible P&S.
- Add the access walkways in front of each panel.

Secondary Equipment Rules - Continued



Fresh Water Coolers

- The coolers are located on the lower level in the Engine Room.
- Assume the coolers are located outboard but adjacent to the Main Engines P&S.
- Add access walkways around each cooler.

Lube Oil Coolers

- The coolers are located on the lower level in the Engine Room.
- Assume the coolers are located outboard but adjacent to the Main Engines P&S.
- Add access walkways around each cooler.

Starting Air Receivers

- The receivers are located on the upper level in the Engine Room and Auxiliary Machinery Space.
- Assume the Air Receivers are located outboard and adjacent to the shell P&S.
- Add access walkways around three sides of each receiver.

Fresh Water Hydrophone Tank

- The tank is located on the upper level in the Auxiliary Machinery Space.
- Assume the tank is located as far aft and outboard to starboard as possible.
- Add access walkways around two sides of the tank.

Secondary Equipment Rules - Continued



Starting Air Compressors

- The compressors are located on the upper level in the Auxiliary Machinery Space.
- Assume the compressors are located outboard but adjacent to the Main Control Room starboard.
- Add access walkways around two sides of the compressors.

Fresh Water Generators

- The Generators are located on the upper level in the Engine Room.
- Assume the generators are located forward and outboard, located approximately at the forward end of the Main Engines P&S.
- Add access walkways around three sides of each generator.

Hydraulic Power Packs

- The power packs are located on the upper level in the Engine Room.
- Assume the power packs are located as far aft and outboard as possible P&S.
- Add access walkways around three sides of each power pack.

Oily Water Separator

- The separator is located on the lower level in the Auxiliary Machinery Space.
- Assume the separator is located as far aft and outboard to starboard as possible.
- Add access walkways around two sides of the separator.

Secondary Equipment Rules - Continued



Stern Tube Lube Oil Coolers

- The coolers are located on the lower level in the Engine Room.
- Assume the coolers are located as far aft, outboard and co-located with the Stern Tube Lube Oil Pumps P&S.
- No walkways are necessary.

Stern Tube Lube Oil Pumps

- The pumps are located on the lower level in the Engine Room.
- Assume the pumps are located in pairs aft, outboard and co-located with the Stern Tube Lube Oil Coolers P&S.
- Add access walkways around one side of the pumps.

Emergency controllable pitch propeller hand pumps

- The hand pumps are located on the lower level in the Engine Room.
- Assume the hand pumps are located as far aft and outboard as possible on the tank bulkhead P&S.
- Add access walkways in front of each hand pump.

Lube Oil Transfer Pumps

- The pumps are located on the lower level in the Engine Room.
- Assume the pumps are located as far aft and outboard as possible adjacent to the side shell, forward of the aft tank P&S.
- Add access walkways around two sides of the pumps.

Secondary Equipment Rules - Continued



Fresh Water Inhibitor Pump

- The pump is located on the lower level in the Engine Room.
- Assume the pump is located as far forward as possible and adjacent to the side shell
- Add access walkways around three sides of the pump

Lube Oil Priming Pumps for Main Engines

- The pumps are located on the lower level in the Engine Room.
- Assume the pumps are located forward of the Main Engines adjacent to the forward bulkhead.
- Add access walkways around one side of the pumps.

Sludge Pump for the Incinerator

- The pump is located on the lower level in the Auxiliary Machinery Space.
- Assume the pump is located between the two built-in tanks on the port side.
- Add access walkways around the pump.

Fresh Water Domestic Pumps

- The pumps are located on the lower level in the Auxiliary Machinery Space.
- Assume the pumps are located side by side between the two built-in tanks on the port side.
- Add access walkways around the pumps.

Secondary Equipment Rules - Continued



Salt Water Pumps for the Fresh Water Generator

- The pumps are located on the lower level in the Engine Room.
- Assume the pumps are located mid way along the length of the Engine Room and adjacent to the side shell P&S.
- Add access walkways around three sides of the pumps

Lube Oil Priming Pumps for Main Engines

- The pumps are located on the lower level in the Engine Room.
- Assume the pumps are located forward of the Main Engines adjacent to the forward bulkhead.
- Add access walkways around one side of the pumps.

Salt Water Stand-by Pumps

- The pumps are located on the lower level in the Engine Room.
- Assume the pumps are located on the center line of the Engine Room between the forward and aft Sea Inlet and Crossover Pipes.
- Add access walkways around the pumps.

Walkways, Removal and Service Routing Rules



The following are the steps to fixing the space requirements for access around equipment, removal and local and transient services running throughout the machinery spaces.

Walkways and ladders

- There is a 1m walkway around all equipment unless otherwise stated.
- Walkways must be perpendicular to each other.
- Maximize the length of straight walkways.
- Ladders must connect to a walkway at the top and bottom.
- There must be a completely clear walkway around each machinery space at the middle level.

Removal routes (not considered in this workshop)

- To be arranged to suit the equipment removal requirements.
- Typically overhead space is required for engine components, gearbox components, pumps and other equipment.
- Individual equipment may require additional space reservations for inspection, maintenance and removal.

Service routes (not considered in this workshop)

- Through machinery service routes to be as straight as possible to minimize pipe bends.
- Assume under floor service routes are combined with walkways to create separate pipe modules or combined with local equipment to form large machinery space modules.

Sea Water Inlet and Crossover Rules



The following are the steps to fixing the position of the sea inlet boxes and the associated crossover pipes in the Engine Room.

Fixing the position of the Sea Inlets

- The sea inlets must be placed at the extreme ends of the Engine Room to provide redundancy in case of damage.
- Each sea inlet must be placed equidistant P/S from the center line of the compartment.

Adding access space around the Sea Inlet and Crossover

- Since the piping is below the level of the walkway there is no need to add a walkway as this will be covered by the pumps located above.

Modularization / Pre-Outfitting Rules

- The sea inlet boxes will be built into the shell structure.
- The crossover piping, strainers etc., will be pre-assembled and pre-outfitted onto the bottom structure.

System Routing Rules



The following are the steps for fixing the starting grid for the engine and auxiliary machinery rooms

Pipe systems (not considered in this workshop)

- Pipes must be run in the dedicated service routes.
- Straight pipes must be maximized.
- Bends or other non-standard shapes must be minimized.

Ventilation systems (not considered in this workshop)

- Ventilation systems must be run in the dedicated service routes.
- Straight vents must be maximized.
- Bends or other non-standard shapes must be minimized.

Electrical systems (not considered in this workshop)

- Electrical systems must be run in the dedicated service routes.
- Standard straight cable ways must be maximized.
- Standard bends for cable ways must be maximized.

Modularization Rules

The following are the steps to creating machinery type outfit modules.



General Rules

- Combine equipment walkways and service routes into complete outfit assemblies that can be built in a dedicated outfit assembly shop and lifted into the unit or ship as a single entity. This will shorten the pre-outfitting durations.
- Design the supporting framework (which replaces all other support structure) using a standard grid pattern and standard materials.
- Do not create odd shaped modules as they are difficult to lift and can cause accuracy problems during the lifting process.