

Volunteer Engine Crew Training Manual



Crew Member's Name:

The Steamer Virginia V Foundation

*Dedicated to the Preservation and Operation of Puget Sound's
Last Wooden Passenger Steamship*

Post Office Box 9566, Seattle, Washington 98109-0566
Tele 206.624.9119 ~ Fax 206.381.3715

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INTRODUCTION

The SS VIRGINIA V (V5) is an incredible cultural and industrial resource. To run the main engineering plant and auxiliaries requires skill, specific training, and dedicated service. The purpose of this document is to outline The Steamer Virginia V Foundation's; the "Foundation", engineering training and safety program requirements for the safe and reliable operation of the vessel. This manual outlines the specific training requirements and duties for the Trainee and Designated Engineer (DE) volunteer positions within the Engineering Department. All volunteers, regardless of prior marine engineering experience, must participate and complete the training requirements outlined in this manual.

VOLUNTEER MANAGEMENT

COMMUNICATIONS

The Foundation staff shall conduct all communications with volunteers. Refer to the Foundation's website for the current listing of staff contact information at www.virginiav.org/.

BENEFITS

The Foundation Engine Room volunteers will receive the following benefits:

- ✓ 5% of all tickets for public events will be set-aside for volunteers and their families. These tickets will be given out on a first- come first- serve basis (however, depending upon the event, you can always request additional tickets).
- ✓ 50 hours of volunteering on the V5 will qualify a volunteer for a free membership to The Steamer Virginia V Foundation.
- ✓ All Designated Engineers and Chief Engineers will receive at least one free V5 shirt a year.
- ✓ V5 volunteers and their families will be invited on non-public placement cruises such as fuel and staging (positioning) runs.

SCHEDULING

All scheduling of volunteers will be handled by the Foundation staff and designated volunteers. Engineering position assignments are subject to approval by the assigned Chief Engineers.

POLICIES

All volunteers are subject to the V5 policies described in the volunteer handbook. The V5 Volunteer Handbook can be found online at www.virginiav.org/volunteer.

Volunteers will be required to undergo random drug and alcohol testing in accordance with U.S. Coast Guard regulations and at the discretion of the Foundation staff.

ORIENTATION

Based on the number of volunteer applications received, orientation sessions may be held once a quarter for all new volunteers. The dates and times of these orientation sessions will be scheduled and announced as the need arises.

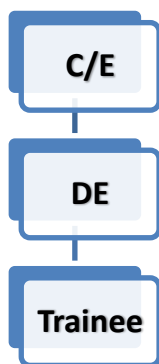
The orientation will include but is not limited to:

- Shipboard Safety
- Shipboard Familiarization
- Equipment Identification
- Engineering Systems Review
- Trainee Duties
- Designated Engineer Duties & Responsibilities
- Drug Testing

OPERATIONS

During vessel operation, the minimum personnel requirements for the V5 engine room are: Chief Engineer (C/E) and a Designated Engineer (DE). The term “Designated Engineer” is the rating the U.S. Coast Guard requires for manning as per the vessel’s Certificate of Inspection (COI). Historically, the Foundation referred to this rating as Fire/Water Tender (FWT). An individual serving in the capacity of Chief Engineer (C/E) must be a marine engineer, licensed by the U.S. Coast Guard. U.S. Coast Guard licensing requirements are not contained within this manual, but are available for review upon request from the Director of Engineering.

The engine room hierarchy is as follows: Chief Engineer, Designated Engineer, and Trainee.



TRAINING & ADVANCEMENT

All volunteers are required to commit to a minimum of 5 cruises on the V5 per year (public and/or private).

After a Trainee has completed his or her training and testing as contained herein, said Trainee may request, at any time, that they be evaluated to advance to the position of Designated Engineer. Only a Chief Engineer may recommend advancement of volunteers from Trainee to Designated Engineer. These recommendations will then be subject to review and approval by the Director of Engineering and

the Executive Director. The skills checklists, contained within the appendices, are to be used as tools to evaluate and re-evaluate the level of performance for the Trainees and Designated Engineers. The Designated Engineer shall provide the necessary training to his or her assigned Trainee as part of the Foundation's training program as identified in this manual. Chief Engineers shall provide training for new volunteers that have the necessary USCG License of Designated Duty Engineer, 1000 HP, Steam and/or Motor or higher.

The Director of Engineering and the Chief Engineers have the exclusive right to determine an individual's suitability to volunteer in the V5 engine room. As such, a Trainee, not performing at or up to the prescribed standards will be asked to submit to additional training and/or vacate their position.

The scheduling of engine room volunteers for specific cruises will be performed by the V5 staff, unless otherwise noted, and is subject to the approval of the Chief Engineers.

SAFETY

Maintaining a safe work environment is essential to the success of the V5. Your safety and the safety of your fellow crewmembers depend upon your ability to adhere to the following guidelines.

GENERAL SHIP SAFETY

The V5 is a smoke free vessel. There is NO smoking and NO open flames permitted on the open decks, public/crew spaces, in the heads, or in the engine room.

Safety issues can occur anywhere on the V5. Be willing to assist in mopping up spills, cleaning heads, and other hazards as they occur.

All volunteers are expected to read and fully understand the emergency information and muster stations in event of emergency. This information is posted in the port side Foc'sle and in Engineering.

ENGINE ROOM SAFETY

Adherence to the following safety points represents minimum safety precautions:

- ✓ All machine/engine room surfaces are assumed to be HOT. Proceed with caution when moving around the main engine, pumps, pipes, tanks, etc.
- ✓ Use a "three-point contact" when oiling engine and pumps underway.
- ✓ Stay hydrated (although bottled water is sometimes available onboard, it is recommended that you bring your own water and/or electrolyte drink).
- ✓ The engine room is a confined space that requires a certain amount of mobility and balance in order to operate safely. It is slippery. Carefully assess your ability to function in this environment.
- ✓ Return tools to their proper storage location in the engineering office or appropriate toolbox after use. Reduce clutter.
- ✓ Remove and replace oil saturated absorbent pads and rags from the main engine foundation, various machinery and bilges.

- ✓ Wear large heat resistant gloves (welding) when installing/removing igniter, mechanical and atomizing burners.
- ✓ Wear eye protection when lighting off boiler, changing out burners, or installing /removing the igniter.
- ✓ Wear 100% cotton clothing. Black or dark colors are preferable as well.
- ✓ Wear anti-skid, oil resistant, leather or cotton shoes. No open toed shoes.
- ✓ Remove all rings, watches, earrings, etc. before beginning work in the engine spaces.
- ✓ All Designated Engineers must carry a flashlight and gloves.
- ✓ Additional safety guidelines at the discretion of the Chief Engineer.

FIREFIGHTING & LIFESAVING

As part of the training program, all volunteers will be required to take a basic marine safety course. The course will cover topics related to:

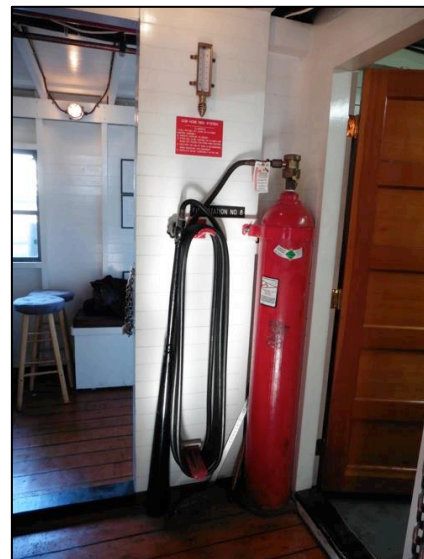
- Basic Firefighting
- Personal Survival Techniques
- Personal Safety
- Social Responsibilities

Proficiency must be displayed in the above disciplines. As part of your orientation onboard the V5, it will be the Trainee's responsibility to identify the location, number, and use of the following:

- Fire Stations
- Fire Fighting Equipment
- Life rafts, Lifejackets and Lifesaving Appliances
- Emergency Escapes



Fire Stations



Fire Extinguishing Systems



Lifejacket Deck Stowage Boxes



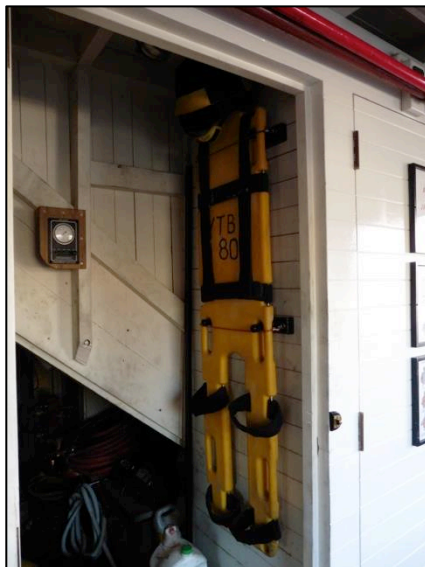
Lifejacket Stowage Locations



Life Rafts



Life Rings



Emergency Equipment



Lifesaving Appliances



Emergency Escapes



Signs & Placards

EMERGENCY STATION BILL

EMERGENCY STATION BILL S.S. VIRGINIA V

Whistle Signals -

<u>Fire and Emergency:</u>	Continuous sounding of the ship's whistle for not less than 10 seconds, supplemented by passing the word over the public address system.	██████████
<u>Abandon Ship:</u>	Seven short blasts followed by one long blast of the ships whistle, supplemented by passing the word over the public address system.	●●●●●●● ██████████
<u>Man over board:</u>	Hail and pass the word "man overboard" to the wheelhouse. 3 prolonged blasts of the ship's whistle. Then announce "crew to man-overboard stations" over the public address system.	████ █████ █████
<u>Grounding:</u>	Announce over public address system "All deck crew report to Wheelhouse."	
<u>Dismissal from Emergency stations:</u>	3 short blasts of the whistle.	●●●

General Instructions -

1. All crew shall familiarize themselves with the *Emergency Station Bill* and the location and duties of their emergency stations immediately upon receiving crew assignment.
2. Life vests shall be worn during all ship drills and emergencies.

Specific Station Bill Instructions -

1. Man-Over-Board (MOB) -
 - a. Any crew member upon witnessing or being informed of a Man-Over-Board (MOB) shall IMMEDIATELY notify the wheelhouse of the event then go to your assigned station bill location.
 - b. Upon hearing the words "MAN OVERBOARD" throw a life ring buoy to the MOB individual, post look-outs, and prepare MOB Recovery gear for use.
2. Fire at sea -
 - a. Any crew member upon discovering or being informed of a fire shall IMMEDIATELY notify the wheelhouse of the event, evacuate passengers in the immediate area of the fire and attempt to fight the fire with the nearest fire extinguisher until other crew arrive then go to your assigned station bill location.
 - b. Upon notification and sounding of the Fire and Emergency signal, fire pump shall be started, all hatches closed (except cargo hatches), blowers and fans stopped, and all air ports secured.
3. Abandon Ship -
 - a. Upon sounding of the Abandon Ship signal, all air ports shall be secured, bilge and ballast pumps started, and all Life Rafts made ready for launching.

EMERGENCY STATION BILL S.S. VIRGINIA V

An Emergency Station Bill contains a listing of vessel crewmembers and their duties in event of a fire and/or other emergencies. The V5 Emergency Station Bill assignments are identified below:

Duties	Fire Emergency	Man Overboard	Abandon Ship	Grounding	Raft
Master	Bridge In charge overall	Bridge In charge overall	Bridge In charge overall Launch Life Rafts In command Life Raft No. 1	Bridge in charge overall	1
Mate / Lead Deckhand	In charge at scene (except Engine room) Attend fire station and back up nozzle man	In charge, Main Deck forward	In charge of embarkation area In command Life Raft No. 2	Assist Chief Engineer at scene	2
Deckhand No. 1	Run out fire hose and attend nozzle at scene	Set-up MOB Apparatus and crowd control lines on Main Deck	Divide pax into Life Raft groups, Direct Additional Crew Members	Muster pax on Passenger Deck INDOORS, Direct Additional Crew Members	1
Deckhand No. 2	Assist Deck 1 at Scene until released by Mate Then muster pax	Set-up MOB Apparatus on Forward Deck then return to Main Deck	Assist Passengers into Life Jackets then to embarkation area	Assist Captain in Wheelhouse	2
Deckhand No. 3	Muster pax, Direct Additional Crew Members	Report to Wheelhouse Assist Captain as needed	Assist Captain with launching Life Rafts	Assist Deck 1 to muster pax on Passenger Deck INDOORS	1
Deckhand Observer	Provide fire ax and fire extinguisher to scene	Assist as needed in MOB recovery	Assist Passengers into Life Jackets then to embarkation area	Assist Lead Guest Service Rep. as needed	2
Chief Engineer	In charge, E/R, attend boiler, secure E/R blowers and electricity in area of fire	In charge, E/R, attend Engine	Secure E/R and boiler	In charge, E/R and at scene	2
Designated Engineer	Attend fire pump and generators	Assist Chief Engineer	Assist securing E/R and boiler	Assist Chief Engineer	1
Engineering Observer	Report to E/R, assist as needed	Report to E/R, assist as needed	Report to E/R, assist as needed	Report to E/R, assist as needed	2
Additional Crew Members	Assist Deckhand No. 3 to muster pax	Assist Deckhand No. 3 to muster pax	Assist Deckhand No. 1 to muster pax	Assist Deckhand No. 3 to muster pax	1
Catering Crew	Secure Galley Assist Deck 3	Assist as needed	Assist as needed	Assist as needed	1

TRAINEE POSITION

JOB DESCRIPTION

Reports to: Chief Engineer / Designated Engineer

Requirements: Engine Department Trainees shall be required to utilize their time onboard the vessel to become familiar with and demonstrate knowledge of the following:

- ✓ The history of the VIRGINIA V (visit www.virginiav.org/),
- ✓ The basic precepts of the “Foundation”,
- ✓ Lifesaving and safety equipment location and practices,
- ✓ The vessel’s particulars
- ✓ The vessel’s construction
- ✓ Identification of equipment
- ✓ Pass a U.S. Coast Guard mandated drug test.

Compensation: Volunteer Position.

Evaluation: The Engine Department Trainee will be evaluated by the SS VIRGINIA V Chief Engineers during assigned cruises. Input from the attending Designated Engineers will be taken into consideration as requested by the Chief Engineer(s).

Advancement: Dependent upon the prior marine engineering experience of the individual, the Engine Department Trainee must complete between three (3) to five (5) cruises in this capacity. In addition to gaining knowledge of the vessel as outlined in this section of the manual, the Trainee should utilize this time to become familiar with the requirements of the Designated Engineer rating. Advancement to the Designated Engineer rating will require a thorough knowledge of that position’s requirements as contained within this manual.

VESSEL PARTICULARS

Vessel Data & Particulars	
Length Overall:	125' - 0" (38m)
Maximum Beam:	24' - 0" (7.3m)
Draft:	8' - 0" (2.4m)
Displacement:	150 tons
Tonnage:	99 Gross / 67 Net
Horsepower:	400 IHP (300kW)
Builder:	Anderson & Company
Year Built:	1922
Call Sign:	WDD9410
Official Number:	222170

VESSEL CONSTRUCTION & ARRANGEMENT

In 1921, Anderson & Company of Maplewood, Washington, began construction of the SS VIRGINIA V. The ship was built of local old-growth fir. The vessel was launched the on March 9, 1922, and towed to downtown Seattle for the installation of her engine and steam plant. In Seattle the engine was removed from SS VIRGINIA IV and installed in SS VIRGINIA V. On June 11, 1922, the SS VIRGINIA V made its maiden voyage from Elliott Bay in Seattle to Tacoma down the West Pass. The vessel continued to make this voyage nearly every day until 1938.

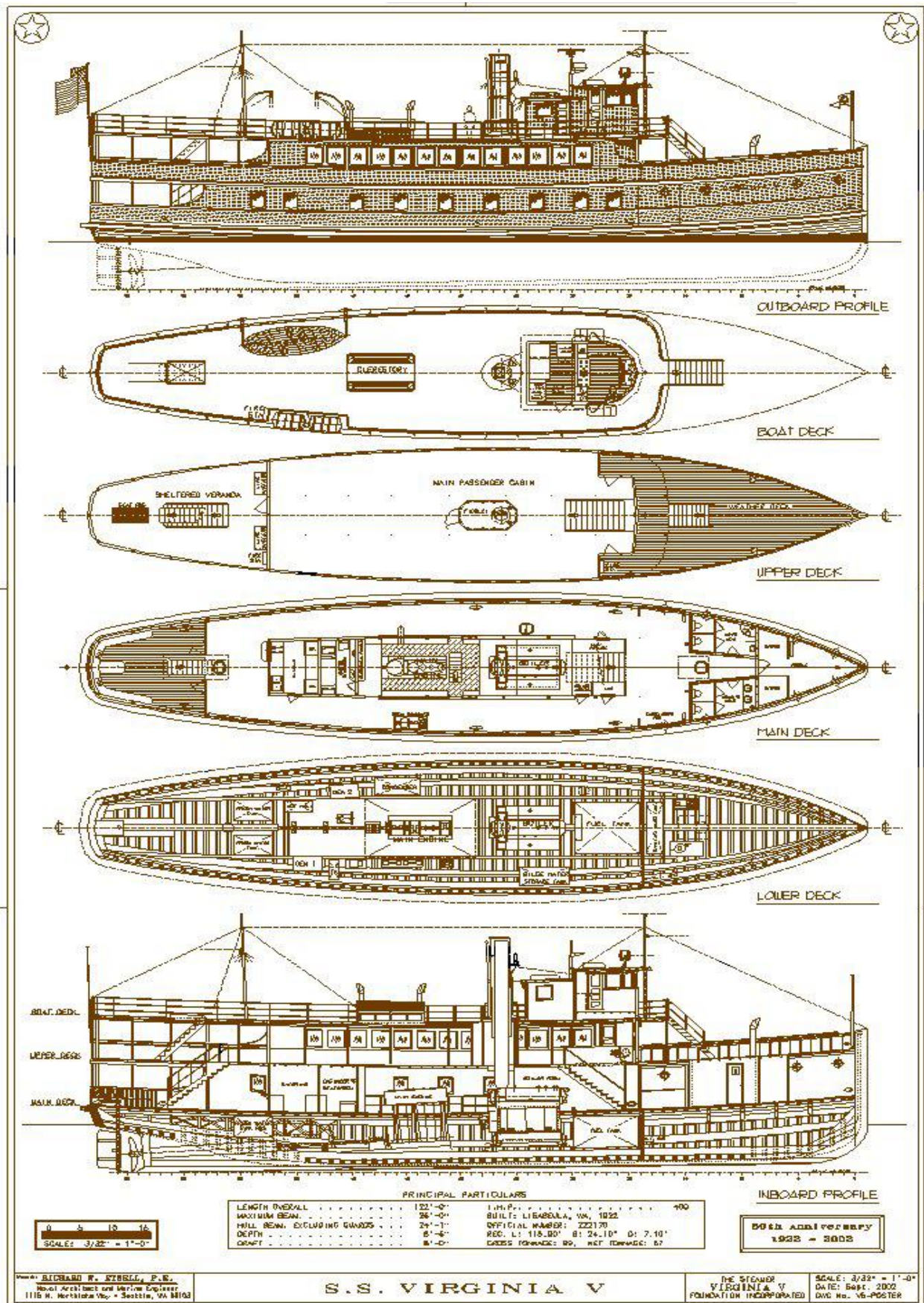


Hull planking being replaced during the vessel's dry-docking in 2005

The vessel drawing on the following page is the General Arrangement of the SS VIRGINIA V. The General Arrangement Drawing depicts the following:

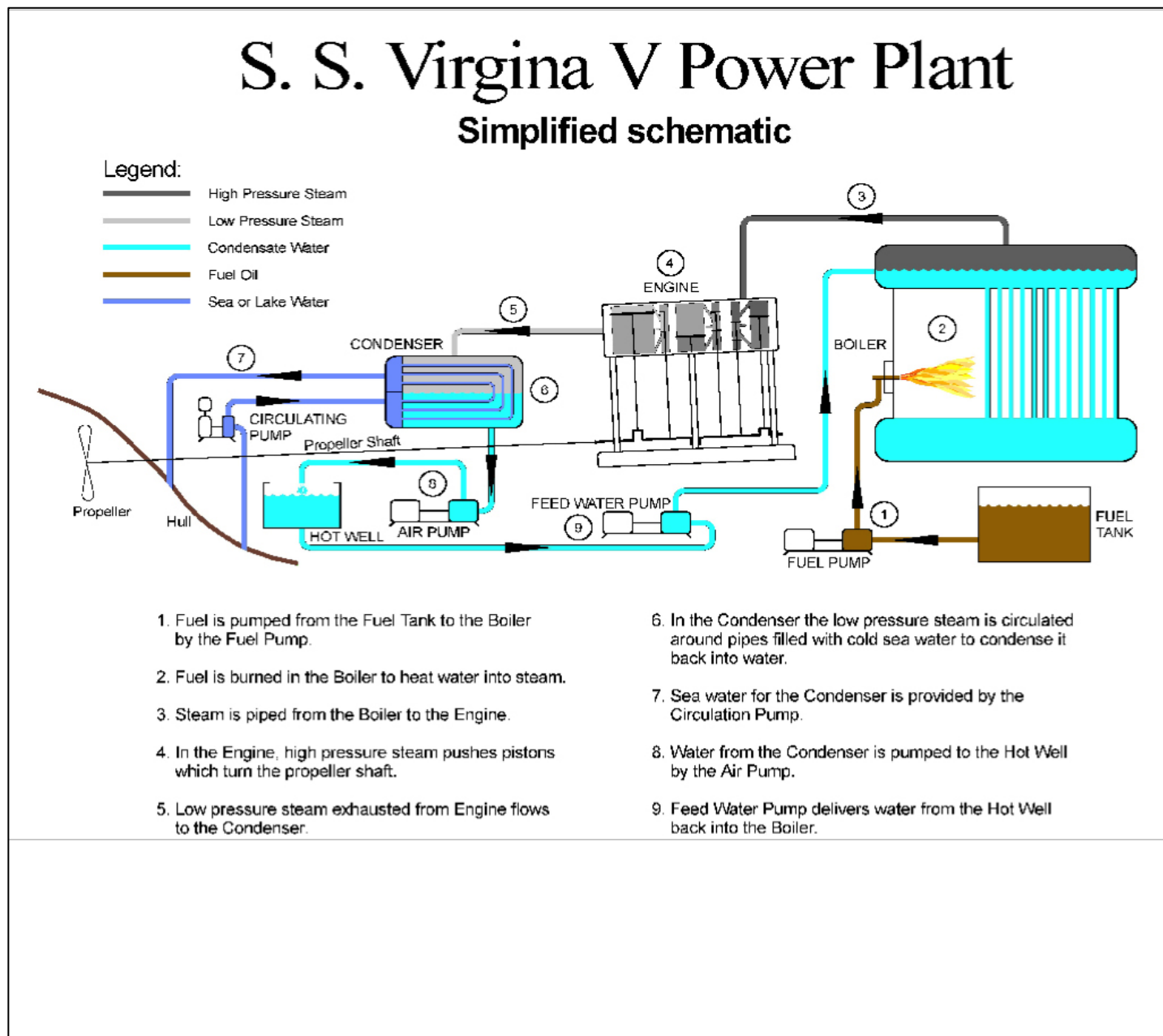
- ✓ Outboard Profile
- ✓ Boat Deck
- ✓ Upper Deck
- ✓ Main Deck
- ✓ Lower Deck
- ✓ Inboard Profile

It is imperative that all SS VIRGINIA V personnel know the arrangement of the vessel, its spaces, and location and use of the onboard lifesaving, safety and firefighting equipment.



EQUIPMENT IDENTIFICATION

Trainees shall identify the location and function of the main engine, propulsion boiler, auxiliaries, tanks and valves. A simplified schematic of the SS VIRGINIA V power plant is provided as a reference.



Note: The vessel's Steam and Condensate Piping Schematic (page 41) provides a more detailed drawing, further identifying system components within the steam, condensate and feedwater circuit.

POWER PLANT

1. Fuel Pumps and Filters – The vessel is outfitted with two (2) sets of fuel pumps: one set of steam reciprocating pumps (no longer in use) and one set of electric powered positive displacement fuel pumps. When properly aligned, the fuel pumps take suction from the vessel's Diesel Oil (fuel) Tank through a set of in-line fuel filters. The fuel is then pumped into the boiler's furnace through an atomizer barrel. (Note: The vessel's 32kW and 36kW Generators also take suction from the Diesel Oil Tank via engine mounted fuel pumps through external duplex filters and engine mounted in-line fuel filters).



Steam Reciprocating Fuel Pumps
(Lower Deck, E/R, Stbd side, FR 36)



Electric Fuel Pumps
(Lower Deck, E/R, Stbd side, FR 37)

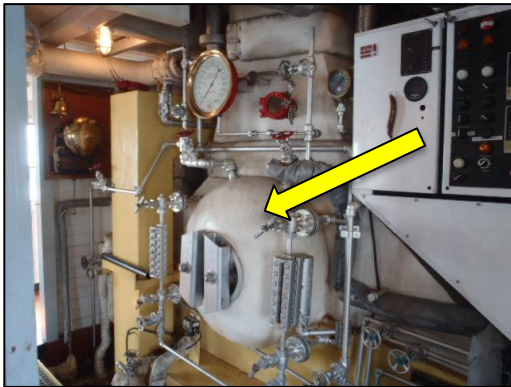


Boiler Fuel Filters
(Lower Deck, E/R, Stbd side, FR 32)

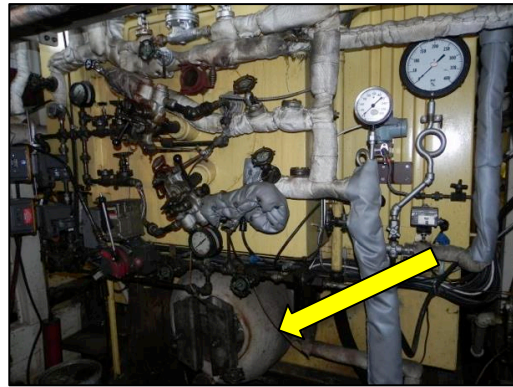


Generator Fuel Filters
(Lower Deck, E/R, Stbd side, FR 46)

2. Main Propulsion Boiler – The vessel is outfitted with a single Main Propulsion Boiler. The burning fuel heats the water within the boiler's generating tubes, thus generating steam for the main engine and auxiliary equipment.



Boiler Steam Drum & Stack
(Main Deck, E/R, C/L, FR 26-32)



Boiler Mud Drum, Fuel & Steam
Piping
(Lower Deck, E/R, C/L, FR 26-32)



Burner rack containing mechanical
and atomizing steam barrels



Torch used for manual firing
(Emergency Operation Only)

3. Main Steam Piping – The main steam line consists of the piping, valves and fittings by which steam from the boiler is delivered to the main engine.

4. Main Engine – The SS VIRGINIA V is outfitted with a triple expansion, double acting, reciprocating steam engine. It is here that heat energy from the steam is converted to mechanical energy. The operating principle of this type of engine is described further within this manual.



Main Engine
(Main Deck, E/R, C/L, FR 36-41)



Main Engine
(Lower Deck, E/R, C/L, FR 36-41)

5. Exhaust Steam – The exhaust steam line consists of the piping, valves and fittings by which steam from the main engine is transferred to the condenser.
6. Main Condenser – The remaining heat of the steam is dissipated and changes state back into water within the Main Condenser. The steam from the Main Engine enters the Main Condenser, which is maintained in a state of vacuum by the condensing of the steam back into water (condensate). This transformation, back to condensate, occurs when the steam entering the condenser passes over tubes carrying cooler seawater supplied by the Circulating Pump. The need for vacuum within a steam system is two-fold in increasing the efficiency of the propulsion plant. By maintaining the Main Condenser under a vacuum, the temperature required for condensing the steam is reduced and therefore increases the thermodynamic efficiency of the cycle. In addition, a steam engine exhausting to a lower pressure (vacuum) can do a greater amount of work than if it exhausts to a higher, positive pressure.



Condenser
(Lower Deck, E/R, Stbd side, FR 38-41)

7. Circulating Pump – The Circulating Pump pumps seawater through the Main Condenser. As stated above, it is the removal of the latent heat from the steam that creates a vacuum in the Main Condenser. This heat removal transforms the steam back to condensate. The Circulating Pump pictured below is of the radial flow type, powered by a vertical simplex steam reciprocating prime mover.



Circulating Pump
(Lower Deck, E/R, Port side, FR 45)

8. Main & Auxiliary Air Pump – These pumps take suction from the condenser and pump the condensate to the Hotwell. The Hotwell serves as a reservoir for the condensate (at atmospheric pressure), now referred to as feed water, for the steam and condensate system.

The term “air pump” is somewhat misleading. The purpose of the air pump is to remove the condensate from the Main Condenser and pump it to the Hotwell. This, along with the cooling effect within the condenser, creates a vacuum. On modern steam plants, vacuum pumps or air ejectors remove non-combustible gases from main and auxiliary condensers and the condensate is pumped from the main condenser hot well through the feedwater system (drain coolers, low pressure feed heaters, feedwater tank, deaerating feedwater heater) by way of condensate pumps.

The Auxiliary Air Pump pictured below is a vertical simplex reciprocating pump. The Main Air Pump is a horizontal simplex reciprocating pump.



Main Air Pump
(Lower Deck, E/R, Port side, FR 41)



Auxiliary Air Pump
(Lower Deck, E/R, Port side, FR 43)

9. Feedwater Pumps – The steam plant is outfitted with two (2) duplex steam reciprocating Feed Pumps. These pumps pump feedwater from the Hotwell to the steam drum of the Main Propulsion Boiler.



Feedwater Pumps
(Lower Deck, E/R, Port side, FR 35)



Hotwell
(Lower Deck, E/R, Port side, FR 47-49)

10. Feedwater Heater – Feedwater is indirectly heated by auxiliary exhaust steam within this coil tube feed heater. The pre-heating of the boiler feedwater eliminates thermal shock to the boiler and increases overall plant efficiency.

The Feedwater Heater is not shown in the simplified drawing above, but is included in the Steam and Condensate Piping Schematic on page 41.



Feedwater Heater
(Main Deck, Port side, FR 36)

AUXILIARY EQUIPMENT

1. Main Fire Pump – The Main Fire Pump is a duplex steam driven pump that is the primary pump for pressurizing the vessel's firemain with seawater for the purpose of combating shipboard fire. The Main Fire Pump takes suction from the sea through the Fire and General Service Pump suction valve and discharges to the firemain and the General Service Manifold.



Main Fire Pump

2. Emergency Fire Pump – The Emergency Fire Pump is an electric driven pump, which acts as a back up to the vessel's steam driven Main Fire Pump. This pump is also routinely used to flush out the Sewage Tank.



Emergency Fire Pump

3. General Service Pump - The General Service Pump is a duplex steam driven pump. This pump serves several purposes onboard the vessel. Using the correct valve arrangement on the General Service Manifold, this pump can be utilized to perform the following functions:
 - a. Pressurize the firemain;
 - b. Act as a back-up Circulating Pump for the Main Condenser;
 - c. Provide flushing water for the Sewage Tank.



General Service Pump



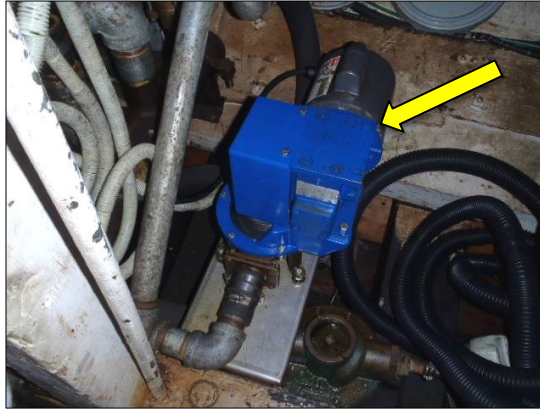
General Service Manifold

4. Oily Water Separator – The Oily Water Separator (OWS) is the device used to insure that overboard discharge of the vessel's bilge water does not contain oil contaminants in excess of 15ppm (parts per million). The throughput of this OWS is rated at 2.2 gallons per minute. ***Vessel Engineers must familiarize themselves with all applicable state, local and federal statutory pollution prevention regulations as they pertain to the vessel's area of operation. Only a U.S.C.G. licensed engineer shall operate the OWS.***



Oily Water Separator

5. Diaphragm Bilge Pump – This pump is an electric motor driven diaphragm pump to pump out the bilge spaces in the lower engine room. The bilge water is pumped from the bilges to the Oily Bilge Tank via the Bilge Manifold.



Electric Diaphragm Bilge Pump

6. Automatic Bilge Pump – The Automatic Bilge Pump is an electric motor driven pump, that can be set on “Automatic” or “Hand” operation to pump out the clean bilge space directly forward of the vessel’s stern tube.



Automatic Bilge Pump

7. Sewage Pump – The Sewage Pump is an electric motor driven pump used to pump sewage from the Sewage Tank to a reception facility ashore via the shore pump out connection.



Sewage Pump



Sewage Shore Discharge Connection

8. Potable Water Pumps – The vessel is outfitted with two (2) electric motor driven Potable Water Pumps. These pumps are used to pump potable water from the Fresh Water Tank to the vessel's Galley, Cleaning Gear Locker, and Engineer's Workshop.



No. 1 Potable Water Pump

STEERING GEAR

The SS VIRGINIA V's steering gear is a hydraulic steering system controlled by the position of the vessel's helm.



Steering Gear compartment in way of transom on Main Deck



Steering Gear hydraulic rams

STACK COVER

Prior to lighting off of the boiler, the stack cover shall be removed from the boiler uptake (exhaust stack). Conversely, upon shutting down the plant, the stack cover shall be reinstalled. The stack cover serves two purposes: (1) prevents foreign objects and rain from entering the boiler when the boiler is not being fired and (2) allows for the retention of heat within the boiler for a longer period of time after the boiler shutdown.



Stack cover (installed)



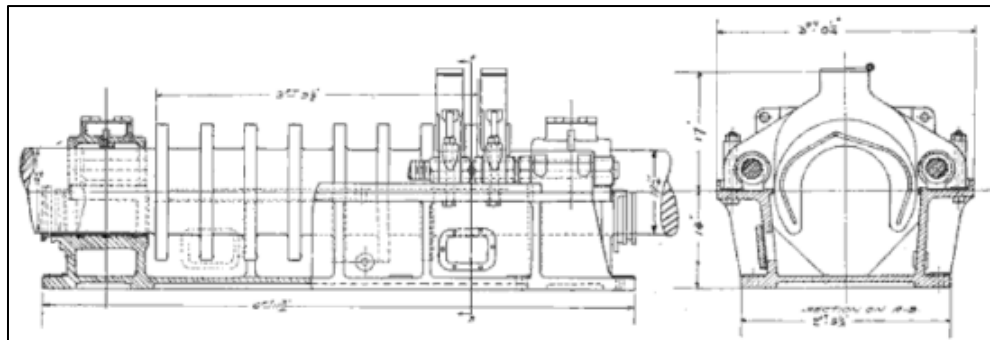
Access ladder behind Pilot House to be rigged onto stack



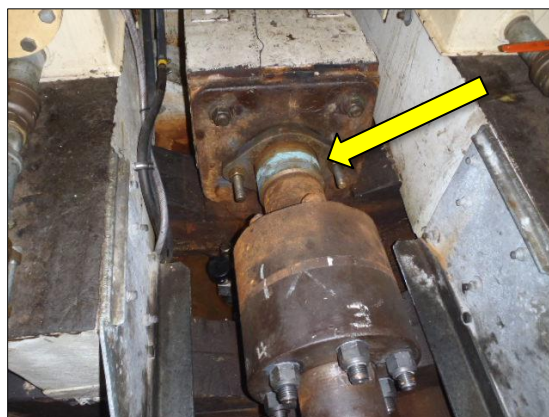
Stack cover and ladder in stowed positions

SHAFTING

1. Thrust Bearing – The thrust bearing, located just aft of the main engine is of a design known as multi-collar horseshoe type. The purpose of the thrust bearing is to absorb the axial force transmitted through the shafting from the propeller while turning in either the ahead or astern direction. This force is transmitted to the vessel's hull. The base of the thrust bearing is filled with lubricating oil in which the shaft collars revolve carrying the oil upward between the collars and horseshoes. As the oil falls back into the base, it carries with it some of the friction heat.

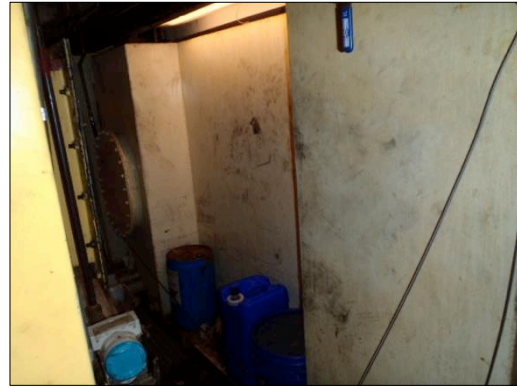


2. Stern Tube & Stern Tube Packing Gland – The stern tube provides the structure that supports and encloses the propulsion shafting and associated bearings where the shafting penetrates the hull of the vessel. This gland seals the area between the shaft and the stern tube, while allowing the shaft to turn. A stuffing box, containing braided packing, is fitted at the inner end of the stern tube to limit the ingress of seawater (FR 49).



TANKS

1. Fuel Oil Tank – The vessel's Fuel Tank is located centerline between FR 20-25. The capacity of this tank is 3,229 gallons of diesel fuel oil.



2. Bilge Tank – The vessel's Bilge Tank is located on the starboard side between FR 26-30. The capacity of this tank is 433 gallons.



3. Sludge Tank – The vessel's Sludge Tank receives the discharge from the OWS in excess of 15ppm.



4. Fresh Water Tank – The Fresh Water Tank, located on the starboard side between FR 49-54 holds the vessel's potable water supply. The capacity of this tank is 635 gallons.



5. Feedwater Tank – The Feedwater Tank, located on the port side between FR 49-54, hold the reserve feed water required for plant operation. The capacity of this tank is 635 gallons.



6. Sanitary Tank – The Sanitary Tank holds the sewage effluent generated onboard the vessel. The tank capacity is 1,170 gallons.

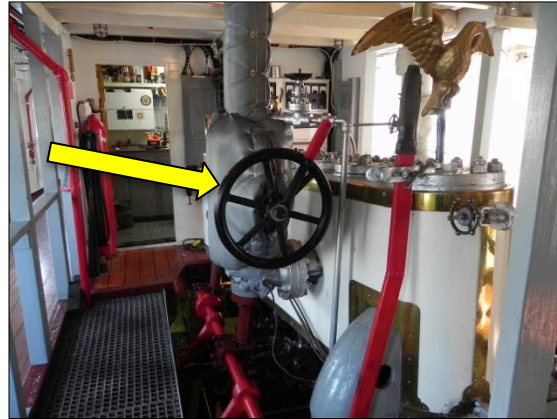


7. Lube Oil Day Tank – This tank contains the lubricating oil used by the FWD to lubricate the main engine and auxiliary pumps.

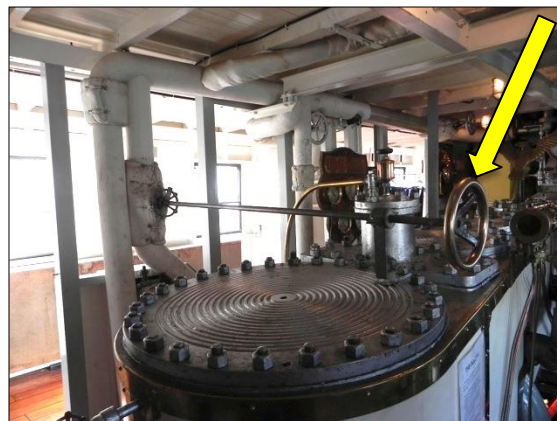


STEAM, CONDENSATE & MISC. VALVES

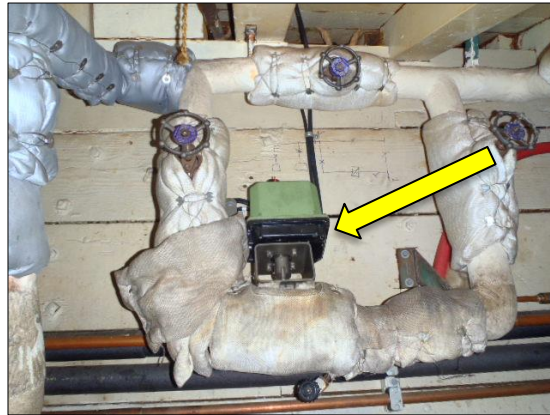
1. Main Engine Throttle Valve – The Main Engine Throttle Valve is used to “throttle” the amount of steam admitted to the engine from the boiler via the main steam piping. This valve is solely operated by the vessel’s Chief Engineer or the Designated Engineer (if so directed) in response to engine orders received via the Engine Order Telegraph (EOT).



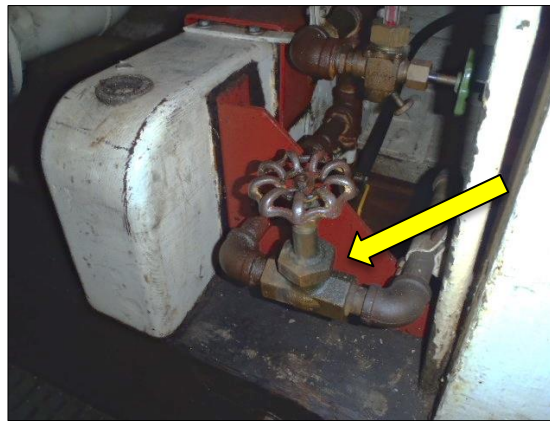
2. Auxiliary Exhaust Valve – The auxiliary exhaust system receives steam from the vessel’s steam pumps that do not exhaust directly to the Main Condenser. Onboard the SS Virginia V, the steam is used to pre-heat the boiler feed water. The pressure of the system is typically maintained at or below 15 psig. Should this pressure exceed 15 psig the Feed Heater relief valve will relieve the excessive pressure. This valve is operated by the Chief Engineer, but may be operated by the Designated Engineer at the Chief Engineer’s discretion.



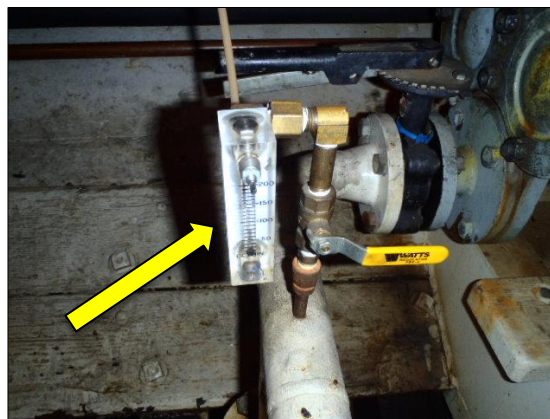
3. Feed Pump Steam Regulating Valve – This valve has been incorporated into the engineering plant to automatically regulate the steam flow to the vessel's Feed Pumps, based on demand. The by-pass valve, located directly above the regulating valve is used during plant start-up.



4. Vacuum Drag – The purpose of the vacuum drag line is to utilize the vacuum in the Main Condenser to take suction from the Feed Water Tank to add water to the Hot Well.

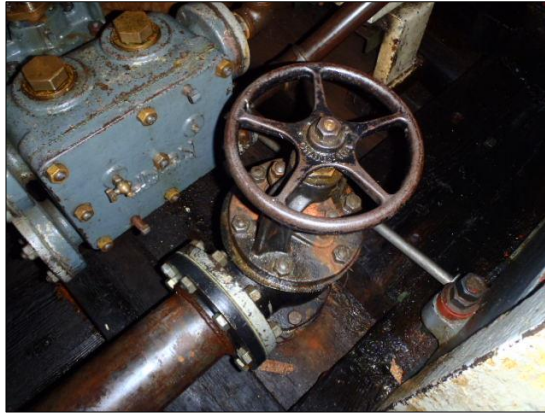


5. Chemical Feed Valve – This is a metering valve arrangement that admits the boiler water treatment chemicals from the chemical dosing drum to the Feed Pump feed water discharge.



SEA WATER VALVES

1. Main Circulator Suction – This sea valve must be opened during plant start-up and operation to provide seawater cooling to the Main Condenser via the Main Circulating Pump.



2. Main Condenser Overboard – This sea valve must be opened during plant start-up and operation to discharge the cooling water from the Main Condenser.



3. Fire & General Service Pump Suction – This sea valve provides the seawater required for the systems serviced by the Main Fire Pump and General Service Pump.



4. Generator Cooling Water Valves – These sea valves supply seawater cooling to the vessel's 32kW and 36kW Diesel Generators.

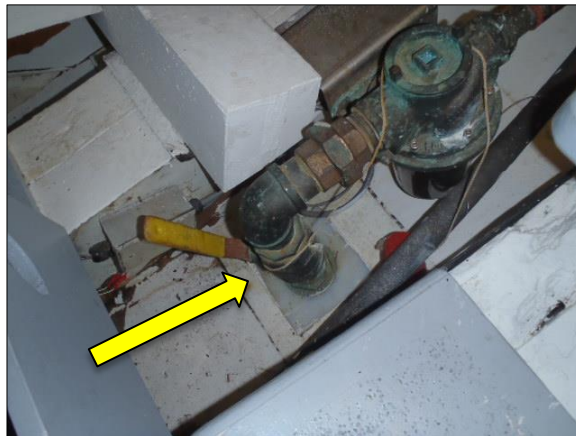


32kW Generator Sea Suction Valve
(Starboard side FR 46)



36kW Generator Sea Suction Valve
(Port side FR 46)

5. Sanitary Pump Suction – The Sanitary Pump Suction sea valve provides seawater supply for the sanitary system. This valve is located in the vessel's Forepeak, port side.



ELECTRICAL

1. Ship's Service Generator (32kW) – The 32kW Ship's Service Generator provides electrical power required to independently operate the vessel's electrical systems. This generator is located on the starboard side in way of FR 46-49.



2. Ship's Service Generator (36kW) – The 36kW Ship's Service Generator provides electrical power required to independently operate the vessel's electrical systems. This generator is located on the port side in way of FR 46-49.



3. Main Switchboard – The Main Switchboard is the device that directs electricity, with switching and load protection, from electrical sources (i.e. generators and shore power) to individual electrical components such as lighting panel boards, transformers, boiler control equipment and individual load systems. The Chief Engineer and/or Designated Duty Engineer are solely responsible for the maintenance and operation of this switchgear.



4. Emergency Lighting Control Panel – This is the vessel's battery emergency lighting system, providing 120 VAC with a 33.3A Converter.



5. Shore Power Connections – The shore power connection, rated at 208 VAC, 100 Amp, 3 phase or 240 VAC, 50 Amp, single phase connects the vessel's Main Switchboard with an external power supply. There are two (2) shore power connections: one (1) port and one (1) Starboard.



6. Boiler Combustion Control Panel – The boiler is outfitted with an automation package that controls and monitors fuel, combustion air and feed water. The Chief Engineer and/or Designated Duty Engineer are solely responsible for the operation of this panel.

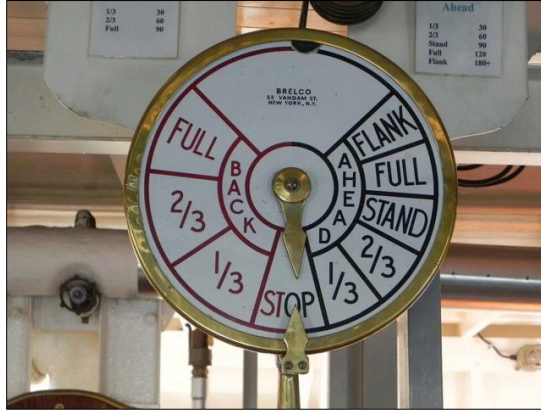


7. Misc. Electrical Panels and Batteries – There are several electrical power distribution panels and battery banks throughout the vessel. It is incumbent upon the Trainee to locate all of these electrical components onboard the vessel and identify the systems that are served by each.



MISCELLANEOUS COMMUNICATIONS

1. Engine Order Telegraph – The Engine Order Telegraph (EOT) is the device that transmits the vessel's speed requirements from the Bridge. Although the operation of the EOT is the responsibility of the Chief Engineer, its operation (answering of bells) may be delegated to a Trainee or Designated Engineer at the Chief Engineer's discretion.



2. Sound Powered Telephone – There is a sound powered communication link between the wheelhouse and the engine operating platform. With this handset, the engineers can have direct voice communication with the bridge. Sound powered telephone communication technology uses electro-mechanical transducers, which enable audio communication without the use of external power or batteries. The sound pressure created from a user's voice, when talking into the transducer, powers the system.



DESIGNATED ENGINEER POSITION

JOB DESCRIPTION

Reports to: Chief Engineer

Requirements: Engine Department Designated Engineer candidates shall be required to utilize their time onboard the vessel to become familiar with and demonstrate knowledge in the following:

- ✓ Basic Steam Engineering,
- ✓ Basic Engine Operation,
- ✓ Basic Reciprocating Pump Operation,
- ✓ Proficiency in the DESIGNATED ENGINEER SKILLS CHECK LIST (Appendix 1.1),
- ✓ Proficiency in the DESIGNATED ENGINEER DUTIES (Appendix 1.2),
- ✓ Proficiency in the DESIGNATED ENGINEER START-UP CHECKLIST (Appendix 1.3),
- ✓ Proficiency in the DESIGNATED ENGINEER SHUT DOWN CHECKLIST (Appendix 1.4),
- ✓ Proficiency in the DESIGNATED ENGINEER OILING PROCEDURES (Appendix 1.5),
- ✓ Proficiency in DESIGNATED ENGINEER OWS OPERATION (Appendix 1.6),
- ✓ Proficiency in DESIGNATED ENGINEER SEWAGE PUMP-OUT PROCEDURES (Appendix 1.7),
- ✓ Vessel Drawings (Appendix 1.8)
- ✓ Pass a U.S. Coast Guard mandated drug test.

Compensation: Volunteer Position.

Evaluation: The skills checklists, contained within the appendices, are to be used as tools to evaluate and re-evaluate, as necessary) the level of performance for the Designated Engineers.

Advancement: There U.S.C.G. has approval and provided guidance to the Foundation for the ability of Designated Duty Engineers, who are not currently (expired) or have not been previously licensed marine engineers, to obtain a license (endorsement) as Chief Engineer *“Restricted to the SS VIRGINIA V”*. The specific requirements for this restricted license are available from the Director of Engineering.

BASIC STEAM ENGINEERING

INTRODUCTION

Marine Engineers spend years training and have acquired a great deal of practical experience in the operation of steam systems. It is the intent of this section of the manual to provide the SS VIRGINIA V Designated Engineer candidates with a very basic understanding of how steam produces power. This basic knowledge is tailored specifically to the operation of the SS VIRGINIA V and is essential to the safe operation of the vessel.

Your training does not stop here. You are encouraged to ask questions of the SS VIRGINIA V's more experienced Designated Engineers and of the licensed Chief Engineers. Take an active interest in learning more about the operation of all equipment onboard, its use, and design theory of operation.

MAIN PROPULSION BOILER

The boiler presently installed on the SS VIRGINIA V is classified as a watertube boiler of the "O" Type. In a watertube boiler, water travels inside tubes, which are surrounded by the by-products of combustion. The "O" Type references the configuration of the generating tubes around the firebox between the steam and water (mud) drums. The maximum allowable working pressure of the boiler is 250 psi, with an operating pressure of approximately 185 – 200 psi. Watertube boilers are designed to circulate hot combustion gases around the outside of a large number of water filled tubes. These tubes extend between an upper header, called a steam drum, and a lower header, called a mud drum.

BOILER DESIGN CHARACTERISTICS	
Mfg:	Babcock & Wilcox
Year Built:	2001
Type:	Watertube "O" Type
MAWP:	250 psi
Operating Pressure:	200 psi
Steam Capacity:	10,000 lbs/hr
Fuel:	No. 2 Diesel Oil
Heating Surface:	1195 sq.ft.
Water Capacity:	833 gallons

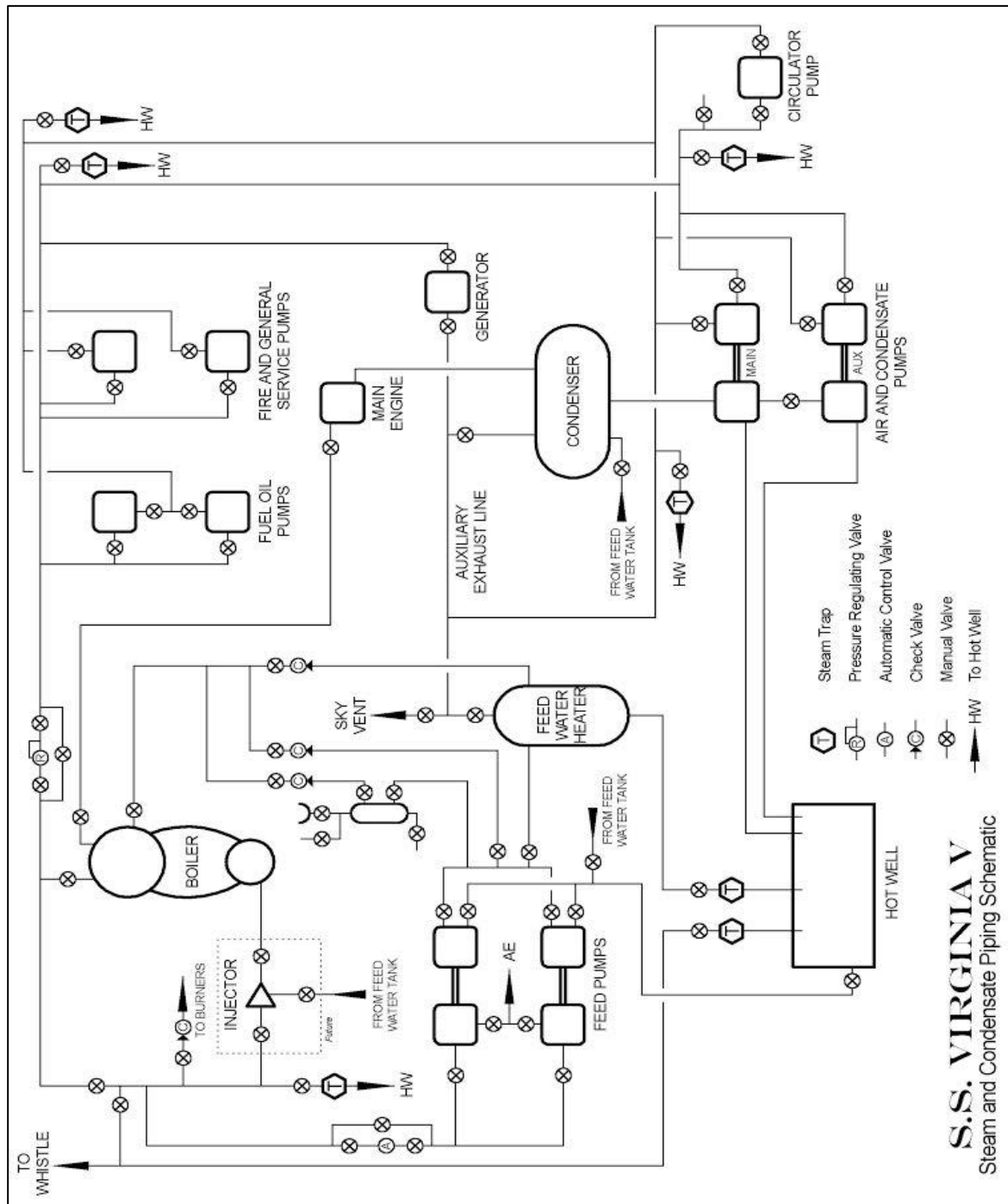
For combustion to occur in the firebox of the boiler, three elements must be present: fuel, oxygen and heat. Fuel is introduced into the firebox from the atomizer. The Forced Draft Fan provides oxygen (air) for combustion and the heat source is the igniter.

There is a great deal of training required to safely operate a boiler. Here again, a licensed Marine Engineer has undergone extensive training and testing to understand boiler controls and safeguards. The Designated Engineer candidate should ask the Chief Engineer about systems associated with the regulation and monitoring of air, fuel and feed water.

STEAM, CONDENSATE & FEED WATER SYSTEMS

The Designated Engineer candidate must have a working knowledge of the steam, condensate and feed water system components.

Once steam is produced by the boiler and at the normal operating pressure, the steam is used to operate the vessel's main engine as well as its auxiliary equipment. The Designated Engineer candidate must be able to identify all of the equipment contained within the schematic below, and demonstrate an understanding of the purpose of each component.



BASIC MAIN ENGINE OPERATION

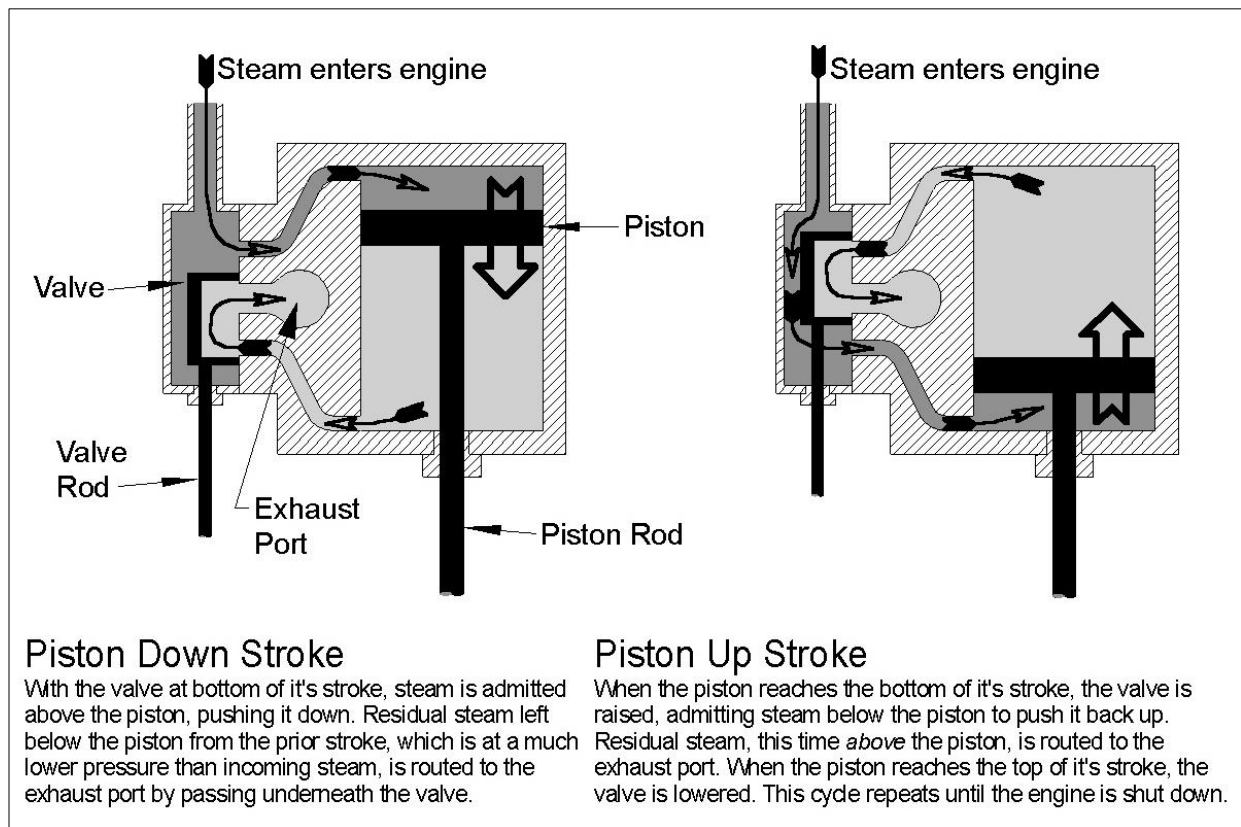
SS VIRGINIA V ENGINE DESIGN CHARACTERISTICS

STEAM ENGINE DESIGN CHARACTERISTICS	
Mfg:	Heffernan Machine Works, Seattle
Year Built:	1901/3
Type:	Triple Expansion, Double Acting
Rated RPM:	200
Rated HP:	400
Stroke:	10-1/4" x 17-1/2" x 28-1/2" x 18"
History:	TYRUS - 1904; VIRGINIA IV - 1920

TRIPLE EXPANSION, DOUBLE ACTING, RECIPROCATING STEAM ENGINE

A steam engine is a machine that turns the heat energy of steam into mechanical energy. When a steam engine is working properly, hot/high pressure steam enters the engine and cold/low pressure steam leaves through the exhaust.

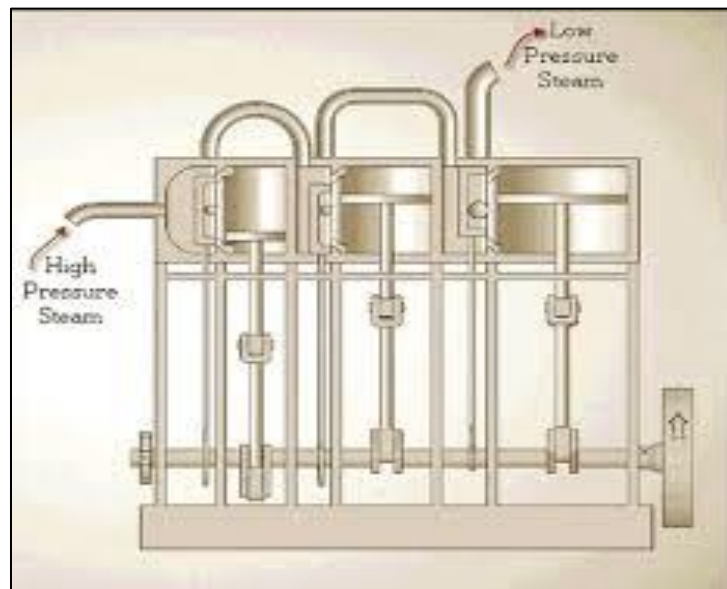
Referencing the diagram below, when the piston is at the top of the stroke and conversely at the bottom of its stroke (double acting), the position of the valve (operated by the valve rod) allows for a "charge" of steam to enter each cylinder at relatively high pressure/temperature.



As the piston moves up and down the cylinder when it is being pushed by the steam, the volume of the opposite area above or below the piston, depending if the piston is in the up or down stroke, increases. This causes the steam's pressure/temperature to drop. Put another way, the steam "expands". The "expanded" steam is discharged through the exhaust port as the associated steam port is lined up with the exhaust port by the valve. In order to improve the efficiency of the engine, the steam needs to expand as much as possible. The more it expands the more energy you're transferring from the steam to the mechanical motion of the piston. The problem is that if you expand the steam too much, the temperature drops significantly, thus significantly reducing the engine's efficiency. This also creates the risk of the steam cooling so much that it turns back into water (condenses). Water in the cylinder can cause knocking and even break engine parts. Excessive cooling causes a "temperature shock" when the next charge of hot steam is put into the engine. Rapid temperature changes can strain the metal and shorten engine life.

The solution is to only partially expand the steam. Although this would solve the problems associated with condensing the steam early in the steam cycle, the issue of reduced engine efficiency remains. To eliminate this problem, a triple expansion engine, utilizing three cylinders as the name implies, offered an answer to this challenge for early marine engine design.

The steam is first expanded part way in the high pressure (H.P.) cylinder. Then this steam is routed to a second intermediate pressure (I.P.) cylinder where it is expanded some more. Finally, the steam is sent to the third low pressure (L.P.) cylinder where it expands one last time. Thus the term "triple expansion".

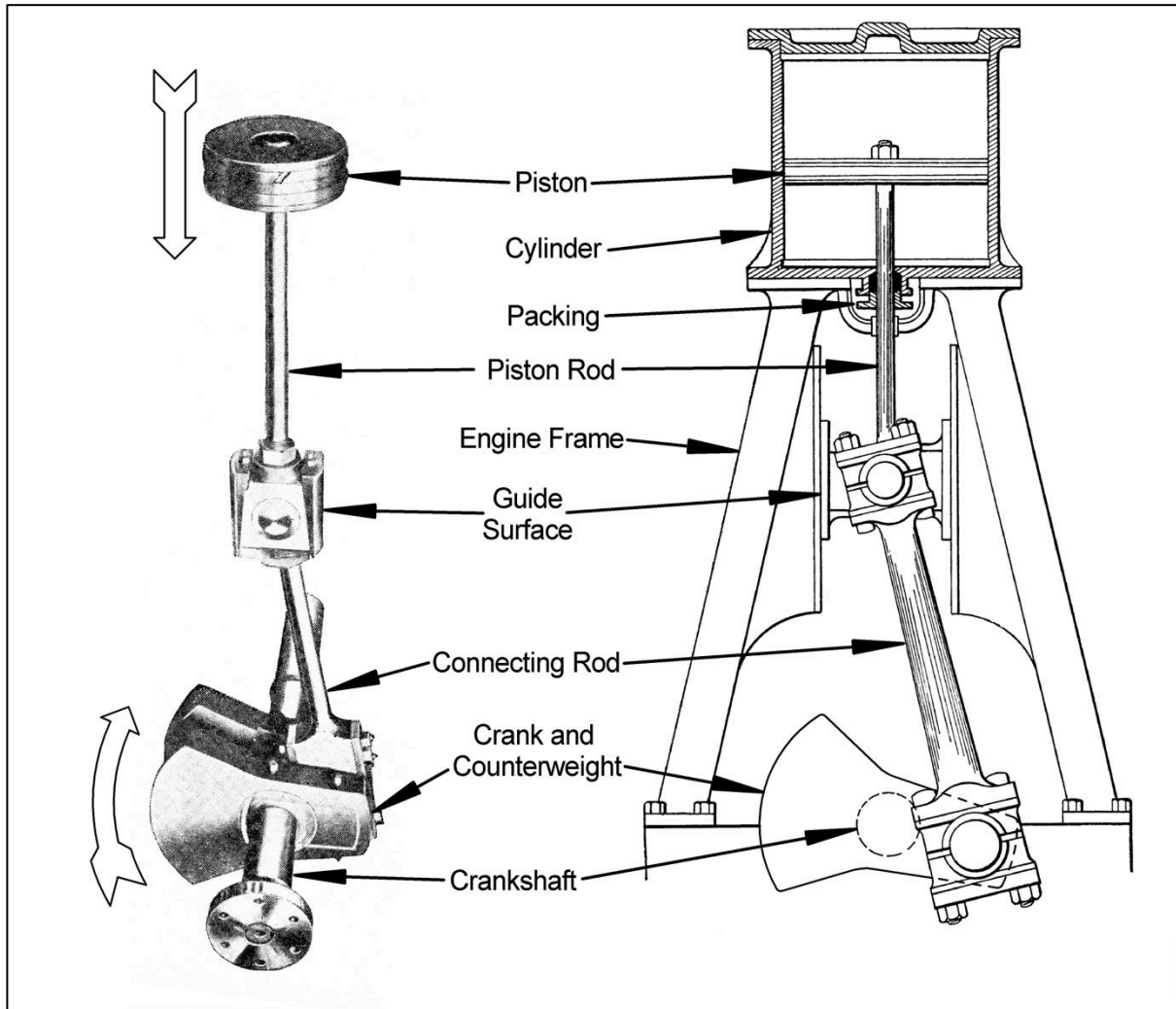


Each individual cylinder only changes the temperature and pressure of the steam within a limited range. So there are fewer problems with temperature shock or condensation. But by the time the steam has passed through the whole engine, most of its energy has been transferred to the pistons.

BASIC ENGINE COMPONENTS

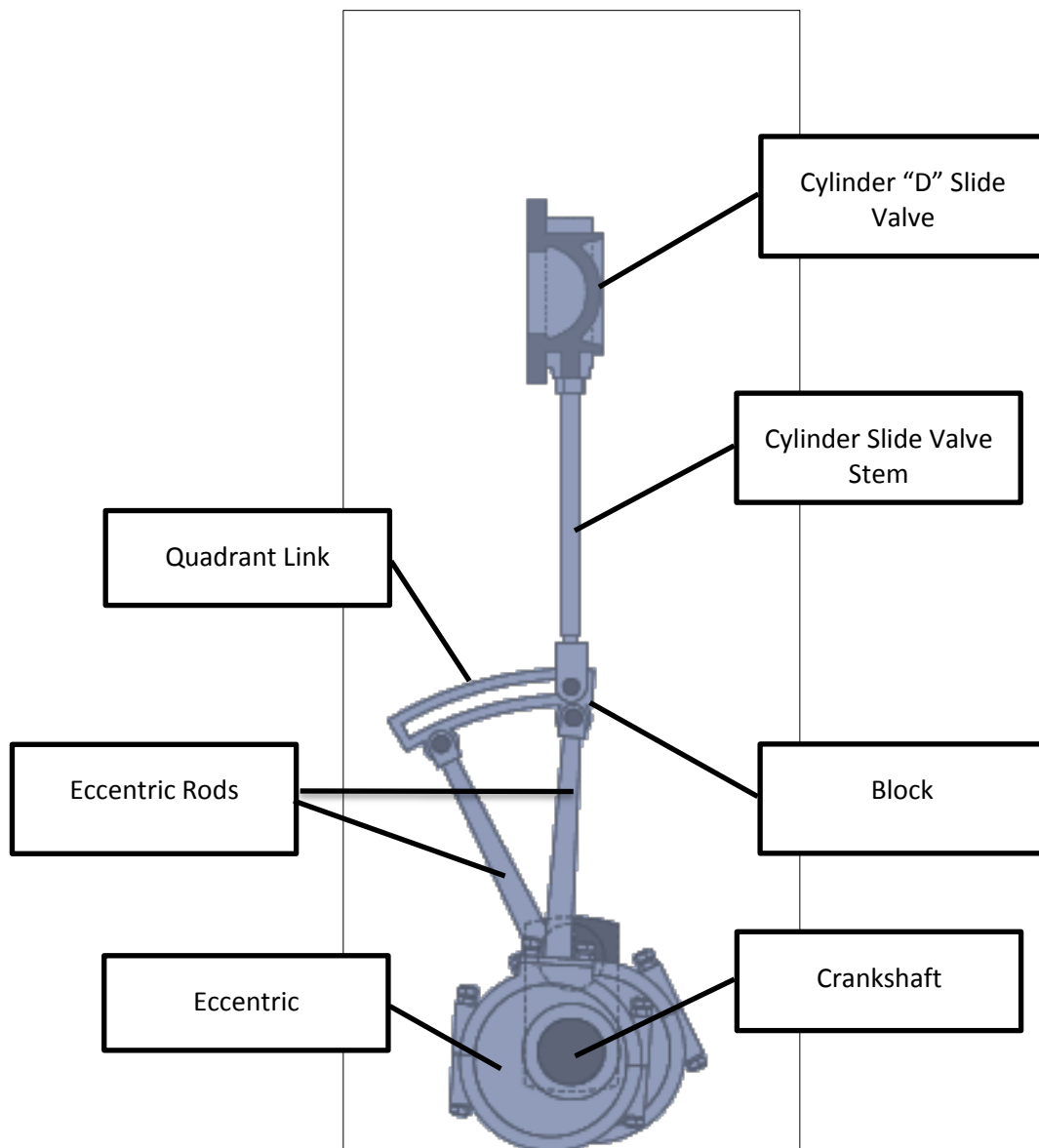
As stated above, heat energy is converted to mechanical energy within the Main Engine. That mechanical energy is then transferred to the propeller shaft via the engine's components.

The simplified figure below identifies the engine's components that transfer the lateral motion of the piston into the rotary motion of the propeller shaft.



REVERSING THE ENGINE

In order to change the rotational direction of the engine to achieve ahead and astern operation, it is necessary to change when steam is admitted into either side of the cylinders. An eccentric attached to the crankshaft moves the valves that control steam admission to the cylinder at the proper time. By changing the position of the eccentric, the motion of the valve is changed with respect to the motion of the crankshaft and thus steam admission is changed resulting in the engine rotating in the opposite direction.



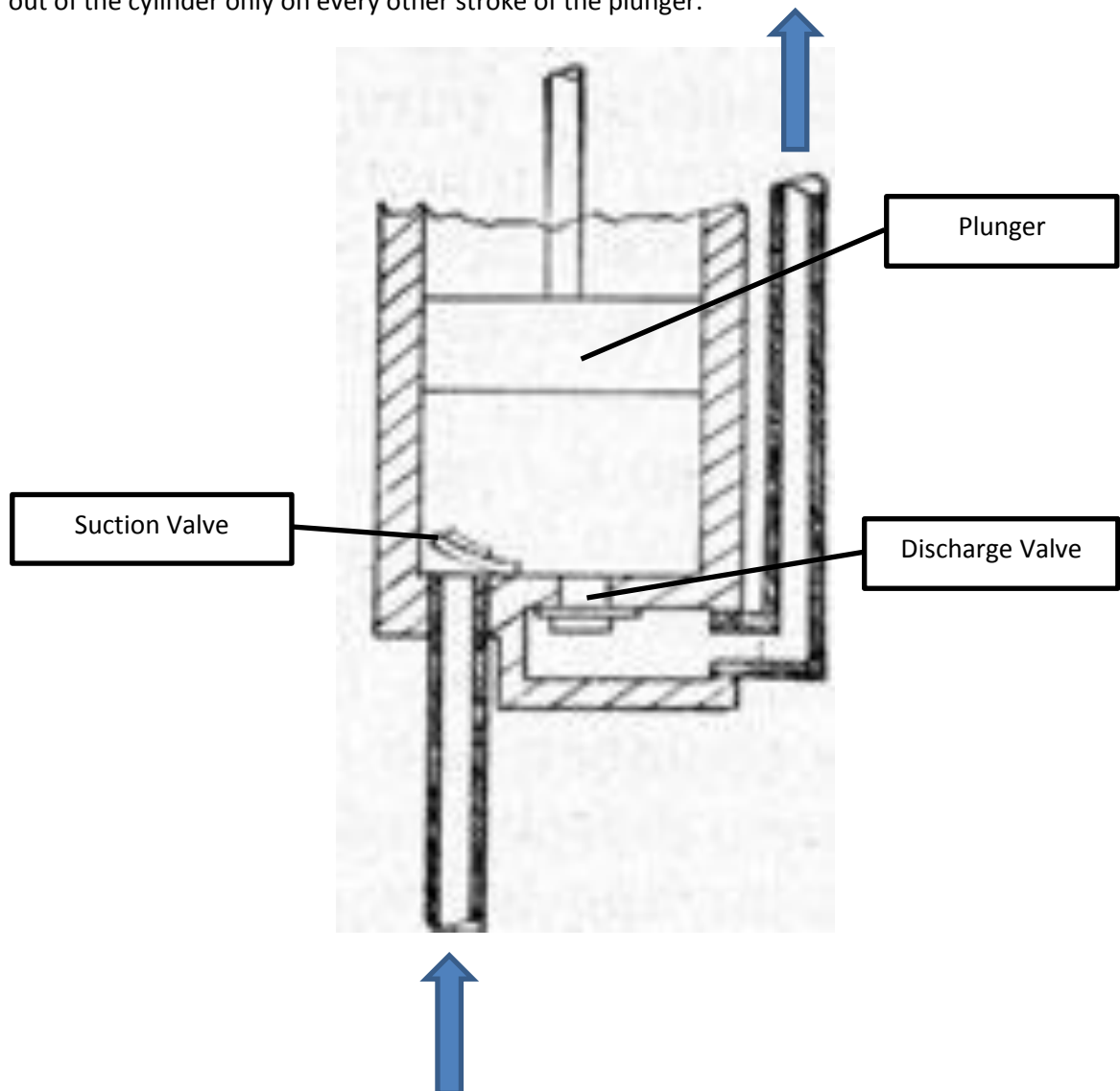
This consists of a set of eccentrics. One eccentric is set to control the valve for ahead operation and the other eccentric is set to control the valves for astern operation.

An eccentric rod runs from each eccentric to either end of the quadrant. The quadrant link is made to slide along a block attached to the foot of the valve stem. The eccentric whose eccentric rod is directly beneath the valve stem thus moves the valve.

BASIC RECIPROCATING STEAM PUMP OPERATION

SIMPLEX PUMPS

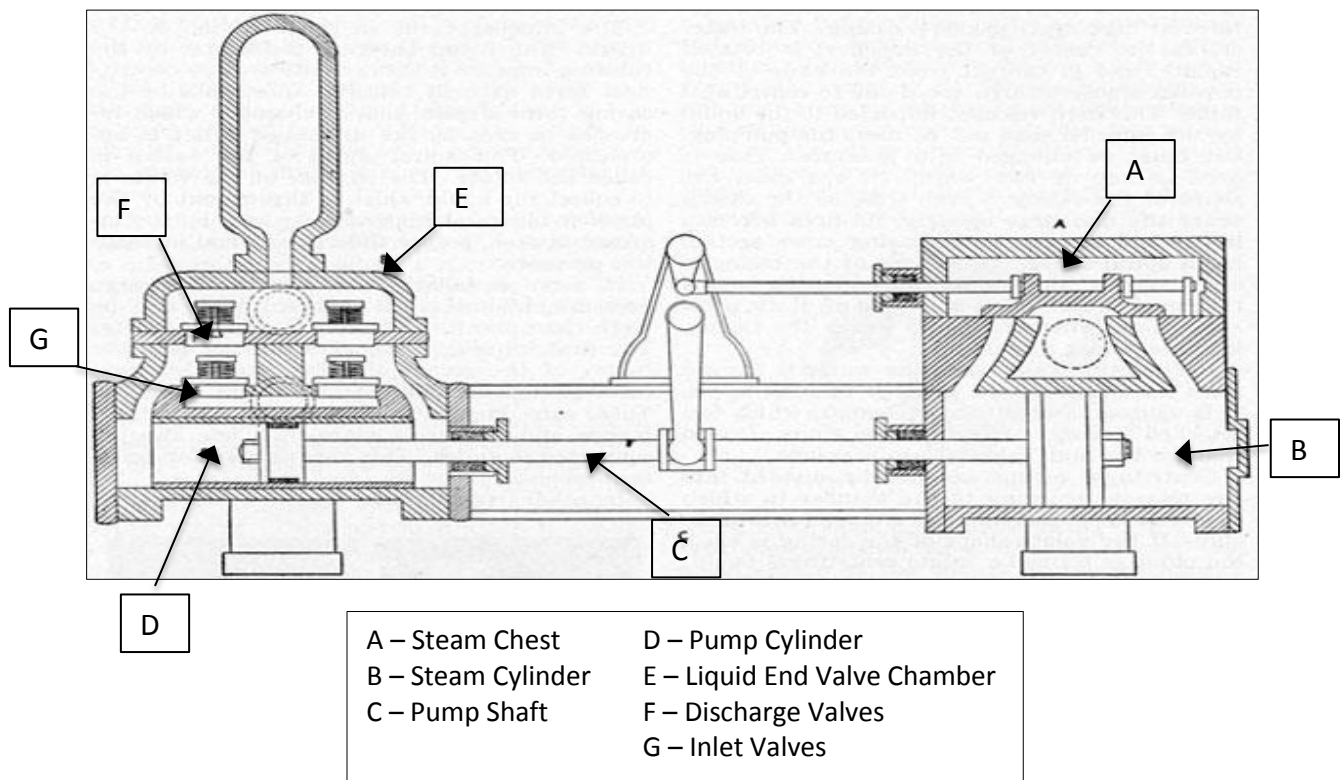
Simplex Pumps - All reciprocating pumps consist of a cylinder in which a close fitting plunger is moved back and forth. A simple sketch of a single acting pump (simplex) is shown in the drawing below. Water is forced up into the pump cylinder by atmospheric pressure as the pump reduces the pressure in the cylinder and suction line. Instead of admitting air or water to the top of the plunger through a valve, on the down stroke it forces the water or air through the discharge valve. The height to which the water may be forced depends upon the power applied to the plunger. The pump described is a single acting pump as it moves water out of the cylinder only on every other stroke of the plunger.



The type of pump generally used on board vessels is a double acting pump, which works the same as the pump described, except that a suction and discharge valve is provided at each end of the cylinder. Thus, while the plunger is forcing water out a discharge valve at one end of the cylinder, water is forced in the other end through the suction valve by atmospheric pressure.

The internal valves are not usually arranged as shown in the simple sketch above but are as shown in the drawing of a double acting-reciprocating pump below. (A) is the steam end of the pump, (B) the water end. Suction (E) and discharge decks (F) are provided above the cylinder and the suction and discharge valves are placed on these decks. The discharge deck is placed above the suction deck, a suction chamber is between the suction deck and the cylinder. The ends of the cylinder are connected by ports to the space above the suction valves and are separated by a division plate. (C) is the pump frame between the steam and water ends.

In the simplex pump an auxiliary valve is controlled by the piston rod, which admits steam to one side of an auxiliary piston in the steam chest, which is moving in a cylinder, slides the main slide valve in the proper direction to admit steam to the cylinder, starting the piston on a new stroke.



DUPLEX PUMPS

The pump type described above is classified as simplex pumps, due to its one pump cylinder design. The discharge from this type is irregular due to the plunger reversing its direction after each stroke. For this reason, a pump having two cylinders was developed, one plunger starting its stroke before the other plunger has finished its stroke. This action gives a much smoother discharge than is possible with the simplex pump.

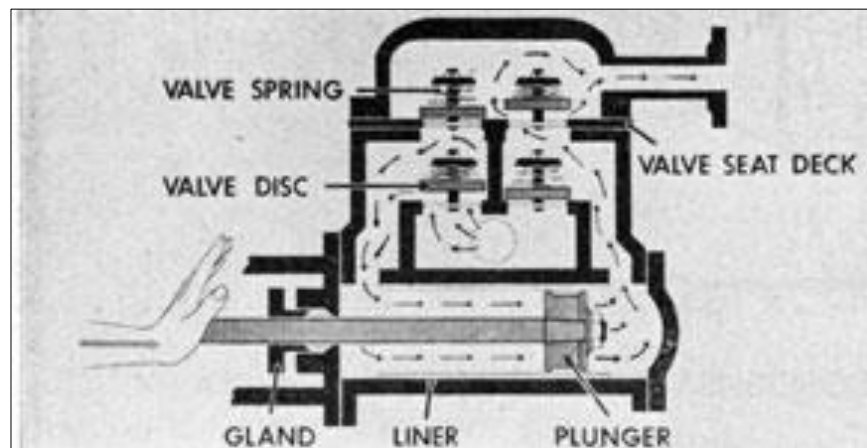
The duplex pump requires twice the number of valves used in a simplex pump, that is, at least four suction valves and four discharge valves.

Similar to the simplex type pump, the plunger is driven directly by a steam piston through a piston rod. Steam is admitted to first one end of the steam cylinder and then to the other, moving the steam piston

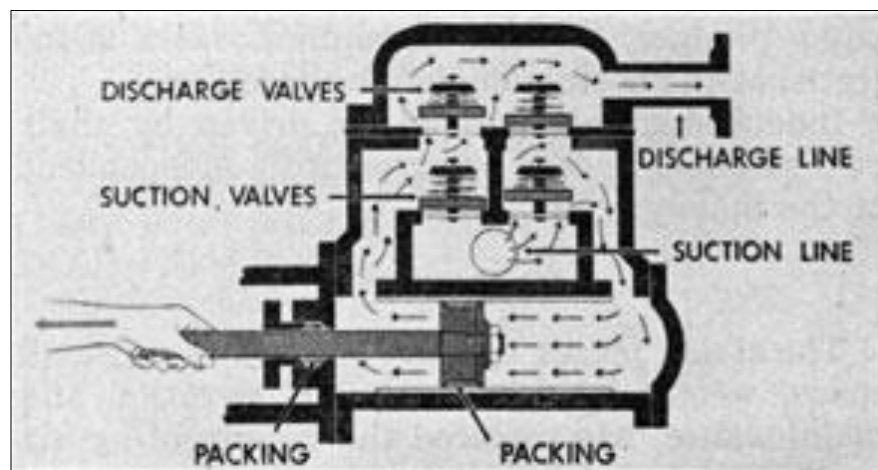
back and forth. The admission of steam is controlled by a slide valve, opening ports to the cylinder for steam to flow through.

The valve is controlled in a different way in the simplex pump than in the duplex pump. In the duplex pump the slide valve for one cylinder is controlled by the piston rod of the other cylinder. Thus as one piston nears the end of its stroke it causes the slide valve of the other cylinder to slide on its seat, opening ports, admitting steam, thus starting the other piston on its stroke.

Referencing the illustration below, the arrows indicate the flow of liquid as the plunger is moved forward. The hand shown on the piston rod is representative of the steam cylinder, which transmits power through the piston rod to the liquid plunger. A partial vacuum is created behind the plunger. Atmospheric pressure is now sufficient to force the liquid through the suction valves, filling the spaces behind the plunger. At the same time liquid is pushed through the discharge valves by the plunger. This discharge pressure aids the springs in holding the suction valves closed and forces the discharge valves open.



On the return stroke the same cycle of events takes place. Each stroke of a double acting pump is a power stroke and the result is a steady, unbroken flow.



STEAM RECIPROCATING PUMP START-UP PROCEDURES

In starting a reciprocating pump, the following operations shall be followed:

1. Make sure that the pump is clear and free to operate;
2. Lubricate all pump linkages;
3. Open the pump discharge valve;
4. Open the pump suction valve;
5. Open the cylinder and steam chest drains;
6. Insure that the steam exhaust valve is open (typically steam pump exhaust valves are left open when securing the plant);
7. Crack open the steam emission (supply) valve;
8. Allow the steam end to drain all condensate until only live steam is exiting the drains;
9. Close all drains;
10. Regulate pump speed by throttling the steam emission valve;
11. Lubricate pump per standing orders.

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APPENDIX 1.1 – DESIGNATED ENGINEER SKILLS CHECKLIST

- ☐ Boiler light off procedures;
- ☐ Main Engine preparation and pre-lubrication;
- ☐ Generator start-up preparation and operation;
- ☐ Feed Pump start-up preparation and operation;
- ☐ Fire Pump start-up preparation and operation;
- ☐ General Service Pump start-up preparation and operation;
- ☐ Circulating Pump start-up preparation and operation;
- ☐ Auxiliary Air Pump start-up preparation and operation;
- ☐ Main Air Pump start-up preparation and operations;
- ☐ Monitor Hotwell level and take extra feedwater as directed by the C/E;
- ☐ Knowledge of main engine and pump shut down procedures;
- ☐ Fill Fresh Water and Feedwater Tanks;
- ☐ Monitor vacuum pressure and understand how vacuum is controlled;
- ☐ Knowledge of system operating parameters (acceptable temperature and pressure limits);
- ☐ Monitor all operating equipment temperatures and pressures;
- ☐ Take and record all tank soundings. Provide to C/E for entry into the Engine Log;
- ☐ Under the direction of the C/E, take condensate sample for boiler water testing;
- ☐ Dose the Chemical Feed Tank when directed by the C/E (wear appropriate PPE);
- ☐ Under the direction of the C/E, line-up sewage system for discharge ashore;
- ☐ Under the direction of the C/E, line-up and fresh water wash the Sewage Tank internals;
- ☐ Under the direction of the C/E line-up Oily Water Separator for bilge water processing;
- ☐ Pump bilges and monitor Oily Bilge Water Tank level;
- ☐ Knowledge of shipboard emergency procedures;
- ☐ Knowledge of shipboard safety requirements;

APPENDIX 1.2 - DESIGNATED ENGINEER DUTIES (START-UP)

A. PREPARATION

- ☐ Read/review Engineering Log from previous cruise.
- ☐ C/E briefing.
- ☐ Pump Sewage Tank if required.

B. BOILER

- ☐ Remove stack cover.
- ☐ Line up fuel oil filter and fuel pump (No. 1 or No. 2 Fuel Pump as directed by C/E).
- ☐ Insert mechanical atomizer for cold plant light off (proper atomizer for warm plant light-off as directed by C/E).
- ☐ Insert igniter probe.
- ☐ Observe light off.
- ☐ Remove igniter probe.

C. MAIN ENGINE

- ☐ Fill drip lubricator and main bearing oil cups. Adjust flow.
- ☐ Hand lubricate all drip funnels and all linkage points.
- ☐ Hand lubricate crosshead guide faces.
- ☐ Lube thrust bearing collars.
- ☐ Loosen stern gland.

D. GENERATORS (32kW & 36kW)

- ☐ Check lube oil and coolant levels.
- ☐ Line up fuel filters.
- ☐ Open seawater valves.
- ☐ Turn on battery switches.
- ☐ Check for leaks after generators are started.

E. FEED PUMPS

- ☐ Line up discharge, suction, exhaust valves and drain valves.
- ☐ Follow STEAM RECIPROCATING PUMP START-UP PROCEDURES (p. 49)
- ☐ Warm up pumps with regulator bypass valve open.
- ☐ Open drip feed meter valve.
- ☐ Fill drip chemical feed tank as directed by C/E.

F. FIRE & GENERAL SERVICE PUMPS

- ☐ Open sea suction skin valve.
- ☐ Open pump suction and discharge valves.
- ☐ Follow STEAM RECIPROCATING PUMP START-UP PROCEDURES (p. 49).
- ☐ Test run each pump (close steam valve upon completion).

G. CIRCULATING PUMP

- ☐ Fill drip oiler, adjust drips and oil pump bearings.
- ☐ Open suction valve on ship's bottom.
- ☐ Open condenser overboard valve.
- ☐ Follow STEAM RECIPROCATING PUMP START-UP PROCEDURES (p. 49).
- ☐ Remove flywheel cover guard. Rotate flywheel and replace guard when pump is in operation.

H. AUXILIARY AIR PUMP

- ☐ Line up air suction through Main Air Pump.
- ☐ Follow STEAM RECIPROCATING PUMP START-UP PROCEDURES (p. 49).
- ☐ Test run pump.
- ☐ Check vacuum pressure.

I. MAIN AIR PUMP

- ☐ Follow STEAM RECIPROCATING PUMP START-UP PROCEDURES (p. 49).
- ☐ Test run pump.
- ☐ Check vacuum pressure.

J. AUXILIARY EQUIPMENT

- ☐ Fill Fresh Water and Reserve Feed Tanks (insure upper and lower sight glass valves are open).
- ☐ Pump bilges being aware of Bilge Tank level (insure upper and lower sight glass valves are open).
- ☐ Monitor Hotwell level. Fill as directed by C/E via the drag line.

K. FORWARD HOLD

- ☐ Open flushing pump sea suction valve and close pump breaker.
- ☐ Pump out Sewage Tank as directed by C/E.

APPENDIX 1.3 - DESIGNATED ENGINEER DUTIES (UNDERWAY)

Make rounds to insure that all machinery is operating properly and within system parameters as identified in APPENDIX 1.4 of this manual. Any abnormal sounds, temperatures, and odors shall be brought to the C/E's immediate attention.

Designated Engineers and Trainees shall be aware of all acceptable operating temperatures and pressures.

A. MAIN ENGINE

- ☐ Check drip rate on oiler.
- ☐ Oil linkage points half hourly (or more frequently based on engine RPM).
- ☐ Oil thrust bearing half hourly (or more frequently based on engine RPM).
- ☐ Keep main bearing oil cups full.
- ☐ Monitor all bearing temperatures with a handheld digital thermometer.
- ☐ Watch stern tube packing for overheating

B. AUXILIARY EQUIPMENT

- ☐ Line up electric fire pump or general service pump to boiler water test cooler as directed by C/E.
- ☐ Adjust auxiliary exhaust pressure valve above main engine. Confer with C/E as to desired auxiliary exhaust pressure to improve plant efficiency.

APPENDIX 1.4 – DESIGNATED ENGINEER OILING PROCEDURES

The initial emphasis is to prepare the boiler for light off. Upon completion of boiler light off, the Designated Engineer and the Trainee shall commence main engine and auxiliary equipment lubrication.

The object of this procedure is to clarify what is considered “good marine practice” regarding main engine and pump lubrication. There will be variations to frequency of oiling rounds and drip lubrication as well as acceptable machinery temperature readings based on ambient temperature and engine speed.

Interval times are only a starting point. On Lake cruises, an oiling round once every 30 minutes should suffice. On longer speed trips it may be necessary to check every 15 minutes to insure proper machinery lubrication and operation. ***Designated Engineers must confer with the C/E regarding frequency of oiling rounds and drip lubrication intervals before each cruise.*** In order to ensure personnel safety, it may be prudent for the C/E to advise/request the Captain that a reduction in engine speed is required to complete oiling the main engine.

Check **all** bearing and guide temperatures with the ship’s infrared digital thermometer. Generally, main bearing temperature should be below 110°F and eccentric straps below 120°F. Main engine guide bottom section temperatures below 150°F and main engine guide top section temperatures below 200°F are satisfactory.

MAIN ENGINE:

- 1) Fill lubricators;
- 2) Fill valve eccentrics;
- 3) Fill thrust box cups;
- 4) Perform an initial lubrication of **all** points;
- 5) Open drips and lubricators;
- 6) Manually pre-lubricate (pour oil) into main connecting rod funnels;
- 7) Main Lubricator:
 - a) Guide drips should leave a small puddle of oil at the top when the engine is running (6 – 12 drips per minute). This is the determining factor for all drips.

Note: The back side of the guides will need to be oiled during rounds. Black scuff marks on the guide surfaces indicates improper lubrication. The faster the RPM the more oil is required on the guide surfaces. Constant vigilance on the guide temperature is required (150 – 200°F). Once a bearing temperature starts to climb it is very difficult to bring it back down.
 - b) Main crank pin drips at the same rate as the guide drips (6 – 12 drips per minute).
 - c) Crosshead pin drips at half the guide rate (3 – 6 drips per minute). If oil is running down the connecting rod, determine if the oil drops are missing the funnel or if there is too much oil.
 - d) Valve guide drips. As stated above, guide drips should leave a small puddle of oil at the top when the engine is running.

- 8) Set main bearing drips between 6 - 12 drips per minute;
- 9) Valve eccentrics will require oiling as necessary. Remember to check as things heat up.
- 10) Thrust box oiling as necessary. Temperatures should be maintained below 140°F. Removing the thrust bearing cover on longer speed trips may be required to allow for a greater heat dissipation rate. The cover must be properly stowed in a safe position/location.

CIRCULATING PUMP:

The Circulating Pump drip lubricator needs to be started early to make sure all the points are lubricated properly. Manually oil all points prior to start-up. If it is dripping properly there is little need to manually oil the pump during pump operation.

- 1) Fill Circulating Pump lubricating oil reservoir when filling the Main Engine lubricating oil reservoir.
- 2) Start drips at same time as the Main Engine (start with 2 – 4 drips per minute after manual lubrication of all points).
- 3) The two main bearing drips should be enough to leave a small puddle in the wicking.
- 4) The main crank bearing should drip about once every 15 seconds.
- 5) The crosshead pin cup should remain with an oil puddle in it.
- 6) The crosshead guides are about the same as the crank bearing. There should be a small amount of oil dripping off the guide.
- 7) The valve guide should have a small puddle on both sides.
- 8) The valve eccentric needs a drip approximately every 5 seconds.
- 9) Make sure the crank bearing does not get flooded as condensing steam creates a water level in the open sump. Pump out regularly using the electric bilge pump.

OTHER PUMPS:

The other pumps need occasional oiling. Most work well with the **30-minute rounds**. The Main Air Pump may need more frequent oiling, as does the Auxiliary Air Pump. Although only running pumps need to be oiled during the 30-minute rounds, be prepared to oil pumps that will be brought on-line as the need arises.

PUMP START-UP ORDER:

Electric Fuel Oil Pumps (Designated Engineer to line-up No. 1 or No. 2 Pump as directed by the C/E). The C/E will start the desired pump from the Boiler Combustion Control Panel. Check fuel oil pressure gauge fuel oil supply pressure to the boiler (approximately 120 psi).

Once steam is supplied to the Auxiliary Steam System, the following pumps shall be started in accordance with the STEAM RECIPROCATING PUMP START-UP PROCEDURES (p. 50):

- 1) Boiler Feed Pump on “bypass” (Inboard or Outboard as directed by the C/E).
- 2) Circulating Pump.
- 3) Main Air Pump (or Auxiliary Air Pump as directed by C/E). Check vacuum gauge.
- 4) Other auxiliaries as directed (i.e. Fire Pump, General Service Pump).

APPENDIX 1.5 – DESIGNATED ENGINEER SHUTDOWN CHECKLIST

A. FEED PUMPS

- ☐ Close Feed Pump discharge valves and chemical metering valve.
- ☐ Close steam supply valve(s) and open drains.

B. MISC. PUMPS

- ☐ Secure all pumps in operation (close steam supply valves, open drain valves).
- ☐ Boiler electric fuel pump suction and discharge valve closed and fuel filter to “OFF” position.
- ☐ Flushing pump: breaker open and sea valve closed.

C. SEA VALVES & STERN TUBE

- ☐ Close circulating pump suction valve and condenser overboard valve.
- ☐ Tighten Stern gland packing.
- ☐ Close auxiliary sea suction valve to fire and general service pumps.

D. 32 kW GENERATOR

- ☐ Fuel filter valve to “OFF” position.
- ☐ Battery disconnect to “OFF” position.
- ☐ Cooling water sea valves closed.
- ☐ Remove sound box covers.

E. 36 kW GENERATOR

- ☐ Fuel filter valve to “OFF” position.
- ☐ Battery disconnect to “OFF” position.
- ☐ Cooling water sea valves closed.
- ☐ Remove sound box covers.

F. TANKS

- ☐ Close Reserve Feed Tank drop valve at bottom of tank and vacuum drag to condenser.
- ☐ Close Reserve Feed Tank lower sight glass valve.
- ☐ Close Fresh Water Tank lower sight glass valve.
- ☐ Bilge Holding Tank lower sight glass valve closed.
- ☐ Sound all tanks as required by C/E.

G. BOILER

- ☐ Remove/stow burner.
- ☐ Boiler stack cover on.

H. ELECTRICAL MISC.

- ☐ Forward Emergency Lighting panel in “UNARMED” position.

APPENDIX 1.6 – DESIGNATED ENGINEER OWS OPERATING PROCEDURE

OWS START-UP:

For informational purposes only. Only the licensed engineer shall line up and start the OWS.

- 1) Close breaker for Oily Water Separator in Foc'sle.
- 2) Check for potable water pressure.
- 3) Turn on OWS.
- 4) Open suction valves from Bilge Water Tank.
- 5) Open potable water, clean discharge and return to bilge tank valves.
- 6) Check Waste Oil Tank and record level in engineering log.
- 7) Check parts per million (PPM) display to make sure it has settled.
- 8) Turn operation switch to "MANUAL" until water is heard to run into the Waste Oil Tank.
- 9) Jog operation switch to "RUN" to make sure the pump will turn.
- 10) Turn to "RUN" if all is satisfactory.

OWS SHUTDOWN:

- 1) Check PPM meter. If over 9.0, set about to flush unit.
- 2) Flush unit by opening potable water line to duplex filter. Make certain not to pressurize unit and cause water to flow into waste oil tank.
- 3) After 10 seconds, close the suction valves to bilge tank.
- 4) Run OWS on potable water until discharge PPM is below 9.0.
- 5) After PPM is below 9.0, turn operation switch to "MANUAL" and discharge oil to Waste Oil Tank.
- 6) Turn unit "OFF" and close potable water valves, clean discharge and bypass valves.
- 7) Turn unit "OFF".
- 8) Measure waste oil in tanks and record.
- 9) Confirm all valves and switches.
- 10) Open breaker in Focsle.

APPENDIX 1.7 – DESIGNATED ENGINEER SEWAGE PUMP OUT PROCEDURE

NOTE (1): *Sewage Pump controls are energized from two (2) sources: Pump Breaker – 208V; 3 Phase and from the Sewage Tank Level – 120V; Single.*

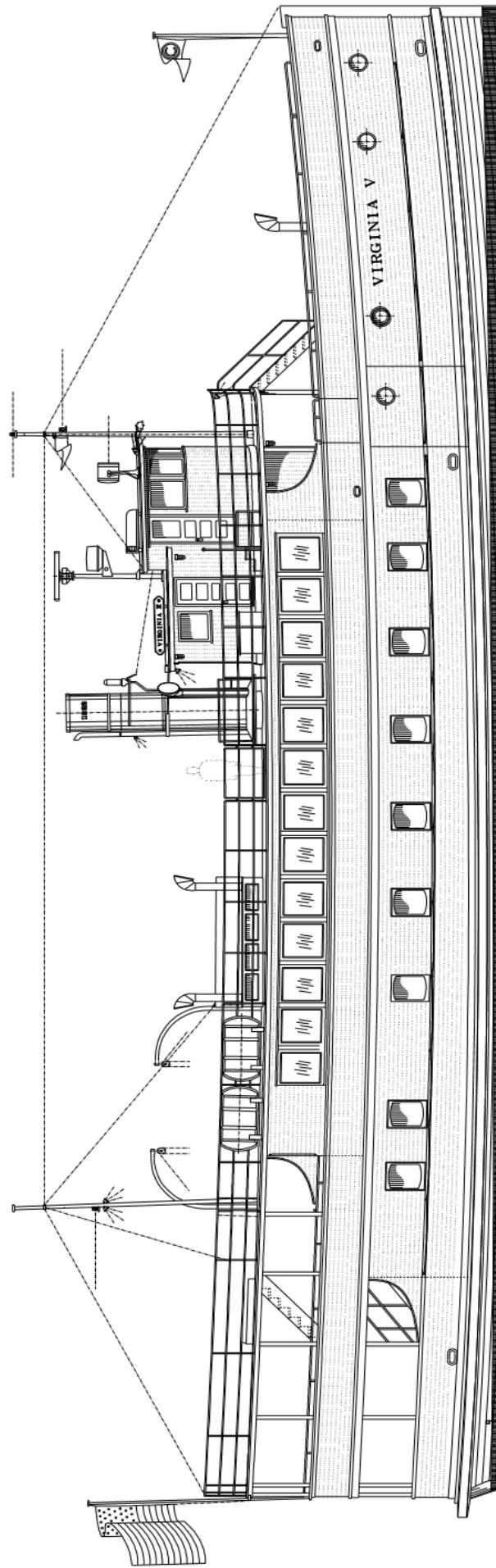
NOTE (2): *Blue spot PVC valves have safety latch, lift to turn.*

- 1) Wear Nitrile gloves.
- 2) Connect shore side hose to ship and shore connections.
- 3) Open shore side valve, then open hose end valve.
- 4) Energize Sewage Pump and sewage level indicators, forward electrical panel.
- 5) In Forward Hold, close upper main sewage line VALVE NO. 2.
- 6) Open primary sewage line stop VALVE NO. 1.
- 7) Confirm flushing line VALVE NO. 6 and tank spray, to starboard of tank are closed and the flushing connection VALVE NO, 5, at Sewage Pump is closed.
- 8) Open Sewage Pump discharge VALVE NO. 4.
- 9) Open Sewage Pump inlet VALVE NO 3.
- 10) Open Sewage Tank sight glass valve and confirm tank liquid level.
- 11) Turn pump control to “AUTO”, pump will start.
- 12) Maintain watch on sight glass. Pump is supposed to stop automatically. If it does not or you hear cavitation turn pump control to “OFF”. When pump stops turn control to “OFF”.
- 13) Close main tank stop VALVE NO. 1.
- 14) Proceed to engineering and line up Electric Fire Pump. Discharge of Fire Pump to the General Service Manifold and to Forward Flushing line. Turn electric fire pump on.
- 15) Proceed to Forward Hold and confirm pressure.
- 16) Confirm hose connections and open ball valve, VALVE NO. 6, beside tank to pressurize hose.
- 17) Turn pump control to “AUTO”.
- 18) Open flushing connection VALVE NO. 5, at Sewage Pump inlet.
- 19) Open main sewage stop VALVE NO. 1. When pump starts close VALVE NO.1.
- 20) Close VALVE NO. 3 pump suction from tank.
- 21) Run pump for 4 minutes, unless pump cavitates. Shut pump off and close flushing supply VALVE NO. 6, then pump suction VALVE NO. 5, and then close discharge VALVE NO. 4.
- 22) Close valve on sewage pump out hose.
- 23) Secure Electric Fire Pump and return to normal alignment.
- 24) Break hose connection to ship.

- 25) Open hose valve and raise hose to drain. Close hose valve and install cap. Close valve on shore connection. Stow hose on dock.
- 26) Open main sewage tank stop, VALVE NO. 1, and upper main sewage line VALVE NO. 2.
- 27) Close main sewage line VALVES NO. 1 and 2. Close Sewage sight glass valve. Install plug in sewage discharge.
- 28) Turn off power to the Sewage Pump in the Foc'sle to de-energize the sewage pump. Sewage Tank level to be left on if getting underway. If not getting underway, de-energize level indicators also.

APPENDIX 1.8 – VESSEL DRAWINGS

DWG. NO.	REV.	DRAWING TITLE
460-1		Outboard Profile
460-6	--	Inboard Profile
460-2	--	Main Deck Plan
460-3	--	Upper Deck Plan
460-4	--	Boat Deck Plan
460-5	--	Hold Plan
--	--	Safety Plan
460-M1	A	Machinery Arrangement
460-M2	A	Bilge System
460-M3	A	Fuel System
460-M4	A	Firefighting System
460-M6	A	Boiler Feedwater System Diagram
460-M7	A	Steam Piping System



PLAN LIST
 480-2 MAIN DECK PLAN
 480-3 UPPER DECK PLAN
 480-4 LOWER DECK PLAN
 480-5 HOLD PLAN
 480-6 INBOARD PROFILE

PRINCIPAL PARTICULARS
 LENGTH OVERALL 127'-0"
 MAXIMUM BEAM 28'-0"
 MAXIMUM DEPTH 8'-0"
 DRAFT 8'-0"
 REG. L. 115.80' B. 24.10' D. 7.10'
 GROSS TONNAGE 991 NET TONNAGE 67

OUTBOARD PROFILE

SCALE: 1/4" = 1'-0"

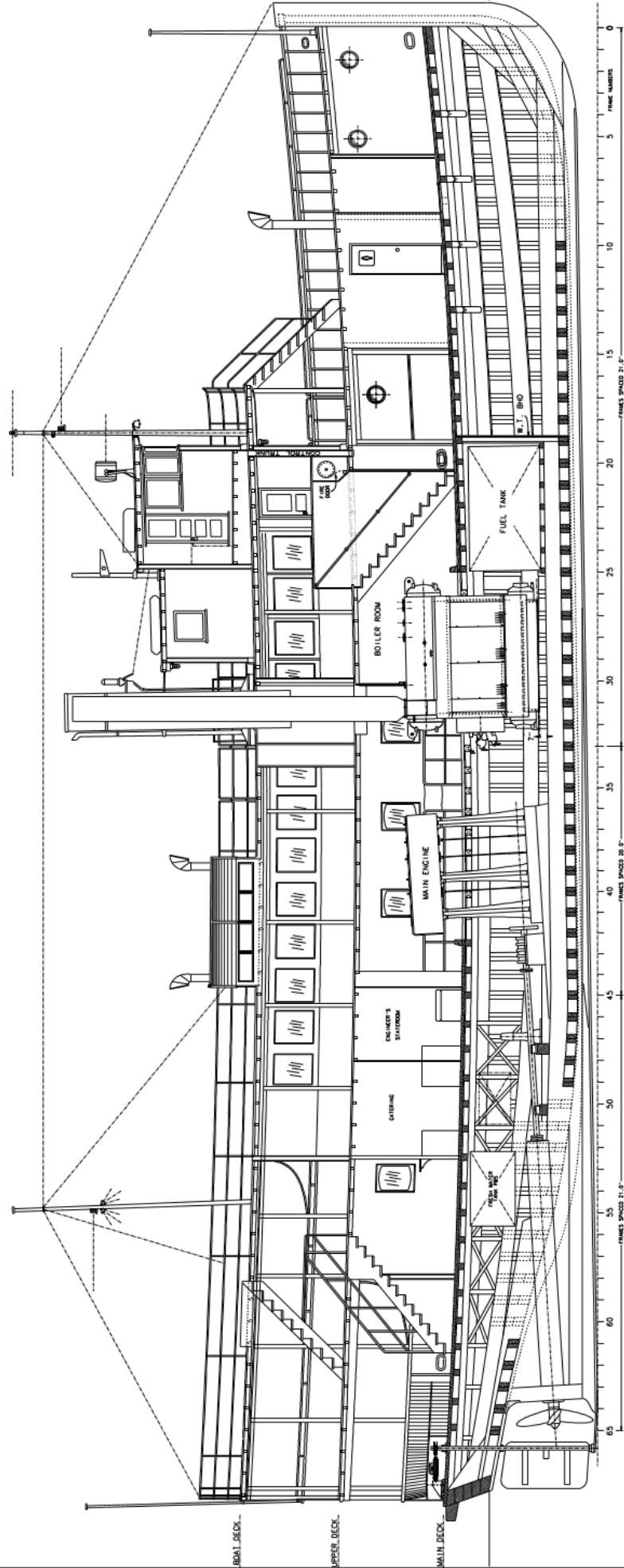
THE STEAMER
VIRGINIA V
 FOUNDATION INCORPORATED

SCALE: 1/4" = 1'-0"
 DATE: 10/10/2002
 Dwg No. 480-1 REV C

S.S. VIRGINIA V



DESIGN BY:
RICHARD W. ETSELL, P.E.
 MARINE ARCHITECT AND MARINE ENGINEER
 1115 N. NORTH LAKE WAY - SEATTLE, WA 98103



INBOARD PROFILE

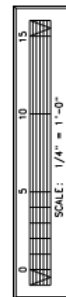
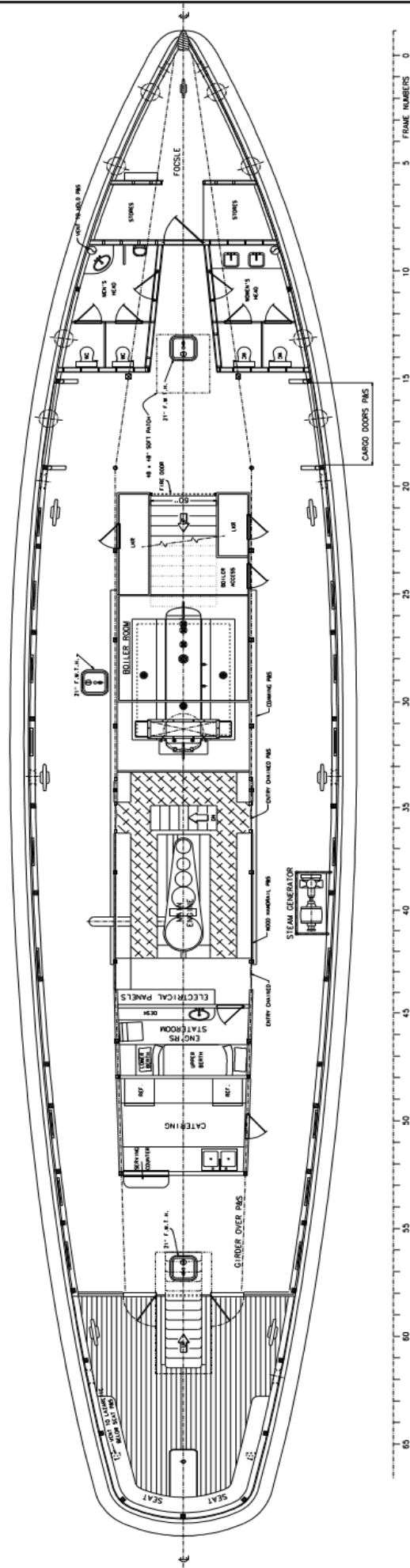
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DATE: 10/10/2002
DWG No. 460-6

THE STEAMER
VIRGINIA V
FOUNDATION INCORPORATED

S.S. VIRGINIA V



DRAWN BY:
RICHARD W. ETSSELL, P.E.
NAVAL ARCHITECT AND MARINE ENGINEER
1115 N. NORTHLINE WAY - SEATTLE, WA 98103

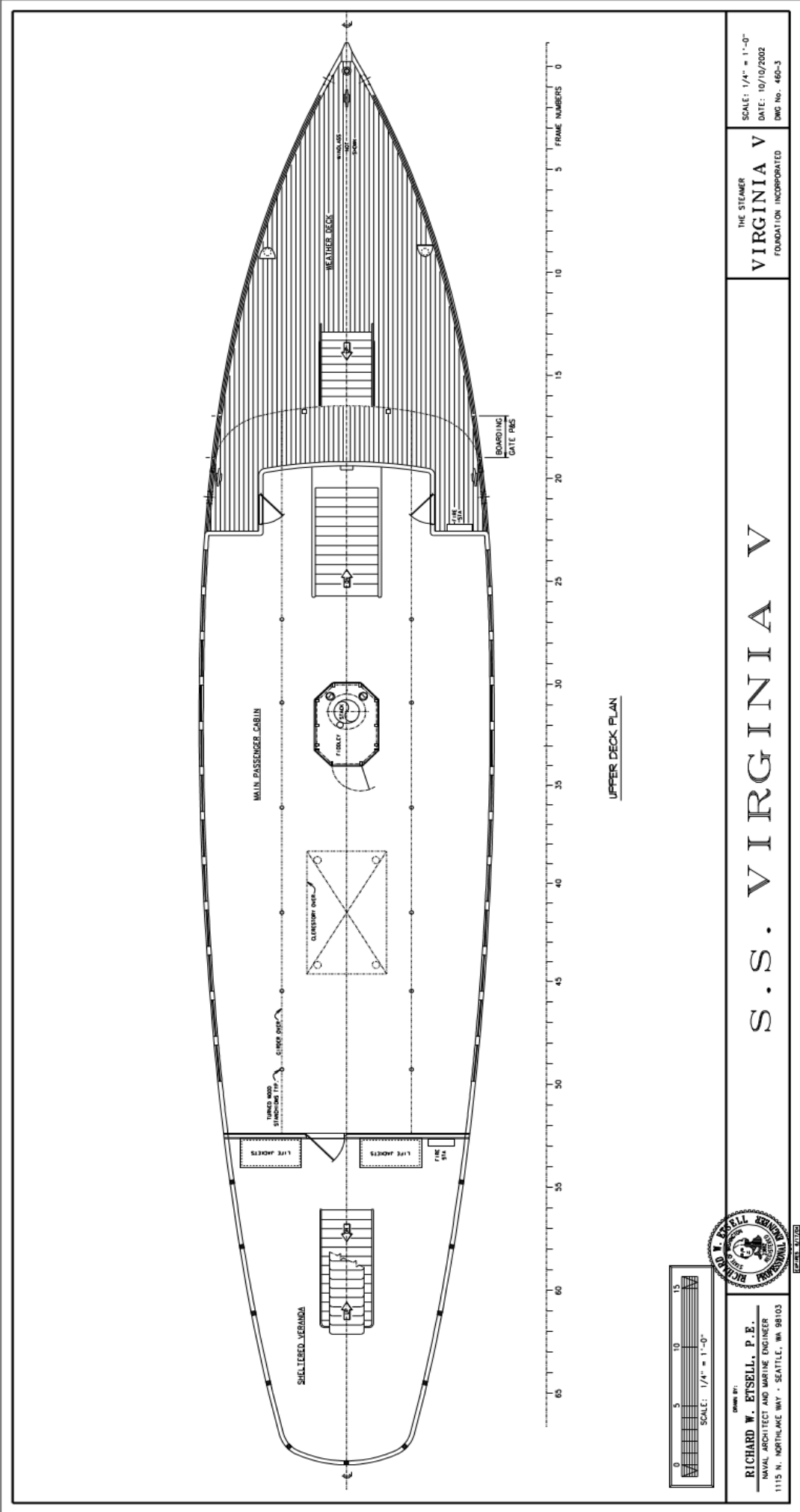


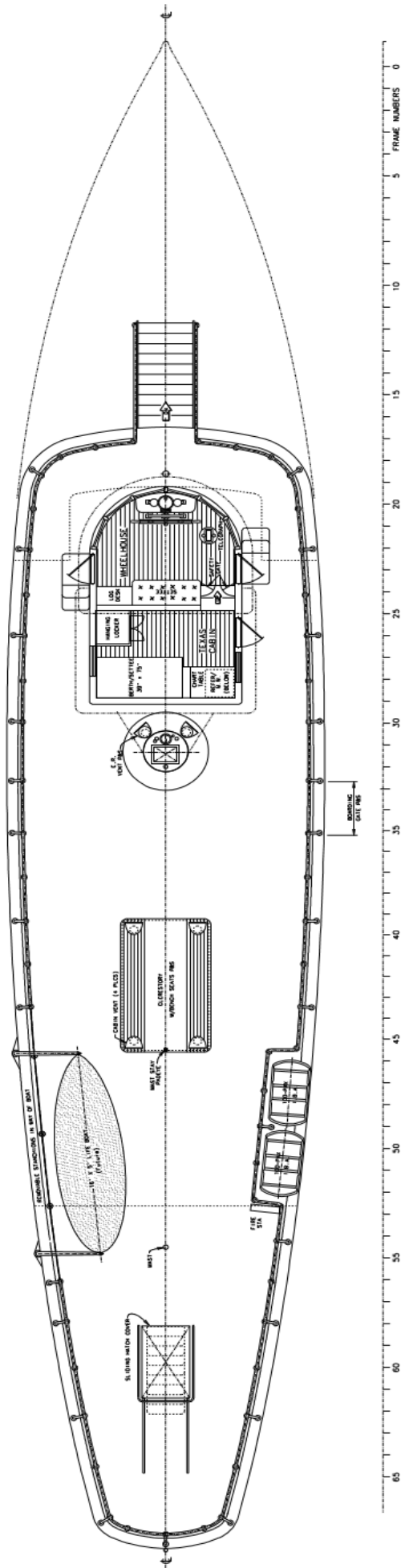
RICHARD W. ETSELL, P.E.
NAVAL ARCHITECT AND MARINE ENGINEER
115 N. NORTHLAKE WAY • SEATTLE, WA 98103

S.S. VIRGINIA V

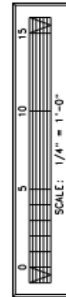
THE STEAMER
VIRGINIA V
FOUNDATION INCORPORATED

SCALE: 1/4" = 1'-0"
DATE: 5/20/00
DWG No. 460-2





BOAT DECK PLAN



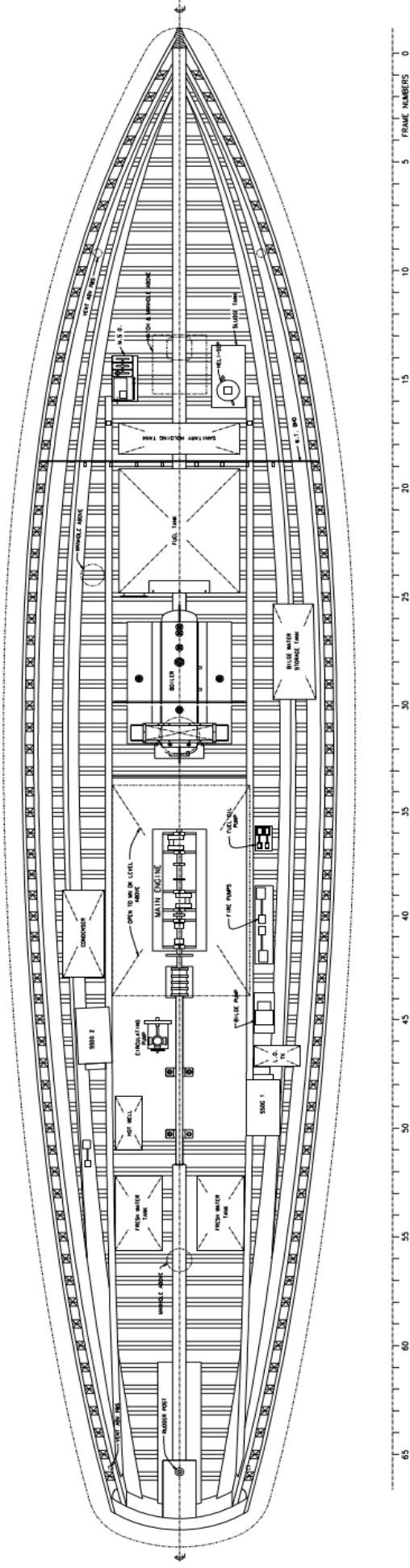
DRAWN BY:
RICHARD W. EISELL, P. E.
 NAVAL ARCHITECT AND MARINE ENGINEER
 1115 N. NORTH LAKE WAY - SEATTLE, WA 98103



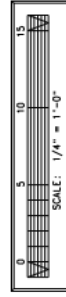
S.S. VIRGINIA V

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VIRGINIA V
 FOUNDATION INCORPORATED

SCALE: 1/4" = 1'-0"
 DATE: 10/10/2002
 DWG No. 460-4



HOLD PLAN

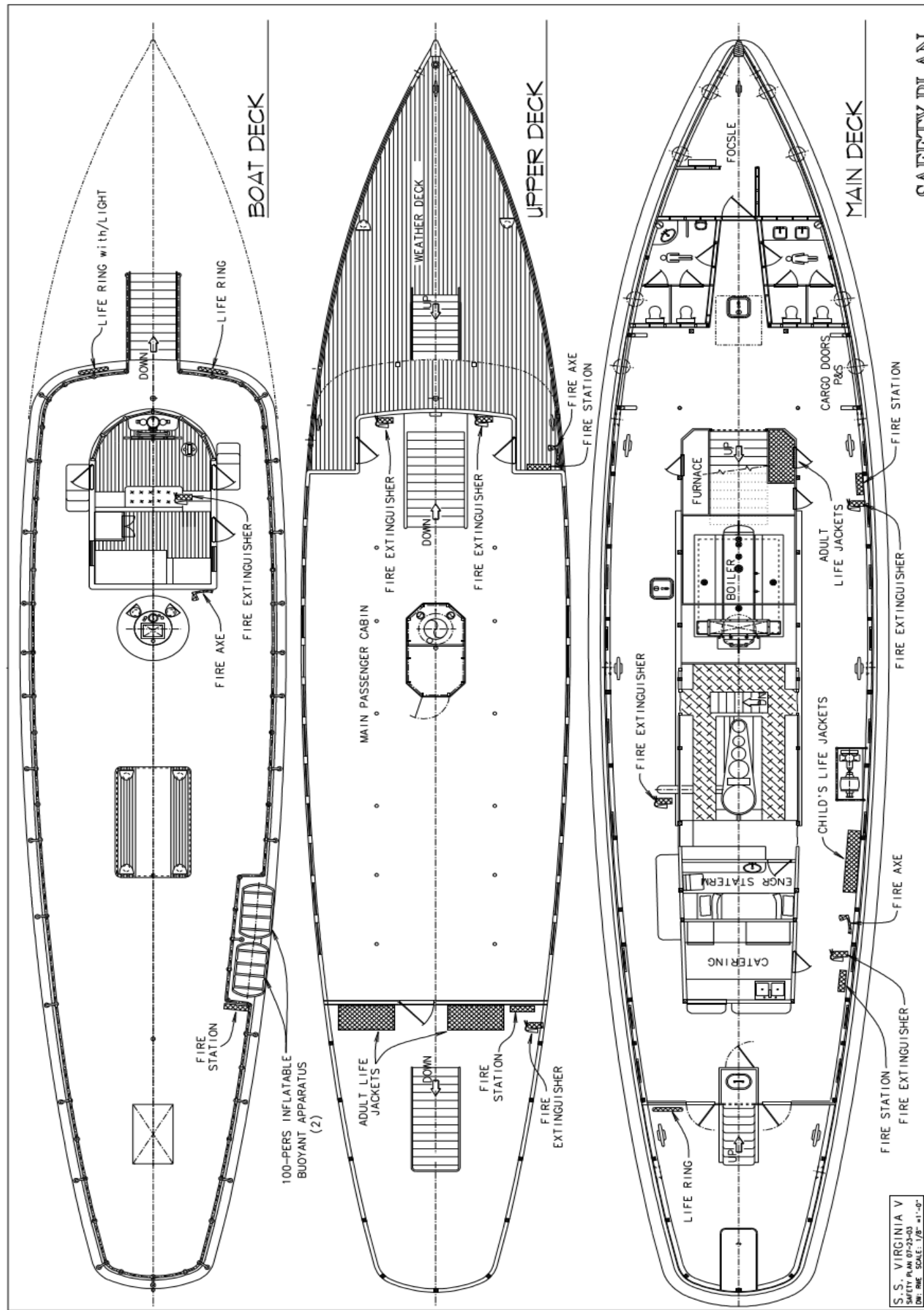


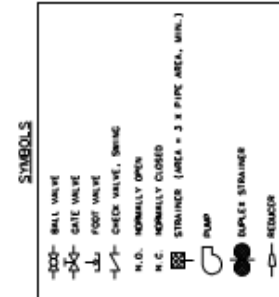
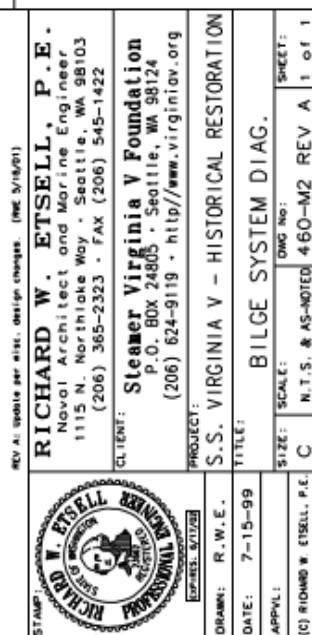
OWNER: **RICHARD W. ETSSELL, P.E.**
NAVAL ARCHITECT AND MARINE ENGINEER
1115 N. NORTHLAKE WAY - SEATTLE, WA 98103

S.S. VIRGINIA V

THE STEAMER
VIRGINIA V
FOUNDATION INCORPORATED

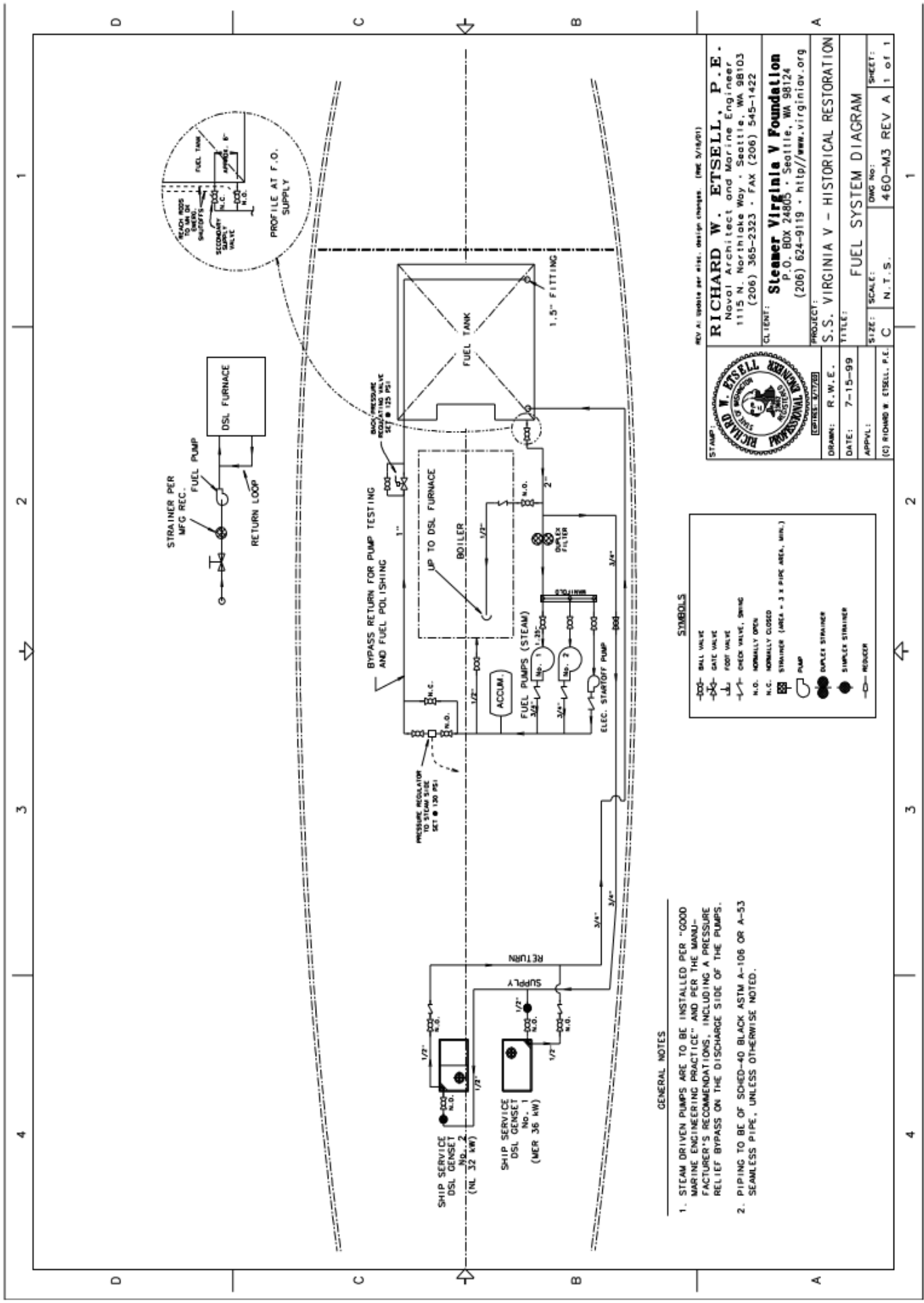
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DATE: 10/10/2002
DWG No. 460-5





GENERAL NOTES

1. OVERBOARD DISCHARGES REFERENCED TO THIS NOTE MUST BE LOCATED AT LEAST 6" ABOVE THE DEEPEST LOAD WATERLINE. SEE 46 CFR 182.520(c) AND 46 CFR 179.350(c).
2. BILGE HIGH LEVEL ALARMS ARE TO BE PROVIDED I.A.W. 46 CFR 182.530. TWO SENSORS ARE REQUIRED - ONE IN THE FORWARD COMPARTMENT AND ONE IN THE MAIN HULL COMPARTMENT. THEY ARE TO CONNECT TO A PANEL IN THE WHEELHOUSE WITH A VISUAL AND AUDIBLE ALARM. IN ADDITION, A VISUAL INDICATOR IS REQUIRED TO INDICATE WHEN THE FLOAT ACTIVATED SUBMERSIBLE PUMPS ARE OPERATING.
3. ALL BILGE SYSTEM PIPING IS TO BE OF A106 OR A53 SCH-80 GALVANIZED PIPE. CONNECTIONS ARE TO



GENERAL NOTES

1. STEAM DRIVEN PUMPS ARE TO BE INSTALLED PER "GOOD MARINE ENGINEERING PRACTICE" AND PER THE MANUFACTURER'S RECOMMENDATIONS, INCLUDING A PRESSURE RELIEF BYPASS ON THE DISCHARGE SIDE OF THE PUMPS.
2. PIPING TO BE OF SCHED-40 BLACK ASTM A-106 OR A-53 SEAMLESS PIPE, UNLESS OTHERWISE NOTED.

SYMBOLS

100	BALL VALVE
100	GATE VALVE
100	FOOT VALVE
100	CHECK VALVE, SWING
100	N.O. NORMALLY OPEN
100	N.C. NORMALLY CLOSED
100	STRAINER (AREA = 3 x PIPE AREA, MIN.)
100	PUMP
100	DUPLEX STRAINER
100	SIMPLE STRAINER
100	REDUCER

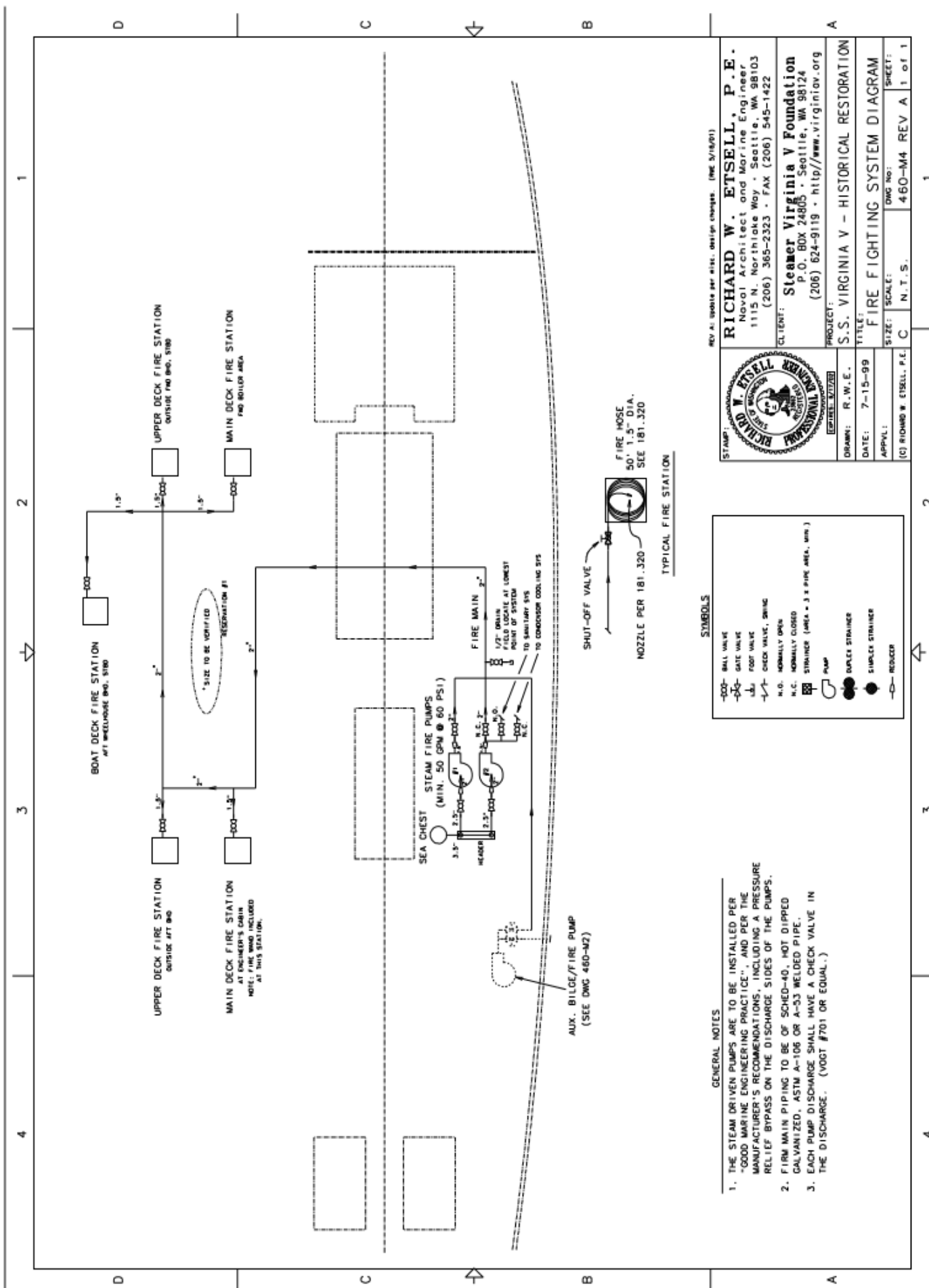


RICHARD W. ETSELL, P.E.
Naval Architect and Marine Engineer
1115 N. Northlake Way • Seattle, WA 98103
(206) 365-2323 • FAX (206) 545-1422

CLIENT: **Steamer Virginia V Foundation**
P.O. BOX 24805 • Seattle, WA 98124
(206) 624-9119 • <http://www.virginiaov.org>

PROJECT: **S.S. VIRGINIA V - HISTORICAL RESTORATION**

DATE:	7-15-99
APPROVED:	R.W.E.
SCALE:	N.T.S.
SHEET:	460-M3 REV A 1 of 1



GENERAL NOTES

1. THE STEAM DRIVEN PUMPS ARE TO BE INSTALLED PER "GOOD MARINE ENGINEERING PRACTICE", AND PER THE MANUFACTURER'S RECOMMENDATIONS, INCLUDING A PRESSURE RELIEF BYPASS ON THE DISCHARGE SIDES OF THE PUMPS.
2. FIRE MAIN PIPING TO BE OF SCHED-40, HOT DIPPED GALVANIZED, ASTM A-106 OR A-53 WELDED PIPE.
3. EACH PUMP DISCHARGE SHALL HAVE A CHECK VALVE IN THE DISCHARGE. (VOGT #701 OR EQUAL.)

SYMBOLS

—	BALL VALVE
—	GATE VALVE
—	FOOT VALVE
—	CHECK VALVE, OPEN
N.O.	NORMALLY OPEN
N.C.	NORMALLY CLOSED
—	STRAINER (AREA = 3 x PIPE AREA, MIN.)
—	PUMP
—	DUPLEX STRAINER
—	SIMPLEX STRAINER
—	REDUCER



REV. A: SPECIAL PER. DESIG. CHANGES (PNC 3/18/01)

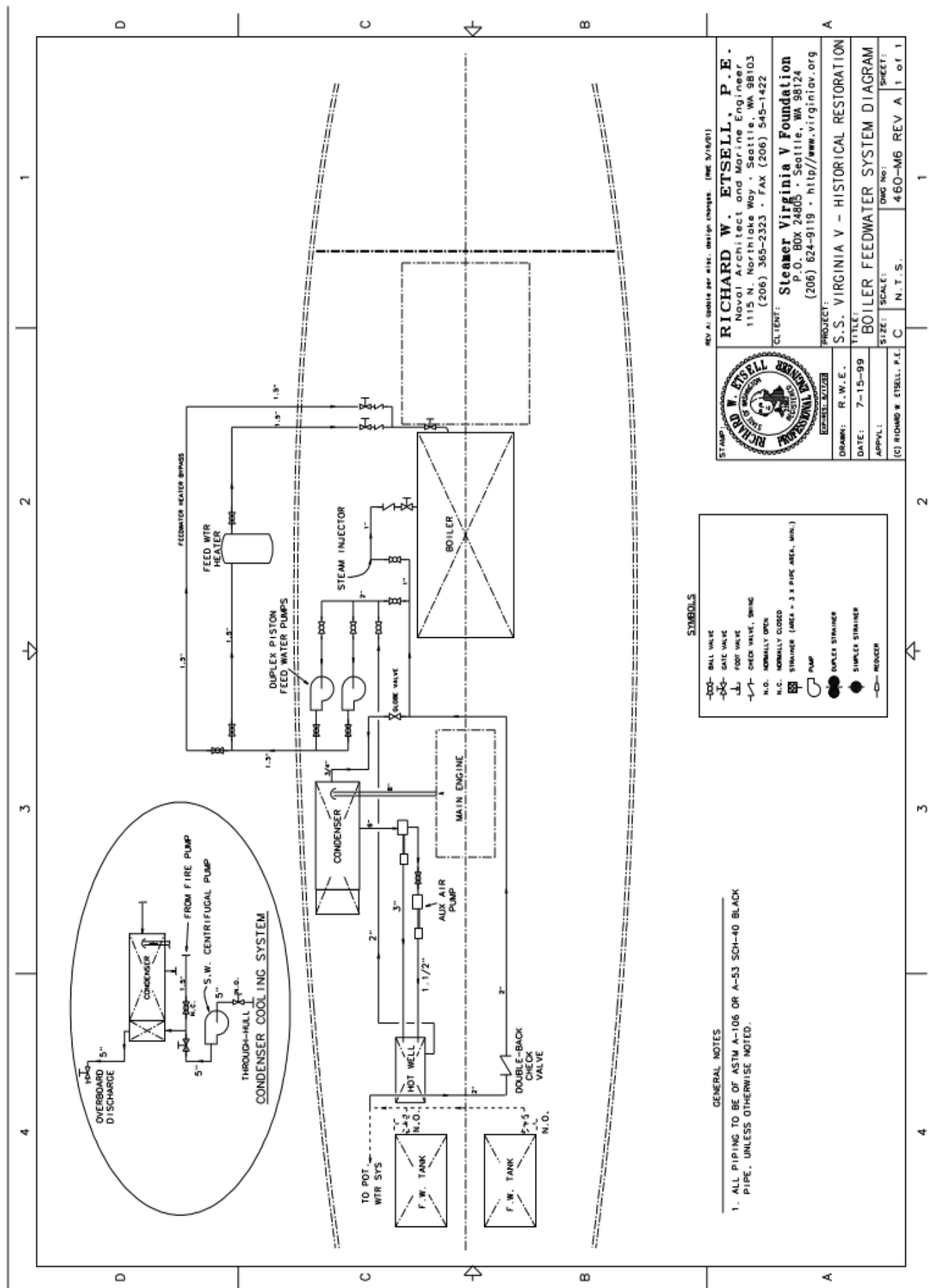
RICHARD W. ETSELL, P.E.
 Naval Architect and Marine Engineer
 1115 N. Northlake Way • Seattle, WA 98103
 (206) 365-2323 • FAX (206) 545-1422

CLIENT: **Steamer Virginia V Foundation**
 P.O. BOX 24805 • Seattle, WA 98124
 (206) 624-9119 • <http://www.virginiav.org>

PROJECT: **S.S. VIRGINIA V - HISTORICAL RESTORATION**

DESIGNED BY: R.W.E.	TITLE: FIRE FIGHTING SYSTEM DIAGRAM
DATE: 7-15-99	DWG No: 460-M4
APPROVED: [Signature]	SCALE: N.T.S.
SHEET: 1 of 1	

(C) RICHARD W. ETSELL, P.E.

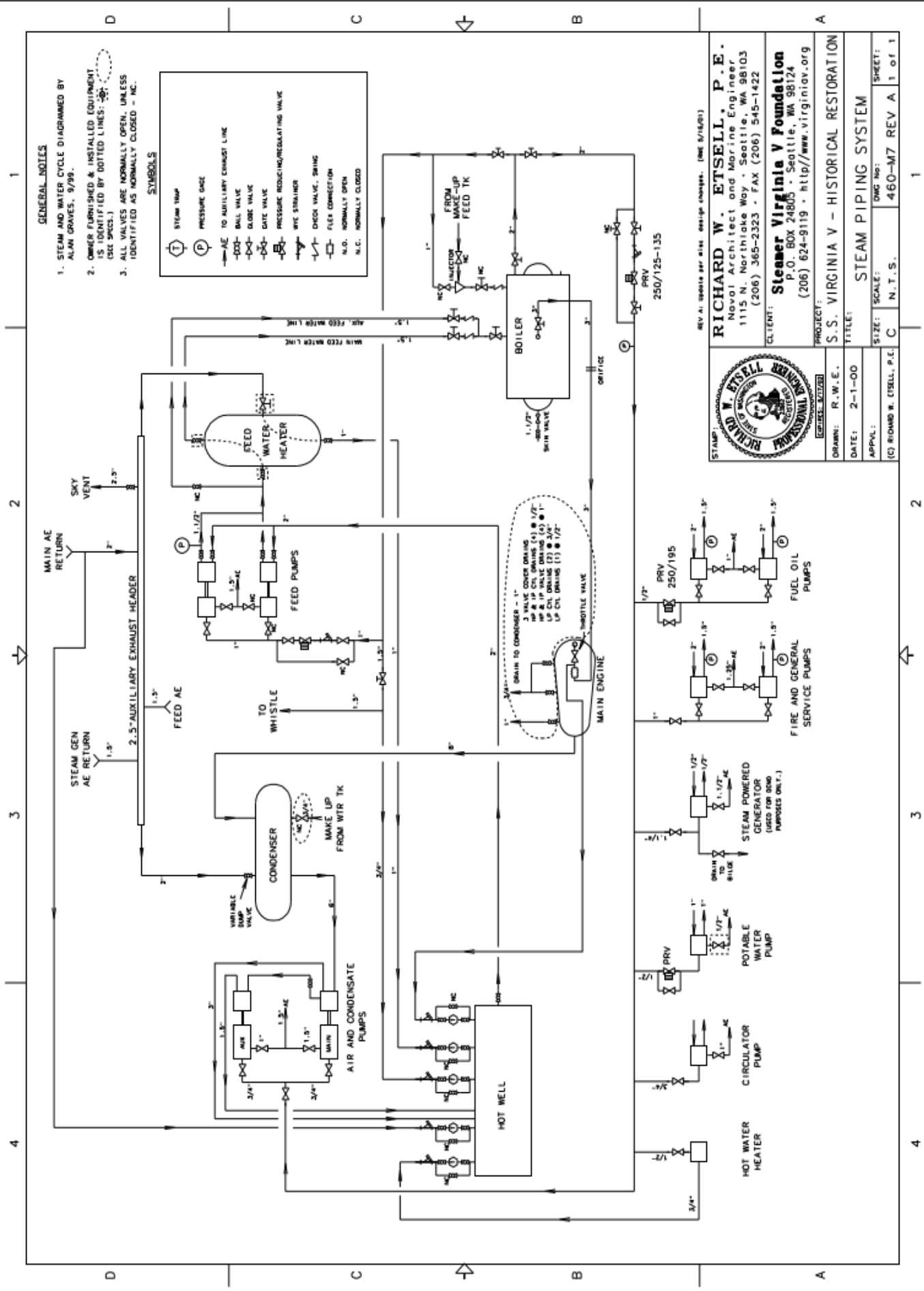


GENERAL NOTES
1. ALL PIPING TO BE OF ASTM A-106 OR A-53 SCH-40 BLACK PIPE, UNLESS OTHERWISE NOTED.

SYMBOLS

- D- BALL VALVE
- G- GATE VALVE
- F- FOOT VALVE
- C- CHECK VALVE, SPRING
- N.O. NORMALLY OPEN
- N.C. NORMALLY CLOSED
- S- STRAINER (AREA = 3 x PIPE AREA, MIN.)
- P- PUMP
- DUPLEX STRAINER
- SIMPLE STRAINER
- R- REDUCER

		REV A: Update per site design changes. (MCE 5/18/01)
RICHARD W. ETSSELL, P.E. Naval Architect and Marine Engineer 1115 N. Northlake Way • Seattle, WA 98103 (206) 365-2323 • FAX (206) 545-1422		
CLIENT: Steamer Virginia V Foundation P.O. BOX 24805 • Seattle, WA 98124 (206) 624-9119 • http://www.virginiav.org		
PROJECT: S.S. VIRGINIA V - HISTORICAL RESTORATION		
DESIGNED BY: R.W.E.	TITLE: BOILER FEEDWATER SYSTEM DIAGRAM	DWG No:
DATE: 7-15-99	SCALE:	SHEET:
APPROVED:	SIZE: C	460-M6 REV A 1 of 1



GENERAL NOTES

1. STEAM AND WATER CYCLE DIAGRAMMED BY ALAN GRAVES, 9/99.
2. OWNER FURNISHED & INSTALLED EQUIPMENT IS IDENTIFIED BY DOTTED LINES. (SEE SPECS.)
3. ALL VALVES ARE NORMALLY OPEN, UNLESS IDENTIFIED AS NORMALLY CLOSED - NC.

SYMBOLS

	STEAM TRAP
	PRESSURE GAGE
	AE TO AUXILIARY EXHAUST LINE
	BALL VALVE
	GLOBE VALVE
	GATE VALVE
	PRESSURE REDUCING/REGULATING VALVE
	WYE STRAINER
	CHECK VALVE, SWING
	FLEX CONNECTION
	N.O. NORMALLY OPEN
	N.C. NORMALLY CLOSED

REV. A: UPDATE PER MISC. DESIGN CHANGES. (ONE 8/16/03)

RICHARD W. ETSSELL, P.E.
 Naval Architect and Marine Engineer
 1115 N. Northlake Way - Seattle, WA 98103
 (206) 365-2323 - FAX (206) 545-1422



Client: Steamer Virginia V Foundation
 P.O. BOX 24805 - Seattle, WA 98124
 (206) 624-9119 - <http://www.virginnav.org>

PROJECT: S.S. VIRGINIA V - HISTORICAL RESTORATION	
DRAWN: R. W. E.	TITLE: STEAM PIPING SYSTEM
DATE: 2-1-00	SCALE: 1" = 10'
APPROVAL:	SHEET: 1 of 1
(C) RICHARD W. ETSSELL, P.E.	

-- END --