



STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION

BEVERLY EAVES. PERDUE  
GOVERNOR

EUGENE A. CONTI, JR.  
SECRETARY

September 9, 2009

**Addendum No. 1**

RE: Contract ID: C202197  
WBS# 38683.3.3  
F.A. # FBD-0012(33)  
**Hyde County (F-4004C)**  
Construction of One (1) 220' x 50' x 12'-6" Passenger Ferry

**September 15, 2009 Letting**

To Whom It May Concern:

Reference is made to the plans and proposal recently furnished to you on this project.

The following revision(s) have been made to the Proposal:

Page no. 0-3, the Contract/Guidance Drawings has been revised. Please void page no. 0-3 in your proposal and staple the revised page no. 0-3 thereto.

Page no. 2-2, sections 236 Propellers and 237 Bow Thruster, have been revised. Please void page no. 2-2 in your proposal and staple the revised page no. 2-2 thereto.

Page no. 2-5, sections 259 Engine Exhaust Piping and 261 Fuel Oil System have been revised. Please void page no. 2-5 in your proposal and staple the revised page no. 2-5 thereto.

Page no. 3-8, section 330 Lighting Systems, has been revised. Please void page no. 3-8 in your proposal and staple the revised page no. 3-8 thereto.

Page no. 4-1, section 400 Navigation and Communications, has been revised. Please void page no. 4-1 in your proposal and staple the revised page no. 4-1 thereto.

Page no. 4-5, section 433 Interior Communications, has been revised. Please void page no. 4-5 in your proposal and staple the revised page no. 4-5 thereto.

Page no. 5-3, section 500 Auxiliary Systems - General, has been revised. Please void page no. 5-3 in your proposal and staple the revised page no. 5-3 thereto.

**MAILING ADDRESS:**  
NC DEPARTMENT OF TRANSPORTATION  
CONTRACT STANDARDS AND DEVELOPMENT UNIT  
1591 MAIL SERVICE CENTER  
RALEIGH NC 27699-1591

TELEPHONE: 919-250-4128  
FAX: 919-250-4119  
WEBSITE: [WWW.NCDOT.ORG](http://WWW.NCDOT.ORG)

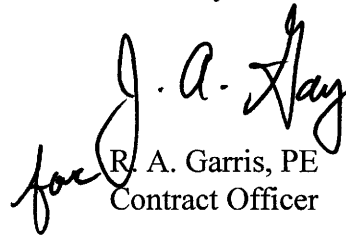
**LOCATION:**  
CENTURY CENTER COMPLEX  
ENTRANCE B-2  
1020 BIRCH RIDGE DRIVE  
RALEIGH NC

Page no. 5-4, section 500.1 Piping, has been revised. Please void page no. 5-4 in your proposal and staple the revised page no. 5-4 thereto.

Page no. 5-14, section 533 Potable Water System, has been revised. Please void page no. 5-14 in your proposal and staple the revised page no. 5-14 thereto.

Page no. 5-16, section 561 Steering System, has been revised. Please void page no. 5-16 in your proposal and staple the revised page no. 5-16 thereto.

Sincerely,

  
R. A. Garris, PE  
Contract Officer

RAG/fca  
Attachments

cc: Mr. J.G Nance, PE  
Ms. D. M. Barbour, PE  
Mr. J.V. Barbour, PE  
Mr. Jack Cahoon  
Mr. Don Chapman  
Mr. Joe Waldrep  
Mr. R. E. Davenport, Jr., PE  
Mr. Ronnie Higgins  
Mr. Larry Strickland  
Ms. Lori Strickland  
Ms. Norma Smith  
Project File (2)

**085 Contract/Guidance Drawings**

The vessel shall be constructed as depicted in below listed Contract Drawings and as described in these Specifications. Information contained in the Contract Drawings is subject to alteration, development, and refinement by the Contractor pursuant to implementing the details of these Specifications, appropriate authoritative agency regulations, and design development.

07069-001-050-1	Propulsion Powering Estimate
07069-001-061-1	Scantling Calculations
07069-001-063-1	Electrical Loads Analysis (Refer to NCDOT website)
07069-001-100-1	Lines Plan
07069-001-101-1	Profiles and Deck Arrangements
07069-001-110-1	Shell Plating and Frames
07069-001-120-1	Scantling Sections
07069-001-120-2	Inboard Structural Profile
07069-001-120-5	Long'l Bulkheads
07069-001-130-1	Main and Lower Deck Plating and Frames
07069-001-150-1	Superstructure and Pilothouse Structure
07069-001-200-1	Engine Room and Tank Room Arrangement
07069-001-243-1	Propulsion Shafting Arrangement and Detail
07069-001-256-1	Engine Cooling Piping Schematic
07069-001-259-1	Engine Exhaust Schematic
07069-001-261-1	Fuel Oil Piping Schematic
07069-001-264-1	Lube & Dirty Oil Schematic
07069-001-320-1	Electrical One-Line Diagram
07069-001-330-1	Lighting Plan
07069-001-506-1	Fills, Vents and Sounds Piping Schematic
07069-001-506-2	Fills, Vents and Sounds Piping Arr & Details
07069-001-514-1	HVAC Calculations (Refer to NCDOT website)
07069-001-521-1	Fire Main Piping Schematic
07069-001-521-2	Fire Main Piping Arrangement and Details
07069-001-522-1	Sprinkler Piping Schematic
07069-001-522-2	Sprinkler Piping Arrangement and Details
07069-001-526-1	Weather Deck Drains
07069-001-528-1	Sanitary Drains / Sewage Treatment System Schematic
07069-001-529-1	Bilge & Oily Water System Piping Schematic
07069-001-529-2	Bilge System Arrangement & Details
07069-001-533-1	Potable Water Piping Schematic
07069-001-533-2	Potable Water Piping Arrangement & Details
07069-001-551-1	Compressed Air Piping Schematic
07069-001-551-2	Compressed Air Piping Arrangements & Details
07069-001-562-1	Rudder Arrangement and Detail
07069-001-600-1	Bulwark Arrangement
07069-001-635-1	Structural Fire Protection
07069-001-801-1	Life Saving Equipment Arrangement
07069-001-832-1	Technical Specifications
07069-001-835-1	Regulatory Tonnage Estimate
07069-001-843-1	Stability Assessment
07069-001-891-1	Evacuation Plan

**Contractor shall install six owner furnished lighted digital tachometers, two each at the EOS Console, Pilothouse Console and Aft Control Station console. These may be part of the engine gauge panel if so provided.**

Contractor shall fill engines with a mixture of freshwater and approved water treatment product. Amount of water treatment added shall be to manufacturer's recommendation for type and size of engines. Provide one water treatment test kit.

**Owner** shall provide the services of an authorized technician to accomplish initial start up of main engines. Test Reports of initial start up shall be provided to the Owner.

**Owner** shall provide the services of an authorized technician to accomplish a PAR test on all engines. See also Section 842.2 for test requirements.

### 236 Propellers

Provide two fixed-pitch propellers fabricated, machined, and balanced in compliance with ISO 484/2 class 1 standards. Design propellers to accommodate rope guards and lifting/pulling bolts. Propellers shall be thoroughly stress relieved prior to machining and finishing. Propellers shall be dynamically balanced and the trailing edges of blades shall be properly ground to prevent "singing". Propellers shall be secured to the tail shafts with propeller nuts, which upon final fitting and tightening shall be welded to the propeller. **The propeller shaft hub (gear mating coupling) shall be owner furnished.**

Propellers shall be Rolls Royce or Owner-approved equal, as follows (subject to confirmation by Rolls Royce):

Material	CF-3 Stainless Steel
Number of blades	5
Diameter	56.00"
Variable Pitch	To be determined @ (1100 hp)
Hydrodynamic P/D (0.60R)	0.902
Projected skew at tip	18.0°
DAR	0.800
PAR	0.682
Actual $T_{max}$ at 0.25R	2.40"
$T_{max}$ at 1.0R	0.403"
T/C at 0.25R	0.159
Total rake at tip	3.920"

### 237 Bow Thruster

The Contractor shall furnish and install one jet-pump, 360° azimuthing bow thruster, Omnithruster model HT600 and appropriate reduction gear to suit the engine. **The thruster engine shall be Owner furnished MTU/Detroit 60 Series, Caterpillar C18 or equal, rated minimum 500 HP at 1800 RPM.** Engine shall be installed on resilient mounts to be approved by the Owner and the engine manufacturer. **The bow thruster gear shall be owner furnished Twin Disc Mg-5114 SC.**

## 259 Engine Exhaust Piping

Contractor shall provide and install complete exhaust system for all diesel engines as shown on Reference 2.2.

Hull penetrations shall be seamless Sch. 80, 316 stainless steel pipe. USCG-approved bulkhead penetrations shall be used where exhaust piping penetrates engine room bulkheads.

Install a ***stainless steel*** expanded metal safety guard around the portion of the emergency generator exhaust piping, which is located above the deckhouse top.

Insulation shall not be installed until systems have been tested to the USCG and Owner's satisfaction. Each system shall be insulated from the engine outlet flange to the weather connection.

Install crankcase vents with flame screens, if recommended by the engine manufacturer, to weather. Emergency generator crankcase vent (if required) shall terminate with a 180° gooseneck above the Deckhouse top.

Cowl silencers shall be installed on this vessel.

## 261 Fuel Oil System

Provide and install a complete fuel oil piping system to all diesel engines to consist of necessary supply lines, return lines, manifolds, ball valves, and all associated fasteners, fittings, etc. in accordance with Reference 2.3, 46CFR 56.50-75, and other applicable CFR sections.

Fuel tank shut-off valves shall be so arranged with stainless steel deck fittings as manufactured by ***Stow Manufacturing Company, p/n 18389-612***, remote reach rods, valve connections, etc. to provide a station outside the Tank Room for closing the fuel supply. ***Deck sockets shall be located near main deck islands away from car lanes.***

See Specification Section 437 for tank level indication requirements.

Fuel oil tanks shall **not** be connected to the dirty oil system.

## 264 Lubricating Oil Systems

Provide a gear and engine lubricating oil system per Reference 2.4 for transfer of oil from the lubricating oil tanks to the main engines and generators.

Provide a dirty oil transfer system per Reference 2.4 for evacuating the main engine and generator oil to the dirty oil tank and for pump out of the dirty oil tank to the discharge station.

Provide pressure switches and/or transducers for alarms and automatic shutdown as described in Section 436 and as required by USCG.

Provide lubricating oil for initial start-up, tests and trials. All engines shall have lubricating oil levels at recommended maximums at time of delivery to Owner. Lube oil tanks shall be filled with Owner-approved oils at the time of delivery to the Owner.

Engine motions and thermal expansions shall be accommodated by USCG-approved flexible connections.

watertight boxes may be used in lieu of kickpipes. Transits using poured sealers or putty type packing shall not be used.

Multi-cable, transit type penetrations shall maintain segregation of power/lighting circuits and low voltage/data/communication circuits. The two different types of circuits shall not share the same multi-cable penetration.

Penetrations of fire rated structure shall utilize fire stops which maintain the fire protection level (Grade A, Grade B, etc.) associated with the fire zone penetrated.

### **329 Receptacles, Junction Boxes, & Misc. Distribution Devices**

#### **329.1 House/General Receptacles**

Duplex receptacles, 20 A, 2 pole, 3 wire (U-ground) shall be furnished and installed throughout the vessel for maintenance and house services.

#### **329.2 Shore Power Receptacles**

Two shore power receptacles shall be provided and located per Reference 3.1. The shore power circuit breakers and generator circuit breakers shall be interlocked such that the shore power breaker cannot be closed at the same time as any of the generator circuit breakers.

The shore connection box/locker shall have a white ***Power Available*** indicator lamp which shall be energized via an auxiliary switch on the shore power circuit breaker deriving power from the load side of the breaker. An engraved phenolic placard with complete operating instructions shall be provided describing the operation of connection to shore power.

Shore power shall be monitored for loss of phase/improper phase rotation via a relay that shall trip the shore power circuit breaker via a 24 VDC shunt trip. Tripping of the relay shall be indicated by a red indicator in the vicinity of the shore power circuit breaker on the ships service switchboard.

#### **329.3 Junction/Connection Boxes**

Each junction/connection box in a damp or wet location shall be watertight, terminal, or stuffing tubes for cable entrance and have external mounting feet. Each watertight connection box shall be mounted on external mounting feet.

Watertight brass junction boxes shall have gaskets, etc. as needed.

All junction boxes shall be identified with phenolic tags, black with white lettering, which correspond with the unique circuit designation keyed to the various electrical plans.

### **330 Lighting Systems**

Interior and exterior lighting fixtures shall be Pahlunh or Owner-approved equal as shown on Reference 3.5. The Contractor shall prepare and submit a list of all lighting fixtures and control devices for approval by the Owner prior to purchasing any items. Interior lighting may be Pauluhn #FAS217 aluminum housing with polyester powder coated finish. Exterior lighting shall be FSS217 stainless steel housing.

Contractor shall provide and install all necessary ancillary materials and equipment, including but not limited to foundations, junction boxes, switches, cabling, hangers, etc. for a complete and operational system.

**GROUP 4 NAVIGATION, COMMUNICATIONS and ELECTRONICS**

400 Navigation and Communications ..... 1  
 421 Non-Electrical Navigation Equipment ..... 3  
 422 Navigation/Search/Flood Lights..... 4  
 423 Electronic Navigation Equipment ..... 4  
 429 Environmental Monitoring Systems..... 4  
 433 Interior Communications..... 5  
 436 Alarm Systems ..... 5  
 437 Tank Level Indication..... 8  
 441 Radio Systems ..... 9

References

- 4.1 07069-001-551-1, Compressed Air Piping Schematic
- 4.2 NC DOT List of Required Electronic Equipment

**400 Navigation and Communications**

Electronic systems shall be in accordance with the applicable regulations of the FCC (47 CFR Part 80), 46 CFR Subchapter H, and ABS Rules. Installation and testing of equipment shall be supervised by the equipment manufacturer's representative. All antennae shall be installed to avoid interference with each other and provide maximum clear reception.

The Contractor shall be responsible for accomplishing FCC inspection and obtaining certification. The systems shall be considered complete only when the FCC inspection and certification has been accomplished. The Contractor may need to apply for a temporary FCC license to get the vessel to North Carolina. The Ferry Division will assist the Contractor, as needed, to secure this license.

The Contractor shall fabricate full-size mockups of the pilothouse consoles and aft control station console (the EOS console is addressed in Section 663). Mockups shall include all controls, switches, gages, screens, electronic components, etc. so that the Owner can review and make adjustments required to NC DOT satisfaction. Once the Owner has approved the console arrangements, consoles shall be manufactured by high quality metal console manufacturer approved by Owner.

Pilothouse Console

*The following items are to be installed in the Pilothouse main control console:*

1. *Steering system controls, one (1) Full follow-up control lever and one (1) non-follow-up*
2. *Engine Throttles*
3. *Bow Thruster Throttle*
4. *Main Engine Gauge Panel (2)*
5. *Bow Thruster Gauge Panel*
6. *Navigation Light Panel*
7. *Alarm Panel*
8. *Magnetic 6" Compass*
9. *General Alarm Contact*
10. *Sound Powered Phone*

### Wind Instruments

Pilothouse shall be fitted with one wind speed/direction sensor mounted on the Pilothouse mast, and one display unit mounted at the Pilothouse console area.

### **433 Interior Communications**

An integrated Interior Communications System (ICS) shall be furnished and installed by the Builder with owner approval of vendor and installation location.

The system shall integrate the telephone, public address (to include automated announcements, public and non-public zones), paging, talkback, loudhailer, elevator intercom, and alarm annunciation. Telephone stations shall be required in the wheelhouse and aft control station.

The system shall include an uninterruptible power supply (UPS); duplicate tone generators and redundant controls; speaker placement, wiring and zoning; as required to comply with USCG requirements for public address, talkback, fire, and general alarm systems.

### **436 Alarm Systems**

#### **436.1 Fire Detection System**

Provide and install a fire detection system as required to comply with USCG requirements. The main alarm panel shall be mounted in the Pilothouse as directed by the Owner. A remote alarm panel shall be mounted in the EOS.

The fire detection/monitoring system will provide the following functions (automatic and Pilothouse manual control):

- Heat detection
- Smoke detection
- Sprinkler system monitoring
- Main ventilation system shutdown
- Detection of CO<sub>2</sub> system activation
- Watertight door closure status
- Alarm activation (interface with Interior Communications System)

Main Ventilation Shutdown:

- Provide, install and terminate all cable required for the automatic shutdown of the main HVAC system fans.
- Provide, install and terminate all cable required for the automatic closure of motorized fire dampers if required.

#### **436.2 Machinery Monitoring & Alarm System (MMAS)**

Provide and install an integrated machinery monitoring and alarm system. The system shall include level sensors, signal conditioning between all sensors and the system, control and display units, and interface with the ICS for ship-wide alarms (if required). Local and remote indication and alarm functions shall be provided for all tank and bilge levels, engines, generators, WT doors, and other auxiliary and electrical equipment as required by USCG.



## 500 Auxiliary Systems - General

### Mechanical and Piping Standards:

- ASTM F-1155-88 Standard Practice for Selection and Application for Piping System Materials. Commercial Ship Design and Construction. Malleable iron fittings ASTM 195 are acceptable as indicated on the plans.
- ASTM Standard Section 1 Iron and Steel Products, Volume 01.07 Shipbuilding.
- CFR 46Subchapter F, Marine Engineering.
- ASHRAE Ventilation Standards.

Except as otherwise described in these Specifications or drawings referenced by these Specifications, piping materials shall be in accordance with ASTM Standard F1155, Standard Practice for Selection and Application of Piping System Materials.

**Interiors of all piping systems shall be cleaned by high velocity flushing or other Owner-approved method to a degree suitable to their service. Particular care shall be exercised for fuel, lubricating oil, compressed air, hydraulic, and potable water piping, which shall be cleaned to a degree that when the flushing medium is passed through a temporary filter, no contamination is detected by unaided human senses**

Templates, gauges and jigs required for the proper machining and assembly of components and furnished by the Contractor shall become the property of the Owner at the conclusion of the work. Templates shall be made of 3/8" steel plate fitted with not less than two removable hardened steel drilling guide bushings for drilling flange holes and other drilling in the components. All such items shall be accurately and substantially made in a manner to retain their accuracy under repeated use and with proper care and handling. At the completion of the work, all patterns, templates, jigs, and gages shall be cleaned and all metal parts given a suitable coating of anti-corrosive grease. The equipment shall then be delivered in first class condition to the Owner. A tag containing the name of the equipment and the purpose of the template, etc., shall be attached securely to the item.

### 500.1 Piping

All piping shall be as set forth below and elsewhere in these specifications and shall be arranged to obtain optimum operating conditions and shall be compatible with the machinery or equipment served.

Piping shall be led as directly as practicable. Piping shall include valves, unions, and fittings necessary to isolate any piece of equipment for repairs without disrupting the entire system. Unions and flanges shall be used to facilitate installation and subsequent replacement with minimum labor and materials. **Flexible connections to machinery components, where vibration may be encountered, shall be threaded or flanged on 2" diameter and above. Piping shall be kept clear of switchgear insofar as practicable.**

Piping shall be secured by supports and hangers so as to avoid excessive strains; avoid the weight of the piping being transmitted to valves and fittings; minimize the effects of vibrations, shock, pitching, and rolling of the vessel consistent with the kind of service in which the vessel will be normally exposed; and permit proper thermal expansion and contraction by changes in direction of pipe runs or by use of expansion bends, joints, loops, or offsets. Hangers for copper pipe to be lined with molded rubber or nylon.

To minimize galvanic corrosion, valves and fittings in salt water lines shall be of the same composition as adjacent piping, unless otherwise specified. Where joining of dissimilar metal piping cannot be practicably avoided, 12" long steel waster pieces shall be installed adjacent to nonferrous valves or fittings.

Galvanizing destroyed by welding or other activity shall be replaced. Where welding destroys the galvanizing not more than 6" from the end of the pipe, the method of replacing galvanizing shall be similar and equal to "Galvweld" on piping 3" and above, or "Galvicon" on piping 2-1/2" and below. All steel piping, regardless of size, shall be hot dipped galvanized when welding or other activity is such that galvanizing has been destroyed more than 6" from the end of ends of a pipe section.

**Joints for steel piping shall be screwed for size 1-1/2" and below and welded for sizes 2" and above, except hydraulic, vents, and sounding pipes. Vent and sounding pipes shall be welded for all sizes. Hydraulic piping at each directional control valve and hydraulic cylinder shall be flanged using 3000# (4) bolt flange "anchor" or equal; All burrs shall be removed from the ends of all piping after any. Pipe ends shall be dressed with a reamer before installation.**

Where not otherwise specified, valves shall be of the flanged or union nut bonnet type. Materials shall be corrosion resisting for the service conditions to which they may be subjected. Valves shall be of the rising stem type. Where three or more valves are located together for the same service, they shall be combined into a manifold. Shutoff valves shall be provided in fuel supply lines, one as close to each tank as practicable, and one as close to each fuel pump as practicable. A brass plate secured by the handwheel nut shall be attached to the handwheel of each valve and inscribed to indicate its function. Valves shall be readily accessible. Where installation conditions do not permit ready access to valves, reach rods shall be provided for operating the same.

All valves to be installed to close against the pressure.

Where pipes are carried through watertight bulkheads, decks, or tank tops, the watertight integrity of the structure shall be maintained. Heat sensitive materials shall not be used in piping systems which penetrate watertight sub-divisions where deterioration of such materials would, in the event of fire, impair the watertight integrity of such sub-divisions. Hydraulic steel tubing and all copper tubing shall penetrate watertight bulkheads and decks using suitable compression type sleeves (Anvil or equal). Where overboard discharge lines are attached to the inside of the hull, the hull shall be reinforced by a doubler or heavy insert plate, to maintain the original strength and integrity. Piping systems shall be designed in accordance with 46CFR 56.50.

All piping, pipe fittings and applicable equipment shall be thoroughly cleaned after fabrication and prior to shipboard installation. After complete shipboard installation each system shall be thoroughly cleaned and flushed of all foreign matter with the applicable system's medium or an approved substitute. System flushing shall be conducted at the applicable system's maximum operating pressure and where practicable, above the normal line velocity. However, prior to flushing operations, items having in line mechanisms capable of trapping or being affected by the carry over of foreign matter shall be either removed or blanked off and bypassed. Flushing of the piping systems shall be witnessed and approved by the Owner.

Reducing valves and all other pressure and flow control devices shall be provided with a strainer at the inlet, a relief valve and a pressure gauge in the discharge side, and a valved bypass. Fittings shall be free from fins and burrs. Joints shall be made with approved pipe joint compound applied to male threads only and all exposed threads on pipes mopped to prevent rust. Threads to be full cut.

## 528 Plumbing Drains and Sewage System

Shipyard shall provide sanitary drains and a sewage treatment system per Reference **Error! Reference source not found.** and these specifications.

Sanitary flushing water to all water closets shall be supplied by a pressure set drawing from the fresh water tank. Piping, valves and fittings shall be 316 stainless steel.

Contractor shall provide and install sanitary pressure set pump. **Pump delivery capacity shall be approximately 300 GPH. Provide and install bladder type, 30 gallon captive air stowage tank, or equal, fitted with pressure-operated switch set to start pump motor at 30 psig and stop at 50 psig.**

Contractor shall provide and install all necessary ancillary materials and equipment including but not limited to all valves, unions, fittings, wax seals, nuts, bolts, lockwashers, hangers, foundations, etc. All hardware shall be stainless steel.

## 529 Bilge System

The bilge system shall be capable of pumping out all compartments below the Main Deck as shown on Reference 5.10. Bilge piping shall be as straight as feasible with a minimum number of bends and elevation changes.

Bilge suctions shall be located as close as possible to the lowest point of the space served. Overboard discharges shall be located in the side shell just under the guard strake.

## 532 Keel Coolers, Engine Cooling

Provide and install **"Fernstrum" keel coolers** for the main engines, reduction gears, ship service generator engines, and thruster engine as shown on Reference 5.14. Installation shall be complete, including but not limited to, all valves, hull fittings and guards, piping, hardware, etc.

Coolers shall be surface-mounted on the bottom shell plating. Provide guards for each cooler; guard design shall be approved by the Owner and Fernstrum prior to fabrication.

Contractor shall provide and install an engine cooling water make up system for all main and ship service generator engines. System shall be supplied from ships fresh water system. Use appropriate size copper tubing and ball valves at each engine expansion tank.

## 533 Potable Water System

The potable water system shall be provided as shown on Reference 5.11 in accordance with the requirements of the USCG, U.S. Public Health Service, and World Health Organization.

Potable water shall be stored in two 2500 gallon steel tanks **independent of the bottom, deck, and side hull plating but common to transverse bulkhead #44.**

Piping in spaces with lining shall be concealed behind ceiling panels or bulkhead liners. Piping shall be run as directly as possible using a minimum of fittings. Install cut-off valves below each lavatory and drinking fountain in supply piping to allow repairs without securing the system.

A fresh water line shall be installed from the potable water system to each engine expansion tank with a 2" minimum air gap. **Copper tubing shall be ½" with a ball valve at each expansion tank.**

Provide and install hose reels and high quality reinforced rubber hose in 50 foot lengths, 3/4" diameter commercial grade, with permanently attached brass couplings and brass nozzles at all seven hose bibs.

The water filters for the Passenger Lounge and Crew Galley coffee stations shall **be ½" npt.**

## 551 Ship's Service Air System

All repairable components shall be fitted with suitable nameplates. Nameplates shall depict manufacturer and model. Each interface with a shipboard system shall be suitably labeled to facilitate component installation.

All components, except generic materials such as piping and cable, shall be from the same manufacturer.

### 559 Environmental Pollution Control

Sewage system shall be installed in accordance with Reference 5.9 as well as CFR 33, Part 159 Subpart A, Regulation 159.3(S). Installation shall be complete in all respects including all foundations, piping, wiring, valves, etc. for a complete operational installation.

Oily water system shall be in accordance with Reference 5.10 as well as CFR 33, Part 155, Subpart B, Regulations 155.330(A), 155.350(a)(2), and 155.360 (2)(c).

### 561 Steering System

The steering system shall be in compliance with all applicable USCG requirements including all regulatory documentation, failure modes analysis, and testing and verification procedures. FMEA and DVTP shall be provided for these systems and submitted to USCG MSC as part of the steering and engine throttle systems. Tillers shall be connected with a rectangular tube section tiller bar (designed to handle rudder torque) so that the two rudders act together. Provide calculations on detail drawing submitted to USCG for approval.

The steering system shall have both full follow up and non follow up controls at the two (2) upper control stations and a non-follow up control in the EOS console adjacent to the engine throttle controls. Refer to console layout for locations.

Starting and stopping of the steering system shall be made by the operator from the main console in the wheelhouse. Three rudder angle indicators shall be installed, one in the Pilothouse console and one on the aft control station console and one in the EOS console. Angle indicators shall be back lighted with red bulb and brightness control rheostat mounted in steering control panel. Face of indicator shall be minimum 4 inch diameter.

#### 561.1 Steering System Performance Requirement

With any one hydraulic power unit serving two hydraulic cylinders, the steering system must be capable of moving the rudder from 35° port helm to 35° starboard helm, hard-over to hard-over in less than 15 seconds. Mechanical stops shall be placed at 35° port and starboard of centerline plus ¼". The steering gear shall meet the performance requirements set forth in 46 CFR 58.25-10. The steering system shall be capable of moving, stopping, and holding the rudders at any angle within their operating range with the vessel speed at 14 knots ahead or 6 knots astern.

The steering system shall be provided with the following major components and any others as required to meet USCG requirements:

<u>Qty</u>	<u>Item</u>	<u>Comments</u>
2	Dual acting steering cylinders	ABS & USCG rules apply,
2	Split-type, straight bore steering tiller	Located in steering compartment
2	Valve body unit	Located in ER aft
2	Dual hydraulic power unit	Located in ER aft
2	Rudder feedback unit	Located in steering compartment
3	Non follow-up lever	Located in EOS, WH & Aft Sta.