

<b>AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT</b>			1. CONTRACT ID CODE <b>J</b>	PAGE OF PAGES <b>1</b>
2. AMENDMENT/MODIFICATION NO. <b>0002</b>	3. EFFECTIVE DATE <b>05-Aug-2002</b>	4. REQUISITION/PURCHASE REQ. NO. <b>W25PHS-2144-8414</b>	5. PROJECT NO.(If applicable)	
6. ISSUED BY CODE <b>DACW61</b>  US ARMY ENGINEER DISTRICT, PHILADELPHIA CONTRACTING DIVISION WANAMAKER BLDG, 100 PENN SQ EAST PHILADELPHIA PA 19107-3390		7. ADMINISTERED BY (If other than item 6) CODE <b>E5CTCLG3</b>  US ARMY ENGINEER DISTRICT, PHILADELPHIA POC: LINDA M. GRIFFITH WANAMAKER BLDG 100 PENN SQUARE EAST PHILADELPHIA PA 19107-3390		
8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)		<input checked="" type="checkbox"/> X	9A. AMENDMENT OF SOLICITATION NO. <b>DACW61-02-R-0035</b>	
		<input checked="" type="checkbox"/> X	9B. DATED (SEE ITEM 11) <b>18-Jul-2002</b>	
			10A. MOD. OF CONTRACT/ORDER NO.	
			10B. DATED (SEE ITEM 13)	
CODE	FACILITY CODE			
<b>11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS</b>				
<input checked="" type="checkbox"/> X The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer <input type="checkbox"/> is extended, <input checked="" type="checkbox"/> X is not extended.				
<p>Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods:</p> <p>(a) By completing Items 8 and 15, and returning <u>1</u> copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.</p>				
12. ACCOUNTING AND APPROPRIATION DATA (If required)				
13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.				
A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.				
B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).				
C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:				
D. OTHER (Specify type of modification and authority)				
E. IMPORTANT: Contractor <input type="checkbox"/> is not, <input type="checkbox"/> is required to sign this document and return _____ copies to the issuing office.				
14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.) The above numbered solicitation is amended as follows:  a. Section C, pages C-1 through C-200 are deleted in their entirety. Substitute therefor with the attached pages C-1 through C-221, annotated Amendment 0002.  b. Please indicate receipt of this Amendment on the Standard Form 33 (SOLICITATION, OFFER AND AWARD) as Amendment 0002. Failure to acknowledge all amendments may be cause for rejection of the bid.  <p style="text-align:center;">(CONTINUED ON NEXT PAGE)</p>				
Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.				
15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)		
		TEL: _____ EMAIL: _____		
15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA	16C. DATE SIGNED	
_____ (Signature of person authorized to sign)		BY _____ (Signature of Contracting Officer)	05-Aug-2002	

SECTION SF 30 - BLOCK 14 CONTINUATION PAGE

The following have been modified:

SF 30 PAGE 2 CONTINUATION

- c. Section E, pages E-1 through E-20 are deleted in their entirety. Substitute therefore with the attached pages numbered E1 through E-30, annotated Amendment 0002.
  
- d. Section J, pages J-1 through J-5 are deleted in their entirety. Substitute therefore with the attached pages number J-1 through J-5, annotated Amendment 0002.

PART I - THE SCHEDULE - SECTION C  
DESCRIPTION/SPECIFICATION/WORK STATEMENT

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**PART I - THE SCHEDULE - SECTION C**  
**DESCRIPTION/SPECIFICATION/WORK STATEMENT**

**C000 GENERAL**

**C001 GENERAL MISSION STATEMENT**

The Marine Design Center (MDC) of the U.S. Army Corps of Engineers (USACE) has issued this solicitation to acquire two self-propelled inland river towboats, conforming to commercial standards. The vessels are intended to serve the U.S. Army Corps of Engineers, Great Lakes and Ohio River Division, one for the Huntington District, the other for the Pittsburgh District.

Two option line items are included in the solicitation for procurement of a third towboat for St. Paul District, and a fourth towboat for Rock Island District. Each vessel is intended to support their respective District's mission on the Upper Mississippi River. Except where specifically noted, the option vessels (CLIN 0003 & CLIN 0004) design and construction requirements are identical to those of the Huntington District vessel (CLIN 0002). Where the specifications and plans do not specifically address the St. Paul Towboat (CLIN 0003) or the Rock Island Towboat (CLIN 0004), it shall be assumed that the requirement for CLIN 0003 or CLIN 0004 is the same as the requirement for CLIN 0002.

A. MISSION

1. Pittsburgh District Towboat (Contract Line Item No. (CLIN 0001))

The primary mission of the towboat will be the year-round mobilization of the Pittsburgh District Repair Floating Plant to perform scheduled and emergency maintenance on the 327 miles of navigable channels and navigable structures on the Ohio, Allegheny and Monongahela Rivers. The vessel will operate approximately 1500 hours per year.

2. Huntington District Towboat (CLIN 0002)

The primary mission of the towboat will be year-round mobilization of the Huntington District Repair Fleet Floating Plant to perform scheduled and emergency maintenance to 400 miles of navigable channels and navigable structures on the Ohio and Kanawha Rivers. The vessel will operate approximately 1500 hours per year.

3. St. Paul District Towboat (Option CLIN 0003)

The mission of this towboat will be to support the seasonal mobilization of the Thompson Dredging Fleet on the Upper Mississippi River. The vessel will also provide support to year-round lock maintenance efforts. The vessel will operate approximately 1500 hours per year.

4. Rock Island Towboat (Option CLIN 0004)

The mission of this towboat will be to provide year-round support of the Upper Mississippi River maintenance fleet of the Rock Island District. The vessel will operate approximately 1500 hours per year.

B. ENVIRONMENTAL CONSIDERATIONS

1. Pittsburgh District Towboat (CLIN 0001)

The vessel shall be capable of operating in both shallow and ice and drift-strewn rivers.

Based on ASHRAE standards and the requirements specified by the Pittsburgh District, the vessel shall be designed to the worst temperature extremes as follows:

Ambient Temperature  
95°F dry bulb max.  
0°F dry bulb min.

2. Huntington District Towboat (CLIN 0002)

The vessel shall be capable of operating in both shallow and ice and drift-strewn rivers.

Based on ASHRAE standards, the vessel shall be designed to the worst temperature extremes at Morgantown and Beckley, WV as follows:

Ambient Temperature  
4°F dry bulb min  
87°F dry bulb max, 73°F wet bulb

3. St. Paul District Towboat (CLIN 0003)

The vessel shall be capable of operating in both shallow and ice and drift-strewn rivers.

Based on ASHRAE standards, the vessel shall be designed to the worst temperature extremes at St. Paul, MN.

4. Rock Island District Towboat (CLIN 0004)

The vessel shall be capable of operating in both shallow and ice and drift-strewn rivers.

Based on ASHRAE standards, the vessel shall be designed to the worst temperature extremes at Rock Island, IL.

C002 PRINCIPAL CHARACTERISTICS

These Specifications are intended to describe the Contract Design requirements for four inland rivers style towboats. The principal dimensions of these vessels are:

Length (W/O Fenders) .....	124'- 0"
Beam Molded.....	33'-10"
Depth (at midship) .....	10'- 3"

The Pittsburgh District Towboat (CLIN 0001) shall have a design full load draft no more than 7'-6". The Huntington, St. Paul, & Rock Island District Towboats (CLIN 0002, CLIN 0003, & CLIN 0004 respectively) shall have a design full load draft no more than 8'-06".

C003 DESIGN STANDARDS

The towboats shall be designed and constructed in accordance with the latest edition and interpretations of the rules, regulations, requirements and standards of the Legislation, Regulatory Agencies and technical organizations listed as follows or as stipulated in the respective specification clause:

- U.S. Army Corps of Engineers, Publication No. EM 385-1-1; "Safety and Health Requirements Manual." May be viewed at internet web site <http://www.usace.army.mil/inet/usace-docs/eng-manuals/em385-1-1/toc.htm>

- American Bureau of Shipping (ABS) “Rules for Building and Classing Steel Vessels for Service on Rivers and Intracoastal Waterways.”
- American Bureau of Shipping “Guide For Crew Habitability on Ships.”
- American Bureau of Shipping “Guide For Shipbuilding And Repair Quality Standard For Hull Structure During Construction.”
- National Shipbuilding Research Program Publication NSRP 0490, January 1998; “Industrial Standards for Hull Structural Penetrations Design Criteria and Details.”
- American Welding Society "Guide For Steel Hull Welding", ANSI/AWS D3.5-85.
- U.S. Coast Guard Regulation 46 CFR Subchapter C - “Uninspected Vessels” (but not for electrical design and installation).
- U.S. Coast Guard Regulation 46 CFR Subchapter J - “Electrical Engineering.”
- U.S. Coast Guard Regulation 46 CFR Subchapter S - “Subdivision and Stability.”
- U.S. Coast Guard, Navigation Rules and Regulations, International and Inland.
- U.S. Coast Guard Regulation 33 CFR Part 164, Navigation Safety Regulations.
- U.S. Public Health Service (USPHS) Publication No.393, “Handbook on Sanitation of Vessel Construction.”
- Institute of Electrical and Electronic Engineers Standards, Publication No. IEEE-45 - “IEEE Recommended Practice for Electrical Installation on Shipboard.”
- Illuminating Engineering Society, “Recommended Practice for Marine Lighting.”
- National Electrical Code (NEC).

C004 CLASSIFICATION AND CERTIFICATION

The Contractor shall be responsible for preparing necessary drawings and calculations, obtaining necessary regulatory body reviews and approvals, obtaining necessary inspections and surveys during construction and for the certification and classing of each vessel as follows:

- ABS classification for “Maltese Cross A-1 Towing Vessel, River Service with Maltese Cross AMS.” USACE shall be designated on the Request for Classification as the owner of these vessels.
- U.S. Public Health Service (FDA) Certificate of Sanitary Construction.

The Contractor shall bear all expenses associated with the acquisition of the required classing and certifications. The recommended ABS point of contact is Mr. Glenn Ashe, who can be reached by phone, or mail, at: (703) 518-0801, [Gashe@eagle.org](mailto:Gashe@eagle.org), or 1321 Prince Street, Suite 200, Alexandria, VA 22314.

If the Contractor intends to launch, test, operate, or tow the vessels “out of class,” the Contractor must specifically advise ABS of such intent and incorporate any and all modifications required by that agency for such operation at no additional cost to the Government and with no additional contract time. Any such modification which, in the opinion of the COR, affects the arrangements, operability or suitability of the vessel shall be removed from the vessel by the Contractor at no additional cost or time and the vessel returned to new condition prior to Final Acceptance.

C005 VESSEL IDENTIFICATION

The vessels to be acquired through this solicitation have been assigned the following names and Marine Design Center hull and project numbers:

Pittsburgh District Towboat (CLIN 0001)

MDC Hull Number .....557  
 MDC Project Number .....2389  
 Vessel Name ..... To be determined

Huntington District Towboat (CLIN 0002)

MDC Hull Number .....556  
 MDC Project Number .....2350  
 Vessel Name ..... To be determined

St. Paul District Towboat (CLIN 0003)

MDC Hull Number .....658  
MDC Project Number .....2594  
Vessel Name ..... To be determined

Rock Island District Towboat (CLIN 0004)

MDC Hull Number .....622  
MDC Project Number .....2555  
Vessel Name ..... To be determined

The vessel names have not been selected at this time. For the purpose of initial documents and drawing preparation, the titles used shall be:

CLIN 0001 .....“CELRP TOWBOAT”  
CLIN 0002 .....“CELRH TOWBOAT”  
CLIN 0003 .....“CEMVP TOWBOAT”  
CLIN 0004 .....“CEMVR TOWBOAT”

Upon selection of the official name for each vessel by the Government, the Contractor shall incorporate the name into all “as-built” documents. The MDC hull number shall be used in lieu of an “Official Number.”

C006 SCOPE OF WORK

A. CONTRACTOR’S RESPONSIBILITY

The contract consists of three phases:

Phase I..... Planning  
Phase II..... Engineering & Scheduling  
Phase III ..... Construction, Tests & Delivery

In accordance with the three phases, the Contractor assumes complete responsibility for designing, building, testing, and delivering the vessels to meet the requirements of the contract. Should the Contractor determine at any time that he is unable to fulfill those responsibilities, he shall notify the COR immediately of the problem experienced and his proposed manner of correction.

**B. PROPULSION DESIGN SUBCONTRACTOR**

The towboat concept designs presented in this package have been generated by CT Marine. The designs utilize CT Marine's extensive knowledge base of towboat design and similar towboats constructed.

The Contractor shall retain CT Marine to provide design input to the contractor's final design, and also to conduct inspection of specific construction and fabrication areas.

CT Marine shall be retained for the following tasks:

- All propeller design calculations.
- Review of Strut final detailed design.
- Review of Nozzle final detailed design.
- Review of Nozzle Installation final detailed design.
- Review of Shafting final detailed design.
- Review of Steering and Flanking rudder final detailed design.
- Review of Steering and Flanking rudder steering linkage final detailed design.
- Inspection of Nozzle and Strut construction.
- Inspection of Nozzle and Strut installation.
- Inspection of Flanking and Steering rudder and steering linkage and gear installations.

The contractor shall coordinate specific drawing and calculation requirements for these tasks with CT Marine. The contractor shall also coordinate inspection dates as required for these tasks with CT Marine.

CT Marine shall generate written reports for each of the tasks delineated above. CT Marine shall furnish a copy of each report to the Government concurrently with submission to the contractor.

**C.B. CONTRACT INTENT**

It is intended that the Contractor will be able to bid, and perform further design development of each vessel from the Contract Design provided by the contract specifications and plans.

The specifications delineate a "Contract Design" for each vessel. The hull geometry, lightship weight and CG, arrangements, hull geometry, rudders, shafting and engine requirements have been developed and shall be incorporated into each final vessel design without change. Structure, mechanical systems, electrical systems, and tank capacities have been considered sufficiently to verify feasibility and to achieve an adequate level of confidence that each vessel concept will meet the performance and operational requirements, and design objectives of the U.S. Army Corps of Engineers.

The plans and specifications of this contract have been prepared in accordance with the referenced design standards. The plans and specifications have not been submitted to ABS, USCG, or USPHS for approval. The Contractor shall prepare a Final Design for each vessel and submit each design for approval to ABS, USPHS, and USACE.

**D**C. DETAILED DESIGN

During Phase II, Engineering & Scheduling, it is the Contractor's responsibility to complete the Detailed Design of each vessel based on the "Contract Design" developed for that vessel. The Detailed Design is the basis for construction and is always completed prior to the start of construction.

Once the Detailed Design phase has commenced, changes in hull dimensions and subdivision, for other than very minor changes in arrangement, will not be made.

The Detailed Design must be so clear in its intent that the features, characteristics, capabilities, design criteria, margins and success criteria of each component or system cannot be mistaken. The level of detail presented and documented by calculation in the Detailed Design shall be sufficient for all required regulatory approvals, and for the Government's quality assurance function.

**D**D. DRAWINGS PROVIDED AND REQUIRED

1. Contract & Reference Drawings

The contract drawings of the "Contract Design" as listed in Section J, Clause J01, Contract Drawings. The Contract Drawings are provided with these specifications for bid purposes as well as to develop the Detailed Design.

Also provided as part of this solicitation are Reference Drawings. Reference Drawings shall be used in conjunction with the Contract Drawings and the specifications to finalize the Detailed Design of each vessel.

It is intended that the Reference Drawings provide general guidance to the Contractor in the methodology intended to develop specific systems or design features as called out in this specification. The exact details presented in the Reference Drawings may not reflect the specific needs of each vessel.

The Reference Drawings provided with the specification are listed in Section J, Clause J01.

## 2. Drawings Required

The minimum drawings required to be completed during the Engineering and Scheduling phase of this contract in order to complete the Detailed Design are listed in Section H, Clause H13, Engineering & Drawings. The requirements for developing the Detailed Design drawings are delineated in Clause H03 with any specific requirements for structure or mechanical systems defined in the relevant contract clauses.

The requirements for “As-Built” drawings of each completed vessel are defined in Section H, Clause H14, “As-Built” Drawings.

### C010 DEFINITIONS

The following definitions are applicable to phrases and acronyms used throughout this contract:

- K.O. - Contracting Officer - A person with the authority to enter into, administer and/or terminate contracts and make related determinations and findings.
- COR - Contracting Officer’s Representative - a member of the contract management and quality assurance team authorized by the Contracting Officer to perform certain administrative and managerial duties. A copy of the COR’s authority letter is furnished to the Contractor.
- GFE - Government Furnished Equipment - Equipment, materials or components furnished by the Government to the Contractor for installation in the vessel.
- USACE - Acronym for United States Army Corps of Engineers.
- MDC - Acronym for Marine Design Center.
- QC - Quality Control - Quality Control is a function of the Contractor. Refer to clause E03. Quality Assurance (QA) is a function of the Government.

## C025 CONTRACTOR QUALITY STANDARDS

The Contractor shall be responsible for the construction of complete and functioning vessels. The Contractor shall utilize the specified components so as to meet specification requirements utilizing construction and testing methods to ensure that the complete vessels shall conform to the intended design.

Inspection by the Marine Design Center is for the purpose of verifying the proper function of the Contractor's quality control measures and is not to be used as a substitute for control of quality by the Contractor.

### A. STRUCTURAL MATERIALS

Unless otherwise specified or noted on the Contract Drawings, all structural hull material shall be in accordance with the following specifications:

- American Bureau of Shipping (ABS), "Rules for Building and Classing Steel Vessels" and "Rules for Building and Classing Steel Vessels for Service on Rivers and Intracoastal Waterways."
- Welding Materials - ABS "Approved Welding Electrodes, Wire-Flux and Wire Gas Combination."

### B. STANDARD PARTS AND MATERIALS

All articles, fittings, equipment, machinery, supplies, and materials used in the construction and outfitting of the vessels shall be the highest grade, free from defects and imperfections, unused and, be the standard product of reputable manufacturers, to the maximum extent practicable. Any material not specified shall be the best of their kind for the purpose intended.

Materials specified herein to meet the requirements of standard specifications published by national authorities shall conform with the respective editions, including amendments, specified. No salvage materials shall be used in the work.

### C. WORKMANSHIP

All labor shall be especially skilled for each kind of work and under competent direction.

In engaging one kind of work with another, marring or damage of previously acceptable construction shall be cause for rejection. All parts of the vessel intended to join or bear upon other parts shall have complete and solid contact and shall fit together

without excessive cold work during erection. Shims or liners shall not be used for the purpose of overcoming a bad fit. Lightening holes may be punched or flame-cut and all edges shall have burrs removed. Holes in members having sharp curvature shall be avoided.

#### D. WELDERS

All welding under this contract shall be done only by welders who have successfully passed qualification tests accepted by the American Bureau of Shipping or other regulatory bodies acceptable to ABS.

The Contractor shall bear the expense of conducting these tests and shall certify, by name to the Contracting Officer, welders who have successfully passed the prescribed tests and hold current, valid certifications.

The Contractor shall require any welder to repeat these tests when in the opinion of the Contracting Officer, the work of the welder indicates a reasonable doubt of his proficiency. In such cases the welder shall be re-certified as above if he successfully passed the retest; otherwise, he shall be disqualified until he has successfully passed the retest.

The Contractor shall maintain records of each welder's certification during the course of the contract. The records are to be available for examination upon request of the Contracting Officer.

#### E. WELDING

All welding **and welding procedures** shall be in accordance with the current rules of the American Bureau of Shipping **and ANSI/AWS D3.5-85**. All welding equipment used on the work shall be of a modern type subject to close control. The electrodes used throughout the work shall be suitable for use with the parent metal at each weld, and be approved by ABS.

Welding procedures, as to direction, length, numbers and sequence of beads, shall be carefully planned to minimize lock-up stresses. Care shall be exercised to produce smooth even beads, especially on all exposed plating and fittings. Beads shall be ground where directed by the Contracting Officer.

The Contractor shall employ appropriate welding procedures and grounding connections to preclude the possibility of anodic erosion of the hull after launching.

#### F. INSTALLATION

Materials and equipment shall be installed in accordance with the approved recommendations of the manufacturer, and in compliance with the contract documents. The installation shall be accomplished by workmen skilled in this type of work.

### G. PLATE FAIRNESS

Steel plating shall be installed using proper welding procedures and sequences to insure fair, undistorted plating panels. The use of filler materials to surface unfair areas is not acceptable.

Maximum allowable plating distortion is depicted in the "Guide For Shipbuilding And Repair Quality Standard For Hull Structure During Construction" from ABS. Distortion shall not exceed the amounts in this guide.

### H. CONSTRUCTION STANDARDS

All material, machinery and equipment shall be new, of current manufacture and suitable for the marine service intended. Spare parts and service shall be readily obtainable.

All material, unless otherwise specified in these specifications or in the drawings, shall be of commercial quality to ASTM, ANSI, or SAE specifications.

During construction and before delivery, the Contractor shall be responsible for protection of all material, equipment, etc., intended for the vessels.

The overweight tolerance of members shall be within the limits defined by the specifications of the American Society for Testing and Materials.

All materials shall be free of imperfections due to manufacturing processes and from defects which adversely affect appearance or serviceability.

All sharp edges or projections which constitute a personnel hazard shall be removed or ground smooth. All notches shall have a radius to prevent stress concentrations.

Where aluminum must be attached to dissimilar metals or between dissimilar alloys of aluminum, fasteners shall be of stainless steel of an approved design with insulation as required to eliminate metal-to-metal contact.

All galvanizing shall be done after fabrication by the hot dip process, and the zinc shall be not less than 98% pure. In instances where some types of metals cannot be hot dip galvanized, zinc silicate coating may then be substituted.

C099 DESIGN COMPENDIUM

The Contractor shall develop and maintain a design history of their involvement in the project. This history will be referred to as the Design Compendium.

The Design Compendium is intended to record and document the design and construction process. A single Design Compendium shall be maintained incorporating all data for all vessels. Data differing from one vessel to another, shall be clearly labeled as to which vessel it pertains.

The Design Compendium shall be organized by Contract Clause, including only those Clauses having design history content.

Design data and calculations are to be clearly presented and easy to follow, with stated introduction, purpose, assumptions, references, method of calculation, discussion of results, summary of results and conclusions.

The design process is presented in a clear path indicating the selected design data as well as the rejected or voided data, and the engineering analysis which lead to each selection/rejection. All background engineering, catalog "cut" sheets, and vendor material validation sheets are included in the Design Compendium.

The Design Compendium shall contain a table of contents. Each section shall contain:

- Applicable rules and regulations
- Correspondence/phone conversation records
- Calculations
- Design sketches
- Equipment selection
- Catalog "cut" sheets

The Design Compendium shall be submitted in its final form, including the construction process, as an "As-Built" document (reference Clause H14).

**C100 SCIENTIFIC**

**C105 HULL GEOMETRY**

A. CONTRACT DRAWINGS

CLIN 0001

557-B105-01, LINES PLAN  
557-B105-02, FRAMES & OFFSETS

CLIN 0002, CLIN 0003 & CLIN 0004

556-B105-01, LINES PLAN  
556-B105-02, FRAMES & OFFSETS

B. GENERAL

The hull shape of each vessel shall be as shown on the Contract Drawings. The hull has been formed to maximize vessel thrust and speed and shall not be altered.

C. PRINCIPAL CHARACTERISTICS

CLIN 0001

Length (W/O Fenders) ..... 124'-0"  
Beam Molded..... 33'-10"  
Depth @ Midship..... 10'-3"  
Draft (Full Load)..... 7'-6"  
Air Draft (Maximum) ..... 34'-0"

CLIN 0002, CLIN 0003 & CLIN 0004

Length (W/O Fenders) ..... 124'-0"  
Beam Molded..... 33'-10"  
Depth @ Midship..... 10'-3"  
Draft (Full Load)..... 8'-06"  
Air Draft (Maximum) ..... No Restriction  
Height of Eye (Minimum) ..... 36'-0"

C115 WEIGHT ESTIMATE & INCLINING

A. TARGET LIGHTSHIP WEIGHT AND LCG

The Concept Design determined that the following weight and LCG were required to meet the draft and stability criteria of each vessel:

CLIN 0001

Lightship Weight .....	424.6	<del>XXX.5</del>	Long Tons
LCG (From Bow).....	64.7	<del>XX.5</del>	Feet

CLIN 0002, CLIN 0003 & CLIN 0004

Lightship Weight .....	452.1	442.9	Long Tons
LCG (From Bow).....	63.2	5	Feet

B. WEIGHT & CENTER OF GRAVITY ESTIMATES & MONITORING

The Contractor shall implement a careful weight estimating and monitoring procedure.

The Contractor shall be bound to the target lightship weight and LCG. The actual lightship weight, VCG and LCG shall be determined by the inclining experiment. (Refer to Clause C115.D)

If the anticipated draft and trim of the vessel are adversely impacted by unpredicted weight growth, the Contractor shall be obligated to determine the cause of the weight growth and take remedial action to return the weight and LCG to the target.

### C. WEIGHT ESTIMATE

During the Engineering & Scheduling phase of the contract, the Contractor shall prepare a detailed weight estimate for each vessel. The estimate shall be based on the Detailed Design. Weights and centers of gravity shall be documented in a spreadsheet type format using MDC's Work Breakdown Structure (WBS) format.

The detailed weight estimate shall be complete with the Vertical and Horizontal location of the center of gravity of all the items included in the estimate. The transverse center of gravity shall be provided for all items that are not symmetrical about the centerline.

The Contractor shall also provide a separate document detailing the weights and centers of the floating deckhouse. The document shall be submitted for Government review and acceptance, prior to selection and arrangement of the isolator spring supports. The format for this weight estimate shall be similar to that prepared for the entire vessel. However, the floating deckhouse weights shall be subtotaled for each level of the deckhouse.

The Contractor shall maintain an updated weight estimate during the Engineering phase and a revised (lightship) weight estimate shall be submitted to MDC at the conclusion of the Engineering & Scheduling phase to ensure compliance with the target.

Upon completion of the Construction phase, the weight estimate shall be updated and a verification of the weight and centers of gravity made against the vessel's inclining.

### D. INCLINING

Upon completion of all work, with the vessels in the lightship condition, an inclining test shall be conducted on each. The inclining test shall be carried out in accordance with ASTM F 1321-90. The Contractor shall provide an inclining report in accordance with this criterion that gives the "as inclined" and "lightship" load condition displacements and CG locations.

## C125 HYDROSTATICS AND CURVES OF FORM

Hydrostatic calculations have been performed, and curves of form determined during the Contract Design. The successful bidder shall be provided with these documents.

The hydrostatic calculations include the shell plating. The following are the design conditions in the full load condition with ballast:

## CLIN 0001

Design (Full Load) Draft ..... 7'-6"  
 Trim..... 0'-0"  
 Displacement..... 598.8 ~~XXX.0~~ Long Tons  
 LCG..... 56.2 ~~XX.1~~ Feet aft of the bow

## CLIN 0002, CLIN 0003 &amp; CLIN 0004

Design (Full Load) Draft ..... 7'-8 3/16" ~~7-1/2"~~  
 Trim ..... 0'-0"  
 Displacement ..... 619.9 ~~609.9~~ Long Tons  
 LCG..... 56.4 ~~2~~ Feet aft of the bow

The Contractor shall only be required to calculate new hydrostatic properties if the hull geometry (including plate thickness) is changed.

If hydrostatic calculations are performed, they shall be in tabular form and completed for drafts from 1 foot to the deck edge in 3-inch increments. The tabulated hydrostatic curves may be plotted on a standard D size drawing or 8-1/2" by 11" paper. Resulting calculations shall be presented in graphic form on a grid background. The curves are to include as a minimum:

- Displacement in fresh water, full and molded
- Center of buoyancy (LCB, VCB)
- Tons per inch immersion (TPI)
- Longitudinal center of flotation (LCF)
- Transverse and longitudinal metacentric heights ( $KM_L$ ,  $KM_T$ )
- Moment to trim one inch (MT1")
- Block prismatic and waterplane coefficients ( $C_b$ ,  $C_p$ ,  $C_w$ )

The hydrostatics shall be performed using the GHS computer software (Creative Systems Inc., Port Townsend, WA 360-385-6212). The hull definition file (or \*.gf file) shall be provided in electronic format (on a 3.5" disk or CD ROM) with the hydrostatics submittal.

C130 COMPARTMENT CAPACITIESA. CONTRACT DRAWINGS

CLIN 0001

557-B130-01, TANK CAPACITY PLAN

CLIN 0002, CLIN 0003 &amp; CLIN 0004

556-B130-01, TANK CAPACITY PLAN

B. TANK CAPACITIES

The minimum tank capacities shall be as follows:

- Fuel Oil Tanks (CLIN 0001)..... 26,000 gallons
- Fuel Oil Tanks (CLIN 0002, 0003 & 0004) ..... 32,000 gallons
- Fuel Oil Day Tank ..... 2,800 gallons
- Genset Fuel Oil Day Tank ..... 500 gallons
- Lube Oil Tank ..... 800 gallons
- Gear Oil Tank ..... 500 gallons
- Hydraulic Oil Tank ..... 600 gallons
- Oily Bilge Tank..... 650 gallons
- Slop (Waste) Oil Tank ..... 650 gallons
- Potable Water Tanks (CLIN 0001)..... 9,900 gallons
- Potable Water Tanks (CLIN 0002 & CLIN 0003)..... 11,400 gallons
- Sewage Holding Tanks ..... 5,400 gallons

The potable water tanks shall be re-configured during the Engineering Phase to efficiently accommodate the capstan motors below the main deck. More potable water capacity is preferred.

Ballast tank capacity and requirements shall be re-evaluated by the Contractor during the Engineering Phase based on the final configuration of the Potable Water tanks and Weight Estimate (Clause C115.C).

Sounding tables in gallons per inch shall be provided for all tanks. The Sounding tables shall be presented in tabular form with one tank per page on 8 1/2" x 11" paper using the GHS computer software. Each table shall include the identity of the tank (as labeled on the drawings), its location in the vessel and the center of gravity (longitudinally, vertical and transversely) of the fluid at each sounding level. The compartmentation definition files shall be submitted in electronic format with the Sounding tables.

Inage capacity sounding tables shall be provided for the main fuel oil tanks, fuel oil day tank, lube oil tanks, hydraulic oil tank, oily bilge tank, waste oil, grey water holding tank, and sewage holding tank. Tables shall note location of the sounding tube, and location and height of striker plate above the baseline and tank bottom.

#### C145 TONNAGE MEASUREMENT

The Contractor shall be required to perform a tonnage measurement calculation for each vessel. The calculation shall comply with the U.S. Coast Guard Code of Federal Regulations Title 46 CFR Part 69, Subpart B, Convention Measurement System.

The Contractor shall provide a Certificate of Measurement issued by the measuring organization, as authorized by 46 CFR 69.15, prior to delivery of each vessel.

The tonnage measurement calculation shall include sketches of each deck level with dimensions shown. A table of volumes showing the total for each level and a summation of volumes shall be provided. Any deductions shall be clearly identified.

#### C150 DAMAGED STABILITY

Each vessel shall meet a one compartment damaged stability standard in the most critical loading condition where, with any one compartment flooded, shall maintain positive righting arm and all parts of the margin line remain above the flooded waterline. The margin line shall be 3 inches below the main deck edge. The hull compartmentation developed during the Contract Design complies with this requirement.

Damaged stability calculations shall show equilibrium water lines, curve of righting arm versus heel angle in 5-degree increments to capsize angle for each flooded compartment. The freeboard shall be reported at the four deck corners, and at each deck knuckle for each damaged condition.

The Contractor shall prepare a damaged stability analysis for each vessel during the Engineering Phase of this contract verifying compliance with this criteria. Any calculations showing a failure to meet this criteria shall be reported in a timely manner to the COR with recommendations for correction. The analysis shall be performed using the GHS computer software and all run files and macros used in calculating the damaged stability shall be submitted with the analysis in electronic format. The analysis shall be repeated using the lightship weight determined by deadweight survey after completion of the vessel (prior to Final Acceptance).

The damaged stability calculations shall be presented in report form with a cover sheet complying with the drawing standards and including a title block (see Clause H13). The report shall include a table of contents, summary, explanation of all assumptions and clear definition of origins and units used, and the finished calculations.

C155 INTACT STABILITYA. GENERAL

Intact stability calculations shall be performed for each vessel in accordance with U.S. Coast Guard Code of Federal Regulations 46 CFR 170.173(e) for protected routes. Specific criteria shall be as follows:

- Positive righting arm to at least 25 degrees of heel.
- No downflooding point to at least 15 degrees of heel.
- At least 10 foot-degrees of righting energy to the smallest of the following heel angles:
  - a. Angle of Max. Righting Arm
  - b. Angle of Downflooding
  - c. 40 degrees

The Contractor shall prepare a Trim and Stability analysis for each vessel during the Engineering Phase of the contract documenting compliance with the criteria. The hull compartmentation developed during the Contract Design complies with this requirement. Any calculations showing a failure to meet the criteria noted herein shall be reported in a timely manner to the COR with recommendations for correction.

The Contractor shall take care to verify that all exterior door sills on the main deck level extend above the worst loading condition with downflooding heel angle of 15 degrees (See Clause C415.A). Any such door sill not meeting this requirement shall be raised to 1-inch above the downflooding waterline.

Thirty days prior to Final Inspection of the vessel, the Contractor shall provide a final Trim and Intact Stability Booklet for that vessel determining loading procedures to maintain a stable platform throughout the loading process. The lightship weight of the vessel shall be that determined from the Inclining Experiment. See contract Clause C115, paragraph D.

The Contractor shall provide intact stability calculations based on the parameters and conditions noted in the following paragraphs.

B. CONDITIONS

- Lightship with no ballast, consumables, personnel or stores
- Lightship with ballast and no consumables, personnel or stores
- 10% consumables (fuel oil, potable water, lube oils, hydraulic oil) and 90% waste (grey water and sewage) with a full compliment of personnel and stores and necessary ballast
- 50% consumables (fuel, lube oils, potable water) and 50% waste (grey water and sewage) with a full compliment of personnel and stores and necessary ballast
- 75% consumables (fuel, lube oils, hydraulic oil, potable water) and 25% waste (grey water and sewage) with a full compliment of personnel and stores and necessary ballast
- Full fuel, hydraulic oil and lube oils, 10% grey water and sewage, and full potable water tanks with a full compliment of personnel and stores and necessary ballast

C. PARAMETERS

Each vessel shall be capable of meeting the following parameters for all load conditions:

- No trim by the bow for any condition
- No heel for any condition
- Maximum trim by the stern of one-quarter degree for any condition
- Maximum draft stated in Clause C105.B

Water ballast shall be provided to achieve the above parameters.

D. CALCULATIONS

The Contractor shall perform calculations showing the following for each condition:

- Drafts forward and aft
- LCG, TCG, VCG
- Righting arm curve

The calculations shall be performed using the GHS computer software. All run files and macros used in the calculations shall be submitted with the analysis in electronic format.

The intact stability calculation shall be performed in report form with a cover sheet complying with required drawing standards and include a drawing title block (refer to Clause H13). The report shall include a table of contents, summary, explanation of all assumptions and clear definition of origins and units used and the finished calculations.

### C170 DRY DOCKING PLAN

The Contractor shall develop a dry docking plan for each vessel. The dry docking plan shall be developed to show the blocking for standard dry docking and for cradles. It shall show all major hull structure on the bottom, all hull penetrations, all transverse and longitudinal bulkheads connecting with the bottom shell, and other features which could interfere with the setting and shifting of the blocks.

The dry docking plan shall include an alternate blocking/cradle arrangement to allow for the servicing of all areas of the bottom of the vessel.

The dry docking plan shall include:

- Lightship weight as determined by the Inclining Experiment and its LCG.
- Full load weight and LCG as determined by the As-Built Stability Calculations.

The plan shall identify the size (foot print) of blocks supporting the hull and maximum block loading (kips/foot-squared). Blocks shall be located to evenly distribute the loads and avoid undue stresses within the hull structure. Blocks shall be located in way of main structural longitudinal and transverse bulkheads wherever possible. Where blocking is located on frames other than bulkheads, appropriate docking brackets shall be designed and installed within the hull. Docking bracket details shall be shown on the structural drawings.

Consideration shall be given to properly supporting the nozzles.

With cradle supports, much of the bow and stern are unsupported. The Contractor shall provide calculations with the drawing submittal showing that the hull strength is adequate to handle the cantilevered load. The load anticipated at each cradle shall be stated on the drawing.

C180 NOISE AND VIBRATIONA. INTRODUCTION

Control of noise and vibration are paramount to the functionality of these vessels. Every effort shall be made to control noise and vibration. The Contractor shall be responsible for any corrective action necessary to reduce excessive noise to the levels described below.

On each vessel, the deckhouse forward of the upper machinery space shall be segregated from the hull and the deckhouse aft.

B. NOISE CRITERIA

The following noise levels shall not be exceeded within the given space:

## HULL

Fwd Store .....	80 dB(A)
Fwd Machinery Space.....	80 dB(A)
Lower Engine Room.....	110 dB(A)
Shaft Alley .....	80 dB(A)

## MAIN DECK

Upper Machinery Space.....	110 dB(A)
Generator Room.....	110 dB(A)
Steering Gear Room.....	80 dB(A)
Engineer's Workshop.....	75 dB(A)
Exterior .....	75 dB(A)

## FLOATING DECKHOUSE

Galley .....	75 dB(A)
Mess .....	65 dB(A)
Lounge (CLIN 0002, 0003 & 0004only) ..	65 dB(A)
Laundry (CLIN 0002, 0003 & 0004only)..	75 dB(A)
Ship's Office .....	60 dB(A)
Staterooms and T/S spaces.....	55 dB(A)
Pilothouse .....	60 dB(A)

C. VIBRATION CRITERIA

See Clause C313 for details.

D. NOISE AND VIBRATION CONTROL

Some control measures that shall be considered to meet the criteria are as follows:

- Effective noise barrier around high noise spaces to prevent noise transmission to adjacent spaces, and sound absorbing material around high noise spaces, to reduce contribution of reverberant noise within the space.
- Installing vibration isolators for the diesel generators and all rotating machinery such as pumps and fans in order to reduce noise and vibration transmission through the structure.
- Flexible mounting of ventilation and other service lines.
- Ensuring that all pipe and duct joints are tight and that all penetrations through spaces are sealed.
- Use of low noise components, e.g. tighter tolerances etc.
- Ensure that the impedance of the foundation supporting the resilient mount is 10 times the impedance of the resilient mount.
- Ensure that the forcing frequencies are not within +/- 25% of the foundation natural frequencies.
- Ensure that the resilient mount/vibration isolator natural frequencies are not greater than 50% of the forcing frequencies.
- All diesel exhaust lines and exhaust silencers shall be mounted using vibration isolators.
- Installing acoustic louvers on all engine and generator room ventilation.

C185 TESTS AND TRIALS

This vessel and its component parts shall undergo testing and trials in accordance with Clause E05.

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**C200 ARRANGEMENTS****C201 VESSEL CONFIGURATION****A. CONTRACT DRAWINGS**

## CLIN 0001

557-B205-01, OUTBOARD PROFILE  
557-B215-01, GENERAL ARRANGEMENT  
557-B233-01, PILOTHOUSE DETAILS  
557-B245-01, HOLD & MACHINERY ARRANGEMENT

## CLIN 0002, CLIN 0003 &amp; CLIN 0004

556-B205-01, OUTBOARD PROFILE  
556-B215-01, GENERAL ARRANGEMENT  
556-B233-01, PILOTHOUSE DETAILS  
556-B245-01, HOLD & MACHINERY ARRANGEMENT

**B. GENERAL**

The configuration of the superstructure, the hull and the deck arrangement for each vessel shall be as shown on the above Contract Drawings. Watertight bulkheads have been located within the hull to maximize damage stability.

The vessels are arranged to provide ready accessibility to machinery and operating equipment for operation, maintenance, and inspection. Provisions have been made for the removal of the main engine, generators, and other major equipment through hatches or other access. Where equipment, machinery or furnishings have not been shown on the drawings, the Contractor shall provide locations and include that information on subsequent revisions of the above drawings.

There shall be no deviations from the contract drawings without written authorization of the COR.

**C215 GENERAL ARRANGEMENTS****A. HULL**

The hull depth of each vessel shall be subdivided, as shown on the Contract Drawings. Subdivisions are provided for transverse and longitudinal bulkheads into the ballast, fuel oil, potable water, grey water and sewage holding tanks, oil tanks, lower engine room, forward machinery space, forward storage, shaft alley and voids.

Access to the various below deck spaces shall be through appropriately sized hatches.

The forward storage space shall be fitted out with steel shelving for storage of rigging and supplies. The forward storage space shall have one square hatch (refer to Clause C415) with a vertical ladder (refer to Clause C427).

B. DECKHOUSE

There shall be no arrangement deviations from the Contract Drawings without written authorization of the COR.

1. Pittsburgh District Towboat (CLIN 0001)

The deckhouse is divided into the aft deckhouse and the floating deckhouse. The floating deckhouse shall have two levels of enclosed space above the Main Deck. Including the Main Deck level, the floating deckhouse shall comprise five staterooms with toilet/shower spaces (4 double and 1 single), galley, pantry, mess, lounge/office, office storage, deck toilet, deck storage, interior stairwell, and pilothouse. The aft deckhouse will include the upper machinery room, generator room, engineer's workshop, steering gear room, stacks, skiff and davit, and laundry.

2. Huntington District Towboat (CLIN 0002), St. Paul District Towboat (CLIN 0003) & Rock Island District Towboat (CLIN 0004)

The deckhouse is divided into the aft deckhouse and the floating deckhouse. The floating deckhouse shall have three and one-half levels of enclosed space above the Main Deck. Including the Main Deck level, the floating deckhouse shall comprise eight staterooms and toilet/shower spaces (3 double and 5 single), galley, pantry, mess, lounge, deck toilet, office, deck storage, laundry, plenum/electronics space, interior stairwell, and a pilothouse. The aft deckhouse shall include the upper machinery room, generator room, engineer's workshop, steering gear room, stacks, and a skiff and davit.

C233 PILOTHOUSE

The pilothouse shall have 360-degree visibility with a standard single piece control console and have a hidden toilet.

C255 CONTROL CONSOLE

A standard one-piece console shall be installed in the pilothouse as shown on the Contract Drawings. The console shall contain all controls, alarms, monitoring equipment, communication, and navigation equipment necessary for the vessel's operation.

The actual position and location of the equipment on the console and in the overhead shall be determined during the Construction Phase. The console arrangement shall be accepted by the COR prior to fabrication.

**C300 STRUCTURE****C301 GENERAL STRUCTURE**

The Contractor shall develop the structure for the Detailed Design and construct the vessels in accordance with the Contract Drawings.

The hull structure scantlings defined on the Contract Drawings provide basic concept level structure only. The drawings have not been submitted to ABS for review, but have been developed based on the ABS Rules specified in Clause C003. It is the responsibility of the Contractor to take these drawings to the next level of Detailed Design with all necessary plating, bulkhead and framing construction, and welding details and submit them to ABS for approval. The Contractor is expected to re-confirm or correct any concept level structure that does not meet the requirements of ABS.

The Contractor shall submit calculations required to determine all principal hull, deck, bulkhead and superstructure scantlings. The Contractor shall also submit calculations required to determine foundation scantlings, rigging components and lifting padeyes. Structural calculations shall be submitted with the associated structural drawings. Structural drawings will not be reviewed without accompanying calculations.

**C305 HULL STRUCTURE****A. CONTRACT DRAWINGS****CLIN 0001**

557-B105-01, LINES PLAN  
557-B105-02, FRAMES & OFFSETS  
557-B205-01, OUTBOARD PROFILE  
557-B215-01, GENERAL ARRANGEMENTS  
557-B245-01, HOLD & MACHINERY ARRANGEMENT  
557-B301-01, INBOARD PROFILE  
557-B306-01, TRANSVERSE & LONG'L STRUCTURAL SECTIONS  
557-B307-01, DECK & BOTTOM STRUCTURE  
557-B605-01, PROPULSION & SHAFTING ARRANGEMENT

**CLIN 0002, CLIN 0003 & CLIN 0004**

556-B105-01, LINES PLAN  
556-B105-02, FRAMES & OFFSETS  
556-B205-01, OUTBOARD PROFILE  
556-B215-01, GENERAL ARRANGEMENTS

556-B245-01, HOLD & MACHINERY ARRANGEMENT  
556-B301-01, INBOARD PROFILE  
556-B306-01, TRANSVERSE & LONG'L STRUCTURAL SECTIONS  
556-B307-01, DECK & BOTTOM STRUCTURE  
556-B605-01, PROPULSION & SHAFTING ARRANGEMENT

B. DESCRIPTION OF WORK

The hull shall be of all welded steel construction and divided into watertight compartments with transverse bulkheads, in accordance with the Contract Drawings.

All hull steel shall conform to ASTM specification A36-81a for structural steel and be certified by ABS. All welding and weld sizes shall be in accordance with the applicable standards of the American Bureau of Shipping and ANSI/AWS D3.5-85.

The shell and main deck plating shall be constructed of longitudinal strakes of lengths consistent with accepted practice for hulls. All seams shall be connected with full penetration welds. Plating layout shall be staggered so that the corners of four plates do not intersect at a common point.

Hull plating transverse seams may not fall within 6 inches forward or aft of flat-of-bottom tangent line.

The hull bottom and side shell shall not be less than 3/8-inch thick plating.

In addition to structural required by ABS Rules, the Contractor shall provide sufficient hull strength in the stern and the bow to support these extremities as cantilevers during dry docking on cradles (refer to Clause C170). Calculations shall be provided with the hull structural drawings submitted to the Government showing that the hull strength meets the criteria without yielding the hull material. Deflection shall not exceed 1/180 of length of unsupported span.

C. PENETRATIONS

When penetrations are made in watertight bulkheads, shell or deck, the plating shall be restored to watertight condition in accordance with the ABS Rules referenced in Clause C003. When penetrations are made in oiltight bulkheads, shell or deck, the plating shall be restored to oiltight condition in accordance with ABS Rules referenced in Clause C003.

All such penetrations and deck openings shall be suitably designed and reinforced in accordance with the National Shipbuilding Research Program Publication NSRP 0490 (reference Clause C003).

D. INSERT PLATES

All deck fittings, deckhouse isolation springs, and deck equipment shall be mounted on insert plates welded continuously into the deck with bulkheads, headers or brackets below. Welding on all under deck structure (bulkheads, headers and brackets) shall be double continuous to 6 inches beyond the insert plate. Plates shall have 6-inch radius corners and extend a minimum of 6 inches beyond the item in all directions.

E. OVERBOARD DISCHARGES

All overboard discharge openings through the shell plating above the waterline, shall be located at or as close to the full load waterline.

All discharge penetrations shall not extend beyond the hull plating and shall be of extra strong pipe welded to a circular insert shell plate. Insert plates shall be of equal or greater thickness than the wall of the attached spool piece. No insert plate shall be less than the hull plate in the area of the penetration plus 1/8th inch.

Any pipe penetrating the hull below the flooded water line shall be fitted with schedule 80 spool pieces and sea valves. The inboard end of the spool piece shall have a 150 lb pipe flange to bolt to the sea valve. The sea valve shall be located less than 6 inches from the hull opening.

Openings shall be located well clear of draft marks and other hull markings as described in Clause C460.

F. LIFTING PADS

Lifting pads shall be provided throughout the generator room, upper machinery room, lower engine room, shaft alley, and steering gear room for the lifting of heavy equipment requiring removal for repair. Pads shall also be provided over soft patches or removal hatches to facilitate equipment removal from below deck.

Structure in way of the lifting pads shall be stiffened to prevent undue deflection under expected loads. The structure shall be designed with a factor of safety not less than 5 based on the ultimate strength of the material. Calculations shall be performed and submitted for lifting pads and support structure intended to lift weights in excess of 500 lbs. Lifting pads rated for 500 lbs. or more shall be shown on the structural drawings.

G. FRAMING FOR DOORS, WINDOWS, HATCHES & MANHOLES

All door, window, hatch and manhole openings shall be provided with headers as necessary to transfer the hull and local stresses around the openings. The headers shall be shown on the structural drawings. The requirements for the door, windows, hatches, and manholes are to be in accordance with Clause C415.

C313 FLOATING DECKHOUSE DESIGNA. DRAWINGS

## CLIN 0001

Contract Drawing #557-B301-02, INBOARD PROFILE  
Reference Drawing #557-B313-01, SPRING ISOLATION DETAILS

## CLIN 0002, CLIN 0003 &amp; CLIN 0004

Contract Drawing #556-B301-02, INBOARD PROFILE  
Reference Drawing #556-B313-01, SPRING ISOLATION DETAILS

B. DESCRIPTION OF WORK

The deckhouse forward of Frame #31 shall be installed as a floating house as shown on the Contract Drawings. This floating deckhouse shall be mounted on vibration isolators to reduce vibration and noise transmitted from the hull to the deckhouse.

The structural framework of the floating deckhouse shall be designed to efficiently direct the deckhouse weight and dynamic loading to the spring supports.

As part of the Detailed Design, the Contractor shall perform calculations to select the vibration isolators and design the supporting foundations and structure for the floating house.

C. DECKHOUSE WEIGHT ESTIMATE

The Contractor shall prepare and submit a detailed weight and center of gravity estimate for the "floating" deckhouse to the Government for review and acceptance. The format shall be in accordance with Clause C115.

Upon the Government's acceptance of the Contractor's detailed weight and centers of gravity estimate for the floating deckhouse, the Contractor shall determine the isolator size(s), number and arrangement, necessary to properly isolate and support the deckhouse.

D. DESIGN CALCULATIONS

The Contractor shall perform calculations for isolator selection as well as to analyze and design the isolator pedestal and supporting hull and floating deckhouse structure. These calculations shall be submitted to the Government for review and acceptance. The calculations submitted shall be neat and contain all assumptions, design methodologies, references and formulas.

## E. LOADING & VIBRATION CRITERIA

The Contractor shall consider the following loading and vibration criteria for arrangement and selection of the vibration isolators:

### 1. Loading Criteria

Deadweight, based upon the greater of the following:

- The results of detailed weight and center of gravity estimate.
- Uniform loading corresponding to “h” values defined in ABS River Rules (Part 3, Section 6 - Towboats) multiplied by a standard cargo density of 45 lbs per cubic foot, applied to all decks including pilothouse top, and deckhouse structure weight.

Combined effect of deadweight and basic wind speed of 100 MPH, in any direction, for vessel docking.

Combined effect of deadweight and dynamic loads. The Contractor shall be responsible for determination of the appropriate dynamic loads for each vessel.

### 2. Vibration Criteria

The forcing frequencies shall not be within +/- 25% of the floating deckhouse structure natural frequencies.

The isolator natural frequencies are not greater than 50% of the forcing frequencies.

The maximum vibration levels occurring in the three individual translation axes (longitudinal, transverse and vertical) and combined multi-axis vibration levels, shall not exceed the maximum weighted root-mean-square acceleration levels shown for the notation “HAB+” in Section 3, Table 1 of the ABS Guide for Crew Habitability on Ships, issued December 2001.

## F. ISOLATOR ARRANGEMENT & SELECTION

Based on the above criteria, the isolators shall be located so that the deckhouse is level (parallel to the plane of the main deck) under static loading conditions. Isolators shall also be located so that they are placed directly over and directly under deckhouse and hull framing or bulkhead structure. Complete or partial mounting of isolators on plate panels is not acceptable. Isolator arrangement shall allow for alignment of isolator

housings in longitudinal and transverse directions, to provide resistance in both directions.

The isolators shall be similar to BXL series, all-directional restrained spring isolators for floor mounting, available from Vibration Eliminator Co., Inc., Copiague, NY (POC - Mr. John Dessi, Tel. 631-841-4000).

Isolators shall be provided with limit stops to prevent collapse of the isolator/deckhouse system, as a result of impact loads from grounding or collision.

The isolators supplied shall be galvanized using the zinc electroplating process and then painted with a marine grade coating, to prevent corrosion.

#### G. ISOLATOR FOUNDATIONS & INSTALLATION

The Contractor shall be responsible for providing isolator pedestals, and hull and deckhouse structure, that are capable of withstand the applied loads. The design of the pedestals, hull and deckhouse structure in way of isolators shall meet the allowable stress criteria defined in the American Institute of Steel Construction (AISC) Allowable Stress Design (ASD) Manual, Ninth Edition, in addition to the requirements of the ABS River Rules.

Insert plates shall be provided on the hull and deckhouse in way of the isolators. See Contract Clause C305.

Isolators shall be mounted on stiffened plate pedestal structures similar to those shown on the Reference Drawings in order to provide the required height for the void space between the floating deckhouse and the main deck. In lieu of the vertical chocks shown as part #6 in the Reference Drawings, flanged tee sections shall be used to provide greater support of the free ends of the bolting flange. The angle of the flared side shall not exceed 60 degrees. The width of the pedestal base plate shall be increased to accommodate the wider tee section stiffeners.

The isolating springs shall be secured to the pedestal and the deckhouse in accordance with the manufacturer's recommendations. The Reference Drawings are provided for installation guidance.

The Contractor shall adjust the isolator deflections after installation, to ensure that the isolator loads are equalized. The Contractor shall provide all materials necessary to achieve the isolator adjustments.

#### H. DECKHOUSE BOOT & GASKET

The Contractor shall supply and install a neoprene boot around the base of the floating deckhouse. The boot shall be similar to that shown on the Referenced Drawings.

The Contractor shall supply and install a gasket between the interface of the floating (forward) deckhouse and the non-floating (aft) deckhouse. Access shall be provided for maintenance of the isolators, cableways, piping and equipment within these spaces.

Both the boot and the gasket shall be designed to be weathertight.

### C315 SUPERSTRUCTURE

#### A. CONTRACT DRAWINGS

##### CLIN 0001

557-B205-01, OUTBOARD PROFILE  
557-B215-01, GENERAL ARRANGEMENT  
557-B233-01, PILOTHOUSE DETAILS  
557-B301-02, INBOARD PROFILE

##### CLIN 0002, CLIN 0003 & CLIN 0004

556-B205-01, OUTBOARD PROFILE  
556-B215-01, GENERAL ARRANGEMENT  
556-B233-01, PILOTHOUSE DETAILS  
556-B301-02, INBOARD PROFILE

#### B. DESCRIPTION OF WORK

The Contractor shall design and construct a steel deckhouse meeting the ABS requirements of 3/6.17 and the dynamic loads resultant from the floating deckhouse (Clause C313). The deckhouse shall be installed on the main deck of each vessel as shown on the appropriate Contract Drawings.

The deckhouse shall be of all welded steel construction. All steel used for the deckhouse shall conform to ASTM specification A36-81a for structural steel. All welding and weld sizes shall be in accordance with the applicable standards of the American Bureau of Shipping.

A maximum air draft of 34 feet above the 10% full load waterline is required for CLIN 0001. No permanent structure or equipment shall extend beyond this height.

The minimum height of eye for the operator standing in the pilothouse of CLIN 0002, CLIN 0003 and CLIN 0004 shall be 36 feet above the full load waterline.

The deckhouse is divided into floating and non-floating sections. The deckhouse, aft of Frame #31, is the non-floating section. The deckhouse forward of Frame #31, is the floating section.

The floating section shall be designed and constructed on a system of vibration isolating springs. The forward deckhouse must be physically disconnected from the aft deckhouse while maintaining the appearance of being a single structure. To that end, the plane where the two structures meet shall be weathertight while allowing the forward deckhouse to move.

### C316 STACKS

Stacks shall be fabricated and installed to house the silencers for the main engines, diesel generator sets, and the fire pump diesel engine. See contract Clause C650 for the requirements of the diesel engine exhaust systems.

The stacks shall be designed and constructed of welded steel on hatches. The stacks and hatches shall be removable to allow the removal of the diesel engines, reduction gears, and generator sets for maintenance or replacement. An exhaust fan shall be mounted on the aft side of each stack.

Removable, weathertight bolted hatches, 26 inches long by 24 inches high (oblong shaped) shall be installed in the inboard sides of each main engine stack. The hatches shall be located at the top and the bottom to permit access to the stacks. For the generator stack, a single hatch, of the same size, shall be located towards the bottom in order to provide access to the stack.

### C317 MASTS

#### A. CONTRACT DRAWING

CLIN 0001

557-B205-01, OUTBOARD PROFILE

CLIN 0002, CLIN 0003 and CLIN 0004

556-B205-01, OUTBOARD PROFILE

#### B. DESCRIPTION

Masts shall be provided and installed for navigation lights, day markers, warning lights, flags, and radar antennas in a similar manner as that shown on the above contract drawing. For CLIN 0001, all masts provided shall ensure that the maximum air-draft for the vessel of 34 feet measured from the 10% full load waterline is met. There is no maximum air-draft requirement for CLIN 0002, CLIN 0003 and CLIN 0004.

The Contractor shall provide and install a Pilot House top mounted navigation light mast that will hinge forward. When in the hinged down position, the mast shall be

located such that all lights may be serviced from the Pilot House top. A mast rest cradle shall be provided to support the mast when it is in the down position.

The flag mast shall incorporate a gaff (spar) and a yardarm. Both the gaff and yardarm shall be fitted with staples, sheaves, and halyards suitable for flying both the United States flag and the USACE flag. Galvanized cleats shall be provided to secure the halyards. The flag mast shall be located on the aft centerline of the floating deckhouse Upper Deck.

Radar antennas shall be mounted on masts that are designed and fabricated for a wind loading. For CLIN 0001, any radar antenna exceeding the maximum air-draft requirement shall be capable of being folded down to meet the height restriction.

### C320 TANKS

#### A. CONTRACT DRAWING

CLIN 0001

557-B130-01, TANK CAPACITY PLAN

CLIN 0002, CLIN 0003 and CLIN 0004

556-B130-01, TANK CAPACITY PLAN

#### B. GENERAL

The towboats contain integral tanks that shall be located in accordance with the contract drawings. The tanks are the ballast tanks, fuel oil tanks, slop oil (waste oil), oily bilge, sewage holding, lube oil, gear oil, hydraulic oil and potable water tanks.

Capacities shall be as stated in Clause C130. Capacity tables shall be created for the tanks in accordance with Clause C130 of the contract.

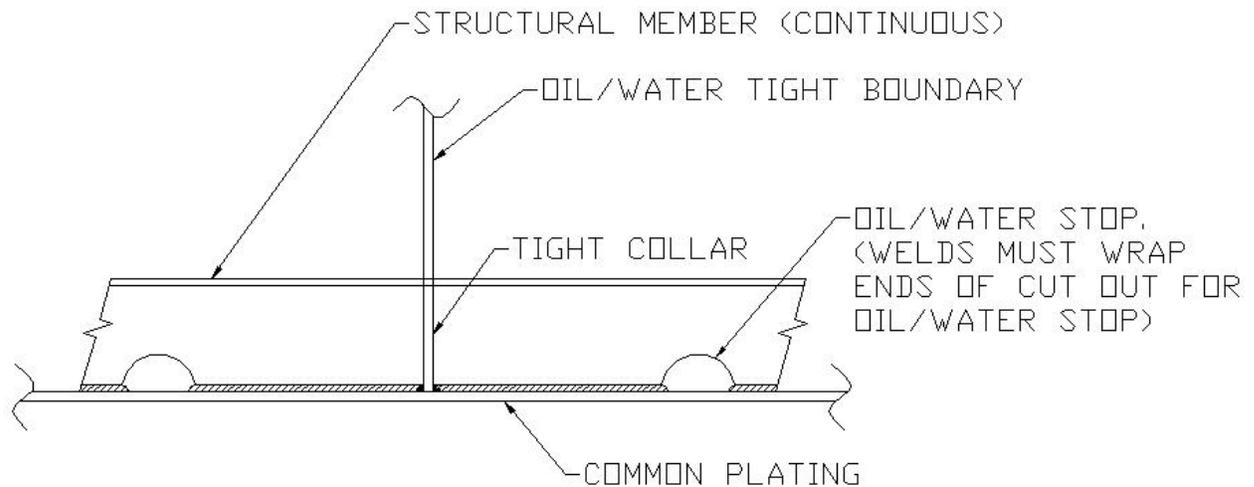
Tanks shall be complete with manholes, access ladders, filling connections, sounding tubes, tank level indicators, drains, vents and all necessary connecting piping, gauges and controls as required by the various clauses of this contract.

All tanks shall be of welded steel construction, except the potable water tanks, which shall be of welded stainless steel construction. The tanks shall be designed and constructed to meet the applicable ABS rules.

Fuel oil storage tanks, forward fuel oil day tank and potable water tanks shall be fitted with double bottoms separating them from the bottom shell. The fuel oil and day tank shall be raised 30-inches above the bottom shell. The potable water tank bottoms shall be a minimum of 24" above the bottom shell and sloped to match the hull form.

The inner bottoms shall be watertight at the watertight transverse compartment bulkheads and accessible through watertight manholes from both ends (refer to Clause C415.G).

The Contractor shall install an oil/water stop for any structure passing through an oil-tight or watertight boundary of an integral tank. The oil/water stop is installed to prevent liquid from transiting from the tank via the structural member passing through the tank and the common plate. The size and location of the oil/water stop shall be acceptable to ABS and shown on the structural and tank drawings. See Sketch #320A for typical oil/stop details.



MDC SKETCH #320A, (TYPICAL OIL/WATER STOP DETAIL)

## C. DESCRIPTION OF WORK

### 1. Ballast Tanks

The ballast tanks shall be located as shown on the contract drawings. However, the Contractor shall re-assess the need for all five tanks upon completion of the potable water tank design. Any ballast tanks deemed unnecessary at that time shall be converted to voids.

The forward ballast tank shall be fitted with a baffle in the fore and aft direction on centerline. The baffle shall be framed with flat bar stiffeners, and shall have 18-inch by 24-inch access openings, limber holes, and vent openings.

Each ballast tank shall be fitted with hatches in accordance with Clause C415 and access ladders in accordance with Clause C427. Vents, sounds, and fills shall be in accordance with Clause C660.

2. Fuel Oil Tanks

The vessels shall be constructed with main fuel oil tanks and fuel oil day tanks in the locations shown on the contract drawings. All fuel oil tanks shall be isolated from the side shell and bottom plating.

The fuel oil tanks' plating and framing shall be designed to ABS scantlings for deep tank bulkheads, tank tops, and bottoms.

The fuel oil tanks shall be fitted with hatches in accordance with Clause C415 and access ladders in accordance with Clause C427. Vents, sounds, and fills shall be in accordance with Clause C630.

3. Slop (Waste) Oil Tank & Oily Bilge Tank

The vessels shall be constructed with a slop (waste) oil tank and an oily bilge tank in the locations shown on the contract drawings. The tanks shall be constructed in the same manner as the main fuel oil tanks.

Each tank shall be fitted with hatches in accordance with Clause C415 and access ladders in accordance with Clause C427. Vents, sounds, and fills shall be in accordance with Clause C637 for the slop (waste) oil tank and in accordance with Clause C660 for the oily bilge tank.

4. Sewage Holding Tanks

The sewage holding tanks shall be located as shown on the contract drawings.

Each tank shall be fitted with hatches in accordance with Clause C415 and access ladders in accordance with Clause C427. Vents, sounds, and fills shall be in accordance with Clause C667.

5. Lube Oil Tank, Gear Oil Tank & Hydraulic Oil Tank

The lube oil tank, gear oil tank, and hydraulic oil tank shall be located as shown on the contract drawings. The tanks shall be constructed isolated from the bottom plating.

Each tank shall be fitted with hatches in accordance with Clause C415. Vents, sounds, and fills shall be in accordance with Clause C635.

6. Potable Water Tanks

The Contractor shall configure and design the potable water tanks at the start of the Engineering Phase of the contract. The tanks shall be located between bulkheads 4 and 15 and shall be clear of the capstan motors extending through the main deck. The total capacity of the potable water tanks shall be at least as much as stated in Clause C130.B. More capacity is preferred.

Welded, 304 stainless steel tanks shall be provided and installed for the potable water. The tank sides and bottom shall be isolated from the side shell and bottom plate of the vessel. The top of the tanks shall be the main deck. All the tank's connections, hatches and fittings shall also be of stainless steel. Structural stiffening interior to the tanks shall be of 304 stainless steel. Exterior stiffeners may be of mild steel if welded in accordance with ABS requirements for stainless steel to mild steel. Insert plates shall be used to tie the top of each stainless steel tank into the main deck.

Each tank shall be fitted with hatches in accordance with Clause C415 and access ladders in accordance with Clause C427. Vents, sounds, and fills shall be in accordance with Clause C665.

C325 SEA CHESTS

A. CONTRACT DRAWINGS

CLIN 0001

557-B245-01, HOLD & MACHINERY ARRANGEMENT

CLIN 0002, CLIN 0003 & CLIN 0004

556-B245-01, HOLD & MACHINERY ARRANGEMENT

B. DESCRIPTION OF WORK

Two sea chests shall be provided as shown on the Contract Drawings. The sea chests shall be sized to provide water to the fire system, and the ballast system.

The sea chests shall be fabricated of plate equal to or greater in thickness than the hull plating to which they are attached.

A removable, ½ inch copper-nickel strainer plate shall be bolted onto the hull opening for each sea chest. The strainer plates shall be secured with stainless steel fasteners and suitable insulated for dissimilar materials. Each strainer plate shall have an open area as required by ABS and shall be flush on the outboard side.

Extra strong pipe couplings shall be welded to each sea chest for attachment of piping. Each sea chest shall be equipped with a 2-inch vent. Provisions shall be made to allow closing of the vent in order to allow blow-down of each sea chest. Blown-down connections shall be installed in each sea chest in accordance with contract Clause C690.

### C326 TRANSDUCER WELLS

#### A. REFERENCE DRAWING

518-D472-01, TRANSDUCER WELL

#### B. DESCRIPTION OF WORK

A transducer well shall be provided and installed for each of the two transducers to be installed for each vessel's depth sounder. The requirements for the depth sounder are in Clause C472.

The above reference drawing is provided for guidance in fabricating and installing the transducer wells. The final well pipe diameters shall be based upon the transducer selected for the depth sounder. The access hatches for each well are listed in contract Clause C415.

Should the transducer wells terminate under the floating deckhouse, provisions shall be made for providing access through the floating deck to allow for removal of each transducer from within the deckhouse.

### C330 FOUNDATIONS

#### A. GENERAL

Suitable foundations shall be provided under all units of machinery, tanks, deck fittings, winches, and other heavy concentrations of weight to properly mount the item, to distribute the loads to the structure, and to avoid undue stresses and vibrations in the hull.

Foundations shall be fabricated from structural steel shapes and plates. Foundation members shall be lightened and openings provided to permit access to all parts of the foundation for inspection, drainage, and maintenance. Web plates of foundations shall be stiffened at holding-down bolts and other points of load concentration.

Bolting surfaces on foundations shall be made coplanar by the use of machined steel shims or poured-in type chocking material. Bolt holes in foundations shall be templated from the unit.

Foundation top flanges/plates shall be level.

All equipment bolted to foundations shall have mounting bolt holes accurately bored (not burned) and reamed to provide a no-slop fit.

The threaded portion of the bolts shall be clear of the foundation or equipment pads, and heavy flat and lock washers used under all nuts. Elastic stop nuts may be substituted for lock washers.

Where dripping of water or oil can be expected, the top plates of foundations shall be tight and project slightly beyond the edges of bedplates or bases of units to be supported. Flat bar shall be seal-welded around the edges of the top plates to retain any leakage of oil or water and quick disconnect fittings provided for drainage.

B. FASTENERS

Unless otherwise specified by the manufacturer, Grade #8 fasteners shall be used for all bolted connections and equipment and machinery holddowns. The threaded portion of bolts shall be clear of the foundation or equipment pads, and heavy flat and lock washers used under all nuts. Elastic stop nuts may be substituted for lock washers.

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**C400 OUTFIT****C406 COATING SYSTEM****A. SURFACE PREPARATION**

Surface preparation for all structural steel shall be in accordance with Steel Structures Painting Council Standards, SSPC-SP10-85 (Near White Metal Blast) throughout. Profile after blasting shall be 1-1/2 to 2-1/2 mils in depth and jagged. All mill scale, weld spatter, dirt, oil, and grease shall be removed.

Immediately upon completion of surface preparation, all steel shall be coated with the coating system described in the following.

Contractor may limit initial coating to base coat only. In this case, or where preconstruction primer is used prior to application of subsequent coats, all steel shall be either water blasted or sand-swept clean (light blast) and any damaged areas repaired prior to application of the remainder of the system. All areas needing repair shall be cleaned to bare metal, spot blasted to restore profile, and re-coated with the base coat.

**B. PAINT REQUIREMENTS**

Paint shall be delivered in sealed containers with labels to indicate manufacturer, contents, and any special instructions. Paints and painting materials shall be stored under cover and protected from extreme temperatures.

Paints shall not be used if they have exceeded the closed shelf life or pot life recommended by the manufacturer. Additionally, paints shall not be applied in weather or humidity conditions not recommended by the manufacturer.

**C. APPLICATION OF COATINGS**

Surface preparation and paint application shall be in strict compliance with the coating manufacturer's recommendations. The Contractor shall take particular care to insure that coating system requirements are met in all areas, especially those difficult to coat, such as flange undersides. All painting on both the interior and exterior surfaces below the main deck shall be accomplished prior to launching of the vessel.

D. COATING SYSTEM

The system is composed of the following coating types:

- self priming epoxy base coat
- abrasion resistant epoxy barrier coat
- fade resistant urethane top coat

A Paint Schedule shall be developed and submitted to MDC during the Engineering Phase of the contract.

E. PRE-QUALIFIED COATINGS

Coating systems from Ameron, BLP Mobile, and International Paint have been pre-qualified for the system above. The Contractor may select any of these systems at his discretion. However, systems may not be “mixed” (i.e. mixing an “a” with a “b” is not acceptable). The specific coating designations to be used are as follows:

- Surface Tolerant Base Coat
  - a. Ameron Amercoat 370
  - b. Amercoat 235 (formerly Devoe Bar Rust 235)
  - c. BLP Mobile MOPOXY-PLUS
  - d. International INTERTUF 262
- Abrasion Resistant Epoxy Barrier Coat
  - a. Ameron Amerlock 400GF
  - b. Amercoat 238 (formerly Devoe Devguard 238)
  - c. BLP Mobile MOPOXY-PLUS FG
  - d. International INTERSHIELD 350
- Fade Resistant Urethane Top Coat
  - a. Ameron Amercoat 450 HS
  - b. Amercoat 369 (formerly Devoe Devthane 369)
  - c. BLP Mobile MOTHANE HS-900
  - d. International INTERTHANE 990 HS

F. NUMBER OF COATS

The number of coats is not specified. The Contractor is required to provide the number of coats necessary to attain the DFT thicknesses required in the schedule below. Thickness applied per coat may not exceed the manufacturer’s recommended maximum thickness. Each coat shall be listed in the Paint Schedule.

G. COATING “TYPE” AND DFT SCHEDULE

All areas of the each vessel shall be coated in accordance with the following schedule:

1. Hull Exterior (below the main deck)

All steel surfaces shall be coated with base coat at 8 mils DFT minimum.

All surfaces shall be overcoated (over the base coat) with barrier coat at 12 mils DFT minimum (not including base coat).

Exterior surfaces of rudders and the interior of each sea chest shall be coated in the same manner as the hull exterior. The interior surfaces of the rudders shall not be coated.

Lettering and numerals on the hull exterior shall be overcoated (over the barrier coat) with top coat at 2 mils DFT minimum.

The base coat and the barrier coat shall both be the same color.

2. Main Deck and Top of the Towknees

All steel surfaces shall be coated with a base coat at 8 mils DFT minimum.

All surfaces shall be overcoated (over the base coat) with barrier coat at 12 mils DFT minimum ( not including the base coat).

Non-skid garnet additive shall be added to the barrier coat.

Deck area shall be overcoated (over the barrier coat and non-skid garnet) with top coat at 4 mils DFT minimum.

3. Deck Fittings

All deck fittings shall receive a base coat at 5 mils DFT minimum and be overcoated (over the base coat) with a barrier coat at 5 mils DFT minimum. A top coat at 2 mils DFT minimum shall overcoat the barrier coat.

4. Hull Interior and Deckhouse Spring Void

Steel surfaces within the hull include the ballast tanks, voids, sewage holding tanks, oily bilge tank, forward storage space, machinery

rooms, shaft alley and deckhouse spring void. The interior of the towknees, interior of spill containments and exterior of sea chests shall also be considered hull interior for coating purposes.

All steel surfaces within the hull, with the exception of the interior of fuel tanks, lube and gear oil tanks, slop (waste oil) tank, and potable water tanks, shall be coated with base coat at 8 mils DFT minimum.

5. Fuel Oil Tanks, Slop (Waste Oil) Tank, Lube & Gear Oil Tanks

The interior surfaces of these tanks shall be maintained with a coat of mineral oil applied immediately following the surface preparation.

The exterior surface of these tanks shall be coated the same as the hull interior except those tank exteriors which are the interior of others of these tanks.

6. Hydraulic Oil Tank

The interior surface of the hydraulic oil tank shall be maintained with a coat of hydraulic oil applied immediately following surface preparation.

The exterior surface of the tank shall be coated the same at the hull interior.

7. Potable Water Tanks

Potable water tanks are stainless steel and shall not be coated.

8. Exterior Decks (Above the Main Deck)

The following exterior surfaces are considered exterior decks and shall be painted accordingly: upper deck, Texas deck (CLIN 0002, CLIN 0003 and CLIN 0004), aft deck of the electric plenum (CLIN 0002, CLIN 0003 and CLIN 0004), pilothouse deck and pilothouse top.

All steel surfaces shall be coated with base coat at 12 mils DFT minimum.

Non-skid garnet additive shall be added to the last base coat.

Deck areas shall be overcoated (over the base coat and non-skid garnet) with top coat at 4 mils DFT minimum.

9. Exterior Deckhouse, Towknee, and Stack Exterior and Railings

The deckhouse, towknee and stack exteriors and the hand railings shall be coated with a base coat at 8 mils DFT minimum.

All steel surfaces shall be overcoated (over the base coat) with a top coat at 4 mils DFT minimum.

10. Interior Deckhouse

All steel deckhouse interior shall be coated with a base coat at 8 mils DFT minimum.

11. Interior Decks

Interior decks not receiving a deck covering (Clause C430) shall be coated with a base coat at 8 mils DFT minimum.

These decks shall be overcoated (over the base coat) with a top coat at 2 mils DFT minimum.

H. COATING COLOR SCHEDULE

Colors shall conform to Federal Standard 595a(3) Colors Identification Numbers. Color chips (3" x 5") may be produced from the General Services Administration/Specifications Section as follows:

GSA/FSS/Specification Section  
470 L'Enfant Plaza East SW, Suite 8100  
Washington, DC 20407

Phone: (202) 619-8925  
FAX: (202) 619-8978

The coloring schedule shall be as follows:

<u>AREA</u>	<u>COLOR/FS595 NUMBER</u>
• Hull Exterior	Black/17038
• Deckhouse Exterior	Old Ivory/17855
• Exterior Deck Coaming	Deck Red/17855
• Main Deck	Deck Red/10076
• Exterior Decks (Above Main Dk.)	Lt. Grey/16515
• Pilothouse Top	Lt. Grey/16515
• Housetop	Deck Red/10076
• Hull Interior	Grey/16473
• Tanks & Voids	Grey/16473
• Upper Machinery Space	Grey/16473

- Generator & Steering Gear Rooms Grey/16473
- Deckhouse Interiors White/27880
- Interior Decks Grey/16473
- Deckhouse Spring Void Lt. Grey/16515
- Towknee Exterior Black/17038
- Towknee Interior Lt. Grey/16515
- Stacks Black/17038
- Stack Band (behind Castle) Red/11136
- Communications Mark Base Plate Red/11136
- Stack Trim Bands (T/B Castle) Silver/17178
- Deck Fittings Yellow/13655
- Masts Old Ivory/17855
- Hull Markings White/27880
- Handrails & Stair Rails Black/17038
- Signature Black/17038
- Name Board Letters Gold/23594
- Name Board Background Blue/25102

On deck areas, both under coat (barrier coat for hull and base coat for deck other than hull) and topcoat shall be the same color.

On exterior hull areas, both the base coat and the barrier coat shall be the same color.

All top coating shall be thick enough to provide complete opaque color coverage. Thickness increased over the DFT minimums required above shall be provided if required for opaque color coverage.

All items of machinery and equipment shall be painted with the individual manufacturer's standard colors. Painted surfaces damaged in handling and installing the equipment shall be repainted.

All unpainted machinery items having black cast or carbon steel surfaces shall be given a prime coat and finish coat of gray machinery enamel.

#### I. FINAL INSPECTION OF PAINTING

The Contractor is responsible for delivering the vessels with all painted surfaces in sound condition, and in accordance with this specification.

Prior to launching of the vessels, all interior and exterior painting shall be thoroughly inspected. If there are any defects or damage in the coating of either vessel, the Contractor shall, as necessary, repair the coating to restore the integrity of the paint system, and to meet the requirements of this specification. All damage shall be cleaned

to bare metal, spot blasted to restore profile, and re-coated with the entire system schedule.

Each vessel shall not be launched until:

- The painting warranty and documentation as required in paragraph I above has been provided to MDC. The warranty and documentation must show compliance with this specification in all areas, and all readings taken.
- The painting has been inspected by an MDC representative. Contractor must provide warranty and documentation prior to MDC inspection.

If outfitting is required after launching, all interior and exterior painting shall be re-inspected prior to Provisional Acceptance, and any damaged areas of the coating shall be repaired by the Contractor as necessary to restore the integrity of the paint system.

Any additional painting required as a result of the Final Inspection shall be done as required to meet this specification at no additional cost to the Government.

#### J. DOCUMENTATION AND WARRANTY

##### 1. Documentation

For each vessel, the Contractor shall provide a written signed statement from the paint manufacturer certifying that all coating application and surface preparation are in accordance with the coating system manufacturer's requirements, and that the coating application meet all requirements in this specification.

The Contractor shall provide documentation logs for each coating applied. The logs shall include the following parameters:

- a. Coating (per specification) type.
- b. Coating manufacturer's requirements for preparation, environmental conditions and application.
- c. Date and time of preparation and application.
- d. Extent and location of area coated.
- e. Surface: preparation, condition at time of coating, temperature at time of coating, dew point at time of coating.
- f. DFT measurements for each applied coating type. Measurements shall be taken as follows:

- all flat surfaces, one reading per every 200 square feet, uniformly distributed.
- undersides of all flanges, one reading per every 50 linear feet of flange, uniformly distributed.
- all free standing structural members, i.e. stanchions, truss diagonals, etc., one reading per 50 linear feet of length each surface, but a minimum of two readings per surface.

Wet film measurements may be taken and converted to DFT as an alternative to direct DFT. In areas where multiple coating types are required, the above DFT requirements are applied to each coating type.

g. Services provided by paint manufacturer's representative (i.e. DFT readings, dew point, etc.), if present during application.

h. Signature of paint manufacturer's representative on site, if present.

## 2. Warranty

For each vessel, the Contractor shall warranty the coating system for one calendar year, commencing at final acceptance. The Contractor shall repair any coating failures during this time period at his cost.

## K. SAFETY AND HEALTH STANDARDS

The U.S. Occupational Safety and Health Administration Regulations(OSHA) for shipyard employees engaged in surface preparation and coatings application shall be in accordance with the OSHA regulations stated in 29 CFR, subpart C.

These regulations require the Contractor to have access to a "competent person" to test compartment atmosphere quality. The "competent person" shall be in accordance with OSHA regulations, stated in 29 CFR, subpart A, 1915.7.

The regulations also require that frequent testing of the atmosphere shall be made in compartments being coated or preserved (or prepared for coating or preservation) by paints and coatings dissolved in highly volatile, toxic and flammable solvents (29 CFR, subpart C, 1915.35(b)), to ensure the atmosphere is not hazardous.

Each compartment inspection and test shall be logged on OSHA Form 74, with instructions on how to maintain a safe atmosphere in these spaces until the completion of the contract.

On 24-hours notice of any Government inspection, and before any representative of the U.S. Government boards the vessel for inspection, each enclosed or confined space to be inspected shall be labeled "Safe for Workers" in accordance with the OSHA regulations stated in 29 CFR 1915.31-36. The initial certificate shall be issued by a National Fire Protection Association (NFPA) certified Marine Chemist. A competent person may re-certify daily provided that the conditions have been maintained.

This means that in all spaces so designated:

- The oxygen content of the atmosphere is at least 19.5 percent and below 22 percent by volume;
- The concentration of flammable vapors is below 10 percent of the lower explosive limit (LEL);
- Any toxic materials in the atmosphere are within permissible concentrations;
- Any residues or materials associated with any work in the space will not produce uncontrolled release of toxic materials under existing atmospheric conditions while maintained as directed.

The Contractor shall notify the Government when this certificate has been issued for each compartment and tank. The vessel will not be inspected and accepted by the Government without a NFPA Marine Chemist certificate for each compartment designated "Safe for Workers."

#### C410 HULL OUTFIT

##### A. DRAWINGS

###### CLIN 0001

Contract Drawing #557-B105-01, LINES PLAN

Contract Drawing #557-B215-01, GENERAL ARRANGEMENT

Contract Drawing #557-B301-02, INBOARD PROFILE

## CLIN 0002, CLIN 0003 &amp; CLIN 0004

Contract Drawing #556-B105-01, LINES PLAN

Contract Drawing #556-B215-01, GENERAL ARRANGEMENT

Contract Drawing #556-B301-02, INBOARD PROFILE

Reference Drawing #518-D410-02, RUBBER FENDERING

A. TOWKNEES

Two towknees with steps leading up their aft sides to the towknee top shall be provided and installed at the bow as shown on the Contract Drawings. The outboard edge of each towknee shall be 26' from the opposite side at midship. The towknees shall be designed and installed integral with the hull structure and shall not extend forward of the headlog.

Each towknee shall be faced with replaceable hard rubber pads (similar to Trellex Morse part number E42010 or E42034) securely bonded to 1/2" steel plate. The towknees shall be width shall be as shown on the contract drawings.

The towknees shall include interior storage space at the main deck level. The space shall be made watertight and fitted with a watertight, hinged door similar to CEN-TEX, drawing No.100 on the inboard side of each towknee.

On the outboard side of each towknee, two 6-inch half-button chocks shall be installed in order to hang face wires. The mounting locations of the half-buttons above the deck shall be determined during the construction phase.

The towknees shall be fitted with railings along the steps in accordance with Clause C425, grab rails on the outboard sides in accordance with Clause C425, and vertical bar rungs on their inboard side in accordance with Clause C427.

B. RUB RAILS

Two rub rails shall be provided and installed on the sides and across the stern of each vessel. The lower rail shall be just above the designed full load waterline. The upper rail shall be half way from the lower rail to the deck edge.

The bow corners shall have rounded towknee type strips similar to Trellex Morse E42049. Effort shall be made to align the side shell rub rails with the forward corner rub rails. The aft corners shall be protected with single layer laminated stern fenders similar to those produced by the Schuyler Rubber Company.

Two tiers of towknee bumpers similar to those applied to the face of the towknees shall be welded to the headlog between the towknees.

Pittsburgh District Towboat (CLIN 0001)

The Contractor shall provide and install 8-inch extra heavy steel half pipe. The pipe shall be tapered with welded caps at its ends. The half-pipe shall be continuously welded to 10" x 1" steel plate with chamfered edges (1/2" on each facing edge at 45 degrees) which shall be continuously welded to the shell.

Huntington District Towboat (CLIN 0002), St. Paul District Towboat (CLIN 0003) & Rock Island District Towboat (CLIN 0004)

The Contractor shall provide and install two rows of rubber "D" type bumpers approximately 8" deep by 8" wide with 3" bore similar to Trellex Morse "D" SHAPE - "O" BORE EXTRUSION F9-5000 along each side of the hull and across the stern. The top of the top rail shall be positioned 3" below the deck edge. Installation of the D-rails shall be in accordance with the Referenced Drawing.

C. SPLASH PLATE

There shall be no splash plates on any vessel. However, CLIN 0001 shall have installed a vertical channel welded on the inboard side of each towknee at the headlog to accommodate timbers for possible future use as a slash plate. Timbers 2" thick shall be assumed for sizing the channel.

D. H-BITTS

A single H-bitt constructed of steel pipe shall be provided and installed on the Main Deck 5' aft of the bow on the centerline.

The bitt shall be constructed of 10 inch schedule 40 steel pipe verticals (spaced 24" center-to-center), with a 5 inch schedule 40 steel pipe cross bar (centered 9" below the top of the vertical pipe). The bitt shall be 24 inches high (overall above the deck) by 54 inches in width. The pipe ends shall be sealed.

The vertical members of the bitt shall extend continuously through the main deck and down to the bottom shell and shall be bracketed and integrated into the hull structure. The bitt shall pass through an insert plate in the main deck and land on an insert plate in the bottom plating. The insert plate shall be at least 1/8-inch thicker than the surrounding plate.

E. CHAFING BAR

A chafing bar shall be installed along the bow deck edge. The bar shall consist of a 1" diameter stainless steel round bar continuously welded to the deck edge from Frame #31 forward to the towknee and continue 30" up the towknee forward outboard edge.

F. ROPE GUARD

A guard shall be provided at the outboard forward floating deckhouse corners. A rounded steel plate with a rounded corner edge shall be installed vertically at the corner. The plate shall be constructed of stainless steel for CLIN 0001 and mild steel for CLIN 0002, CLIN 0003, and CLIN 0004. This plate shall extend from the main deck up 30 inches and be fully supported structurally to withstand a 1" wire rope running against it from any deck equipment. The plate shall be of welded construction and not interfere with the movement of the floating deckhouse.

C415 DOORS, WINDOWS, HATCHES AND MANHOLESA. CONTRACT DRAWINGS

## CLIN 0001

557-B205-01, OUTBOARD PROFILE  
557-B215-01, GENERAL ARRANGEMENT  
557-B233-01, PILOTHOUSE DETAILS  
557-B245-01, HOLD & MACHINERY ARRANGEMENT

## CLIN 0002, CLIN 0003 &amp; CLIN 0004

556-B205-01, OUTBOARD PROFILE  
556-B215-01, GENERAL ARRANGEMENT  
556-B233-01, PILOTHOUSE DETAILS  
556-B245-01, HOLD & MACHINERY ARRANGEMENT

B. GENERAL

Doors, windows, hatches and manholes shall generally be located as shown on the contract drawings.

All door, window, hatch, and manhole openings shall be provided with headers and framing as necessary to transfer the hull and local structural stresses around the openings. The headers shall be shown on the structural drawings. The structural requirements are in Section C300.

C. DOORS

All doors shall be equipped with handles inside and outside and a door stop. All hardware shall be stainless steel. All doors shall be 6'-8" high (unless noted otherwise). Frames shall be provided for each door appropriate to the service intended.

1. Exterior Doors

All exterior doors shall be sized with swing as noted on the Contract Drawings. The doors (except the plenum/electronics space of CLIN 0002, CLIN 0003 & CLIN 0004) shall be weathertight, stainless steel, solid core, spring-loaded rubber seals, and piano hinged similar to the OMEGA Products Inc. standard door. The doors shall be completely seal welded at the top to prevent rain entering inside the core and corroding the door from the inside out. All main deck doors without stairs shall have a minimum 6-inch sill, however the sill shall be sized in accordance with Clause C155.A. All other exterior doors shall have 2-inch sills. Doors not located under the roof overhang shall have a flat bar or other device to shield the top of the door from rainwater. The doors shall be fitted with wire mesh safety glass (minimum 18" x 24"), except the pilothouse doors shall have 18" x 36" fixed lights set 42" above the deck. All exterior doors shall be fitted with automatic closures except the double doors and the door into the electronics/plenum space (CLIN 0002, CLIN 0003 & CLIN 0004). Door handles shall be lever type opening downward.

The door to the electronics/plenum half-space (CLIN 0002, CLIN 0003 & CLIN 0004) shall be 36" wide x 42" high, hinged to open into the space. The door shall be fitted with a 12" x 12" fixed wired safety glass and a 2" sill shall be provided. The door shall be double panel, hollow steel (steel to be a minimum of 16 gauge) fitted with a minimum of three hinges and intended for marine weathertight service. This door shall have lock and hardware the same as all other exterior doors.

2. Watertight Doors

The lower engine room shall be accessible to the shaft alley and the forward machinery space through steel, quick acting sliding dog type, 6-dogged, watertight doors. These doors shall meet ABS requirements to preserve the tightness of the adjacent bulkhead and shall be certified by ABS. The clear opening of these doors shall be no less than 28" x 60" with 6 inch radius corners. The bottom of each door shall be 6" above the floor plates on either side of the opening. Each door shall be fitted with a door alarm as required by contract Clause C692.

3. Fume Tight Doors

Fume tight doors shall be fitted at the exits from the upper machinery space to the floating deckhouse (one each side of the void), generator room and engineer's workshop; from the steering gear room forward within the deckhouse; at each stairwell landing; at each plenum closet; and the three doors surrounding the stairwell at the upper deck (CLIN 0001). Swing and sizes shall be as shown on the Contract Drawings.

Fume tight doors shall be fitted with a minimum of three hinges, automatic closures, and the door handles shall be the lever type opening downward. Each fume tight door shall be fitted with a 12" x 12" wired safety light. Sills shall be sized to suit manufacturer's recommendations but shall not be less than 2".

Fume tight doors adjacent to machinery spaces shall be fire rated.

No fume tight door shall be fitted with any type of lock.

4. Interior Doors

Each interior door shall be double panel, hollow steel (steel to be a minimum of 16 gauge) fitted with a minimum of three hinges and intended for marine use. All doors shall be standard 6'-8" high with width and swing as shown on the Contract Drawings. Door handles shall be knob type. Sills shall be as necessary to fit doors in accordance with manufacturer's recommendations or as noted herein.

Each toilet space door shall be fitted with louvered bottom. A 2" sill shall be provided at each toilet space door.

5. Locks and Keys

All locks shall have interchangeable cores, designed as a system and procured from a single manufacturer. The lock system shall be designed on a "grand master" and "master" basis similar to that of the Best Lock Corporation. The grand master shall open all locks on the vessel. The "grand master" key of one vessel shall not provide access to any other vessel under this contract.

All exterior doors shall be fitted with mortise cylinder locks (common key) with latch bolt and dead bolt. The dead bolt shall operate by key from both sides.

For privacy, the toilet space doors shall be fitted with provisions for latching the door from the inside of the space. This latch shall be releasable from the outside in an emergency.

Stateroom, pantry, stairwell closets, and office doors shall be fitted with locks and keyed differently. Each lock shall be a mortise cylinder lock with a dead bolt. The dead bolt shall operate by key from the outside and latch from the inside. Additionally, the staterooms shall have suitable privacy latches (not slip bolts) matching the deadbolt hardware and operable from the inside.

Personnel lockers and drawers within staterooms shall be provided with locks to secure each crewpersons personal effects. Each locker and drawer set shall be keyed alike. Each "set" shall be keyed differently.

A lock shall also be provided for the storage room within the office (CLIN 0001). This lock shall be a mortise cylinder lock with a dead bolt. The dead bolt shall operate by key from the outside and latch from the inside.

The door separating the deck storage room from the rest of the floating deckhouse shall be fitted with a mortise cylinder lock with latch bolt and dead bolt. The dead bolt shall operate by key from both sides.

One each vessel, six “grand master” keys shall be provided to open all doors.

Master keys shall be provided as follows:

- Machinery spaces, plenum closets and the electronics/plenum space (CLIN 0002, CLIN 0003 & CLIN 0004) - all doors associated with the upper machinery space, engineer’s workshop, steering gear room, plenum closets on each deck, deck storage room, and the electronic/plenum room (CLIN 0002, CLIN 0003 & CLIN 0004).
- Galley - all doors associated with the galley, pantry, stairwell closets, and laundry (CLIN 0002, CLIN 0003 & CLIN 0004).
- Staterooms - all doors associated with staterooms, except the personnel lockers.
- Personnel Lockers and Drawers - all lockers and drawers within staterooms.

Two keys shall be furnished for each lock and 10 blank keys of each type fitted. Two “grand master” keys and two of each “master” key shall be provided. All keys shall be tagged with brass tags and numbered.

A locking wall mounted key cabinet shall be located in the office. This cabinet shall be large enough to store keys for each space, plus each master and the grand master on separate hooks.

#### D. WINDOWS

All windows shall be 1/4-inch thick safety glass. All windows shall be of the same manufacturer to provide consistent styling, function and ease of repair. All windows shall be supplied with radius corners.

The glass shall be set in neoprene glazing with extruded aluminum frames, which are clipped or bolted into the deckhouse structure in accordance with the manufacturer's recommendations.

Except the center forward pilothouse window, aluminum framed insect screens with stainless steel mesh shall be provided for all opening windows. Screens shall be fitted into a track incorporated into the window frame.

##### 1. Aft Deckhouse & Floating Deckhouse

All deckhouse windows, except the pilothouse, shall have medium tint. Windows shall be generally located as shown on the Contract Drawings. Windows shall be of the horizontal sliding type with the aft panel opening. Mini-blinds shall be provided and installed on all deckhouse windows except the pilothouse. General sizing for all windows shall be 30" wide by 24" high.

##### 2. Pilothouse

The pilothouse shall have windows all around for maximum visibility. The windows shall have radius corners and shall be of clear glass. The forward and aft windows shall slope inward at their base to prevent glare. The front center windows shall be three across. The center forward window shall open inward and hinge up with a latch to secure it in the open position to the overhead. All other pilothouse windows shall be fixed. Mullions between pilothouse windows shall be minimum width possible to reduce visibility obstruction. The tops of the windows shall be 6' - 6" above the deck with a minimum projected height of 36".

Independently operated windshield wipers shall be supplied and installed for the pilothouse windows as follows:

- Forward, centerline, and port and starboard corner windows shall be fitted with a single blade, straight-line window wiper similar to a WYNN, Type "C." The wipers shall be sized to cover as much window area as possible without the blades touching the mullions. A two speed AC motor (radio suppressed) shall be supplied for each wiper. Each wiper unit shall come with a park sensor.

- The forward, port and starboard windows and the aft centerline window shall each be fitted with a single blade pendulum type wiper similar to a WYNN, type 1602S, standard duty wiper. Each wiper shall be sized to cover as much window area as possible without the blades touching the mullions. A single speed AC motor (radio suppressed) shall be supplied for each wiper.

An electric fan for defrosting the windows shall be mounted at the five forward-most windows and at the aft center window. The fans shall be adjustable, low speed, with steel fan guards.

The wiper and fan controls shall be mounted on or in the console within comfortable reach of the operator. The position of the controls shall be determined during the construction phase.

The pilothouse windows shall all have see-through dark smoke colored shades, mounted on clutch spring-less rollers.

### 3. Engineer's Workshop Window

The window between the engineer's workshop and the upper machinery space shall be a fire rated window. The window shall be approximately 36" wide x 24" high and fixed.

### E. STORAGE HATCH

A 36" x 36" square clear opening watertight ABS grade hatch with a 6-inch coaming shall be installed on the main deck forward of the floating deckhouse to provide access to the forward storage space in the hull. The hatch shall have a spring balanced cover similar to CEN-TEX Marine, drawing No. 214.

F. EMERGENCY ESCAPE HATCHES

An emergency, flush, steel, hinged, ABS grade watertight hatch with a 20-inch clear opening (similar to CEN-TEX Marine Drawing No. 401) shall be fitted in the main deck outboard of the deckhouse in way of the forward machinery space and shaft alley. Each emergency hatch shall have a stainless steel "T" type handle and round bar shaft with an escape wheel type handle attached to the underside of the hatch.

G. MANHOLES

The manholes in the main deck shall be located generally as shown on the Contract Drawings.

Each hull compartment having access through the main deck shall be fitted with 24 inch manholes. These manholes shall be ABS grade aluminum cover with steel ring, flush, round, and watertight similar to FREEMAN Flush Watertight Hatch Model 24AMSR. A 5/16" galvanized steel chain shall be attached to the hatch cover and the under side of the deck to secure the cover from loss when open. Care shall be taken to isolate the steel chain from the aluminum cover.

Clean-out manholes shall be provided and installed in all oil tanks. The hatches shall be raised, bolted, oil tight hatches similar to NABRICO model DF-154-18, with a clear opening of 18". The hatches shall be located on the side of the tank where there is room for access to the tank interior. Each hatch shall be supplied with gaskets suitable for the respective oil service of that tank.

Fuel oil storage and day tanks shall be accessed through oil tight, raised, bolted plate manholes similar to CEN-TEX drawing No.302. these oblong hatches shall have a clear opening of 15" x 23". Each hatch shall be supplied with gaskets suitable for fuel oil service. The hatches shall be located on the sides, toward the top of the tank where there is room for access to the tank interior. The fuel oil storage tanks and forward day tank shall be fitted with two such manholes arranged at opposite ends of the tank.

Each potable water tank shall be accessed through a raised, bolted plate, watertight clean-out hatch. The hatches shall be fabricated of the same material as the tank bulkhead plating. The hatches shall be square, with 18" x 18" clear opening. The hatches shall be located on the side near the top of the tanks where there is room for access to the tank interior. On the opposite diagonal end of each potable water tank a raised, bolted plate, watertight clean-out hatch 12" x 12" clear opening shall be installed to assist in cleaning and gas freeing each potable water tank. The hatches shall be fabricated of the same material as the tanks.

All hatches for the potable water tanks shall be outfitted with gaskets meeting the requirements of USPHS/FDA for potable water service.

#### H. TRANSDUCER WELL HATCHES

A bolted hatch similar to BAYWOOD model B-189 shall be provided and installed at the main deck for each transducer well (refer to Clause C326).

### C420 DECK FITTINGS

#### A. CONTRACT DRAWINGS

CLIN 0001

557-B215-01, GENERAL ARRANGEMENT

CLIN 0002, CLIN 0003 & CLIN 0004

556-B215-01, GENERAL ARRANGEMENT

#### B. KEVELS

Kevels shall generally be located as shown on the Contract Drawings. Kevels shall be 36-inch cast steel of the open type with smooth formed openings similar to NABRICO DF-482. Kevels with plate edges in openings are not acceptable. Kevels shall be continuously welded to deck insert plates that are at least 1/8-inch thicker than the surrounding deck plate.

C. ROLLER BUTTON CHOCKS

Roller button chocks shall be provided and installed as shown on the Contract Drawings. CLIN 0001 shall be equipped with 8 - roller button chocks, four port and four starboard in the foredeck area. CLIN 0002, CLIN 0003 and CLIN 0004 shall be equipped with 6 - roller button chocks, three port and three starboard in the foredeck area.

Roller button chocks shall be 15-inch roller type similar to BLACKBURN model RB-100 for use with 1" diameter wire rope.

The roller chocks shall be mounted on foundations that angle the rope payout upward for use with floating plant and docks whose fittings are higher than the deck of this vessel. The foundations shall be welded to deck insert plates that are at least 1/8 inch thicker than the surrounding deck plate and supported under the main deck with headers and brackets as necessary to assure the load will be transferred to the main hull structure.

D. BUTTON CHOCKS

Fixed button chocks shall be provided and installed as shown on the Contract Drawings. The chocks shall be single 10-inch cast steel button chock, similar to NABRICO DF-185. Button chocks shall be located on top of each towknee and at each deck corner for a total of six chocks per vessel.

The button chocks shall be welded to deck insert plates that are at least 1/8 inch thicker than the surrounding deck plate and supported below the deck or towknee top plate with headers and brackets as necessary to assure the line loading will be transferred to the main hull structure.

C425 WALKWAYS, RAILINGS, GRATINGS AND FLOOR PLATES

A. DRAWINGS

CLIN 0001

Contract Drawing #557-B205-01, OUTBOARD PROFILE  
 Contract Drawing #557-B215-01, GENERAL ARRANGEMENT  
 Contract Drawing #557-B233-01, PILOTHOUSE ARRANGEMENT  
 Contract Drawing #557-B245-01, HOLD & MACHINERY  
 ARRANGEMENT  
 Contract Drawing #557-B301-01, INBOARD PROFILE  
 Reference Drawing #577-D425-01, HANDRAILS, GRATINGS &  
 WALKWAYS

## CLIN 0002, CLIN 0003 &amp; CLIN 0004

Contract Drawing #556-B205-01, OUTBOARD PROFILE

Contract Drawing #556-B215-01, GENERAL ARRANGEMENT

Contract Drawing #556-B233-01, PILOTHOUSE ARRANGEMENT

Contract Drawing #556-B245-01, HOLD & MACHINERY  
ARRANGEMENT

Contract Drawing #556-B301-01, INBOARD PROFILE

Reference Drawing #577-D425-01, HANDRAILS, GRATINGS &  
WALKWAYSB. WALKWAYS

A minimum 33-inch clear walkway (clear of handrails and grab rails) shall be provided along each side of each level of the deckhouse above the main deck as shown on the Contract Drawings. The walkway shall be extended around the forward side of the deckhouse extending from side to side at each level. Each deck at each side shall have a 3-foot length of walkway (measured longitudinally) extend to the vessel side for access to other vessels and marine structures. The walkway at the forward side of the pilothouse deck (CLIN 0001), in way of the center front three windows, and forward side of the electronics/plenum deck (CLIN 0002, CLIN 0003 & CLIN 0004) shall be constructed of an open type grating as described elsewhere in this Clause.

The walkway along side the deckhouse at the main deck shall be no less than 30-inches clear walkway (clear of grab rails and handrails) inboard of the kevels.

Walkways above the main deck shall be constructed of welded steel. The outer edge of the walkway shall have a flat bar coaming extending 2 inches above the walkway plate to trap rain water. A similar coaming shall be installed at all ladder openings and all other openings in the walkway.

C. RAILINGS1. Main Deck

Provide and install grab rails around the entire deckhouse. The grab rails shall be 1-1/2 inch mild steel square tubing with 3/16" wall thickness supported every 6 feet and positioned 34 inches above the deck. The clearance between the grab rail and the bulkhead shall be 3 inches. Grab rails shall also be provided on the outboard side of each towknee.

A suspended swing-away chain rail shall be installed outboard of the main deck deckhouse, port and starboard from Frame 13 to Frame 60. Reference Drawing 577-D425-01 is provided for guidance.

The 1/4-inch stainless steel vertical chains shall be located on approximately 6-foot centers, attached at the top to swing arms, and at the deck to tension springs and quick release hooks. Each hook shall clip to padeye welded to the deck. Each swing arm shall extend outward to permit clear passage for a 6-foot person. The verticals shall be positioned in order to not interfere with the deck fittings.

The 3/16-inch stainless steel horizontal chain railings shall pass through rings on the verticals and shall be fastened at both ends with safety snap hooks. The railing shall be 42 inches high and shall have a second course 20" above the deck.

A single portable 3/16-inch stainless steel safety chain shall be installed from the upper forward horizontal tier of the chain rail system forward to the aft outboard edge of the towknee and between each towing knee at the headlog. Each end of each chain shall be secured with a safety snap hook. Steel staples shall be welded to the towknee to secure the chain 42" above the deck. An additional staple shall be welded to the corner of the deckhouse to provide alternate method of support if the swing-away chain railing is removed. A single removable stanchion shall be provided between the kevel and the first roller chock near the deck edge to support the forward deck safety chain rail. The chain shall pass through a steel staple welded to the stanchion. The stanchion shall be temporarily connected to the main deck by way of a socket in the main deck. The socket shall be of stainless steel and have walls as thick as the surrounding deck plate. The socket shall be provided with a plug for use when the stanchion is not in use.

Provide and install a portable two-tier chain handrail across the transom extending forward to the swing-away chain rail, port and starboard. The portable stanchions shall be 1-1/2 inch square tube with 3/16" wall thickness set on 6-inch high square tube stubs, which are welded to the deck, spaced 4 to 6 feet apart. The stubs shall be fitted with drain holes to prevent build up of water inside. The stanchions shall be pinned to the stubs with 3/8-inch diameter stainless steel hex head bolts with nylock nuts. Each stanchion shall be equipped with two lengths of 3/16-inch stainless steel chain fitted with welded staples to one side of the post. The other end of the chains shall be fitted with snap hooks to engage staples on the next stanchion. Chain heights at the stanchions shall be 20 inches and 42 inches above the main deck.

2. Towknees

The Contractor shall provide and install handrails on both sides of the steps leading up the aft side of each towknee. The handrails shall be 1-1/2 welded mild steel square tube with 3/16" thick wall in two tiers with vertical stanchions approximately every 5 feet measured horizontally. The top tier shall be 34 inches measured vertical above the step toe. The lower tier shall be 15 inches measured vertically.

The railings on the top of the towknees shall be of similar height and construction as the handrails described for the upper deck.

Grab rails similar to those around the main deck deckhouse shall be fitted to the outboard sides of the towknees.

3. Main Deck Interior

The Contractor shall provide and install a two tier square tube railing system around the openings in the main deck between the upper machinery space and the lower engine room.

The railings and stanchions shall be 1-1/2 inch mild steel square tube with 3/16" wall thickness. The top railing shall be 42 inches above the deck and the second tier shall be 20 inches above the deck. The stanchions shall be located at frames and spaced no more than 6 feet apart. The railings around the engine cutouts shall be removable to allow for ease of removal of the main engines.

4. Upper Deck

Wherever a 42" high fashion plate bulwark is not present, provide a stationary square tube railing around the perimeter of the deck. Where openings are required for ladders and side egress walkway extensions, the opening shall be no wider than the ladder or ramp. The top railing shall be 1-1/2 inch mild steel square tube with 3/16" wall thickness, 42 inches above the deck. An intermediate rail of 1-1/2 inch mild steel square tube with 3/16" wall thickness shall be positioned 20 inches above the deck. The railings shall be set on 1-1/2 inch mild steel square tube with 3/16" wall thickness stanchions located over deck support structure and spaced no more than 5 feet apart. Provide a length of 1/4-inch stainless steel chain with end snap hooks and staples welded to the stanchions at each tier in way of openings.

5. Texas Deck and Electronic/Plenum Deck (CLIN 0002, CLIN 0003 & CLIN 0004 only)

Provide and install a square tube railing around the perimeter of the Texas Deck and the electronics/plenum half-deck similar to the Upper Deck.

6. Pilothouse Deck

Provide and install a square tube railing around the perimeter of the pilothouse deck similar to the Upper Deck.

7. Pilothouse Top

Provide and install a single 1-1/2 inch mild steel square tube grab rail around the perimeter of the pilothouse top 3-inches above the Pilothouse Top Deck. If the air draft height restriction of CLIN 0001 does not permit a permanent grab rail, the grab rail shall be omitted on that vessel.

D. GRATINGS

Grating supplied and installed shall be of the hot dip galvanized bar type, non-skid of about 3/16 inch x 1 inch flat bars on 1 inch centers and shall be designed to support a load of 100 lbs. per square foot. Deflection under fully loaded conditions shall not exceed .01 times the span.

Gratings shall be accurately fabricated and free from paint, warp, twist, or other defects affecting their appearance or serviceability. Grating shall be cut and banded for fitting around piping, ducting, etc., in such a manner that no sacrifice of strength results.

Grating shall be installed in accordance with the manufacturer's recommendations. Clip fasteners shall be stainless steel and provided by the manufacturer of the grating and shall be attached to the support structure with stainless steel hex head bolts with nylock nuts.

Grating sections shall be located:

- Over the Main Deck Openings over the Main Engines.
- Over the Steering and Flanking Rudder tiller arms and stops.
- (CLIN 0001) On the Pilothouse Deck in front of and on the Port and Starboard sides of the Pilothouse.
- (CLIN 0002, CLIN 0003 & CLIN 0004) On the Electronics/Plenum Deck front of and on the Port and Starboard sides of the Pilothouse as shown on the Contract Drawing.

The bearing bars of the grating forward and just below the Pilothouse front shall run fore and aft.

The bearing bars to the port and starboard of the Pilothouse front grating shall run transversely to provide the minimum vision obstruction.

E. FLOOR PLATES

Floor plates shall be provided in the lower engine room, forward machinery space, shaft alley and forward storage space. The floor plates shall be positioned above the longitudinals and transverses and supported through a framework of angles and stanchions to the hull structure.

Floor plates shall be 1/4 inch aluminum diamond tread. These plates shall be in sections for easy removal and shall be secured with countersunk flat head stainless steel screws (minimum 1/4" diameter screws on 24" centers). Sections shall be sized so that a single person may lift out each panel. The supports shall not extend above the surface of the abutting plates. The plates shall be required to be flat and free from warp, twist, and other defects affecting their appearance and serviceability.

Generally, the floor plates and their support structure shall be designed to support static loads of 100 lbs. per square foot without excessive deflections. Floor plates shall be locally reinforced, as necessary, where greater loadings are contemplated in the removal or disassembly of machinery for overhaul.

Hinged sections of floor plate shall be provided in way of all valves, strainers, and under floor equipment requiring operation, inspection or maintenance. Flush type lifting rings or finger holes (ground smooth) shall be provided in the hinged plate sections.

Care shall be taken to isolate dissimilar metals.

C427 VERTICAL AND INCLINED LADDERS

A. CONTRACT DRAWINGS

CLIN 0001

557-B205-01 OUTBOARD PROFILE

557-B215-01 GENERAL ARRANGEMENT

557-B233-01 PILOTHOUSE DETAILS

557-B245-01 HOLD & MACHINERY ARRANGEMENT

557-B301-02 INBOARD PROFILE

CLIN 0002, CLIN 0003 & CLIN 0004  
556-B205-01 OUTBOARD PROFILE  
556-B215-01 GENERAL ARRANGEMENT  
556-B233-01 PILOTHOUSE DETAILS  
556-B245-01 HOLD & MACHINERY ARRANGEMENT  
556-B301-02 INBOARD PROFILE

B. VERTICAL LADDERS

Vertical ladders shall be installed at all hatches, bolted plate accesses, from the emergency exits to the main deck and from the pilothouse deck to the pilothouse top. All vertical ladders shall be removable, except for individual rungs welded to the structure.

With the exception of any 304 stainless steel ladders in the potable water tanks, all vertical ladders shall be carbon steel construction of (minimum) 2-1/2 inch x 3/8 inch flat bar stringers with (minimum) 5/8 inch square rungs set on edge and welded to the stringers on 12 inch centers. All rungs shall have at least 16 inch wide effective rung width and 7 inch toe room. Ladders more than 8 feet long shall have intermediate supports.

Where ladders are required on bulkheads or tank sides, they may be separate rungs of 3/4 inch square bar welded to the structure. Where not extended from side to side of adjacent structure, these rungs shall be stirrup shaped to prevent slipping endwise. Rungs shall be a minimum of 12 inches wide with 7 inches toe room. Rungs shall be fitted on the inboard side of each towknee.

C. INCLINED LADDERS

The Contractor shall provide and install inclined ladders for the vessels in the locations shown on the Contract Drawings. The inclined ladder widths shall be as measured from the Contract Drawings. The raiser heights shall be between 7 inches and 8-1/2 inches and all raisers in any one ladder shall be of equal height. The interior inclined ladder from the floating main deck to the pilothouse shall be considered a single inclined ladder and all raisers shall be the same height throughout. The angle of any inclined ladder shall not exceed 50 degrees from the horizontal.

All inclined ladders shall be constructed of mild steel, except for the ladder leading down to the lower engine room, which shall be fabricated from non-skid open type grating treads with nosing installed. The ladder leading to the lower engine room shall have a dirt shield installed behind it, as well as being removable to assist in the maintenance and replacement of equipment. Fasteners shall be stainless steel.

Inclined ladders with bulkheads on one or both sides shall have a handrail on one side only. The height of the top of the handrail shall be 34 inches measured vertically from the tread toe. Freestanding ladders shall have two courses of handrails installed on both sides of the ladder, with the top of the top handrail measuring 34 inches vertically from the tread toe.

Non-skid tread and safety nosing, similar to WOOSTER, shall be installed on all inclined ladders.

#### C430 DECK COVERING AND CEILING

##### A. DECK COVERING

###### 1. Exterior Decks

The exterior decks consist of the main deck, top of the towknees, the upper deck, the Texas deck (CLIN 0002, CLIN 0003 & CLIN 0004), the electronics/plenum deck (CLIN 0002, CLIN 0003 & CLIN 0004), the pilothouse deck, and the pilothouse top. A non-skid surface shall be applied to all of these decks. See coating schedule in Clause C406.

###### 2. Interior Decks

All steel interior decks shall be prepared as recommended by the deck covering manufacturer prior to the floor covering installation.

Floor coverings and accessories, including any necessary sealers and finish coating, shall be installed in accordance with the manufacturer's recommendations and instructions.

For all interior spaces of the floating deckhouse that receive a floor covering (other than paint), a sanitary cove base shall be installed. The cove base shall be of similar material and color to the adjacent floor covering, and shall be a minimum of 4 inches high. The cove base shall be worked around all bulkheads, cabinets and equipment. The coving shall be sealed at the top and bottom edge with a long lasting silicone seal. Where coving will not fit below doorways, the coving shall be trimmed to suit or sealed by other means on an instance-by-instance basis as determined on site by the COR.

Care shall be taken to account for the deck drains when installing the floor coverings in the toilet spaces and the laundry (CLIN 0002, CLIN 0003 & CLIN 0004). The floor coverings in these spaces shall be sloped down to the drains.

During the Construction Phase, the COR shall select the floor covering colors from available colors. A maximum of five different colors may be chosen.

Specific deck coverings shall be as follows:

a. Machinery/Work Spaces

The electronics/plenum room (CLIN 0002, CLIN 0003 & CLIN 0004), deck storage room, the walkway between the floating deckhouse and the upper machinery space, the upper machinery space, the engineer's workshop, the generator room, and the steering gear room are all considered machinery/work spaces. The decks of these spaces shall all receive a coating system in accordance with Clause C406).

The clothes washer/dryer area (CLIN 0001) of the upper machinery space shall be enclosed in a 6" high watertight sill. The area shall be served by a floor drain connected to the grey water system.

b. Pilothouse

The pilothouse floor shall be an overlay similar to 1/8-inch Dex-O-Tex Magnabond, 1 inch thick Insulite insulation, and 3/8-inch resilient rubber marine flooring similar to Tuflex (Tuflex Rubber Products, Tampa, FL 1-800-543-0390). Transition between tiles and other deck coverings shall include pieces specifically designed for this purpose (such as Tuflex Reducer Strip).

c. Stairwell Landings

The stairwell landings shall be an overlay similar to 1/8-inch Dex-O-Tex Magnabond, 1-inch thick Insulite insulation, and 1/8-inch thick raised radial rubber tile similar to Flexco (RBT).

d. Wet Spaces

The toilet/showers spaces, deck toilets, and the laundry room (CLIN 0002, CLIN 0003 & CLIN 0004) are all considered wet spaces.

All wet spaces on the upper deck and above shall have floors with an overlay similar to 1/8-inch Dex-O-Tex Magnabond, 1-inch thick Insulite insulation, and shall be covered with a poured neoprene latex mastic similar to Neotex-28 type Dex-O-Tex.

All wet spaces on the floating deckhouse main deck shall have floors with an overlay similar to 1/8-inch Dex-O-Tex Magnabond, 1-1/4 inch thick Insulite insulation, and shall be covered with a poured neoprene latex mastic similar to Neotex-28 type Dex-O-Tex.

e. Upper Deck & Texas Deck (CLIN 0002, CLIN 0003 & CLIN 0004)

All other spaces on the upper deck and the Texas deck (CLIN 0002, CLIN 0003 & CLIN 0004) shall have floors with an overlay similar to 1/8-inch Dex-O-Tex Magnabond, 1-inch thick Insulite insulation, and 1/8-inch thick raised radial rubber tile similar to Flexco (RBT).

f. Main Deck Level (Within the Floating Deckhouse)

All other spaces on the main deck level of the floating deckhouse, except the deck storage room, shall have floors with an overlay similar to 1/8-inch Dex-O-Tex Magnabond, 1-1/4 inch thick Insulite insulation, and 1/8-inch thick raised radial rubber tile similar to Flexco (RBT).

B. CEILING

1. Upper Deck, Texas Deck (only CLIN 0002, CLIN 0003 & CLIN 0004), & Main Deck Levels

A suspended, vinyl faced, Class A fire resistant, fiberglass panel ceiling, 5/8-inch thick (minimum), shall be installed for the overhead of the Upper Deck, the Texas Deck (CLIN 0002, CLIN 0003 & CLIN 0004), and Main Deck (forward of the upper machinery space) levels, except the toilet/shower spaces. The ceiling furnished shall be a drop-in ceiling tile system similar to ARMSTRONG Commercial Ceiling Panels type "Random Fissured" with square lay-in with acoustical NRC minimum value of .55 and minimum R value of 2.6 Btu using metal T tracks, 24 inch x 24 inch and 24 x 48 inch tile sizes, and perimeter support angles. The metal track system shall also accept and support the standard 2 x 4 foot two tube fluorescent light fixtures. The track system shall be hung from the framing system of the deck above. The color scheme of the ceiling and track system shall be selected by the COR from available color options.

The finished clear headroom height shall be 7'-0" except where additional height is required for door clearance. The ceiling may be "stepped" to accommodate extended ceiling height at doors. The entire space adjacent to extended ceiling height doorways shall be of the same height as at the doorway with the step down to 7'-0" head clearance occurring at the transition to the next space.

2. Toilet/Shower Spaces

All combination toilet/shower spaces shall be furnished with a suspended, vinyl plastic paint faced, fire resistive, mineral fiber, non-perforated panel ceiling, 5/8-inch thick (minimum). The ceiling furnished shall be a drop-in ceiling tile system similar to ARMSTRONG Ceramaguard Fine Fissured Ceiling Panels with square lay-in using metal T tracks, 24 inch x 24 inch and 24 x 48 inch tile sizes, and perimeter support angles. The metal track system shall also accept and support the fan and light fixtures. The track system shall be hung from the framing system of the deck above. The finished clear headroom shall be 7'-0". The color scheme of the ceiling and track system shall be selected by the COR from available color options.

### 3. Pilothouse Deck Level

Furnish and install a suspended, vinyl plastic paint faced, fire resistive, mineral fiber, panel ceiling, 5/8-inch thick (minimum). The ceiling furnished shall be a drop-in ceiling tile system similar to ARMSTRONG Ceramaguard Fine Fissured Ceiling Panels with square lay-in using metal T tracks, 24 inch x 24 inch and 24 x 48 inch tile sizes, and perimeter support angles. The metal track system shall also accept and support the standard 2 x 4 foot two tube fluorescent light fixtures. The track system shall be hung from the framing system of the overhead above. The finished clear headroom height shall be 7'-0".

Oak plywood minimum 3/4 inch thick shall be furnished and installed for the full width ceiling above the console in the Pilothouse. The lower side of the plywood shall be flush with the finished drop ceiling surface. Plywood in this area shall be used for mounting overhead equipment. To support these loads, the plywood shall be bracketed and bolted directly to steel house structure. Fore and aft length of plywood shall match fore and aft length of the console.

### C435 JOINER WORK

Joinery shall include all Contractor constructed closets, cabinets, settees, custom cabinetry and trim work. Trim and molding associated with sheathing and insulation is included with the sheathing and insulation in Clause C436. Cabinets purchased complete from a manufacturer or retailer shall be identified on the furnishings plan (Clause C437).

The Contractor shall develop a drawing detailing the construction of all custom joiner work. Sufficient detail shall be provided to permit future maintenance and repair of each unit. Units purchased complete from a manufacturer or retailer shall not be included on this plan. However, catalog cut-sheets shall be provided with the furnishing plan (Clause C437).

In the Pilothouse, wood or vinyl covered aluminum trim shall be fitted around windows, doors, consoles, controls and electrical panels as required to present a pleasing appearance.

In order to minimize mullions between forward Pilothouse windows, no joinery shall be provided between forward windows.

There shall be no wood behind joinery. If used, furring strips shall be metal.

All items mounted against the bulkhead panels shall be fastened through the panels directly to vessel structure.

Doors, windows, lighting fixtures, and ventilation penetrations shall be integrated into the joinery system using moldings and trim pieces provided by the sheathing or joinery manufacturer for that purpose.

All cabinetry shall be provided and installed complete with appropriate drawer slides, hinges and handles.

The color scheme of joiner work shall be selected by the COR from available color options.

#### C436 INSULATION AND SHEATHING

##### A. INSULATION

Insulation shall be provided for all exterior deckhouse bulkheads and deckheads, the underside of the floating deckhouse and all interior deckhouse decks, the interior of the stacks, the interior of the plenum closets, the interior bulkheads of the engineer's workshop, and for bulkhead and deckheads bordering the below deck lower engine room, the forward machinery space, shaft alley and forward storage space (to 12 inches above the floor plates).

Insulation, sheathing, and the mounting system used for each shall be suitable for marine workboat service, anticipating high levels of dampness and vibration, and temperature extremes. Insulation shall be in accordance with USCG regulations.

Installation shall be in accordance with the manufacturers' recommendations for the intended service. However, as a minimum, the mounting studs shall be welded to bulkhead/roof structure. Adhesive mounting is not acceptable.

The insulation system shall be fiberglass similar to CLAREMONT's Claretex N-3A Hullboard and sufficient to meet the acoustic criteria in Clause C180, and the thermal criteria in Clause C685. In all cases, insulation thickness shall not be less than 4 inches.

Insulation in the lower engine room, forward machinery space, shaft alley, forward storage room, deck storage room, upper machinery space, generator room, engineer's workshop, passageway along side generator room (CLIN 0001), steering gear room, stacks, plenum closets, and electronics/plenum space (CLIN 0002, CLIN 0003 & CLIN 0004) shall be specially faced on the inboard surface with a fiberglass scrim reinforced mylar damage resistant material similar to CLAREMONT's "Tuff-Skin 1613."

All insulation shall be kerfed to wrap around stiffeners larger than 4 inches in depth, with additional filler under flanges. The system shall be applied to stack hatches such that the hatches may be removed with the system integral with the hatch.

B. SHEATHING

1. Installation

Sheathing shall be provided in all areas with insulation, except as noted within this clause. All interior bulkheads of the floating deckhouse shall be sheathed, except as noted within this clause.

Since the insulation treatment wraps around stiffeners, furring strips shall be required to provide a firm fair base for the sheathing. The furring strips shall be mounted to stiffeners with stand offs to avoid crushing the insulation and acoustical treatments. Sufficient furring shall be provided to provide a fair surface for the sheathing. All furring shall be metal. No wood is permitted behind sheathing.

Framing, furring strip, and fastener spacing shall prevent drumming and vibration of sheathing. The sheathing shall be fastened to the furring strips or the deckhouse framing by pop rivets, or self-tapping stainless steel sheet metal screws. The fastening system may be assisted by the use of adhesive similar to 3M Company's 42-NF Plus NV FASTBOND between the metal furring and the sheathing. However, the adhesive shall not be a substitute for effective securing of the sheathing with fasteners. All fasteners not in machinery spaces shall be covered with decorative caps.

Access panels shall be provided as required for access to wiring or piping behind the sheathing. Access panels shall present a pleasing appearance and be consistent with the surrounding sheathing. Edges shall be ground smooth or covered with vinyl trim.

All items mounted against the bulkhead panels shall be fastened through the panels directly to bulkhead support structure.

## 2. Machinery Spaces

The lower engine room, forward machinery space, shaft alley, forward storage space, upper machinery space, generator room, engineer's workshop, steering gear room, passage along side the generator room (CLIN 0001), deck storage room, plenum closets, and the electronics/plenum space (CLIN 0002, CLIN 0003 & CLIN 0004) shall be considered machinery spaces for the purpose of this clause.

The plenum closets and the interior of the stacks shall not be sheathed.

Sheathing in the machinery spaces shall be 14 gage perforated aluminum sheets with a minimum of 30% open area. The perforated sheathing shall have a white baked enamel or equal finish.

## 3. Floating Deckhouse

Sheathing for vertical surfaces within the floating deckhouse shall be about .050 inch thick aluminum sheet with vinyl finish similar to MALLYCLAD, Madison Heights, MI 48071 (313-585-4110).

Vertical sheathing panels shall extend above the ceiling to ensure a finished line at the ceiling edge. All vertical edges shall be properly sealed and trimmed with materials provided by the manufacturer of the sheathing for that purpose. The bottom edge of the sheathing shall be sealed prior to the installation of the coving (Clause C430).

Vinyl faced aluminum trim pieces shall be fabricated and installed to finish off the openings around windows to the sheathing. When available, trim pieces shall be provided by the same manufacturer as the sheathing.

Sheathing shall not be installed behind the shower modules.

The color scheme of the sheathing shall be selected by the COR from available color options, four colors maximum.

#### C437 FURNITURE AND FURNISHINGS

##### A. CONTRACT DRAWINGS

###### CLIN 0001

557-B215-01 GENERAL ARRANGEMENT  
557-B233-01 PILOTHOUSE ARRANGEMENT  
557-B245-01 HOLD & MACHINERY ARRANGEMENT

###### CLIN 0002, CLIN 0003 & CLIN 0004

556-B215-01 GENERAL ARRANGEMENT  
556-B233-01 PILOTHOUSE ARRANGEMENT  
556-B245-01 HOLD & MACHINERY ARRANGEMENT

##### B. ENGINEER'S WORKSHOP

A working area shall be provided adjacent to the upper machinery space and it shall be equipped with a 30" x 60" x 34" high workbench fitted with 1 3/4" thick hardwood top and metal lower shelf and steel cabinets with doors above and shelf under cabinets, similar to EQUIPTO Tool Bench system. A table with chair shall be provided for the engineer to sit and work from a laptop style computer. Shelving shall be provided for the Operator's Manual and reference books. The Generator Controls shall be located within this space as shown on the Contract Drawings.

##### C. LAUNDRY

The laundry area (CLIN 0001) shall be located at the forward end of the upper machinery space as shown on the Contract Drawings. The laundry room (CLIN 0002, CLIN 0003 & CLIN 0004) shall be located within the floating deckhouse on the main deck level aft as shown on the Contract Drawings.

The Laundry shall contain the following:

- A stainless steel deep sink with a combining faucet with a separate lever type handle for hot water and a separate lever type handle for cold water. The spigot shall be a high gooseneck spigot with hose bibb.
- A large capacity washing machine similar to WHIRLPOOL ULTIMATE CARE II WASH SYSTEM Model LSQ9665JQ with a 3-speed motor and 3.0 cu. ft. capacity shall be provided and installed. The washing machine shall be of the same manufacture and matching model as the clothes dryer.
- A large capacity clothes dryer similar to WHIRLPOOL GOLD ELECTRIC DRYER WITH ULTIMATE CARE II Model GEQ8858KQ with 7.0 cu. ft. capacity and front door lint screen. The clothes dryer shall be of the same manufacture and matching model as the washing machine.
- A cabinet over the washer and dryer to store cleaning supplies.

Permanent hook-up to vessel water and drain systems will be provided for the washing machine. The dryer shall be properly vented to the outdoors. The washer and dryer shall each have a dedicated electrical receptacle and shall be on separate circuits with breakers.

D. GALLEY AND MESS

The Galley/Mess Area shall be arranged as shown on Contract Drawings.

The Huntington Towboat (CLIN 0002), the ST. Paul Towboat (CLIN 0003), and the Rock Island Towboat (CLIN 0004) shall have a commercial quality vertical trash compactor similar to Compactors, Inc. (843-686-5503) Model TA-4500 with a loading chute door 24" x 18-1/2", 6 cu. ft. capacity and cycling time less than 30 seconds. This compactor shall be located within the upper machinery space against the forward bulkhead near the doorways into the floating deckhouse.

The Galley areas for each vessel shall contain:

- Counter with cabinets and drawers below and cabinets above. All cabinets and drawers shall be fitted with handles.
- Countertop and backsplash to be stainless steel with a drain board built-in.
- Permanent hook-up to vessel water and drain systems will be provided for the dishwasher, and the icemakers. Each galley appliance shall have a dedicated electric single receptacle (non-GFCI) and shall be on separate circuits with breakers.
- A 36-inch stainless steel range hood with light. The hood shall exhaust to the outdoors. The outdoor exit shall be equipped with a weather tight damper that opens when the fan is on.
- Pantry space with shelving and a lockable door.
- All galley appliances shall be of a size and shape that will permit removal from the vessel through existing passageways without alterations or modifications.
- Colors for cabinets and appliances shall be selected by the COR from the available colors.

For the Pittsburgh Towboat (CLIN 0001) specifically, the following shall be provided in the galley:

- A residential style under the counter dishwasher similar to WHIRLPOOL Model GU1200XTK. Color shall be compatible with the galley interior and shall be approved by the COR prior to purchase.
- A residential style electric range with self cleaning oven base.
- Microwave oven, 1.5 cubic feet, 1600 watt minimum similar to HOBART model HM1600.
- One industrial style stainless steel double door refrigerator with a minimum capacity of 35 cu. ft. similar to TRUE Model T-35.
- One industrial style stainless steel single door freezer with a minimum capacity of 23 cu. ft. similar to TRUE Model T-23F.

- An icemaker. The ice machine shall be similar to a MANITOWOC, Model QM45 making 95 lbs. of ice per day with a storage bin for 33 lbs. The condenser shall be air cooled. The ice machine shall be equipped with a water filtration system supplied by the ice machine manufacturer.
- Under counter type 15” residential style trash compactor similar to WHIRLPOOL Model GX900QPK. Color shall be compatible with the galley interior and shall be approved by the COR prior to purchase.
- A stainless steel triple basin sink with a single lever faucet and D spout. One side of the sink shall contain a rinser (hose spray).

For the Huntington (CLIN 0002), St. Paul (CLIN 0003), and Rock Island (CLIN 0004) Towboats, the following specific features shall be provided in the galley:

- A heavy-duty industrial style under the counter dishwasher similar to HOBART Model LX18 with a 304 series stainless steel tank, door and top panel. All attachments including racks shall be provided.
- A heavy-duty commercial style stainless steel electric range with 6 burners with marine options including oven door latch similar to GARLAND Model S686.
- A commercial style stainless steel 24” counter griddle similar to HOBART CG20.
- Two residential style refrigerator/freezers with ice maker. Each refrigerator/freezer shall have a minimum capacity of 21 cubic feet, and be a current model by a U.S. manufacturer and shall be similar to WHIRLPOOL Model GR2SHKXX. Color shall be compatible with the galley interior and shall be approved by the COR prior to purchase.
- One residential style upright automatically defrosting freezer with a minimum capacity of 24 cubic feet, and be a current model by a U.S. manufacturer and shall be similar to WHIRLPOOL Model EV250NXXQ. Color shall be compatible with the galley interior and shall be approved by the COR prior to purchase.
- Microwave oven with a minimum capacity of 1.2 cu. Ft. and 1200 watts similar to SHARP Model R-330EK.

- Coffee maker with two warmers similar to BUNN Pour-Omatic Model VPR. In addition to the two pots necessary to operate the unit, two spare coffee pots and one case of filters shall be provided with the unit.
- A stainless steel double basin sink with a single lever faucet and D spout. One side of the sink shall contain a rinser (hose spray).

The Mess area shall contain:

- A table and matching chairs with a seating arrangement for eight people.
- A 35" color television, with a VCR and DVD provided and wired to the television (CLIN 0001 only). This combination shall be mounted to the forward inboard bulkhead of the Mess adjacent to the electrical plenum closet.

Colors of tabletop and chair cushions, to be selected by the COR from the available colors.

E. LOUNGE (CLIN 0002, CLIN 0003 & CLIN 0004)

A lounge shall be provided and furnished with the following:

- A sofa.
- Chair matching the sofa.
- Side table.
- Table lamp.
- A coffee table.
- A 32" color television with a TV stand suitable to also hold the DVD and VCR equipment.
- A VCR and DVD complete and wired to the television and mounted on the TV stand.
- Water cooler.

Colors of furniture to be selected by the COR from the available colors.

F. OFFICE/LOUNGE (CLIN 0001)

An office with lounge furnishings shall be provided and furnished with the following:

- Workstation suitable for a desktop computer extending along the longitudinal inboard bulkhead and around the aft corner in accordance with the Contract Drawings.
- Desk chair.
- 42” wide, 4 drawer, lockable steel lateral file cabinet.
- Sofa.

Colors of workstation, chair, sofa and file cabinet to be selected by the COR from the available colors.

G. STATEROOMS1. General

Staterooms are located in the floating deckhouse and shall be arranged as shown on the Contract Drawings.

The bunks shall be built for an 80-inch twin size mattress with a 1-inch “finger” clearance left all around the mattress. The berth in the Captain’s stateroom shall be built for a standard double/full size mattress.

A bunk light shall be provided and installed above each berth. A duplex outlet shall be installed in each stateroom bulkhead (minimum four per room), with no more than two duplex receptacles on a single circuit with breaker.

Colors of the bunks, chairs and cushions, storage lockers, and desks to be selected by the COR from the available colors.

2. Single Staterooms

For the single crew staterooms, each shall be equipped as follows:

- A single berth with locking drawers below. Draw locks shall be keyed alike.
- One customized locker with two individual locking cabinets side-by-side above and two locking drawers below approximately 54" wide by 24" deep full height as shown on the Contract Drawings.
- Two bulkhead mounted coat hooks.

3. Double Staterooms

For the double crew quarter staterooms, each shall be equipped as follows:

- A double berth (upper and lower) with locking drawers beneath the lower berth. Drawers shall not be keyed alike.
- One customized locker with two individual locking cabinets side-by-side above and two locking drawers below approximately 54" wide by 24" deep full height as shown on the Contract Drawings.
- Four wall mounted coat hooks.
- For the two double staterooms sharing a T/S space on the port aft side of the upper deck, a corner vitreous china lavatory shall be mounted on the bulkheads as shown on the Contract Drawings. The faucets provided for the lavatory sinks shall be low flow type, cast brass, chrome plated, and dual handled. A mirror and shelf shall be fitted over the sink. Two towel bars shall be mounted on the bulkhead along side the lavatory.

4. Pilot's Stateroom (CLIN 0001)

The Pilot's stateroom, shall be equipped as follows:

- A double berth (upper and lower) with locking drawers beneath the lower berth.
- One customized locker with two individual locking cabinets side-by-side above and two locking drawers below approximately 54" wide by 24" deep full height as shown on the Contract Drawings.
- Four wall mounted coat hooks.
- A desk.
- A desk chair.

5. Oiler's Stateroom (CLIN 0002, CLIN 0003 & CLIN 0004))

The Oiler's stateroom, shall be equipped as follows:

- A single berth with locking drawers beneath the lower berth.
- One customized locker with two individual locking cabinets side-by-side above and two locking drawers below approximately 54" wide by 24" deep full height as shown on the Contract Drawings.
- Two wall mounted coat hooks.
- A desk.
- A desk chair.

6. Captain's Stateroom

The Captain's stateroom, shall be equipped as follows:

- A single berth sized for a standard double/full mattress with locking drawers beneath the lower berth.
- One customized locker with two individual locking cabinets side-by-side above and two locking drawers below approximately 54" wide by 24" deep full height as shown on the Contract Drawings.
- Two wall mounted coat hooks.
- A corner workstation with file cabinet below (CLIN 0001 only).
- A desk chair (CLIN 0001 only).
- A sofa and coffee table (CLIN 0002, CLIN 0003 & CLIN 0004 only).

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F. OFFICE (CLIN 0002, CLIN 0003 & CLIN 0004)

The Office shall be arranged as shown on the Contract Drawings. It shall contain the following:

- Two workstations suitable for desktop computers and additional desktop space for computer printer, copier, and fax machine.
- Three desk chairs.
- Three file cabinets below the workstation desktop.
- Cabinets below the desktops to store office supplies.

Colors of all furnishings shall be selected by the COR from available colors.

G. TOILETS AND SHOWERS

Toilet/shower spaces and the deck toilet are located in the deckhouse and shall be arranged as shown on the Contract Drawings. All toilet/shower spaces and deck toilet shall contain the following, except as noted:

- A low consumption water closet (1.6 gallons). The water closets with tanks shall be CRANE Galaxy Model 3674 (vitreous china) with elongated rims. Each water closet shall be supplied with an open front seat with lid and stainless steel hinge.
- A 24 by 24 inch built-in vanity with storage base beneath. The vanity shall contain a countertop-mounted lavatory. The vanity countertop shall be covered with Formica, color to be selected by the COR from available colors. No vanity shall be supplied for the shared toilet/shower space on the upper deck aft port side.

- A CRANE vitreous china lavatory shall be supplied for each vanity. The lavatory frame shall be supplied by the Contractor. The faucets provided for the lavatory sinks shall be low flow type, cast brass, chrome plated, and dual handled. No lavatory shall be supplied for the shared toilet/shower space on the upper deck aft port side.
- A mirror and shelf over the sink, two towel bars, three robe hooks, liquid soap container, paper towel holder for folded towels, and a toilet paper holder. No mirror, shelf, liquid soap dispenser, or paper towel holder shall be supplied for the shared toilet/shower space on the upper deck aft port side.
- A fluorescent light without receptacle shall be installed over each mirror. No fluorescent light shall be installed in the shared toilet/shower space on the upper deck aft port side.
- A GFCI duplex receptacle shall be provided in the head.

In addition, each Toilet/Shower space shall include:

- A square stainless steel shower, minimum of 36 x 36 inches. The shower stall shall be similar to an OMEGA Products, Square Unit. Each shower shall be equipped with a shower curtain. All plumbing fixtures shall be provided including showerhead and dual faucets.

All water closets and lavatories shall be white. All exposed valves and fixtures shall be chrome-plated brass.

#### H. LINEN AND DECK LOCKERS

The closet within the stairwell just above the upper deck shall be outfitted with three shelves to be used as a linen locker.

Flammable and combustible liquids lockers shall be provided in accordance with the Contract Drawings. Two lockers shall be provided for the Pittsburgh towboat (CLIN 0001) and three shall be provided for the Huntington (CLIN 0002), St. Paul (CLIN 0003), and Rock Island (CLIN 0004) towboats. The lockers shall be properly vented in accordance with the Corps Safety Manual.

I. DECK STORAGE ROOM

The deck storage room shall be provided with 10 bulkhead mounted coat hooks, metal shelving for parts and equipment storage and a workbench with an 8" swivel base vise attached at one end.

J. ELECTRONICS/PLENUM SPACE (CLIN 0002, CLIN 0003, & CLIN 0004)

The space below the pilothouse shall be outfitted with shelves and racks to mount the electronic equipment.

K. PILOTHOUSE

The pilothouse shall be furnished with:

- Movable swivel pilot's chair. The chair shall be similar to TURNBULL CO., series 299, model 525-013.
- Chart table
- Overhead pull-down style rack for charts
- Settee with padded seat and back and drawers below and knee wall to prevent tripping hazard
- Control and operating console across the front of the pilothouse
- Computer workstation
- A vanity with a small stainless steel bar sink. The countertop shall be covered with Formica and contain a cabinet beneath.
- Small refrigerator
- Two chairs with arms and swivel base, each suitable for use at the computer workstation
- AM/FM/CD stereo (only CLIN 0002, CLIN 0003 & CLIN 0004)
- Concealable toilet

Colors of the pilot's chair, chart table, settee, console, the vanity and the chairs shall be selected by the COR from the available colors.

C445 LIFESAVING AND SAFETYA. GENERAL

The Contractor shall provide and install the lifesaving and safety equipment listed below. The final equipment locations shall be made by the COR during the Construction Phase.

B. LIFESAVING EQUIPMENT1. Buoyant Apparatus

One rectangular buoyant apparatus with net platform shall be provided and installed. The apparatus shall be USCG approved similar to a JIM-BUOY model 1310 (10 person capacity) with glass reinforced surface, shall be international orange in color, with retro-reflective tape per USCG Rules, with life line, and shall be fitted with a water light. The buoyant apparatus shall be set up to float-free from the vessel. The vessel name shall be stenciled on the buoyant apparatus.

2. Life Rings

Eight 30-inch diameter life rings, USCG approved, similar to a JIM-BUOY model number CGO-30 fitted with rope, shall be installed on life ring racks. An additional two life rings shall be provided for the Huntington (CLIN 0002), St. Paul (CLIN 0003) and Rock Island (CLIN 0004) towboats. Each life ring shall be provided with a self-igniting waterlight. Additionally, two of the life rings shall be provided with a self-activating smoke signal.

Each life ring shall be provided with 100 feet of 3/8-inch lifeline. The lifeline provided shall be resistant to deterioration from ultraviolet light. Each life ring shall be international orange in color, and shall be marked with retro-reflective tape per USCG Rules. The vessel name shall be stenciled on each life ring.

Two life rings, one with smoke, shall be mounted at the pilothouse deck level. Four life rings, one with smoke, shall be mounted at the main deck level. Two life rings shall be mounted at the upper deck level and two at the Texas deck level (CLIN 0002, CLIN 0003, & CLIN 0004).

3. Life Preservers

Nine USCG approved Type I PFD life preservers (eleven for CLIN 0002, CLIN 0003 & CLIN 0004) shall be provided for the appropriate vessel. The life preservers provided shall be similar to SAFEGUARD model 190RT, international orange in color, and shall be marked with retro-reflective tape per USCG Rules. Each life preserver shall have the vessel name stenciled on it. Stowage of the life preservers shall be assigned by the COR during the Construction Phase.

C. SAFETY EQUIPMENT

1. First Aid Kit

One 24-unit first aid kit in waterproof container to be mounted in the mess/lounge area.

2. Distress Signals

Twelve USCG approved hand held distress signals shall be provided. Six signals shall be orange smoke and six shall be red distress flares. The signals shall be stored in a heavy-duty, waterproof, polythene type container with lid. The signals shall be stored in the pilothouse.

3. Fog Bell

One chrome plated cast bronze fog bell shall be provided and mounted on the forward side of the deckhouse. The bell shall be remotely operable by the pilot in the pilothouse. The bell shall have a bottom diameter of 12 inches, and shall be similar to a PERKO, model 150-012 CHR.

4. Clock and Barometer

One 4-inch diameter chrome plated marine clock and matching barometer to be mounted in the pilothouse.

C450 UTILITY BOAT AND DERRICKA. CONTRACT DRAWINGS

## CLIN 0001

557-B205-01, OUTBOARD PROFILE  
557-B215-01, GENERAL ARRANGEMENT

## CLIN 0002, CLIN 0003 &amp; CLIN 0004)

556-B205-01, OUTBOARD PROFILE  
556-B215-01, GENERAL ARRANGEMENT

B. DESCRIPTION OF WORK

The Contractor shall provide a utility boat and an electric/hydraulic deck crane for raising and lowering the boat. The utility boat and deck crane shall be located as shown on the Contract Drawings. The name of the towboat shall be stenciled on the port and starboard sides of the utility boat hull.

The Contractor shall provide and install an electric-hydraulic crane similar to AUTOCRANE model 8406H. The crane shall be sized for adequate capacity, outreach and hook height to lift and launch the utility boat, into the water, with 3 feet of clearance beyond the towboat side. A crane larger than the AUTOCRANE identified herein shall be provided, if required to handle the utility boat as described above.

The utility boat provided shall be a flat bottom Jon boat with a length overall of 20 feet, with 7 feet beam overall, and be similar to a SEAARK Marine River Runner model 20. The boat shall have the following features:

- Provided with a 35 Hp outboard diesel motor similar to YANMAR D36.
- Battery and fuel tank.
- Provided with a rain cover.
- Equipped with the USCG safety package, including navigation lights.

The utility boat shall rest on padded wooden cradles, with the bow slightly higher than the stern, so that any rainwater will collect and flow out of the drain plug. The cradle shall be high enough at the stern in order that the motor can remain “down” in the normal operating position.

Securing cleats and tag lines shall be supplied with the utility boat for use with the deck in raising and lowering the boat into the water.

C456 WINCHES AND CAPSTANSA. CONTRACT DRAWINGS

## CLIN 0001

557-C205-01, OUTBOARD PROFILE  
557-C215-01, GENERAL ARRANGEMENT

## CLIN 0002, CLIN 0003, &amp; CLIN 0004

556-C205-01, OUTBOARD PROFILE  
556-C215-01, GENERAL ARRANGEMENT

B. WINCHES

Each winch shall have no hydraulic components and shall be solely electrically powered. Each winch shall have an electric self-adjusting spring-loaded brake with a manual release and a manual locking dog for emergency use in case of electric brake failure.

Each winch shall have a holding force of not less than 60 tons and a line pull of at least 12000 pounds and a full drum speed of at least 16 FPM. Each winch shall be welded to a deck as stated below, and aligned with the roller buttons at the vessel side.

One hundred feet of 1 - inch diameter 6x19 IPS IWRC wire rope shall be provided on each winch drum. Three-foot long swaged eyes shall be provided in each rope.

The winches shall be welded to deck insert plates, and local reinforcement shall be provided under the deck in way of each winch.

Winches shall have local controls and remote controls in the pilothouse.

Special requirements for each vessel are as follows:

1. Pittsburgh District Towboat (CLIN 0001)

Four electrically powered barge winches similar to PATTERSON Model WWP65-7.5-14L/R Electric Winch shall be provided and installed at the bow, as shown on the Contract Drawings. Two double drum barge winches may be provided in lieu of four individual winches to preserve deck working space.

2. Huntington District Towboat (CLIN 0002), St. Paul District Towboat (CLIN 0003), & Rock Island Towboat (CLIN 0004)

Two electrically powered barge winches similar to PATTERSON Model 65-7.5-14L/R Electric Winch shall be provided and installed at the bow, as shown on the Contract Drawings.

C. CAPSTANS

1. Pittsburgh District Towboat (CLIN 0001)

One double barreled electric capstan similar to Schoellhorn-Albrecht Capstan Model 22300 spur geared with a 14-inch 21063 barrel and 10 hp forward and reversing motor shall be provided and installed on the bow deck area about 6 feet forward of the deckhouse and at centerline as shown on the Contract Drawings.

The capstan shall have a minimum starting pull of 12,000 lbs., a running pull of 6,000 lbs. at 48 FPM and a static (bollard) pull of 100,000 lbs. Power source shall be electric two-speed motor with a spur gear reducer. The barrel shall be 14-inch diameter.

2. Huntington District Towboat (CLIN 0002), St. Paul District Towboat (CLIN 0003), & Rock Island Towboat (CLIN 0004)

Two double barreled electric capstans similar to Schoellhorn-Albrecht Capstan Model 22300 spur geared with a 14-inch 21063 barrel and 10 hp forward and reversing motor shall be provided and installed on the bow deck area about 6 feet forward of the deckhouse and spaced about 8 feet as shown on the Contract Drawings.

The capstans shall have a minimum starting pull of 12,000 lbs., a running pull of 6,000 lbs. at 48 FPM and a static (bollard) pull of 100,000 lbs. Power source shall be electric two-speed motor with a spur gear reducer. The barrel shall be 14-inch diameter.

C460 NAMEPLATES, NOTICES AND MARKINGSA. DRAWINGS

## CLIN 0001

Contract Drawing #557-B205-01, OUTBOARD PROFILE  
Reference Drawing #610-B460-01, COMMUNICATIONS MARK

## CLIN 0002, CLIN 0003, &amp; CLIN 0004

Contract Drawing #556-B205-01, OUTBOARD PROFILE  
Reference Drawing #610-B460-01, COMMUNICATIONS MARK

B. COLOR SCHEDULE

The color schedule for the draft marks, hull markings, name boards, and stack insignia shall be in accordance with Clause C406.

C. DRAFT MARKS

Draft marks of raised Arabic type numerals, 6-inches in height and cut from 1/4 inch steel plate, shall be continuously welded to the shell plating. The draft numbers shall be located on the port and starboard sides of the vessel as shown on the Contract Drawings. The draft marks shall be measured from the underside of the bottom plating projected to the bottom of the numerals. The bottom of the figures shall correspond to multiples of 1 foot of draft.

D. HULL MARKINGS

The title "U.S. ARMY CORPS OF ENGINEERS," in Gothic letters 12 inches high, shall be cut from 1/4 inch steel plate and continuously welded to the vessel. The title shall be located on the port and starboard sides as shown on the Contract Drawings.

The title "U.S. ARMY CORPS OF ENGINEERS," in Gothic letters 8 inches high with a 4 inch space below to the home port, all cut from 1/4-inch plate shall be centered and seal-welded on the stern of the vessel on centerline.

The home port for each vessel shall be as follows:

CLIN 0001	PITTSBURGH, PA
CLIN 0002	HUNTINGTON, WV
CLIN 0003	ST. PAUL, MN
CLIN 0004	ROCK ISLAND, IL

The Contracting Officer's Representative shall approve the exact locations of the hull markings prior to installation.

E. NAME BOARDS

The name of the towboat shall be displayed on name boards at four locations:

- Port and starboard abreast the Pilothouse at the outboard rails.
- Above the stern at the aft end of the Upper Deck at the handrails
- The front of the vessel at centerline in the rail of the deck below the Pilothouse Deck.

The Contracting Officer's Representative shall approve the exact locations prior to installation.

Name boards shall be made of steel, rectangular in shape, 14 ga. thick, with 12 inch high Gothic letters printed in gold porcelain finish with a blue porcelain finish background. The name boards shall be provided with a 2-inch minimum border all around.

F. STACK INSIGNIA

Two Corps of Engineers "Communications Mark" devices shall be fabricated and installed, one each on the outboard side of the port and starboard stacks in clear view when the vessel is viewed in profile. This Communication Mark is detailed in the Reference Drawing. The Contractor shall adjust the scale of the drawing, while maintaining relative proportion, so that the largest insignia which will fit on the side of the stacks can be utilized.

The castle and border of the insignia and the base plate shall be made of 316 stainless steel plate, 3/8-inch thick and the castle and border shall be attached to the base plate with 2-inch long stainless steel standoffs. The base plate shall be the background for the Communication Mark and will be coated with red urethane paint, as noted in Clause C406. Both sides of the base plate shall be coated with millage equal to that applied to the deckhouse exterior. An assembled Communications Mark shall be bolted to each stack, on the outboard side, centered in the stack band. The edges of the plates shall be furnished true and smooth with no burrs.

Painted red stack bands shall completely encircle each stack. The red stack bands shall be trimmed with painted silver bands. The width of each red stack band shall be twice the height of the castle with 6 inch silver bands above and below the red stack band. The red and silver are defined in Clause C406.

#### C461 NOTICES AND MARKINGS

##### A. NAMEPLATES

Nameplates, serial number plates, tags, etc. shall remain in place on the equipment as furnished by suppliers. The Contractor shall use caution during construction to not damage or paint over nameplates. Damaged name plates shall be replaced prior to Final Acceptance.

All nameplates and notices shall be stamped or engraved on brass or plastic plates. All weather exposed nameplates, notices, and markings shall be of brass.

As a minimum, the following signs shall be provided:

- Four signs reading “DANGER NO TRESPASSING U.S. GOVERNMENT PROPERTY” shall be placed on the Main Deck. One shall be placed on the aft side of the deckhouse, one shall be located on the forward side of the deckhouse and two additional shall be placed on the deckhouse side bulkheads (exterior) one port and one starboard.
- “NO SMOKING” notices shall be placed at each fuel oil fill station and at the flammable chemicals deck locker.
- All controls, gauges, switches, etc., shall be labeled with phenolic label plates to permit operation of the vessel.

- An engraved metal fire control plan complying with the ABS Rules (Part 4, Section 7, paragraph 7.25.10). See Clause C679.
- Manholes, vents, fills and sounds shall be marked with tank identification and intended service with brass tags.
- Confined spaces shall have a sign stating “Confined Space DANGER Permit Required” that shall be located at each entry to each tank, hull void and hold compartment.
- The shore power receptacle shall be labeled to show the proper voltage; number of phases; and maximum current draw. Shore power receptacle notice shall also describe the recommended connecting procedure.

#### C480 TELEPHONE & DATA COMMUNICATIONS

Each stateroom shall be pre-wired for a future computer and telephone system. The pre-wiring shall include the appropriate wall jack for equipment connection.

For CLIN 0001, CAT-5 cable shall be pre-wired to serve:

- The pilothouse
- The five staterooms on the upper deck
- The deck storage
- The galley/mess
- The crew’s lounge
- The engineer’s workshop

For CLIN 0001, the system supplied shall allow for wireless remote tie-in.

For CLIN 0002, CLIN 0003 and CLIN 0004, CAT-5 cable shall be pre-wired to serve:

- The pilothouse
- The three staterooms on the Texas deck
- The ship’s office
- The four staterooms on the upper deck
- The crew’s lounge
- The deck storage
- The galley/mess
- The stateroom on the main deck
- The engineer’s workshop

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C481 TELEVISION SYSTEM

Each vessel shall be equipped with an omni-direction television antenna system. The antenna system supplied shall be similar to a Rivertronics RT-1000, RiverTenna model. The Contractor is responsible for providing and installing the entire system. The equipment to be supplied by the Contractor includes but is not limited to the antenna, pre-amp power supply, 2-way splitters, distribution amps, wall outlet covers, terminators, connectors, and coaxial cable.

The system shall be set up for 120 volt AC power and grounded in accordance with the manufacturer's recommendations. The antenna shall be mounted in order to not interfere with the navigation and communication equipment, and shall have the ability to be lowered in order to meet the height above the waterline requirement in contract Clause C105.

For CLIN 0001, antenna service shall be set up to serve the following spaces:

- The five staterooms on the upper deck
- The galley\mess
- The crew's lounge

For CLIN 0002, CLIN 0003, and CLIN 0004, antenna service shall be set up to serve the following spaces:

- The three staterooms on the Texas deck.
- The four staterooms on the upper deck.
- The crew's lounge.
- The galley\mess
- The stateroom on the main deck

**C600 MACHINERY****C601 GENERAL REQUIREMENTS FOR PIPING SYSTEMS & MACHINERY****A. GENERAL**

All machinery and piping systems shall be in accordance with the regulatory bodies referenced in contract Clauses C003 and C004, and shall also comply with additional regulatory bodies where specified. References made to specific sections of codes, rules and standards in these specifications are intended to emphasize specific salient items.

All equipment shall be rated for marine duty service.

All pumps are to be provided with mechanical seals.

Machinery guards shall be provided over all rotating and hazardous machinery. The guarding shall be consistent with that required by the U.S. Army Corps of Engineers, "Safety and Health Requirements Manual."

Manufacturers' recommendations, concerning fabrication and installation, shall be followed in addition to these specifications.

**B. PRESSURE & TEMPERATURE GAUGES**

All pressure gauges shall give readings in psig and all temperature gauges shall give readings in degrees Fahrenheit. The gauges shall be selected so the operating point is in the middle of the gauge range. All gauges shall be fitted with gauge isolation valves.

Pressure gauges shall be provided on the discharge of all pumps, and pressure/vacuum gauges shall be provided on the suction side on all positive displacement pumps and the bilge and ballast pumps.

Temperature gauges shall be provided on all piping that transfers a medium in excess of ambient temperature.

### C. PIPING – GENERAL REQUIREMENTS

The use of the designation “line” in this specification is defined as all pipe, fittings, and valves in a piping run between the points indicated.

Piping shall be sized and arranged to obtain optimum operating conditions for the equipment and intended service. Items of piping not covered in these specifications, but required for proper installation and operation shall be furnished and installed the same as if specified.

System design shall route all piping as directly as practicable; shall not interfere with structure, machinery access or handling gear; and shall be sufficiently flexible and supported to account for thermal expansion, shock, vibration and the working of the vessel. Wherever practicable, piping shall be run below the grating or sole level. No piping runs shall be made through access openings.

A sufficient number of unions and /or flanges shall be installed in all pipe lines to permit dismantling of the lines and equipment. Valves shall be installed in sufficient quantity to isolate any piece of equipment in the systems.

Sufficient drains shall be provided to permit draining of all lines within the vessel in an even trim condition. The drains shall be provided at low spots in the piping, located so that they will be readily accessible. Screwed plugs shall be brass in all piping systems.

Pipes passing through watertight or oiltight bulkheads shall be made of extra heavy pipe in that section, in way of the penetration and the bulkhead or deck shall maintain its integrity. Where pipes pass through watertight bulkheads or decks, the penetrations shall be watertight.

Heat sensitive materials shall not be used in piping systems that penetrate watertight subdivisions where deterioration of such systems would, in the event of a fire, impair the watertight integrity of such bulkheads. Copper tubing that penetrates watertight bulkheads and decks shall use a suitable stuffing tube. Spool pieces with flanges shall be provided for all galvanized pipe penetrations to prevent the destruction of galvanizing due to welding.

All piping exposed in unheated spaces or to the weather and carrying fluids that can freeze shall be electrically heat traced, except that the fire main piping may be designed such as to be a dry system when not pressurized. Freeze protection shall be provided by installing drain plugs at all low points in all piping systems carrying fluids that can freeze.

D. PIPING – SPECIFIC REQUIREMENTS

All piping shall be schedule 40, ASTM A-53, Type S or E except where otherwise indicated.

All piping between the side shell and the first inboard valve shall be a minimum of schedule 80. Fasteners for valves at the hull connections and sea chests shall be stainless steel. All tank penetrations shall be through schedule 80 welded couplings unless specified elsewhere.

When three or more valves are located together for the same service, they shall be combined in a manifold.

Manually operated valves shall be readily operable by one person, directly or through mechanical advantage type operators.

E. PIPE ROUTING RESTRICTIONS

Piping shall not be run over or in the vicinity of switchboards, distribution panels, or other electrical equipment unless unavoidable, in which case flanged joints, valves, etc. shall not be installed in the vicinity.

Piping conveying flammable materials shall not be routed adjacent to or over hot surfaces unless unavoidable, in which case adequate shields shall be provided.

F. FLOATING DECKHOUSE PIPING FLEXIBILITY

All piping traversing between the main deck and the floating deckhouse and the after deckhouse and the floating deckhouse, shall be designed and installed with adequate flexibility to account for the movement of the floating deckhouse.

G. PIPE HANGERS

Rigid hangers shall be designed and located in accordance with ASTM Practices for the Design and Installation of Rigid Pipe Hangers, F708-92 (1997). The hangers shall safely support the weight of the piping, its operating or test fluid (whichever is heavier), and its insulation and lagging (where installed).

The number of supports installed, the type selected and their location shall prevent excessive vibration of piping under all system operating conditions, but they shall not constrain the piping to such an extent as to cause excessive transfer of load from support to piping or from support to support.

The locations and type of supports selected shall be to prevent excessive stress from being transmitted by the piping to machinery, equipment, or ship structure.

Hangers for copper pipe or tubing shall be lined with plastic. Non-ferrous metal pipes shall be insulated from direct contact with any steel structure.

#### H. PIPE CLEANING

All piping, piping appurtenances and applicable equipment shall be thoroughly cleaned after fabrication and prior to installation in the vessel. After complete 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 temperature, and above normal line velocity. However, prior to flushing operations, such units as heat exchangers, and control valves, having in-line mechanisms capable of trapping or being affected by the carryover of foreign matter, shall either be removed or blanked-off and bypassed.

### C602 EQUIPMENT & PIPE MARKING

#### A. EQUIPMENT MARKING

Nameplates, serial number plates, tags, etc. shall remain in place on the equipment as furnished by suppliers. The Contractor shall use caution during construction to not damage or paint over nameplates. Damaged name plates shall be replaced prior to Final Acceptance.

All nameplates and notices shall be stamped or engraved on brass or plastic plates. All weather exposed nameplates, notices, and markings shall be of brass.

All controls, gauges, switches, etc., shall be labeled with phenolic label plates to permit operation of the vessel. This includes pilothouse equipment as well.

Label plates shall be attached to all mechanical equipment to indicate the system and function of the equipment.

#### B. PIPE MARKING

The Contractor shall mark all piping in the vessel to indicate its service and usage. The pipes shall be marked at each termination and at each watertight bulkhead penetration to indicate service and flow direction. Piping shall also be marked at the midpoint of long compartment runs.

Where possible, the Contractor shall follow wordings/combinations that conform to ANSI/OSHA specifications. To meet this requirement, standard markers, similar to those available from Seton shall be used.

All piping shall be marked and color coded in accordance with the following:

<u>SYSTEM LEGEND</u>	<u>MARKER COLOR</u>	<u>LETTER COLOR</u>
BALLAST	GREEN	WHITE
BILGE	GREEN	WHITE
BLACK WATER	BLACK	WHITE
CO2	RED	BLACK
COMPRESSED AIR	YELLOW	BLACK
DECK DRAIN	GRAY	WHITE
ENGINE COOLING	BLUE	WHITE
FIRE MAIN	RED	WHITE
FUEL OIL	YELLOW	BLACK
GEAR OIL	YELLOW	BLACK
GRAY WATER	GRAY	WHITE
HYDRAULIC	YELLOW	BLACK
LUBE OIL	YELLOW	BLACK
OILY BILGE	ORANGE	BLACK
POTABLE WATER	GREEN	BLACK
WASTE OIL	ORANGE	BLACK

The size of the legend letters and the length of the marker color field shall be as follows:

<u>OUTSIDE DIAMETER OF PIPE OR COVERING IN INCHES</u>	<u>MINIMUM LENGTH OF COLOR FIELD IN INCHES</u>	<u>SIZE OF LEGEND LETTERS IN INCHES</u>
¾ to 1-3/8	8	½
1-1/2 to 2-3/8	8	¾
2-1/2 to 6	12	1-1/4
8 to 10	24	2-1/2
over 10	32	3-1/2

Label plates shall be attached to all valves, manifolds, and pumps to indicate the system and function of the equipment.

For valves, the label plates shall be installed over the stem of the hand wheel, where possible, and shall indicate the direction of opening (or closing). The nameplate shall be 14 gauge (or heavier) brass with ¼ inch high engraved letters filled with black paint.

C605 PROPULSION SYSTEMA. CONTRACT DRAWINGS

## CLIN 0001

557-B605-01, PROPULSION SHAFTING & ARRANGEMENT  
 557-B615-01, STEERING LINKAGE & STRUT

## CLIN 0002, CLIN 0003, &amp; CLIN 0004

556-B605-01, PROPULSION SHAFTING & ARRANGEMENT  
 556-B615-01, STEERING LINKAGE & STRUT

B. MAIN ENGINES

The Contractor shall provide and install two, identical, marine-type, V-12, 4-stroke-cycle diesel engines of American manufacture. The engines shall operate at a continuous rating, rated for a minimum of 1500 bhp. Each engine shall be turbocharged/aftercooled. The engines shall be installed so that when the clutches are engaged to propel the vessel forward, the propellers rotate "inboard at the top."

The plans and specifications have been developed using the Caterpillar 3512B high displacement, continuous "A" engine with a 1500 bhp at 1200 RPM rating to assure a technically integrated system. Engines rated as high as 1800 RPM at maximum continuous rating are acceptable. However, lower RPM is desirable. If an engine different than that used in the Contract Design is selected, any resulting impact to other areas of the design shall be the responsibility of the Contractor. The engine footprint shall be similar to the Contract Design engine allowing access all around the engine for maintainability. However, no changes (except as noted in Clause C606.E) shall be considered in the hull form, rudders, shafting, nozzles, propeller RPM or propeller characteristics. The reduction gears must also maintain the internal shaft brake and all other gear related requirements (such as throttle boost, torque up, etc.).

~~Each engine shall operate at a continuous rating, rated for 1500 bhp at 1200 RPM, similar to a Caterpillar Model 3512B, high displacement, continuous "A." Each engine shall be turbocharged/aftercooled.~~

Each engine shall be provided with the manufacturer's standard equipment as well as the following features and options:

- Approved by ABS.
- Same rotation.

- **Electronic controlled unit injectors (for improved fuel efficiency and decreased emissions).**
- Set up for air start. Air starting motors to be supplied by the engine manufacturer. Air starting motors shall be of the oil-less type.
- Set up for electronic controls.
- Configured as a closed jacket water cooled system using keel coolers. Coolant level sensors and gauges to be provided.
- Auxiliary expansion tanks and/or larger jacket water pumps if required to handle the cooling volume. Auxiliary expansion tanks shall be fitted with low alarms.
- Electric jacket water heater.
- Each engine shall be equipped with a crankcase vent filter/collector system similar to a NELSON EcoVent Recirculator. The EcoVent shall be supplied with a manometer and the drain line shall be returned directly to the engine oil sump, below the oil level.
- Each engine turbocharger and exhaust manifold shall be insulated or jacketed to maintain an outer skin temperature of less than 125 degrees F.
- Engine overspeed protection shall be provided in accordance with ABS Rules.
- Electric prelube pumps.
- The water, lube and fuel lines to all engine connections shall be fitted with USCG and ABS approved flexible connections.
- Each main engine oil sump shall be fitted with a ball valve and quick disconnect fitting so that oil can be added to or drawn from the sumps.
- Provided with a full length drip pan under the engine.
- Inboard access for local instrumentation panel and engine maintenance points.
- Each engine shall be supplied with lifting eyes and mounting support. The Contractor is responsible for supplying suitable foundations for the engines and marine transmissions.

- The fuel rate of the main engines shall be compared to the original factory performance specifications (PAR TEST) during the vessel's test and trials. This comparison shall be made for the entire operating range of the engines by a representative of the engine manufacturer using instrumentation to acquire real-time fuel rate and engine output.
- Four sets of manuals shall be supplied for the engines and the gears.
- Spare parts in accordance with contract Clause C805.

The engines and all associated equipment shall be installed in strict compliance with the engine manufacturer's recommendations and the installation shall be approved by the manufacturer's field representative.

#### C. ENGINE COMBUSTION AIR

Each main engine shall be fitted for a dedicated source of outside air for combustion. Each combustion inlet shall be fitted with an intake air cartridge filter similar to an Amer-Kleen Cartridge Double-Pak manufactured by American Air Filter. The Contractor shall size the filters based on the engine manufacturer's combustion requirements for the main engines selected.

#### D. MAIN ENGINE STARTING/STOPPING

Each engine shall be set up for air start. Starting and stopping of the main engines shall be at the Main Engine Control Panels located in the lower engine room between the main engines and from the pilothouse console.

The Contractor shall provide and install on the pilothouse console, in accordance with ABS Rules, an emergency engine shutdown for each main engine. The emergency shutdowns shall be alarmed at the Main Engine Control Panels. Normal operation shall be resumed only after manual reset of the emergency shutdowns at the Main Engine Control Panels. No automatic restarting is allowed after activation of the emergency shutdowns. All emergency shutdown buttons shall be provided with guards to prevent accidental activation.

### E. REDUCTION GEAR & SHAFT BRAKE

The Contractor shall provide and install a reverse-reduction gear similar **equal** to a FALK model 2083 MRH. ~~with internal shaft brake for each main engine. The gear ratio shall be 4.500:1 based on the selection of the 1200 RPM engine. Each gear is to be capable of handling the full horsepower of each main engine in both ahead and astern operation.~~

~~Each gear shall the Contractor.~~

~~Bolts in the collision chocks shall be snugged against the engines after final alignment. Sufficient clearance shall be provided between the engines and the collision chock bolts to accommodate engine thermal dimension be suitable for throttle boost, torque up control sequencing, and shall have electric shift capability. Each gear is to produce Full RPM Ahead to Full RPM Astern in 12 seconds. Shaft brakes shall be provided to fulfill this requirement.~~

**Each gear shall have the following features:**

- **Reduction ratio to provide propeller/shaft RPM of 267 rpm**
- **Equal reduction ratios for ahead and astern**
- **Approved by ABS**
- **Unlimited operation in either ahead or astern rotational modes, at full engine rated power**
- **Unlimited operation in either ahead or astern thrust modes, at full engine rated power**
- **Horizontal offset configuration**
- **Hydraulic clutches**
- **Internal shaft brake**
- **Throttle boost capability ahead and astern, with minimum 25% boost over engine idle RPM**
- **Torque up capability with overlapping engagement of clutch and shaft brake**
- **Produce full RPM ahead to full RPM astern in 12 seconds**

- **Electric shift capability**

Each gear is to be provided complete with pumps, filters, thermometers, and the appropriate engine flange and controls. A torsional input coupling shall be provided.

The opposed propeller rotation will be provided by running one gear in forward and one gear in reverse.

F. PROPULSION CONTROL SYSTEM

The Contractor shall provide and install a complete control system for each main engine and reduction gear similar to the Sturdy Marine Propulsion Control System (MPCS). The control system shall be single point, set up for full electronic control with all electronic throttle and shift. No mechanical actuators may be provided as part of the control system. The installed control system shall meet the recommendations and practices of the engine, gear, and control system manufacturers.

The control system for each main engine and gear set shall incorporate:

- Throttle boost
- Engine torque-up sequencing
- Proportional neutral delay
- Shaft brake

The control system shall be configured to sequence the engines, reduction gears, clutches, and shaft brakes to accommodate and utilize torque-up and engine throttle boost. Control system delays, as well as boost and/or torque-up features shall be fully adjustable through software changes.

The control system supplied shall serve two stations, the engineer's workshop (station #1) and the pilothouse (station #2). Each control station shall be equipped with a dual lever control head. The main station for the control heads (throttles) shall be the engineer's workshop. Control is granted/transferred from this station to the pilothouse control head. Control of the throttles may be taken away from the pilothouse to the engineer's workshop at any time.

The control system shall also interface with the steering electronic controls to allow for independent flanking rudder and steering rudder operation. See contract Clause C615 for these requirements.

Power for the control system shall be set up such that:

- The power supplied is from a clean source.

- Back-up source of power is automatically transferred to in the event of a loss of primary power.

G. MAIN ENGINE INSTRUMENTATION & ALARMS

The Contractor shall supply and install the standard, local instrumentation panel supplied by the engine manufacturer. The local instrumentation panels shall be mounted inboard, between the main engines.

Each main engine shall be provided with an engine monitoring system available from the engine manufacturer. For these vessels, the Contractor shall supply and install a system similar to a Caterpillar Engine Vision System and a Caterpillar Engine Monitoring System.

The monitoring system provided and installed shall report and display engine system diagnostics and present audible and visual alarms for any of the engine and gear parameters measured. All audible alarms shall be provided with silencer buttons.

The Engine Vision System shall be installed in the engineer's workshop and shall allow for the simultaneous monitoring of each main engine and gear's operating parameters. For engine monitoring in the pilothouse, the Contractor shall supply and install the Engine Monitoring System for each main engine and gear set. All pilothouse instrumentation shall be furnished with lights and dimmer switches.

The instrumentation provided for the engineer's workshop shall be connected to an audible horn and flashing light located in the upper engine room as well as a set located in the lower engine to give notice of an engine or gear problem.

The engineer's workshop shall also contain the following additional alarms and instrumentation for the main engines and gears:

- Low starting air pressure alarm
- Pyrometers for measuring the exhaust stack temperatures
- Low level alarm for auxiliary expansion tanks

In addition to the Engine Monitoring System, the pilothouse shall also have shaft tachometers supplied and installed for each main engine. The shaft tachometers shall be supplied with lights and dimmer switches.

## H. TORSIONAL VIBRATION ANALYSIS

A complete torsional vibration analysis shall be performed on the propulsion drive train, and the results shall be submitted to the COR for review and approval during the Engineering Phase of the contract. The analysis shall include calculations of the natural frequencies, location of all critical speeds within the entire speed range of the engines, and an estimate of the maximum vibration stresses encountered within this range. All terms and formulae used in the development of this analysis shall be explicitly indicated. The torsional critical speeds shall be checked in accordance with ABS requirements.

The results of the analysis shall insure that each assembled system, which included the diesel engine, coupling, reduction gear, shaft brake, shafting and propeller shall be free of objectionably (“barred ranges”) critical speeds due to torsional vibration over the complete range of operation from 10% below idling speed to 10% above the maximum engine speed rating.

If the Contractor’s analysis indicates that there are critical speeds in the operating range, the COR shall be immediately notified with documentation of the problem and recommended solution.

## I. PROPULSION SYSTEM ALIGNMENT

All propulsion system final alignment shall be performed with the vessel complete and afloat at normal load displacement. Alignment shall be in accordance with the engine and gear manufacturers’ requirements and ABS requirements.

The shafting installation and alignment shall be checked prior to launch to verify proper bearing alignment and to ensure that no shafting is binding.

Collision chocks shall be provided and installed for both engines to prevent engine movement. The collision chocks shall be welded to the engine beds. Threaded jacking bolts shall be provided in the engine mounting pads to aid in engine alignment.

The engines and reduction gears shall be chocked after alignment with resin chocking. Chocking shall be applied in accordance with the manufacturer’s recommended procedure. All surfaces, including bolts, shall be coated with proper releasing agent.

After being properly chocked, the mounting bolts shall be torqued down to manufacturer’s specifications. All engine and reduction gear foundation bolts shall be fitted bolts provided by **the Contractor.**

Bolts in the collision chocks shall be snugged against the engines after final alignment. Sufficient clearance shall be provided between the engines and the collision chock bolts to accommodate engine thermal dimensional growth.

## C606 PROPELLERS & NOZZLES

### A. CONTRACT DRAWINGS

#### CLIN 0001

557-B605-01, PROPULSION SHAFTING & ARRANGEMENT

557-B614-01, KORT NOZZLE

557-B615-01, STEERING LINKAGE & STRUT

#### CLIN 0002, CLIN 0003, CLIN 0004

556-B605-01, PROPULSION SHAFTING & ARRANGEMENT

556-B614-01, KORT NOZZLE

556-B615-01, STEERING LINKAGE & STRUT

### B. CONTRACT DESIGN SELECTION

During Contract Design, calculations showed that the following propellers would be appropriate for use on each vessel:

- 5 blade
- 80 inch diameter
- Inboard Turning
- 87 inch variable pitch – approximate
- 0.94 DAR -approximate
- CT INLAND Style

### C. DETAILED DESIGN SELECTION

The Contractor shall prepare propeller calculations to finalize the selection of the propellers. The calculations shall be submitted to the COR for review prior to purchase by the Contractor.

The propellers provided shall be:

- Five-bladed, 80-inch diameter, similar to CT INLAND style wheels available from Rolls Royce\Bird-Johnson.
- The actual variable pitch and DAR shall be determined as required for a design speed of 6.5 mph.

- ABS grade CF-3 stainless steel.
- Double-sided, anti-singing edges.
- One of the propellers shall be right hand and one shall be left hand.
- Set up to rotate inboard at the top.
- Each propeller shall be provided with a fairwater cap covering the propeller nut and providing for smooth waterflow.
- Provided with pull holes in the hubs.

D. DESCRIPTION OF WORK

The Contractor shall install the propellers in accordance with the contract drawings listed above.

The Contractor shall provide an ABS statement of fact that each propeller meets all ISO R484, Class II fabrication, finish, and balance requirements. ABS certificates shall be provided to the COR for each propeller including the spares. See contract Clause C805 for spares.

E. NOZZLES

Each vessel shall be equipped with propeller nozzles. The entire inside of the nozzles, including leading and trailing edge radii, shall be stainless steel. The nozzle profile shall be type CT-28. The nozzle length shall be 52.625 and the inside diameter shall be 81 inches.

No part of the nozzle shall extend below the baseline. The Contractor shall adjust the design of the engine foundation, shaft alignment, strut, etc. to raise the nozzle 11/16" so it does not extend below the baseline. The nozzle shall be designed and constructed in accordance with the Contract Drawing. The nozzles shall be designed and constructed to be integral with the hull structure. Fairing plates shall be designed to provide a smooth transition from the hull form to the nozzle.

C610 SHAFTING SYSTEMA. CONTRACT DRAWINGS

## CLIN 0001

557-B605-01, PROPULSION SHAFTING & ARRANGEMENT  
557-B614-01, CT28 KORT NOZZLE  
557-B615-01, STEERING LINKAGE & STRUT

## CLIN 0002, CLIN 0003, CLIN 0004

556-B605-01, PROPULSION SHAFTING & ARRANGEMENT  
556-B614-01, CT28 KORT NOZZLE  
556-B615-01, STEERING LINKAGE & STRUT

B. DESCRIPTION OF WORK

The contract drawings listed above present a Contract Design for the shafting and struts. During the Detailed Design the Contractor shall perform engineering to finalize the shafting system, including raising the shaft line to match the raised nozzle (Clause C606.E).

Specific requirements of the shafting system are as follows:

- Shaft material shall be ABS Grade II steel.
- Shafts shall be continuous, without knuckle joints, ABS approved.
- Nickel-chrome-boron liners shall be fitted over the shaft where the shaft makes contact with the bearings and the shaft seal.
- The shaft “propeller end” and the “coupling end” details shall be to SAE J755 and SAE J756, respectively.
- The strut bearing and the stern tube bearing shall be similar to Johnson DURAMAX cutless bearings.
- Stuffing boxes shall be inflatable “air seal” type with grease lubrication, similar to Johnson, Figure 1787-IR.

A “scoop” shall be provided on the ~~fw~~aft end of each stern tube sized and located in order to force water into the stern tube during the ahead operation of the vessel for lubrication of the stern tube bearings. Each stern tube shall be provided with a vent, terminating at the main deck level.

C. SHAFT STRUTS

Shaft struts shall be installed in accordance with the above contract drawings. The shaft strut arm shall be fabricated with a semi-circular front and trailing edge. The shaft strut arm shall run through the hull plating and be welded to the main structural members. Doubler plates shall act as closure plates around the strut arm.

The shaft strut shall be sized as required by ABS.

C612 RUDDERS

A. CONTRACT DRAWINGS

CLIN 0001

557-B605-01, PROPULSION SHAFTING & ARRANGEMENT  
557-B612-01, RUDDER ARRANGEMENT (3 sheets)  
557-B615-01, STEERING LINKAGE & STRUT

CLIN 0002, CLIN 0003, CLIN 0004

556-B605-01, PROPULSION SHAFTING & ARRANGEMENT  
556-B612-01, RUDDER ARRANGEMENT (3 sheets)  
556-B615-01, STEERING LINKAGE & STRUT

B. DESCRIPTION OF WORK

The contract drawings listed above present a Contract Design for the steering and flanking rudders. During the Detailed Design the Contractor shall verify that the rudder stock scantlings meet the requirements of the current ABS Rules and shall make any changes that may become necessary to meet those rules. The Contractor shall provide and install the stocks and rudders based on his final design.

Speed for the steering and flanking rudder designs shall be 12 mph. The hard over angle for all rudders shall be 45 degrees. It should be noted that ABS requires increases in stock size for rudders that rotate more than 35 degrees, and for speeds in excess of 10 mph. Rudders, rudder ports and bearings, and tillers shall be redesigned as required to accommodate the larger rudder stocks.

The Contractor shall perform all detail engineering necessary to incorporate the rudders into the steering system final design including rudder construction, stocks, bearings, stops, seals, grease fittings and keys.

### C. GENERAL REQUIREMENTS

All cylinder foundations, jockey bars, and tillers shall be fitted with bronze bushings. Bushings shall be located where the cylinders meet the foundations or tillers and where the jockey bars meet the tillers.

Pins supplied shall be stainless steel. There shall be grease grooves on the pins with drilled passageways and alemite fittings. The Contractor shall ensure that all pins installed do not result in a loose fit. Anti-rotation clips shall be installed for the pins joining the jockey bars to the tiller arms.

Rudder stocks shall be fabricated from ABS approved steel with nickel-chrome-boron liners in way of the upper and lower bearings. The upper and lower rudder stock bearings shall be made from SAE 660 bronze pressed into the housings.

The steering and flanking rudder tubes shall be sealed at the bottom with plates and packed with grease.

### D. STEERING RUDDERS

The steering rudder system shall consist of four steering rudders similar to those shown on the contract drawings. The steering rudders shall be keyed alike and be interchangeable.

Steering rudder travel shall be 45 degrees to each side of centerline. Maximum time for travel from hardover to hardover shall not be greater than 10 seconds in the bollard condition.

The steering rudders shall be configured to provide independent steering rudder pair control actuation and movement. The port steering rudder pair shall not be mechanically linked to the starboard steering rudder pair.

### E. FLANKING RUDDERS

The flanking rudder system shall consist of four flanking rudders similar to those shown on the contract drawings. The leading and trailing edges of the flanking rudders shall be notched to clear the propeller shaft in the hardover condition. The flanking rudders shall be keyed alike and be interchangeable.

Flanking rudder travel shall be 45 degrees to each side of centerline. Maximum time for travel from hardover to hardover shall not be greater than 10 seconds in the astern bollard condition.

The flanking rudders shall be configured to provide independent flanking rudder pair control actuation and movement. The port flanking rudder pair shall not be mechanically linked to the starboard steering rudder pair.

## C615 STEERING SYSTEM

### A. CONTRACT DRAWINGS

#### CLIN 0001

557-B605-01, PROPULSION SHAFTING & ARRANGEMENT  
557-B612-01, RUDDER ARRANGEMENT (3 sheets)  
557-B615-01, STEERING LINKAGE & STRUT

#### CLIN 0002, CLIN 0003, CLIN 0004

556-B605-01, PROPULSION SHAFTING & ARRANGEMENT  
556-B612-01, RUDDER ARRANGEMENT (3 sheets)  
556-B615-01, STEERING LINKAGE & STRUT

### B. SYSTEM SIZING REQUIREMENTS

The contract drawings listed above present a Contract Design for the steering system. The Contractor shall perform engineering to finalize the system and establish a Detailed Design.

The system to be provided is an electro-hydraulic steering system providing for full follow-up control for the steering and flanking rudders. The system shall meet all ABS requirements for towboats.

Sizing of the steering hydraulics (pumps, cylinders, etc) shall be based on the most demanding powering condition to allow the steering rudders and the flanking rudders to go from hardover to hardover in 10 seconds. Both flanking and steering rudder travel is from 45 degrees to each side of centerline.

### C. SYSTEM CONFIGURATION

The system provided shall be configured such that:

- The main (steering) rudder pairs can be operated independently of each other. There is no central jockey bar tying the port steering rudder pair to the starboard steering rudder pair.
- The flanking rudder pairs can be operated independently of each other. There is no central jockey bar tying the port flanking rudder pair to the starboard flanking rudder pair.

- The system is equipped with “electronic jockey bar” capability that allows for the pair of steering rudders to be tied together as well as it allows for the pair of flanking rudders to be tied together at the operator’s discretion. This simulates a standard towboat steering and flanking system utilizing central jockey bars to tie the port and starboard rudder pairs together.
- The steering system is also electrically interlocked with the propulsion system controls to provide an auto-centering feature. See contract Clause C605 for the requirements of the propulsion control system.

The electrical interlocks are set up to operate in the following manner:

There is an electrical interlock between each main (steering) rudder pair (port and starboard) and its corresponding main engine. The interlocks automatically center a main (steering) rudder pair when the corresponding main engine is operating in the astern direction, without affecting the position of the other main (steering) rudder pair. As such, the main steering rudder levers (in the pilot house) normally only control the main rudders when the corresponding engines are in the ahead direction.

There is an electrical interlock between each flanking rudder pair (port and starboard) and its corresponding main engine. The interlocks automatically center a flanking rudder pair when the corresponding main engine is operating in the ahead direction, without affecting the position of the other pair of flanking rudders. As such, the flanking rudder levers (in the pilot house) normally only control the flanking rudder pairs when the corresponding engines are in the astern direction.

The auto-centering feature for the main (steering) rudders and the flanking rudders can be overridden by the operator by activating the ‘electronic jockey bar’ feature.

#### D. SYSTEM MODES

A selector switch shall be installed on the pilothouse console allowing the operator to select one of the three different modes of operation for the steering system. Those modes are full follow-up mode, override mode, and jog mode.

The modes are defined as follows:

- If full follow-up (FFU) mode is selected, the electrical interlocks are enabled between the pair of steering rudders (the astern interlock) and the pair of flanking rudders (the ahead interlock). The vessel then responds as described above.

- If the override (OVR) mode is selected, the electrical interlocks are disabled. In the override mode, the vessel's steering responds in the normal towboat style.
- If the jog (JOG) mode is selected, the steering system operates in a non-follow-up mode. There are no interlocks enabled. The vessel is then steered using the jog levers in the pilothouse, with individual jog levers controlling each pair of main rudders (port or starboard) and each pair of flanking rudders (port or starboard).

E. EQUIPMENT

1. Hydraulic Power Packs

The Contractor shall provide and install two hydraulic power units located in the steering gear room. One power unit shall serve the main (steering) rudder system with the second unit serving the flanking rudder system.

Each power unit shall be equipped with two electric motors, with each motor powering dual integrated pumps. The pumps shall be dual stacked of the positive displacement type. The outlets from each pump shall be plumbed to separate cylinders in order that differing loads on the port and starboard rudder pairs do not result in different rudder speeds.

One motor and dual pump set shall be sized to fully supply the cylinders in its respective (flanking or steering) rudder system. The second motor and dual pump set on the hydraulic power unit shall be a back-up to the first motor and dual pump set on the hydraulic unit.

The motors on the hydraulic units shall be electrically driven, with each motor set up on a separate motor controller, powered from the 480 volt AC system.

A hydraulic oil temperature gauge shall be mounted on each hydraulic unit.

A 2-inch deep drip pan shall be fabricated around each hydraulic power unit. The hydraulic fluid used in the systems shall be biodegradable.

2. Cylinders

A cylinder shall be provided for each pair of flanking rudders and steering rudders. The cylinders provided shall be of the unbalanced type.

3. Steering & Flanking Levers

Two paired sets (port and starboard) of “stacked” steering and flanking levers shall be provided in the pilothouse. Both steering levers shall be linked mechanically to move simultaneously. Similarly, both flanking levers shall be linked mechanically to move simultaneously.

Jog levers for the flanking and steering rudders shall also be installed in the pilothouse. The jog levers allow for operation in the non-follow-up mode.

4. Rudder Angle Indicators

Dial type rudder angle indicators shall be provided and installed in the pilothouse, two for the main (steering) rudders and two for the flanking rudders. The rudder angle indicators installed in the pilothouse shall be furnished with lights and dimmer switches.

5. Piping

All hydraulic piping and fittings shall be socket welded steel, schedule 40, minimum.

All valves shall be steel, ASTM A-216.

6. Instrumentation, Alarms, & Selector Switches

The Contractor shall provide and install the following main system controls in the pilothouse:

Off-on switches and selector switches for operating the hydraulic pumps.  
Pump running indicator lights for each pump.  
Steering Mode Selector Switches.

Contractor shall provide and install alarm panels in the pilothouse, engineer’s workshop, and the steering gear room. The panels shall omit visual and audible alarms. Alarm silencing buttons shall be installed at each panel.

F. CONTROLS, ALARMS & INSTRUMENTATION

The Contractor shall provide and install a steering system control and alarm panel in the pilothouse. The panel shall contain the following:

- Off-on switches and selector switches for operating the hydraulic pumps
- Motor running indicator lights for each motor
- Steering Mode Selector Switches
- System alarms

The steering system alarms provided in the pilothouse shall be in accordance with the ABS River Rules, Section 4/3.2.14 and shall also include a loss of hydraulic system pressure alarm. The alarms provided shall be visual and audible. Alarm silencing buttons shall be installed for the panel.

The Contractor shall provide and install steering system alarm panels in the engineer's workshop and the steering gear room. The alarm panels supplied shall mimic the alarms required above. Each panel shall also omit visual and audible alarms and be provided with alarm silencing buttons.

The alarm panel located in the engineer's control room shall also incorporate motor running indicator lights for each motor.

C630 FUEL OIL SYSTEM

A. GENERAL REQUIREMENTS

For each vessel, the Contractor shall provide and install all pumps, filters, piping, hoses, and valves necessary to form a complete fuel oil system. The system shall serve the main engines and diesel generator sets, and have the capability of transferring fuel between the fuel oil tanks, including the day tank.

All fuel oil piping shall be seamless black steel, A106.

B. FUEL OIL TANKS

See Clauses C130 and C320 for fuel oil tank capacities and details of the construction of the fuel oil tanks.

C. VENTS, SOUNDS & FILLS

All vents, sounds, and fills shall be installed outside of the deckhouse.

The main fuel oil tanks shall be filled via a fuel manifold, located in the forward machinery space. The tank fills shall be through a 3-inch nominal line. The tank fills shall be located port and starboard in spill containments. Each fuel fill shall terminate 18 inches above the deck with a bronze screw cap labeled "FUEL."

Each main fuel oil tank shall be fitted with a 4-inch vent that terminates in a gooseneck and is fitted with a corrosion-resistant flame screen.

The fill stations shall be located, port and starboard, between Frame #30 and #32. The fills and vents shall terminate inside permanent spill containment boxes that entirely enclose the vents and fills. The box shall be fitted with a watertight door fitted with a hasp and padlock. Each door shall incorporate a rain lip and air passage for ventilating the enclosure when the door is closed.

Each main fuel oil tank shall be fitted with a 1-1/2 inch sounding tube. Each sounding tube shall be run as straight as practical and located at the lowest part of the tank. The sounding tube shall be of the flush mount type, with tee wrench. At the tank bottom there shall be installed a 6 inch x 6 inch striking plate of at least 3/16 inch thickness, seal welded to the tank bottom.

A sounding tape and plumb bob shall be supplied for each vessel in order to sound the tanks.

The forward and aft day tanks shall each be fitted with vents that terminate 18 inches above the main deck. The vents shall be located in spill containments fitted with watertight, hinged lids, hasps, and padlocks. Each lid shall incorporate a rain lip and air passage for ventilating the enclosure when the lid is closed.

D. STRIPPING CONNECTIONS

A 1-inch (nominal) pipe drain, with a gate type shut-off valve shall be fitted approximately 1/2 inch from bottom of each main fuel oil tank, the forward day tank, and the aft day tank at the end nearest the lower engine room.

E. SUPPLY & RETURN LINES

The Contractor shall install supply and return lines for each main engine and each diesel generator set engine. The size of the lines installed shall be in accordance with the engine manufacturer's requirements for the engines selected.

For the main engines, fuel shall be supplied from and returned to the forward fuel oil day tank. The fuel return lines shall be fitted with fuel oil coolers. High and low fuel oil suction shall be provided in day tank. The high suction shall be approximately 9 inches above the tank bottom, and the low shall be approximately 3 inches above the tank bottom.

For the diesel generator engines, fuel shall be supplied and returned to the aft day tank. The fuel return lines shall be fitted with fuel oil coolers. The return headers from the engines shall enter the day tanks at the end of the tank opposite from the exits for the fuel supply headers. The return headers shall also be installed as high as possible in the fuel oil tanks.

The Contractor shall be responsible for sizing, providing, and installing ABS and USCG approved flexible connections between each main engine and each diesel generator for connecting to the fuel supply headers and fuel return headers. The flexible connections supplied shall also meet the engine manufacturer's specifications.

F. EMERGENCY SHUT-OFF VALVES & ISOLATION VALVES

Each tank connection subject to a static head of fuel shall have a shut-off valve at the tank with a remote operated reach-rod operable from the outside the house on the main deck level. The reach-rods shall run as directly as possible to the shut off valves to avoid problems with the U-joints.

Additional ball valves shall be installed for the fuel oil system in order to allow for isolating the system for maintenance and repair.

G. FUEL OIL TRANSFER SYSTEM

The fuel oil system shall facilitate transfer of fuel oil between the main fuel oil tanks and allow for the filling of the forward and aft day fuel oil tanks. The transfer system consists of a manifold, knife-edge strainer, fuel transfer pump, and piping.

A positive displacement fuel oil transfer pump and motor, similar to an Oberdorfer, shall be provided and installed.

An emergency stop button for stopping the fuel oil transfer pump shall be installed at Frame #38, port side as well as at the fuel transfer station in the forward machinery space. The buttons shall be used in case of overfilling of the tanks while transferring fuel or in case of a fire.

A manually operated, CUNO "Auto Klean" knife-edge strainer shall be provided and installed on the inlet side of the fuel oil transfer pump. The CUNO filter to be supplied shall be similar to type EG.

The CUNO "Auto Klean" knife-edge strainer shall be provided with a pipe drain with a shut-off type valve and pipe cap in place of the drain plug. There shall be sufficient space for a small metal container to be placed under the drain.

All transfer lines shall be installed approximately 6 inches from the bottom of the fuel oil tanks.

#### H. TANK GAUGING & FILL ALARMS

The main fuel oil tanks and the day tanks shall be fitted with a liquid level gauge similar to a KENCO model 9900 series level gauge with integral valves. The liquid level gauges shall have all stainless steel construction and each gauge shall be calibrated to show  $\frac{1}{4}$  tank level, the  $\frac{1}{2}$  tank level, and the  $\frac{3}{4}$  tank level.

For each main fuel oil tank, a remote reading tank capacity gauge shall be installed in the engineer's workshop. The gauges shall give the amount of fuel remaining in each main fuel oil tank in gallons.

For the forward and aft fuel oil day tanks, low level alarms shall be installed. A warning shall sound at a tank capacity of 25% and low alarm at a capacity of 10%. The alarms shall be audible and visual and shall be recorded at alarm panels located in the engineer's workshop and at the pilothouse console.

Alarm panels shall be installed at each fuel fill station, the fuel transfer station in the forward machinery space, and the engineer's workshop to report a high tank level in the main fuel oil tanks. Audible and visual alarms shall be received at these panels with a warning sounding at a tank capacity of 90% and a high alarm at a capacity of 95%.

#### I. PRIMARY FUEL FILTERS

The fuel oil supply lines to each main engine and each diesel generator set shall be equipped with individual duplex RACOR fuel filters/water separators.

The Contractor shall be responsible for sizing, providing, and installing the RACOR filters based on the main engines and diesel generators selected. The RACOR filters supplied shall meet the engine manufacturer's specifications.

The RACOR filters shall be mounted so a 5-gallon bucket can be placed under the filter. The bucket shall rest on a tray or pan 24 inches by 24 inches with 6-inch deep sides.

### C635 LUBE OIL SYSTEM

#### A. GENERAL REQUIREMENTS

For each vessel, the Contractor shall provide and install all components, piping, and valves necessary to form a complete lube oil system. The lube oil system shall supply clean lube oil to the main engines, gears, and generator diesel engines.

All lube oil piping shall be seamless black steel, A106.

The lube oil tank(s) shall be sized and constructed of welded steel in accordance with Clauses C130 and C320.

The main engine and generator engine sumps shall be fitted with quick disconnects in accordance with Clause C605 and Clause C733 of the contract.

#### B. TANKS, FILL & VENT CONNECTIONS

A non-integral tank shall be sized and constructed to hold lube oil. See Clause C320 for details of the tank's construction. The tank shall be fitted with a mechanical gage for reading the tank's liquid capacity.

The tank shall be equipped with a 1-1/2 inch fill and 2-inch vent. The fill and vent shall terminate 18 inches above the main deck. The fill line shall be run straight in order to also serve as a sounding pipe. The fill shall be fitted with a bronze screw cap and safety chain. The fill line shall be clearly labeled for its use.

The vent shall terminate in a gooseneck and be fitted with a corrosion-resistant flame screen.

The fill and vent shall terminate in a permanent spill containment box that entirely encloses the vent and fill. The box shall be fitted with a watertight, hinged lid fitted with a hasp and padlock. Each lid shall incorporate a rain lip and air passage to ventilate the enclosure.

C. DRAIN CONNECTION

A 1-inch (nominal) pipe drain, with a shut-off valve and pipe cap, shall be fitted at the lowest point of the lube oil tank. The drain shall be arranged so that a oil can or 5-gallon bucket can be placed beneath it.

D. LUBE OIL TRANSFER SYSTEM

The Contractor shall supply and install a gear pump, similar to an Aeroquip FLOCS 15 for transferring fuel from the lube oil tank to the main engines and generator sets. The pump shall be located so that it can service the main engines and the generator set engines. A y-strainer shall be provided on the suction side of the pump.

The lube oil transfer system shall be hard piped to the vicinity of the engine sumps and terminate at ball valves with quick disconnect couplings. The Contractor shall supply lengths of hose to connect the lube oil system from the valves to the engine sump connections.

C636 WASTE OIL SYSTEM

A. GENERAL REQUIREMENTS

For each vessel, the Contractor shall provide and install all components, piping, pumps, and valves necessary to form a waste oil system. The waste oil system shall be provided to collect oil from the main engines, gears, and generator set engines without draining into the bilges.

B. TANK FILL, VENT & STRIPPING CONNECTIONS

The waste oil tank shall be fitted with a liquid level indicator. The waste oil tank shall be designed and constructed of welded steel in accordance with Clauses C130 and C320.

A 1-1/2 inch pump out line shall be installed in the waste oil tank and shall terminate 18 inches above the deck with a bronze screw cap. The pump out line shall be run straight in order to also serve as a sounding pipe.

A 2-inch vent, with corrosion-resistant flame screen, shall also connect to the waste oil tank.

The tank pump out line and vent shall terminate in a permanent spill containment enclosure on the main deck. The enclosure shall be fitted with a watertight, hinged lid. The lid shall incorporate a rain lip and air passage to ventilate the enclosure.

A ¾- inch nominal pipe with pipe plug shall be fitted at the lowest point possible for the waste oil tank. This line shall be used for tank cleaning purposes.

C. SYSTEM CONFIGURATION

For each vessel, the Contractor shall supply and install an air-operated double diaphragm pump similar to a Wilden to be used to pump out the sumps. The pump shall be portable to allow for pumping out the main engines, gears and diesel generator set engines.

Hard piped connections shall be installed in the generator room and the lower engine room. The connections shall terminate with a ball valve and quick disconnect coupling to allow for attaching the pump. Sections of hose with fittings shall be supplied to enable attaching the pump to the sumps and the hard piped waste oil system.

C637 OILY BILGE SYSTEM

A. GENERAL REQUIREMENTS

The Contractor shall provide and install an oily bilge system consisting of an oily water tank, liquid level indicator, an oily bilge pump, piping, and oil removal system. There shall be no oily water separator. The system shall be provided to collect oily water from the main engine drip pans and from the lower engine room bilges to the oily bilge tank. The system shall also be capable of pumping to a shore connection.

The oily bilge tank shall be designed and constructed in accordance with Clauses C130 and C320. The oily tank shall be fitted with a liquid level indicator.

The oily water bilge pump shall be a self-priming and shall be capable of taking suction from any main engine drip pan or any bilge in the lower engine room. The pump shall discharge directly into the oily water holding tank located in the lower engine room. The pump shall be capable of pumping approximately 20 gpm.

The Contractor shall provide an anti-static hose for the pump capable of reaching all of the main engine drip pans and all of the bilges in the lower engine room.

B. TANK, VENT & STRIPPING CONNECTION

A 1-1/2 inch pump out line shall be installed in the oily bilge water tank and shall terminate 18 inches above the deck with a bronze screw cap. The pump out line shall be run straight in order to also serve as a sounding pipe.

A 2-inch vent, with corrosion-resistant flame screen, shall also connect to the oily bilge water tank.

The tank pump out line and vent shall terminate in a permanent spill containment enclosure on the main deck. The enclosure shall be fitted with a watertight, hinged lid. Each lid shall incorporate a rain lip and air passage to ventilate the enclosure.

A 3/4-inch pipe with pipe plug shall be fitted at the lowest point possible for the tank. This line shall be used for tank cleaning purposes.

C640 ENGINE COOLING SYSTEM

A. CONTRACT DRAWINGS

CLIN 0001

557-B205-01, OUTBOARD PROFILE

557-B215-01, GENERAL ARRANGEMENT

CLIN 0002, CLIN 0003, CLIN 0004

556-B205-01, OUTBOARD PROFILE

556-B215-01, GENERAL ARRANGEMENT

B. SYSTEM SIZING REQUIREMENTS

Approximate locations for the grid coolers are shown on the above listed contract drawings. During Detailed Design, the Contractor shall perform engineering to size the engine cooling pumps and coolers based on the final selection of the main propulsion engines and gears, and the diesel generator engines. The coolers shall be sized in accordance with the engine and gear manufacturers' recommendations. The Contractor shall submit calculations for the sizing of all engine coolers.

The coolers shall be sized as follows:

For the main propulsion engines and gears, the engine cooling pumps and grid coolers shall be sized to cool the full engine horsepower at a vessel forward speed of 1 knot and the water temperature of 85 degrees F. Separate coolers shall be supplied for the jacket water coolers and the aftercoolers in accordance with the engine manufacturer's requirements.

For the generator set diesel the engines, the cooling pumps and grid coolers shall be sized to cool the full generator outputs at a vessel forward speed of 0 knots and the water temperature of 85 degrees F.

C. COOLER REQUIREMENTS

The Contractor shall provide and install grid coolers similar to Fernstrum. The grid coolers shall be set up with the following features:

- Each grid cooler shall be double pass.
- Each grid cooler shall be of the thru-hull type with special gasket kits for installation.
- The circulating mixture shall be 50 percent water and 50 percent ethylene glycol by volume.
- Each grid cooler shall be rugged all welded (or brazed) construction.
- The grid cooler recesses shall be configured in accordance with the cooler manufacturer's requirements. Sloped ends shall be provided in the recesses.
- The outboard faces of the grid coolers shall be recessed at least 3 inches inside of the surrounding hull surfaces.
- Bar type cooler guard grates, removable with minimum ½ inch diameter stainless steel bolts and nuts, shall be installed over all grid coolers.
- Provided with auxiliary expansion tanks and/or larger jacket water pumps if required to handle the cooling system volume.

Flexible hose connections for the cooling water on the main engines, gears, and the diesel generator set engines shall be suited for temperatures up to 250 degrees F and pressure to 20 psig.

D. PIPING & VALVES

All piping shall be steel, non-galvanized with welded joints and fittings. The piping shall incorporate drains to allow for removing\adding coolant and to allow for working on the coolant system.

Bolted flanges shall be fitted to permit removal of pipe sections at the engine and cooler connections.

Flanged stainless steel ball type shut-off valves shall be furnished and installed at both the inlet and outlet connections to the external grid coolers. The ball valves shall have operating handles fitted with stops or detents for open and closed positions to indicate valve open and valve closed positions.

The low point of each cooling system shall be fitted with a stripping connection to allow for the draining of the cooling system.

E. GRID COOLER VENTS

All cooling systems shall be vented at the main deck level to allow for removal or bleeding off of trapped air from the cooling systems. Vents shall be equipped with ball type shut-off valves that may be locked in the closed position. The vents shall terminate at a height of 18 inches above the main deck.

All grid cooler recessed pockets shall be vented to allow entrapped air in the pockets to escape.

C650 ENGINE EXHAUST SYSTEMS

A. SYSTEM SIZING REQUIREMENTS

During Detailed Design, the Contractor shall perform engineering to size the engine exhaust systems based on the final selection of the main propulsion engines, and the diesel generator set engines. The systems shall be designed and sized not to exceed the engine manufacturer's required maximum back pressure. System installations shall be in strict accordance with the engine manufacturers' recommendations.

B. EXHAUST SYSTEM REQUIREMENTS

Each exhaust system shall be independently routed from each engine exhaust outlet through the upper deck openings and up into its respective stack. Exhaust piping in way of the upper deck opening is to be supplied with a sufficient number of take down joints or bolted connections to facilitate a clear opening when removed. The silencer for each engine shall be located in its respective stack.

Each silencer shall be similar to a Nelson 300 attenuation level 300 model. Each silencer shall have the following features:

- 35-db reduction minimum.
- Spark arrestor.
- High temperature corrosion resistant exterior coating.
- Brackets for mounting the mufflers inside the stacks.
- Cleanouts piped to an accessible location.

The silencers and exhaust line flanges shall be to ASA 125 lb standards complete with high temperature gaskets and bolts.

Suitable flanged adapters shall be provided and installed at each engine exhaust outlet. Pipe taps, 1/4 inch, shall be provided near each engine outlet to allow for the checking of the system backpressure. Steel plugs shall be provided for each tap. The Contractor is required to provide the equipment necessary and to test each system's backpressure at the exhaust elbows during tests and trials. See contract Section E.

Flanged, lined stainless steel expansion sections shall be provided, and shall be sized and located in order to prevent over stressing of the engine connecting flanges, anchor points, and piping. The joints shall use multi-ply bellows construction.

#### C. EXHAUST SYSTEM FEATURES

The piping runs between each main engine and diesel generator set engine silencer outlet and the "ends" shall incorporate the following:

- Rain proof slip joint seals at the stack top exhaust pipe penetrations.
- A 45-degree elbow and a 45-degree mitered pipe, facing up aft, and outboard.
- The exhaust pipe and fittings above the silencers shall be stainless steel.

Each exhaust system "up to and including" the silencer shall be suitably insulated. The insulation shall be a non-asbestos type similar to CLAREMAT 1200 insulating blanket. The insulation thickness shall be such that the surface temperature of the insulation does not exceed 125 degrees F. The insulation surface shall be covered by CLARTEX 1925 A557 pad fabrics. The pad fabrics shall be held in place with lacing hooks and lacing wire.

C660 BILGE & BALLAST SYSTEMA. CONTRACT DRAWINGS

## CLIN 0001

557-B130-01, TANK CAPACITY PLAN

557-B245-01, HOLD &amp; MACHINERY ARRANGEMENT

## CLIN 0002, CLIN 0003, &amp; CLIN 0004

556-B130-01, TANK CAPACITY PLAN

556-B245-01, HOLD &amp; MACHINERY ARRANGEMENT

B. DESCRIPTION OF WORK

Each vessel shall be furnished with a separate bilge system for dewatering compartments and a separate ballast system for trimming out the vessel. There shall also be sump pumps provided to remove water from beneath the stuffing boxes.

C. BILGE SYSTEM

The Contractor shall provide and install all pumps, manifolds, strainers, valves, piping, and gauges necessary to form a complete clean bilge system for each vessel. The oily bilge system is described in contract Clause C637.

The clean bilge system shall be designed and installed in accordance with ABS rules. The system is a fixed system configured to remove water from all watertight compartments, voids, and the inner bottom beneath the main fuel oil tanks and the fuel oil service tank. The clean bilge system shall serve:

- Forward Stores
- Fuel Oil Tank Innerbottom
- Forward Machinery Space
- Port Cooler Void
- Starboard Cooler Void
- Lower Engine Room
- Shaft Alley
- Aft, Port Void #1
- Aft, Starboard Void #1
- Aft, Port Void #2
- Aft, Starboard Void #2

Each subdivision has an independent bilge suction. Each bilge suction shall be protected by a suction strainer located at the low point of each compartment. Each suction strainer shall have a clear opening three times the total area of the connected suction pipe. The clean bilge system discharges the water overboard through a discharge located at least 12 inches above the full load waterline.

The Contractor shall provide and install a bilge suction manifold or series of stop-check valves. Also acceptable will be gate valves with check valves arranged in a fabricated manifold. The manifold shall be located in the same space as the bilge pump it normally serves, and shall be capable of being locally controlled and easily accessible at all times.

The Contractor shall supply and install two bilge pumps similar to those manufactured by Crown (Barnes Pumps). Each pump shall be a self-priming, centrifugal pump having ABS type approval. The pumps shall be electric drive type, with the pumps and motors furnished as matched sets from the pump manufacturer. The motor controllers for the pumps shall be set-up with low voltage release. See contract Clause C750.

The Contractor shall submit a system curve and calculations (including NPSH calculations) to the COR for review and acceptance during the Engineering Phase of the contract before procuring the pumps.

#### D. BALLAST SYSTEM

The Contractor shall provide and install a pump, manifold, strainers, valves, piping, and gauges necessary to form a complete ballast system for each vessel. The ballast system shall be designed and installed in accordance with ABS rules. Each vessel contains five ballast tanks:

- Forward Ballast Tank
- Port Ballast Tank #2
- Starboard Ballast Tank #2
- Port Ballast Tank #3
- Starboard Ballast Tank #3

The ballast system shall be set up for the following operations:

- Filling ballast tanks
- Discharging ballast tanks overboard
- Transferring water between ballast tanks

The ballast system shall be set up to take in water through one of the sea chests. The system shall discharge water overboard through a discharge located at least 12 inches above the full load waterline.

Discharge/suction gate valves shall be installed to allow the tanks to be lined up to the discharge or suction of the ballast pump. A duplex strainer, similar to a Mueller model #692 shall be installed on the inlet side of the ballast pump that is connected to the sea chests.

The ballast pump installed shall be similar to an Ingersoll-Dresser, type D-800. The pump shall be a self-priming, centrifugal pump with bronze impeller. The pump shall be electric drive type, with the pump and motor furnished as a matched set from the pump manufacturer. The motor controller for the pump shall be set-up with low voltage protection. See contract Clause C750.

E. BALLAST TANKS

The ballast tanks shall be constructed in accordance with contract Clause C320. Each ballast tank shall be equipped with a:

- Tank filling line. The size of the lines shall be determined by the Contractor during Final Design.
- Vent with flame screen. Each tank vent size shall be at least 125% of the effective area of the filling line selected above.
- 1-1/2 inch sounding tube. The sounding tube shall be as straight as practical and located at the lowest part of the tank, where practicable. The sounding tube shall be of the flush mount type, with tee wrench. At the tank bottom there shall be installed a 6 inch x 6 inch striking plate of at least 3/16 inch thickness, seal welded to the tank bottom.

F. SHAFT STUFFING BOX SUMP PUMPS

The Contractor shall provide and install in an automatic sump pump similar to a Rule, model 2800 in each sump. The pumps shall be powered from the vessels 120 volt AC system. Separate overboard discharge lines shall be provided for each sump pump. Each overboard discharge shall be located approximately 12 inches below the main deck.

C665 POTABLE WATER SYSTEMA. CONTRACT DRAWINGS

## CLIN 0001

557-B130-01, TANK CAPACITY PLAN

557-B245-01, HOLD &amp; MACHINERY ARRANGEMENT

## CLIN 0002, CLIN 0003, CLIN 0004

556-B130-01, TANK CAPACITY PLAN

556-B245-01, HOLD &amp; MACHINERY ARRANGEMENT

B. DESCRIPTION OF WORK

Potable water shall be distributed throughout each vessel from the potable water tanks located in the forward stores. The vessel shall take on potable water from an off-vessel source.

The Contractor shall provide and install all components, piping, valves, and vents necessary to form a complete potable water system. All components supplied for the system shall be sized to fit through a USCG standard 28 inch x 60 inch clear opening watertight door with 6 inch radius corners.

C. DISTRIBUTION SYSTEM REQUIREMENTS

A potable water distribution system shall be supplied and installed to provide service to all fixtures on the vessel requiring potable water. The system installed shall comply with all applicable guidelines set forth by the U.S. Public Health Service. The system shall be arranged so that the entire system can be gravity drained for cold weather lay-up.

Cold-water service shall be supplied to all sinks, showers, toilets, hot water heaters, icemakers, the washing machine, dishwasher, water fountain, and the hose bibbs located in throughout the vessel.

Hot water service shall be supplied to all sinks, showers, the washing machine, and the dishwasher.

Piping material from the tanks to the pressure sets shall be stainless steel. From the pumps to the remainder of the system the piping material shall be ASTM B-88, type K, seamless copper. The solder connections shall be lead free.

To assist in maintenance and repair, shut-off valves shall be supplied and installed at all hot and cold water piping outlets including the sinks, toilets, showers, dishwasher, washing machine, ice machine, and refrigerator/freezer icemakers. These valves shall be quarter-turn ball valves, with each being easily accessible without special tools.

Since all the vessels operate in cold climates, no piping shall be run on or against exterior bulkheads. All potable water-piping running through unheated spaces shall be heat traced and insulated. All hot water piping shall be insulated.

The Contractor shall install the piping with flexible connections where it transitions from the floating deckhouse into the hull or aft deckhouse. Care shall be taken to insure that the piping does not freeze in the spring void beneath the floating deckhouse.

#### D. POTABLE WATER PRESSURE SETS

Two potable water pressure sets with pumps shall be provided and installed with all required pressure switches, pressure gauges, and pressure relief valves. The system shall be set up requiring only the use of one pressure set. The second pressure set shall be a back-up unit.

The potable water system shall be set up such that the pressure sets cut in at 40 psi (low pressure cut-in) and cut out at 60 psi (high pressure cut-out).

The pressure sets shall be furnished with a precharged water tank with a minimum capacity of 96 gallons. The precharged water tanks should be supplied with a relief valve, which is capable of discharging the full output of the pumps. Each pump shall have a capacity of no less than 15 gpm at a pressure of 60 psi.

#### E. WATER FILTERS

##### 1. Tank Inlet Filters

In-line water filters for removing dense particles (sand, rust, grit) and sediment shall be installed between each fill station and each potable water tank. The filters shall be located in order to allow ease of access for changing and maintaining the filter elements or cartridges.

The filter housing shall have 1-1/2 inch inlets and outlets. A dedicated spanner wrench shall be supplied with the filter housings to assist in changing the filter elements or cartridges.

The filter elements or cartridges supplied shall be capable of removing particles that are a nominal 50 micron and larger. Each filter or set of filters shall be capable of filtering upto 40 gpm of water at 100 psi.

2. Tank Outlet Filters

The outlet of each potable water tank shall be fitted with a high flow, heavy-duty whole house water filter similar to an Aqua-Pure. The filter shall be outfitted with filter cartridges that that treat the water for taste\odor\chemicals.

F. HOT WATER HEATERS

1. CLIN 0001, CLIN 0003 & CLIN 0004

Two, 85-gallon, dual element, electric water heaters shall be provided complete with all accessories shall be provided. One unit shall serve the main deck and the other shall be located above the main deck and serve all decks above the main deck. The heaters shall be wired for 480 volt AC, 3-phase with 3000-watt elements. The heaters shall have a recovery rate of at least 36 gal/hr at 100 degree F temperature rise. The units shall be supplied with an automatic temperature control adjustable to 180 degree F.

2. CLIN 0002

One, 85-gallon, dual element, electric water heater shall be provided complete with all accessories. The unit shall be located in the area of the pressure set. The heater shall be wired for 480 volt AC, 3-phase with 3000 watt elements. The heater shall have a recovery rate of at least 36 gal/hr at 100 degree F temperature rise. The unit shall be supplied with an automatic temperature control adjustable to 180 degree F.

### G. POTABLE WATER TANKS

The potable water tanks are described in contract Clause C320. Each potable water tank shall be equipped with a:

- Liquid level indicator similar to a GEMS SureSite. The indicator shall be of all stainless steel construction and shall be suitable for potable water service. Each gauge shall be calibrated to show  $\frac{1}{4}$  tank level, the  $\frac{1}{2}$  tank level, and the  $\frac{3}{4}$  tank level.
- 1-inch drain with ball valve and pipe cap shall be installed on each tank to allow for the draining of the tanks. Each tank's stripping connection shall be fitted at the lowest point of each tank.

A 1-inch drain with ball valve and pipe cap shall be installed on each tank to allow draining of the tank.

A backflow-preventer shall be installed between the potable water tanks and the pressure sets.

### H. POTABLE WATER FILL STATIONS

The Contractor shall provide and install a 1-1/2 inch potable water fill and 2 inch vent for each potable water tank. The potable water filling stations shall be located on the main deck on the port and starboard sides of the deckhouse.

At each filling station, the fill line shall terminate with a brass screw cap fastened by a chain to an adjacent bulkhead or fixture in such a manner that the cap will not touch the deck when hanging free. The filling connection shall be clearly marked by means of 1/2-inch lettering (minimum), stamped on a non-corrosive label plate, or equivalent.

Enclosures shall be provided for each fill with lockable hinged doors with staples to hold them open. Each door shall be provided with gaskets to prevent the intrusion of water.

Padlocks with three keys, similar to those manufactured by MASTER LOCK, shall be provided to lock each filling station enclosure.

I. HOSE BIBBS & FIXTURES

All fixtures (sinks, etc) are described in Clause C437.

The Contractor shall supply and install freeze-proof hose bibbs in the following locations:

<u>Deck Level</u>	<u>Frame #</u>	<u>Location</u>
Pilothouse	23	Aft
Upper Deck	23	Stbd
Upper Deck	26	Port
Main Deck	24	Stbd
Main Deck	28	Port
Main Deck	47	Port
Main Deck	47	Stbd

For the CLIN 0002, CLIN 0003, and CLIN 0004, a hose bibb shall also be installed on the Texas Deck at Frame #22, port.

The freeze-proof hose bibbs shall be 5/8 inch with each hose bibb outfitted with a vacuum breaker.

Interior hose bibs shall also be installed in the machinery space and in the lower engine room. Each hose bibb furnished shall be 5/8 inch with each hose bibb outfitted with a vacuum breaker.

C667 SANITARY & SEWAGE SYSTEM

A. CONTRACT DRAWINGS

CLIN 0001

557-B130-01, TANK CAPACITY PLAN  
 557-B215-01, GENERAL ARRANGEMENT  
 557-B233-01, PILOTHOUSE DETAILS  
 557-B245-01, HOLD & MACHINERY ARRANGEMENT

CLIN 0002, CLIN 0003 & CLIN 0004

556-B130-01, TANK CAPACITY PLAN  
 556-B215-01, GENERAL ARRANGEMENT  
 556-B233-01, PILOTHOUSE DETAILS  
 556-B245-01, HOLD & MACHINERY ARRANGEMENT

## B. DESCRIPTION OF WORK

For each vessel, the Contractor shall provide and install all components, piping, valves, and vents necessary to form a complete sanitary and sewage system. The sanitary and sewage system shall comply with all applicable guidelines set forth by the U.S. Public Health Service.

The sanitary and sewage system shall be set up to allow for:

- Treating both gray and black water
- Overboard discharge of treated water where allowable
- Retention of treated water
- Retention of untreated black and/or gray water

All fixtures connected to the sanitary and sewage system are described in contract Clause C437.

## C. SYSTEM CONFIGURATION & REQUIREMENTS

### 1. General Requirements

The system consists of two separate sections; a gray water section and a black water section. Each system shall be piped separately to the onboard sewage treatment plant.

All horizontal drain and sewer piping shall be installed with a slope of  $\frac{1}{4}$  inch per foot and use the minimum number of elbows. The system shall also be installed with cleanouts and low point drains, and be arranged so that the entire system can be gravity drained for cold weather lay-up.

The Contractor shall install the piping with flexible connections where it transitions from the floating deckhouse into the hull or aft deckhouse. Care shall be taken to insure that the piping does not freeze in the spring void beneath the floating deckhouse.

### 2. Black Water Service

Black water is collected from the water closets and urinals. Water closets are located on the pilothouse deck, the Texas deck, upper deck and main deck levels. Two urinals are located on the main deck level.

The Contractor shall provide and install vent piping for all water closets and urinals. The vent piping may be run common where possible with each vent fitted with a flame screen.

The black water piping shall be routed directly from the water closets and urinals to the treatment plant. There shall be an emergency bypass line installed that allows for directing untreated black water to the sewage holding tank in the case that the treatment plant is out of service.

### 3. Gray Water Service

Cast brass "P" traps with clean outs, shall be provided and installed in the drain lines from the stateroom and toilet space sinks, the utility sinks, the ice makers, the showers, and the pilothouse sink. Traps shall be provided on all other fixtures where so recommended by the fixture manufacturer.

The Contractor shall supply and install 1-1/2 inch nominal deck drains in each toilet space and a 2-inch nominal deck drain for the Laundry Room for CLIN 0002, CLIN 0003, and CLIN 0004. All deck drains furnished shall have steel bodies with removable bronze strainer plates and shall have a 2:1 ratio of strainer open area to pipe area. All deck drains shall be connected to the gray water system.

Gray water is also collected from the sinks, showers, water fountain, and the washing machine. There is a sink at the pilothouse deck level, and there are sinks and showers on the Texas deck, upper deck, and main deck levels. The washing machines are located on the main deck level. There is also gray water collected from the galley sink with waste disposer, dishwasher, and two ice machines. This equipment is located on the main deck level.

The Contractor shall provide and install vent piping for the gray water drain lines. The vent piping may be run common where possible with each vent fitted with a flame screen.

The system shall be set up to run into a common line that directs the gray water to the treatment plant. There shall be an emergency bypass line installed that allows for directing the untreated gray water to the gray water holding tank in the case that the treatment plant is out of service.

D. SEWAGE TREATMENT PLANT

The Contractor shall supply and install an on-board sewage treatment system for treating both the black and gray water generated on the vessel from a 16-person crew. The system installed shall be similar to an Owens Kleen Tank meeting the following requirements:

- The unit supplied shall meet the effluent requirements in order to meet USCG/IMO Certification.
- Provided with a stainless steel media tank.
- Provided with a regenerative turbine blower.
- Set-up to receive water directly from the black and gray water systems.
- All components supplied for the system shall be sized to fit through a USCG standard 28 inch x 60-inch clear opening watertight door with 6-inch radius corners.

The treatment plant shall be set-up to discharge treated water to:

- overboard.
- the sewage holding tank.
- the gray water tank.

The routing of the treated water shall be at the operator's discretion.

The Contractor shall provide and install all vents required by the treatment plant manufacturer for proper operation of the equipment. Power for the equipment shall be supplied from the 480/208Y/120 volt system.

Compressed air from the compressed air system shall be supplied to the treatment plant in accordance with the manufacturer's recommendations. The Contractor is responsible for all piping, valves, pressure reducers, etc required to connect the compressed air system to the treatment plant.

E. HOLDING TANKS

The sewage holding tank and the gray water holding tank shall be constructed in accordance with contract Clause C320. The sewage holding tank and the gray water holding tank each shall be equipped with a:

- liquid level gauge similar to a KENCO model 9900 series level gauge with integral valves. Each gauge shall be calibrated to show  $\frac{1}{4}$  tank level, the  $\frac{1}{2}$  tank level, and the  $\frac{3}{4}$  tank level.
- 2-inch stripping connection to allow the pumping out of each tank at dockside. Each tank's stripping connection shall be fitted at the lowest point of each tank.
- 2-1/2 inch vent. Each vent shall be fitted with a flame screen.
- 1-1/2 inch sounding tube. The sounding tube shall be as straight as practical and located at the lowest part of the tank, where practicable. The sounding tube shall be of the flush mount type, with tee wrench. At the tank bottom there shall be installed a 6 inch x 6 inch striking plate of at least 3/16 inch thickness, seal welded to the tank bottom.

The fire main shall be interconnected to both the sewage holding tank and the gray water holding tank to allow for the flushing of the tanks during stripping operations. The flushing line shall be installed as specified in contract Clause C675.

F. TANK STRIPPING PUMP

The Contractor shall supply and install a stripping pump similar to a MP\Jaeger Pumps, model #2CT trash pump. The pump shall be capable of passing 1-1/2 inch diameter solids, maximum.

The discharge line from the pump shall terminate at the main deck level, 18 inches above the deck. The deck connection shall be fitted with a bronze screw cap and safety chain. The discharge line shall be clearly labeled for its use.

C669 DRAINAGE SYSTEMA. DRAWINGS

Reference Drawing #518-D669-01, DRAINAGE SYSTEM

CLIN 0001

557-B215-01, GENERAL ARRANGEMENT

CLIN 0002, CLIN 0003 & CLIN 0004

556-B215-01, GENERAL ARRANGEMENT

B. DESCRIPTION OF WORK

The Contractor shall provide and install all components, piping, deck drains, and valves necessary to form a complete drainage system. The reference drawing is provided as general guidance for installing the drainage system.

For the Pittsburgh District towboat (CLIN 0001), deck drains shall be installed in the following, approximate, deck locations:

- Pilothouse Deck, at Frame #21, port and starboard
- Pilothouse Deck at Frame #29, port and starboard
- Upper Deck, at Frame #10, port and starboard
- Upper Deck, at Frame #20, port and starboard
- Upper Deck, at Frame #28, port and starboard
- Upper Deck, at Frame #31, port and starboard
- Upper Deck, at Frame #42, port and starboard
- Upper Deck, at Frame #57, port and starboard
- Main Deck, between Frame #31 and Frame #32, port and starboard

For the Huntington District towboat (CLIN 0002), the St. Paul District towboat (CLIN 0003), and the Rock Island District towboat (CLIN 0004), deck drains shall be installed in the following, approximate, deck locations:

- Pilothouse Deck, aft, port and starboard
- Electronics\Plenum Deck, aft, port and starboard
- Texas Deck, forward, port and starboard
- Texas Deck, at Frame #20, port and starboard
- Texas Deck, aft, port and starboard
- Upper Deck, forward, port and starboard
- Upper Deck, at Frame #21, port and starboard
- Upper Deck, at Frame #30, port and starboard

- Upper Deck, at Frame #31, port and starboard
- Upper Deck, at Frame #45, port and starboard
- Upper Deck, aft, port and starboard
- Main Deck, between Frame #31 and Frame #32, port and starboard

The drain lines from the scuppers shall run from deck level down inside the deckhouse where possible to prevent freezing in the winter. The drain lines shall be routed beneath the main deck and exit the hull side at a distance 8 to 12 inches above the waterline.

The drain lines shall be 1-1/2 inch nominal pipe. All deck drains shall be supplied with removable bronze strainer plates similar to BFG model #DK-5015. All overboard discharges for the drains shall be sloped a minimum of 1/4 inch per foot. Clean out plugs shall be installed at the locations of the overboard lines.

The drain headers may be combined with other drain headers and run overboard, but the headers shall not be combined with the bilge, HVAC, or sanitary and sewage systems.

#### C670 VENTS, SOUNDS AND FILLS

##### A. GENERAL BACKGROUND

Vents and sounds are required for the various piping systems of the contract. The specific requirements for each system are listed in the respective clause for that system.

Other compartments requiring vents and sounds are listed below with their requirements.

##### B. VOIDS

A minimum 1-1/2 inch vent and a 1-1/2 inch sounding tube shall be installed for the following voids:

- Fuel Oil Tank Innerbottom
- Port Cooler Void
- Starboard Cooler Void
- Aft, Port Void #1
- Aft, Starboard Void #1
- Aft, Port Void #2
- Aft, Starboard Void #2

Each vent shall terminate by way of a return bend. Vent construction shall be in accordance with all applicable ABS rules.

Each sounding tube shall be run as straight as practicable and located at the lowest part of each tank. Each sounding tube shall be flush mount type, with tee wrench. Below the sounding tube, at the tank bottom, there shall be a 6 inch x 6-inch striking plate of at least 3/16-inch thickness, seal welded to the tank bottom.

### C675 FIRE MAIN

#### A. CONTRACT DRAWINGS

##### CLIN 0001

557-B205-01, OUTBOARD PROFILE  
557-B215-01, GENERAL ARRANGEMENT  
557-B233-01, PILOTHOUSE DETAILS  
557-B245-01, HOLD & MACHINERY ARRANGEMENT

##### CLIN 0002, CLIN 0003 & CLIN 0004

556-B205-01, OUTBOARD PROFILE  
556-B215-01, GENERAL ARRANGEMENT  
556-B233-01, PILOTHOUSE DETAILS  
556-B245-01, HOLD & MACHINERY ARRANGEMENT

#### B. DESCRIPTION OF WORK

Each vessel shall be outfitted with a fire main system for fighting onboard vessel fires. The Contractor shall prepare calculations to finalize the selection of the equipment, design the systems, and install all equipment.

#### C. FIRE MAIN

##### 1. General Requirements

The Contractor shall provide and install all components, piping, and valves necessary to form a complete fire main for each vessel. The fire main shall be arranged through valves to take suction from the sea chests and discharge to the fire stations located throughout each vessel.

## 2. System Design

The fire main system shall be designed to account for the following:

- The fire pump shall be sized to deliver water simultaneously from the two highest hydrants at a pitot tube pressure of at least 50 psi and a flow rate of at least 80 gpm.
- Set up as a dry system and will only be under pressure during use.

The Contractor shall perform calculations to determine the size of the fire pump and the size of the system's distribution piping. The calculations along with cutsheets of the equipment selected shall be submitted for review and acceptance by the COR prior to the purchase of any equipment by the Contractor.

## 3. Hydrants

For all the vessels, fire hydrant stations shall be supplied in the approximate locations on the vessel as follows:

- Lower engine room - aft
- Main deck level at Frame #17, port and starboard
- Main deck level at Frame #50, port and starboard
- Upper deck level at Frame #24, port and starboard
- Pilothouse deck level – aft bulkhead

For CLIN 0002, CLIN 0003, and CLIN 0004, additional fire stations shall be supplied in the approximate locations on the vessels as follows:

- Texas deck level at Frame #20, port and starboard
- Plenum deck level – aft bulkhead

The actual position and location of the fire stations shall be determined during the Engineering Phase.

A brass angle valve shall be installed at the outlet of each fire hydrant. The outlet of each hydrant shall be in the horizontal position.

#### 4. Fire Pump

The Contractor shall supply and install a fire pump similar to an Ingersoll-Dresser, type D-800. The pump shall be a self-priming, centrifugal pump with bronze impeller. The pump shall be electric drive type, with the pump and motor furnished as a matched set from the pump manufacturer. The motor controller for the pump shall be set-up with low voltage release. See contract Clause C750.

A relief valve shall be provided and installed on the discharge of the fire pump that relieves back to the pump suction. A pressure gauge shall be fitted on the discharge side of the fire pump.

Each fire pump shall be capable of starting from:

- Locally by the fire pump
- The pilothouse console
- The engineer's workshop
- Each fire hydrant station

At each starter location, pump running lights shall be installed to indicate that the fire pump is running.

#### 5. Fire Hoses, Nozzles & Racks

Each fire station shall be equipped with a single length of 75 feet of fire hose that is in accordance with the standards set forth by the USCG in 46 CFR, subchapter H, subpart 76.10(n). The hoses supplied shall be 1-1/2 inch.

Each fire hose shall be equipped with an USCG approved brass nozzle. The nozzles shall be a combination type, capable of producing either a solid stream or water spray.

Hose racks for stowing the 1-1/2 inch hoses shall be installed at each hydrant. The racks shall provide provisions for easy payout of the fire hose. A spanner wrench shall also be provided at each hydrant.

#### 6. Gray Water Holding Tank & Sewage Holding Tank Flushing

The Contractor shall provide and install 1 inch flushing line connections from the fire main to both the sewage holding tank and the gray water holding tank to allow for the flushing of the tanks during stripping operations. See contract Clause C667.

A pressure gauge and a globe valve shall be installed in each flushing line prior to connecting to each tank.

A warning sign shall be posted adjacent to each globe valve used for flushing. The warning sign shall read "AVOID OVER-PRESSURIZING OF THE TANK. OPEN VALVE SLOWLY."

## C677 FIXED FIRE EXTINGUISHING SYSTEM

### A. SYSTEM REQUIREMENTS

The Contractor shall provide and install two separate fixed carbon dioxide (CO<sub>2</sub>) fire extinguishing systems. Each system shall be designed and installed in accordance with the standards set forth by the USCG in 46 CFR, subchapter H, subpart 76.15 – Carbon Dioxide Extinguishing Systems, Details.

One system shall be set up to protect the main engine room. Remote pull stations for this system shall be provided on the main deck at Frame #36, on the port and starboard sides.

The second system shall be set up to protect the generator room. A remote pull station for this system shall be provided on the main deck at Frame #43 on the port side.

### B. LOCATION OF CYLINDERS

The CO<sub>2</sub> cylinders shall be located in the steering gear room. The cylinders are to be mounted in racks which shall be attached to the deck or bulkhead.

Provisions shall be made for the removal and installation of the cylinders. Weighing bars shall be installed for each rack to allow for the weighing of the cylinders.

### C. ALARMS & SHUTDOWNS

Audible alarms shall be provided in the spaces protected that will automatically sound prior to discharge of CO<sub>2</sub> into the respective spaces.

A discharge delay of 20 seconds shall be provided in order to allow personnel in these spaces time to evacuate and allow the ventilation system time to wind down. The discharge delay shall not depend on any source of power other than the CO<sub>2</sub>.

Provisions shall be made for the automatic shutdown of the supply and exhaust ventilation fans for the engine room and the generator room. See contract Clause C685.

#### D. INSTRUCTIONS & WARNINGS

Instructions and warnings shall be posted in accordance with USCG requirements. As a minimum, the following shall be posted:

- At each pull station, clear instructions relating to the operation of the system.
- Warnings of protection at the entrance to each space protected.
- At the entrance to the steering gear rooms, warning that CO2 is stored in the space.

#### C678 FIRE DETECTION AND ALARM SYSTEM

The Contractor shall provide and install all components, necessary to form a complete electrical fire detection and alarm system. The electrical fire detection and alarm system provided shall meet all applicable USCG, ABS, and NFPA Rules, with all equipment being UL listed. The system shall be installed throughout the main deckhouse as well as in the engineering and machinery spaces, and the forward stores.

The primary power source for the fire detection system shall be the AC electrical system. The secondary power source shall be from a built-in back-up power supply system consisting of two 24-volt DC batteries with battery charger that will provide a minimum of 84 hours of system operation if the AC electrical service is interrupted. Switchover from the primary source to the secondary source shall be automatic.

The detection system shall be designed to give visual alarm signals and sound audible alarms to be heard throughout the vessel when a fire has been detected. If a fire has been detected in any space on the vessel, the fire detection system is integrated with the HVAC system to shutdown the HVAC system as well as any ventilation fans or heaters serving the spaces except the fans serving the upper and lower engine room, and the generator room.

The system shall include electric smoke detectors and heat sensors wired to a detection cabinet. The specific detector or sensor used in a space shall be based on the system manufacturer's recommendations for that space.

The main detection cabinet and an alarm panel shall be located in the pilothouse. Remote annunciator units and alarm panels shall be located in the engineer's control room and on the exterior bulkhead at the front end of main deckhouse. The alarm panels shall include indicator lights for each compartment protected. The panels shall include silencing buttons that allow for the audible alarms to be silenced at any panel.

A red indicating light shall be installed on the pilothouse top in order to give a visual signal of the activation of the fire detection system.

### C679 FIRE SAFETY EQUIPMENT

#### A. PORTABLE FIRE EXTINGUISHERS

The Contractor shall supply and install portable fire extinguishers as defined below for the Pittsburgh District towboat (CLIN 0001):

<u>Space</u>	<u>Classification</u>	<u>Number</u>
Pilothouse	B-II or C-II	1
Upper Deck Passageway	A-II or B-II	1
Crew's Lounge	A-II or B-II	1
Deck Storage	A-II or B-II	1
Galley/Mess	B-II or C-II	1
Main Deck Passageway	A-II or B-II	1
Upper Engine Room	B-II	2
Engineer's Work Area	A-II or B-II	1
Generator Room	B-II	1
Steering Gear Room	B-II	1
Forward Stores	A-II	1
Forward Machinery Space	B-II	1
Lower Engine Room	B-II	2
Shaft Alley	C-II	1

The Contractor shall supply and install portable fire extinguishers as defined below for the Huntington District towboat (CLIN 0002), the St. Paul District towboat (CLIN 0003) and the Rock Island District towboat (CLIN 0004):

<u>Space</u>	<u>Classification</u>	<u>Number</u>
Pilothouse	B-II or C-II	1
Plenum\Electronics	C-II	1
Texas Deck Passageway	A-II or B-II	1
Crew's Lounge	A-II or B-II	1
Upper Deck Passageway	A-II or B-II	1
Deck Storage	A-II or B-II	1
Galley/Mess	B-II or C-II	1
Main Deck Passageway	A-II or B-II	1
Upper Engine Room	B-II	2
Generator Room	B-II	1
Workshop	A-II or B-II	2
Steering Gear Room	B-II	1

Forward Stores	A-II	1
Forward Machinery Space	B-II	1
Lower Engine Room	B-II	2
Shaft Alley	C-II	1

The classification of the extinguishers to be supplied and their mounting locations shall be in accordance with the ABS and USCG Rules.

All extinguishers shall be supplied with racks or holders for mounting.

B. FIRE AXES

Two fire axes shall be provided and installed on the vessel. The axes shall be mounted at the main deck level on the exterior deckhouse bulkhead, approximately at Frame #15, port and starboard.

C. FIRE CONTROL PLAN

The Contractor shall produce a Fire Control Plan in accordance with the ABS River Rules (Part 4, Section 7, paragraph 7.25.10).

The Fire Control Plan shall be submitted for review and approval by the COR during the construction phase. After approval, an engraved metal copy shall be produced and mounted in the galley\mess area. The engraved metal copy shall be in accordance with Clause C460 of the contract.

C685 HEATING, VENTILATION AND AIR CONDITIONINGA. CONTRACT DRAWINGS

## CLIN 0001

557-B215-01, GENERAL ARRANGEMENT

557-B233-01, PILOTHOUSE DETAILS

557-B245-01, HOLD &amp; MACHINERY ARRANGEMENT

## CLIN 0002, CLIN 0003 &amp; CLIN 0004

556-B215-01, GENERAL ARRANGEMENT

556-B233-01, PILOTHOUSE DETAILS

556-B245-01, HOLD &amp; MACHINERY ARRANGEMENT

B. DESCRIPTION OF WORK

Each vessel shall be outfitted with heating, air conditioning, and ventilation throughout the various spaces shown on the above drawings. The Contractor shall prepare calculations to finalize the selection of the equipment, design the systems, and install all equipment.

C. CONDITIONED SPACES

The entire deckhouse forward of Frame #31 shall be air conditioned, heated and receive outside ventilation air. The engineer's workshop, aft between Frame #44 and Frame #50 on the starboard side, shall also be air conditioned, heated and receive outside ventilation air.

1. Load Calculations

The Contractor shall perform heating and cooling load calculations in order to size the air conditioning, heating and ventilation system for the above spaces. The heating and cooling load calculations along with cutsheets of the equipment selected shall be submitted for review and acceptance by the COR prior to the purchase of any equipment by the Contractor.

The heating and cooling loads shall be based on criteria from the SNAME Technical and Research Bulletin Nos. 4-7 and 4-16 and from the ASHRAE Cooling & Heating Load Calculation Manual (GRP 158). Temperature criteria to be used for each vessel is listed below:

## For CLIN 0001 (Pittsburgh, PA)

- Outside air (cooling): 89 degrees F DB, 72 degrees F WB
- Indoor air (cooling): 75 degrees F DB @ 50% RH
- Indoor air (heating) 75 degrees F
- Outside air (heating) 0 degrees F

## For CLIN 0002 (Huntington, WVA)

- Outside air (cooling): 91 degrees F DB, 74 degrees F WB
- Indoor air (cooling): 75 degrees F DB @ 50% RH
- Indoor air (heating) 70 degrees F
- Outside air (heating) 10 degrees F

## For CLIN 0003 (St. Paul, MN)

- Outside air (cooling): 89 degrees F DB, 73 degrees F WB
- Indoor air (cooling): 75 degrees F DB @ 50% RH
- Indoor air (heating) 70 degrees F
- Outside air (heating) -12 degrees F

## For CLIN 0004 (Moline, IL)

- Outside air (cooling): 91 degrees F DB, 75 degrees F WB
- Indoor air (cooling): 75 degrees F DB @ 50% RH
- Indoor air (heating) 70 degrees F
- Outside air (heating) -4 degrees F

Outside ventilation air shall be supplied to each conditioned space on the basis of 15 cfm/person. For determining the necessary amount of ventilation air to be supplied, it may be assumed that the:

- Pilothouse has two people
- Staterooms have either one or two people as marked
- Crew's Lounge has four people
- Ship's Office has two people
- Mess Area has eight people
- Galley has two people
- Deck Storage area has two people
- Laundry area has one person
- Engineer's workshop has two people

The load calculations must also account for the electrical and electronics equipment in the electronics room located on the plenum deck for CLIN 0002, CLIN 0003, and CLIN 0004.

## 2. System\Equipment Selection

Based on the above load calculations, equipment shall be selected for a ductless split air conditioning similar to the AmericaSeries manufactured by Enviromaster International (EMI). The system supplied shall have the following features:

- Heat pump system with supplemental electric heat.
- Ability to add outside fresh air.
- Each space shall be fitted with its own air handler/evaporator unit with thermostatic control mounted on the unit.
- Multi-zone, allowing for up to four separate evaporators to be connected to a single condensing unit.
- Each evaporator circuit includes an independent compressor, valves, lines, etc with the cabinet and fan only common to each evaporator served by a respective condensing unit.

Based on the heating and cooling calculations performed above the Contractor shall size the appropriate air handlers/evaporators for each space and match the air handlers to the appropriate serving condenser.

The selection of a mounting type (floor, ceiling, or wall) for an air handler/evaporator unit shall be based on minimizing the unit's obtrusiveness in the space it is serving.

Each condensate line from an air handler/evaporator shall be insulated. The condensate line from each air handler/evaporator shall drain together into a common header with the common headers discharging overboard. The condensate drains from the air handlers/evaporators shall not be combined with any other systems' overboard discharge lines.

## 3. Fire Detection System Interconnection

Each air handler shall be provided with controls linked to the fire detection and alarm system. All of the air handlers shall shutdown with the activation of the fire detection and alarm system. See contract Clause C678.

D. VENTILATION

1. Upper & Lower Engine Room

The Contractor shall provide and install a mechanical supply and exhaust ventilation system for the upper and lower engine room.

a. Ventilation Calculations

The ventilation system shall be designed to:

- provide a minimum of two air changes per minute to the upper and lower engine room or maintain the space temperature at 120 degrees F or below. The larger criteria should be used. It shall be assumed that the outside temperature is 95 degrees F.
- provide positive pressure to the entire space (upper and lower engine room) at all times.
- account for carrying away the radiated heat of both main engines operating at the engines' maximum rating at the same time.
- supply and carry away the proper amount of air for all other equipment operating in the upper and lower engine room.

The Contractor shall perform calculations to determine the sizes of the supply inlets and exhaust outlets required and the size of the supply and exhaust fans required. The calculations along with cutsheets of the equipment selected shall be submitted for review and acceptance by the COR prior to the purchase of any equipment by the Contractor.

b. Supply Fans

Each supply fan shall be installed in an intake plenum, with one plenum located on the port side and the second plenum located on the starboard side. The plenums shall be located between Frame #42 and Frame #44. Each plenum shall be provided with a removable access plate in the upper room to allow for access from inside the upper engine room to the fans for maintenance purposes.

Each plenum opening in the bulkhead shall be fitted with an automatic, balanced type louver with blade seal and stainless steel insect screen. The plenums shall terminate as low as possible in the lower engine room.

The supply fans provided shall be marine duct axial blowers, similar to Hartzell, series 44 with TEFC, 480 volt AC, three phase motors. The motors and controls shall be two speed. The motor controller for each fan shall be set-up with low voltage release. See contract Clause C750.

c. Exhaust Fans

An exhaust fan shall be provided and mounted, with gaskets, in the aft end of each engine room stack. Each exhaust fan outlet is to be fitted with an automatic balanced type louver with blade seal, and stainless steel insect screen.

The exhaust fans provided shall be marine type duct axial blowers or propeller fans, similar to Hartzell, with TEFC, 480 volt AC, three phase motors. The motors and controls shall be two speed. The motor controller for each fan shall be set-up with low voltage release. See contract Clause C750.

d. Fire Suppression System Interconnection

Provisions shall be made for the automatic shutdown of the supply and exhaust ventilation fans and the automatic closure of the louvers of the supply and exhaust ventilation fans for the engine room upon activation of the fixed fire suppression system. See contract Clause C677.

The Contractor shall provide and install emergency stop buttons for the supply and exhaust fans exterior of the upper and lower engine room. The stop buttons shall be mounted in a watertight enclosure at Frame #38 on the port side.

## 2. Generator Room

The Contractor shall provide and install a mechanical supply and exhaust ventilation system for the generator room.

### a. Ventilation Calculations

The ventilation system shall be designed to:

- provide a minimum of two air changes per minute to the generator room or maintain the space temperature at 120 degrees F or below. The larger criteria should be used. It shall be assumed that the outside temperature is 95 degrees F.
- provide positive pressure to the entire space (generator room) at all times.
- account for carrying away the radiated heat of both generator sets operating at same time at full load.
- supply and carry away the proper amount of air for all other equipment operating in the generator room.

The Contractor shall perform calculations to determine the size of the supply inlet and exhaust outlet required and the size of the supply fan and exhaust fan required. The calculations along with cutsheets of the equipment selected shall be submitted for review and acceptance by the COR prior to the purchase of any equipment by the Contractor.

### b. Supply Fan

The supply fan shall be installed on the upper deck with watertight cowling, between Frame #44 and Frame #46 (the forward, port corner of the generator room). The fan shall be connected to a plenum that terminates the generator room.

The intake on the supply fan shall be fitted with an automatic, balanced type louver with blade seal and stainless steel insect screen. The intake louver shall close automatically upon activation of the fixed fire suppression system.

The supply fan provided shall be a marine duct axial blower, similar to a Hartzell, series 44, with TEFC, 480 volt AC, three phase motor. The motor and controls shall be two speed. The motor controller for the fan shall be set-up with low voltage release. See contract Clause C750.

c. Exhaust Fan

An exhaust fan shall be provided and mounted, with gasket, in the aft end of the generator room stack. The exhaust fan outlet is to be fitted with an automatic balanced type louver with blade seal, and stainless steel insect screen.

The exhaust fan provided shall be a marine type duct axial blower or propeller fan, similar to a Hartzell, with TEFC, 480 volt AC, three phase motor. The motor and controls shall be two speed. The motor controller for the fan shall be set-up with low voltage release. See contract Clause C750.

d. Fire Suppression System Interconnection

Provisions shall be made for the automatic shutdown of the supply and exhaust ventilation fans and the automatic closure of the louvers of the supply and exhaust ventilation fans for the generator room upon activation of the fixed fire suppression system. See contract Clause C677.

The Contractor shall provide and install emergency stop buttons for the supply and exhaust fans exterior of the generator room. The stop buttons shall be mounted in a watertight enclosure at Frame #38.

3. Steering Gear Room

The Contractor shall provide and install a natural supply inlet and a mechanical exhaust outlet fan for the steering gear room.

a. Ventilation Calculations

The ventilation system shall be designed to:

- provide a minimum of one air change per five minutes.
- supply air for the air compressors.

The Contractor shall perform calculations to determine the size of the supply inlet and mechanical exhaust outlet fan required for the steering gear room. The calculations along with cutsheets of the equipment selected shall be submitted for review and acceptance by the COR prior to the purchase of any equipment by the Contractor.

b. Supply Inlet

A motor operated intake louver shall be installed on the starboard bulkhead. The intake louver shall be gasketed and provided with a stainless steel insect screen.

The louver shall automatically open upon start-up of the exhaust fan.

c. Exhaust Fan

An exhaust fan shall be provided and mounted, with gasket, on the port side bulkhead. It shall be provided with a bug screen and automatic balanced type louvers.

d. Fire Detection System Interconnection

Provisions shall be made for the automatic shutdown of the exhaust ventilation fan and the automatic closure of the supply inlet louver for the steering gear room upon activation of the fire detection system. See contract Clause C678.

The Contractor shall provide and install an emergency stop button for the exhaust fan in a watertight enclosure at Frame #38 on the main deck level.

4. **Forward** Machinery Space

The Contractor shall provide and install a natural supply inlet and a mechanical exhaust outlet fan for the **forward** machinery space.

a. Ventilation Calculations

The ventilation system shall be designed to:

- provide a minimum of one air change per six minutes.

- supply and carry away the proper amount of air for all equipment operating in the machinery space.

The Contractor shall perform calculations to determine the size of the supply inlet and mechanical exhaust outlet fan required for the forward machinery space. The calculations along with cutsheets of the equipment selected shall be submitted for review and acceptance by the COR prior to the purchase of any equipment by the Contractor.

b. Supply Inlet

A supply plenum shall be built from the forward machinery space to the main deck level on the starboard side. The plenum shall be watertight with a motor operated intake louver. The intake louver shall be gasketed and provided with a stainless steel insect screen.

The louver shall automatically open upon start-up of the exhaust fan.

c. Exhaust Outlet

An exhaust plenum shall be built from the forward machinery space to the main deck level on the port side. The plenum shall be watertight, gasketed, and provided with a stainless steel insect screen.

An exhaust fan shall be provided and mounted, with gasket, on the port side forward machinery space bulkhead. The fan shall be installed with a fan guard.

d. Fire Detection System Interconnection

Provisions shall be made for the automatic shutdown of the exhaust ventilation fan and the automatic closure of the supply inlet louver for the forward machinery space upon activation of the fire detection system. See contract Clause C678.

The Contractor shall provide and install an emergency stop button for the forward machinery space exhaust fan in a watertight enclosure at Frame #38 on the main deck level.

5. Engineer's Workshop & Deck Storage Area

The Contractor shall provide and install exhaust fans for the engineer's workshop (between Frame #44 and Frame #50, aft, starboard side) and the deck storage area, forward.

Each space shall be outfitted with a two speed, shutter-mounted exhaust fan similar to a Grainger's stock #2C713. Each fan shall have a 16 inch diameter propeller and shall be provided with wire guards that meet OSHA regulations.

Provisions shall be made for the automatic shutdown of the exhaust fans upon activation of the fire detection system. See contract Clause C678.

6. Toilet\Head Space Fans

The Contractor shall provide and install exhaust fans and fan/lights for the head and toilet spaces.

Each stateroom head shall be outfitted with a commercial duty combination exhaust fan/light similar to a Broan model HD80L. The fan shall be capable of exhausting a minimum of 80 cfm of air from the head space to the outside of the deckhouse. Each exhaust fan shall be supplied from the 120 volt AC system and be on a GFCI-protected branch circuit.

Provisions shall be made for the automatic shutdown of the exhaust fans in the stateroom heads, the crew's lounge head, and the public head upon activation of the fire detection system. See contract Clause C678.

7. Forward Stores & Shaft Alley

The forward stores and shaft alley shall be provided with vents in accordance with the ABS Rules.

The vents shall run to a minimum height of 18 inches above the main deck, and terminate with a gooseneck fitting. A corrosion-resistant screen shall be installed at the vent terminals.

E. HEATING

The Contractor shall provide and install the following electric heaters

<u>LOCATION</u>	<u>HEATER TYPE</u>	<u>QUANTITY</u>	<u>VOLTAGE</u>
Hold Level:			
Forward Stores	3 kW	2	480, 3Ø
Forward Machinery Space	3 kW	1	480, 3Ø
Lower Engine Room	5 kW	2	480, 3Ø
Shaft Alley	5 kW	1	480, 3Ø
Main Deck Level:			
Passageway (Frame #25)	1.5 kW	1	120, 1Ø
Upper Machinery Space	3 kW	2	480, 3Ø
Generator Room	5 kW	1	480, 3Ø
Engineer's Workshop	1.5 kW	1	120, 1Ø
Steering Gear Room	5 kW	2	480, 3Ø
Upper Deck Level:			
Passageway (Frame #26)	1.5 kW	1	120, 1Ø
Crew's Lounge	1.5 kW	1	120, 1Ø
Pilothouse	1.5 kW	2	120, 1Ø

The heaters supplied and installed shall be similar to those available from Grainger. The 1.5 kW heaters are stock #3UG12, the 3 kW heaters are stock #4E299, and the 5 kW heaters are stock #2E582.

The actual position and location of the heaters in the spaces served shall be determined during the Construction Phase.

Provisions shall be made for the automatic shutdown of the heaters through out the vessel upon activation of the fire detection system. See contract Clause C678.

C690 COMPRESSED AIR SYSTEMA. CONTRACT DRAWING

CLIN 0001

557-B245-01, HOLD &amp; MACHINERY ARRANGEMENT

CLIN 0002, CLIN 0003 &amp; CLIN 0004

556-B245-01, HOLD &amp; MACHINERY ARRANGEMENT

B. DESCRIPTION OF WORK

For each vessel, the Contractor shall provide and install all equipment, components, and piping required for two complete, separate compressed air systems. One system shall be a self-contained system serving the air horn. The second system, ship's service, shall provide:

- Starting air for the main engines. See Clause C605.
- ~~C733.Starting air for one of the diesel generator set engines. See Clause~~
- Control air for the shaft brakes. See Clause C605.
- Service air for the sewage treatment plant. See Clause C667.
- Service air for the air tool stations.
- Blowdown air for the sea chests. See Clause C325.

The Contractor shall submit calculations performed to determine the size of the ship's service system components (air receivers, air compressors, etc). The calculations along with 'cutsheets of the equipment selected shall be submitted for review by the COR prior to the purchase of any equipment by the Contractor.

C. AIR COMPRESSORS

For the starting air\ship's service compressed air system, two, 2-stage air compressors shall be provided and installed. The compressors provided shall be set up to run at 1755 rpm and provide air at 250 psi. The compressors shall be air cooled and each compressor shall be provided with an hour meter.

The compressors shall be mounted in the ~~steering gear~~ **lower engine** room with each compressor mounted on vibration isolators with a design transmissibility of 20% or less.

The system shall be set up to maintain 225-psi air in the air receivers. Pressure switches shall be provided to cut-in both air compressors when the system pressure drops to 150 psi and cutout when the system pressure of 225 psi is reached.

D. PIPING & EQUIPMENT

Piping for both compressed air systems shall be seamless black iron, ASTM A106.

A separator/filter with automatic drain shall be provide immediately downstream of the compressors. The drain shall be piped to a drain pan.

Reducing stations shall be supplied and installed to reduce the system air from 225 psi to the pressures required for the air starters, control air for the shaft brakes, and for the air tool stations. The air tool stations are to be supplied with 100-psig air.

Filters and air dryers shall be installed to condition the control air for the shaft brakes. Types and sizes of filters shall be in accordance with the shaft brake\gear manufacturer's recommendations. See contract Clause C605 for shaft brake requirements.

E. AIR TOOL STATIONS

Air tool stations shall be provided and installed in the following locations:

- Forward Machinery Space
- Lower Engine Room, fore and aft
- Shaft Alley
- Upper Engine Room, fore and aft
- Generator Room
- Steering Gear Room
- Engineer's Workshop
- Deck Storage Area
- Forward main deck, exterior

Each air tool station shall be equipped with a filter/regulator/lubricator unit rated to operate between 0-125 psig.

F. SEA CHEST BLOWDOWN

A 1 inch line with valves shall be installed from the starting air\ship's service compressed air system to each sea chest. These lines shall be used to blowdown each respective sea chest.

G. AIR RECEIVERS

Two horizontal air receivers, minimum 200-gallon capacity each, rated at not less than 350 psig, shall be provided and installed. A third receiver, as sized by the horn manufacturer shall be supplied for the self-contained air horn system.

All three receivers shall be:

- Constructed and certified in accordance with the ASME Code for Unfired Pressure Vessels. Each receiver shall be stamped and an ASME Certificate of Inspection shall be furnished with the receiver.
- The design, fabrication, and testing of the air receivers shall be in accordance with the ABS Rules (which also requires survey at the plant of manufacture for fabrication and testing).
- Supplied with an automatic condensate drain valve to allow for the removal of accumulated oil and water. The valve shall empty into a drain pan located beneath each receiver.
- Provided with a pressure gauge and relief valve.

H. AIR HORN SYSTEM

The Contractor shall supply and install an air compressor and tank unit dedicated to serve the air horn. The compressor and receiver supplied shall be similar to those available from Kahlenberg Brothers. The receiver shall meet the requirements outlined above.

For CLIN 0002, CLIN 0003, and CLIN 0004, the compressor and receiver shall be installed on the plenum deck in the electronics room. The air horn compressor shall be supplied power from the 208Y/120 volt AC system. The requirements for the air horn shall be in accordance with contract Clause C472.

For CLIN 0001, the compressor and receiver shall be installed in the deck storage area.

C692 ALARM SYSTEMSA. REFERENCE DRAWINGS

#518-D692-01 GENERAL ALARM SYSTEM

#518-D692-02 BILGE ALARM SYSTEM SCHEMATIC

B. GENERAL ALARM SYSTEM

For each vessel, a General Alarm System shall be provided and installed in accordance with USCG regulations. Reference drawing #518-D692-01 is provided for general guidance for designing and installing the system.

Bells shall be installed throughout the vessels as general emergency alarm signals. The tone of the bells shall be different from that of the Fire Detection System. See Clause C678. In addition to the bells, red flashing lights or red rotating beacons shall be installed in areas with high background noise. Lights and bells, shall be installed in the vessels as follows:

For CLIN 0001:

- Upper Deck – bell in the passageway
- Upper Deck Exterior – aft end of house at Frame #29
- Main Deck (deckhouse interior, forward of Frame #39) bell and light in the galley mess area, and bell in the crew's lounge
- Upper Engine Room – bell and light centrally located
- Engineer's Workshop – bell
- Generator Room – bell and light
- Steering Gear Room – bell and light
- Hold Level – bell and light in the Forward Machinery Space, Lower Engine Room, and the Shaft Alley
- Main Deck Exterior – forward bulkhead of the main deckhouse (Frame #13), and Frame #36, port and starboard.

For CLIN 0002, CLIN 0003 and CLIN 0004:

- Plenum Deck (Electronics Room) - bell
- Texas Deck – bell in the passageway
- Upper Deck – bell in the passageway and the Crew's Lounge
- Upper Deck Exterior – aft end of house at Frame #29
- Main Deck (deckhouse interior, forward of Frame #36) bell and light in the galley mess area, and bell in the passageway at Frame #25
- Upper Engine Room – bell and light centrally located
- Engineer's Workshop – bell

- Generator Room – bell and light
- Steering Gear Room – bell and light
- Hold Level – bell and light in the Forward Machinery Space, Lower Engine Room, and the Shaft Alley
- Main Deck Exterior – forward bulkhead of the main deckhouse (Frame #13), and Frame #36, port and starboard.

A 12-volt DC battery and battery charger shall be provided and installed for each system. For details of the battery and battery charger, see contract Clause C706. The General Alarm panel provided shall be similar to those manufactured by J-Box, Marrero, LA ([www.jboxinc.com](http://www.jboxinc.com)) and comply with USCG, 46 CFR, subpart 113.25.

The General Alarm bells and lights shall be marked in accordance with contract Clause C461.

#### C. BILGE ALARM SYSTEM

The Contractor shall provide and install a Bilge Alarm System for each vessel. Reference drawing #518-D692-02 is provided for general guidance for designing and installing the system.

The system shall be powered directly from the 12 volt DC system.

Bilge level sensors or switches shall be installed in the following voids or compartments below the main deck level:

- Forward Stores
- Fuel Oil Tank Innerbottom
- Forward Machinery Space
- Lower Engine Room
- Port Cooler Void
- Starboard Cooler Void
- Shaft Alley
- Aft, Port Void #1
- Aft, Starboard Void #1
- Aft, Port Void #2
- Aft, Starboard Void #2

The Contractor shall provide and install a monitoring panel with audible and visual alarms in the pilothouse and in the engineer's control room. The monitoring panel in the pilothouse shall be provided with a dimmer switch. The monitoring panels in the pilothouse and the engineer's control room shall be provided with silencing buttons for the audible alarms in the panels.

A yellow indicating light shall be installed on each pilothouse top in order to give a visual signal of the activation of the bilge alarm system.

D. WATERTIGHT DOOR ALARM

For each vessel, the Contractor shall provide and install a watertight door alarm to indicate that the watertight doors in the hold are open. An alarm panel with audible and visual alarms shall be installed in the pilothouse and in the engineer's control room. The panel in the pilothouse shall be provided with a dimmer switch. The panels in the pilothouse and the engineer's workshop shall be provided with silencing buttons for the audible alarms in the panels.

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## **C700 ELECTRICAL**

### **C701 GENERAL REQUIREMENTS FOR ELECTRICAL SYSTEMS**

An electrical power system shall be provided and installed to provide power for each of the vessel's electrical equipment. The system consists of an AC section and a DC section.

The design, construction and installation of all system components shall be suitable in all respects for marine service and the intended application. All system components shall be furnished new and unused.

The design ambient temperature for all electrical equipment in machinery spaces shall be 50 degrees C and all current carrying conductors shall be copper. The design ambient temperature for motors is defined in contract Clause C750.

Equipment shall be located and oriented as conveniently as practicable for operation and maintenance. All equipment shall be accessible for removal, servicing and adjustment without dismounting or removal of other equipment.

Unless otherwise specified, all machinery, equipment, materials and installation shall be in accordance with all applicable rules, regulations and recommendations contained in the current issue of the publications listed in Clause C003, including any revisions that have been published in the Federal Register prior to the date of this contract.

All the equipment furnished shall bear the approval of the Underwriters Laboratories, where applicable. Contract references to specific sections of codes, rules and standards in these specifications are intended to emphasize specific salient items. All equipment and design shall be furnished in compliance with all applicable sections of the codes, rules, and standards cited in Clause C003 and Clause C004.

### **C702 ELECTRICAL EQUIPMENT & CABLING MARKING**

#### **A. DESIGNATION SYSTEM**

All designation of circuits, panelboards, nameplates, etc shall be in accordance with Annex B of IEEE Standard 45 – 1998 edition.

## B. EQUIPMENT MARKING REQUIREMENTS

All electrical equipment shall be provided with standard label plates indicating manufacturer, model number, and electrical characteristics (operating voltage, phase, amperage, etc.). The nameplates, serial number plates, identification tags, etc. that are installed on the equipment shall remain in place on the equipment as furnished by suppliers. The Contractor shall use caution during construction to not damage or paint over nameplates or tags. Damaged nameplates or tags shall be replaced prior to Final Acceptance.

The Contractor shall install identification labels for all equipment. All nameplates and notices shall be stamped or engraved on brass or plastic plates. All weather exposed nameplates, notices, and markings shall be of brass.

All distribution panels shall be labeled with designation plates. All breakers in the distribution panels shall be numbered and the panel identification cards filled out to identify the breaker's service. See USCG, 46 CFR, subchapter J, paragraph 111.40-11.

All other controls, gauges, switches, etc., shall be labeled with phenolic label plates to permit operation of the vessel. This includes pilothouse equipment as well.

## C. CABLE MARKING

All interconnecting cables and wiring shall be marked at each termination and at each watertight bulkhead or deck with circuit or system identification. Power distribution wiring shall be marked to indicate phase and polarity. All cables shall be suitably identified throughout their length with cable tags identifying the circuit designation.

The tags are to be fabricated from strip aluminum or bronze with raised lettering and shall be securely fastened to the cable by banding.

Cable identification shall be in accordance with the electrical cable schedule developed per contract Clause C725.

## D. IDENTIFICATION OF MOTOR CONTROLLERS

Each motor controller and motor control center shall be marked in accordance with USCG, 46 CFR, subchapter J, paragraph 111.70-3(d).

## E. SHORE POWER & OFF-VESSEL IDENTIFICATION

The Contractor shall install an identification plate for the shore power receptacle in accordance with the ABS River Rules (Part 4, Section 4, paragraph 4/4A4.7.5).

An identification plate with similar information shall also be installed for the off-vessel receptacle.

C705 AC ELECTRICAL SYSTEMSA. PRIMARY POWER SYSTEM

The primary power system supplied for each vessel shall be rated as a 480 volt AC, 3-phase, 3-wire, 60 Hz, ungrounded system. Power to this system shall be supplied by the generator sets or through shore power.

The generator sets for the primary power system are set up for parallel operation.

B. SECONDARY POWER SYSTEM

The secondary power system supplied for each vessel shall be rated as a 208Y/120 volt AC, 3 phase, 4-wire, 60 Hz, grounded system. Power to this system shall be supplied from the main switchboard through a transformer.

C706 DC ELECTRICAL SYSTEMSA. REFERENCE DRAWING

603-D720-02, ONE LINE DIAGRAM (DC)

B. DESCRIPTION OF WORK

The Contractor shall supply and install a 12 volt DC electrical system for the navigation, communication, steering, emergency lighting loads, and the Bilge Alarm System. A reference drawing has been provided for guidance in designing the 12 volt DC system. The system components shall be sized based on the DC Load Analysis calculated per contract Clause C710 and a One Line Diagram (DC) shall be prepared for the system in accordance with contract Clause C720.

For CLIN 0002, CLIN 0003, and CLIN 0004, the DC system power supply, battery charger, and battery, as well as associated equipment, shall be located in the Electronics Room on the Half Deck. For CLIN 0001, the DC system power supply, battery charger, and battery, as well as associated equipment, shall be located in the Deck Storage area on the main deck level.

For all the towboats, the DC system distribution panel shall be located in the pilothouse.

Equipment supplied that requires 24-volt DC power for operation shall be either:

- Connected to the 12 volt DC system via a 24 volt DC to 12 volt DC converter
- Or installed with its own dedicated power supply

For reference, systems requiring DC power that are not part of the DC systems are the Fire Detection & Alarm System (contract Clause C678), the General Alarm System (contract Clause C692), and the starting battery systems supplied for one of the diesel generator sets and the diesel driven fire pump engine.

C. DC SYSTEM PANELBOARD

A DC distribution panel shall be provided and installed similar to those manufactured by Paneltronics. The DC panel shall include, but not be limited to the following basic components and features:

- Power available light with dimmer switch
- Line voltage meter
- Load current meter

D. BATTERIES & BATTERY CHARGERS

1. Battery Requirements

All batteries provided shall be suitable for marine use and shall be rated for a minimum of 200 ampere-hours.

The Contractor shall provide and install 12 volt DC batteries for the 12 volt DC system and for the General Alarm System. The size of the 12 volt DC system battery shall be based on the Load Analysis performed per contract Clause C710. The General Alarm System battery shall be sized in accordance with contract Clause C692.

For the starting of each vessel's diesel generator sets, the Contractor shall supply and install a 24-volt DC battery bank for each generator set. Charging of the 24 volt DC starting battery banks shall also be accomplished by its respective 24-volt DC engine alternator attached to the generator set diesel engine. See Clause C733.

For CLIN 0002, CLIN 0003, and CLIN 0004, the batteries for the 12 volt DC system and for the General Alarm System shall be located on the Plenum Deck\Electronics Space. For CLIN 0001, the batteries for the 12 volt DC system and for the General Alarm System shall be located in the Deck Storage area on the main deck.

The 24-volt DC starting battery banks shall be installed in the Generator Room.

Each battery or set of batteries shall be placed in vented, high-density polyethylene boxes with lockable, hinged covers.

## 2. Battery Chargers

For the 12-volt DC system and the General Alarm System, the Contractor shall supply and install a battery charger for each system similar to a La Marche, model A41 series. Each charger supplied shall be USCG listed for marine service and built to carry continuous loads. The battery chargers for the 12 volt DC system and the General Alarm System shall be sized to meet the power requirements for that respective system's batteries. For CLIN 0002, CLIN 0003, and CLIN 0004, the battery chargers shall be mounted on the Plenum Deck in the Electronics Space. For CLIN 0001, the battery chargers shall be located in the Deck Storage area.

For the 24 volt DC starting system, the Contractor shall supply and install a battery charger similar to a La Marche model ESC battery charger for each diesel generator set. The battery chargers for the 24 volt DC starting system shall be sized to meet the power requirements for the generator set diesel engine starting batteries. The battery chargers shall be mounted in the Generator Room and be suitable for operation in 50 degrees C.

The input voltage for all chargers shall be 120 volt AC, 60 Hz and all chargers shall be supplied with ammeters.

## 3. Overload & Reverse Current Protection

Overload and reverse current protection for the battery conductors shall be in accordance with USCG, 46 CFR, subchapter J, paragraph 111.15-25.

### C710 LOAD ANALYSIS

#### A. AC LOAD ANALYSIS

The Contractor shall develop a complete load analysis for the 480/208Y/120 volt AC electrical system for each vessel based on the actual equipment selected for installation. Each load analysis should be set up for the following modes:

- Towing - Summer
- Towing – Winter
- In-Port/Shore Power - Summer
- In-Port/Shore Power - Winter

#### B. DC LOAD ANALYSIS

The Contractor shall develop a complete load analysis for the 24 volt DC and 12 volt DC systems for each vessel based on the actual equipment selected for installation. Each load analysis should be set up for the following modes:

- Summer - Day
- Winter - Night
- Emergency Condition

### C715 FAULT CURRENT & CIRCUIT BREAKER ANALYSIS

The Contractor shall prepare a complete detailed fault current analysis and circuit breaker coordination study for each vessel.

The fault current analysis shall demonstrate that all protective devices such as fuses and circuit breakers have sufficient short circuit breaking and making capacities. A listing of all protective devices, their locations, use, manufacturer, model, and interrupting rating shall be submitted with the fault current analysis.

The circuit breaker coordination study shall demonstrate that only the circuit breaker closest to the fault will open under short circuit conditions.

Copies of time-current characteristics for all breakers involved in the coordination study shall be submitted with the study.

### C720 ONE LINE DIAGRAMS

The Contractor shall develop complete AC and DC one line diagrams for each vessel based on the final equipment selections.

Catalog cutsheets shall be provided for all AC system and DC system components with the submission of the respective system's one line diagram.

### C725 CABLING REQUIREMENTS

#### A. VOLTAGE DROP & CABLE SCHEDULE

The Contractor shall prepare separate cable schedules for all circuits in the AC electrical system and for all circuits in the DC electrical system for each vessel.

A voltage drop calculation shall be included on each cable schedule for each circuit. For each AC circuit, a 5% maximum voltage drop is allowed from the switchboard to the connected load. For each DC circuit analysis, a 5% maximum voltage drop is allowed from the DC power source to the connected load.

The cable schedules and voltage drop analyses shall be submitted to the COR for review prior to the Construction Phase.

#### B. CABLE REQUIREMENTS

Cables shall be similar to L.F. GAUBERT, Specification #474, TNIB Series, 90°C rated, armored, USCG & ABS approved. Armored cables used shall be basket weave armor (bronze jacket) in accordance with IEEE-45 or equivalent (as classified by UL as IEEE-45 equivalent). The armored cable shall be installed grounded at both ends.

The Contractor shall select the size of the cables based on the voltage drop analysis and the current distribution requirements from the one-line diagrams. All cables for receptacle circuits shall be 12 AWG or larger.

All wiring shall be clipped and bracketed to provide straight, vertical and horizontal runs throughout the vessel. Care shall be taken to run all power cables separate from all control signal cables in order to avoid field interference.

All cable installations shall be supported on galvanized steel brackets, and shall comply with all applicable provisions of IEEE-45 Clause 10. Cable supports shall be heavy enough to bear the weight of cables without bending, and all supports shall have rough or sharp edges removed so that cable armor will not be damaged. Horizontal runs of cable shall be supported by brackets spaced every 2 feet. Vertical runs of cables shall be supported every 2 feet with individual cable straps and bar hangers or brackets.

Soldering shall be performed only with resin or other neutral flux. Ends of all wires not tinned by the cable manufacturer shall be tinned before securing to terminals or before applying lugs. Solderless lugs shall be used wherever practicable. Terminals or lugs that are to be soldered to cable ends shall first be cleaned and tinned or treated with a neutral flux to ensure a good bond.

Connections to equipment and terminal boards shall be made with compression type connectors.

Ring tongue compression terminals shall be used for all control terminations. Ends of all cables shall be sealed against moisture by taping in combination with insulating compounds or other approved methods.

Cable penetrations throughout non-watertight bulkheads and decks shall have ample bearing surfaces. Cable penetrations through watertight decks or bulkheads shall use multi-cable transits similar to the ROX System or brass or steel stuffing tubes. Multi-cable transits shall be installed with spares to allow for the addition of cables. Enclosure penetrations shall use brass stuffing tubes.

All cables shall be identified in accordance with contract Clause C702.

#### C730 LIGHTING AND RECEPTACLES

##### A. REFERENCE DRAWING

603-D720-02, ONE LINE DIAGRAM (DC)

##### B. GENERAL REQUIREMENTS

The Contractor shall provide and install complete lighting systems in order to adequately light each vessel. The lighting systems shall consist of:

- Interior Lighting
- Exterior Lighting
- Emergency Lighting
- Floodlights
- Searchlights
- Flanking Lights
- Navigation Lights
- Instrument Lighting

The Contractor shall provide and install convenience receptacles throughout the vessel interior and exterior.

### C. INTERIOR & EXTERIOR LIGHTING

All fixtures shall be marine type and made of corrosion resistant materials and shall be spaced evenly to provide proper distribution of light. Fixture installation shall be such that the low point of all fixtures is above the lowest structural members.

All lighting switches shall be marine type, watertight where required by location, and shall be mounted for convenient operation.

The lighting level (measured in foot-candles), shall be in accordance with the guidelines established in the IES Lighting Handbook for Marine Lighting.

#### 1. Interior Lighting

Interior lighting fixtures shall be fluorescent, ceiling mounted or surface mounted fixtures, controlled by a switch at each entrance to the compartment. Fluorescent type lamps shall be rapid start and cool white.

The pilothouse shall also be equipped with a 12 volt DC, twin tube, 8-watt light with red for night vision underway and white for normal use. The light shall be similar to a Guest model #836C-3-2R fixture.

The Contractor shall provide and install a fluorescent bunk light at the head of each bed in each stateroom.

For each stateroom and/or head space, the Contractor shall install:

- A fluorescent light over each mirror.
- A combination exhaust fan/light. See contract Clause C685.

The fluorescent lights installed over the mirrors and the combination fan/lights shall be on GFCI protected circuits.

#### 2. Exterior Lighting

Two types of exterior deck lighting shall be provided and installed in order to provide sufficient lighting shall to maintain an illumination level on the decks for safe operation at night. The exterior lighting shall be energized from the 120 volt AC system.

Watertight, bulkhead mounted incandescent type fixtures shall be installed along the sides and ends of the deckhouse, on all deck levels. The lights furnished shall be similar to Pauluhn, model 707B. The exterior lighting for each deck level shall be divided into two circuits, port

and starboard, with each circuit controlled by a separate switch. The switches for the deck lighting shall be located in the pilothouse.

In addition to the bulkhead mounted fixtures, watertight step lights similar to Pauluhn, model 814S shall be provided and installed along the sides and ends of the deckhouse at the main deck level. The fixtures furnished shall be of the incandescent type and flush mounted in the bulkheads. The step lights shall be divided into two circuits, port and starboard, with each circuit controlled by a separate switch. The switches for the deck lighting shall be located in the pilothouse.

### 3. Emergency Lighting

Each vessel shall be provided with a separate, emergency 12 volt DC lighting system for interior and exterior lighting. The purpose of the system to be installed is to provide lighting for egress to/from the vessels. The emergency lighting is configured to allow for automatic operation upon failure of the AC lighting system or for manual (all-the-time) operation. Reference drawing #603-D720-02 is provided for guidance in designing the system.

For the interior spaces, 12-volt DC twin tube fluorescent fixtures, similar to a Guest model #836C-3 shall be provided and installed. For the exterior and machinery spaces, watertight, 12-volt DC incandescent fixtures shall be installed.

Emergency lighting units of the interior type shall be located as follows:

<u>LOCATION</u>	<u>QUANTITY</u>
Pilothouse	1
Electronics Room	2
Texas Deck Level:	
Passageway	1
Upper Deck Level:	
Lounge	1
Passageway	2
Main Deck Level:	
Galley	1
Mess Area	1
Passageway	2
Deck Storage Area	2
Engineer's Workshop	1
Interior Stairwell:	
Each Landing	1

In addition, for CLIN 0002, CLIN 0003, and CLIN 0004, emergency lights of the interior type shall be located as follows:

<u>LOCATION</u>	<u>QUANTITY</u>
Electronics Room	2
Texas Deck Level:	
Passageway	1
Upper Deck Lounge	1

In addition, for CLIN 0001 emergency lights of the interior type shall be located as follows:

<u>LOCATION</u>	<u>QUANTITY</u>
Office\Lounge	1
Engineer's Passageway	1

Emergency lighting units of the exterior type shall be located as follows:

<u>LOCATION</u>	<u>QUANTITY</u>
Pilothouse Deck	3
Half Deck	1
Texas Deck	2
Upper Deck	6
Main Deck	9
Upper Machinery Space	2
Generator Room	2
Steering Gear Room	2
Forward Stores	1
Forward Machinery Space	2
Lower Engine Room	4
Shaft Alley	1

In addition, for CLIN 0002, CLIN 0003, and CLIN 0004, emergency lights of the exterior type shall be located as follows:

<u>LOCATION</u>	<u>QUANTITY</u>
Half Deck	1
Texas Deck	1

D. FLOODLIGHTS

Marine rated, 500W quartz/halogen lamp floodlights similar to Phoenix model MS500QH shall be provided and installed on each vessel. The floodlights shall be shock mounted in the following locations:

<u>LOCATION</u>	<u>QUANTITY</u>	<u>DIRECTION FACING</u>
Upper Deck Level:		
Port - aft	1	Aft
Starboard aft	1	Aft
Main Deck Level:		
Port	2	Port
Starboard	2	Starboard
Port – forward	1	Forward
Starboard – forward	1	Forward
Port – aft	1	Aft
Starboard – aft	1	Aft

In addition for CLIN 0002, CLIN 0003, and CLIN 0004, the following floodlights shall be supplied and installed:

<u>LOCATION</u>	<u>QUANTITY</u>	<u>DIRECTION FACING</u>
Texas Deck Level:		
Port	2	Port
Starboard	2	Starboard
Port – aft	1	Aft
Starboard – aft	1	Aft

The floodlights shall be set up with no more than two lights on a circuit.

The switches for each circuit shall be located in the pilothouse except for the main deck port, forward and starboard, forward floodlights. The port, forward and the starboard, forward floodlights shall be installed with three way switches that allow for operation from the pilothouse or from inside the deckhouse at the forward main deck work area.

E. SEARCHLIGHTS

The Contractor shall provide and install two 1 kW, Xenon searchlights, similar to Carlisle & Finch, set up for 460 volt AC, three phase service.

The searchlights shall be mounted on the pilothouse top, with two lights mounted directly above the steering levers, facing forward. The searchlights shall be installed with distant electric control for operation from the pilothouse console. The foundations for the lights shall be in accordance with Clause C330 of the contract.

The exterior surfaces of each searchlight shall be finished in white enamel. Each searchlight shall be provided with a canvas storage cover.

F. FLANKING LIGHTS

The Contractor shall provide and install four flanking lights, one located on each stern corner of the upper deck, port and starboard, and one located on each forward corner of the upper deck, port and starboard. The flanking lights are similar to Phoenix, model MRS 64/1000S, local hand control type searchlights.

G. NAVIGATION LIGHTS

Each vessel shall be furnished with a complete system of navigation lights in accordance with the USCG Navigation Rules, International and Inland. Each vessel will operate on the Western Rivers and the Ohio River System. See contract Clauses C001 and C003. The navigation lighting system shall also include USCG lights required for a "vessel not under command" and a "vessel restricted in her ability to maneuver."

The navigation lighting system shall be set up for 120 volt AC. All navigation lights provided shall be similar to figures 1164 to 1168 series, manufactured by Perko, except the whistle light provided by the air horn manufacturer (see contract Clause C472).

A supervised, solid-state, navigation light panel shall be supplied similar to those manufactured by J-Box, Marrero, LA (www.jboxinc.com) and installed in the pilothouse. The navigation light panel supplied shall include “tell-tale” panel alarms to indicate the failure of the lights primary bulb and indicate that the secondary bulb is in operation. The panel shall also incorporate circuits for the anchor light and the whistle light and a panel dimmer switch.

#### H. INSTRUMENT LIGHTING

All instrument lights and gauges in the pilothouse console shall be provided with lights. The lights shall have dimmer switches.

#### I. EQUIPMENT & CONVENIENCE RECEPTACLES

##### 1. Equipment Connections & Receptacles

The swing meter, galley equipment, ice machines, trash compactor, washer, and dryer shall all be installed on dedicated circuits, with non-GFCI receptacles and breakers, unless required by the equipment manufacturer. Where equipment is supplied with plugs, the Contractor shall install a dedicated, single receptacle for each different equipment's service. The voltage and phase required for each piece of equipment is dependent upon the equipment selected.

##### 2. Interior Convenience Receptacles

All interior convenience receptacles shall be rated for 2 pole, 3 wire, 15 amp or 20 amp, 125 volt AC service. All receptacles, including GFCI receptacles, shall be hospital and/or industrial/institutional grade receptacles similar to those manufactured by Hubbell.

The receptacles listed below may be grouped on circuits with other receptacles serving the same space or area except that each galley counter top receptacle shall be installed on separate, dedicated circuits.

The following interior receptacles shall be furnished and installed for CLIN 0001:

<u>Location</u>	<u>Type</u>	<u>Rating</u>	<u>Other</u>
Pilothouse			
Port	Duplex	15 amp	
Starboard	Duplex	15 amp	
Counter-top	Duplex	20 amp	GFCI Receptacle
Staterooms (per each room)			
On a bulkhead	Duplex	15 amp	2 per room
Adjacent to mirrors	Duplex	15 amp	GFCI Receptacle
Toilet\Showers			
Adjacent to mirror	Duplex	15 amp	GFCI Receptacle
Captain's\Pilot's Staterooms (per each room)			
Near Desk	Duplex	20 amp	
Passageways			
Upper Deck Bhd	Duplex	20 amp	
Main Deck Bhd	Duplex	20 amp	
Deck Storage			
Port Bhd	Duplex	20 amp	
Starboard Bhd	Duplex	20 amp	
Crew's Lounge			
Near Desk	Duplex	20 amp	
Port Bulkhead	Duplex	15 amp	
Mess Area			
Fwd Bhd – Floor	Duplex	20 amp	GFCI Receptacle
TV Service – Fwd, High	Single	20 amp	Separate Circuit

Pantry Bulkhead	Duplex	20 amp	GFCI Receptacle
Galley			
Counter Top Level	Duplex	15 amp	GFCI Receptacles Separate Circuits
Supply Total = 4			
Upper Engine Room:			
Forward Bulkhead	Duplex	20 amp	
Port Bulkhead	Duplex	20 amp	
Stbd Bulkhead	Duplex	20 amp	
Aft Bulkhead	Duplex	20 amp	
Engineer's Workshop			
Counter Top Level	Duplex	20 amp	
Aft Bulkhead	Duplex	20 amp	
Generator Room	Duplex	20 amp	GFCI Protected
Steering Gear Room			
Port Bulkhead	Duplex	20 amp	
Starboard Bulkhead	Duplex	20 amp	

The following interior receptacles shall be furnished and installed for CLIN 0002, CLIN 0003, and CLIN 0004:

<u>Location</u>	<u>Type</u>	<u>Rating</u>	<u>Other</u>
Pilothouse			
Port	Duplex	15 amp	
Starboard	Duplex	15 amp	
Counter-top	Duplex	20 amp	GFCI Receptacle
Plenum Deck (Electronics Room)			
Aft Bulkhead	Duplex	20 amp	
Port Bulkhead	Duplex	20 amp	
Stbd Bulkhead	Duplex	20 amp	

Staterooms (per each room)				
On a bulkhead	Duplex	15 amp		2 per room
Adjacent to mirrors	Duplex	15 amp		GFCI Receptacle
Toilet\Showers				
Adjacent to mirror	Duplex	15 amp		GFCI Receptacle
Oiler's Stateroom				
Near Desk	Duplex	20 amp		
Passageways				
Texas Deck Bhd	Duplex	20 amp		
Upper Deck Bhd	Duplex	20 amp		
Main Deck Bhd	Duplex	20 amp		
Crew's Lounge				
Forward Bhd	Duplex	15 amp		
Aft Bulkhead	Duplex	15 amp		
Ship's Office				
Near Desk – Aft	Duplex	20 amp		
Near Desk	Duplex	20 amp		
– Fwd Port				
Near Desk	Duplex	20 amp		
– Fwd Stbd				
Aft Bulkhead	Duplex	15 amp		
Deck Storage				
Port Bhd	Duplex	20 amp		
Stbd Bhd	Duplex	20 amp		
Mess Area				
Fwd Bhd – Floor	Duplex	20 amp		GFCI Receptacle
TV Service	Single	20 amp		Separate Circuit
– Fwd, High				
Pantry Bulkhead	Duplex	20 amp		GFCI Receptacle

Galley			
Counter Top Level	Duplex	15 amp	GFCI
			Receptacles
Supply Total = 4			Separate Circuits
Engineer's Workshop			
Counter Top Level	Duplex	20 amp	
Aft Bulkhead	Duplex	20 amp	
Generator Room	Duplex	20 amp	GFCI
			Protected
Steering Gear Room			
Port Bhd	Duplex	20 amp	
Starboard Bhd	Duplex	20 amp	

### 3. Exterior & Waterproof Receptacles

All exterior and waterproof receptacles supplied shall be rated for 2 pole, 3 wire, 20 amp, 125 volt AC service. All receptacles supplied shall be similar to Pauluhn, model #2584B-125. GFCI circuit breakers shall be installed for the circuits serving the receptacles listed below.

The following waterproof receptacles shall be furnished and installed for each vessel:

<u>Location</u>	<u>Type</u>	<u>Circuit Rating</u>
Exterior		
Main Deck Forward	Duplex	20 amp
Main Deck Aft	Duplex	20 amp
Main Deck Port - Forward	Duplex	20 amp
Main Deck Port – Aft	Duplex	20 amp
Main Deck Stbd – Forward	Duplex	20 amp
Main Deck Stbd – Aft	Duplex	20 amp
Upper Deck Port	Duplex	20 amp
Upper Deck Stbd	Duplex	20 amp
Upper Deck Aft	Duplex	20 amp
Upper Deck – Frame #50	Duplex	20 amp
Pilohouse Stbd	Duplex	20 amp
Pilohouse Port	Duplex	20 amp
Pilohouse Aft	Duplex	20 amp

Forward Stores	Duplex	20 amp
Forward Machinery Space		
Port Bulkhead	Duplex	20 amp
Stbd Bulkhead	Duplex	20 amp
Aft Bulkhead	Duplex	20 amp
Lower Engine Room		
Forward Bulkhead	Duplex	20 amp
Aft Bulkhead	Duplex	20 amp
Port Bulkhead	Duplex	20 amp
Stbd Bulkhead	Duplex	20 amp
Shaft Alley	Duplex	20 amp

In addition, the following exterior receptacles shall be furnished and installed for CLIN 0002, CLIN 0003, and CLIN 0004:

<u>Location</u>	<u>Type</u>	<u>Circuit Rating</u>
Exterior		
Texas Deck Port	Duplex	20 amp
Texas Deck Starboard	Duplex	20 amp
Texas Deck Aft	Duplex	20 amp
Plenum Deck Aft	Duplex	20 amp

The receptacles may be grouped on circuits with other receptacles serving the same space or area. All receptacles shall be located a minimum of 3 feet above the deck or sole plating.

C735 ELECTRICAL POWER PLANTA. CONTRACT DRAWINGS

CLIN 0001

557-B215-01, GENERAL ARRANGEMENT

CLIN 0002, CLIN 0003 &amp; CLIN 0004

556-B215-01, GENERAL ARRANGEMENT

B. DIESEL GENERATOR SET REQUIREMENTS

The Contractor shall provide and install for each vessel two diesel generator sets as located on the contract drawings.

The diesel generator sets shall be a 4 stroke-cycle marine type, in-line 6 cylinder meeting ABS rules similar to a Caterpillar, model 3304B. Each diesel generator shall a continuous rating of 105 kW minimum at 0.8 power factor at 60 Hz and 1800 rpm. The generators shall be set up to supply 480 volt AC, 3-phase, 3-wire, ungrounded, 60 Hz electrical power.

Each generator shall be equipped with an amortisseur winding and shall be capable of delivering 110 percent load for two hours without exceeding permissible limits of temperature rise. Each generator, along with its regulation and excitation systems shall be capable of supporting overload conditions as well as maintaining short circuit currents of such magnitude and duration as required to properly actuate selective tripping of downstream protective devices.

Each voltage regulator shall be a solid state volts-per-hertz voltage regulator and shall be capable of automatically maintaining constant rated generator voltage throughout the load range of the generator. Each voltage regulator shall be capable of maintaining steady state regulation within 1 percent of rated voltage from no load condition to 110 percent rated load condition and shall include a voltage adjusting rheostat with a plus and minus 10 percent adjustment range.

The voltage dip on each generator shall not exceed 25 percent while starting the largest motor on the vessel across-the-line with the main bus load at 30 percent capacity.

Each diesel engine and generator shall be provided with the following features and options:

- Approved by ABS.
- Voltage droop on each generator that is adjustable for parallel operation.
- **The generator shall have a** A drip proof, guarded enclosure, and shall be air cooled and self-ventilated.
- A brushless excitation system and an automatic solid state voltage regulator.
- An engine mounted fuel pump with a minimum lift of 10 feet.
- Set up for battery start.
- Dedicated DC control system including battery and charger for controls and automatic shutdowns.
- Electronic governor.
- Emergency stop pushbutton.
- Turbocharged-aftercooled.
- Configured as a closed jacket water cooling system using keel coolers. Coolant level sensors and gauges to be provided.
- Auxiliary expansion tanks and/or larger jacket water pumps if required to handle the cooling system volume.
- A jacketed manifold and dry exhaust system.
- Each engine turbocharger and exhaust manifold shall be insulated or jacketed to maintain an outer skin temperature of less than 125 degrees F.
- Each engine shall be equipped with a crankcase vent filter/collector system similar to a NELSON EcoVent Recirculator. The EcoVent shall be supplied with a manometer and the drain line shall be returned directly to the engine oil sump, below the oil level.
- Each generator supplied with an electric heater.

- The water, lube and fuel lines to all engine connections shall be fitted with USCG and ABS approved flexible connections.
- Each diesel engine oil sump shall be fitted with a ball valve and quick disconnect fitting so that oil can be added to or drawn from the sumps.
- A steel base frame with drip pan under the engine.
- Mounted on vibration mounts in order to isolate engine vibration. See contract Clause C180 for noise and vibration requirements.
- Each engine shall be supplied with lifting eyes and mounting support. The Contractor is responsible for supplying suitable foundations for the engines and generators.
- Switchgear controls and instrumentation shall be provided and installed as outlined in contract Clause C740.
- Load bank testing of the diesel engine and generator shall be in accordance with Section E of the contract.
- Four sets of manuals shall be supplied for the diesel engines and generator sets. See contract Clause H16.
- Spare parts in accordance with contract Clause C805.

The diesel engines and generator sets and all associated equipment shall be installed in strict compliance with the engine manufacturer's recommendations and the installation shall be approved by the manufacturer's field representative.

#### C. DIESEL ENGINE COMBUSTION AIR

Each generator diesel engine shall be fitted with a dedicated source of outside air for combustion. The combustion inlet shall be protected from rain and shall be fitted with a bug screen. Provisions shall be made for closing the inlet in case of a fire.

D. GENERATOR SET STARTING/STOPPING

Each generator set shall be set up for starting and stopping locally, at the generator set in the generator room.

The diesel generator sets shall be electric start. Each generator set shall be provided with 24 volt DC starting including starter motor, batteries, battery charging alternator, ammeter, and regulator. See Clause C706.

The starting batteries shall be marine, heavy duty, rated in accordance with the engine manufacturer's recommendations. The Contractor shall provide and install a battery box with cover for the diesel engine starting batteries. The battery boxes shall be located in the generator room.

E. GENERATOR SET ALARMS & INSTRUMENTATION

The diesel generator sets shall be set up to automatically shutdown upon activation of the following alarms:

- Engine overspeed
- Low lube oil pressure
- High jacket water temperature

Alarms shall be provided for each generator set. The alarm panels shall be located both in the generator room and in the engineer's workshop. The panels shall be set up such that silencing an alarm at one panel automatically silences the alarm at a second panel.

The alarms shall have both audible and visual signals at both the generator room panel and the engineer's workshop panel. The alarms shall be provided with fault light lock-in circuitry, lockout of additional alarm lights after engine shutoff, alarm silence buttons, and circuit test button.

The following alarms shall be included for each generator set at both the generator room panel and the engineer's workshop panel:

- Engine overspeed
- Low lube oil pressure
- High jacket water temperature
- Low starting battery voltage

The diesel generator manufacturer shall provide a local control panel, with mechanical gauges, installed at each generator set. Each panel shall have, as a minimum, the following instrumentation:

- |  |            |
|--|------------|
| • Engine hour <b>or service</b> meter        | Tachometer |
| • Jacket water temperature gauge (degrees F) | Watt meter |
| • Lube oil pressure gauge (psi)              | Volt meter |
| • Fuel pressure gauge (psi)                  | Amp meter  |

An instrument panel shall be provided and installed for each generator set in the engineer's workshop. The following instrumentation shall be included on the panel:

- Generator "power available" indicator
- Jacket water temperature gauge (degrees F)
- Lube oil pressure gauge (psi)

The following instrumentation and alarms shall be installed in the pilothouse for each generator set:

- Generator set running light
- Generator trouble light and audible alarm

The diesel generator trouble alarm shall be provided with fault light lock-in circuitry, lockout of additional alarm lights after engine shutoff, and alarm silence button. The instrument panel installed in the pilothouse shall be furnished with a dimmer switch.

#### C740 SWITCHBOARD & POWER CONTROL

##### A. CONTRACT DRAWING

CLIN 0001

557-B215-01, GENERAL ARRANGEMENT

CLIN 0002, CLIN 0003 & CLIN 0004

556-B215-01, GENERAL ARRANGEMENT

## B. OVERVIEW

A switchboard shall be provided and installed for the electrical systems and shall be located as shown on the above contract drawings. Front layouts, catalog cutsheets of major components, and diagrams of the switchboard shall be submitted for review by the COR prior to the purchase of any equipment by the Contractor.

The switchboard shall be configured to contain:

- A generator control section
- A shore power section
- A 480 volt AC distribution section

The generator control section shall enable paralleling of the generator sets. The switchboard shall also be configured to prevent paralleling between the shore power and either generator set.

The switchboard shall be designed, constructed, and installed in accordance with ABS rules.

## C. SWITCHBOARD REQUIREMENTS

### 1. General Requirements

The switchboard shall be front accessible, and fully serviceable from the front. It shall be freestanding and adequately supported to resist vibration. Switchboard shall be set up to provide for top and bottom cable entry.

Space heaters for the switchboard sections shall be provided to prevent condensation within the enclosure during idle periods. The space heaters shall be energized from the ship's service 208Y/120 volt AC system.

### 2. Generator Set Switchboard Sections (Parallel Operation)

The switchboard shall include sections for monitoring and control of each generator set as well as a synchronizing section for paralleling of the generator sets. For each generator set, the associated switchboard section shall include the following components and features:

- Automatic synchronizer.
- "AUTO-MANUAL" synchronizer selector switch.

- Generator power available indicating light.
- Voltage regulator control rheostat.
- Speed control rheostat.
- Voltmeter and selector switch.
- Ammeter and selector switch.
- Frequency meter.
- Wattmeter.
- Multifunctional Amp transducer.
- Multifunctional Volt transducer.
- Multifunctional Watt transducer.
- Frequency transducer.
- Manual “ON-OFF” switch with indicating light for the switchboard space heater.
- “ON-OFF-AUTO” switch with indicating light for the associated generator space heater. When in the “AUTO” position, the space heater shall be energized whenever the associated generator breaker is open.

The synchronizing section of the switchboard shall include the following components:

- Synchroscope.
- Selector switch to select the incoming generator.
- Generator breaker “CLOSE” pushbutton for the each generator.
- Speed control rheostat for each generator.
- One voltmeter for each generator.

- One frequency meter for each generator.

An automatic synchronizer shall be provided for each generator that will automatically synchronize the incoming generator, as selected by the generator selector switch, with the 480 volt AC bus and close the generator breaker when the two power sources are synchronized. Automatic synchronization, breaker closing and load balancing, shall occur:

- When the breaker close pushbutton is pressed and the synchronizer selector switch is in the “LOCAL AUTO” position.
- When the synchronizer selector switch is in the “REMOTE AUTO” position.

When in the “MANUAL” position, pushing the close pushbutton will by-pass the automatic synchronizer and close the breaker of the selected generator.

Each generator breaker shall be provided with reverse power protection that will trip the generator under reverse power conditions. The setting shall be between 8% and 15% of the main generator rating. Each generator breaker shall also be interlocked such that the generator breaker cannot be closed unless its associated generator is generating power. Each generator breaker shall also open if its associated generator voltage collapses.

### 3. Shore Power Operation – Switchboard Section

The switchboard shall include a section for monitoring the incoming shore power. The shore power section of the switchboard shall include the following components and features:

- Shore power available indicating light.
- Voltmeter.
- Ammeter.
- Frequency meter.
- Phase sequence/loss system.

The phase sequence/loss system for the shore power connection consists of:

- A phase sensing relay with correct phase light (green), neutral position, and incorrect phase (red)
- Shore power reversed phase indicating light.
- Three-position shore power phase reversal switch with “normal” and “reversed” settings separated by an “OFF” switch position.

To prevent paralleling between the shore power and the generator sets, electrical and mechanical (safe/run device for the shore power service) interlocking shall be provided. The main bus shall only be energized at any given time by the generator sets or the shore power.

#### 4. Isolation Ground Bus & Ground Detection

The switchboard shall also incorporate an isolation ground bus. Connections shall be made from AC system distribution panels back to the isolation ground bus in the switchboard. Grounding shall then be made to the starboard diesel generator engine.

For ground detection, the switchboard shall also include:

- Ground detection lights and test switch for the 480 volt AC system.
- Ground detection ammeter and test switch for the 208Y/120 volt AC system.

#### 5. Switchboard Breakers

##### a. General Circuit Breaker Requirements

The interrupting rating of each circuit breaker shall be suitable for the maximum short circuit current available at the point of application as determined by short circuit analysis. The circuit breakers provided shall have a minimum interrupting rating of 10,000A RMS symmetrical at their respective voltage level, and shall be capable of interrupting without damage, the maximum fault current at the breaker from the system.

Circuit breaker coordination and selectivity shall be provided so that, for a fault on any part of the system, the fault is cleared by the protective device that is closest to the point of fault without tripping upstream breakers in accordance with USCG, 46 CFR, subchapter J, subpart 111.51.

b. Generator Sets & Shore Power Sections

The generator breakers shall be provided with adjustable time delay under voltage trip devices. The generator and shore power breakers shall be provided with trip characteristics to provide maximum selective coordination with downstream circuit breakers and motor operations.

The switchboard shall contain molded case, electronic trip device circuit breakers for the generators, and for the shore power service.

The main section of the switchboard shall contain, as a minimum, the breakers for the generator sets, the shore power (two breakers), the off-vessel power service, the transformer feed, the steering and flanking gear motors, the feeds to the 480 volt AC distribution section. There also should be two spare breakers in this section.

c. 480 Volt Distribution Section

Molded case, draw-out type, circuit breakers shall be provided for all of the equipment required for control of the 480 volt, three-phase, 60 Hz equipment, and for the 480 volt AC distribution system.

The 480 volt distribution bus circuit breakers shall be manually operated and provided with inverse time, ambient-temperature-compensated, thermal magnetic trips and shall have interchangeable thermal trip units and adjustable magnetic trips in ratings where available.

As a minimum, four spare breakers shall be provided. The spare breakers shall have trip ratings representative of the trip ratings furnished for other loads connected to the main switchboard.

Any remaining "spaces" for circuit breakers shall be fitted with plug-in assemblies of appropriate frame size and blank cover plates.

Single phase loads shall be distributed as evenly as possible among the three phases of the three-phase, 4-wire system, to achieve optimum phase current balance.

#### C745 DISTRIBUTION PANELBOARDS

##### A. DESCRIPTION OF WORK

Power and lighting panelboards shall be used to supplement the distribution section of the switchboard for all of the electrical loads on the vessels. Panelboards shall be located so that they are readily accessible.

The panelboards shall be dead front circuit breaker type equipped with molded case circuit breakers. All panelboards shall be fitted with isolation ground bars.

All panelboards shall be equipped with main circuit breakers for the feed into the panelboard.

All panelboards and breakers shall be marked in accordance with contract Clause C702.

##### B. AC SYSTEM CIRCUIT BREAKERS

The distribution panelboards shall be connected to feeder circuit breakers in the 480-volt main switchboard as well as to the 480-volt to 208Y/120 volt transformer feed.

As far as practicable, load distribution should be such that the distribution panelboards shall feed electrical loads that are located in their respective areas.

Single phase loads shall be distributed as evenly as possible among the three phases of the three phase, 4-wire system, to achieve optimum phase current balance.

The panelboards shall be equipped with molded case circuit breakers with ratings and the number of poles to satisfy system requirements. The 208Y/120 volt AC panelboards shall be similar to Square D. Stab (plug in) type circuit breakers shall be used.

The circuit breakers in all the panelboards shall have quick make, quick break, trip-free mechanism. The interrupting rating of each circuit breaker shall be suitable for the maximum short circuit current available at the point of application as determined by short circuit analysis. The circuit breakers provided shall have a minimum interrupting rating of 10,000 RMS symmetrical amperes at their respective voltage levels, and shall be capable of interrupting without damage to the fault current available at the breaker from the system.

In addition, each of the distribution panelboards shall be provided with a minimum of four spare breakers, with trip ratings representative of trip ratings furnished for other loads.

Circuit breakers for the motor controllers shall be in accordance with contract Clause C750. Breakers for the transformer shall be in accordance with contract Clause C755.

#### C. DC SYSTEM CIRCUIT BREAKERS

The DC system distribution panelboard and circuit breakers shall be in accordance with contract Clause C706.

### C750 MOTORS AND CONTROLLERS

#### A. MOTORS

All motors shall be drip-proof protected, except those exposed to the weather, which shall be waterproof construction. All motors shall be NEMA type, and shall be sized and designed for continuous operation of the driven auxiliary at rated capacity.

All motors shall be designed for an ambient temperature of 50 degrees C.

All motors shall be equipped with anti-friction bearings. All motors using grease lubricated bearings shall be provided with grease fittings and shall have positive means for preventing grease from being forced out upon the motor windings.

#### B. CONTROLLERS

All controllers shall have manually reset thermal overload protection, line disconnect device, and integral start/stop push-button set. Controllers arranged for automatic or remote operation shall also be provided with Hand-Auto or Local-Remote selector switch. Exterior mounted controllers shall be mounted in watertight enclosures.

Controllers for the small HP motors shall be full-voltage magnetically operated type. In cases where starting motors across the line can produce 25% voltage dip on the system with the bus at 30% capacity, reduced voltage starters shall be used.

C. MOTOR CONTROLLER – BREAKER COORDINATION CIRCUITS

Switchboard breakers and panelboard breakers for motors and motor controllers shall sized and installed in accordance with the following:

- Motor feeder circuit breakers installed in a switchboard section or motor panel shall be rated near to and not more than 250% of the motor FLA.
- The motor control circuits shall be in accordance with MDC Sketch #750A.
- All motor controllers shall have short circuit and ground fault protection by circuit breaker rated at  $AT = 125\% \text{ FLA}$  and  $IT = 10 \times \text{FLA}$  of the motor.
- See MDC Sketch #750B for the motor circuit logic.

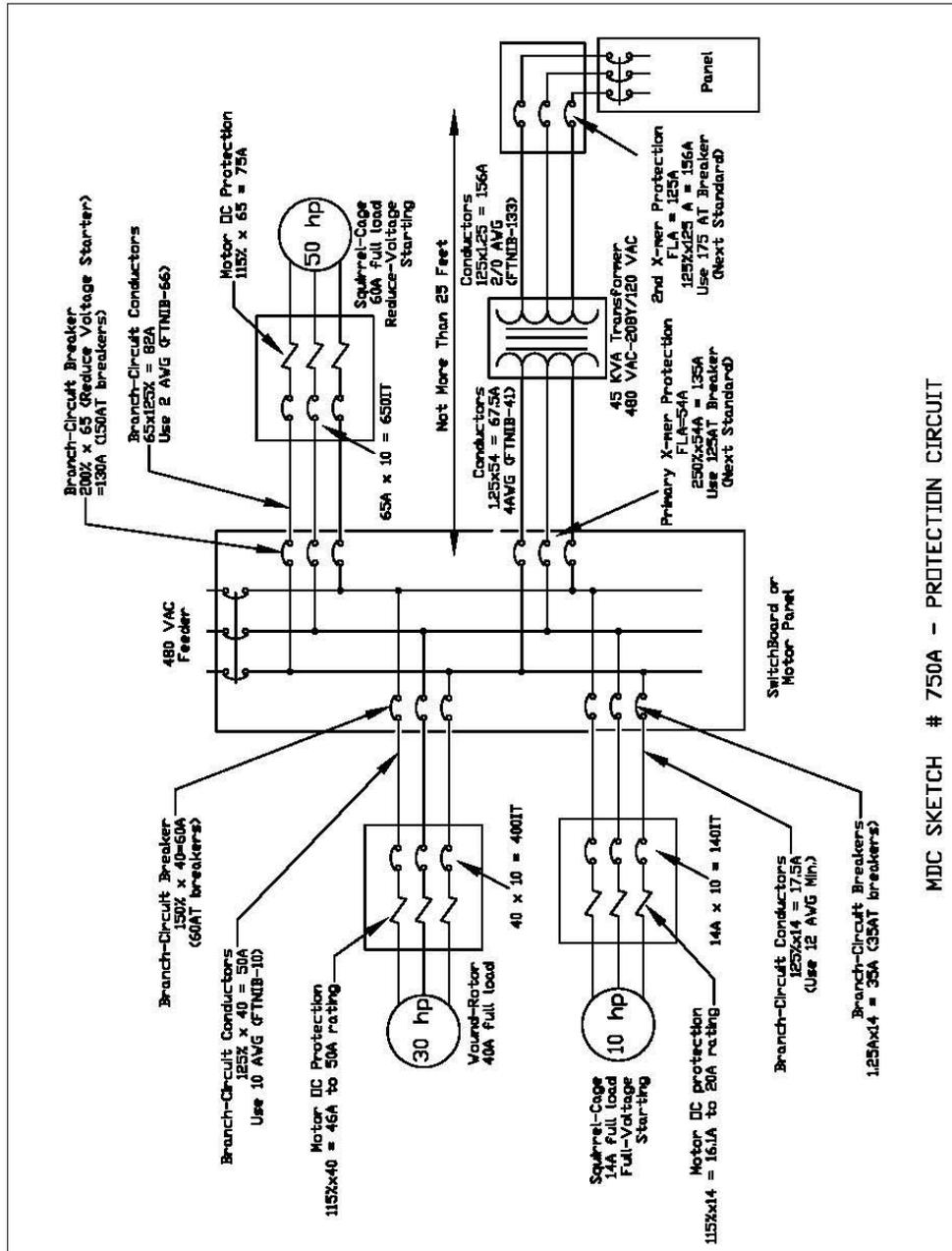
D. MOTOR UNDER-VOLTAGE PROTECTION

All motor controllers shall be provided protection against an under-voltage condition. Protection against under-voltage shall be either low-voltage protection (LVP) or low-voltage release (LVR).

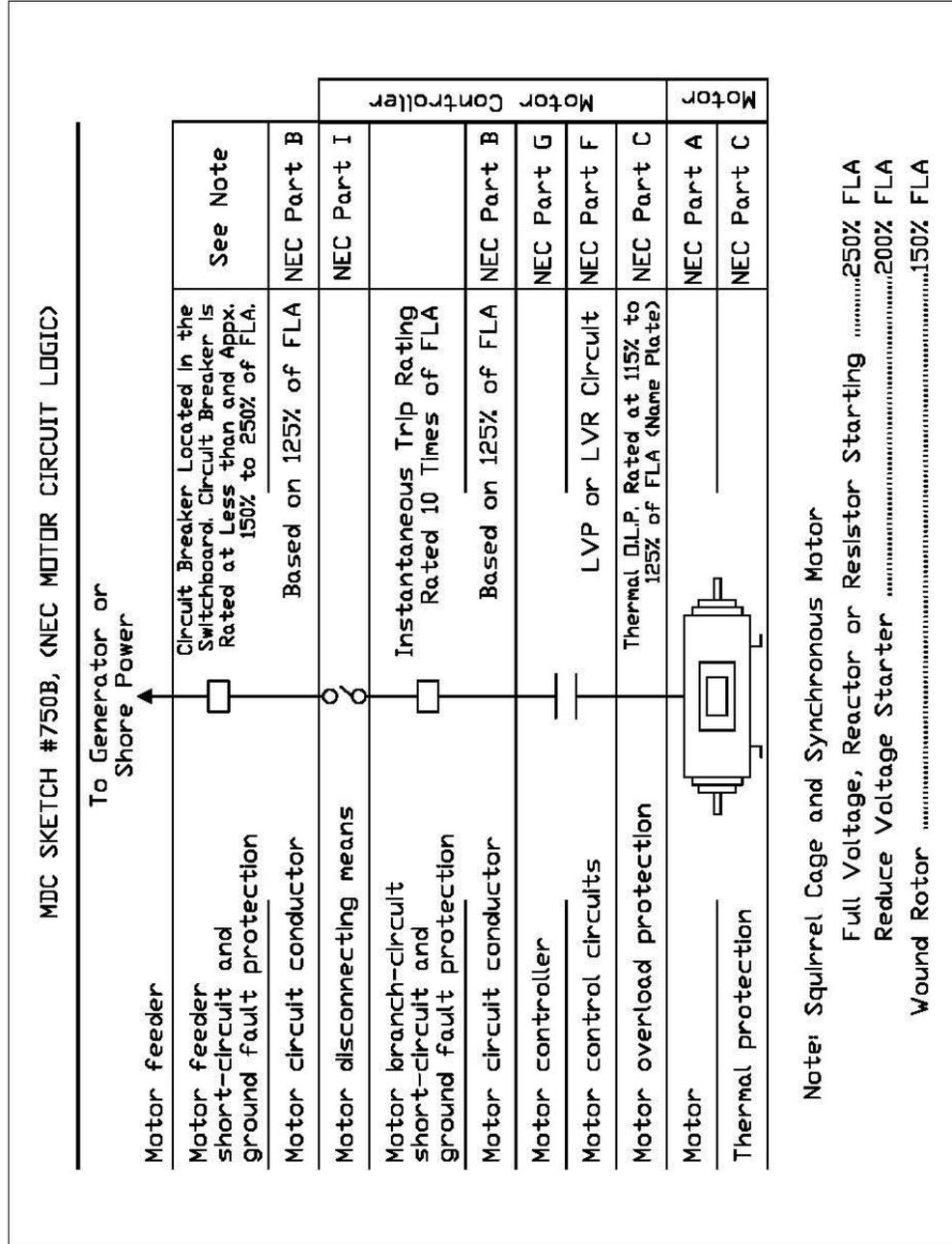
The motor controllers for the following systems shall be provided and installed with low-voltage release (LVR):

- Steer gear pumps
- Bilge pumps
- Fire main pump
- Air compressors
- Engine room supply and exhaust fans
- Generator room supply and exhaust fans

All motor controllers not having LVR shall be provided and installed with low-voltage protection (LVP) unless the motor is less than 2 hp.



MDC SKETCH # 750A - PROTECTION CIRCUIT



## C755 TRANSFORMERS

### A. TRANSFORMER SIZING REQUIREMENTS

The Contractor shall provide and install one transformer to connect the 480 volt AC, three phase, 3-wire, 60 Hz system to the 208Y/120 volt AC, three phase, 4 wire, 60 Hz system.

The transformer shall be sized based on the results of the AC Load Analysis and the development of the AC One-Line Diagram. See contract Clauses C710 and C720.

### B. GENERAL REQUIREMENTS

The transformer shall be three phase, 60 Hz, marine dry type, convection air cooled and shall be adequately sized to satisfy system requirements.

The secondary system shall be bonded at the transformer.

The transformer selected shall be suitable for exterior mounting with the transformer being mounted on the aft upper deck, above the switchboard. The Contractor is responsible for providing a foundation beneath the transformer.

### C. INSULATION

The transformer shall have class H insulation and copper conductors. The design ambient temperature shall be a minimum of 50°C. The transformer shall be designed to deliver rated KVA continuously without the benefit of internal fans to circulate air. All insulating materials shall be in accordance with NEMA standards.

Provisions shall be made to completely isolate the core and coil from the enclosure. There should be no metal-to-metal contact. Rubber vibration isolating pads shall be installed by the manufacturer between the core and the enclosure. The core should then be visibly grounded to the enclosure by means of a flexible grounding conductor.

### D. CONSTRUCTION

The enclosure shall be constructed of heavy gauge sheet steel, shall be drip-proof, and shall be given a suitable corrosion resisting treatment. The entire assembly shall be rigid self-supporting construction. Panels shall be capable of being readily open or removed for access to interior for installation, maintenance, and repair.

E. TRANSFORMER CIRCUIT BREAKERS

The transformer feeder circuit breaker shall be sized to be near to but not more than 250% of the primary current. The secondary transformer circuit breaker shall be rated or sized at 125% or the next standard size of circuit breaker. See MDC Sketch #750A.

C760 SHORE POWER & OFF VESSEL SERVICES

A. SHORE POWER SERVICE

Each towboat shall be set up to accept 480 volt AC, three phase, 100 amp shore power service.

The Contractor shall provide and install two reverse service (inlet angle junction box), shore power (load making, load breaking) receptacles on each vessel. The use of this type of receptacle and plug shall allow the shore power circuit breaker to remain closed in the event of low voltage or loss of power from shore.

The reverse service receptacles to be supplied for each vessel shall be similar to a MELTRIC, model #31-64243. The corresponding connectors to be supplied for use with the receptacles shall be similar to a MELTRIC, model #31-68243.

For CLIN 0001, CLIN 0003, and CLIN 0004, the Contractor shall also provide 100 feet of 4-conductor shore power cable for 100 amp service. For CLIN 0002, the Contractor shall also provide 125 feet of 4-conductor shore power cable for 100 amp service.

One end of the cable shall be fitted with the MELTRIC connector for use on the vessel. For CLIN 0001, the shore side end of the cable shall be fitted with a plug similar to a Bryant. Model #4100P7W rated for 480 volt, three phase, 100 amp service. For CLIN 0002, CLIN 0003, and CLIN 0004, the second end of the cable shall be set up for use on the shore side and shall be fitted with a Government furnished connector to match the shore side service.

One shore power receptacle shall be located on the starboard side of each vessel and the second shore power receptacle shall be located on the port side of each vessel. The shore power receptacles shall be located at midships.

The shore power receptacles shall be labeled for operation in accordance with contract Clause C702.

B. OFF VESSEL SERVICE

Each towboat shall be set up to provide off-vessel power service. The service to be provided is 480 volt AC, 100 amp, three phase power.

The Contractor shall provide and install off-vessel power receptacles on the port and starboard side of each vessel.

The receptacles provided shall be similar to a Load Breaking MELTRIC model #31-64243, rated for 480 volt, 100 amp, 3-pole, 4-wire service with steel angle/junction box. The off-vessel service shall be fed through a circuit breaker mounted in the main switchboard.

The Contractor shall also provide a 100 foot length of 4 conductor power cable for the off-vessel service. One end of the cable shall be fitted with a plug similar to a Load Breaking MELTRIC Male Plug, model #31-68243 and for CLIN 0001, the other end of the cable shall be fitted with a Bryant model #4100C7W connector. For CLIN 0002, CLIN 0003, and CLIN 0004, connectors to match the off-vessel receptacle shall be Government furnished.

The off-vessel receptacle shall be labeled for operation in accordance with contract Clause C702.

C765 COMMUNICATIONS EQUIPMENT

A. PUBLIC ADDRESS/LOUDHAILER SYSTEM

A public address/loudhailer system similar to a RAYTHEON, model RAY-430 shall be provided and installed in order to provide communication between the pilothouse and the stations listed below. The system shall be provided with the following basic components and features:

1. Master Control Unit

The master control unit is located in the pilothouse that shall include a portable microphone handset, with a press-to-talk switch and a 15-foot retractable coiled cord, and an internal speaker with volume controls for the microphone and talkback circuits. Controls shall consist of a power switch, and a selector for the talkback circuits or the loudhailer. The unit shall be powered from the 12 volt DC system.

For CLIN 0002, a second master control unit shall be supplied and installed in the ship's office.

2. Talk Back, Hands-Free Stations

Talk back, hands free stations shall be provided and located on the foredeck, the main deck, port and starboard by the fuel fill stations, and the upper deck by the utility boat.

3. High Powered Loudspeakers

A high powered loudspeaker shall be located in the overhead, on the forward Texas Deck and a second speaker shall be located on the aft end of Texas Deck.

4. Automatic Foghorn Capability

The foghorn feature of the unit shall be equipped with six preprogrammed fog signals meeting the requirements of the USCG International and Inland Rules-of-the-Road.

B. INTERIOR COMMUNICATION

Interior communications shall be provided by a fixed, two-way calling and voice communication system. The system shall be powered from a main or reserve power supply that is independent of the vessel's electrical system.

For CLIN 0001, stations shall be provided in the following locations:

Captain's Stateroom	Mess Area
Pilot's Stateroom	Upper Machinery Space
Engineer's Stateroom	Engineer's Workshop
Crew's Stateroom – Forward	Generator Room
Crew's Stateroom – Aft	Steering Gear Room
Deck Storage	Forward Machinery Space
Crew's Lounge	Lower Engine Room

For CLIN 0002, CLIN 0003, and CLIN 0004, stations shall be provided in the following locations:

Captain's Stateroom	Main Deck Passageway
Pilot's Stateroom	Upper Machinery Space
Ship's Office	Engineer's Workshop
Crew's Lounge	Generator Room
Upper Deck Passageway	Steering Gear Room
Deck Storage	Forward Machinery Space
Mess Area	Lower Engine Room

A “call signaling” horn and flashing light shall be installed in the upper engine room, generator room, steering gear room, machinery space, and lower engine room to alert personnel when those stations are being called. Headsets shall be provided at those stations.

For CLIN 0001, CLIN 0003, and CLIN 0004, master control unit shall be installed in the pilothouse. For CLIN 0002, master control units shall be installed in the pilothouse as well as in the ship’s office.

### C770 NAVIGATION EQUIPMENT

#### A. GENERAL REQUIREMENTS

Navigation equipment shall be furnished for each towboat in accordance with USCG Regulations 33 CFR, Subchapter P - Part 164, Navigation Safety Regulations. The equipment provided shall allow for operation on the Mississippi River and the Ohio River Systems.

As a minimum, the following equipment shall be provided and installed:

- Two radars
- One fathometer (depth sounder) with transducers port and starboard
- One swing meter
- One GPS/DGPS
- Two VHF radios with antennas
- One air horn

Appropriate navigation lights and shapes (day markers) as required for operation on the Mississippi River and the Ohio River Systems shall be provided for the vessel in accordance with the USCG Navigation Rules International-Inland. The installation of the navigation lights and the searchlights are defined in contract Clause C730.

The Contractor shall supply and install on the starboard towknee, a receptacle that allows for plugging in a portable, remote transducer for the depth sounder. The Contractor shall supply the remote transducer on a boom along with the matching plug for the receptacle.

For CLIN 0002, three additional VHF radios shall be supplied. The radios shall be installed in the crew’s lounge, ship’s office, and the mess area.

C. DISTRICT RADIO

For CLIN 0001, CLIN 0003 and CLIN 0004, a district radio will be supplied as Government furnished equipment. The Contractor shall install the radio in the pilothouse.

D. AIR HORN REQUIREMENTS

An air horn, similar to a Kahlenberg model Q3-A, figure #413 air horn with light bracket and M-300 whistle light (clear lens) shall be provide and installed. The horn, whistle light, and light bracket shall be chrome plated. The air horn shall be supplied with a bronze manual whistle valve. Air for the horn shall be supplied from a dedicated air compressor and receiver similar to those available from Kahlenberg. See contract Clause C690 for air receiver requirements.

E. WIND MONITOR

A wind monitoring system similar to those manufactured by R.M. Young Company shall be supplied and installed. A Wind Monitoring Model #05106 MA (Marine Use), shall be provided and installed on the pilothouse top. A Marine Wind Tracker Model #06206 shall be installed in the pilothouse. A signal line surge protector, model #19120 shall be provided and 5-conductor, shielded, 22 AWG sensor cabling, model #18446, shall be used throughout the system.

The system requires 24 volt DC power. The Contractor shall supply and install a 12 volt to 24 volt DC converter to feed power from the 12 volt DC system to the 24 volt DC system.

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**C800 SPARE PARTS****C805 MAJOR EQUIPMENT**

The following spare parts shall be furnished for each vessel:

A. **PROPULSION EQUIPMENT**

<u>Description</u>	<u>Quantity</u>	<u>Packaging</u>
Propeller – Left Hand	1	OUTSIDE
Propeller – Right Hand	1	OUTSIDE
Interchangeable Propeller Shafts	2 shafts/sets	OUTSIDE
With a set of		
Keys		PROTECTED
Propeller Nuts		PROTECTED
Fairwater Caps		PROTECTED
Steering Rudders (Interchangeable)	4	OUTSIDE
Flanking Rudders (Interchangeable)	4	OUTSIDE
Steering Rudder Cylinder	1	PROTECTED
Flanking Rudder Cylinder	1	PROTECTED
Steering Rudder Jockey Bar	1 bar	PROTECTED
Flanking Rudder Jockey Bar	1 bar	PROTECTED

The spare jockey bars shall be mounted on a bulkhead in the steering gear room.

## Engine Equipment

Main Engine Air Starting Motor	1	PROTECTED
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B. FILTERS

<u>Description</u>	<u>Quantity</u>	<u>Packaging</u>
Main Engine Filters:		
Air Cleaner Elements	1 case	CONSUMABLE
Fuel Oil	1 case	CONSUMABLE
Lube Oil	1 case	CONSUMABLE
Crankcase Vent Filter Elements	1 case	CONSUMABLE
RACOR Filter Elements	1 case	CONSUMABLE
Marine Transmission Filters	1 case	CONSUMABLE
Steering Hydraulics	1 case	CONSUMABLE
Diesel Generator Engine Filters:		
Air Cleaner Elements	1 case	CONSUMABLE
Fuel Oil	1 case	CONSUMABLE
Lube Oil	1 case	CONSUMABLE
Crankcase Vent Filter Elements	1 case	CONSUMABLE
RACOR Filter Elements	1 case	CONSUMABLE
AutoCrane Hydraulic Filters	1 case	CONSUMABLE

Refer to Section D of the contract for packing and marking of spare parts.

C810 OTHER EQUIPMENT

The following spare parts and materials shall be furnished for each vessel:

<u>Description</u>	<u>Quantity</u>	<u>Packaging</u>
Window Wipers:		
One spare wiper blade shall be provided For each pilothouse window wiper	1 per window	CONSUMABLE
Searchlight Bulbs	2 bulbs	CONSUMABLE
Flanking Light Bulbs	1 case	CONSUMABLE

Navigation Light Bulbs	1 case	CONSUMABLE
Ice Machine Water Filters	1 case	CONSUMABLE
Potable Water System Filter Cartridges		
Filling Filters	1 case	CONSUMABLE
Tank Exit Filters	1 case	CONSUMABLE

Refer to Section D of the contract for packing and marking of spare parts.

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PART I - THE SCHEDULE - SECTION E  
INSPECTION AND ACCEPTANCE

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PART I - THE SCHEDULE - SECTION E  
INSPECTION AND ACCEPTANCE

E01 INSPECTION

The contract will be managed by the Marine Design Center (MDC) of the U.S. Army Corps of Engineers (USACE) and is subject to inspection by its appointed representatives to insure strict compliance with the terms of the contract. No Government Representative, except the Contracting Officer, is authorized to change any provision of the specifications, nor shall the presence or absence of a Government Representative relieve the Contractor from any requirements of the contract.

The Contractor shall provide gas-free and oxygen level certificates for all compartments prior to permitting entrance for work or inspection. This procedure shall be reflected in the Contractor's Quality Control plans.

E02 LAUNCHING

The Contractor shall be responsible for the satisfactory launching of each vessel at the time and date selected and mutually agreed upon by the Contractor and the COR.

The Contractor shall provide a written notice to the COR 7 calendar days prior to each launching. Prior to launching, all painting below the main deck (interior and exterior) must be completed. The Contractor shall schedule 3 days between hull inspection and launch to allow any new paint on the hull interior and exterior to cure properly.

E03 QUALITY CONTROL AND INSPECTION

A. GENERAL

During the proposal phase of this procurement, the Contractor submitted a Contractor Quality Control (CQC) and Inspection Program for the work required in this contract. Full compliance with this Program is the Contractor's responsibility.

Responsible authorized personnel shall inspect the work in progress and all completed work, conduct necessary tests and record the data required. An Authorized Contractor Representative shall sign the records attesting to the validity of the information. Contractor certified inspection is an integral part of all work, therefore the COR will consider the entire contract incomplete if Contractor documentation and records signed by the Contractor's Authorized Representative are not complete.

## B. SUBCONTRACTORS

Work subcontracted and/or performed away from the shipyard is covered by this inspection system. The prime Contractor cannot delegate the authority to witness or perform, and sign for tests and inspections conducted away from the shipyard, without approval of the COR.

If the subcontractor has an established Quality Control program with designated organization and personnel, the prime Contractor may designate an appropriate individual in that organization as his authorized representative. Such designation shall clearly indicate that the individual is an employee of a subcontractor and his appointment shall be subject to the approval of the COR.

## C. TESTING

When any workmanship, material, or apparatus fails to pass any test or inspection, it shall be fully retested only after all known faults have been eliminated. Where directed by the COR, such failed material or apparatus shall be completely removed from the work and renewed. Any defects in workmanship or material shall be remedied by the Contractor at no additional cost to the Government, except where work was performed on material furnished by the Government.

## E04 FACILITIES FOR PERSONNEL

While it is not intended that the Marine Design Center will have a Resident Engineer's Office, the Contractor shall provide office space for use by a Marine Design Center staff of two.

The space shall be convenient to the work site and consist of a desk, chair, one commercial telephone, access to the Contractor's telephone system, and one drawing table suitable for layout of drawings for study. The commercial telephone shall have speakerphone capability. The space shall be air conditioned, heated, ventilated, well maintained and well secured, and be convenient to toilet and shower facilities. The space and facilities shall be suitable for both male and female staff.

Government Representatives attending the construction may bring with them communication equipment, cameras, and various items of test equipment. The Contractor shall permit unencumbered ingress and egress to and from the shipyard and each vessel with such equipment.

Upon request, the Government representative shall have the unrestricted use of a facsimile machine, photocopier, word-processing equipment, paper, supplies, etc.

In addition, the Contractor shall furnish two parking spaces within the shipyard, in safe locations and accessible to the assigned offices.

E05 TRIALS, TESTS AND DEMONSTRATIONS

## A. GENERAL REQUIREMENTS

All trials, tests and demos shall be performed on each vessel.

## 1. Levels of Testing

The Contractor shall perform tests on all equipment, machinery, and systems; individually, and integrated as a whole. The tests shall be performed as necessary to demonstrate satisfactory compliance with the Specification requirements contained in Section C, "DESCRIPTIONS/ SPECIFICATIONS/WORK STATEMENTS," of this Contract.

The Contractor shall perform five levels of testing as follows:

Level 1	.....Pre-Trial Tests
Level 2	.....Builder's Dock Trials
Level 3	.....Dock Trials
Level 4	.....Open Water Trials
Level 5	.....Final Acceptance Demonstrations

All demonstrations, tests, and trials shall be performed as specified herein and as specified in Contract Section C. The Contractor shall furnish all labor, materials, tools, and test equipment as necessary and perform the testing, trials, and demonstrations specified.

## 2. Consumables and Operating Fluids

The Contractor shall furnish all fuel oil, hydraulic oil, lubricating oil, engine anti-freeze, treatment chemicals, degreasing agents, gases, potable water and any other consumables required to perform the tests and demonstrations.

## 3. Test Agenda and Test Memoranda

The Contractor shall prepare an Agenda and Test Memoranda of the required tests and trials for each vessel in accordance with the requirements set forth herein. Two copies of the Agenda and Test Memoranda shall be submitted to the COR for review and approval 60 days prior to the scheduled testing (see Clause H02).

## a. Test Agenda

For each vessel, the Contractor shall prepare a Test Agenda for Level 3 and 4 Tests and Trials. The Agenda shall be a complete, detailed schedule of all tests, trials and demonstrations specified in this clause. The Test Agenda shall be arranged by day, not date, and shall list the specific tests, trials, and demonstrations, and the sequence in which these will be performed.

b. Test Memoranda

For each vessel, the Contractor shall prepare Test Memoranda for all systems and equipment tested under the Levels 1, 2, 3, 4, and 5 test and trial requirements of this clause.

The test memoranda shall describe the actual test procedures, and data to be taken. The procedures shall be in accordance with the "start-up" procedures for the equipment, as delineated in the operating manuals furnished for the equipment by the manufacturer. The Contractor shall incorporate demonstrations of all applicable controls, instruments, and alarms, into each system's Builder's Dock Trials, Dock Trials, Open Water Trials, and Final Acceptance Demonstrations sections of the Test Memoranda. Data recorded in time intervals shall be tabular so that data trends can be easily recognized.

Each test memorandum shall:

- (1) Reference the manufacturer's manual(s) used to format the test procedure.
- (2) Describe instrumentation for each test.
- (3) Include a blank space for relevant nameplate data, ambient conditions, tested parameter values for each time interval, designated values for pass/fail.
- (4) Include signature blocks for Contractor Representative and Government Representative witness signatures, times, and dates.
- (5) Include a space for writing comments.

The Test Memoranda shall be typed on 8-1/2 inch by 11-inch sheets of paper, single side, in three-ring notebook, with dividers for each section. Each page shall include the Marine Design Center project number (#2350, etc.) at the top.

The memoranda shall be arranged by system and equipment, with each level of testing for a specific system or piece of equipment recorded under the respective heading.

4. Test Reports

For each vessel, the Contractor shall compile the results of all tests and trials in a Test Report in accordance with the requirements set forth herein. Four levels of test reporting are required in accordance with the following schedule.

- a. Within 2 days of the completion of any Pre-Trial test, a copy of the documentation of that test shall be available to the COR for review.
- b. A preliminary Builder's Dock Trial Test Report shall be available to the COR for examination following the successful completion of Pre-Trial Tests (Level 1) and the Builder's Dock Trials (Level 2).
- c. Following the successful completion of Dock Trials (Level 3), the Contractor shall make the Dock Trials Test Report available to the COR for review.

(1) Test Report Requirements (Levels 1, 2 and 3).

The Contractor shall make available a Test Report comprised of the results of all required Level 1, Level 2 and Level 3 tests and trials, and the results of all Vendor's tests. The Test Report shall be the filled-in version of the Test Memoranda. The test report shall be maintained current as tests and test levels progress. The test report shall be furnished in three-ring binders, with dividers for each test.

The Test Report, including the results of all Level 1 and Level 2 trials, shall be available to the COR prior to, and during, the Level 3 tests. The Test Report, including the results of all Level 1, Level 2 and Level 3 tests and trials, shall be available for review by the COR prior to and during the Level 4 trials.

The Test Report, including the results of all Level 1, Level 2, Level 3, and Level 4 tests and trials, shall be available for review by the COR prior to and during the Level 5 demonstrations.

(2) Test Report Review and Approval

The Test Report shall be reviewed and approved by both the Contractor and the COR at the conclusion of each level of testing. Review and approval of the Test Report by the Contractor and the COR is a precondition of moving to the next level of testing.

d. Within 10 calendar days following the successful completion of Acceptance Trials (Level 5), the Contractor shall submit the Acceptance Trials Test Report to the COR for review.

(1) Test Report Requirements (Level 5)

The final version of the Test Report, including results of all five levels of the tests and trials, shall be bound in three ring binders and submitted in triplicate, within 30 calendar days following successful completion of the Level 5 demonstrations, and prior to Final Payment.

5. Deficiencies

The COR will compile a list of deficiencies which will be given to the Contractor. All deficiencies shall be corrected. Final Acceptance of each vessel will be made following remedy of all deficiencies.

The successful completion of all tests, trials, demonstrations and remedied deficiencies, shall be determined by the COR.

B. PRE-TRIAL TESTS (LEVEL 1)

All trials, tests and demos shall be performed on each vessel.

The Pre-Trial tests are designed to ensure proper construction, and installation of all equipment, piping, and electrical systems, tanks, and exterior and interior bulkheads. For each vessel, pre-trial tests shall be performed during the course of construction and prior to the beginning of Builder's Dock Trials (Level 2).

The COR shall be notified at least 24 hours in advance of any such testing and may, at his discretion, send a Government representative to witness any or all tests. The Contractor shall coordinate with ABS to ensure that they are present for all tests required to be witnessed for class.

Documentation of all pre-test inspection shall be in accordance with the requirements of Section E03 (Quality Control and Inspection). All deficiencies, including cracks, leaks, grounds detected in new circuits, or poor workmanship shall be corrected prior to commencement of Builder's Trials (Level 2). Pre-trial tests shall include the following:

1. Hull

All tanks and watertight bulkheads shall be tested in accordance with ABS Rules. All watertight/oiltight manholes and hatches shall be tested in accordance with ABS Rules.

2. Superstructure

All weathertight exterior bulkheads and decks shall be hose tested for tightness prior to coating. All weathertight doors, windows, manholes, and hatches, shall be hose tested for tightness.

3. Piping Systems

- a. General

The testing requirements set forth herein include system flushing procedures which shall be performed to demonstrate system cleanliness and integrity.

- b. Compressed Air

Upon completion of installation, the piping of each compressed air system shall be hydrostatically tested in accordance with the ASME code. The system shall be inspected for leaks at the welds, fittings, etc. Upon completion of the hydrostatic test, the entire system shall be blown dry with air. The Contractor shall take proper precautions to protect the engine controls, whistle, water closets, and air tool stations.

- c. Steering System Hydraulics

Upon completion of the installation, the system's piping and fittings shall be flushed with hydraulic fluid. Jumpers shall be provided as necessary. Flushing shall be accomplished using a Contractor furnished pump to circulate the hydraulic fluid, and the Contractor furnished filters to collect all contaminants.

- d. Piping Systems

After thorough flushing, hydrostatically test all piping systems for leaks at 1-1/2 times working pressure for a period of not less than 10 minutes per test. Each system shall be inspected for leaks at the welds, fittings, hoses, etc.

e. HVAC

Blow out with compressed air all installed ductwork. Operationally test each supply and exhaust fan, along with the ducting to ensure absence of leaks, adequate support, and acceptable vibration levels.

f. Potable Water

The Contractor shall clean, chlorinate, and flush all system tanks and piping.

4. Electrical Cabling

Insulation resistance readings of all installed power and lighting cable shall be taken using a 500 volt megger, and shall be in accordance with IEEE Standard 45, Section 46. The measured cable insulation resistance must meet or exceed the minimum values outlined in the referenced IEEE publication. Also, measure the voltage drop of the longest receptacle circuit. A complete record of all readings shall be kept to assure that all circuits and equipments have been checked.

5. Exhaust Systems

Blank off and test the flanges, welds, and gaskets of each exhaust system using compressed air and soap bubbles. The main engine exhausts, and the diesel generator exhausts shall all be checked in this manner.

C. BUILDER'S DOCK TRIALS (LEVEL 2)

All trials, tests and demos shall be performed on each vessel.

Builder's Dock Trials are a preliminary "run-through" of all required Dock Tests (Level 3) by the Contractor. The intent of this testing is to provide both the Contractor and the COR reasonable assurance that all equipment and systems have been thoroughly prepared and are ready for formal testing in Dock Trials (Level 3).

For each vessel, Builder's Dock Trials shall be conducted at the Contractor's facility listed in Section B of the contract. The COR shall be notified, in writing, at least 2 working days prior to the scheduled commencement date of Builder's Trials. The Test Report must be current prior to commencing Builder's Dock Trials.

The trials shall be of sufficient scope and duration to assure that all machinery and equipment is operable and all systems are complete. The trials need not be carried out to the same degree as the Level 3 testing.

D. DOCK TRIALS (LEVEL 3)

All trials, tests and demos shall be performed on each vessel.

Dock Trials are the operability tests the Contractor must perform in the presence of the Government Representative to demonstrate the proper installation, operation, control, and performance of all equipment, machinery, and systems installed as part of this Contract. Specific dock trials and demonstrations are defined in paragraph E.

In addition, each test or demonstration shall include control, instrumentation and alarm operation as applicable.

Prior to the start of Dock Trials, all construction and installations must be complete (except for final cleaning and touch-up painting), and all Level 1 and Level 2 testing must be successfully completed and documented. The Test Report must be current through the two levels of testing and approved by the COR before Level 3 testing can proceed.

Commencement of Dock Trials shall not be sooner than one full working day after completion of Builder's Dock Trials. The COR shall be notified immediately of any condition which would delay the conduct of Dock Trials.

The COR shall be notified in writing 10 working days in advance of the date set for testing of each vessel. Results of the Level 2 Testing must be faxed to the Marine Design Center at least one full day prior to the start of the Dock Trials, if Level 2 Testing was not attended by a Government Representative.

All testing and trials shall be conducted in the presence of a Government representative and any vendor representatives required by the Contract. The tests shall be conducted in accordance with the Agenda.

The Contractor shall indicate in the test memoranda which tests will be performed using the diesel generator(s) and which tests will be performed using the shore power.

During dock trials and thereafter, the atmosphere in spaces being prepared for, and preserved by, paints and tank coatings dissolved in highly volatile, toxic, and flammable solvents (29 CFR 1915.35(b)), shall be tested frequently and shall be in accordance with the U.S. Occupational Safety and health Agency Standards regulations stated in CFR 1915.31-36.

Within 24-hours of final inspection, and before any representative of the U.S. Government boards the vessel for such duties, each compartment or space to be inspected shall be certified "SAFE FOR WORKERS" by the National Fire Protection Associations (NFPA) certified Marine Chemist. This means that in the compartment or space so designated:

- a. The oxygen content of the atmosphere is at least 19.5 percent and below 22 percent by volume;
- b. The concentration of flammable vapors is below 10 percent of the lower explosive limit (LEL);
- c. Toxic materials in the atmosphere are within permissible concentrations;
- d. Any residues or materials associated with any work in the space shall not produce uncontrolled release of toxic materials under existing atmospheric conditions while maintained as directed on the Marine Chemist's certificate.

The Contractor shall notify the Government when this certificate has been issued. A vessel will not be inspected and accepted by the Government without an NFPA Marine Chemist certificate for each hull compartment designated "SAFE FOR WORKERS."

The success of all tests and the existence of any deficiencies shall be determined by the COR. Deficiencies shall be remedied prior to start of the Open Water Trials (Level 4).

#### E. SPECIFIC DOCK TRIALS AND DEMONSTRATIONS (LEVEL 3)

All trials, tests and demos shall be performed on each vessel.

##### 1 INCLINING TEST

The inclining test shall be carried out in accordance with ASTM F 1321-90. For each vessel, the Contractor shall provide an inclining report in accordance with this criteria which gives the "as inclined" and "lightship" load condition displacements and CG locations. The report shall be included as part of the Test Memoranda.

##### 2 WINDOW & DOOR, DECKHOUSE BOOT & GASKET TIGHTNESS

Using a hose, demonstrate weather tightness of all windows, and doors, the boot surrounding the base of the floating deckhouse and the gasket between the floating deckhouse and the aft deckhouse.

##### 3 MAIN ENGINES

For each main engine, demonstrate the following in the presence of an authorized manufacturer's representative:

- Cold starting. The cold starting testing shall demonstrate the minimum number of starts required by ABS for each engine.
- Starting and stopping of each engine from its local panel and its pilothouse panel.
- Emergency stop from the pilothouse console. Resetting at the local engine panel.
- Automatic shutdown for engine overspeed.
- Engine alarms at its local panel and at the pilothouse console. Ensure the proper operation of all alarm test circuits for each main engine.
- Operation of engine jacket water heaters.
- Engage reduction gear.

#### 4 DIESEL GENERATOR SETS

For each diesel generator set, demonstrate the following in the presence of an authorized manufacturer's representative:

- Cold starting.
- Starting and stopping of each generator set from its local panel. Starting and stopping of each generator set from the pilothouse.
- Alarms at its local panel. Ensure the proper operation of all alarm test circuits.
- Automatic shutdown for engine overspeed.
- Operation of the generator heaters.

#### 5 LOAD BANK TESTING

Each diesel generator set shall be load bank tested. Operate each generator set at 1/4, 1/2, 3/4 and full loads in 15 minute intervals, and then at 110% rated load (with the use of a load bank) for a minimum of 2 hours until the jacket water and exhaust temperatures stabilize. All engine and generator parameters shall be recorded at 5-minute intervals for the partial and full load periods, and at 15-minute intervals for the 110% load period.

## 6 ENGINE COOLING SYSTEM

Demonstrate that proper cooling water flow takes place during the operation of the main engines and diesel generators. Inspect the system for leaks.

## 7 ENGINE EXHAUST SYSTEM

Demonstrate the operation of each main engine and diesel generator exhaust system. Inspect each system for leaks and verify the backpressure on each system.

## 8 STEERING SYSTEM

Before leaving the dock for Open Water Trials, demonstrate the operation of the steering rudders and flanking rudders from hard over to port to hard over to starboard, and intermediate positions to simulate normal operation.

Demonstrate the operation of the rudder angle indicators.

Demonstrate the emergency operation of the non-follow up/jog lever for the steering rudders. Demonstrate the emergency operation of the non-follow up/jog lever for the flanking rudders.

Demonstrate the operation of both hydraulic pumps.

Demonstrate the operation of the visual and audible alarms for loss of hydraulic pressure or low oil level in the reservoir.

## 9 FUEL OIL SYSTEM

Ensure proper flow to the main engines and the diesel generators during operation. **Ensure flow to all day tanks.** Demonstrate the operation of all remote operated shut-off valves.

## 10 BILGE SYSTEM

Demonstrate the operation of the bilge system by using the bilge pump to suction bilge water from each compartment, and then discharge the water overboard. Record the pump discharge pressure for the pump. Align the fire pump for bilge service and demonstrate the fire pump's ability to take suction from the farthest bilge suction.

#### 11 SHAFT (~~POOH~~) SEAL SUMP PUMPS

Demonstrate the operation of the shaft (~~pooh~~) seal sump pumps to discharge water overboard.

#### 12 POTABLE WATER

Demonstrate that there is adequate flow of hot and cold water from each respective fixture (sinks, shower, water closets, ~~water cooler~~, **clothes washer, ice maker**, and hose bibb).

Allow the flow to continue from an outlet until the potable water pump starts and note the “cut-in” pressure. Ascertain that the pump shuts off when the pressure reaches the “cut-off” pressure. Measure the chlorine level in the potable water tank using a standard test kit.

Demonstrate the operation of the liquid level gauge for the potable water tank.

#### 13 SANITARY & SEWAGE SYSTEM

Flush each head several times to demonstrate the operability of the system. Demonstrate operation of the marine sanitation device and automatic sump/pump.

Demonstrate the operation of each gray water drain from the galley sink, **clothes washer, laundry sink**, lavatories, and showers. Demonstrate the operation of the three-way valves to direct flow to the sanitary holding tank or overboard.

Demonstrate the operation of the sanitary holding tank liquid level gauge.

#### 14 DRAINAGE SYSTEM

For the weather deck drains, demonstrate the operation of all scupper drains to drain water from their respective decks.

#### 15 FIREMAIN AND FIRE PUMP

Demonstrate the starting capability of the fire pump from the local station and all remote stations.

Demonstrate the operation of the indicators for the fire pump suction and discharge valves.

#### 16 FIXED FIRE EXTINGUISHING (CO<sub>2</sub>) SYSTEM

Demonstrate the proper operation of the CO<sub>2</sub> system. Demonstrate the operation of the audible alarms and the automatic shutdown of the ventilation system fans. (These tests may be done concurrently with the required ABS tests on this system. A Government representative must be present to witness the tests).

#### 17 FIRE DETECTION & ALARM SYSTEM

Demonstrate the operation of the fire detection system. The testing and trials shall demonstrate:

- The activation of the alarms from each smoke detector and heat sensor.
- The automatic shutdown of the HVAC System and any ventilation fans serving the air handlers in the floating main deckhouse, the toilet/head space fans, the deck storage, the engineer's workshop, the forward machinery space and the steering gear room.
- The operation of the red indicating light on the pilothouse top.
- Operation of the system battery charger.

A representative of the alarm system shall be present during the tests and trials of the detection and alarm system.

#### 18 HVAC

##### A HEAT PUMP - HEATING AND COOLING

Demonstrate the satisfactory operation of each heat pump to cool, heat, and admit outside ventilation air to its respective zone. Measure and record the temperatures at each air register during the heating and cooling modes. Measure and record the cfm at each register. Demonstrate the operation of the temperature controls and fan control for each zone. Ensure that the smoke sensors/heat sensors activate the system's controls to shut down the system in case of fire.

Demonstrate the operation of each electric resistance heater located in each supply duct leading from each heat pump. Demonstrate the operation of each manually adjustable damper at each duct outlet.

A representative of the air conditioning and heating system supplier shall be present during the tests and trials of the system.

## B SPACE VENTILATION

Demonstrate the satisfactory operation of the supply and exhaust fans for the lower and upper engine rooms **and the generator room.**

Record the air velocities at each fan and duct discharge, and calculate the cfm.

Demonstrate the operation of the galley/mess vent hood and each head compartment ventilation fan. Measure and record the cfm for each fan.

Demonstrate the operation of the supply fans for the galley/mess area and the crew quarters.

Demonstrate the operation of the exhaust fan for the **engineer's workshop, steering gear room, deck storage room and forward machinery space.**

## C SPACE HEATING

Demonstrate the operation of the electric resistance heaters in the:

- Lower and upper engine rooms
- Tank space
- Head spaces
- Workshop

## 19 COMPRESSED AIR SYSTEM

Demonstrate the charging of the air receivers **from atmospheric to the system design pressure.** Record the amount of time to charge **the each** receiver.

~~Demonstrate the lead-lag ability of each compressor. Demonstrate that the lag compressor will cut in at 20 psig lower than the lead compressor. Demonstrate that both compressors will cut out at 175 psig.~~ **ability of each compressor to cut in at a set pressure and cut out at a set pressure.**

Demonstrate airflow to all air tool stations ~~and the water closets.~~

**Demonstrate airflow to the shaft brakes.**

**Demonstrate airflow to the sewage treatment plant.**

Demonstrate airflow to each sea chest blowdown.

Demonstrate the operation of the air horn system by:

- Demonstrating the charging of the receiver
- Operating the relief valve
- Operating the horn

Verify correct operation of the desiccant air dryer.

Demonstrate the operability of all relief valves and receiver drain valves.

~~Using the compressed air system, demonstrate the blowdown of the sea chests.~~

## 20 ALARM SYSTEMS

Demonstrate the operation of each alarm system:

- General Alarm System
- Bilge Alarm System

Each station of an alarm system shall be tested for operation showing the activation and silencing of the visual and audible alarms of the system.

Demonstrate the operation of the pilothouse top indicating lights for the Bilge Alarm System.

Demonstrate the operation of the battery charger for the General Alarm System.

## 21 WINCHES & CAPSTANS

Operate the deck winches in both directions under power. Demonstrate the operation of the selector switch and operation from the deck stations and the pilothouse stations.

Operate the capstan(s) in both directions under power. Demonstrate the operation of the switch.

## 22 ROLLER BUTTONS

Demonstrate the operation of the roller buttons.

## 23 MISCELLANEOUS EQUIPMENT

Demonstrate the operation of the galley/mess equipment:

- Refrigerators/freezers
- Electric range (oven and stove top)
- Griddle
- Ice maker
- Coffee maker
- Microwaves

24 PILOTHOUSE WINDOW WIPERS & FANS

Demonstrate the operation of the windshield wipers and pilothouse fans.

25 COMMUNICATION EQUIPMENT

- A Public Address/Loud Hailer System - Demonstrate the operation of the public address/loud hailer system. Demonstrate the talkback feature of the system. Demonstrate the automatic foghorn operation of the system.
- B Interior Communications - Demonstrate the two-way intercom system from all stations.

26 AC ELECTRICAL SYSTEM

- A General - In order to demonstrate the operation of the electrical system as integrated system, the Contractor shall perform approximately ½ of the Level 3 machinery tests using the diesel generators. The remaining ½ of the Level 3 machinery tests shall performed using shore power supplied through the vessel's shore power receptacle. It is the Contractor's option as to which tests shall be powered from shore power and which tests shall be powered by the diesel generators.
- B Switchgear - Demonstrate the operation of all circuit breakers and all equipment in the main switchboard. For the two generator breakers, the shore power breaker, and the off-vessel breaker, safely demonstrate all mechanical and electrical interlocks.
- C Switchboard - Demonstrate all features of the switchboard such as the voltmeters and selector switches, ammeters and selector switches, frequency meters and selector switches, power available indicator lights, space heaters,

ground detection lights and test switches, and ground ammeter and test switch. Demonstrate the operation of the phase sequence/loss system.

- D Distribution Panels - Demonstrate the operation of all circuit breakers in the distribution panel boards.

27 DC ELECTRICAL SYSTEM

- A General - Verify the operation of the batteries and battery chargers before and after starting the diesel generators.
- B Distribution Panel - Demonstrate the operation of all circuit breakers in the DC panels.
- C Demonstrate the operation of the battery selector switches. Verify the proper operation of the 24/12-volt DC converters.

28 LIGHTING

- A Lighting - Demonstrate the operation of all interior lights, exterior lights, and floodlights. Demonstrate the operation of all lighting switches.
- B Emergency Lighting - Demonstrate the operation of all emergency lights, including the manual override switch to turn the emergency lights on or off.
- C Console Control Lighting - Demonstrate the operation of all the lights for all gauges and instrumentation installed in the pilothouse console. Demonstrate the operation of the dimmer switches for the lights.
- D Navigation Lights - Demonstrate the operation of all navigation lights. Demonstrate the operation of all circuit breakers and "bulb-out" alarms in the navigation lighting panel.
- E Searchlights - Demonstrate the operation of the Xenon searchlights. Demonstrate the operation of the flanking lights. Demonstrate all searchlight controls.

## 29 RECEPTACLES

- A Convenience Receptacles - Demonstrate the operability of all convenience receptacles by using 80% load for each receptacle. Check the receptacles for polarity. For GFCI types, demonstrate their ability to reset.
- B Shore Power Receptacle - Demonstrate the operation of the shore power receptacle to supply power to the vessel.
- C Off-Vessel Receptacle - Demonstrate the operation of the off-vessel receptacle to supply power overboard by using a load bank.

~~30 NOISE SURVEY~~

~~The survey will entail the taking of sufficient noise measurements in each of the vessel spaces to determine noise levels. A report shall be prepared containing the survey results.~~

~~The Contractor shall perform the survey using a subcontractor especially qualified for this work either by training or experience. The Contractor shall identify the proposed subcontractor in the Subcontracting Plan and include the subcontractor's qualifications.~~

~~The survey shall be conducted for each of the following conditions with all ventilation equipment and systems in full operation:~~

- ~~• Both main propulsion engines at full speed, and one generator operating at normal bus load.~~
- ~~• Both main propulsion engines off, and one generator running.~~

~~The sound levels reported for each compartment shall be based on the average of the broadband A-weighted sound pressure levels taken at various representative locations of the reverberant field of the compartment or space in question. These measurements shall typically be taken at locations within a space where operating personnel are expected to spend a majority of their time. Measurements shall be taken in accordance with NVIC 12-82.~~

~~A report shall be prepared by the Contractor detailing the test results. The report shall include:~~

- ~~• A tabulation of the actual raw data taken during the survey for noise.~~
- ~~• Sketches of the spaces measured with the recorded sound levels denoted at the location of their measurement. Reduced size general arrangement drawings will be acceptable for this purpose.~~

~~The Contractor shall take corrective action as necessary to achieve the required criteria. The report shall describe any compartments which present a noise hazard according to OSHA regulation, 29 CFR 1910.95 "Occupational Noise Exposure."~~

## F. OPEN WATER TRIALS (LEVEL 4)

All trials, tests and demos shall be performed on each vessel.

### 1 GENERAL

After all items on the schedule of Dock Tests (Level 3) have been satisfactorily completed and any deficiencies corrected to the satisfaction of the COR, the Contractor shall commence a program of Open Water Trials.

The Contractor's personnel shall operate the vessel and shall make all observations and record all data. The Contractor shall provide appropriately licensed personnel as may be required by the USCG for conduct of trials. The Contractor shall coordinate with ABS to assure that all trials required to be witnessed for class are witnessed.

Commencement of Open Water Trials shall not be sooner than one full working day after completion of Dock Tests.

The COR shall be notified immediately of any condition which would delay the conduct of the Open Water Trials.

The COR shall be notified in writing 10 working days in advance of the date set for the trials.

All testing and trials shall be conducted in the presence of a Government representative and any vendor representatives required by the contract. The trials shall follow the agenda prepared under paragraph A.3 (a).

### 2 TRIAL LOCATION

The site of the trials shall be such that accurately placed targets can be readily observed for the purpose of computing speeds. **Alternately, the onboard DGPS may be used to measure the trial course.** The site of the trials shall also be free from fog and traffic, with a depth of water of at least 20 feet. The Contractor shall take the vessel to the nearest mile range that will provide the required minimum depth and permit operation of the vessel at full speed.

### 3 TRIAL CONDITIONS

Each vessel shall be complete and ready for trials, with a six to eight person trial crew aboard, with tools and miscellaneous equipment.

The trial conditions are:

- Full (100%) fuel oil in all fuel oil tanks at 5600 gallons and ballast as necessary for a draft of 8'-0" (for CLIN 0002, CLIN 0003 and CLIN 0004) or 7'-6" (for CLIN 0001), with approximately 6 to 9 inches of aft no trim
- Full (100%) lube oil
- Full (100%) transmission oil
- Full (100%) hydraulic oil
- Full (100%) potable water tank
- Empty sanitary holding tanks
- Empty oily bilge water tank
- Empty slop/waste oil tank

Before trials, record all fuel tank soundings, record level of the potable water tank, and record tank levels for the lube oil tank, transmission oil tank, and hydraulic oil tank. Ensure that sanitary holding tank, oily water tank, and the waste oil tank are empty.

Record drafts at the draft marks and read the hull freeboards at the four corners. These draft readings shall be used to calculate the displacements and LCG. Compare these values to the updated final weight estimate.

After trials are completed, again read the drafts and take the freeboards as a double check on the trial displacement and trim. Record fuel tank soundings, record level of potable water tanks, and record tank levels for the lube oil tank, transmission oil tank, and hydraulic oil tank. Calculate the fuel (volume) consumed during the trial period.

#### 4 GENERAL TRIAL DATA

The following general data shall be furnished by the Contractor. This data shall be recorded at the location of the runs:

- Location of trial course and direction of runs
- Depth of water
- Density of the water
- Wind velocity, temperature and direction relative to the course
- Displacement of vessel at beginning of trials
- Draft readings of the vessel fore and aft
- Freeboard forward and aft

- Fuel consumption for each pair of runs (Volume of fuel)
- Total number/weight of people on board
- Ballast carried (if any)
- Propeller diameter, pitch and style

## 5 SPEED TRIALS

Speed trials are to be run over a measured distance in both directions to determine the speed of the vessel. The vessel shall be run at 600 rpm, 900 rpm, 1200 rpm, 1500 rpm (if applicable), 1800 rpm (if applicable), or maximum engine rpm as permitted by the bow wash.

The trial course selected shall be laid out over a depth in excess of 20 feet of water. Two runs over the course shall be made at each of the engine speeds, reversing the direction after each trial run.

The following performance data shall be recorded for each engine at the start and finish of each run:

- Engine jacket water temperature
- Lube oil pressure
- Lube oil temperature
- Transmission oil pressure
- Transmission oil temperature
- Engine exhaust temperature
- Shaft tachometer
- Engine tachometer
- Engine compartment temperature (hatches closed)
- Time over the course for each run

The engine and transmission gauges and instrumentation shall be read at the local panels in the engine room and at the pilothouse panel.

## 6 ENGINE PERFORMANCE TEST

~~A PAR Test shall be performed for the main engines.~~ The fuel rate of the main engines shall be compared to the original factory performance specifications during the vessel's test and trials. This comparison shall be made for the entire operating range of the engines by the engine manufacturer's representatives using instrumentation to acquire real-time fuel rate and engine output, similar to the Caterpillar PAR test.

## 7 BOLLARD TEST

#### A. Head Against a Pier

The vessel headlog shall be put against a pier, bulkhead or a mooring dolphin, and the engine RPM gradually increased to full speed ahead. Record that RPM and hold that RPM until the engine temperature increases to 20 degrees above the normal operating temperature or 20 minutes whichever comes first.

The bollard rpm shall be checked against the predicted rpm to verify the propeller design point. ~~Corrective action shall be taken if the actual rpm varies by more than plus or minus 10 rpm from predicted bollard. In no case shall the bollard rpm be less than 92% of the design rpm.~~

During the testing, note any excess vibration and record gauge readings of the main engines every five minutes on the test forms.

#### B. Thrust Measurement

The bollard thrust in deep water (more than 20 feet) of the vessel at full continuous power is to be measured and recorded, for both ahead and astern pull. The bollard measurement shall be made with the vessel in open water, using a tether secured to a suitably sized bollard or similar device. The bollard thrust shall be measured through use of a certified dynamometer, with a remote read out. If the dynamometer is installed in a wire rope line, the dynamometer shall be fitted with a swivel device to eliminate torque on the dynamometer. The Contractor shall provide an auxiliary boat for the duration of the bollard test, to maintain the heading of the vessel against current or wind.

### 8 MANEUVERABILITY TRIALS

During main engine testing in the ahead direction, operate the steering rudders from hard over to port to hard over to starboard, and intermediate positions to simulate normal operation. Note time to turn rudders to hard over and vessel time to turn 90 degrees from the original heading.

During main engine testing in the astern direction, operate the flanking rudders in a similar manner and record data as before.

Going full rpm ahead, demonstrate and record times for:

- Operating the steering rudders and flanking rudders from 0 degrees to 45 degrees port, and from 45 degrees port back to 0 degrees.
- Operating the steering rudders and flanking rudders from 0 degrees to 45 degrees starboard, and from 45 degrees starboard back to 0 degrees.

Going full rpm astern, demonstrate and record times for:

- Operating the steering rudders and flanking rudders from 0 degrees to 45 degrees port, and from 45 degrees port back to 0 degrees
- Operating the steering rudders and flanking rudders from 0 degrees to 45 degrees starboard, and from 45 degrees starboard back to 0 degrees

With the vessel running at 900 rpm, 1200 rpm, 1500 rpm (if applicable), 1800 rpm (if applicable), and the highest rpm allowed by the bow wash, put the steering rudders hard over to starboard and continue the turn until the vessel reaches its initial heading (360 degree turn). Estimate the turning circle diameter from the propeller and hull wake. Note the time required.

Repeat this maneuver by turning to port and again note the turning diameter and time.

Demonstrate the emergency operation of the non-follow up/jog lever for the steering rudders. Demonstrate the emergency operation of the non-follow up/jog lever for the flanking rudders. The emergency operation of the system shall be performed making 360-degree turn in each direction and while making a series of S-curves.

## 9 CRASH STOP

The vessel shall be brought from full speed and rpm ahead to full rpm astern in the water as quickly as possible (without damaging the reverse gears or engines). Record the distance the vessel travels, and the time from full speed and rpm ahead to full rpm astern in the water.

## 10 TOWING TRIALS

The vessel shall be tested for a period of not less than two hours pushing ahead barge(s) at a maximum engine RPM without overloading the engines.

- The vessel shall push two deck cargo barges that are approximately 150 feet x 35 feet (at a 2 foot draft) during the towing trials.

The Contractor may use other barge sizes as long as equivalent resistance is provided. The equivalent resistance shall be verified and documented by use of the Howe Equation.

For the towing trials, record data as for speed trials.

During this time steering and maneuvering shall be demonstrated while pushing the barge(s).

## 11 COMMUNICATION EQUIPMENT

During the Open Water Trials, operation of the following communication equipment shall be demonstrated:

- A Public Address/Loud Hailer System - During trials, demonstrate the operation of the public address/loud hailer system.
- B VHF Radios - Demonstrate the operation of the two VHF marine radios.
- C District Radio - Demonstrate the operation of the District radio.

## 12 NAVIGATION EQUIPMENT

During the Open Water Trials, operation of the following navigation equipment shall be demonstrated:

- A Radar - Verify the accuracy and demonstrate the operation of the radar.
- B Depth Sounder - During the trials, verify the accuracy and demonstrate the operation of the depth sounder.
- C Swing Meter - Demonstrate the operation of the swing meter.

## 13 NOISE SURVEY

The survey will entail the taking of sufficient noise measurements in each of the vessel spaces to determine noise levels. A report shall be prepared containing the survey results.

The Contractor shall perform the survey using a subcontractor especially qualified for this work either by training or experience. The Contractor shall identify the proposed subcontractor in the Subcontracting Plan and include the subcontractor's qualifications.

The survey shall be conducted for each of the following conditions with all ventilation equipment and systems in full operation:

- Both main propulsion engines at full speed, and one generator operating at normal bus load.
- Both main propulsion engines off, and one generator running.

The sound levels reported for each compartment shall be based on the average of the broadband A-weighted sound pressure levels taken at various representative locations of the reverberant field of the compartment or space in question. These measurements shall typically be taken at locations within a space where operating personnel are expected to spend a majority of their time. Measurements shall be taken in accordance with NVIC 12-82.

A report shall be prepared by the Contractor detailing the test results. The report shall include:

- A tabulation of the actual raw data taken during the survey for noise.
- Sketches of the spaces measured with the recorded sound levels denoted at the location of their measurement. Reduced size general arrangement drawings will be acceptable for this purpose.

The Contractor shall take corrective action as necessary to achieve the required criteria (Clause C180). The report shall describe any compartments which present a noise hazard according to OSHA regulation, 29 CFR 1910.95 "Occupational Noise Exposure."

#### G. FINAL ACCEPTANCE DEMONSTRATIONS (LEVEL 5)

Final Acceptance Demonstrations are tests the Contractor must perform following delivery at the destination of each vessel to demonstrate to the operating staff the proper operation, and performance of all the equipment, machinery, and electrical systems functioning as an "integrated whole" as described herein.

Final Acceptance Demonstrations shall be conducted following successful completion of Level 3 tests, correction of all deficiencies and delivery of the vessel to the designated delivery point. Final Acceptance Demonstrations must be performed in the presence of a Representative of the Contracting Officer.

The contractor shall provide sufficient personnel and resources to operate all of the equipment and demonstrate its proper installation.

## H. DOCUMENTATION

The Contractor shall prepare a Schedule for all levels of testing. The Schedule shall be a complete, detailed listing of all the tests, trials and demonstrations required by this contract. The Schedule shall be arranged by day, not date, and shall list the specific tests, trials and demonstrations and the sequence in which they will be performed.

The Contractor shall prepare Test Data Sheets for all equipment and systems required to be tested or demonstrated under this contract, for each vessel. The Data Sheets shall contain the information required by Clause E03, "Quality Assurance and Control" as well as the procedures of each test, the results of each tested function, nameplate data of equipment tested, and the designated areas for "Pass/fail," witness' signatures, dates and comments.

The Contractor shall incorporate demonstrations of all applicable controls, instruments, and alarms, into each system's Builder's Trials, Dock and River Tests, and Final Acceptance Demonstrations sections of the Test Data Sheets. Data recorded in time intervals shall be tabular so that data trends can be easily recognized.

The Test Data Sheets shall be typed, single sided, on 8-1/2 inch x 11 inch sheets of paper.

The Contractor shall provide a Test Report, for each vessel, comprised of the results of all required tests, trials and demonstrations performed, and all deficiencies noted. The Test Report shall be filled in version of the Test Data Sheets and shall be available to the COR at all times throughout the construction of each vessel.

The Data Sheets shall be organized into a comprehensive Test Report and arranged by system and level of testing similar to the following outline:

- X. System (or equipment)
  - a. Pre-Trial Tests
  - b. Builder's Trials
  - c. Dock and River Tests
  - d. Final Acceptance Demonstrations

The Test Report shall be reviewed and approved by both the Contractor and the COR at the conclusion of each level of testing. Review and approval of the Test Report by the Contractor and the COR is a precondition of moving to the next level of testing.

The final version of the Test Report, including the reports of the Regulatory Bodies and the Regulatory Body Certificates, shall be bound in a durable hard cover and submitted to the COR in duplicate prior to Final Payment.

#### E06 FINAL INSPECTION

When all work and testing has been satisfactorily completed at the builders yard, the Contractor and a Government Representative shall make a complete physical inspection and inventory of each vessel. A “punch list” of deficiencies will be developed and presented to the Contractor for corrective action.

All corrective action necessary to eliminate the “punch list” deficiencies shall be completed at the Contractor’s facility. The Contractor shall give the COR 7 working days notice prior to the desired date of reinspection.

Prior to any inspection or reinspection the vessel and all their equipment shall be thoroughly cleaned and all painting and finishes put in first class condition.

#### E07 PROVISIONAL ACCEPTANCE

Following satisfactory completion of all tests and trials, correction of all “punch list” deficiencies, and receipt of all contract deliverables, each vessel will be Provisionally Accepted at the builder’s yard. Delivery of each vessel may not be started until Provisional Acceptance of the vessel has been made.

#### E08 FINAL ACCEPTANCE

Final Acceptance will be made upon delivery of each vessel, afloat and “Ready for Service” at the delivery point designated and following successful completion of the Final Acceptance Demonstrations. “Ready for Service” is defined as clean inside and out; all trash, dunnage, lashing, and delivery related material disposed of; loose items of outfit in place; all electrical and mechanical systems operational; equipment properly adjusted; instruments and electronics calibrated or aligned, fuel and water tanks filled and damaged paint touched up.

Each vessel will be subject to a complete inspection at the time of delivery.

The Contractor shall provide necessary personnel, equipment and materials to make the vessel “Ready for Service.”

E09 COMMERCIAL WARRANTY OF SUPPLIES

For each vessel, the Contractor shall assign, in writing, all commercial warranties for equipment provided under this contract to the Government. The effective date of all commercial warranties shall be the date of Final Acceptance for that vessel.

E10 RESPONSIBILITY FOR SUPPLIES

The following, clause 52.246-16, "Responsibility for Supplies" (Apr 1984), is incorporated by full test.

## 52.246-16 RESPONSIBILITY FOR SUPPLIES (APR 1984)

(a) Title to supplies furnished under this contract shall pass to the Government upon formal acceptance, regardless of when or where the Government takes physical possession, unless the contract specifically provides for earlier passage of title.

(b) Unless the contract specifically provides otherwise, risk of loss of or damage to supplies shall remain with the Contractor until, and shall pass to the Government upon--

(1) Delivery of the supplies to a carrier, if transportation is f.o.b. origin; or

(2) Acceptance by the Government or delivery of the supplies to the Government at the destination specified in the contract, whichever is later, if transportation is f.o.b. destination.

(c) Paragraph (b) of this section shall not apply to supplies that so fail to conform to contract requirements as to give a right of rejection. The risk of loss of or damage to such nonconforming supplies remains with the Contractor until cure or acceptance. After cure or acceptance, paragraph (b) of this section shall apply.

(d) Under paragraph (b) of this section, the Contractor shall not be liable for loss of or damage to supplies caused by the negligence of officers, agents, or employees of the Government acting within the scope of their employment.

(End of clause)

PART III  
LIST OF DOCS, EXHIBITS AND ATTACHMENTS  
SECTION J

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PART II  
LIST OF DOCS, EXHIBITS AND ATTACHMENTS  
SECTION J

J01 CONTRACT AND REFERENCE DRAWINGS

The following drawings shall form a part of this solicitation. Please note that Drawings will be provided to the successful bidder in electronic file form:

A. Contract Drawings

**CLIN 0001**

Drawing No. 557-B000-01, Rev 1, COVER  
 Drawing No. 557-B105-01, Rev 1, LINES PLAN  
 Drawing No. 557-B105-02, Rev 1, FRAMES & OFFSETS (2 SHTS)  
 Drawing No. 557-B130-01, Rev 1, TANK CAPACITY PLAN  
 Drawing No. 557-B205-01, Rev 1, OUTBOARD PROFILE  
 Drawing No. 557-B215-01, Rev 1, GENERAL ARRANGEMENT (2 SHTS)  
 Drawing No. 557-B233-01, Rev 1, PILOTHOUSE DETAILS  
 Drawing No. 557-B245-01, Rev 1, HOLD & MACHINERY ARRANGEMENT  
 Drawing No. 557-B301-02, Rev 1, INBOARD PROFILE  
 Drawing No. 557-B306-01, Rev 1, TRANSVERSE & LONG'L STRUCTURAL SECTIONS  
 Drawing No. 557-B307-01, Rev 1, DECK & BOTTOM STRUCTURE  
 Drawing No. 557-B605-01, Rev 1, PROPULSION & SHAFTING ARRANGEMENT  
 Drawing No. 557-B612-01, Rev 1, STEERING RUDDER ARRANGEMENT  
 Drawing No. 557-B612-02, Rev 1, FLANKING RUDDER ARRANGEMENT  
 Drawing No. 557-B614-01, Rev 1, 81.00" CT28 KORT NOZZLE  
 Drawing No. 557-B615-01, Rev 1, STEERING LINKAGE & STRUT

**CLIN 0002, CLIN 0003 & CLIN 0004**

Drawing No. 556-B105-01, Rev 1, LINES PLAN  
 Drawing No. 556-B105-02, Rev 1, FRAMES & OFFSETS (2 SHTS)  
 Drawing No. 556-B130-01, Rev 1, TANK CAPACITY PLAN  
 Drawing No. 556-B205-01, Rev 1, OUTBOARD PROFILE  
 Drawing No. 556-B215-01, Rev 1, GENERAL ARRANGEMENT (2 SHTS)  
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Drawing No. 556-B612-02, Rev 1, FLANKING RUDDER ARRANGEMENT  
Drawing No. 556-B614-01, Rev 1, 81.00" CT28 KORT NOZZLE  
Drawing No. 556-B615-01, Rev 1, STEERING LINKAGE & STRUT

B. Reference Drawings

Drawing No. 556-B313-01, Rev 1, SPRING ISOLATION DETAILS  
Drawing No. 557-B313-01, Rev 1, SPRING ISOLATION DETAILS  
Drawing No. 518-D410-02, Rev 0, RUBBER FENDERING  
Drawing No. 577-D425-01, Rev 0, HANDRAILS, GRATING & WALKWAYS  
Drawing No. 610-B460-01, Rev 0, COMMUNICATIONS MARK  
Drawing No. 518-D472-01, Rev 0, TRANSDUCER WELL  
Drawing No. 518-D669-01, Rev 0, DRAINAGE SYSTEM  
Drawing No. 518-D692-01, Rev 0, GENERAL ALARM SYSTEM  
Drawing No. 518-D692-02, Rev 0, BILGE ALARM SYSTEM SCHEMATIC  
Drawing No. 603-D720-02, Rev 0, ONE LINE DIAGRAM (DC) (2 SHTS)

J02 PERFORMANCE EVALUATION FOR SERVICE & SUPPLY CONTRACTS

In accordance with Federal Acquisition Regulation 42.15 and Engineer Regulation 715-1-19 dated July 5, 1996, this contract action is subject to the requirement for Contractor performance evaluation in the elements listed on the attached form.

At a minimum, the performance evaluation shall be completed within 45 days of completion of each year's performance. Additional (interim) evaluations may be prepared if any element listed is being performed unsatisfactorily.

The period of evaluation will begin on the date of acknowledgment of receipt of the Notice To Proceed and will run concurrent with the performance period of the contract.

J03 ENG FORM 2454

The Contractor shall utilize the ENG Form 2454 for the Construction Plan required by Clause H06.



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