



STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
16 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0016

Janet T. Mills
GOVERNOR

Bruce A. Van Note
COMMISSIONER

November 26, 2024
Subject: Construction of a Hybrid Ferry
State WIN: 024605.10
Location: Lincolnville
Amendment No. 4

Dear Sir/Ms.:

Remove pages 59 and 67 out of 144 in the Technical Specifications (page 106 and 114 of the total contract book) dated September 12, 2024 and **Replace** with the attached pages 59 and 67 out of 144 in the Technical Specifications dated November 21, 2024.

Remove pages 65 and 68 out of 144 in the Technical Specifications (pages 112 and 115 of the total contract book) dated September 12, 2024 and **Replace** with the attached pages 65 and 58 of 144 in the Technical Specifications dated November 26, 2024

Remove pages 192 through 216 (25 pages) titled Part 3 - Technical Offer Dated 9/6/2024 and **Replace** with the attached Part 3 - Technical Offer Dated 11/22/2024

The following questions have been received:

Question: Section 423.1 references 446.1 but that section is not included in the document. Please advise where to find section 446.1.

Response: See Changes above

Consider these changes and information prior to submitting your bid on **December 18, 2024**.

Sincerely,

A handwritten signature in blue ink, reading 'George Macdougall'.

George M. A. Macdougall P.E.
Contracts & Specifications Engineer

The CONTR is responsible to provide and install a Zinus SWC200 rapid charging cable receptacle as part of the integrated power and propulsion system by ABB. The Zinus receptacle shall be installed on the 02 deck port at approximately FR 72. Final location will be determined in conjunction with the separate MaineDOT terminal upgrade project. Foundation and cable penetration locations to be approved by MaineDOT prior to construction. (See ABB specifications for additional requirements/details). The CONTR is responsible to install up to two (2) positioning switches provided by ABB. These switches will provide positive feedback to the rapid charging system that the vessel is in a safe position for charging. If the vessel moves while in dock, they will alert the system to disconnect. Switches must be located so that they contact continuous vertical structure on the pier. Final location will be determined in conjunction with the separate MaineDOT terminal upgrade project. Switches will be small, bolt mount components weighing less than 50lbs each. The CONTR is responsible to provide a Zinus ZPP800 rapid charging device as part of the integrated power and propulsion systems by ABB and delivered directly to MaineDOT at the Lincolnville, ME terminal in advance of the delivery of the vessel. Installation will be done as part of a separate MaineDOT contract.

324.1 SWITCHBOARDS & POWER PANELS

324.1.1 MAIN SWITCHBOARDS

The CONTR shall provide and install marine switchboards, provided as part of the integrated power and propulsion system by ABB, capable of distributing and transferring between shore power and hybrid system inputs. With Diesel Generator's off, switchboard shall allow connection of shore power to ESS battery system for charging through the ABB Onboard DC Grid.

The switchboards shall be located in the engine room as per DWGS D372-A1-1 and D372-A9. Metering and indicators for current, voltage, ground fault, and power available shall be provided as per USCG requirements. Switchboards shall be designed primarily for front access.

324.1.2 EMERGENCY SWITCHBOARD

The CONTR shall provide and install a marine emergency switchboard, by ABB, capable of distributing power to the emergency power panels and automatically energizing upon loss of ESS, Diesel Generator, or shore power in compliance with the requirements of 46 CFR Subchapter "J" for Subchapter "H" passenger vessels. Switchboard shall be designed primarily for front access.

324.1.3 POWER PANELS

Distribution breaker panels shall be Square "D", or approved equal, and must meet the requirements of IEEE STD 45, Section 23.1. The electrical equipment scheme (DWGS D372-A1-1) and general arrangement drawing (D372-A9) designate panel locations. At a minimum, the AC power/lighting distribution system shall include two main distribution sections (part of ship's service switchboard), emergency distribution section (part of emergency switchboard), engine room power/lighting panel, engine room ventilation power panel, crew space

The CONTR shall provide and install a Weems & Plath Model Admiral 290700 or approved equal, aneroid barometer. Location shall be to the approval of the MaineDOT.

421.1.10 ANEMOMETER

The CONTR shall provide and install a Maximum, Inc. Model Vigilant (black dial face w/white lettering) or approved equal, anemometer complete with mast mount sensor, AC adapter, and pilothouse display. Location of both sensor and display shall be to the approval of the MaineDOT.

422.1 NAVIGATION LIGHTS & NAVIGATION LIGHT PANELS

Navigation lights shall be provided and arranged to comply with the requirements of the Inland Rules Of The Road (Ref: D372-A8). The CONTR shall provide and install a 120VAC navigation light panel that is compatible with McDermott LED navigation lights (J-Box, Glamox, Loco-Light, or approved equal) in the pilothouse. The panel is to be compliant with IEEE Standard 45 Section 34.2 and USCG 46 CFR 111.75-17. Navigation lights shall be USCG approved by McDermott or approved equal as shown on DWG D372-A8. Screens fitted behind navigation lights shall be painted matte black or as required by USCG. All lights on masts shall be wired to individual plugs and sockets suitable for the marine exterior environment.

- (2 double) sidelight (red) 10-point, LED, McDermott TB3 or equal
- (2 double) sidelight (green) 10-point, LED, McDermott TB3 or equal
- (4 double) masthead light (white) 20-point, LED, McDermott TB6 or equal
- (2 double) stern light (white) 12-point, LED McDermott TB3 or equal
- (2 each) anchor light (white) 32-point, LED McDermott TB3 or equal
- (2 each) not under command (red) 32-point, LED McDermott TB3 or equal

Reference: DWG D372-A8

423.1 NAVIGATION SYSTEMS (ELECTRONIC)

The CONTR shall provide and install the following electronic navigation systems. The manufacturers and models listed shall be considered to be OR APPROVED EQUAL and may differ depending upon MaineDOT's preferences to match existing fleet equipment. The CONTR shall provide a factory certified Tech Rep for Electronic Navigation Equipment commissioning, startup, and sea trials.

- RADAR: (2) Furuno FR8125 w/4 foot antennas, inter-switched, 115VAC and 24 VDC
- GPS UNIT: (1) Furuno GP170D
- VHF RADIO: (2) ICOM M506 (See Section 441.1)

SWBS SECTION 400 ALARMS, INTERNAL COMMUNICATIONS, NAVIGATION

The following specifications and drawings referenced provide for the Alarms, Navigation Systems, and Internal Communications Systems Modifications required to be performed under this contract:

- 400.1 REFERENCE DRAWINGS
- 421.1 NAVIGATION SYSTEMS (NON-ELECTRICAL)
- 422.1 NAV LIGHTS & NAV LIGHT PANEL
- 423.1 NAV SYSTEMS (ELECTRONIC)
- 433.1 INTERNAL COMMUNICATIONS (PA, SP PHONE, GEN ALARM, LOUD Hailer)
- 436.1 SAFETY & SECURITY SYSTEMS
- 439.1 CCTV
- 441.1 EXTERNAL COMMUNICATION (RADIOS)
- 441.2 EXTERNAL COMMUNICATION (AIS)
- 441.3 EXTERNAL COMMUNICATIONS (Wi-Fi)

400.1 REFERENCE DRAWINGS

D372-A1-1 GEN ARRGTs HOLD & MAIN DECK

D372-A1-2 GENERAL ARRGTs 01-DECK & PILOTHOUSE

D372-A8 COLREGS PLAN & NAVIGATION LIGHT MAST DETAILS

D372-P10 COMPRESSED AIR PIPING SCHEMATIC

421.1 NAVIGATION SYSTEMS (NON-ELECTRICAL)

421.1.1 FLAGS & SHAPES

The CONTR shall provide (2) black portable, nylon folding Not-Under-Command balls to comply with the Inland Rules of the Road (CalJune, or equal, 24" diameter). The CONTR shall provide (1) black portable, nylon folding Anchor ball (CalJune, or equal, 24" diameter). These day shapes shall be stowed in the pilothouse with line and hardware suitable for rapid deployment.

- HAILER/INTERCOM: Furuno LH5000 (Locations: PH control, Main Deck (2) intercoms one each loading station)
- AIS: (1) Furuno FA170 (See Section 446.1)
- DEPTH SOUNDER: Furuno FCV588
- NAV COMPUTER – local CPU with (2) 24” dimmable monitors
- SAT COMPASS: Furuno SC70
- AUTOPILOT: Simrad AP70 Mk II to interface with the Jastram Engineering, steering system
- NMEA Backbone system to link Electronic Navigation Systems

See Sections 439.1, 441.1, & 441.2 for additional pilothouse electronic equipment.

433.1 INTERNAL COMMUNICATIONS

433.1.1 PUBLIC ADDRESS & EMERGENCY NOTIFICATION SYSTEM

The CONTR shall provide and install a commercial quality Public Address System which incorporates an Emergency Notification System feature, Zenitel SPA-V2-Redundant PAGA System, or equal. The System amplifier shall be located in the Pilothouse and shall be powered on an emergency circuit. System shall comply with 46 CFR 121.610, with announcements made from Pilothouse station. The system shall be capable of sounding a General Alarm signal, as required by 46 CFR 120.550(c).

The System shall be complete and shall incorporate the following equipment: Pilothouse mike; amplifier; equalizer module; exterior and interior speakers; volume Control module; power conditioner module; (4) auxiliary jack input in securable weather rated boxes on weather decks. The system shall provide a flashing light feature on speakers when notifications are being made, in addition to audible signal. Additional emergency announcements may be made to appear on the television screens mounted in the passenger cabins. CONTR shall provide power and mounting for two (2) television screens per cabin as well as CAT 6 cabling for communication with the units. CONTR to submit documentation to MaineDOT prior to ordering.

Interior speakers (ceiling mount style) shall be located to the approval of the MaineDOT. These are a minimum and for reference only. Additional speakers may be required per USCG requirements.

- Port passenger cabin (2)
- Starboard passenger cabin (2)
- Crew Break room (2)
- Engine room EOS (1)
- Auxiliary Engine Room (1)
- Engineers Workshop (1)

ABB MARINE & PORTS PROPOSAL

Maine DOT – Islesboro Ferry

Part 3 - Technical Offer



IMPORTANT NOTICE

This ABB technical offer is preliminary and, as such, is non-binding. It is tendered for discussion only, does not constitute a term to contract, and ABB can, without notice, make any change at ABB's discretion.



Project	Islesboro Ferry
Owner	Maine DOT
Yard	TBD
ABB ref. No.	OPP-20-3650425
Shipyard ref. No	TBD
Document ID	2DNPJSEP76WR-325612387-29090
Date of first issue	05/28/24
Revision	D
Revision date	11/22/2024



1 Revision Table

Rev	Date	Notes
-	05/27/24	Initial submittal
A	06/14/24	Revise SOW language, tables to reflect Maine DOT comments
B	08/16/24	Updated to reflect Maine DOT comments
C	09/06/24	Updated to reflect Maine DOT comments
D	11/22/2024	Updated ABB Equipment List and section 5 to include ZPP800 tower. Added missing EDG and Emergency Switchboard to Single Line Diagram.
E		
F		

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3 Definitions and Abbreviations

Terms	Definitions
BOL	Beginning of Life (of the ESS)
CFR	Code of Federal Regulations
DOL	Direct Online
EOL	End of Life (of the ESS)
ESCS	Energy Storage Control System
ESS	Energy Storage System (i.e. batteries)
FAT	Factory Acceptance Testing
HAT	Harbor Acceptance Testing
HMI	Human Machine Interface
IC	Input Circuit
IGBT	Insulated Gate Bipolar Transistor
INU	Inverter Unit
LCL	Type of Sine Filter
LCU	Liquid Cooling Unit
LV	Low Voltage
MCR	Maximum Continuous Rating
ODCG	Onboard DC Grid™
PEMS™	Power and Energy Management System
RBAC	Role Based Access Control
SAT	Sea Acceptance Testing
SCU	Switchboard Control Unit
SOC	State of Charge (of the ESS, varies constantly during use)
SOH	State of Health (of the ESS, which slowly degrades over its useful life)
SWBD	Switchboard
TS	Transport Split
UPS	Uninterruptable Power Supply

4 ABB Offer Overview

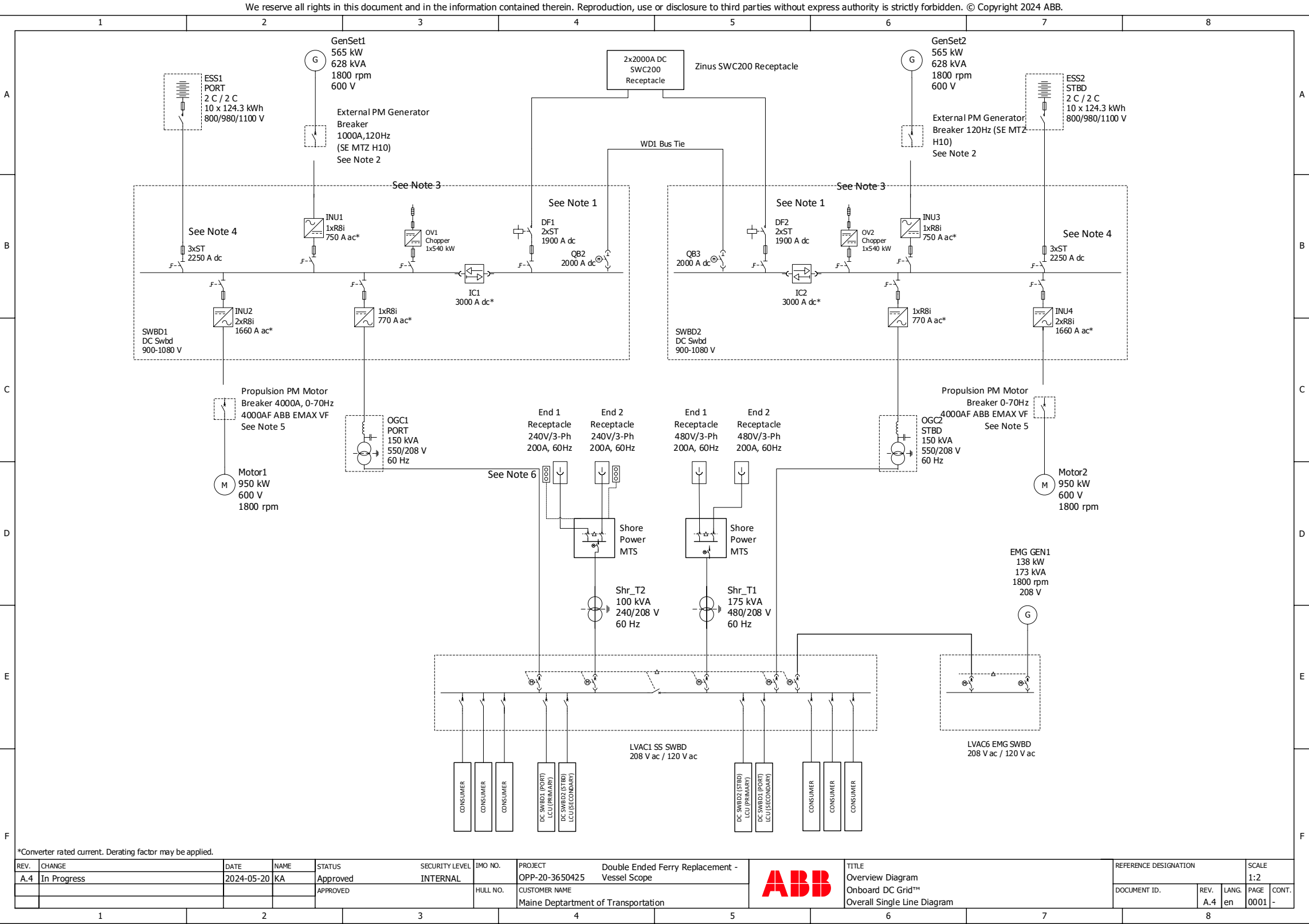
ABB's offer includes the following scope of supply and support activities described in the table below. The table presents an overview of the primary areas of scope included in ABB's offer with more detail provided in the following sections.

Section	Description
ABB Scope of Supply / System Overview	This section describes the solution that has been developed during Functional Design based on requirements development and detailed technical discussions with the Owner and the Design Agent. This design baseline may evolve during the Engineering Support phase with shipyard.
ABB Engineering Support	This section describes the typical minimum engineering deliverables that ABB will provide during the engineering phase of the project, which typically begins just after contract signing. Once a shipyard is selected, ABB will work with the shipyard and/or designer to agree on the Master Deliverables List (MDL) and an associated master schedule.
ABB Support to Acceptance Testing	This section describes the acceptance testing events that have been included in ABB's offer.
Shipyard Commissioning and Vessel Trials	This section describes ABB's site commissioning activities. It also defines and assigns responsibility to the various interfaces between ABB and the shipyard.
ABB Onsite and Classroom Training	This section describes any training that is included in the offer, and/or what training opportunities ABB offers.
Appendices	These sections describe the equipment in ABB's scope and provide preliminary drawings and datasheets. Final equipment specifications may evolve through the design process, though typically changes are modest. Any design changes will be communicated through the MDL deliverables.



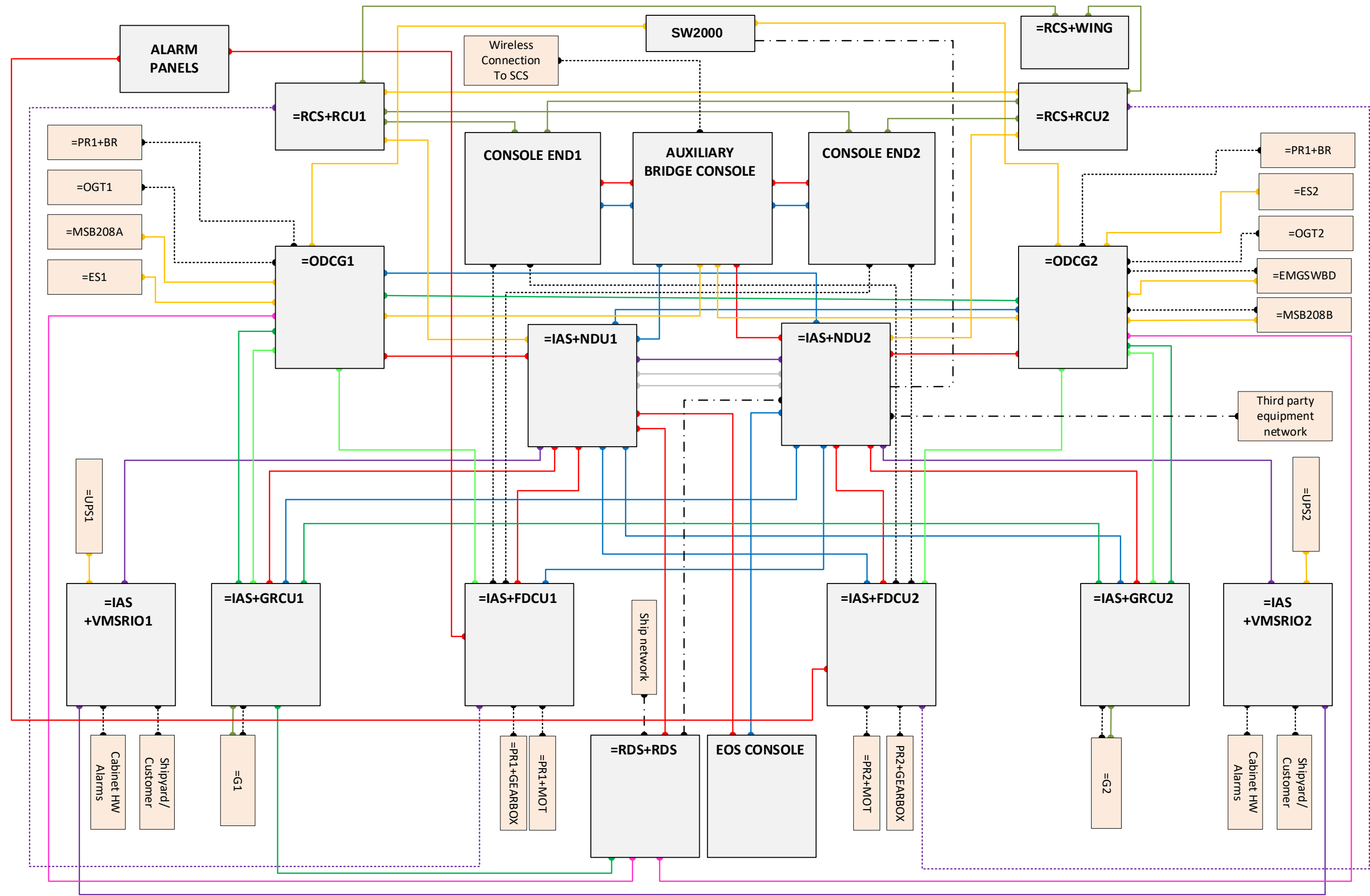
4.1 ABB System Overview

4.1.1 Electrical Single Line Diagram





4.1.2 Controls and Automation Overall Topology Diagram (PEMS, IAS, RCS)



4.1.3 ABB Equipment List

Equipment Item No	ABB Category	Equipment Name	Detailed Description	Vendor	Qty	Unit	Comment
01.1	01.2	Ship Service Generator Sets			2	pieces	
01.1.1	01	CAT C18 Engine	Diesel Engine, 1800RPM (Fixed), 578kW (775hp), EPA Tier 3, Keel Cooled, Packaged with Alternator on a Skid	Milton CAT	2	pieces	
01.1.2	01.1	565kWe Alternator	1800RPM, 565kWe, Permanent Magnet Generator	Ramme	2	pieces	
01.2	01.2	Emergency Generator Set	Diesel Genset, 1800RPM (Fixed), 138kW @ 0.8pf, EPA Tier 3, Radiator-Cooled	Milton CAT	1	pieces	
03.1	03	208VAC Main Switchboard	208/120V, 30kA, 2-Bus, Low Voltage Main Switchboard	Austevol	1	pieces	
03.2	03	208VAC Emergency Switchboard	208/120V, 30kA, Emergency Switchboard	Austevol	1	pieces	
03.3	03	240V Shore Connect Panel	240V, 3-Ph, Shore Charging Connection Panel	TBC	1	pieces	
03.4	03	480V Shore Connect Panel	480V, 3-Ph, Shore Charging Connection Panel	TBC	1	pieces	
03.5	03	Synchronize Pushbutton Control Panel	Shore Synchronization Control Panel	TBC	2	pieces	
04.1	04	Offgrid Converter Transformer	150kVA, 550/208V Offgrid Transformer with LC Filter	Trafotek	2	pieces	
04.3	04	Shore Transformer 1	100kVA, 240/208V Shore Transformer	TBC	1	pieces	
04.4	04	Shore Transformer 2	175kVA, 480/208V Shore Transformer	TBC	1	pieces	
05.1	05	230V Control Power UPS	10kVA, 230V, 1-Ph, 30-min Marine UPS	ABB	2	pieces	
06.1	06	DC Switchboard 1	ACS880 Multidrive, Liquid Cooled, DC Switchboard	ABB	1	pieces	
06.2	06	DC Switchboard 2	ACS880 Multidrive, Liquid Cooled, DC Switchboard	ABB	1	pieces	
06.3	06	PM Generator Disconnect Cabinet	Standalone Breaker Cabinet, 1000A SE MTZ 1000 Air Circuit Breaker (120Hz)	Austevol	2	pieces	Half height, bottom mounted
06.4	06	PM Motor Disconnect Cabinet	Standalone Breaker Cabinet, 4000A VF SACE Low/Mid Frequency Air Circuit Breaker (0-70Hz)	Austevol	2	pieces	
07.1	07	Energy Storage System	2446kWh, 20 x E2250V1, 1100VDC Energy Storage System	Corvus	1	shipset	
09.1	09	Propulsion Motor	950kW, 600V, 1800 RPM Permanent Magnet Motor	Ramme	2	pieces	
11.1	11	DC Fast Charge Receptacle	SWC200 2x4400A Receptacle	Zinus	1	pieces	
11.2	11	DC Fast Charge Tower	ZPP800 4400A DC Tower	Zinus	1	pieces	To be delivered directly to MaineDOT
20.1	20/27	PEMS/IAS Single Screen Workstation	800xA PEMS Workstation / Server, Loose Parts (27" Monitor, Panel PC, Trackball and Keyboard)	ABB	2	kit	
20.2	20/27	PEMS/IAS Dual Screen Workstation	800xA PEMS Workstation / Server, Loose Parts (2x 27" Monitor, Panel PC, Trackball and Keyboard)	ABB	1	kit	
20.3	20/27	Alarm Extension Viewer Panel	PP875M Alarm Viewer Panel	ABB	3	pieces	
20.4	20/27	Network Distribution Unit (NDU) / IAS CPU Cabinet	ZERO 8W - Network Hardware and 800M IAS CPU Cabinet	ABB	2	pieces	Bulkhead Mounted Cabinet
20.5	20	PEMS GRCU Control Cabinet	ZERO 8W - 800M CPU and IO Control Cabinet	ABB	2	pieces	Bulkhead Mounted Cabinet
20.6	20	PEMS FDCU Control Cabinet	ZERO 8W - 800M CPU and IO Control Cabinet	ABB	2	pieces	Bulkhead Mounted Cabinet
20.7	20	PEMS SCCS Control hardware	Network switch, wifi access point, power supply	ABB	1	kit	Control parts mounted in bridge console
20.8	20	PEMS ESCS+SCU Control Hardware	CPU and IO Control Cabinet	ABB	1	kit	Control Parts Installed in DC Switchboards
20.9	21	Bridge Remote/Propulsion Control Station	Drop-In Control Panel with Throttle Levers, EOT, Gauges, Controls and Indicators	Kwant	2	kit	Drop-in Panels and Loose Parts for Console
20.10	21	Outdoor Wing Remote/Propulsion Control Station	Drop-In Control Panel with Throttle Levers Gauges, Controls and Indicators, IP67	Kwant	2	kit	Drop-in Panels and Loose Parts for Console
20.11	21	EOS Remote/Propulsion Control Station	Drop-In Control Panel with Throttle Levers, EOT, Gauges, Controls and Indicators	Kwant	2	pieces	Drop-in Panels and Loose Parts for Console
20.12	21	Remote Control Unit Cabinet	CPU Control Cabinet	Kwant	2	pieces	
22.1	22	ABB Remote Diagnostics System Cabinet	ZERO 8W OS Control Cabinet, Fold-Down Keyboard	ABB	1	pieces	
27.1	27	VMS RIO Cabinet	ZERO 8W IO Control Cabinet	ABB	2	pieces	

4.1.4 System Overview

The Onboard DC Grid™ (ODCG) switchboard system is configured as two independent switchboards separated by a bus-tie breaker. Consumers are connected to these two switchboards.

The switchboards will normally be connected to form a closed DC bus. The Power and Energy Management System (PEMS™) will ensure that the number of connected energy sources is optimized. The system is designed to avoid a single fault causing loss of more than 50% power.

4.1.5 Regulatory and Classification Society

The regulatory authority for this vessel is the United States Coast Guard (USCG).

The vessel is unclassified. However, all equipment and systems furnished under this contract shall be designed, constructed, and installed according to ABS Rules for Building and Classing Marine Vessels July 2023 and ABS Rules for Steel Vessels Under 200 feet, as applicable.

4.2 ABB Engineering Support

4.2.1 Project Engineering Schedule and Design Freeze

ABB cannot begin ordering equipment from the respective factories until “design freeze.” To reach design freeze, various milestones must be met and agreed upon. The table below summarizes the key milestones.

ABB Scope (as appropriate)	Key Data to be Agreed Upon with Shipyard for Design Freeze
All equipment	• Overall Single Line Diagram (ABB deliverable) • ABB Main Equipment List (ABB deliverable) • Equipment Technical Specifications (ABB deliverable) (e.g. cooling, sizing, arrangement, weight) • Mounting / foundation detail
01 Generator	• Generator voltage
02/03 MV/LV SWBD's	• Electrical Load List with margins • Loading Factors per Operational Mode
04 Transformer	• Electrical Load List with margins • Loading Factors per Operational Mode • Largest LVAC switchboard load (which might drive off-grid converter)
05 UPS	• N/A
06 Drives	• Inputs for shipyard-supplied direct-connected equipment (e.g. alternators) • Largest LV AC switchboard load (which might drive off-grid converter)
07 ESS	• N/A
09 MV/LV Motors	• Hull design inputs as necessary (e.g. steering tube column height, propeller dimensions)
20 Power & Energy Management System (PEMS™)	• Inputs for shipyard-supplied direct-connected equipment (e.g. alternators)
21 Remote Control System	• N/A
22 Remote Diagnostic System	• N/A
26 Cyber Security	• N/A

ABB Scope (as appropriate)	Key Data to be Agreed Upon with Shipyard for Design Freeze
27 Integrated Alarm System (IAS)	Confirm all systems, mimics, functional description, and IO points

NOTE for the following tables: R = Responsible, S = Support, A = Approve, I = Inform

4.2.2 Project Management and Engineering Services

Action	Responsible party	
	Shipyard	ABB
Dedicated ABB Project Manager and Technical Engineering Lead		R
Hardware and software engineering of ABB scope equipment		R
Software Application Engineering of controls as necessary (e.g. Drive Control Unit (DCU), Switchboard Control Unit (SCU)) through Factory Acceptance Test		R
All studies identified in the Master Deliverables List (MDL)		R

4.2.3 Flag State and Class Certification

ABB has estimated engineering hours to support all expected and standard USCG regulatory submittals for which it is responsible. However, as USCG certification can sometimes be unpredictable, ABB reserves the right to request additional compensation if USCG approval activities exceed the scope of ABB's standard offering for reasons beyond its control. The vessel will not be classed.

Action	Responsible party	
	Shipyard	ABB
Communication with and obtaining all approvals from the flag state (e.g., US Coast Guard)	R	S
Demonstrate compliance with all USCG requirements for ABB's scope of equipment and support the shipyard/designer with the necessary information it needs to achieve flag state certification		R

4.2.4 Cabling

Action	Responsible party	
	Shipyard	ABB
System block diagrams stating all cables to/from ABB equipment		R
Connection Details drawing for each ABB scope equipment indicating cable termination details for power cables		R
System block diagrams stating cable type (e.g. ethernet, CAT 6) for control/data cables		R

Action	Responsible party	
	Shipyard	ABB
For Onboard DC Grid™/Onboard Microdrive, manuals indicating cable type requirements		R
Single line diagram with rated power and voltage level for equipment		R
All cable sizing between equipment (including lengths, wire routing diagrams, voltage drop calculations, cable numbering, number of conductors per cable) (based on ABB drawings above)	R	
Cable schedules (based on shipyard's cable sizing)	R	
Cable termination schedules (based on ABB drawings above)	R	

4.2.5 Integrated Alarm System (IAS)

Action	Responsible party	
	Shipyard	ABB
Basic integration of ABB Integrated Automation System (IAS) with the Main Switchboard		R
Basic Alarm and Monitoring of motor(s) powered by the ABB's drives, (e.g.: Load reduction at high temperature in windings)		R
BUS communications interface to alarm system (IAS, IACMS) (Bus communication type to be agreed upon)		R
Basic Integration with remote control system(s) of the thruster frequency converter(s) and soft starter(s)		R
Basic Integration with Integrated Alarm System (IAS) of the thruster frequency converter(s)		R
Design, procurement, and installation of all sensors, hardware, cabling, and other equipment for non-ABB scope vessel system (e.g., cooling water, HVAC) and sharing schematic drawings and IO information with ABB for integration with IAS	R	
Add non-ABB scope vessel systems (e.g. cooling water, HVAC) into IAS display on Operation Workstations (OWS)		R

4.2.6 Documentation / Master Deliverables List (MDL)

ABB's Master Deliverables List (MDL) defines the project deliverables to the shipyard. This list varies for each project but generally consists of the following only as far as it pertains to ABB's scope of supply unless otherwise stated.

Drawing list will be reviewed and agreed between ABB and the shipyard. All submittals to USCG are to be done by the shipyard.

Drawing Title	Per	Typical for USCG Approval	Comments
Electrical System Scope			
Overall Single Line Diagram	Shipset	True	Electrical single line diagram showing principal topology of ABB equipment scope and interfaces to major non-ABB scope equipment. This drawing may evolve as needed until design freeze.
Electrical System Philosophy	Shipset	True	Document to describe the various operational modes of the vessel's propulsion and power system.
Fault Current Calculations and Protective Device Coordination Analysis - ODCG SWBD	Shipset	True	Short circuit calculation and selectivity are limited to primary components of the main switchboard and low voltage AC systems. Voltage drop calculation starting heavy consumers studies, selectivity studies and coordination studies for the Main Switchboard in ABB Scope of Supply
Fault Current Calculations and Protective Device Coordination Analysis - LV System	Shipset	True	
Selectivity Study - LV System	Shipset	True	
Connection Diagrams	Shipset	False	Showing terminal mounting points and cables for all equipment in ABB's scope of supply
THD in AC Distribution System	Shipset	False	Total Harmonic Distortion
Vital Systems LV DC Power Distribution Load Analysis	Shipset	True	
Parameter Setting list	Shipset	False	
Energy Storage System - Energy Balance Study	Shipset	False	
Regulatory			
Failure Modes and Effects Analysis (FMEA) Input	Shipset	True	As per USCG CFR requirements, ABB to provide necessary supporting documentation for ABB scope of supply equipment for shipyard to develop and seek approval of the project FMEA.
Design Verification Test Procedure (DVTP) Input	Shipset	True	As per USCG CFR requirements, ABB to provide necessary supporting documentation for ABB scope of supply equipment for shipyard to develop and seek approval of the project DVTP.
Periodic Safety Test Procedures (PSTP) Input	Shipset	True	As per USCG CFR requirements, ABB to provide necessary supporting documentation for ABB scope of supply equipment for shipyard to develop and seek approval of the project PSTP.
Equipment Drawings and Manuals			
Main Equipment List	Shipset	False	Summary of ABB scope equipment
Consumer List	Shipset	False	Summary of ABB scope equipment power consumption
Part List	Shipset	False	
Heat Dissipation to Air and Water	Shipset	False	Summary of ABB scope equipment heat dissipation data
Equipment Arrangement Drawings	Equipment, as applicable	False	All key dimensional and mechanical drawings including pertinent interfaces (e.g. piping connections, foundations, system interface requirements, wet/dry weights, center of gravity, electrical connection types / locations, lifting points, heat dissipation, airborne noise estimates, and the required equipment maintenance envelopes).
Equipment Technical Specification	Equipment, as applicable	False	
Equipment Functional Description	Equipment, as applicable	Some (e.g. ESS, Onboard DC Grid™)	
Cables and Grounding Guideline	Onboard DC Grid™ / Onboard Microdrive	False	

Drawing Title	Per	Typical for USCG Approval	Comments
Equipment Control Wiring Diagram	Equipment, as applicable	Typically only for LV Switchboard	Internal control wiring diagram of equipment.
Equipment Interface Power Block Diagram	Equipment, as applicable	True	Power interfaces between equipment.
Equipment Interface Automation and Control Block Diagram	Equipment, as applicable	True	Automation and control interfaces between equipment.
Automation & Controls – General			
System Topology	Shipset	True	
Interface Guide	Shipset	False	
System 800xA Function Description	Shipset	False	
Automation System Block Diagram	Automation System, as applicable	True	e.g. IAS Block Diagram, PEMS™ Block Diagram
Automation & Controls – Integrated Automation System (IAS)			
IO List	Shipset	False	Complete list of I/O points for all automation systems
Operator Workstation & Server (OWS)	Shipset	False	Interface monitor and computer for shipyard-supplied engineering operating station.
HMI Graphic displays	Shipset	False	Human Machine Interface mimic drawings for different ship systems.
History Server	Shipset	False	
Alarm Printer	Shipset	False	
IAS Function Description	Shipset	False	
IAS HAT Test Procedure	Shipset	False	Hardware Acceptance Test
IAS HAT Test Report	Shipset	False	Hardware Acceptance Test
IAS SAT Test Procedure	Shipset	False	Software Acceptance Test
IAS SAT Test Report	Shipset	False	Software Acceptance Test
IAS Change Management Workflow	Shipset	False	
Automation & Controls – Marine Cyber Security			
Marine Cyber Security Function Description	Shipset	False	
Marine Cyber Security System Information	Shipset	False	
Marine Cyber Security Internal Handover Check List	Shipset	False	
Marine Cyber Security External Handover Check List	Shipset	False	
Marine Cyber Security Review Check List	Shipset	False	
Marine Cyber Security Testing Procedures	Shipset	False	
Automation & Controls – Power & Energy Management System (PEMS™)			
Power & Energy Management System Function Description	Shipset	True	
Power & Energy Management System Block Diagram	Shipset	True	
Power & Energy Management System Hardware Acceptance Test (HAT) Procedure	Shipset	False	
Power & Energy Management System Hardware Acceptance Test (HAT) Report	Shipset	False	

Drawing Title	Per	Typical for USCG Approval	Comments
Power & Energy Management System Software Acceptance Test (SAT) Procedure	Shipset	False	
Power & Energy Management System Software Acceptance Test (SAT) Report	Shipset	False	
Automation & Controls – Propulsion Control System (PCS)			
Propulsion Control Function Description	Shipset	True	
Propulsion Control System Block Diagram	Shipset	True	
Automation & Controls – Remote Control System (RCS)			
Remote Control System Function Description	Shipset, as applicable	True	
Automation & Controls – Remote Diagnostic System (RDS)			
ABB Ability™ Marine RDS - Functional Description	Shipset	False	
RDS Block Diagram	Shipset	False	
Factory Acceptance Testing			
Factory Acceptance Test (FAT) Procedure	Equipment or System, as applicable	False	Factory Acceptance Test plan for each piece of ABB scope equipment.
Factory Acceptance Test (FAT) Report	Equipment or System, as applicable	False	Factory Acceptance Test report for each piece of ABB scope equipment.
Commissioning and Site Support			
Pre-Commissioning Check List - signed by yard	Equipment / System	False	Checklist of expected shipyard activities to have been complete before ABB can begin commissioning each piece of ABB scope equipment.
Commissioning Procedures	Equipment / System as applicable	False	ABB's commissioning activities for each ABB scope of supply equipment.
Commissioning Report	Equipment / System as applicable	False	ABB's commissioning test report for each ABB scope of supply equipment.
Spare Parts and Special Tools	Shipset	False	A list of recommended spare parts and/or tools where provided by the equipment supplier.
Vessel Trials			
Dock Acceptance Test (DAT) Procedure	Equipment / System, as applicable	False	
Sea Trial Acceptance Test (SAT) Procedure	Equipment / System, as applicable	False	
Sea Trial Report	Shipset	False	

4.3 Program Governance Assumptions

This section describes the Program Governance model included in this offer.

4.3.1 Submittals to Shipyard

ABB has planned for all submitted documents and drawings to undergo one fifteen (15) day review cycle by the shipyard. In addition, certain documents (ex: operational and functional descriptions) may require review/approval by Maine DOT.

5.3.2 Technical Meeting Allowance

An initial kickoff meeting will be held after contract execution for this scope of work and before the start of on-site construction. Attendees will include the following stakeholders:

- Project Manager(s) for ABB, Customer and Vessel Owner
- Project Engineering Team (ABB and Designer)
- Shipyard Representatives
- Any additional personnel requested by the customer

In accordance with Maine DOT's specifications, progress meetings with stakeholders will be held periodically at a mutually agreed interval of no more than one month. Additional technical discussions can be facilitated as necessary. Minutes will be taken by a designated party from the project team and distributed for all technical meetings.

5.3.3 Formal Design Review Meetings

Prior to the freeze of any design elements, a formal meeting will be held with stakeholders. This is in addition to the above submittal process.

4.4 ABB Support to Acceptance Testing

This section describes the Acceptance Testing that has been included in the offer.

4.4.1 Factory Acceptance Test (FAT)

Action	Responsible party	
	Shipyard	ABB
Factory Acceptance Test of Equipment in ABB Scope of Supply		R
Travel arrangements for any shipyard, owner, Class, or regulatory personnel to equipment factory	R	

4.4.2 Factory Acceptance Test List (FAT)

Equipment Category	Equipment Description	FAT Included (Y/N)	Witnessed ¹ (W) or Report Review (R)	Customer option to Witness in person (Y/N/Virtually)
01.1 Engines	CAT C18 EPA Tier 3, Ship Service Gensets, PM	Y	W	Y
01.1 Engines	550kW PM Generator	Y	R	N
01.2 Gensets	CAT C7.1 Air-Cooled Emergency Genset	Y	W	Y
03 LV Switchboards	208VAC Main Switchboard	Y	W	V
03 LV Switchboards	208VAC Emergency Switchboard	Y	W	V
03 LV Switchboards	PM Motor and PM Generator Disconnect Cabinets	Y	W	V
04 Transformers	150kVA, 480/480V Offgrid Transformer with LC Filter	Y	W	V
04 Transformers	200kVA, 240/480V Shore Transformer	Y	W	V
04 Transformers	12kVA 208/230V 1-Phase UPS Transformer	N	n/a	n/a
05 UPS	10kVA, 1-Ph, 30-min Marine UPS	Y	W	V
06 Drives	Onboard DC Switchboard	Y	W	Y
06 Drives	Input Circuit	Y	W	N
07 ESS	Corvus Orca Modules	Y	R	N
07 ESS	Corvus Orca PDM	Y	W	V
09 LV Motors	950kW PM Propulsion Motor	Y	R	N

20 (PEMS)	ABB PEMS Software ²	Y	W	Y
20 (PEMS)	ABB PEMS Cabinets	Y	W	N
21 Remote Control System	Kwant RCS (Cabinets, levers and control panels)	Y	W	Y
22 Remote Diagnostic System	ABB Remote Diagnostics System	N	N	N
27 Integrated Alarm System (IAS)	ABB IAS Software	Y	W	Y

Notes:

- 1) At ABB's description, ABB may witness subcontractor FAT Tests virtually as a strategy to reduce travel and associated emissions.
- 2) ABB requests that Operator's Captain/Engineer attend PEMS Software FAT (held in USA) to gain an understand of the system functionality and interface, and to provide feedback prior to commissioning.

4.4.3 Shipyard Planning and Accommodations

Action	Responsible party	
	Shipyard	ABB
Site office for ABB and office facilities for minimum 2 personnel while ABB is on site with ability to expand to 8 personnel during commissioning. Office to include furniture, lockers, internet connections, restroom, kitchen, and cleaning.	R	
Safe working conditions for commissioning engineers	R	
ABB commissioning schedule (well before commissioning phase starts). The schedule will take account for shipyard milestones, duration of ABB commissioning activities, required testing times for ABB equipment and system, as well as required testing times for the yard to achieve Vessel Trial readiness. To ensure efficient use of resources, shipyard must present a completed report (e.g. "pre-commissioning checklist") confirming completion of its activities before ABB can initiate travel for its Commissioning team. ABB commissioning starts when installation, assembly, and cabling connections of equipment are completed, power is available, and facilities are made ready by the Shipyard.	R	S

4.4.4 Equipment Handling, Storage, and Physical Installation

Action	Responsible party	
	Shipyard	ABB
Lifting, hauling, and landing ABB equipment onboard	R	
Storage instructions for ABB equipment		R
Installation instructions of ABB equipment		R

Action	Responsible party	
	Shipyard	ABB
Installation of ABB equipment	R	
Rigging or disconnecting any non-ABB equipment that might interfere with the ABB scope (e.g. mooring winches, electrical or hydraulic cabinets)	R	
Welding or cutting hull	R	
Any supporting structure for rigging parts	R	
Storage, protection, and preservation of ABB equipment after delivery to the shipyard.	R	
Installation, preparation, flushing, etc. of support systems (e.g. water cooling, exhaust, lubrication)	R	
Pipe flushing and pressure testing with ABB's approval	R	

4.4.5 Cable Connections

Action	Responsible party	
	Shipyard	ABB
All cable installation and cable terminations to and between ABB equipment	R	
Cable glands on Onboard DC Grid™ (Roxtec or similar)		R
Cable connection testing (including megger testing)	R	
Interconnections to external drives panels	R	
Cables and accessories for external interconnection of equipment	R	

4.4.6 ABB Equipment Installation Verification and Set-to-Work

Action	Responsible party	
	Shipyard	ABB
Check cable work finished	R	
Check cubicles installed mechanically	R	
Check cubicle earthing connected in every cubicle	R	
Check all cabling installed and connected (both ends) and tested (including megger)	R	
Check cooling water pipes connected and pressure tested	R	
Checking of critical points before startup		R

4.4.7 Power feeds

Action	Responsible party	
	Shipyard	ABB
Low voltage shore power available	R	
Supply voltage for UPS available	R	
240 VAC / 440 VAC voltage available	R	
Power supply solution for pre-charging drives / DC Link bus	R	S
Checking of critical points before startup		R

4.4.8 Equipment Preparation

Action	Responsible party	
	Shipyard	ABB
Steel work finished	R	
Insulation work finished	R	
Electrical rooms cleaned and painted	R	
Floors of the electrical room ready	R	
Rubber mats in Main Switchboard rooms	R	

Action	Responsible party	
	Shipyards	ABB
Working lights in operation	R	
Ventilation working	R	
Safety level of operations in compliance with Shipyards HSSE requirements.	R	
Cleaning of ABB equipment	R	
Install/pull cables	R	

4.4.9 Commissioning Kick-Off Meeting

Action	Responsible party	
	Shipyards	ABB
Commissioning responsibilities confirmed	R	A
Safety regulations of ABB and YARD confirmed	R	A
Contact persons of ABB and YARD confirmed	R	A
Site office and dressing room arranged for ABB	R	I
ABB Reporting (ABB Commissioning Work Report)		R

4.4.10 Commissioning

Action	Responsible party	
	Shipyards	ABB
Commissioning of ABB equipment (after the prerequisites are fulfilled and as specified above)		R
Functional testing ABB equipment		R
If shipyard has any special testing requirements for the batteries (as applicable), any pre-charging (to occur only after ABB has successfully commissioned ESS and handed over control of the system to the shipyard)	R	
Testing of physical interfaces between ABB equipment and other equipment	R	
Operation of commissioned equipment	R	

Action	Responsible party	
	Shipyard	ABB
Waiting time by ABB Commissioning engineers	R	
Earthing system	R	
Assistance to the other system suppliers only insofar as interconnection test is required with ABB scope equipment.		R

4.5 Vessel Trials

4.5.1 Dock Trials Acceptance Tests (DAT)

Action	Responsible party	
	Shipyard	ABB
Dock Trial test plans for ABB equipment		R
Main power available continuously	R	
Propulsion drives operational	S	R
Propulsion control system operational	S	R
Possibility to turn propellers	R	
Person outside of vessel to avoid detachment of vessel	R	
Suitable number of mooring ropes	R	
Dock Trial Acceptance Tests accepted	R	A

4.5.2 Vessel Trial Acceptance Tests (VAT)

Action	Responsible party	
	Yard	ABB
Vessel Trial test plans for ABB equipment		R
ABB scope equipment verification activities	R	S
Training or coaching regarding the operations of new system after sea trial	R	S
Drydock fees	R	
FMEA/DVTP verification activities	R	S

4.6 ABB Onsite and Classroom Training

ABB Marine Academy training allows operators to become more proactive in operating and maintaining equipment, which results in increased availability and less downtime. Course participants can visit ABB factories or workshops and get answers from the engineers who designed the equipment and systems themselves.

Safety - Training supports the crew toward safe operations, with ability to get the most of their equipment in all situations.

Performance - Marine Academy training for ABB equipment allows the highest operational performance leading towards more efficient and sustainable operations.

Quality - Knowledge is power; with customized courses from Marine Academy your crew reaches most safe, efficient and sustainable operations.

Here is an applicable list of available standard and customizable ABB Marine Academy classes:

- HV Safety course, Management and operational level STCW approved
- Power Distribution system
- Propulsion drive systems
- Propulsion simulation
- Marine Machines
- Powerplant training
- Automation of 800xA
- Advisory software suite
- Onboard DC Grid™
- ACS880 Drives
- eLearnings

5 Technical Solution Specifications

ABB has identified sections of the RFQ considered to be “general requirements,” which generally affect some or all equipment aboard. These expectations will be communicated to the various suppliers.

<u>Appendix</u>	<u>Specification</u>
01	Generators
01.1	Engines
03	LV Switchboards
04	Transformers
05	UPS
06	Drives
07	ESS
09	LV Motors
11	Shore Charging System (Receptacle and Tower)
20-27	PEMS-IAS
21	RCS
22	RDS
26	Cybersecurity