

SECTION 14900 – RO-RO RAMP Mechanical, Electrical and Control System

All work and materials shall conform to the Drawings, MDOT Standard Specifications and the following:

1.0 System Overview

The Contractor is to design, fabricate and install an operating lift system for the Ro-Ro Ramp (bridge). The system includes the hydraulic lift as well as the hydraulic lock off pin assemblies along with all appurtenances required for a fully operational system.

The design life for the system shall be twenty (20) years.

The hydraulic system operates four (4) hydraulic cylinders. Two (2) main lift cylinders will raise and lower the bridge. Two (2) lock off pin cylinders will extend and retract two (2) live load pins for the live load hanger bars on the bridge.

The main lift cylinders are single speed, but will incorporate flow controls that may be adjusted at the hydraulic power unit during system setup to control cylinder extend and retract speed. The main lift cylinders will have counterbalance valves installed on the rod end of the cylinders. This will prevent any unintended movement of the transfer bridge, i.e. hose or tube failure.

Pressure relieve valves will be incorporated in the retract/extend circuit on the lock off pin cylinders to prevent the live load pins from retracting if the weight of the bridge is on the live load pins and/or extending into the hanger bars while misaligned with the hanger bars slots. Additionally, a pressure relief valve will be incorporated in the bridge circuit to prevent excessive downward loading of the hanger bars. Limit switches will prevent the bridge from rising while the live load pins are engaged.

The main lift cylinders will be utilized by the operator to raise/lower the bridge to the desired position. When the bridge is in the correct position, the lock off pin cylinders will extend the live load pins into the live load hanger bar slots and then lowered to rest on the hanger bars.

2.0 Operational Requirements

The system operates under two sequences; transition ramp supported on the lift beam or transition ramp supported on the vessel.

2.1 Transition Ramp Supported On Lift Beam

This operation requires the transition ramp to bear upon the lift beam. The bridge is supported by the live load hanger bar during all live load operations. Prior to live load operations, the height of the main bridge may require adjusting with the following operations:

- Activate the main hydraulic lift cylinder lifting the bridge slightly to disengage the hanger bar.
- Retract the live load pins.
- Continue to raise or lower the main bridge to desired elevation and so the live load pins coincide with the hanger bar slots.
- Extend the live load pins into the hanger bar slots.
- Lower bridge so hanger bars are fully engaged.

2.2 Transition Ramp Supported On Vessel

This operation requires the transition ramp to bear upon a moored vessel. The main bridge is supported by the live load hanger bars during all live load operations. Prior to live load operations, the height of the main bridge will require adjusting to allow the transition ramp to bear on the vessel with the following operations:

- Activate the main lift cylinders lifting the bridge slightly to disengage the hanger bars.
- Retract the live load pins.
- Continue to raise the main bridge such that the transition ramp is at an elevation above the vessel deck.
- The vessel will move forward under the transition ramp bearing area.
- Activate the main lift cylinders and lower the bridge such that the transition ramp is fully supported by the vessel. Note: the transition ramp will be bearing on the vessel deck and will have a downward slope to the main bridge.
- Continue to lower the main bridge cylinders approximately three feet and so the live load pins coincide with a hanger bar slot.
- Extend the live load pins into the hanger bar slots.
- Lower bridge so hanger bars are fully engaged.

3.0 Design

The design for this entire system shall be performed under the direction of a professional engineer(s) registered in the State of Maine. Local and state laws, codes and ordinances are to take precedence over specifications. The design of the system shall be completed, reviewed and approved by the Owner prior to ordering materials. The design shall include design calculations as well as design drawings. The design shall be submitted as a whole system with all components at the following stages:

- 30% design
- 80% design
- Final design review
- Fully completed sealed and signed plans.

3.1 Mechanical System - Design

The scope of this section is to provide a design for a complete and functional hydraulic system inclusive of, but not limited to, the following:

- A. Complete Hydraulic Power Unit, including valving.
- B. Transfer Bridge Hydraulic Cylinders.
- C. Transfer Bridge Lock Cylinders.
- D. Tubing, hoses and installation material.

The mechanical system shall be designed to lift the entire dead load in normal operating conditions. However, the system shall be sized to lift and hold the entire dead plus live load of the system.

References

- ASTM American Society for Testing and Materials
- ANSI American National Standards Institute
- AWS American Welding Society
- NFPA National Fluid Power Association
- NEMA National Electrical Manufacturer's Association
- ASME American Society of Mechanical Engineers
- SAE Society of Automotive Engineers

3.2 Electrical and Control System - Design

The scope of this section is to provide a design for a complete and functional electrical system to power, monitor and control the Ro-Ro Ramp hydraulic system. The system to be designed starts at the hydraulic power unit on the float.

Regulatory Requirements:

- Local Laws and Ordinances
- State and Federal Laws
- NEC National Electrical Code
- NFPA-101 Life Safety Code
- UL Underwriters' Laboratories
- NESC National Electrical Safety Code
- ANSI American National Standards Institute
- NEMA National Electrical Manufacturers' Association
- IEEE Institute of Electrical and Electronics Engineers
- ICEA Insulated Cable Engineers Association
- OSHA Occupational Safety and Health Act
- FM Factory Mutual Engineering Standards
- ISA Instrument Society of America
- ETL Electrical Testing Labs
- NETA National Electrical Testing Association
- Federal, State and Local Building Codes
- All authorities having jurisdiction

Wherever the requirements of the specification exceed those of the governing codes and regulations, the requirements of the specification shall govern. Nothing in this specification shall be construed as relieving the contractor from complying with any requirements of the specification that may be in excess of the requirements of governing codes or regulations.

If any conflict occurs between the aforementioned codes or regulations and specification, it is intended that the more stringent requirement apply. Nothing in the specification shall be construed to permit work not conforming to governing codes or regulations.

4.0 Submittals

Upon completion of the design, submittals are required for all products for approval prior to any purchasing or manufacturing. Each section (mechanical & electrical) submittals shall be complete, incomplete or piecemeal submittals will be returned without action.

4.1 Mechanical System Submittals

All components shall be made of corrosion resistant material or be provided with a corrosion resistant finish such as 316 stainless steel, zinc plated steel, steel painted with marine grade epoxy paint.

Required submittals:

- Manufacturer's data sheets for all components
- Hydraulic reservoir drawing
- Hydraulic power unit general arrangement drawing
- Hydraulic schematic with bill of material
- Shop hydraulic cylinder drawings.
- Shop manifold drawings (custom only).

All components shall be defined with OEM part numbers. Shop drawings shall have sufficient detail of components to determine the clearances required for installation, operation and maintenance.

The hydraulic system submittals shall have catalog cut sheets using arrows or similar pointing methods to provide easy identification of the component being submitted. The catalog cut sheets shall be organized and keyed to match a Bill of Materials. The Bill of Materials shall identify all of the proposed equipment and components for the hydraulic system.

Drawings:

The contract plans contain some detail dimensions, but are not shop drawings. The manufacturer is responsible for dimension and performance verification and final assembly of the hydraulic system.

Provide submittal/approval and as-built electrical drawings for the system. Drawings shall be submitted in hard copy format for review. The final set of drawings shall be printed for the O&M manuals and additionally delivered in AutoCAD 2000 or better electronic format.

Information required on the drawings includes, but is not limited to the following: Material, dimensions, tolerances, surface finish, weld requirements, torque requirements, and any other information needed to define the assembly or component.

The sufficiency of details provided in submittal for approval shall be to the satisfaction of the Resident.

4.2 Electrical and Control System Submittals

Submittals are required for all products noted for approval prior to any purchasing or manufacturing. The scope of this section is to provide a complete and functional electrical system to power, monitor and control the transfer ramp hydraulic system. All materials, equipment and installations are to be operated in a marine environment. All enclosures shall be UL listed NEMA 4X rated Stainless Steel. All controls, indicators, operators etc... shall have a UL and NEMA protection rating that meets or exceeds the enclosure rating where they are installed.

The contractor shall be responsible for providing, installing, wiring, testing, placing into operation equipment and systems, a fully functional ferry terminal as specified herein. Additionally, the contractor shall be responsible for furnishing and installing all incidental items not specifically shown or specified which are required by good practice to provide a complete system specified.

Minimum required submittals:

1. Conduit and Raceways.
2. Raceway supports.
3. Wire & Cable
4. Ground rods and grounding equipment
5. Device boxes.
6. Junction boxes.
7. Circuit breakers and enclosed circuit breakers.
8. Disconnect switches.
9. Dry-type transformers.
10. Wire connectors and terminal blocks.
11. Wiring devices.

12. Enclosures, Cabinets.
13. One-line power diagram with load calculations.
14. Transfer/Transition control system.
15. Complete specification and catalog cut sheets for proposed equipment.

The electrical system submittals shall have catalog cut sheets using arrows or similar pointing methods to provide easy identification of the component being submitted. The catalog cut sheets shall be organized and keyed to match a Bill of Materials. The Bill of Materials shall identify all of the proposed equipment and components for the electrical system.

Drawings:

Provide submittal/approval and as-built electrical drawings for the system. Drawings shall be submitted in hard copy format for review. The final set of drawings shall be printed for the O&M manuals and additionally delivered in AutoCAD 2000 or better electronic format.

5.0 Materials and Workmanship

5.1 Electrical and Control System Materials and Workmanship

All electrical components shall be approved, or listed and labeled by UL or other testing laboratory accredited by the State of Maine, when available. Non-listed or non-approved components may be used if listed or approved components are not available. A written request to use non-listed or non-approved components shall be submitted to the Resident for approval, prior to installation. Control panels and enclosures, if not approved or listed and labeled catalog units, shall be assembled and labeled by a UL certified assembly shop or shall be field certified as a unit by UL or other testing laboratory accredited by the State of Maine.

All materials, equipment and workmanship are subject to inspection at any time by the Resident. The contractor shall correct any work, materials, or equipment not in accordance with specification, or found to be deficient or defective, in a manner satisfactory to the Resident at no additional cost to the contracting agency. The contractor shall provide assistance and cooperation if needed, during inspections. An electrical inspector will inspect the work of this contract. The contractor shall schedule these inspections with the Resident, provide all necessary assistance in the work of the inspection, and perform all corrections directed by the inspector at no additional cost to the contracting agency.

The contractor shall obtain and pay for all licenses, permits and inspections required by laws, ordinances and rules governing work specific herein. The contractor shall consult with and follow the requirements of the local Utilities serving the area and shall coordinate the work with them.

Throughout this contract, provide protection for all materials and equipment against loss, effects of weather and/or damage.

Drawings show circuiting and switching details. Exact conduit and equipment locations are not shown unless detailed or specifically dimensioned. All equipment shall be located and installed to be readily accessible for operation and maintenance. Final location shall be subject to approval by the Resident. The Resident reserves the right to require minor changes in location of equipment prior to roughing in, without incurring additional costs or changes.

The general contractor shall provide the adequate temporary electrical power for all required work.

6.0 Testing

It is the intent of this testing and commissioning to assure that all electrical and mechanical equipment is operational and is installed in accordance with the design specifications. A test report shall be submitted for approval, 3-weeks prior to testing and commissioning, for approval. There shall be a single person responsible for the testing and commissioning. All testing and commissioning shall be performed in the presence of the Resident and 3-weeks notice shall be provided prior to performing the testing and commissioning. The contractor shall provide adequate support and equipment during testing and commissioning.

The following is a minimum guideline for the testing and commissioning of the completed system:

1. Utilize a step-by-step test plan (Resident approved).
2. Verify that electric motor rotation is correct.
3. Verify wiring between HPU and remote operator enclosure is correct.
4. Verify that the following are wired and operating correctly:
 - Reservoir heater
 - Low oil switch
 - High temperature switch
 - Return filter dirty filter indicator switch
 - Pressure filter dirty filter indicator switch
 - Verify the “hanger up limit” switch
 - Verify all solenoid operations are properly wired
5. Verify that all interlocks operate correctly.
6. Ro-Ro Ramp:
 - Bleed air from lock actuators and transfer actuators.
 - Verify lock pin actuation cylinder proximity switch functionality.
 - Adjust pressure & flow settings for lock pin cylinders, extend/retract (record settings).
 - Adjust flow settings on the main lift cylinders and pressure setting on blind end (record settings).
 - Operate main lift cylinders through entire working range.
7. The Ro-Ro Ramp shall be raised and lowered a minimum of 4 extend/retract cycles, from the extreme up to the extreme down position. Verify smooth operation with no binding or unusual noises. Monitor motor current during operation to verify operation within rated range.
8. Test the Ro-Ro Ramp for leakage at two positions. The extreme up position shall be held for a minimum of 1 hour. Halfway between extreme up and horizontal shall be held for a minimum of 1 hour. The cylinders’ position shall not change during the test period beyond what is attributable to thermal expansion.

7.0 Operational and Maintenance Manuals

The contractor shall submit an operation and maintenance manual for the complete system and shall contain the following minimum information:

Mechanical

- Full size as-built drawings for complete hydraulic system.
 - Hydraulic schematic with bill of material.
 - Drawings showing general construction and dimensions of Hydraulic power unit.
 - Full size as-built cylinder assembly drawings, including bill of Material
- Manufacturer's Information
 - Catalog data sheets (with specific part numbers clearly indicated).
- Spare parts list
- Maintenance & lubrication instructions for mechanical equipment, including warnings and precautions to be observed during maintenance actions.

Electrical/Control

- Full size as-built drawings for complete electrical/control system.
 - Electrical system wiring diagrams and schematics.
 - Console and cabinet panel assembly layouts (control, MCC, PLC).
- Manufacturer's Information
 - Catalog data sheets (with specific part numbers clearly indicated).
- Spare parts list
- Maintenance instructions for electrical equipment, including warnings and precautions to be observed during maintenance actions.

The manual shall be assembled in a three-ring binder with "D" rings and with vinyl cover to allow title sheet inserts. Each section/subsection shall be separated with laminated tabbed divider sheets, with suitable title. All documents and drawings shall be original, no photocopies or faxes are allowed. All component part numbers shall be the original OEM part numbers. A preliminary manual shall be submitted for review and approval. Upon final approval, six (6) complete manuals shall be delivered to the Resident.

8.0 Training

Two (2) eight hour days of training shall be provided by the contractor for operation and maintenance of the completed hydraulic system. The training will include hydraulic, electrical and structure systems. The training shall be organized and be administered to a multi-disciplined group. Training sessions shall be devoted to the theory of operation, maintenance and troubleshooting of the system. The contractor shall furnish all necessary instruction sheets, training aids, paper, and booklets to supplement training.

Training shall not commence until the system is operational and the system has been conditionally accepted by the Resident.

9.0 Warranty

Warranty shall be for parts and labor (exclusive of consumables) to maintain equipment per performance requirements of this specification for at least one year after installation and start-up is complete or upon receipt by Customer. The contractor is to be solely responsible for all warranty claims; even for their suppliers and subcontractors consistent with the standards, terms, and conditions of this specification.

As part of the warranty, the supplier shall be responsible for correction of all safety related deficiencies at no cost to the customer for the period of 1 year after startup and acceptance. OSHA, MISHA, and other specifications, codes, and standards as listed in the "Applicable Specifications" section of this specification shall be the basis of this warranty.

*** END OF SECTION ***