

PART 1 - GENERAL

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| <u>1.1 RELATED REQUIREMENTS</u> | .1 | Section 45 05 17 - Pipe Welding. |
| | .2 | Section 45 20 13 - High Pressure Hydraulic Piping. |
| <u>1.2 REFERENCES</u> | .1 | Canadian Standards Association (CSA International)
.1 CSA B51.14, Boiler, Pressure Vessel and Pressure Piping Code.
.2 CSA S826 Series 01, Ferry Boarding Facilities. |
| | .2 | Green Seal Environmental Standards (GSES)
.1 Standard GS-11-2013, Edition 3.1, Environmental Standard for Paints and Coatings. |
| | .3 | National Fire Code of Canada (NFCC 2010) |
| | .4 | American Society of Mechanical Engineers (ASME)
.1 ASME B31.3-2012, Process Piping. |
| <u>1.3 ACTION AND INFORMATIONAL SUBMITTALS</u> | .1 | Provide submittals in accordance with Section 01 33 00 - Submittal Procedures. |
| | .2 | Product Data:
.1 Provide manufacturer's printed product literature, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations. |
| <u>1.4 DELIVERY, STORAGE AND HANDLING</u> | .1 | Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions. |
| | .2 | Delivery and Acceptance Requirements:
.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address. |
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<u>1.4 DELIVERY, STORAGE AND HANDLING (Cont'd)</u>	.3	Packaging Waste Management: remove for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
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PART 2 - PRODUCTS

<u>2.1 NOT USED</u>	.1	Not used.
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PART 3 - EXECUTION

<u>3.1 APPLICATION</u>	.1	Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.
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<u>3.2 CONNECTIONS TO EQUIPMENT</u>	.1	In accordance with manufacturer's instructions unless otherwise indicated.
	.2	Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
	.3	Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

<u>3.3 CLEARANCES</u>	.1	Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and National Fire Code of Canada.
	.2	Provide space for disassembly, removal of equipment and components as recommended by manufacturer without interrupting operation of other system, equipment, components.

<u>3.4 DIELECTRIC COUPLINGS</u>	.1	General: compatible with system, to suit pressure rating of system.
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3.4 DIELECTRIC
COUPLINGS
(Cont'd)

- .2 Locations: where dissimilar metals are joined.
- .3 NPS 2 and under: isolating unions.

3.5 PIPEWORK
INSTALLATION

- .1 Install pipework to CSA B51.
- .2 Screwed fittings jointed with Teflon tape.
- .3 Protect openings against entry of foreign material.
- .4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .5 Assemble piping using fittings manufactured to ANSI standards.
- .6 Group piping wherever possible and as indicated.
- .7 Remove scale and other foreign material before assembly.
- .8 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
- .9 Check Valves:
 - .1 Install check valves on discharge of pumps and as indicated.

3.6 FLUSHING OUT OF

- .1 Before start-up, clean interior of piping systems in accordance with requirements of ASME B31.3 - Cleaning supplemented as specified in relevant mechanical sections.
 - .2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.
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3.7 PRESSURE
TESTING OF
EQUIPMENT AND
PIPEWORK

- .1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.
- .2 Pipework: test as specified in relevant sections of mechanical work.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Conduct tests in presence of Departmental Representative.
- .6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

3.8 EXISTING
SYSTEMS

- .1 Connect into existing piping systems at times approved by Departmental Representative.
- .2 Request written approval by Departmental Representative 10 days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.

3.9 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/ Demolition Waste Management and Disposal.

PART 1 - GENERAL

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| <u>1.1 RELATED REQUIREMENTS</u> | .1 | Section 45 74 14 - Mechanical Ramp Lifting Mechanism. |
| | .2 | Section 45 05 05 - Installation of Pipework. |
| | .3 | Section 45 05 29 - Hangers and Supports for Hydraulic Piping. |

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| <u>1.2 REFERENCES</u> | .1 | American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
.1 ANSI/ASME B31.1-2014, Power Piping.
.2 ANSI/ASME B31.3-2012, Process Piping.
.3 ANSI/ASME Boiler and Pressure Vessel Code-2013:
.1 BPVC 2013 Section I: Power Boilers.
.2 BPVC 2013 Section V: Nondestructive Examination.
.3 BPVC 2013 Section IX: Welding and Brazing Qualifications. |
| | .2 | American Welding Society (AWS)
.1 AWS C1.1M/C1.1-2000(R2012), Recommended Practices for Resistance Welding.
.2 AWS Z49.1-2013, Safety in Welding, Cutting and Allied Process.
.3 AWS W1-2000, Welding Inspection Handbook. |
| | .3 | Canadian Standards Association (CSA International)
.1 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
.2 CSA B51-14(R2007), Boiler, Pressure Vessel and Pressure Piping Code.
.3 CSA-W117.2-12, Safety in Welding, Cutting and Allied Processes.
.4 CSA W178.1-2014, Certification of Welding Inspection Organizations.
.5 CSA W178.2-2014, Certification of Welding Inspectors. |

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| <u>1.3 ACTION AND INFORMATIONAL SUBMITTALS</u> | .1 | Provide submittals in accordance with Section 01 33 00 - Submittal Procedures. |
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1.3 ACTION AND
INFORMATIONAL
SUBMITTALS
(Cont'd)

1.4 QUALITY
ASSURANCE

- .1 Qualifications:
 - .1 Welders:
 - .1 Welding qualifications in accordance with CSA B51.
 - .2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.
 - .3 Submit welder's qualifications to Departmental Representative.
 - .4 Each welder to possess identification symbol issued by authority having jurisdiction.
 - .2 Inspectors:
 - .1 Inspectors qualified to CSA W178.2.
 - .3 Certifications:
 - .1 Registration of welding procedures in accordance with CSA B51.
 - .2 Copy of welding procedures available for inspection.
 - .3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

1.5 DELIVERY,
STORAGE AND
HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

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| <u>2.1 PIPE, FITTING
AND FLANGE</u> | .1 | All pipe welding shall be done designated construction areas. |
| | .2 | Stainless steel pipe: to ASTM A312, Grade 316L. |
| | .3 | Stainless steel fittings: to ANSI B83.48, Grade 316L. |
| <u>2.2 FILLER MATERIAL</u> | .1 | Shielded metal arch electrodes (manual welding) to conform to CAN/CSA W48. Grade to be of tensile strength equivalent to or greater than the ultimate tensile strength of the parent metal, and to be suitable for the electric current characteristics, position of welding, and other conditions of intended use. |
| <u>2.3 EQUIPMENT</u> | .1 | Welding equipment to be 200 A or larger dc machines, and to be designed and maintained in an acceptable condition to obtain the specified results. |

PART 3 - EXECUTION

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| <u>3.1 APPLICATION</u> | .1 | Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets. |
| <u>3.2 QUALITY OF WORK</u> | .1 | Welding: in accordance with ANSI/ASME B31.1 B31.3, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and special procedures specified elsewhere in Section 45 74 14 - Mechanical Ramp Lifting Mechanism. |
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3.3 INSTALLATION
REQUIREMENTS

- .1 Identify each weld with welder's identification symbol.
- .2 Backing rings:
 - .1 Where used, fit to minimize gaps between ring and pipe bore.
 - .2 Do not install at orifice flanges.
- .3 Fittings:
 - .1 NPS 2 and smaller: install welding type sockets.
 - .2 Branch connections: install welding tees or forged branch outlet fittings.

3.4 INSPECTION AND
TESTS - GENERAL
REQUIREMENTS

- .1 Review weld quality requirements and defect limits of applicable codes and standards with Departmental Representative before work is started.
- .2 Formulate "Inspection and Test Plan" in co-operation with Departmental Representative.
- .3 Do not conceal welds until they have been inspected, tested and approved by inspector.
- .4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

3.5 SPECIALIST
EXAMINATIONS AND
TESTS

- .1 General:
 - .1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by Departmental Representative.
 - .2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.
 - .3 Inspect and test 100% of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination and 20% of welds to magnetic particle (hereinafter referred to as "particle") tests.
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| 3.5 SPECIALIST EXAMINATIONS AND TESTS
<u>(Cont'd)</u> | .2 | Hydrostatically test welds to ANSI/ASME B31.1. |
| | .3 | Visual examinations: include entire circumference of weld externally and wherever possible internally. |
| | .4 | Failure of visual examinations or particle testing:
.1 Upon failure of welds, perform additional testing as directed by Departmental Representative of total of up to 10% of welds, selected at random by Departmental Representative by full gamma ray radiographic tests. |
| 3.6 DEFECTS CAUSING REJECTION
<u></u> | .1 | As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code. |
| 3.7 REPAIR OF WELDS WHICH FAILED TESTS
<u></u> | .1 | Re-inspect and re-test repaired or re-worked welds at Contractor's expense. |
| 3.8 CLEANING
<u></u> | .1 | Clean in accordance with Section 01 74 11 - Cleaning. |
| | .2 | Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management. |

PWGSC	HANGERS AND	Section 45 05 29
Caribou/Wood Islands Ferry Ramp	SUPPORT FOR	Page 1
Project No. R.064789.001 /	HYDRAULIC	
R.064790.001	PIPING	2015-04-20

PART 1 - GENERAL

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|--------------------------------|----|--|
| <u>1.1 SCOPE</u> | .1 | This Section specifies hangers and supports for piping system. |
| | .2 | Design, select, locate and provide pipe hangers and supports for piping in accordance with the requirements of the specifications and as shown. |
| <u>1.2 REFERENCE STANDARDS</u> | .1 | Conform to the following reference standards:
.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
.1 ANSI/ASME B31.1, Power Piping, (SI Edition). |
| | .2 | Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
.1 MSS SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.
.2 MSS SP-69, Pipe Hangers and Supports - Erection and Application.
.3 MSS SP-89, Pipe hangers and Supports - Fabrication and Installation practices. |
| | .3 | ULC, Underwriters' Laboratories of Canada. |
| <u>1.3 DESIGN REQUIREMENTS</u> | .1 | Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies. |
| | .2 | Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP-58. |
| | .3 | Ensure that supports, guides, anchors do not transmit excessive quantities of heat to structure. |
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1.3 DESIGN
REQUIREMENTS
(Cont'd)

- .4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .5 provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP-58.

1.4 SHOP DRAWINGS
AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 1.
- .2 Submit shop drawings and product data for following items:
 - .1 All bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.

1.5 MAINTENANCE
DATA

- .1 Provide maintenance data.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Unless otherwise specified, pipe hangers and supports, structural attachments, fittings and accessories are to be 316 stainless steel.
- .2 Provide AISI Type 304 stainless steel nuts, bolts, washers and threaded rods, for submerged and exposed, above ground conditions.
- .3 Pipe hangers and supports in submerged locations to be 304 stainless steel.

2.2 PIPE HANGERS
AND SUPPORTS

- .1 Type 3 - Pipe Clamp: Provide stainless steel pipe clamps, with configuration and components as follows:

PWGSC	HANGERS AND	Section 45 05 29
Caribou/Wood Islands Ferry Ramp	SUPPORT FOR	Page 3
Project No. R.064789.001 /	HYDRAULIC	
R.064790.001	PIPING	2015-04-20

2.2 PIPE HANGERS
AND SUPPORTS
(Cont'd)

- .1 (Cont'd)
 - .1 Steel pipe (uninsulated) - Single Bolt Pipe Clamp: B-Line B3140, or Grinnell Fig. 212, or Hunt 60.
- .2 Type 6 - Framing Channel Pipe Clamp: Provide steel pipe clamps with configuration and components as follows:
 - .1 Steel pipe (uninsulated) - B-Line 2007, Powerstrut PS1100, or Unistrut P1109 Series.
- .3 Type 11 - Offset Pipe clamp: provide carbon steel pipe clamps with configuration and components as follows:
 - .1 Steel pipe - B-Line B3148, or Grinnell fig. 103, or Hunt 301.
- .4 Type 12 - Riser Clamp: Provide carbon steel riser clamps with configuration and components as follows:
 - .1 Steel pipe - B-Line B3373, Grinnell Fig. 261, Superstrut C-720, or Taylor No. 82, or Hunt 40.

2.3 STRUCTURAL
ATTACHMENT

- .1 Type A - Malleable iron Concrete Insert provide malleable iron concrete inserts with insert nuts; B-Line B3014 with B3014N, Grinnell Fig. 282, or Unistrut M26 with M2808 through M2824.
- .2 Type B - Side Beam Bracket: provide malleable iron or carbon steel bracket; Grinnell Fig. 202, or B-Line B3062, or Hunt 50.
- .3 Type C - Malleable Beam Clamp With Extension Piece: provide malleable iron clamp and extension pieces with steel tie rods; Grinnell Fig. 218 with Fig. 157 extension piece, or B-Line B3054 with Fig. B3203 extension piece, Hunt 812.
- .4 Type D - Steel Beam Clamp with Eye Nut: Provide forged steel beam clamps and weldless eye nuts; Grinnell Fig. 292, B-Line B3291 series.
- .5 Type E - Steel channel clamp: provide malleable iron clamp and heel plates, and steel bolts and nuts; Grinnell Fig. 226 with Fig. 157 extension piece.

PWGSC	HANGERS AND	Section 45 05 29
Caribou/Wood Islands Ferry Ramp	SUPPORT FOR	Page 4
Project No. R.064789.001 /	HYDRAULIC	
R.064790.001	PIPING	2015-04-20

2.3 STRUCTURAL

ATTACHMENT (Cont'd)

- .6 Type F - Welded Beam Attachment: provide carbon steel beam attachments; B-Line B3083, or Grinnell Fig. 66, or Hunt 52B.
- .7 Type G - Adjustable Beam Attachment: provide carbon steel beam attachments; B-Line B3082, or Hunt 50S.
- .8 Type H - Double Channel Bracket: provide single channel attachment. Provide a carbon steel double framing channel cantilever bracket assembly; B-Line B297-12 through B297-36, Powerstrut PS809, or Unistrut P2542 series.
- .9 Type J - Single Channel Bracket: Provide single channel attachment. Provide a carbon steel single framing channel cantilever bracket assembly; B-Line B198-6 through B198-24, Powerstrut PS661, or Unistrut P2231 through P22234.
- .10 Type K - Wall mounted channel: provide 41 mm x 62 mm carbon steel framing channel; B-Line B12 or Unistrut P5500.
- .11 Type L - Pipe stanchion attachment: Provide minimum 12 mm thick carbon steel baseplate. Anchor bolt holes: 1.6 mm larger than bolt diameter. provide nonshrink grout between the baseplate and upstand.
- .12 Type M - Welded Steel Bracket: Provide carbon steel brackets which comply with MSS Type 32 and FEDSPEC Type 33 for medium welded bracket; Grinnell Fig. 195. Heavy welded bracket to comply with MSS Type 33 and FEDSPEC Type 34; Grinnell Fig. 199.
- .13 Type P - Framing Channel Post Base: provide carbon steel post bases of standard design manufactured by framing channel manufacturer. Single channel: Unistrut P 2072A, B-Line B280, Powerstrut PS 3033. Double channel: Unistrut P2073A, B-Line B281, or Powerstrut PS3064.
- .14 Type Q - Continuous concrete inserts: provide 300 mm long carbon steel concrete inserts; Unistrut P3253.

2.4 ACCESSORIES

- .1 Hanger Rods: provide AISI Type 304 stainless steel rods, threaded on both ends or continuous threaded and sized as required.
- .2 Weldless Eye Nut: Provide forged steel eye nuts and comply with MSS and FEDSPEC Type 17; Grinnell Fig. 290, or B-Line B3200, or Hunt 88.
- .3 Welded Eye Rod: provide carbon steel eye rods with eye welded closed. Inside diameter of eye to accommodate a bolt diameter 3.2 mm larger than the rod diameter; Grinnell Fig. 278, or B-Line B3211, or Hunt 95R.
- .4 Turnbuckle: provide forged steel turnbuckles; Grinnell Fig. 230, or B-Line B3202, or Hunt 84.
- .5 Framing Channels: provide 41 mm x 62 mm roll formed carbon steel framed channel, having a thickness of 2.7 mm. Channel to have a continuous slot along one side with in-turned clamping ridges. Single Channel: Unistrut P5500, B-Line B12, Powerstrut PS150. Double Channel: Unistrut P5501, B-Line B12A, Powerstrut PS 150 2T3.

PART 3 - EXECUTION

3.1 HANGERS AND SUPPORT LOCATION

- .1 Design and locate hangers and supports as near as possible to concentrated loads such as valve, flanges, etc. Locate hangers, supports and accessories within appropriate span lengths to support continuous pipeline runs unaffected by concentrated loads.
- .2 Provide hangers and/or base supports within one metre of each change in direction on each leg, on one side of each valve, and on the first spool piece or fitting extending from a piece of equipment.
- .3 Locate hangers and supports to ensure that connections to equipment, tanks, etc. are substantially free from loads transmitted by the piping.

3.1 HANGERS AND SUPPORT LOCATION (Cont'd)

- .4 Support piping so that temporary pipe supports will not be required when removing parts of the piping system for equipment maintenance.
- .5 Support piping so that no pockets will be formed in the span due to sagging of the pipe between supports caused by the weight of the pipe, medium in the pipe, insulation, valves and fittings.
- .6 Provide supplementary structural steel members where structural bearing does not exist or where inserts are not in suitable locations.

3.2 INSTALLATION

- .1 Unless otherwise specified, do not drill or burn holes in the building structural steel.
- .2 Do not use hanger components for purposes other than for which they were designed. Do not use hanger components for rigging and erection purposes.
- .3 Recoat ends of framing channels cut to length with zinc dust-zinc oxide coating.
- .4 Include any piping support modifications on the shop drawings submitted prior to fabrication or installation.
- .5 Review the drawings prior to installation of piping, conduit, and fixtures by this or any other Division. Identify any conflicts and confirm the routing of each section of pipework prior to commencement of installation. Advise of any conflicts with existing services. Where necessary, amend the routing of pipework to avoid conflict and provide shop drawings showing proposed routing.
- .6 Prior to installation, inspect and field measure to ensure that previous work is not prejudicial to the proper installation of piping.

3.2 INSTALLATION .7 All minor modifications to accommodate
(Cont'd) installed equipment and structural
 components are subject to review. Do not
 commence work on related piping until
 Departmental Representative's review is
 complete.

3.3 ADJUSTMENTS .1 Adjust hangers and supports to obtain
 required pipe slope and elevation. Use shims
 made of material that is compatible with the
 piping material. Adjust stanchions prior to
 grouting of baseplates.

PART 1 - GENERAL

<u>1.1 RELATED REQUIREMENTS</u>	.1	Section 45 05 17 - Pipe Welding.
	.2	Section 45 05 05 - Installation of Pipework.
<u>1.2 REFERENCES</u>	.1	Conform to the following reference standards.
	.1	American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
	.1	ANSI/ASME B31.1-2014, Power Piping.
	.2	ANSI/ASME B31.3-2012, Process Piping.
	.3	ANSI/ASME Boiler and Pressure Vessel Code-2013:
	.1	BPVC 2013 Section I: Power Boilers.
	.2	BPVC 2013 Section V: Nondestructive Examination.
	.3	BPVC 2013 Section IX: Welding and Brazing Qualifications.
	.2	Canadian Standards Association (CSA International)
	.1	CSA B51-14 - Boiler, pressure Vessel and pressure piping code.
	.2	CSA S826 Series 01 - Ferry Boarding Facilities.
	.3	American Society for Testing and Materials (ASTM)
	.1	ASTM A312/312M, Seamless and Welded Austenitic Stainless Steel Pipe.
<u>1.3 OPERATING AND MAINTENANCE DATA</u>	.1	Provide maintenance data for incorporation into the manual specified in Section 01 33 00 - Submittal Procedures.
<u>1.4 SUBMITTALS FOR REVIEW</u>	.1	Provide as specified in Division 01.
	.2	Submit document listing pipe, fittings, and valving to be used for each pipe system.

1.4 SUBMITTALS FOR
REVIEW
(Cont'd)

- .3 Design, select, locate and provide piping supports, pipe guides, and anchors required for final piping layout. Typical details and acceptable attachments shown on the drawings are provided only for general guidance.
- .4 Provide the necessary submittals and ensure the proper registration of piping systems and system components as required by the regulatory authorities having jurisdiction.
- .5 Provide hanger, guide anchor and supports design details including locations and illustrative drawings.

1.5 SUBMITTALS FOR
INFORMATION ONLY

- .1 Submit copies of all original submittals and all related correspondence made as part of the regulatory submissions required by regulatory authorities.
- .2 Product Samples: Where specified or when directed by the Departmental Representative, provide mill test results product samples.
- .3 Submit current and complete documentation of the welder's qualifications prior to the commencement of welding.

1.6 PIPE MATERIALS
- GENERAL

- .1 All pipe materials to be new, free from defects and conforming to applicable reference standards.
- .2 Where any standard referenced has been superseded prior to bidding, the Contractor shall comply with the current standard.

1.7 JOINTS -
GENERAL

- .1 Connect piping using joints not readily disassembled only where shown and where not otherwise specified. provide joints which may be disassembled at the minimum, within 1.0 m of any connection to equipment, on both sides of structural penetrations, within 0.6 m of all threaded end valves, and at the spacing specified in the detailed piping specification sheets.
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1.7 JOINTS - GENERAL (Cont'd)	.2	For schedule rated stainless steel pipe smaller than 80 mm in diameter, socket-weld pipe. Where disassembly is required, use threaded unions.
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PART 2 - PRODUCTS

2.1 THREADED COUPLINGS	.1	Make screwed joints using American Standard threads to ANSI B1.20.1.
	.2	Use Teflon Tape as threaded lubricant for threaded joints.

2.2 FITTINGS	.1	Provide socket welding fittings in stainless steel pipelines less than 80 mm CI. 3000, same material as the pipe.
	.2	Provide long radius elbows unless otherwise shown.

2.3 HYDRAULIC TUBING MATERIAL	.1	316L, seamless, stainless tubing to ASTM Standard A312 designed to operate at 20.7MPa (3000psi).
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2.4 HYDRAULIC HOSE MATERIAL	.1	Hoses to be complete with 316L stainless steel end fittings, shall meet SAE standards and shall be approved for a pressure rating by the hose manufacturer for 20.7MPa (3000psi).
	.2	Hoses used outdoors shall be compatible with marine environments and UV exposure.

2.5 WELDING MATERIALS	.1	Use welding materials conforming to CSA W48.1.
	.2	Provide electrodes compatible with the material welded and which deposit metal with strength and corrosion resistance properties at least equivalent to the base metal.

<u>2.5 WELDING MATERIALS (Cont'd)</u>	.3	Provide proper storage for welding rod. Provide rod ovens in cold or inclement weather.
<u>2.6 DISSIMILAR METAL CONNECTIONS</u>	.1	Where dissimilar metals are to be connected, furnish dielectric fittings and/or isolating flanges.
<u>2.7 CATHODIC PROTECTION</u>	.1	Provide cathodic protection of piping, pipe fittings and appurtenances where specified.
<u>2.8 EXTERIOR FINISHES - SHOP APPLIED</u>	.1	Provide produces with factory applied coatings and finishes as specified.
<u>2.9 EXTERIOR FINISHES - FIELD APPLIED</u>	.1	Use field applied finishes only for: short lengths of metal pipe in a piping system where the length of pipe which requires coating is less than 3.0 metres unless otherwise specified; to repair shop-applied exterior finishes; to make up cutback distances at joints; and for fittings, couplings, valves and other appurtenances.
<u>2.10 DIELECTRIC COUPLINGS</u>	.1	Wherever pipes of dissimilar metals are joined.
	.2	Insulating unions for pipe sizes 50 mm and smaller and insulating flanges for pipe sizes larger than 50 mm.
<u>2.11 DRAIN VALVES</u>	.1	Locate at all low points and section isolating valves unless otherwise specified.
	.2	Minimum 20 mm size unless otherwise specified: straight pattern bronze with hose end male thread and complete with cap and chain.

2.12 VIBRATION ISOLATION

- .1 Elastomeric Pads:
 - .1 Type P1: neoprene waffle or ribbed, 9 mm minimum thickness, 50 durometer, maximum loading 350 kPa.
 - .2 Type P2: rubber waffle or ribbed, 9 mm minimum thickness, 30 durometer natural rubber, maximum loading 415 kPa.
 - .3 Type P3: neoprene-steel-neoprene, 9 mm minimum thick neoprene bonded to 1.71 mm steel plate, 50 durometer neoprene, waffle or ribbed, holes sleeved with isolation washers.
 - .4 Type P4: rubber-steel-rubber, 9 mm thick rubber bonded to 1.71 mm steel plate, 30 durometer natural rubber, waffle or ribbed, holes sleeved with isolation washers.
 - .5 Acceptable product: Korfund, Vibron, Vibro-Acoustics.
- .2 Elastomeric Mounts:
 - .1 Type M1: colour coded, neoprene-in-shear, maximum durometer of 60, threaded insert and two bolt-down holes, rubbed top and bottom surfaces.
 - .2 Acceptable product: Korfund, Vibron, Vibro-Acoustic.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- .1 Install pipework in accordance with Section 45 05 05 - Installation of Pipework and as specified herein.
- .2 Conform to requirements of ANSI B31 code for pressure piping.
- .3 Install straight, parallel and close to walls and ceilings, with specified pitch. Use standard fittings for direction changes.
- .4 Install groups of piping parallel to each other, spaced to permit application of insulation, identification, and service access, on trapeze hangers.
- .5 Make pipe ends round and true, suitable for weld connection.

3.1 PIPING
INSTALLATION
(Cont'd)

- .6 Ream ends of pipe and tubes before being made up.
- .7 Use non-corrosive lubricant or teflon tape applied to male thread only.
- .8 Clean ends of pipes or tubing and recesses of fittings to be brazed or soldered. Assemble joints without binding.
- .9 Support piping during construction to prevent abnormal stresses on the pipe works.
- .10 Install pipe supports where indicated on the drawings or as required.
- .11 Install pipe hangers as required.

3.2 VALVES
INSTALLATION

- .1 Storage of Valves:
 - .1 Store valves in cool and clean location, away from moving vehicles or other objects.
 - .2 Prevent dirt and debris entering the valve internals.
 - .3 Protect the valve seats against painting.
 - .4 Store valves with their handwheels, operator shafts and operators in an upright position.
- .2 Handling Valves:
 - .1 Use sling either around valve body or with bolts or rods through the flange holes.
- .3 Installation of Valves;
 - .1 Installation of valves to be by competent personnel and in strict accordance with manufacturer's instructions.
 - .2 Inspect pipe and remove all foreign debris or objects that may prevent closing of valves prior to the installation of any valves.

3.3 PROTECTION OF
OPENINGS

- .1 Protect equipment and system openings from dirt, dust and other foreign materials.
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3.3 PROTECTION OF OPENINGS
(Cont'd)

.2 Thoroughly clean piping, ducts and equipment of dirt, cuttings, and other foreign substances prior to being put into operation.

3.4 EQUIPMENT PIPING CONNECTIONS

.1 Where equipment connections are a different size from the piping serving it all associated isolating valves and fittings to be the larger pipe size unless specifically indicated otherwise on the drawings. This rule to also apply in the case of control valves.

3.5 SLEEVES

.1 Provide individual PVC sleeves for all pipes, tubes or ducts penetrating all walls and floor slabs. Grout tightly in place for full depth of wall or slab.

.2 Sizes:

.1 Provide 6 mm clearance all around, between sleeves and pipe or between sleeve and insulation.

.3 Terminate sleeves flush with surface of concrete and masonry and above floors.

.4 Voids Around Pipes:

.1 Caulk between sleeve and pipe in foundation walls and below grade floors with oakum and PC-4 caulking compound between sleeve and pipe.

.2 Where sleeves pass through walls or floors, caulk space between sleeve and insulation or between sleeve and pipe with dry oakum. Seal space at each end of sleeve with waterproof, fire retardant, non-hardening mastic.

.3 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint.

.5 Where pipes and ducts pass through walls and floors having a fire separation rating, pack the space with approved caulking material and seal in accordance with CGSB 19-GP-9.

3.6 VIBRATION
ISOLATION

- .1 Installation:
 - .1 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mounting to level equipment.
 - .2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping and ducting passage through walls and floors do not transmit vibrations.
 - .3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:
 - .1 Up to 100 mm size: first 3 points of support; 150 mm to 200 mm size: first 4 points of support; 250 mm size and larger: first 6 points of support.
 - .2 First point of support to have static deflection of twice deflection of isolated equipment, but not more than 50 mm.
 - .4 Where isolation is bolted to the floor avoid short circuiting of sound pads by using vibration isolation washers.
 - .5 Block and shim level all based so that ductwork and piping connections can be made to a rigid system at the operating level before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.7 CUTTING AND
PATCHING

- .1 Minimize cutting and patching required. Set sleeves and mark openings in concrete for and masonry structure prior to the placement of concrete or masonry.

PART 1 - GENERAL

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| <u>1.1 RELATED REQUIREMENTS</u> | .1 | Section 45 05 05 - Installation of Pipework. |
| | .2 | Section 45 05 17 - Pipe Welding. |
| | .3 | Section 45 20 13 - High Pressure Hydraulic Piping. |
| | .4 | Section 26 29 10 - Motor Starters to 600V. |

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|-----------------------|----|--|
| <u>1.2 REFERENCES</u> | .1 | CSA Group |
| | .1 | CSA B51-14 - Boiler, Pressure Vessel and Pressure Piping Code. |
| | .2 | CSA S826 Series 01 - Ferry Boarding Facilities. |
| | .3 | CSA G4-09(R2014) - Steel Wire Rope For General Purpose and For Mine Hoisting and Mine Haulage. |
| | .4 | CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations. |
| | .2 | Green Seal (GS) |
| | .1 | GS-11-11, Standard for Paints and Coatings. |
| | .3 | South Coast Air Quality Management District (SCAQMD) |
| | .1 | SCAQMD Rule 1168-05, Adhesives and Sealants Applications. |

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| <u>1.3 ACTION AND INFORMATIONAL SUBMITTALS</u> | .1 | Provide submittals in accordance with Section 01 33 00 - Submittal Procedures. |
| | .2 | Product Data: |
| | .1 | Submit manufacturer's instructions, printed product literature and data sheets for Mechanical Ramp Lifting Mechanisms and include product characteristics, performance criteria, physical size, finish and limitations. |
| | .3 | Shop Drawings: |
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1.3 ACTION AND
INFORMATIONAL
SUBMITTALS
(Cont'd)

- .3 (Cont'd)
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Nova Scotia and prince Edward Island, Canada.
 - .2 Indicate on drawings:
 - .1 Power units: space, size and location.
 - .2 Control station location.
 - .3 Location of disconnect switch and electric power requirements.
 - .4 Manufacturer's Field Reports:
 - .1 As required per CSA B51.

1.4 CLOSEOUT
SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 Closeout Submittals
- .2 Operation and Maintenance Data: submit operation and maintenance data for Mechanical Ramp Lifting Mechanisms into manual.
 - .1 Include:
 - .1 Description of system's method of operation.
 - .2 Manufacturer's instructions covering maintenance requirements and parts catalogue giving complete list of repair and replacement parts with cuts and identifying numbers.
 - .3 Legible schematic wiring diagrams covering electrical equipment as supplied and installed, including changes made in final work, with symbols listed corresponding to identity or markings on equipment.

1.5 DELIVERY,
STORAGE AND
HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .3 Storage and Handling Requirements:
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| 1.5 DELIVERY,
STORAGE AND
HANDLING
(Cont'd) | .3 (Cont'd) | .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area. |
| | | .2 Store and protect hydraulic platform lifts from nicks, scratches, and blemishes. |
| | | .3 Replace defective or damaged materials with new. |
| | .4 | Packaging Waste Management: remove for reuse as specified in Construction Waste management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal. |

PART 2 - PRODUCTS

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|---------------------------|----|--|
| 2.1 SYSTEM
DESCRIPTION | .1 | Provide a complete lifting mechanism package consisting of 2 hydraulic lifting winches capable of lifting, lowering, braking and operating in constant tension. Ancillary components such as controls, wire ropes, sheaves and hydraulic power packs shall be included in the package. |
| | .2 | Rated load: |
| | .1 | 12080 kg on the port side of the ramp. |
| | .2 | 11670 kg on the starboard side of the ramp. |
| | .3 | Travel: 3790 mm, measured at the end of the main span of the ramp. |
| | .4 | Line Speed: 2m/min, in "UP" direction and 2m/min in "DOWN" direction with rated load in both directions. |

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|----------------|----|---|
| 2.2 COMPONENTS | .1 | Use major components from standard product line of one manufacturer, or combine with products of another manufacturer provided such items are designed and produced under co-ordinated specifications to ensure safe and smooth operating system. |
| | .1 | Standard of acceptance: Hawboldt Industries. |
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2.2 COMPONENTS
(Cont'd)

- .2 Use components which have performed satisfactorily together under conditions of normal use in not less than two other installations of similar design and for a period of at least one year. Furnish to Departmental Representative names and addresses of owners, in which proposed combination of major components has so performed.
- .3 Major components means winch, motor, pumping unit, controller, operation and control systems.
- .4 Bearings according to manufacturer recommendations, but shall not exceed allowable stress of parent material in which they are retained.

2.3 ELECTRICAL
WIRING, CONDUIT AND
FITTINGS

- .1 Use steel compression type fittings where electrical metallic tubing is used. Do not use fittings with set screws.
- .2 Do not use rigid PVC conduit.

2.4 POWER SUPPLY

- .1 Power supply: 575 V, 3 phase, 60 Hz.
- .2 Do not parallel conductors to increase current carrying capacity, unless individually fused.
- .3 Do not use armoured flexible metal conduit as grounding conductor.

2.5 LUBRICATION

- .1 Provide means of lubricating bearings requiring periodic lubrication.
 - .2 When used, provide grease fittings to fit same gun.
 - .3 Use grease cups of automatic feed compression type.
 - .4 Points of lubrication to be visible and accessible.
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- 2.6 LIFTING WINCHES
- .1 Design lifting winch units with single layer of winding.
 - .2 Provide sufficient drum diameter and face to receive wire ropes in grooving and wind in single layer with not less than two permanent turns of rope beyond length required for prescribed limits of travel.
 - .3 Drum diameter shall be 1016mm (40").
 - .4 Drum grooves shall have the following characteristics:
 - .1 The pitch of groove shall equal wire rope diameter plus 10%.
 - .2 The radius of the groove shall equal the radius of the wire rope plus 10%.
 - .5 The wire rope shall be moored to the drum in a manner designed to avoid rope damage and to obtain a level of effectiveness comparable to that of other wire rope terminations.
 - .6 Locate lifting winches as shown on the drawings.
 - .7 Ensure ropes do not rub against adjacent turns as they wind and unwind on winch drum.
 - .8 Include hydraulically operated, constant tension, planetary integral fail safe drive unit to drum complete with band brake.
 - .9 Include means for testing braking system. Guard external gears against accidental contact and provide for ready inspection of gears.
 - .10 Protect system from weather through hot dipped galvanized coating and from mechanical damage.

- 2.7 WIRE LIFTING ROPE
- .1 Provide preformed 38mm (1-1/2"), right or left regular lay as shown on the drawings, 6 x 37 classification, steel core, lifting rope in conformance to CSA Standard G4.
 - .2 Rope class: 110/120IPS.
 - .3 Lubrication: Standard.

2.7 WIRE LIFTING

ROPE

(Cont'd)

- .4 Provide rope with a minimum manufacturer's listed breaking load of 103.4 tonnes (114 tons).
- .5 Wire rope shall have minimum angle of helical strand with axis of rope of 34 degrees.
- .6 Provide approximately 18m of wire rope total for each winch assembly.
- .7 Wire rope terminations shall consist of loops formed with a steel thimble and double saddle type wire clips per manufacturer's instructions.

2.8 SHEAVES

- .1 Provide sheaves of cast or forged steel with minimum hardness of the groove contact area of Rockwell-C35.
- .2 Sheave diameter shall be as shown on the drawings.
- .3 Sheave groove diameter shall be equal to the nominal wire rope diameter plus 1.59mm (1/16").
- .4 The groove/wire rope contact angle shall be between 120 and 150 degrees.
- .5 Sheave shall be complete with plain bronze bushing sized to fit 76.2mm pin as detailed on structural drawings.

2.9

ELECTRO-HYDRAULIC SYSTEM

- .1 Provide hydraulic system consisting essentially of hydraulic pumps, hydraulic winches, pressure relief valve, fluid reservoir, valves, and connections. Minimize leakage from hydraulic system. Install drip pan under reservoir pump and other leakage areas.
- .2 Hydraulic System Pressures:
 - .1 The hydraulic system shall be designed to ensure that the maximum encountered pressure in all parts of the system does not exceed 207bars (3000psi).

- 2.9
ELECTRO-HYDRAULIC
SYSTEM
(Cont'd)
- .2 (Cont'd)
- .2 The continuous operating pressure shall not exceed 196bars (2800psi).
- .3 The minimum holding pressure required to support the unbalanced ramp load shall not be less than 35bars (500psi), unless the system and related components are designed to operate at less than this pressure.
- .4 Rated operating pressure for hydraulic components:
- .1 Piping, tubing and their fittings: 207bars (3000psi).
- .2 Flexible hose and hose fittings for pressure lines: 280bars (5000psi).
- .3 Winch drives, pumps, valves and all other components: 207 bars (3000psi).
- .5 The minimum burst pressure for all components other than control valves, and pumps shall be 4.0 times their rated operating pressure. Control valves, and pumps shall have a minimum burst pressure of 2.5 times their rated operating pressure.
- .3 Include:
- .1 Oil seals, gaskets, oil connections, and air elimination means.
- .2 Pump suction-line strainer.
- .3 Fluid-level gauge with minimum fluid level clearly indicated.
- .4 Reservoir with valved drain, filling opening filter and cover, and reservoir vent that will not allow entrance of dust.
- .5 Safety orifice at winches to control oil flow in case of pipe breakage.
- .4 Provide pump motor starters as specified in specification section 26 29 10 - Motor Starters to 600V.
- 2.10 CONTROL SYSTEM
- .1 Operating movements:
- .1 The movement of the hydraulic lifting mechanism shall be controlled electronically through proportional solenoid-activated valving units.
- .2 Valving units shall be marine service rated and control the speed, acceleration, deceleration and constant tension application of the ramp.

- 2.10 CONTROL SYSTEM .2
(Cont'd)
- There shall be 2 control stations; one located in the existing control booth and one located on the ramp as indicated on the drawings.
- .1 Joysticks and pushbuttons shall be permanently and clearly labelled.
- .2 Indoor Control Booth: At a minimum, the indoor control station shall be lockable and have two joysticks indicating "Raise Bridge", "Lower Bridge" and a pushbutton indicating "constant Tension" as well as "ON" and "OFF" for each pump set and constant tension operation. The control station shall have the ability to operate the lifting winches in unison and independently.
- .3 Outdoor Control Station: At a minimum, the outdoor control station shall have a joystick indicating "Raise Bridge", "Lower Bridge" as well as pushbuttons indicating "ON" and "OFF" for the constant tension operation. The control station shall have the ability to operate the lifting winches in unison.
- .3 Provide accurately controlled stopping in both up and down directions and maintain platform in multiple positions at which it is stopped until direction button is pressed.
- .4 Provide approved limit switches to limit regular up and down travel of platform. These limit switches should be capable of being overridden only from the control booth.
- .5 Provide an approved extreme high limit fault switch located approximately 127mm (5") from the point of collision between the sheave and the winch. The fault switch shall be capable of being overridden if there is a call from the controls to lower the ramp.
- .6 Provide indicator alarms to indicate sensor and limit switch malfunctions. Alarms shall include but not be limited to:
- .1 Lower limit switch malfunction.
- .2 Upper limit switch malfunction.
- .3 Extreme high limit fault switch malfunction.
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- 2.10 CONTROL SYSTEM .6 (Cont'd)
(Cont'd) .4 Ramp Level Sensor malfunction.
- .7 Lifting mechanism sequence of operation:
.1 WHEN FERRY IS DOCKING THE OPERATOR SHALL MANUALLY RAISE AND LOWER THE RAMP AS REQUIRED.
.2 ONCE THE RAMP IS RESTING ON THE FERRY, THE OPERATOR SHALL PLACE THE WINCHES IN CONSTANT TENSION MODE. THE CONSTANT TENSION WILL NOT BE USED TO LIFT THE RAMP; THE CONSTANT TENSION WILL ONLY BE USED TO TAKE UP SLACK ON THE WIRE ROPE. DURING CONSTANT TENSION MODE THE WINCHES WILL BE CAPABLE OF DESPOOLING TO ACCOMMODATE LOADING PROCESSES.
.3 ONCE THE FERRY IS READY TO DEPART, THE OPERATOR WILL MANUALLY RAISE THE RAMP AND USE THE WINCH BRAKE TO LOCK THE RAMP IN PLACE. THE WINCH BRAKE WILL ALSO BE ACTIVATED BY LIMIT SWITCHES CONNECTED TO THE COUNTERWEIGHT SYSTEM & THE EXTREME HIGH LIMIT FAULT SWITCH.

- 2.11 SOURCE QUALITY .1 Tests, Inspection:
CONTROL .1 Where welding is used for pressurized piping, use welders fully qualified for pressure vessel welding.
.2 Subject welds to non-destructive inspection as required by Section 45 05 17 - Pipe Welding.
.3 Inspection and testing will be carried out by firm approved by Departmental Representative.

PART 3 - EXECUTION

- 3.1 EXAMINATION .1 Verification of conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for Mechanical Ramp Lifting Mechanism installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
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|--------------------------------------|----|--|
| <u>3.1 EXAMINATION
(Cont'd)</u> | .1 | (Cont'd)
.3 proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative. |
| <u>3.2 FIELD QUALITY
CONTROL</u> | .1 | Site Tests:
.1 Perform and meet tests required by Departmental Representative authorities having jurisdiction.
.2 Supply instruments and carry out additional specified tests to approval of Departmental Representative.
.3 Submit to Departmental Representative approval certificates issued by jurisdictional authorities.
.4 Test hydraulic system by hydrostatic method. |
| | .2 | Manufacturer's Field Services:
.1 provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation. |
| <u>3.3 CLEANING</u> | .1 | Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
.1 Leave Work area clean at end of each day. |
| | .2 | Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning. |
| | .3 | Remove protective coverings from finished surfaces and components. |
| | .4 | Clean surfaces and components ready for inspection. |
| | .5 | Touch up and restore to new condition, damaged or defaced factory finished surfaces. |
| | .6 | Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management. |
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|----------------------------|-------------|---|
| 3.3 CLEANING
(Cont'd) | .6 (Cont'd) | .1 Remove recycling containers and bins from site and Dispose of materials at appropriate facility. |
| 3.4 CLOSEOUT
ACTIVITIES | .1 | Demonstration:
.1 Instruct designated accommodation maintenance personnel in care, adjustment and operation of Mechanical Ramp Lifting Mechanism.
.2 Provide competent instructor for not less than two eight-hour days after completion and acceptance of work.
.3 Forward statement Departmental Representative countersigned by accommodation personnel confirming these instructions have been provided. |