

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 23 05 00 - Common Work Results for HVAC
- .2 Section 23 05 05 - Installation of Pipework
- .3 Section 23 05 17 - Pipe Welding
- .4 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
- .5 Section 23 05 53.01 - Mechanical Identification

1.2 REFERENCES

- .1 American Iron and Steel Institute (AISI)
- .2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - .1 ANSI/ASME B1.20.1-2013, Pipe Threads, General Purpose (Inch).
 - .2 ASME B31.1-07, Power Piping.
- .3 ASTM International
 - .1 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .2 ASTM A105/A105M-13, Standard Specification for Carbon Steel Forgings for Piping Applications.
 - .3 ASTM A106/A106M-13, Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service.
 - .4 ASTM A181/A181M-13, Standard Specification for Carbon Steel Forgings, for General-Purpose Piping.
 - .5 ASTM A193/A193M-12b, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
 - .6 ASTM A194/A194M-13, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
 - .7 ASTM A234/A234M-13e1, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-14.5-M88, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.
- .5 CSA International
 - .1 CSA B51-14, Boiler, Pressure Vessel and Pressure Piping Code.
- .6 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .8 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
 - .1 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .1 Include in shop drawings: plans, elevations, sections, of following.
 - .1 Prefabricated sections with field connection points.
 - .2 Branch connections.
 - .3 Equipment connections.
 - .4 Pipe supports.

- .5 Expansion joints, anchors and guides. Include relevant engineering data.
- .6 Include relevant engineering data.
- .7 Expansion loops, anchors and guides.
- .8 Vents, drains.
- .9 Pipeline identification data.
- .2 Shop drawings for alternative systems for expansion loops as reviewed by Departmental Representative before fabrication, to include.
 - .1 Calculations based on temperature between -18 degrees C and system operating temperature plus 25%.
- .4 Proposed alterations to existing high pressure system are to be reviewed by certified boiler inspector of authorized insurance company under contract with PWGSC. If existing system was registered (and a P# exists), they will prepare a Piping Data Report using the P# of existing system and submit it to Provincial Authority. They may require registration of existing system or a drawing be prepared and stamped by a Professional Engineer showing proposed changes. Contractor pays for all applications, permits, and other associated fees for above work.
- .5 Once approved drawings are received, construction may proceed with quality control and compliance to specs provided by Departmental Representative for in-house project.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide Project Record Documents in accordance with Section 01 78 00 - Closeout Submittals and 23 05 00 - Common Work Results for HVAC supplemented with:
 - .1 Information relating to elevations, inverts and location of piping, branches, anchors, expansion joints, loops.
 - .2 Valve data.
 - .3 Details of permanent instrumentation.
 - .4 Details of permanent provisions for temporary instrumentation.
 - .5 Access points.
 - .6 Details of pipe grades, vents, drip points.

- .7 Drainage provisions at low points.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Extra Materials/Spare Parts:
 - .1 Furnish following spare parts:
 - .1 Valve seats: one for every ten valves, each size. Minimum: one.
 - .2 Balls: one for every ten valves, each size. Minimum: one.
 - .3 O-Rings: one for every twenty of each type and size supplied. Minimum: two.
 - .4 Valve handles: two of each size.
 - .5 Flange gaskets: one for every ten flanged joints. Minimum one.
- .3 Tools:
 - .1 Furnish special tools for maintenance of systems and equipment.
 - .2 Include following:
 - .1 Lubricant gun for expansion joints.

1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: ensure Work is performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial regulations.
- .2 Inspections:
 - .1 Inspect new piping prior to hydrostatic test. Where Province has approved drawings, certified boiler inspector to inspect installation.
 - .2 Costs for inspection to be covered by Contractor.

1.7 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:

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Packaging Waste Management: remove for reuse pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Valves to be repackable under full line pressure while fully open.

2.2 HIGH PRESSURE STEAM (275 TO 1034 KPA) AND PUMPED CONDENSATE RETURN UP TO 860 KPA

- .1 Piping:
 - .1 To ASTM A53/A53M, Grade B or ASTM A106/A106M.
 - .2 Steam:
 - .1 NPS 1/2 to 1-1/2: Schedule 80, seamless.
 - .2 NPS 2 to 10: Schedule 40-ERW, bevel ends.
 - .3 NPS 12 and over: 10 mm wall, ERW.
 - .3 Pumped condensate return: Schedule 80, ERW, screwed or plain ends.
- .2 Fittings:
 - .1 NPS 1/2 to 1-1/2: Class 3000, 20 MPa, forged steel, screwed ends, to ASTM A105/A105M.
 - .2 NPS 2 and over: Schedule 40, bevel ends, to ASTM A234/A234M, Grade WPB.
- .3 Fittings for pumped condensate return:
 - .1 Schedule 80, ERW, plain ends, to ASTM A53/A53M, Grade B.
- .4 Couplings, caps, plugs:
 - .1 NPS 1/2 to 1-1/2: Class 3000, screwed, to ASTM A105/A105M.

- .5 Unions:
 - .1 NPS 1/2 to 1-1/2: Class 3000, screwed ends, steel-to-steel ground joints to ASTM A105/A105M.
- .6 Flanges:
 - .1 NPS 1/2 to 1-1/2: Class **300 or to match valve as required**, full faced screwed, to ASTM A105/A105M.
 - .2 NPS 2 and over: Class **300 or to match valve as required**, full faced, weld neck, bored to suit pipe, to ASTM A105/A105M.
- .7 Studs, bolts and nuts:
 - .1 Studs, bolts: With heavy hex heads, alloy steel to ASTM A193/A193M, grade B7.
 - .2 Nuts: Semi-finished heavy hex., to ASTM A194/A194M, grade 2H.
- .8 Gaskets:
 - .1 Steel flex, 1.6 mm thick, full face, rated for temperature and pressure of system.
- .9 Gate valves for steam systems:
 - .1 NPS 1/2 to 1-1/2: Class 800, screwed ends, forged steel body, union bonnet, solid wedge disc, rising stem.
 - .2 NPS 2 and over: Class 300, full faced flanged ends, cast steel body, hardened stainless steel trim, OS Y, wedge disc.
- .10 Gate valves for pumped condensate return:
 - .1 NPS 1/2 to 1-1/2: Class 800, screwed ends, forged steel body, union bonnet, solid wedge disc, rising stem.
 - .2 NPS 2 and over: Class 150, full faced flanged ends, cast steel body, hardened stainless steel trim, OS Y, wedge disc.

2.3 HIGH PRESSURE STEAM UP TO 6.0 MPA

- .1 Piping:
 - .1 To ASTM A106/A106M, Grade A.

- .2 Steam:
 - .1 NPS 1/2 to 1-1/2: Schedule 80 seamless, plain ends.
 - .2 NPS 2 and over: Schedule 40 seamless, bevel ends.
- .2 Fittings for steam:
 - .1 NPS 1/2 to 1-1/2: Class 3000, forged steel, socket weld, to ASTM A105/A105M.
 - .2 NPS 2 to 10: Schedule 40 welding fittings, seamless, bevel ends, to ASTM A234/A234M, Grade WPB.
 - .3 NPS 12 and over: 10 mm wall thickness, seamless, bevel ends, to ASTM A234/A234M, Grade WPB.
- .3 Couplings:
 - .1 NPS 1/2 to 1-1/2: Class 3000, socket weld, to ASTM A181/A181M, Class 70.
- .4 Flanges:
 - .1 NPS 1/2 and 3/4: Class 3000, raised face, socket weld bored to match pipe, to ASTM A181/A181M, Class 70.
 - .2 NPS 1 to 12: Class 3000, raised face, weld neck, bored to match pipe, to ASTM A181/A181M, Class 70.
- .5 Studs, bolts and nuts:
 - .1 Studs, bolts: With heavy hex heads, alloy steel, to ASTM A193/A193M, Grade B7.
 - .2 Nuts: Semi-finished, heavy hex, to ASTM A194/A194M, Grade 2H.
- .6 Gaskets:
 - .1 Steel flex, 1.6 mm thick, rated for temperature and pressure of system.
- .7 **Remarks:**
 - .1 **These are to be used on the new boiler up to and including the pressure relief valves.**

2.4 BASES, HANGERS AND SUPPORTS

- .1 Conform to Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment supplemented as specified herein.
- .2 Provide to details as indicated.
- .3 Submit shop drawings for approval before fabrication.
- .4 Percussion type inserts not permitted.
- .5 Power driven fasteners not permitted.

2.5 THERMOMETERS

- .1 Thermometer:
 - .1 Bi-metallic, self-indicating, 90 mm diameter, mercury-free, dial type, variable angle, to CAN/CGSB-14.5
 - .2 Accuracy: 0.5% over full range.
 - .3 Range: maximum 1.5 times maximum operating temperature.
- .2 Thermowell: separable stainless steel.

2.6 PRESSURE GAUGES

- .1 Dial type, 90 mm diameter, self-indicating.
- .2 Accuracy: 0.5% over full range.
- .3 Range: 1.5 times operating pressure.
- .4 Accessories:
 - .1 Shut-off valve: class 300 steel ball.
 - .2 Syphon (for steam service).
 - .3 Liquid pulsating service: provide liquid-filled pressure gauges.
 - .4 Diaphragm (for corrosive service).

2.7 FABRICATION

- .1 Do work in accordance with ASME B31.1.
- .2 Joints:

- .1 Accessible locations: screwed, flanged or welded to match piping specification.
- .2 Elsewhere: welded throughout, except at flanged components.
- .3 Screwed joints:
 - .1 To ANSI/ASME B1.20.1.
 - .2 Provide clean machine-cut threads.
 - .3 Use PTFE tape or lead-free pipe dope or paste on male threads.
- .4 Branch connections:
 - .1 Use butt or socket-weld fittings.
 - .2 Mains NPS 2-1/2 and smaller: use weldolets, threadolets, or 2 Mpa half couplings as reinforcements.
 - .3 Mains NPS 3 and larger: welded branch connections can be used.
 - .4 In grooved systems: tees and reducing tees can be used.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Lay out work in accordance with lines and grades as indicated.
- .2 Verify lines, levels, dimensions as indicated against established benchmarks. Report discrepancies to Departmental Representative and obtain written instruction.
- .3 When required by Departmental Representative, provide drawings showing relative locations of various services.

3.2 WELDING

- .1 Perform welding in accordance with Section 23 05 17 - Pipe Welding supplemented as specified herein.
- .2 Notwithstanding the requirements of referenced section, the following shall apply:
 - .1 Welding to be in accordance with ASME B31.1.
 - .2 Welding to be executed by certified pipe welders.
 - .3 Pipe fitting to be executed by certified pipe fitters.

3.3 INSTALLATION

- .1 Installation to be performed by certified steam fitters.
- .2 Install pipework in accordance with Section 23 05 05 - Installation of Pipework, as specified herein.
- .3 Clearances:
 - .1 Maintain clearance around systems, equipment and components and between pipes and structures for O M to manufacturer's recommendations, for greater of:
 - .1 Observation of operation, inspection, servicing, maintenance.
 - .2 Disassembly, removal of equipment and components without interrupting operation of other system, equipment, components.
 - .2 Except where indicated, install to permit separate thermal insulation of pipes.
- .4 Flanges: use suitable graphite lubricant on bolts and nuts.
- .5 Drain valves.
 - .1 Install at low points in piping systems, at equipment, at section isolating valves and elsewhere as required.
 - .2 Pipe drain valves discharge separately to above floor drain. Discharge to be visible.
 - .3 Weld couplings for drains into piping to ASME B31.1.
- .6 Provide for pipe movement as indicated and in accordance with expansion joint manufacturer's installation instructions.
- .7 Branch take-offs:
 - .1 Use welding tees.
 - .2 Where reducing tees of proper size are unavailable, use available tees with reducers. Tees with increasers not acceptable.
 - .3 Weldolets may be used at drip legs only provided ratio of outlet size to pipe size is 0.5 or smaller.
- .8 Cap open ends of piping during installation. Remove foreign material from inside piping.

- .9 Grade nominally horizontal piping in direction of flow to low point for condensate drainage.
- .10 Flanges: tighten bolts evenly with torque wrench.
- .11 Revisions to location of piping require written approval of Departmental Representative.
- .12 Connections to equipment:
 - .1 Use flanged valves for isolation and ease of maintenance and assembly.
 - .2 Use double swing joints and swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.4 PIPE SUPPORTS

- .1 In accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment, supplemented as specified herein.
- .2 Install to manufacturer's recommendations.

3.5 VALVES

- .1 Install isolating valves at branch take-offs, at pieces of equipment and elsewhere as indicated.
- .2 Install in accordance with manufacturer's recommendations.
- .3 Install in accessible locations.
- .4 Depending upon piping configuration and ease of operation, on horizontal pipes install with stem horizontal or above.
- .5 Valves to be accessible for maintenance without removing adjacent piping.

3.6 INSTALLATION OF THERMOWELLS

- .1 In general, to be installed in elbows.
 - .1 Minimize turbulence and resistance to flow.
 - .2 Install in direction of flow.
 - .3 Full length of thermowell to be in the fluid being measured.
 - .4 Increase size of piping to ensure velocity of fluid at thermowell is equal to flow rate in adjacent piping.

3.7 FIELD QUALITY CONTROL

.1 Inspections:

.1 Leave joints in piping systems uncovered until tests are completed and system inspected as directed by Departmental Representative.

.2 Radiographic inspections:

.1 Notwithstanding inspection specified in Section 23 05 17 - Pipe Welding, carry out radiograph inspections of 20% of welds on steam, HP drip, and pumped condensate return to ASME B31.1.

.2 If joints on 20% radiographic test fail, radiograph joints performed by welder whose joint failed.

.3 Radiograph repaired joints to ASME B31.1.

.4 Perform Wet magnetic particle tests on welded slip-on flanges.

.5 Submit results of radiographs, together with copy of welder's licence and description of procedures used, to inspector of insurance company under contract to PWGSC.

.3 Departmental Representative to inspect new piping prior to hydrostatic pressure tests for compliance with approved drawings and specifications.

.4 Where Province has approved the drawings, certified boiler inspector to inspect installation.

.5 Obtain from Departmental Representative requirements for inspection and testing of system modifications, design changes and repairs performed in-house.

.6 Pay costs for inspections.

.2 Hydrostatic Pressure Tests:

.1 Pressure tests are required to verify quality assurance.

.2 Give Departmental Representative minimum of 48 hours notice of intention to perform pressure tests.

.3 After installation and before concealing, subject piping to hydrostatic pressure tests to 1.5 times maximum working pressure and maintain test pressure without loss for 24 hours.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or test media.

- .5 Provide additional supports to steam piping as required and remove after testing is successfully completed.
- .6 Conduct tests in presence of Departmental Representative and as required by the certified boiler inspector of insurance company under contract to PWGSC.
- .7 Bear costs for tests, for repairs or replacement, retesting, making good.
- .8 Insulate or conceal work after approval and certification of tests by Departmental Representative.

3.8 PAINTING

- .1 Paint hangers, supports, exposed steelwork with 2 coats of rust inhibitive primer after construction and prior to beginning of insulation.

3.9 FLUSHING AND CLEANING

- .1 Cleaning Solutions:

Tri-sodium phosphate:	0.40 kg per 100 L water in system
Sodium carbonate:	0.40 kg per 100 L water in system
Low-foaming detergent:	0.01 kg per 100 L water in system

- .2 Timing:
 - .1 Systems to be operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.
- .3 Cleaning Agency:
 - .1 Retain services of qualified water treatment specialist to perform system cleaning.
- .4 Install instrumentation including flow meters, orifice plates, Pitot tubes, flow metering valves only after cleaning is certified as complete by water treatment specialist.
- .5 Conditions at time of cleaning:
 - .1 Systems to be free from construction debris, dirt and other foreign material.
 - .2 Control valves to be operational, fully open to ensure that terminal units can be cleaned properly.
 - .3 Strainers to be clean prior to initial fill.
 - .4 Install temporary filters on pumps not equipped with permanent filters.

- .5 Install pressure gauges on strainers to detect plugging.
- .6 Steam lines with spring hangers to be blocked for support
- .6 Cleaning procedures:
 - .1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:
 - .1 Cleaning procedures, flow rates, elapsed time.
 - .2 Chemicals and concentrations to be used.
 - .3 Inhibitors and concentrations.
 - .4 Specific requirements for completion of work.
 - .5 Special precautions for protecting piping system materials and components.
 - .6 Complete analysis of water to be used. This is to ensure water being used will not damage systems or equipment.
- .7 Steam Systems: in addition to general requirements as specified above, perform following:
 - .1 If using temporary connection into potable service, ensure that there is no possibility of backflow or cross-contamination.
 - .2 Fill system with water or correct heat transfer fluid, ensure air is vented from system.
 - .3 Use water meter to record volume of water in system to +/- 0.5%
 - .4 Add cleaning solution and circulate at 60 degrees C for 36 hours. Drain quickly as possible.
 - .5 Refill with water plus inhibitors. Test concentration and adjust to recommended levels. Flush velocity in system mains and branches to be adequate to ensure removal of debris. System pumps may be used for circulating cleaning solution provided velocities are adequate.
 - .6 Add cleaning solution to system. Establish circulation, raise temperature slowly to maximum design or 82 degrees C minimum. Circulate for 12 hours, ensuring flow in circuits. Remove heat, continue to circulate until temperature is below 38 degrees C. Drain quickly as possible.
 - .7 Refill with clean water. Circulate for 6 hours at design temperature. Drain.

- .8 Repeat procedures specified above. Flush through at low point drains in system.
- .9 Refill with clean water adding sodium sulphite (test for residual sulphite).
- .10 Remove internal components of steam traps until flushing and warm-up have been completed.
- .11 Open drip points to atmosphere. If needed for protection of personnel or environment, install flexible hose and direct discharge to safe location.
- .8 Steam boilers: to CSA B51.
- .9 Report on Completion of cleaning:
 - .1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.
- .10 Waste Management: separate waste materials for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

3.10 SYSTEM START-UP - GENERAL

- .1 Start-up systems after written approval of installation from Departmental Representative.
- .2 Provide 3 days written notice to Departmental Representative of intention to start-up, and commission systems.
- .3 Timing: after:
 - .1 Cleaning is completed.
 - .2 Pressure tests are completed.
 - .3 Joints radiographed as specified.
 - .4 Painting of supports, steelwork to be completed before heat is applied to system.
- .4 Provide continuous supervision during start-up.

3.11 SYSTEM START-UP STEAM SYSTEMS

- .1 Start-up system with internal parts of steam traps removed and with drip points open to atmosphere.
- .2 If necessary for personnel protection or for environmental reasons, install flexible hoses to direct discharge to safe location.

- .3 Slowly charge entire system with low pressure steam monitoring expansion joints, loops, anchors, guides, other provisions for pipe movement.
- .4 During warm-up, check operation of expansion loops, joints, anchors and guides.
 - .1 If sliding type bind, or if bellows type flex incorrectly, shut down system, re-align, repeat start-up sequence.
 - .2 Verify removal of condensate from balanced pressure type expansion joints.
- .5 Check adequacy of accessibility to expansion joints for monitoring, servicing.
- .6 Adjust pipe supports, hangers, springs as necessary.
- .7 Monitor pipe movement, performance of expansion joints, loops, anchors, guides.
- .8 Adjust piping system to eliminate water hammer.
- .9 Starting at drip point closest to source, verify removal of condensate, then re-install steam trap internal parts. Repeat sequence down the line.
- .10 Test operation of operating, limit and safety controls.
- .11 Clean out strainer baskets and dirt pockets repeatedly until system is thoroughly clean.
- .12 Re-tighten bolts as systems settle down.
- .13 Adjust valve packings as systems settle down.
- .14 Check operation of drain valves.
- .15 Check operation of make-up system by simulating blowdown and leakage. Adjust PRV on water make-up. Ensure backflow preventer is operating properly.
- .16 Verify:
 - .1 Proper operation of steam traps.
 - .2 Adequacy of cooling legs adjacent to steam traps requiring same for proper operation.
- .17 Record pressure drops across control valves at design flow rate.
- .18 Fasten any loose items of equipment to ensure quiet operation of system.
- .19 Test condensate pumping units for operation, capacity, operation of controls.

3.12 COMMISSIONING

- .1 Instrumentation: verify accuracy of thermometers and pressure gauges by comparison with calibrated test instruments.
- .2 Full scale tests: upon completion, conduct full scale tests at maximum design flow rates, operating temperatures and pressures for continuous consecutive period of 48 hours to demonstrate compliance with design requirements.
- .3 If steam system is designed to go off-line frequently, (producing excessive quantities of condensate) verify adequacy of condensate removal systems.
- .4 Reports: in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Reports, supplemented as specified herein.
- .5 Training:
 - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O M Personnel.

3.13 IDENTIFICATION

- .1 In accordance with Section 23 05 53.01 - Mechanical Identification.

3.14 DEMONSTRATIONS

- .1 Operate at design temperatures, pressures, flow rates for consecutive period of 48 hours to demonstrate compliance with design criteria and design intents.
- .2 Demonstrations also to show completeness of O M personnel training.

3.15 CERTIFICATES

- .1 Obtain data form for new pressure vessels, including heat exchangers, chillers, boilers, tanks from manufacture and submit data form and fee at own expense to authority having jurisdiction for certificate for pressure vessels.

END OF SECTION