1. GENERAL
	1. SCOPE
		1. The work to be performed includes all new equipment, labor and materials required to furnish and install Vertical Multi-Port Boilers as described in this product guide specification.
	2. REFERENCES
		1. ASME
		2. CSD-1, Controls and Safety Devices
		3. CSA/CUL
		4. GE GAP (Formerly I.R.I.)
		5. NFPA 85
		6. NEC, National Electric Code
		7. UL-795
	3. SUBMITTALS
		1. Product Data: Submit manufacturer’s technical product data, including rated capacities of selected model, weights (shipping, installed and operating), installation and start-up instructions, and furnished accessory information.
		2. Shop Drawings: Submit manufacturer’s end assembly drawings indicating dimensions, connection locations, and clearance requirements.
		3. Wiring Diagrams: Submit applicable manufacturer’s electrical requirements for the boiler including ladder type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory installed and portions to be field installed.
	4. QUALITY ASSURANCE
		1. Manufacturer’s Qualifications: Firms regularly engaged in the manufacture of vertical tubeless boilers and pressure vessels, whose products have been in satisfactory use in service for not less than sixty (60) years. The manufacturer must be a privately owned, American company. The boiler must be manufactured in the USA and be able to participate in projects that require a level of USA content of boiler materials. The specifying engineer, contractor and end customer must have the option to visit the factory during the manufacture of the boilers and be able to witness manufacturing, test fire, and other relevant procedures.
		2. The boiler package shall be certified to UL 795.
		3. The boiler will be rated for a maximum allowable working pressure of 150 PSIG for ASME Section I, 15 PSIG for ASME Section IV, or higher pressures upon request. Refer to job schedule for additional clarification.
		4. The flame safeguard to control the supply of fuel and air to the boiler for combustion shall be the Siemens LMV series for full linkage-less modulated operation.
		5. The entire boiler system and its installation shall conform to the manufacturer’s instructions, applicable codes and associated National Board requirements.
		6. The equipment shall be in strict compliance with the requirements of this specification and shall be the manufacturer’s standard commercial product unless specified otherwise. Additional equipment features, details, accessories, etc. which are not specifically identified but which are a part of the manufacturer’s standard commercial product, shall be included in the equipment being furnished.
		7. The equipment shall be of the type, design, and size that the manufacturer currently offers for sale and appears in the manufacturer’s current catalog. The boiler and burner shall be of the same manufacturer.
		8. The equipment shall fit within the allocated space, leaving ample allowance for maintenance and inspection.
		9. The equipment shall be new and fabricated from new materials. The equipment shall be free from defects in materials and workmanship.
		10. All units of the same classification shall be identical to the extent necessary to ensure interchangeability of parts, assemblies, accessories, and spare parts wherever possible.
		11. In order to provide unit responsibility for the specified capacities, efficiencies, and performance, the boiler manufacturer shall certify in writing that the equipment being submitted shall perform as specified.
		12. Boilers must be fully factory test fired prior to shipment. Test firing shall include filling with water, adjusting operating and safety control settings, and setting combustion points throughout the entire combustion range. Manufacturer shall supply copies of the test fire report, including fuel air settings and combustion test results. Factory representatives, specifying engineers, installing contractors and/or end users/customers shall all be welcome to witness the boiler being built and/or test fired at the manufacturer’s factory.
		13. Boiler inspection shall include a hydrostatic test in the presence of an inspector having a National Board Commission. The inspector shall certify a Data Report which shall be delivered with the boiler as evidence of ASME code compliance. In addition to the ASME symbol, the boiler shall bear a National Board Registration Number.
	5. WARRANTY

		1. Boiler
			1. Five (5) Year (60 Months) Material and Workmanship Warranty:
				1. The pressure vessel is covered against defective material or workmanship for a period of five (5) years from the date of shipment from the factory. Fulton will repair or replace F.O.B. factory any part of the equipment, as defined above, provided this equipment has been installed, operated and maintained by the buyer in accordance with approved practices and recommendations made by Fulton. The commissioning agency must also successfully complete and return the equipment Installation and Operation Checklists to Fulton's Quality Assurance department. This warranty covers any failure caused by defective material or workmanship; however, waterside corrosion or scaling is not covered. Therefore, it is imperative that the boiler water management and chemistry be maintained as outlined in the Installation and Operation Manual.
			2. Parts Warranty:
				1. Fulton will repair or replace F.O.B. factory any part of the equipment of our manufacture that is found to be defective in workmanship or material within one (1) year of shipment from the factory provided this equipment has been installed, operated and maintained by the buyer in accordance with approved practices and recommendations made by both Fulton and the component manufacturers and the commissioning agency has successfully completed and returned the equipment Installation and Operation Checklists to Fulton's Quality Assurance department.
			3. General:
				1. Fulton shall be notified in writing as soon as any defect becomes apparent. This warranty does not include freight, handling or labor charges of any kind. These warranties are contingent upon the proper sizing, installation, operation and maintenance of the boiler and peripheral components and equipment. Warranties valid only if installed, operated, and maintained as outlined in the Fulton Installation and Operation Manual. No Sales Manager or other representative of Fulton other than the Quality Manager or an officer of the company has warranty authority. Fulton will not pay any charges unless they were pre-approved, in writing, by the Fulton Quality Manager. This warranty is exclusive and in lieu of all other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Fulton shall in no event be liable for any consequential or incidental damages arising in any way, including but not limited to any loss of profits or business, even if the Fulton Companies has been advised of the possibility of such damages. Fulton's liability shall never exceed the amount paid for the original equipment found to be defective. To activate the warranty for this product, the appropriate commissioning sheets must be completed and returned to the Fulton Quality Assurance department for review and approval.
		2. Premier Steam Engineered System
			1. Ten (10) year (120 months) Material and Workmanship Warranty:
				1. The pressure vessel is covered against defective material or workmanship for a period of ten (10) years from the date of shipment from the factory. Fulton will repair or replace F.O.B. factory any part of the equipment, as defined above, provided this equipment has been installed, operated and maintained by the buyer in accordance with approved practices and recommendations made by Fulton. The commissioning agency must also successfully complete and return the equipment Installation and Operation Checklists to Fulton's Quality Assurance department. This warranty covers any failure caused defective material or workmanship; however, waterside corrosion or scaling is not covered. Therefore, it is imperative that the boiler water management and chemistry be maintained as outlined in the Installation and Operation Manual. There is a $1,000 labor allowance for any failed pressure vessel that is covered under the above warranty.
			2. Parts Warranty:
				1. Fulton will repair or replace F.O.B. factory any part of the equipment of our manufacture that is found to be defective in workmanship or material within one (1) year of shipment from the factory provided this equipment has been installed, operated and maintained by the buyer in accordance with approved practices and recommendations made by both Fulton and the component manufacturers and the commissioning agency has successfully completed and returned the equipment Installation and Operation Checklists to Fulton's Quality Assurance department.
			3. General:
				1. The extended warranty is valid only for boilers that are purchased as part of a Premier Steam Engineered system. Generally, this system MUST include ALL of the following equipment in order for the warranty to apply. Any deviation or additional equipment specified by Fulton Engineering must be used and maintained per the Installation and Operation Manual as well: Fulton Boiler with model number as listed above; feedwater or deaerator system with preheat kit; Fulton blowdown tank; Water softener; Chemical feed system; Automatic conductivity surface or timer based bottom blowdown, which must operate to maintain a TDS level as specified in the Installation and Operation Manual. Fulton shall be notified in writing as soon as any defect becomes apparent. This warranty does not include freight, handling or labor charges of any kind except as noted above. These warranties are contingent upon the proper sizing, installation, operation and maintenance of the boiler and peripheral components and equipment. Warranties valid only if installed, operated, and maintained as outlined in the Fulton Installation and Operation Manual. No Sales Manager or other representative of Fulton other than the Quality Manager or an officer of the company has warranty authority. Fulton will not pay any charges unless they were pre-approved, in writing, by the Fulton Quality Manager. This warranty is exclusive and in lieu of all other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Fulton shall in no event be liable for any consequential or incidental damages arising in any way, including but not limited to any loss of profits or business, even if the Fulton Companies has been advised of the possibility of such damages. Fulton’s liability shall never exceed the amount paid for the original equipment found to be defective. This warranty applies only in the U.S.A. and Canada. To activate the warranty for this product, the appropriate commissioning sheets must be completed and returned to the Fulton Quality Assurance department for review and approval.
2. PRODUCTS
	1. ACCEPTABLE MANUFACTURERS
		1. This specification is based on the Vertical Multi-Port Series boilers as manufactured by Fulton Steam Solutions, Inc. Equivalent units and manufacturers must meet all performance criteria for all fuel options, and will be considered upon prior approval.
		2. Basis of Design: Fulton Steam Solutions, Inc. Models:
			1. VMP-40 – 1,380 lb/hr (1,339,000 BTU/hr Output)
			2. VMP-49.5 – 1,708 lb/hr (1,658,000 BTU/hr Output)
			3. VMP-50 – 1,725 lb/hr (1,673,000 BTU/hr Output)
			4. VMP-60 – 2,070 lb/hr (2,009,000 BTU/hr Output)
			5. VMP-80 – 2,760 lb/hr (2,678,000 BTU/hr Output)
			6. VMP-100 – 3,450 lb/hr (3,348,000 BTU/hr Output)
			7. VMP-130 – 4,485 lb/hr (4,352,000 BTU/hr Output)
			8. VMP-150 – 5,175 lb/hr (5,022,000 BTU/hr Output)

Steam Output rating at 212 oF feedwater temperature, 0 psig (Sea Level to 2000 ft)

* + 1. The boiler manufacturer shall have the capability to construct an engineered system, skid mounted, including but not limited to mounting any number of boilers in a common system with common piping headers and single source customer connections for single source steam supply, make up water, drain, electrical power, fuel supply, and condensate return. Electrical panel boxes for the system must be available along with all wiring requirements. Other available components shall include feed-water tanks and pumps, chemical feed systems, water softeners, carbon filters, and various relevant valves and other accessories. The system manufacturer shall have the engineering capabilities for all aspects of the mechanical and electrical design aspects of the skid mounted system.
		2. Customers, engineers and contractors shall have the option to visit the boiler manufacturer’s factory to witness manufacturing, testing, and other operational safety inspections associated with the referenced boilers.
		3. Boiler should be capable of achieving an efficiency up to 85% without the use of an economizer.
	1. BOILER CONSTRUCTION
		1. The boiler shall be completely factory assembled as a self-contained unit. Each boiler shall be neatly finished, thoroughly tested, and properly packaged for shipping.
		2. The pressure vessel design and construction shall be in accordance with Section I or Section IV of the ASME Code for steam boilers. The boiler shall comply with CSD-1 code requirements and carry a UL listing (CSA/CUL approval for Canada).
		3. It shall be acceptable to vent the boiler using sealed combustion (drawing in fresh air from the outdoors) or to draw air from the mechanical room itself.

			1. The flue (exhaust) stack and any components associated with the stack must be suitable for 1,000 F.
			2. The stack arrangement must supply a negative 0.02"w.c. to negative 0.04" w.c. pressure with the burner off standing hot and negative 0.04” w.c. to negative 0.08” w.c. pressure with the burner running hot.
		4. The pressure vessel shell, furnace, flue pipes, and heads shall be SA-53B ERW pipe or SA-516 Grade 70 plate and have the following minimum thickness (150 psig design):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VMP Model | Shell (Inches) | Head (Inches) | Furnace (Inches) | Flue Pipes(inches) |
| 40 | 0.313 | 0.625 | 0.5 | 0.218 |
| 49.5 | 0.313 | 0.625 | 0.5 | 0.218 |
| 50 | 0.313 | 0.5 | 0.5 | 0.218 |
| 60 | 0.313 | 0.5 | 0.5 | 0.218 |
| 80 | 0.375 | 0.5 | 0.5 | 0.276 |
| 100 | 0.375 | 0.5 | 0.5 | 0.276 |
| 130 | 0.375 | 0.625 | 0.5 | 0.276 |
| 150 | 0.375 | 0.625 | 0.5 | 0.276 |

* + 1. The pressure vessel flue pipes shall be a minimum of Schedule 80 pipes. Turbulators are installed in the flue pipes to enhance the heat transfer and distribute the flow of the flue gases.
		2. The pressure vessel shall be insulated with 3 in. high temperature blanket insulation, and all necessary refractories shall be installed in the boiler.
		3. The boiler shall be supported on a reinforced bottom pan with angle iron support.
		4. The jacket shall be a minimum of 18 gauge carbon steel and shall have a primer and finish coat of paint.
		5. The optional stainless steel jacket must be a minimum of 20 gauge 304 stainless steel.
	1. BOILER DESIGN

		1. The boiler shall be a vertical tubeless design. The top mounted forced draft burner will fire from the top of the boiler down through a circular furnace. The burner location and firing method shall be such that combustion takes place within the water-backed furnace portion of the boiler. The boiler shall be of a vertical firetube design. Water tube type boilers are unacceptable. Boiler combustion chamber and convective heat transfer surfaces shall be of a vertical design.
		2. The boiler input shall not exceed the fuel usage specified on the Fulton Vertical Multi-port Product Data Submittal for the specified model size.
		3. The capacity of each unit shall be able to produce continuously the steam rate specified by the steam output on the Fulton VMP Product Data Submittal for the specified model size.
		4. Adequate hand-holes shall be provided for access to the water side of the boiler. Hand-holes and cleanout openings shall be provided at the lower part of the boiler so that the entire bottom of the boiler may be cleaned.
		5. Boiler to have two (2) bottom blowdown connections and one surface blowdown connection as standard.
		6. Flue gases shall preheat the combustion air. The combustion air preheater arrangement shall be an internal, integral part of the boiler assembly. External heat exchangers are not permitted.
		7. The boiler shall make use of turbulators inserted into the flue pipes to enhance heat transfer and distribute the flow of flue gases.
		8. External radiation heat losses from the boiler shall be less than 0.5% of the rated boiler input (assuming an ambient air temperature of 70°F, and the boiler is operating at no more than 100 PSIG steam pressure).
		9. The boiler shall have an optional configuration for dual fuel with natural gas/propane, with modulated operation on both fuels. The changeover of fuels shall require the change of a fuel selector switch, burner orifice change, and closing of manual valves.
		10. The boiler shall have an optional configuration for dual fuel with NG/LP and #2 oil, modulated on both fuels. The changeover of fuels shall only require the change of a fuel selector switch and closing of manual valves.
		11. The boiler shall have an optional configuration for firing #2 oil only, modulated operation.
		12. When firing with #2 oil, the boiler shall be provided with an oil pump assembly and all interconnecting piping and components (valves, etc) to the burner.
		13. The boiler shall have an optional configuration for NEMA 3R construction (outdoor operation).
		14. The boiler shall have an optional configuration for digester gases and bio gases. Factory engineers must have the opportunity to review and approve these applications in advance. Digester gases and bio gases are not tested at the factory.
		15. The operating water capacity of the boiler shall not be less than:
			1. VMP-40 – 153 Gallons (579 liters)
			2. VMP-49.5 – 231 Gallons (874 liters)
			3. VMP-50 – 219 Gallons (829 liters)
			4. VMP-60 – 245 Gallons (927 liters)
			5. VMP-80 – 348 Gallons (1,317 liters)
			6. VMP-100 – 477 Gallons (1,806 liters)
			7. VMP-130 – 749 Gallons (2,835 liters)
			8. VMP-150 – 749 Gallons (2,835 liters)
		16. The dimensions of the boiler shall not be less than (Overall Width with water column x Boiler Height with Trim and Fuel Train Assembly):
			1. VMP-40 – 82.5 in x 105 in (2,096 mm x 2,667 mm)
			2. VMP-49.5 – 86 in x 109 in (2,184 mm x 2,769 mm)
			3. VMP-50 – 87 in x 109 in (2,210 mm x 2,769 mm)
			4. VMP-60 – 87 in x 115 in (2,210 mm x 2,921 mm)
			5. VMP-80 – 97 in x 122 in (2,464 mm x 3,099 mm)
			6. VMP-100 – 105 in x 122 in (2,667 mm x 3,099 mm)
			7. VMP-130 – 112 in x 133 in (2,845 mm x 3,378 mm)
			8. VMP-150 – 112 in x 133 in (2,845 mm x 3,378 mm)
		17. The operating weight of the boiler shall not be less than:
			1. VMP-40 – 7,175 lb (3,255 kg)
			2. VMP-49.5 – 8,424 lb (3,821 kg)
			3. VMP-50 – 8,631 lb (3,915 kg)
			4. VMP-60 – 9,545 lb (4,330 kg)
			5. VMP-80 – 12,208 lb (5,538 kg)
			6. VMP-100 – 14,577 lb (6,612 kg)
			7. VMP-130 – 21,749 lb (9,865 kg)
			8. VMP-150 – 22,649 lb (10,273 kg)
	2. CONTROLS
		1. The flame safeguard control shall be provided for modulated type control on all fuels and shall provide the following:
			1. The control shall provide a 30 second minimum pre-purge and post-purge time.
			2. The control shall maintain a running history of operating hours, number of cycles, and the most recent 25 control lockouts.
			3. The control is connected to a display module, which is capable of retrieving the information listed above.
			4. The controller shall provide combustion settings at a minimum of ten individual points throughout the combustion range.
			5. The controller shall have a door mounted HMI screen as standard
		2. A flame observation port shall be provided.
		3. The boiler, when firing natural gas, shall have a minimum turndown of:
			1. 40-100 HP: 3:1
			2. 130-150 HP: 5:1
		4. The boiler, when firing natural gas, shall have an optional turndown of:
			1. 40-80 HP: 5:1
			2. 100-150 HP: 8:1
		5. The boiler shall be set up for a minimum of 2:1 turndown when firing on #2 oil.
		6. Airflow shall be controlled by a servo-operated butterfly valve. Fuel flow shall be controlled by a servo-operated butterfly valve for gas operation.
		7. Burner selection and Burner and Safety Controls:
			1. Burner location and firing method to be such that combustion takes place within the water backed furnace of the boiler. Burner to be top mounted and of the vertically down fired design. Side fired burner designs are not acceptable. A side fired burner will cause undue stress on the boiler furnace. Burner controls shall be modulating type as described above and are to include the following:

				1. Operating pressure control for automatic start and stop of burner operation.
				2. High Limit Pressure Controller with manual reset.
				3. Two low water cut-off probes to cause shut down of unit when water level drops to minimum safe level (one in the water column and one in the boiler shell). The probe in the shell shall be manual reset to comply with ANSI/ASME CSD-1 Code.
				4. Boilers shall have an air safety switch to prevent operation until sufficient combustion is assured.
				5. Flame detector to prove combustion flame presence.
				6. An optional contact for a feedwater pump shall be included and consist of a single phase motor starter or contacts for a 3 phase pump.
				7. An electronic type combustion flame safeguard shall be included to provide full protection against flame failure. The control shall maintain a running history of operating hours, number of cycles, and the most recent six flame failures. This control shall have the capability to be connected to a key board display module which will retrieve that information.
				8. Burner motor control shall have thermal overload protection.
				9. Burner controller shall have CSD-1 compliant emergency stop contact.
		8. Boiler pressure controller to be digital PID type controller mounted on the panel box door. The controller shall be capable of retransmitting a process value as a 4-20mA output. The controller shall have a separate proportional, integral, and derivative control values. Controller shall also have the capability of individual boiler set point on and boiler set point off values.

All controls to be panel mounted in a NEMA \_\_ enclosure and so located on the boiler as to provide ease of servicing the burner and boiler without disturbing the controls. Panel shall be located to prevent possible damage by water, fuel or heat, of combustion gases. Controls connected to water or fuel shall be installed outside the main boiler control panel. All controls shall be mounted and wired according to Underwriters’ Laboratories requirements.

* 1. MAIN FUEL TRAIN COMPONENTS

		1. A factory mounted main gas train shall be supplied. The gas train shall be fully assembled, wired, and installed on the boiler and shall comply with CSD-1 and/or CSA code. The CSD-1/CSA gas train must be rated for 5 PSI incoming gas pressure, include FM approved components, and be ventless. Compliance with other codes is available upon request. The maximum pressure rating of the components shall not be less than \_\_\_.
		2. Standard CSD-1 fuel trains shall comply with IRI, which has been replaced by GE GAP. Normally open vent valves are no longer required between the safety shut off valves. NFPA 85 compliance shall be available from the factory to comply with local codes or regulations that specifically require a vent valve.
		3. Custom fuel trains are available upon request.
	2. BOILER FITTINGS & TRIM
		1. The boiler shall be supplied with an ASME Section I or Section IV safety relief valve. The safety relief valve size shall be in accordance with ASME code requirements and set at 150 psig for Section I Pressure Vessels, or 15 psig for Section IV Pressure Vessels. Custom set pressures upon request.
		2. A water column shall be piped to the boiler at the factory. A gauge glass and drain valve will be supplied. The gauge glass shall be protected by four brass rods as an additional safety factor. The water column shall also include the primary low water cutoff prove to automatically shutoff burner operation when water falls below a predetermined level. An auxiliary low water cutoff probe shall be mounted in the boiler shell. The water column shall contain two water level probes, one to “start” and one to “stop” the feed water pump.
		3. A steam pressure gauge shall be included with the boiler, mounted on the water column, and shall be complete with test connection.
		4. Feedwater stop and check valve shall be supplied at factory in line to an internally baffled feed connection in boiler shell to prevent thermal shock.
		5. Additional standard trim shall include at a minimum two (2) quick and two (2) slow opening bottom blow down valves and water column blow down valve.
		6. A surface blowdown connection shall be provided, and provided with a manual valve.
		7. A high water connection and trap assembly shall be provided when necessary.
		8. The boiler shall come with lifting eyes accessible for rigging. Transporting by fork lift is also acceptable.
		9. Instructions for installation, operation and maintenance of the boiler shall be contained in a manual provided with each boiler.
		10. A wiring diagram corresponding to the boiler configuration shall be included with each boiler.
		11. A factory test fire report corresponding to the boiler configuration shall be included with each boiler.
1. EXECUTION
	1. INSTALLATION
		1. Equipment and materials shall be installed in an approved manner and in accordance with the boiler manufacturers’ installation requirements.
		2. The installer shall construct a flat, level foundation designed to support the entire load. Calculations shall be based upon the maximum or filled weight of the system. The boiler should be located in dry surroundings on a level base, making sure that there is sufficient room around the boiler to enable the operator and/or the maintenance engineer to gain access to all parts of the boiler. Check location for ease of water supply and electrical connections. Place the boiler on a non combustible floor with clearances to unprotected combustible materials, including plaster or combustible supports.
		3. Assemble unit sections and parts shipped loose or unassembled for shipment purposes. Follow manufacturer's installation recommendations and instructions.
		4. Install electrical control items furnished by manufacturer per wiring diagram provided by manufacturer.
		5. Complete feedwater, steam, blowdown, fuel, safety valve discharge, and vent piping installation as required by manufacturer for operation of system.
		6. Provide applicable air intake and exhaust piping, size and type as recommended by the manufacturer to maintain appropriate draft, and rated for the temperatures as listed above.
	2. FIELD QUALITY CONTROL
		1. After boiler installation is completed, the manufacturer shall provide the services of a field representative for starting the unit and training the operator.
		2. Arrange with National Board of Boiler and Pressure Vessel Inspectors for inspection of boilers and piping. Obtain certification for completed boiler units, deliver to Owner, and obtain receipt.

END OF SECTION