1. General
	1. SCOPE
		1. The work to be performed includes all new equipment, labor and materials required to furnish and install Vertical Tubeless Fulton ICS Low Emissions Boilers as described in this product guide specification.
	2. REFERENCES
		1. ASME
		2. CSD1, Controls and Safety Devices
		3. CSA/CUL
		4. GE GAP
		5. NFPA
		6. NEC, National Electric Code
		7. UL-795, -508A
	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 (100psi for the ICS LE – 9.5), 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 Honeywell 7897 series for on/off linkage-type 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.
		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. 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. He 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 DA system with preheat kit; Fulton blowdown tank; Water softener; Chemical feed system; Automatic 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 ICS LE Series boilers as manufactured by Fulton Boiler Works, 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 Boiler Works, Inc. Models:

			1. ICS LE-9.5 – 328 lb/hr (319,000 BTU/hr)
			2. ICS LE -10 – 345 lb/hr (335,000 BTU/hr)
			3. ICS LE -15 - 518 lb/hr (503,000 BTU/hr)
			4. ICS LE -20 – 690 lb/hr (670,000 BTU/hr)
			5. ICS LE -25 – 863 lb/hr (837,000 BTU/hr)
			6. ICS LE -30 – 1,035 lb/hr (1,005,000 BTU/hr)

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, feedwater, drain, electrical power, fuel supply, condensate return, and vents. 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.
	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 of the ASME Code for steam boilers. The boiler shall comply with CSD-1 code requirements and carry a UL listing (CAS/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 .02” to negative .04” W.C. pressure with the burner off.
		4. The pressure vessel shell, furnace, and heads shall be SA-53B ERW/SA106B pipe or SA-516 Grade 70 plate and have the following thickness (150 psig design):

|  |  |  |  |
| --- | --- | --- | --- |
| ICS LE Model | Shell (Inches) | Head (Inches) | Furnace (Inches) |
| 9.5 (100 psi) | .375 | .500 | .322 |
| 10 | .354 | .500 | .365 |
| 15 | .315 | .500 | .365 |
| 20 | .313 | .500 | .500 |
| 25 | .313 | .500 | .500 |
| 30 | .313 | .625 | .500 |

* + 1. The pressure vessel shall be insulated with compatible high temperature castable mixtures. The pressure vessel subject to direct flame shall be insulated with high strength, low permanent linear change, and high temperature limit castable. The remaining area shall be insulated with a lightweight, low thermal conductive castable. These castables assure strength so that cyclic thermal stress and cracking which can damage the insulation, does not occur. Insulation thickness shall be as follows:
			1. 9.5-15 BHP – 3 ½”
			2. 20 BHP – 4”
			3. 30 BHP – 4 ¼”
		2. The jacket shall be carbon steel.
	1. BOILER DESIGN

		1. The boiler shall be a vertical tubeless design with a centrally located furnace. 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 of the boiler.
		2. The burner NOx emissions shall be less than 20ppm corrected to 3% O2.
		3. The boiler input shall not exceed the fuel usage specified on the Fulton ICS Low Emissions Product Data Submittal for the specified model size.
		4. The capacity of each unit shall be able to produce continuously the steam rate specified by the steam output on the Fulton ICS Low Emissions Product Data Submittal for the specified model size.
		5. 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.
		6. The boiler will make use of welded convection fins to enhance heat transfer and distribute the flow of flue gases.
		7. The boiler shall have an optional configuration for NEMA 3R construction (outdoor operation).
		8. The water volume of the boiler shall not be less than:

			1. ICS LE -9.5 – 16 Gallons (60 liters)
			2. ICS LE -10 – 24 Gallons (90 liters)
			3. ICS LE -15 – 39 Gallons (147 liters)
			4. ICS LE -20 – 77 Gallons (291 liters)
			5. ICS LE -25 –82 Gallons (310 liters)
			6. ICS LE -30 – 170 Gallons (643 liters)
		9. The dimensions of the boiler in operation shall not be less than (Overall Width with water column x Boiler Height with Trim and Fuel Train Assembly):

			1. ICS LE -9.5 – 35.5 in x 83 in (902 mm x 2109 mm)
			2. ICS LE -10 – 37 in x 80 in (940 mm x 2032 mm)
			3. ICS LE -15 – 39 in x 86 in (991 mm x 2185 mm)
			4. ICS LE -20 – 46.5 in x 91.5 in (1182 mm x 2375 mm)
			5. ICS LE -25 – 47 in x 93.5 in (1194 mm x 237 mm)
			6. ICS LE -30 – 52.5 in x 101 in (1334 mm x 2375 mm)
		10. The approximate operating weight of the boiler shall not be less than:

			1. ICS LE -9.5 – 2,183 lb (990 kg)
			2. ICS LE -10 – 2,200 lb (998 kg)
			3. ICS LE -15 – 2,725 lb (1,236 kg)
			4. ICS LE -20 – 4,392 lb (1,992 kg)
			5. ICS LE -25 – 4,374 lb (1,984 kg)
			6. ICS LE -30 – 6,868 lb (3,115 kg)
	2. CONTROLS
		1. The flame safeguard control shall provide on/off type control 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 six control lockouts.
		2. A flame observation port shall be provided.
		3. 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 down fired design. Burner controls shall be of on/off 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. Gas fired boilers shall have an air safety switch to prevent operation until sufficient combustion is assured.
				5. Flame detector to prove combustion.
				6. A contact for a feedwater pump shall be included and consist of a single phase motor starter or optional 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. Three-phase burner motor control shall have thermal overload protection.
				9. Burner motors shall be provided with fuse type overcurrent protection.
			2. 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.
	3. 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. 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.
	4. BOILER FITTINGS & TRIM
		1. The boiler shall be supplied with an ASME Section I 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 (100 psi for ICS LE – 9.5). 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 Y-type blow down valve 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 shall be provided as standard.
		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