

Alpine Commercial Model C Condensing Hot Water Boiler Specification

Note to Specifier: Select desired project specific product features & equipment options [\[in blue\]](#)
Revision 04/29/2020

PART 1 GENERAL

1.11 SUMMARY

- A. Boiler. A gas-fired, floor-standing, condensing hot water, watertube boiler, including controls and required safety devices for indoor space-heating. Boiler shall be factory-built to provide central space heating and include support for indirect domestic hot water (DHW) heating. Boiler shall not be installed for use in gravity hot water systems or systems containing significant amounts of dissolved oxygen.

1.12 REFERENCES

- A. Intertek (ETL)
 - 1. ETL certified to ANSI Z21.13/CSA 4.9
- B. American Society of Mechanical Engineers:
 - 1. ASME Section IV - Boiler and Pressure Vessel Code - Heating Boilers
 - 2. [\[ASME CSD-1 – Controls and Safety Devices for Automatically Fired Boilers\]](#)
- C. American Society of Heating, Refrigeration and Air Conditioning Engineers
 - 1. ASHRAE: Standard 90.1 Energy Standard for Buildings
- D. American National Standards Institute:
 - 1. ANSI Z21.13 – Gas Fired Low Pressure Steam and Hot Water Boilers
- E. Hydronics Institute, Division of Air Conditioning, Heating and Refrigeration Institute:
 - 1. BTS-2000: Testing Standard to Determine Efficiency of Commercial Space Heating Boilers as defined by Department of Energy in 10 CFR Part 431.
- F. National Fire Protection Association:
 - 1. NFPA 54 - National Fuel Gas Code (ANSI Z223.1)
- G. [\[Relevant local and/or project specific Codes and Standards\]](#)

1.13 SUBMITTALS

- A. In accordance with Contract Documents. Minimum product data shall include:
 - 1. Capacities, accessories and options included with boiler.
 - 2. General layout, dimensions, size and location of all required connections.
 - 3. Electrical characteristics
 - 4. Weight and mounting loads.
 - 5. Manufacturer's installation and start-up instructions.
 - 6. Equipment Operation and Maintenance Manuals.

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1.14 QUALITY ASSURANCE

- A. Manufacturer shall use an adequate number of skilled workers, trained and experienced in the necessary crafts, and who are completely familiar with the specified requirements, pertinent contract documents, and methods needed for proper performance of the work described therein.

1.15 DELIVERY, STORAGE, AND HANDLING

- A. Shall be in accordance with contract documents.
- B. Equipment and accessories shall be received in factory shipping, packaging and inspected for damage. Boiler shall be kept in a vertical position from time of delivery to final installation.
- C. While stored, all equipment shall be protected from external elements such as inclement weather, job site construction activity, etc. and shall also be protected from damage by leaving packaging in place until installation.

1.16 WARRANTY

- A. The boiler shall come with a 9-year pro-rated warranty on its heat exchanger and a one year limited warranty on all other parts.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Boiler shall be manufactured by U.S. Boiler Company, Lancaster, PA
- B. Installed boiler shall be a model _____ (select model number from right) [\[ALP399C, ALP500C, ALP600C, ALP700C, ALP800C\]](#). Refer to the Equipment Schedule in the Contract Drawings for the specific design and performance criteria.
- C. It shall be the responsibility of the Contractor to insure that any substituted equipment is equivalent in fit, form and function to the specified equipment. The cost of any additional work caused by the substitution of equipment shall be borne by the Contractor.

2.2 GENERAL REQUIREMENTS

- A. Boiler
 - 1. The boiler shall be assembled, fire-tested and shipped as a factory-packaged unit, complete with jacket, gas manifold, burner and controls mounted & wired, with boiler connections specified in this section.
 - 2. The boiler shall be constructed in conformance to ASME Section IV. [\[, ASME CSD-1\]](#) and ANSI Z21.13. The boiler shall bear the ASME "H" stamp with a maximum allowable working pressure (MAWP) of 160 PSI. Pressure vessel shall be subjected to a hydrostatic pressure test of 240 PSIG at the factory before shipment.
 - 3. The boiler shall be an ultra-high efficiency condensing boiler with a stainless steel, watertube pressure vessel, which shall not require a refractory combustion

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chamber. Pressure vessel shall have a minimum heat transfer area of [ALP399C – 41.8, ALP500C – 58.1, ALP600C – 76.2, ALP700C – 76.2, ALP800C – 87.0] square feet and a waterside pressure loss no more than [Refer to Flow and Pressure Drop Table at the end of this specification] feet of head at a [20°F, 25°F, 30°F, 35°F] temperature difference between the supply and return water temperatures.

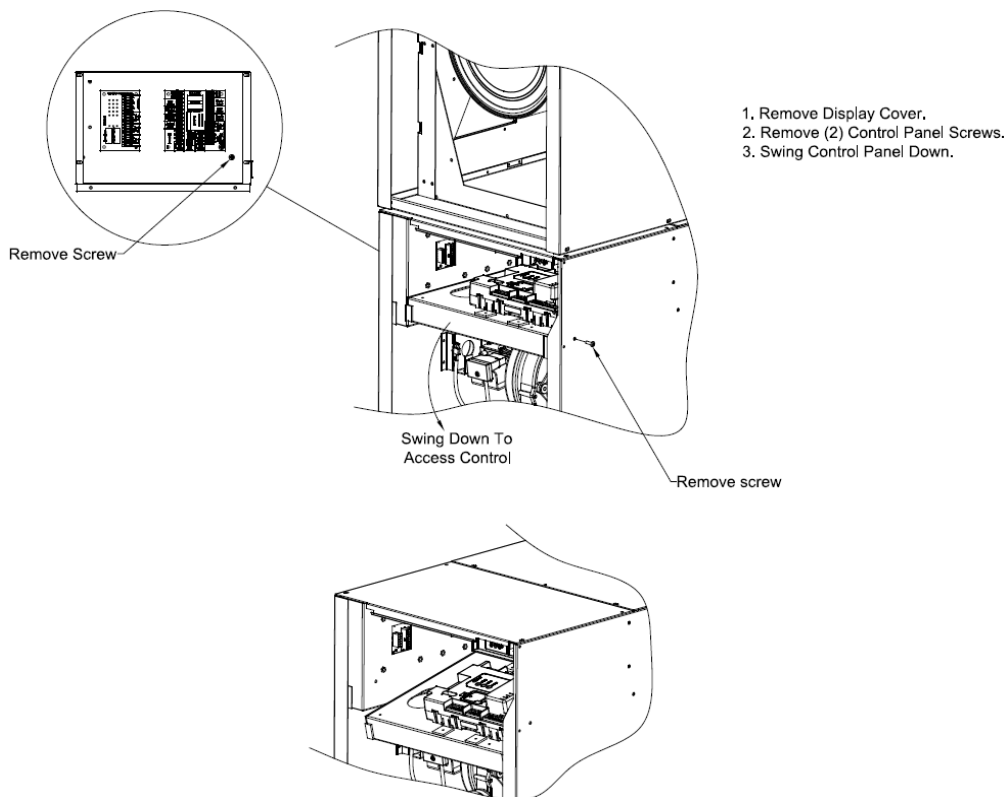
4. The boiler shall be equipped with an integral pre-mix, metal-mesh type forced draft burner incorporating full modulation with 5:1 turndown.
5. The boiler gas valve shall be designed with zero pressure regulation and equipped with a variable speed blower system to precisely control the fuel/air mixture, providing fully modulating firing rates for maximum efficiency.
6. All wiring and piping connections shall be located on the left-side of the boiler. Piping connections include: supply / return water connections, relief / drain tapping [(omit for ALP500C thru ALP800C since piped off supply piping)], condensate trap drain, and gas valve inlet connection. Condensate trap shall have a factory supplied compression fitting. A factory supplied drain valve and oversized relief valve shall be provided with the boiler(s).
7. The heat exchanger flue passages and combustion chamber on the top half of the boiler shall be accessible from the front of the boiler for cleaning. The flue passages and combustion chamber on the bottom half of the boiler shall be accessible from the rear of the boiler for cleaning.
8. The boiler shall be built with a heavy duty 20 gauge steel jacket with a rust resistant powder coat finish to allow for same-size or smaller model stacking without the need of a separate rack system. Jackets made of plastic or resin material shall not be acceptable. The boiler jacket shall contain an internal electrical cabinet for power and limit circuit wiring, providing a clean finished look when the jacket is installed. Electrical connections shall be accessible from left-side of the boiler on two (2) separate printed circuited boards (120VAC high and 24VAC/5VDC low voltage) with fused connections for protection and clear labeling for simple and accurate wiring. Individual lift-off jacket front panel may be installed after system piping and wiring to allow ease of access to the pressure vessel.
 - a. The electrical components shall be separated from incoming combustion air gas, which may contain excess humidity, dust and other contaminants brought through ducted combustion air.

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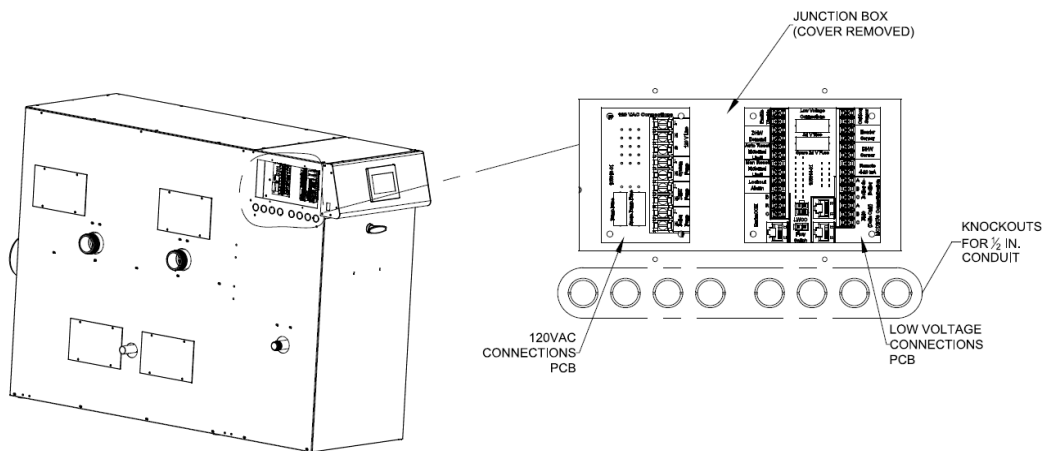
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Stacked Boiler Control Access



Left-side Wiring and Piping Connections

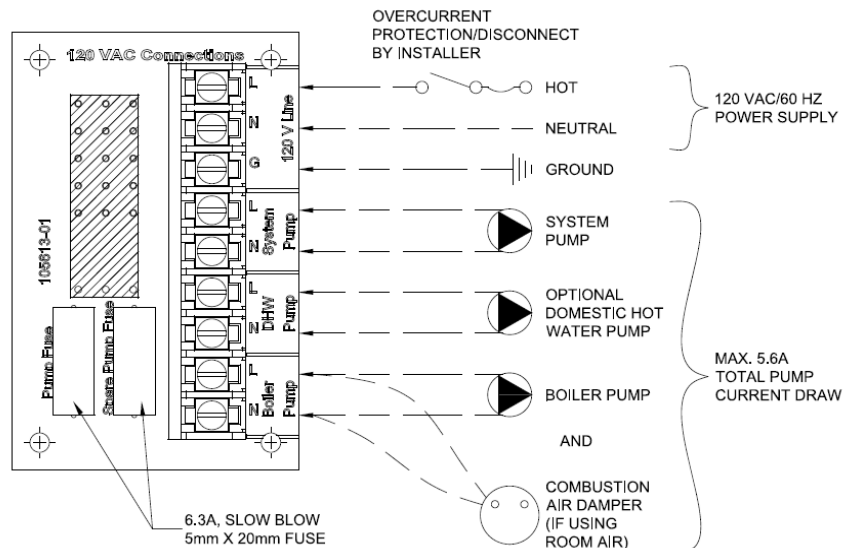


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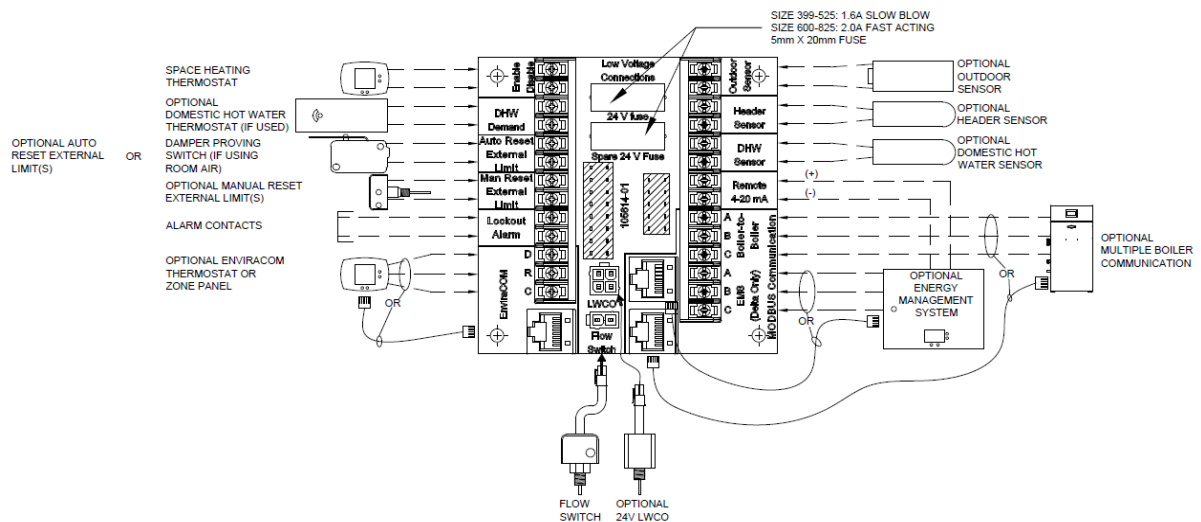
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120 VAC Field Wiring



Low Voltage Field Wiring



9. A polypropylene condensate trap with a float-actuated shut-off switch shall be located within the boiler jacket and beneath the heat exchanger drain pan. The float-actuated shutoff switch must be located upstream from any bends in the condensate trap. Float switches located on the downstream side of the condensate trap shall not be acceptable due to the possibility of blockages occurring in the trap bends.

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B. Boiler Control System

1. Scope of Supply

Boiler Control System shall provide safety interlocks and water temperature control. The control system shall be fully integrated into the boiler control cabinet and incorporate single and multiple boiler control logic, inputs, outputs and communication interfaces. The control system shall coordinate the operation of up to eight (8) fully modulating hot water boilers and circulation pumps. The control system shall simply control boiler modulation and on/off outputs based on the boiler water supply temperature and an operator-adjusted setpoint. However, using parameter menu selections, the control system shall allow the boiler to respond to remote system water temperature and outside air temperatures with domestic hot water priority (DHWP) and warm weather shut down (WWSD) or energy management system (EMS) firing rate demand, remote setpoint or remote start/stop commands. In order to support large domestic demands it shall be parameter-selectable to start two boilers simultaneously in response to a DHWP demand.

2. Boiler Control

Using PID (proportional-integral-derivative) based control, the remote system water temperature shall be compared with a setpoint to establish a target boiler firing rate. If the secondary loop flow speed is greater than the primary loop flow speed, firing rate is increased in response to the decrease in secondary loop temperature. When the remote system temperature is near the boiler high limit temperature, the boiler supply sensor shall limit the maximum boiler supply temperature to prevent boiler high limit events. Alternately, using parameter menu selections, the control system shall allow the boiler to respond directly to boiler supply temperature and setpoint to establish a target boiler firing rate while remote system water temperature is used for display purposes only. Each boiler's fuel flow control valve shall be mechanically linked to the air flow control device to assure an air rich fuel/air ratio. All the automated logic required to ensure that pre-purge, post-purge, light-off, and burner modulation shall be provided.

3. Hot Water Temperature Setpoint

When the controller is in the local control mode, the control system shall establish the setpoint based on outside air temperature and a reset function curve, or be manually adjusted by the operator. When enabled, the setpoint shall be adjusted above a preset minimum setpoint upon sensing a domestic hot water demand contact input. When in remote mode, the control system shall accept a 4-20ma or Modbus [*OPTION: 0-10Vdc] remote setpoint or firing rate demand signal from an external EMS.

4. Multiple Boiler Sequence

The controller shall incorporate its peer-to-peer communications on each connected boiler (up to eight [8] units) by using standard RJ45 ethernet cables. The control system shall allow the connected boilers to exchange signals as required to provide coordinated fully modulating lead/lag functions. It shall not be required to wire individual control signals between boilers. Multiple boilers shall be modulated in "Unison" (all at the same firing rate). To increase operational

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efficiency, the control system shall utilize both water temperature and firing rate based boiler sequencing algorithms to start and stop the boilers and shall minimize the total number of boilers in operation. The control system shall start and stop boilers when the water temperature is outside the adjustable temperature limit for longer than the adjustable time delay. In order to minimize temperature deviations, the control system shall start and stop the next boiler when the "lead" boiler is at an adjustable firing rate limit for longer than the adjustable time delay. The control system shall monitor both boiler lockout and limit circuits to automatically skip over those boilers that are powered down for maintenance, tripped or otherwise will not start. The boiler shall be run at low fire for warm-up for a preset low fire hold time. When enabled, warm weather shut down control logic shall prevent boiler operation. The controller shall also be capable of auto-rotation of the boilers based on user-selected run time hours.

5. User Interface

A touch screen message display shall be provided to display real time KBTU/hr, numeric data, startup and shutdown sequence status, alarm, system diagnostic, first-out messages and boiler historical information. In the event of a fault condition, the display shall provide help screens to determine the cause of the problem and corrective actions. Historical information shall include graphical trends, lockout history, boiler & circulator cycle counts and run time hours.

6. Circulator Control

The controller shall be capable of sequencing the boiler, domestic hot water or system circulators. Simple parameter selections shall allow all three pumps to respond properly to various hydronic piping arrangements including either a boiler or primary piped indirect water heater. The controller shall perform circulator exercise to help prevent pump rotor seizing.

7. EMS Communication

Shall control and monitor the boiler via RS485 Modbus communication or direct wiring. The control shall allow for either communication for boiler peer-to-peer communication or EMS communication interfaces but not simultaneously. Boiler operation shall not be lost due to corrupt or loss of EMS communication. The boiler control system shall allow individual boiler limits, lockout, boiler and system temperatures and firing rate status to be readable and water setpoint, boiler firing rate, and start/stop command to be readable and writable. The control shall provide easy parameter selection and options for the following: Modulation Source (4-20ma or Modbus [*OPTION: 0-10Vdc]); Setpoint Source (4-20ma or Modbus [*OPTION: 0-10Vdc]); and Enable/Disable (contact wired or Modbus). [OPTION: The boiler control system shall network with a communication gateway to connect with BACnet [LonWorks] [Johnson Controls Metasys N2] communication protocol.]

*Note to Spec Writer: 0-10Vdc option is available with EMS Signal Converter

8. Quality Assurance

The boiler control system shall be supplied as part of a factory-assembled and tested burner control cabinet.

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C. Boiler Trim (shall include

1. Combination pressure-temperature gauge, 3-1/2 inch diameter.
2. Dual-purpose high limit/supply sensor and single-purpose return temperature sensor - shall be mounted on the supply and return connections inside the boiler jacket. Each sensor shall be accessible through a removable access door on the left side of the boiler. The boiler control shall measure supply and return temperatures and notify the operator if the direction of flow is reversed.
 - a. The boiler control shall adjust to impending temperature changes in such a way to minimize fuel consumption and maximize efficiency. The control shall measure temperatures and the rate of change in those temperatures and respond early, rather than waiting for temperatures to exceed limit control settings.
3. Outdoor air temperature sensor, if required, to automatically adjust the modulation rate setpoint on the boiler according to the outdoor temperature to optimize boiler operation and efficiency.
4. Dual high limit/flue gas temperature sensor shall be mounted in the flue vent connector to monitor flue gas temperatures and reduce the blower speed when flue gas temperatures exceed 184°F. If the flue temperatures exceed 194°F, a forced boiler recycle results.
5. ASME Section IV safety relief valve sized to exceed the gross output of the boiler which shall be factory set to relieve pressure at [50 PSI – ALP399C & ALP500C, 60 PSI – ALP600C, ALP700C & ALP800C. 80 & 100PSI Optional for All Sizes] water working pressure.
6. Water flow switch to prevent the burner operation during low water flow conditions.
7. Air vent valve shall be included to release trapped air inside the boiler's heat exchanger.
8. Drain valve, 3/4 inch.
9. Boiler stacking brackets are packaged separately and included in boiler crate.
10. High Temperature Limit, automatic and manual reset, to prevent burner operation if water temperature conditions rise above maximum boiler design temperature. Limit switch to be manually reset on the control interface.
11. [High and low gas pressure switches with a range of 4.5 - 13.5 PSIG, wired to put the boiler into a hard lockout, requiring manual reset of the boiler primary safeguard control.] (NOTE TO SPECIFIER: To comply with ASME CSD-1)
12. OPTION [Low water cutoff (LWCO) device with manual reset. Boiler shall be fitted with a probe type LWCO located above the lowest safe permissible water level established by the boiler manufacturer. LWCO shall be UL listed and FM approved and suitable for commercial hydronic heating service at 80 PSI.] (NOTE TO

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SPECIFIER: May be needed to comply with ASME CSD-1 pending local jurisdiction requirements)

D. Vent & Intake Air Connections

1. Universal Boiler vent connection shall accept CPVC, polypropylene or stainless steel without the need of a separate vent adapter.
2. Combustion analyzer test port shall be available on the boiler vent connection.
3. The vent system shall be in accordance with National Fuel Code, NFPA 54/ANSI Z221.3 or CAN/CSA B149.1 Installation Code for Canada, or, applicable provisions of local building codes.
4. The boiler shall be vented using PVC/CPVC vent material in accordance with local code. A Factory supplied 90° elbow (schedule 80 CPVC) and a 30-inch length of schedule 40 CPVC pipe must be installed as a transition from the boiler to traditional solid core schedule 40 PVC vent material. Foam core pipe shall not be an approved vent material for either intake/exhaust piping. Vent connections must be located at the rear of the boiler. (NOTE TO SPECIFIER: Other venting options available. Please contact your local factory representative for details or consult the Alpine Commercial Condensing Boiler manual)
5. Air intake shall be connected into the boiler vestibule NOT directly into the boiler blower assembly.
6. Air intake piping shall be PVC that is sealed and pressure tight. Pipe must be at least the same size as the inlet air connection on the boiler. (NOTE TO SPECIFIER: Other air intake options available. Please contact your local factory representative for details or consult the Alpine Commercial Condensing Boiler manual).
7. Venting shall have an equivalent length of up to [ALP399C & ALP500C – 100, ALP600C thru ALP800C– 200] feet maximum and combustion intake air shall have an equivalent length of up to 100 feet maximum.

2.3 PERFORMANCE

- A. Boiler efficiency shall be as stated in the Equipment Schedule of the Contract Documents.
- B. The burner shall emit no more than 20 ppm NOx and 200 ppm CO (corrected to 3% O₂) at all firing rates.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Boiler installation shall comply with contract documents and boiler manufacturer's printed instructions.
- B. Installer shall always use a combustion analyzer to complete gas valve combustion settings during boiler start up.

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- C. Installer shall flush and clean the boiler upon completion of installation in accordance with manufacturer's start-up instructions. The boiler must be isolated when any cleaning or testing of system piping is being performed.
- D. Install skid plumb and level, to plus or minus 1/16 inch over base.
- E. Maintain manufacturer's recommended clearances around and over equipment, and as required by local Code.
- F. Manufacturer-recommended clearances shall be maintained around and over equipment, and as required by local Code.
- G. All electrical conduit, piping, exhaust vent, and air intakes shall be installed with clearances for service of all equipment.
- H. Exhaust vent shall always be connected to boiler vent connection.
- I. If shown in Contract Drawings, installer shall connect full sized air inlet vent to flanged connector on boiler.
- J. Fuel piping shall always be connected in accordance with NFPA 54. Pipe size to be the same, or greater, than the gas train inlet connection.
- K. Installer shall use full size (minimum) pipe/tubing on all gas vent connections.
- L. Installer shall connect water piping, full size, to supply and return connections.
- M. All piping accessories shall be installed per the details on the contract drawings.
- N. Installer shall install discharge piping from relief valves (open termination for viewing) and all drains to nearest floor drain while adhering to governing environmental requirements.
- O. Installer shall provide necessary water treatment to satisfy manufacturer's specified water quality limits.

END OF SECTION

PART 4 APPENDIX

4.1 OTHER SPECIFICATIONS

FLOW AND PRESSURE DROP TABLE

MODELS	35°F Δ T (Min)		30°F Δ T		25°F Δ T		20°F Δ T (Max)	
	Flow (GPM)	Δ P (Ft.Hd.)	Flow (GPM)	Δ P (Ft.Hd.)	Flow (GPM)	Δ P (Ft.Hd.)	Flow (GPM)	Δ P (Ft.Hd.)
ALP399C	21.5	6.1	25.1	7.9	30.2	10.8	37.7	15.9
ALP500C	27.7	5.2	32.3	6.8	38.8	9.3	48.5	13.6
ALP600C	33.9	4.7	39.6	6.1	47.5	8.4	59.4	12.4
ALP700C	39.4	6.0	45.9	7.9	55.1	10.9	68.9	16.1
ALP800C	43.4	5.9	50.7	7.8	60.8	10.8	76.0	16.1

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SPECIFICATIONS TABLE

Specification	Boiler Model				
	ALP399C	ALP500C	ALP600C	ALP700C	ALP800C
Altitude (ft. above sea level) ¹	0-10,100	0-10,100 ²	0-10,100	0-10,100 ³	0-6,000 ⁴
Fuel	Shipped for Natural Gas, Field Converted for LP Gas		Shipped for Natural Gas or Shipped for LP Gas (no Field Conversion)		
Max. Allowable Water Temperature (°F)	210	210	210	210	210
Max. Allowable Working Pressure (psi)	160	160	160	160	160
Factory Supplied Safety Relief Valve (psi)*	50	50	60	60	60
Boiler Water Volume (gal.)	3.4	4.3	5.4	5.4	6.2
Heat Transfer Area (sq. ft.)	41.8	58.1	76.2	76.2	87.0
Approx. Shipping Weight (lb.)	316	368	458	458	500

* Optional 80 psi and 100 psi safety relief valves are available for all models.

¹ Follow Instructions for High Altitude Installations above 2000 ft. (see Appendix A)

² ALP500C LP cannot be installed above 6,000 ft.

³ ALP700C LP cannot be installed above 7,800 ft.

⁴ ALP800C natural gas cannot be installed above 6,000 ft. ALP800C LP can be installed up to 10,100 ft.

RATING TABLE

Alpine Series Gas-Fired Boilers						
						
Model Number	Input (MBH)		Gross Output (MBH)	Net Ratings Water ¹ (MBH)	Thermal Efficiency (%)	Combustion Efficiency (%)
	Min.	Max.				
ALP399C	80	399	375	326	94.1	94.5
ALP500C	100	500	485	422	97.0	96.0
ALP600C	125	625	594	517	95.0	96.0
ALP700C	145	725	689	599	95.0	95.0
ALP800C	160	800	760	661	95.0	94.0

Ratings shown are for installations at sea level and elevations up to 2000 ft. at minimum vent length. For elevations above 2000 ft., see Appendix A Instructions for High Altitude Installations above 2000 ft.

¹ Net AHRI Water Ratings based on allowance of 1.15. Consult manufacturer before selecting boiler for installations having unusual piping and pickup requirements, such as intermittent system operation, extensive piping systems, etc.