ASCEND® 1500

ON-DEMAND GAS-FIRED with BUILT-IN DIGITAL RECIRCULATION VALVE

ASCEND® On-Demand Gas Fired Water Heaters are provided as a complete packaged water heating solution with The Brain® Digital Recirculation Valve (DRV) “ON-BOARD” for hot water system water temperature control.

With the DRV on board, ASCEND® on-demand water heaters provide the world’s first fully integrated, single footprint, tankless hot water generation and water temperature control solution compliant with ASSE 1017.

The Brain® on board delivers precise temperature control while ensuring water that reaches the heater is brought above legionella survival temperatures.

ASCEND® deploys a multiple pass condensing technology so that energy and heat from the combustion process is fully optimized by the unit’s heat exchanger. This innovative design maximizes the condensing condition across a broader operational range than traditional water heating technologies to deliver operating efficiencies as high as 99.8%.

ASCEND® 1000

ASCEND® 1500 Performance Chart: Delivered GPM to Delta T (F)							
ASCEND 1500®	Delta T (F) based on 125°F DRV set point				Minimum System Draw-Off	Minimum Recirculation Flow Rate	C_v
	85	75	65	55			
GPM	35.3	40	46.2	54.6	0 GPM	5 GPM	22

ASCEND® 1500 Performance Chart: Pressure Drop (in PSIG) to Flow Rate (in GPM)							
ASCEND 1500®	Pressure Drop (PSIG)				Minimum System Draw-Off	Minimum Flow Rate	C_v
	5	10	15	20			
GPM	48	70	85	89	0 GPM	5 GPM	22

ASCEND® 1500 Performance Chart: Pressure Drop (in BARG) to Flow Rate (in LPM)							
ASCEND 1500®	Pressure Drop (BARG)				Minimum System Draw-Off	Minimum Flow Rate	K_v
	0.3	0.7	1.0	1.4			
LPM	181.7	265	321	371	0 LPM	19 LPM	19

ASCEND® 1500 Performance Chart: Delivered GPM to Delta T (F)				
ASCEND 1500®	Input		Water Heater Output	
	BTU	kW	BTU	kW
	1,475,000	432	up to 1,430,750	419

Designs, materials, weights, and performance ratings are approximate and subject to change without notice. Visit **armstrong**international.com for the most up-to-date information.

ASCEND® 1500

TECHNICAL SPECIFICATIONS

General		
Protection	NEMA250 Type 3	
Ambient Temperature	Minimum Ambient Temperature: 35°F (2°C)	Maximum Ambient Temperature: 122°F (50°C)
Ambient Humidity	95% Non-Condensing	
Air Intake / Exhaust	8” SS Fas N’ Seal / Duravent	
Installation Environment	Suitable for indoor use only	
Materials	Valve: Stainless Steel, Electronics Casing: PC / ABS	
Safety	Seven fail-safe cold triggers supported by integral self-diagnostics and a programmable over-temp limit	
Connections		
Hot Water Inlet / Mixed Water Outlet	1-1/2” NPT Male Connections	
Cold Water Inlet	2” VIC Groove Connection	
Gas Connection	1-1/2” NPT Male Connection	
Recirculation Return	1” NPT Male Connection	
Pressures		
Inlet Supply Pressures	Maximum Pressure: 160 psi (11.03 bar)	Minimum Pressure: 20 psi (1.5 bar)
Supply Pressure Differential	Nominally equal	
Temperatures		
Cold Water Supply Temperature	Minimum Cold Water Temperature: 35.6°F (2°C)	
Min. Recirculation Temperature Loss	1°F (≤ 1°C)	
Min. Continuous Recirculation Flow	5 GPM (19 LPM)	
Recirculation Circuit		
Minimum Distance to First Outlet	25 ft (7.6 m)	
Electrical		
Power Supply	120 - 240V AC - 50/60 Hz	
Supply Fuse / Circuit Breaker	20 AMP grounding is required	
Battery - DRV40	Qty (2) CR - P2 6V	
Configurable Settings		
Set Point Range	81°F to 158°F (27°C to 70°C)	
High Temperature Alert	Minimum of 2°F (1°C) above DRV set point	
High Temperature Error	5°F (2°C) above DRV set point	
Thermal Disinfection Temperature	Programmable range of 158°F to 185°F (70°C to 85°C)	
Thermal Disinfection Set-Up	Disinfection Duration: ≤ 100 minutes	Disinfection Cool Down Duration: ≤ 30 hours
Units of Measure	Degrees Fahrenheit (°F) or Degrees Celsius (°C)	

Continued on next page

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ASCEND® 1500

TECHNICAL SPECIFICATIONS

Connectivity		
DRV40 Valve ONLY	Modbus RTU	RS-485 port for connection to building automation systems (BAS) operating on Modbus RTU protocol
	SAGE® Module	RS-485 port for connection to SAGE® module with Modbus TCP, BACnet TCP/IP, BACnet MSTP, or LonWorks protocessor *Note: Protocessors for other BAS protocols may be available upon request*
	SAGE® Subscription	Real-time monitoring, recording, and documentation dashboard for Armstrong Hot Water Systems
Heater	BACnet / LonWorks	Connection via Protonode for all BMS / BAS systems for monitoring heater in real time
Standards and Approvals		
DRV40 Valve ONLY	ASSE 1017	Certified & Listed
	CSA B125.3-11	Compliant
	UL	Listed
	CE	Listed
Heater	ANSI / CSA	Listed

ASCEND® 1500

WRITTEN SPECIFICATIONS

Category: ABH Gas-Fired Water Heaters

Type: On-Demand with Built-In Temperature Control

Model: ASCEND® 1000

Part 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract apply to this Section, including General and Supplementary Conditions and Division 01 Specification Sections.

1.2 Summary

A. This Section includes packaged, factory-fabricated and -assembled, gas-fired, high efficiency condensing domestic water heaters, trim and accessories for generating hot potable water.

1.3 Submittals

A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
   1. Prior to flue vent installation, engineered calculations and drawings must be submitted to Architect/ Engineer to thoroughly demonstrate that size and configuration conform to recommended size, length, and footprint for each submitted water heater.

B. Pressure Drop Curve: Submit pressure drop curve for flows ranging from 0 GPM to maximum value of water heater.

C. Shop Drawings: For water heaters, water heater trim, and accessories, include:
   1. Plans, elevations, sections, details and attachments to other work
   2. Wiring Diagrams for power, signal, and control wiring

D. Source Quality Control Test Reports: Reports shall be included in submittals.

E. Field Quality Control Test Reports: Reports shall be included in submittals

F. Operation and Maintenance Data: Data to be included in water heater emergency, operation and maintenance manuals.

G. Warranty: Standard warranty specified in this Section.

H. Other Informational Submittals.
   1. ASME Stamp Certification and Report: Submit “A,” “S,” or “PP” stamp certificate of authorization, as required by authorities having jurisdiction, and document hydrostatic testing of piping external to water heater.

1.4 Quality Assurance

A. Electrical Components, Devices and Accessories: Condensing water heaters must be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASME Compliance: Condensing water heaters must be constructed in accordance with ASME Water heater and Pressure Vessel Code, Section IV (HLW) Potable Water Heaters.

C. DOE Compliance: Minimum efficiency shall comply with 10 CFR Part 431, Subpart G, Appendix C, “Uniform Test Method for the Measurement of Thermal Efficiency and Standby Loss of Gas-Fired and Oil-Fired Instantaneous Water Heaters and Hot Water Supply Boilers (Other Than Storage-Type Instantaneous Water Heaters)”

D. UL Compliance. Condensing water heaters must be tested for compliance with UL 795, “Commercial-Industrial Gas Heating Equipment.” Condensing water heaters shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

E. NOx Emission Standards. When installed and operated in accordance with manufacturer’s instructions, condensing water heaters shall comply with the NOx emission standards outlined in South Coast Air Quality Management District (SCAQMD), Rule 1146.2; and the Texas Commission on Environmental Quality (TCEQ), Title 30, Chapter 117, Rule 117.465.

F. Low Lead Compliance: Condensing water heaters must conform to the requirements of ANSI/NSF 372, hence that the weighted average of the wetted surface area in contact with potable water must be no greater than 0.25% lead content.

1.5 Coordination

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement and formwork requirements are specified in Division 03.

1.6 Warranty

A. Standard Warranty: Water heaters shall include manufacturer's standard form in which manufacturer agrees to repair or replace components of water heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Period
   Full warranty coverage assumes the operation of an annual onsite equipment service program. Maintenance logs may be requested.
   Coverage commences upon the date entered on the field commissioning report on file with Armstrong. If the startup date cannot be verified, then warranty coverage commences 60 days from the date of manufacture. If a commissioning report is not provided, Armstrong reserves the right to independently determine the appropriate warranty coverage.
   a. Warranty Period for Heat Exchanger:
      10-year pro-rated, limited warranty against failure due to condensate corrosion, thermal stress, mechanical defect, or workmanship.
   b. Warranty Period for Digital Recirculation Valve:
      5-year conditional warranty on all parts against mechanical defects or workmanship other than preventative maintenance service items.
   c. Warranty Period for Water Heater – All Other Components
      1-year conditional warranty on all parts against mechanical defects or workmanship other than preventative maintenance service items.

Part 2 - PRODUCTS

2.1 Manufacturers

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide ARMSTRONG ASCEND Model 800; or a comparable product inclusive of ASSE 1017 & ASSE - IAPMO IGC 384-2022 Certified Integral "on board" Digital Recirculation Valve by one of the following:

1. ARMSTRONG INTERNATIONAL

2.2 Construction

General: The water heating plant shall generate 160°F hot water to mitigate waterborne pathogens and blend to a 125°F system set point by an ASSE 1017 Certified Integral "on board" Digital Recirculation Valve. Each water heater shall be UL Listed; ASME Section IV (HLW) coded and stamped and shall incorporate an FM Gas train.

Model: Ascend 1500 shall have an input of 1,475 MBH, output of 1,430 MBH, 35.3 GPM at 85°F temperature rise when fired with natural gas or propane, turndown ratio up to 5:1, NOx emissions of less than 20 ppm.

A. Description: Water Heater shall be of water tube condensing design with integral "on board" digital recirculation valve and provided factory fabricated, assembled, and performance tested as follows:

1. Flue gas vent connections
2. Combustion air intake connections
3. Water supply, return, and condensate drain connections
4. Pre-wired controls

Water Heater shall be lab tested, certified, and listed under ANSI Z21.10.3/CSA 4.3 and shall comply with the energy efficiency requirements of ASHRAE Standard 103 and so certified by an ASHRAE approved testing agency to have the following:

1. Water Heater shall operate at high fire with a minimum thermal efficiency of 90% when supplied with 160°F entering water.
2. Water Heater shall operate at thermal efficiency of 99.8% when supplied with 54°F entering water.
3. Water Heater shall operate at a combustion efficiency of up to 94.7%.
4. Water Heater shall have a rating for Oxides of Nitrogen (NOx) of 30 ppm or less, when corrected to 3% O_2.
5. Water Heater shall have an AFUE rating of 93.7% or greater.
6. Water Heater shall operate at altitudes up to 9,000 feet above sea level without additional parts or loss of BTU output.
7. Water Heater shall have an integral “on board” digital recirculation valve.

B. Heat Exchanger: Heat exchanger shall be constructed of 316L stainless steel and shall bear the ASME HLW stamp for 160 PSI working pressure and shall be National Board listed.

C. Combustion Chamber: Shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided. The stainless-steel combustion chamber shall be designed to drain condensation to the bottom of the heat exchanger assembly, keeping the primary combustion chamber free of excess moisture.

D. Burner: The burner shall be a premix design and constructed of high temperature stainless steel to provide a full input burner port loading ratio of 3,400 btu/sq. inch or greater. Burner shall be suitable for firing with natural gas or propane.

E. Blower: Centrifugal fan with ECM drive to operate during each burner firing sequence, to pre-purge and post-purge the combustion chamber, and to provide 8:3:1 modulating firing rates for maximum efficiency.

F. Gas Train: Shall be supplied with a negative pressure gas valve providing precise control of the air-gas offset ratio and maximum firing rate. The gas valve outlet shall be coupled to an air gas mixing venturi with a full port gas valve outlet and a free air inlet of no less than 2.5 times greater than the gas valve outlet area.

G. Ignition: The ignition system shall be direct-spark ignition with integrated flame sensor and soft start. Hot-surface ignition shall not be accepted

H. Condensate Drain: The heater shall contain an external condensate drain trap that shall allow condensation to drain freely from the heat exchanger assembly, while providing a water trapping height of a minimum of 1.5 times the maximum fan outlet pressure. This trap shall contain an integral neutralizer system. The safety control system shall incorporate a pressure switch or transducer that monitors the condensate drain system for any restriction causing a backup or leakage through trap and shall shut the appliance down and display a fault code to indicate such a condition exists.

Casing:

1. Jacket: Sheet metal, with snap-in or interlocking closures
2. Control Compartment Enclosures: NEMA 250, Type 3
3. Finish: Powder coated rear, side, and top panels, and molded plastic front cover
4. Combustion-Air Connections: Inlet and vent duct collars
5. Mounting base to secure Ascend
    a. The heater shall be supplied with a seismic rated and certified upon request.
    b. Seismic Fabrication Requirements: Fabricate mounting base and attachment to heater pressure vessel, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Section 230548 “Vibration and Seismic Controls for HVAC” when mounting base is anchored to building structure.

I. Characteristics and Capabilities:
   1. Heating Medium: Hot water
   2. Design Water Pressure Rating: 160 psig
   3. Safety Relief Valve Setting: 125 psig
   4. Entering-Water Temperature: see Schedule
   5. Leaving-Water Temperature: see Schedule
   6. Design Water Flow Rate: per heater manufacturer requirements
   7. Minimum Water Flow Rate: per heater manufacturer requirements
   8. Design Pressure Drop: per heater manufacturer requirements
   9. Minimum Efficiency AFUE: 93.7 percent
   10. Minimum Thermal Efficiency: 90 percent at high-fire with 160°F incoming water and 20°F delta T
   11. Minimum Combustion Efficiency: up to 94.7 percent
   12. Heater Input: 1,475 MBH
   13. Heater Output Capacity: 1,430 MBH
   14. Gas Pressure: 4” to 14” water column

2.3 Trim

A. Safety Relief Valve: ASME rated and sized as required.

B. Optional Pressure and Temperature Gage: Minimum 2-inch- diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.

C. Heater Air Vent: Automatic or Manual

D. Drain Valve: Minimum ¾ NPT Female

E. Circulation Pump: Non-overloading pumps with motor having lubricated bearings; designed to operate at specified heater pressures and temperatures; sized for heater required flow rates.

F. Condensate Neutralizer: Each condensing heater system shall be supplied with a condensate neutralizer. The neutralizer shall be factory engineered and sized for the heater condensate capacity with adequate soak-time to bring the condensate to a pH of 7 and with sufficient volume of neutralizing agent to provide for 2000 hours of operation in a fully condensing application. The neutralizing agent shall be ½” – ¾” common limestone aggregate.

2.4 Controls - Water Heater

A. The heater shall utilize integrated control circuit and components. The control system shall have an LCD display with self-diagnostic microprocessor controls for heater set-up, heater status, and heater diagnostics. All components shall be easily accessed and serviceable from the front of the jacket without removing any additional panels. The heater controls shall be equipped with the following:
   1. Dual High Limit sensor (fixed and adjustable)
   2. Exhaust temperature sensor
   3. Gas inlet pressure transducer
   4. Flue back pressure/ condensate back up protection
   5. Water flow protection (flow switch or transducer)
   6. Built-in freeze protection

B. Optional Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display all points displayed on the local display(s).
   1. Hardwired Points
      a. Monitoring
      b. Inlet/Outlet temperature
      c. Exhaust temperature
      d. Gas inlet pressure
      e. Run Status

f. Additional Monitor and Control Points (Specifier insert below)
   1.) _____
   2.) _____
   3.) _____

2.5 Controls - Digital Recirculation Valve (Integral "On Board")

A. Digital Recirculation Valve: DRV40
   1. DRV shall have four thermistors integral of the mixing valve body that measure the cold water and recirculation return inlet, hot water inlet, mixed water outlet, and over-temp safety measures.
   2. DRV mixing valve body shall be of 316L stainless steel, mixing valve proportioner of 316L stainless steel,
   3. DRV40 shall have 1-1/2" outlet connections that will deliver 48 gpm @ 10 psig.
   4. DRV shall be capable of + / - 2° F control during high, low, or extended periods of zero demand on the system, with a continuous recirculation of >5 gpm. Temperature control shall be achieved without aquastat-like control of the recirculation pump.
   5. DRV setpoint (system) shall be configured by the factory to customer specification. DRV shall also be field adjustable.
   6. DRV shall be certified to ASSE 1017, UL listed, and conform to CSA B125.

B. DRV shall have the following operational specifications
   1. + / - 2°F (1°C) water temperature control
   2. 1° F minimum mixed water outlet to recirculated return inlet differential (system temperature loss)
   3. Minimum continuous recirculation of 5 gpm
   4. Automatic shutoff of hot water upon cold water inlet supply failure
   5. Automatic shutoff of hot water flow in the event of a power failure
   6. Programmable setpoint range of 81–158° F (27–70° C)
   7. Programmable thermal disinfection mode
   8. Programmable 1st level hi/lo temperature alert display
   9. Programmable temperature error level for safety shutdown

2.6 Controls - Building Management Systems - Water Heater

A. Building Automation System Interface (optional): Factory install hardware and software to enable building automation system to monitor, control, and display all points displayed on the local display(s).
   1. Hardwired Points:
      a. Monitoring
      b. Inlet/Outlet temperature
      c. Exhaust temperature
      d. Gas inlet pressure
      e. Run Status
      f. Additional Monitor and Control Points (Specifier insert below)
         1.) _____
         2.) _____
         3.) _____

2.6 Controls - Building Management Systems - Digital Mixing Valve

A. Digital Recirculation Valve shall have the following connectivity options:
   1. BACnet MSTP on-board for connection to building automation system (BAS) operating on BACnet MSTP protocol
   2. MODBUS RTU RS485 port for connection to building automation system (BAS) operating on MODBUS RTU protocol
   3. RS485 port for connection to SAGE® module with MODBUS TCP, BACnet TCP/IP, or Lon Works protocessor*
      Note: Protocessors for other BAS protocols available upon request

2.7 Electrical Power

A. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

B. Multiple heaters shall be provided with a pre-wired power supply to heaters and heaters pump with an individual service disconnect for each heater for a single-point field electrical connection.

1. Electrical Characteristics
    a. Volts: 208-240 V.
    b. Phase: Single/Split
    c. Hertz: 60
    d. Full Load Amperes: < 7

2.8 Piping Kits

A. Water Heater shall be provided with pre-piped water and gas manifolds for single point supply and return connections.

1. WATER: Manifolds shall be copper reverse return piping to eliminate any unwanted residual flow through off heaters. Each heater pump assembly shall have flanged 1/4-turn full port brass ball valves for isolation. The package shall be Lead Free and rated for design pressure applications. Piping shall be constructed in such a fashion as to allow it to remain in its finished position during shipping. All piping shall be air tested to a minimum of 100 PSI and checked to be free of leaks at the factory; all ball valves will be cycled during this pressure test to ensure their integrity. Piping is sized for maximum flow rate of package specification.
2. GAS: Common gas manifold constructed of welded or threaded black steel pipe and shall contain a drip leg at the single point gas connection. The common gas manifold shall contain corrugated stainless steel flexible tubing to each heater, as well as an individual brass ¼ turn gas-rated shutoff valve. The entire gas piping system shall be factory engineered and installed prior to shipment. Piping shall be constructed in such a fashion as to allow it to remain in its finished position during shipping. All piping shall be air tested to a minimum of 30 PSI and checked to be free of leaks; all ball valves will be cycled during this pressure test to ensure their integrity. Piping is sized for maximum flow rate.

2.9 Source Quality Control

A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions and carbon monoxide in flue gas, and to achieve combustion efficiency. Perform hydrostatic testing.

B. Test and inspect factory-assembled water heaters, before shipping, according to ASME Boiler and Pressure Vessel Code.

1. If water heaters are not factory assembled and fire-tested, the local vendor is responsible for all field assembly and testing.

C. Allow Owner access to source quality-control testing of water heaters. Notify Architect fourteen days in advance of testing.

Part 3 - EXECUTION

3.1 Examination

A. Before water heater installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations. Examine piping and electrical connections to verify actual locations, sizes and other conditions affecting water heater performance, maintenance and operations.

1. Final water heater locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where water heaters will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Water Heater Installation

A. Water Heaters must be installed level and anchored to floor or wall as required.
B. Install gas-fired heaters according to NFPA 54.
C. Assemble and install heater trim.
D. Install electrical devices furnished with heater but not specified to be factory mounted.
E. Install control wiring to field-mounted electrical devices.

3.3 Connections

A. Piping installation requirements are specified in other Division 23 sections. Drawings indicate general arrangement of piping, fittings and specialties.
B. Install piping adjacent to water heater to permit service and maintenance.
C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
D. Connect gas piping to water heater gas-train inlet with unions. Piping shall be at least full size of gas train connection. Provide a reducer if required.
E. Connect hot-water piping to supply and return water heater tappings with shutoff valve and union or flange at each connection.
F. Multiple heaters shall be piped in reverse return or provided with balancing valves on hot water outlet. Each water heater shall have individual isolation valves for servicing and a hot water hose connection for start-up and field testing.
G. Install piping from safety relief valves to nearest floor drain.
H. Water Heater Venting
    1. Install flue venting kit and combustion-air intake.
    2. Connect venting full size to water heater connections. [Comply with requirements in Division 23 Section “Breechings, Chimneys and Stacks.”]
I. Ground equipment according to Division 26 Section “Grounding and Bonding for Electrical Systems.”
J. Connect wiring according to Division 26 Section “Low-Voltage Electrical Power Conductors and Cables.”

3.4 Field Quality Control

A. Perform test and inspections and prepare reports.
    1. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect components, assemblies and equipment installations, including connections, and to assist in testing.
B. Tests and Inspections
    1. Installation and Startup Test: Perform installation and startup checks according to manufacturer’s written instructions.
    2. Leak Test: Perform hydrostatic test. Repair leaks and retest until no leaks exist.
    3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
    4. Controls and Safeties: Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
        a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
        b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
C. Water Quality: The following water quality guidelines shall be adhered to. Water heaters requiring more stringent water quality guidelines shall not be permitted.

D. A water chemistry analysis should be performed prior to installation. If the water quality exceeds any of the following levels consult the factory for system design recommendations

Water Quality Guidelines	
Total Dissolved Solids:	≤ 450 PPM
Chlorides	≤ 120 PPM
Free Chlorine	≤ 0.5 PPM
Hardness ($CaCO_3$):	≤ 12 grains (205 PPM or mg/L)
PH ≤ 6.5 or ≥ 7.5	

E. Occupancy Adjustments: When requested within 2 months of system commissioning, provide on-site assistance adjusting system to suit actual occupied conditions. Provide up to two visits to project during other than normal occupancy hours for this purpose.

ASCEND® 1500
CONNECTIVITY

The Brain® and SAGE®

SAGE® works seamlessly with The Brain® as it analyzes data to track behavior and performance as an integral component of a hot water system operation protocol which complies with a standard of care.

The Brain® and every derivative assembly is supplied with an integral RS-485 serial port. This port provides a direct connection to Building Automation Systems that operate on a **Modbus RTU** or **BACnet MSTP** protocol.

The RS-485 port is also deployed for direct connection to an optionally supplied Building System (BS) Module.

SAGE® Options

SAGE® for Building Automation Systems (BAS) – BS Module available with BAS specific ProtoCessor cards for connection to systems which operate on **Modbus TCP**, **BACnet™ TCP/IP**, **BACnet™ MSTP**, or **LonWorks™** protocols.

SAGE® for Mobile Connectivity - Featuring smart hot water system dashboard monitoring, secure remote programming, multi-location view, temperature and system diagnostic alerts, with unlimited digital documentation and automated report generation.

Mobile connectivity may be enabled by a customer activated no-term subscription.

Optional Building System (BS) Module

Adding a suffix “BS” to The Brain® DRV (example: DRV25BS) will automatically add SAGE®, the supplemental hardware and software required to maximize the connectivity features of Armstrong digital technology.

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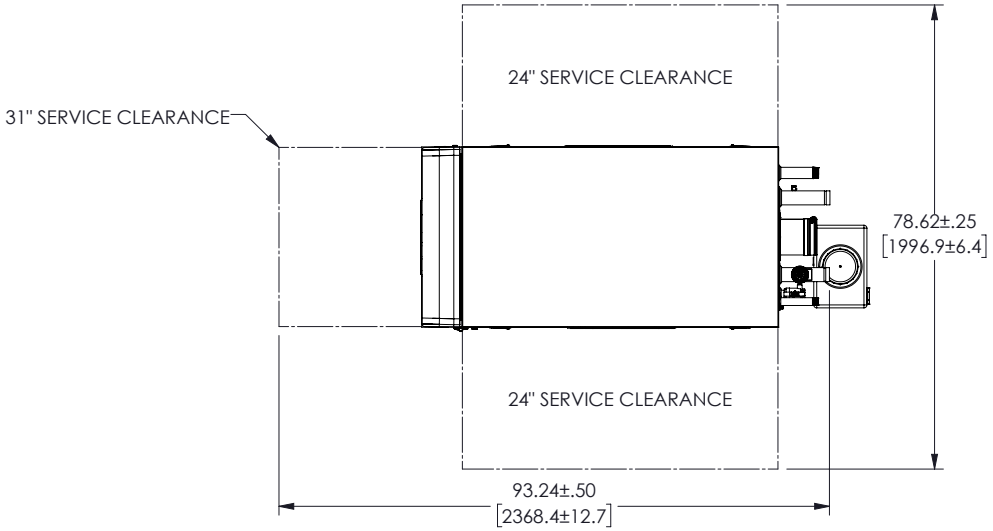
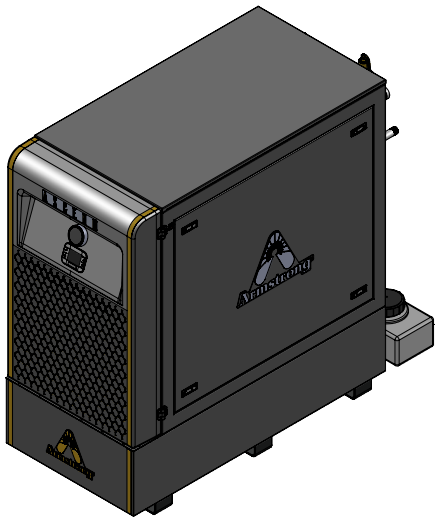
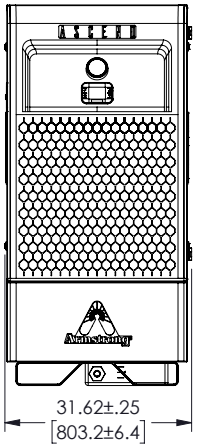
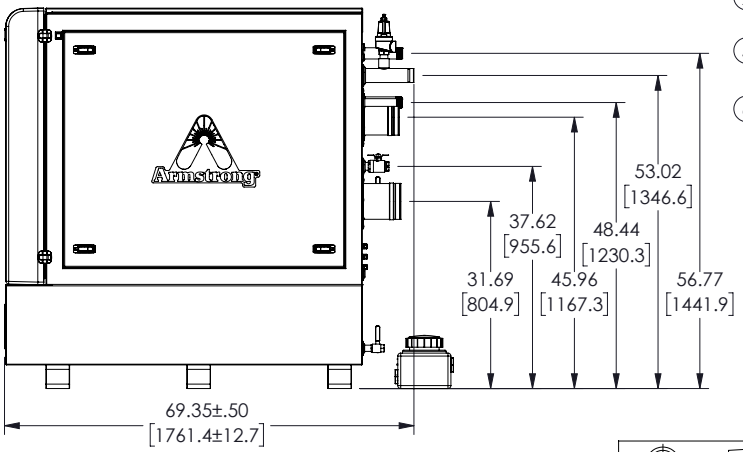
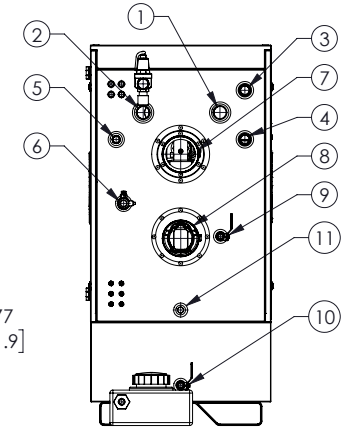










ITEM NO.	DESCRIPTION	CONNECTION
1	COLD WATER INLET	2" VIC
2	HOT WATER OUTLET	2" VIC
3	DRV MIXED OUTLET	1-1/2 NPT
4	DRV COLD WATER INLET	1-1/2 NPT
5	RECIRCULATION LINE	1 NPT
6	GAS INLET	1 NPT
7	AIR INTAKE	6" SS
8	EXHAUST VENT	8" SS
9	HEX DRAIN	3/4 NPT
10	EXPANSION DRAIN	3/4 NPT
11	CONDENSATE OUTLET	1"

DO NOT SCALE DRAWING
TOLERANCES UNLESS OTHERWISE SPECIFIED
DIMENSIONING ENGLISH [mm]
FRACTIONAL ± 1/64
ANGULAR: ± 2

	IN.	MM
DECIMAL .XXXX ±	.0005	-----
.XXX ±	.005	.010
.XX ±	.015	.10
.X	----------	.3

	NAME	DATE
DRAWN	Michael Lewandowski	02/09/2021
RELEASED		

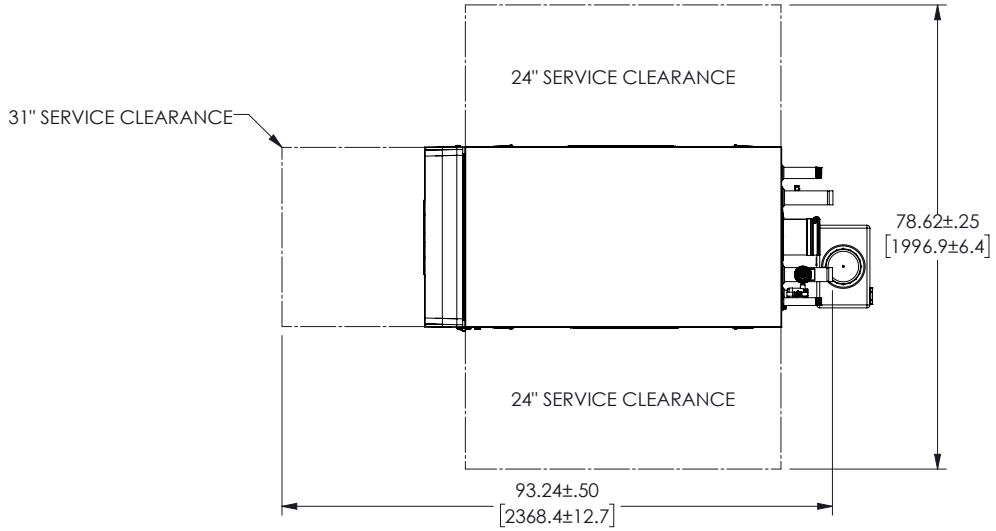
ARMSTRONG INTERNATIONAL

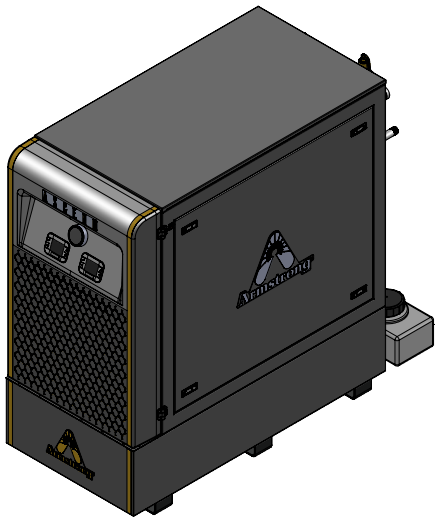
1500MBH ASCEND BCB DRV

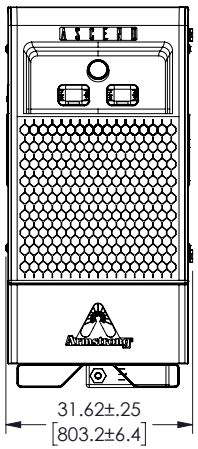
MATERIAL

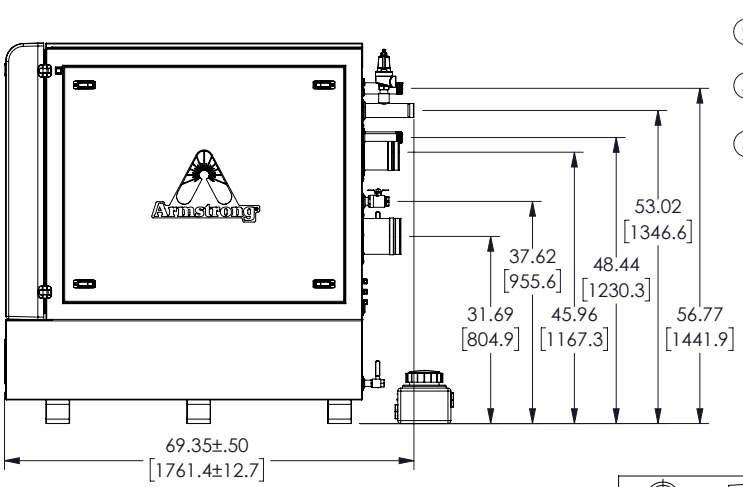
SHEET 1 OF 1

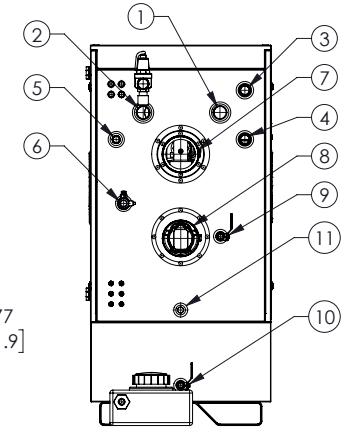
REV A DWG.











ITEM NO.	DESCRIPTION	CONNECTION
1	COLD WATER INLET	2" VIC
2	HOT WATER OUTLET	2" VIC
3	DRV MIXED OUTLET	1-1/2 NPT
4	DRV COLD WATER INLET	1-1/2 NPT
5	RECIRCULATION LINE	1 NPT
6	GAS INLET	1 NPT
7	AIR INTAKE	6" SS
8	EXHAUST VENT	8" SS
9	HEX DRAIN	3/4 NPT
10	EXPANSION DRAIN	3/4 NPT
11	CONDENSATE OUTLET	1"

DO NOT SCALE DRAWING
TOLERANCES UNLESS OTHERWISE SPECIFIED
DIMENSIONING ENGLISH [mm]
FRACTIONAL ± 1/64
ANGULAR: ± 2

		IN.	MM
DECIMAL	.XXXX ±	.0005	-----
	.XXX ±	.005	.010
	.XX ±	.015	.10
	.X	----------	.3

	NAME	DATE
DRAWN	Michael Lewandowski	02/09/2021
RELEASED		

ARMSTRONG INTERNATIONAL

1500MBH ASCEND BCB CCB DRV

MATERIAL

SHEET 1 OF 1

REV A DWG.