BTRS-900 System Description

The BTRS-900 is a complete reaction system for vapor phase catalyst evaluation and continuous flow process analysis. The system can be provided with one or two distinct reactor trains. The system with two reactor trains can operate independently or in parallel. The unit is comprised of two major sections. These are the **Unheated Feed Section** and the **Heated Process Section**. The majority of the process components are housed within one of the two heated oven enclosures, i.e. the valve oven and the reactor oven. Forced convection blower assemblies provide heating for the ovens. This heated environment ensures that condensation within the process stream is minimized.

Feed Section

The Feed Section is capable of handling up to four gas inputs (two of which can be used for liquid feeds if desired), and one dedicated liquid feed input per reactor train. Three inputs can be used for high-pressure liquid metering pumps.

The components as described below direct the inputs to the mixer/vaporizer and reactor.

The **Manual Feed Controls** include inline filters, automated isolation valves, high-pressure metering valves, 3-way diverter valves, and reverse-flow check valves. These valves permit automatic on/off control, manual flow control, and manual flow measurement of gases prior to being directed into the system. These manual controls are mounted on the front panel of the unit.

The **Automatic Feed Controls** include inline filters, mass flow controllers, automated isolation valves, and reverse-flow check valves. These components permit automatic on/off control, automatic flow control, and precise electronic flow measurement of gases.

The **Dedicated Liquid Feed Input** includes an inline filter, automated isolation valve, and reverse-flow check valve.

The **System Failsafe Purge** input is connected to the feed section of the unit. This purge is utilized by the system to displace process gas and liquid in the complete process system in the event that all feed inputs are shut off either intentionally or by failsafe condition.

Both the Manual Feed and Automatic Feed Controls facilitate computer control of the feed streams and System Failsafe Purge scheme.

The **Reactor Purge** input is connected to the reactor section of the unit. This purge is utilized by the system to displace process gas and liquid in the reactor when the reactor is offline.

Optional equipment such as **Liquid Feed Tanks**, **Weigh Scales**, **Liquid Pumps**, and **Heated Feeds** can be provided based on the customer's needs.

Process Section - Reactant Handling

The reactants, gas and liquid, are passed through a heated **Mixer/Vaporizer** for blending and creation of a single homogeneous, non-pulsating vapor phase stream to be fed into the reactor. This unit is housed in the valve oven.

The heated, near zero dead volume, multi-port **Reactor Status Valve** dictates the routing of the feed stream. In the *Offline* position the feed stream is routed to the system effluent section, while the inert reactor purge gas is routed through the reactor and subsequently to the reactor purge vent. Routing the

feed stream to the effluent section provides a means of performing analytical sampling of the feed stream. In the *Online* position the feed stream is routed to the reactor and the inert reactor purge gas is routed directly to the reactor purge vent. The reactor outlet is now routed to the effluent section for performing gas/liquid separation, analytical sampling, or venting of the effluent stream. This unit is housed in the valve oven.

Optional equipment for unique flow schemes such as **upflow/downflow switching** or **independent/series operation** of two reactors can be provided.

Process Section - Reactor

The **Fixed-Bed Tubular Reactor** is provided with a single or multi-zone heater depending on the customer's uniformity requirements. The reactor is designed to provide an isothermal zone in the center of the reactor bed. The reactor is tubed for downflow (standard) or upflow operation. The reactor and heater are mounted within the reactor oven.

The **Pressure Gauge/Transducer** and the **Automated Back Pressure Regulator** are used to control the reaction pressure. The reaction pressure is controlled automatically from the computer. The pressure sensing and pressure regulating devices have their pressure ends located in the reactor oven.

Process Section - Effluent Handling

The **Gas/Liquid Separator**, located upstream of the backpressure regulator, provides a temperature controlled depository for effluent liquid to condense prior to reaching the backpressure regulator. The Gas/Liquid Separator can be drained manually, with time based automatic drain valve action, or with closed loop level control.

The heated, near zero dead volume, multi-port **Sample Valve**, located downstream from the back pressure regulator, can be provided for transfer of a measured vapor phase effluent slug from the system to the customer supplied gas chromatograph or some any other suitable analytical equipment. This unit is housed in the valve oven. A heated transfer line and carrier gas controls are provided for sample transfer to the customer's analytical equipment. If the Sample Valve is not provided, a pressure controlled effluent stream can be sent directly to the customer's analytical equipment or the effluent stream can just be vented.

Optional equipment such as **Product/Waste Tanks**, **Weigh Scales**, **Wet Test Flow Meters**, and **GC Switching Valve** can be provided based on the customer's needs.

BTRS-900 Applications

Chemical
- Hydrogenation
- Functional Group Modification
- Selective Oxidation
- Ammoxidation
- Isomerization

Petrochemical
- Cracking
- Reforming
- Isomerization
- Fisher-Tropsch

Environmental
- Liquid Waste Disposal
- Total Oxidation
- Effluent Treatment
- Resource Conservation

Food & Pharmaceutical
- Fermentation
- Supported-Enzyme Catalysis
- Hydrogenation

BTRS-900 Product Specification

General

System Ratings:	Operating Pressure: 450 psi / 1450 psi / 2900 psi…(31 bar / 100 bar / 200 bar) Reactor Temperature: 650°C…(1,202°F) Oven Temperature: 250°C…(482°F)
Dimensions:	Cabinet: 52"…(132cm) wide x 78"…(198cm) tall x 25"…(63cm) deep. Valve Oven: 7"…(18cm) wide x 40"…(101cm) tall x 6.5"…(16cm) deep. Reactor Oven: 15"…(38cm) wide x 40"…(101cm) tall x 14"…(35cm) deep.
Power:	220 VAC, 50/60 Hz, 60 Amp service, Single Phase
Wetted Materials:	300 Series Stainless Steel, Teflon®(PTFE), Kel-F®(PCTFE), Kalrez®, Nitronic® 60, Vespel® (Polyimide), Nickel alloy A-286 (A-286 is on the 20 & 40 mL, 2,900 psi…(200 bar) models only)
Bulkheads:	Compression fittings for stainless steel tubing with nominal 1/8" OD x 1/16" ID.
Filter Rating:	7 micron.
Mass Flow Controller:	50:1 flow control range.
Isolation Valves:	2-way, bellows-sealed, soft seat.
Metering Valves:	18 turn, 0.047"…(1.19 mm) orifice, 1° stem, 0.010 Cv micrometer handle.
Ball Valves:	3-way, 180° actuation for directional flow switching and shut-off.
Check Valves:	O-ring seal design, 20 psi…(1.4 bar) cracking pressure.
Thermocouples:	Type-K (Nickel-Chromium & Nickel-Aluminum).
Tubing:	1/8" OD x 1/16" ID 316 Stainless Steel Seamless tubing.

Notes: Kel-F® is a registered trade name of 3M Company. In 1996, 3M discontinued manufacturing of Kel-F & today, all PCTFE resin is manufactured by Daikin under the trade name of Neoflon ® or by Allied Signal under the trade name of Aclon ®. Kel-F is still the most commonly used trade name used to describe PCTFE. Teflon® and Vespel® are registered trademarks of Dupont Co., Wilmington DE. Kalrez® is a registered trademark of Dupont Dow Elastomer, Wilmington DE. Nitronic® is a registered trademark of AK Steel Corporation, Middletown OH produced under license by Electralloy Div. of G.O. Carlson Inc., Oil City PA.

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Feed Components

Feed streams are provided for four (4) reactant feeds, one (1) dedicated liquid feed, the system failsafe purge, the reactor purge, and the GC carrier gas for each of the reactors.

Reactant Feeds:	Four (4) feed lines consisting of a bulkhead, inline filter, automated isolation valve (normally closed), manual metering valve, manual 3-way diverter valve, and a reverse flow check valve. Each of these feeds can integrate an optional electronic Mass Flow Controller for automated flow control capability. Up to two of these feeds may be used for liquid reactant.
Liquid Feed:	One (1) feed line consisting of a bulkhead, inline filter, automated isolation valve (normally closed), and a reverse flow check valve.
System Failsafe:	System failsafe purge gas feed consisting of a bulkhead, inline filter, automatic isolation valve (normally open), manual metering valve, manual 3-way diverter valve, and a reverse flow check valve. The system failsafe purge is used to purge system when no feeds are active.
Reactor Purge:	Reactor purge gas feed consisting of a bulkhead, inline filter, 2-way isolation valve, manual-metering valve, pressure gauge, and a reverse flow check valve on the inlet stream. A manual metering valve is on the outlet stream.
GC Carrier:	GC Carrier feed consisting of a bulkhead, inline filter, manual flow controller, manual 3-way diverter valve, reverse flow check valve, and injection port. The GC carrier gas is used to sweep the sample into the GC.
Liquid Pumps:	Optional high-pressure liquid feed pumps can be provided. The pumps are integrated into the control system and can pump feeds at various pressures, temperatures, and flow rates. Both piston and syringe pump styles are available.

Liquid Feed Tanks: Liquid feed tanks can be provided with the capability of being thermally regulated and pressurized dependent on the required condition needed to maintain the feed in the liquid state.

Weigh Scale: For actual measurement of liquid uptake by the system. Precision weigh scales can be provided that are integrated into the control system. The weigh scales provide an accurate means of obtaining data for mass balance and closed loop control of the liquid feed mechanism.

Valve Oven Components

The valve oven contains the mixing and feed stream routing components for the system.

Mixer Vaporizer: Four (4) inputs consisting of an inline filter and residence tubing coil. The unit is facilitates the preheating and mixing of the feeds into a homogeneous blend.

Status Valve: Optional multiport switching valve with 1/8" tube connections, 8-ports, 2-positions, air operator, and automatic control. The valve controls the diverting of either the feed stream or the reactor purge gas through the reactor. When the feed stream is not routed through the reactor, the feed stream is routed to the effluent handling section where it can subsequently be sent to the GC.

Sample Valve: Optional multiport switching valve with 1/8" tube connections, 8-ports, 2-positions, air operator, and automatic control. The valve controls the diverting of a measured vapor phase effluent slug of either the feed stream or the reactor effluent to the GC.

Reactor Oven Components

The reactor oven contains the reactors and pressure control components for the system.

Tubular Reactor: The tubular reactor includes inlet filter, outlet filter and full-length internal thermowell. Up to two reactors can be utilized in the sizes given in the table below.

Volume	Inside Dia	Outside Dia	Heated Length	Heater
5 cc	0.31"…7.9mm	0.56"…14.3mm	6"…152.4mm	675 W, Single Zone
10 cc	0.31"…7.9mm	0.56"…14.3mm	12"…304.8mm	1,350 W, Single Zone
20 cc	0.52"...13.1mm	0.75"…19.1mm	6"…152.4mm	675 W, Single Zone
40 cc	0.52"...13.1mm	0.75"…19.1mm	12"…304.8mm	1,350 W, Three Zone
100 cc	1.0"...25.4mm	2.125"…54mm	17"…431.8mm	2,380 W, Three Zone

The standard end fitting of the tubular reactor is equipped with an unused (plugged) connection. It can be used to feed liquids (trickle feed) directly to the reactor through a dedicated line that bypasses the mixer/vaporizer assembly.

The reactor tubing configuration creates downward flow, i.e. in the top and out the bottom unless otherwise specified. Pre-bent tubing to produce reverse reactor flow (upward) is included as loose parts with the system.

Pressure Gauge:
Isolator: 316 SS, silicon oil filled (located in oven).
Gauge: 2-1/2" diameter face, dual scale psi…bar (located on exterior oven wall).
Transducer: Accuracy of +/- 0.13% of full scale at constant temperature (located on exterior oven wall).

Back Pressure Regulator: Provides closed-loop, automatic pressure control for the reaction system. The pressure portion is located in oven. The positioner controller is located on exterior oven wall.

Gas/Liquid Separator: The optional gas/liquid separator is located on the outlet of the reactor before the backpressure regulator. It can be the thermostatically heated or cooled via a chiller depending on the conditions required. Level control of the liquid hold-up is accomplished via a manual metering valve and a manual ball valve for draining to a collection tank. An optional automatic valve can be used for draining via a fixed time base or an optional liquid level probe can be used to dictate the automatic drain valve activation.
Volume: 150 mL
Cooling Coil: ¼" Copper tubing.
Manual Drain: Metering Valve and ¼-turn ball valve.

Analytical Components

Heated Transfer Line: The optional heated transfer line connects the sample valve to a GC. It ensures a complete sample arrives at the GC by delivering it at elevated temperature to prevent any condensation. Optional heated transfer lines can be used to connect between components outside of the oven and maintain higher temperature operation.
Length: 6 feet…(1.83m)
Inside Dia: 0.027"…(0.69mm)
Max Temp: 300^{6}C…(572^{6}F)
GC Adapter: Universal needle nut assembly including needles, septa, nut & ferrule.

Liquid Product Tanks: Liquid product/waste tanks can be provided with the capability of being thermally regulated dependent on the required condition needed to maintain the product/waste in the liquid state.

Weigh Scale: For actual measurement of liquid product/waste by the system. Precision weigh scales can be provided that are integrated into the control system. The weigh scales provide an accurate means of obtaining data for mass balance.

Wet Test Meter: Wet test meters can be provided to accurately measure the volume of gas vented by the system. The flow rate is monitored by the computer control system and can be used for mass balance.

Operating Pressure Ranges and Component Ratings

Maximum Operating Pressure	Gauge Range / Transducer Rating	Maximum Allowable Working Pressure	Rupture Disk Rating
450 psi…(31 bar)	600 psi…(42 bar) / 500 psi…(35 bar)	500 psi @ 1202^{6}F (35 bar @ 650^{6}C)	500 psi…35 bar
1,450 psi…(100 bar)	2,000 psi…(138 bar) / 3,000 psi…(207 bar)	1,600 psi @ 1,202^{6}F (110 bar @ 650^{6}C)	1,600 psi…110 bar
2,900 psi…(200 bar)	5,000 psi…(345 bar) / 3,000 psi…(207 bar)	3,200 psi @ 1,202^{6}F (220 bar @ 650^{6}C)	3,144 psi…216 bar

Minimum Controllable Pressure is 25 psi.

Control System

The control system is an integrated package utilizing PLC and supervisor computer/software package custom designed by Autoclave to operate the unit autonomously and reliably while storing all system data and events.

Heat Control: All heater control loops for the ovens, reactors, gas/liquid separators, transfer lines, etc are closed loop control with failsafe power interrupting capability. Temperatures are constantly monitored to ensure safe operation.

Pressure Control: All pressure control loops for the reactors are closed loop control with overpressure protection in the form of mechanical overpressure devices and constant monitoring by the control system.

Alarm Monitoring: Temperature, Pressure, Flow, etc are monitored for both abnormal (notify the operator) conditions and automatic failsafe conditions.

Totally Integrated: The control system integrates the actions of all appropriate devices in order to enable complete control, repeatability, and hands-free operation.

Data Acquisition: All process variables, system states, customer commands, alarms and events are monitored by the system and stored on the computer's hard drive.

Remote Support: Autoclave Engineers embeds their code with remote access ability to anywhere in the world with an analog phone line or network/internet capability. Through this connection problems can be debugged, modifications can be made, and updates can be loaded directly by Autoclave's Control Engineers.

BTRS-900 Configuration

Configuration for Reactor Train #1:

☒ **Feed–1:**
☐ Manual Feed Components.
☒ Mass Flow Controller:
Gas Type:
Inlet Pressure:_____, Max Outlet Pressure: _____ (50 psi less than Inlet Pressure)
Flowrate: _____ sccm (50:1 ratio)
Min Outlet Pressure:

☒ **Feed–2:**
☐ Manual Feed Components
☒ Mass Flow Controller:
Gas Type:
Inlet Pressure _____, Max Outlet Pressure: _____ (50 psi less than Inlet Pressure)
Flowrate: _____ sccm (50:1 ratio)
Min Outlet Pressure:

☒ **Feed–3:**
☐ Manual Feed Components
☐ Mass Flow Controller:
Gas Type:
Inlet Pressure:_____, Max Outlet Pressure: _____ (50 psi less than Inlet Pressure)
Flowrate: _____ sccm (50:1 ratio)
Min Outlet Pressure:
--- OR ---
☒ Piston Liquid Feed Pump: Liquid:
Inlet Pressure: _____ Inlet Temperature:
Outlet Pressure: _____ Outlet Temperature:
Flowrate:
---- OR ---
☐ Syringe Liquid Feed Pump: Liquid:
Inlet Pressure: _____ Inlet Temperature:
Outlet Pressure: _____ Outlet Temperature:
Flowrate:
☐ Feed Tank:
Volume: ☐ 1 Gallon…(3.8 bar) ☐ ½ Gallon…(1.9 bar)
Material: ☐ 304/316 Stainless Steel
☐ Other:
Pressure: _____ Temperature:
☐ Weigh Scale: Maximum Weight:

☒ **Feed–4:**
☒ Manual Feed Components
☐ Mass Flow Controller:
Gas Type:
Inlet Pressure: _____, Max Outlet Pressure: _____ (50 psi less than Inlet Pressure)
Flowrate: _____ sccm (50:1 ratio)
Min Outlet Pressure:
--- OR ---
☒ Piston Liquid Feed Pump: Liquid:
Inlet Pressure: _____ Inlet Temperature:
Outlet Pressure: _____ Outlet Temperature:
Flowrate:
---- OR ---
☐ Syringe Liquid Feed Pump: Liquid:
Inlet Pressure: _____ Inlet Temperature:
Outlet Pressure: _____ Outlet Temperature:
Flowrate:
☐ Feed Tank:
Volume: ☐ 1 Gallon…(3.8 bar) ☐ ½ Gallon…(1.9 bar)
Material: ☐ 304/316 Stainless Steel
☐ Other:
Pressure: _____ Temperature:
☐ Weigh Scale: Maximum Weight:

☒ **Feed–5:** ☒ Manual Feed Components
☐ Piston Liquid Feed Pump: Liquid:
Inlet Pressure: _____ Inlet Temperature:
Outlet Pressure: _____ Outlet Temperature:
Flowrate:
---- OR ---
☐ Syringe Liquid Feed Pump: Liquid:
Inlet Pressure: _____ Inlet Temperature:
Outlet Pressure: _____ Outlet Temperature:
Flowrate:
☐ Feed Tank:
Volume: ☐ 1 Gallon…(3.8 bar) ☐ ½ Gallon…(1.9 bar)
Material: ☐ 304/316 Stainless Steel
☐ Other:
Pressure: _____ Temperature:
☐ Weigh Scale: Maximum Weight:

☐ **Reactor Status Valve:** Seat Material: ☐ Polyimide (482^{6}F…(250^{6}C))
☐ Peek (392^{6}F…(200^{6}C))
(Maximum Pressure: 1450 psi…(100 bar))

☐ **Sample Valve:** Seat Material: ☐ Polyimide (482^{6}F…(250^{6}C))
☐ Peek (392^{6}F…(200^{6}C))

☒ **Reactor:** Pressure: _____ Temperature:
Material of Construction: ☒ 316 SS ☐ A-286 ☐ Inconel 800HT
☐ Other
Reactor Volume: ☐ 5 cc ☐ 10 cc ☐ 20 cc ☒ 40 cc ☐ 100 cc
☐ Other
Reactor Cooling: ☐ Yes ☐ No

☒ **Pressure Indication:** Pressure Range: ☒ 450 psi…(31 bar) ☐ 1,450 psi…(100 bar)
☐ 2,900 psi…(200 bar)
☐ Other

☒ **Pressure Control:** ☒ Automatic

☐ **Vent Flow Monitor:** ☐ Wet test meter with manual readout only.
☐ Wet test meter with control system interface.

☐ **Gas/Liquid Separator:** Pressure:
Temperature: ☐ Ambient ☐ Ambient to –50^{6}F…(-58^{6}C)
☐ Ambient to 482^{6}F…(250^{6}C)
Level Control: ☐ Manual with manual ball valve.
☐ Automatic with air operated valve and timed drain.
☐ Automatic with air operated valve and level probe for closed-loop drain control (300^{6}F…(149^{6}C))

☐ **Product/Waste Tank:** Volume: ☐ 1 Gallon…(3.8 bar) ☐ ½ Gallon…(1.9 bar)
Temperature: ☐ Ambient ☐ Ambient to –50^{6}F…(-58^{6}C)
☐ Ambient to 482^{6}F…(250^{6}C)
☐ Weigh Scale: Maximum Weight:

Configuration for Reactor Train #2:

☐ **Feed–1:** ☐ Manual Feed Components.
☐ Mass Flow Controller:
Gas Type:
Inlet Pressure:_____, Max Outlet Pressure: _____ (50 psi less than Inlet Pressure)
Flowrate: _____ sccm (50:1 ratio)
Min Outlet Pressure:

☐ **Feed–2:** ☐ Manual Feed Components
☐ Mass Flow Controller:
Gas Type:
Inlet Pressure:_____, Max Outlet Pressure: _____ (50 psi less than Inlet Pressure)
Flowrate: _____ sccm (50:1 ratio)
Min Outlet Pressure:

☐ **Feed–3:** ☐ Manual Feed Components
☐ Mass Flow Controller:
Gas Type:
Inlet Pressure:_____, Max Outlet Pressure: _____ (50 psi less than Inlet Pressure)
Flowrate: _____ sccm (50:1 ratio)
Min Outlet Pressure:
--- OR ---
☐ Piston Liquid Feed Pump: Liquid:
Inlet Pressure: _____ Inlet Temperature:
Outlet Pressure: _____ Outlet Temperature:
Flowrate:
---- OR ---
☐ Syringe Liquid Feed Pump: Liquid:
Inlet Pressure: _____ Inlet Temperature:
Outlet Pressure: _____ Outlet Temperature:
Flowrate:
☐ Feed Tank:
Volume: ☐ 1 Gallon…(3.8 bar) ☐ ½ Gallon…(1.9 bar)
Material: ☐ 304/316 Stainless Steel
☐ Other:
Pressure: _____ Temperature:
☐ Weigh Scale: Maximum Weight:

☐ **Feed–4:** ☐ Manual Feed Components
☐ Mass Flow Controller:
Gas Type:
Inlet Pressure:_____, Max Outlet Pressure: _____ (50 psi less than Inlet Pressure)
Flowrate: _____ sccm (50:1 ratio)
Min Outlet Pressure:
--- OR ---
☐ Piston Liquid Feed Pump: Liquid:
Inlet Pressure: _____ Inlet Temperature:
Outlet Pressure: _____ Outlet Temperature:
Flowrate:
---- OR ---
☐ Syringe Liquid Feed Pump: Liquid:
Inlet Pressure: _____ Inlet Temperature:
Outlet Pressure: _____ Outlet Temperature:
Flowrate:
☐ Feed Tank:
Volume: ☐ 1 Gallon…(3.8 bar) ☐ ½ Gallon…(1.9 bar)
Material: ☐ 304/316 Stainless Steel
☐ Other:
Pressure: _____ Temperature:
☐ Weigh Scale: Maximum Weight:

☐ **Feed–5:** ☐ Manual Feed Components
☐ Piston Liquid Feed Pump: Liquid:
Inlet Pressure: _____ Inlet Temperature:
Outlet Pressure: _____ Outlet Temperature:
Flowrate:
---- OR ---
☐ Syringe Liquid Feed Pump: Liquid:
Inlet Pressure: _____ Inlet Temperature:
Outlet Pressure: _____ Outlet Temperature:
Flowrate:
☐ Feed Tank:
Volume: ☐ 1 Gallon…(3.8 bar) ☐ ½ Gallon…(1.9 bar)
Material: ☐ 304/316 Stainless Steel
☐ Other:
Pressure: _____ Temperature:
☐ Weigh Scale: Maximum Weight:

☐ **Reactor Status Valve:** Seat Material: ☐ Polyimide (482°F…(250°C))
☐ Peek (392°F…(200°C))
(Maximum Pressure: 1450 psi…(100 bar))

☐ **Sample Valve:** Seat Material: ☐ Polyimide (482°F…(250°C))
☐ Peek (392°F…(200°C))

☐ **Reactor:** Pressure: _____ Temperature:
Material of Construction: ☐ 316 SS ☐ A-286 ☐ Inconel 800HT
☐ Other
Reactor Volume: ☐ 5 cc ☐ 10 cc ☐ 20 cc ☐ 40 cc ☐ 100 cc
☐ Other
Reactor Cooling: ☐ Yes ☐ No

☐ **Pressure Indication:** Pressure Range: ☐ 450 psi…(31 bar) ☐ 1,450 psi…(100 bar)
☐ 2,900 psi…(200 bar)
☐ Other

☐ **Pressure Control:** ☐ Automatic

☐ **Vent Flow Monitor:** ☐ Wet test meter with manual readout only.
☐ Wet test meter with control system interface.

☐ **Gas/Liquid Separator:** Pressure:
Temperature: ☐ Ambient ☐ Ambient to –50°F…(-58°C)
☐ Ambient to 482°F…(250°C)
Level Control: ☐ Manual with manual ball valve.
☐ Automatic with air operated valve and timed drain.
☐ Automatic with air operated valve and level probe for closed-loop drain control (300°F…(149°C))

☐ **Product/Waste Tank:** Volume: ☐ 1 Gallon…(3.8 bar) ☐ ½ Gallon…(1.9 bar)
Temperature: ☐ Ambient ☐ Ambient to –50°F…(-58°C)
☐ Ambient to 482°F…(250°C)
☐ Weigh Scale: Maximum Weight:

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