Catalog Sections: VCUD Series

Catalog Section	Section Number
Product Information	P.1-VCUD
Suggested Specs	S.1-VCUD
Material of Construction	M.1-VCUD
Selection Table	ST.1-VCUD
Dimensions	D.1-VCUD
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Submittal Sheet	SD.1-VCUD
O&M	OM.1-VCUD
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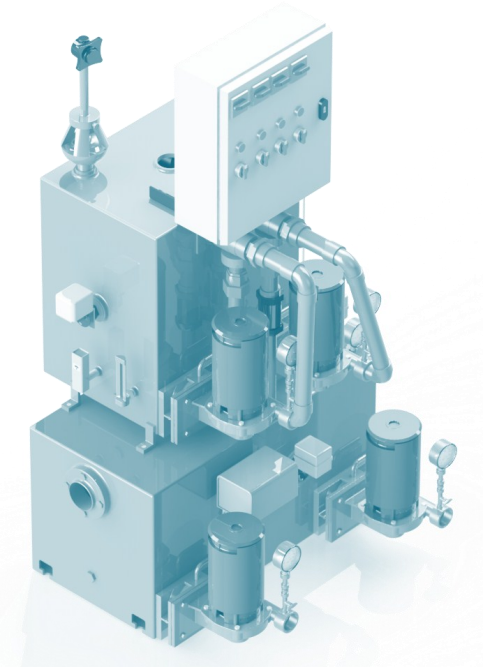
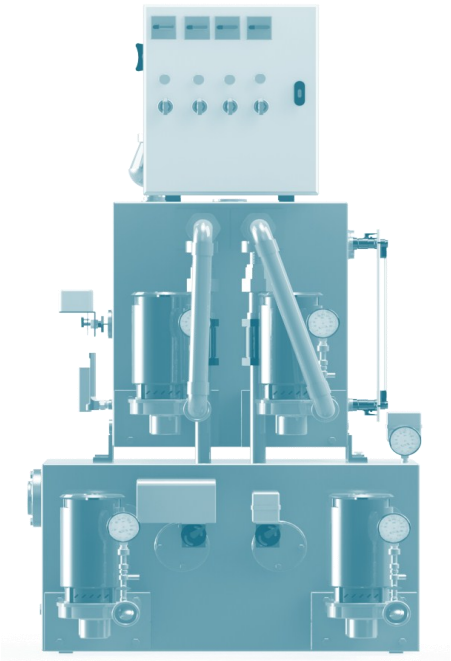
VCUD - ISO VIEW



VCUD - Front View



Product Information: VCUD Condensate Return Units P.1-VCUD

Fig 1: VCUD ISO View

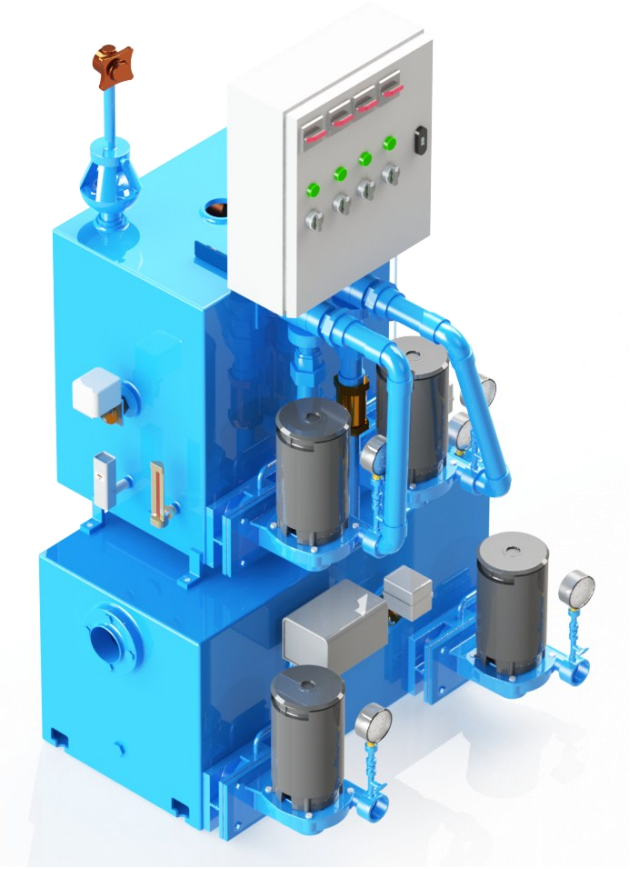
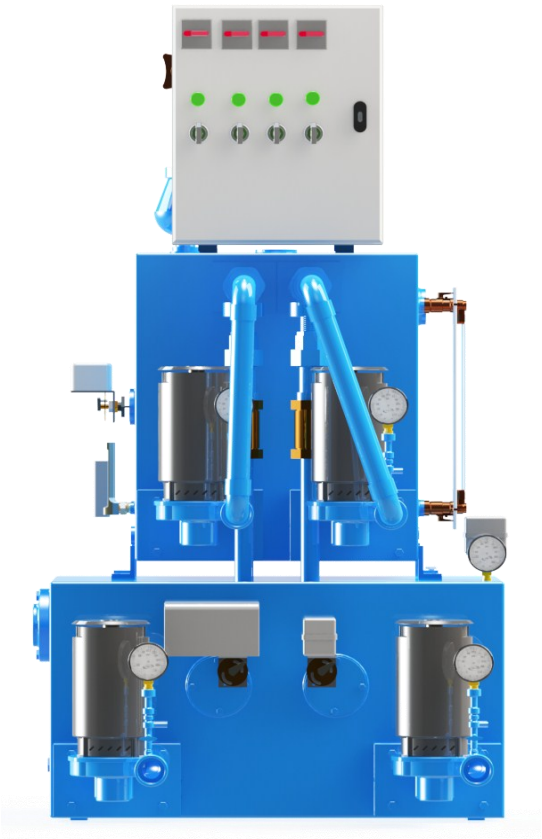


Fig 2: VCUD Front View



The VCUD series are designed for vacuum condensate service where the pump system provides a vacuum: drawing condensate into the receiver.
The innovative VCUD product design combine individually controlled water pumps mounted on a heavy gauge steel receiver (hurling tank) with independent air and water chamber systems. Water circulation through a factory designed venturi orifice system creates a controlled vacuum used to draw condensate from the system into the condensate receiver. This innovative design increases the efficiency of moving condensate from its source to the condensate receiver as compared to standard gravity fed systems. Condensate receivers are available from 35 to 120 Gallon capacity in cast iron construction.

Pumps are rated from 7.5 GPM to 45 GPM with discharge pressures to 60psi with motors sized to 5HP.

- **MOTOR**: Drip-proof, ball bearing design available in single phase and 3 phase voltages.
- **PUMP**: The motor and rotating assembly are removable without disturbing piping connection. Maximum water temperature at the pump suction is 210°F (available to 250°F).
- **RECEIVER**: Single-piece cast iron condensate with above mounted copper bearing steel hurling tank.
- **STANDARD FEATURES**: Gauge glass, thermometer, pump discharge pressure gauges, vacuum pressure switch, low water cut-off-switch, high temperature limit switch, mechanical alternating switches, 120V solenoid water bronze make-up valve with air-gap fitting, individual pump isolating valves, factory mounted and wired, UL 508 listed, NEMA 1 control panel containing: individual fuse disconnect switches, across the line magnetic starters with thermal overload protection and under voltage protection, hand-off-auto selector switches, pump running pilot lights, 120V control circuit transformer, terminal strip.

Refer to factory for additional options.

Suggested Specifications: VCUD S.1-VCUD

Vacuum Duplex Condensate Return Units
Series VCUD

Furnish and install as shown in the plans a Federal Pump Corporation series VCUD Duplex Vacuum Condensate Return Unit with each pump rated as shown in the pump schedule. The entire unit including float switches, vacuum gauge, gauge glasses, low water cut off switch, high temp limit switch and associated system accessories shall be mounted and wired to a vacuum condensate control panel, factory assembled and supplied as a single operating unit. Pump manufacturer will provide single unit responsibility of the vacuum condensate unit and electrical controls.

Each duplex vacuum condensate return unit shall include (2) separate receivers, one designed for condensate collection and the second for vacuum generation (hurling tank) both assembled together to operate as a single unit. The condensate collection receiver shall be of cast iron construction and include (2) close coupled cast iron bronze fitted pumps directly connected to close coupled motors sized in accordance with the equipment schedule. Pumps shall be top pull out design to permit removal of the motor and rotating assembly without disturbing discharge piping. Each pump shall include an enclosed bronze balanced impeller and mechanical shaft seal with copper venting line from the seal chamber to the receiver. Electric motors shall be ODP (Open Drip Proof) design or as shown in the equipment schedule. Pumps will be designed to withstand maximum water temperature of 210°F. Isolation valves located between the pump suction and receiver will be provided pre-mounted by the pump manufacturer that provide for the isolation and removal of the entire pump casing for future overhaul and prevent leaking from the receiver. System piping from pump discharge connections shall be provided by the installing contractor.

The vacuum condensate return unit(s) will include a receiver mounted mechanical alternating float switch that alternates the lead operation of each pump. Upon reaching the factory predetermined high water level in the cast iron condensate receiver, the float switch will initiate the lead pump that will discharge the condensate to a remote boiler feed or other receiver. The float switch will disengage the lead pump upon a predetermined factory set low water level in the cast iron receiver and mechanically alternate the second pump to operate as the lead pump for the next cycle. Float switch will be Square D or equal externally mounted; NEMA 1 design or as shown on the plans.

The vacuum chamber (hurling tank) shall be constructed of 5/8" steel reinforced tank mounted above the cast iron condensate receiver and include(2) close coupled cast iron bronze fitted pumps directly connected to close coupled motors sized in accordance with the equipment schedule. Pumps shall be top pull out design to permit removal of the motor and rotating assembly without disturbing discharge piping. Each pump shall include an enclosed bronze balanced impeller and mechanical shaft seal with copper venting line from the seal chamber to the receiver. Electric motors shall be ODP (Open Drip Proof) design or as shown in the equipment schedule. Pumps will be designed to withstand maximum water temperature of 210°F. Isolation valves located between the pump suction and receiver will be provided pre-mounted by the pump manufacturer that provide for the isolation and removal of the entire pump casing for future overhaul and prevent leaking from the receiver. Vacuum receiver will be provided with a Federal Pump venturi effect assembly piped from the vacuum pumps though isolated individual pump supply lines each provided with independent check valves. The venturi assembly will be supplied in bronze construction with stainless steel mesh and brass perforated end caps. Vacuum pumps will be sized to provide suitable flow rates through the venturi assembly to draw 8" Hg vacuum within the condensate tank drawing condensate from the supply lines to the condensate receiver.

Operation Sequence:

The vacuum condensate unit will provide a vacuum as specified, whose purpose is to draw condensate from the condensate return piping system to the condensate receiver.

Vacuum connections including piping and check valves extending from the vacuum receiver to the condensate receiver will provide a vacuum to the condensate receiver that will draw condensate from the piping system to the condensate receiver. The vacuum chamber mounted above the condensate receiver will circulate water thru a Federal Pump supplied venturi nozzle with integral stainless steel mesh filters with vacuum pumps sized as outlined in the equipment schedule. Upon a drop in condensate tank vacuum to 3" Hg, the system mounted vacuum switch will start the vacuum pump that will circulate water through the system mounted venturi nozzle creating a vacuum designed to draw condensate from the piping system. Increase in condensate liquid level within the condensate receiver will terminate (hurling pump) operation at specified vacuum conditions.

A solenoid water make-up valve located at the top of the vacuum receiver will be initiated by a high temperature limit switch that measures the water temperature in the vacuum receiver adding cold water to the circulating pump operation. In cases where systemic issues including failing steam traps or other issues increase condensate return temperature, the solenoid water make-up valve will open providing cold domestic water into the hurling tank to prevent high temperature condensate fluid circulation in the hurling tank typically caused by failed steam traps or other systemic issues system conditions. Excess water level in the hurling tank will be piped to drain.

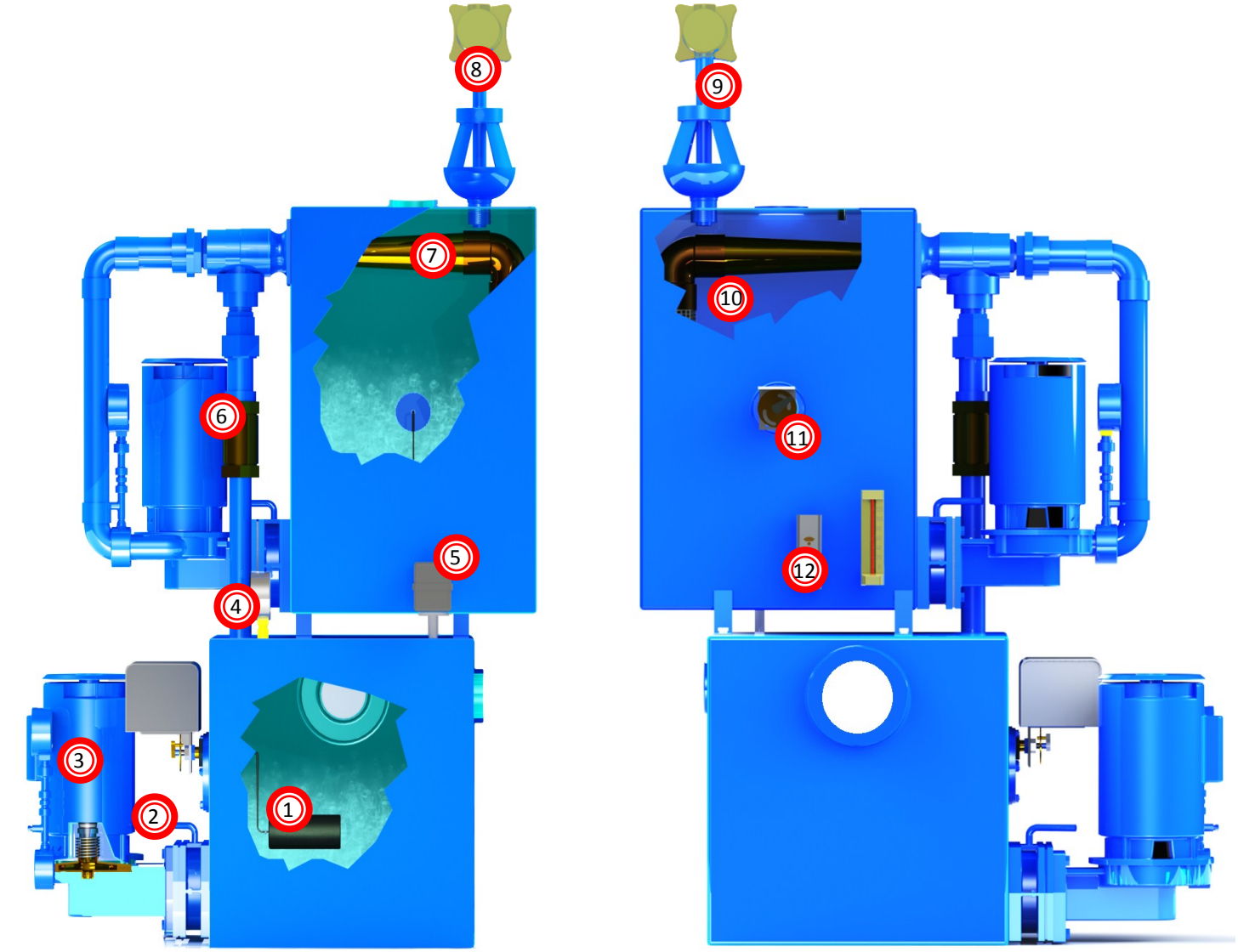
System controls will include: Thermometer to measure water temperature within the system, vacuum switch to measure and control operation of the vacuum pumps, high temperature limit switch to operate make-up solenoid water valve, low water cut-off switch to cease operation if water levels remain low, individual pressure gages at each of the (4) pumps and mechanical alternating float switches located at the condensate and vacuum receiver areas. Each sensor and float switch will be assembled to the unit and wired to the system control panel provided as a single unit by the pump manufacturer.

The pump manufacturer will test each vacuum condensate unit prior to shipment. The test shall verify the condensate tank, once isolated from the system, is capable of holding specified vacuum for a period of ten minutes.

Contractor will verify downstream steam traps or other sources of condensate are functioning effectively reducing the risk of higher temperature condensate returned to the vacuum condensate system.

Pump manufacturer representative will be available for start-up service and witness the operation of the vacuum condensate unit through 3 separate cycles. During the field start-up, the pump manufacturer's representative will verify all vacuum related connections are installed properly using a (smoke test). A smoldering or smoke like device will be placed at each connection within the vacuum condensate system to visually confirm the smoke is not drawn into the condensate receiver.

Material of Construction: VCUD Series M.1-VCUD



Item	Item No	Material	Description	Rating	Applications
Float Switch	1	Steel/Brass	Mech. Alt Float Switch	316 St Steel Float	High temp condensate use.
Isolation Valve	2	Cast Iron/Steel	Pump Isolating Valve	100 psi	Isolates pump from receiver
Condensate Motor	3	Steel/Cast Iron	Condensate pump/Motor	210°F/175lb CWP	Condensate Pump/motor combination
Vacuum Supply Line	4	Steel	Vacuum Supply Line	125 psi	Supplies vacuum to condensate tank
Vacuum Switch	5	Steel	Adjustable	NEMA1-115V	Adjustable low/high limit Vacuum Switch
Check Valve	6	Bronze	Vacuum Check Valve	0-25" Hg	Provides vacuum check valve feature
Venturi	7	Brass/Stainless Steel	Venturi/Orifice Vacuum Assembly	100 psi	Provides for system vacuum
Solenoid Valve	8	Bronze	Make-up Valve	NEMA1-115V	Provides for cooling water in Hurling Tank
Air Gap	9	Cast Iron	Air gap fitting	30 psi	Provides air gap between water supply and condensate system
Hurling Tank	10	Copper Bearing Steel	Vented	ASTM A588	Creates System Vacuum
Float Switch	11	Stainless Steel	Low water cut-off switch	NEMA1-115V	Terminates operation on low water level
Aquastat	12	Steel	Temperature sensing element	NEMA1-115V	Tempering high temperature condensate

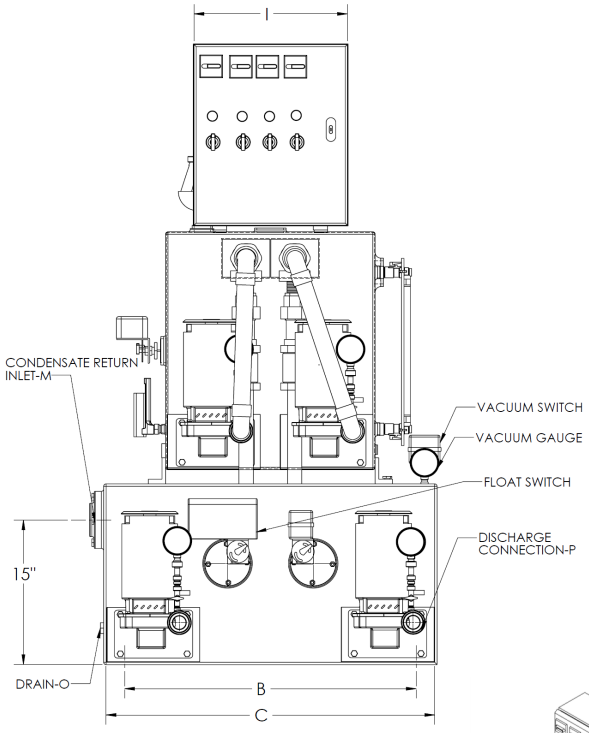
Selection Table: VCUD Series

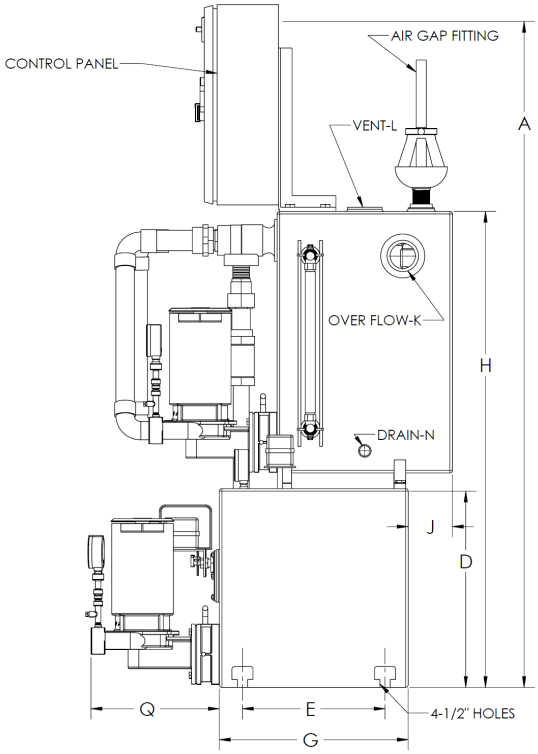
VCUD Condensate Table
10,000-65,000 EDR - 3500RPM Pumps

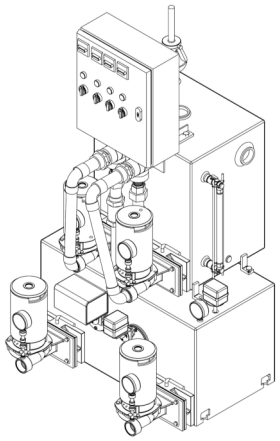
Sq.-Ft EDR	Pump Pressure psi	Pump Capacity GPM	HP rating Condensate Pump	Pump Model Con-densate	Receiver Capacity-CI Gallons	Vacuum Rating at 5 1/2" Hg	Vacuum Pump HP 3500RPM	Vacuum Tank Size Steel	System No.
10,000	10	15	1/3	1.25CCF					VCUD-1010-2-CI-2
	15		1/2	1.25CCF					VCUD-1015-2-CI-2
	20		1/2	1.25CCF					VCUD-1020-2-CI-2
	25		3/4	1.25CCF	35	6	1	38	VCUD-1025-2-CI-2
	30		3/4	1.25CCF					VCUD-1030-2-CI-2
	40		1	1.25CCF					VCUD-1040-2-CI-2
	50		2	1.25CCF					VCUD-1050-2-CI-2
	60		3	1 CGF					VCUD-1060-2-CI-2
15,000	10	22 1/2	1/3	1.25CCF					VCUD-1510-2-CI-2
	15		1/2	1.25CCF					VCUD-1515-2-CI-2
	20		3/4	1.25CCF					VCUD-1520-2-CI-2
	25		3/4	1.25CCF	45	8	1	40	VCUD-1525-2-CI-2
	30		3/4	1.25CCF					VCUD-1530-2-CI-2
	40		1	1.25CCF					VCUD-1540-2-CI-2
	50		1 1/2	1 CGF					VCUD-1550-2-CI-2
	60		3	1 CGF					VCUD-1560-2-CI-2
20,000	10	30	1/3	1.25CCF					VCUD-2010-2-CI-2
	15		1/2	1.25CCF					VCUD-2015-2-CI-2
	20		3/4	1.25CCF					VCUD-2020-2-CI-2
	25		3/4	1.25CCF	45	12	1 1/2	40	VCUD-2025-2-CI-2
	30		1	1.25CCF					VCUD-2030-2-CI-2
	40		1 1/2	1.25CCF					VCUD-2040-2-CI-2
	50		2	1.25CCF					VCUD-2050-2-CI-2
	60		3	1 CGF					VCUD-2060-2-CI-2
30,000	10	45	1/2	1.25CCF					VCUD-3010-2-CI-2
	15		3/4	1.25CCF					VCUD-3015-2-CI-2
	20		3/4	1.25CCF					VCUD-3020-2-CI-2
	25		1	1.25CCF	45	14	3	40	VCUD-3025-2-CI-2
	30		1	1.25CCF					VCUD-3030-2-CI-2
	40		1 1/2	1.25CCF					VCUD-3040-2-CI-2
	50		3	1 CGF					VCUD-3050-2-CI-2
	60		5	1 CGF					VCUD-3060-2-CI-2
40,000	10	60	3/4	1.25CCF					VCUD-4010-2-CI-2
	15		3/4	1.25CCF					VCUD-4015-2-CI-2
	20		1	1.25CCF					VCUD-4020-2-CI-2
	25		1 1/2	1.25CCF	70	22	3	40	VCUD-4025-2-CI-2
	30		2	1.25CCF					VCUD-4030-2-CI-2
	40		3	1.25CCF					VCUD-4040-2-CI-2
	50		3	1.5CGF					VCUD-4050-2-CI-2
	60		5	1 CGF					VCUD-4060-2-CI-2
65,000	10	97 1/2	1	1 1/2 CCF					VCUD-6510-2-CI-2
	15		1 1/2	1 1/2 CCF					VCUD-6515-2-CI-2
	20		1 1/2	1 1/2 CCF					VCUD-6520-2-CI-2
	25		2	1 1/2 CCF	120	36	3	40	VCUD-6525-2-CI-2
	30		2	1 1/2 CCF					VCUD-6530-2-CI-2
	40		3	1 1/2 CCF					VCUD-6540-2-CI-2
	50		5	1 1/2 CCF					VCUD-6550-2-CI-2
	60		7 1/2	1 1/2 CCF					VCUD-6560-2-CI-2

Dimensions: VCUD Series D.1-VCUD

VCUD Series: 35 Gallon





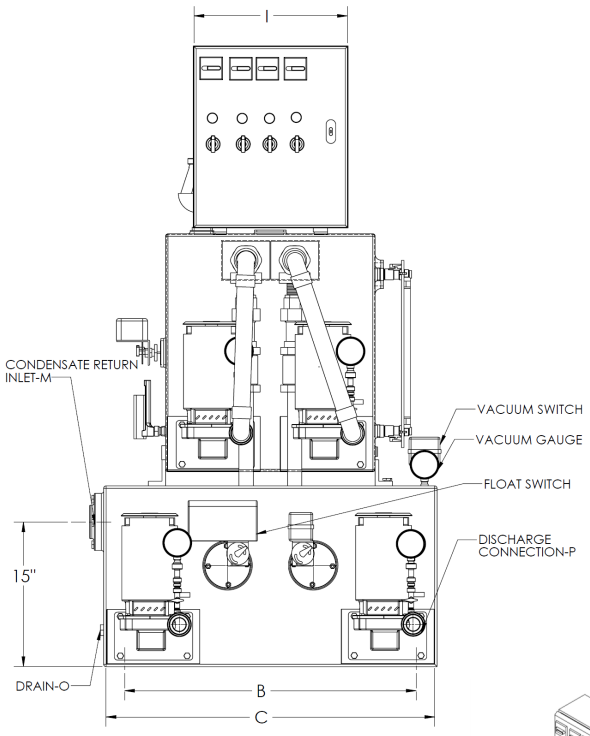


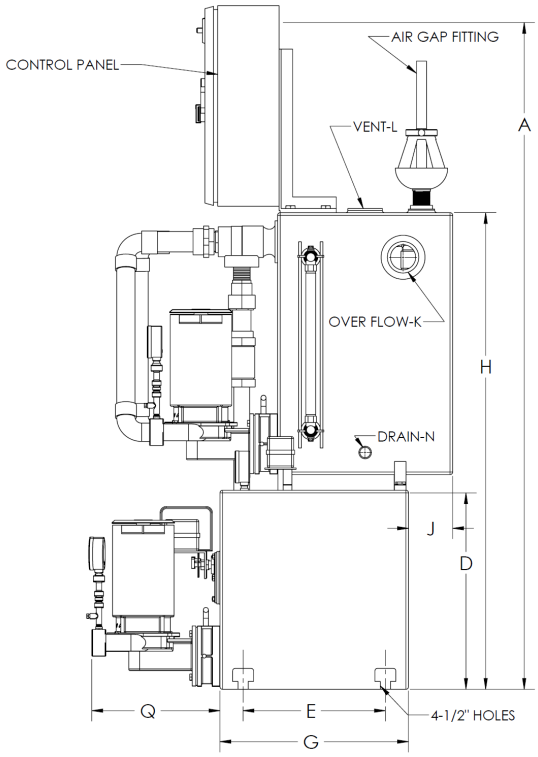
Receiver Size	A*	B	C	D	E	G	H*	I*	J	K	L	M	N	O
35 Gallon	63 1/4	28 1/2	30 3/4	18 3/4	12	15 3/4	42 1/4	20	6	2	2 1/2	3	3/4	3/4

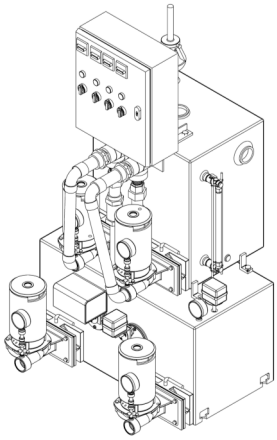
Receiver Size	Pump Discharge Pressure psi	Pump Type	P	Q
35 Gallon	0-50	1.25 CCF	1 1/4 (NPT)	13 3/4
35 Gallon	51-60	1 CGF	1 (FLANGE)	16 3/4

*Note: Dimensions may vary based upon Motor HP and options selected.

VCUD Series: 45 Gallon





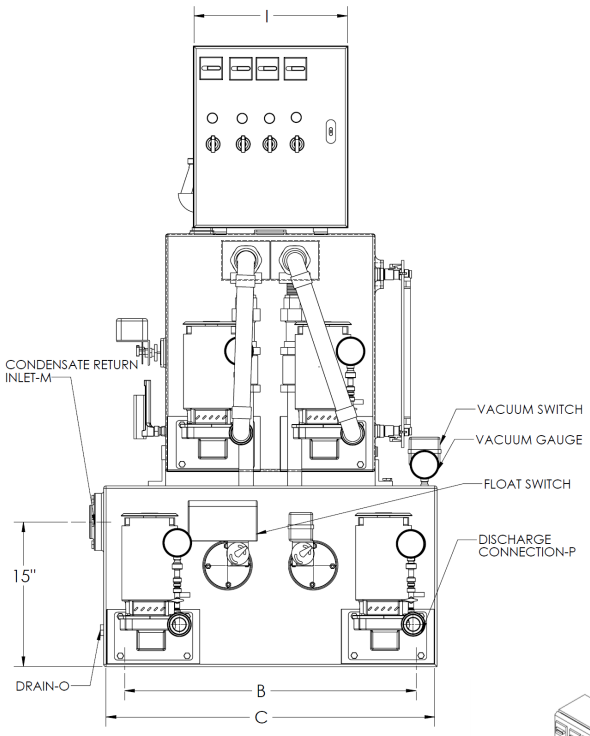


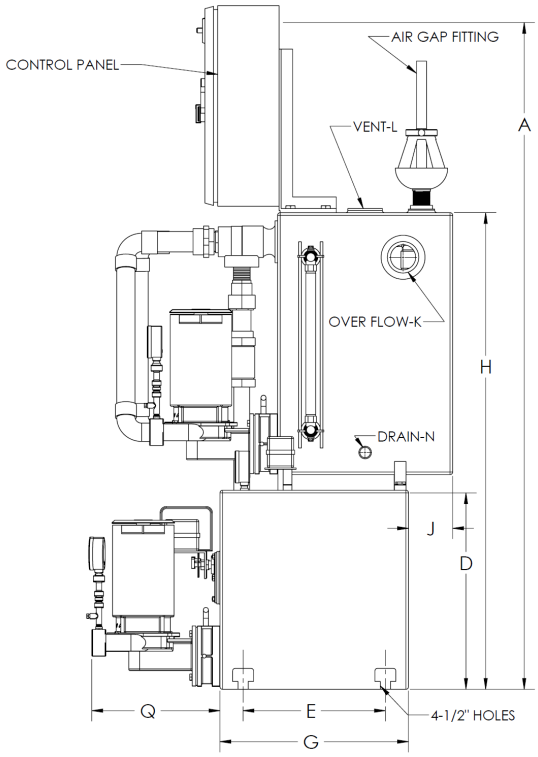
Receiver Size	A*	B	C	D	E	G	H*	I*	J	K	L	M	N	O
45 Gallon	67 1/4	32 3/4	34 3/4	18 3/4	14	17 3/4	46 1/4	20	4	2	2 1/2	3	3/4	3/4

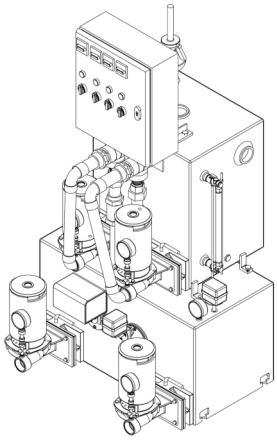
Receiver Size	Pump Discharge Pressure psi	Pump Type	P	Q
45 Gallon	0-40	1.25 CCF	1 1/4 (NPT)	14
45 Gallon	41-60	1 CGF	1 (FLANGE)	17

*Note: Dimensions may vary based upon Motor HP and options selected.

VCUD Series: 70 Gallon





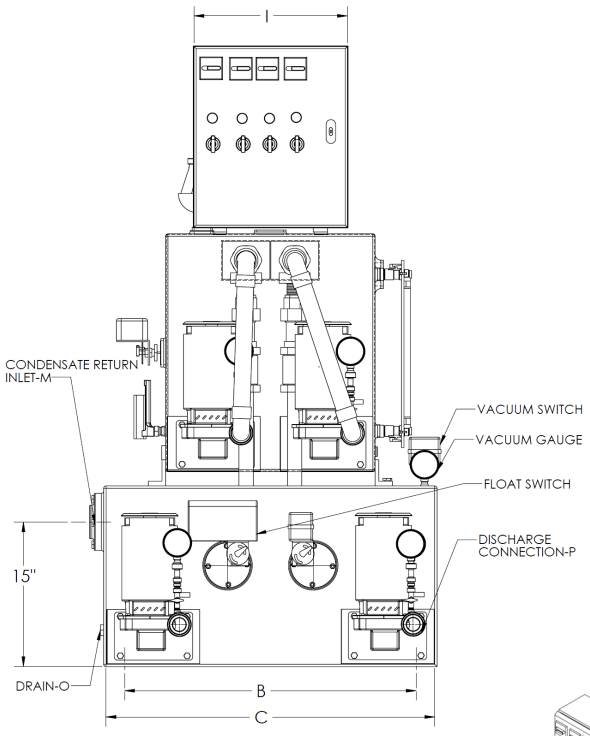


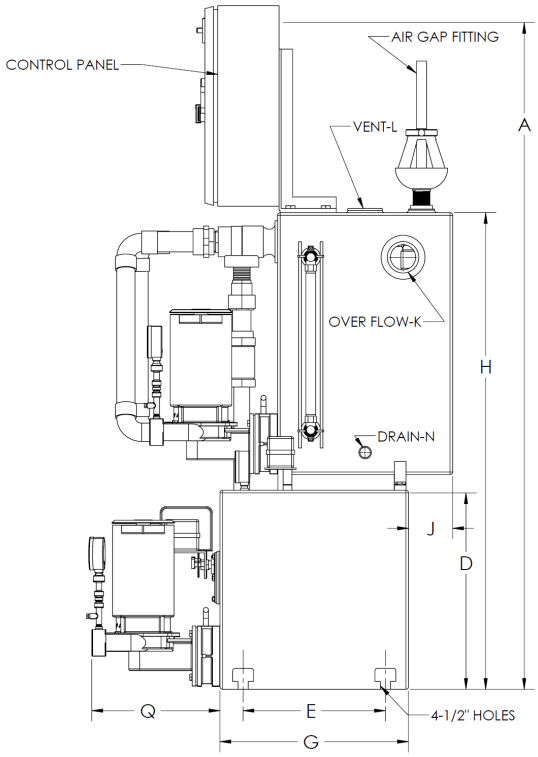
Receiver Size	A*	B	C	D	E	G	H*	I*	J	K	L	M	N	O
70 Gallon	67 1/4	41 1/2	43 3/4	18 3/4	18	21 3/4	46 1/4	20	0	2	2 1/2	3	1 1/4	1 1/4

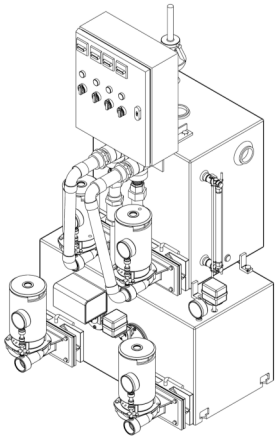
Receiver Size	Pump Discharge Pressure psi	EDR	Pump Type	P	Q
70 Gallon	0-40	40,000	1.25 CCF	1 1/4 (NPT)	13 3/4
70 Gallon	41-50	40,000	1.5 CGF	1 1/2 (FLANGE)	16 3/4
70 Gallon	51-60	40,000	1 CGF	1 (FLANGE)	13 3/4
70 Gallon	0-60	65,000	1.5 CCF	1 1/2 (FLANGE)	13 3/4

*Note: Dimensions may vary based upon Motor HP and options selected.

VCUD Series: 120 Gallon







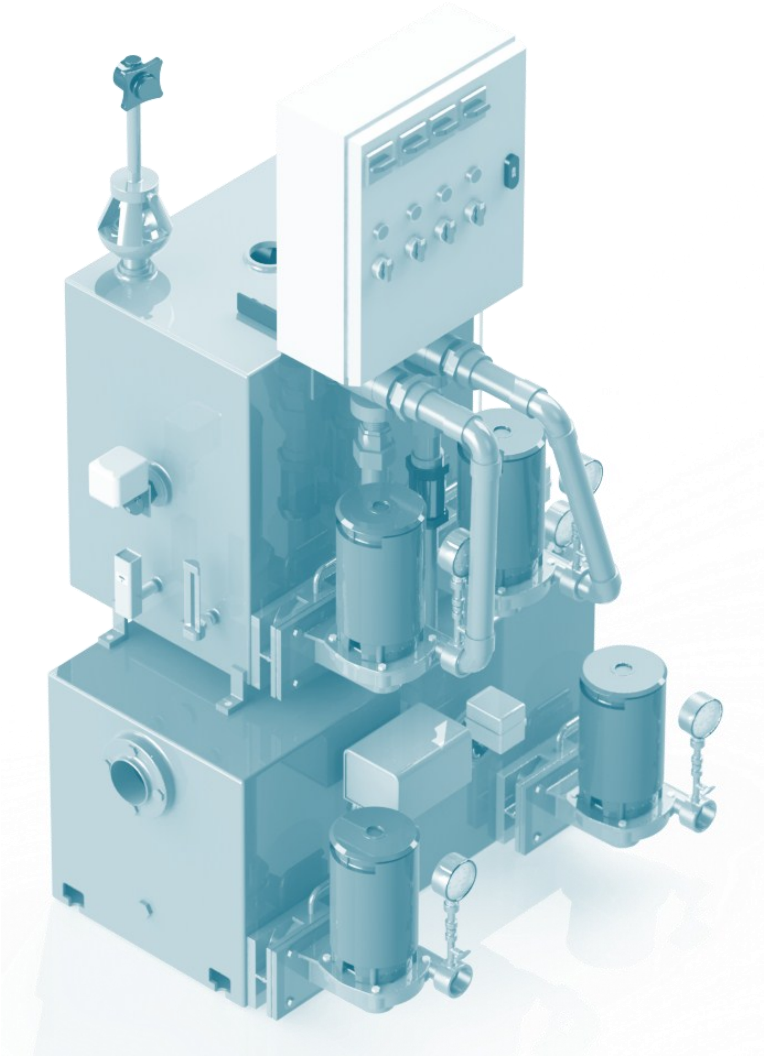
Receiver Size	A*	B	C	D	E	G	H*	I*	J	K	L	M	N	O
120 Gallon	69 1/4	41 1/2	43 3/4	20 3/4	29	32 3/4	48 1/4	20	0	2	2 1/2	4	1 1/4	1 1/4

Receiver Size	Pump Discharge Pressure psi	EDR	Pump Type	P	Q
120 Gallon	0-40	40,000	1.25 CCF	1 1/4 (NPT)	13 3/4
120 Gallon	41-50	40,000	1.5 CGF	1 1/2 (FLANGE)	16 3/4
120 Gallon	51-60	40,000	1 CGF	1 (FLANGE)	13 3/4
120 Gallon	0-60	65,000	1.5 CCF	1 1/2 (FLANGE)	13 3/4

*Note: Dimensions may vary based upon Motor HP and options selected.

Product Code: 1
Vacuum Condensate Units—VCUD

SUBMITTAL DATA



Customer: _____

Purchase Order Number: _____

Project Name: _____

Project Location: _____

Equipment Number: _____

Tag Number: _____

Condensate Receiver Size: _____

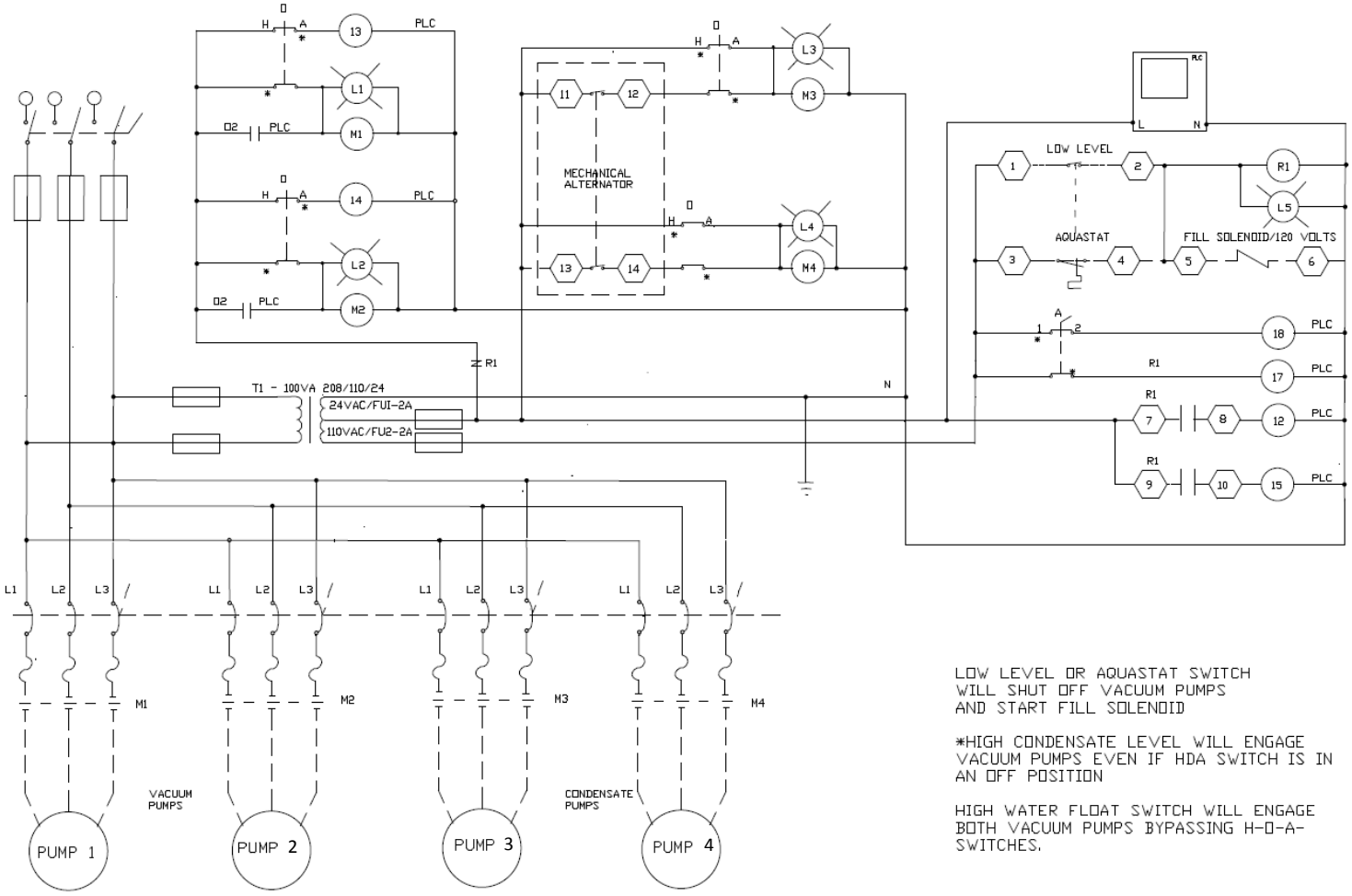
Float Switch Type: _____

Control Panel: _____

Accessories: _____

- ☐ Exterior Thermometer
- ☐ Gauge Glass
- ☐ Solenoid Make-Up Valve with air gap
- ☐ Control Panel Mounted and Wired
- ☐ High Temperature Limit Switch
- ☐ Pump Pressure Gauges

Wiring Diagram
Vacuum Condensate Units–VCUD



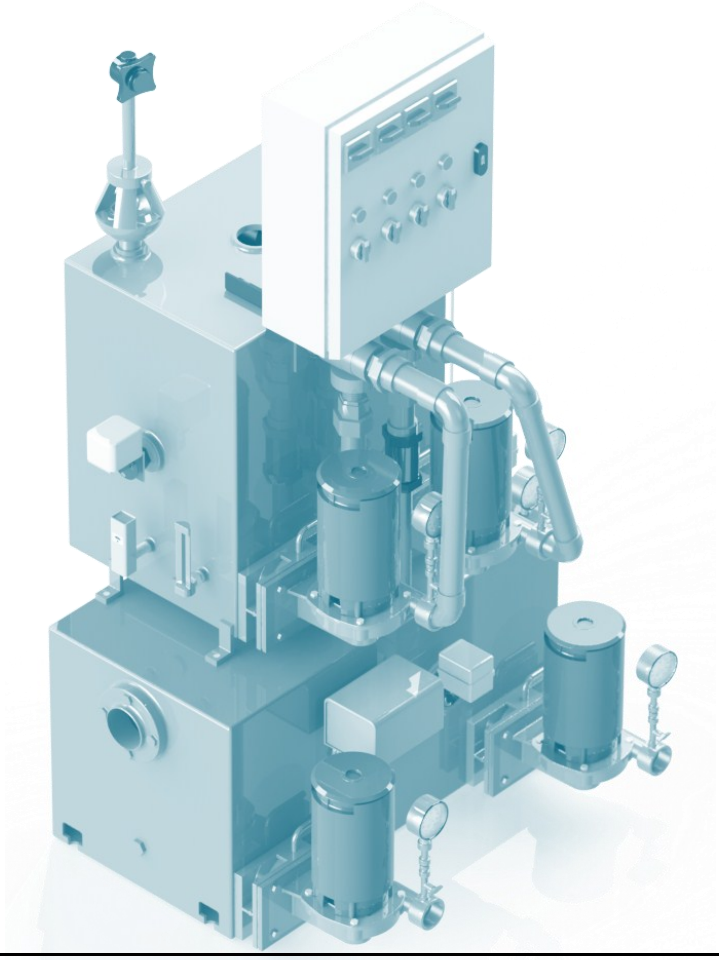
Item	HP	RPM
Condensate Pump 1		3500
Condensate Pump 2		3500
Vacuum Pump 1		3500
Vacuum Pump 2		3500

VOLTS
☐ 208
☐ 230
☐ 460

Product Code: 1

Vacuum Condensate Units-VCUD

Installation, Operation and Maintenance Overview



Warning Symbol! This symbol used throughout the Operations manual draws the user's attention to safety instructions. When used the safety warning decal advises: ATTENTION! BE ALERT! YOUR SAFETY IS INVOLVED! FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN A SAFETY HAZARD!

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NOTE: SUBSTITUTION OF REPLACEMENT PARTS BY OTHER SUPPLIERS THAN FEDERAL PUMP OR SERVICE PROVIDERS NOT AUTHORIZED BY FEDERAL PUMP VOIDS ALL EQUIPMENT WARRANTY AND MAY LEAD TO EQUIPMENT MALFUNCTION. ENSURE ALL REPLACEMENT PARTS ARE FACTORY AUTHORIZED AND SERVICED BY FACTORY DESIGNATED REPRESENTATIVES!

These instructions are provided as a guideline to support the installation and maintenance of Federal Pump Vacuum Condensate return systems. By following the instructions, the life of the pumping unit can be extended. The Vacuum Condensate Unit should be installed by licensed contractor.

1. Mechanical Components and Installation

Pump Identification and inspection: Immediately upon receipt of the condensate unit, inspect and check the unit for any shipment related damages. If damages are noticed, do not put the unit in operation. Report the damage to the transportation's shipping agent or other parties responsible. Each condensate unit is provided with a nameplate that identifies the serial or model number of the unit. Refer to that serial number when requesting service and replacement parts in the future.

Locating and storing the equipment: Upon receipt of the condensate pump unit, ensure the unit is installed in a dry area with ambient temperatures ranging from 60 degree F to 85 degree F and stored above floor level ensuring the condensate unit is not emerged in water due to any potential flooding. If the unit is not stored but planned for immediate installation, ensure the unit is accessible for inspection and maintenance 360 degrees and provide clearance around the condensate unit for free air circulation; mount the unit on an elevated foundation well above wet or damp floors (3"-6"or as shown on the plans). In addition to floor level potential hazards, ensure the unit is not exposed to any above head dripping potential water intrusion into the electric motors, external switches and/or control panel. Locate the unit as shown on the construction documents (new or replacements) and ensure a well-qualified and licensed mechanic is involved in the installation. Once the vacuum condensate unit is mounted to the elevated pump pad; the units should be shimmed level and grouted with cement. Once the grouting cement has hardened, tighten down the "hold-down" bolts. Hold down bolts should be sized and located as shown in the plans or the product specifications provided with this unit.

Recommended piping connections: The Federal Pump condensate unit generally is provided with a receiver tank, hurling (vacuum) tank, float switch(s), pump and electric motor combination and a system mounted control panel. Connections from the receiver tank to the pump are completed at the factory prior to shipment to the customer. If the piping from the receiver to the pump is missing or damaged, do not proceed with the installation until the damage is repaired. Connections to the condensate receiver include:

a. Drain connections from the receiver to a separate drain.
b. Connections from the discharge of the pump to its intended area of service.
c. Vent pipe from the top of the condensate unit to a predetermined vent connection.
d. The condensate unit has a make-up water solenoid valve which will require the contractor to connect to a fresh water source.
e. These connection should be made by a licensed contractor, certified in boiler or mechanical equipment installations, and authorized by local permitting agencies.

Caution: DO NOT connect steam returns from equipment or common returns which carry high pressure steam directly to the vacuum return mains or to the vacuum pump. High pressure steam returns must be piped through a properly sized flash tank or economizer, prior to connecting them to the vacuum return mains. Return mains should be sloped downward to the vacuum condensate accumulator tank. Lift connections should not be used on return mains. If necessary to lift the condensate to a height greater than four (4) feet, several steps of lift connections should be used.

Piping connections should be made in accordance with all local building code requirements. Refer to your local building department inspectors for additional information. Piping provided by the installer should include pipe hangers located and sized accordingly to ensure there is no pipe strain transmitted to the pumps. Connections from each pump to the system piping should include individual isolating valves, check valves and other fittings as shown in the drawings.

Caution: DO NOT connect steam returns from equipment or common returns which carry high pressure steam directly to the vacuum return mains or to the vacuum pump. High pressure steam returns must be piped through a properly sized flash tank or economizer, prior to connecting them to the vacuum return mains. Return mains should be sloped downward to the vacuum condensate accumulator tank. Lift connections should not be used on return mains. If necessary to lift the condensate to a height greater than four (4) feet, several steps of lift connections should be used.

fig 1: Typical Piping Arrangement for Duplex Vacuum Condensate Unit

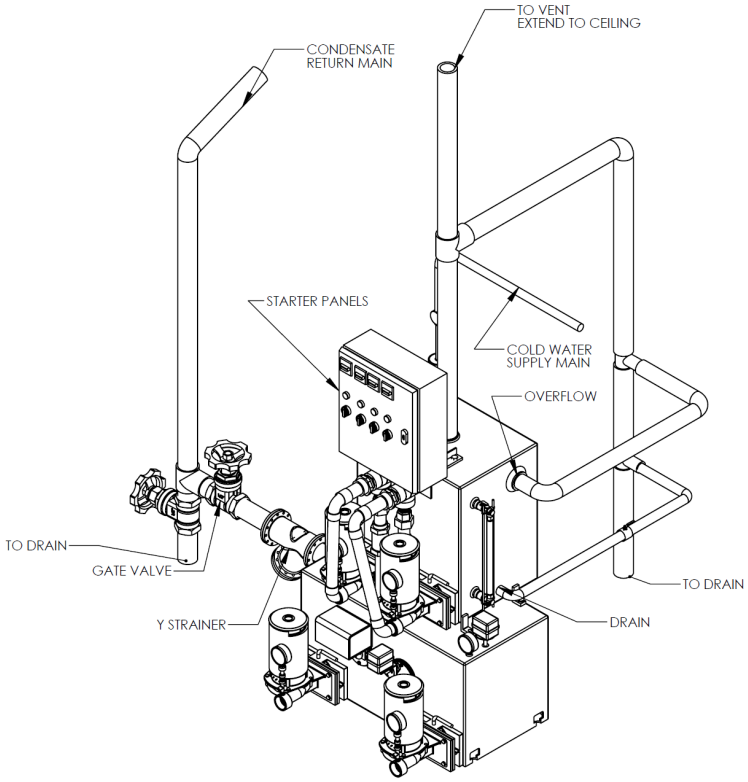
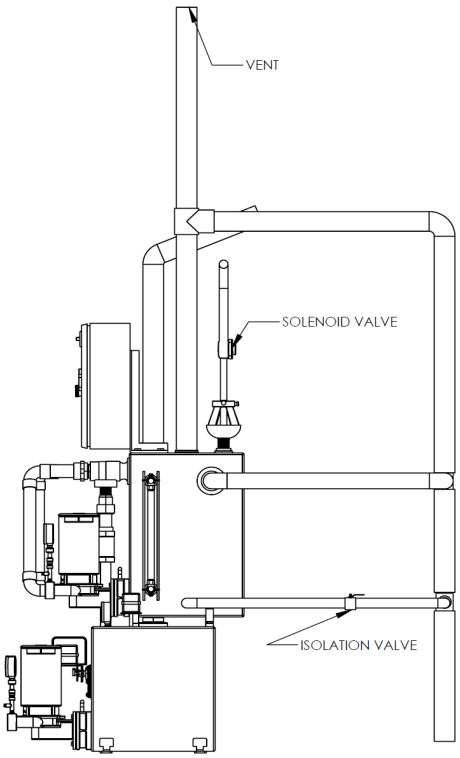


fig 2: Typical Piping Arrangement for Duplex Vacuum Condensate Unit



Pump and System components: The Federal Pump vacuum condensate unit includes a number of electromechanical devices that should be identified prior to pressuring the system or prior to providing power to the system. Those devices may include:

1. Lower condensate receiver tank with (2) pumps-duplex system; (1) pump for a simplex system
2. Float switch(s) for on/off automatic operation of the condensate pumps.
3. Gauge glass for external view of the condensate level in the tank (optional)
4. Pressure gages to measure pump discharge pressure (optional)
5. Thermometer to measure receiver liquid temperatures (optional)
6. Hurling tank that develops the vacuum with separate set of (2) circulating pumps.
7. Temperature and vacuum switches used for automatic operation of the system.
8. Low water level cut-out switch
9. Control panel wired to the system electric components.

Prior to starting the unit, ensure each component is in sound condition and connected appropriately. Prior to any electric or water connections the installer needs to verify the electric power source (voltage and cycles) corresponds to the motor nameplate power requirements. The installer needs to ensure the pump rotates freely when turned by hand prior to any electrical connections. ENSURE POWER TO THE VACUUM CONDENSATE UNIT IS SHUT OFF AT THE SOURCE PRIOR TO THE INITIAL INSPECTION OF THE UNIT AND DURING START-UP PROCEDURES.

Upon inspection of the condensate unit and verification that external connections are adequate for the intended use, the installer should proceed with the electrical inspection:

2. *Electric components and installation:* The Federal Pump condensate unit is provided with electric motors, float switches and (in most cases) a receiver mounted control panel that has been pre-wired and pre-set by the factory. Check all connections to ensure they are tight and are not exposed to potential water flooding, leaks or damage. Upon inspection and approval of the electric connections between the motors, controller and float switch and pilot devices the installer is ready to complete the installation.

a. **Electric Motors**: The duplex vacuum condensate system includes (4) electric motors. (2) of the motors are associated with the condensate pump (lower tank system) and (2) of the motors are associated with the vacuum hurling tank located above the condensate tank. These motors are prewired by the pump manufacturer to the system control panel that controls the automatic operation of the system. Installer to check all wiring connections from the motors to the system control panel and ensure all connections is tight. Each motor should turn freely by hand and operate in a clockwise direction. When electric service is provided to the control panel, the installer should "bump test" the motors to ensure they are turning in a clockwise direction (when viewed from the backside of the motor) If the motor is turning in the wrong direction, on 3 phase current, interchange any 2 wires at the incoming line terminal block . Installer to ensure the system is located in a dry place, elevated 3-6" off the floor on its own "pad" and ensure there is no overhead leaking pipes or pipes that may have external condensate that may, in the future, provide water dripping conditions over the vacuum condensate system installation. If there is the possibility of overhead water or other fluids dripping or leaking onto the vacuum condensate system, the installer should cease initial start-up and remedy that potential concern.

b. **Control Panel**: The vacuum condensate system has been provided with a factory designed and installed control panel that provides for automatic operation of the system. Control panels may vary from geographic region or may vary based upon the selection criteria. Refer to the pump manufacturer's earlier submissions and wiring diagrams for the specific service and application for this unit. In general, however, the control panel includes starters, power disconnect switch, pilot run lights HOA switches that provide for the overall system control. The control panel has been pre-wired and connected to the electric motors, various control switches and ready to be wired to the power supply. Connect the power supply to the control panel and ensure the control panel disconnect switch, H-O-A switches are both in the 'OFF" position.

Electric connections: **A certified electrician or other qualified mechanic will connect the electric power to the control panel disconnect switch and follow the wiring diagram provided in the control panel by the factory prior to shipment. Power from the source should remain in the off position during installation and start-up review! Do not provide power to the vacuum condensate unit until all preliminary start-up items mentioned in this operations and maintenance manual have been reviewed thoroughly by qualified and licensed installers well versed in electromechanical equipment installations.**

c. **System Switches:** The vacuum condensate unit has been provided with system switches that provide operating performance to the system controller to assist in its automatic operation. Those switches may vary by installation but generally include:

- ◊ **Condensate tank float switch**: The float switch mounted in the lower condensate tank measures the liquid level within the lower condensate tank and signals operation of the lead pump based upon pre-determined high water level in the condensate receiver tank. Once the tank level recedes, due to the pumping action, the float switch will terminate pump operation and automatically place the second pump in a lead position to start operation of the pumps when the level within the condensate receiver again rises to high level. This switch is referred to as a mechanical alternating float switch that automatically alternates the lead pump operation ensuring even wear and tear for the duplex pumps.

- ◊ **Vacuum Switch**: The vacuum switch, located in the lower condensate receiver, measures the vacuum within the lower condensate receiver and signals the vacuum jet pumps (upper tank chamber) to automatic operation based upon the vacuum declining in the lower tank. Generally speaking the range of operation provides for the pumps to be started at 3”HG vacuum and terminate at 8” vacuum. These settings may vary by installation and should be reviewed against the previous approved submissions from the pump manufacturer prior to the installation of the equipment.

- ◊ **Aquastat**: The system is provided with an aquastat (pre-set at 190°F) that measures the temperature of the condensate liquid and signals the operation of the system solenoid valve if temperature limits exceed the design conditions. The solenoid valve, installed in the upper hurling tank, provides cold water to the hurling tank reducing water temperature within design conditions. Continued operation of higher temperature condensate return may signal stem trap failure elsewhere in the system that needs to be addressed immediately.

HIGH WATER TEMPERATURE IN THE CONDENSATE SYSTEM MAY INDICATE DOWNSTREAM FAILURE OF STEAM TRAPS. EXCESSIVE TEMPERATURES THAT EXCEED 220 DEGREE F REQUIRE INSPECTION OF STEAM TRAPS OR OTHER SYSTEM CONDITIONS. IF SYSTEM CONDITIONS REMAIN AT HIGHER TEMPERATURES, THE SYSTEM WILL SHUT-DOWN AND SIGNAL HIGH WATER TEMPERATURE ALARMS. NOTE: FAILURE TO ADDRESS THOSE SYSTEM DOWNSTREAM ISSUES MAY DAMAGE THE PUMPING EQUIPMENT PERMANENTLY!

3. Start –UP Check List

- ☐ **Power is off!**
- ☐ **All valves leading to and from the condensate unit are in the off position!**
- ☐ **All piping connections have been made as outlined in the engineer's plans!**
- ☐ **All piping connections are tight!**
- ☐ **All electrical connections are tight!**
- ☐ **Pump is installed on elevated pad and not subject to any dripping water or other fluids!**
- ☐ **All switches are in place, not loose or broken!**
- ☐ **System is bolted down and grouted in place!**

System Piping: Open all valves from system piping to the vacuum condensate system.

◊ **Hurling tank:** Slowly open the water supply to the hurling tank (upper tank) and fill the hurling tank until the water level reaches ½ way level of the sight glass provided on the exterior of the hurling tank. Close off water supply. Open isolating valves from the hurling tank to the pumps mounted in the upper hurling tank and check for leaks.

◊ **Condensate tank**: Slowly open main fed line from the system to the condensate tank allowing the condensate tank to fill. Open the valves from the condensate tank to the pumps mounted on the condensate tank and check for leaks. Open discharge valves from the condensate pumps to system discharge and check for leaks.

◊ **Vacuum Switch**: Check the system vacuum gauge and ensure the set points are calibrated properly. Default factory settings are for low vacuum at 3'Hg to start pumps and high vacuum at 8" Hg to terminate pump operation.

◊ **Aquastat**: Check system settings for aquastat and ensure temperature setting is set for 190°F at minimum.

◊ **System Strainer**: The vacuum condensate pump should include an inlet strainer sized according to plans. Ensure the inlet strainer is free of all debris.

◊ **Vent connection**: Ensure hurling tank (upper tank) vent connections are in place and all valves open.

◊ **Power**: Energize system control panel. Open power disconnect switch from remote source and check electrical connections. Ensure disconnect switch and HOA switches on the vacuum condensate system are in the off position. Open system control panel and test for incoming power.

Upon completion of the electric installation, the installer should measure the electric connections with appropriate amp gages or other devices to ensure the connections are appropriate and meet all local building codes.

Upon completion of the electric connections, the installer will ensure the system controller door is closed and move the disconnect switch or switches from "off" position to "on" position and turn the HOA into hand position and "bump start" the pump motors ensuring they are rotating I n the proper direction. Once the motor rotation is confirmed (operating in clockwise rotation when viewed from the motor end), the installer will place the HOA switch into "Auto" operation.

At this point the system has been energized and will automatically operate engaging the hurling tank pumps almost immediately responding to lack of vacuum in the lower condensate tanks. The installer should view the factory mounted vacuum switch and witness the increased vacuum in the lower tank. As the vacuum increases from 0" Hg to factory preset upper limit of 8"Hg, it is recommended to operate a "smoke test" where the use of a burning cigar may be employed and placed near every fitting to ensure the fittings are secure. If smoke from the cigar is drawn into the receiver, the installer should shut the system down, tighten all connections and re-energize the system.

Operation sequence:

The Federal Pump vacuum condensate unit has been designed to provide automatic operation of the entire system once system power and piping connections have been completed.

Basis of operation:

The vacuum condensate system has been designed to draw a vacuum in the range of 3-8" Hg (or as otherwise specified and pre-designed)

Lower Condensate Collection: The lower portion of the system includes the condensate receiver and pumps that are designed to stat pump operation based upon the liquid level within the condensate receiver. Upon the liquid level reaching a pre-determined high level in the condensate receiver, the float switch with activate the lead pump that will pump the condensate from the receiver to a predetermined location. Once the liquid level drops to a pre-determined level, the float switch will automatically shut down the lead pump and alternate operation to the lag pump that will repeat the pump operation once the condensate level in the receiver reaches the predetermined high water level. The lower condensate receiver includes a vacuum connection from the hurling tank (mounted above the lower condensate receiver) that provides a vacuum in the condensate receiver designed to draw condensate from the system to the lower condensate receiver. This vacuum condition generally provides a 3"-8"Hg vacuum condition within the condensate receiver designed to draw condensate from the system to the receiver. The lower condensate receiver includes:

- Set of pumps (Duplex system)
- Mechanical Alternating Float switch (automatic operation of the lower condensate pumps)
- Isolation valves between the pumps and the condensate tanks that provide for pump maintenance.
- Individual pump pressure switches that provide indication of pump pressure ratings.
- Tank mounted thermometer that provides indication of condensate temperature.
- Gauge glass that provides external indication of liquid level in the condensate receiver.
- Vacuum switch that initiates or terminates accumulator tank pumps that develop system vacuum.
- High temperature alarm switch that signals unusually high condensate return temperatures and initiates cool water make up solenoid valve to reduce condensate temperatures.

Installer to ensure all downstream steam traps are in proper working order. Steam traps that are not in proper working condition may allow the transmission of higher temperature condensate to the vacuum condensate system causing for system failure or indication of high temperature condensate signaling failed steam trap operation. Federal Pump has designed a solenoid make-up valve that introduces cooled water to the system to assist in offsetting increased condensate return temperatures due to failing steam traps and may result in purging high temperature water to drain due to failed steam traps. Condensate return water in excess of 210 degrees F may signal this condition.

Upper Unit: Hurling Tank: The fabricated steel tank located above the cast iron condensate collection tank has been designed to induce a vacuum in the lower condensate tank by pumping water through a venturi (mounted inside the hurling tank) whose purpose is to create a vacuum in the condensate tank inducing condensate flow to the lower condensate receiver.

Federal Pump has preset the vacuum pressure switch to initiate hurling tank pump operation when the vacuum drops to 3"Hg signaling the pumps located in the Upper Hurling Tank to initiate operation and draw the desired vacuum. The hurling tank includes (2) pumps designed to operate in a similar lead-lad fashion as designed for the lower condensate pumps. Increasing flow through the fixed venturi by operating both hurling tank mounted pumps increases the vacuum due to increased flow through the fixed venturi and orifice.

A vacuum feed line extending from the hurling tank to the lower condensate tank provides the vacuum to the lower condensate tank thus driving total system operation.

4. Maintenance

Annual system maintenance is recommended for the Vacuum Condensate Systems.

1. Clean out all strainers that lead to and from the vacuum condensate unit. Ensure all vent lines are clear from obstruction.
2. Review each pump/motor combination at least twice a year and check for any small leaks. These leaks may require changing the mechanical seals.
3. Each Federal Pump is provided with enclosed bearings that do not require greasing. Refer to Federal Pump local sales and service center for replacement parts kits.
4. Maintenance mechanic should review the system at least twice a year to ensure pumps are alternating properly, ensure there are no leaks in the condensate tanks and ensure condensate liquid temperatures are below 220 degree F.
5. System related issues including failed steam traps or other system design issues will affect the life of the vacuum condensate unit. Ensure system valves, piping and other components are operating properly.

Use only Authorized Federal Pump replacements parts to ensure warranty and extended product life.