

ChargeSecure™

INSTALLATION, STARTUP, AND OPERATING MANUAL



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To ensure proper functionality and optimum performance, it is strongly recommended that Hillphoenix refrigeration systems be installed/serviced by qualified and certified technicians who have experience working with commercial refrigeration systems. For a list of Hillphoenix authorized installation/service contractors, please visit our website: www.hillphoenix.com

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This volume is an Installation and Startup manual.

Hillphoenix Learning Center Systems Division

IMPORTANT

At Hillphoenix®, the safety of our customers and employees, as well as the ongoing performance of our products, are top priorities. To that end, we include important warning messages in all Hillphoenix installation and operations handbooks, accompanied by an alert symbol paired with the word "DANGER", "WARNING", or "CAUTION".

All warning messages will inform you of the potential hazard; how to reduce the risk of case damage, personal injury or death; and what may happen if the instructions are not properly followed.

DANGER

Indicates an immediate threat of death or serious injury if all instructions are not followed carefully.

WARNING

Indicates a potential threat of death or serious injury if all instructions are not followed carefully.

CAUTION

Indicates that failure to properly follow instructions may result in case damage.

Revision History

[illegible]

GENERAL INFORMATION

The ChargeSecure is an integrated charge-preservation system designed for Hillphoenix engineered and manufactured CO₂ booster racks. The ChargeSecure requires no additional or synthetic refrigerants. Instead, the ChargeSecure utilizes the system's existing refrigerant charge, piping, and gas cooler for operation and to maintain system pressures below the CO₂ flash tank relief valve setpoints. Activated automatically in the event of a power loss to the rack, the ChargeSecure ensures minimal to no loss of refrigerant during extended periods of power or phase loss. This guide is intended to provide details and instructions for the field installation or retrofit of the ChargeSecure on a Hillphoenix-manufactured CO₂ booster rack.

Note: The following procedure will require depressurization of isolated sections of the system to make the necessary connections to the flash tank and oil management system. These activities may only be conducted by qualified, trained, and licensed professionals familiar with CO₂ booster refrigeration systems.

1. ChargeSecure Mounting Details

Step 1: ChargeSecure can be installed onto CO₂ Rack Main Frame as seen in **Figure A** using factory-supplied mounting components. ChargeSecure can also be floor mounted or wall mounted next to the unit no more than 15 ft away from Receiver.

Note: When doing floor mount of ChargeSecure, use factory-supplied bracket to ensure there is a minimum 2" gap below the ChargeSecure unit for air intake.

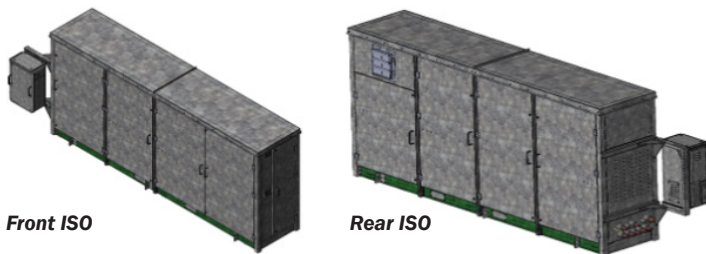


Figure A: ChargeSecure mounting details for CO₂ rack shown as reference

2. Prepare the rack for installation of the ChargeSecure

Step 1: Based on the distance between the ChargeSecure and the rack, prepare all piping lines as indicated in **Figure B (Page 8)**.

- 1) ChargeSecure suction line
- 2) ChargeSecure discharge line
- 3) ChargeSecure oil supply

Step 2: Install the necessary fittings and valves in each line that HPX supplies as indicated in **Figure B (Page 8)**.

Note: 8mm hydraulic steel tubes should be used for all ChargeSecure field-installed piping.

Section 3 and 4 below can be done without shutting down the rack.

For Sections 5 through 7, prepare the piping from ChargeSecure up to the rack and then shutdown the system to minimize the downtime.

3. ChargeSecure Suction Line Installation Details:

Step 1: This section covers ChargeSecure Suction line installation, which is Item 1 in PID **Figure B (Page 8)**.

Step 2: Close receiver manifold service and access valves (V-624) on the Rack.

Step 3: Connect the field-installed ChargeSecure suction pipe to manifold access valve (V-624) on the rack using supplied fittings as indicated in **Figure C (page 9)**.

4. High-Pressure Valve Bypass Line Installation Details:

Step 1: This section covers High-Pressure Valve Bypass Solenoid installation, which is Item 4 in PID **Figure B (Page 8)**.

Step 2: Close drain line access valves (V-639A and V-639B). If you are not able to find V-639A on unit, then use access valve V-621.

Step 3: Connect the field-installed high-pressure bypass line to drain access valves (V-639A and 639B) on Rack using supplied fittings as indicated in **Figure D (Page 10)**. If you are not able to find V-639A on unit, then use access valve V-621.

Step 4: Insulate the bypass line with 3/4" thickness insulation.

Step 5: Bypass Solenoid (V-687) to be wired to ChargeSecure control panel per wiring diagram indicated in **Figure D2 (Page 11)**.

5. Oil Supply Line Installation Details:

Step 1: Shut down the rack.

Step 2: Close oil reservoir feed line access valve (V-665), ChargeSecure oil supply service valve (V-663A) and all compressor oil supply lines (V-314,324,114 and 124).

Step 3: Connect the field-installed oil supply pipe to the oil manifold end (remove the end cap of manifold) on Rack using supplied fittings as indicated in **Figure E (Page 12)**.

6. DOS Feed Line Bypass and Oil Reservoir Vent Line Nozzle Installation Details:

Step 1: This section covers Oil Pressurization Solenoid and Reservoir Pressure Holdback installation, which are Items 5 & 6 in PID **Figure B (Page 8)**.

Step 2: Close DOS feed line access valve (V-662).

Step 3: Connect the field installed DOS bypass line to main oil feed line on Rack using supplied fittings as indicated in **Figure F**.

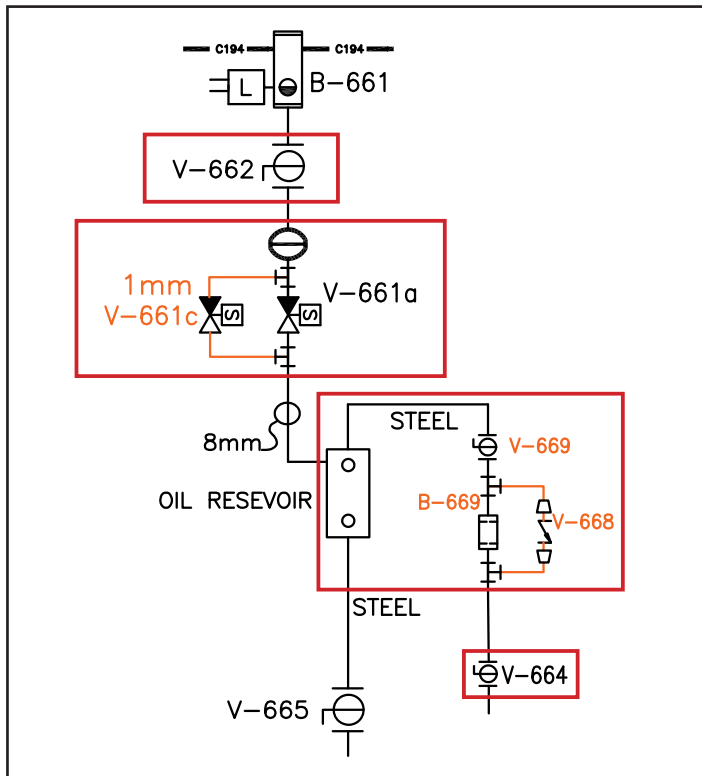


Figure F: DOS Feed Line Bypass Installation details

Step 4: Oil Pressurization Solenoid (V-661c) is to be wired to ChargeSecure control panel per wiring diagram in **Figure F2 (Page 13)**.

Step 5: Close Oil reservoir vent line access valve (V-664).

Step 6: Install Ball Valve (V-669) and Nozzle (B-669) on Oil Reservoir Vent Line as indicated in **Figure F**.

Step 7: Install the bypass check valve (V-668) assembly to Oil Reservoir vent line on Rack using supplied fittings as indicated in **Figure F**.

7. ChargeSecure Discharge Line Installation Details:

Step 1: Assemble the discharge line pipe and associated valves as described in Section 2.

Step 2: Close all MT compressors discharge service valves (V-112 and V-122); the number of compressors will be based on Rack model and close MT discharge line service V-615A. Vent the refrigerant between Compressor outlet and V-615A using access valve V-611.

Step 3: Connect the assembled discharge line pipe to MT discharge line after DOS on Rack using supplied fittings as indicated in **Figure G (Page 14)**.

Step 4: Once all piping is complete, follow the Hillphoenix/Advansor startup guide to properly vacuum the system. This guide can be reached by scanning the QR code on the side of the ChargeSecure Unit.

Important Note: For Flex models ONLY: Make sure to rework the DOS outlet line shown in Figure H1. Create an inverted U-trap and connect the ChargeSecure discharge to the side as shown in the picture below. This allows the oil to drain back into the DOS. Ensure that C194 tees and fittings are used.

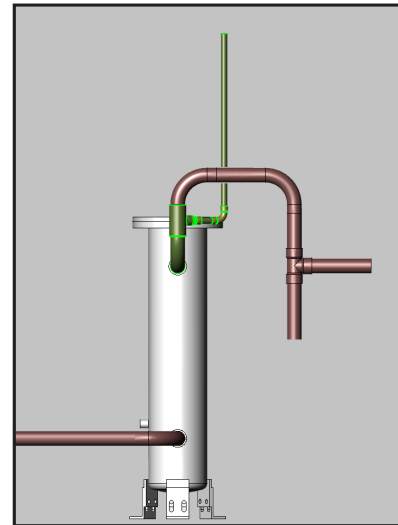


Figure H1: Inverted U-trap and ChargeSecure Discharge Line

For all other models: Ensure the DOS outlet line is a vertical riser. ChargeSecure discharge must be connected above the DOS as shown in Figure H2

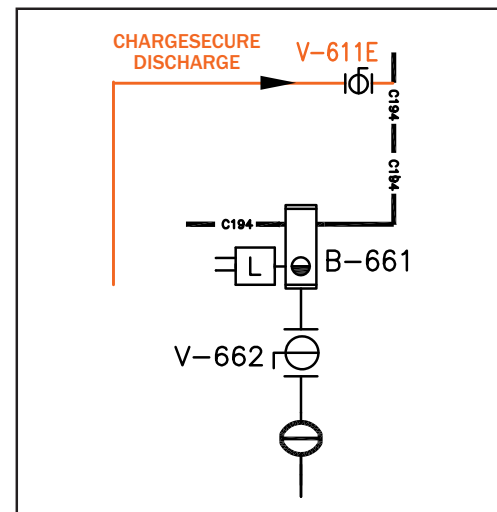


Figure H2: Ensure the DOS outlet line is a vertical riser

GENERAL INFORMATION

8. Connect the electrical supply to the ChargeSecure according to Figure K.

1. Note: ChargeSecure operates at 208VAC single-phase power. If using a backup generator or outside source UPS, ensure that the output is compatible with the requirements of the ChargeSecure.

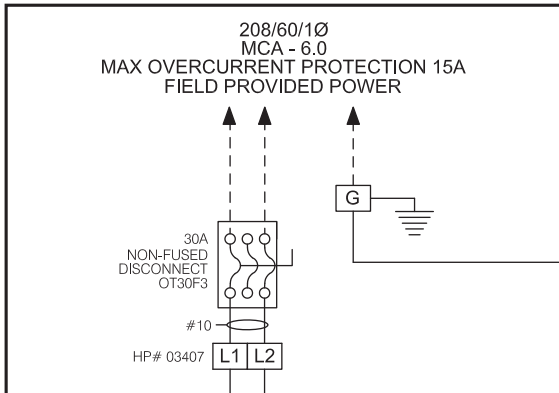


Figure K – ChargeSecure standard wiring information

2. If installing with a Hillphoenix-supplied battery pack/module, follow the wiring diagram in **Figure L**.

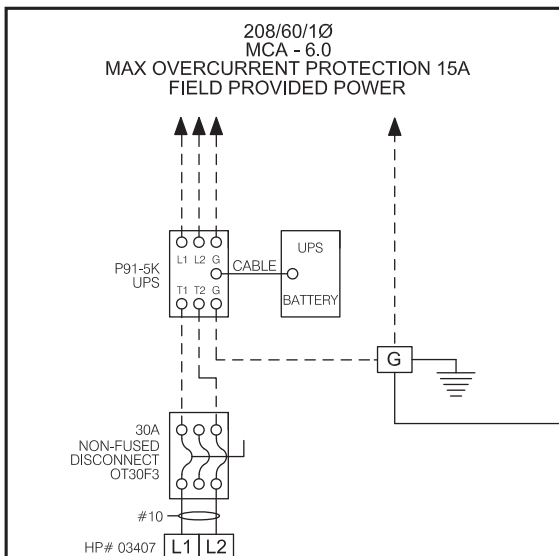


Figure L – ChargeSecure wiring diagram excerpt

9. Verify all isolation valves associated with the CSU are in the open position.

ChargeSecure Unit Operational Test

- Verify power comes from generator or backup UPS
- Turn “Run Enable Override” Switch to “Manual”
- Turn the “Compressor Maintenance Run Timer” to 5 minutes. This will force the unit compressor to start
- Verify the unit oil solenoid valves both open for 30 seconds after compressor start (critical to first-run oil operation)
- Monitor the unit suction and discharge pressure for proper operation
 - Discharge should raise
 - Suction should lower
- Once proper operation is verified, turn off the “Start Enable Override” and allow the timer to continue to zero.

Note: if the rack is in "phase-loss alarm" the unit may continue to run until the timer hits zero and the flash tank falls below the lower setpoint limit.

GENERAL INFORMATION

ChargeSecure Fault Tree

Function	Failure	Causes of Failure	Effects	Recommended Action
Unit to start upon rack phase loss + set pressure	Failure to start	No input signal from rack phase loss	AFEA/AFEB - Run enable missing	Ensure that the ChargeSecure VFD is receiving the run-enable signal from rack phase loss (refer to ChargeSecure wiring diagram provided with unit)
		Suction transducer failure	VFD will not receive high-pressure signal to start or throw an error code related to a transducer failure causing the unit to not start and leading to refrigerant loss in the flash tank	Test transducer for proper operation and replace if needed Ensure VFD is receiving appropriate signal from transducers Parameter 12.12 - Actual value in Bar
		Backup power not present	Without backup power to the ChargeSecure the VFD will not be able to drive the compressor and valves. This will cause the ChargeSecure to not start leading to refrigerant loss in the flash tank	Verify power from backup UPS or generator and service as needed
Compressor	Compressor failure	Lack of oil	Compressor fails to properly pump refrigerant causing poor system operation	Verify the presence of oil in ChargeSecure oil supply line Verify proper operation of oil solenoid valves Validate no impurities in oil Verify pressure differential in oil line
		Equalization solenoid valve failure	VFD will not receive pressure signal and will throw an error code related to a transducer failure causing the unit to not start and leading to refrigerant loss in the flash tank	Verify proper operation of solenoid valve
		Discharge transducer failed		Test transducer for proper operation and replace if needed Ensure VFD is receiving appropriate signal from transducers Parameter 12.22 - Actual value in Bar
VFD/Controller	Won't start compressor	High-pressure alarm	Safety chain will be broken resulting in fault 5901 - Safe Torque off	Ensure that high pressure switch is not activated and is properly wired. Investigate potential high-pressure issue Parameter 12.12 - Actual value in Bar
		Overheating due to VFD fan failure or insufficient air flow	Fault A79C - Temperature exceeded	Reset VFD and replace if needed
		Other faults	Various	Refer to the ACS380 machinery control program Firmware manual - Document Number: 3AXD50000029275
Prevent Refrigeration Loss	ChargeSecure not preventing refrigerant loss	Rack MT disc to MT suction leak	Internal system leak causing unintended refrigerant loss in flash tank	Inspect and repair rack internal leaks as needed
		Rack MT suction leak to receiver leak	ChargeSecure will take longer to pull flash-tank pressure leading to higher energy usage. If battery is not sized properly ChargeSecure could shutdown causing refrigerant loss	
		Leaky rack relief valve	Internal system leak causing unintended refrigerant loss	

A RETROFIT PIPING SCHEMATIC

B FREQUENTLY ASKED QUESTIONS

C WARRANTY VALIDATION CHECKLIST

A1 RETROFIT PIPING SCHEMATIC

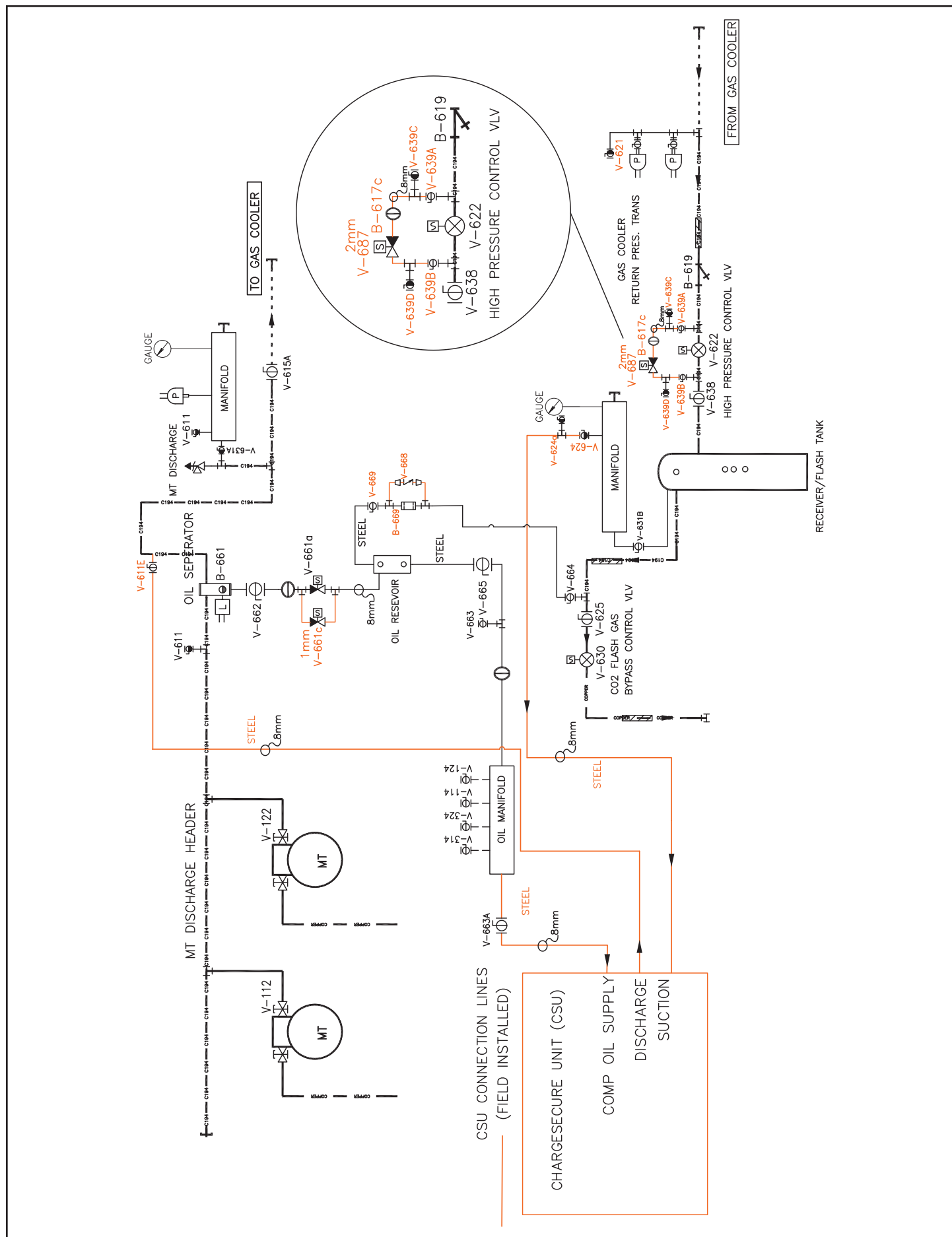


Figure B: ChargeSecure and Rack Piping details

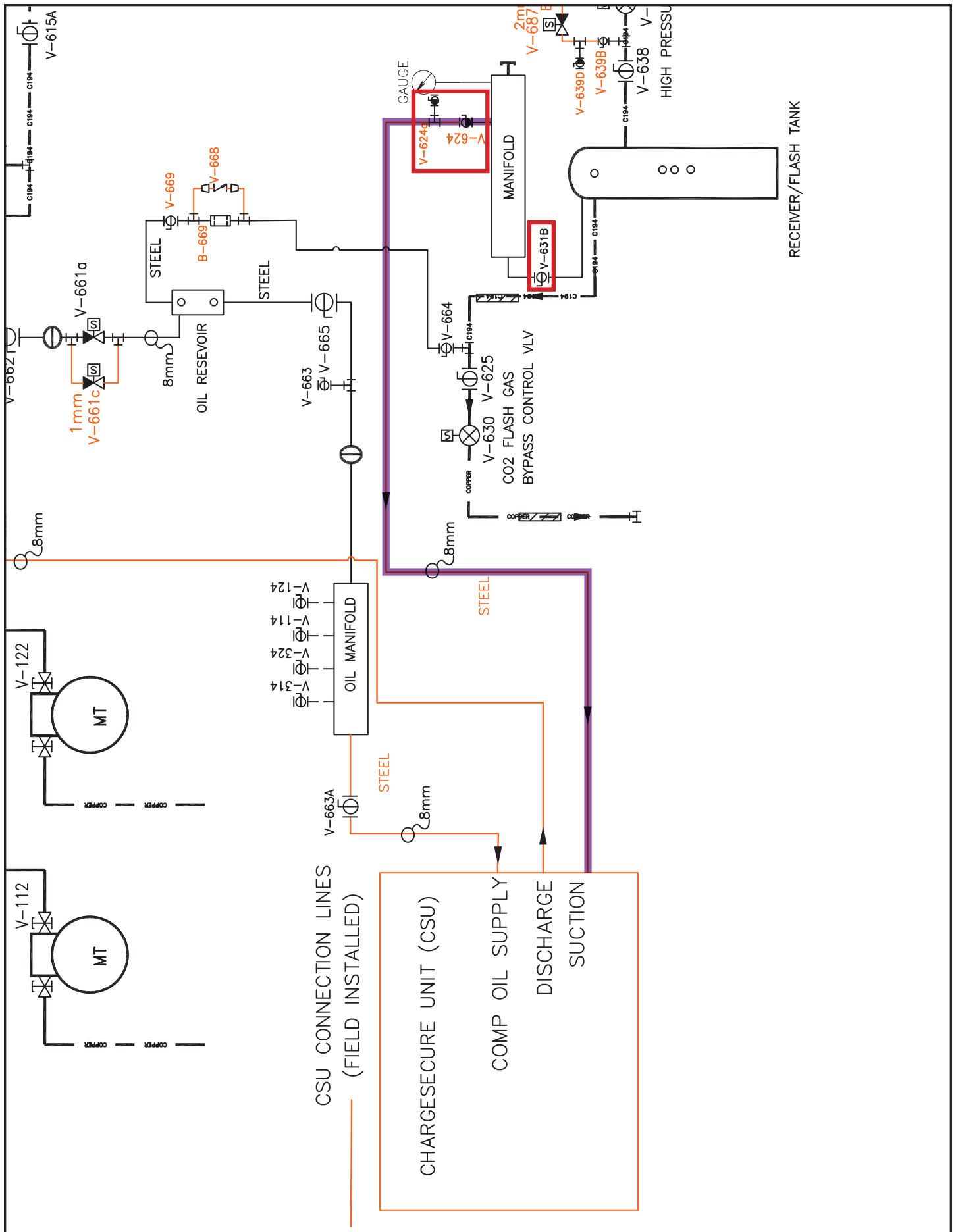


Figure C: ChargeSecure Suction line installation details

A3 RETROFIT PIPING SCHEMATIC

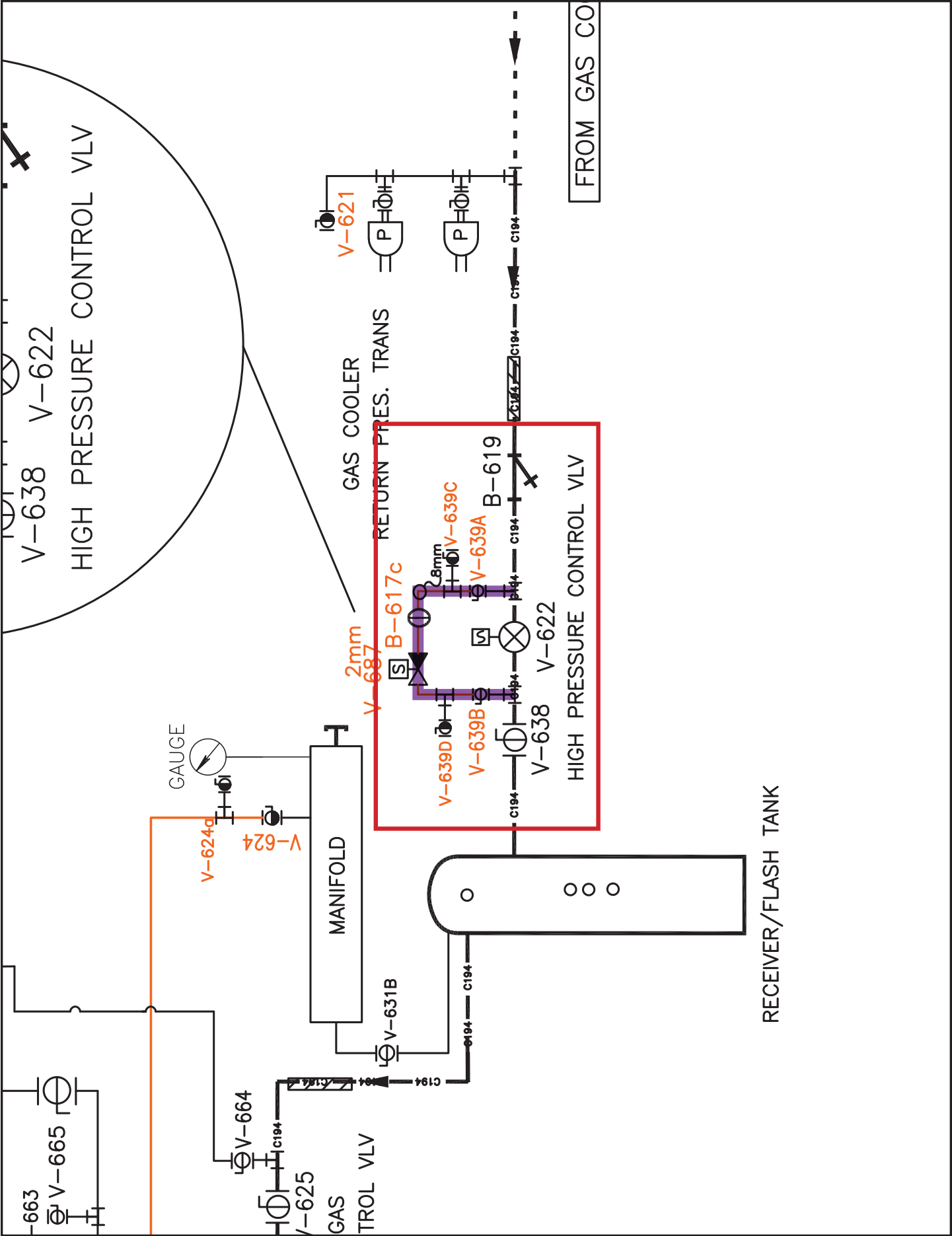


Figure D: High-pressure valve bypass installation details

A4 RETROFIT PIPING SCHEMATIC

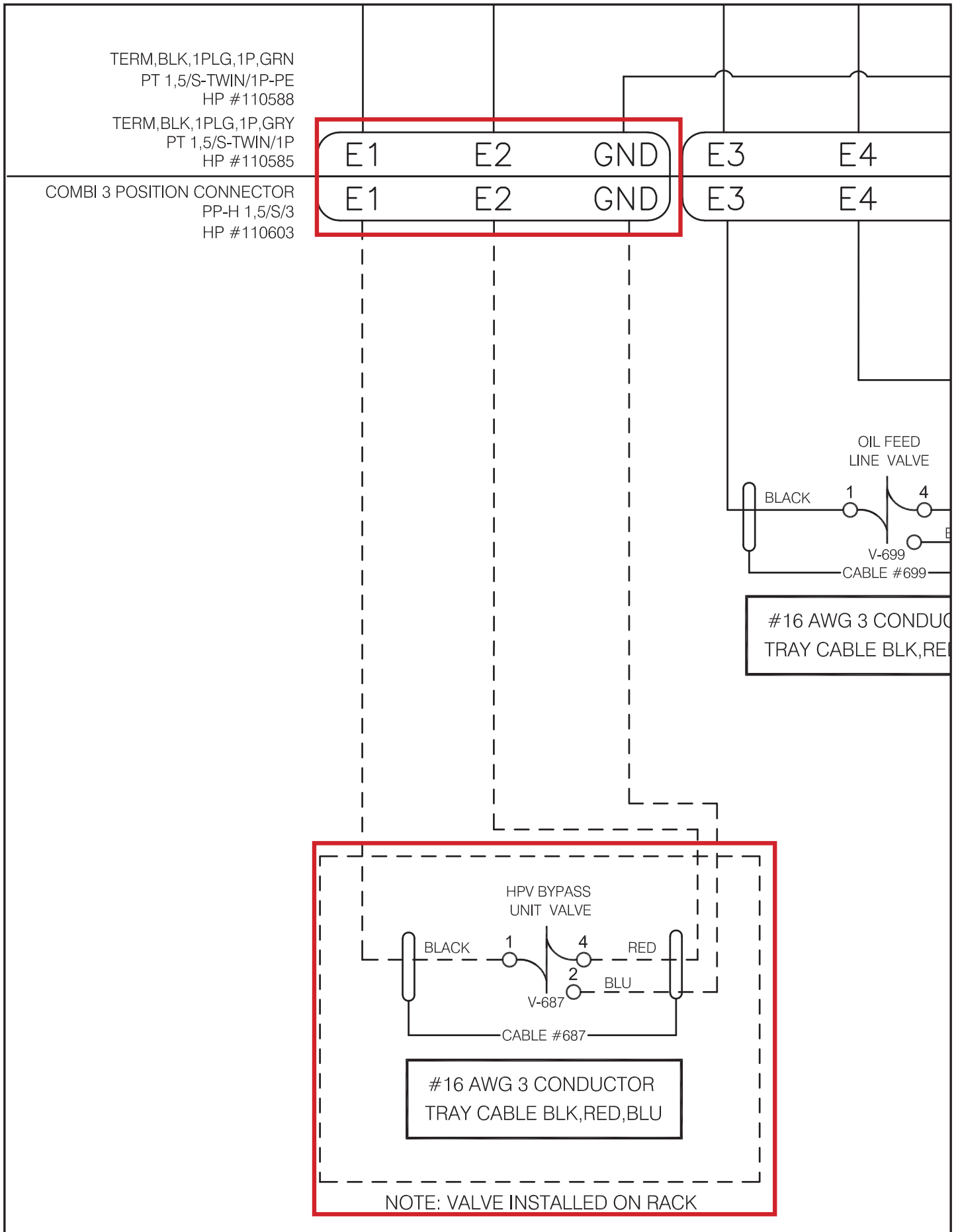


Figure D2 – ChargeSecure wiring diagram excerpt

A5 RETROFIT PIPING SCHEMATIC

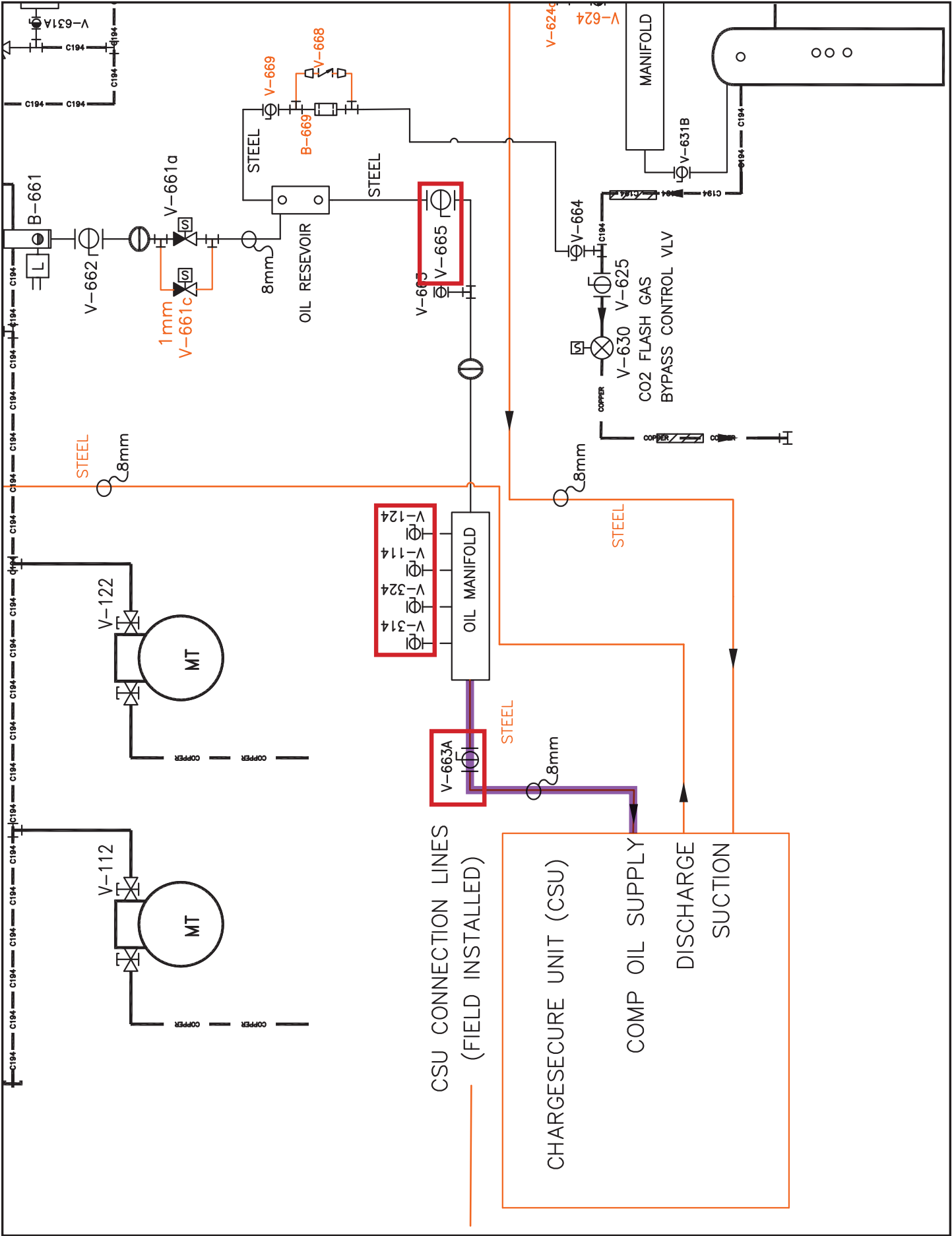


Figure E: ChargeSecure Oil Supply line installation details

A6 RETROFIT PIPING SCHEMATIC

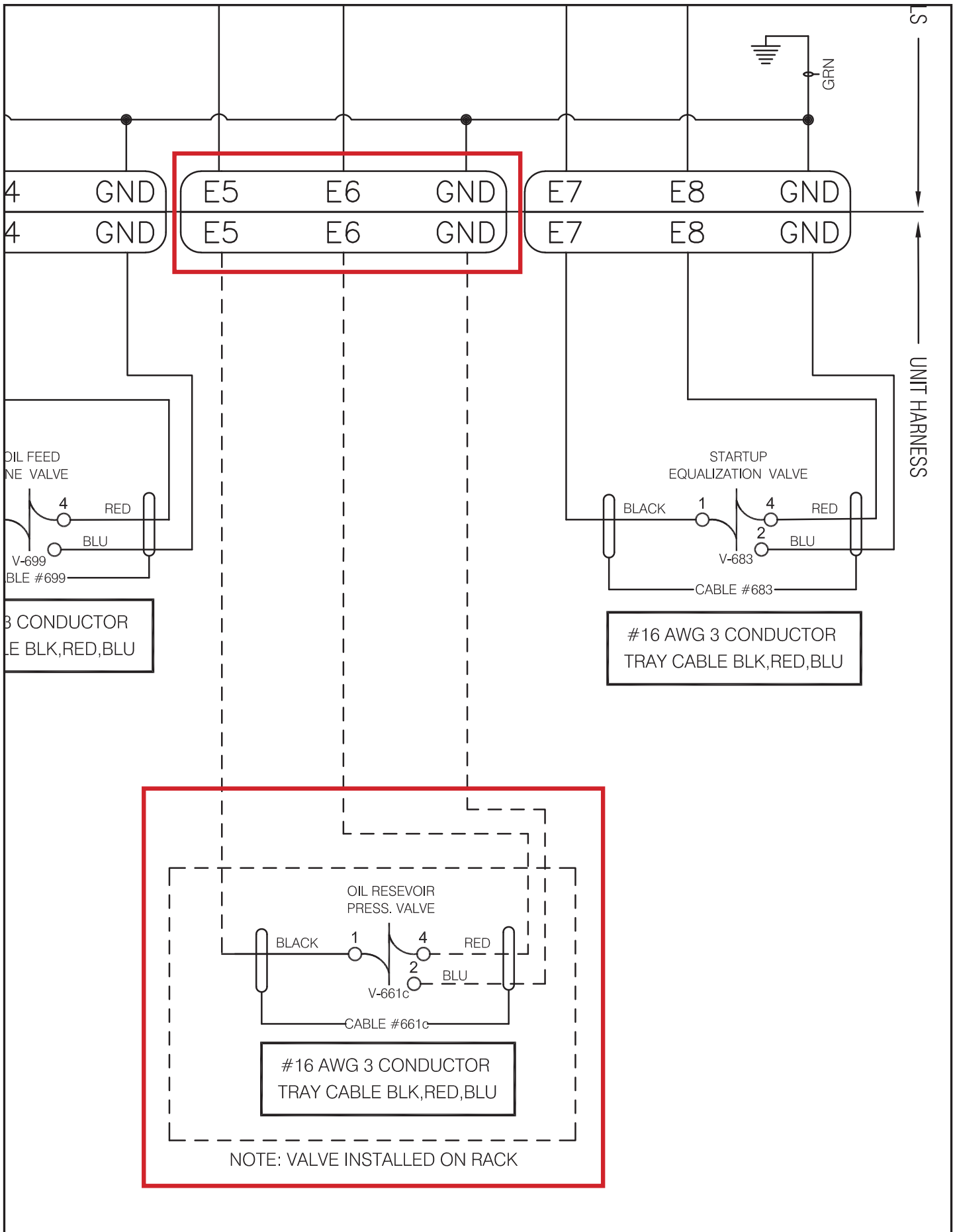


Figure F2 – ChargeSecure wiring diagram excerpt

A7 RETROFIT PIPING SCHEMATIC

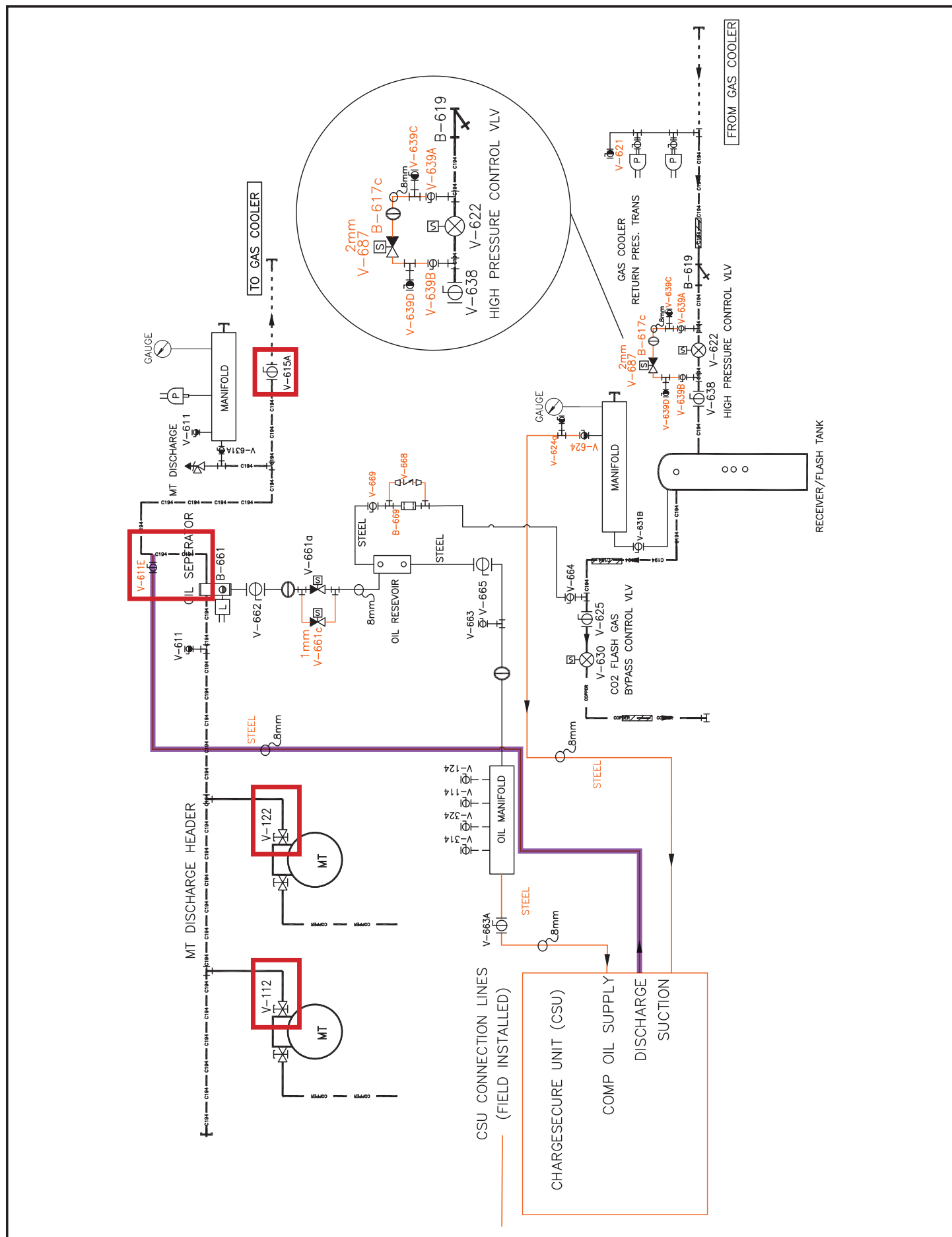


Figure G: ChargeSecure Discharge line installation detail

ChargeSecure Frequently Asked Questions

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ChargeSecure Q&A

Q: How will ChargeSecure know that it needs to turn on? What activates it?

There are two incidents that need to happen for ChargeSecure to turn on 1) When there is a power outage and 2) When the pressure exceeds the predefined setpoint. ChargeSecure will automatically turn on and reduce the flash tank pressure to below the predefined set point.

Q: How does ChargeSecure work?

When pressure exceeds the predefined setpoint the unit turns on and compresses the gas from the flash tank to the gas cooler, from where the gas is cooled by natural convection and then expands back to the receiver. This consequently reduces the overall pressure of the liquid line.

Q: How is ChargeSecure different than the HFC Auxiliary Backpack unit used today?

ChargeSecure uses the CO₂ and oil present in the system, whereas the HFC system uses HFC. The HFC system condensing unit condenses the gas in the flash tank using a heat exchanger. ChargeSecure is much smaller and can provide a longer run time as it uses only 1.8 amps vs approximately 15 amps with the HFC backup unit.

Q: What charge will ChargeSecure protect?

ChargeSecure preserves charge from the gas cooler to the liquid line up to the EEV's.

Q: Does ChargeSecure have its own controls, or will it be integrated into the rack controls?

ChargeSecure has its own control panel that makes ChargeSecure's operation independent of the rack's controls.

Q: What will ChargeSecure's power source be?

ChargeSecure can run on either a backup battery or can be connected to a backup generator (208V or 240V / 1ph / 60Hz).

Q: Where can the backup battery / UPS be installed?

The backup battery / generator can be installed anywhere indoors (closed chamber) within 300 feet of the ChargeSecure unit. Hillphoenix recommends installing the battery pack indoors to avoid extreme temperatures and battery performance degradation.

Q: For ChargeSecure operation, does the gas cooler need to be running?

No; the charge will be cooled by effect of ambient conditions when it passes through the gas cooler.

Q: Will there be various sizes / capacities of ChargeSecure?

No. ChargeSecure comes in one size that can fit into all Hillphoenix's food retail racks, (Flex, Flex-Mini, and Flex-MAX) (up to and including flash tanks capable of holding 2265 lbs of CO₂). For larger (industrial racks), multiple units can be installed.

Q: Why is ChargeSecure only installed on Hillphoenix racks?

Hillphoenix has no visibility on the competitors' systems and oil management control strategies, hence we cannot and will not guarantee proper operation of ChargeSecure on competitors' racks. Moreover, competitors' racks do not have any piping provisions for proper installation of ChargeSecure.

Q: How long does each battery last? How long will the unit run?

ChargeSecure will run on a single backup battery for approximately 10-12 hours after the unit is triggered to start. The exact duration will vary depending on multiple factors depending on outdoor ambient, flash tank capacity and line run lengths.

Q: What is the life of the battery pack? How often should it be replaced?

ChargeSecure uses standard lead-acid batteries which typically have a life of 10 years.

Q: How much of the CO₂ charge will ChargeSecure protect? What about the remaining charge?

ChargeSecure is designed to protect the charge in the flash tank, gas cooler and liquid lines up to expansion valves, making up to Approximately about 70% of total charge. This constitutes the critical charge in non-airconditioned areas where the charge is more susceptible to faster pressure rise.

B2 FREQUENTLY ASKED QUESTIONS

Q: What do I need to install a ChargeSecure on an existing rack?

A retrofit kit will be provided by Hillphoenix for installation on existing racks.

Q: Can ChargeSecure be installed outdoors?

Yes; ChargeSecure's enclosure is NEMA 3R rated for outdoor installation.

Q: Does the chargeSecure require an additional cold weather kit for locations below 5° F?

No; ChargeSecure is designed for low ambient temperature installations (built-in insulation). It is designed for ChargeSecure to be installed in temperatures as low as -30° F.

Q: How can we ensure the proper operation of ChargeSecure?

By following installation and maintenance procedures in the I & O manual. Moreover, it is advised to schedule a monthly manual testing of ChargeSecure for 5 minutes. The testing procedure is detailed on the I & O manual.

For more details on ChargeSecure please go to:

<https://www.hillphoenix.com/chargesecure/>

C1 HILLPHOENIX WARRANTY VALIDATION CHECKLIST

This checklist provides the means for confirming that the steps and procedures required to start up the ChargeSecure system, as laid out in the guide, have been properly performed. Sign (on the following page) and submit the completed checklist to Hillphoenix for validation of warranty coverage.

<p>Mail: Systems Operations 2016 Gees Mill Rd. Conyers, GA 30013 Fax: 770.285.3080 Email: info@Hillphoenix.com Or your local Field Service Engineer</p>	<p>Contact Information Technician performing checks:</p> <p>Name: _____</p> <p>Phone: _____ Email: _____</p>
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☐ **Follow rack startup procedure. Once the rack is properly operating:**

1. Ensure all CSU circuit breakers are in the ON position
2. Close the panel door and switch on the disconnect
3. Verify that suction, oil, and discharge isolation valves are open
4. Turn "Run Enable Override" Switch to "Manual"
5. Turn the "Compressor Maintenance Run Timer" to 5 minutes. This will force the unit compressor to start
6. Verify the unit oil solenoid valves are both open for 30 seconds after compressor start (critical to first run oil operation)
7. Monitor the unit suction and discharge pressure for proper operation
8. Once proper operation is verified, turn off the "Start Enable Override" and allow the timer to continue to zero.
9. Note: if the rack is in "phase-loss alarm" the unit may continue to run until the timer hits zero and the flash tank falls below the low setpoint limit

Signature: _____

Date: _____



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WARRANTY

HEREINAFTER REFERRED TO AS MANUFACTURER

FOURTEEN-MONTH WARRANTY. THE MANUFACTURER'S PRODUCT IS WARRANTED TO BE FREE FROM DEFECTS IN MATERIAL AND WORKMANSHIP UNDER NORMAL USE AND MAINTENANCE FOR A PERIOD OF FOURTEEN MONTHS FROM THE DATE OF ORIGINAL SHIPMENT. A NEW OR REBUILT PART TO REPLACE ANY DEFECTIVE PART WILL BE PROVIDED WITHOUT CHARGE, PROVIDED THE DEFECTIVE PART IS RETURNED TO THE MANUFACTURER. THE REPLACEMENT PART ASSUMES THE UNUSED PORTION OF THE WARRANTY.

This warranty does not include labor or other costs incurred for repairing, removing, installing, shipping, servicing, or handling either defective parts or replacement parts. The fourteen-month warranty shall not apply:

1. To any unit or any part thereof which has been subject to accident, alteration, negligence, misuse or abuse, operation on improper voltage, or which has not been operated in accordance with the manufacturer's recommendation, or if the serial number of the unit has been altered, defaced, or removed.
2. When the unit, or any part thereof, is damaged by fire, flood, or other acts of God.
3. Outside the continental United States.
4. To labor cost for replacement of parts, or for freight, shipping expenses, sales tax, or upgrading.
5. When the operation is impaired due to improper installation.
6. When installation and startup forms are not properly completed or returned within two weeks after startup.

THIS PLAN DOES NOT COVER CONSEQUENTIAL OR LIQUIDATED DAMAGES. The manufacturer shall not be liable under any circumstances for any consequential or liquidated damages, including loss of profit, additional labor cost, loss of refrigerant or food products, or injury to personnel or property caused by defective material or parts or for any delay in its performance hereunder due to causes beyond its control.

The foregoing shall constitute the sole and exclusive remedy of any purchases and the sole and exclusive liability of the Manufacturer in connection with this product. The Warranties are Expressly in Lieu of All Other Warranties, Express or Implied, and All Other Obligations or Liabilities on Our Part. The Obligation to Repair or Replace Parts or Components Judged to be Defective in Material or Workmanship States Our Entire Liability Whether Based on Tort, Contract, or Warranty. We Neither Assume Nor Authorize Any Other Person to Assume for Us Any Other Liability in Connection with Our Product.

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