



Czero Hydraulic Power Unit
<https://czero-solutions.com/>



HPU Unit Overview

Czero is looking to sell a custom Hydraulic Power Unit (HPU), details and specifications provided within this summary. The unit has an estimated running life of 650 hrs and was built in 2021. The unit will be provided empty (no oil, drained). It has been operated and stored indoors. It is rated for outdoor duty. The current location of the unit is in Fort Collins, CO.

The HPU sale will include the following items:

- HPU skid with reservoir (drained)
- Misc. supply and return hoses
- Cooling Unit/Radiator and associated plumbing (supply and return hoses)

Controls Related:

- User's manual (Operational)
 - The user's manual will include details to access the web-based HMI which can be accessed over ethernet with a cat5 cable and a computer through a web-browser.

Features

This HPU has several features:

- Highly configurable system. Equipped with motor speed control (VFD) and variable displacement pumps. Plumbed with three pressure rails all rated and capable of 5000psi. Designed for five pump motor groups, currently configured with three that supply two rails. Mounting provisions exist for additional 2 pump motor groups.
- 1500-gallon reservoir
- US made. Uses the highest quality motors, pumps and VFDs
- Single HPU skid with remote cooling unit
- Indoor/outdoor rated
- All plumbing connections can be made from either end
- The cooling radiator motor is driven by VFD to allow for power and noise reduction when the heat load is less than the capacity.
- The VFD enclosures are cooled by NEMA 4 rated A/C units allowing the system to operate in -20 to 110°F ambient conditions.
- Very little use (estimated 650 hrs)

Expandability and flexibility for future:

- **The unit has mounts for 2 additional pump/motor sets on a third pressure rail (Rail C), as depicted in renderings later in this document. The third pressure (Rail C) rail is currently plumbed in place.**

Control Method/System

- The unit is PLC controlled and web interfaceable. HPU does not have a local HMI but has a web-based HMI which can be accessed over ethernet with a cat5 cable and a computer through a web-browser.
- The control system is a Beckhoff CX5140 paired with three Parker pump controllers.
- The HPU has two independent rails with independent setpoints which can be set from the web HMI
- Manual mode of the system is available from the web-based HMI – No system safeties are active when the system is operated in manual mode.

Specs

Calculated Total System Weight with Oil (see lifting section for breakdown)	38,400 lbf
Overall Dimensions HPU Oil Cooling Radiator Assembly	288" x 129" x 114" (L x W x H) 83" x 44" x 76" (L x W x H)
Hydraulic Oil	1500 gallons Shell Tellus S2 MX32 Hydraulic Oil (previously used, drained)
Pressure Rails Maximum System Pressure Rating (all rails) *Rail A (current settings shown, see Rail Capacity on next slide) *Rail B (current settings shown, see Rail Capacity on next slide) Rail C	5000psi 127gpm @ 2300psi (2500psi relief valve setting). Limited by 200hp motor 132gpm @ 4400psi (4800psi relief valve setting). Limited by 200hp motor No motor/pump sets in place, can accommodate 2 additional
Cooling Capacity	332hp [248kW] of heat dissipation @ 124gpm and full radiator fan speed Oil temperature will be controlled within 100-180°F (ideal target 120-140°F)
Filtration Cooling and Filtration Loop Return Filter	5 micron filter 3x 10 micron filters in parallel NOTE: All filters have a pressure switch to indicate fouling, a 35psi bypass, and drop tube with a magnetic core
Required Oil Cleanliness	NAS 1638 Class 8 cleanliness level (ISO 4406 19/17/14) or better
Ambient Conditions	Indoor/outdoor rated -20 to 110°F Up to 5000ft elevation without derate

***Current pressure limits are set based on available motor power and original application requirements. Pressure can be increased as needed, see pump curve on next slide for rail capacities.**

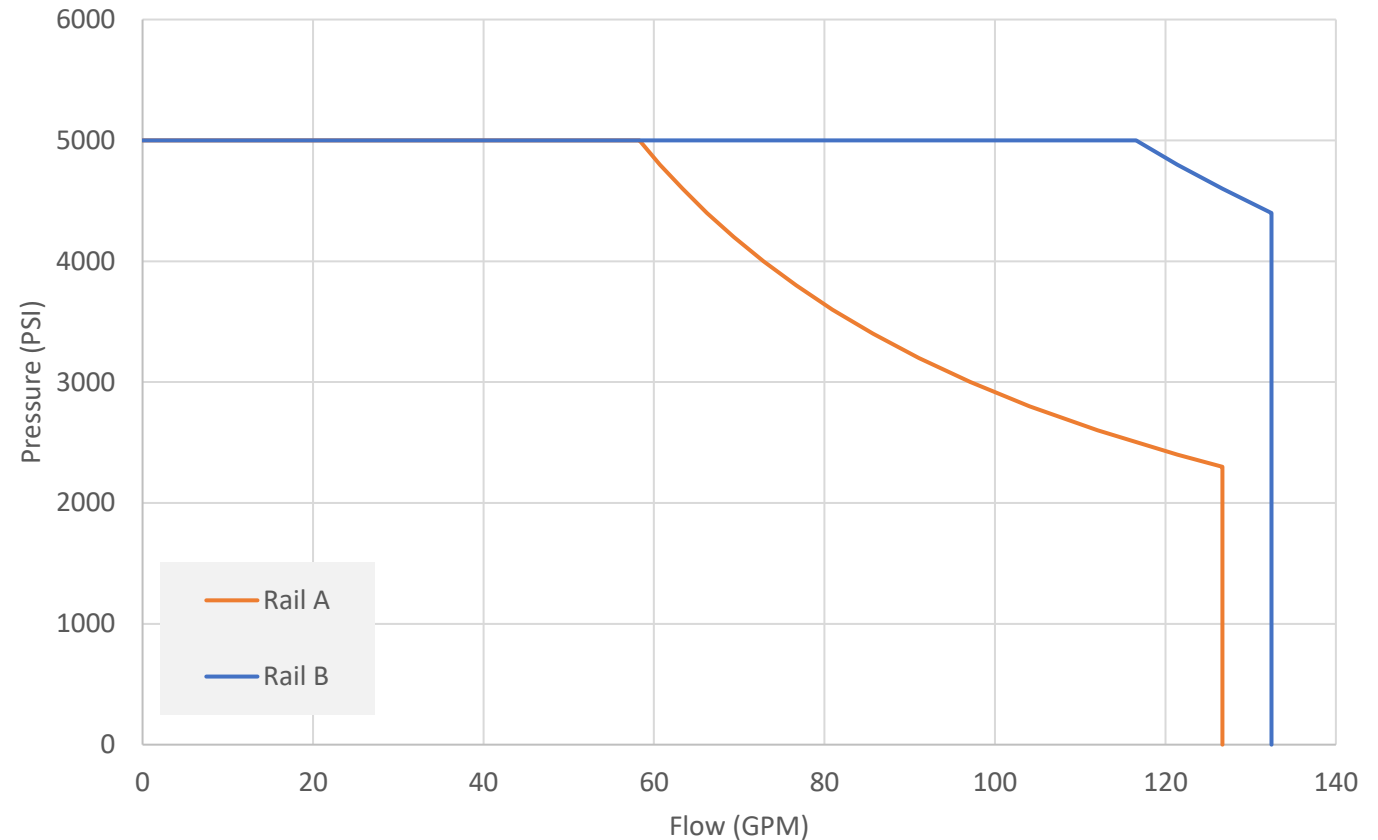
Current Rail Capacities (Pump Curve)

Rail A

- Pressure: 5000 psi max
- Flow: Flow limited to 127 gpm, max pump capacity. Plot assumes pressure and flow capabilities of 200hp motor, with efficiencies.

Rail B

- Pressure: 5000 psi max
- Flow: Flow limited to 132 gpm, max pump set capacity. Plot assumes pressure and flow capabilities of 2X 200hp motor, with efficiencies.



Major Equipment List

VFDs (motor drives)

- 3X – Parker PN: 10G-411-3200-BF
 - VARIABLE FREQUENCY DRIVE, IP20 RATED, 480VAC, 160KW (215HP), BRAKING MODULE FITTED, C3 EMC FILTER FITTED

Motors (see details later in document)

- 3X - 200HP, TEFC, 460V 3P, Severe Duty, Baldor Reliance, several added features/customizations (see details later in document)

Pumps

- 1X – Parker PN: PV270R4D3T1NFDV
 - VARIABLE DISPLACEMENT SWASH PLATE PISTON PUMP, OPEN CIRCUIT, 270CC/REV, CLOCKWISE ROTATION, SAE E 4 BOLT MOUNT, KEYED SHAFT, ENGLISH PORTS/THREADS, NITRILE SEALS, PROPORTIONAL DISPLACEMENT CONTROL WITH DISPLACEMENT FEEDBACK
- 2X – Parker PN: PV140R4F3T1NFDV
 - VARIABLE DISPLACEMENT SWASH PLATE PISTON PUMP, OPEN CIRCUIT, 140CC/REV, CLOCKWISE ROTATION, SAE F 4 BOLT MOUNT, SAE F KEYED SHAFT, ENGLISH PORTS/THREADS, NITRILE SEALS, PROPORTIONAL DISPLACEMENT CONTROL WITH DISPLACEMENT FEEDBACK

Cooler (see details later in document)

- 1X - HD325-3 : AKG HD-Series Cooler

Overview

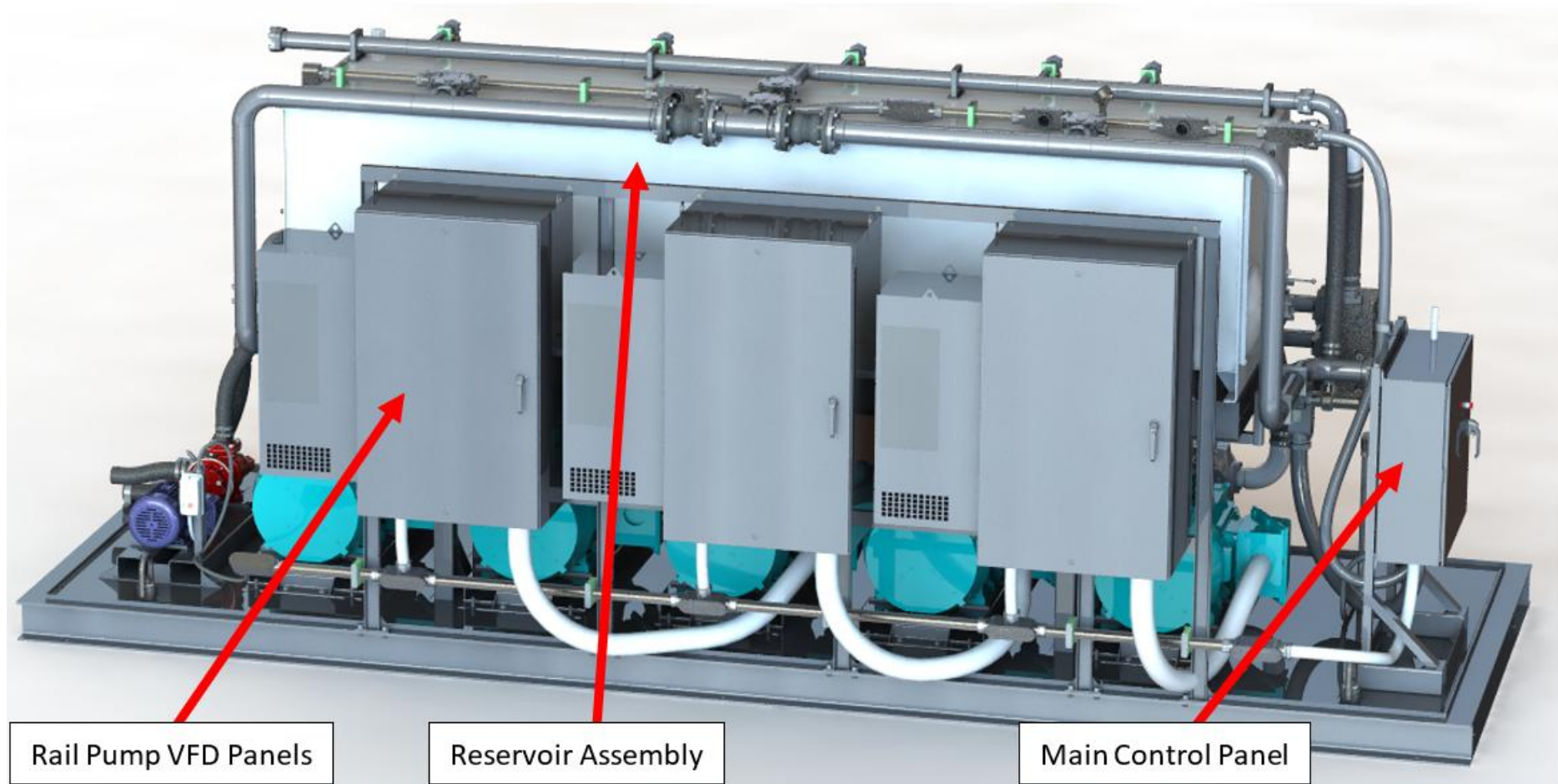


Figure 1: HPU Assembly from the VFD Side

Lifting (HPU Skid Only)

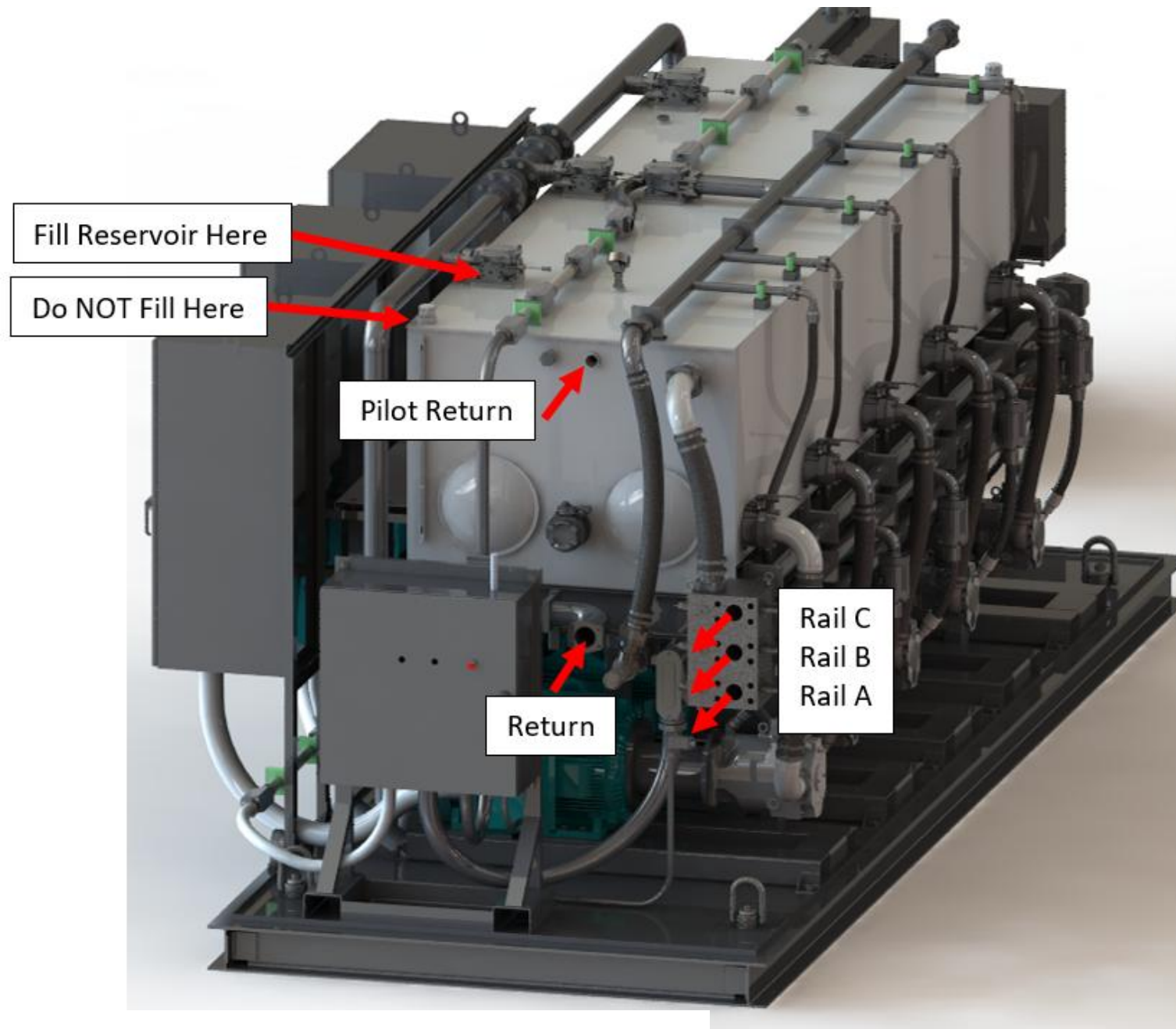
Description	Calculated Weight	Lifting Accommodations
Complete HPU without Oil (Does not include remote mounted oil cooling radiator assembly)	31,300 lbf	Four hoist rings at the corners of the assembly

Plumbing

There are several fluid connections that need to be made between the HPU and the consumer. These connections are summarized in the table below and shown in the following images.

Connection	Interface (on HPU Side)	Pressure Rating	Maximum Recommended Length of Interconnection	Location
Rail A Pressure	3" Code 62 Flat Face Flange	5000 psi	100ft	Either end of the HPU
Rail B Pressure	3" Code 62 Flat Face Flange	5000 psi	100ft	Either end of the HPU
Rail C Pressure (Future Expansion)	3" Code 62 Flat Face Flange	5000 psi	100ft	Either end of the HPU
Oil Return (All Rails)	4" Code 61 Flat Faced Flange	100 psi	100ft	Either end of the HPU
Pilot Return (not a filtered return)	2" Female NPT	100 psi	100ft	Either end of the HPU near the top of the reservoir
HPU to Oil Cooling Radiator	3" Code 61 Flat Face Flange (on both systems)	100 psi	70ft	Oil Supply: The outlet port of the pump. Oil Return: The rail just above the pump that runs along the bottom of the reservoir.
Air Supply for the Vortex Cooler		80-100 psi		The cooler is in the main controls enclosure.

Plumbing



Plumbing

The oil cooling and filtration loop runs in parallel to the high-pressure loops. Hot oil is pulled from the reservoir and pumped to the cooling radiator. The oil is always flowing at full capacity through this loop, but the radiator fan may be on/off or running slower based on the heat load. Cooled oil returns from the radiator and flows through a header below the reservoir. A small amount of cool oil is branched off to each rail pump case. This oil flushes the case and ensures the pump does not overheat. This oil is then recombined with the main oil flow. In order to drive the flow through the pump cases, a back pressure regulating valve is utilized. This valve is set by Czero and should not be adjusted. The combined oil from the pump cases and the remaining cool oil (which makes up the majority of the flow) is returned through a 5-micron filter to the reservoir.

Note: Actual unit has only three motor/pump sets. System can be expanded to include third pressure rail with 2 additional pump/motor groups as shown in image.

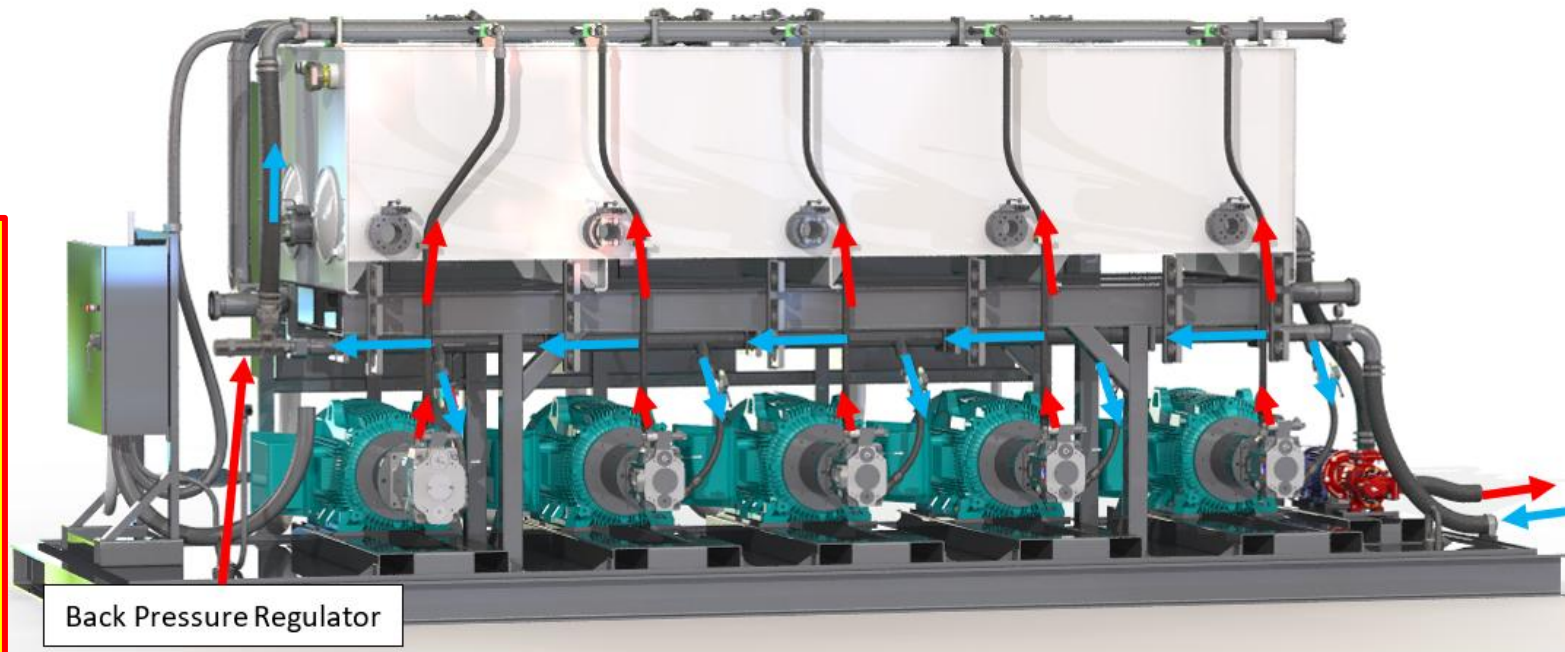
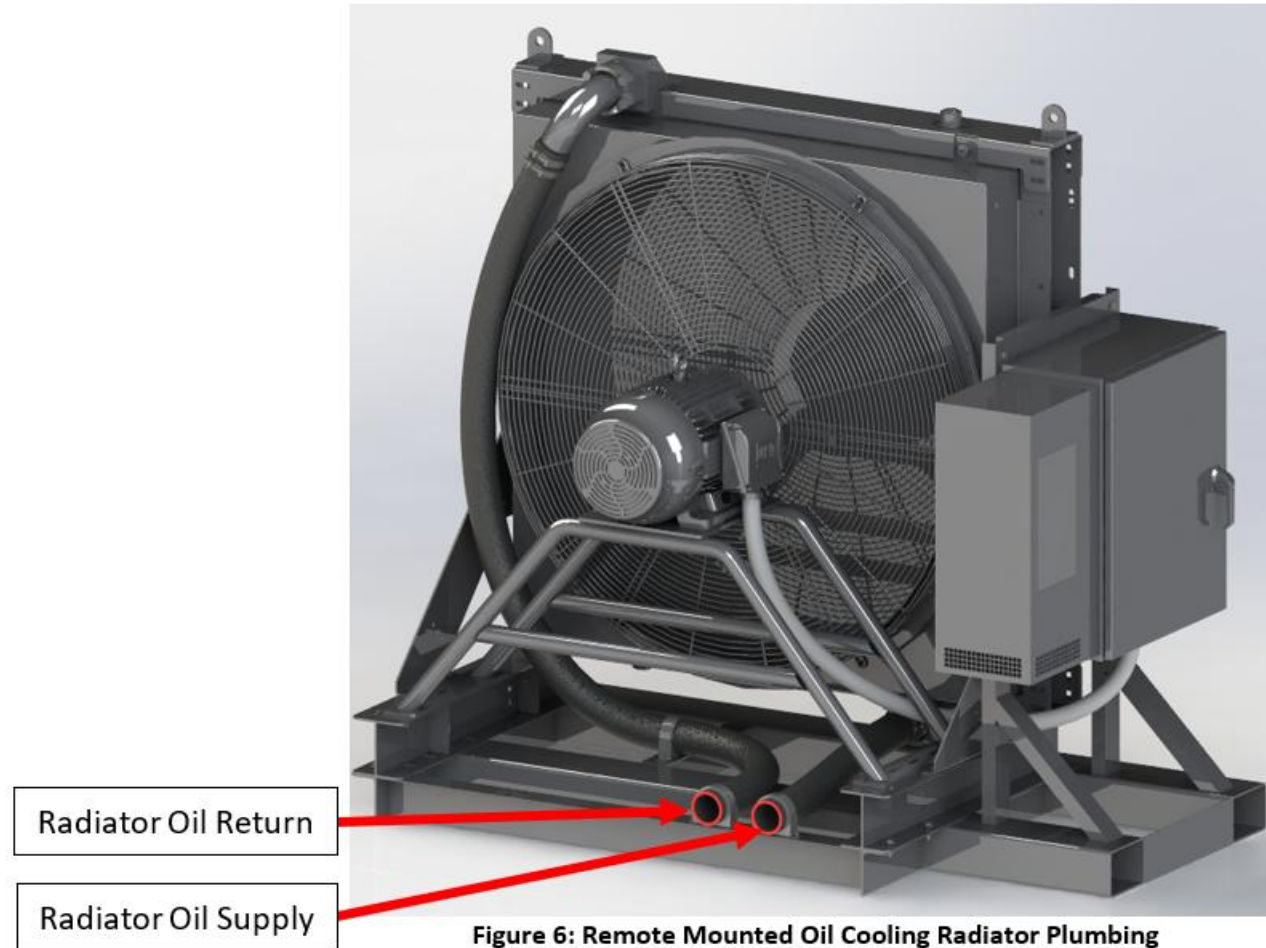


Figure 5: Oil Cooling and Filtration Loop (Some Plumbing Hidden for Clarity)

Plumbing



Electrical

There are six electrical power connections in total. The national electrical code should be followed when making/installing any electrical connections to the HPU.

- Rail pump VFD power (3x)
 - 480VAC 3Ø
 - 260A Supply
 - Each VFD enclosure must be supplied from its own fused disconnect. Utilize fuse PN: AJT-600
- Cooling pump line starter power (1x)
 - 480VAC 3Ø
 - 40A Supply
 - Enclosure must be supplied from its own fused disconnect. Utilize fuse PN: JJS-90
- Main control panel power (1x)
 - 110VAC 1Ø
 - 15A Supply
- Oil cooling radiator VFD power (1x)
 - 480VAC 3Ø
 - 20A Supply

Filters

There are four (4) filters on this system that need to be changed periodically. All four filters are located on the top of the reservoir. The three filters along the edge of the tank are the return line filters and these function in parallel. All three of these filters contain 10-micron elements. The filter closer to the center of the reservoir is the cooling and filter loop filter. This filter contains a 5-micron element. The filters have a pressure switch that will indicate the need to change a filter, but it is recommended to change these elements on a maintenance schedule to avoid unnecessary downtime.

The filters are located on top of the reservoir which is high off of the ground. This presents a fall hazard when the filters are being changed by personnel. Appropriate safety precautions need to be followed.

Filter Assembly	Description	Replacement Element
Parker P/N: GLF4210QBSI2Y48MD	10-micron return filter (Qty: 3)	Parker P/N: 946437Q
Parker P/N: GLF4205QBSI2Y48MD	5-micron cooling and filter loop filter	Parker P/N: 946436Q

Sensors

Sensor	Make	Location in System
Rail A Pressure	Omega P/N: PX359-5KGI	In the valve manifold block (bottom port labeled PT001)
Rail B Pressure	Omega P/N: PX359-5KGI	In the valve manifold block (middle port labeled PT002)
Rail C Pressure	Omega P/N: PX359-5KGI	In the valve manifold block (top port labeled PT003)
Cooling and Filtration Loop Pressure	Omega P/N: PX359-150GI	Cooling pump outlet port
Rail A Pump Outlet Temperature	Omega P/N: M12LCP-KSS-1/8-U-0600	Just above the rail A pump outlet port
Rail B Pump 1 Outlet Temperature	Omega P/N: M12LCP-KSS-1/8-U-0600	Just above the rail B pump 1 outlet port
Rail B Pump 2 Outlet Temperature	Omega P/N: M12LCP-KSS-1/8-U-0600	Just above the rail B pump 2 outlet port
Rail C Pump 1 Outlet Temperature (future expansion)	Omega P/N: M12LCP-KSS-1/8-U-0600	Just above the rail C pump 1 outlet port
Rail C Pump 2 Outlet Temperature (future expansion)	Omega P/N: M12LCP-KSS-1/8-U-0600	Just above the rail C pump 2 outlet port
Cooling and Filtration Loop Supply Oil Temperature	Omega P/N: M12LCP-KSS-1/8-U-0600	Adjacent to the reservoir valve on the cooling pump suction line
Cooling and Filtration Loop Return Oil Temperature	Omega P/N: M12LCP-KSS-1/8-U-0600	Located where the return hose from the radiator attaches to the HPU
Bulk Oil Temperature	Bult into Innovative Components P/N: 99372	Located at the tip of the reservoir level switch assembly which is installed from the top of the reservoir

Pictures



Pictures



Pictures

Rail C is in place and mounts exist for 2 additional pump/motor sets.



Pictures

Rail C is in place and mounts exist for 2 additional pump/motor sets.



Pumps

2X on HPU



1X on HPU

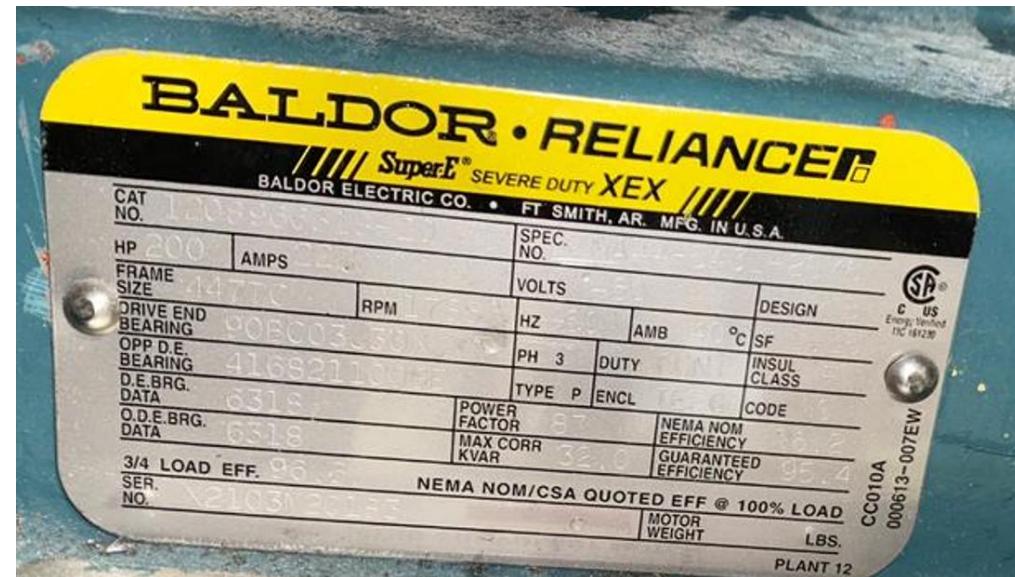


Motors

3 motors, all the same

BALDOR RELIANCE

Motor Nameplate details clarified below:



CAT NO. 1208966318-20				SPEC. NO. MA44-5431-2876							
HP 200		AMPS 222		VOLTS 460			DESIGN B				
FRAME SIZE 447TC		RPM 1780		HZ 60		AMB 40C		SF 1.15			
DRIVE END BEARING 90BC03J30X				PH 3		DUTY CONT		INSUL CLASS I			
OPP D.E. BEARING 416821106GE				TYPE 3		ENCL TEFC		CODE G			
D.E. BRG. DATA 6318		POWER FACTOR 87				NEMA NOM EFFICIENCY 96.2					
O.D.E. BRG. DATA 6318		MAX CORR KVAR 32				GUARANTEED EFFICIENCY 95.4					
3/4 LOAD EFF. 96.5									NEMA NOM/CSA QUOTED EFF @ 100% LOAD		
SER. NO. X2103M20183						MOTOR WEIGHT					

Radiator

<https://www.onehydraulics.com/products/hd900-15-3exp>



HD325-3 : AKG HD-Series Cooler

AKG | SKU: HD325-3



Usually Ships Within: 4-6 Weeks

Price: \$20,783.99



PSI	OIL	AIR	WATER
MAX. WKG. PR.	250		
MAX. WKG. TEMP.	250		