



PRE-ENGINEERED VAPOR RECOVERY SOLUTIONS

Unimac packages deliver flexible and scalable solutions with excellent performance for a wide variety of site conditions. Our VRU design is drawn from in-house expertise that spans a wide range of industries, as well as collaborative resources.

All VRU components are selected during the design process to optimize unit productivity, maximize efficiency, meet broad code compliance, and incorporate common industry practices.

Packages come fully documented and include System P&ID, Electrical Diagram, General Arrangement Drawings, Operating Manuals and Parts Books.

20 to 500 MSCFD
Up to 200 PSIG

Other flows & sizes available

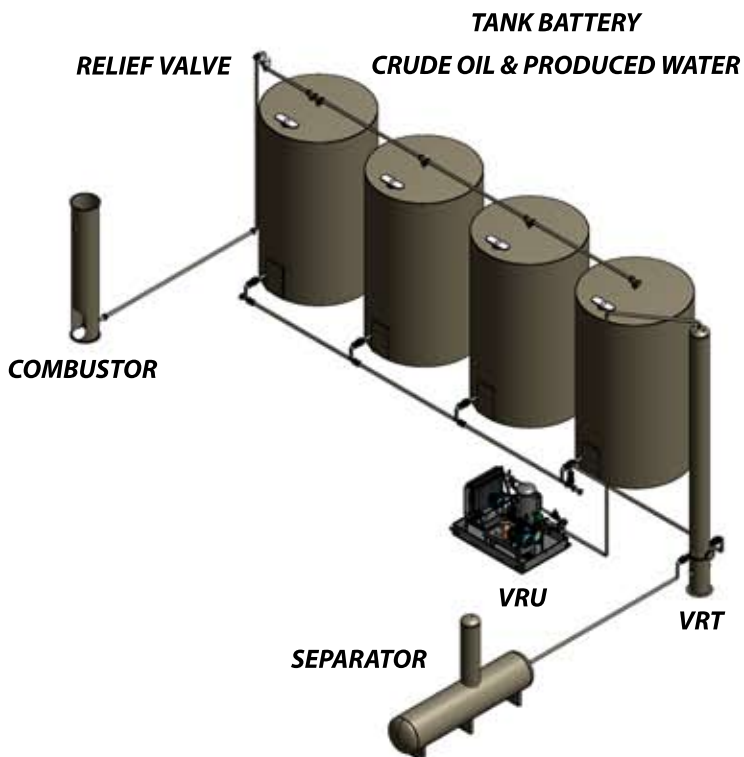


VRU DEPLOYMENT STRATEGIES

VRU Economics

The VRU is a recognized control device for affected facilities, capturing VOC emissions by more than 95%. This facilitates compliance with New Source Performance Standards (NSPS) 40 CFR Part 40 Subpart 0000.

In addition, a VRU produces a return on investment (ROI). Even with lower Natural Gas prices, the value of this gas stream significantly offsets the capital equipment, installation and operating costs. Factoring in the higher Btu value of the vapors, ROI is measured in months not years.



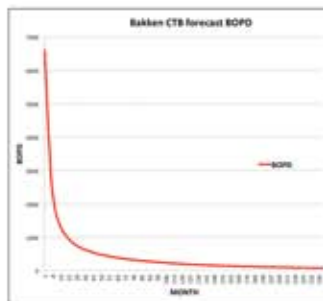
Predicted Production Rates

Installing a control device at an affected facility will maximize ROI while complying with Subpart 0000 regulations.

Are predicted production rates relatively stable over the life of the facility or is it an unconventional shale play with a rapid decline rate? Many factors are considered when selecting the best solution for a given situation.

Applications with rapid decline rates may justify installing more than one VRU (sized = or < max predicted flow) to capture vapors at production start-up.

Production Forecast



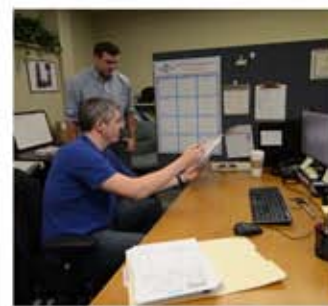
Application Review



Compressor Sizing



Design & Proposal

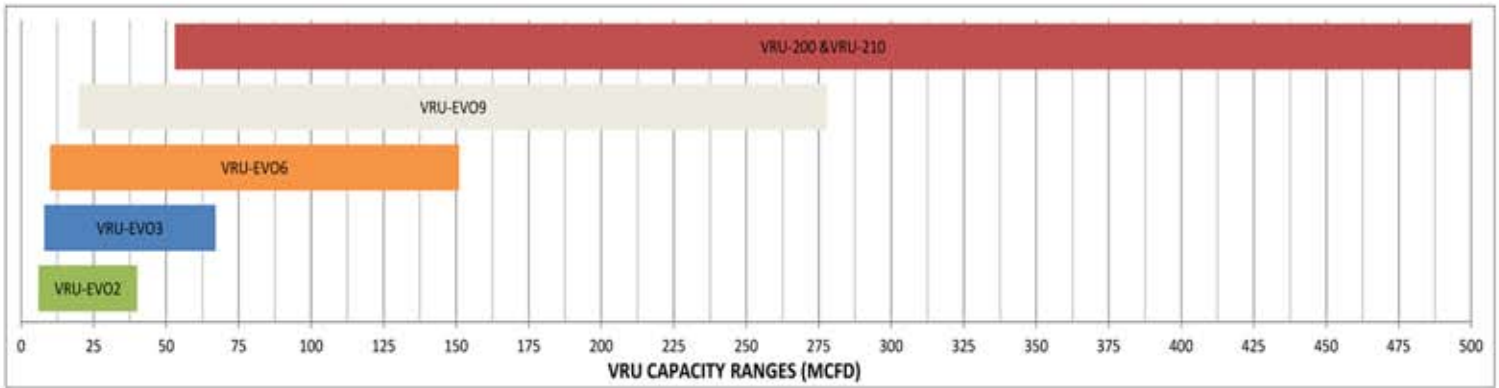


Made to Move

Unimac's VRU is built to facilitate multiple site deployments which are predicted in rapidly declining unconventional shale plays. The skids have fork lifting pockets as well as lifting eyes. Panel racks are self-contained and designed with lifting provisions for installation in an unclassified area. Wiring is Class 1 Division 1 MC-HL cable which significantly reduces the labor time and cost when compared with rigid conduit, and it can be buried or run in cable trays.

The VRU Series is a pre-engineered package that is customizable. Thoughtful, clean design offers easy service access. All of the components are carefully selected and fully compatible.

VRU SERIES PERFORMANCE

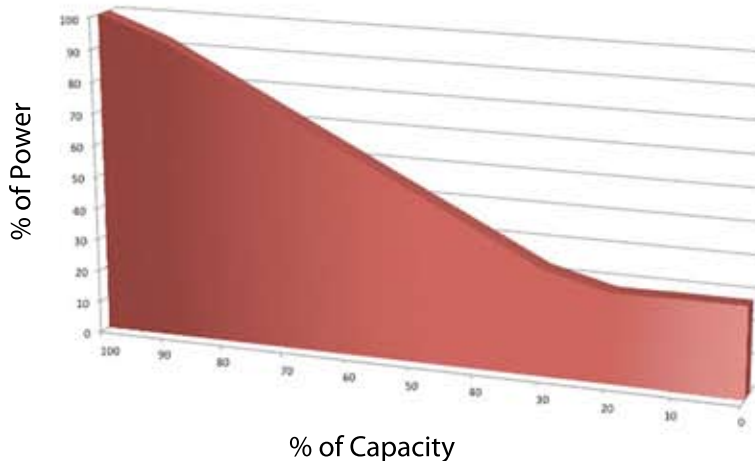


Based on 0 PSIG Suction, 0 FASL, 68 F, 125 PSIG Discharge

VRU MODEL	Capacity Ranges				Motor		
	Min. RPM	MCFD @ Min.	Max. RPM	MCFD @ Max.	HP	RPM	Drive
VRU-EVO2	3000	23	4800	40	10	3600	Direct
VRU-EVO3	2500	33	4800	67	15	3600	Direct
VRU-EVO6	1400	42	4200	151	30	3600	Direct
VRU-EVO9	1400	83	4200	278	50	3600	Direct
VRU-200	1600	215	3200	400	75	3600	Direct
VRU-210	1600	215	4000	500	100	3600	Direct

Capacity Controls

Flexible capacity control is achieved by synergistically coordinating the VFD, inlet valve, and bypass circuit operation. The inlet valve controls vapor flow into the VRU based on available suction pressures. This allows the VRU to isolate from the process creating significant safety and operational advantages. The compressor speed is modulated by the VFD to accommodate any vapor capacities within design parameters. Once the compressor reaches minimum design speed, additional reduction in output is accomplished with a bypass circuit. This cascade continually provides efficient, accurate, responsive, and dynamic control of the VRU.





STANDARD EQUIPMENT

Rotary Screw Compressor 1

(See page 5 for description)

Direct Coupled 2

To maximize efficiency and minimize maintenance requirements, the gas compressor are directly coupled to the drive motor using a non-lubricated elastomer element. This coupling absorbs torsional shock loads, minimizes radial loads, prevents any thrust load transmission, and accepts significant parallel misalignment without wear.

Drive Motor 3

Each VRU is equipped with a drive motor that features premium efficient 208-230/460/3/60, TEFC (IP55) Class I, Div 2, Groups A,B,C & D, Class H wire / Class F (DT80K) insulation, cast iron frame, 3550 RPM, a 1.25 Service Factor, and MGI Part 31 rating for use with a VFD - 20:1 turn down.

Combination Lubricant & Final Gas Cooler 4

The coolers consist of a multi-pass 'fin and tube' heat exchangers that are air-cooled. They are ASME code stamped and are constructed with carbon steel. The lubricant coolant system heat exchanger and final gas heat exchanger are both mounted to a common frame. The temperature of the compressed discharge gas leaving this cooler is reduced to within 20°F of ambient. This allows the exiting gas it to be recirculated during any bypass capacity control required.

Lubricant Coolant Sealant System 5

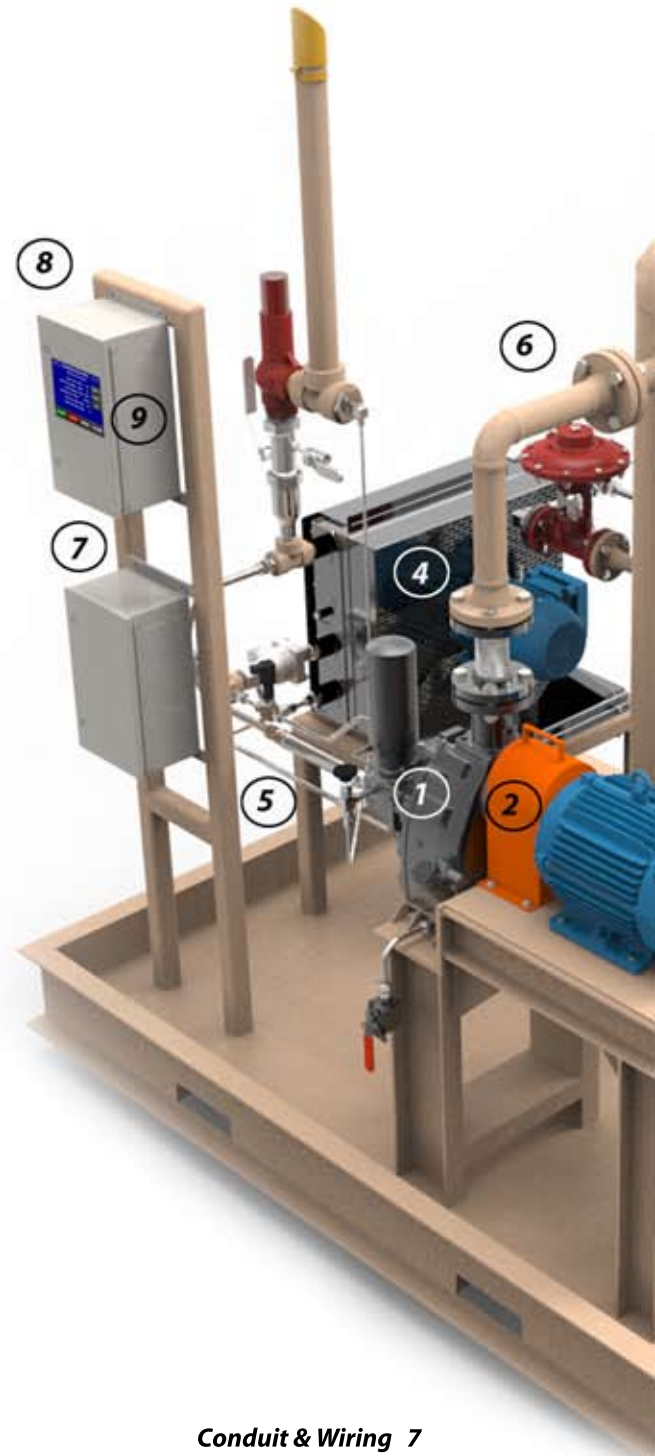
(See page 5 for description)

Piping & Tubing 6

Careful considerations are taken during the design process in regards to the piping and tubing routing. All piping and tubing placement is reviewed to accommodate component locations, customer connections locations, serviceable access areas, and overall ease of VRU installation. All piping complies with ANSI section B31.3 and consists of 'seamless' schedule 80 black piping with forged steel fittings. Piping with diameter 2" and larger is welded with RF flanges and semi-metallic gaskets. All tubing is 316 SS (035 -.065 gauge) with C.S. two ferrule mechanical grip type fittings.

Conduit & Wiring 7

All pressure, temperature, instruments and controls are pre-wired to the PLC using Type MC-HL armored Instrument cable, Class 1 classified. All 3PH motors are wired to a common junction box (Class 1 Division 2 classified) using Type MC-HL armored cable, 600V Power cable. Customer responsible for 3PH power from the junction box to the VFD Motor Panel.



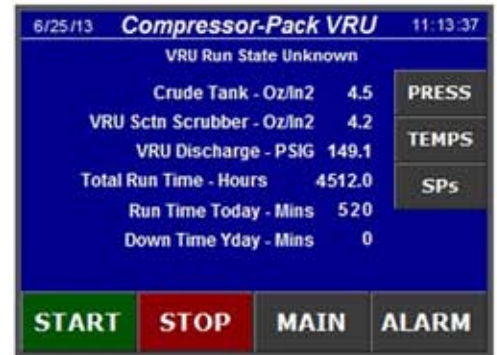
Numerous options and customizations are available to the VRU Series standard Bill of Materials including full weatherproof enclosure, low ambient package, Class 1 Div 1 classification, NACE certification, etc. See page 6 for additional information.

8 PLC Panel

The PLC is specifically designed to operate our VRU at a variety of operating/field conditions. It continually monitors and controls all of the process variables within locally configurable operational parameters. It is built on the SCADA-Pack platform with 32 bit CMOS micro controller, Non-Volatile RAM CMOS RAM, with a (2 year life) lithium battery. Each PLC is UL Certified, housed in NEMA 4X Class 1 Div 2 enclosures, and powered by 24 VDC. The PLC collects data that can be retrieved via Mod bus protocol using either RS232 or Ethernet communications connecting to a host SCADA system.

9 Touch pad Control

Simple and intuitive VRU control is provided by an easy to operate large-screen color touch pad. All operating information (such as pressures, temperatures, and any advisory messages) is easily accessible and can provide trending data for reporting. The programing features password protected access and allows service technicians to modify set points (within factory allowable ranges) to suit specific field conditions while onsite.



10 Suction Gas Scrubber ASME

The suction scrubber provides inlet gas storage volume and facilitates proper operation and control by capturing any liquid condensate prior to the compressor intake. All pressure vessels are ASME code stamped and can handle up to 100 PSIG MAWP. The scrubber is included with a mist pad, automatic condensate control level switch, high level shut-down switch, relief valve, and site glass with isolation valves.

11 Condensate Removal Pump

These cast-iron internal gear pumps are close-coupled to a 1 HP, 1800 RPM, Class 1 Div 2, 3PH Electric Motor. Each pump includes a mechanical seal and a built in relief valve. A level switch in the suction scrubber regulates the pumps operation. When condensate levels reach design parameters the system will drain the condensate to the skid's edge using SS tubing.

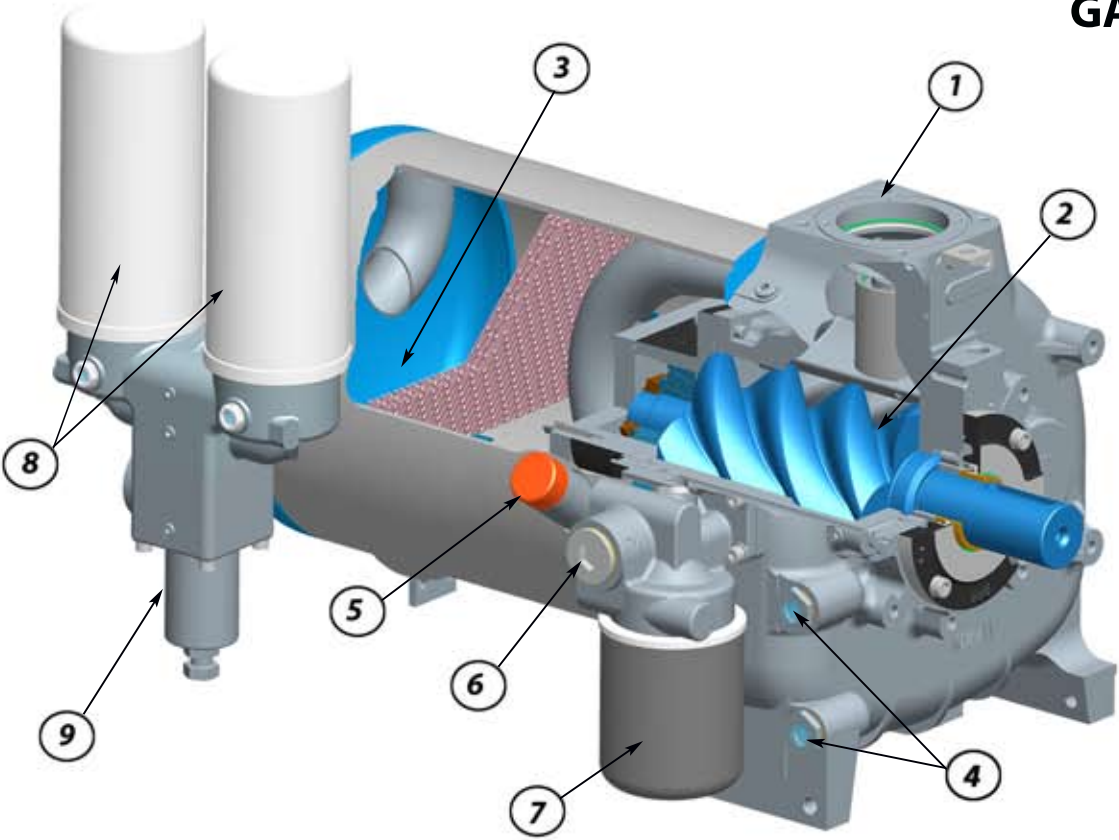
12 Motor Control Panel

A Variable Frequency Drive (VFD) is integral to precision capacity control. By varying the compressor speed to match the available flow, the VFD provides energy efficiency, a "soft start", and single phase protection. The VFD is housed in a NEMA 3R metal enclosure and is mounted independent of the VRU skid for easy installation in a separate, unclassified area. The unit includes a rotary 'through-the-door-handle' circuit breaker, condensate pump contactors, cooling fan contactors, control transformer, H-O-A, e-stop, and a "power-on" light.

Proven field reliability has been achieved by over sizing the drive and the addition of a forced air ventilation system.

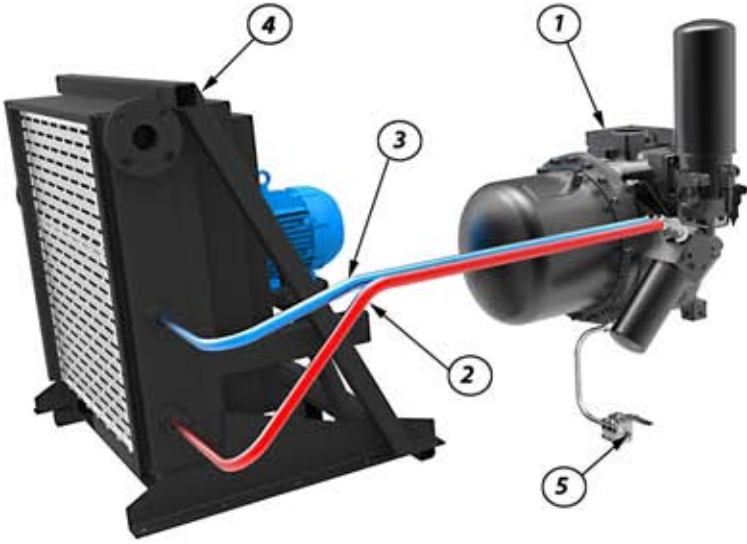


GAS COMPRESSOR



- 1. Gas Intake
- 2. Rotary Screw
- 3. Lubricant Reservoir
- 4. Sight Glass
- 5. Fill Plug
- 6. Thermostat
- 7. Lubricant Filter
- 8. Separator Element
- 9. Minimum Press. Valve

Gas Compressor Manufactured in Germany, every gas end is bench tested before leaving the factory to assure a high level of quality. The compressors are lubricant flooded, single staged, and feature the proprietary ROLLING PROFILE® helical lobes. The ROLLING PROFILE® helical lobes optimize torque characteristics and reduce internal leakage causing ultimate compressor efficiency. The compressor also includes larger bearings and a superior lubricant injection system that provide a long life cycle. Their unique design integrates the lubricant reservoir, lubricant filter, thermostat, minimum pressure valve, and final separator in one component. This design dramatically reduces the number of possible leak points in the system.



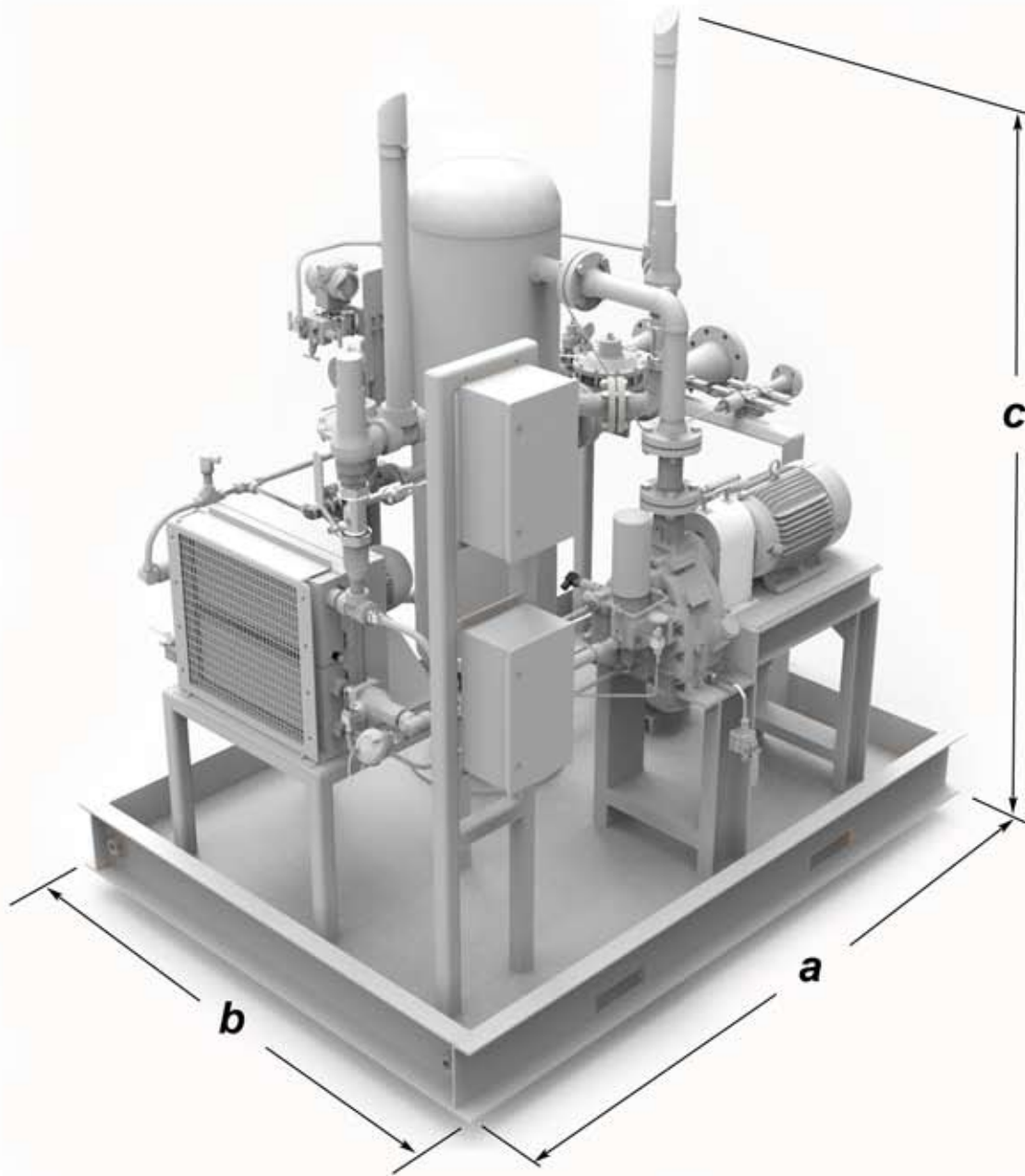
- 1. Gas Compressor
- 2. Lubricant Out
- 3. Lubricant In
- 4. Heat Exchanger
- 5. Drain

Lubricant Coolant Sealant System

A Poly-glycol based (PGS) synthetic lubricant is selected for its resistance to hydrocarbon dilution. By maintaining its viscosity and lubricity properties, the lubricant drain intervals are greatly extended. PGS lubricant enhances performance with superior wear protection, thermal stability, oxidation stability, reduced sludge formation, and decreased deposit formation.

Differential pressure circulates the lubricant and injects it into the compression chamber. It is then used to lubricate bearings, help seal gaps between the rotors, and provide system cooling. The lubricant is separated from the gas discharge stream (down to 3-5 ppm by weight), cooled, filtered and cycled back into the system.

VRU SERIES DIMENSIONS



	Length (a)		Width (b)		Height (c)		Gas Inlet		Gas Out		Weight	
	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	lbs.	kg
VRU-EVO2	80	2032	60	1524	88	2235	2	51	1	25	2600	1180
VRU-EVO3	80	2032	60	1524	88	2235	2	51	1	25	2720	1234
VRU-EVO6	100	2540	80	2032	88	2235	3	77	2	51	4370	1982
VRU-EVO9	100	2540	80	2032	88	2235	3	77	2	51	4790	2173
VRU-200	120	3048	80	2032	88	2235	4	102	2	51	7850	3561
VRU-210	120	3048	80	2032	88	2235	4	102	2	51	8070	3661

The information in this brochure is subject to change without notice

Weatherproof Enclosure

A sheet metal enclosure is powder coated and lined with high grade acoustic foam suitable for outdoor installation. The heavy gauge steel frame provides a rigid platform for mounting the removable hinged access doors, allowing easy service access 360 degrees around the VRU. A proprietary "door hold" design secures the door at 90 degrees with a simple, single hand release. Frames are trimmed with a neoprene bulb gasket, and doors tightly fasten with quarter turn "lift and turn" compression latches.



Pre-wired Panel Rack Mounted for Shipping

The remote "panel rack" is designed to be installed ten feet away in an unclassified area. All of the interconnecting MC-HL power and control cables can be pre-wired and tested at the manufacturer's facility. The panel rack and VRU skid are designed to mate and fasten for transport then de-couple for installation.



Low Ambient Package

The enclosure temperature is constantly monitored and controlled by cycling the heat exchanger fan motor. Automatic louvers direct the heated exhaust air outside, or re-circulate based on temperature. Low wattage, self regulating heat cable is installed on the suction scrubber and condensate drain tubing. A quilted fiberglass jacket insulates and covers the heat cable.



ANSI / NACE MR0175 / ISO 151546 Compliant Construction

The specific composition of the sour gas in the application or installation is assessed. This forms the basis for determining the specific material requirements in accordance with MR0175/ISO 151546. Based on the available input data, the most suitable corrosion-resistant material and construction methods are selected.



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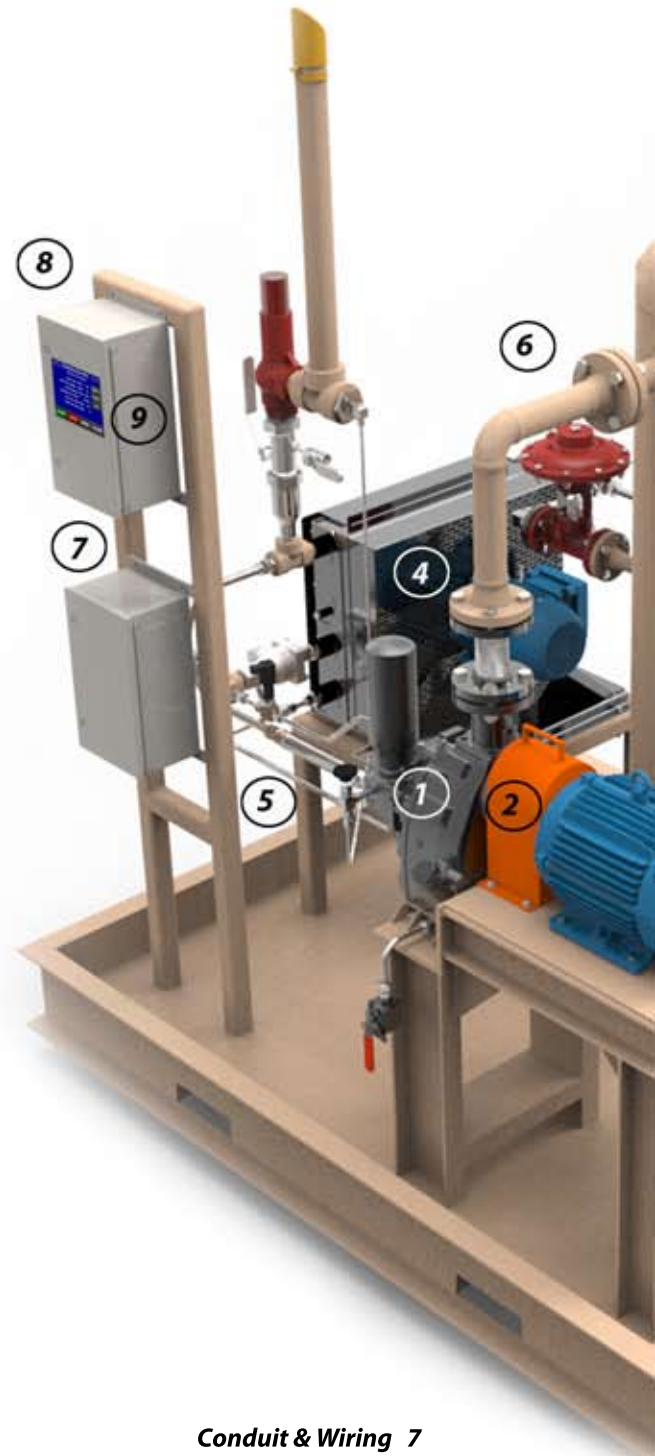
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