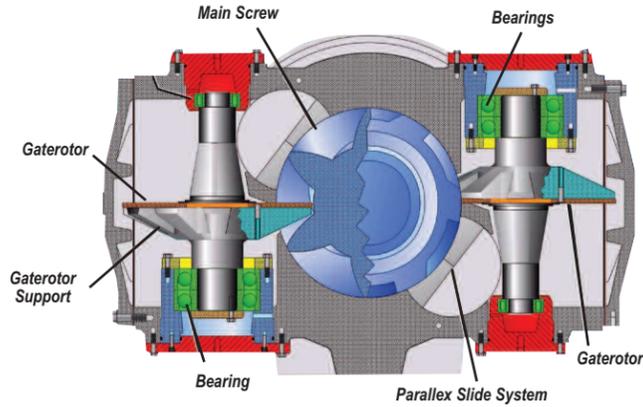
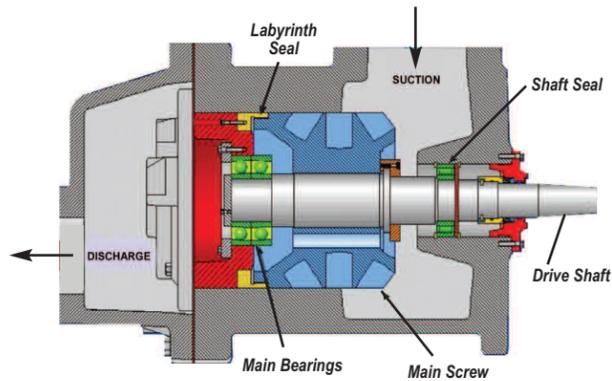


Single Screw Compressors

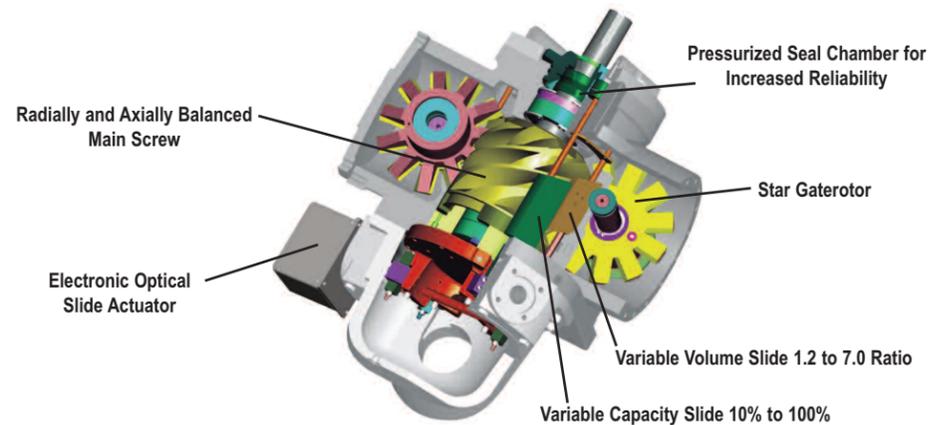
Design & Operation



The standard Vilter Single Screw Compressor (as shown in this end view drawing) consists of two rotating gaterotor assemblies and a main screw assembly. All bearings are pressure fed with oil.



This side view cross-sectional drawing of a Vilter oil flooded Single Screw illustrates the suction and the discharge ports as well as the various seals and drive shaft.



The VSS Vilter Single Screw compressor is a rotary, positive displacement compressor which incorporates a main screw and gaterotors. Compression of the gas is accomplished by the engagement of the gaterotors with the helical grooves in the main screw. An electric motor imparts the rotary motion through a driveshaft to the compressor's main rotor, which in turn rotates the two inter-meshed gaterotors.

The compressor is comprised of three fundamental components which rotate and complete the work of the compression process. This typically includes a cylindrical main screw with six helical grooves and gaterotors with 11 teeth. The rotational axes of the gaterotors are parallel to each other and mutually perpendicular to the axis of the main screw.

The World's Best Compressors™

For Industrial Refrigeration

VSS Single Screw Compressor



Featuring the Exclusive



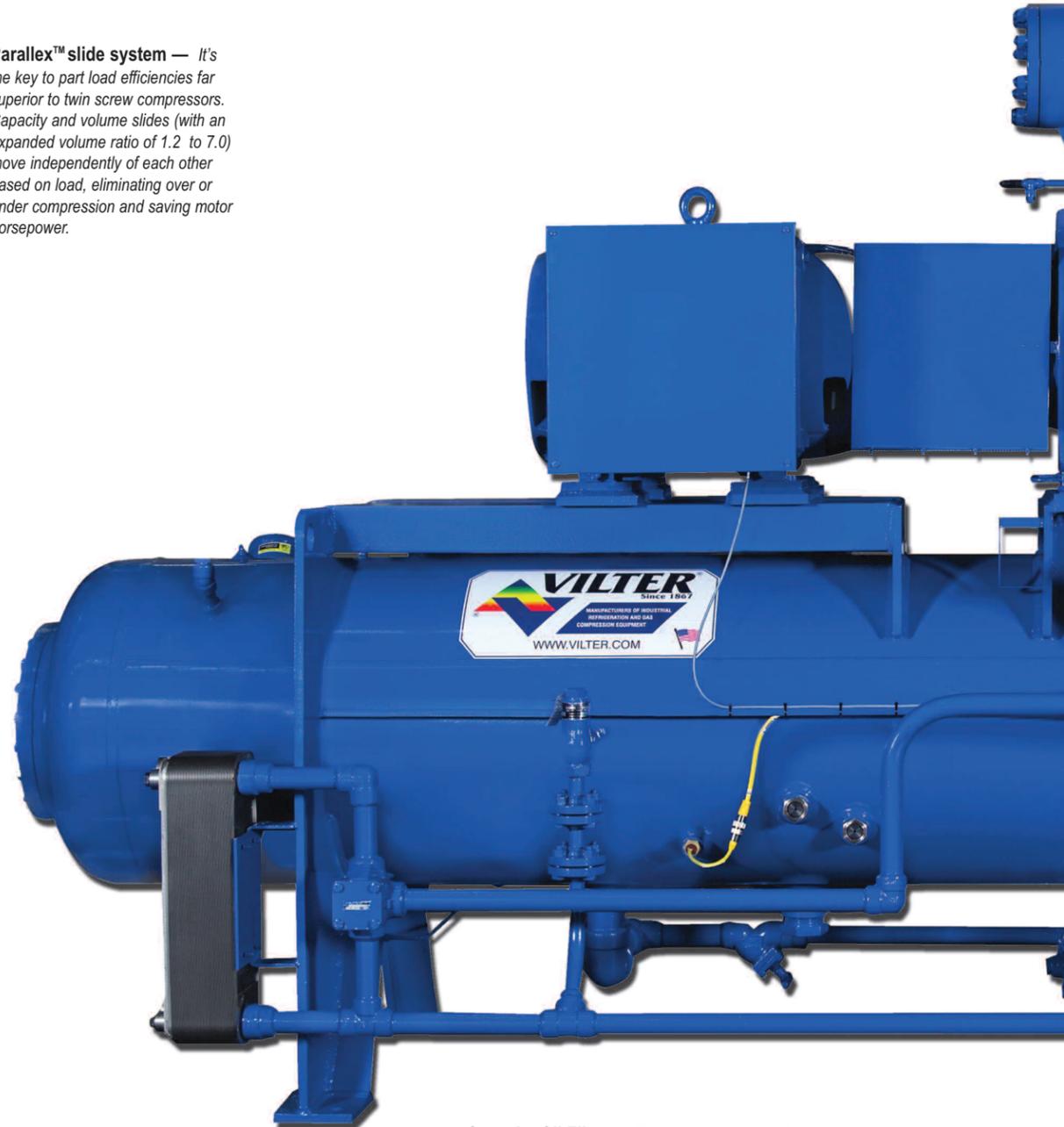
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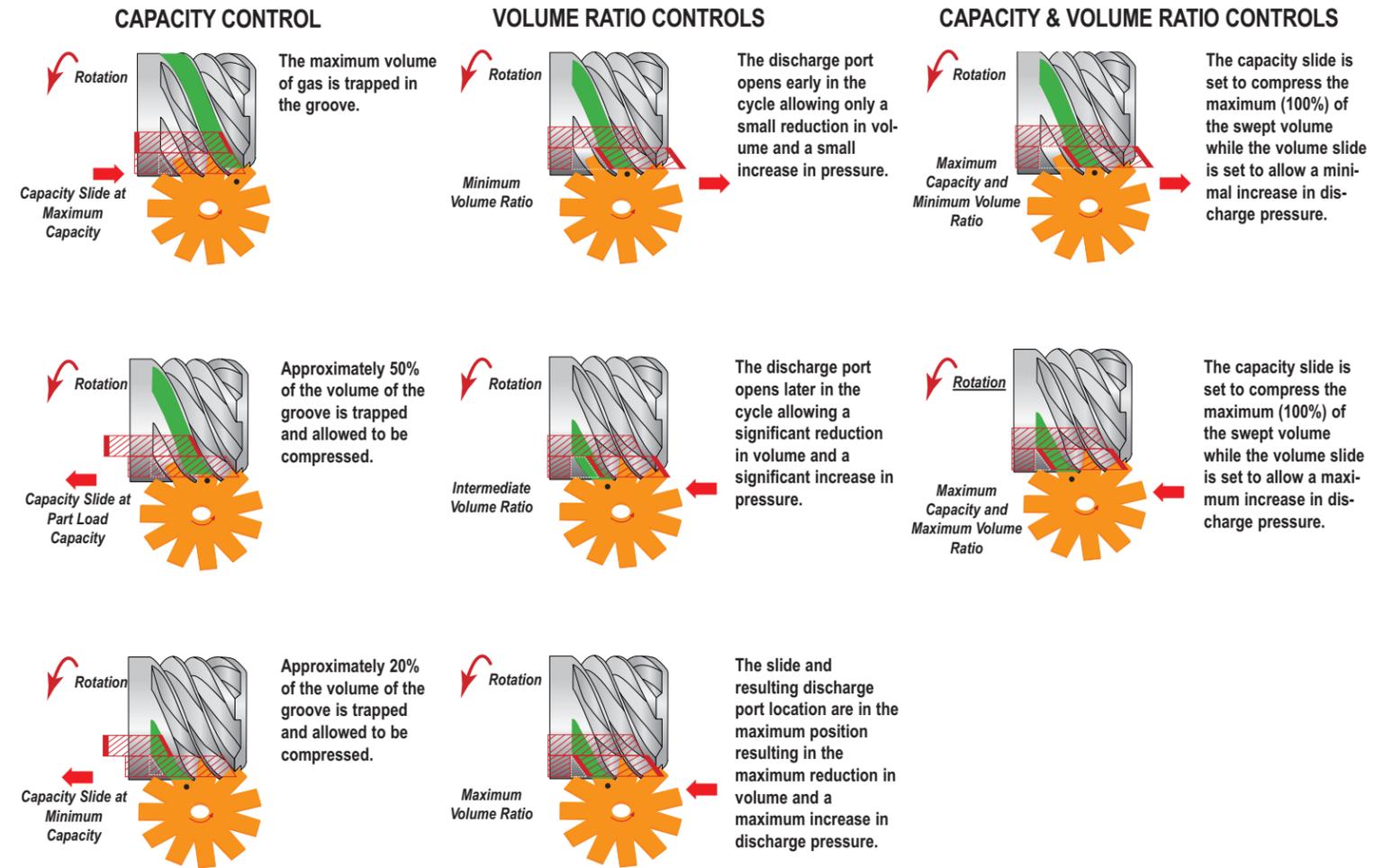
Parallex™ slide system — It's the key to part load efficiencies far superior to twin screw compressors. Capacity and volume slides (with an expanded volume ratio of 1.2 to 7.0) move independently of each other based on load, eliminating over or under compression and saving motor horsepower.



Large Capacity Oil Filter — Filters lubricating oil before injection into the compressor. Internal cartridge filter removes all particles larger than 12 microns. Filter inlet and outlet are equipped with transducers for monitoring pressure drop, and shut off valves for servicing.

Available with dual oil filters.

- Oil Cooling Options—**
- Thermosyphon
 - Water Cooled
 - Liquid Injection
 - V-Plus



Shaft Seal System

A shaft seal system prevents any of the process gas from leaking around the drive shaft of the main screw to the environment. The oil flooded Single Screw compressor has two seal types; the standard single mechanical face seal or a triple mechanical face seal with purge capabilities depending on the process requirements. The stationary carbon face of the seal rides on a hydrodynamic film of oil on the rotating mating ring which is fixed on the shaft. The optional triple seal allows various options including a purge and vent to be connected to the housing thus adding a secondary safety buffer during operation. The incorporation of this seal is shown in the cross-section of the oil flooded gas end.

Design

Each rotating assembly within the gas end has two sets of bearings. A typical oil flooded Single Screw compressor consists of two rotating gaterotor assemblies and a main screw assembly, each having one pair of angular contact bearings to maintain axial position of the assembly and a cylindrical roller bearing to support the opposite end. All of the bearings are pressure fed with oil. The oil, upon draining from the bearings, is drawn into the suction of the main screw and is discharged with the process gas and injected oil. Since the main screw has no loads except for gravity, the bearings are considered over designed since they are determined by the required shaft diameter for the applied horsepower. The Single Screw design does not restrict the bearing sizes for the gaterotor supports. As a result, the bearings are optimized for maximum reliability.

Slide Design

The dual slide design on the Vilter Single Screw compressor offers the highest level of flexibility and performance optimization for screw compressors. This design actually has two slides per compression side of the gas end. The two slides are commonly referred to as the capacity slide and the volume slide. The capacity slide moves from positions of 20% to 100% of flow to allow the compressor to match the system flow requirements. Although lower flow rates are possible, they are not recommended since this reduces the amount of oil flowing through the gas end and may result in overheating. The volume slide allows the discharge port to be positioned in the optimum location depending on the capacity slide location, the properties of the gas and the injectant.

A unique feature of the dual slide design is that it allows the compressor to start completely unloaded. This is unlike any other screw compressor. When both slides are in the open position an unrestricted flow path through the compressor is created. If for any reason the gas end is completely full of oil, the position of the slides on startup will allow the oil to be swept out of the gas end thus preventing the possibility of hydraulic lock. The slides also allow the operation at extremely low ratios down to 1.2. However, the recommended operating points for optimum design efficiency occurs at pressure ratios of 2.0 and greater. Due to their design, Single Screw compressors are able to operate more efficiently and reliably with higher suction pressures and lower ratios than other types of screw compressors.

Since the capacity and volume slides operate in parallel (not in series like other types of screw compressors), an important feature of the Single Screw compressor is the ability to operate with optimum efficiency even at part load conditions. Other types of screw compressors have dual slides which operate in series. This results in one of the slides blocking off some of the porting behind the other slide creating a restriction and performance penalty at part load conditions.

Conclusion

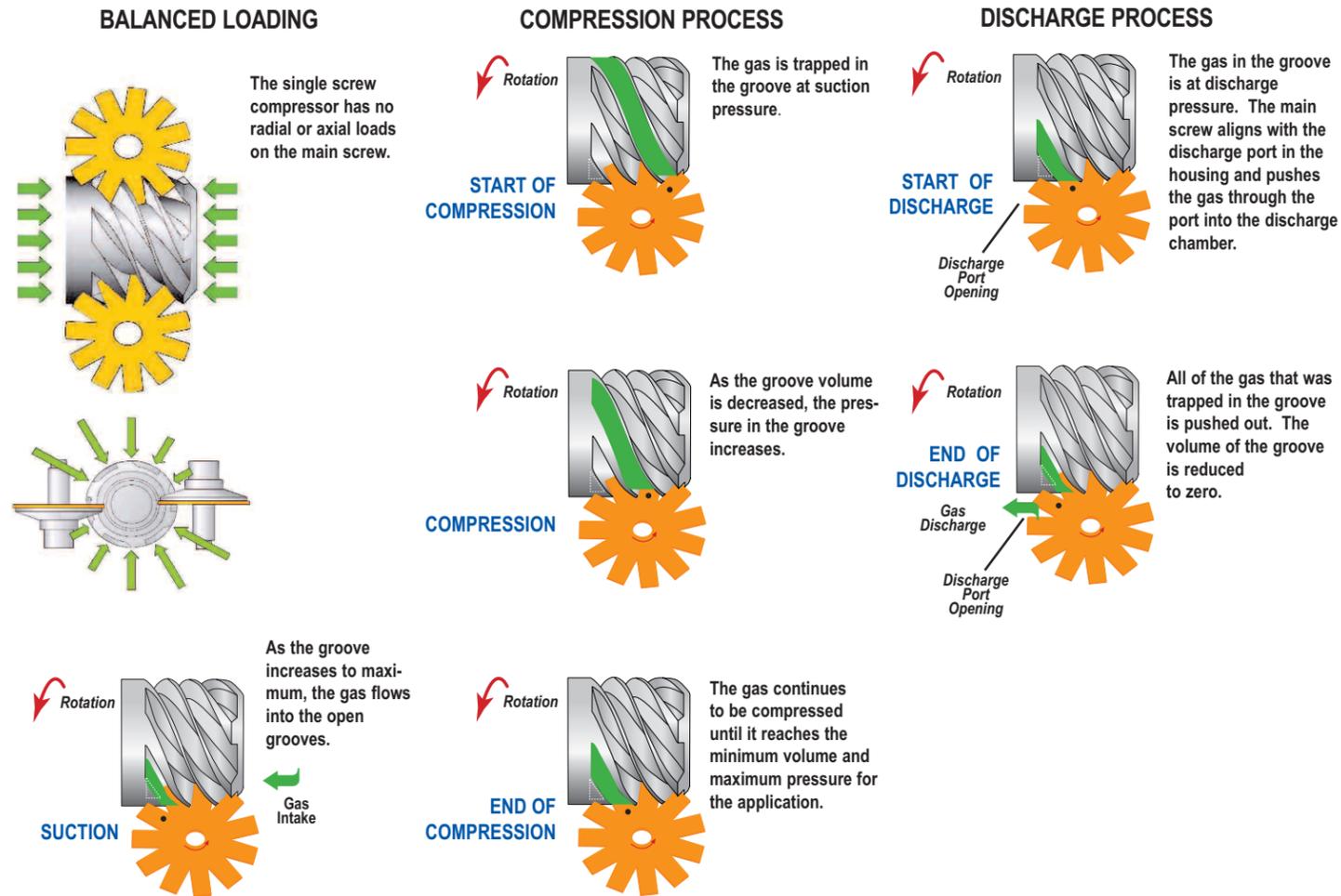
The Vilter single screw compressor with the 5/15-year warranty and Parallex™ slide system makes it the most efficient and reliable compressor in the world. It's superior to any other single screw and most certainly every twin screw.

Thousands of single screws are in operation worldwide for gas compression, air conditioning, refrigeration, and petrochemical industries.



Vilter Single Screw Compressor – Design and Operation

The World's Best Compressors™ For Industrial Refrigeration



Vision 20/20™ Microprocessor Control

- Reliable Operation
- Enhance Communications
- Easy to Use
- Flexible and Expandable

Block and bleed valves are standard

Vilter's VSS single screw compressors deliver longer life, higher reliability and better energy efficiency than twin screw compressors and have fewer moving parts than reciprocating compressors. The key to the single screw compressor's reliability is in its balanced design. The balanced design results in ultra-low bearing loads with significantly decreased vibration and sound levels. The inherent balanced design advantages allows Vilter to offer the exclusive 5/15 Warranty, including 5-years on the compressor and 15-years on the bearings. The key to the single screw compressor's high efficiency is Vilter's exclusive Parallelex™ slide system allowing the compressor to run at optimum efficiency through its full range of capacity. Providing the highest reliability and surpassed energy efficiency... **The World's Best Compressors™** are available only from Vilter!



Theory

The compression cycle begins after suction gas fills the top and bottom grooves of the main screw at the suction end of the casing. Since the screw compressor has two gaterotors, the compression process occurs simultaneously on opposite sides of the screw; the top and bottom. As the main screw rotates, it in turn drives the gaterotors. The engagement of the gaterotor with a screw groove traps the suction gas and begins the compression process. As the screw rotates, the engagement of the gaterotor continues, thus reducing the initial volume of the groove and increasing the pressure in the groove. Once again this occurs simultaneously on opposite sides of the screw.

Finally, as the main screw rotates toward the completion of the compression cycle, the groove aligns with a port in the housing at the discharge end of the casing. The gas and any liquid in the groove are radially discharged through the port into the discharge plenum. Since there are six grooves in the main screw, the compression process simultaneously occurs six times in two locations per revolution of the screw. Operation at 3600 RPM results in 21,600 simultaneous compression strokes at the top and bottom grooves per minute and a relatively smooth flow of discharge gas.

Balanced Loading

One advantage of the Single Screw compressor is the fact that there are no net radial or axial forces exerted on the main screw or drive shaft components due to the work

of compression. Since the compression process occurs symmetrically and simultaneously on opposite sides of the screw, the forces due to compression are canceled out. The only vertical loads exerted on the main screw bearings are due to gravity. Since the discharge end of the screw is vented to suction, the suction gas pressure is exerted on both ends of the screw resulting in balanced axial loads.

The Single Screw has an inherent design advantage of reduced loading during the compression process. This is due to the fact that the gaterotor tooth area decreases as the gas pressure in the groove approaches discharge pressure. When the gaterotor first engages with the main screw the compression process begins. As rotation continues, the gaterotor tooth area exposed to the gas pressure increases. The resultant force creates the axial loads on the gaterotor assembly. Approximately half way through the stroke, or when the radial axis of the gaterotor is perpendicular to the rotational axis of the main screw, the maximum area of the gaterotor is exposed to the gas pressure. As the compression cycle continues, the pressure within the groove increases but the area of the gaterotor exposed to the discharge pressure continues to decrease. The lower loads transmitted to the components and bearings result in higher reliability. At the end of the stroke, the area of the gaterotor has been reduced to zero as it disengages from the main screw.

Another design feature of the Single Screw compressor that enhances reliability is the loads on the gaterotor assemblies are well defined and isolated from the main screw. Since the gaterotor assemblies are independent

and do not interfere with the rest of the main screw body, bearings can be sized for maximum reliability.

Sealing During Compression

Sealing is accomplished by the combination of precision running clearances and an injected liquid (coolant/lubricant) which is allowed to leak through and thus seal the clearances during the compression process. In the Single Screw compressor, this liquid must also have adequate viscosity to lubricate the bearings. The liquid is swept into the groove during the suction process and also injected into the compression groove during the compression process to maximize sealing of the running clearances.

Due to the rotation of the screw, centrifugal force impels the injected liquid to the circumferential clearance volume between the screw and the housing. This minimizes the leakage described as cascading. Cascading is defined as the leakage from the high pressure groove past the land separating the grooves into the trailing low pressure groove. Another inherent attribute of the Single Screw design is that there is more surface area on the lands near the discharge end of the groove than near the middle of the groove. This attribute also minimizes leakage from the highest pressure region of the groove. Another area where the leakage is minimized is between the high pressure end of the groove to the volume behind the screw which is at suction pressure. This potential leak path is sealed by means of a non-contacting hydrodynamic seal known as a viscoseal, windback seal, or labyrinth seal.

VSS Specifications

| Vilter Model Number | CFM | Base Ratings (a) | | | | Standard Connection Sizes | | Length | Unit Dimensions and Weights (b) | | | Shipping Weight (lbs) |
|---------------------|------|------------------|-----|------|-----|---------------------------|-----------|--------|---------------------------------|-------------------------|--------|-----------------------|
| | | Ammonia | | R-22 | | Suction | Discharge | | Width, Single Oil Filter | Width, Dual Oil Filters | Height | |
| VSS-751 | 778 | 302 | 327 | 278 | 307 | 5 | 4 | 12'-7" | 3'-7" | 4'-4" | 8'-0" | 5300 |
| VSS-751E | | 333 | 344 | 318 | 326 | | | | | | | |
| VSS-901 | 880 | 344 | 358 | 315 | 339 | 5 | 4 | 12'-7" | 3'-7" | 4'-4" | 8'-0" | 5350 |
| VSS-901E | | 381 | 381 | 364 | 365 | | | | | | | |
| VSS-1051 | 1070 | 415 | 461 | 382 | 426 | 5 | 5 | 14'-0" | 4'-1" | 4'-10" | 8'-8" | 6600 |
| VSS-1051E | | 458 | 486 | 432 | 449 | | | | | | | |
| VSS-1201 | 1193 | 468 | 500 | 427 | 458 | 6 | 5 | 14'-0" | 4'-1" | 4'-10" | 8'-10" | 6800 |
| VSS-1201E | | 518 | 531 | 488 | 587 | | | | | | | |
| VSS-1551 | 1526 | 598 | 645 | 546 | 611 | 6 | 5 | 14'-2" | 5'-8" | 5'-8" | 9'-10" | 9200 |
| VSS-1551E | | 660 | 682 | 629 | 655 | | | | | | | |
| VSS-1851 | 1790 | 711 | 738 | 644 | 693 | 8 | 5 | 14'-2" | 5'-8" | 5'-8" | 9'-10" | 9300 |
| VSS-1851E | | 704 | 781 | 736 | 738 | | | | | | | |
| VSS-2101 | 2020 | 803 | 811 | 726 | 765 | 8 | 5 | 14'-2" | 5'-8" | 5'-8" | 9'-10" | 9300 |
| VSS-2101E | | 885 | 858 | 824 | 810 | | | | | | | |

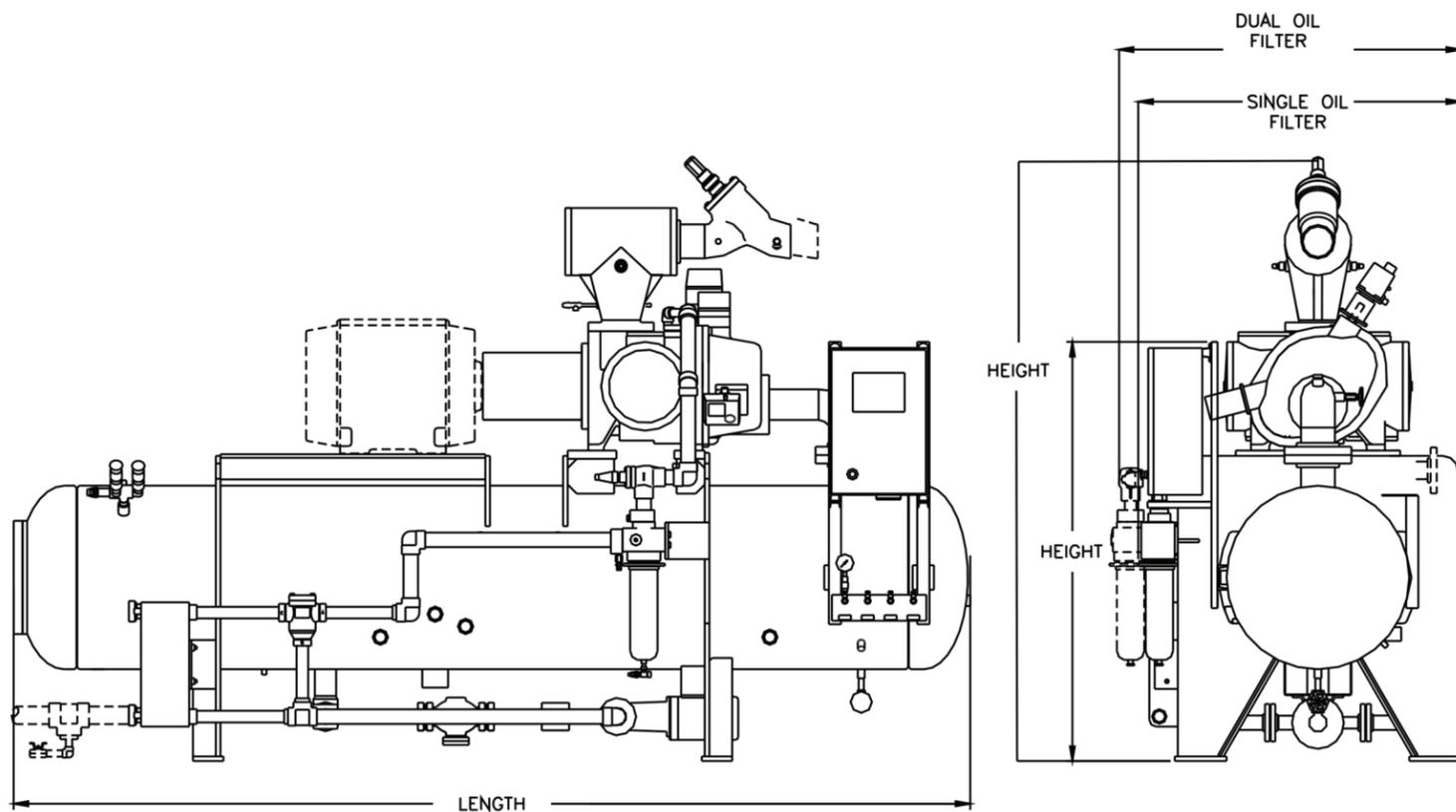
(a) Tons and BHP based on + 20°F and 95°F; 10°F liquid subcooling, saturated suction.

Ratings for other refrigerants are available, consult Vilter for more information.

(b) Dimensions and weights are approximate, and are based on use with thermosiphon plate oil cooling, standard size oil separator and standard motor.



VSM Single Screw Compressor
From Nominal 150 CFM thru 700 CFM



VSS Single Screw Compressor
From Nominal 750 CFM thru 3000 CFM