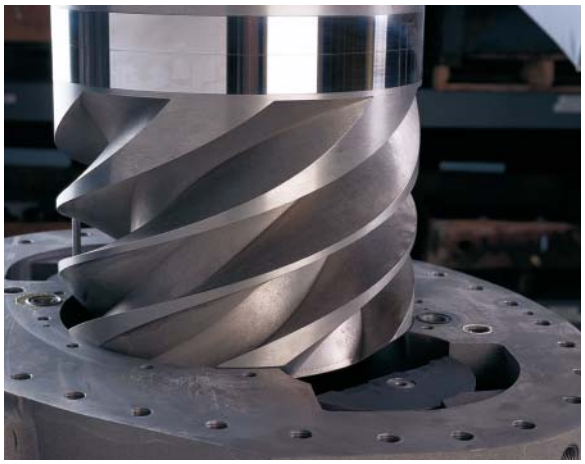
Single Screw Ammonia Heat Pumps

Harness Your Heat… Don’t Reject it

Vilter™

EMERSON™
Climate Technologies



Harness Your Heat, Don't Reject It

Industrial processes consume considerable energy from two primary sources in the production of their products. Mechanical refrigeration applied in the processing and preservation of products consumes electrical energy, while the hot water supplied for clean-up, cooking and process heating employs mostly fossil fuels.

The considerable energy absorbed by ammonia in industrial refrigeration is usually discarded to the atmosphere as wasted heat. This rejected heat has the potential to significantly offset and reduce the quantity of fossil fuels required to produce hot water in the plant.

With a growing interest in conserving energy and water, industrial processors are enhancing the use of their refrigeration system's wasted heat by employing the latest innovations in compressor technology and optimizing the use of their resources. End-users are realizing the powerful potential of applying industrial heat pumps to their processes and converting their waste heat into useable heat, afforded through the use of the high pressure capabilities of single screw compressor technology.

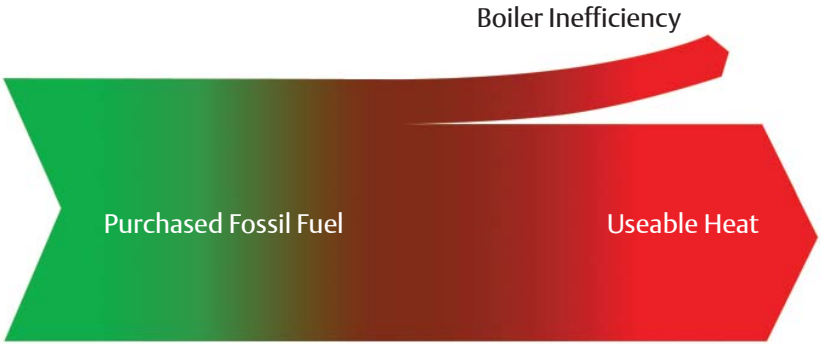
Vilter has extended the Single Screw compressor line with the addition of high pressure heat pump screw compressor models. These screw compressor units, with frames constructed of nodular/ductile iron or cast steel, are capable of operating with ammonia at extremely high condensing temperatures. Integrated into existing ammonia refrigeration systems, the heat pump compressors provide a cost effective solution to harnessing and converting your heat of rejection to high grade hot water, up to 195°F (90°C).

The Vilter high pressure heat pump compressors retain the single screw's inherent design advantages of balanced forces for long life and high reliability, and parallel slides for peak performance at full or part load performance and reliability superior to any twin screw compressor.

Single Screw Ammonia Heat Pump
at a major meat processing facility

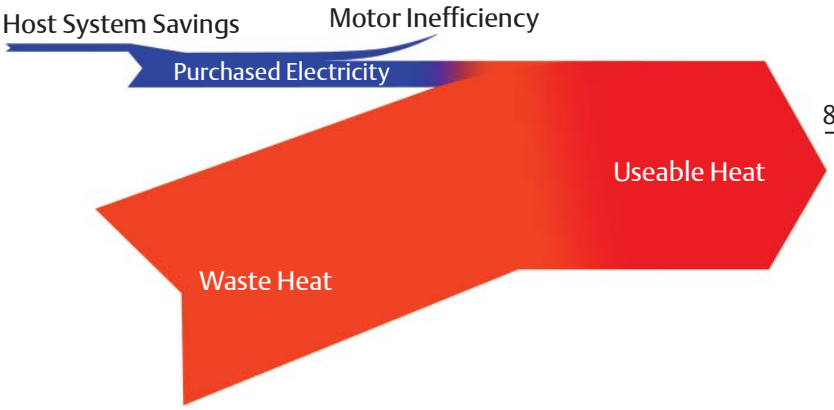
- Model VHP-SC-451-600
- Converts waste heat to hot water
- Eliminates fossil fuel hot water heater
- Retrofit to an existing ammonia system
- 200 GPM at 62°F to 145°F
  (45.4 m^3/h at 16.7°C to 62.8°C)
- Average COP of 5.0

Energy Efficiency Comparison: Fossil Fuel Boiler vs. Heat Pump



Fossil Fuel Boiler

$$\frac{\text{100 Units of Useable Heat}}{\text{120 Units of Energy Consumed}} = \textbf{0.83 COP}$$



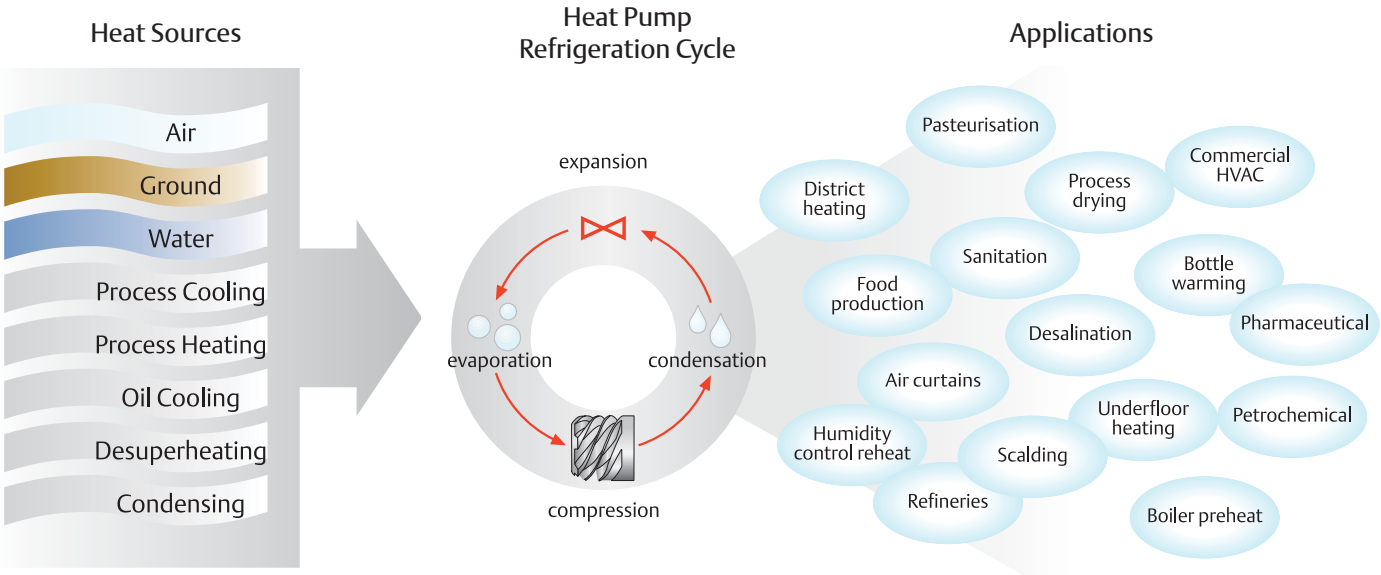
Heat Pump

$$\frac{\text{83.3 Units of Waste Heat + 16.7 Units of Compressor Energy}}{\text{16.7 Units of Compressor Energy}}$$

$$= \frac{\text{100 Units of Useable Heat}}{\text{16.7 Units of Compressor Energy}} = \textbf{6.0 COP}$$

Sources of Recoverable Heat

Heat pumps extract heat from a variety of sources and convert the heat to higher temperatures for use in many industrial applications. The advanced compression capabilities of Vilter's single screw technology have contributed to the development of heat pumps for industrial applications, providing higher capacities and a greater range of temperatures than prior generations of heat pump compressors.



Vilter Ammonia Scavenging Heat Pump Performance

VHP-SC-___-___ (CFM - HP)	Saturated Suction		Outlet Water Temperature		Water Flow Rate		Heating Capacity		Shaft Power		COP
	°F / psig	°C / barg	°F	°C	GPM	m3/h	MBH	kW	BHP	kW	
291-300	95 / 181	35.0 / 12.5	132.3	55.7	137.0	31.1	5,292	1,551	209.8	156.4	9.91
	85 / 152	29.4 / 10.5	133.2	56.2	119.0	27.0	4,649	1,362	221.4	165.1	8.25
	75 / 126	23.9 / 8.7	134.2	56.8	102.5	23.3	4,056	1,189	225.3	168.0	7.07
	95 / 181	35.0 / 12.5	143.5	61.9	115.0	26.1	5,083	1,490	252.3	188.1	7.92
	85 / 152	29.4 / 10.5	144.6	62.6	99.8	22.7	4,468	1,309	258.5	192.8	6.79
	75 / 126	23.9 / 8.7	145.3	62.9	85.6	19.4	3,862	1,132	251.7	187.7	6.03
291-350	95 / 181	35.0 / 12.5	149.8	65.4	104.9	23.8	4,968	1,456	273.5	203.9	7.14
	85 / 152	29.4 / 10.5	151.9	66.6	90.3	20.5	4,369	1,280	277.4	206.9	6.19
	75 / 126	23.9 / 8.7	151.1	66.2	77.3	17.6	3,711	1,088	267.7	199.6	5.45
	95 / 181	35.0 / 12.5	156.7	69.3	91.1	20.7	4,852	1,422	295.1	220.1	6.46
	85 / 152	29.4 / 10.5	158.3	70.2	78.7	17.9	4,253	1,246	288.8	215.4	5.79
	75 / 126	23.9 / 8.7	160.8	71.6	67.0	15.2	3,706	1,086	283.9	211.7	5.13
341-350	95 / 181	35.0 / 12.5	132.0	55.6	170.2	38.7	6,543	1,918	252.6	188.4	10.18
	85 / 152	29.4 / 10.5	132.7	55.9	148.5	33.7	5,764	1,689	266.0	198.4	8.51
	75 / 126	23.9 / 8.7	133.6	56.4	128.5	29.2	5,041	1,477	270.3	201.6	7.33
	95 / 181	35.0 / 12.5	142.9	61.6	143.8	32.7	6,311	1,850	302.8	225.8	8.19
	85 / 152	29.4 / 10.5	143.9	62.2	125.3	28.5	5,561	1,630	310.0	231.2	7.05
	75 / 126	23.9 / 8.7	144.5	62.5	107.9	24.5	4,823	1,413	302.0	225.2	6.28
341-400	95 / 181	35.0 / 12.5	149.3	65.2	131.3	29.8	6,184	1,812	328.4	244.9	7.40
	85 / 152	29.4 / 10.5	151.2	66.2	113.5	25.8	5,454	1,598	332.6	248.0	6.44
	75 / 126	23.9 / 8.7	150.3	65.7	97.6	22.2	4,645	1,361	321.0	239.4	5.69
	95 / 181	35.0 / 12.5	156.0	68.9	114.4	26.0	6,056	1,775	353.7	263.8	6.73
	85 / 152	29.4 / 10.5	157.4	69.7	99.2	22.5	5,321	1,559	346.5	258.4	6.03
	75 / 126	23.9 / 8.7	159.8	71.0	84.8	19.3	4,651	1,363	340.4	253.8	5.37
451-450	95 / 181	35.0 / 12.5	131.6	55.3	235.0	53.4	8,992	2,635	355.2	264.9	9.95
	85 / 152	29.4 / 10.5	132.2	55.7	206.1	46.8	7,951	2,330	371.8	277.3	8.40
	75 / 126	23.9 / 8.7	133.0	56.1	179.2	40.7	6,978	2,045	375.7	280.2	7.30
451-500	95 / 181	35.0 / 12.5	142.4	61.3	197.3	44.8	8,616	2,525	423.5	315.8	7.99
	85 / 152	29.4 / 10.5	143.4	61.9	172.7	39.2	7,623	2,234	431.1	321.5	6.95
	75 / 126	23.9 / 8.7	144.1	62.3	149.3	33.9	6,643	1,947	420.2	313.3	6.21
451-600	95 / 181	35.0 / 12.5	149.0	65.0	179.0	40.7	8,406	2,464	457.9	341.5	7.21
	85 / 152	29.4 / 10.5	150.8	66.0	155.6	35.3	7,444	2,182	461.1	343.8	6.34
	75 / 126	23.9 / 8.7	149.9	65.5	134.4	30.5	6,368	1,866	445.9	332.5	5.61
	95 / 181	35.0 / 12.5	155.8	68.8	155.2	35.2	8,197	2,402	491.4	366.4	6.55
	85 / 152	29.4 / 10.5	157.1	69.5	135.3	30.7	7,234	2,120	481.9	359.4	5.90
	75 / 126	23.9 / 8.7	159.2	70.7	116.3	26.4	6,345	1,860	471.4	351.5	5.29
601-500	95 / 181	35.0 / 12.5	131.4	55.2	275.0	62.5	10,490	3,074	401.4	299.3	10.27
	85 / 152	29.4 / 10.5	131.9	55.5	241.6	54.9	9,276	2,719	415.1	309.5	8.78
	75 / 126	23.9 / 8.7	132.5	55.8	210.6	47.8	8,152	2,389	422.9	315.4	7.57
601-600	95 / 181	35.0 / 12.5	142.0	61.1	231.2	52.5	10,048	2,945	472.4	352.3	8.36
	85 / 152	29.4 / 10.5	143.0	61.7	202.5	46.0	8,902	2,609	484.7	361.4	7.22
	75 / 126	23.9 / 8.7	143.6	62.0	175.6	39.9	7,774	2,278	474.8	354.1	6.43
	95 / 181	35.0 / 12.5	148.7	64.8	209.6	47.6	9,808	2,874	511.7	381.6	7.53
	85 / 152	29.4 / 10.5	150.4	65.8	182.6	41.5	8,701	2,550	518.6	386.7	6.59
	75 / 126	23.9 / 8.7	149.3	65.2	158.4	36.0	7,460	2,186	504	375.8	5.82
	95 / 181	35.0 / 12.5	155.4	68.6	181.8	41.3	9,569	2,804	551.9	411.6	6.81
	85 / 152	29.4 / 10.5	156.8	69.3	159.0	36.1	8,483	2,486	553.3	412.6	6.02
	75 / 126	23.9 / 8.7	158.3	70.2	137.5	31.2	7,440	2,180	533	397.5	5.48

VHP = Vilter Heat Pump, SC = Scavenging, CFM = Nominal Compressor Displacement in Cubic Feet Per Minute, HP = Motor Horsepower, COP = Coefficient of Performance
Ratings are based on: 1) 160°F (71.1°C) superheated heat pump suction temperature (discharge from host refrigeration system).
2) 55°F (12.8°C) inlet water temperature.
3) 60 Hz power.
Consult factory for performance ratings at alternate conditions.

EmersonClimate.com/Vilter