ENGINEERING
TOMORROW

Application guidelines

Inverter scroll compressors
VZH088-117-170
single

R410A



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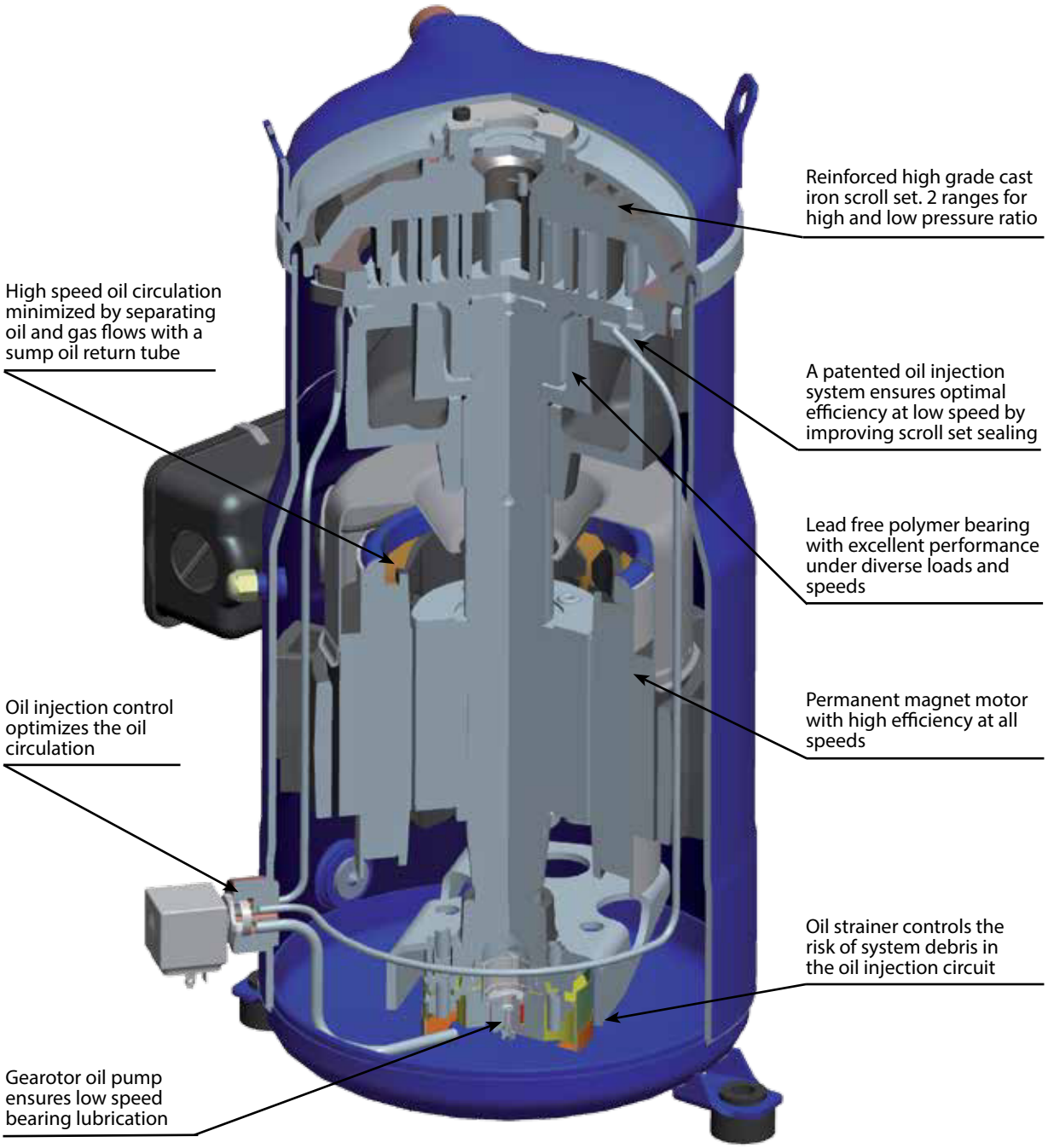
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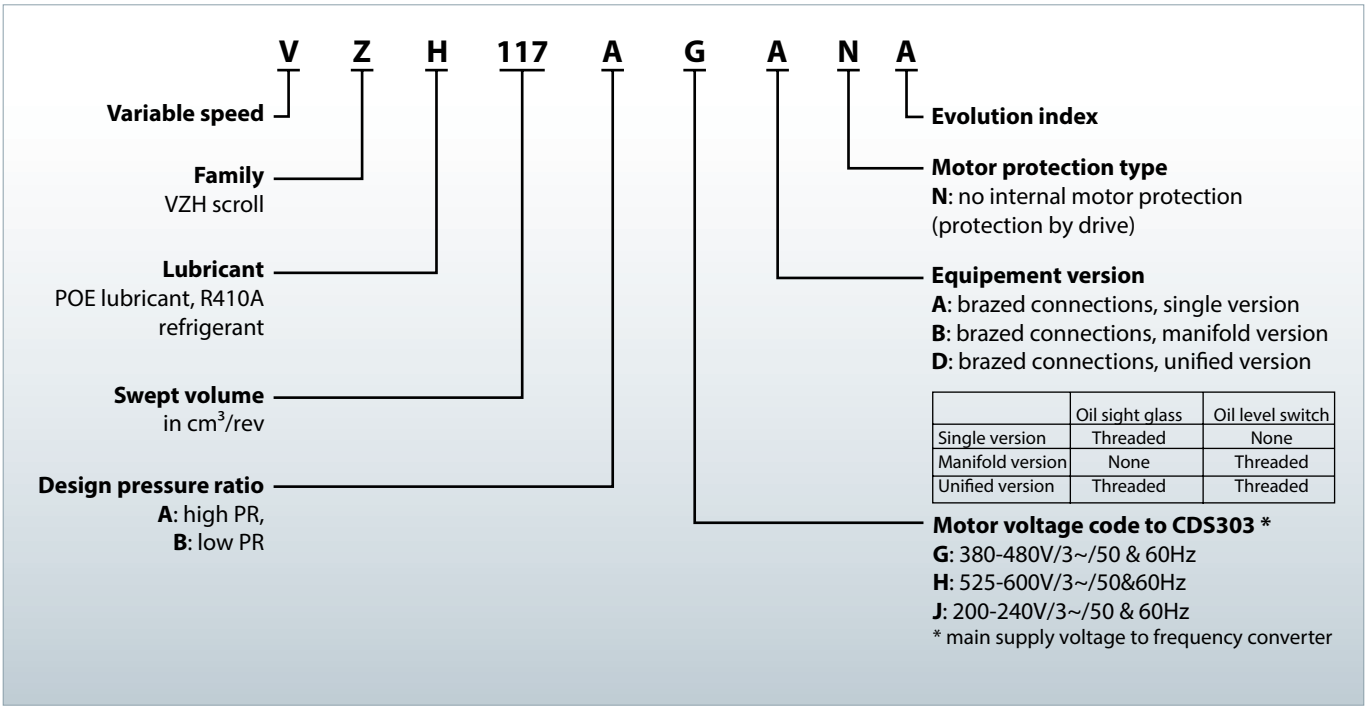
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Reinforced high grade cast iron scroll set. 2 ranges for high and low pressure ratio
High speed oil circulation minimized by separating oil and gas flows with a sump oil return tube
A patented oil injection system ensures optimal efficiency at low speed by improving scroll set sealing
Lead free polymer bearing with excellent performance under diverse loads and speeds
Oil injection control optimizes the oil circulation
Permanent magnet motor with high efficiency at all speeds
Oil strainer controls the risk of system debris in the oil injection circuit
Gearotor oil pump ensures low speed bearing lubrication

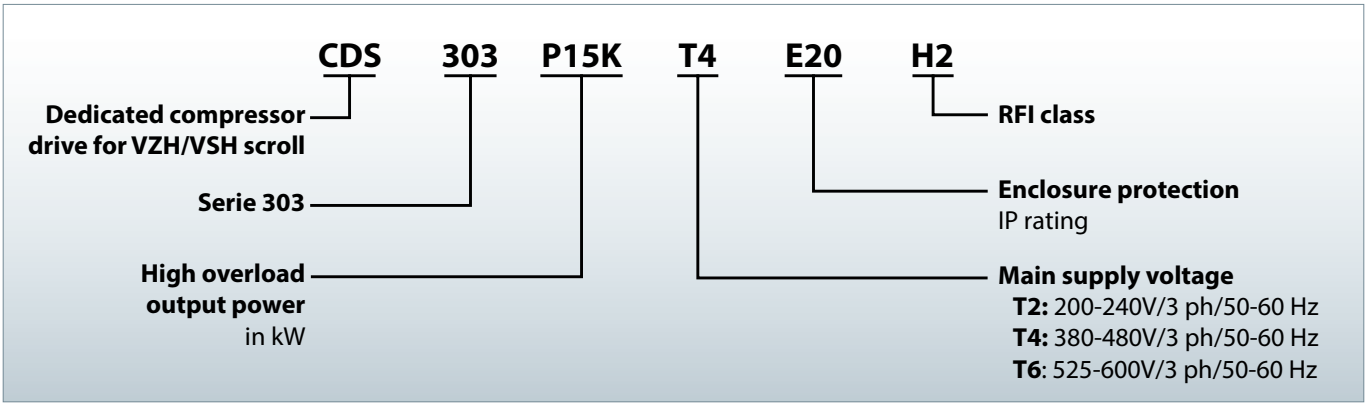
Application guidelines	Variable speed compressors	Single compressors
Compressor size	Variable speed offers more flexibility in compressor selection than fixed speed compressors. Selection of the right variable speed compressor size can be done by different methods: 1. Maximum cooling capacity: Select a compressor size which achieves the peak load system cooling capacity demand at its maximum speed. 2. Nominal cooling capacity: Select a compressor size which achieves the nominal system cooling capacity at a rotational speed of 3600 - 4500 rpm (60-75 rps).	3. Best Seasonal Efficiency Ratio: Select a compressor size which achieves the minimum system cooling demand at its minimum speed. Ensure that the compressor is able to cover the peak load system cooling capacity. This selection makes the compressor to run for a maximum of time at part load where the system efficiency is highest. Performance tables at 3 speeds can be found in the following pages. Detailed performances can be found in datasheets and in selection programs.
Frequency converter variants	Different frequency converter variants are available according to: 1. Main supply voltage 2. IP class (CDS303 drives are available in IP20 or IP55 housings)	3. RFI class (Radio Frequency Interference) H2 or H3 4. Printed Circuit Board (PCB) coated or not coated.
Compressor and frequency converter combinations	When the compressor size and mains voltage have been defined with above selection criteria, the code number tables from section "Ordering information and packaging" give the appropriate frequency converter sizes and up to 8 corresponding code numbers for each compressor model.	⚠ **Note this compressor is equipped with a four poles electrical motor so the applied frequency from the inverter will be 50 Hz for 25 rps (1500 rpm) up to 200 Hz for 100 rps (6000 rpm).**

Compressor nomenclature



	Oil sight glass	Oil level switch
Single version	Threaded	None
Manifold version	None	Threaded
Unified version	Threaded	Threaded

Frequency converter nomenclature



Note:
High overload output power: output power @160% Torque
Normal overload: output power @110% torque, it is the power printed in the nameplate.

For example:
T/C: CDS303P15KT4E20H2-P15K high overload output power, take the reference of drive nomenclature
18.5kW(400V)-normal overload power, power printed in the nameplate.
Please note in this guideline, only drive power use high overload power; all the other data, such as fuses/circuit breaker, etc. is reference to Normal overload power.

Compressor specifications

Compressor model	Swept volume (cu.in/rev)	Displacement				Oil charge (dm^3)		Net weight (lbs)
		25 rps (cu.ft/h)	50 rps (cu.ft/h)	60 rps (cu.ft/h)	100 rps (cu.ft/h)	Single and manifold version	Unified version	
VZH088	5.39	272	544	657	1088	3.3	3.8	121
VZH117	7.13	357	717	869	1434	3.6	4.1	134
VZH170	10.39	523	1045	1261	1914	6.7	7.7	247

Frequency converter specifications

Mains supply voltage	T2: 200 - 240 V +/-10% (3-phase)
	T4: 380 - 480 V +/-10% (3-phase)
	T6: 525 - 600 V +/-10% (3-phase)
Supply frequency	50 / 60 Hz
Output voltage	0 - 100 % of supply voltage
Inputs	6 digital (0 - 24 V), 2 analogue (0 /±10 V or 4 - 20 mA, scalable)
Programmable outputs	2 digital (0- 24 V), 1 analogue (0-24 V), 2 relay
Protection functions	Over-current protection, low / high current handling
Compressor functions	Discharge gas temperature protection, pressostat / thermostat function, short cycle protection, oil return management

Oil injection control

VZH compressors are equipped with an oil injection system that makes the compression pockets more tight thus improving the isotropic efficiency of the compressor as well as controls the oil circulation ratio, at all running speeds.
The frequency converter via an oil injection valve controls this system. The oil injection valve is a normally closed valve. At low speed, the valve is closed and the oil is injected to the scroll set suction ports.

The compressors are delivered with no coils. 208V-240V or 24V coils are available as accessory (refer to "Accessories" section). The coil must be installed for oil injection control.

Control parameters are factory preset but accessible on the parameter list as read only values.

Bearings lubrication

Optimal bearings lubrication is ensured by a gearotor oil pump at all compressor speeds.

Capacity at EN12900 rating conditions - High pressure ratio - VZH088AJ - VZH117AJ - VZH170AJ

Models	rpm	rps	Te	-13		-10		0		10		20		30		40		50		59	
			Tc	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe
VZH088AJ	1500	25	70	-	-	-	-	19800	1.57	24800	1.66	30800	1.73	37900	1.75	46100	1.65	-	-	-	-
			90	-	-	-	-	17500	2.21	22300	2.18	28000	2.21	34500	2.25	42100	2.24	50700	2.14	59500	1.91
			110	-	-	-	-	15000	3.22	19500	3.02	24600	2.95	30600	2.95	37300	2.97	45000	2.96	52900	2.88
			130	-	-	-	-	-	-	-	-	20500	4.03	25600	3.94	31500	3.93	38200	3.96	44900	3.97
			140	-	-	-	-	-	-	-	-	-	-	22700	4.57	28100	4.53	34200	4.55	40300	4.59
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600	60	70	37500	4.35	40200	4.38	50300	4.46	62600	4.55	77200	4.66	94500	4.79	114600	4.95	-	-	-	-
			90	32100	5.36	34700	5.38	44200	5.46	55500	5.54	69000	5.64	84800	5.75	103200	5.89	124600	6.05	146400	6.23
			110	-	-	-	-	38300	6.81	48500	6.87	60500	6.94	74600	7.03	91000	7.14	110100	7.27	129600	7.41
			130	-	-	-	-	-	-	-	-	51000	8.77	63100	8.82	77300	8.89	93800	8.98	110800	9.07
			140	-	-	-	-	-	-	-	-	-	-	56700	9.97	69600	10.01	84700	10.07	100400	10.14
			145	-	-	-	-	-	-	-	-	-	-	-	-	61300	11.32	74900	11.36	89200	11.40
	6000	100	70	-	-	-	-	82300	8.06	102300	8.42	126300	8.84	154800	9.34	188000	9.92	-	-	-	-
			90	-	-	-	-	73500	9.67	92200	9.94	114400	10.26	140500	10.64	171000	11.08	206200	11.62	242300	12.18
			110	-	-	-	-	64600	11.85	81400	12.02	101200	12.23	124400	12.48	151500	12.78	182800	13.16	215000	13.57
			130	-	-	-	-	-	-	-	-	85700	15.01	105400	15.12	128500	15.27	155400	15.48	183200	15.72
			140	-	-	-	-	-	-	-	-	-	-	94600	16.82	115500	16.90	139900	17.02	165200	17.17
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VZH117AJ	1500	25	70	-	-	-	-	26500	2.07	33300	2.17	41400	2.28	50900	2.30	61900	2.17	-	-	-	-
			90	-	-	-	-	23500	2.90	29900	2.86	37500	2.91	46300	2.96	56500	2.95	68100	2.81	79900	2.51
			110	-	-	-	-	20200	4.23	26200	3.97	33100	3.87	41000	3.88	50100	3.91	60500	3.89	71000	3.79
			130	-	-	-	-	-	-	-	-	27500	5.30	34400	5.17	42300	5.17	51200	5.20	60300	5.21
			140	-	-	-	-	-	-	-	-	-	-	30500	6.00	37700	5.95	45900	5.98	54200	6.02
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600	60	70	50400	5.72	54000	5.75	67500	5.85	84000	5.97	103600	6.12	126800	6.29	153900	6.50	-	-	-	-
			90	43100	7.04	46500	7.07	59300	7.17	74500	7.27	92600	7.40	113800	7.55	138600	7.73	167200	7.95	196500	8.18
			110	-	-	-	-	51400	8.94	65100	9.02	81200	9.12	100100	9.24	122200	9.38	147800	9.55	174000	9.73
			130	-	-	-	-	-	-	-	-	68500	11.52	84700	11.59	103800	11.67	125900	11.79	148700	11.92
			140	-	-	-	-	-	-	-	-	-	-	76100	13.09	93400	13.15	113700	13.23	134700	13.32
			145	-	-	-	-	-	-	-	-	-	-	-	-	82200	14.87	100600	14.91	119700	14.98
	6000	100	70	-	-	-	-	110500	10.59	137300	11.06	169600	11.62	207800	12.27	252400	13.03	-	-	-	-
			90	-	-	-	-	98700	12.70	123700	13.06	153600	13.47	188600	13.97	229500	14.56	276800	15.26	325300	16.00
			110	-	-	-	-	86700	15.56	109200	15.79	135800	16.06	167000	16.39	203300	16.79	245400	17.28	288600	17.82
			130	-	-	-	-	-	-	-	-	115000	19.71	141500	19.86	172500	20.06	208600	20.33	245900	20.65
			140	-	-	-	-	-	-	-	-	-	-	126900	22.10	155000	22.19	187800	22.35	221800	22.56
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VZH170AJ	1500	25	70	-	-	-	-	40800	3.23	50600	3.21	62400	3.17	76300	3.06	92500	2.83	-	-	-	-
			90	-	-	-	-	35700	4.30	45000	4.25	55900	4.24	68800	4.24	83700	4.19	101000	4.05	118700	3.80
			110	-	-	-	-	30100	5.80	38400	5.61	48200	5.53	59700	5.52	73000	5.54	88500	5.53	104300	5.47
			130	-	-	-	-	-	-	-	-	39200	7.31	48900	7.19	60300	7.15	73600	7.17	87300	7.19
			140	-	-	-	-	-	-	-	-	-	-	42800	8.25	53100	8.15	65200	8.13	77700	8.15
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600	60	70	76400	7.78	81200	7.83	99800	8.03	122700	8.23	150500	8.41	183900	8.53	223200	8.55	-	-	-	-
			90	66500	10.06	71100	10.07	88700	10.18	110200	10.34	135900	10.53	166600	10.70	202700	10.83	244700	10.89	288100	10.84
			110	-	-	-	-	78000	13.02	97200	13.06	120100	13.18	147300	13.33	179300	13.50	216700	13.63	255500	13.70
			130	-	-	-	-	-	-	-	-	101500	16.56	124500	16.62	151700	16.73	183800	16.87	217200	16.99
			140	-	-	-	-	-	-	-	-	-	-	111400	18.56	135900	18.62	165000	18.73	195500	18.84
			145	-	-	-	-	-	-	-	-	-	-	-	-	118500	20.72	144400	20.78	171800	20.88
	6000	100	70	-	-	-	-	164400	14.09	204200	14.78	252100	15.56	308900	16.50	375400	17.67	-	-	-	-
			90	-	-	-	-	144600	17.58	181500	18.20	225300	18.81	276900	19.47	337200	20.25	407100	21.22	478800	22.31
			110	-	-	-	-	127700	21.86	160900	22.52	200000	23.06	245800	23.55	299200	24.04	361000	24.61	424600	25.25
			130	-	-	-	-	-	-	-	-	171900	28.55	211200	28.96	257000	29.27	310100	29.55	364900	29.83
			140	-	-	-	-	-	-	-	-	-	-	191300	32.24	233000	32.50	281500	32.67	331700	32.81
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

To: Evaporating temperature in °F
Tc: Condensing temperature in °F
Qo: Cooling capacity in Btu

Superheat = 10 K
Subcooling = 0 K
Pe: Power input in kW

Presented data are for models with motor voltage code J

Capacity at ARI rating conditions - High pressure ratio - VZH088AJ - VZH117AJ - VZH170AJ

Models	rpm	rps	Te	-13		-10		0		10		20		30		40		50		59	
			Tc	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe
VZH088AJ	1500	25	70	-	-	-	-	21100	1.57	26500	1.66	32900	1.73	40400	1.75	49100	1.65	-	-	-	-
			90	-	-	-	-	18900	2.21	24100	2.18	30200	2.21	37200	2.25	45300	2.24	54600	2.14	64000	1.91
			110	-	-	-	-	16500	3.22	21400	3.02	27000	2.95	33500	2.95	40800	2.97	49200	2.96	57700	2.88
			130	-	-	-	-	-	-	-	-	23100	4.03	28900	3.94	35400	3.93	42800	3.96	50300	3.97
			140	-	-	-	-	-	-	-	-	-	-	26200	4.57	32300	4.53	39200	4.55	46200	4.59
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600	60	70	40200	4.35	43000	4.38	53800	4.46	66800	4.55	82300	4.66	100700	4.79	122100	4.95	-	-	-	-
			90	34800	5.36	37500	5.38	47700	5.46	59900	5.54	74400	5.64	91400	5.75	111200	5.89	134000	6.05	157400	6.23
			110	-	-	-	-	42100	6.81	53200	6.87	66300	6.94	81700	7.03	99600	7.14	120300	7.27	141500	7.41
			130	-	-	-	-	-	-	-	-	57500	8.77	71100	8.82	86800	8.89	105200	8.98	124100	9.07
			140	-	-	-	-	-	-	-	-	-	-	65300	9.97	80000	10.01	97200	10.07	115000	10.14
			145	-	-	-	-	-	-	-	-	-	-	-	-	73400	11.32	89500	11.36	106300	11.40
	6000	100	70	-	-	-	-	88000	8.06	109200	8.42	134800	8.84	165000	9.34	200300	9.92	-	-	-	-
			90	-	-	-	-	79500	9.67	99600	9.94	123400	10.26	151500	10.64	184100	11.08	221800	11.62	260500	12.18
			110	-	-	-	-	71000	11.85	89400	12.02	110900	12.23	136200	12.48	165700	12.78	199800	13.16	234700	13.57
			130	-	-	-	-	-	-	-	-	96600	15.01	118600	15.12	144400	15.27	174300	15.48	205200	15.72
			140	-	-	-	-	-	-	-	-	-	-	109000	16.82	132800	16.90	160500	17.02	189300	17.17
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VZH117AJ	1500	25	70	-	-	-	-	28300	2.07	35600	2.17	44200	2.28	54300	2.30	66000	2.17	-	-	-	-
			90	-	-	-	-	25400	2.90	32300	2.86	40500	2.91	49900	2.96	60800	2.95	73300	2.81	85900	2.51
			110	-	-	-	-	22200	4.23	28700	3.97	36300	3.87	44900	3.88	54800	3.91	66100	3.89	77500	3.79
			130	-	-	-	-	-	-	-	-	31000	5.30	38700	5.17	47500	5.17	57500	5.20	67500	5.21
			140	-	-	-	-	-	-	-	-	-	-	35200	6.00	43300	5.95	52600	5.98	62000	6.02
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600	60	70	53900	5.72	57700	5.75	72200	5.85	89700	5.97	110500	6.12	135200	6.29	163900	6.50	-	-	-	-
			90	46700	7.04	50400	7.07	64100	7.17	80500	7.27	99900	7.40	122700	7.55	149200	7.73	179800	7.95	211200	8.18
			110	-	-	-	-	56500	8.94	71500	9.02	89000	9.12	109700	9.24	133700	9.38	161400	9.55	190000	9.73
			130	-	-	-	-	-	-	-	-	77200	11.52	95400	11.59	116600	11.67	141200	11.79	166600	11.92
			140	-	-	-	-	-	-	-	-	-	-	87700	13.09	107400	13.15	130500	13.23	154400	13.32
			145	-	-	-	-	-	-	-	-	-	-	-	-	98500	14.87	120100	14.91	142600	14.98
	6000	100	70	-	-	-	-	118100	10.59	146600	11.06	180900	11.62	221400	12.27	268800	13.03	-	-	-	-
			90	-	-	-	-	106700	12.70	133600	13.06	165700	13.47	203300	13.97	247100	14.56	297800	15.26	349600	16.00
			110	-	-	-	-	95400	15.56	119900	15.79	148900	16.06	182900	16.39	222400	16.79	268100	17.28	315100	17.82
			130	-	-	-	-	-	-	-	-	129700	19.71	159300	19.86	193800	20.06	234000	20.33	275400	20.65
			140	-	-	-	-	-	-	-	-	-	-	146300	22.10	178200	22.19	215500	22.35	254100	22.56
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VZH170AJ	1500	25	70	-	-	-	-	43600	3.23	54100	3.21	66600	3.17	81300	3.06	98600	2.83	-	-	-	-
			90	-	-	-	-	38600	4.30	48600	4.25	60300	4.24	74100	4.24	90200	4.19	108700	4.05	127600	3.80
			110	-	-	-	-	33100	5.80	42200	5.61	52900	5.53	65400	5.52	79900	5.54	96700	5.53	113900	5.47
			130	-	-	-	-	-	-	-	-	44100	7.31	55000	7.19	67700	7.15	82500	7.17	97800	7.19
			140	-	-	-	-	-	-	-	-	-	-	49400	8.25	61100	8.15	74800	8.13	89000	8.15
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600	60	70	81800	7.78	86900	7.83	106600	8.03	131000	8.23	160600	8.41	196000	8.53	237700	8.55	-	-	-	-
			90	72000	10.06	77000	10.07	95900	10.18	119000	10.34	146600	10.53	179500	10.70	218200	10.83	263200	10.89	309700	10.84
			110	-	-	-	-	85800	13.02	106700	13.06	131700	13.18	161300	13.33	196100	13.50	236800	13.63	278900	13.70
			130	-	-	-	-	-	-	-	-	114500	16.56	140100	16.62	170500	16.73	206200	16.87	243300	16.99
			140	-	-	-	-	-	-	-	-	-	-	128400	18.56	156300	18.62	189300	18.73	223900	18.84
			145	-	-	-	-	-	-	-	-	-	-	-	-	142000	20.72	172500	20.78	204700	20.88
	6000	100	70	-	-	-	-	175700	14.09	218000	14.78	268900	15.56	329200	16.50	399900	17.67	-	-	-	-
			90	-	-	-	-	156400	17.58	196000	18.20	243000	18.81	298400	19.47	363100	20.25	437900	21.22	514700	22.31
			110	-	-	-	-	140500	21.86	176700	22.52	219300	23.06	269200	23.55	327300	24.04	394500	24.61	463400	25.25
			130	-	-	-	-	-	-	-	-	193800	28.55	237700	28.96	288700	29.27	347900	29.55	408800	29.83
			140	-	-	-	-	-	-	-	-	-	-	220400	32.24	267900	32.50	323000	32.67	380000	32.81
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

To: Evaporating temperature in °F
Tc: Condensing temperature in °F
Qo: Cooling capacity in Btu

Superheat = 11.1 K
Subcooling = 8.3 K
Pe: Power input in kW

Presented data are for models with motor voltage code J

Capacity at EN12900 rating conditions - High pressure ratio - VZH088AG - VZH117AG - VZH170AG

Models	rpm	rps	To	-13		-10		0		10		20		30		40		50		59	
			Tc	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe
VZH088AG	1500 rpm	25	70	-	-	-	-	19900	1.55	25000	1.63	31100	1.70	38200	1.72	46500	1.62	-	-	-	-
			90	-	-	-	-	17600	2.17	22500	2.14	28200	2.17	34800	2.21	42400	2.21	51100	2.10	60000	1.88
			110	-	-	-	-	15200	3.16	19600	2.97	24800	2.90	30800	2.90	37600	2.92	45400	2.91	53300	2.83
			130	-	-	-	-	-	-	-	-	20700	3.96	25800	3.87	31700	3.86	38500	3.89	45300	3.90
			140	-	-	-	-	-	-	-	-	-	-	22900	4.49	28300	4.45	34400	4.47	40600	4.50
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	37800	4.28	40500	4.30	50700	4.38	63000	4.47	77800	4.58	95200	4.71	115500	4.86	-	-	-	-
			90	32400	5.27	34900	5.29	44500	5.36	55900	5.44	69500	5.54	85400	5.65	104000	5.78	125500	5.95	147500	6.12
			110	-	-	-	-	38600	6.69	48800	6.75	61000	6.82	75200	6.91	91700	7.01	110900	7.14	130600	7.28
			130	-	-	-	-	-	-	-	-	51400	8.62	63600	8.67	77900	8.73	94500	8.82	111600	8.91
			140	-	-	-	-	-	-	-	-	-	-	57100	9.79	70100	9.83	85400	9.89	101100	9.96
			145	-	-	-	-	-	-	-	-	-	-	-	-	61700	11.12	75500	11.16	89800	11.20
	6000 rpm	100	70	-	-	-	-	82900	7.92	103100	8.27	127300	8.69	155900	9.17	189500	9.75	-	-	-	-
			90	-	-	-	-	74100	9.50	92900	9.77	115300	10.08	141600	10.45	172300	10.89	207800	11.41	244100	11.97
			110	-	-	-	-	65100	11.64	82000	11.81	101900	12.01	125300	12.26	152600	12.56	184200	12.92	216700	13.33
			130	-	-	-	-	-	-	-	-	86300	14.75	106200	14.85	129500	15.00	156600	15.21	184600	15.45
			140	-	-	-	-	-	-	-	-	-	-	95300	16.53	116300	16.60	141000	16.72	166500	16.87
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VZH117AG	1500 rpm	25	70	-	-	-	-	26700	2.03	33600	2.14	41700	2.24	51300	2.26	62400	2.13	-	-	-	-
			90	-	-	-	-	23700	2.85	30200	2.81	37800	2.86	46700	2.91	56900	2.90	68600	2.76	80500	2.47
			110	-	-	-	-	20300	4.15	26400	3.90	33300	3.81	41300	3.81	50500	3.84	60900	3.82	71500	3.72
			130	-	-	-	-	-	-	-	-	27700	5.20	34700	5.08	42600	5.07	51600	5.11	60800	5.12
			140	-	-	-	-	-	-	-	-	-	-	30700	5.90	38000	5.84	46200	5.87	54600	5.92
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	50800	5.62	54400	5.65	68000	5.75	84600	5.87	104400	6.01	127800	6.18	155000	6.39	-	-	-	-
			90	43500	6.92	46900	6.94	59700	7.04	75100	7.15	93300	7.27	114700	7.42	139600	7.60	168500	7.81	198000	8.04
			110	-	-	-	-	51800	8.78	65600	8.86	81800	8.96	100900	9.07	123100	9.21	148900	9.38	175300	9.56
			130	-	-	-	-	-	-	-	-	69000	11.31	85400	11.38	104500	11.47	126800	11.58	149900	11.71
			140	-	-	-	-	-	-	-	-	-	-	76700	12.86	94100	12.91	114600	12.99	135800	13.09
			145	-	-	-	-	-	-	-	-	-	-	-	-	82900	14.61	101300	14.65	120600	14.71
	6000 rpm	100	70	-	-	-	-	111300	10.40	138400	10.87	170900	11.41	209300	12.05	254300	12.80	-	-	-	-
			90	-	-	-	-	99400	12.48	124700	12.83	154700	13.24	190100	13.72	231300	14.30	278900	14.99	327700	15.72
			110	-	-	-	-	87400	15.29	110000	15.51	136800	15.78	168200	16.10	204900	16.49	247300	16.97	290800	17.50
			130	-	-	-	-	-	-	-	-	115900	19.37	142600	19.51	173800	19.70	210200	19.97	247700	20.29
			140	-	-	-	-	-	-	-	-	-	-	127900	21.71	156200	21.80	189200	21.95	223500	22.16
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VZH170AG	1500 rpm	25	70	-	-	-	-	41100	3.18	51000	3.16	62900	3.11	76900	3.00	93200	2.78	-	-	-	-
			90	-	-	-	-	36000	4.22	45300	4.17	56300	4.17	69300	4.17	84400	4.12	101800	3.98	119600	3.74
			110	-	-	-	-	30400	5.70	38700	5.51	48600	5.43	60100	5.43	73600	5.44	89200	5.44	105100	5.38
			130	-	-	-	-	-	-	-	-	39400	7.18	49300	7.06	60800	7.03	74100	7.04	87900	7.06
			140	-	-	-	-	-	-	-	-	-	-	43200	8.10	53500	8.01	65700	7.99	78300	8.01
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	77000	7.64	81800	7.70	100500	7.89	123600	8.09	151700	8.26	185300	8.38	224900	8.40	-	-	-	-
			90	67000	9.88	71600	9.90	89400	10.00	111000	10.16	136900	10.34	167800	10.51	204200	10.64	246600	10.69	290300	10.65
			110	-	-	-	-	78600	12.79	97900	12.83	121000	12.95	148400	13.10	180700	13.26	218400	13.39	257400	13.46
			130	-	-	-	-	-	-	-	-	102300	16.26	125400	16.32	152900	16.43	185200	16.57	218800	16.69
			140	-	-	-	-	-	-	-	-	-	-	112200	18.23	137000	18.29	166200	18.40	196900	18.51
			145	-	-	-	-	-	-	-	-	-	-	-	-	119400	20.35	145500	20.42	173100	20.51
	6000 rpm	100	70	-	-	-	-	165700	13.85	205700	14.52	254000	15.28	311200	16.21	378300	17.36	-	-	-	-
			90	-	-	-	-	145700	17.27	182800	17.88	227000	18.48	279000	19.13	339800	19.90	410200	20.85	482400	21.91
			110	-	-	-	-	128700	21.47	162100	22.12	201500	22.65	247700	23.13	301500	23.62	363800	24.18	427800	24.80
			130	-	-	-	-	-	-	-	-	173200	28.04	212800	28.45	259000	28.75	312500	29.03	367700	29.30
			140	-	-	-	-	-	-	-	-	-	-	192700	31.67	234800	31.92	283600	32.09	334200	32.23
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

To: Evaporating temperature in °F
Tc: Condensing temperature in °F
Qo: Cooling capacity in Btu

Superheat = 10 K
Subcooling = 0 K
Pe: Power input in kW

Presented data are for models with motor voltage code G

Capacity at ARI rating conditions - High pressure ratio - VZH088AG - VZH117AG - VZH170AG

Models	rpm	rps	To	-13		-10		0		10		20		30		40		50		59	
			Tc	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe
VZH088AG	1500 rpm	25	70	-	-	-	-	21300	1.55	26700	1.63	33100	1.70	40700	1.72	49500	1.62	-	-	-	-
			90	-	-	-	-	19100	2.17	24300	2.14	30400	2.17	37500	2.21	45700	2.21	55000	2.10	64500	1.88
			110	-	-	-	-	16700	3.16	21600	2.97	27200	2.90	33700	2.90	41100	2.92	49600	2.91	58100	2.83
			130	-	-	-	-	-	-	-	-	23300	3.96	29100	3.87	35700	3.86	43100	3.89	50700	3.90
			140	-	-	-	-	-	-	-	-	-	-	26400	4.49	32500	4.45	39500	4.47	46600	4.50
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	40500	4.28	43300	4.30	54200	4.38	67300	4.47	83000	4.58	101400	4.71	123000	4.86	-	-	-	-
			90	35100	5.27	37800	5.29	48100	5.36	60400	5.44	75000	5.54	92100	5.65	112000	5.78	135000	5.95	158600	6.12
			110	-	-	-	-	42400	6.69	53600	6.75	66800	6.82	82300	6.91	100300	7.01	121200	7.14	142600	7.28
			130	-	-	-	-	-	-	-	-	58000	8.62	71600	8.67	87500	8.73	106000	8.82	125100	8.91
			140	-	-	-	-	-	-	-	-	-	-	65800	9.79	80700	9.83	97900	9.89	115900	9.96
			145	-	-	-	-	-	-	-	-	-	-	-	-	74000	11.12	90200	11.16	107100	11.20
	6000 rpm	100	70	-	-	-	-	88600	7.92	110100	8.27	135800	8.69	166200	9.17	201800	9.75	-	-	-	-
			90	-	-	-	-	80100	9.50	100300	9.77	124300	10.08	152600	10.45	185500	10.89	223500	11.41	262400	11.97
			110	-	-	-	-	71600	11.64	90000	11.81	111800	12.01	137300	12.26	167000	12.56	201300	12.92	236500	13.33
			130	-	-	-	-	-	-	-	-	97300	14.75	119500	14.85	145500	15.00	175600	15.21	206700	15.45
			140	-	-	-	-	-	-	-	-	-	-	109800	16.53	133800	16.60	161700	16.72	190700	16.87
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VZH117AG	1500 rpm	25	70	-	-	-	-	28600	2.03	35800	2.14	44500	2.24	54700	2.26	66500	2.13	-	-	-	-
			90	-	-	-	-	25600	2.85	32600	2.81	40800	2.86	50300	2.91	61300	2.90	73800	2.76	86500	2.47
			110	-	-	-	-	22400	4.15	29000	3.90	36500	3.81	45300	3.81	55200	3.84	66600	3.82	78000	3.72
			130	-	-	-	-	-	-	-	-	31300	5.20	39000	5.08	47900	5.07	57900	5.11	68100	5.12
			140	-	-	-	-	-	-	-	-	-	-	35400	5.90	43700	5.84	53000	5.87	62500	5.92
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	54300	5.62	58200	5.65	72700	5.75	90300	5.87	111400	6.01	136200	6.18	165100	6.39	-	-	-	-
			90	47100	6.92	50700	6.94	64600	7.04	81100	7.15	100600	7.27	123600	7.42	150300	7.60	181200	7.81	212800	8.04
			110	-	-	-	-	57000	8.78	72000	8.86	89700	8.96	110500	9.07	134700	9.21	162700	9.38	191400	9.56
			130	-	-	-	-	-	-	-	-	77800	11.31	96100	11.38	117400	11.47	142300	11.58	167900	11.71
			140	-	-	-	-	-	-	-	-	-	-	88400	12.86	108300	12.91	131500	12.99	155500	13.09
			145	-	-	-	-	-	-	-	-	-	-	-	-	99300	14.61	121000	14.65	143700	14.71
	6000 rpm	100	70	-	-	-	-	119000	10.40	147700	10.87	182300	11.41	223100	12.05	270800	12.80	-	-	-	-
			90	-	-	-	-	107500	12.48	134600	12.83	166900	13.24	204800	13.72	249000	14.30	300000	14.99	352200	15.72
			110	-	-	-	-	96100	15.29	120800	15.51	150000	15.78	184300	16.10	224100	16.49	270200	16.97	317400	17.50
			130	-	-	-	-	-	-	-	-	130700	19.37	160500	19.51	195300	19.70	235800	19.97	277500	20.29
			140	-	-	-	-	-	-	-	-	-	-	147400	21.71	179600	21.80	217100	21.95	256000	22.16
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VZH170AG	1500 rpm	25	70	-	-	-	-	43900	3.18	54500	3.16	67100	3.11	82000	3.00	99300	2.78	-	-	-	-
			90	-	-	-	-	38900	4.22	48900	4.17	60800	4.17	74700	4.17	90800	4.12	109500	3.98	128600	3.74
			110	-	-	-	-	33400	5.70	42500	5.51	53300	5.43	65900	5.43	80500	5.44	97400	5.44	114700	5.38
			130	-	-	-	-	-	-	-	-	44500	7.18	55400	7.06	68300	7.03	83100	7.04	98500	7.06
			140	-	-	-	-	-	-	-	-	-	-	49700	8.10	61500	8.01	75400	7.99	89700	8.01
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	82400	7.64	87500	7.70	107400	7.89	132000	8.09	161800	8.26	197500	8.38	239500	8.40	-	-	-	-
			90	72500	9.88	77500	9.90	96700	10.00	119900	10.16	147700	10.34	180900	10.51	219800	10.64	265200	10.69	312000	10.65
			110	-	-	-	-	86400	12.79	107500	12.83	132700	12.95	162500	13.10	197600	13.26	238600	13.39	281000	13.46
			130	-	-	-	-	-	-	-	-	115300	16.26	141200	16.32	171800	16.43	207700	16.57	245100	16.69
			140	-	-	-	-	-	-	-	-	-	-	129300	18.23	157500	18.29	190800	18.40	225600	18.51
			145	-	-	-	-	-	-	-	-	-	-	-	-	143100	20.35	173800	20.42	206300	20.51
	6000 rpm	100	70	-	-	-	-	177000	13.85	219700	14.52	270900	15.28	331700	16.21	402900	17.36	-	-	-	-
			90	-	-	-	-	157600	17.27	197500	17.88	244900	18.48	300700	19.13	365800	19.90	441200	20.85	518500	21.91
			110	-	-	-	-	141500	21.47	178100	22.12	221000	22.65	271200	23.13	329800	23.62	397400	24.18	466900	24.80
			130	-	-	-	-	-	-	-	-	195300	28.04	239500	28.45	290900	28.75	350500	29.03	411900	29.30
			140	-	-	-	-	-	-	-	-	-	-	222100	31.67	269900	31.92	325500	32.09	382900	32.23
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

To: Evaporating temperature in °F
Tc: Condensing temperature in °F
Qo: Cooling capacity in Btu

Superheat = 11.1 K
Subcooling = 8.3 K
Pe: Power input in kW

Presented data are for models with motor voltage code G

Capacity at EN12900 rating conditions - High pressure ratio - VZH088AH - VZH117AH - VZH170AH

Models	rpm	rps	To	-13	-10	0	10	20	30	40	50	59
			Tc	Qo	Qo	Qo	Qo	Qo	Qo	Qo	Qo	Qo
VZH088AG	1500 rpm	25	70	-	-	19900	25000	31100	38200	46500	-	-
			90	-	-	17600	22500	28200	34800	42400	51100	60000
			110	-	-	15200	19600	24800	30800	37600	45400	53300
			130	-	-	-	-	20700	25800	31700	38500	45300
			140	-	-	-	-	-	22900	28300	34400	40600
			145	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	37800	40500	50700	63000	77800	95200	115500	-	-
			90	32400	34900	44500	55900	69500	85400	104000	125500	147500
			110	-	-	38600	48800	61000	75200	91700	110900	130600
			130	-	-	-	-	51400	63600	77900	94500	111600
			140	-	-	-	-	-	57100	70100	85400	101100
			145	-	-	-	-	-	-	61700	75500	89800
	6000 rpm	100	70	-	-	82900	103100	127300	155900	189500	-	-
			90	-	-	74100	92900	115300	141600	172300	207800	244100
			110	-	-	65100	82000	101900	125300	152600	184200	216700
			130	-	-	-	-	86300	106200	129500	156600	184600
			140	-	-	-	-	-	95300	116300	141000	166500
			145	-	-	-	-	-	-	-	-	-
VZH117AG	1500 rpm	25	70	-	-	26700	33600	41700	51300	62400	-	-
			90	-	-	23700	30200	37800	46700	56900	68600	80500
			110	-	-	20300	26400	33300	41300	50500	60900	71500
			130	-	-	-	-	27700	34700	42600	51600	60800
			140	-	-	-	-	-	30700	38000	46200	54600
			145	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	50800	54400	68000	84600	104400	127800	155000	-	-
			90	43500	46900	59700	75100	93300	114700	139600	168500	198000
			110	-	-	51800	65600	81800	100900	123100	148900	175300
			130	-	-	-	-	69000	85400	104500	126800	149900
			140	-	-	-	-	-	76700	94100	114600	135800
			145	-	-	-	-	-	-	82900	101300	120600
	6000 rpm	100	70	-	-	111300	138400	170900	209300	254300	-	-
			90	-	-	99400	124700	154700	190100	231300	278900	327700
			110	-	-	87400	110000	136800	168200	204900	247300	290800
			130	-	-	-	-	115900	142600	173800	210200	247700
			140	-	-	-	-	-	127900	156200	189200	223500
			145	-	-	-	-	-	-	-	-	-
VZH170AG	1500 rpm	25	70	-	-	41100	51000	62900	76900	93200	-	-
			90	-	-	36000	45300	56300	69300	84400	101800	119600
			110	-	-	30400	38700	48600	60100	73600	89200	105100
			130	-	-	-	-	39400	49300	60800	74100	87900
			140	-	-	-	-	-	43200	53500	65700	78300
			145	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	77000	81800	100500	123600	151700	185300	224900	-	-
			90	67000	71600	89400	111000	136900	167800	204200	246600	290300
			110	-	-	78600	97900	121000	148400	180700	218400	257400
			130	-	-	-	-	102300	125400	152900	185200	218800
			140	-	-	-	-	-	112200	137000	166200	196900
			145	-	-	-	-	-	-	119400	145500	173100
	6000 rpm	100	70	-	-	165700	205700	254000	311200	378300	-	-
			90	-	-	145700	182800	227000	279000	339800	410200	482400
			110	-	-	128700	162100	201500	247700	301500	363800	427800
			130	-	-	-	-	173200	212800	259000	312500	367700
			140	-	-	-	-	-	192700	234800	283600	334200
			145	-	-	-	-	-	-	-	-	-

To: Evaporating temperature in °F
Tc: Condensing temperature in °F
Qo: Cooling capacity in Btu

Superheat = 10 K
Subcooling = 0 K
Pe: Power input in kW

Presented data are for models with motor voltage code G

Capacity at ARI rating conditions - High pressure ratio - VZH088AH - VZH117AH - VZH170AH

Models	rpm	rps	To	-13	-10	0	10	20	30	40	50	59
			Tc	Qo	Qo	Qo	Qo	Qo	Qo	Qo	Qo	Qo
VZH088AG	1500 rpm	25	70	-	-	21300	26700	33100	40700	49500	-	-
			90	-	-	19100	24300	30400	37500	45700	55000	64500
			110	-	-	16700	21600	27200	33700	41100	49600	58100
			130	-	-	-	-	23300	29100	35700	43100	50700
			140	-	-	-	-	-	26400	32500	39500	46600
			145	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	40500	43300	54200	67300	83000	101400	123000	-	-
			90	35100	37800	48100	60400	75000	92100	112000	135000	158600
			110	-	-	42400	53600	66800	82300	100300	121200	142600
			130	-	-	-	-	58000	71600	87500	106000	125100
			140	-	-	-	-	-	65800	80700	97900	115900
			145	-	-	-	-	-	-	74000	90200	107100
	6000 rpm	100	70	-	-	88600	110100	135800	166200	201800	-	-
			90	-	-	80100	100300	124300	152600	185500	223500	262400
			110	-	-	71600	90000	111800	137300	167000	201300	236500
			130	-	-	-	-	97300	119500	145500	175600	206700
			140	-	-	-	-	-	109800	133800	161700	190700
			145	-	-	-	-	-	-	-	-	-
VZH117AG	1500 rpm	25	70	-	-	28600	35800	44500	54700	66500	-	-
			90	-	-	25600	32600	40800	50300	61300	73800	86500
			110	-	-	22400	29000	36500	45300	55200	66600	78000
			130	-	-	-	-	31300	39000	47900	57900	68100
			140	-	-	-	-	-	35400	43700	53000	62500
			145	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	54300	58200	72700	90300	111400	136200	165100	-	-
			90	47100	50700	64600	81100	100600	123600	150300	181200	212800
			110	-	-	57000	72000	89700	110500	134700	162700	191400
			130	-	-	-	-	77800	96100	117400	142300	167900
			140	-	-	-	-	-	88400	108300	131500	155500
			145	-	-	-	-	-	-	99300	121000	143700
	6000 rpm	100	70	-	-	119000	147700	182300	223100	270800	-	-
			90	-	-	107500	134600	166900	204800	249000	300000	352200
			110	-	-	96100	120800	150000	184300	224100	270200	317400
			130	-	-	-	-	130700	160500	195300	235800	277500
			140	-	-	-	-	-	147400	179600	217100	256000
			145	-	-	-	-	-	-	-	-	-
VZH170AG	1500 rpm	25	70	-	-	43900	54500	67100	82000	99300	-	-
			90	-	-	38900	48900	60800	74700	90800	109500	128600
			110	-	-	33400	42500	53300	65900	80500	97400	114700
			130	-	-	-	-	44500	55400	68300	83100	98500
			140	-	-	-	-	-	49700	61500	75400	89700
			145	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	82400	87500	107400	132000	161800	197500	239500	-	-
			90	72500	77500	96700	119900	147700	180900	219800	265200	312000
			110	-	-	86400	107500	132700	162500	197600	238600	281000
			130	-	-	-	-	115300	141200	171800	207700	245100
			140	-	-	-	-	-	129300	157500	190800	225600
			145	-	-	-	-	-	-	143100	173800	206300
	6000 rpm	100	70	-	-	177000	219700	270900	331700	402900	-	-
			90	-	-	157600	197500	244900	300700	365800	441200	518500
			110	-	-	141500	178100	221000	271200	329800	397400	466900
			130	-	-	-	-	195300	239500	290900	350500	411900
			140	-	-	-	-	-	222100	269900	325500	382900
			145	-	-	-	-	-	-	-	-	-

To: Evaporating temperature in °F
Tc: Condensing temperature in °F
Qo: Cooling capacity in Btu
Subject to change without prior notice.

Superheat = 11.1 K
Subcooling = 8.3 K
Pe: Power input in kW

Presented data are for models with motor voltage code G

Capacity at EN12900 rating conditions - Low pressure ratio - VZH088BJ - VZH117BJ - VZH170BJ

Models	rpm	rps	Te	-13		-10		0		10		20		30		40		50		59	
			Tc	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe
VZH088BJ	1500	25	70	-	-	-	-	22100	1.84	27200	1.74	33300	1.65	40300	1.58	48500	1.54	-	-	-	-
			90	-	-	-	-	18500	2.47	23300	2.39	28900	2.30	35400	2.22	42900	2.14	51500	2.08	60400	2.03
			110	-	-	-	-	-	-	19400	3.16	24400	3.11	30300	3.04	37100	2.96	45000	2.88	53100	2.80
			130	-	-	-	-	-	-	-	-	-	-	24900	4.13	31000	4.08	38100	4.01	45300	3.94
			140	-	-	-	-	-	-	-	-	-	-	-	-	27800	4.79	34400	4.74	41200	4.67
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600	60	70	37000	4.64	39700	4.64	50000	4.59	62500	4.48	77500	4.36	95100	4.26	115600	4.24	-	-	-	-
			90	32000	5.83	34500	5.87	44200	5.91	55800	5.85	69500	5.72	85600	5.57	104200	5.44	125600	5.38	147500	5.41
			110	-	-	-	-	-	-	48800	7.50	61100	7.43	75500	7.29	92100	7.13	111200	6.98	130600	6.89
			130	-	-	-	-	-	-	-	-	-	-	63800	9.48	78200	9.34	94800	9.17	111700	9.02
			140	-	-	-	-	-	-	-	-	-	-	-	-	70200	10.66	85500	10.51	101100	10.35
			145	-	-	-	-	-	-	-	-	-	-	-	-	66000	11.38	80500	11.24	95500	11.08
	6000	100	70	-	-	-	-	81700	7.98	101200	7.94	124700	7.89	152500	7.92	185000	8.12	-	-	-	-
			90	-	-	-	-	74000	10.39	92500	10.42	114600	10.32	140600	10.20	170800	10.14	205800	10.23	241700	10.53
			110	-	-	-	-	-	-	81400	13.10	101200	13.10	124400	12.95	151600	12.76	183000	12.62	215300	12.60
			130	-	-	-	-	-	-	-	-	-	-	104000	16.07	127100	15.88	154100	15.63	182100	15.43
			140	-	-	-	-	-	-	-	-	-	-	-	-	112900	17.59	137400	17.34	162800	17.08
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VZH117BJ	1500	25	70	-	-	-	-	29600	2.42	36600	2.29	44700	2.17	54100	2.08	65100	2.02	-	-	-	-
			90	-	-	-	-	24900	3.25	31300	3.14	38800	3.02	47500	2.91	57600	2.81	69200	2.73	81100	2.67
			110	-	-	-	-	-	-	26000	4.15	32800	4.08	40700	3.99	49900	3.88	60400	3.78	71300	3.68
			130	-	-	-	-	-	-	-	-	-	-	33500	5.43	41600	5.36	51100	5.27	60800	5.17
			140	-	-	-	-	-	-	-	-	-	-	-	-	37300	6.29	46100	6.22	55300	6.13
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600	60	70	49700	6.09	53300	6.10	67100	6.03	83900	5.88	104000	5.72	127600	5.60	155200	5.57	-	-	-	-
			90	42900	7.66	46400	7.71	59300	7.76	74900	7.68	93300	7.51	114800	7.32	139900	7.15	168600	7.06	198000	7.10
			110	-	-	-	-	-	-	65500	9.84	82100	9.76	101300	9.58	123600	9.36	149200	9.16	175300	9.04
			130	-	-	-	-	-	-	-	-	-	-	85600	12.45	104900	12.27	127200	12.05	149900	11.85
			140	-	-	-	-	-	-	-	-	-	-	-	-	94300	14.00	114800	13.80	135700	13.59
			145	-	-	-	-	-	-	-	-	-	-	-	-	88500	14.94	108100	14.76	128200	14.55
	6000	100	70	-	-	-	-	109700	10.48	135900	10.43	167400	10.37	204600	10.41	248300	10.67	-	-	-	-
			90	-	-	-	-	99300	13.64	124200	13.68	153800	13.56	188700	13.40	229300	13.32	276300	13.44	324400	13.82
			110	-	-	-	-	-	-	109200	17.21	135800	17.20	167000	17.01	203500	16.76	245700	16.57	289000	16.55
			130	-	-	-	-	-	-	-	-	-	-	139600	21.10	170700	20.86	206900	20.53	244400	20.26
			140	-	-	-	-	-	-	-	-	-	-	-	-	151600	23.10	184400	22.77	218500	22.44
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VZH170BJ	1500	25	70	-	-	-	-	42200	3.30	51900	3.15	63400	2.99	77000	2.81	92800	2.61	-	-	-	-
			90	-	-	-	-	36100	4.57	45200	4.42	56000	4.28	68600	4.13	83300	3.96	100300	3.77	117800	3.57
			110	-	-	-	-	-	-	38300	5.90	48000	5.76	59500	5.64	72900	5.52	88400	5.38	104400	5.24
			130	-	-	-	-	-	-	-	-	-	-	49200	7.56	61100	7.48	74900	7.40	89100	7.33
			140	-	-	-	-	-	-	-	-	-	-	-	-	54500	8.67	67400	8.63	80800	8.59
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600	60	70	71600	8.72	76900	8.67	97100	8.49	121600	8.30	151000	8.07	185900	7.78	226800	7.40	-	-	-	-
			90	62400	11.09	67400	11.05	86100	10.91	108700	10.77	135600	10.62	167400	10.43	204800	10.17	248200	9.83	293000	9.43
			110	-	-	-	-	-	-	94700	13.77	118600	13.67	146800	13.54	180000	13.38	218700	13.15	258800	12.87
			130	-	-	-	-	-	-	-	-	-	-	123500	17.48	151900	17.37	185400	17.22	220300	17.03
			140	-	-	-	-	-	-	-	-	-	-	-	-	136500	19.77	167200	19.65	199300	19.50
			145	-	-	-	-	-	-	-	-	-	-	-	-	128400	21.10	157600	20.99	188300	20.85
	6000	100	70	-	-	-	-	161800	15.35	202200	15.41	250400	15.25	307400	14.78	374200	13.94	-	-	-	-
			90	-	-	-	-	144300	18.92	182000	19.17	226900	19.30	279800	19.22	341600	18.86	413300	18.15	487200	17.15
			110	-	-	-	-	-	-	159300	23.79	199600	24.03	247200	24.17	303000	24.12	367900	23.83	434800	23.29
			130	-	-	-	-	-	-	-	-	-	-	209000	30.26	257500	30.36	314400	30.31	373500	30.07
			140	-	-	-	-	-	-	-	-	-	-	-	-	232000	34.04	284400	34.05	339200	33.91
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

To: Evaporating temperature in °F
Tc: Condensing temperature in °F
Qo: Cooling capacity in Btu

Superheat = 10 K
Subcooling = 0 K
Pe: Power input in kW

Presented data are for models with motor voltage code J

Capacity at ARI rating conditions - Low pressure ratio - VZH088BJ - VZH117BJ - VZH170BJ

Models	rpm	rps	To	-13		-10		0		10		20		30		40		50		59	
			Tc	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe
VZH088BJ	1500 rpm	25	70	-	-	-	-	23600	1.84	29100	1.74	35500	1.65	43000	1.58	51600	1.54	-	-	-	-
			90	-	-	-	-	20000	2.47	25200	2.39	31200	2.30	38100	2.22	46200	2.14	55400	2.08	64900	2.03
			110	-	-	-	-	-	-	21300	3.16	26800	3.11	33200	3.04	40600	2.96	49200	2.88	58000	2.80
			130	-	-	-	-	-	-	-	-	-	-	28100	4.13	34800	4.08	42700	4.01	50800	3.94
			140	-	-	-	-	-	-	-	-	-	-	-	-	31900	4.79	39400	4.74	47200	4.67
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	39600	4.64	42500	4.64	53400	4.59	66700	4.48	82600	4.36	101400	4.26	123100	4.24	-	-	-	-
			90	34600	5.83	37400	5.87	47800	5.91	60200	5.85	75000	5.72	92200	5.57	112200	5.44	135100	5.38	158500	5.41
			110	-	-	-	-	-	-	53600	7.50	67000	7.43	82700	7.29	100700	7.13	121500	6.98	142600	6.89
			130	-	-	-	-	-	-	-	-	-	-	71800	9.48	87800	9.34	106300	9.17	125100	9.02
			140	-	-	-	-	-	-	-	-	-	-	-	-	80800	10.66	98100	10.51	115800	10.35
			145	-	-	-	-	-	-	-	-	-	-	-	-	77200	11.38	94000	11.24	111200	11.08
	6000 rpm	100	70	-	-	-	-	87400	7.98	108100	7.94	133000	7.89	162500	7.92	197000	8.12	-	-	-	-
			90	-	-	-	-	80000	10.39	99900	10.42	123600	10.32	151500	10.20	183900	10.14	221400	10.23	259800	10.53
			110	-	-	-	-	-	-	89400	13.10	110900	13.10	136300	12.95	165800	12.76	200000	12.62	235000	12.60
			130	-	-	-	-	-	-	-	-	-	-	117000	16.07	142800	15.88	172900	15.63	203900	15.43
			140	-	-	-	-	-	-	-	-	-	-	-	-	129800	17.59	157600	17.34	186500	17.08
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VZH117BJ	1500 rpm	25	70	-	-	-	-	31700	2.42	39000	2.29	47700	2.17	57700	2.08	69300	2.02	-	-	-	-
			90	-	-	-	-	26900	3.25	33800	3.14	41800	3.02	51200	2.91	62000	2.81	74400	2.73	87100	2.67
			110	-	-	-	-	-	-	28600	4.15	36000	4.08	44600	3.99	54500	3.88	66000	3.78	77800	3.68
			130	-	-	-	-	-	-	-	-	-	-	37700	5.43	46800	5.36	57300	5.27	68200	5.17
			140	-	-	-	-	-	-	-	-	-	-	-	-	42800	6.29	52900	6.22	63400	6.13
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	53200	6.09	57000	6.10	71700	6.03	89600	5.88	110900	5.72	136100	5.60	165300	5.57	-	-	-	-
			90	46500	7.66	50200	7.71	64200	7.76	80900	7.68	100600	7.51	123800	7.32	150600	7.15	181400	7.06	212800	7.10
			110	-	-	-	-	-	-	72000	9.84	90000	9.76	111000	9.58	135200	9.36	163000	9.16	191400	9.04
			130	-	-	-	-	-	-	-	-	-	-	96400	12.45	117900	12.27	142700	12.05	167900	11.85
			140	-	-	-	-	-	-	-	-	-	-	-	-	108400	14.00	131700	13.80	155500	13.59
			145	-	-	-	-	-	-	-	-	-	-	-	-	103600	14.94	126200	14.76	149300	14.55
	6000 rpm	100	70	-	-	-	-	117300	10.48	145100	10.43	178500	10.37	218100	10.41	264500	10.67	-	-	-	-
			90	-	-	-	-	107300	13.64	134100	13.68	165900	13.56	203300	13.40	246900	13.32	297200	13.44	348700	13.82
			110	-	-	-	-	-	-	119900	17.21	148900	17.20	182900	17.01	222600	16.76	268400	16.57	315500	16.55
			130	-	-	-	-	-	-	-	-	-	-	157100	21.10	191700	20.86	232100	20.53	273800	20.26
			140	-	-	-	-	-	-	-	-	-	-	-	-	174300	23.10	211600	22.77	250400	22.44
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VZH170BJ	1500 rpm	25	70	-	-	-	-	45100	3.30	55400	3.15	67700	2.99	82000	2.81	98800	2.61	-	-	-	-
			90	-	-	-	-	39000	4.57	48900	4.42	60400	4.28	74000	4.13	89700	3.96	107900	3.77	126600	3.57
			110	-	-	-	-	-	-	42000	5.90	52700	5.76	65200	5.64	79700	5.52	96600	5.38	113900	5.24
			130	-	-	-	-	-	-	-	-	-	-	55400	7.56	68600	7.48	84000	7.40	99900	7.33
			140	-	-	-	-	-	-	-	-	-	-	-	-	62700	8.67	77300	8.63	92500	8.59
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	76700	8.72	82300	8.67	103800	8.49	129800	8.30	161100	8.07	198100	7.78	241600	7.40	-	-	-	-
			90	67600	11.09	73000	11.05	93100	10.91	117400	10.77	146200	10.62	180400	10.43	220500	10.17	267000	9.83	315000	9.43
			110	-	-	-	-	-	-	104000	13.77	130000	13.67	160800	13.54	196900	13.38	239000	13.15	282500	12.87
			130	-	-	-	-	-	-	-	-	-	-	138900	17.48	170700	17.37	208000	17.22	246800	17.03
			140	-	-	-	-	-	-	-	-	-	-	-	-	157000	19.77	191800	19.65	228300	19.50
			145	-	-	-	-	-	-	-	-	-	-	-	-	150200	21.10	183900	20.99	219300	20.85
	6000 rpm	100	70	-	-	-	-	172900	15.35	215800	15.41	267100	15.25	327700	14.78	398500	13.94	-	-	-	-
			90	-	-	-	-	156000	18.92	196600	19.17	244800	19.30	301500	19.22	367800	18.86	444600	18.15	523600	17.15
			110	-	-	-	-	-	-	174900	23.79	218900	24.03	270800	24.17	331400	24.12	401900	23.83	474600	23.29
			130	-	-	-	-	-	-	-	-	-	-	235200	30.26	289300	30.36	352600	30.31	418400	30.07
			140	-	-	-	-	-	-	-	-	-	-	-	-	266700	34.04	326400	34.05	388600	33.91
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

To: Evaporating temperature in °F
Tc: Condensing temperature in °F
Qo: Cooling capacity in Btu

Superheat = 11.1 K
Subcooling = 8.3 K
Pe: Power input in kW

Presented data are for models with motor voltage code J

Capacity at EN12900 rating conditions - Low pressure ratio - VZH088BG - VZH117BG - VZH170BG

Models	rpm	rps	To	-13		-10		0		10		20		30		40		50		59	
			Tc	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe
VZH088BG	1500 rpm	25	70	-	-	-	-	22200	1.81	27400	1.71	33500	1.62	40600	1.55	48900	1.51	-	-	-	-
			90	-	-	-	-	18700	2.43	23500	2.35	29100	2.26	35600	2.18	43200	2.10	51900	2.04	60900	2.00
			110	-	-	-	-	-	-	19500	3.10	24600	3.05	30500	2.98	37400	2.91	45400	2.82	53500	2.75
			130	-	-	-	-	-	-	-	-	-	-	25100	4.06	31300	4.01	38400	3.94	45700	3.87
			140	-	-	-	-	-	-	-	-	-	-	-	-	28000	4.71	34600	4.65	41500	4.59
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	37300	4.56	40000	4.56	50400	4.51	63000	4.40	78100	4.28	95800	4.19	116500	4.16	-	-	-	-
			90	32200	5.73	34800	5.77	44500	5.81	56200	5.74	70000	5.62	86200	5.47	105000	5.35	126600	5.28	148600	5.31
			110	-	-	-	-	-	-	49200	7.36	61600	7.30	76000	7.16	92800	7.00	112000	6.85	131600	6.76
			130	-	-	-	-	-	-	-	-	-	-	64300	9.31	78800	9.18	95500	9.01	112500	8.86
			140	-	-	-	-	-	-	-	-	-	-	-	-	70800	10.47	86100	10.32	101900	10.17
			145	-	-	-	-	-	-	-	-	-	-	-	-	66500	11.18	81100	11.04	96200	10.88
	6000 rpm	100	70	-	-	-	-	82400	7.84	102000	7.80	125600	7.75	153600	7.78	186400	7.98	-	-	-	-
			90	-	-	-	-	74500	10.20	93200	10.23	115500	10.14	141600	10.02	172100	9.96	207400	10.05	243500	10.34
			110	-	-	-	-	-	-	82000	12.87	101900	12.87	125400	12.72	152700	12.54	184400	12.39	216900	12.38
			130	-	-	-	-	-	-	-	-	-	-	104800	15.78	128100	15.60	155300	15.35	183400	15.15
			140	-	-	-	-	-	-	-	-	-	-	-	-	113800	17.28	138400	17.03	164000	16.78
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VZH117BG	1500 rpm		70	-	-	-	-	29800	2.38	36800	2.25	45000	2.13	54500	2.04	65600	1.98	-	-	-	-
			90	-	-	-	-	25100	3.19	31500	3.08	39100	2.97	47800	2.86	58000	2.76	69700	2.68	81700	2.62
			110	-	-	-	-	-	-	26200	4.08	33000	4.01	41000	3.92	50200	3.82	60900	3.71	71800	3.61
			130	-	-	-	-	-	-	-	-	-	-	33700	5.33	41900	5.27	51500	5.18	61300	5.08
			140	-	-	-	-	-	-	-	-	-	-	-	-	37500	6.18	46500	6.11	55700	6.02
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600 rpm		70	50100	5.99	53700	5.99	67600	5.92	84500	5.78	104800	5.62	128600	5.50	156400	5.47	-	-	-	-
			90	43300	7.52	46700	7.57	59800	7.62	75400	7.54	94000	7.38	115700	7.19	140900	7.02	169900	6.94	199500	6.97
			110	-	-	-	-	-	-	66000	9.67	82700	9.59	102100	9.41	124500	9.20	150300	9.00	176700	8.88
			130	-	-	-	-	-	-	-	-	-	-	86300	12.23	105700	12.05	128100	11.83	151100	11.64
			140	-	-	-	-	-	-	-	-	-	-	-	-	95000	13.76	115600	13.56	136700	13.35
			145	-	-	-	-	-	-	-	-	-	-	-	-	89200	14.68	108900	14.50	129100	14.30
	6000 rpm		70	-	-	-	-	110500	10.29	136900	10.25	168600	10.18	206200	10.22	250200	10.48	-	-	-	-
			90	-	-	-	-	100000	13.40	125100	13.44	155000	13.32	190100	13.16	231000	13.08	278400	13.20	326800	13.58
			110	-	-	-	-	-	-	110000	16.90	136800	16.90	168300	16.71	205000	16.46	247500	16.28	291200	16.26
			130	-	-	-	-	-	-	-	-	-	-	140600	20.73	172000	20.49	208500	20.17	246200	19.90
			140	-	-	-	-	-	-	-	-	-	-	-	-	152700	22.69	185800	22.37	220200	22.04
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VZH170BG	1500 rpm		70	-	-	-	-	42500	3.24	52300	3.09	63900	2.94	77500	2.76	93500	2.56	-	-	-	-
			90	-	-	-	-	36400	4.49	45600	4.34	56400	4.20	69100	4.06	84000	3.89	101100	3.71	118700	3.50
			110	-	-	-	-	-	-	38500	5.79	48400	5.66	59900	5.54	73400	5.42	89000	5.29	105100	5.15
			130	-	-	-	-	-	-	-	-	-	-	49600	7.42	61500	7.34	75400	7.27	89800	7.20
			140	-	-	-	-	-	-	-	-	-	-	-	-	55000	8.52	67900	8.48	81400	8.43
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600 rpm		70	72200	8.57	77500	8.51	97800	8.34	122500	8.16	152100	7.93	187300	7.64	228600	7.27	-	-	-	-
			90	62900	10.89	67900	10.85	86800	10.71	109500	10.58	136600	10.43	168700	10.24	206300	9.99	250100	9.65	295200	9.26
			110	-	-	-	-	-	-	95500	13.53	119500	13.42	147900	13.30	181400	13.14	220400	12.91	260800	12.64
			130	-	-	-	-	-	-	-	-	-	-	124400	17.17	153100	17.06	186800	16.92	222000	16.73
			140	-	-	-	-	-	-	-	-	-	-	-	-	137500	19.42	168400	19.31	200800	19.16
			145	-	-	-	-	-	-	-	-	-	-	-	-	129400	20.72	158800	20.62	189700	20.48
	6000 rpm		70	-	-	-	-	163000	15.07	203700	15.14	252300	14.98	309700	14.52	377000	13.70	-	-	-	-
			90	-	-	-	-	145400	18.58	183400	18.84	228600	18.96	281900	18.88	344200	18.52	416500	17.83	490900	16.85
			110	-	-	-	-	-	-	160500	23.37	201200	23.61	249100	23.74	305300	23.70	370600	23.41	438100	22.87
			130	-	-	-	-	-	-	-	-	-	-	210500	29.72	259500	29.82	316800	29.77	376300	29.54
			140	-	-	-	-	-	-	-	-	-	-	-	-	233700	33.44	286600	33.45	341800	33.31
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

To: Evaporating temperature in °F
Tc: Condensing temperature in °F
Qo: Cooling capacity in Btu

Superheat = 10 K
Subcooling = 0 K
Pe: Power input in kW

Presented data are for models with motor voltage code G

Capacity at ARI rating conditions - Low pressure ratio - VZH088BG - VZH117BG - VZH170BG

Models	rpm	rps	To	-13		-10		0		10		20		30		40		50		59	
			Tc	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe
VZH088BG	1500 rpm	25	70	-	-	21800	1.85	26400	1.76	31800	1.67	37900	1.60	45000	1.54	53000	1.51	-	-	-	-
			90	-	-	18300	2.46	22700	2.39	27700	2.31	33400	2.24	39900	2.16	47400	2.09	55900	2.04	65400	2.00
			110	-	-	-	-	19000	3.12	23600	3.09	28800	3.03	34900	2.97	41700	2.90	49600	2.82	58400	2.75
			130	-	-	-	-	-	-	-	-	24100	4.08	29600	4.05	35800	4.01	43000	3.94	51200	3.87
			140	-	-	-	-	-	-	-	-	-	-	26800	4.73	32900	4.70	39700	4.65	47600	4.59
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	39900	4.56	49200	4.54	60200	4.46	73300	4.35	88600	4.25	106300	4.18	126400	4.17	-	-	-	-
			90	34900	5.73	43700	5.80	54200	5.78	66300	5.70	80500	5.57	96700	5.44	115200	5.34	136200	5.28	159700	5.31
			110	-	-	-	-	48000	7.36	59200	7.35	72000	7.26	86700	7.13	103400	6.99	122400	6.85	143700	6.76
			130	-	-	-	-	-	-	-	-	62300	9.36	75400	9.29	90200	9.16	107100	9.01	126100	8.86
			140	-	-	-	-	-	-	-	-	-	-	69100	10.56	83000	10.46	98800	10.32	116700	10.17
			145	-	-	-	-	-	-	-	-	-	-	-	-	79300	11.17	94700	11.04	112100	10.88
	6000 rpm	100	70	-	-	80700	7.83	98000	7.83	118400	7.78	142400	7.75	170300	7.81	202300	8.01	-	-	-	-
			90	-	-	73500	10.14	90200	10.24	109700	10.20	132500	10.10	158800	10.00	188900	9.96	223100	10.05	261700	10.34
			110	-		-	-	80400	12.79	98300	12.89	119000	12.83	142900	12.69	170300	12.52	201500	12.39	236800	12.38
			130	-	-	-	-	-	-	-	-	102000	15.83	122800	15.76	146800	15.58	174200	15.35	205500	15.15
			140	-	-	-	-	-	-	-	-	-	-	111400	17.40	133400	17.26	158800	17.03	187900	16.78
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VZH117BG	1500 rpm	25	70	-	-	29200	2.44	35500	2.31	42600	2.20	50900	2.10	60300	2.03	71100	1.98	-	-	-	-
			90	-	-	24600	3.23	30400	3.14	37100	3.04	44800	2.94	53600	2.84	63600	2.75	75000	2.68	87800	2.62
			110	-	-	-	-	25500	4.10	31600	4.05	38700	3.98	46800	3.90	56000	3.81	66500	3.71	78400	3.61
			130	-	-	-	-	-	-	-	-	32300	5.36	39700	5.32	48100	5.26	57700	5.18	68700	5.08
			140	-	-	-	-	-	-	-	-	-	-	36000	6.21	44100	6.18	53300	6.11	63800	6.02
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	53600	5.99	66000	5.96	80900	5.86	98400	5.72	119000	5.58	142600	5.49	169700	5.47	-	-	-	-
			90	46800	7.52	58700	7.62	72700	7.60	89100	7.48	108000	7.32	129800	7.15	154600	7.01	182800	6.94	214400	6.97
			110	-	-	-	-	64500	9.66	79400	9.65	96700	9.54	116400	9.37	138800	9.18	164300	9.00	192800	8.88
			130	-	-	-	-	-	-	-	-	83600	12.29	101200	12.20	121100	12.03	143700	11.83	169200	11.64
			140	-	-	-	-	-	-	-	-	-	-	92700	13.86	111400	13.74	132700	13.56	156700	13.35
			145	-	-	-	-	-	-	-	-	-	-	-	-	106500	14.66	127100	14.50	150400	14.30
	6000 rpm	100	70	-	-	108400	10.28	131500	10.28	159000	10.22	191200	10.18	228600	10.25	271500	10.52	-	-	-	-
			90	-	-	98600	13.31	121000	13.45	147300	13.40	177900	13.27	213100	13.13	253500	13.08	299400	13.20	351300	13.58
			110	-	-	-	-	108000	16.80	131900	16.93	159800	16.85	191800	16.66	228600	16.44	270500	16.28	317900	16.26
			130	-	-	-	-	-	-	-	-	137000	20.79	164800	20.69	197000	20.46	233800	20.17	275800	19.90
			140	-	-	-	-	-	-	-	-	-	-	149500	22.85	179100	22.66	213200	22.37	252300	22.04
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VZH170BG	1500 rpm	25	70	-	-	41700	3.30	50400	3.16	60500	3.03	72300	2.89	85800	2.73	101400	2.54	-	-	-	-
			90	-	-	35800	4.56	44100	4.42	53700	4.29	64800	4.16	77500	4.02	92100	3.88	108700	3.71	127500	3.50
			110	-	-	-	-	37600	5.86	46400	5.74	56600	5.62	68400	5.52	81900	5.41	97300	5.29	114800	5.15
			130	-	-	-	-	-	-	-	-	47700	7.49	58300	7.41	70600	7.34	84600	7.27	100600	7.20
			140	-	-	-	-	-	-	-	-	-	-	53000	8.57	64600	8.52	77900	8.48	93200	8.43
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	77200	8.57	95400	8.41	117000	8.25	142700	8.07	172800	7.85	207800	7.57	248200	7.23	-	-	-	-
			90	68100	10.89	85300	10.77	105500	10.65	129300	10.52	157100	10.38	189300	10.20	226500	9.96	269000	9.65	317300	9.26
			110	-	-	-	-	93300	13.58	114800	13.49	139800	13.39	168800	13.27	202300	13.12	240800	12.91	284700	12.64
			130	-	-	-	-	-	-	-	-	120600	17.23	146000	17.15	175500	17.05	209600	16.92	248700	16.73
			140	-	-	-	-	-	-	-	-	-	-	134000	19.50	161400	19.41	193300	19.31	230000	19.16
			145	-	-	-	-	-	-	-	-	-	-	-	-	154500	20.71	185300	20.62	220900	20.48
	6000 rpm	100	70	-	-	159000	15.00	194900	15.13	237100	15.11	286400	14.88	343600	14.39	409300	13.59	-	-	-	-
			90	-	-	142700	18.46	176700	18.72	216500	18.90	262800	18.96	316300	18.83	377800	18.47	448000	17.83	527600	16.85
			110	-	-	-	-	156700	23.23	193100	23.47	235400	23.66	284300	23.75	340600	23.68	405000	23.41	478200	22.87
			130	-	-	-	-	-	-	-	-	203700	29.60	247200	29.75	297400	29.83	355300	29.77	421500	29.54
			140	-	-	-	-	-	-	-	-	-	-	227200	33.36	274300	33.45	328800	33.45	391500	33.31
			145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

To: Evaporating temperature in °F
Tc: Condensing temperature in °F
Qo: Cooling capacity in Btu

Superheat = 11.1 K
Subcooling = 8.3 K
Pe: Power input in kW

Presented data are for models with motor voltage code G

Capacity at EN12900 rating conditions - Low pressure ratio - VZH088BH - VZH117BH - VZH170BH

Models	rpm	rps	To	-13	-10	0	10	20	30	40	50	59
			Tc	Qo	Qo	Qo	Qo	Qo	Qo	Qo	Qo	Qo
VZH088BG	1500 rpm	25	70	-	-	22200	27400	33500	40600	48900	-	-
			90	-	-	18700	23500	29100	35600	43200	51900	60900
			110	-	-	-	19500	24600	30500	37400	45400	53500
			130	-	-	-	-	-	25100	31300	38400	45700
			140	-	-	-	-	-	-	28000	34600	41500
			145	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	37300	40000	50400	63000	78100	95800	116500	-	-
			90	32200	34800	44500	56200	70000	86200	105000	126600	148600
			110	-	-	-	49200	61600	76000	92800	112000	131600
			130	-	-	-	-	-	64300	78800	95500	112500
			140	-	-	-	-	-	-	70800	86100	101900
			145	-	-	-	-	-	-	66500	81100	96200
	6000 rpm	100	70	-	-	82400	102000	125600	153600	186400	-	-
			90	-	-	74500	93200	115500	141600	172100	207400	243500
			110	-	-	-	82000	101900	125400	152700	184400	216900
			130	-	-	-	-	-	104800	128100	155300	183400
			140	-	-	-	-	-	-	113800	138400	164000
			145	-	-	-	-	-	-	-	-	-
VZH117BG	1500 rpm	25	70	-	-	29800	36800	45000	54500	65600	-	-
			90	-	-	25100	31500	39100	47800	58000	69700	81700
			110	-	-	-	26200	33000	41000	50200	60900	71800
			130	-	-	-	-	-	33700	41900	51500	61300
			140	-	-	-	-	-	-	37500	46500	55700
			145	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	50100	53700	67600	84500	104800	128600	156400	-	-
			90	43300	46700	59800	75400	94000	115700	140900	169900	199500
			110	-	-	-	66000	82700	102100	124500	150300	176700
			130	-	-	-	-	-	86300	105700	128100	151100
			140	-	-	-	-	-	-	95000	115600	136700
			145	-	-	-	-	-	-	89200	108900	129100
	6000 rpm	100	70	-	-	110500	136900	168600	206200	250200	-	-
			90	-	-	100000	125100	155000	190100	231000	278400	326800
			110	-	-	-	110000	136800	168300	205000	247500	291200
			130	-	-	-	-	-	140600	172000	208500	246200
			140	-	-	-	-	-	-	152700	185800	220200
			145	-	-	-	-	-	-	-	-	-
VZH170BG	1500 rpm	25	70	-	-	42500	52300	63900	77500	93500	-	-
			90	-	-	36400	45600	56400	69100	84000	101100	118700
			110	-	-	-	38500	48400	59900	73400	89000	105100
			130	-	-	-	-	-	49600	61500	75400	89800
			140	-	-	-	-	-	-	55000	67900	81400
			145	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	72200	77500	97800	122500	152100	187300	228600	-	-
			90	62900	67900	86800	109500	136600	168700	206300	250100	295200
			110	-	-	-	95500	119500	147900	181400	220400	260800
			130	-	-	-	-	-	124400	153100	186800	222000
			140	-	-	-	-	-	-	137500	168400	200800
			145	-	-	-	-	-	-	129400	158800	189700
	6000 rpm	100	70	-	-	163000	203700	252300	309700	377000	-	-
			90	-	-	145400	183400	228600	281900	344200	416500	490900
			110	-	-	-	160500	201200	249100	305300	370600	438100
			130	-	-	-	-	-	210500	259500	316800	376300
			140	-	-	-	-	-	-	233700	286600	341800
			145	-	-	-	-	-	-	-	-	-

To: Evaporating temperature in °F
Tc: Condensing temperature in °F
Qo: Cooling capacity in Btu

Superheat = 10 K
Subcooling = 0 K
Pe: Power input in kW

Presented data are for models with motor voltage code G

Capacity at ARI rating conditions - Low pressure ratio - VZH088BH - VZH117BH - VZH170BH

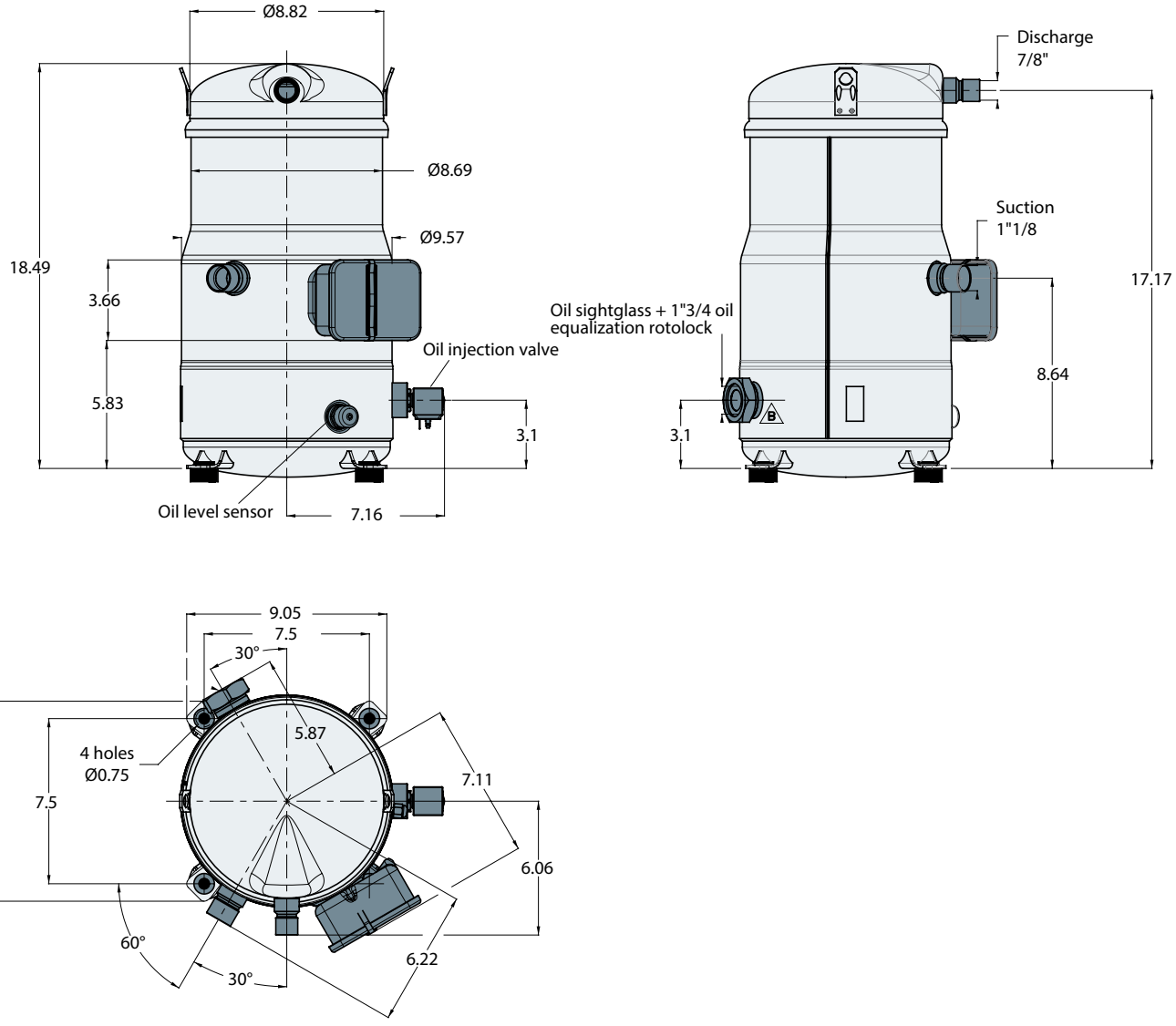
Models	rpm	rps	To	-13	-10	0	10	20	30	40	50	59
			Tc	Qo	Qo	Qo	Qo	Qo	Qo	Qo	Qo	Qo
VZH088BG	1500 rpm	25	70	-	21800	26400	31800	37900	45000	53000	-	-
			90	-	18300	22700	27700	33400	39900	47400	55900	65400
			110	-	-	19000	23600	28800	34900	41700	49600	58400
			130	-	-	-	-	24100	29600	35800	43000	51200
			140	-	-	-	-	-	26800	32900	39700	47600
			145	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	39900	49200	60200	73300	88600	106300	126400	-	-
			90	34900	43700	54200	66300	80500	96700	115200	136200	159700
			110	-	-	48000	59200	72000	86700	103400	122400	143700
			130	-	-	-	-	62300	75400	90200	107100	126100
			140	-	-	-	-	-	69100	83000	98800	116700
			145	-	-	-	-	-	-	79300	94700	112100
	6000 rpm	100	70	-	80700	98000	118400	142400	170300	202300	-	-
			90	-	73500	90200	109700	132500	158800	188900	223100	261700
			110	-	-	80400	98300	119000	142900	170300	201500	236800
			130	-	-	-	-	102000	122800	146800	174200	205500
			140	-	-	-	-	-	111400	133400	158800	187900
			145	-	-	-	-	-	-	-	-	-
VZH117BG	1500 rpm	25	70	-	29200	35500	42600	50900	60300	71100	-	-
			90	-	24600	30400	37100	44800	53600	63600	75000	87800
			110	-	-	25500	31600	38700	46800	56000	66500	78400
			130	-	-	-	-	32300	39700	48100	57700	68700
			140	-	-	-	-	-	36000	44100	53300	63800
			145	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	53600	66000	80900	98400	119000	142600	169700	-	-
			90	46800	58700	72700	89100	108000	129800	154600	182800	214400
			110	-	-	64500	79400	96700	116400	138800	164300	192800
			130	-	-	-	-	83600	101200	121100	143700	169200
			140	-	-	-	-	-	92700	111400	132700	156700
			145	-	-	-	-	-	-	106500	127100	150400
	6000 rpm	100	70	-	108400	131500	159000	191200	228600	271500	-	-
			90	-	98600	121000	147300	177900	213100	253500	299400	351300
			110	-	-	108000	131900	159800	191800	228600	270500	317900
			130	-	-	-	-	137000	164800	197000	233800	275800
			140	-	-	-	-	-	149500	179100	213200	252300
			145	-	-	-	-	-	-	-	-	-
VZH170BG	1500 rpm	25	70	-	41700	50400	60500	72300	85800	101400	-	-
			90	-	35800	44100	53700	64800	77500	92100	108700	127500
			110	-	-	37600	46400	56600	68400	81900	97300	114800
			130	-	-	-	-	47700	58300	70600	84600	100600
			140	-	-	-	-	-	53000	64600	77900	93200
			145	-	-	-	-	-	-	-	-	-
	3600 rpm	60	70	77200	95400	117000	142700	172800	207800	248200	-	-
			90	68100	85300	105500	129300	157100	189300	226500	269000	317300
			110	-	-	93300	114800	139800	168800	202300	240800	284700
			130	-	-	-	-	120600	146000	175500	209600	248700
			140	-	-	-	-	-	134000	161400	193300	230000
			145	-	-	-	-	-	-	154500	185300	220900
	6000 rpm	100	70	-	159000	194900	237100	286400	343600	409300	-	-
			90	-	142700	176700	216500	262800	316300	377800	448000	527600
			110	-	-	156700	193100	235400	284300	340600	405000	478200
			130	-	-	-	-	203700	247200	297400	355300	421500
			140	-	-	-	-	-	227200	274300	328800	391500
			145	-	-	-	-	-	-	-	-	-

To: Evaporating temperature in °F
Tc: Condensing temperature in °F
Qo: Cooling capacity in Btu

Superheat = 11.1 K
Subcooling = 8.3 K
Pe: Power input in kW

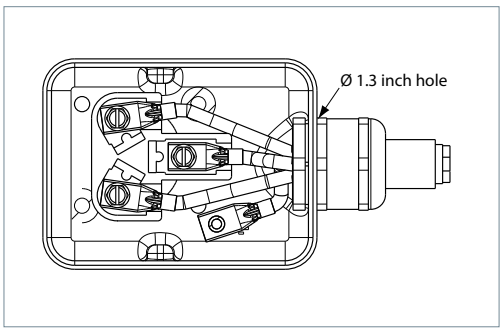
Presented data are for models with motor voltage code G

VZH088 -G/H unified version

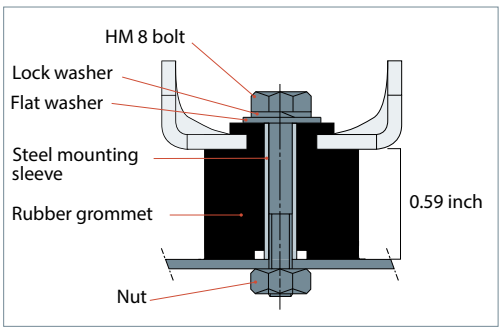


All dimensions in inch

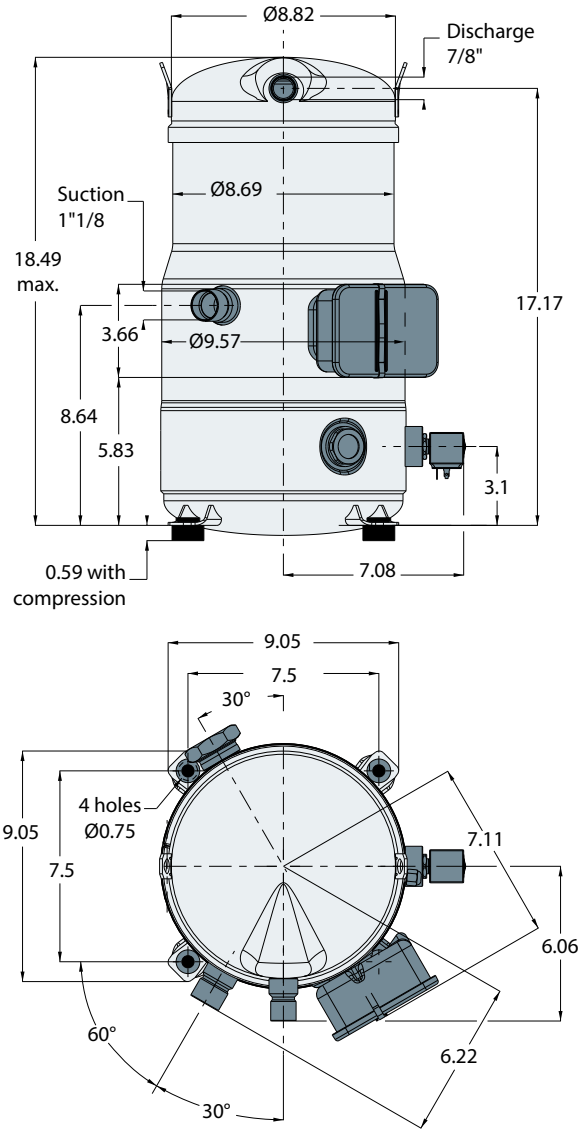
Electrical box



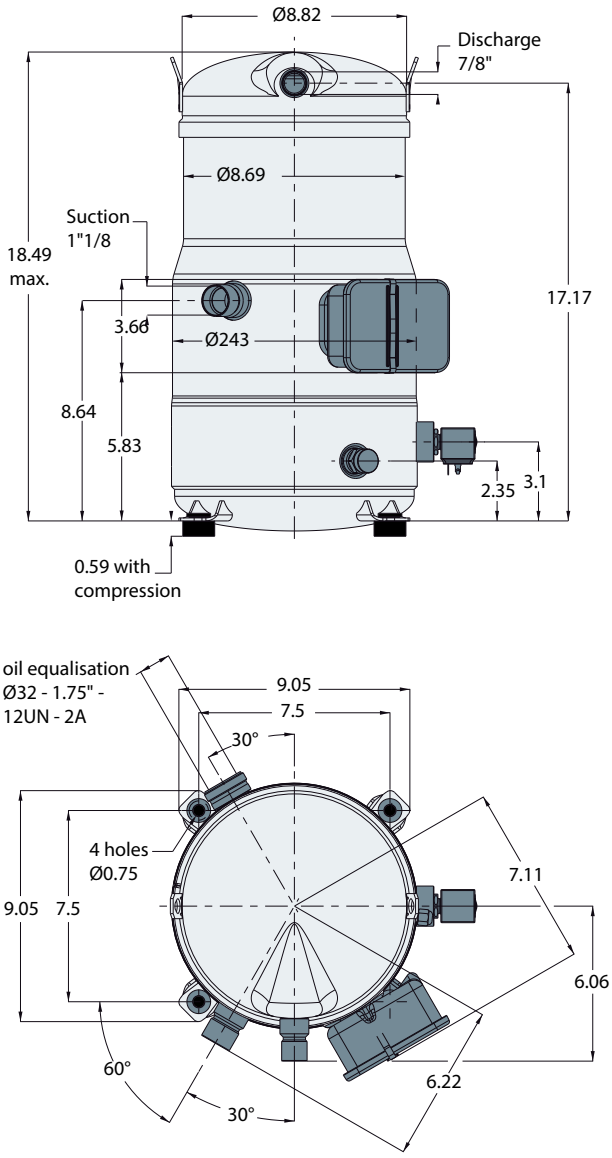
Grommet



VZH088-G/H single version

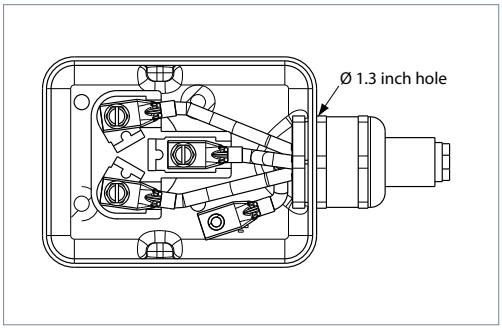


VZH088-G/H manifolded version

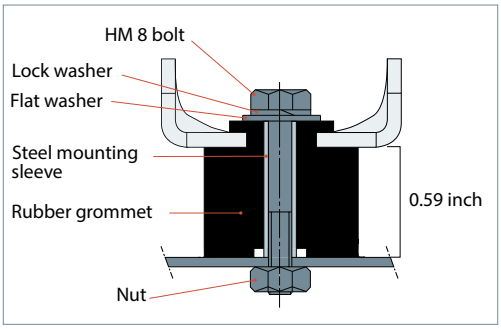


All dimensions in inch

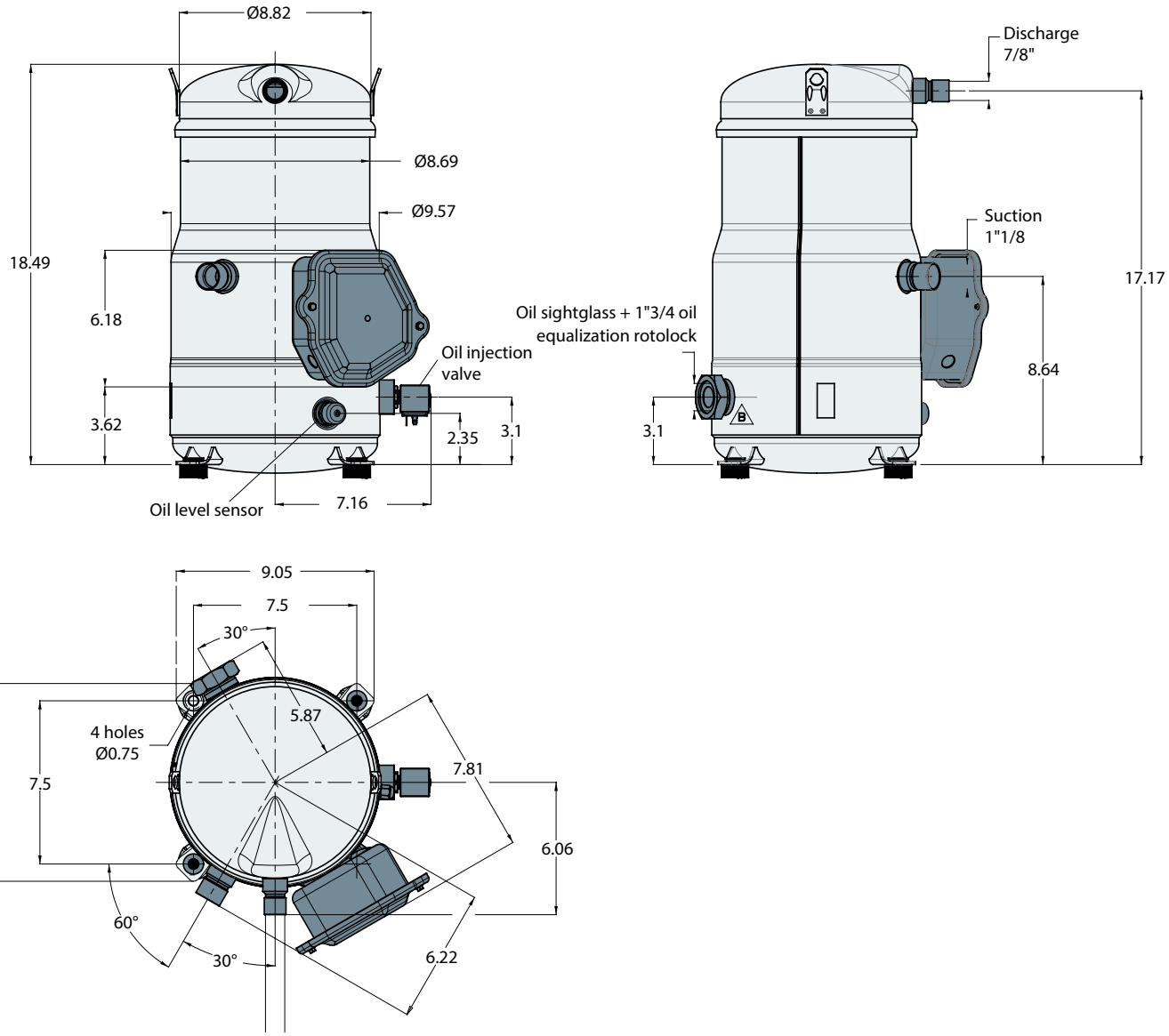
Electrical box



Grommet

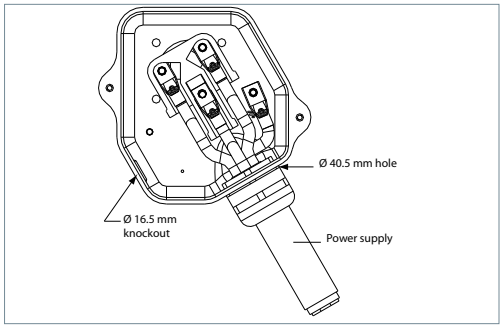


VZH088-J unified version

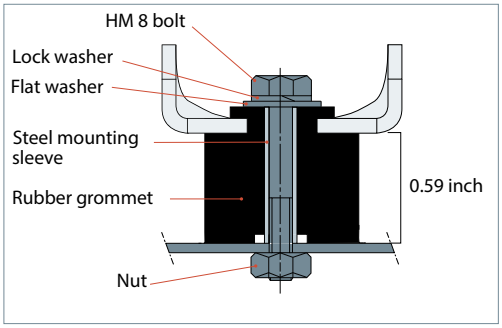


All dimensions in inch

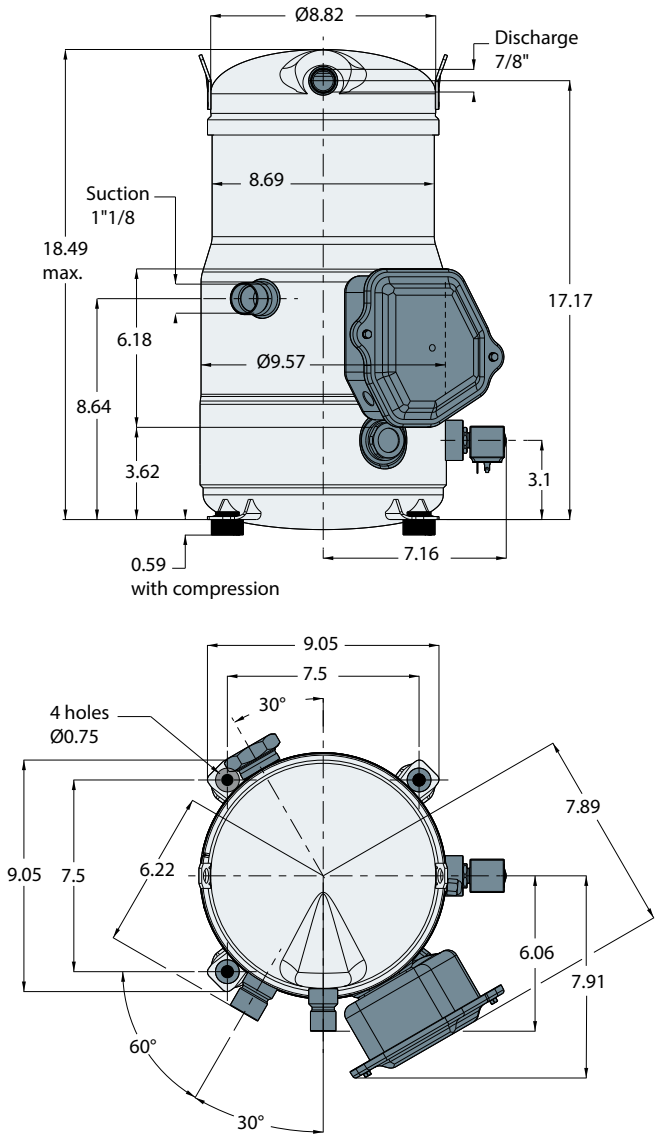
Electrical box



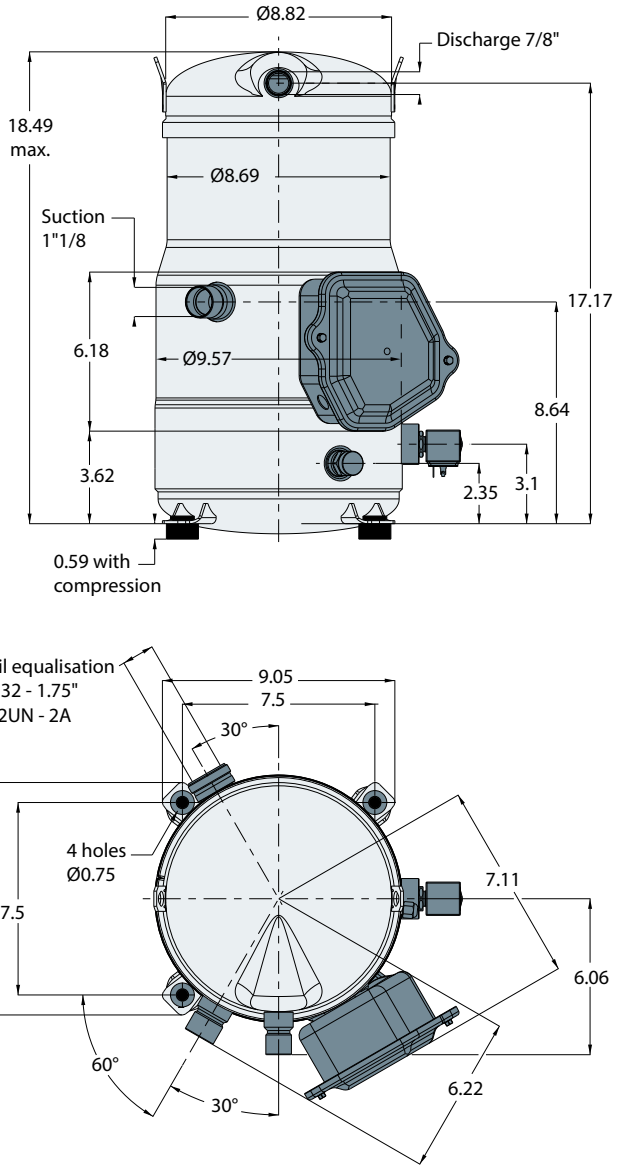
Grommet



VZH088-J single version

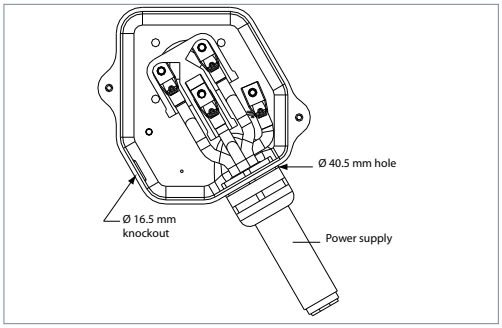


VZH088-J manifolded version

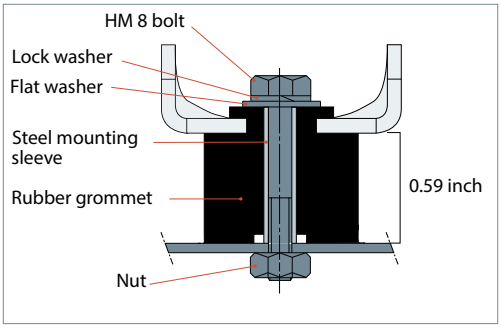


All dimensions in inch

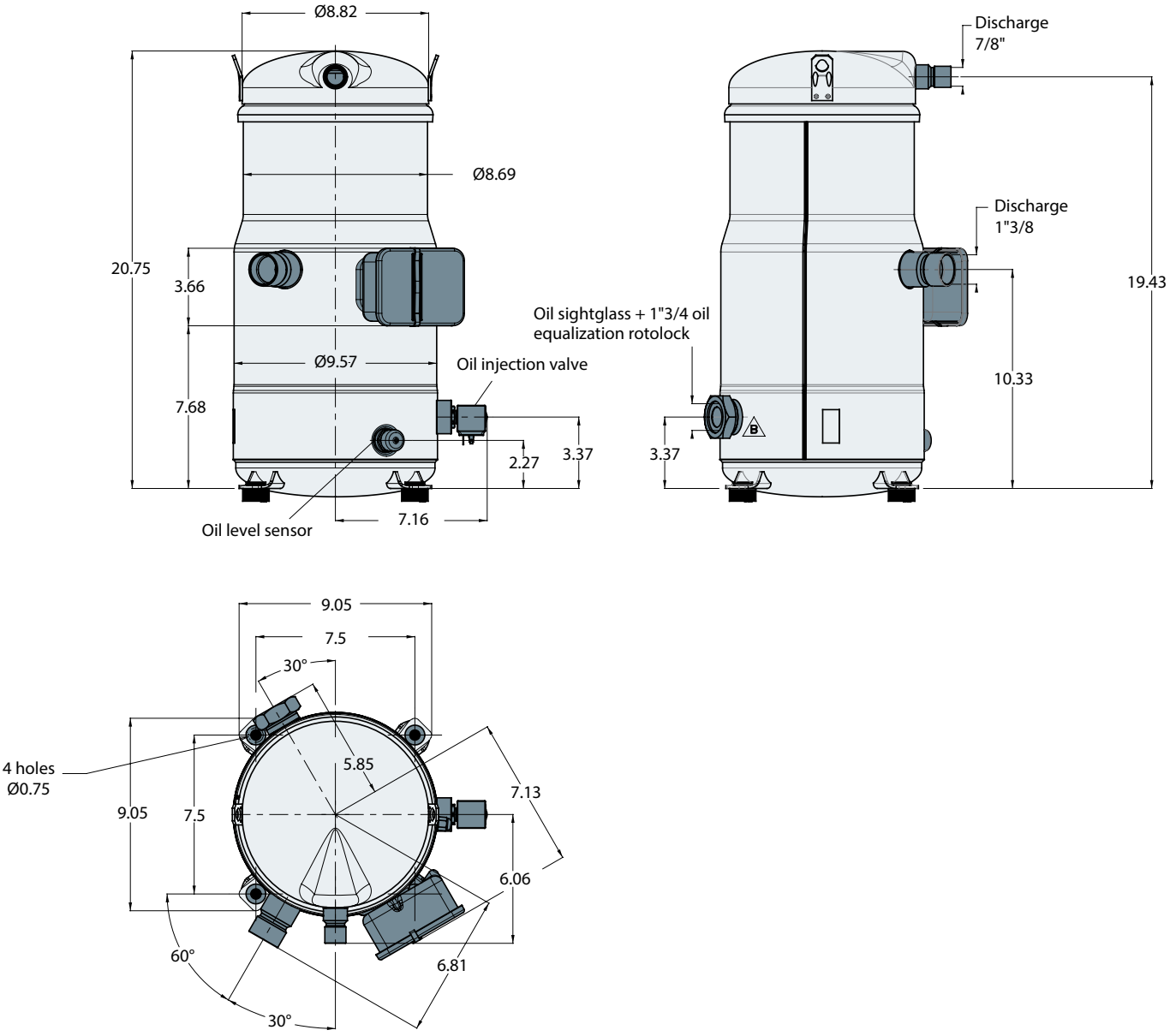
Electrical box



Grommet

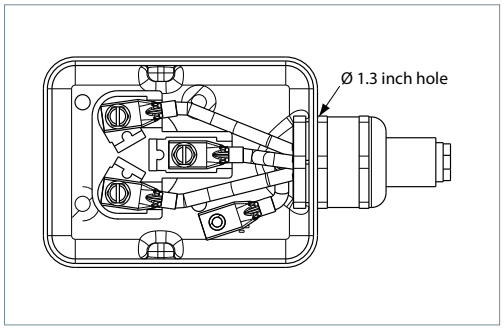


VZH117-G/H unified version

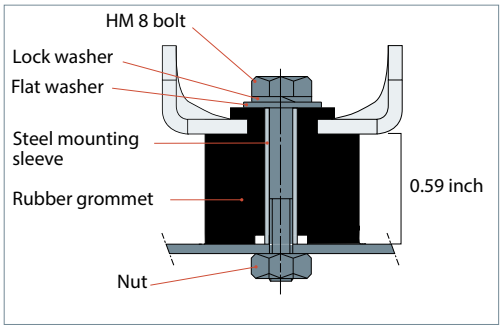


All dimensions in inch

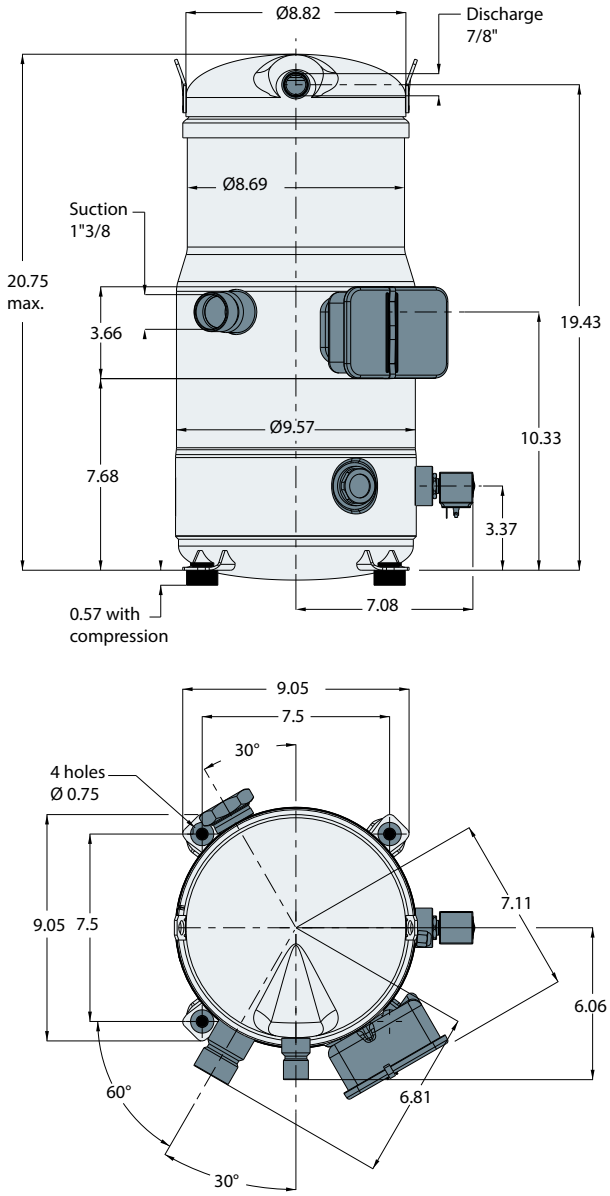
Electrical box



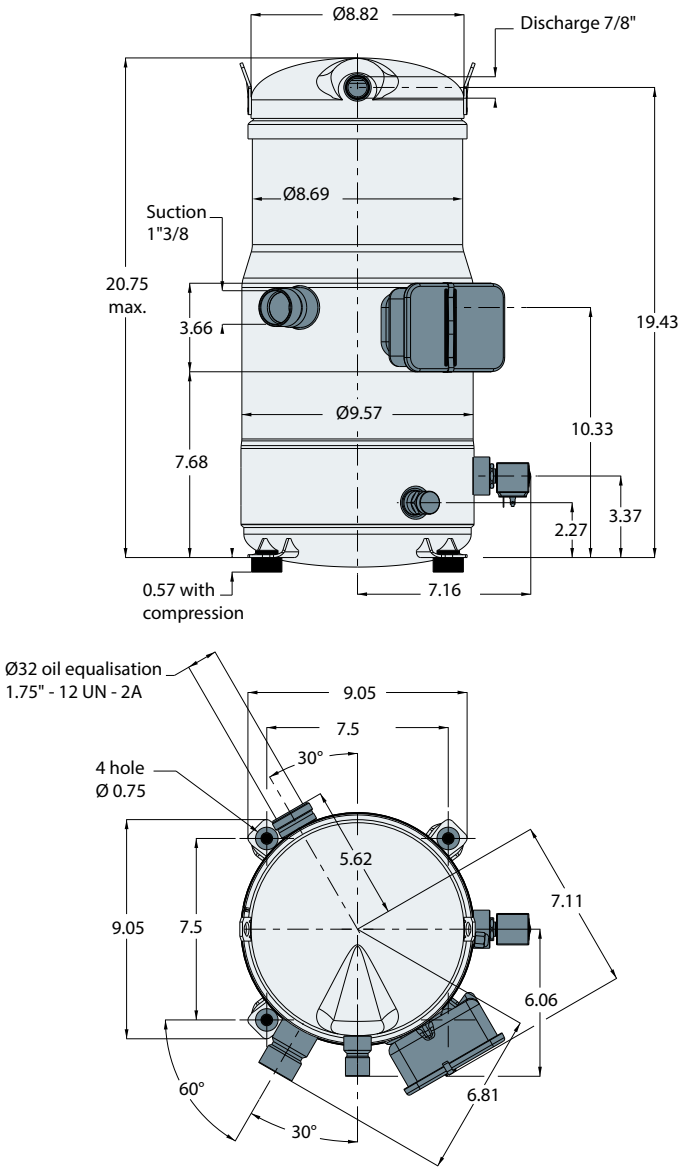
Grommet



VZH117-G/H single version

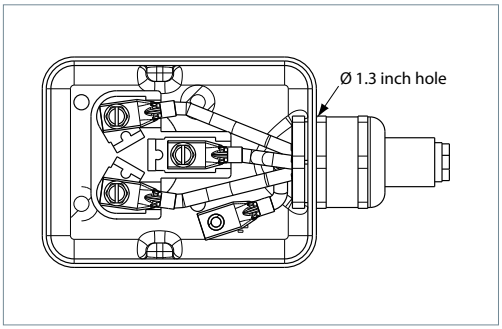


VZH117-G/H manifolded version

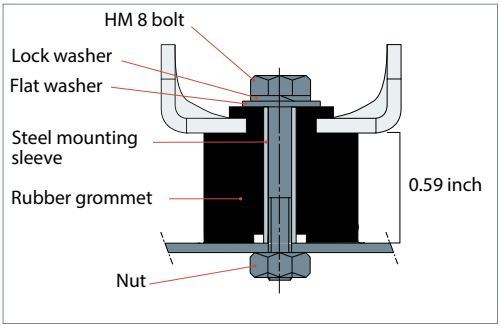


All dimensions in inch

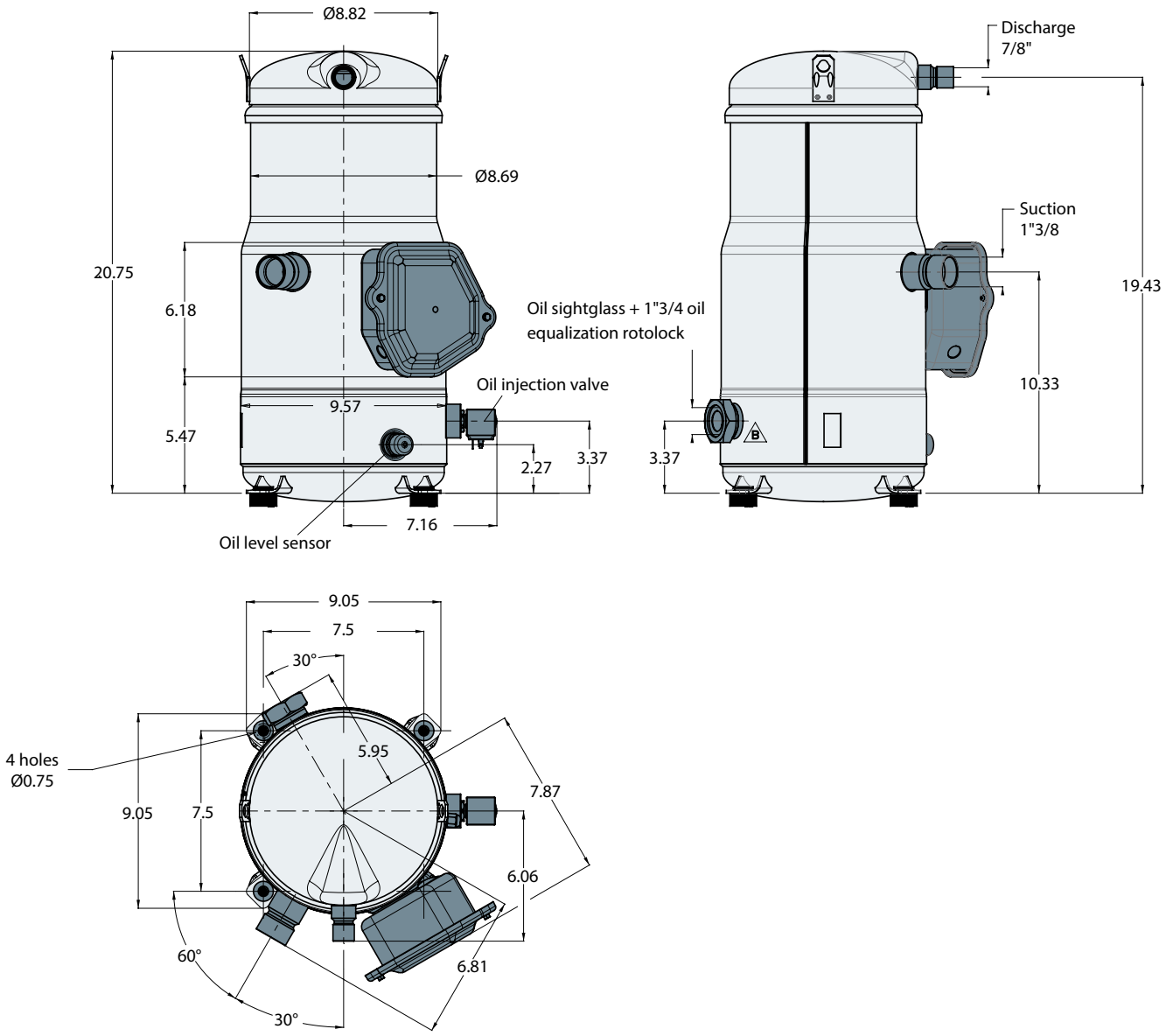
Electrical box



Grommet

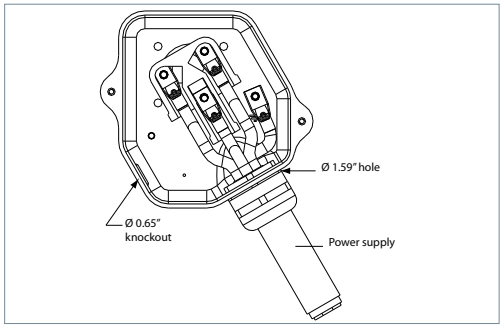


VZH117-J unified version

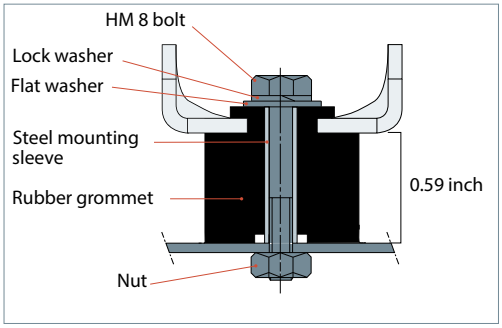


All dimensions in inch

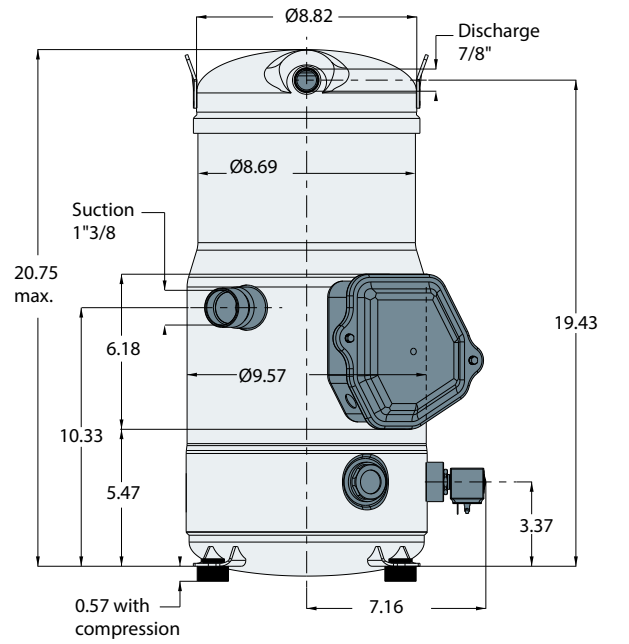
Electrical box

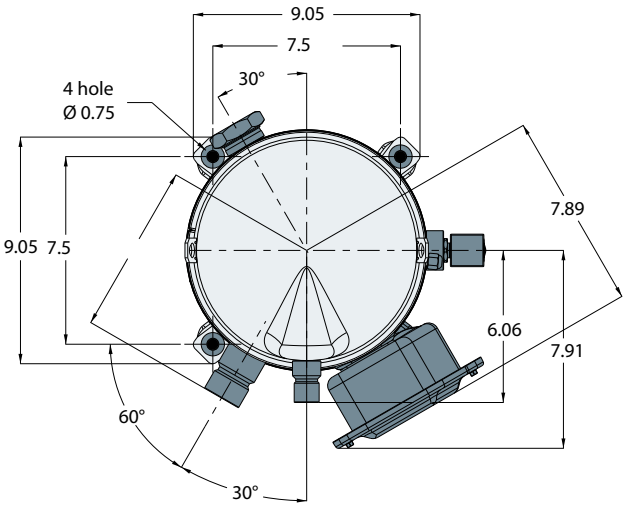


Grommet

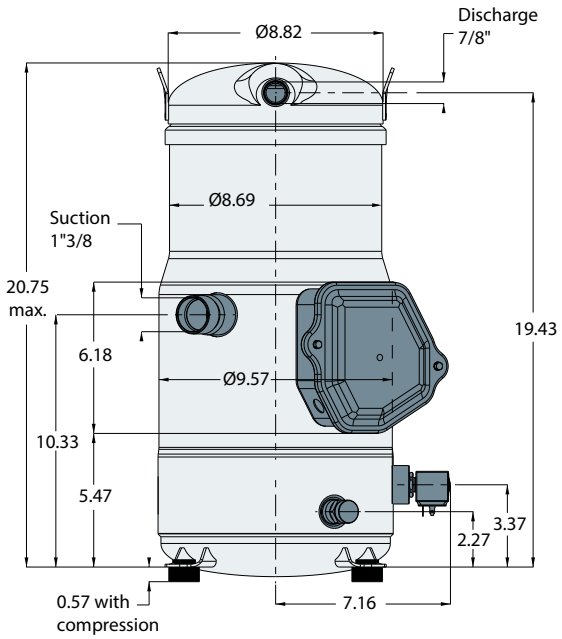


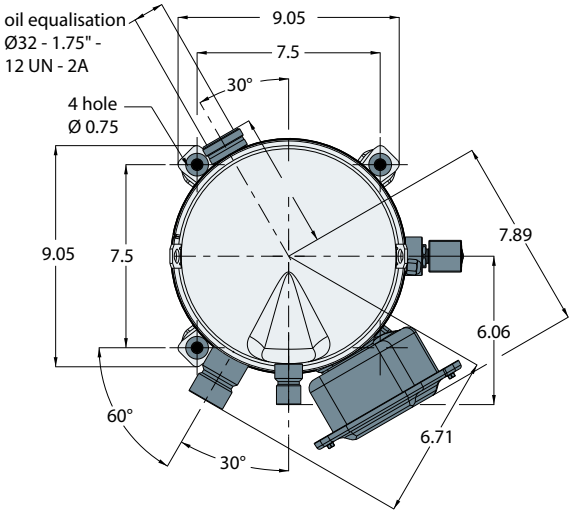
VZH117-J single version





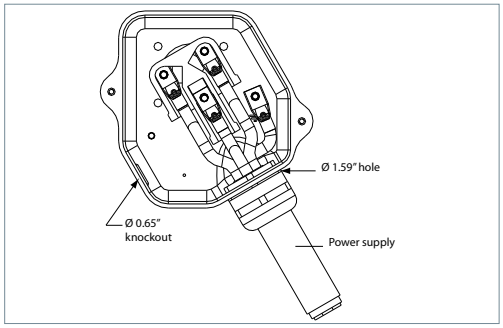
VZH117-J manifolded version



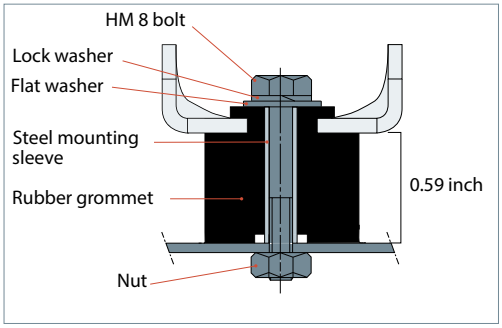


All dimensions in inch

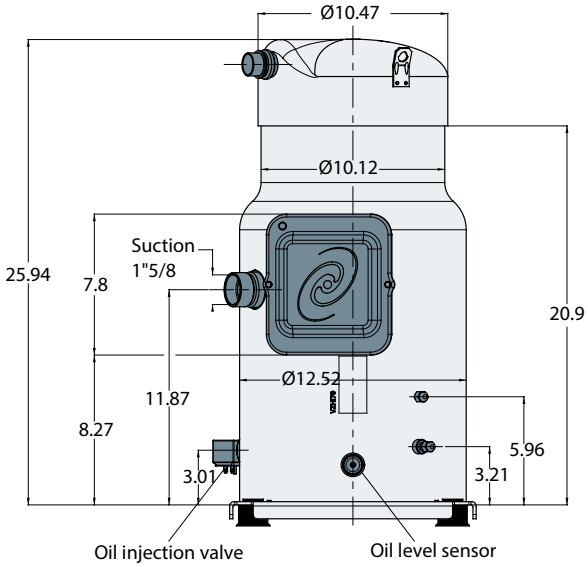
Electrical box

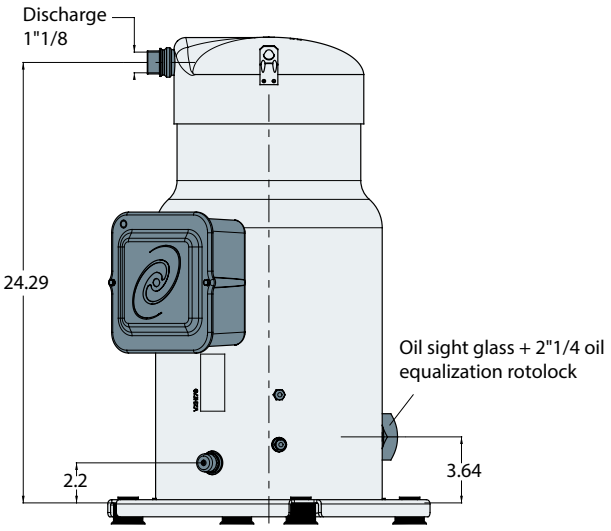


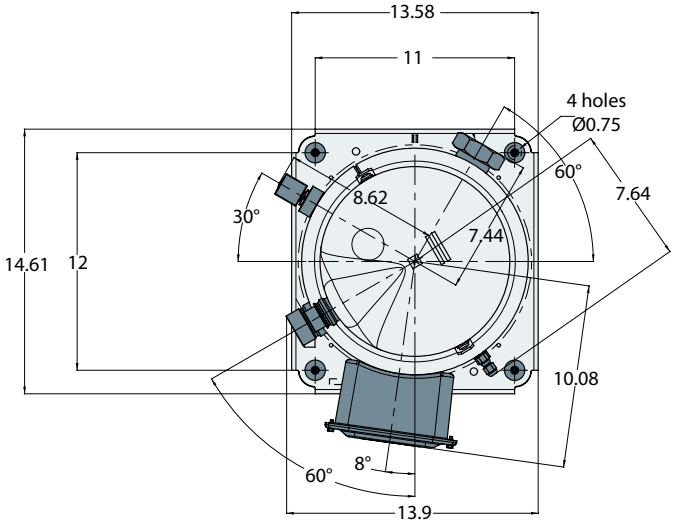
Grommet



VZH170-G/H unified version

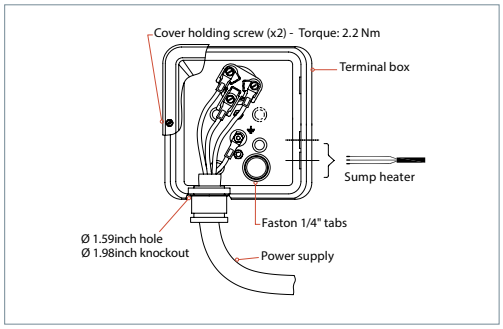




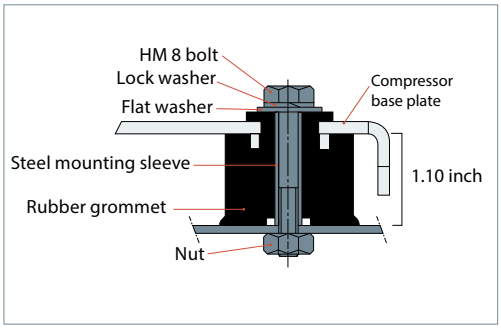


All dimensions in inch

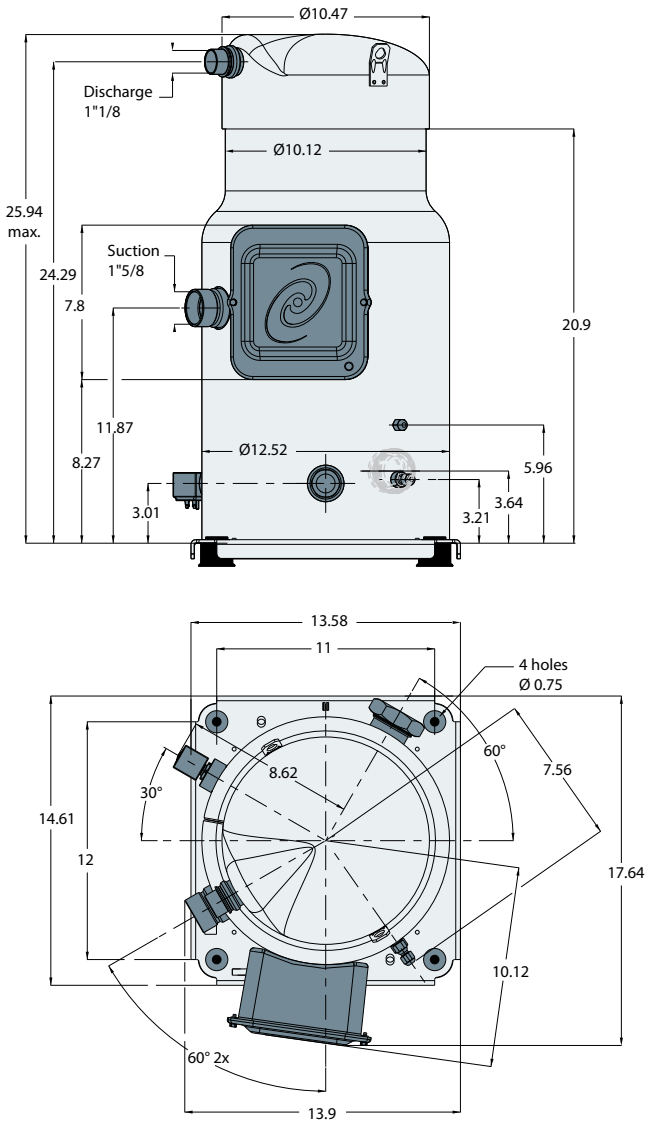
Electrical box



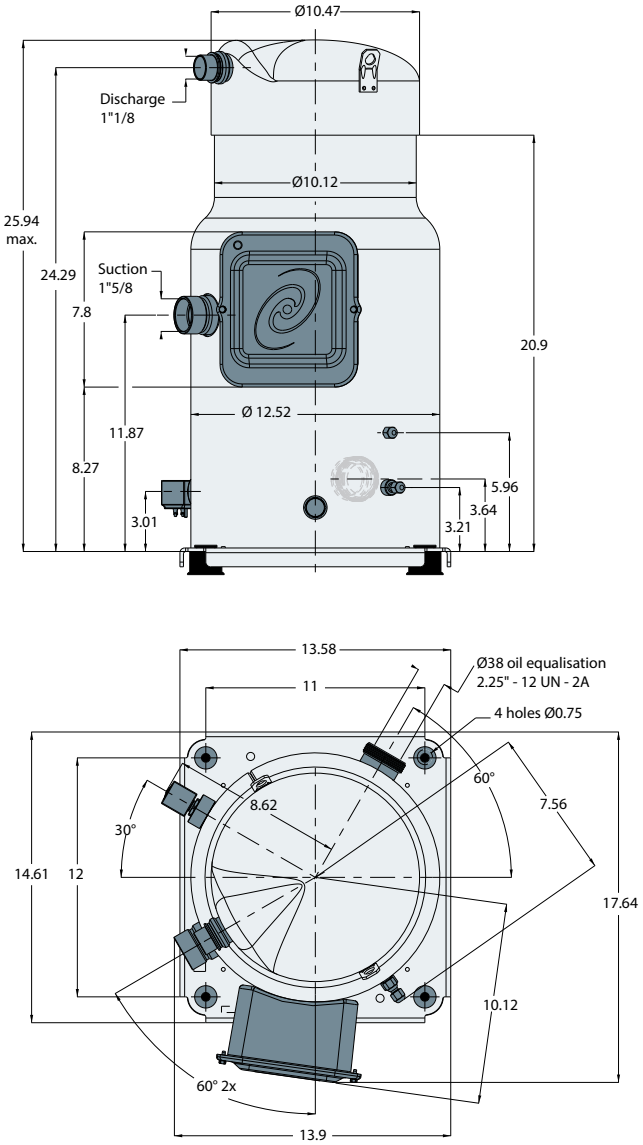
Grommet



VZH170-G/H single version

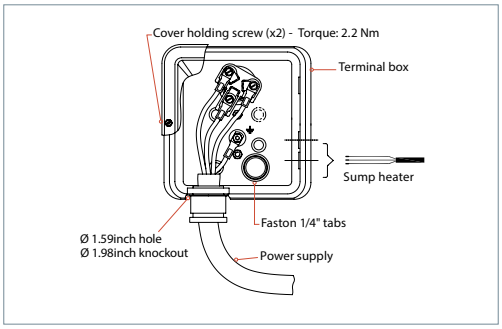


VZH170-G/H manifolded version

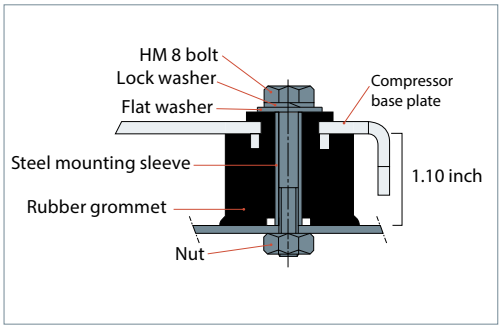


All dimensions in inch

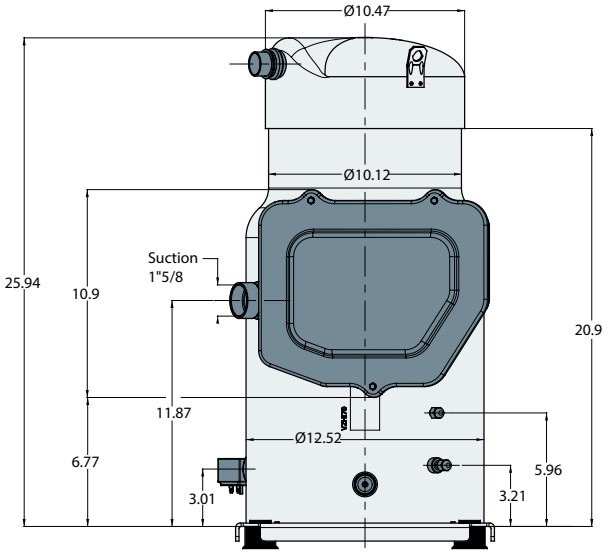
Electrical box

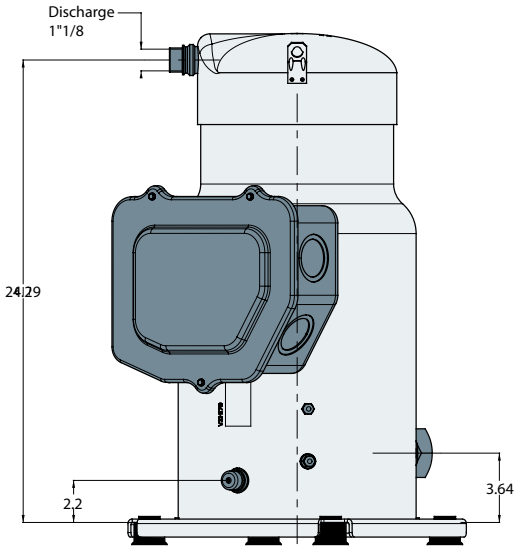


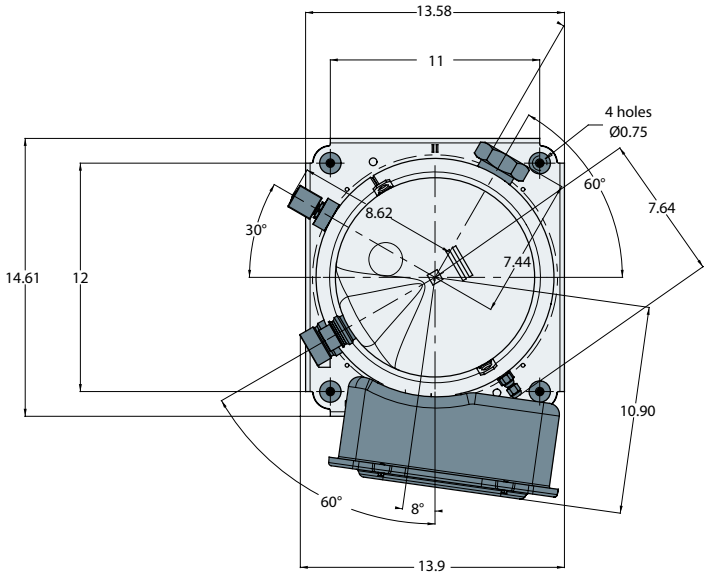
Grommet



VZH170-J unified version

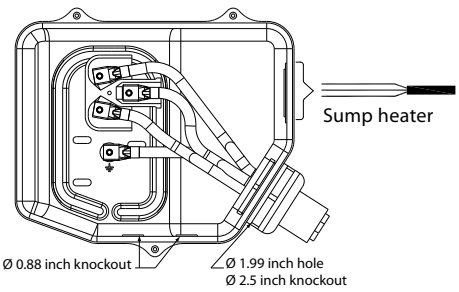




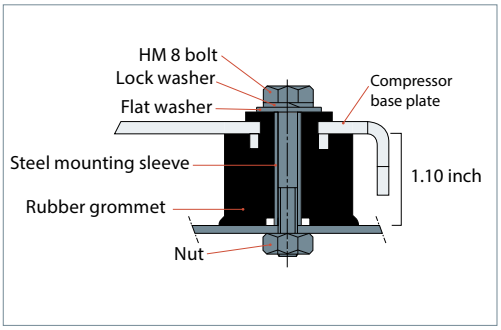


All dimensions in inch

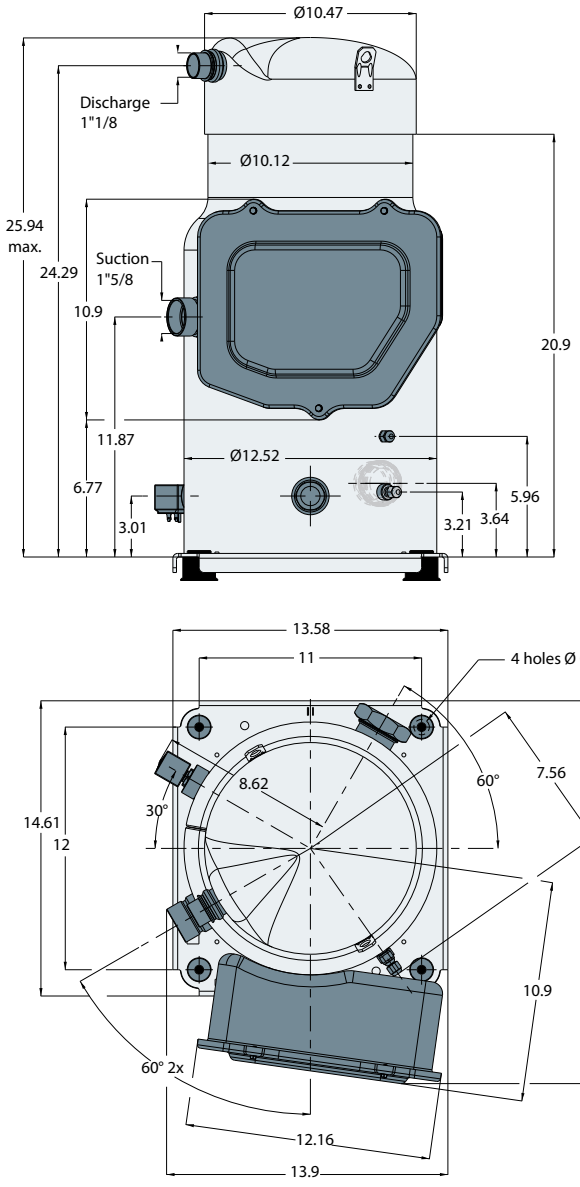
Electrical box



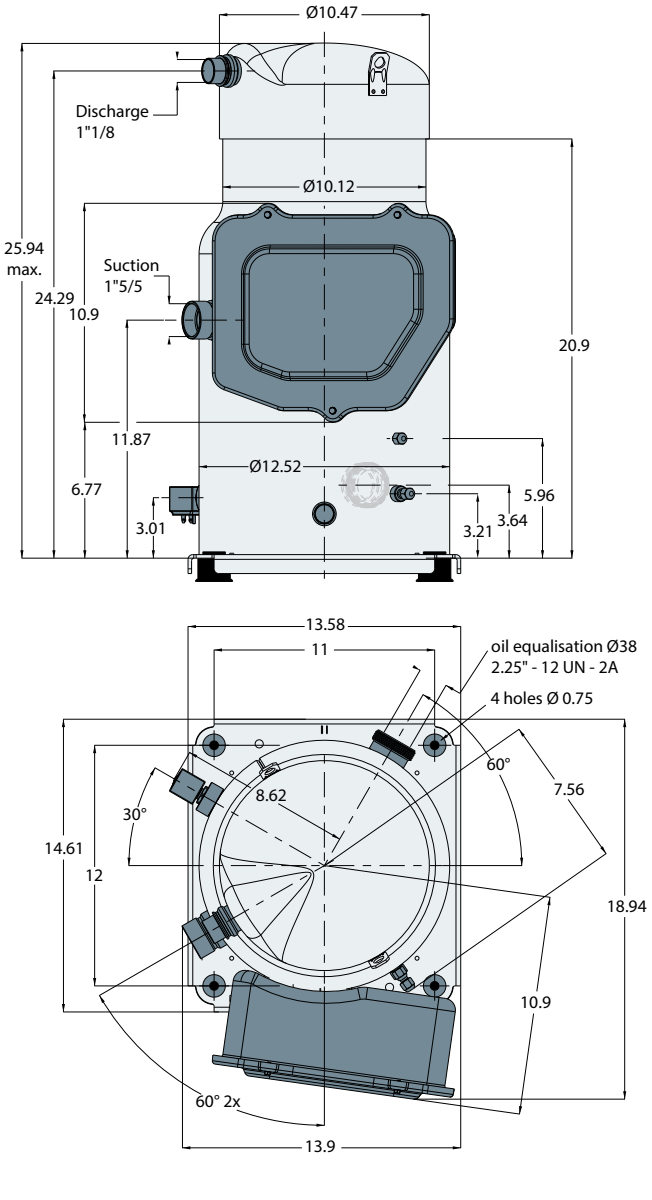
Grommet



VZH170-J single version

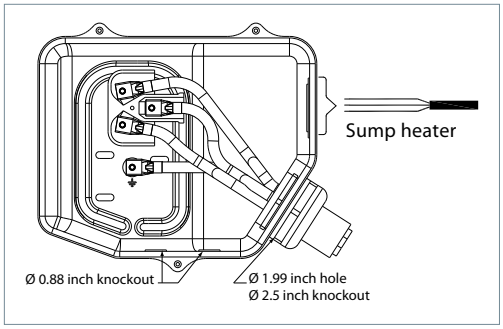


VZH170-J manifolded version

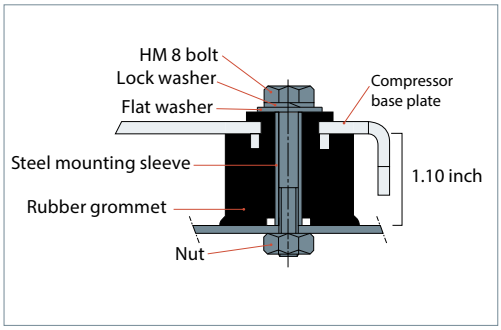


All dimensions in inch

Electrical box



Grommet



Sight glass / oil level switch

VZH compressors single versions come equipped with a threaded oil sight glass with 1"1/8 – 18 UNEF connection. It can be used for visual check of oil amount and conditions.

VZH compressors manifold versions come equipped with a screw-in optical part on oil level switch port located below the electrical box.

Danfoss also provides VZH compressors unified versions. These version compressors come equipped with both a threaded oil sight glass to the oil equalization port and an oil level switch.

The oil sight glass is located on the opposite side of the electrical box and customers could do visual check through the oil sight glass. The screw-in part of oil level switch is located below the electrical box. As to the oil level switch, if the unified version is used for single application and customers still would like to use oil level switch function for better oil control, customers need to order 120Z0561 or 120Z0562 to get the electrical part. If it is for manifolding application, then tandem accessory kit is provided, please refer to VZH hybrid manifold guideline (FRCC.PC.049) to select the right kits.

Schrader

The oil fill connection and gauge port is a 1/4" male flare connector incorporating a schrader valve.

Oil equalisation connection

VZH compressors are equipped with rotolock oil equalisation connection. This connection is used when compressors are mounted in parallel. Contact Danfoss for further details and refer to the VZH hybrid manifold guideline (FRCC.PC.049).

While for a VZH unified version compressor, the oil sight glass fitting is pre-installed on the equalization port. For use in hybrid manifold applications, the threaded oil sight glass needs

	Oil equalization
VZH088	Rotolock 1"3/4
VZH117	Rotolock 1"3/4
VZH170	Rotolock 2"1/4

to be removed in order to connect the oil equalization line. An additional rotolock nut needs to be ordered (sales code 8153124 or 8153126).

Oil drain fitting

VZH170 are equipped with oil drain connection. This connection is a female 1/4" NPTF flare fitting, which allows oil to be removed for testing, replacement etc…

This fitting contains an internal extension tube in order to collect the oil at the bottom of the oil sump.

VZH088 and VZH117 are not equipped with oil drain fitting.

Suction & discharge connections

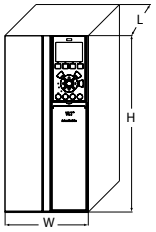
VZH compressors are all delivered with suction and discharge brazed connections only. They are copper platted steel connections.

Rotolock adaptors are available, refer to section "Accessories".

	Suction	Discharge
VZH088	1" 1/8	7/8"
VZH117	1" 3/8	7/8"
VZH170	1" 5/8	1"1/8

Frequency converter dimensions

Frequency converter dimensions depend on supply voltage, IP rating and power. The below table gives an overview of the overall dimensions and different drive enclosures (B1 - C3). Details for each drive enclosure are on the following pages.




B1/B2


B3


B4/C1/C3

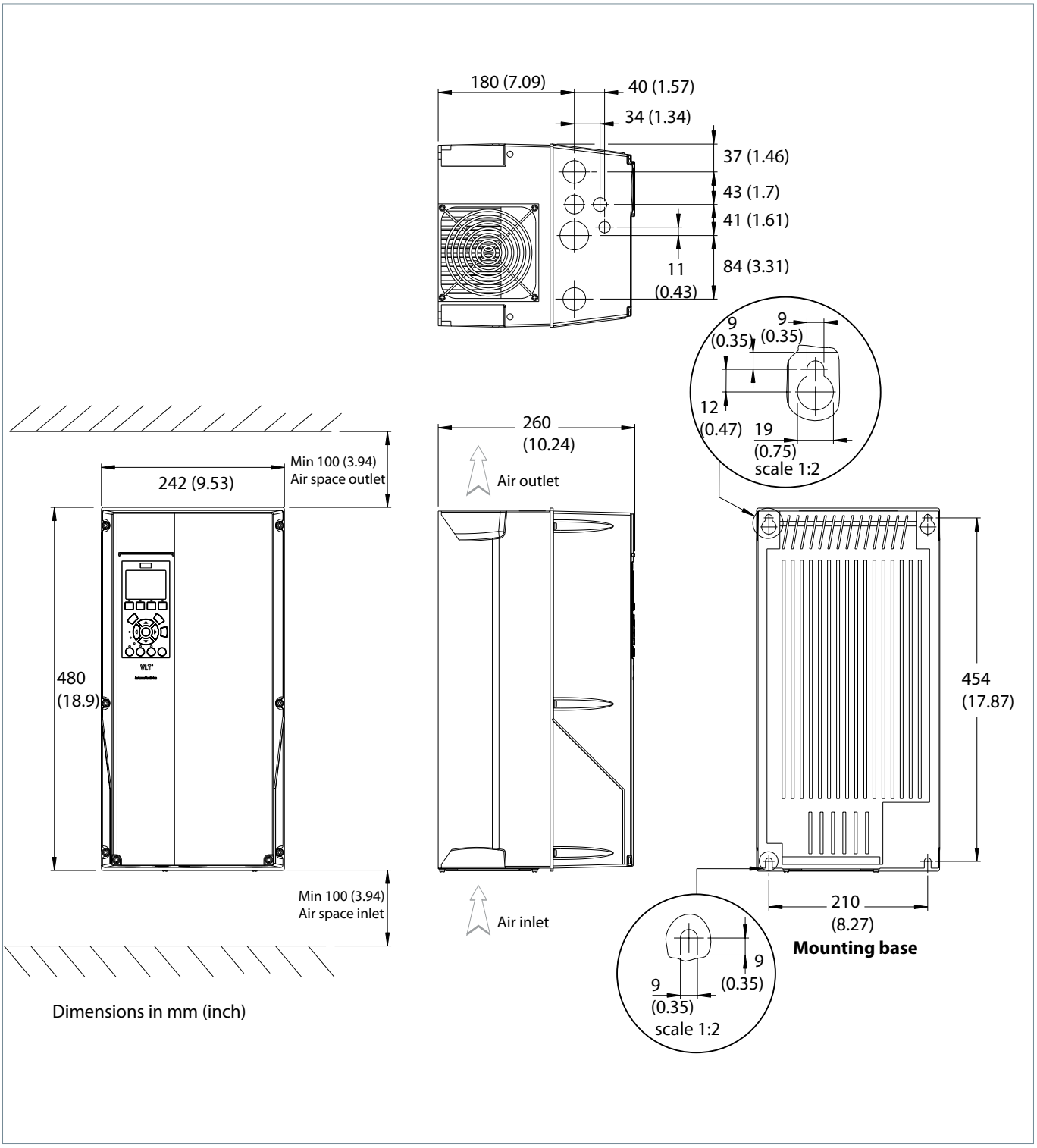
Bracket

Drive supply voltage	Drive power kW	Compressor voltage code	Compressor model	IP20			IP55		
				Drive enclosure	Overall drive size (H x W x L) inch	bracket supplied (mm^2)	Drive enclosure	Overall drive size (H x W x L) inch	bracket supplied (mm^2)
T2: 200-240/3/50-60	15	J	VZH088	B4	23.43x9.09x9.53	2pcs, ø24-28k28b 1pcs, ø32-36 k36b	C1	26.78x12.13x12.20	1pcs, ø32-36 k36b 1pcs, ø36-40 k40b
	18.5		VZH117	C3	24.8x12.13x13.15	1pcs, ø32-36 k36b 1pcs, ø36-40 k40b	C1	26.78x12.13x12.20	1pcs, ø32-36 k36b 1pcs, ø36-40 k40b
	22		VZH170	C3	24.8x12.13x13.15	1pcs, ø32-36 k36b 1pcs, ø36-40 k40b	C1	26.78x12.13x12.20	1pcs, ø32-36 k36b 1pcs, ø36-40 k40b
T4: 380-480/3/50-60	15	G	VZH088	B3	16.5x6.5x9.76	3pcs, Ø13-22	B1	18.9x9.45x10.24	3pcs, ø3-32
	18.5		VZH117	B4	23.42x9.09x9.53	2pcs, ø24-28 k28b	B2	25.6x9.53x10.24	3pcs, ø3-32
	22		VZH170	B4	23.42x9.09x9.53	2pcs, ø24-28 k28b	B2	25.6x9.53x10.24	3pcs, ø14-40
T6: 525-600/3/50-60	18	H	VZH088	B4	23.42x9.09x9.53	2pcs, ø24-28 k28b	-	-	-
	30		VZH117	B4	23.42x9.09x9.53	2pcs, ø24-28 k28b	-	-	-
	30		VZH170	B4	23.42x9.09x9.53	2pcs, ø24-28 k28b	-	-	-

For customers who needs other size brackets, please refer to accessories for ordering.

CDS303 frequency converter - enclosure B1

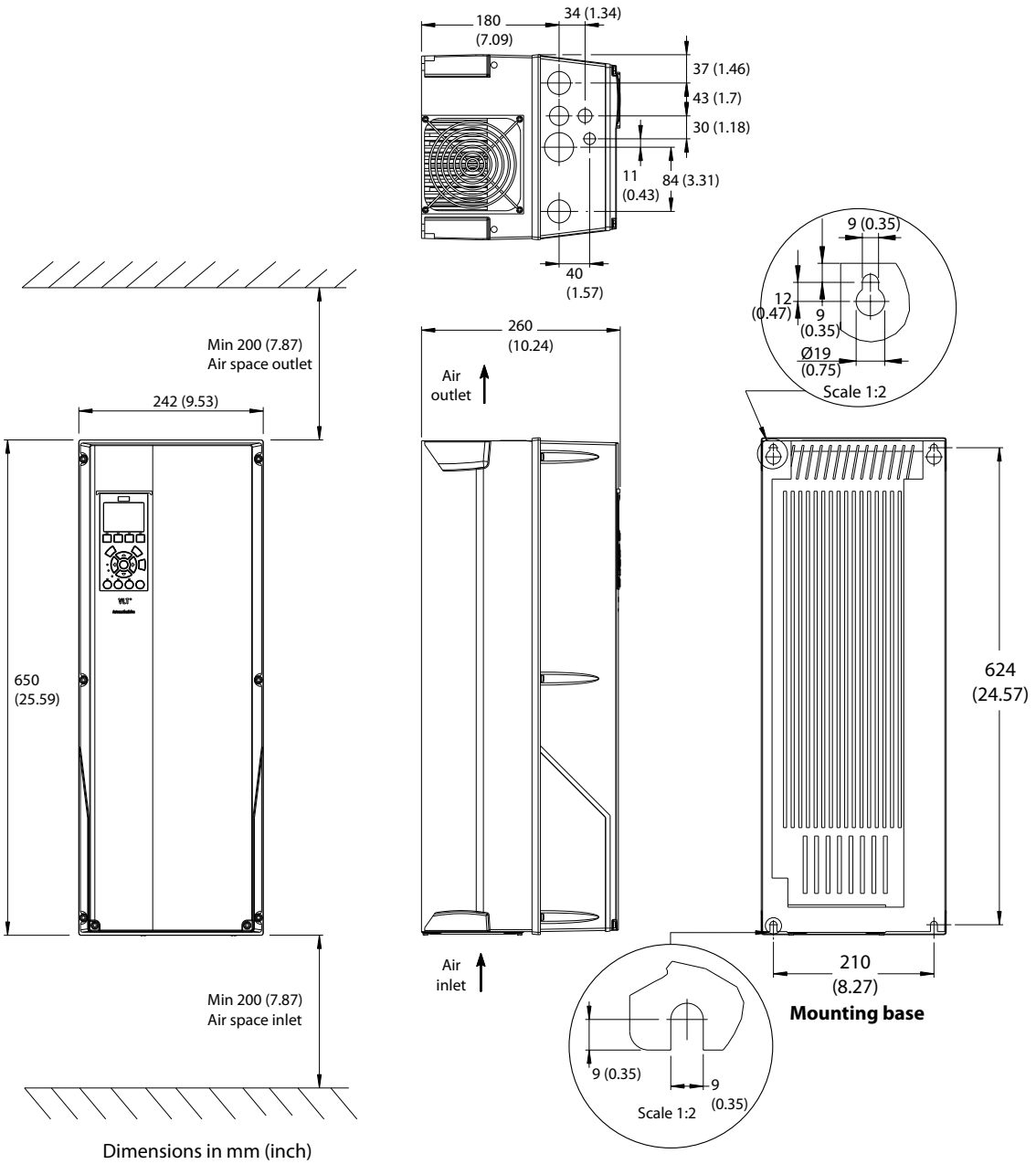
380-480 Volts - 15 kW - IP55 housing



Dimensions in mm (inch)

CDS303 frequency converter - enclosure B2

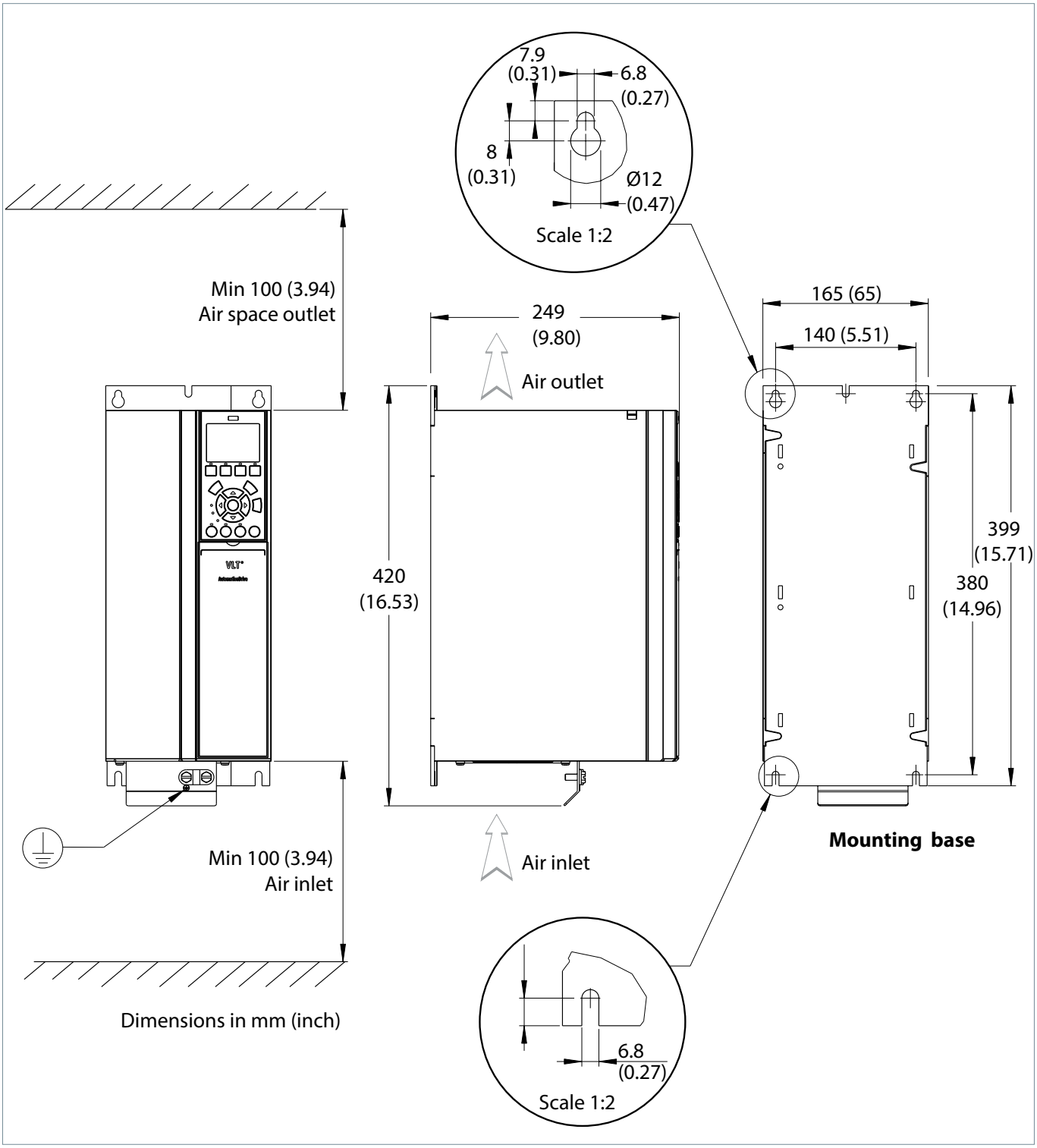
380-480 volts – 18-22 kW - IP55 housing



Dimensions in mm (inch)

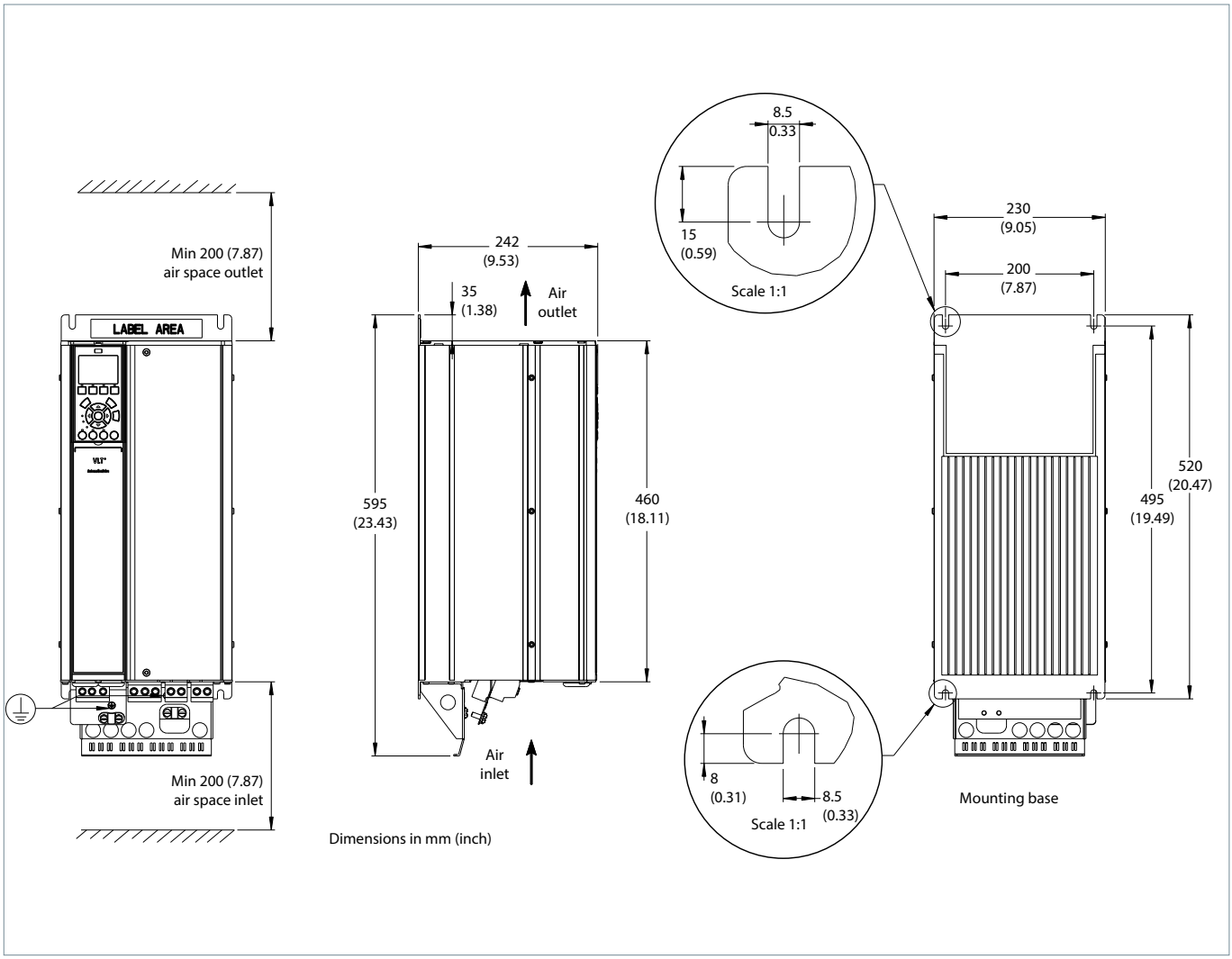
CDS303 frequency converter - enclosure B3

380-480 volts - 15 kW - IP20 housing



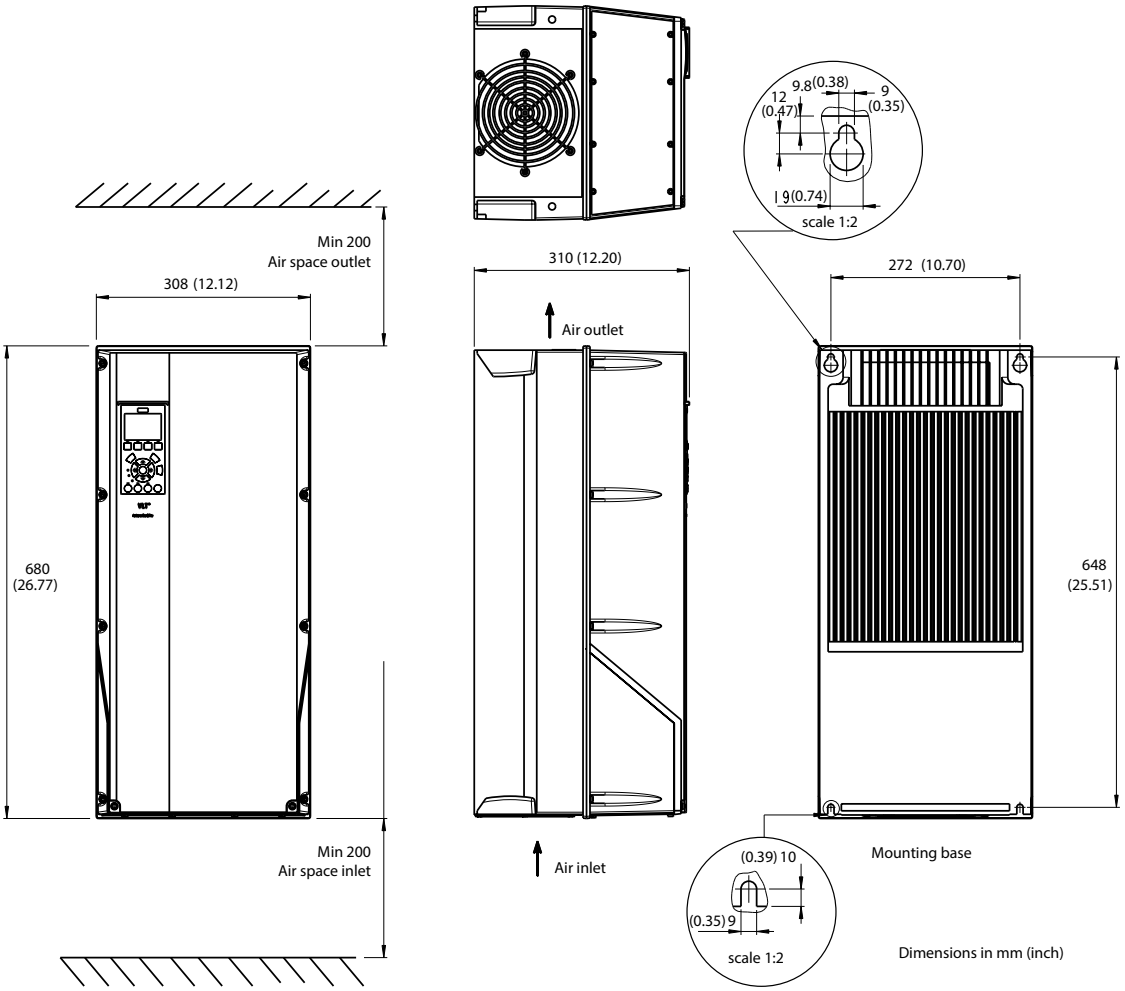
CDS303 frequency converter - enclosure B4

380-480 volts – 18-22 kW - IP20 housing
200-240 volts – 15 kW - IP20 housing
525-600 volts - 18-30 kW - IP20 housing



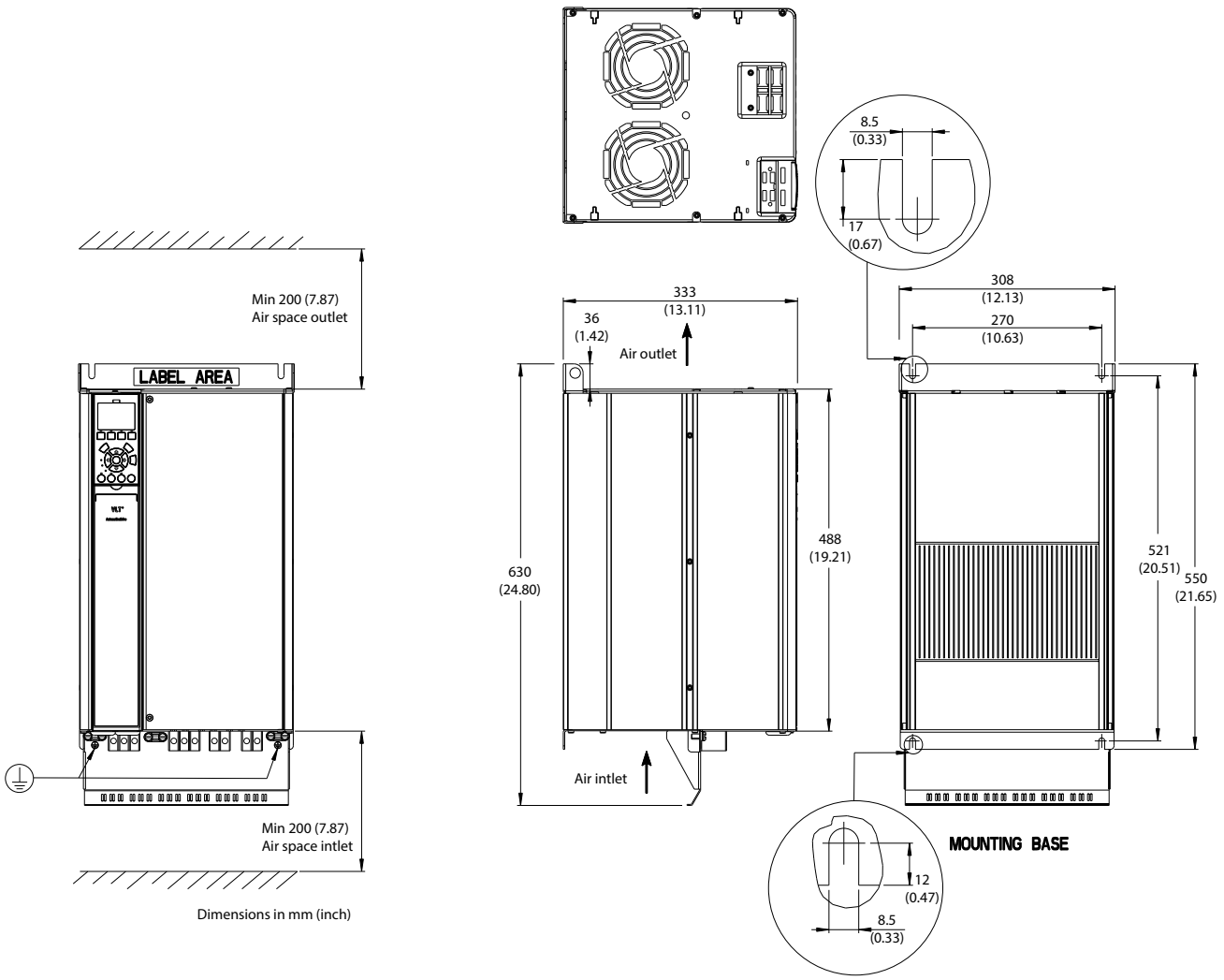
CDS303 frequency converter - enclosure C1

200-240 volts – 15-18-22 kW - IP55 housing



CDS303 frequency converter - enclosure C3

200-240 volts – 18-22 kW - IP20 housing



Supply voltage

Because VZH compressors are powered by a frequency converter, the mains frequency, 50 or 60 Hz, is no longer an issue. Only the mains voltage is to be taken into account. With 3 motor voltage codes, the most common mains voltages and frequencies are covered. Never connect the VZH compressor directly to the mains power supply.

On VZH all data published and in our polynomials are based on 208V frequency converter supply for code J and 400V frequency converter supply for code G.

When having a supply of 230V, 380V or 460V the following coefficients must be applied:

$I_{460} = 0.87 * I_{400}$
$I_{380} = 1.05 * I_{400}$
$I_{230} = 0.90 * I_{208}$

There is no modification for cooling capacity and power input.
Since data published for code H is based on 575V frequency converter supply, thus there will be no coefficients modification applied for H code.

Voltage code	Mains voltage range of drive
J	200-240 V / 3 ph / 50 Hz & 200-240 V / 3 ph / 60 Hz (±10%)
G	380-480 V / 3 ph / 50 Hz & 380 - 480 V / 3 ph / 60 Hz (±10%)
H	525-600 V / 3 ph / 50 Hz & 525-600 V / 3 ph / 60 Hz (±10%)

Compressor electrical specifications

	Compressor	RW (Ohm)	RLA (A)	MMT (A)
200 - 240 Volt	VZH088-J	0.03	74.8	93.5
	VZH117-J	0.02	88.0	110.0
	VZH170-J	0.01	115.0	143.8
380 - 480 Volt	VZH088-G	0.10	37.5	46.9
	VZH117-G	0.08	44.0	55.0
	VZH170-G	0.05	61.0	76.3
525 - 600 Volt	VZH088-H	0.10	37.5	46.9
	VZH117-H	0.08	44.0	55.0
	VZH170-H	0.05	61.0	76.3

RW: Winding resistance per winding (in CDS303 parameter list)
RLA: Rated load current
MMT: Maximum must trip current
Note that parameter 1-30 in the frequency converter settings reflects the winding resistance per winding. This is not the same value as measured at the motor terminals.

RLA (Rated Load Amp)

Rated Load Amp value is the current value at maximum load, in the operating envelope, and at maximum speed. We have agency (UL, CE, etc) approved at our max operating, the drive can limit the amps but the OEM is responsible for that submittal to agency.

MMT (Maximum Must Trip current)

The Maximum Must Trip current is defined for compressors not equipped with their own motor protection. This MMT value is the maximum at which the compressor can be operated in transient conditions and out of the operating envelope. The tripping current of external overcurrent protection, in this case preprogrammed in the drive, never exceeds the MMT value. For VZH compressors, according to UL requirements, MMT value is 125% of RLA. This value is printed on the compressor nameplate.

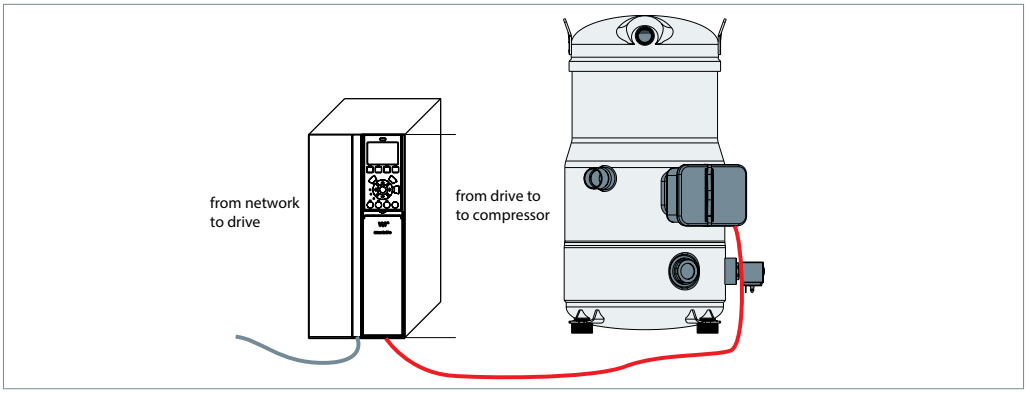
Fuses / circuit breakers

Danfoss recommends using the fuses/circuit breakers listed below to protect service personnel and property in case of component break-down in the frequency converter. For circuit breakers, Moeller types have been tested and are recommended. Other types of circuit breakers may be used provided they limit the energy to a level equal to or lower than the Moeller types.

Frequency converter		EN50178 compliant fuses		UL Compliant fuses						Recommended circuit breaker	
				Bussmann			SIBA	Little fuse		IP20	IP55
		Size	Type	Type RK1	Type J	Type T	Type RK1	Type RK1	Type RK1	Moeller type	
200-240 V	CDS-15kW	125 A	gG	KTN-R125	JKS-150	JJN-125	2028220-125	KLN-R125	A2K-125R	NZMB1-A100	NZMB2-A200
	CDS-18.5 kW	125 A	gG	KTN-R125	JKS-150	JJN-125	2028220-125	KLN-R125	A2K-125R	NZMB2-A200	NZMB2-A200
	CDS-22 kW	160 A	gG	FWX-150	-	-	2028220-150	L25S-150	A25X-150	NZMB2-A200	NZMB2-A200
380-480 V	CDS-15 kW	63 A	gG	KTS-R50	JKS-50	JJS-50	5014006-050	KLS-R50	A6K-50R	PKZM4-50	PKZM4-63
	CDS-18.5 Kw	63 A	gG	KTS-R60	JKS-60	JJS-60	5014006 -063	KLS-R60	A6K-60R	NZMB1-A100	NZMB1-A100
	CDS-22 kW	80 A	gG	KTS-R80	JKS-80	JJS-80	2028220-100	KLS-R80	A6K-80R	NZMB1-A100	NZMB1-A100
525-600V	CDS-18.5 kW	40A	gG	KTS-R50	JKS-50	JJS-50	5014006-050	KLS-R50	A6K-50R	NZMB1-A100	-
	CDS-30 kW	63A	gG	KTS-R80	JKS-80	IJS-80	5014006-080	KLS-R80	A6K-80R	NZMB1-A100	-

Wire sizes

Below table lists recommended wiring sizes for the motor compressor power supply cables. These wiring sizes are valid for a cable length up to 65 ft.



	From network to frequency converter			From frequency converter to compressor		
	Type	in^2	AWG	Type	in^2	AWG
200 - 240 V	CDS-15kW	0.04	4	VZH088-J	0.04	4
	CDS-18.5 kW	0.05	2	VZH117-J	0.05	2
	CDS-22 kW	0.08	1	VZH170-J	0.08	1
380 - 400 V	CDS-15 kW	0.009	10	VZH088-G	0.009	10
	CDS-18.5 Kw	0.015	8	VZH117-G	0.015	8
	CDS-22 kW	0.025	6	VZH170-G	0.025	6
525 - 600 V	CDS-18.5 kW (IP20)	0.015	8	VZH088-H	0.009	10
	CDS-30kW (IP20)	0.04	4	VZH117-H	0.015	8
	CDS-30kW (IP20)	0.04	4	VZH170H	0.025	6

Wiring & EMC protection

The motor compressor power supply from the CDS303 frequency converter to the VZH compressor must be done with a braided screened / armored cable. This cable needs to have its screen / armor conduit connected to earth on both ends. Avoid terminating this cable connection with twisting ends (pigtails) because that would result in an antenna phenomena and decrease the effectiveness of the cable.

Control cables to the CDS303 frequency converter must use the same installation principles as the power supply cable.

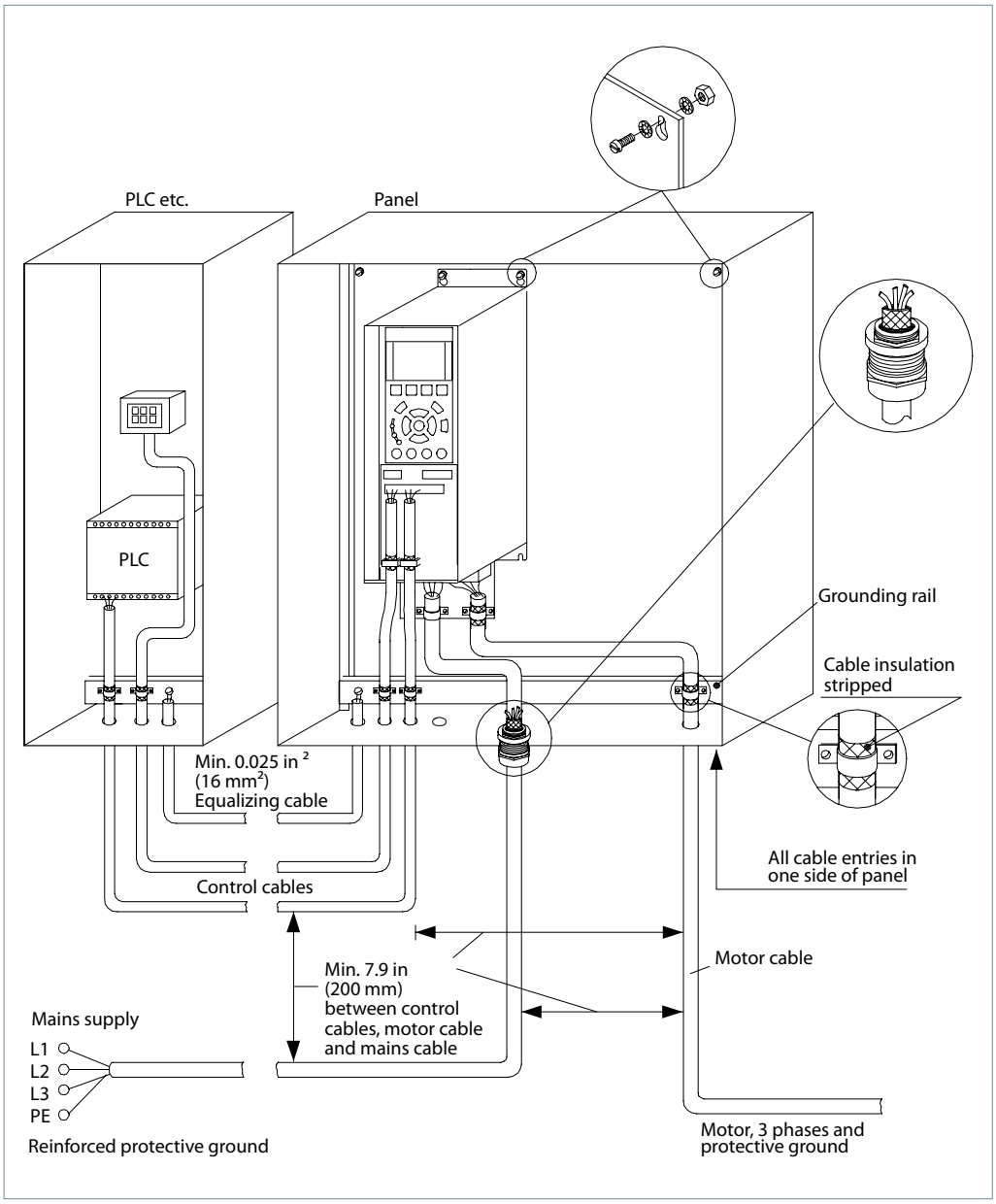
The motor compressor cable must be installed in a conduit separated from the control and mains cables.

Physical installation of the frequency converter on the mounting plate must ensure good electrical contact between the mounting plate and the metal chassis of the converter. Use star-washers and galvanically conductive installation plates to secure good electrical connections. Refer to instructions MG34M302 for tightening torques and screw sizes.

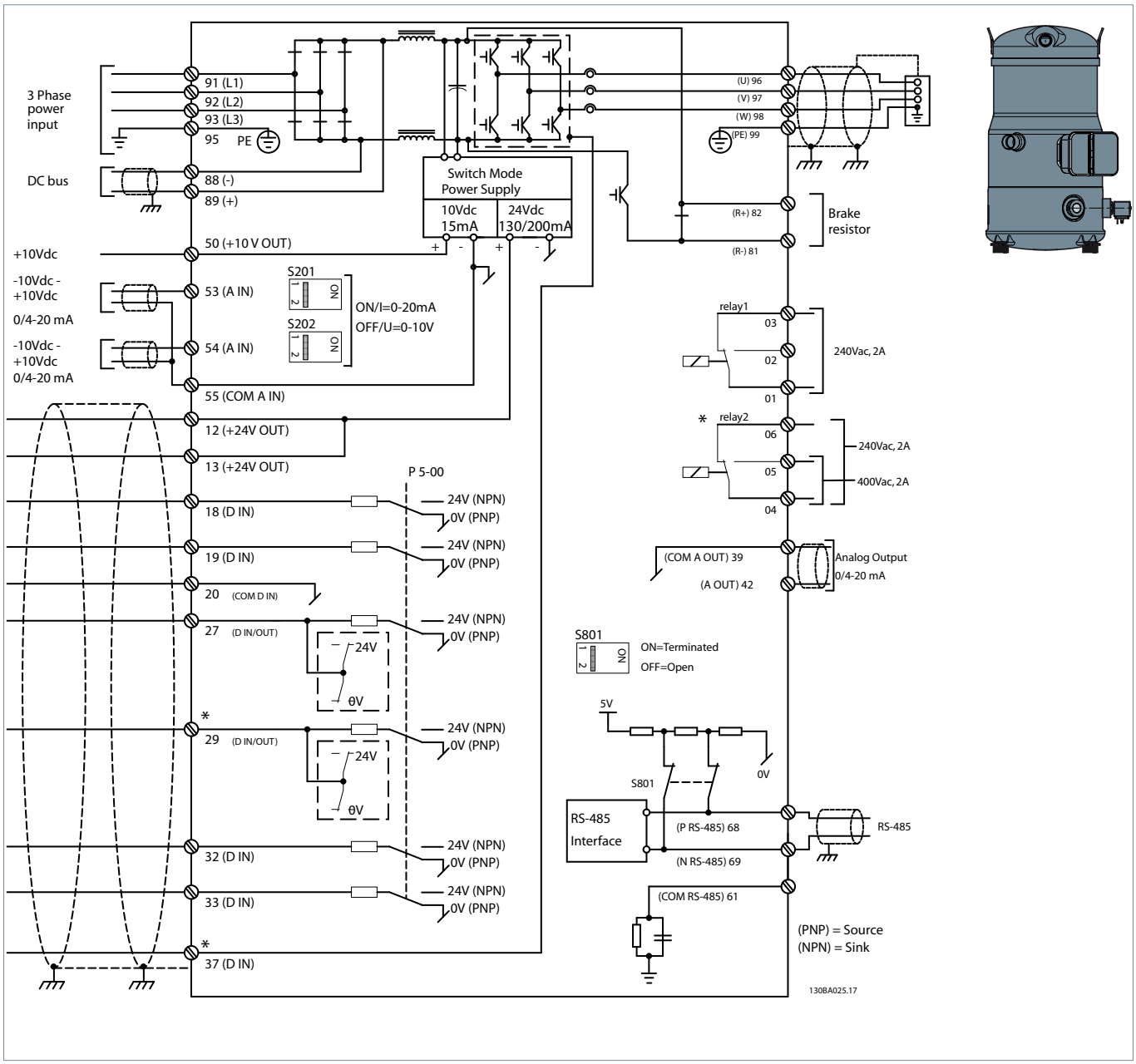
Note that the CDS303 must be mounted on a plain wall to ensure a good air flow through its heat exchanger.

EMC correct installation of an IP20 frequency drive CDS303

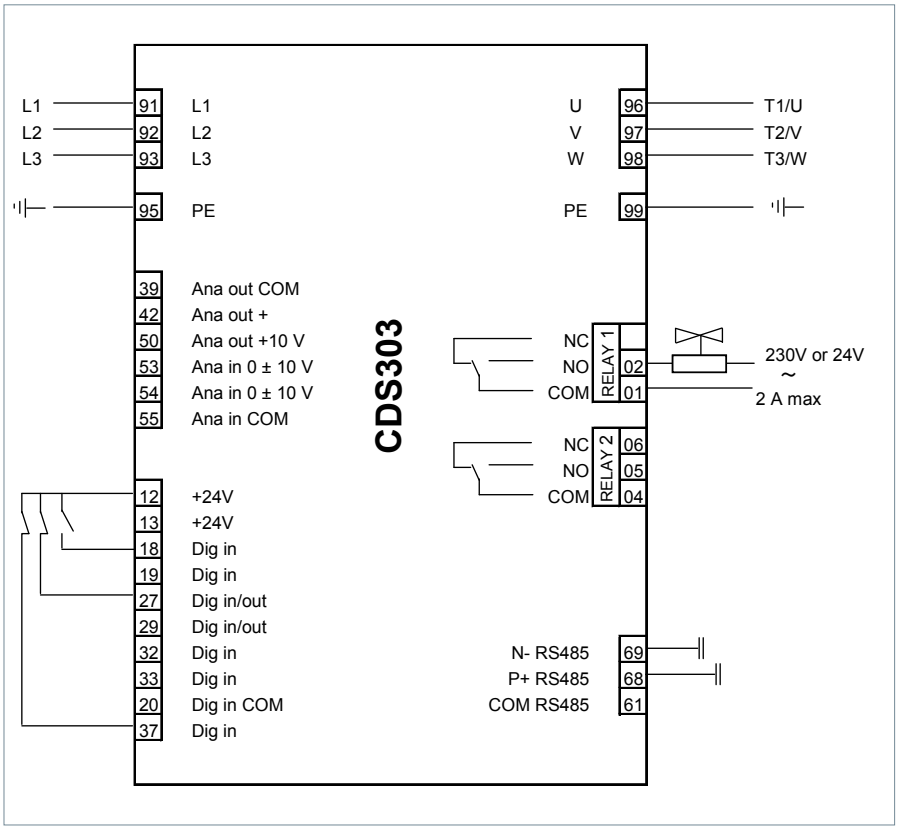
EMC qualification reports are available upon request to Danfoss technical support.



Wiring diagram



Wiring connections



Legends:

Ana:	Analogue
Dig:	Digital
in:	Input
out:	Output
COM:	Common
NC:	Normally-closed
NO:	Normally-open

		Open loop	Process loop
91, 92, 93	3 Phase mains input	X	X
95	Earth	X	X
39, 42	Analogue output	-	-
50	Analogue output	-	-
53	PLC+ (0 to 10 V)	X	-
54	Sensor -	-	X
55	PLC-	X	-
12	HP/LP switch	X	X
12	External On/Off (NO)	X	X
13	Factory bridged to 37	X	X
13	Sensor +	-	X
18	External On/Off (NO)	X	X
19	Digital input	-	-
27	HP/LP switch (NC) / safety devices	X	X
29	Digital input/output	-	-
32, 33	Digital input	-	-
20	Digital input Common	-	-
37	Factory bridged to 13	X	X
98	To compressor terminal T3	X	X
97	To compressor terminal T2	X	X
96	To compressor terminal T1	X	X
99	To compressor earth connection	X	X
02, 01	Relay 1 to oil solenoid valve	X	X
06, 05, 04	Relay 2	-	-
69, 68	RS485 Bus	-	-
61	RS485 Bus Common	-	-

-: Optional connection
X: Mandatory connection

The CDS303 frequency converter is factory preset with parameters for the open loop control principle. The process loop control principle can be selected by changing parameters in the «Quick menu».
Open loop: preset on input 53
0 - 10 V control
Frequency converter in slave mode
Process loop: preset on input 54
4 - 20 mA control
Frequency converter under own PID controller

T37 is CE and UL approved for STO, Safety Torque Function

Electrical connections

Electrical power is connected to the compressor terminals by Ø 3/16" (4.8 mm) screws. The maximum tightening torque is 3 Nm. Use a 1/4" ring terminal on the power leads.

The cable gland has to be of EMC design to guaranty a good grounding of the armored cable. Paint free areas on electrical box allow correct ground continuity.

Soft-start control

The CDS303 frequency converter generates by design a compressor soft start with an default initial ramp up of 2700rpm/s.

Current inrush will not exceed the frequency converter maximum current.

Basically seen from the mains the inrush peak reach a level which is only a few percent more than the rated nominal current.

Phase sequency and reverse rotation protection

The CDS303 frequency converter is preset to run the VZH compressors clockwise so the only care is to properly connect the CDS303 output to the compressor connectors:

- CDS303 terminal U (96) to VZH terminal T1/U
- CDS303 terminal V (97) to VZH terminal T2/V
- CDS303 terminal W (98) to VZH terminal T3/W

Mains connection to the CDS303 frequency converter order has no influence on the output phase sequence which is managed by the frequency converter.

However, the connection between the drive and the compressor can still be mis-wired. Special attention needs to be paid and strictly follows wire connection instruction.

IP rating

The compressor terminal box IP rating according to CEI529 is IP54 when correctly sized IP54 rated cable glands are used.

Element	Numerals or letters	Meaning for the protection of equipment
First characteristic numeral	0 1 2 3 4 5 6	Against ingress of solid foreign objects (non protected) ≥ 1.97 in (50 mm) diameter ≥ 0.47 in (12.6 mm) diameter ≥ 0.098 (2.5 mm) diameter ≥ 0.039 in (1.0 mm) diameter dust protected dust tight
Second characteristic numeral	0 1 2 3 4 5 6 7 8	Agains ingress of water with harmful effects (non protected vertically dripping dripping (15° tilted) spaying splashing jetting porwerful jetting temporary immersion continuous immersion

Motor protection

Motor protection is provided by the frequency converter. All parameters are factory preset in order to guaranty locked rotor or overload current protection.

When a warning situation is reached in the current control, the CDS303 frequency converter will automatically reduce the compressor speed in order to keep the motor current of the compressor below the maximum allowed.

Voltage imbalance

The maximum allowable voltage imbalance between each phase is 3%. Voltage imbalance causes high amperage over one or several phases, which in turn leads to overheating and possible drive damage.

Mains imbalance function in CDS303 frequency converter can be set to "[0] Trip" or "[1] Warning" in 14.12 parameter. It is, by default, factory preset to "[1] Warning".

Then the compressor electrical motor is never affected by main voltage imbalance situations which are totally made transparent by the frequency converter.

Approvals and certificates

VZH compressors comply with the following approvals and certificates.

CE 0062 or CE 0038 (European Directive)	CE	VZH code G & code J
UL (Underwriters Laboratories)	c UL us	All VZH models
EMC 2014/30/EU		All VZH models

Pressure equipment directive 2014/68/EU

Products	VZH088	VZH117	VZH170
Fluids	Group 2		
Category PED	II		
Evaluation module	D1		
TS - service temperature LP	-31°F < TS < 131°F		-31°F < TS < 123.8°F
PS - service pressure LP	483 psi(g)	483 psi(g)	438 psi(g)

Low voltage directive 2014/35/EU

Products	VZH088-117-170
Declaration of conformity ref. Low voltage directive 2014/35/EU	Contact Danfoss

Internal free volume

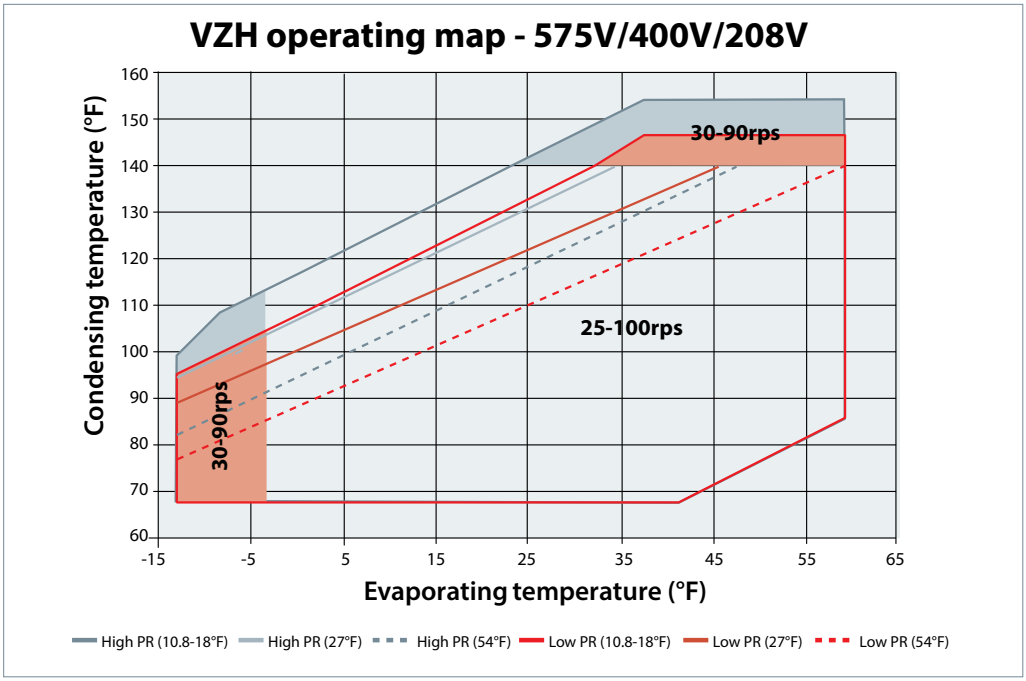
Products	Internal free volume at LP side without oil (lb)
VZH088	28
VZH117	33
VZH170	66

Application envelopes

The operating envelopes for VZH scroll compressors are given in the figures below, where the condensing and evaporating temperatures represent the range for steady state operation. Under transient conditions, such as start-up and defrost, the compressor may operate outside this envelope for short periods.

The figures below show the operating envelopes for VZH compressors with refrigerants R410A. Due to bearing loads and scroll stability,there will be speed restrictions on the envelops. The operating limits serve to define the envelope within which reliable operations of the compressor are guaranteed:

- Maximum discharge gas temperature: +275°F.
- In any condition the expansion device must ensure a suction super heat within 9°F to 54°F.
- To avoid liquid floodback, oil sump superheat should also be taken care of. Please refer to "liquid floodback during operation" section.
- Attention to suction line insulation to reduce usefulness superheat.
- Minimum and maximum evaporating and condensing temperatures as per the operating envelopes.
- VZH drive could only protect compressor from over current. Customers need to have high pressure, low pressure sensor and discharge temperature thermostat to fully protect the envelop. Since out of map running will threaten the reliability of compressor, customers must qualify map protection under all extreme conditions.



Note: Red and Gray filled area are limited to 30-90rps.
for 380V power input, permitted highest condensing temperature will decrease accordingly:
-High PR: 25-100rps, SH 10.8-18°F, condensing temperature from 140°F to 133°F; 30-90rps, condensing temperature from 154°F to 149°F
-Low PR: 25-100 rps, SH 10.8-18°F, condensing temperature from 140°F to 133°F; 30-90 rps, condensing temperature from 145°F to 144°F

Short cycle timer function

Short cycle control is directly provided by the CDS303 frequency converter, when parameter 28.0x is enabled.
The function is factory set to enabled, with minimum running time 12 seconds and interval between starts 300 seconds.
Short cycle settings are accessible in parameter 28.0x list, in the "compressor functions" menu.

When fully controlled from an external main controller it is recommended to limit to 12 the number of start / stop per hour.

Please note to ensure compressor is well lubricated, it is required to keep VZH compressor running at least 3 minutes each time after start.

Discharge gas temperature protection function

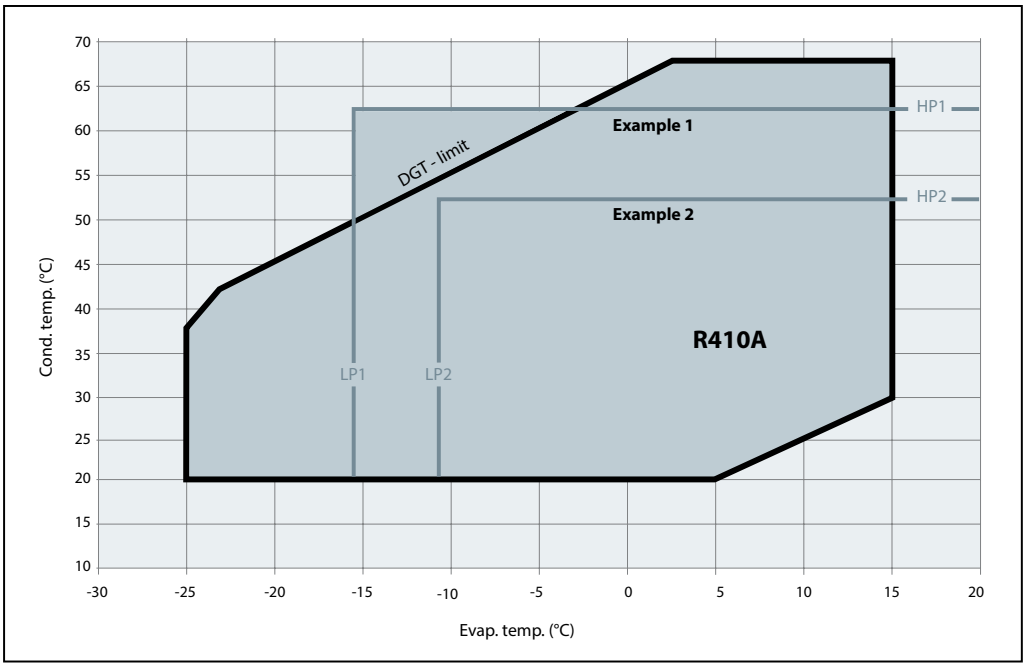
A discharge temperature monitor function can be enabled in the frequency converter. All settings are available in parameter list 28.2x, they are factory preset as follow:

- 28.20: [0] none - temperature source (sensor input)
- 28.21: [60] °C - temperature unit
- 28.24: 130 - warning level
- 28.25: [1] decrease cooling - warning action
- 28.26: 145 - emergency level
- 28.27: is the actual discharge temperature measured by the sensor.

To activate the discharge temperature monitor function, with the factory setting, the only modification required is to connect the sensor to Analog Input 54 (4 - 20 mA) between 13 and 54, and set the parameter 28.20 to "[2] Analog input 54". When the warning level is reached "decrease cooling" action starts by decreasing the compressor speed by steps of 10 rps(600rpm) every 3 minutes until the temperature, either drops below the level, programmed in parameter 28.24 (warning level) or exceed the level programmed in parameter 28.26 (emergency level). When the emergency level is reached, the compressor is stopped and the frequency converter shows an "alarm".

Discharge gas thermostat

Discharge gas temperature (DGT) protection is required if the high and low pressure switch settings do not protect the compressor against operations beyond its specific application envelope. Please refer to the examples below, which illustrate where DGT protection is required (Ex. 1) and where it is not (Ex. 2).



Example 1 (R410A, SH = 10.8°F)
LP switch setting:
LP1 = 3.3 bar (g) (-15.5°C/4.1°F)
HP switch setting:
HP1 = 38 bar (g) (62°C/143.6°F)
Risk of operation beyond the application envelope.
DGT protection required.

Example 2 (R410A, SH = 10.8°F)
LP switch setting:
LP2 = 4.6 bar (g) (-10.5°C/13.1°F)
HP switch setting:
HP2 = 31 bar (g) (52°C/125.6°F)
No risk of operation beyond the application envelope.
No DGT protection required.

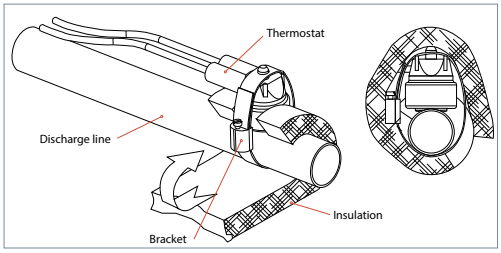
The discharge gas temperature must not exceed 275°F.

A discharge gas temperature protection device must be installed on all heat pumps. In reversible air-to-air and air-to-water heat pumps the discharge temperature must be monitored during development test by the equipment manufacturer.

The compressor must not be allowed to cycle on the discharge gas thermostat. Continuous operations beyond the compressor's operating range will cause serious damage to the compressor!

A DGT accessory is available from Danfoss: refer to accessories pages at the end of this document.

The discharge gas thermostat accessory kit (code no.7750009) includes all components required for installation, as shown below. The thermostat must be attached to the discharge line within 5.91 inch from the compressor discharge port and must be thermally insulated and tightly fixed on the pipe.



Oil return management function (single compressor)

Insufficient oil level can be the result of oil depositing itself in pipes and heat exchangers. The oil deposit can be returned to the crankcase, by increasing velocity for short periods, at regular time intervals or when velocity is too low to ensure adequate oil returns.

With oil return management these two oil return mechanisms can be programmed in the CDS303.

With oil return management function enabled, the CDS303 performs oil return by boosting the compressor speed to 4200 rpm (70 rps) for a selectable duration as programmed in parameter 28.13. The boosts are performed at fixed time intervals (as programmed in parameter 28.12) or if the compressor speed has been less than 3000 rpm (50 rps) for too long (as programmed in 28.11) whichever occurs first. Thus the maximum time between two consecutive oil return boosts is programmed in 28.12.

ID	Name	Factory Setup	"long pipe (25-30m)"	Unit
2810	Oil Return Management	On	On	
2811	Low Speed Running Time	60	30	min
2812	Fixed Boost Interval	24	6	h
2813	Boost Duration	30	60	s

Considering oil return risk, split system with more than 10m piping length need mandatory application approval by Danfoss application specialists.

Oil return management in hybrid manifolding

Use the accessory "oil level switch" with the appropriate compressor housing having the fitting preassembled and refer to the VZH hybrid manifold guideline (FRCC.PC.049).

High and low pressure protection

High pressure

According to EN378-2, a high-pressure (HP) safety switch is required to shut down the compressor. The high-pressure switch can be set to lower values depending on the application and ambient conditions. The HP switch must either be placed in a lockout circuit or consist of a manual reset device to prevent cycling around the high-pressure limit. If a discharge valve is used, the HP switch must be connected to the service valve gauge port, which must not be isolated. The HP switch must be connected to the CDS303 input 37 or an external contactor placed between the drive and the compressor.

Low pressure

A low-pressure (LP) safety switch must be used. Deep vacuum operations of a scroll compressor can cause internal electrical arcing and scroll instability. VZH compressors exhibit high volumetric efficiency and may draw very low vacuum levels, which could induce such a problem. The minimum low-pressure safety switch (loss-of-charge safety switch) setting is given in the following table. For systems without pump-down, the LP safety switch must either be a manual lockout device or an automatic switch wired into an electrical lockout circuit. The LP switch tolerance must not allow for vacuum operations of the compressor. LP switch settings for pump-down cycles with automatic reset are also listed in the table below. Lock-out circuit or LP switch or series with other safety devices must be connected to CDS303 input 27.

Pressure settings

Pressure settings		R410A
Working pressure range high side	psi(g)	High PR 195.8 - 645.4 Low PR 195.8 - 580.1
Working pressure range low side	psi(g)	33.36 - 168.24
Maximum high pressure safety switch setting	psi(g)	652.67
Minimum low pressure safety switch setting *	psi(g)	21.75
Minimum low pressure pump-down switch setting **	psi(g)	33.36

*LP safety switch shall never be bypassed.
** Recommended pump-down switch settings: 21 psi below nominal evaporating temperature with minimum of 33 psig

Electronic expansion valve

With variable capacity systems, an electronic expansion valve (EXV) is the mandatory solution to handle refrigerant mass flow variations. Danfoss recommend to use ETS products. Ramp-up and ramp-down settings, of both EXV and compressor, must be done with great care. Customer could also use thermostatic expansion valve(TXV) if they have qualified their systems and get Danfoss approval.

Ramp-up of the EXV must be shorter than the ramp-up of the compressor, to avoid any low pressure operation on suction side of the compressor. The EXV can also be opened, up to a certain degree, before the start up of the compressor.

Ramp-down of the EXV must be longer than the ramp-down of the compressor, also to avoid low pressure operation (except with pump-down).

EXV should be closed, and remained closed, when the compressor is off, to avoid any liquid refrigerant entering the compressor.

It is recommended to use expansion valve with MOP (Maximum Operating Pressure) function. MOP is a feature added to EXV's (also to TXV's) that limit the maximum suction pressure of the unit. The customer would need to set this at the 15°C limit we have on our VS operating envelope. Regardless of EXV or TXV, customer needs to qualify the expansion device. Testing needs to be done at both max and min operating conditions to guarantee the valve closes enough on the min and opens far enough on the max.

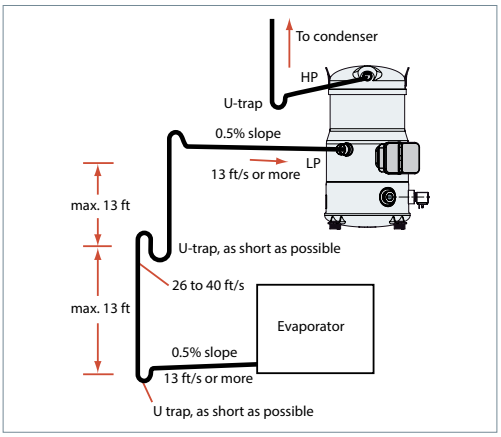
Essential piping design considerations

The working pressure in systems with R410A is about 60% higher than in systems with R22 or R407C. Consequently, all system components and piping must be designed for this higher pressure level.
Proper piping practices should be employed to ensure adequate oil return, even under minimum load conditions with special consideration given to the size and slope of the tubing coming from the evaporator. Tubing returns from the evaporator should be designed so as not to trap oil and to prevent oil and refrigerant migration back to the compressor during off-cycles.
In systems with R410A, the refrigerant mass flow will be lower compared to R22/R407C systems. To maintain acceptable pressure drops and acceptable minimum gas velocities, the refrigerant piping must be reduced in size compared to R22 / R407C systems. Take care not to create too high pressure drops neither since in R410A systems the negative impact of high pressure drops on the system efficiency is stronger than in R22/R407C systems.
CDS303 frequency converter integrates a special feature in the compressor functions in order to improve and secure the oil recovery from the system. Refer to "Oil Return Management" section.

Piping should be designed with adequate three-dimensional flexibility. It should not be in contact with the surrounding structure, unless a proper tubing mount has been installed. This protection proves necessary to avoid excess vibration, which can ultimately result in connection or tube failure due to fatigue or wear from abrasion. Aside from tubing and connection damage, excess vibration may be transmitted to the surrounding structure and generate an unacceptable noise level within that structure as well. For more information on noise and vibration, see "Sound and Vibration Management" section.

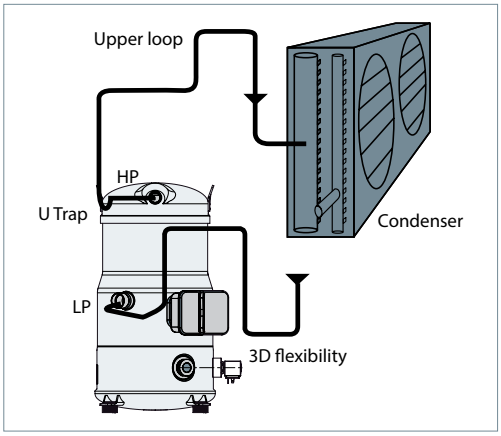
Suction lines

If the evaporator lies above the compressor, as is often the case in split or remote condenser systems, the addition of a pump-down cycle is strongly recommended. If a pump-down cycle were to be omitted, the suction line must have a loop at the evaporator outlet to prevent refrigerant from draining into the compressor during off-cycles.
If the evaporator were situated below the compressor, the suction riser must be trapped so as to prevent liquid refrigerant from collecting at the outlet of the evaporator while the system is idle, which would mislead the expansion valve's sensor (thermal bulb) at start-up.



Discharge lines

When the condenser is mounted at a higher position than the compressor, a suitably sized «U»-shaped trap close to the compressor is necessary to prevent oil leaving the compressor from draining back to the discharge side of the compressor during off cycle. The upper loop also helps avoid condensed liquid refrigerant from draining back to the compressor when stopped.
For inverter applications with long lines it is recommended to use an oil separator even if it is only the condenser which is far away from the unit.
Piping design must also be made with care in order to make sure the remaining oil not trapped by the oil separator is well carried over the system.
Basic principal is shown here. Note that for the discharge line, same concept as for suction line with U-trap every 13 ft must be applied between discharge U-trap and upper U-trap when the condenser is above the compressor unit.
It is also recommend installing one check valve on the discharge line to the condenser next to the condenser to avoid the possibility of having the discharge tube full of liquid during off cycles; discharge lines flooded by liquid being able to create start-up issues by drive over-torque or HP switch trip.



Oil management

Compressors discharge a small percentage of oil that is mixed with the compressed refrigerant. The oil is circulated through the system and the compressor is dependent on the system design to bring it back. The use of variable speed compressor technology in systems with long piping, especially for split systems, is among the most challenging configurations for oil return. In order to prevent compressors from breaking down due to oil level issues, Danfoss requires the use of an oil separator in all long piping systems, particularly for split systems.

Variable speed compressors used in split systems as well as long piping provide an increased challenge to system oil management due to the reduced velocities at low speed operation. Low oil velocity can cause oil deposits in pipes, heat exchangers and other system components that can cause an insufficient oil level inside the compressor.

It is the responsibility of the systems OEM to ensure the proper oil return to the compressors including the qualification of all possible operating modes, equipment configurations and accessory options (multiple evaporators, reheat coils for example) that could impact oil return to the compressors.

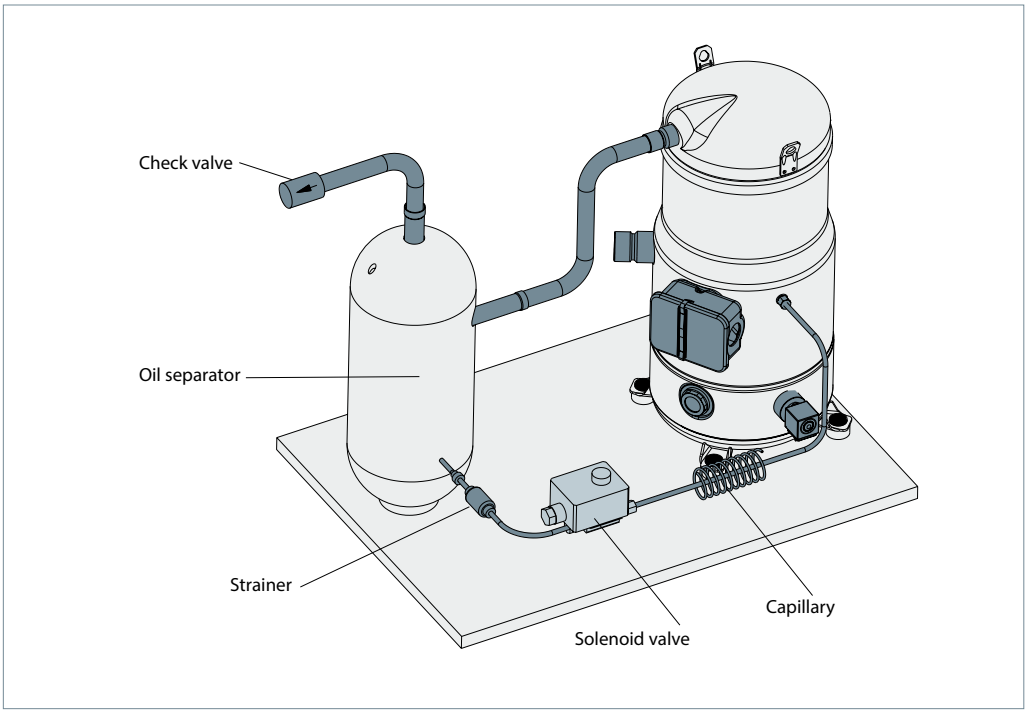
Especially for split systems using variable speed compressors, in which every installation is unique and qualification of individual installations is not practical, Danfoss requires that OEMs install an oil separator.

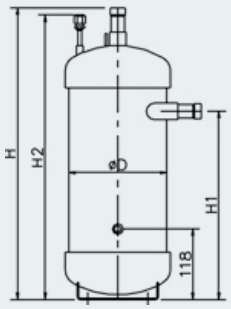
The requirement of an oil separator is also suitable for any other system with complex piping (long line set, U trap…), multiple heat exchangers and elevation changes.

Many oil separator designs exist, the selection, requirements and recommendations of the Oil Separator manufacturer should be followed.

Customers have the opportunity to select Chiyoda (CE marked) since it has been tested successfully by Danfoss. Detailed information hereafter.

Please note that an oil separator is not 100% efficient. A good system design and efficient oil management remain essential.



Compressor			VZH088	VZH117	VZH170
"OS separator (CE)"	Brand		Chiyoda		
	Contact information		Email: sales@chiyodaseiki.com Tel: +86(512)62833498 Address: No.1 Sheng gang Rd, Suzhou Industrial Park, Jiang su,PRC, China. Website: http://www.chiyodaseiki.com/		
	Model		OS-165DF088CE	OS-165DF117CE	OS-165DF170CE
	outline				
	Type		centrifugal		
	ΦD: Outter Diameter(mm)		Φ165.2	Φ165.2	Φ165.2
	Volume(L)		7.2	8.3	10.5
	Inlet size(in)		7/8"	7/8"	1"1/8
	outlet size (in)		7/8"	7/8"	1"1/8
	Footprint LxW(mm x mm)		190.5x102		
	H1: Height(mm)		297	355	469
	H2: Height(mm)		457	515	635
	H: Height(mm)		469	527	645
Capillary tube	Inner diameter(mm)		Φ1.6	Φ1.8	Φ1.8
	length(mm)		1400	1530	1380
Strainer	Mesh size		100	100	100
Solenoiid valve "Model: Danfoss (Orifice Φ2.0) (CE)"	Orifice(mm)		Φ2.0		
	code number		032F1201		
	connection(in)		1/4"		
solenoil coil	"24V 50Hz AC"	code number	018F6257		
		specification	1m 3-core cable		
	"220-230V 50/60Hz AC"	code number	018F6282		
		specification	1m 3-core cable		

Customers can of course contact Danfoss application engineers for support regarding recommendations in such systems.

Heat exchangers

To obtain optimum efficiency of the complete refrigerant system, optimized R410A heat exchangers must be used. R410A refrigerant has good heat transfer properties: it is worthwhile designing specific heat exchangers to gain in size and efficiency.

An evaporator with optimized R410A distributor and circuit will give correct superheat at outlet and optimal use of the exchange surface. This is critical for plate evaporators that have generally a shorter circuit and a lower volume than shell & tubes and air cooled coils.

For all evaporator types a special care is required for superheat control leaving the evaporator and oil return.

A sub-cooler circuit in the condenser that creates high sub-cooling will increase efficiency at high condensing pressure. In R410A systems the positive effect of sub-cooling on system efficiency will be significantly larger than in R22/ R407C systems.

Furthermore, for good operation of the expansion device and to maintain good efficiency in the evaporator it is important to have an adequate liquid sub-cooling. Without adequate sub-cooling, flash gas will be formed at the expansion device resulting in a high degree of vapor at the evaporator inlet leading to low efficiency.

Refrigerant charge limits

VZH compressors can tolerate liquid refrigerant up to a certain extend without major problems. However, excessive liquid refrigerant in the compressor is always unfavorable for service life. Besides, the installation cooling capacity may be reduced because of the evaporation taking place in the compressor and/or the suction line instead of the evaporator. System design must be such that the amount of liquid refrigerant in the compressor is limited. In this respect, follow the guidelines given in the section: "Essential piping design recommendations" in priority.

If the refrigerant charge exceeds the values in below table, a suction line accumulator is strongly recommended.

Model	Refrigerant charge limit (lb)
VZH088	13.2
VZH117	17.6
VZH170	29.0

More detailed information can be found in the paragraphs hereafter. Please contact Danfoss technical support for any deviation from these guidelines.

Off-cycle migration

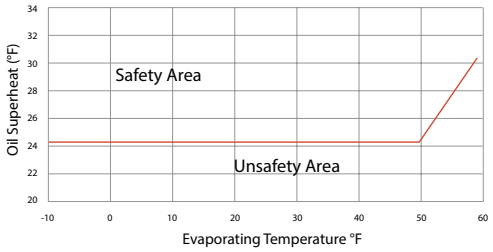
Liquid refrigerant can find its way into the compressor by means of off-cycle migration or liquid floodback during operation.

Off-cycle refrigerant migration is likely to occur when the compressor is located at the coldest part of the installation, when the system uses a bleed-type expansion device, or if liquid is allowed to migrate from the evaporator into the compressor sump by gravity. If too much liquid refrigerant accumulates in the sump it will saturate the oil and lead to a flooded start: when the compressor starts running again, the refrigerant evaporates abruptly under the sudden decrease of the bottom shell pressure, causing the oil to foam, and can also take much oil out of compressor, then result in oil loss in sump. This will be risky of bearing seizing especially for system with large refrigerant and without oil separator. In extreme situations, this might result in liquid slugging (liquid entering the scroll elements), which must be avoided as it causes irreversible damage to the compressor.

The presence of liquid in the crankcase can be easily detected by checking the sump level through the oil sight glass. Foam in the oil sump indicates a flooded start.

VZH scroll compressors can tolerate occasional flooded starts as long as the total system charge does not exceed the maximum compressor refrigerant charge limit.

Off-cycle migration can be prevented by implementing a crankcase heating or adding a pump-down cycle to the operation cycle and a liquid line solenoid valve.

	Crankcase heater / sump heater: When the compressor is idle, the oil temperature in the sump of the compressor must be maintained at no lower than 18°F above the saturation temperature of the refrigerant on the low-pressure side. This requirement ensures that the liquid refrigerant is not accumulating in the sump.	A crankcase heater is only effective if capable of sustaining this level of temperature difference. Tests must be conducted to ensure that the appropriate oil temperature is maintained under all ambient conditions (temperature and wind). Provide separate electrical supply for the heaters so that they remain energized even when the machine is out of service (eg. seasonal shut-down).
	Liquid line solenoid valve (LLSV): An LLSV may be used to isolate the liquid charge on the condenser side, thereby preventing against charge transfer or excessive migration to the compressor during off-cycles. When installed,	EXV ensures also this function. The quantity of refrigerant on the low-pressure side of the system can be further reduced by using a pump-down cycle in association with the LLSV.
	Pump-down cycle: A pump-down cycle represents one of the most effective ways to protect against the off-cycle migration of liquid refrigerant. Once the system has reached its set point and is about to shut off, the LLSV on the condenser outlet closes. The compressor then pumps the majority of the refrigerant charge into the condenser and receiver before the system	stops on the low pressure pump-down switch. This step reduces the amount of charge on the low side in order to prevent off-cycle migration. The recommended low-pressure pump-down switch setting is 21 psig below the nominal evaporating pressure. It shall not be set lower than 33 psi.
	Liquid receiver: Refrigerant charge optimization varies with compressor speed. To avoid flash gas at low speed, a receiver may be necessary. Receiver dimensioning requires special attention.	The receiver shall be large enough to contain part of the system refrigerant charge, but shall not be too large, to avoid refrigerant overcharging during maintenance operations.
Liquid floodback during operation	Liquid floodback occurs when liquid refrigerant returns to the compressor when it is running. During normal operation, refrigerant leaves the evaporator and enters the compressor as a superheated vapour. The suction gas can still contain liquid refrigerant for example with a wrong dimensioning, a wrong setting or malfunction of the expansion device or in case of evaporator fan failure or blocked air filters. A continuous liquid floodback will cause oil dilution and, in extreme situations, lead to liquid slugging. VZH scroll compressors can tolerate occasional liquid floodback. However system design must be such that repeated and excessive floodback is not possible. During operations, liquid floodback may be detected by measuring either the oil sump temperature or the discharge gas temperature. If	at any time during operations, the oil superheat shall be above the safe limit defined in the Dilution Chart (See graph below). Oil superheat is given by the formula: Oil superheat (°F)= Oil sump temperature (°F) - Saturated suction temperature(°F) Dilution Chart 

Low ambient compressor operations

Low ambient operations and minimum pressure differential at steady running conditions

The VZH compressor requires a minimum pressure differential between the suction and discharge pressures (please refer to operation envelop) to force the orbiting scroll-down against the oil film on the thrust bearing. Anything less than this differential and the orbiting scroll can lift up, causing a metal-to-metal contact. It is therefore necessary to maintain sufficient discharge pressure in order to ensure this pressure differential. Care should be taken during low ambient operations when heat removal from air-cooled condensers is greatest and head pressure control may be required for low ambient temperature applications. Operation under low pressure differential may be observed by a significant increase in the sound power level generated by the compressor.

Low ambient start-up

Under cold ambient conditions, upon start-up the pressure in the condenser may be so low that a sufficient pressure differential across the expansion device cannot be developed to properly feed the evaporator. As a result, the compressor may go into abnormal low suction pressure, which can lead to compressor failure. Under no circumstances should the compressor be allowed to operate under vacuum. The low-pressure control must be set in accordance with the table section "Pressure settings" in order to prevent this from happening.

Low pressure differentials can also cause the expansion device to "hunt" erratically, which might cause surging conditions within the evaporator, with liquid spillover into the compressor. This effect is most pronounced during low load conditions, which frequently occur during low ambient conditions.

Head pressure control under low ambient conditions

Several possible solutions are available to prevent the compressor from drawing down to a vacuum upon start-up under low ambient conditions. In air-cooled machines, cycling the fans with a head pressure controller will ensure that the fans remain off until the condensing pressure has reached a satisfactory level. In water-cooled units, the same can be performed using a water regulator valve that is also operated by head pressure, thereby ensuring that the water valve does not open until the condensing pressure reaches a satisfactory level.

Note: The minimum condensing pressure must be set at the minimum saturated condensing temperature shown in the application envelopes.

Under very low ambient conditions, in which testing has revealed that the above procedures might not ensure satisfactory condensing and suction pressures, the use of a liquid receiver with condenser and receiver pressure regulators would be possible.

Condensing pressure control is also strongly recommended to improve any system efficiency. The most accurate value is to control the condensing temperature at 12 K above the ambient temperature for air cooled condensers.

For further information, please contact Danfoss Technical support.

Crankcase heaters

A crankcase heating will minimize refrigerant migration caused by the large temperature gradient between the compressor and the remainder of the system. Refer to crankcase heating section "Crankcase heating function" for details and settings.

Low load operations

It is recommended that the unit be tested and monitored at minimum load and, if possible, during low ambient conditions as well. During conditions of low load on the system, the following considerations should be taken into account to ensure proper system operating characteristics.

The superheat setting of the expansion device should be sufficient to ensure proper superheat levels during low loading periods. 5 to 6 K stable superheat is required. In addition, the refrigerant charge should be sufficient to ensure proper sub-cooling within the condenser so as to avoid the risk of flashing in the liquid line before the expansion device. The expansion device should be sized to ensure proper control of the refrigerant flow into the evaporator.

	An oversized valve may result in erratic control. This can lead to liquid refrigerant entering the compressor if the expansion valve does not provide stable refrigerant super-heat control under varying loads. • Condenser fans should be cycled in such a way that the minimum pressure differential is maintained between the suction and discharge pressures. Inverter fans can also be used to control the amount of heat to be removed from the condenser.	• The compressors should be run for a minimum period in order to ensure that the oil has sufficient time to properly return to the compressor sump and that the motor has sufficient time to cool under conditions of lowest refrigerant mass flows. Refer to section "Oil return management function".
Brazed plate heat exchangers	A brazed plate heat exchanger needs very little internal volume to satisfy the set of heat transfer requirements. Consequently, the heat exchanger offers very little internal volume for the compressor to draw vapor from on the suction side. The compressor can then quickly enter into a vacuum condition. It is therefore important that the expansion device be sized correctly and that a sufficient pressure differential across the expansion device be available to ensure adequate refrigerant feed into the evaporator. This aspect is of special concern when operating the unit under low ambient and load conditions. For further information on these conditions, please refer to the previous sections. Due to the small volume of the brazed plate heat exchanger, no pump-down cycle is normally required.	The suction line running from the heat exchanger to the compressor must be trapped to avoid refrigerant migration to the compressor. When using a brazed plate condenser heat exchanger, a sufficient free volume for the discharge gas to accumulate is required in order to avoid excess pressure build-up. At least 1 meter of discharge line is necessary to generate this volume. To help reduce the gas volume immediately after start-up even further, the supply of cooling water to the heat exchanger may be opened before the compressor starts up so as to remove superheat and condense the incoming discharge gas more quickly. Because of the large compressor capacity variation and VZH capability to run at low condensing temperature an EXV (electronic expansion valve) is mandatory.
Reversible heat pump systems	Transients are likely to occur in reversible heat pump systems, i.e. a changeover cycle from cooling to heating, defrost or low-load short cycles. These transient modes of operation may lead to liquid refrigerant carry-over (or flood-back) or excessively wet refrigerant return conditions. As such, reversible cycle applications require specific precautions for ensuring a long compressor life and satisfactory	operating characteristics. Regardless of the refrigerant charge in the system, specific tests for repetitive flood-back are required to confirm whether or not a suction accumulator needs to be installed. The following considerations cover the most important issues when dealing with common applications. Each application design however should be thoroughly tested to ensure acceptable operating characteristics.

Discharge temperature monitoring	Heat pumps frequently utilize high condensing temperatures in order to achieve a sufficient temperature rise in the medium being heated. At the same time, they often require low evaporating pressures to obtain sufficient temperature differentials between the evaporator and the outside temperature. This situation may result in high discharge temperature; as such, it is mandatory that a discharge gas safety control is carried to protect the compressor from excessive	temperatures. Operating the compressor at too high discharge temperatures can result in mechanical damage to the compressor as well as thermal degradation of the compressor lubricating oil and a lack of sufficient lubrication. Refer to section "Discharge gas temperature protection" function for frequency converter settings and accessories availability.
Discharge line and reversing valve	The VZH scroll compressor is a high volumetric machine and, as such, can rapidly build up pressure in the discharge line if gas in the line becomes obstructed even for a very short period of time which situation may occur with slow-acting, reversing valves in heat pumps. Discharge pressures exceeding the operating envelope may result in nuisance high-pressure switch cutouts and can generate excessive load on bearings and motor. To prevent such occurrences, it is important that a 1-meter minimum discharge line length be allowed between the compressor discharge port and the reversing valve or any other restriction. This gives sufficient free volume for the discharge	gas to collect and to reduce the pressure peak during the time it takes for the valve to change position. At the same time, it is important that the selection and sizing of the reversing or 4-way valve ensure that the valve switches quickly enough to prevent against too high discharge pressure and nuisance high-pressure cutouts. Check with the valve manufacturer for optimal sizing and recommended mounting positions. It is strongly recommended to reduce the compressor speed to 25/30 rps before the 4-way valve is moved from a position to another. Refer also to high and low pressure protection.
Defrost test	In order to check liquid flood back during defrost cycle, the defrost test must be carried out in the most unfavorable condition, at 0°C evaporating temperature. During defrost test, liquid flood back can be detected by either measuring oil superheat or monitoring drive alarm. If at any time during defrost operations, the oil superheat drops to the unsafety area in the Dilution Chart (see graph in the section "Liquid floodback during operation"),	or drive alarm A49 (or A18) occurs, this indicates liquid flood back. In such cases a suction accumulator is mandatory. The suction accumulator offers protection by trapping the liquid refrigerant upstream from the compressor. The accumulator should not be sized for less than 50% of the total system charge.
Defrost and reverse cycle	After the 4-way valve is moved to defrost position, and in order to shorten the defrost period, the compressor speed can be maintained at 70 rps during the defrost period.	When the compressor is started again, after defrost, it will run at 50rps for at least 1 min. Thus to avoid excessive liquid refrigerant to come back to the compressor sump.

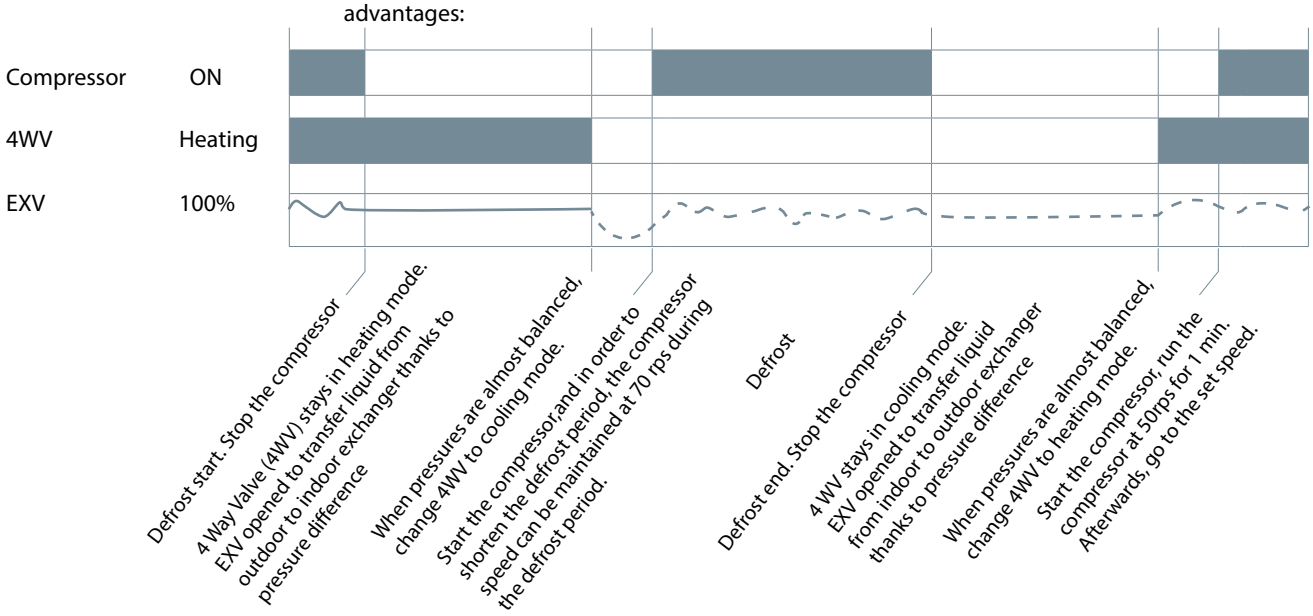
Defrost cycle logic

In reversible systems, the defrost logic can be worked out to limit liquid flood back effect by:

1. Running full load during defrost to share liquid refrigerant between all compressors.

2. Transferring liquid refrigerant from one exchanger to the other one thanks to pressures.

The following defrost logic combines both advantages:



Defrost cycle logic must respect all system components recommendations, in particular 4 way valve Max. Operating Pressure Differential. Opening degree and time have to be set in order to keep a minimum pressure for 4 way valve moving.
Danfoss recommend above defrost cycle logic, but the control logic is also system specified.

Suction line accumulator	The use of a suction line accumulator is strongly recommended in reversible-cycle applications. This because of the possibility of a substantial quantity of liquid refrigerant remaining in the evaporator, which acts as a condenser during the heating cycle. This liquid refrigerant can then return to the compressor, either flooding the sump with refrigerant or as a dynamic liquid slug when the cycle switches back to a defrost cycle or to normal cooling operations.	The suction accumulator becomes mandatory in case of below situations. - Defrost test indicates there is continuous liquid flood during defrost. More details please refer to section "defrost test". - No defrost test performed. - Sustained and repeated liquid slugging and floodback are observed in wet climates where it is necessary to frequently defrost the outdoor coil in an air source heat pump.
Water utilizing systems	Apart from residual moisture in the system after commissioning, water could also enter the refrigeration circuit during operation. Water in the system shall always be avoided. Not only because it can shortly lead to electrical failure, sludge in sump and corrosion but in particular because it can cause serious safety risks. Common causes for water leaks are corrosion and freezing. **Corrosion**: Materials in the system shall be compliant with water and protected against corrosion.	**Freezing**: When water freezes into ice its volume expands which can damage heat exchanger walls and cause leaks. During off periods water inside heat exchangers could start freezing when ambient temperature is lower than 32°F. During on periods ice banking could occur when the circuit is running continuously at too low load. Both situations should be avoided by connecting a pressure and thermostat switch in the safety line.

Running sound level

For all VZH models, noise level given in table doesn't include inferior hood attenuation.

Model	Frequency RPS	200V		400V		575V	
		Without acoustic hood (dBA)	With acoustic hood (dBA)	Without acoustic hood (dBA)	With acoustic hood (dBA)	Without acoustic hood (dBA)	With acoustic hood (dBA)
VZH088	30	70	64	69	62	72	66
	60	78	73	77	72	79	73
	90	86	80	85	79	88	82
VZH117	30	73	67	71	64	72	66
	60	82	77	80	75	82	76
	90	88	83	87	81	91	85
VZH170	30	72	66	72	65	77	71
	60	84	78	85	78	85	79
	90	95	90	94	89	95	89

Average sound power for reference at ARI A/C conditions measured in free space.
Note: running sound level for 575V VZH is preliminary data

Sound generation in a refrigeration or air conditioning system

Typical sound and vibration in refrigeration and air conditioning systems encountered by design and service engineers may be broken down into the following three source categories.
Sound radiation: this generally takes an airborne path.
Mechanical vibrations: these generally extend along the parts of the unit and structure.
Gas pulsation: this tends to travel through the cooling medium, i.e. the refrigerant.

The following sections focus on the causes and methods of mitigation for each of the above sources.

Compressor sound radiation

For sound radiating from the compressor, the emission path is airborne and the sound waves are travelling directly from the machine in all directions.

The VZH scroll compressor is designed to be quiet and the frequency of the sound generated is pushed into the higher ranges, which not only are easier to reduce but also do not generate the penetrating power of lower-frequency sound.

Use of sound-insulation materials on the inside of unit panels is an effective means of substantially reducing the sound being transmitted to the outside. Ensure that no components capable of transmitting sound/vibration within the unit come into direct contact with any non insulated parts on the walls of the unit.

Because of the VZH unique design of a full-suction gas-cooled motor, compressor body insulation across its entire operating range is possible. Acoustic hoods are available from Danfoss as accessories. These hoods are quick and easy to install and do not increase the overall size of the compressors to a great extend.

Mechanical vibrations

Vibration isolation constitutes the primary method for controlling structural vibration. VZH scroll compressors are designed to produce minimal vibration during operations. The use of rubber isolators on the compressor base plate or on the frame of a manifolded unit is very effective in reducing vibration being transmitted from the compressor(s) to the unit. Once the supplied rubber grommets have been properly mounted, vibrations transmitted from the compressor base plate to the unit are held to a strict minimum. In addition, it is extremely important that the frame supporting the mounted compressor be of sufficient mass and stiffness to help dampen any residual vibration potentially transmitted to the frame.

For further information on mounting requirements, please refer to the section on mounting assembly.

Speed by-pass	If vibrations occurs at some typical frequencies of the VZH variable speed compressor system, design must be checked: frame, piping, pipes using cushioned clamps. But if some frequencies remain showing unacceptable vibration level,	speed by-pass is adjustable in the frequency converter, in order to avoid some frequency ranges. Four by-pass ranges are adjustable, and settings can be done in parameters 4.6x.
Gas pulsation	The VZH scroll compressor has been designed and tested to ensure that gas pulsation has been optimized for the most commonly encountered air conditioning pressure ratios. On heat pump installations and other installations where the pressure ratio lies beyond the typical range, testing should be conducted under all expected	conditions and operating configurations to ensure that minimum gas pulsation is present. If an unacceptable level is identified, a discharge muffler with the appropriate resonant volume and mass should be installed. This information can be obtained from the component manufacturer.

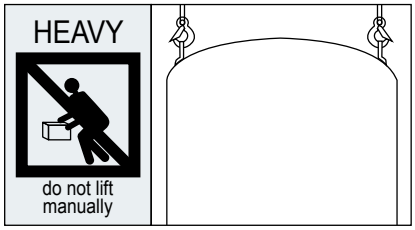
Each compressor is shipped with printed instructions for installation. These instructions can also be downloaded from: http://instructions.cc.danfoss.com

Compressor handling

Each VZH scroll compressor is equipped with two lift rings on the top shell. Always use both these rings when lifting the compressor. Use lifting equipment rated and certified for the weight of the compressor. A spreader bar rated for the weight of the compressor is highly recommended to ensure a better load distribution. The use of lifting hooks closed with a clasp certified to lift the weight of the compressor is also highly recommended. Always respect the appropriate rules concerning lifting objects of the type and weight of these compressors. Maintain the compressor in an upright position during all handling operations.

Never use only one lifting lug to lift the compressor. The compressor is too heavy for the single lug to handle, and the risk is that the lug could separate from the compressor with extensive damage and possible personal injury as a result.

When the compressor is mounted as part of an installation, never use the lift rings on the compressor to lift the installation. The risk is that the lugs could separate from the compressor or that the compressor could separate from the base frame with extensive damage and possible personal injury as a result.



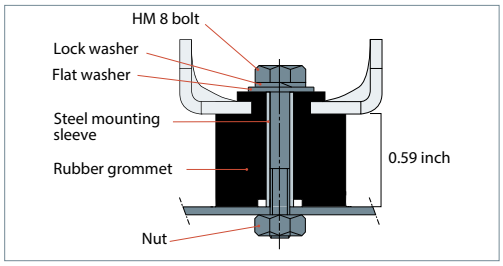
Never apply force to the terminal box with the intention of moving the compressor, as the force placed upon the terminal box can cause extensive damage to both the box and the components contained inside.

Mounting

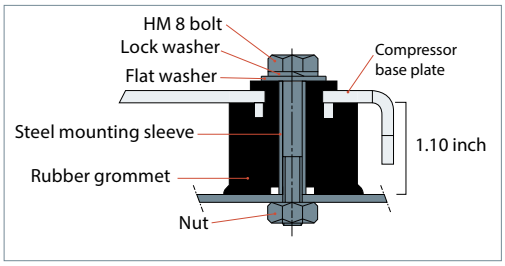
Maximum inclination from the vertical plane while operating must not exceed 3 degrees.

VZH compressors come delivered with four rubber mounting grommets and metal sleeve liners that serve to isolate the compressor from the base frame. These grommets must always be used to mount the compressor in a single application. The grommets must be compressed until contact between the flat washer and the steel mounting sleeve is established. The grommets attenuate to a great extent the transmission of compressor vibrations to the base frame.

The required bolt size for the VZH088 & 117 compressors is HM8-40. This bolt must be tightened to a torque of 11 ft/lbs.



The required bolt size for VZH170 compressors is HM8-55 and must be tightened to a torque of 15 ft/lbs.



Removing connections shipping plugs

Before the suction and discharge plugs are removed, the nitrogen holding charge must be released via the suction schrader valve to avoid an oil mist blowout. Remove the suction plug first and the discharge plug afterwards. The plugs shall be removed only just before connecting the compressor to the installation in order to avoid moisture from entering the compressor. When the plugs are removed, it is essential to keep the compressor in an upright position so as to avoid oil spillage.

System cleanliness

The refrigerant compression system, regardless of the type of compressor used, will only provide high efficiency and good reliability, along with a long operating life, if the system contains solely the refrigerant and oil it was designed for. Any other substances within the system will not improve performance and, in most cases, will be highly detrimental to system operations. The presence of non-condensable substances and system contaminants such as metal shavings, solder and flux, have a negative impact on compressor service life. Many of these contaminants are small enough to pass through a mesh screen and can cause considerable damage within a bearing assembly.

The use of highly hygroscopic polyolester oil in R410A compressors requires that the oil be exposed to the atmosphere as little as possible. System contamination is one of main factors affecting equipment reliability and compressor service life. It is important therefore to take system cleanliness into account when assembling a refrigeration system. During the manufacturing process, circuit contamination may be caused by:

- Brazing and welding oxides,
- Filings and particles from the removal of burrs in pipe-work,
- Brazing flux,
- Moisture and air.

Consequently, when building equipment and assemblies, the precautions listed in the following paragraphs must be taken.

Tubing

Only use clean and dehydrated refrigeration grade copper tubing. Tube-cutting must be carried out so as not to deform the tubing roundness and to ensure that no foreign debris remains within the tubing. Only refrigerant grade fittings should be used and these must be of both a design and size to allow for a minimum pressure drop through the completed assembly. Follow the brazing instructions bellow. Never drill holes into parts of the pipe-work where filings and particles can not be removed.

Filter driers

For new installations with VZH compressors with polyolester oil, Danfoss recommends using the Danfoss DML 100% molecular sieve, solid core filter drier. Molecular sieve filter driers with loose beads from third party suppliers shall be avoided. For servicing of existing installations where acid formation is present the Danfoss DCL solid core filter driers containing activated alumina are recommended.
The drier is to be oversized rather than undersized. When selecting a drier, always take into account its capacity (water content capacity), the system refrigeration capacity and the system refrigerant charge.

Brazing and soldering

Copper to copper connections

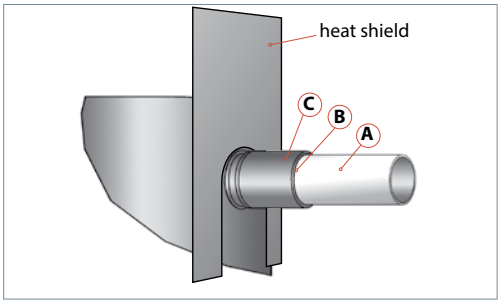
When brazing copper-to-copper connections, the use of copper/phosphorus brazing alloy containing 5% silver or more with a melting temperature of below 800°C is recommended. No flux is required during brazing.

Dissimilar metals connections

When manipulating dissimilar metals such as copper and brass or steel, the use of silver solder and anti-oxidant flux is necessary.

Compressor connection

When brazing the compressor fittings, do not overheat the compressor shell, which could severely damage certain internal components due to excessive heating. Use of a heat shield and/or a heat-absorbent compound is highly recommended. Due to the relatively sizable tubing and fitting diameters a double-tipped torch using acetylene is recommended for brazing operation on VZH compressors.



For brazing the suction and discharge connections, the following procedure is advised:

- Make sure that no electrical wiring is connected to the compressor.
- Protect the terminal box and compressor painted surfaces from torch heat damage (see diagram).
- Remove the Teflon gaskets when brazing rotolock connectors with solder sleeves.
- Use only clean refrigeration-grade copper tubing and clean all connections.
- Use brazing material with a minimum of 5% silver content.
- Purge nitrogen or CO_2 through the compressor in order to prevent against oxidation and flammable conditions. The compressor should not be exposed to the open air for extended periods.
- Use of a double-tipped torch is recommended.
- Apply heat evenly to area A until the brazing temperature is reached. Move the torch to area B and apply heat evenly until the brazing temperature has been reached there as well, and then begin adding the brazing material. Move the torch evenly around the joint, in applying only enough brazing material to flow the full circumference of the joint.
- Move the torch to area C only long enough to draw the brazing material into the joint, but not into the compressor.
- Remove all remaining flux once the joint has been soldered with a wire brush or a wet cloth. Remaining flux would cause corrosion of the tubing.

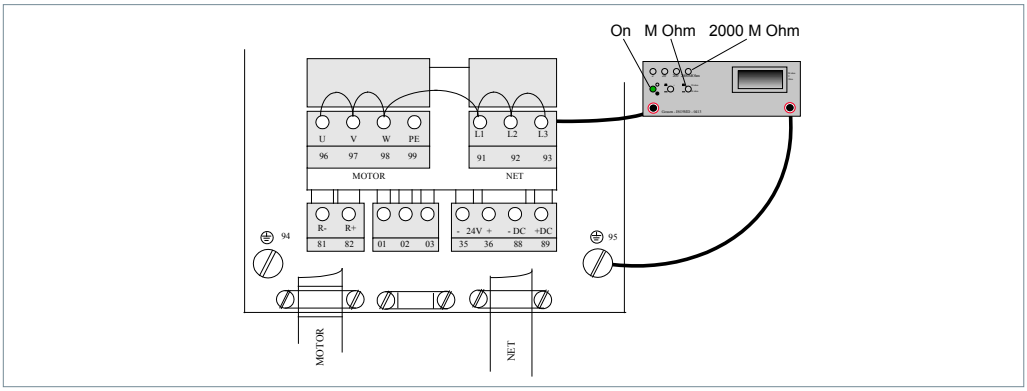
Ensure that no flux is allowed to enter into the tubing or compressor. Flux is acidic and can cause substantial damage to the internal parts of the system and compressor.

The polyolester oil used in VZH compressors is highly hygroscopic and will rapidly absorb moisture from the air. The compressor must therefore not be left open to the atmosphere for a long period of time. The compressor fitting plugs shall be removed just before brazing the compressor. The compressor should always be the last component brazed into the system

Before eventual unbrazing the compressor or any system component, the refrigerant charge must be removed from both the high- and low-pressure sides. Failure to do so may result in serious personal injury. Pressure gauges must be used to ensure all pressures are at atmospheric level.

For more detailed information on the appropriate materials required for brazing or soldering, please contact the product manufacturer or distributor. For specific applications not covered herein, please contact Danfoss for further information.

High voltage test



It is not necessary to perform a Hipot test (dielectric withstand test) on frequency converters. This has already been done during factory final test.

If a Hipot test has to be done anyway, following instructions must be followed in order to not damage the frequency converter:

- Compressor not connected
- L1, L2, L3, U, V, W terminals must be shorten and connected to high voltage terminal of the testing device.
- Ground terminal (chassis) must be connected to low voltage terminal of the testing device.
- 2000VDC(for T2)/2150VDC(for T4)/2250VDC (for T6) for 1 seconds must be applied
- Ramp up time 3 seconds
- Full DC voltage must be established during 2 seconds
- The current leakage during the test must be below 1mA
- Ramp down time to 0V in 25 seconds.

When running high voltage tests of the entire installation, frequency converter and compressor electrical motor compressor test can be conducted together. When conducting a high voltage test make sure the system is not under vacuum: this may cause electrical motor compressor failure.

System pressure test

Always use an inert gas such as nitrogen for pressure testing. Never use other gasses such as oxygen, dry air or acetylene as these may form an inflammable mixture. Do not exceed the following pressures:

Maximum compressor test pressure (low side)	483 psi(g) for VZH088 & 117 438 psi(g) for VZH170
Maximum compressor test pressure (high side)	653 psi(g)
Maximum pressure difference between high and low side of the compressor	537 psi

Pressurize the system on HP side first then LP side to prevent rotation of the scroll. Never let the pressure on LP side exceed the pressure on HP side with more than 73 psi.

Leak detection

Leak detection must be carried out using a mixture of nitrogen and refrigerant or nitrogen and helium, as indicated in the table below. Never use other gasses such as oxygen, dry air or acetylene as these may form an inflammable mixture.
Pressurize the system on HP side first then LP side.

Leak detection with refrigerant	Leak detection with a mass spectrometer
Nitrogen & R410A	Nitrogen & Helium

Vacuum pump down and moisture removal

Moisture obstructs the proper functioning of both the compressor and the refrigeration system. Air and moisture reduce service life and increase condensation pressure, which causes abnormally high discharge temperatures that are then capable of degrading the lubricating properties of the oil. The risk of acid formation is also increased by air and moisture, and this condition can also lead to copper plating. All these phenomena may cause both mechanical and electrical compressor failures. The typical method for avoiding such problems is a vacuum pump-down executed with a vacuum pump, thus creating a minimum vacuum of 500 microns (0.67 mbar). Please refer to News bulletin TI1-026-0302 "Vacuum pump down and dehydration procedure".

Refrigerant charging

For the initial charge the compressor must not run and eventual service valves must be closed. Charge refrigerant as close as possible to the nominal system charge before starting the compressor. This initial charging operation must be done in liquid phase as far away as possible from the compressor. The best location is on the liquid line between the condenser outlet and the filter drier. Then during commissioning, when needed, a complement of charge can be done in liquid phase: slowly throttling liquid in on the low pressure side as far away as possible from the compressor suction connection. The refrigerant charge quantity must be suitable for both summer and winter operations.

Refer to news bulletin FRCC.EN.050 "Danfoss Commercial Compressors recommended refrigerant system charging practice" for more details.

Loss of charge protection

Customer need to protect compressor against loss of charge. Compared with fix speed compressor, loss of charge could be more severe to variable speed compressors. When loss of charge occurs, variable speed compressors will speed up to compensate capacity reduction, Further drive will active derating function to slow compressor heating up. Thus compressors will run longer time at high temperature but low oil viscosity than fixed speed and will lead to compressor damage eventually. Low pressure switch and discharge gas thermostat could protect loss of charge somehow. But it is highly recommended to protect compressor from high superheat.

Commissioning

The system must be monitored after initial startup for a minimum of 60 minutes to ensure proper operating characteristics such as:

- Proper metering device operation and desired superheat readings
- Suction and discharge pressure are within acceptable levels
- Correct oil level in compressor sump indicating proper oil return
- Low foaming in sight glass and compressor sump temperature 10K above saturation temperature to show that there is no refrigerant migration taking place
- Acceptable cycling rate of compressors, including duration of run times.

A short cycling protection is provided in the CDS303 frequency converter. It is factory preset "enabled" with the following parameters in:
28.01 - interval between 2 starts: 300 secondes
28.02 - minimum run time: 12 seconds.

This minimum run time is set to guaranty long enough running time at start up in order to create enough refrigerant flow velocity in the system to recover the oil to the compressor sump.

- Current draw of compressor within acceptable values (RLA ratings)
- No abnormal vibrations and noise.

⚠ **Note this compressor is equipped with a four poles electrical motor so the applied frequency from the inverter will be 50 Hz for 25 rps (1500 rpm) up to 200 Hz for 100 rps (6000 rpm).**

Oil level checking and top-up

In installations with good oil return and line runs up to 20 m, no additional oil is required. If installation lines exceed 20 m, additional oil may be needed. 4% of the total system refrigerant charge (in kg) can be used to roughly define the required oil top-up quantity (in liters) but in any case the oil charge has to be adjusted based on the oil level in the compressor sight glass. This procedure must be conducted with the system running at high load (compressor at full speed)

When the compressor is running under stabilized conditions the oil level must be visible in the sight glass.

The presence of foam filling in the sight glass indicates large concentration of refrigerant in the oil and / or presence of liquid returning to the compressor.

Mandatory check is made at low load and stabilised conditions, compressor at minimum speed, for a minimum duration of 1 hour. The oil level must be always visible at the compressor sight glass. If any deviation is observed, this means that some oil is trapped in the system, heat exchangers and/or pipes.

The CDS303 frequency converter integrates an oil recovery management algorithm which needs to be adjusted in regards to the system design. Oil return management function forces the compressor to rotate at 4200rpm (70 Hz) for an adjustable given period of time in order to build a good refrigerant gas velocity in the system to allow the oil recovery to the compressor sump. This oil management function is factory preset with the following parameters:

- 28-10 Oil return management : enabled
- 28-11 Low speed running time : 60 minutes. This is the duration during which the compressor rotation speed is below 3000rpm (50 Hz)
- 28-12 Fixed boost interval : 24 hours
- 28-13 Boost duration : 30 seconds

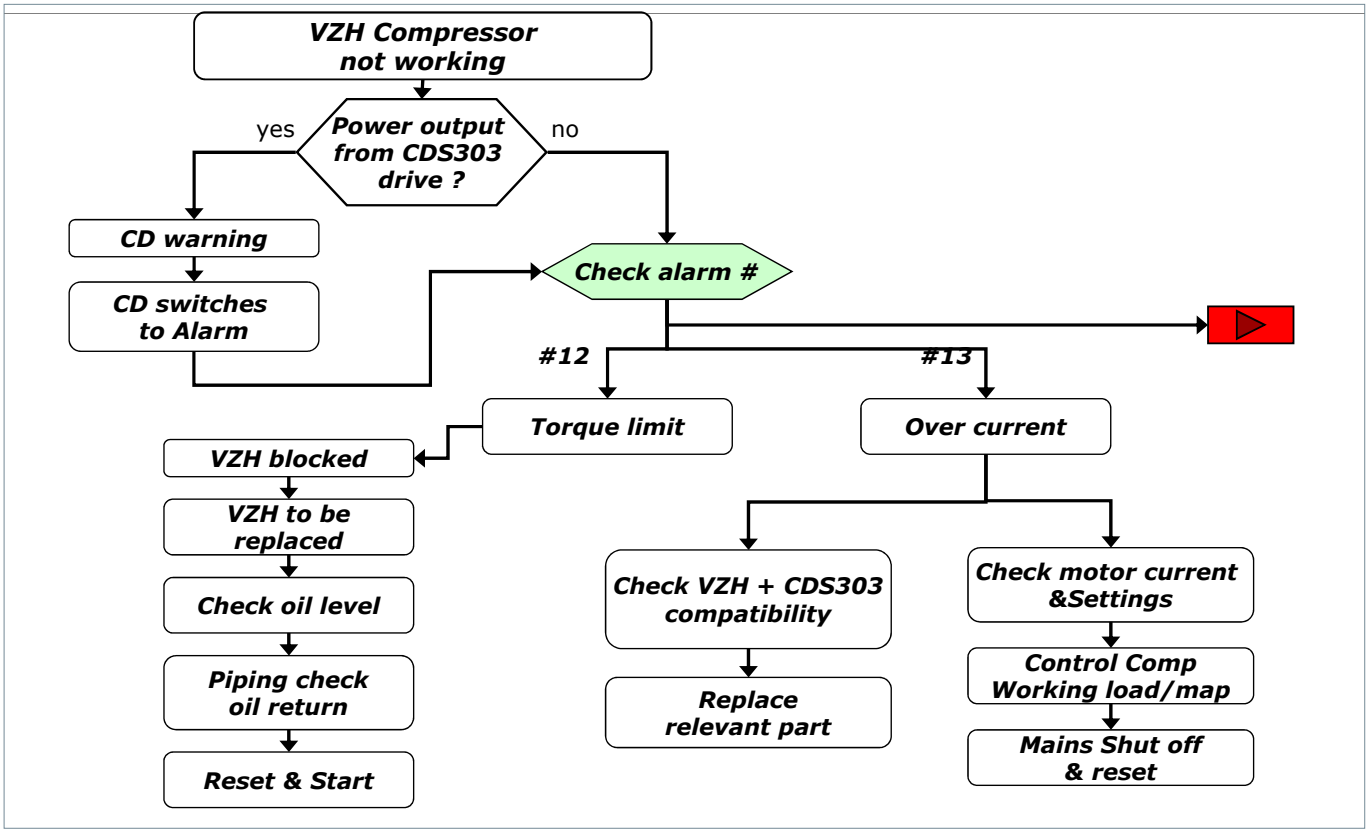
If the oil level decreases down to the bottom side of the sight glass, parameter 28-11 must be adjusted to start the boost cycle. During this boost cycle the oil level in the sight has to be monitored in order to adjust the boost duration on parameter 28-13 to a value that allows the oil level to be recovered at ½ of the sight glass.

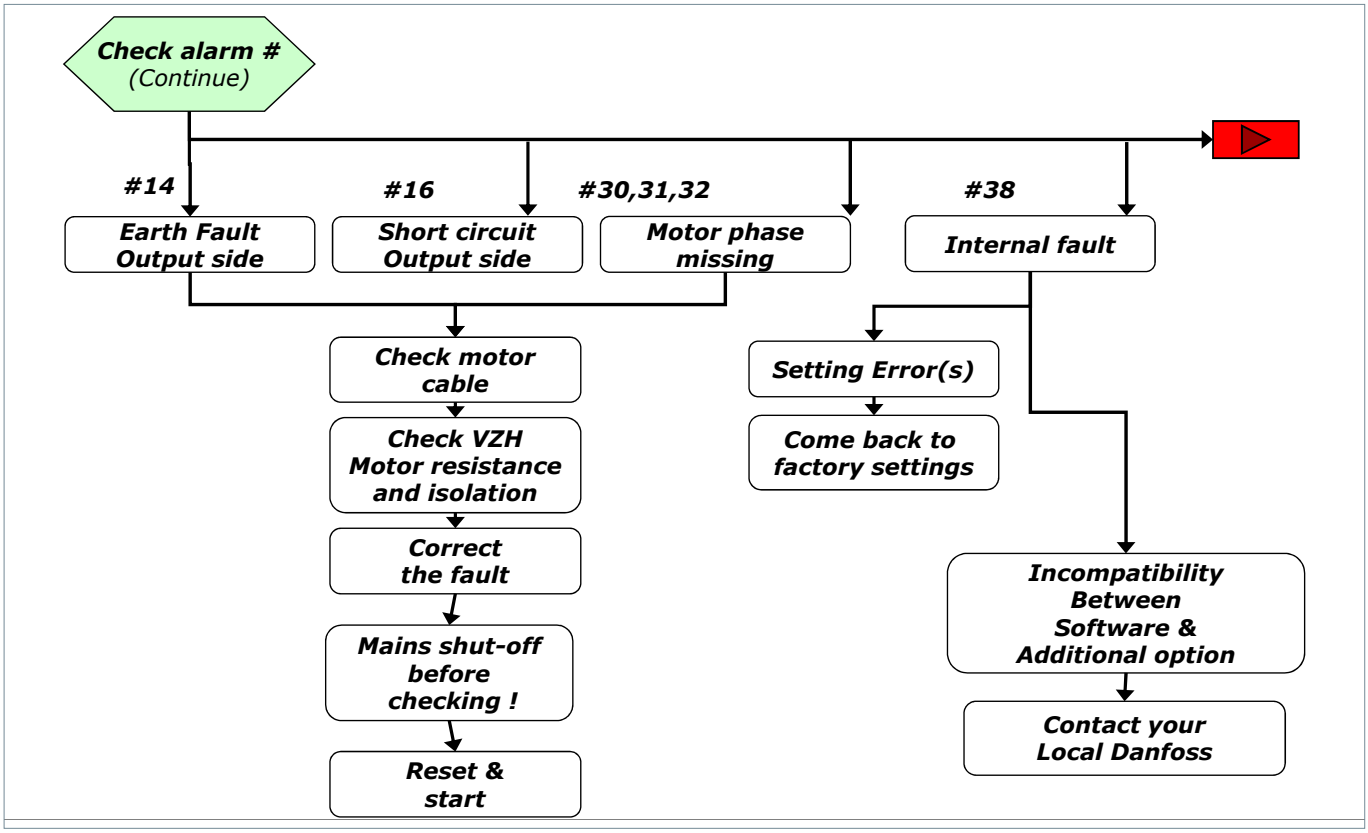
The oil level can also be checked a few minutes after the compressor stops, the level must be between ¼ and ¾ of sight glass.

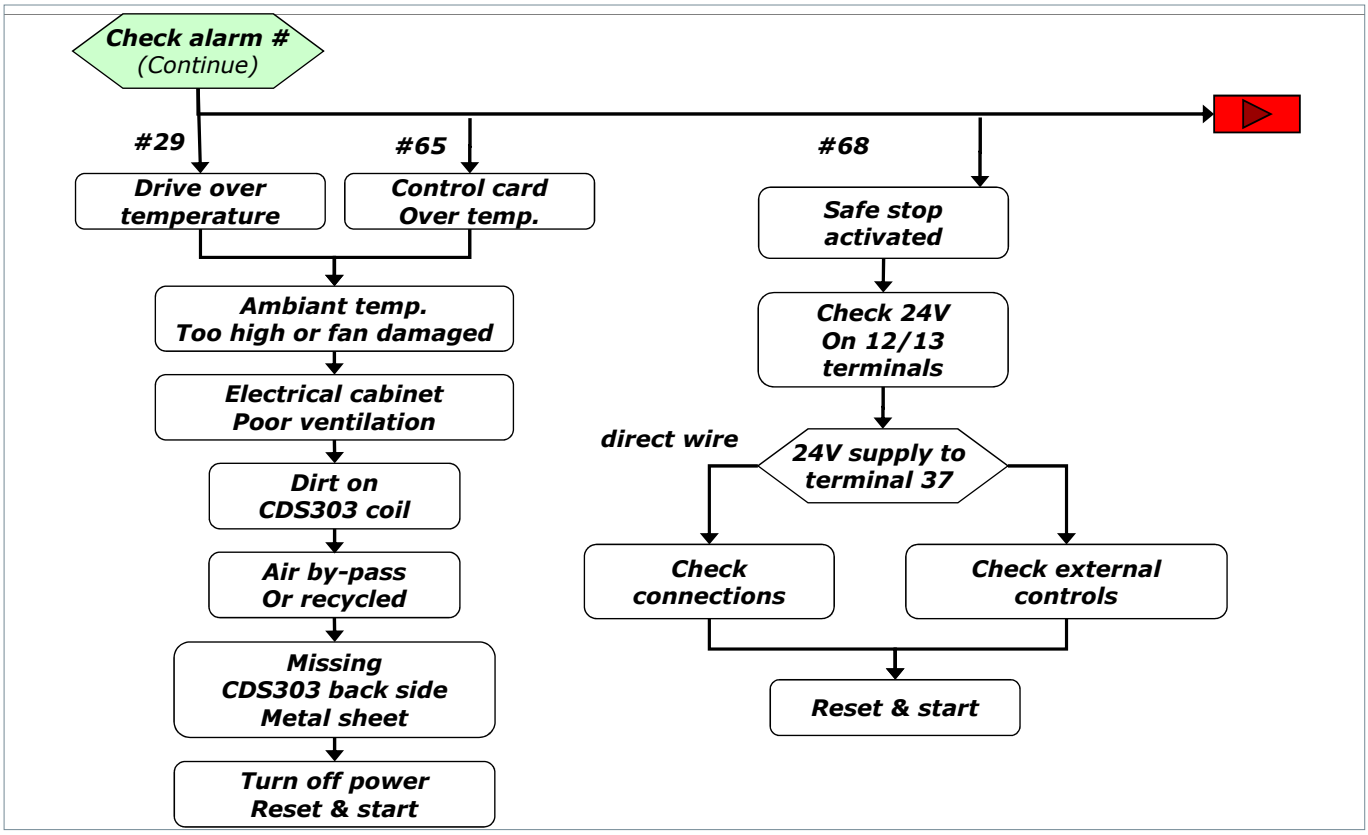
When the compressor is off, the level in the sight glass can be influenced by the presence of refrigerant in the oil.

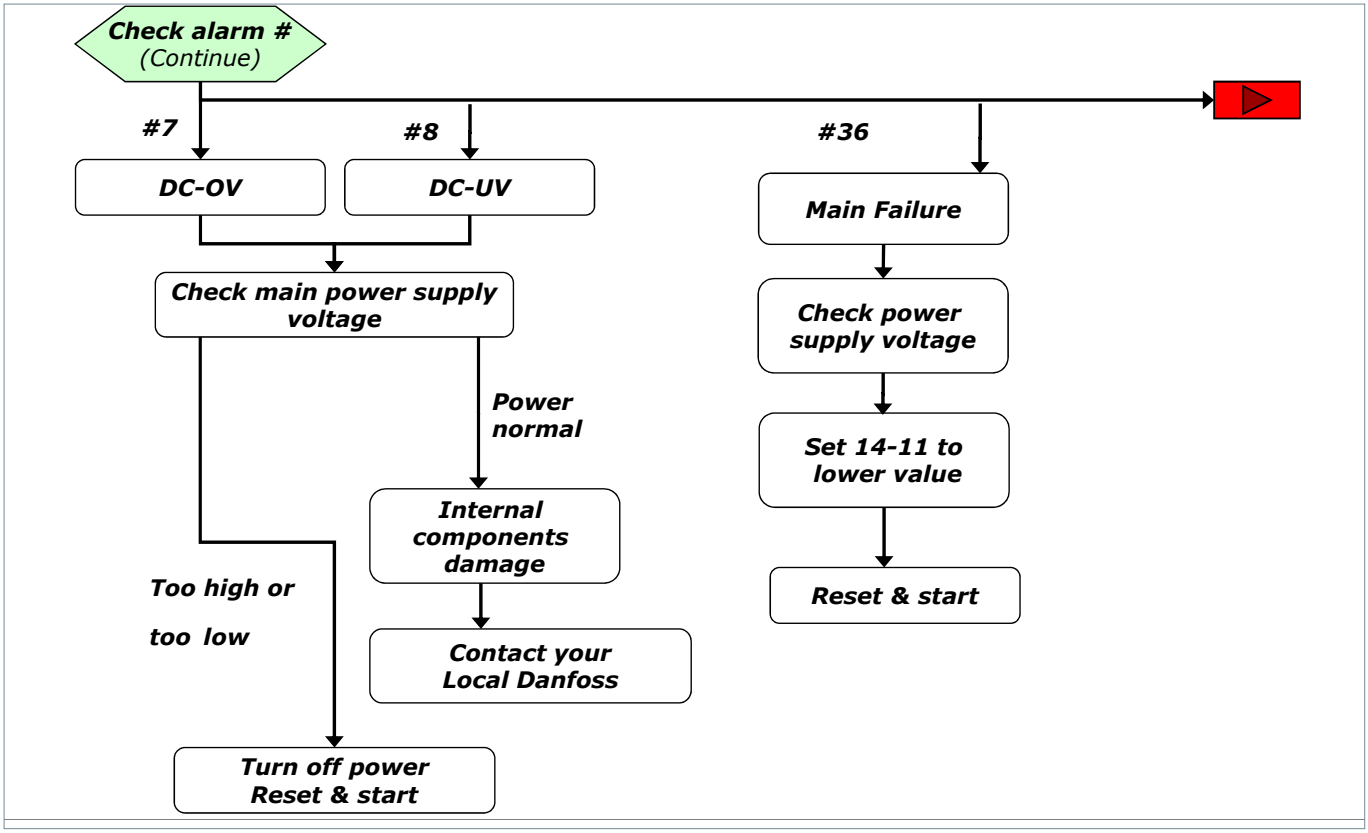
Always use original Danfoss POE oil 160SZ from new cans.

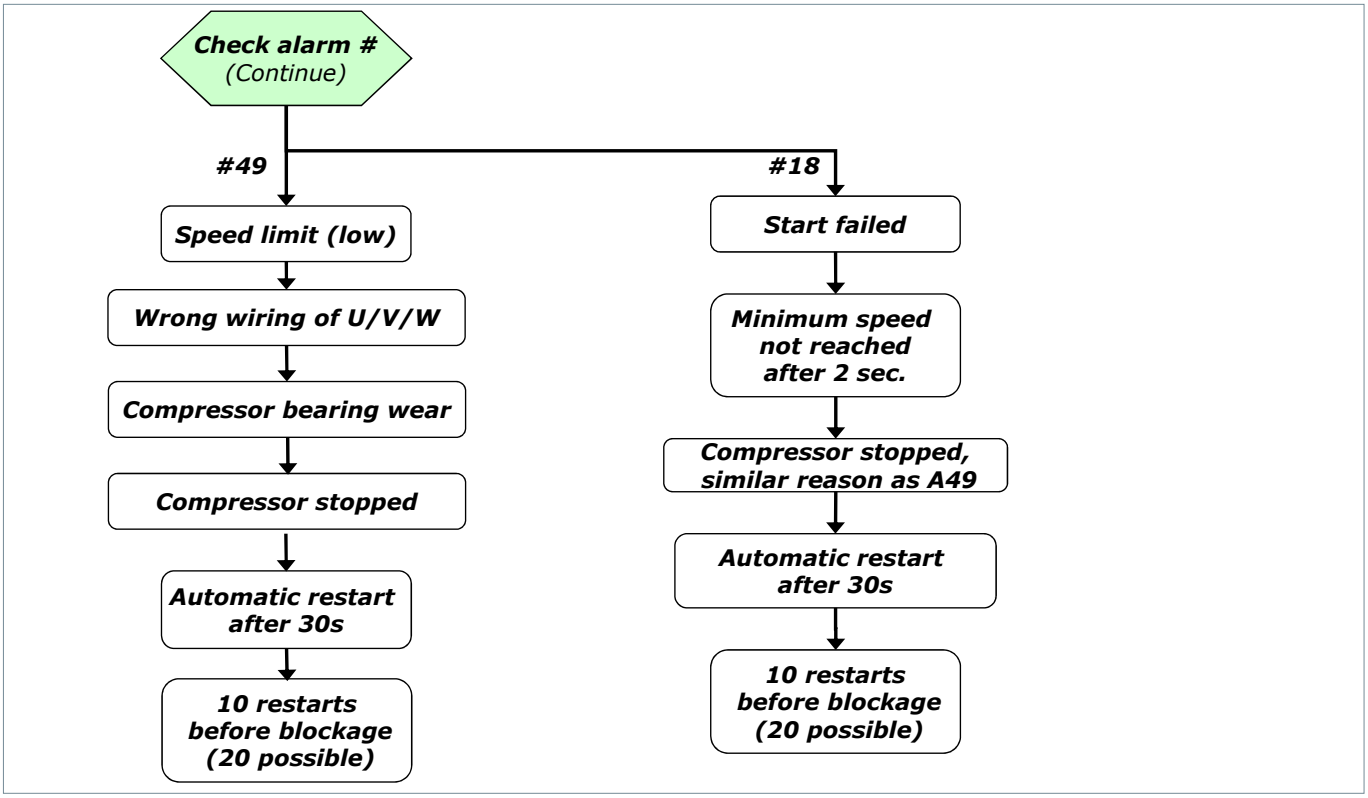
Top-up the oil while the compressor is idle. Use the schrader connector or any other accessible connector on the compressor suction line and a suitable pump. See News bulletin "Lubricants filling in instructions for Danfoss Commercial Compressors".


VZH Compressor not working
Power output from CDS303 drive ?
yes
no
CD warning
CD switches to Alarm
Check alarm #
#12
#13
Torque limit
Over current
VZH blocked
VZH to be replaced
Check oil level
Piping check oil return
Reset & Start
Check VZH + CDS303 compatibility
Replace relevant part
Check motor current &Settings
Control Comp Working load/map
Mains Shut off & reset


Check alarm # (Continue)
#14
#16
#30,31,32
#38
Earth Fault Output side
Short circuit Output side
Motor phase missing
Internal fault
Check motor cable
Check VZH Motor resistance and isolation
Correct the fault
Mains shut-off before checking !
Reset & start
Setting Error(s)
Come back to factory settings
Incompatibility Between Software & Additional option
Contact your Local Danfoss


Check alarm #
(Continue)
#29
#65
#68
Drive over temperature
Control card Over temp.
Safe stop activated
Ambiant temp. Too high or fan damaged
Check 24V On 12/13 terminals
Electrical cabinet Poor ventilation
direct wire
24V supply to terminal 37
Dirt on CDS303 coil
Check connections
Check external controls
Air by-pass Or recycled
Reset & start
Missing CDS303 back side Metal sheet
Turn off power Reset & start


Check alarm #
(Continue)
#7
#8
#36
DC-OV
DC-UV
Main Failure
Check main power supply voltage
Check power supply voltage
Power normal
Set 14-11 to lower value
Internal components damage
Too high or
too low
Reset & start
Contact your Local Danfoss
Turn off power Reset & start



More information on CDS303 inverter trouble shooting checklist is described in document "FRCC.PC.036".

Kit ordering and shipping

The tables on the following pages give code numbers for ordering purposes for the VZH compressor and CDS303 frequency converter kit packed and shipped separately.

Packaging

Compressor single pack



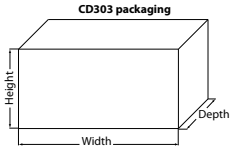
Compressor model	Height (in)	Width (in)	Depth (in)	Weight (lb)
VZH088	28.3	22.2	18.5	154.3
VZH117	28.3	22.2	18.5	167.6
VZH170	30.1	20.3	17.7	247.0

Compressor industrial pack



Compressor model	Nbr*	Length (in)	Width (in)	Height (in)	Gross Weight (kg)	Static stacking pallets
VZH088	8	45.3	37.4	26.8	1089	2
VZH117	8	45.3	37.4	29.5	1199	2
VZH170	4	1150	40.0	30.2	1426	2

Frequency converter single pack



Drive supply voltage	Drive power (kW)	IP20				IP55			
		Height (in)	Width (in)	Depth (in)	Weight (lbs)	Height (in)	Width (in)	Depth (in)	Weight (lbs)
T2: Code J	15	13.6	31.9	12.6	53.0	16.9	31.7	15.9	101.0
	18 - 22	17.2	31.7	12.9	79.0	17.2	31.7	15.9	101.0
T4: Code G	15	13.7	19.7	13.0	28.7	13.6	31.9	12.6	53.0
	18 - 22	13.6	31.9	12.6	53.0	13.6	31.9	12.6	62.0
T6: Code G	18.5-30	13.6	31.9	12.6	53.0	-	-	-	-

Ordering information

VZH scroll compressors can be ordered in single packs or industrial packs while VZH frequency converters can only be ordered in single pack.

Please use the code numbers from below tables for ordering. A coil for injection valve must be ordered separately.

Compressors single pack

Compressor model	Pressure ratio	Equipment version	Technical Name	X=motor code		
				G 380-480V/3ph/ 50&60Hz	J 200-240V/3ph/ 50&60Hz	H 525-600V/3ph/ 50&60Hz
VZH088	High	Single	VZH088AXANA	120G0010	120G0012	120G0047
	Low	Single	VZH088BXANA	120G0011	120G0013	120G0049
	High	Manifold	VZH088AXBNA	120G0022	120G0024	120G0048
	Low	Manifold	VZH088BXBNA	120G0023	120G0025	120G0050
	High	Unified	VZH088AXDNA	120G0102	120G0103	120G0104
	Low	Unified	VZH088BXDNA	120G0105	120G0106	120G0107
VZH117	High	Single	VZH117AXANA	120G0014	120G0016	120G0051
	Low	Single	VZH117BXANA	120G0015	120G0017	120G0053
	High	Manifold	VZH117AXBNA	120G0026	120G0028	120G0052
	Low	Manifold	VZH117BXBNA	120G0027	120G0029	120G0054
	High	Unified	VZH117AXDNA	120G0108	120G0109	120G0110
	Low	Unified	VZH117BXDNA	120G0111	120G0112	120G0113
VZH170	High	Single	VZH170AXANB	120G0018	120G0020	120G0055
	Low	Single	VZH170BXANB	120G0019	120G0021	120G0057
	High	Manifold	VZH170AXBNB	120G0030	120G0032	120G0056
	Low	Manifold	VZH170BXBNB	120G0031	120G0033	120G0058
	High	Unified	VZH170AXDNB	120G0114	120G0115	120G0116
	Low	Unified	VZH170BXDNB	120G0117	120G0118	120G0119

Compressors industrial pack

Compressor model	Technical Name	X = Motor code	
		Code G	Code J
VZH088	VZH088AXANA	120G0078	120G0080
	VZH088BXANA	120G0079	120G0081
	VZH088AXBNA	120G0090	120G0092
	VZH088BXBNA	120G0091	120G0093
VZH117	VZH117AXANA	120G0082	120G0084
	VZH117BXANA	120G0083	120G0085
	VZH117AXBNA	120G0094	120G0096
	VZH117BXBNA	120G0095	120G0097
VZH170	VZH170AXANB	120G0086	120G0088
	VZH170BXANB	120G0087	120G0089
	VZH170AXBNB	120G0098	120G0100
	VZH170BXBNB	120G0099	120G0101

Coils

Coil model	Code no.
208V-240V coil + adaptor	120Z0521
24V coil + adaptor	120Z0522

VZH voltage code G - 380-480 Volt

Compressor model	Frequency converter				
	Model & power	IP class	RFI class	Coating	Code n° for ordering
VZH088-G	CDS303 15.0kW	IP20	H3	No	134G3576
				Yes	134G3577
			H2	No	134F9366
				Yes	134G3578
		IP55	H3	No	134G4008
				Yes	134G4010
			H2	No	134G4012
				Yes	134G4013
VZH117-G	CDS303 18.5kW	IP20	H3	No	134G3579
				Yes	134G3580
			H2	No	134F9368
				Yes	134G3581
		IP55	H3	No	134G4015
				Yes	134G4016
			H2	No	134G4018
				Yes	134G4019
VZH170-G	CDS303 22.0kW	IP20	H3	No	134G3582
				Yes	134G3583
			H2	No	134F9371
				Yes	134G3584
		IP55	H3	No	134G4020
				Yes	134G4021
			H2	No	134G4022
				Yes	134G4023

LCP: user interface 120Z0326 (accessory)

VZH voltage code G - 525-480 Volt

Compressor model	Frequency converter			
	Model & power	IP class	RFI class	Code n° for ordering
VZH088-H	CDS303 18.5kW	IP20	HX	134L7237
VZH117-H	CDS303 30kW	IP20	HX	134L7239
VZH170-H	CDS303 30kW	IP20	HX	134L7239

VZH voltage code J - 200-240 Volt

Compressor model	Frequency converter				
	Model & power	IP class	RFI class	Coating	Code n° for ordering
VZH088-J	CDS303 15.0kW	IP20	H3	No	134G3474
			H2	No	134F9361
				Yes	134X1964
		IP55	H3	No	134G4001
			H2	No	134G4002
VZH117-J	CDS303 18.5kW	IP20	H3	No	134G3585
			H2	No	134F9363
				Yes	134X1965
		IP55	H3	No	134G4003
			H2	No	134G4004
VZH170-J	CDS303 22.0kW	IP20	H3	No	134G3586
			H2	No	134F9365
				Yes	134X1966
		IP55	H3	No	134G4005
			H2	No	134G4006

LCP: user interface 120Z0326 (accessory)

Valves, adapters, connectors & gaskets for use on suction and discharge connections

Solder sleeve adapter sets

Type	Code n°	Description	Application	Packaging	Pack size
	120Z0125	Solder sleeve adapter set (1"3/4 Rotolock, 1"1/8 ODF), (1"1/4 Rotolock, 7/8" ODF)	VZH088	Multipack	8
	120Z0405	Solder sleeve adapter set (1"3/4 Rotolock, 1"3/8 ODF), (1"1/4 Rotolock, 7/8" ODF)	VZH117	Multipack	8
	7765028	Solder sleeve adapter set, (2"1/4 Rotolock, 1"5/8 ODF), (1"3/4 Rotolock, 1"1/8 ODF)	VZH170	Multipack	6

Crankcase heaters & thermostats

Crankcase heaters

Type	Code n°	Description	Application	Packaging	Pack size
	7773109	Belt type crankcase heater, 65 W, 110 V, CE mark, UL	VZH088-117	Multipack	6
	7973001	Belt type crankcase heater, 65 W, 110 V, CE mark, UL		Industry pack	50
	7773107	Belt type crankcase heater, 65 W, 230 V, CE mark, UL		Multipack	6
	120Z0038	Belt type crankcase heater, 65 W, 230 V, CE mark, UL		Multipack	8
	7973002	Belt type crankcase heater, 65 W, 230 V, CE mark, UL		Industry pack	50
	7773117	Belt type crankcase heater, 65 W, 400 V, CE mark, UL		Multipack	6
	120Z0039	Belt type crankcase heater, 65 W, 400 V, CE mark, UL		Multipack	8
	120Z0466	Belt type crankcase heater, 65 W, 460 V, CE mark, UL		Multipack	6
	120Z0467	Belt type crankcase heater, 65 W, 575 V, CE mark, UL		Multipack	6
	7773110	Belt type crankcase heater, 75 W, 110 V, CE mark, UL	VZH170	Multipack	6
	7773108	Belt type crankcase heater, 75 W, 230 V, CE mark, UL		Multipack	6
	7773118	Belt type crankcase heater, 75 W, 400 V, CE mark, UL		Multipack	6

Surface sump heaters

Type	Code n°	Description	Application	Packaging	Pack size
	120Z0388	Surface sump heater, 80 W, 24 V, CE, UL	VZH088-117	Multipack	8
	120Z0389	Surface sump heater, 80 W, 230 V, CE, UL		Multipack	8
	120Z0390	Surface sump heater, 80 W, 400 V, CE, UL		Multipack	8
	120Z0391	Surface sump heater, 80 W, 460 V,CE, UL		Multipack	8
	120Z0402	Surface sump heater, 80 W, 575 V, CE, UL		Multipack	8
	120Z0360	Surface sump heater + bottom insulation, 56 W, 24 V, CE, UL	VZH170	Multipack	6
	120Z0376	Surface sump heater + bottom insulation, 56 W, 230 V, CE, UL		Multipack	6
	120Z0377	Surface sump heater + bottom insulation, 56 W, 400 V, CE, UL		Multipack	6
	120Z0378	Surface sump heater + bottom insulation, 56 W, 460 V, CE, UL		Multipack	6
	120Z0379	Surface sump heater + bottom insulation, 56 W, 575 V, CE, UL		Multipack	6

Discharge thermostats and sensors

Type	Code n°	Description	Application	Packaging	Pack size
	120Z0157	Discharge temperature sensor / converter kit	VZH all models	Single pack	1
	120Z0158	Discharge temperature sensor	VZH all models	Single pack	1
	120Z0159	Discharge temperature converter	VZH all models	Single pack	1
	7750009	Discharge thermostat kit	VZH all models	Multipack	10

Lubricant, acoustic hoods and spare parts

Acoustic hoods

Type	Code n°	Description	Application	Packaging	Pack size
	120Z0509	VZH088-G acoustic hood	VZH088-G/H	Single pack	1
	120Z0510	VZH088-J acoustic hood	VZH088-J	Single pack	1
	120Z0511	VZH088-G manifolding acoustic hood	VZH088-G/H manifolding	Single pack	1
	120Z0512	VZH088-J manifolding acoustic hood	VZH088-J manifolding	Single pack	1
	120Z0513	VZH117-G acoustic hood	VZH117-G/H	Single pack	1
	120Z0514	VZH117-J acoustic hood	VZH117-J	Single pack	1
	120Z0515	VZH117-G manifolding acoustic hood	VZH117-G/H manifolding	Single pack	1
	120Z0516	VZH117-J manifolding acoustic hood	VZH117-J manifolding	Single pack	1
	120Z0517	VZH170-G acoustic hood	VZH170-G/H	Single pack	1
	120Z0519	VZH170-J acoustic hood	VZH170-J	Single pack	1
	120Z0518	VZH170-G manifolding acoustic hood	VZH170-G/H manifolding	Single pack	1
	120Z0520	VZH170-J manifolding acoustic hood	VZH170-J manifolding	Single pack	1

Mounting kits

Type	Code n°	Description	Application	Packaging	Pack size
	120Z0066	Mounting kit for 1 scroll compressor including 4 grommets, 4 sleeves, 4 bolts, 4 washers	VZH088-117	Single pack	1
	8156138	Mounting kit for 1 scroll compressor including 4 grommets, 4 sleeves, 4 bolts, 4 washers	VZH170	Single pack	1

Terminal boxes, covers & T-block connectors

Type	Code n°	Description	Application	Packaging	Pack size
	8173230	T block connector 52 x 57 mm	VZH088-G/H, VZH117-G/H	Multipack	10
	8173021	T block connector 60 x 75 mm	VZH088-J.VZH117-J.VZH170-G/H	Multipack	10
	8173331	T block connector 80 x 80 mm	VZH170-J	Multipack	10
	120Z0146	Electrical box	VZH088-G/H.VZH117-G/H	Single pack	1
	120Z0147	Electrical box	VZH170-J	Single pack	1
	120Z0538	Electrical box	VZH170-G/H	Single pack	1
	120Z0149	Electrical box cover	VZH088-G/H.VZH117-G/H	Single pack	1
	120Z0150	Electrical box cover	VZH170-J	Single pack	1
	120Z0537	Electrical box cover	VZH170-G/H	Single pack	1
	120Z0151	Electrical box cover	VZH088-117-J	Single pack	1

Coil

Type	Code n°	Description	Application	Packaging	Pack size
	120Z0521	Coil / 208-240V and adaptor	VZH all models	Single pack	1
	120Z0522	Coil / 24V and adaptor	VZH all models	Single pack	1

Valve Body

Type	Code n°	Description	Application	Packaging	Pack size
	120Z0145	Valve body	VZH all models	Single pack	1

Lubricant / oils

Type	Code n°	Description	Application	Packaging	Pack size
160SZ	7754023	POE lubricant, 160SZ, 1.05 quart can	VZH with R410A	Multipack	12

Oil level switch

Type	Code n°	Description	Application	Packaging	Pack size
	120Z0561	Oil level switch - electrical part (24V AC/DC)	All models	Single pack	1
	120Z0562	Oil level switch - electrical part (230V AC)	All models	Single pack	1

Spare parts frequency converter

LCP's

Type	Code n°	Description	Application	Packaging	Pack size
	120Z0326	LCP display	Frequency converter / All models	Single pack	1
	175Z0929	RS cable to LCP	Frequency converter / All models	Single pack	1
	130B0264	LCP cradle, required to mount the LCP on IP55 casings	Frequency converter / All models	Single pack	1

Fans

Type	Code n°	Description	Application	Packaging	Pack size
	130B3406	Fan IP55	VZH117 G & J	Single pack	1

Control card

Type	Code n°	Description	Application	Packaging	Pack size
	130B5667	Control card	Frequency converter / All models	Single pack	1

Accessory bags

Type	Code n°	Description	Application	Packaging	Pack size
	130B1300	Accessorry bag IP20	VZH088-J, VZH117-G, VZH170-G	Single pack	1
	130B0980	Accessorry bag IP20	VZH088-G	Single pack	1

Relays card

Type	Code n°	Description	Application	Packaging	Pack size
	120Z0350	Relays card	Frequency converter	Single pack	1

Brackets *

Type	Code n°	Description	Application	Packaging	Pack size
	120Z0642	16AC bracket for VZH088/117 CDS303 drives	Frequency converter	Single pack	1
	120Z0643	20AC bracket for VZH088/117 CDS303 drives	Frequency converter	Single pack	1

* To be released

Previous version	Current version
• Page 8: Compressor nomenclature	• Page 7: Updated Compressor nomenclature
• Page 9: Compressor specifications	• Page 8: Updated Oil charge in Compressor specifications
• Page 10-21: Table header "Freq. (Hz)"	• Page 9-20: Change the header from "Freq. (Hz)" to "rps"
	• Page 21,23,25,27,29: Added Outlinle diagram for Unifed versions
• Page 28: Sight glass / oil level switch & Oil equalisation connection	• Page 33: Updated Sight glass / oil level switch & Oil equalisation connection
• Page 28: Bracket photos	• Page 34: Added drive type beside the bracket photos
• Page 42: Application envelopes	• Page 49: Updated Application envelopes & Operating map
• Page 46: Pressure settings – working pressure range high side 195.8 - 645.42 psi(g)	• Page 52: Working pressure range high side to "High PR 195.8 – 645.4 / Low PR 195.8 - 580.1 psi(g)"
• Page 51: Liquid floodback during operation	• Page 58: Liquid floodback during operation
	• Page 61: Added Defrost test
• Page 54: Defrost cycle logic	• Page 62: Updated Defrost cycle logic chart
• Page 55: Suction line accumulator	• Page 63: Updated Suction line accumulator
• Page 67: Compressors single pack	• Page 76: Added Unified version to Compressors single pack
• Page 70: Ordering information table	• Page 78: Updated Ordering information table, added new ordering codes in the table
• Page 71-73: Accessories	• Page 79-81: Update accessories information, deleted phased out codes, add new codes in accessories table
• Page 74-93: VZH088-170 hybrid manifolding	• All the pages of hybrid manifolding were removed

ENGINEERING
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Danfoss Commercial Compressors

is a worldwide manufacturer of compressors and condensing units for refrigeration and HVAC applications. With a wide range of high quality and innovative products we help your company to find the best possible energy efficient solution that respects the environment and reduces total life cycle costs.

We have 40 years of experience within the development of hermetic compressors which has brought us amongst the global leaders in our business, and positioned us as distinct variable speed technology specialists. Today we operate from engineering and manufacturing facilities spanning across three continents.



Danfoss Scrolls



Danfoss Inverter Scrolls



Danfoss Turbocor Compressors



Danfoss Maneurop Reciprocating Compressors



Danfoss Optyma Condensing Units



Danfoss Light Commercial Refrigeration Compressors

Our products can be found in a variety of applications such as rooftops, chillers, residential air conditioners, heatpumps, coldrooms, supermarkets, milk tank cooling and industrial cooling processes.

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