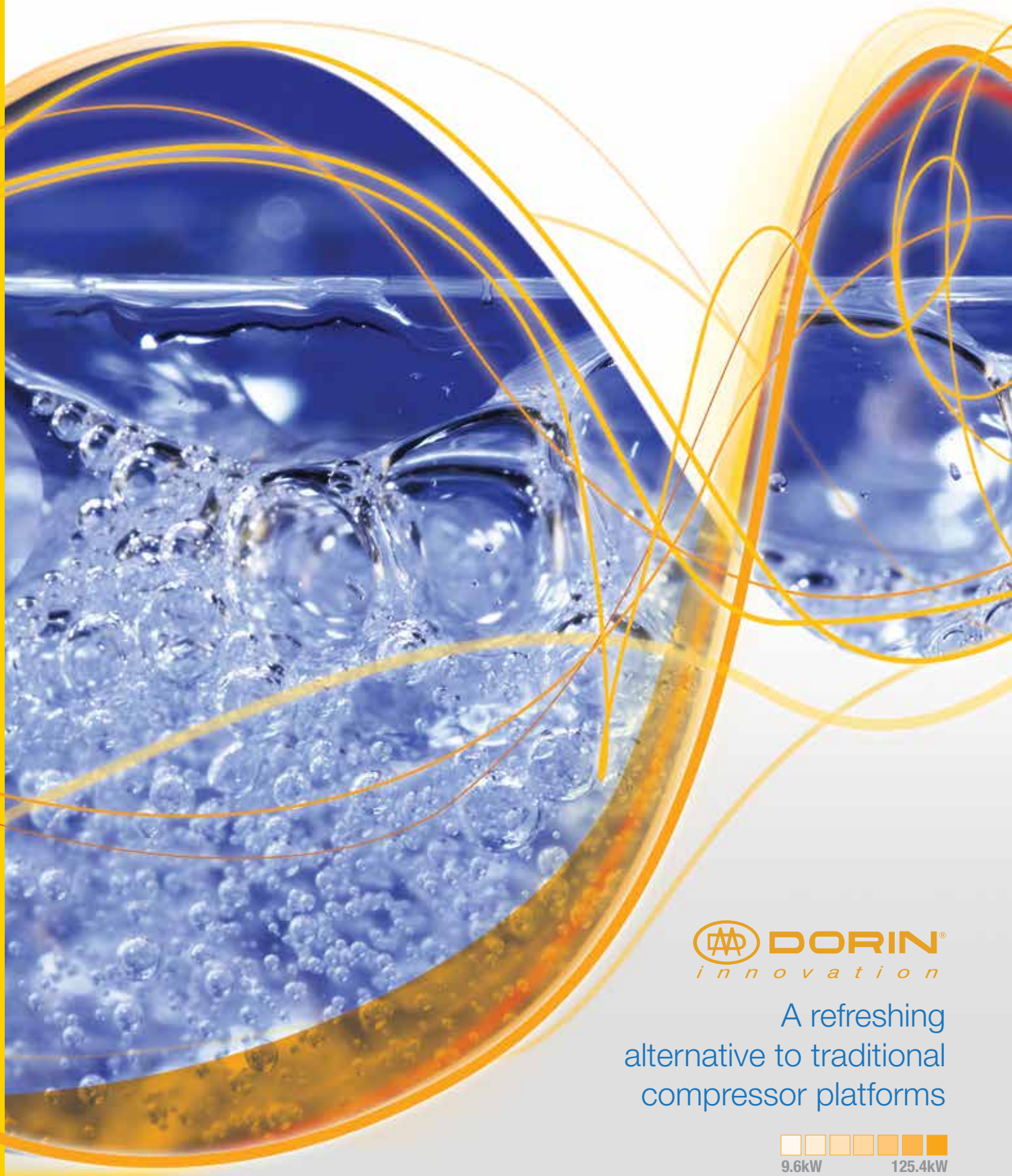
Dorin CO_2 Compressor Range

HEATCRAFT™ Worldwide Refrigeration



DORIN® innovation

A refreshing alternative to traditional compressor platforms

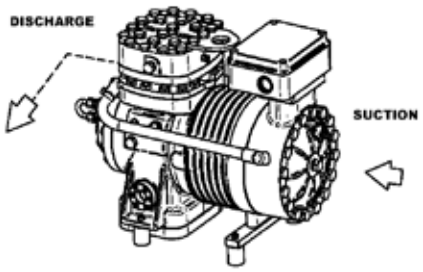
9.6kW 125.4kW

Dorin CO_2 Compressor Range
TCS Range
Transcritical Single Stage Compressor

Design Issues

Considering the operating conditions of a transcritical CO_2 compressor, it has been decided to develop a completely new compressor platform, without trying to modify a standard HFCs compressor. The design has been developed using the most modern solid modellation tools such as FEM analysis.

Nowadays HFCs reciprocating compressors work almost exclusively at 1450 rpm. For these CO_2 compressors it has been possible to develop models with two poles electric motor (rotating at 2900 rpm) thanks to the small amount of compressed refrigerant compared to the crankcase and bigger wall thicknesses. This led to the design of silent and low-vibrating compressor models equipped with two poles electric motor; in this way it has been possible to double the swept volume with the same compressor platform, leading to very favourable performance/price ratio.



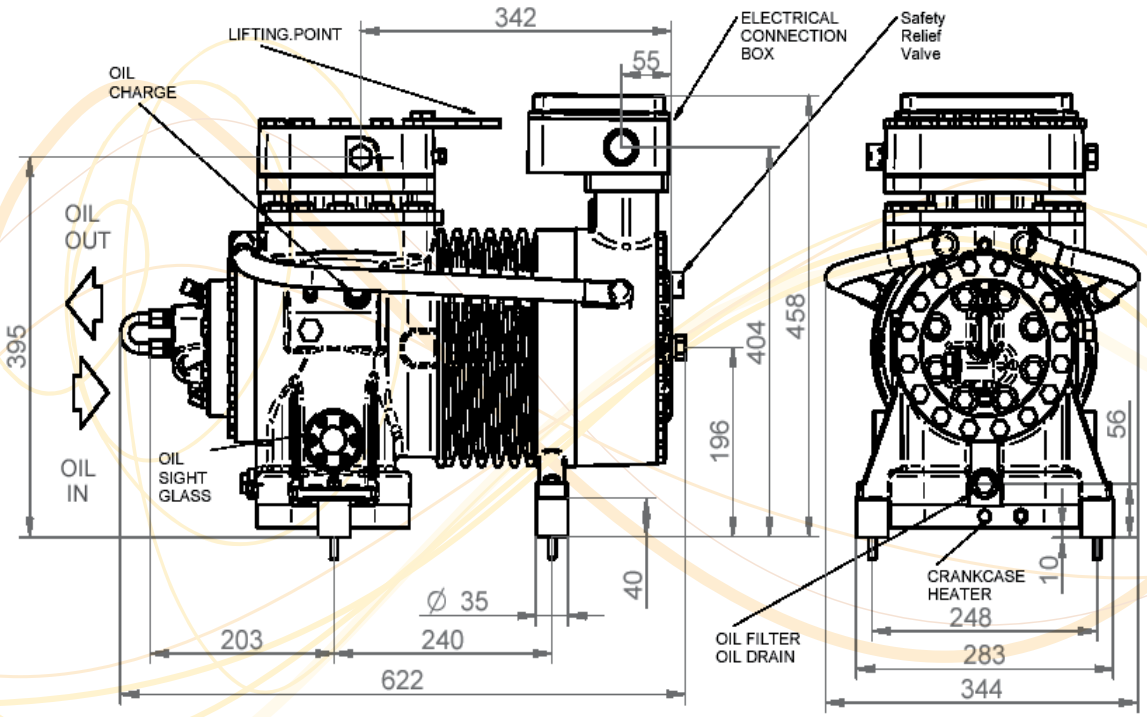
Features

DORIN CO_2 compressors are standardly equipped with:

- electric motors with thermistor protection
- oil pump
- oil pump cover adjusted for oil cooler installation (The use of the oil cooler is strictly recommended. It will have to withdraw about 20% of the electric motor power absorption. Oil temperature shall not exceed 65°C. It's also important that oil temperature shall not decrease under 30°C as this is a symptom of liquid refrigerant inside the lubricant.)
- low and high pressure relief valve with relieving set point of respectively 100 bar (Pss) and 163 bar (PS)
- CPM3 protection module
- crankcase heater
- special lubricant for CO_2 transcritical application
- electric box with IP55 class of protection

DORIN CO_2 compressors are PED certified.

Compressor Dimensions



Dorin CO_2 Compressor Range
TCS Range
Transcritical Single Stage Compressor

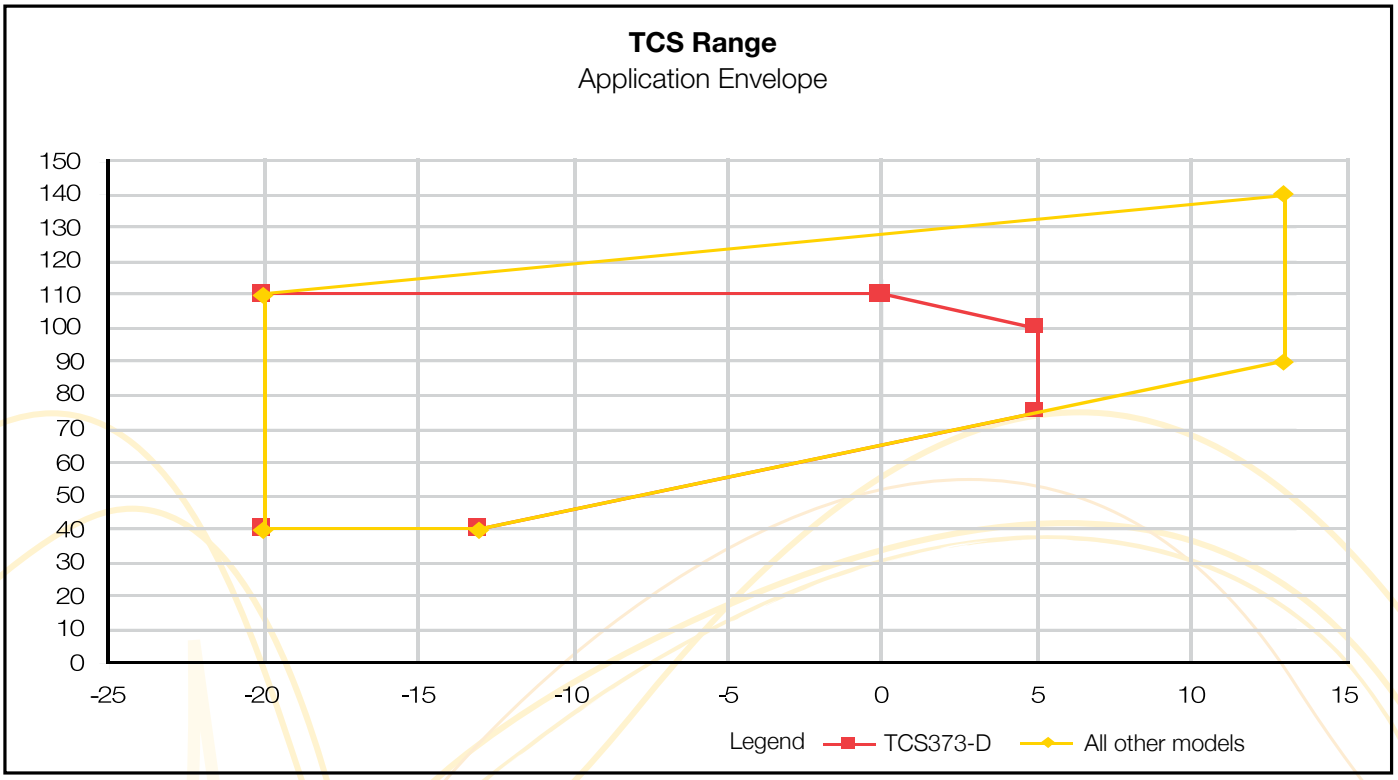
Technical Data

The following table outlines the compressor range with their main features. For inverter application we strictly recommend to consult Heatcraft's technical department.

TCS RANGE SUBCRITICAL SINGLE STAGE									
Model	RPM	Swept Volume (m^3/h)	Suction NPT	Discharge NPT	Weight (kg)	Oil Charge (kg)	FLA (A) 380V / 50hz	LRA (A) 380V / 50hz	Nominal Motor Power (kW)
TCS340/4-D	1450	3.5	1/2	1/2	123	1.8	11.0	75.4	4.0
TCS350/4-D	1450	4.3	3/4	1/2	126	1.8	15.0	83.2	5.0
TCS362/4-D	1450	5.4	3/4	1/2	130	1.8	17.0	90.2	6.0
TCS340-D	2900	7.0	3/4	1/2	133	1.8	24.0	172.6	12.0
TCS351-D	2900	8.8	3/4	1/2	136	1.8	33.0	215.1	15.0
TCS362-D	2900	10.7	3/4	1/2	140	1.8	38.0	255.3	18.0
TCS373-D	2900	12.6	3/4	1/2	140	1.8	38.0	255.3	18.0

FLA full load current LRA locked rotor current

The following chart represents the application envelopes of TCS compressors, valid for values lower than 10K for suction superheat.



Dorin CO_2 Compressor Range
TCS340/4-D
Transcritical Single Stage Compressor

Technical Data

Transcritical compressors require a gas cooler rather than a condenser. This device will cool down the compressed CO_2. Therefore the global efficiency of the system will strongly depend on how efficiently the heat exchange occurs inside the gas cooler. There will be found higher refrigerating capacity for lower gas cooler outlet temperature. The lower the gas cooler's outlet temperature the higher the compressor's cooling capacity.

Compressor performances for TCS Range compressors

TCS 340/4-D TRANSCRITICAL SINGLE STAGE						
t_ev	p_suc	tgc_out	p_dis	beta	Q	P
TCS 340/4-D						
-20	19.72	15	75	3,803	6.2	3.2
		25	75	3,803	5.3	3.2
		35	90	4,564	3.8	3.4
		40	110	5,578	2.9	3.7
-15	22.93	15	75	3,271	7.7	3.3
		25	75	3,271	6.6	3.3
		35	90	3,925	5.0	3.7
		40	110	4,797	3.9	4.1
-10	26.50	15	75	2,830	9.5	3.3
		25	75	2,830	8.1	3.3
		35	90	3,396	6.1	3.9
		45	120	4,528	5.0	4.8
0	34.86	15	75	2,151	14.5	3.4
		25	75	2,151	12.4	3.4
		35	90	2,582	9.3	4.4
		15	100	2,869	12.9	4.5
		25	100	2,869	11.4	4.5
		45	120	3,442	7.3	5.3
5	39.69	15	75	1,890	17.5	3.3
		25	75	1,890	14.9	3.3
		35	90	2,268	11.2	4.2
		15	120	3,023	14.7	5.4
		25	120	3,023	13.1	5.4
		35	120	3,023	11.2	5.4
		45	120	3,023	8.8	5.4
10	45.01	15	75	1,666	21.0	3.1
		25	75	1,666	17.8	3.1
		35	90	2,000	13.6	4.1
		15	120	2,666	17.7	5.5
		25	120	2,666	15.8	5.5
		35	120	2,666	13.5	5.5
		45	120	2,666	10.6	5.5
		15	130	2,888	17.1	5.9
		25	130	2,888	15.3	5.9

Preliminary data subject to variation without notice.

Data is valid with 10K of suction gas useful superheat
t_ev evaporating temperature (ºC)
p_suc suction pressure (bar_a)
tgc_out gas cooler outlet temperature (ºC)
p_dis discharge pressure (bar_a)
beta pressure ratio
Q refrigerating capacity (kW)

Dorin CO_2 Compressor Range
TCS362-D & TCS373-D
Transcritical Single Stage Compressor

TCS 362-D TRANSCRITICAL SINGLE STAGE						
t_ev	p_suc	tgc_out	p_dis	beta	Q	P
TCS 362-D						
-20	19.72	15	75	3,803	21.9	9.9
		25	75	3,803	18.8	9.9
		35	90	4,564	13.7	10.3
		40	110	5,578	11.0	11.6
-15	22.93	15	75	3,271	27.0	10.4
		25	75	3,271	23.1	10.4
		35	90	3,925	17.6	11.2
		40	110	4,797	14.5	12.8
-10	26.50	15	75	2,830	33.3	10.5
		25	75	2,830	28.5	10.5
		35	90	3,396	21.8	11.7
		45	120	4,528	18.4	15.3
0	34.86	15	75	2,151	47.9	12.2
		25	75	2,151	41.0	12.2
		35	90	2,582	31.4	14.1
		15	100	2,869	44.5	14.9
		25	100	2,869	39.1	14.9
		45	120	3,442	25.5	16.5
5	39.69	15	75	1,890	56.7	12.4
		25	75	1,890	48.5	12.4
		35	90	2,268	37.7	14.9
		15	120	3,023	50.4	17.4
		25	120	3,023	45.0	17.4
		35	120	3,023	38.4	17.4
		45	120	3,023	30.4	17.4
10	45.01	15	75	1,666	68.0	11.7
		25	75	1,666	57.9	11.7
		35	90	2,000	45.7	14.7
		15	120	2,666	60.7	17.9
		25	120	2,666	54.3	17.9
		35	120	2,666	46.3	17.9
		45	120	2,666	36.5	17.9
		15	130	2,888	59.1	19.5
		25	130	2,888	52.7	19.5

TCS 373-D TRANSCRITICAL SINGLE STAGE						
t_ev	p_suc	tgc_out	p_dis	beta	Q	P
TCS 373-D						
-20	19.72	15	75	3,803	26.0	11.8
		25	75	3,803	22.3	11.8
		35	90	4,564	16.3	12.2
		40	110	5,578	13.1	13.5
-15	22.93	15	75	3,271	32.0	12.4
		25	75	3,271	27.4	12.4
		35	90	3,925	20.9	13.6
		40	110	4,797	16.8	14.9
-10	26.50	15	75	2,830	39.5	12.5
		25	75	2,830	33.8	12.5
		35	90	3,396	25.9	13.9
		40	110	4,151	23.8	16.5
0	34.86	15	75	2,151	56.4	14.5
		25	75	2,151	48.5	14.5
		35	90	2,582	37.1	16.8
		15	100	2,869	52.7	17.9
		25	100	2,869	46.1	17.9
		40	110	3,155	34.2	19.5
5	39.69	15	75	1,890	66.6	14.7
		25	75	1,890	57.1	14.7
		35	90	2,268	44.5	17.7

Preliminary data subject to variation without notice.

Data is valid with 10K of suction gas useful superheat
t_ev evaporating temperature (°C)
p_suc suction pressure (bar_a)
tgc_out gas cooler outlet temperature (°C)
p_dis discharge pressure (bar_a)
beta pressure ratio
Q refrigerating capacity (kW)

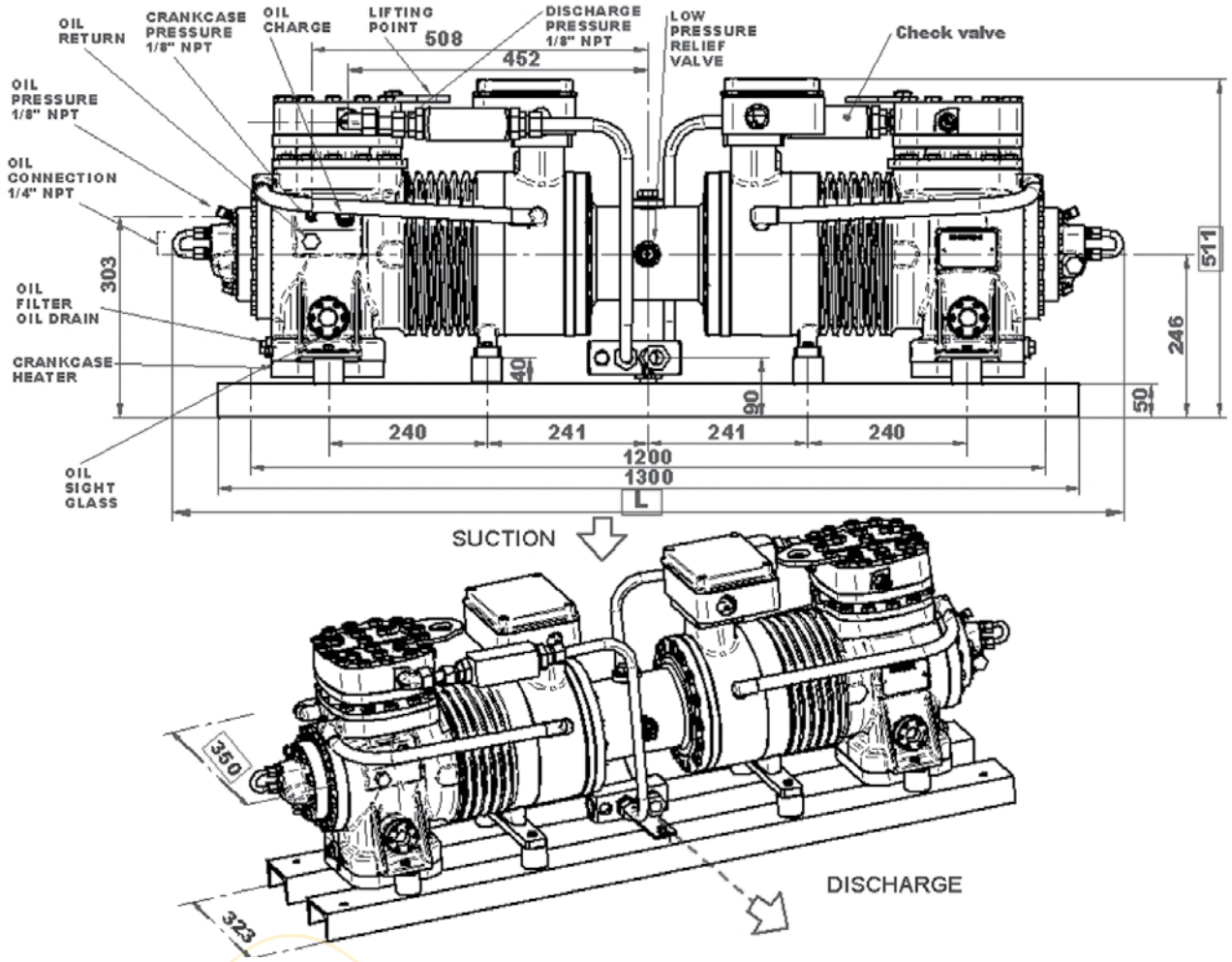
Important:

CO_2 compressors can work at higher pressure levels than HCFCs or HFC compressors. This has two main benefits:

- pressure drops inside the system become less important
- the heat transfer coefficient is very high in both evaporators and gas coolers

Those two aspects make it easy to understand how it kept the same refrigerating capacity and the same temperature of the ambient that has to be refrigerated. The mean DeltaT inside the heat exchangers (evaporators and gas coolers) can be kept at lower value if compared with standard systems (for instance with actual technology 2K DeltaT are plausible values inside the gas coolers). Therefore if a correct comparison between CO_2 systems and standard systems has to be made, the performances of standard systems will have to be evaluated with lower evaporating and higher condensing temperatures than the ones mentioned in the previous tables.

Dimensions



Technical Data

T-TCS RANGE TRANSCRITICAL SINGLE STAGE							
Model	Compressors	RPM	Swept Volume (m^3/h)	Suction NPT	Discharge NPT	Weight (kg)	Length L (mm)
T-TCS380/4-D	2 x TCS340/4-D	1450	7.0	1″	3/4″	250	1404
T-TCS3100/4-D	2 x TCS350/4-D	1450	8.6	1″	3/4″	280	1404
T-TCS3124/4-D	2 x TCS362/4-D	1450	10.8	1″	3/4″	290	1404
T-TCS380-D	2 x TCS340-D	2900	14.0	1″	3/4″	295	1404
T-TCS3102-D	2 x TCS351-D	2900	17.6	1″	3/4″	300	1404
T-TCS3124-D	2 x TCS362-D	2900	21.4	1″	3/4″	310	1434
T-TCS3146-D	2 x TCS373-D	2900	25.2	1″	3/4″	310	1434

Performances

For evaluation of cooling capacities and input power, refer to the values specified in the previous pages for each single compressor.

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