



Sabroe

Refrigeration Plant Computation

Version 23.10

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Date : 2014/03/21	Time : 09.34.51	
User : SABROE REFRIG.- BIRMINGHAM		
Prog : COMP1/204401	Print : def. not found	

SINGLE STAGE COMPRESSOR

compressor type	SAB 193 S VSD	refrigerant	R 717
number of compressors	1.00	evaporating temperature	-37.7 deg.C
compressor load	100.0 %	condensing temperature	32.5 deg.C
drive shaft speed	3600.0 RPM (list)	total suction superheat	0.0 K
internal volume ratio	optimal	suction line superheat	0.0 K
suction line loss	1.0 K	total liquid subcooling	53.2 K
discharge line loss	1.0 K		

total cooling capacity	214.8 kW	total shaft power req.	126.8 kW
total heating capacity	257. kW	drive shaft torque	336. Nm
		cooling cap./shaft power ratio	1.69
		cooling cap./line power ratio	1.58

economiser type (open)	SVER 0408	side load	none
no.of economisers	1.00		
economiser evap. temp.	-20.7 deg.C		
economiser evap. press.	1.84 bar_a		
liquid temp. after economiser	-20.7 deg.C		
line loss - eco. to port	0.5 K		
total eco. flash gas flow	0.0365 kg/s		
COP(with eco)/COP(without eco)	1.14		
economizer check valve	CK1 32		
economizer suction valve	ICS 25-15		
economizer bypass valve	ICS 25-10		
total eco. capacity	39.7 kW		

oil cooling system	water cooling	oil specifications	Sabroe PAO 68 354
oil cooler type	XPHE ANHP52-060H	oil inlet temperature	65.0 deg.C
number of oil coolers	1	total oil flow	9.3 m3/h
oil cooler load - actual	84.8 kW	oil density	806.7 kg/m3
oil cooler load - min. cap.	N/A	oil specific heat capacity	2.25 kJ/kgK
oil separator (SC):	OHU 04123D/2719 D1	oil kinematic viscosity	34.1 cSt
number of oil separators:	1.0	oil heat conductivity	0.139 W/m.K
oil separator load:	15.8 %	oil weight percentage	100.00 %
oil carryover - total:	2.6 ppm	total charge of oil	156.8 litre
discharge check valve(s):	4 in. (1)		

motor:	Leroy/153kW/400V/60Hz/IP23//B35	power line	60Hz - 400 V
start-up:	VSD - 0.4 sec.	equalization temp.(max)	32.5 deg.C
motor eff.	0.930	motor line power cons.	136.3 kW
		coupling type.	BP38U- Spacer 7,0

operating conditions:		discharge pressure	12.93 bar_a
suction pressure	0.77 bar_a	discharge temperature	82.23 deg.C
suction temperature	-37.75 deg.C	disch. temp. at min. load	69.39 deg.C
suction specific volume	1.4679 m3/kg	discharge specific volume	0.1247 m3/kg
enthalpy difference (ref.)	1306.16 kJ/kg	condenser subcooled liquid density	592.9 kg/m3
suction side mass flow	0.1644 kg/s	evaporator saturated liquid density	687.3 kg/m3
swept volume	1018.5 m3/h	pressure ratio (p2/p1)	16.83

errors and warnings:
 NB: chosen motor may be bigger than needed
 NB: motor efficiency is approximate only
 NB: At certain VSD frequencies, resonance vibrations may occur.
 NB: Skipping limited frequency ranges may be necessary.
 NB: All data valid for factory built VSD unit only !
 NB: Sound computation "box" with non-standard dimensions.
 NB: Oil carry over estimate valid for current conditions only !
 NB: design limits violation - please run Design Limits Check !
 Oil cooler notes:
 NB: oil cooler type fixed
 Note : High port pressure drop on cold side (>10.0 % of tota

Full load performance data for chillers and other refrigeration systems are according to ISO-R916.
 Measurement tolerances according to ISO-917.
 Data subject to change without notice.



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OIL COOLER (high stage)

oil cooler type	XPHE ANHP52	number of oil coolers	1.00
total capacity	84.8 kW	logarithmic mean temperature diff.	45.19 K
transfer-coeff.- service	321.2 W/m2K	transfer-coeff.- clean	574.5 W/m2K
primary side (temp.drop):			
refrigerant (354) Sabroe PAO 68		percentage by weight	100.0 %
inlet temperature	82.2 deg.C		
outlet temperature	64.4 deg.C	total flow	9.3 m3/h
pressure loss	97.1 kPa	fouling factor	.000098 m2.K/W
velocity	5.31 m/s		
density	801.9 kg/m3	specific heat capacity	2.286 kJ/kg.K
dynamic viscosity	22.213 Cpoise	thermal conductivity	0.138 W/m.K
secondary side (temp. rise):			
secondary refrigerant (200) WATER			
inlet temperature	25.3 deg.C		
outlet temperature	30.3 deg.C	total flow	14.7 m3/h
pressure loss	64.3 kPa	fouling factor	.000020 m2.K/W
velocity	5.07 m/s		
density	996.4 kg/m3	specific heat capacity	4.181 kJ/kg.K
dynamic viscosity	0.839 Cpoise	thermal conductivity	0.612 W/m.K
special PHE output:			
no. of cassettes and type	1*59 H/1*60 H	service transfer coefficient	321.2 W/m2K
design/rating mode	rating	clean transfer coefficient	574.5 W/m2K
plate material	AISI-316		
plate thickness	0.4 mm	margin	10.00 %
primary side connection - in/out	1/1		
secondary side connection - in/out	1/1	excessive area	77.74 %
hot side channel pressure loss	11.23 mbg		
cold side channel pressure loss	5.34 mbg		

errors and warnings:
Oil cooler notes:
NB: oil cooler type fixed
Note : High port pressure drop on cold side (>10.0 % of tota

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EVAPORATOR

evaporator type	EPHE M10BW	number of evaporators	1.00
primary side:		total capacity	214.8 kW
primary refrigerant	R-717	mean temperature diff.	4.03 K
evaporating temperature	-37.7 deg.C	fouling factor	0.000035 m2.K/W
secondary side:		percentage by weight	57.8 %
secondary refrigerant (202) ETHYLENE_GLYCOL		freezing temperature	-45.3 deg.C
inlet temperature	-29.8 deg.C	total flow	40.0 m3/h
outlet temperature	-36.0 deg.C		
pressure loss	24.2 kPa		
velocity	1.41 m/s		
density	1097.0 kg/m3	specific heat capacity	2.859 kJ/kg.K
dynamic viscosity	71.060 Cpoise	thermal conductivity	0.414 W/m.K
min. wall temperature	-37.5 deg.C	secondary side pass number	1
special PHE output:			
no. of cassettes and type (hot/cold side)	1*226 HG/1*227 HW	service transfer coefficient	507.6 W/m2K
design/rating mode	design	clean transfer coefficient	570.2 W/m2K
plate material	AISI-316	refrigerant pressure loss	0.41 mbg
plate thickness	0.5 mm	margin	10.00 %
max. pressure loss sec. side	10.00 mbg	available liquid head	1.05 mbg
primary side connection - in/out	1/2	quality of vapour	0.70
secondary side connection - in/out	1/1	excessive area	0.32 %
hot side channel pressure loss	23.0 kPa		
cold side channel pressure loss	0.39 mbg		

errors and warnings:

NB: unit height may be reduced by reducing "Max. Liquid Head"
 NB: brine concentration adjusted down to highest possible(eutectic)
 NB: suitable for closed systems only (dp-channel < 2.7 mbg.)
 NB: nucleate boiling multiplier automatically disabled
 NB: vapour quality set to max. 0.7 for evap. temp. below zero.



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CONDENSER

condenser type	CPHE M10BW	number of condensers	1.00
primary side:			
primary refrigerant	R-717	total capacity	256.7 kW
condensing temperature	32.5 deg.C	mean temperature diff.	4.22 K
condenser liquid subcooling	1.0 K		
		fouling factor	0.000020 m2.K/W
secondary side:			
secondary refrigerant (200) WATER			
inlet temperature	25.3 deg.C		
outlet temperature	30.3 deg.C	total flow	44.4 m3/h
pressure loss	40.2 kPa		
velocity	1.57 m/s		
density	996.4 kg/m3	specific heat capacity	4.181 kJ/kg.K
dynamic viscosity	0.839 Cpoise	thermal conductivity	0.612 W/m.K
special PHE output:			
no. of cassettes and type (hot/cold side)	1*37 HW/1*36 HG	service transfer coefficient	3535.2 W/m2K
design/rating mode	design	clean transfer coefficient	4663.6 W/m2K
plate material	AISI-316	refrigerant pressure loss	0.09 mbg
plate thickness	0.6 mm	margin	22.00 %
max. pressure loss sec. side	10.00 mbg		
primary side connection - in/out	1/1	superheated vapour temp.	82.23 deg.C
secondary side connection - in/out	1/1	excessive area	0.59 %
hot side channel pressure loss	0.10 mbg		
cold side channel pressure loss	38.8 kPa		

errors and warnings:



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PAC UNIT DATA - SAB 193S

plant load percentage	100.0	%
plant cooling capacity	214.8	kW
plant heating capacity	256.7	kW
total shaft power consumption	126.8	kW
total line power consumption	136.3	kW
shaft cooling power ratio	1.69	
shaft heating power ratio	2.03	
line cooling power ratio	1.58	
line heating power ratio	1.88	

chiller unit expansion valve	1 x HFI-040FD
unit expansion valve load	51.4 %

errors and warnings: