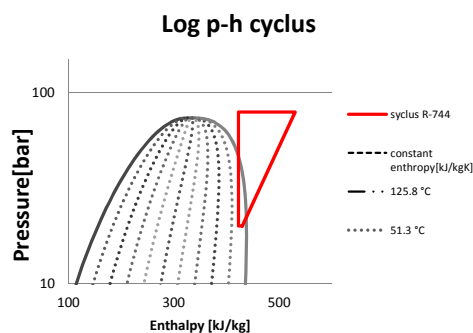


Experiment no: 4
Date: 22.05.2012
Operator: Obrist/Roman
Mode: comp.test 1000 rpm
Measured points 24

Components		Description
Compressor		Piston compressor
Gascooler/condenser		Air fan
Gasscooler condenser		Water to sink
Gascooler/condenser	4a/b	Heat to glycol
Internal heat exchanger		
Evaporator	6a/b	R-774/glycol
Separator		
Oil separator		



System performance

			Total Deviation	Total uncertainty	Comment
COP	-	0.9	± 0.01	1.47 %	
Compressor Speed	[rpm]	1000	± 2.00	0.2 %	
Mass flow R744	[kg/h]	653	± 1.79	0.3 %	
Mass flow water/ethyleneglycol	[kg/h]	0.0	± 0.00	35.8 %	
Ambient temperature	[°C]	20.1	± 0.04	0.2 %	
Supply power	[kW]	23.9	± 0.05	0.2 %	
Power consumption compressor	[kW]	21.2	± 0.19	0.9 %	
Danfoss VSD efficiency		88.67 %	± 0.01	0.93 %	
Volumetric efficiency		58.2 %	± 0.19 %	0.32 %	
Isentropic efficiency		72.0 %	± 0.67 %	0.94 %	
Oil circulation rate (OCR)		0.0042 %	± 0.674 %	68.07 %	Uncertainty high due to on/off valve
Heat rejection	[kW]	19.5	± 0.13	0.7 %	
Cooling capacity	[kW]	0.0	± 0.00	0.0 %	
Pressure, evaporator, inlet	[bar]	55.1	± 0.14 0.00	0.3 %	
Pressure, throttle valve,in	[bar]	79.7	± 0.23	0.3 %	
Temperature, throttle valve, in	[°C]	51.3	± 0.24	0.5 %	
Temperature, throttle valve out	[°C]	-1.3	± 0.03	2.0 %	

Compressor

			Total Deviation	Total uncertainty	Comment
Inlet suction pressure	[bar]	20.1	± 0.05	0.3 %	
Inlet temperature	[°C]	-10.8	± -0.18	1.6 %	
Inlet super heat	[K]	8.6	± 0.18	2.1 %	
Outlet pressure	[bar]	79.4	± 0.23	0.3 %	
Outlet temperature	[°C]	125.8	± 0.04	0.03 %	
Pressure ratio	[-]	4.0	± 0.015	0.4 %	
Lubricant return mass flow rate:	[kg/h]	0.0	± 0.02	68.1 %	on/off valve
Temperature, lubricant return:	[°C]	29.6	± 0.03	0.1 %	
Compressor Speed	[rpm]	1000	± 2.00	0.2 %	
Torque	[Nm]	203	± 1.90	0.9 %	
Power consumption	[kW]	21.2	± 0.19	0.9 %	
Massflow R-744	[kg/h]	653	± 1.79	0.3 %	
Specific volume (suction line)	[m³/kg]	0.02	± 0.00	0.1 %	
Density CO2 (suction line)	[kg/m³]	49.2	± 0.05	0.1 %	
Volumetric efficiency	[%]	<u>58.2 %</u>	± 0.19 %	0.32 %	
Isentropic efficiency	[%]	<u>72.0 %</u>	± 0.67 %	0.94 %	

Aircooler					
Gascooler TAG 2			Total Deviation	Total uncertainty	Comment
Specific heat difference	<i>kJ/kg</i>	77.1	±	1.63	2.1 %
Capacity	<i>[kW]</i>	14.0	±	0.30	2.1 %
Temperature difference R-744	<i>°C</i>	55.6	±	0.85	1.5 %
Mass flow air	<i>kg/h</i>	-			
Effect	<i>%</i>		±		
Pressure drop	<i>bar</i>	0.1	±	0.00	3.9 %
Mass flow R744	<i>kg/h</i>	653	±	1.79	0.3 %
Inlet temperature		116.6	±		
Outlet temperature		60.94			
			±		
			±		
Watercooler					
Gascooler TAG 3			±		
Specific heat difference	<i>kJ/kg</i>	14.2		2.06	14.5 %
Cooling capacity	<i>kW</i>	2.6	±		14.5 %
Mass flow water	<i>Kg/h</i>		±		
Temperature difference R-744	<i>°C</i>	7.4		1.01	13.6 %
Pressure drop	<i>bar</i>	0.0		0.00	10.1 %
Mass flow R-744	<i>kg/h</i>	653	±	1.79	0.3 %
Temperature difference water	<i>°C</i>	1.6		0.07	4.7 %
Gascooler 4a					
R744 side			Total Deviation	Total uncertainty	Comment
Inlet temperature	<i>°C</i>	53.5	±	0.55	1.0 %
Outlet temperature	<i>°C</i>	41.4	±	0.03	0.1 %
Specific heat difference	<i>kJ/kg</i>	0.03	±	0.00	4.5 %
Temperature difference	<i>°C</i>	12.1	±	0.55	4.5 %
Mass flow R744	<i>Kg/h</i>	653	±	1.79	0.3 %
Cooling capacity	<i>kW</i>	6.1	±	0.27	4.5 %
Pressure drop	<i>bar</i>	0.02	±	0.01	26.1 %
Glycol side					
Specific heat difference	<i>kJ/kg</i>	0.05	±	0.32	692.9 %
Temperature difference	<i>°C</i>	13.2	±	0.09	0.7 %
Mass flow glycol	<i>Kg/h</i>	-3	±	0.00	0.0 %
Cooling capacity	<i>kW</i>	-0.04	±	0.00	0.2 %
Pressure drop	<i>Pa</i>	0.00	±	0.00	3.0 %

Gascooler 4b						
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R744 side

Inlet temperature	°C	53.5	±	0.1 %
Outlet temperature	°C	53.9	±	0.1 %
Specific heat difference	<i>kJ/kg</i>	1.0	±	89.1 %
Temperature difference	°C	0.4	±	133.0 %
Mass flow R744	<i>kg/h</i>	653	±	0.3 %
Cooling capacity	<i>kW</i>	0.00	±	89.4 %
Pressure drop	<i>Bar</i>	0.04	±	6.1 %

Glycol side

Specific heat difference	<i>kJ/kg</i>	121.7	±	94.2 %
Temperature difference	°C	34.8	±	0.4 %
Mass flow glycol	<i>Kg/h</i>	-2	±	0.1 %
Cooling capacity	<i>kW</i>	-409	±	0.1 %
Pressure drop	<i>bar</i>	0.01	±	10.0 %

IHX						
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HP side

			Total Deviation	Total uncertainty	Comment
Specific heat difference	<i>kJ/kg</i>	2.0	±	0.96	47.2 %
Temperature difference	°C	0.9	±	0.30	32.9 %
Mass flow R744	<i>kg/h</i>	653	±	1.79	0.3 %
Cooling capacity	<i>kW</i>	0.4	±	0.00	0.0 %
Pressure loss	<i>bar</i>	1.9	±	0.00	0.0 %
			±		

LP side

Specific heat difference	<i>kJ/kg</i>	13.3	±	0.55	4.1 %
Temperature difference	°C	36.9	±	0.18	0.5 %
Mass flow R744	<i>Kg/h</i>	653	±	1.79	0.3 %
Cooling capacity	<i>kW</i>	0.0	±	0.00	0.0 %
Pressure loss	<i>bar</i>	0.02	±	0.00	7.0 %
Superheat IHX inlet	[°C]	7.8			

Evaporator 6a						
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R744 side

			Total Deviation	Total uncertainty	Comment
Pressure inlet	<i>bar</i>	55.1	±	0.14	0.25 %
Temperature difference	°C	-4.1	±	0.00	0.0 %
Mass flow R744	<i>kg/h</i>	653	±	1.79	0.3 %
Heat difference R744	<i>kJ/kg</i>	-184	±	-0.10	0.1 %
Cooling capacity	<i>kW</i>	-33.41	±	-0.02	0.1 %
Pressure drop	<i>bar</i>	0.02	±	0.00	3.6 %

Glycol side

Specific heat difference	<i>kJ/kg</i>	6.59	±	71	1072.2 %
Temperature difference	°C	1.90	±	0.06	3.2 %
Mass flow glycol	<i>Kg/h</i>	0	±	0.00	35.8 %
Cooling capacity	<i>kW</i>	0.00	±	1	11641230.7 %
Pressure drop	<i>bar</i>	0.01	±	0.00	11.3 %

Evaporator 6b					
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R744 side

Pressure inlet	<i>bar</i>	55.1	±	0.14	0.25 %
Specific heat to R744	<i>kJ/kg</i>	-8.0	±	0.00	0.0 %
Temperature difference	°C	19.1	±	0.03	0.2 %
Mass flow R744	<i>kg/h</i>	653	±	1.8	0.3 %
Cooling capacity	<i>kW</i>	0.0	±	0.00	0.0 %
Pressure drop	<i>bar</i>	0.03	±	0.00	2.6 %

Glycol side

Specific heat out	<i>kJ/kg</i>	18961.1	±	66873.1	352.7 %
Temperature difference	°C	3260.0	±	8.19	0.3 %
Mass flow glycol	<i>Kg/h</i>	-0	±	0.00	35.8 %
Cooling capacity	<i>kW</i>	0.1	±	0.25	354.5 %
Pressure drop	<i>bar</i>	0.01	±	0.00	5.5 %