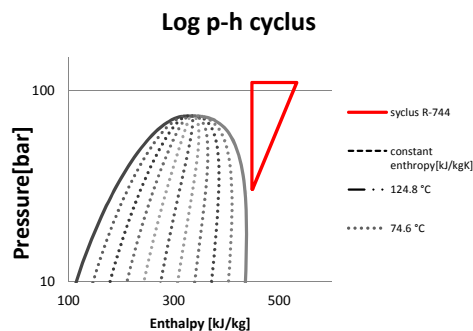


Experiment no: 4
Date: 22.05.2012
Operator: Obrist/Roman
Mode: comp.test 2000 rpm
Measured points 44

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	-	1.0	± 0.01	0.83 %	
Compressor Speed	[rpm]	2000	± 4.00	0.2 %	
Mass flow R744	[kg/h]	2493	± 5.10	0.2 %	
Mass flow water/ethyleneglycol	[kg/h]	0.0	± 0.00	24.5 %	
Ambient temperature	[°C]	19.2	± 0.03	0.2 %	
Supply power	[kW]	65.8	± 0.13	0.2 %	
Power consumption compressor	[kW]	59.5	± 0.27	0.5 %	
Danfoss VSD efficiency		90.45 %	± 0.00	0.49 %	
Volumetric efficiency		72.7 %	± 0.45 %	0.62 %	
Isentropic efficiency		71.2 %	± 0.39 %	0.55 %	
Oil circulation rate (OCR)		0.5244 %	± 0.389 %	108.59 %	Uncertainty high due to on/off valve
Heat rejection	[kW]	58.5	± 0.60	1.0 %	
Cooling capacity	[kW]	9.7	± 0.08	0.8 %	
Pressure, evaporator, inlet	[bar]	32.4	± 0.08 0.00	0.3 %	
Pressure, throttle valve,in	[bar]	110.0	± 0.28	0.3 %	
Temperature, throttle valve, in	[°C]	74.6	± 0.03	0.0 %	
Temperature, throttle valve out	[°C]	-1.3	± 0.03	2.0 %	

Compressor

			Total Deviation	Total uncertainty	Comment
Inlet suction pressure	[bar]	30.5	± 0.08	0.3 %	
Inlet temperature	[°C]	4.7	± 0.01	0.3 %	
Inlet super heat	[K]	9.7	± 0.01	0.2 %	
Outlet pressure	[bar]	110.4	± 0.28	0.3 %	
Outlet temperature	[°C]	124.8	± 0.05	0.04 %	
Pressure ratio	[-]	3.6	± 0.013	0.4 %	
Lubricant return mass flow rate:	[kg/h]	13.1	± 14.35	109.2 %	on/off valve
Temperature, lubricant return:	[°C]	68.6	± 1.15	1.7 %	
Compressor Speed	[rpm]	2000	± 4.00	0.2 %	
Torque	[Nm]	284	± 1.41	0.5 %	
Power consumption	[kW]	59.5	± 0.27	0.5 %	
Massflow R-744	[kg/h]	2493	± 5.10	0.2 %	
Specific volume (suction line)	[m³/kg]	0.01	± 0.00	0.1 %	
Density CO2 (suction line)	[kg/m³]	75.7	± 0.06	0.1 %	
Volumetric efficiency	[%]	<u>72.7 %</u>	± 0.45 %	0.62 %	
Isentropic efficiency	[%]	<u>71.2 %</u>	± 0.39 %	0.55 %	

Aircooler					
Gascooler TAG 2			Total Deviation	Total uncertainty	Comment
Specific heat difference	<i>kJ/kg</i>	77.0	±	0.41	0.5 %
Capacity	<i>[kW]</i>	53.3	±	0.30	0.6 %
Temperature difference R-744	<i>°C</i>	45.8	±	0.05	0.1 %
Mass flow air	<i>kg/h</i>	-			
Effect	<i>%</i>		±		
Pressure drop	<i>bar</i>	0.1	±	0.01	6.6 %
Mass flow R744	<i>kg/h</i>	2493	±	5.10	0.2 %
Inlet temperature		122.5	±		
Outlet temperature		76.62			
			±		
			±		
Watercooler					
Gascooler TAG 3			±		
Specific heat difference	<i>kJ/kg</i>	0.7		0.00	0.0 %
Cooling capacity	<i>kW</i>	0.5	±		0.0 %
Mass flow water	<i>Kg/h</i>		±		
Temperature difference R-744	<i>°C</i>	0.5		0.04	7.8 %
Pressure drop	<i>bar</i>	0.0		0.00	7.2 %
Mass flow R-744	<i>kg/h</i>	2493	±	5.10	0.2 %
Temperature difference water	<i>°C</i>	2.3		0.10	4.5 %
Gascooler 4a					
R744 side			Total Deviation	Total uncertainty	Comment
Inlet temperature	<i>°C</i>	76.1	±	0.01	0.0 %
Outlet temperature	<i>°C</i>	57.3	±	0.04	0.1 %
Specific heat difference	<i>kJ/kg</i>	0.06	±	0.00	1.3 %
Temperature difference	<i>°C</i>	18.9	±	0.05	0.3 %
Mass flow R744	<i>Kg/h</i>	2493	±	5.10	0.2 %
Cooling capacity	<i>kW</i>	40.0	±	0.53	1.3 %
Pressure drop	<i>bar</i>	0.03	±	0.01	17.4 %
Glycol side					
Specific heat difference	<i>kJ/kg</i>	0.06	±	0.45	726.1 %
Temperature difference	<i>°C</i>	17.8	±	0.13	0.7 %
Mass flow glycol	<i>Kg/h</i>	-3	±	0.00	0.0 %
Cooling capacity	<i>kW</i>	-0.06	±	0.00	0.2 %
Pressure drop	<i>Pa</i>	0.00	±	0.00	1.5 %

Gascooler 4b					
R744 side					
Inlte temperature	°C	76.1	±	0.1 %	
Outlet temperature	°C	73.7	±	0.0 %	
Spesific heat difference	<i>kJ/kg</i>	5.6	±	13.7 %	
Temperature difference	°C	2.4	±	1.7 %	
Mass flow R744	<i>kg/h</i>	2493	±	0.2 %	
Cooling capacity	<i>kW</i>	0.00	±	13.8 %	
Pressure drop	<i>Bar</i>	0.06	±	10.1 %	
Glycol side					
Spesific heat difference	<i>kJ/kg</i>	159.0	±	108.0 %	
Temperature difference	°C	45.2	±	0.4 %	
Mass flow glycol	<i>Kg/h</i>	-2	±	0.1 %	
Cooling capacity	<i>kW</i>	-534	±	0.1 %	
Pressure drop	<i>bar</i>	0.01	±	7.8 %	

IHX					
HP side		Total Deviation		Total uncertainty	Comment
Spesific heat difference	<i>kJ/kg</i>	2.2	±	0.52	24.1 %
Temperature difference	°C	0.6	±	0.04	6.3 %
Mass flow R744	<i>kg/h</i>	2493	±	5.10	0.2 %
Cooling capacity	<i>kW</i>	1.5	±	0.36	24.1 %
Pressure loss	<i>bar</i>	1.8	±	0.00	0.0 %
LP side					
Spesific heat difference	<i>kJ/kg</i>	39.7	±	0.34	0.9 %
Temperature difference	°C	34.7	±	0.03	0.1 %
Mass flow R744	<i>Kg/h</i>	2493	±	5.10	0.2 %
Cooling capacity	<i>kW</i>	0.1	±	0.00	0.0 %
Pressure loss	<i>bar</i>	0.04	±	0.00	7.6 %
Superheat IHX inlet	<i>[°C]</i>	36.7			

Evaporator 6a					
R744 side		Total Deviation		Total uncertainty	Comment
Pressure inlet	<i>bar</i>	32.4	±	0.08	0.25 %
Temperature difference	°C	-4.1	±	0.00	0.0 %
Mass flow R744	<i>kg/h</i>	2493	±	5.10	0.2 %
Heat difference R744	<i>kJ/kg</i>	14	±	0.09	0.7 %
Cooling capacity	<i>kW</i>	9.67	±	0.06	0.7 %
Pressure drop	<i>bar</i>	0.02	±	0.00	4.1 %
Glycol side					
Spesific heat difference	<i>kJ/kg</i>	9.23	±	110	1196.5 %
Temperature difference	°C	2.66	±	0.08	3.1 %
Mass flow glycol	<i>Kg/h</i>	0	±	0.00	24.5 %
Cooling capacity	<i>kW</i>	0.00	±	1	11256036.4 %
Pressure drop	<i>bar</i>	0.01	±	0.00	3.9 %

Evaporator 6b					
R744 side					
Pressure inlet	<i>bar</i>	32.4	±	0.08	0.25 %
Spesific heat to R744	<i>kJ/kg</i>	0.3	±	0.00	0.0 %
Temperature difference	°C	19.1	±	0.03	0.2 %
Mass flow R744	<i>kg/h</i>	2493	±	5.1	0.2 %
Cooling capacity	<i>kW</i>	0.0	±	0.00	0.0 %
Pressure drop	<i>bar</i>	0.02	±	0.00	2.8 %
Glycol side					
Spesific heat out	<i>kJ/kg</i>	18945.3	±	66873.0	353.0 %
Temperature difference	°C	3255.5	±	8.19	0.3 %
Mass flow glycol	<i>Kg/h</i>	-0	±	0.00	24.5 %
Cooling capacity	<i>kW</i>	0.1	±	0.31	353.8 %
Pressure drop	<i>bar</i>	0.01	±	0.00	4.0 %