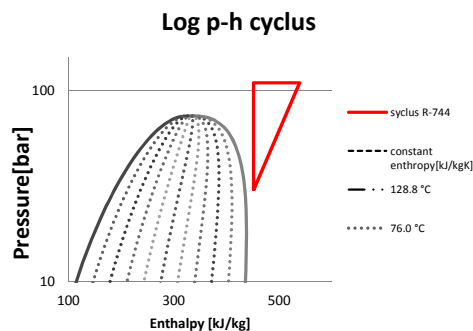


Experiment no: 4
Date: 22.05.2012
Operator: Obrist/Roman
Mode: comp.test 1000 rpm
Measured points 28

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	1.15 %	
Compressor Speed	[rpm]	1000	± 2.00	0.2 %	
Mass flow R744	[kg/h]	1113	± 2.90	0.3 %	
Mass flow water/ethyleneglycol	[kg/h]	0.0	± 0.00	36.9 %	
Ambient temperature	[°C]	19.4	± 0.05	0.3 %	
Supply power	[kW]	33.4	± 0.08	0.2 %	
Power consumption compressor	[kW]	30.8	± 0.22	0.7 %	
Danfoss VSD efficiency		92.22 %	± 0.01	0.72 %	
Volumetric efficiency		65.9 %	± 0.27 %	0.41 %	
Isentropic efficiency		62.4 %	± 0.47 %	0.75 %	
Oil circulation rate (OCR)		0.0033 %	± 0.468 %	45.85 %	Uncertainty high due to on/off valve
Heat rejection	[kW]	27.0	± 0.28	1.0 %	
Cooling capacity	[kW]	3.9	± 0.03	0.9 %	
Pressure, evaporator, inlet	[bar]	31.3	± 0.08 0.00	0.3 %	
Pressure, throttle valve,in	[bar]	110.4	± 0.32	0.3 %	
Temperature, throttle valve, in	[°C]	76.0	± 0.05	0.1 %	
Temperature, throttle valve out	[°C]	-1.3	± 0.03	2.0 %	

Compressor

			Total Deviation	Total uncertainty	Comment
Inlet suction pressure	[bar]	30.4	± 0.09	0.3 %	
Inlet temperature	[°C]	6.5	± 0.04	0.6 %	
Inlet super heat	[K]	11.7	± 0.04	0.3 %	
Outlet pressure	[bar]	110.1	± 0.31	0.3 %	
Outlet temperature	[°C]	128.8	± 0.10	0.08 %	
Pressure ratio	[-]	3.6	± 0.015	0.4 %	
Lubricant return mass flow rate:	[kg/h]	0.0	± 0.02	45.8 %	on/off valve
Temperature, lubricant return:	[°C]	28.8	± 0.04	0.1 %	
Compressor Speed	[rpm]	1000	± 2.00	0.2 %	
Torque	[Nm]	294	± 2.16	0.7 %	
Power consumption	[kW]	30.8	± 0.22	0.7 %	
Massflow R-744	[kg/h]	1113	± 2.90	0.3 %	
Specific volume (suction line)	[m³/kg]	0.01	± 0.00	0.2 %	
Density CO2 (suction line)	[kg/m³]	74.2	± 0.15	0.2 %	
Volumetric efficiency	[%]	<u>65.9 %</u>	± 0.27 %	0.41 %	
Isentropic efficiency	[%]	<u>62.4 %</u>	± 0.47 %	0.75 %	

Aircooler					
Gascooler TAG 2			Total Deviation	Total uncertainty	Comment
Specific heat difference	<i>kJ/kg</i>	71.6	±	1.51	2.1 %
Capacity	<i>[kW]</i>	22.1	±	0.47	2.1 %
Temperature difference R-744	<i>°C</i>	43.0	±	0.70	1.6 %
Mass flow air	<i>kg/h</i>	-			
Effect	<i>%</i>		±		
Pressure drop	<i>bar</i>	0.1	±	0.01	9.7 %
Mass flow R744	<i>kg/h</i>	1113	±	2.90	0.3 %
Inlet temperature		122.7	±		
Outlet temperature		79.73			
			±		
			±		
Watercooler					
Gascooler TAG 3			±		
Specific heat difference	<i>kJ/kg</i>	1.3		1.56	117.7 %
Cooling capacity	<i>kW</i>	0.4	±		0.0 %
Mass flow water	<i>Kg/h</i>		±		
Temperature difference R-744	<i>°C</i>	1.1		0.70	61.3 %
Pressure drop	<i>bar</i>	0.0		0.00	21.6 %
Mass flow R-744	<i>kg/h</i>	1113	±	2.90	0.3 %
Temperature difference water	<i>°C</i>	2.4		0.10	4.1 %

Gascooler 4a					
R744 side			Total Deviation	Total uncertainty	Comment
Inlet temperature	<i>°C</i>	78.6	±	0.11	0.1 %
Outlet temperature	<i>°C</i>	53.4	±	0.16	0.3 %
Specific heat difference	<i>kJ/kg</i>	0.08	±	0.00	1.5 %
Temperature difference	<i>°C</i>	25.2	±	0.20	0.8 %
Mass flow R744	<i>Kg/h</i>	1113	±	2.90	0.3 %
Cooling capacity	<i>kW</i>	25.6	±	0.40	1.6 %
Pressure drop	<i>bar</i>	0.03	±	0.01	17.8 %
Glycol side					
Specific heat difference	<i>kJ/kg</i>	0.05	±	0.43	809.0 %
Temperature difference	<i>°C</i>	15.1	±	0.12	0.8 %
Mass flow glycol	<i>Kg/h</i>	-2	±	0.00	0.1 %
Cooling capacity	<i>kW</i>	-0.04	±	0.00	0.2 %
Pressure drop	<i>Pa</i>	0.00	±	0.00	2.9 %

Gascooler 4b					
R744 side					
Inlte temperature	°C	78.6	±	0.3 %	
Outlet temperature	°C	75.7	±	0.1 %	
Spesific heat difference	<i>kJ/kg</i>	6.2	±	20.4 %	
Temperature difference	°C	2.9	±	4.5 %	
Mass flow R744	<i>kg/h</i>	1113	±	0.3 %	
Cooling capacity	<i>kW</i>	0.00	±	20.6 %	
Pressure drop	<i>Bar</i>	0.05	±	4.0 %	
Glycol side					
Spesific heat difference	<i>kJ/kg</i>	164.8	±	85.7 %	
Temperature difference	°C	46.9	±	0.4 %	
Mass flow glycol	<i>Kg/h</i>	-1	±	0.1 %	
Cooling capacity	<i>kW</i>	-404	±	0.1 %	
Pressure drop	<i>bar</i>	0.01	±	11.2 %	

IHX					
HP side			Total Deviation	Total uncertainty	Comment
Spesific heat difference	<i>kJ/kg</i>	2.8	±	0.61	21.6 %
Temperature difference	°C	1.3	±	0.07	5.6 %
Mass flow R744	<i>kg/h</i>	1113	±	2.90	0.3 %
Cooling capacity	<i>kW</i>	0.9	±	0.00	0.0 %
Pressure loss	<i>bar</i>	1.8	±	0.00	0.1 %
LP side					
Spesific heat difference	<i>kJ/kg</i>	35.4	±	0.35	1.0 %
Temperature difference	°C	30.4	±	0.04	0.1 %
Mass flow R744	<i>Kg/h</i>	1113	±	2.90	0.3 %
Cooling capacity	<i>kW</i>	0.0	±	0.00	0.0 %
Pressure loss	<i>bar</i>	0.04	±	0.00	7.5 %
Superheat IHX inlet	<i>[°C]</i>	32.9			

Evaporator 6a					
R744 side			Total Deviation	Total uncertainty	Comment
Pressure inlet	<i>bar</i>	31.3	±	0.08	0.25 %
Temperature difference	°C	-4.1	±	0.00	0.0 %
Mass flow R744	<i>kg/h</i>	1113	±	2.90	0.3 %
Heat difference R744	<i>kJ/kg</i>	13	±	0.09	0.7 %
Cooling capacity	<i>kW</i>	3.93	±	0.03	0.7 %
Pressure drop	<i>bar</i>	0.02	±	0.00	9.0 %
Glycol side					
Spesific heat difference	<i>kJ/kg</i>	9.09	±	106	1162.2 %
Temperature difference	°C	2.61	±	0.08	3.2 %
Mass flow glycol	<i>Kg/h</i>	0	±	0.00	36.9 %
Cooling capacity	<i>kW</i>	0.00	±	1	11459750.5 %
Pressure drop	<i>bar</i>	0.01	±	0.00	5.2 %

Evaporator 6b					
R744 side					
Pressure inlet	<i>bar</i>	31.3	±	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>	1113	±	2.9	0.3 %
Cooling capacity	<i>kW</i>	0.0	±	0.00	0.0 %
Pressure drop	<i>bar</i>	0.02	±	0.00	3.0 %
Glycol side					
Spesific heat out	<i>kJ/kg</i>	18946.1	±	66873.0	353.0 %
Temperature difference	°C	3255.7	±	8.19	0.3 %
Mass flow glycol	<i>Kg/h</i>	-0	±	0.00	36.9 %
Cooling capacity	<i>kW</i>	0.1	±	0.33	354.9 %
Pressure drop	<i>bar</i>	0.01	±	0.00	5.2 %