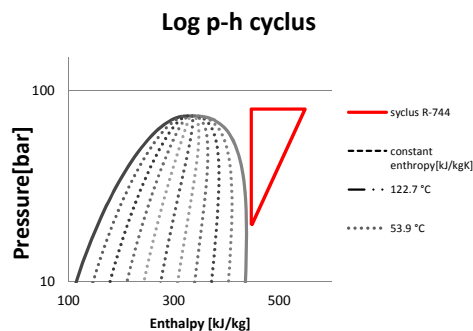


Experiment no: 4
Date: 22.05.2012
Operator: Obrist/Roman
Mode: comp.test 2500 rpm
Measured points 31

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	0.81 %	
Compressor Speed	[rpm]	2500	± 5.00	0.2 %	
Mass flow R744	[kg/h]	1883	± 3.98	0.2 %	
Mass flow water/ethyleneglycol	[kg/h]	0.0	± 0.00	31.8 %	
Ambient temperature	[°C]	22.6	± 0.15	0.7 %	
Supply power	[kW]	58.8	± 0.12	0.2 %	
Power consumption compressor	[kW]	52.0	± 0.30	0.6 %	
Danfoss VSD efficiency		88.39 %	± 0.00	0.53 %	
Volumetric efficiency		67.9 %	± 0.62 %	0.91 %	
Isentropic efficiency		67.2 %	± 0.37 %	0.55 %	
Oil circulation rate (OCR)		0.7589 %	± 0.366 %	114.56 %	Uncertainty high due to on/off valve
Heat rejection	[kW]	53.5	± 0.22	0.4 %	
Cooling capacity	[kW]	0.0	± 0.00	0.0 %	
Pressure, evaporator, inlet	[bar]	56.0	± 0.14 0.00	0.3 %	
Pressure, throttle valve,in	[bar]	79.8	± 0.20	0.3 %	
Temperature, throttle valve, in	[°C]	53.9	± 0.02	0.0 %	
Temperature, throttle valve out	[°C]	-1.3	± 0.03	2.0 %	

Compressor

			Total Deviation	Total uncertainty	Comment
Inlet suction pressure	[bar]	20.0	± 0.05	0.3 %	
Inlet temperature	[°C]	-10.6	± -0.02	0.2 %	
Inlet super heat	[K]	8.9	± 0.02	0.2 %	
Outlet pressure	[bar]	80.1	± 0.20	0.3 %	
Outlet temperature	[°C]	122.7	± 0.05	0.04 %	
Pressure ratio	[-]	4.0	± 0.015	0.4 %	
Lubricant return mass flow rate:	[kg/h]	14.4	± 16.62	115.4 %	on/off valve
Temperature, lubricant return:	[°C]	91.2	± 0.96	1.0 %	
Compressor Speed	[rpm]	2500	± 5.00	0.2 %	
Torque	[Nm]	199	± 1.21	0.6 %	
Power consumption	[kW]	52.0	± 0.30	0.6 %	
Massflow R-744	[kg/h]	1883	± 3.98	0.2 %	
Specific volume (suction line)	[m³/kg]	0.02	± 0.00	0.1 %	
Density CO2 (suction line)	[kg/m³]	49.0	± 0.05	0.1 %	
Volumetric efficiency	[%]	<u>67.9 %</u>	± 0.62 %	0.91 %	
Isentropic efficiency	[%]	<u>67.2 %</u>	± 0.37 %	0.55 %	

Aircooler						
Gascooler TAG 2				Total Deviation	Total uncertainty	Comment
Specific heat difference	<i>kJ/kg</i>	97.5	±	0.39	0.4 %	
Capacity	<i>[kW]</i>	51.0	±	0.23	0.5 %	
Temperature difference R-744	<i>°C</i>	65.3	±	0.08	0.1 %	
Mass flow air	<i>kg/h</i>	-				
Effect	<i>%</i>		±			
Pressure drop	<i>bar</i>	0.1	±	0.01	7.9 %	
Mass flow R744	<i>kg/h</i>	1883	±	3.98	0.2 %	
Inlet temperature		120.2	±			
Outlet temperature		54.91				
			±			
			±			
Watercooler						
Gascooler TAG 3			±			
Specific heat difference	<i>kJ/kg</i>	0.1		0.00	0.0 %	
Cooling capacity	<i>kW</i>	0.1	±		0.0 %	
Mass flow water	<i>Kg/h</i>		±			
Temperature difference R-744	<i>°C</i>	0.3		0.08	25.8 %	
Pressure drop	<i>bar</i>	0.0		0.00	5.2 %	
Mass flow R-744	<i>kg/h</i>	1883	±	3.98	0.2 %	
Temperature difference water	<i>°C</i>	2.3		0.11	4.6 %	

Gascooler 4a						
R744 side				Total Deviation	Total uncertainty	Comment
Inlet temperature	<i>°C</i>	54.6	±	0.03	0.1 %	
Outlet temperature	<i>°C</i>	45.0	±	0.04	0.1 %	
Specific heat difference	<i>kJ/kg</i>	0.02	±	0.00	2.6 %	
Temperature difference	<i>°C</i>	9.6	±	0.05	0.5 %	
Mass flow R744	<i>Kg/h</i>	1883	±	3.98	0.2 %	
Cooling capacity	<i>kW</i>	12.9	±	0.33	2.6 %	
Pressure drop	<i>bar</i>	0.04	±	0.00	12.7 %	
Glycol side						
Specific heat difference	<i>kJ/kg</i>	0.05	±	0.35	714.6 %	
Temperature difference	<i>°C</i>	14.2	±	0.10	0.7 %	
Mass flow glycol	<i>Kg/h</i>	-3	±	0.00	0.1 %	
Cooling capacity	<i>kW</i>	-0.04	±	0.00	0.2 %	
Pressure drop	<i>Pa</i>	0.00	±	0.00	2.0 %	

Gascooler 4b							
--------------	--	--	--	--	--	--	--

R744 side

Inlet temperature	°C	54.6	±	0.1 %
Outlet temperature	°C	54.1	±	0.1 %
Specific heat difference	<i>kJ/kg</i>	0.9	±	72.7 %
Temperature difference	°C	0.5	±	13.8 %
Mass flow R744	<i>kg/h</i>	1883	±	0.2 %
Cooling capacity	<i>kW</i>	0.00	±	72.8 %
Pressure drop	<i>Bar</i>	0.04	±	17.0 %

Glycol side

Specific heat difference	<i>kJ/kg</i>	111.2	±	199.5 %
Temperature difference	°C	31.8	±	0.4 %
Mass flow glycol	<i>Kg/h</i>	-2	±	0.1 %
Cooling capacity	<i>kW</i>	-351	±	0.1 %
Pressure drop	<i>bar</i>	0.01	±	5.9 %

IHX						
-----	--	--	--	--	--	--

HP side

			Total Deviation	Total uncertainty	Comment
Specific heat difference	<i>kJ/kg</i>	1.4	±	0.49	35.9 %
Temperature difference	°C	0.3	±	0.03	9.6 %
Mass flow R744	<i>kg/h</i>	1883	±	3.98	0.2 %
Cooling capacity	<i>kW</i>	0.7	±	0.00	0.0 %
Pressure loss	<i>bar</i>	1.8	±	0.00	0.1 %

LP side

Specific heat difference	<i>kJ/kg</i>	7.0	±	0.44	6.3 %
Temperature difference	°C	41.1	±	0.03	0.1 %
Mass flow R744	<i>Kg/h</i>	1883	±	3.98	0.2 %
Cooling capacity	<i>kW</i>	0.0	±	0.00	0.0 %
Pressure loss	<i>bar</i>	0.03	±	0.00	13.6 %
Superheat IHX inlet	[°C]	11.5			

Evaporator 6a						
---------------	--	--	--	--	--	--

R744 side

			Total Deviation	Total uncertainty	Comment
Pressure inlet	<i>bar</i>	56.0	±	0.14	0.25 %
Temperature difference	°C	-4.1	±	0.00	0.0 %
Mass flow R744	<i>kg/h</i>	1883	±	3.98	0.2 %
Heat difference R744	<i>kJ/kg</i>	-200	±	-0.10	0.0 %
Cooling capacity	<i>kW</i>	-104.84	±	-0.05	0.0 %
Pressure drop	<i>bar</i>	0.03	±	0.00	2.0 %

Glycol side

Specific heat difference	<i>kJ/kg</i>	6.36	±	78	1223.9 %
Temperature difference	°C	1.84	±	0.07	4.0 %
Mass flow glycol	<i>Kg/h</i>	0	±	0.00	31.8 %
Cooling capacity	<i>kW</i>	0.00	±	1	14387241.0 %
Pressure drop	<i>bar</i>	0.01	±	0.00	6.8 %

Evaporator 6b						
---------------	--	--	--	--	--	--

R744 side

Pressure inlet	<i>bar</i>	56.0	±	0.14	0.25 %
Specific 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>	1883	±	4.0	0.2 %
Cooling capacity	<i>kW</i>	0.0	±	0.00	0.0 %
Pressure drop	<i>bar</i>	0.03	±	0.00	10.0 %

Glycol side

Specific heat out	<i>kJ/kg</i>	18956.9	±	66873.1	352.8 %
Temperature difference	°C	3258.8	±	8.19	0.3 %
Mass flow glycol	<i>Kg/h</i>	-0	±	0.00	31.8 %
Cooling capacity	<i>kW</i>	0.1	±	0.28	354.2 %
Pressure drop	<i>bar</i>	0.01	±	0.00	5.1 %