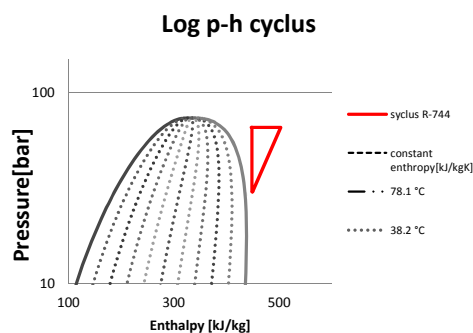


Experiment no: 4
Date: 22.05.2012
Operator: Obrist/Roman
Mode: comp.test 3500 rpm
Measured points 46

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	0.85 %	
Compressor Speed	[rpm]	3500.0222	± 7.00	0.2 %	
Mass flow R744	[kg/h]	4832	± 10.00	0.2 %	
Mass flow water/ethyleneglycol	[kg/h]	0.0	± 0.00	19.7 %	
Ambient temperature	[°C]	22.1	± 0.19	0.9 %	
Supply power	[kW]	82.4	± 0.36	0.4 %	
Power consumption compressor	[kW]	72.5	± 0.40	0.6 %	
Danfoss VSD efficiency		87.95 %	± 0.00	0.45 %	
Volumetric efficiency		81.4 %	± 0.31 %	0.38 %	
Isentropic efficiency		64.4 %	± 0.40 %	0.63 %	
Oil circulation rate (OCR)		1.0994 %	± 0.403 %	26.73 %	Uncertainty high due to on/off valve
Heat rejection	[kW]	73.9	± 0.31	0.4 %	
Cooling capacity	[kW]	0.0	± 0.00	0.0 %	
Pressure, evaporator, inlet	[bar]	61.9	± 0.15 0.00	0.3 %	
Pressure, throttle valve,in	[bar]	60.9	± 0.15	0.3 %	
Temperature, throttle valve, in	[°C]	38.2	± 0.01	0.0 %	
Temperature, throttle valve out	[°C]	-1.3	± 0.03	2.0 %	

Compressor					
			Total Deviation	Total uncertainty	Comment
Inlet suction pressure	[bar]	30.2	± 0.08	0.3 %	
Inlet temperature	[°C]	4.4	± 0.02	0.4 %	
Inlet super heat	[K]	9.6	± 0.02	0.2 %	
Outlet pressure	[bar]	65.9	± 0.17	0.3 %	
Outlet temperature	[°C]	78.1	± 0.03	0.03 %	
Pressure ratio	[-]	2.2	± 0.008	0.4 %	
Lubricant return mass flow rate:	[kg/h]	53.7	± 14.52	27.0 %	on/off valve
Temperature, lubricant return:	[°C]	72.2	± 0.07	0.1 %	
Compressor Speed	[rpm]	3500.0222	± 7.00	0.2 %	
Torque	[Nm]	198	± 1.16	0.6 %	
Power consumption	[kW]	72.5	± 0.40	0.6 %	
Massflow R-744	[kg/h]	4832	± 10.00	0.2 %	
Specific volume (suction line)	[m³/kg]	0.01	± 0.00	0.1 %	
Density CO2 (suction line)	[kg/m³]	75.2	± 0.06	0.1 %	
Volumetric efficiency	[%]	<u>81.4 %</u>	± 0.31 %	0.38 %	
Isentropic efficiency	[%]	<u>64.4 %</u>	± 0.40 %	0.63 %	

Aircooler						
Gascooler TAG 2			Total Deviation	Total uncertainty	Comment	
Spesific heat difference	<i>kJ/kg</i>	54.7	±	0.35	0.6 %	
Capacity	<i>[kW]</i>	73.4	±	0.49	0.7 %	
Temperature difference R-744	<i>°C</i>	35.3	±	0.05	0.1 %	
Mass flow air	<i>kg/h</i>	-				
Effect	<i>%</i>		±			
Pressure drop	<i>bar</i>	0.4	±	0.00	0.5 %	
Mass flow R744	<i>kg/h</i>	4832	±	10.00	0.2 %	
Inlet temperature		76.7	±			
Outlet temperature		41.40				
			±			
			±			
Watercooler						
Gascooler TAG 3			±			
Spesific heat difference	<i>kJ/kg</i>	-0.4		0.00	0.0 %	
Cooling capacity	<i>kW</i>	-0.5	±		0.0 %	
Mass flow water	<i>Kg/h</i>		±			
Temperature differenca R-744	<i>°C</i>	0.8		0.04	5.2 %	
Pressure drop	<i>bar</i>	0.0		0.00	0.4 %	
Mass flow R-744	<i>kg/h</i>	4832	±	10.00	0.2 %	
Temperature difference water	<i>°C</i>	1.9		0.10	5.4 %	

Gascooler 4a						
R744 side			Total Deviation	Total uncertainty	Comment	
Inlet temperature	<i>°C</i>	40.6	±	0.02	0.0 %	
Outlet temperature	<i>°C</i>	38.5	±	0.02	0.1 %	
Spesific heat difference	<i>kJ/kg</i>	0.00	±	0.00	13.8 %	
Temperature difference	<i>°C</i>	2.0	±	0.04	1.7 %	
Mass flow R744	<i>Kg/h</i>	4832	±	10.00	0.2 %	
Cooling capacity	<i>kW</i>	4.2	±	0.59	13.8 %	
Pressure drop	<i>bar</i>	0.04	±	0.00	9.7 %	
Glycol side						
Spesific heat difference	<i>kJ/kg</i>	0.04	±	0.37	904.6 %	
Temperature difference	<i>°C</i>	11.7	±	0.11	0.9 %	
Mass flow glycol	<i>Kg/h</i>	-4	±	0.00	0.0 %	
Cooling capacity	<i>kW</i>	-0.04	±	0.00	0.3 %	
Pressure drop	<i>Pa</i>	0.00	±	0.00	1.6 %	

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

R744 side

Inlet temperature	°C	40.6	±	0.1 %
Outlet temperature	°C	39.8	±	0.0 %
Specific heat difference	<i>kJ/kg</i>	0.5	±	86.9 %
Temperature difference	°C	0.8	±	3.3 %
Mass flow R744	<i>kg/h</i>	4832	±	0.2 %
Cooling capacity	<i>kW</i>	0.00	±	86.9 %
Pressure drop	<i>Bar</i>	0.06	±	5.5 %

Glycol side

Specific heat difference	<i>kJ/kg</i>	77.7	±	218.0 %
Temperature difference	°C	22.2	±	0.6 %
Mass flow glycol	<i>Kg/h</i>	-2	±	0.1 %
Cooling capacity	<i>kW</i>	-292	±	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>	6.8	±	0.42	6.2 %
Temperature difference	°C	0.9	±	0.02	2.4 %
Mass flow R744	<i>kg/h</i>	4832	±	10.00	0.2 %
Cooling capacity	<i>kW</i>	9.1	±	0.56	6.2 %
Pressure loss	<i>bar</i>	1.8	±	0.00	0.1 %

LP side

Specific heat difference	<i>kJ/kg</i>	29.1	±	0.58	2.0 %
Temperature difference	°C	23.4	±	0.02	0.1 %
Mass flow R744	<i>Kg/h</i>	4832	±	10.00	0.2 %
Cooling capacity	<i>kW</i>	0.4	±	0.00	0.0 %
Pressure loss	<i>bar</i>	0.04	±	0.01	18.1 %
Superheat IHX inlet	[°C]	4.5			

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

R744 side

			Total Deviation	Total uncertainty	Comment
Pressure inlet	<i>bar</i>	61.9	±	0.15	0.25 %
Temperature difference	°C	-4.1	±	0.00	0.0 %
Mass flow R744	<i>kg/h</i>	4832	±	10.00	0.2 %
Heat difference R744	<i>kJ/kg</i>	-204	±	-0.09	0.0 %
Cooling capacity	<i>kW</i>	-273.57	±	-0.12	0.0 %
Pressure drop	<i>bar</i>	0.04	±	0.00	1.7 %

Glycol side

Specific heat difference	<i>kJ/kg</i>	7.43	±	91	1224.8 %
Temperature difference	°C	2.14	±	0.08	3.9 %
Mass flow glycol	<i>Kg/h</i>	0	±	0.00	19.7 %
Cooling capacity	<i>kW</i>	0.00	±	2	14111350.2 %
Pressure drop	<i>bar</i>	0.01	±	0.00	4.9 %

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

R744 side

Pressure inlet	<i>bar</i>	61.9	±	0.15	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>	4832	±	10.0	0.2 %
Cooling capacity	<i>kW</i>	0.0	±	0.00	0.0 %
Pressure drop	<i>bar</i>	0.05	±	0.00	1.3 %

Glycol side

Specific heat out	<i>kJ/kg</i>	18944.7	±	66873.0	353.0 %
Temperature difference	°C	3255.3	±	8.19	0.3 %
Mass flow glycol	<i>Kg/h</i>	-0	±	0.00	19.7 %
Cooling capacity	<i>kW</i>	0.1	±	0.35	353.5 %
Pressure drop	<i>bar</i>	0.01	±	0.00	4.3 %