ClimaCheck

Performance analysis and
Energy optimisation

Manufacturing of Chillers/Heat Pumps
Developement and testing

Hemsida www.climacheck.com

ClimaCheck Sweden AB

- Complete line-up for field and fixed performance analysis
- Based on patent from 1986.
- ClimaCheck was founded in 2004
- Distribution in 15countries.
- Rapid increase in the global market.
- Customers today: over 30 Manufacturing Companies. Arround 400 contractors from Europe to Asia :
  - **Carrier/Trane/Thermia**
  - **DuPont, Solvay**
  - **Copeland/Bitzer**
  - **Carrefour, Metro (Italien), ICA, Axfood, Tesco**

Winner 2009
”Refrigeration Product of the Year”
at RAC-exhibition in England

ClimaCheck Sweden AB

Customer demands

- Performance according to specifications
- Correct amount of refrigerant in the system
- Components adjusted to specified operation ambient conditions.

Why so important?

ClimaCheck Sweden AB

Customer demands:

- Customer should get ”what he paid for”
- The Manufacturer wants to secure quality and lower risk of compressor failure
- Correct analysis and documentation increases the competence and trust in the market.

More Possibilities!

Hemsida www.climacheck.com

ClimaCheck Sweden AB

Developement of Chillers and Heat Pumps:

- Frequence modulation is more and more common-ClimaCheck gives the correct capacity and COP
- New compressor technologies-verification
- New technology should be tested inside the lab-not in field

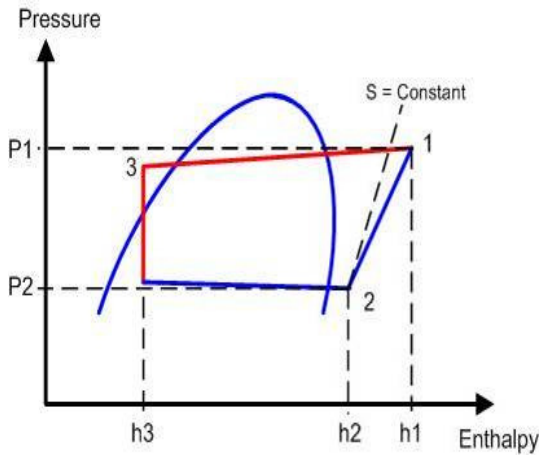
The ClimaCheck Method!

Hemsida www.climacheck.com

The ClimaCheck Method is based on the following principles

1. Pressure and temperature measurement around the compressor
   - Gives enthalpy difference

2. Temperature liquid refrigerant
   - Gives enthalpy out of the condenser and into the evaporator.



3. Energy balance over compressor gives mass flow
   - (Heat losses are known and Thermal efficiency is introduced in the calculation)

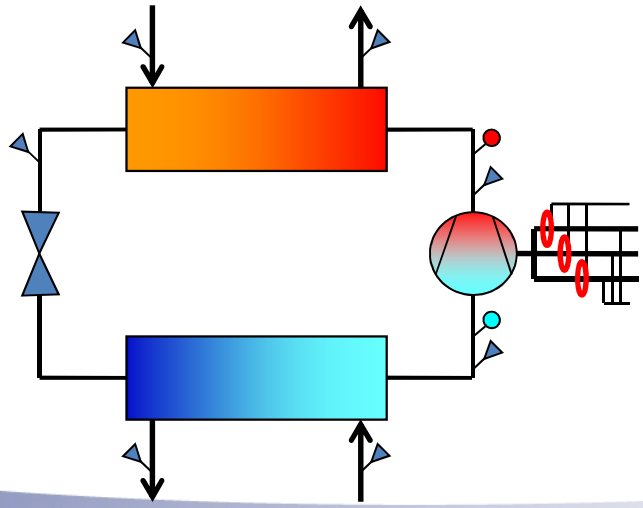
4. Mass flow gives heating- and cooling capacity

Additional information:

1. Brine and Coolant temperature
   - For accurate control of set values

2. Ambient temperatur and humidity
   - For accurate control of aircooled condensers

3. Input power
   - Total input power including pumps etc.

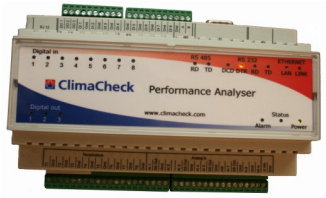


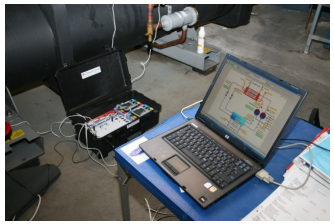
ClimaCheck Sweden AB

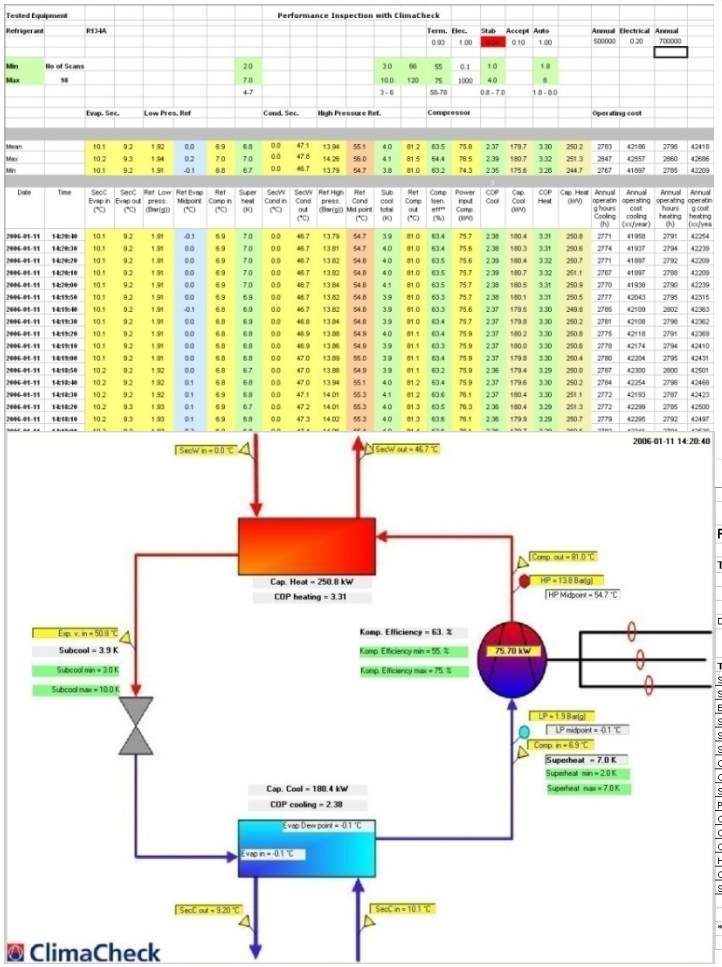
Protocol

Testat system:							
Datum:	2006-01-11						
Driftfall	**Mätta värden**		**Nominella värden**	**Avvikelse från nominell**			**Kommentar**
DatumDatum	**2006-01-11**						
Tid för mätning	**14:26:00**						
Kyleffekt	185.1	kW				%	
Värmeeffekt	256.1	kW				%	
COP Kyla	2.44					%	
COP Värme	3.37					%	
Elektrisk effekt	75.9	kW				%	
Cirkulationsflöde värmekrets	37.7	l/s				%	
Frostkyddsmedel typ	Water						
Frostkyddsmedel koncentration	100	Volym-%					
Cirkulationsflöde kylkrets	129.5	l/s				%	
Frostkyddsmedel typ	Water						
Frostkyddsmedel koncentration	100	Volym-%					
Sekundär kall in (Köldb./luft)	10.6	°C					
Sekundär kall ut (Köldb./luft)	9.5	°C					
Överhettning Kompressor	7.3	K					
Sekundär varm in (Kylmedel/luft)	40.6	°C					
Sekundär varm ut (Kylmedel/luft)	46.4	°C					
Köldmedium	R134A						
Kompressor tryckrörstemperatur	80.9	°C					

ClimaCheck Sweden AB







ClimaCheck

Report from Perfromance inspction:

Tested Equipment:

Date: 2006-01-11

	Uppmätt värde		Nominella Data	Avvikelse				Kommentarer
Time for measuremen	14:21:10							
Secondary Cold in	10.1	°C	12.0	-1.89	K			
Secondary Cold out	9.2	°C	7.0	2.18	K			
Evaporation	0.0	°C	2.0	-1.97	K			
Super heat Comp.	6.9	K	5.0	1.89	K			
Secondary Warm in	0.0	°C	40.0	-40.00	K			
Secondary Warm out	46.6	°C	45.0	1.60	K			
Compressor discharge	81.0	°C	80.0	1.03	K			
Condensing	54.7	°C	50.0	4.68	K			
Sub cool before exp.	3.9	K	5.0	-1.05	K			
Power Input	75.7	kW	70.0	5.70	kW	8.1	%	
Comp isen. efficiency	63.1	%	64.0	-0.90	-			
Cooling Capacity	180.2	kW	190.0	-9.80	kW	-5.2	%	
COP Cooling	2.38		2.60	-0.22		-8.4	%	
Heating Capacity	250.6	kW	260.0	-9.40	kW	-3.6	%	
COP Heating	3.31		3.50	-0.19		-5.4	%	
Stability*	0.03		0.10	0.00				

* If unstable this must be taken into account when evaluatin

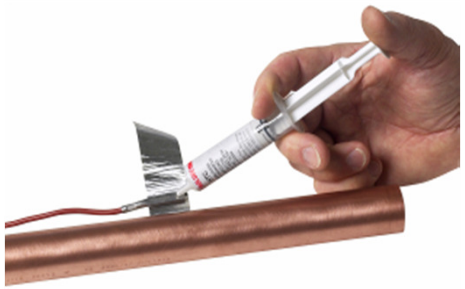
External measurement> small temperature differences
> inaccurate measurement has big impact on performance calculation

- System 12°C/ 7°C Brine temerature
  - Inaccuracy of 0.25 K gives 10% error in cooling capacity
- System 40°C/ 45°C Coolant temp
  - Inaccuracy of 0.25 K gives 10% error in cooling capacity
- Control at ”0-load” is important and simple
- Perception of time constants increases knowledge

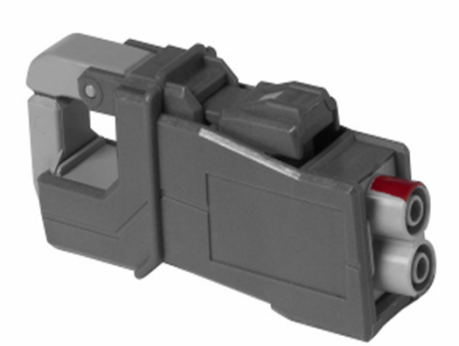
Internal method for refrigeration processes

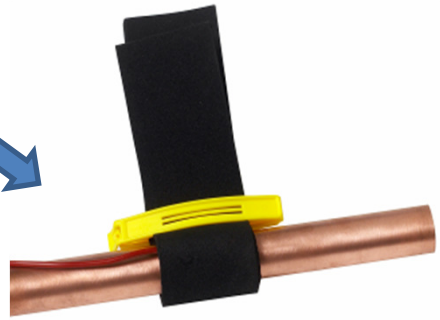
- Gives detailed and accurate information
  - COP (5%), Cooling- and Heating capacity (7%)
  - Gives more information than performance
    - All components are evaluated
      - Compressor efficiency
      - Heat Exchanger analysis (Medium temp. difference, KA)
      - Correct amount of refrigerant charge
      - Expansion valve control and capacity control
      - etc
  - Faster and more complete analysis
  - Less demand of stability – less sensitive towards measuring error
    - 1% on pressure probes
  - Cost efficient

Easy to apply



20 minutes





Analysis

- Components
  - Refrigerant charge
    - Subcooling
  - Expansion valve
    - Superheat
  - Compressor
    - Efficiency
  - Condensor
    - Temperature difference
  - Evaporator
    - Temperature difference
- System
  - Temperature levels
  - Stability
  - Control
  - Usage of capacity
  - Heat recovery
  - Free cooling

ClimaCheck Sweden AB

Manufacturing and testing

Optimisation
Control of COP-Heating/cooling capacity
Refrigerant charge

Hemsida www.climacheck.com