

Smart Scale Energy Solutions Cooling Systems

Efficiency monitoring refreshes the cooling system performance

Benefits

Analyzing the performance of a cooling system helps to:

- Benchmark efficiency of cooling systems compared to similar systems or industry values
- Determine the cost of refrigeration
- Assess a system's ability to meet added loads
- Quantify benefits of system modifications and improvements
- Verify predicted performance



Refrigeration energy accounts for a huge proportion of overall energy costs in many industries. A small reduction of energy consumption leads to significant cost savings. Precondition for effective measurement is the knowledge about the system characteristics at different operating conditions.

The Challenge Efficient refrigeration requires more than efficient components, it depends mainly on system configuration and operation. As refrigeration systems are custom engineered systems, individual analysis of the supply and demand side is necessary to find the ideal point of operation.

The Solution Define the right KPIs which help you to evaluate:

1. Cooling system efficiency,
2. System leakages,
3. Specific energy consumption.

This is the precondition for energy management and cost reduction. Our energy and data manager RSG40 collects, stores and displays all the required data.

1. Cooling System Efficiency

Refrigeration efficiency is usually expressed as an energy efficiency ratio (EER) or coefficient of performance (COP). For the evaluation of the refrigeration efficiency it is necessary to quantify the contribution of all system components, such as condenser fans or pumps and distribution pumps and include this into the calculation which is then called the coefficient of system performance (COSP).

Monitoring refrigeration efficiency to

- Evaluate and run the system at the ideal point of operation (load with highest COP or COSP),
- Benchmark the system's efficiency,
- Indicate requirement/effect of maintenance (cleaning of heat exchanger in evaporator or condenser).

Apart from efficiency calculation cooling load data are used to calculate the load factor, which helps to detect peaks in demand, reduce start/stop cycles or run the system at the most efficient time (e.g. night time operation and buffering of cooling energy using a cooling storage).

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People for Process Automation

Furthermore the lifetime of the equipment can be lengthened if the system is running at a constant load.

2. System Leakages Constant monitoring allows you to detect trends and expose developing faults. A good example for that is monitoring of suction and discharge pressure to detect refrigerant leakage.

- Detect and repair disruptions or leakages to run the system reliable, efficient and lengthen lifetime.
- Avoid system problems due to leakages (e.g. system is not able to provide the required cooling).
- Reduce maintenance and unscheduled downtimes.

3. Consumption The exact measurement of the refrigeration energy consumption per product unit or per m³ and year (cooling chamber) is essential to assess the system efficiency and to optimize the production processes. The loads that significantly affect costs can be highlighted by analyzing the data. Furthermore the data are suitable for a carbon footprint evaluation.

Waste Heat Recovery Refrigeration systems produce a lot of waste heat which is usable as space or water heating. The measurement of the waste heat recovery rate (in desuperheaters or condenser) is useful to:

- Quantify the energy savings due to waste heat recovery.
- Adjust the system to the most efficient operation (condensate temperature influence COP and waste heat recovery rate).

RSG40 Analysis The energy and data manager RSG40 collects, stores and displays all the data required for the monitoring of direct and indirect cooling system. By using the intuitive Field Data Manager software (FDM) it can be accessed from the desk and processed into a user friendly and meaningful format.

System performance and trends:

- Compressor and System Efficiency (COP, COSP)
- Refrigeration loss
- Pump efficiency
- Specific energy consumption
- Waste heat recovery rate

On Site Cooling systems are often individual and customized. Depending on the specific refrigeration system (e.g. direct / indirect systems, dry / flooded evaporators, single / multi-stage, absorption chillers or cooling towers) customized solutions can be developed.



Memograph M RSG40 with process display

✓ Payback Calculation Example:

Situation:

- Cooling capacity 400 kW
- Compressor capacity 100 kW
- Operating time: 8,000 h/a

Sources of energy loss:

- Leakage loss 20% refrigerant leads to 10% efficiency loss (Can be reduced by leakage detection to 5% efficiency loss)
- Blocked condenser, no liquid sub cooling (Can be eliminated in time, 5% savings)
- Adjustment to load variation (Saves about 3% energy)

Payback:

Overall costs of instruments for compressor efficiency, leakage monitoring: 10,200 €

Electricity costs: 0.15 € /kWh

Total amount refrigeration energy reduction: 13% * (400 kW * 8,000 h/a) = 416,000 kWh, (i.e. approx. 104,000 kWh electrical energy)

Savings:

104,000 kWh * 0.15 € = 15,600 €/a

10,200 € / 15,600 € = 0.67 years

! The payback period is less than 7 months.

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