

Energy Efficiency of Refrigerating Systems – Information No. 1

Good Planning Saves Money: Tips for Contractors



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This information helps building contractors and operators who want to reconstruct or restore a refrigeration or air conditioning system, or build a new one.

The correct location and adequate space for the refrigeration or air conditioning system can reduce investment and operating costs.

The costs of the system need to be considered for its entire life cycle; investment costs are just a fraction of the operating costs over the whole utilization period of the system.

Several trades are usually involved in setting up a refrigeration or air conditioning system, so right from the beginning particular attention needs to be paid to interfaces. Good coordination between the trades reduces costs with little effort.

Constructing a refrigeration or air conditioning system is a complex project that takes routine and experience. Conducting the project professionally ensures that it will be a success and prevents irritation on the construction site, expensive construction defects, additional costs and high long-term operating costs.

Experience has shown that the same critical points are often not seen as important enough. This document provides recommendations on how to make the right decisions.



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Recommendation 1

Consult a refrigeration expert early on

It must be possible to implement the system concept within the building structure. The arrangement in the building, the space needed, the loads of the components, vibrations and noise emissions, piping routes, air circulation, electrical connection power and occupational safety requirements all need to be taken into account and defined at an early stage. An architect should be consulted if necessary.

The statutory specifications on the use of refrigerants, the product safety requirements and the requirements resulting from the hazard assessment in accordance with the Betriebssicherheitsverordnung also need to be taken into account in decision making. It is also important to check whether it is possible to apply for subsidies.

Consulting a refrigeration expert early on reduces costs with little effort.

Advance planning forms the basis of integrating the refrigerating system into the building. That is why the refrigeration expert – ideally a planner for refrigeration systems – should be consulted even at this early stage. The refrigeration needs should be determined as accurately as possible in order for the system to be sized correctly and operated efficiently. It is important to check whether heat recovery is useful.

Recommendation 2

Do not choose the cheapest option

A refrigerating system that seems cheap can become expensive for the operator, as the initial investment only accounts for a small fraction of the total costs of a refrigerating system over its entire life cycle. More than two thirds of these costs are the result of electricity consumption.

Planning the refrigerating system correctly, with the right system concept, the lowest possible temperature rises, correctly-sized heat exchangers, efficient compressors, pumps and fans and on demand control can be crucial in reducing energy consumption. This is not feasible with the cheapest option.

Making a reasonable purchase decision means considering more than just the investment costs. To find out what the system will really cost over its entire life cycle (investment, maintenance and energy costs), the usage conditions need to be determined. More information can be found in the “Guidelines for Planning Refrigerating Systems” document.

Recommendation 3

Coordinate work and monitor its quality

Even for small capacity refrigerating systems, coordinating the work is preventing from time-consuming, costly corrections.

Coordinating the various trades is an important contribution with relatively low costs that pay off.

The effort involved in coordination depends on the scale of the project. Coordination can be conducted by a suitable person, e.g. a craftsman (specialist refrigeration or air conditioning company), planner (refrigeration, air conditioning) or construction manager.



Recommendation 4

Do not scrimp on planning

If no planning is done, there is a danger of the system engineer choosing a standard solution. Although this reduces costs for the planner if the system engineer is commissioned directly, the specific requirements of the refrigerating system might not be sufficiently taken into account.

For refrigerating systems with larger investment volumes, a clear separation between planning services and installation is recommended.

The costs for planning services are governed by the Ordinance on the Honorariums for Services of the Architects and Engineers (HOAI).

Pay attention to the quality of the most important components.

The contract for work states which specifications apply to the refrigeration or air conditioning system. These must be monitored as construction progresses. In the acceptance inspection, check whether the main components, such as evaporators (power, area, plate fin spacing), condensers/recoolers (power, area, plate fin spacing), condensers (type, manufacturer), expansion valves and cooling control devices are corresponding to the contract.

Announce in the contract of work that the components offered in accordance with the specification will be checked when the refrigerating system is accepted.

The recommendations of the document "Guidelines for Planning Refrigerating Systems, Section 10: Commissioning, Optimization, Operating Manual" are also to be taken into account.

As the building contractor or operator, remember that planning services are an expense that you will pay for whatever happens. You can then also demand appropriate performance.

If you do not want to involve an independent refrigeration planner for a small system (e.g. a commercial refrigerating system), planning and coordination should be delegated to the contractor.

Recommendation 5

Plan your purchase decision

Careful planning when purchase a component can prevent unnecessary costs.

Example

A spontaneous decision to procure a blast freezer, to order it directly from the manufacturer and to have the refrigeration expert incorporate it into the refrigerating system can be expensive.

If the new blast freezer means that the evaporation temperature of the entire refrigerating system has to be set 4 K lower, the energy consumption of the refrigerating system will rise by 10 to 15%.

Make the extra effort to talk to the planner for refrigerating systems in advance about whether a new device is suitable for incorporation into the planned new construction or the existing refrigerating system. As well as the performance and temperature requirements (evaporation and condensation temperatures), check whether the device can be operated with the present refrigerant in the system.

Careful planning pays off.



Recommendation 6

Choose your standard chiller carefully

A chiller is needed for building air conditioning of buildings. Using standard temperatures and the calculated refrigeration power to select and install the most economically chiller seems like an easy option.

When chillers that are designed for the usual standard effective temperatures (6/12 °C or 7/12 °C) are used for the refrigeration of cooling ceilings (19/21 °C), this is not economical from an energetically point of view. It is better to use a chiller designed for refrigerating cooling ceilings.

As well as the effective temperature, the pressure loss in the cold water piping system also has a decisive impact on the energy consumption and the size of the circulation pumps.

Discuss the temperature levels of the refrigerating systems and the pressure loss of the products selected with the planner during the tender phase. In addition, the cooling water temperatures chosen for the recooling system should be as low as possible. The chiller should be designed in such a way that the recooling temperatures can also be reduced using lower outside temperatures. This saves considerable energy costs.

Recommendation 7

Do not leave refrigeration to the tenant

In rented properties, it is often impossible to predict the refrigeration demand during the planning phase. The amount of waste heat the refrigerating system has to discharge varies widely from tenant to tenant. As a result, no refrigerating system is usually provided – with the exception of basic air conditioning – and the appropriate system is retrofitted by the tenant. However, tenants tend to install individual solutions that provide no option for heat recovery. They are also often unable to put the recooling in the ideal position, causing it to work inefficiently due to poor positioning.

If the application of refrigeration and waste heat is expected for the use of the space, it will save costs later if individual solutions are avoided and there is an overall concept that enables piping to be laid properly and provides enough space for a machine room and the installation of heat exchangers, e.g. recoolers.

Recommendation 8

Keep the construction engineer up to date

You have signed a contract of work with the refrigeration company, which should include all services. On site, you get to know the construction engineer and find that he is not aware of all the details in the contract. This can result in deviations from the contract. The more progress has been made on implementing the refrigerating system, the more expensive the necessary corrections will be.

In the contract of work, demand the presence of the construction manager responsible for installation when the order is made and discussed. This will ensure that he is familiar with the contract. Holding an initial project meeting before work begins is recommended, in order to discuss the interfaces and schedule in particular and to exchange contact details. For larger projects, holding regular construction meetings is recommended.

Recommendation 9

Sign a maintenance agreement

Any subsequent adjustment of the system should be included in the service- or maintenance contract.

In practice, when commissioned, refrigerating systems and especially air conditioning systems are set in such a way that they meet the high requirements of high summer. Too little attention tends to be paid to partial load situations in spring, fall and winter. Subsequent adjustment of the system is required to ensure that it works as well as possible with partial load, too.

Note the recommendations of the document “Guidelines for Planning Refrigerating Systems, Point 10: Commissioning, Optimization, Operating Manual” and VDMA Specification 24186 “Program of services for the maintenance of air-handling and other technical equipment in buildings”.

Note

VDMA Specifications can be ordered from Beuth Verlag, 10772 Berlin, phone: 030/2601-2260, fax: 030/2601-1260.

What changes for you when you accept the refrigerating system?

As the building contractor, you assume that your refrigeration expert is aware of and adheres to the statutory framework (e.g. Pressure Equipment Directive, EU F-Gas Regulation) and normative requirements (e.g. DIN EN 378). However, please note that responsibility for the system in accordance with the German Industrial Safety Ordinance passes to the employer upon system acceptance.

You will find more information on energy efficiency and cost efficiency at www.kwt.vdma.org/Energieeffizienz

Recommendations on the topic of “Good planning saves money”

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- increase awareness of planners, installers and operators of refrigerating systems for the topic of energy efficiency and help them enhance their skills.
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