

### User-related aspects

- Calculate the required cooling/heating capacity  
→ Tip: Ask the manufacturer to calculate the correct cooling/heating capacity!
- Compare the required working temperatures with the working temperature range of the temperature-control solution  
→ Tip: Ask the manufacturer for assistance!
- Observe the pressure values and operating conditions of the reactor
- Ensure thorough mixing in the reactor

### Criteria for an optimized temperature-control solution

Relevance				Evaluation criteria	Fulfilled
--	-	+	++		
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Ability to enter maximum permissible pressure values	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Ability to enter temperature differentials between feed and reactor	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Ability to enter temperature differentials between reactor and inside of jacket	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	High cooling and heating capacities	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Wide working temperature range	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Air-cooled → flexible installation → saves cooling water	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Water-cooled → may be completely enclosed → requires water connection	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Powerful pump	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Pressure value set either as stages or pressure specification	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Pump with dynamic viscosity compensation	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Magnetically-coupled pump for hydraulically sealed cooling circuit	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Self-lubricating, low-maintenance pump	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Internal expansion vessel with supplementary cooling → Avoids overheating the temperature-control system, lowering the risk of injury	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Robust temperature-control system even when ambient temperature is above +35 °C	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Highly precise control electronics requiring minimal effort to set parameters	<input type="checkbox"/>

## Checklist 2: Investment protection

### User-related aspects

- Preventative maintenance tasks
- Regularly-scheduled cleaning
  - Tip: Check the manufacturer's service and support offerings!
- Consider technical requirements and conditions needed at installation site, i.e. power connection

### Criteria for an optimized temperature-control solution

Relevance				Evaluation criteria	Fulfilled
--	-	+	++		
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Pressure built quickly and in a controlled manner, protecting the application	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Low-maintenance pump (self-lubricating) → avoids secondary costs and downtime	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Wide working temperature range → for repeating experiments at short time intervals with several different temperatures	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Wear-free heat exchanger (in water-cooled units) → avoids contaminating the cooling water and clogging the system	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Air-cooled temperature-control unit → saves costly cooling water	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Closed temperature-control circuit → longer service life for heat-transfer liquid	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Space required for the temperature-control unit → Footprint <u>PLUS</u> space needed for connections and air feed/exhaust	<input type="checkbox"/>

### Checklist 3: Operational safety

#### User-related aspects

- Operator must observe Machinery Directive
- User must be trained and have the necessary skills and knowledge  
→ Tip: Ask the manufacturer about user training!

#### Criteria for an optimized temperature-control solution

Relevance				Evaluation criteria	Fulfilled
--	-	+	++		
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Installation and initial operation procedures are fast and straightforward → potential support from manufacturer	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Display is well organized and shows all relevant information	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Display includes values and graphs	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Notices and error messages are in plain-language text	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Integrated touch function → greater user convenience	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Multiple user levels (password protected) → administrator can set parameters → other users retrieve preset settings → avoids unintended changes and improper use	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Extensive interfaces → standard interfaces like Ethernet and USB	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Integration into control systems	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Network-based remote control → complete access to all functions → user interface on control PC is identical to display on unit	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Data collected for experiment documentation	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Rapid and straightforward reproduction of a series of experiments	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Heat-transfer liquid covers the entire working temperature range → reduces the need to change fluid → simplifies inventory → no interruption when switching between experiments with high and low temperatures	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Operational noise level → quiet units are more ergonomic	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Easily accessible fluid filling opening	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Easy transport → ideally by one person	<input type="checkbox"/>