1. Introduction

Many technical processes require heating of the product to temperatures above the ambient temperature. Fundamentally, a distinction is made between two types of heating possibilities.

Direct Heating: The product is mainly and directly heated from outside by combustion gases or electric heating elements (Fig. 1.1).

Indirect Heating: A recirculating heat transfer medium (the so-called "heat carrier") is used between heater and heat consumer (Fig. 1.2). This type of heating presents the basic principle of a heat transfer plant.

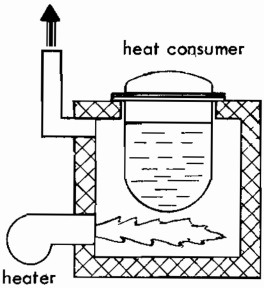


Fig. 1.1 Direct Heating

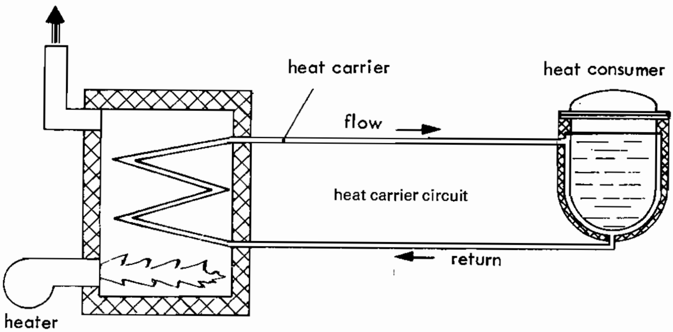


Fig. 1.2 Indirect Heating

A heat transfer plant is a plant in which the heat carrier flows (from the heater to the heat consumer and back) between boundary walls at which heat is neither added nor removed (with the exception of natural losses). This intermediate boundary system for the transport of the heat carrier defines the basis of the heat transfer plants described in this book.

Plants containing a heat carrier medium but in which one of the boundary walls of the medium is simultaneously a heat transfer surface to the heat consumer are thus not to be termed heat transfer plants.

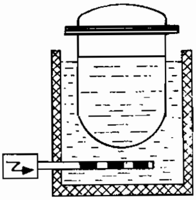


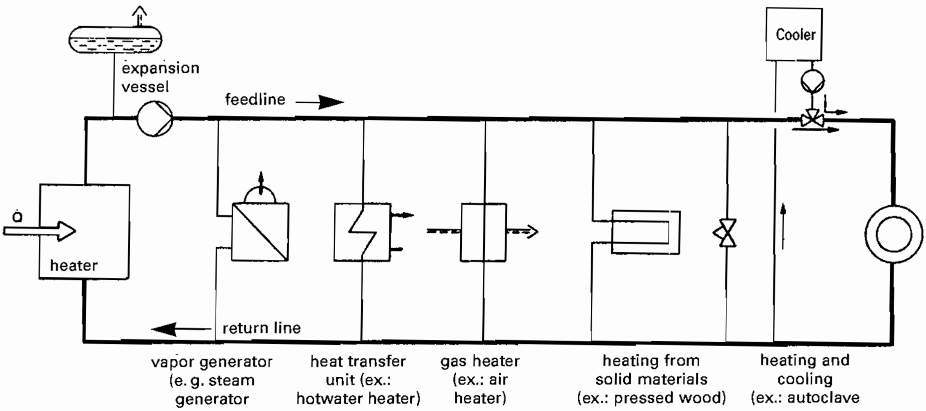
Fig. 1.3 Heating with Contact Medium

An example of such a system is the heating shown in (Fig. 1.3). The contact liquid in the double jacket is electrically heated, flows upward by natural buoyancy and is cooled at the boundary wall. This does not meet the definition of a heat transfer plant and, in this case, it is not a heat carrier medium but a contact medium and not a heat transfer plant but a heat exchanger.

The Advantages of a Heat Transfer Plant in General Compared with the Directly Heated Plant

1. local overheating of the product to be heated is avoided.
2. the temperature of the product can be controlled very accurately and uniformly. The flow temperature can also be adapted to the requirements.
3. a heater in the immediate neighbourhood of the consumer is not required (production safety rules with regard to ignition and explosion risk).
4. the heater can be arranged centrally and the heat transferred through the heat carrier circuit to one or several consumer points.
5. the efficiency of the centrally heated plant is higher than that of individual directly heated consumers.
6. feeding of fuel to each firing point and installation of flue gas chimneys are saved compared with individually fired plants.
7. direct firing of individual consumers necessitates large maintenance expenditure.
8. the heat transfer conditions can be optimized at the consumer.
9. heating and cooling processes can be carried out with the same heat carrier.
10. storage of heat energy is possible. This is advantageous where heat requirements fluctuate strongly with high short-term peak loads.
11. a central or local transformation to warm or hot water in heat exchangers, to steam in steam generators or hot air in air heaters is possible.
12. a conversion of the fuel system at the directly fired consumer to another fuel is very expensive.
13. the thickness of insulation at the consumer can be kept small and local excess temperatures at heat conducting bridges can be avoided.

The heating of heat consumers by a recirculating heat carrier has found wide acceptance because of these advantages of the indirectly heated plant (Fig. 1.4).



Heat generation:	$\dot{Q}$	Electrical	Electrical resistance heating
direct, by means of:		Solid materials:	Wood
heating oil:	EL		Coal, etc.
	M	indirect, by means of:	liquids
	S		gases
gases:	Natural Gas		vapors
	synthetic gas		

Fig. 1.4 Basic Design of a HeatTransfer Plant