

## **Pinch Technology Second Generation**

**Analysis with crisscross optimisation prior to design**

**Design with loop optimisation for minimum area and minimum cost**

**Example Case 6**

**Example from the MAGNETS User Manual**

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### Case 6 – Example from the MAGNETS User Manual

Case 6 refers to a 6 streams example from the MAGNETS User Manual. The specific data are given in Table 6.1.

On the basis of the global trade-off (Fig. 6.1) a HEN was developed for a Heating load of 3575 kW. A solution for minimum area is shown in Fig. 6.2. A second solution for the same minimum area would relocate the Cooler from hot stream H1 to a similar position on hot stream H5. However, targeting for minimum cost will put the cooler on hot stream H3, saving 1.7 % on the network cost for a small area penalty of 0.5%. The position of the Cooler on hot stream H3 is crucial for obtaining an overall optimum.

Final optimisation leads to the network of Fig. 6.3 with lower cost, lower area and higher smallest network DeltaT's than the best network known so far (Table 6.2).

The data set has also been studied using multi-stream heat exchangers (MSHEN, Xiao, ... Roetzel, 2006). Also this scenario could be improved using one single Cooler on hot stream H3, and even better with only one Cooler on hot stream H1 and again with lower surface area and higher smallest network DeltaT's (Fig. 6.4).

Tsupply °C	Ttarget °C	Heat MW	DTMin K	U*f MW/K,m <sup>2</sup>	Description -
500	320	1080		2	H1
480	380	400		2	H2
460	360	600		2	H3
380	360	400		2	H4
380	320	720		2	H5
290	660	6660		2	C1
700	700	3559.2		2	Heating
300	320	99.2		2	Cooling

Heating = 140/kW,year, Cooling = 10/kW,year  
 Annual HEX Cost = 1200 x Area<sup>0.6</sup>

**Table 6.1**



Fig.6.1

Published Results Optimum Heat Exchanger Networks				
	Area (m <sup>2</sup> )	Cost ('000)	# HEX	SDT(K) <sup>(1)</sup>
Yee and Grossmann (1990)	200.9	576.64	7	
MAGNETS User Manual	295.5	575.60	9	
Lewin (1998)		573.21		
Wen et al. (2007)	258.0	571.70	8	4.4
This research	253.9	570.76	8	4.6
With Multistream heat exchangers				
Xiao, Roetzel et al (2005)	300.0	557.30	6	3.7
This research	295.5	554.29	5	4.4

<sup>(1)</sup> Smallest DeltaT (K)

Table 6.2

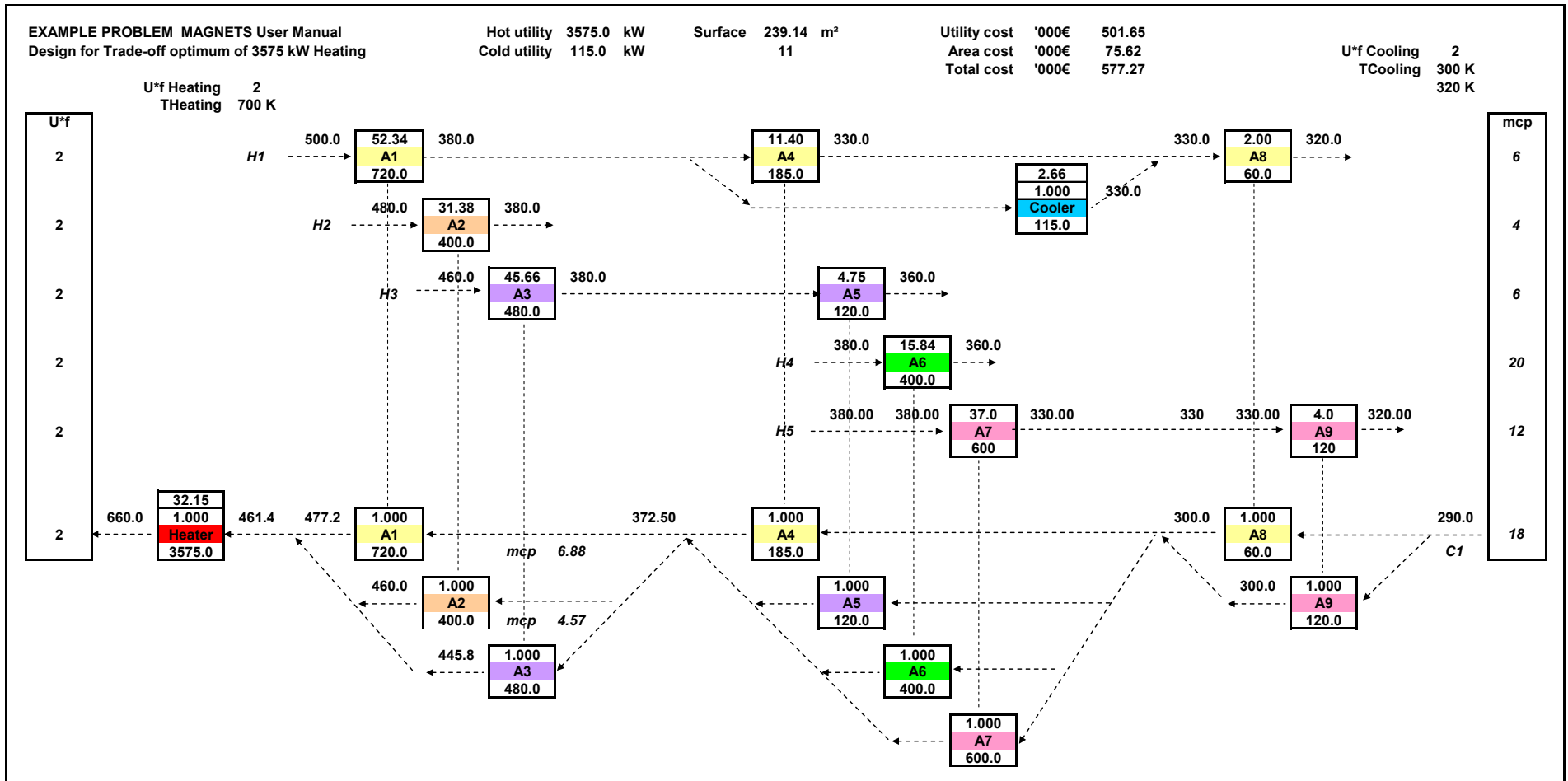


Fig.6.2

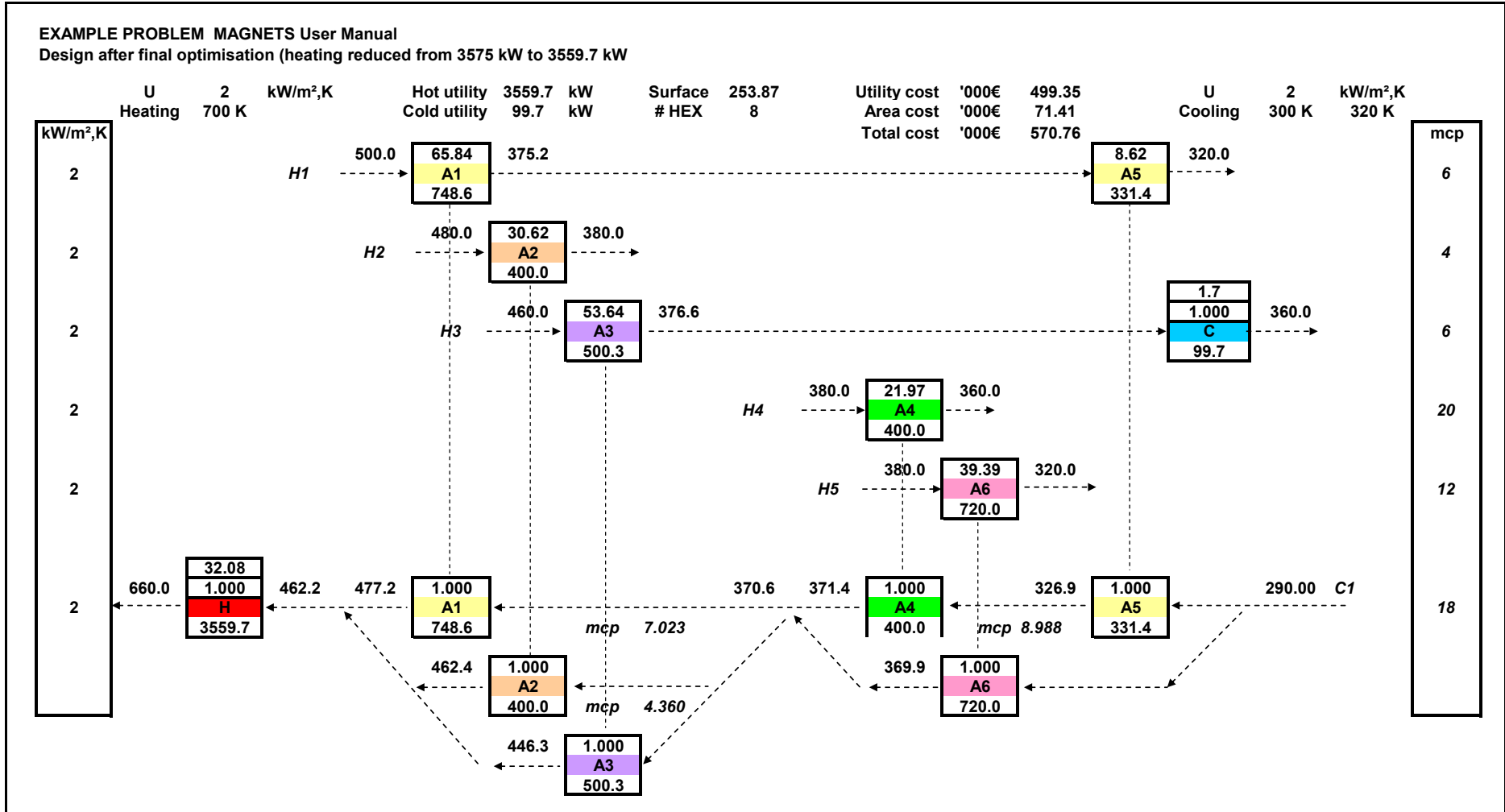


Fig.6.3

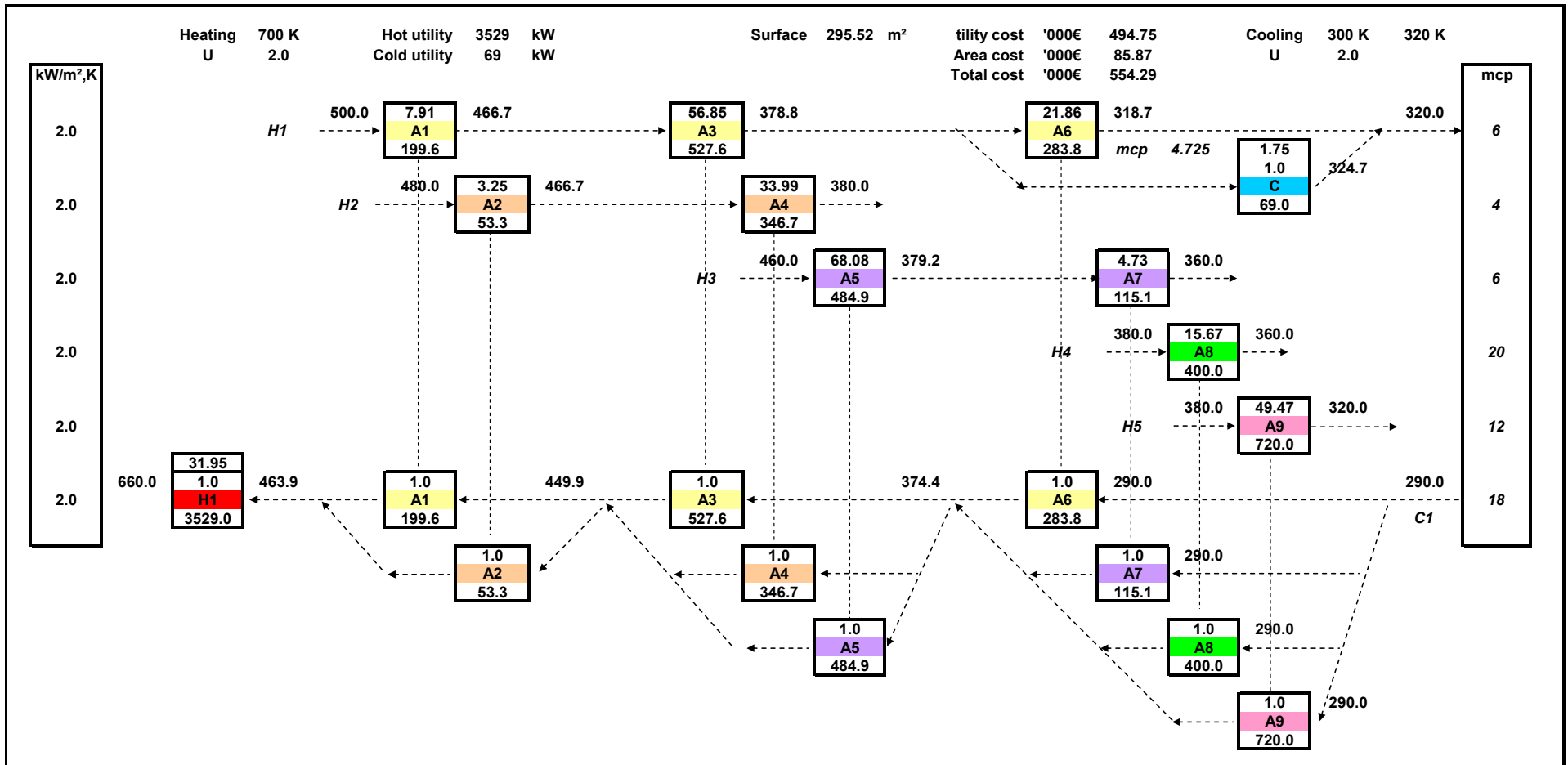


Fig. 6.4