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Selection of reference concepts

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List of references

(1) HTR-E 03/01 D-2-2-1, Preliminary HTR-E Recuperator technical survey Deliverable n°13

(2) HTR-E 03/06 D-2-2-2-1 Preliminary – HTR-E WP2 Recuperator Consultations of manufacturers Deliverable n°14

1. Selection of the reference concepts

During the WP2 4th meeting held in PETTEN, December 02,2003, it was decided between partners to recall the selection of reference concepts issued from the deliverables 13 (Ref.1) and 14 (Ref.2) and briefly explained the reasons of this selection.

The recuperator represents a technical challenge, and a first-of-a kind design, because of its size, strong constraint for the compactness, and of the stringent requirements on thermal effectiveness, leak-tightness, pressure difference between both sides, thermo mechanical resistance, materials, reliability, and cost.

The printed circuit technology (PCHE) is based on plate sheets chemically etched and assembled by diffusion bonding. This technology is well controlled by HEATRIC which manufactured many printed circuit heat exchangers in stainless steel and some in Nickel alloys.

The plate fin technology (PFHE) is based on very thin fins assembled by brazing on flat foils, in order to increase the heat exchange performances. This concept appears more economical but less robust than the printed circuit one. This technology is well mastered by NORDON and the technological risk is low for temperatures up to about 500°C.

Note: *The helical tubular exchanger concept has been fully developed, manufactured and qualified successfully in Germany and in Japan for HTR applications but at a small scale (10MW), but it appears not able to respect the HTR-E recuperator requirements, in particular the constraint for the compactness.*

Manufacturers capabilities summary:

Concept	Thermo mechanical resistance	ISIR capability	Compactness	Cost
PFHE	-	-	+	++
PCHE	+	-	+	+
Tubes	++	+	- -	- -

HT materials experience is not an issue for all concepts.

These are the reasons why, in Europe, HEATRIC and NORDON have been identified as more promising candidates to fulfil HTR-E requirements and the decision to go ahead on these two concepts has been taken.

The followings steps are scheduled :

- engineering studies, like thermal-hydraulic simulation, thermal and structural behaviour of the recuperator block, to be performed in the deliverable D15,
- manufacturing of prototypes, HEATRIC has proposed a concept (to be defined in D17) which is based to be tested upon the new configuration of the CLAIRE loop. The

adaptation of the test rig and the program of tests will be defined in the deliverables D18 and D19.

The reference design will be selected at the end of the tests program and after expertises of the mock-ups at the end of year 2005.