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SUBJECT: EFFICIENCY OF HRT PRESSURIZER HEATER INSULATION

TO: Distribution

FROM: R. F. Hughes

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SUMMARY

Tests have recently been completed which permit a direct measurement of the efficiency of the aluminum concentric cylindrical shell type insulation assembly for the HRT Pressurizer Heater. (Reference: Drawings E-25488, D-25496, and Figure 1).

The measured efficiency was 50 per cent for a heater operating temperature of 750°F; the corresponding heat loss is approximately 1 Kw. An estimated breakdown of this heat loss is as follows:

	Kw
From Outside Cylindrical Shell	.60
From 6 Heater-Insulation Support Clamps	.25
From Heater-Assembly Ends	<u>.15</u>
	1.00

The relatively low insulation efficiency is attributed to the following factors:

- (a) The 6 clamps which fasten insulation to heater increase the heat transfer area of the assembly to ambient air by about 20%.
- (b) Supporting the insulation off the heater in the manner indicated by Drawing E-25488 permits heat to be transferred directly by conduction from heater through clamps to outside cylindrical shell effectively by-passing insulation (average measured exterior shell temperature equal 230°F for rated operation compared to theoretical 180°F).
- (c) The outside cylindrical shell is fabricated of steel which has a relative high radiation emissivity ($e \approx .60-.70$); heat loss by radiation is estimated to be one-half of gross loss.
- (d) The ends of the heater assembly are uninsulated; the geometry of the design, the requirement that all insulation be removable for heater maintenance, the requirement that the insulation be unimpaired after submergence in water, make this problem difficult.

TYPE OF TEST

The electrical power input necessary to maintain the heater at a prescribed operating temperature for the case of the heater enclosed in the aluminum concentric cylindrical shell insulation assembly and for the case of the heater bare of insulation was measured. The results for heater operating temperatures ranging from 650°F to 850°F are shown in Figure 2. For a heater temperature of 750°F, the installation of the insulation assembly reduced the heat loss from 2 Kw to 1 Kw.

HEATER REDESIGN

The prospect for reducing heat loss by undertaking the redesign of the pressurizer heater is limited because it is difficult to conceive how the basic design concept-namely, a removable clamped clam shell with integral insulation - can be altered compatible with heater maintenance requirements and without consideration of pressurizer changes.

Accepting the basic heater design, the prospect of reducing heat loss is estimated as follows:

	Power Saving, Kw
(1) Replace steel outer insulation shell with aluminum shell	.15
(2) Redesign clamps with objective of reducing loss factors (a) and (b) listed above	<u>.10</u>
	.25

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H.R.T. PRESSURIZER HEATER

Fig. 1

FIGURE 2

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