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NOMOGRAM FOR CALCULATING TAI LIMITS

A nomogram is attached as Figure 1 which may be used to determine TAI limits. The nomogram was developed to meet the need for a rapid and accurate method for calculating these limits. The technical bases for determining individual tube outlet temperature limits is given in HW-65729(1). According to these bases, the TAI limit is to be determined by the following equation:

$$T_L - T_i = \left[\frac{41.45 (P_{FH})^{.709}}{(P_{FH} - P_{RH} - 15)^{1/2}} - T_i \right] \left(\frac{P_{LIT} - P_{RH} - 15}{P_{PAN} - P_{RH} - 15} \right)^{1/2} \quad (1)$$

Where: T_L = Tube outlet temperature limit, °C
 T_i = Tube inlet water temperature, °C
 P_{FH} = Front header pressure, psig
 P_{RH} = Rear header pressure, psig
 P_{LIT} = Panellit low trip pressure, psig
 P_{PAN} = Normal Panellit pressure, psig

All pressures are measured in the control room.

The following nomenclature is used in the nomogram in addition to that given above:

$$x = \frac{41.45 P_{FH}^{.709}}{(P_{FH} - P_{RH} - 15)^{1/2}}$$

$$y = \left(\frac{P_{LIT} - P_{RH} - 15}{P_{PAN} - P_{RH} - 15} \right)^{1/2}$$

$$P_{MRH} = P_{RH} + 15$$

PROCEDURE

The TAI limit is determined in four steps using the nomogram as follows:

1. Align the value of P_{FH} in column 1 with the value of $P_{FH} - P_{MRH}$ in column 3 and read x in column 2.
2. Align the value of $P_{LIT} - P_{MRH}$ in column 4 with the value of $P_{PAN} - P_{MRH}$ in column 7 and read y in column 5.
3. Align the value of y found in step 2 (column 5) with the value of $x - T_i$ in column 8 and read $T_L - T_i$ in column 6.
4. To find T_L , add the inlet temperature to the value of $T - T_i$ found in step 3.

An example is provided as a part of the nomogram. An unclassified version of the nomogram may be obtained from the author upon request.

(1) HW-65729, "Technical Review of TAI Limits", P. A. Carlson, to be issued.

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P. A. Carlson

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Reactor Engineering

Approved for use:

R. E. Trumble

R. E. Trumble, Supervisor
Reactor Engineering

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FIGURE 1

Nomogram for TAI Equation

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M P L E

$H = 450,$
 $T_i = 10^\circ\text{C}$

$P_{MRH} = 400$ AND READ $X = 157$

WITH $P_{PAN} - P_{MRH} = 120$ AND

≈ 0.71 AND READ $T_L - T_i = 104$

$= 114^\circ\text{C}$

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