8. Calculation of Converter Constants.

The converter constants are those constants used in the calculation program which are derived from the data in the converter specification only. They do not contain any data from the operation condition specifications. Calculation of the first converter constants is described below.

The cross-sectional area of the catalyst bed, A_{Cat} m^2, is found from the formula:

$$A_{Cat} = 0.785398 \; (D_B^2 - n \; D_o^2 - n_T \; D_T^2) \qquad (24)^{+)}$$

The numerical factor is 0.25π. Calculation of A_{Cat} is carried out by instruction No. 36 (see the summary in Section 21), but several instructions will be required in the final code for this

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+) Equations marked with an asterisk are those actually used in the calculation program.

calculation. It is seen from the summary that A_{Cat} is stored in locations 72÷73 and from section 22 that A_{Cat} is stored in the floating notation.

The next constant considered is the catalyst volume, V_{Cat} m^3. This is found from:

$$V_{Cat} = L\, A_{Cat} \qquad (25)\ *)$$

The corresponding instruction is No. 37. Note, that L is stored with a scale factor, whereas A_{Cat} and V_{Cat} are stored in the floating notation.

The outer surface area per unit length of the catalyst cooling tubes is called a_1 (m) and found from:

$$a_1 = 3.14159\ n\ D_o \qquad (26)\ *)$$

The total surface area of the cooling tubes is found from:

$$S = a_1\, L \qquad (27)\ *)$$

Next, we consider the free cross-sectional flow area, A_{tubes} (m^2), of the catalyst cooling tubes in the first core tube zone $(0 \leq x \leq L')$:

$$A_{tubes} = \frac{\pi}{4}\, n\, (D_i^2 - D_{Co}^2 - n_k\, D_k^2) \qquad (28)$$

The factor in the parenthesis is used later in another formula. We therefore calculate:

$$a_2 = D_i^2 - D_{Co}^2 - n_k\, D_k^2 \qquad (29)\ *)$$

and then:

$$A_{tubes} = 0.785398\ n\ a_2 \qquad (30)\ *)$$

The equivalent diameter, $D_{e,tubes}$ (m), for the tube cross-section in the first core tube zone is:

$$D_{e,tubes} = \frac{a_2}{D_i + D_{Co} + n_k\, D_k} \qquad (31)\ *)$$

In the second core tube zone $(L' \leq x \leq L)$ we find A'_{tubes} and $D'_{e,tubes}$ from the equations below. Calculation of these two constants is by-passed by means of instruction No. 43, if there

is only one core tube zone.

$$A'_{tubes} = 0.785398\ n\ (D_i^2 - (D'_{Co})^2) \qquad (32)\ +)$$

$$D'_{e,tubes} = D_i - D'_{Co} \qquad (33)\ +)$$

The remaining converter constants and their calculation are discussed in the following sections because a certain knowledge of the operation variables is necessary.