Subject: PTC 6S – 1988, Heat Rate equations (1) and (2) in para. 9.6.4.

Question 1: If the efficiency of a turbine section is increased, does the heat rate decrease?

Answer 1: Yes. An increase in efficiency in a turbine section would contribute to a decrease in heat rate from that section so the $\Delta HR\%$ for that section would be negative.

Question 2: If that is true, then, when the $\Delta \eta_{hp}\%$ in Eq.1 and $\Delta \eta_{ip}\%$ in Eq.2 in para. 9.6.4 are positive, the corresponding $\Delta HR\%$ should be negative. Therefore, should equations (1), (2) in section 9.6.4 be corrected to the following?

\[
\Delta HR_{hp}\% = -\frac{\Delta \eta_{hp}\% (UE_{hp})(Q_{hp})}{3412.142(kW_{tot})} - \frac{\Delta \eta_{hp}\% (UE_{hp})(Q_{rhr})}{HR(kW_{tot})} \quad (1)
\]

\[
\Delta HR_{ip}\% = -\Delta \eta_{ip}\% \left(\frac{UE_{ip}}{UE_{rh}}(L.F.)\right) \left(1 - \frac{UE_{hp}(Q_{hp})}{3412.142(kW_{tot})}\right) \quad (2)
\]

Answer 2: No. The Committee refers the Inquirer to the example shown in Section 9.8 of PTC 6S – 1988 that indicates a decrease in efficiency would calculate an increase in heat rate. The key here is that

\[
\Delta \eta\% = \frac{(\eta_1 - \eta_2)(100)}{\eta_1}
\]

If efficiency goes up, the term becomes negative, and the change in heat rate would become negative.

Question 3: For the definition of subscripts 1 and 2 in section 9.6.4, the reader is referred to Section 2. What is listed in Section 2.3, SUBSCRIPTS, is not related to equations.

\[
\Delta \eta = \eta_1 - \eta_2 \\
\Delta \eta\% = \frac{\Delta \eta(100)}{\eta_1} \\
\Delta HR\% = \frac{(HR_2 - HR_1)100}{HR_1}
\]

Please clarify.

Answer 3: It is true that the subscript numbers in the equations do not refer to different locations in the turbine blade path. In this section, the subscript 1 refers to the initial performance or reference test, and any other subscripts refer to subsequent tests.

In addition to this inconsistency, an error exists in the definition of $\Delta HR\%$. The correct definition is:

\[
\Delta HR\% = \frac{(HR_2 - HR_1)100}{HR_1}
\]