Pitot-Statics

OBS/MEAS
TRUE
CHARTS
EQN OF STATE

$h_{pi} \leftrightarrow P_s \leftrightarrow q_{ci} \leftrightarrow V_i \leftrightarrow M_i \leftrightarrow h_{pi}$ *Indicated*

$h_{pc} \leftrightarrow P_a \leftrightarrow q_c \leftrightarrow V_c \leftrightarrow M_T \leftrightarrow h_{pc}$ *Calibrated*

$$q \equiv \frac{1}{2}\rho_a V_T^2 \equiv \frac{1}{2}\rho_{SSL} V_e^2 \equiv \frac{\gamma}{2} P_a M_T^2$$

$$q_c = q\left(1 + \frac{M^2}{4} + \frac{M^4}{40} + \ldots\right)$$

$P_{SSL} = 2116.217\ psf$

$\rho_{SSL} = 0.0023769\ \frac{slug}{ft^3}$

$T_{SSL} = 288.15\ K$

$a_{SSL} = 0.0019812\ \frac{K}{ft}$

$g_0 = 32.174049\ \frac{ft}{sec^2}$

$R = 3089.8\ \frac{ft \cdot lb}{slug \cdot K}$

$\gamma = 1.4$

$1\ nm = 6076.1155\ ft$

$1\ kt = 1.6878099\ \frac{ft}{sec}$

$k = 0.95 @ TPS$

$\ldots\left(\frac{\gamma - 1}{2}\right) = 0.2$

h_{po}

$h_{pi} = h_{po} + \Delta h_{pic}$

STD CHARTS

h_{pi}

$h_{pc} = h_{pi} + \Delta h_{pos}$

STD CHARTS

h_{pc}

P_S

$\Delta P = P_S - P_a$

P_a

$\delta = \frac{P_a}{P_{SSL}}$

$q_{ci} = P_T - P_S$

$\Delta P = q_c - q_{ci}$

$q_c = P_T - P_a$

q_{ci}

q_c

P_T

$V_i = \left\{\frac{2\gamma}{\gamma - 1}\frac{P_{SSL}}{\rho_{SSL}}\left[\left(\frac{P_T - P_S}{P_{SSL}} + 1\right)^{\frac{\gamma-1}{\gamma}} - 1\right]\right\}^{\frac{1}{2}}$

Impact Pressure CHARTS

$V_c = \left\{\frac{2\gamma}{\gamma - 1}\frac{P_{SSL}}{\rho_{SSL}}\left[\left(\frac{P_T - P_a}{P_{SSL}} + 1\right)^{\frac{\gamma-1}{\gamma}} - 1\right]\right\}^{\frac{1}{2}}$

Impact Pressure CHARTS

CHARTS

$V_e = \left\{\frac{2\gamma}{\gamma - 1}\frac{P_a}{\rho_{SSL}}\left[\left(\frac{P_T - P_a}{P_a} + 1\right)^{\frac{\gamma-1}{\gamma}} - 1\right]\right\}^{\frac{1}{2}}$

$V_T = \left\{\frac{2\gamma}{\gamma - 1}\frac{P_a}{\rho_a}\left[\left(\frac{P_T - P_a}{P_a} + 1\right)^{\frac{\gamma-1}{\gamma}} - 1\right]\right\}^{\frac{1}{2}}$

CHARTS

$M_i = \left\{\frac{2}{\gamma - 1}\left[\left(\frac{P_T - P_S}{P_S} + 1\right)^{\frac{\gamma-1}{\gamma}} - 1\right]\right\}^{\frac{1}{2}}$

$M_T = \left\{\frac{2}{\gamma - 1}\left[\left(\frac{P_T - P_a}{P_a} + 1\right)^{\frac{\gamma-1}{\gamma}} - 1\right]\right\}^{\frac{1}{2}}$

$T_{TOT} = T_a\left(1 + \left(\frac{\gamma - 1}{2}\right)M_T^2\right)$

$OAT_i = OAT_o + \Delta OAT_{ic}$

OAT_i

$T_a = \frac{OAT_i}{1 + \frac{\gamma - 1}{2} M_T^2 k}$

$\theta = \frac{T_a}{T_{SSL}}$

T_a

$a = 661.48\sqrt{\theta}\ \ kts$

$a = \sqrt{\gamma R T_a}$

a

V_o

$V_i = V_o + \Delta V_{ic}$

MACH CHARTS

V_i

$V_c = V_i + \Delta V_{pos}$

MACH CHARTS

V_c

$V_e = V_c + \Delta V_c$

V_e

$V_T = \frac{V_e}{\sqrt{\sigma}}$

V_T

$V_T = M_T a$

M_o

$M_i = M_o + \Delta M_{ic}$

M_i

$M_T = M_i + \Delta M_{pos}$

M_T

Calibrated Values

$\sigma = \frac{\delta}{\theta}$

$\sigma = \frac{\rho_a}{\rho_{SSL}}$