Definitions of the Symbols Used in the Above Equations

A_c Cylinder area.
A_e Effective area of piston.
A_k Piston area.
A_0 Effective area of the piston at atmospheric pressure and temperature t_s.
C Circumference of the piston at the surface of the pressure fluid.
H_a Pressure difference in the atmosphere between the reference level of the piston gage and the reference level of the system to be measured.
H_{fp} Pressure head of the column of pressure transmitting fluid between the reference level of the piston gage and the reference level of the system to be measured.
M_{fa} Mass of the pressure fluid at atmospheric pressure contributing to the load on the piston.
M_m Mass of the loading weights, including the piston assembly.
P Absolute (total) pressure.
P_a Atmospheric pressure at the reference level of the piston gage.
V_{fa} Volume of the submerged part of the piston above the cylinder.
V_{fp} Volume of the part of the piston below the cylinder.
Y Young's modulus.
a Fractional change in effective area with unit change in temperature.
b Fractional change in effective area with unit change in pressure.
d Fractional change in area with unit change in jacket pressure.
g_L Local acceleration due to gravity.
h_a Height of the air column measured from the reference level of the piston gage to the reference level of the system. Measurements up from the piston gage reference level are positive.
h_{fp} Height of the column of pressure fluid measured from the reference level of the piston gage to the reference level of the system. Measurements up from the piston gage reference level are positive.
Δh Height of the reference level of the piston gage with respect to the bottom of the piston. Measurements up from the bottom of the piston are positive.
k Proportionality factor relating force, mass and gravity.
p_g Gage pressure.
p_j Jacket pressure.
p_p Pressure measured by piston gage at the reference level of the piston gage.
P_z Jacket pressure required to reduce the piston-cylinder clearance to zero.
t Temperature of the piston gage.
t_m Temperature at which piston and cylinder are measured.
t_s Reference temperature (usually the nominal room temperature).
y_{fa} Length of the submerged part of the piston above the cylinder.
y_{fp} Length of the part of the piston below the cylinder.
α_c Temperature coefficient of linear expansion of the cylinder.
α_k Temperature coefficient of linear expansion of the piston.
γ Surface tension of the pressure fluid.
μ Poisson's ratio for the piston.
ρ_a Mean density of the air displaced by the load.
ρ_{fa} Density of the pressure fluid at atmospheric pressure.
ρ_{fp} Density of the pressure fluid at pressure P.
ρ_m Density of the weights.

10. Appendix C. Examples of Calculations

Fluid—Aviation instrument oil
Piston gage No. 1357, Washington, D.C.

Machine Calculation:

a. Weights: Piston, 1, 2, 3, 4, 5, 6, 7, 8
Accumulative total: 1998.0 psi (from table 1, column (4))
Temperature: 26 °C
Correction factor: 0.99967 (from table 3)
$p_p = 1998.0 \times 0.99967 = 1997.3$ psi

b. Weight No. $M_m \times 7.6726$ (from table 1, column (3))

Piston	9.701	
1	19.981	99.631 accumulative total
2	19.983	from column (4)
3	49.966	
6	499.56	
7	499.63	
8	499.54	
	1598.361 psi	

Temperature: 26 °C
Correction factor: 0.99975 (from table 3)
$p_p = 1598.36 \times 0.99975 = 1598.0$ psi

Slide Rule Calculation:

a. Weights: Piston, 1, 2, 3, 4, 5, 6, 7, 8
Accumulative total: 1998.0 psi (from table 1, column (4))
Temperature: 26 °C
Correction factor: −0.00033 (from table 4)
Correction $= -0.00033 \times 1998.0 = -0.7$ psi
$p_p = 1998.0 - 0.7 = 1997.3$ psi

Correction Table Calculation:

a. Weights: Piston, 1, 2, 3, 4, 5, 6, 7, 8
Accumulative total: 1998.0 (from table 1, column (4))
Temperature: 26 °C
Correction = −0.7 psi (from table 5)
$p_p = 1998.0 - 0.7 = 1997.3$ psi

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