Attachment 1

Formulas for Calculation of Test Time and Acceptable Leakage based on System Size

Reference the procedure's Test Planning Requirements article (7.1)

Caution: This attachment is for isostatic (constant temperature) testing

Determining Test Time

Volume = Test System Volume

A = Area

L = Length

P1 = Initial Pressure

P2 = Final Pressure

t = Test Time

Leak Rate: $1x10^{-3}$ atm ml/sec

Conversion Units:

1 atm = 14.696 psi

1 in^3 = 16.387 ml

1 min = 60 second

Volume = Area x Length

Example

Assume Area = 2.0 in^2

Assume Length is 10 inch

V = A* L = 2 * 10 = 20 in^3

EQ.1 Leak Rate = [Test System Volume * (P2-P1)]/t] -- (pressure*volume/time)

Set P1 = 1 psig (this pressure is the high level test pressure)

Set P2 = 0.5 psig (this pressure is selected to give a reasonable time, several iterations may be required)

Delta Pressure = 0.5 psig (1-.5 psig)

Rearrange **EQ 1** to solve for t

t = [V* (.5)]/Leak Rate

Leak Rate = 0.53 psi in^3 /min (conversion from $1x10^{-3}$ atm ml/sec x 14.696 psi/atm x 1 in^3/16.387 ml x 60 sec/1 min)

t = [20 in^3 * (0.5 psi)]/ 0.53 psi in^3 /min]

t = 5.3 min

For fidelity use 2 times calculated time: 10.6 minutes.

If pressure does not decrease to less than 0.5 psi in 10.6 minutes, then the test is acceptable

Calculating Leak Rate

The pressure drop can be converted to a leak rate by multiplying the pressure drop with the inner volume of the part and by then dividing the result by the measurement time needed for the pressure drop.

The leak rate is calculated as the volume of the Test System, the pressure change, and the duration required for the change.

Example: Assume values as follows:

Test System: 200 cc

Pressure Drop: 30 Pa

Test Time: 5 s

Leak rate = 200cc x 30 Pa/5 s = 0.012mbar l/s = 1.2E-1mbar l/s