# Pressure and Density Altitude from QNH, Temperature and Humidity

Pressure altitude, station pressure, air density and density altitude at an airfield from its elevation, altimeter setting (QNH), temperature and humidity.

**Method:** ISA pressure and density altitude with humid-air density

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Field elevation | 1,650.0 | m |
| Altimeter setting (sea-level pressure) | 1,010.0 | hPa |
| Outside air temperature | 35.000 | °C |
| Relative humidity (0 for dry air) | 30.000 | % |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Pressure altitude | 1,676.1 | m |
| Station pressure | 827.45 | hPa |
| Air density | 0.92823 | kg/m³ |
| Density altitude | 2,797.5 | m |
| Density altitude by the rule of thumb (36.6 m per °C, dry) | 2,806.8 | m |
| Density ratio ρ/ρ₀ | 0.75774 | |

**Notes for this case**

- Density altitude is the ISA altitude with the same air density; aircraft and engine performance follow it. Humid air is lighter than dry air, adding typically 50–150 m on hot humid days.

## Formula and method

$$p = QNH\left(1 - \frac{0.0065\,h_{field}}{T_0}\right)^{5.2559}, \quad h_p = \frac{T_0}{0.0065}\left[1 - \left(\frac{p}{p_0}\right)^{1/5.2559}\right]$$

$$\rho = \frac{p - e}{R_d T} + \frac{e}{R_v T}, \quad h_\rho = \frac{T_0}{0.0065}\left[1 - \left(\frac{\rho}{\rho_0}\right)^{1/4.2559}\right]$$

### Variables

| | | |
|---|---|---|
| $h_{field}$ | Field elevation | m |
| $QNH$ | Altimeter setting (sea-level pressure) | Pa |
| $T$ | Outside air temperature | K |
| $RH$ | Relative humidity (0 for dry air) | - |
| $h_p$ | Pressure altitude | m |
| $p$ | Station pressure | Pa |
| $\rho$ | Air density | kg/m³ |
| $h_\rho$ | Density altitude | m |
| $h_{\rho,rule}$ | Density altitude by the rule of thumb (36.6 m per °C, dry) | m |

| | | |
|---|---|---|
| $\sigma$ | Density ratio $\rho/\rho_0$ | - |

## Method and standards

ISA altitude relations.

## Assumptions and limits

- ISA troposphere relations; altitudes below about 11 km.

## References

ISA pressure and density altitude with humid-air density

# Report details

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|---|---|
| Report reference | FCC-64C5-DT72 (the same inputs always give the same reference) |
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| Release checks | 3 reference cases of this calculator, computed independently, are checked on every release |

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

### This calculator online

https://calc.firecad.com/mechanical/aerospace/density-altitude

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.