# TECHNICAL ANNEXURE
## Understanding Radial, Axial & Newton Forces in Torque Hinge Varieties

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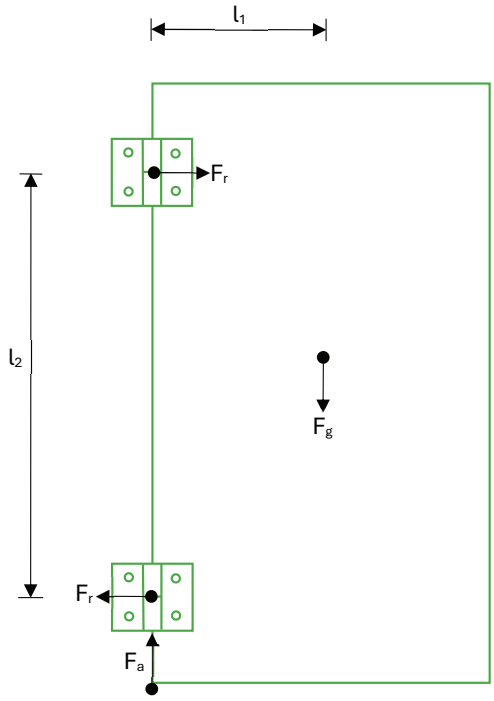
| **Sample Name:** | Torque Hinge Product SKU's |
| **Part Number:** | TH###-##-## |
| **Report Job No#:** | LOK010626TA - MS |
| **Report Date:** | 01/06/2026 |
| **Annexure Details:** | Radial & Acial Forces on Hinges<br>Calculating Newton Force on Hinges |
| **Approved by:** | Technical Product Manager<br>Engineering Manager |

## Radial and Axial Forces on Hinges (Vertical alignment)




$F_g$ = weight of door (N)

m = mass of door (kg)

g = acceleration due to gravity = 9.8 ($ms^{-2}$)

$l_1$ = horizontal distance from hinge pin to door centre of gravity (m)

$l_2$ = vertical distance between hinge centres (m)

$F_r$ = radial force acting on hinge (N)

$F_a$ = axial force on hinge (N)

n = number of hinges

$F_g = m.g$

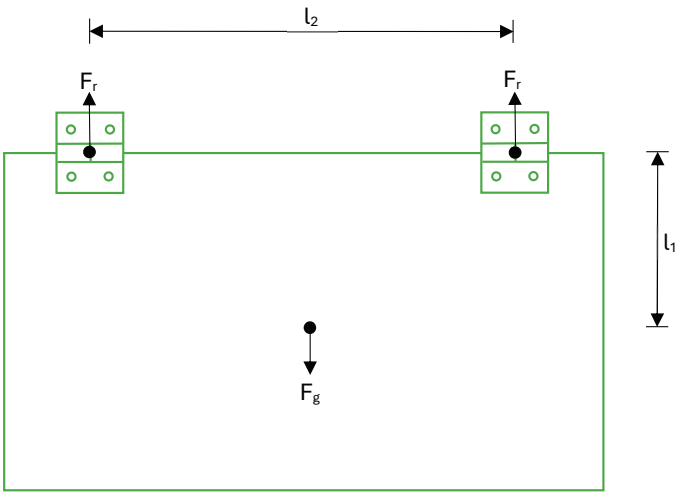
$F_r = F_g.l_1 / l_2$

$F_a = F_g$ (for poorly fitted/toleranced hinges) See note 1.

$F_a = F_g/n$ (for tightly toleranced hinges) See note 1.

**Note 1:** Due to tolerances between hinge plates and pins, weight would typically be opposed by only one hinge. In the case where multiple hinges are closely toleranced, the weight of the door would be proportioned between the hinges.

## Radial and Axial Forces on Hinges (Horizontal alignment – closed position)




$F_g$ = weight of door (N)

m = mass of door (kg)

g = acceleration due to gravity = 9.8 ($ms^{-2}$)

$l_1$ = horizontal distance from hinge pin to door centre of gravity (m)

$l_2$ = vertical distance between hinge centres (m)

$F_r$ = radial force acting on hinge (N)

$F_a$ = axial force on hinge (N)

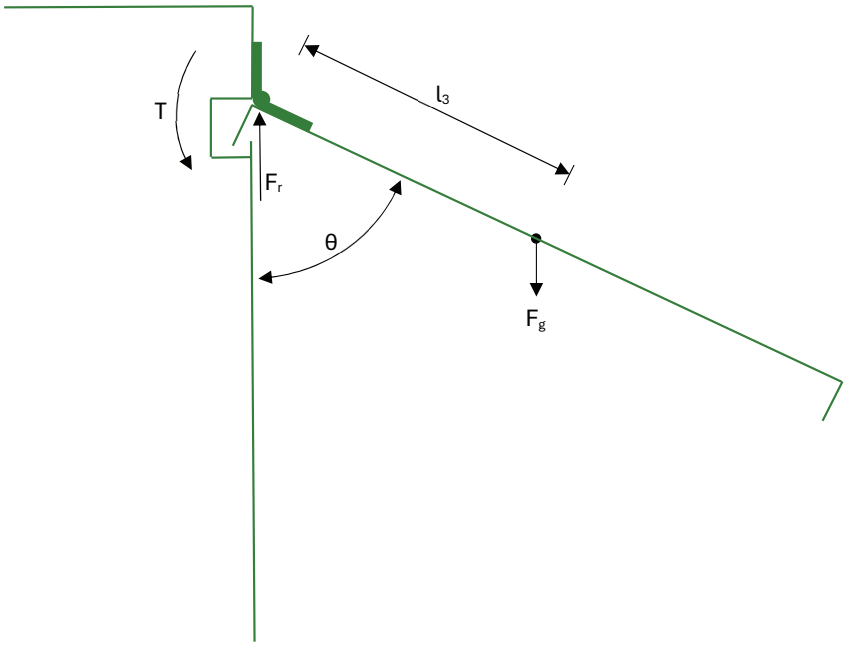
n = number of hinges

$F_g = m.g$

$F_r = F_g / n$

$F_a = 0.N$

**Torque, Radial and Axial Forces on Hinges (Horizontal alignment – opened position)**




$F_g$ = weight of door (N)

m = mass of door (kg)

g = acceleration due to gravity = 9.8 ($ms^{-2}$)

$l_3$ = distance from hinge pin to door centre of gravity (m)

θ = opening angle (deg)

$F_r$ = radial force acting on hinge (N)

$F_a$ = axial force on hinge (N)

T = Torque on hinge (Nm)

n = number of hinges

$F_g = m.g$

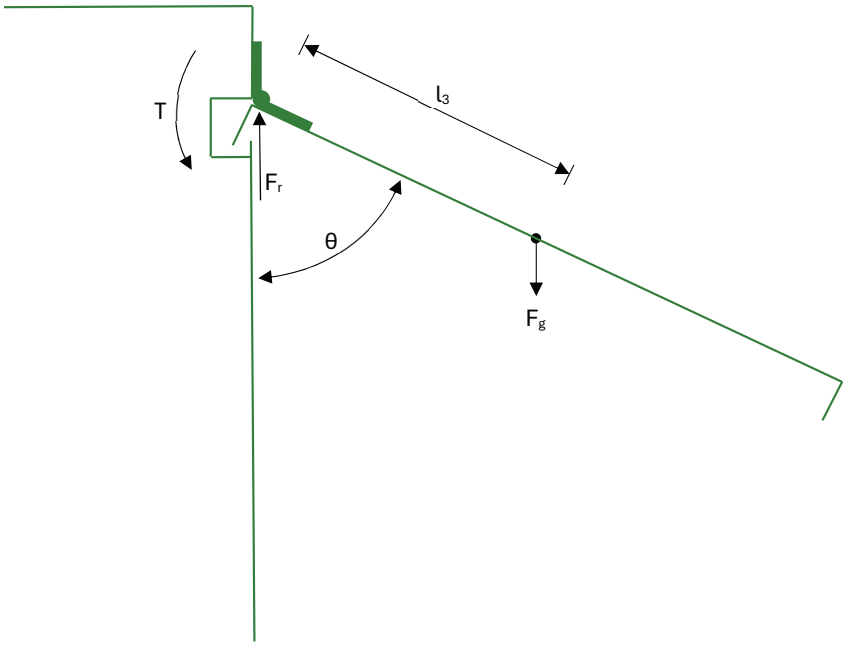
$F_r = F_g / n$

$F_a = 0.N$

$T = (F_g . l_3 . \sin \theta)/n$ See note 2.

**Note 2:** For a torque hinge, this is the minimum value of opposing torque required by the hinge to hold the door open at the angle θ.

**Example** – Calculate the axial force, radial force and minimum Torque value required for each hinge to maintain the door in the opened position.




**Assumptions:**

m = mass of door (kg) = **20 kg**

$l_3$ = distance from hinge pin to door centre of gravity (m) = **0.5 m**

θ = opening angle (deg) = **90°**

n = number of hinges = **2**

**Calculations:**

$F_g = m.g = 20 \times 9.8 =$ **196 N**

$F_r = F_g / n = 196/2 =$ **98 N**

$F_a =$ **0 N**

$T = (F_g . l_3 . \sin \theta)/n = (196 \times 0.5 \times \sin(90°))/2 =$ **49 Nm**

**Answers:**

Each hinge must have a minimum torque rating of 49 Nm and a minimum radial force rating of 98 N. There is no requirement for an axial force rating in this scenario.

***Quick Calculation Method – Not accurate, but reasonably close.***

*As a rule of thumb, for a door that is hinged at the top and opens upwards, the minimum torque rating of each hinge can be calculated by:*

*Multiplying the mass of the door (in kg) by the height of the door (in m).*

*Multiply this answer by 5.*

*Then divide the new answer by the number of hinges (typically 2).*

*In the previous example, the answer using this method is **50 Nm**.*



*** END OF REPORT ***

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