Brake Hydraulic System: Pedal Force to Deceleration

Line pressure, brake torque, braking force and deceleration from pedal force, pedal and booster ratios, master cylinder and caliper sizes and pad friction.

Method: Hydraulic brake force chain

Input parameters

Unit system: SI

Parameter	Value	Unit
Pedal force	300.00	N
Pedal ratio	4.0000	
Booster ratio	5.0000	
Master cylinder bore	23.800	mm
Front caliper piston diameter	57.000	mm
Front pistons per side	1.0000	
Rear caliper piston diameter	38.000	mm
Pad friction coefficient	0.38000	
Front effective disc radius	125.00	mm
Rear effective disc radius	115.00	mm
Tyre rolling radius	310.00	mm
Vehicle mass	1,500.0	kg

Calculated results

Parameter	Value	Unit
Line pressure	134.87	bar
Front brake torque per wheel	3,269.4	N·m
Rear brake torque per wheel	1,336.8	N·m
Total braking force	29.718	kN
Deceleration	2.0202	
Front share of braking	70.978	%

Notes for this case

• p = F_p·i_p·i_b/A_mc; clamp force = p × piston area; each caliper has two pad faces, so T = 2μpA_pr_eff (floating caliper, rear single piston). Braking force = 2(T_f + T_r)/r_t for four wheels; deceleration is capped by tyre grip and the ideal front/rear split (see brake distribution). Pressure-limiting valves and ABS are not modelled.

Formula and method

$$p = \frac{F_p i_p i_b}{A_{mc}}, \quad T = 2\mu_p p A_{pist} r_{eff}, \quad \frac{a}{g} = \frac{2(T_f + T_r)}{r_t m g}$$

Variables

F_p	Pedal force	N
i_p	Pedal ratio	-
i_b	Booster ratio	-
d_{mc}	Master cylinder bore	m

d_f	Front caliper piston diameter	m
n_f	Front pistons per side	-
d_r	Rear caliper piston diameter	m
μ_p	Pad friction coefficient	-
r_f	Front effective disc radius	m
r_r	Rear effective disc radius	m
r_t	Tyre rolling radius	m
m	Vehicle mass	kg
p	Line pressure	Pa
T_f	Front brake torque per wheel	N·m
T_r	Rear brake torque per wheel	N·m
F_b	Total braking force	N
a/g	Deceleration	-
$F_{b,f}/F_b$	Front share of braking	-

Method and standards

Brake chain.

Assumptions and limits

- Rigid hydraulics; booster linear; four disc brakes.

References

Hydraulic brake force chain

Report details

Report reference	FCC-8KXW-8D96 (the same inputs always give the same reference)
Generated	23 November 2026, 18:00 UTC
Calculator	Brake Hydraulic System: Pedal Force to Deceleration
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
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

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Reopens the calculator with the inputs of this report.