Reciprocating Compressor Gas Rod Load

Gas rod loads in compression and tension of a double-acting reciprocating compressor cylinder from bore, piston rod diameter and suction and discharge pressures.

Method: Gas rod load of a double-acting cylinder

Input parameters

Unit system: SI

Parameter	Value	Unit
Cylinder bore	0.30000	m
Piston rod diameter	0.070000	m
Suction pressure (absolute)	1.0000	MPa
Discharge pressure (absolute)	3.0000	MPa
Pressure acting on the rod end outside the packing (absolute)	101.33	kPa

Calculated results

Parameter	Value	Unit
Head-end piston area	706.86	cm²
Crank-end piston area	668.37	cm²
Rod load in compression	144.83	kN
Rod load in tension	130.22	kN
Rod load reverses (1 yes, 0 no)	1.0000	

Notes for this case

• Gas loads at the dead centres: compression = p_dA_h − p_sA_c − p_aA_rod; tension = p_dA_c + p_aA_rod − p_sA_h. Makers limit both; the load must also reverse each revolution to lubricate the crosshead pin. Inertia loads are added in a full rod-load analysis.

Formula and method

$$F_c = p_d A_h - p_s A_c - p_a A_r, \quad F_t = p_d A_c + p_a A_r - p_s A_h$$

Variables

D	Cylinder bore	m
d	Piston rod diameter	m
p_s	Suction pressure (absolute)	Pa
p_d	Discharge pressure (absolute)	Pa
p_a	Pressure acting on the rod end outside the packing (absolute)	Pa
A_h	Head-end piston area	m²
A_c	Crank-end piston area	m²
F_c	Rod load in compression	N
F_t	Rod load in tension	N
$\mathrm{reversal}$	Rod load reverses (1 yes, 0 no)	-

Method and standards

Rod load.

Assumptions and limits

- Static gas loads at dead centres; no valve losses.

References

Gas rod load of a double-acting cylinder

Report details

Report reference	FCC-N0WS-XC1H (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/compressors/reciprocating-compressor-rod-load

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Reopens the calculator with the inputs of this report.