Shaft Alignment: Thermal Growth and Cold Offset

Vertical thermal growth of a driver and driven machine from their foot-to-shaft heights and temperature rises, and the cold offset to set at alignment.

Method: Linear thermal expansion of machine supports

Input parameters

Unit system: SI

Parameter	Value	Unit
Driver: foot to shaft centreline height	355.00	mm
Driver casing expansion coefficient	11.000	µm/(m·K)
Driver casing mean temperature rise	25.000	K
Driven: foot to shaft centreline height	300.00	mm
Driven casing expansion coefficient	11.000	µm/(m·K)
Driven casing mean temperature rise	120.00	K

Calculated results

Parameter	Value	Unit
Driver growth	0.097625	mm
Driven growth	0.39600	mm
Set the driver this much higher when cold (negative = lower)	0.29837	mm

Notes for this case

• Each machine's shaft rises by α h ΔT as its casing warms between the feet and the centreline. If the driven machine (a hot pump or turbine) grows more than the motor, set the motor higher by the difference when cold, so the shafts come into line at running temperature. Use the mean temperature rise of the supports, not of the process fluid; pedestal heating, piping forces and soft feet also move machines, so confirm with hot-alignment checks where it matters.

Formula and method

$$\delta = \alpha h \Delta T, \quad \text{cold offset} = \delta_2 - \delta_1$$

Variables

h_1	Driver: foot to shaft centreline height	m
α_1	Driver casing expansion coefficient	1/K
ΔT_1	Driver casing mean temperature rise	K
h_2	Driven: foot to shaft centreline height	m
α_2	Driven casing expansion coefficient	1/K
ΔT_2	Driven casing mean temperature rise	K
δ_1	Driver growth	m
δ_2	Driven growth	m
$\delta_2 - \delta_1$	Set the driver this much higher when cold (negative = lower)	m

Method and standards

Thermal growth.

Assumptions and limits

- Uniform casing temperature rise; vertical growth only.

References

Linear thermal expansion of machine supports

Report details

Report reference	FCC-F67H-YTEA (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/instrumentation/vibration-noise/shaft-alignment-thermal-growth

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.