True Power Factor with Harmonic Distortion

True power factor of a non-linear load as displacement factor times distortion factor from current THD, with apparent power and rms current.

Method: PF = cos φ₁ / √(1 + THD_I²) (IEEE 1459 definitions)

Input parameters

Unit system: SI

Parameter	Value	Unit
Displacement power factor (fundamental)	95.000	%
Current total harmonic distortion	40.000	%
Active power	100.00	kW
Line voltage	415.00	V

Calculated results

Parameter	Value	Unit
Distortion factor	0.92848	
True power factor	0.88205	
Apparent power	113.37	kVA
RMS line current	157.72	A

Notes for this case

• Voltage assumed sinusoidal. Capacitors correct only displacement power factor; filters or active front ends are needed to improve the distortion factor.

Formula and method

$$DF = \frac{1}{\sqrt{1 + THD_I^2}}, \quad PF = \cos\phi_1 \cdot DF, \quad S = \frac{P}{PF}$$

Variables

$\cos\phi_1$	Displacement power factor (fundamental)	-
THD_I	Current total harmonic distortion	-
P	Active power	W
V	Line voltage	V
DF	Distortion factor	-
PF	True power factor	-
S	Apparent power	VA
I_{rms}	RMS line current	A

Method and standards

IEEE 1459 definitions.

Assumptions and limits

- Sinusoidal voltage.

References

• PF = cos φ₁ / √(1 + THD_I²) (IEEE 1459 definitions)

Report details

Report reference	FCC-SXET-TR8W (the same inputs always give the same reference)
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Release checks	2 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/electrical/power-quality/true-power-factor-harmonics

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.