

Anexo Técnico 1

Âmbito do Credenciamento

Metrologia Industrial – Elétrica e Pressão

Referência: MI002

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Nº.	Grandeza/Instrumento Medido	Gama de medição	Melhor Incerteza	Procedimento
Elétrica				
1	Tensão Contínua	$0 \leq U < 0.3 \text{ V}$	$0.013 \% \times U + 0.000010 \text{ V}$	PT 04.2 – Calibração de Multímetros
		$0.3 \leq U < 3 \text{ V}$	$0.010 \% \times U + 0.000015 \text{ V}$	
		$3 \leq U < 33 \text{ V}$	$0.010 \% \times U + 0.000150 \text{ V}$	
		$33 \leq U < 330 \text{ V}$	$0.012 \% \times U + 0.001500 \text{ V}$	
		$330 \leq U \leq 1020 \text{ V}$	$0.012 \% \times U + 0.005500 \text{ V}$	
1.1	Tensão Alternada	$0 \leq U < 0.03 \text{ V } 45 \leq F < 65 \text{ Hz}$	$0.33 \% \times U + 0.000060 \text{ V}$	
		$0 \leq U < 0.03 \text{ V } 65 \leq F < 1000 \text{ Hz}$	$0.34 \% \times U + 0.000060 \text{ V}$	
		$0.03 \leq U < 0.30 \text{ V } 45 \leq F < 65 \text{ Hz}$	$0.15 \% \times U + 0.000060 \text{ V}$	
		$0.03 \leq U < 0.30 \text{ V } 65 \leq F < 1000 \text{ Hz}$	$0.16 \% \times U + 0.000060 \text{ V}$	
		$0.3 \leq U < 3.3 \text{ V } 45 \leq F < 65 \text{ Hz}$	$0.10 \% \times U + 0.000180 \text{ V}$	
		$0.3 \leq U < 3.3 \text{ V } 65 \leq F < 1000 \text{ Hz}$	$0.11 \% \times U + 0.000180 \text{ V}$	
		$3.3 \leq U < 33 \text{ V } 45 \leq F < 65 \text{ Hz}$	$0.10 \% \times U + 0.001800 \text{ V}$	
		$3.3 \leq U < 33 \text{ V } 65 \leq F < 1000 \text{ Hz}$	$0.12 \% \times U + 0.001800 \text{ V}$	
	Tensão Alternada	$33 \leq U < 330 \text{ V } 45 \leq F < 65 \text{ Hz}$	$0.14 \% \times U + 0.018000 \text{ V}$	

		$33 \leq U < 330 \text{ V } 65 \leq F < 1000 \text{ Hz}$	$0.15 \% \times U + 0.018000 \text{ V}$	PT 04.2 – Calibração de Multímetros
		$330 \leq U < 1020 \text{ V } 45 \leq F < 65 \text{ Hz}$	$0.14 \% \times U + 0.180000 \text{ V}$	
		$330 \leq U < 1020 \text{ V } 65 \leq F < 1000 \text{ Hz}$	$0.15 \% \times U + 0.180000 \text{ V}$	
1.2	Corrente Contínua	$0 \leq I < 330 \text{ uA}$	$0.075 \% \times I + 0.0000001 \text{ A}$	PT 06.0 – Calibração de Pinças Amperimétricas
		$0.330 \leq I < 3.3 \text{ mA}$	$0.065 \% \times I + 0.00000025 \text{ A}$	
		$0.0033 \leq I < 0.033 \text{ A}$	$0.05 \% \times I + 0.00000125 \text{ A}$	
		$0.033 \leq I < 0.330 \text{ A}$	$0.05 \% \times I + 0.0000165 \text{ A}$	
		$0.330 \leq I < 1.1 \text{ A}$	$0.15 \% \times I + 0.000220 \text{ A}$	
		$1.1 \leq I < 3 \text{ A}$	$0.19 \% \times I + 0.000220 \text{ A}$	
		$3 \leq I < 11 \text{ A}$	$0.25 \% \times I + 0.0025 \text{ A}$	
		$11 \leq I < 20.5 \text{ A}$	$0.5 \% \times I + 0.00375 \text{ A}$	
1.3	Corrente Alternada	$29 \leq I < 330 \text{ uA } 45 \leq F < 65 \text{ Hz}$	$0.25 \% \times I + 0.00000075 \text{ A}$	
		$29 \leq I < 330 \text{ uA } 65 \leq F < 1000 \text{ Hz}$	$0.26 \% \times I + 0.00000075 \text{ A}$	
		$0.330 \leq I < 3.3 \text{ mA } 45 \leq F < 65 \text{ Hz}$	$0.22 \% \times I + 0.0000009 \text{ A}$	
		$0.330 \leq I < 3.3 \text{ mA } 65 \leq F < 1000 \text{ Hz}$	$0.23 \% \times I + 0.0000009 \text{ A}$	
		$0.0033 \leq I < 0.033 \text{ A } 45 \leq F < 65 \text{ Hz}$	$0.10 \% \times I + 0.000012 \text{ A}$	
		$0.0033 \leq I < 0.033 \text{ A } 45 \leq F < 65 \text{ Hz}$	$0.10 \% \times I + 0.000012 \text{ A}$	
		$0.0033 \leq I < 0.033 \text{ A } 65 \leq F < 1000 \text{ Hz}$	$0.19 \% \times I + 0.000012 \text{ A}$	
		$0.033 \leq I < 0.33 \text{ A } 45 \leq F < 65 \text{ Hz}$	$0.10 \% \times I + 0.00012 \text{ A}$	
		$0.033 \leq I < 0.33 \text{ A } 65 \leq F < 1000 \text{ Hz}$	$0.19 \% \times I + 0.00012 \text{ A}$	
		$0.33 \leq I < 1.1 \text{ A } 45 \leq F < 65 \text{ Hz}$	$0.10 \% \times I + 0.0012 \text{ A}$	
		$0.33 \leq I < 1.1 \text{ A } 65 \leq F < 1000 \text{ Hz}$	$0.24 \% \times I + 0.0012 \text{ A}$	
		$1.1 \leq I < 3 \text{ A } 45 \leq F < 65 \text{ Hz}$	$0.09 \% \times I + 0.0015 \text{ A}$	
		$1.1 \leq I < 3 \text{ A } 65 \leq F < 1000 \text{ Hz}$	$0.24 \% \times I + 0.0015 \text{ A}$	
		$3 \leq I < 11 \text{ A } 45 \leq F < 65 \text{ Hz}$	$0.25 \% \times I + 0.006 \text{ A}$	
		$3 \leq I < 11 \text{ A } 65 \leq F < 1000 \text{ Hz}$	$0.40 \% \times I + 0.006 \text{ A}$	
		$11 \leq I < 20.5 \text{ A } 45 \leq F < 65 \text{ Hz}$	$0.50 \% \times I + 0.015 \text{ A}$	
		$11 \leq I < 20.5 \text{ A } 65 \leq F < 1000 \text{ Hz}$	$0.52 \% \times I + 0.015 \text{ A}$	
1.4	Corrente Alternada Com recurso a bobine	$20.5 \leq I < 150 \text{ A } 45 \leq F < 65 \text{ Hz}$	$0.28 \% \times I + 0.025 \text{ A}$	
		$20.5 \leq I < 150 \text{ A } 65 \leq F < 440 \text{ Hz}$	$0.79 \% \times I + 0.027 \text{ A}$	
		$150 \leq I < 1025 \text{ A } 45 \leq F < 65 \text{ Hz}$	$0.28 \% \times I + 0.09 \text{ A}$	
		$20.5 \leq I < 150 \text{ A } 65 \leq F < 440 \text{ Hz}$	$0.79 \% \times I + 0.1 \text{ A}$	
1.5		$10.89 \text{ uW} \leq P < 3.36 \text{ W}$	$0.15\% \times P$	

	Potência corrente contínua	$3.36 \text{ W} \leq \textbf{P} < 306 \text{ W}$	$0.11\% \times \textbf{P}$		
		$306 \text{ W} \leq \textbf{P} < 3.06 \text{ KW}$	$0.22 \% \times \textbf{P}$		
		$3.06 \text{ kW} \leq \textbf{P} < 20.91 \text{ KW}$	$0.54 \% \times \textbf{P}$		
1.6	Potência corrente alternada	$10.89 \text{ }\mu\text{W} \leq \textbf{P} < 2.97 \text{ mW}$ $45 \leq \textbf{F} < 65 \text{ Hz}$	$0.58 \% \times \textbf{P}$		
		$2.97 \text{ mW} \leq \textbf{P} < 9.18 \text{ W}$ $45 \leq \textbf{F} < 65 \text{ Hz}$	$0.51 \% \times \textbf{P}$		
		$9.18 \text{ W} \leq \textbf{P} < 33.66 \text{ W}$ $45 \leq \textbf{F} < 65 \text{ Hz}$	$0.36 \% \times \textbf{P}$		
		$33.66 \text{ W} \leq \textbf{P} < 91.80 \text{ W}$ $45 \leq \textbf{F} < 65 \text{ Hz}$	$0.51 \% \times \textbf{P}$		
		$91.80 \text{ W} \leq \textbf{P} < 336.60 \text{ W}$ $45 \leq \textbf{F} < 65 \text{ Hz}$	$0.36 \% \times \textbf{P}$		
		$336.60 \text{ W} \leq \textbf{P} < 918 \text{ W}$ $45 \leq \textbf{F} < 65 \text{ Hz}$	$0.52 \% \times \textbf{P}$		
		$918 \text{ W} \leq \textbf{P} < 2.24 \text{ kW}$ $45 \leq \textbf{F} < 65 \text{ Hz}$	$0.37 \% \times \textbf{P}$		
		$2.24 \leq \textbf{P} < 4.59 \text{ kW}$ $45 \leq \textbf{F} < 65 \text{ Hz}$	$0.49 \% \times \textbf{P}$		
		$4.59 \leq \textbf{P} < 20.91 \text{ kW}$ $45 \leq \textbf{F} < 65 \text{ Hz}$	$0.67 \% \times \textbf{P}$		
	Fase (Tensão vs. Tensão)	$45 \leq \textbf{F} < 65 \text{ Hz}$	0.25°		
		$65 \leq \textbf{F} < 500 \text{ Hz}$	1.5°		
		$500 \leq \textbf{F} < 1000 \text{ Hz}$	5.0°		
	Resistência	$0 \leq \textbf{R} < 1.9 \text{ }\Omega$	$0.5 \% \times \textbf{R}$	PT 07.0 – Calibração de Medidores de Resistência de Isolamento	
		$1.9 \leq \textbf{R} < 1000 \text{ }\Omega$	$0.025 \% \times \textbf{R}$		
		$1000 \text{ }\Omega \leq \textbf{R} < 1.9 \text{ M}\Omega$	$0.025 \% \times \textbf{R}$		
		$1.9 \text{ M}\Omega \leq \textbf{R} < 190 \text{ M}\Omega$	$0.1 \% \times \textbf{R}$		
	Resistência de isolamento	$1 \text{ }\Omega \leq \textbf{R} < 5.9 \text{ k}\Omega$	$0.1 \% \times \textbf{R}$		
		$10 \text{ k}\Omega \leq \textbf{R} < 1 \text{ M}\Omega$	$0.2 \% \times \textbf{R}$		
		$1 \leq \textbf{R} < 10 \text{ M}\Omega$	$0.3 \% \times \textbf{R}$		
		$10 \leq \textbf{R} < 1000 \text{ M}\Omega$	$0.5 \% \times \textbf{R}$		
		$1 \leq \textbf{R} < 10.05 \text{ G}\Omega$	$1 \% \times \textbf{R}$		
		$10.05 \leq \textbf{R} < 18.24 \text{ G}\Omega$	$3 \% \times \textbf{R}$		
	Pressão				
24	Manômetros	$0 \text{ MPa} \leq \textbf{P}^{(3)} \leq 350 \text{ Bar}$	$0,025\% \times \text{Divisão}$		PT 02.2 – Calibração de Manômetros
25	Válvulas de alívio/Reguladores de fluxo	$0 \text{ MPa} \leq \textbf{P}^{(3)} \leq 350 \text{ Bar}$	$0,025\% \times \text{Divisão}$	PT 05.1	
26	Testes hidroestáticos	$0 \text{ MPa} \leq \textbf{P}^{(3)} \leq 350 \text{ Bar}$	$0,025\% \times \text{Divisão}$	PT 03.1	
27	Pressostatos	$0 \text{ MPa} \leq \textbf{P}^{(3)} \leq 350 \text{ Bar}$	$0,025\% \times \text{Divisão}$	PT 09.0	
28	Transdutores de Pressão	$0 \text{ MPa} \leq \textbf{P}^{(3)} \leq 350 \text{ Bar}$ $0 < \textbf{U} < 30 \text{ V}$ $0 < \textbf{I} < 30 \text{ mA}$	$0,025\% \times \text{Divisão}$ $0.02\% \times \textbf{U} + 0.09 \text{ V}$ $0.02\% \times \textbf{I} + 0.09 \text{ A}$	PT 08.0	

Notas:

- (1) **U**: Tensão (V – volt)
(2) **f**: Frequência (Hz – Hertz)
(3) **I**: Corrente elétrica (A – Ampere)
(4) **W**: Potência (W – Watt)
(5) **F**: Fase (° - grau)
(6) **R**: Resistência (Ω - Ohm)

Grandezas disponíveis para calibração:

Grandeza	Gama de medição	Unidade
Pressão	0 até 350 bar	Bar (ou equivalente)
Corrente (medição) - DC	0 até 30 mA	Ampere
Tensão (medição) - DC	0 até 30 V	Volts
Corrente (Geração) – AC e DC	0 até 1025 A	Ampere
Potência – AC e DC	0 até 20.91 KW	Watt
Fase	0° até 360°	°
Resistência	0 até 190 M Ω	Ohm
Resistência de Isolamento	0 até 1575 V	Volt
	0 até 18.24 G Ω	Ohm