INTERNATIONAL STANDARD ISO 17123-2

Optics and optical instruments – Field procedures for testing geodetic and surveying instruments – Parte2: Levels

**Full test procedure**

Antes de iniciar o teste, permitir que o aparelho se aclimatize à temperatura ambiente (2 minutos/grau na diferença de temperatura). De forma a manter a influência da refracção tão pequena quanto possível, seleccionar uma área de teste razoavelmente horizontal, devendo o solo ser compacto e uniforme (evitar superfícies cobertas por asfalto ou cimento). No caso do o Sol incidir directamente, o aparelho deve ser protegido por um guarda-sol. O aparelho deve ser colocado numa posição aproximadamente equidistante relativamente às miras (30 m ± 3 m). Entre cada par de observações o aparelho deve mudar ligeiramente de posição.

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| Data: \_\_\_\_ /\_\_\_\_\_ /\_\_\_\_Hora: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Grupo: \_\_\_\_\_\_\_\_\_\_\_\_\_\_Operador: \_\_\_\_\_\_\_\_\_\_\_Aparelho: \_\_\_\_\_\_\_\_\_\_\_\_Condições atmosféricas: \_\_\_\_\_\_\_\_­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

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| --- | --- | --- | --- | --- |
| $$i$$ | $$l\_{A}^{i}$$ | $$l\_{B}^{i}$$ | $$d^{i}=l\_{A}^{i}-l\_{B}^{i}$$ | $$r^{i}=d\_{1}-d^{i}$$ |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |
| 4 |  |  |  |  |
| 5 |  |  |  |  |
| 6 |  |  |  |  |
| 7 |  |  |  |  |
| 8 |  |  |  |  |
| 9 |  |  |  |  |
| 10 |  |  |  |  |
| trocar miras de posição |
| 11 |  |  |  |  |
| 12 |  |  |  |  |
| 13 |  |  |  |  |
| 14 |  |  |  |  |
| 15 |  |  |  |  |
| 16 |  |  |  |  |
| 17 |  |  |  |  |
| 18 |  |  |  |  |
| 19 |  |  |  |  |
| 20 |  |  |  |  |
| trocar miras de posição |
|  |  |  | $$d\_{1}=\frac{\sum\_{i=1}^{20}d^{i}}{20}$$ | $$\sum\_{i=1}^{20}r^{i}$$ |
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| --- | --- | --- | --- | --- |
| $$i$$ | $$l\_{A}^{i}$$ | $$l\_{B}^{i}$$ | $$d^{i}=l\_{A}^{i}-l\_{B}^{i}$$ | $$r^{i}=d\_{1}-d^{i}$$ |
| 21 |  |  |  |  |
| 22 |  |  |  |  |
| 23 |  |  |  |  |
| 24 |  |  |  |  |
| 25 |  |  |  |  |
| 26 |  |  |  |  |
| 27 |  |  |  |  |
| 28 |  |  |  |  |
| 29 |  |  |  |  |
| 30 |  |  |  |  |
| trocar miras de posição |
| 31 |  |  |  |  |
| 32 |  |  |  |  |
| 33 |  |  |  |  |
| 34 |  |  |  |  |
| 35 |  |  |  |  |
| 36 |  |  |  |  |
| 37 |  |  |  |  |
| 38 |  |  |  |  |
| 39 |  |  |  |  |
| 40 |  |  |  |  |
|  |
|  |  |  | $$d\_{1}=\frac{\sum\_{i=21}^{40}d^{i}}{20}$$ | $$\sum\_{i=11}^{40}r^{i}$$ |
|  |  |  |  |  |

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(a diferençanão tem influência no desvio padrão experimental s do desnível observado mas é um indicador da diferença nas origens das duas miras)

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| --- | --- | --- | --- | --- | --- |
| $$\sum\_{i=1}^{20}r^{i^{2}}$$ | $$\sum\_{i=21}^{40}r^{i^{2}}$$ | $$\sum\_{i=1}^{40}r^{i^{2}}$$ | $\sum\_{i=1}^{20}r^{i^{2}}$+ $\sum\_{i=21}^{40}r^{i^{2}}$- $\sum\_{i=1}^{40}r^{i^{2}}$ | $$s=\sqrt{\frac{\sum\_{i=1}^{40}r^{i^{2}}}{38}}$$ | $$s\_{km de nivelamento duplo}=\frac{s}{\sqrt{2}}\sqrt{\frac{1000}{60}}=2.89 s$$ |
|  |  |  |  |  |  |

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| 1. O desvio padrão experimental s é menor do que o correspondente valor σ indicado pelo fabricante ou que outro valor previamente determinado?
2. Dois desvios padrão experimentais s e $\tilde{s}$ determinados a partir de duas amostras diferentes de observações pertencem à mesma população, supondo que ambas as amostras têm o mesmo número de graus de liberdade?

(os valores s e $\tilde{s}$ podem ser obtidos através de duas amostras observadas com o mesmo aparelho mas diferentes operadores, de duas amostas observadas com o mesmo aparelho em ocasiões diferentes ou de duas amostras observadas por aparelhos diferentes)1. A diferença δ na origem das duas miras é igual a zero?
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|  | Hipótese nula | Hipótese alternativa |
| a) | s < σ | s ≥ σ |
| b) | s = $\tilde{s}$ | s ≠ $\tilde{s}$ |
| c) | δ = 0 | δ $\ne 0$ |

Para os testes seguintes adopta-se o nível de significân cia 1-α=0.95 e, de acordo com as observações realizadas, o número de graus de liberdade é ν=38.

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| 1. A hipótese nula não é rejeitada se: s $<σ\sqrt{\frac{χ\_{1-α}^{2}}{ν}} ⇔s< σ\sqrt{\frac{χ\_{0.95}^{2}}{38}}$ $⇔$ $σ\sqrt{\frac{53.38}{38}} ⇔s<1.19 σ$
2. A hipótese nula não é rejeitada se : $\frac{1}{F\_{1-\frac{α}{2}} (ν,ν)}< \frac{s}{ \tilde{s}}< F\_{1-\frac{α}{2}} \left(ν,ν\right)$ $⇔ \frac{1}{F\_{1-0.975} (38,38)}< \frac{s}{ \tilde{s}}< F\_{1-0.975} \left(38,38\right) ⇔0.52 $<$ \frac{s}{ \tilde{s}} < $1.91
3. A hipótese nula não é rejeitada se: $\left|δ\right|< s\_{δ} t\_{1-\frac{α}{2}}\left(ν\right)$ $⇔ \left|δ\right|< \frac{s}{\sqrt{10}} t\_{0.975}\left(38\right)$ $⇔ \left|δ\right|< 2.02\frac{s}{\sqrt{10}} ⇔ \left|δ\right|<0.64 s $, com $s\_{δ} $sendo o desvio padrão experimental de δ
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