

INTERNATIONAL
STANDARD

ISO
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**Optics and optical instruments — Ancillary
devices for geodetic instruments —**

**Part 1:
Invar levelling staffs**

*Optique et instruments d'optique — Équipements annexes pour
les instruments géodésiques —*

Partie 1: Mires de nivelllement en invar

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 12858-1 was prepared by Technical Committee ISO/TC 172, *Optics and optical instruments*, Subcommittee SC 6, *Geodetic and surveying instruments*.

ISO 12858 consists of the following parts, under the general title, *Optics and optical instruments — Ancillary devices for geodetic instruments*:

- *Part 1: Invar levelling staffs*
- *Part 2: Tripods*

Annex A of this part of ISO 12858 is for information only.

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Introduction

ISO 12858 consists of a series of parts which detail specifications for ancillary devices to be used with geodetic instruments in surveying. This first part specifies requirements for Invar levelling staffs.

Additional parts, covering other ancillary devices, may be added to ISO 12858 as the need arises.

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Optics and optical instruments — Ancillary devices for geodetic instruments —

Part 1: Invar levelling staffs

1 Scope

This part of ISO 12858 specifies the most important requirements of Invar levelling staffs used in geodesy and industry for precise measurement of heights in combination with either an optical-mechanical level equipped with a parallel plate micrometer, or a digital level of comparable precision.

This part of ISO 12858 is not applicable to the detailed design and construction of Invar levelling staffs (e.g. materials, handles, fixing points for the struts, fixing of the Invar strip and of the circular level), which may be selected by the manufacturer as appropriate.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this part of ISO 12858. For dated references, subsequent amendments to, or revisions of, this publication do not apply. However, parties to agreements based on this part of ISO 12858 are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 9849, *Optics and optical instruments — Geodetic instruments — Vocabulary*.

3 Terms and definitions

For the purposes of this International Standard, the terms and definitions given in ISO 9849 apply.

4 Design

Invar levelling staffs are normally manufactured in nominal lengths of 2 m and 3 m. However, other alternative lengths may be adopted.

The detailed design and construction are left to the manufacturer (see Scope).

Examples of Invar levelling staffs are shown in annex A.

5 Invar scale strip

The Invar strip carrying the scale shall have a thermal coefficient of expansion (α) for which

$$|\alpha| \leq 1 \times 10^{-6} \cdot K^{-1}$$

where K is the unit of temperature Kelvin.

6 Scale and scale numbering

The Invar scale strip on levelling staffs may be equipped with one or two parallel sets of scales. The scale marks shall be sharp, parallel to the baseplate and of equal thickness. The colours of the scale marks and of the scale numbering shall be of good contrast. In the case of two parallel sets of scales, they shall be offset (staff constant, equal to the difference between the two opposite scale values), the value of which shall be indicated on the staff frame or on the Invar scale strip.

The scale numbering shall be on the staff frame, adjacent to the Invar scale strip. In the case of two parallel sets of scales, the scale numbering shall be placed adjacent to the respective scales, on each side of the Invar scale strip.

Levelling staffs for digital levels shall be equipped with an Invar scale strip bearing a bar-coded pattern (no scale numbering necessary). The scale marks shall be sharp, parallel to the base, of an appropriate colour and exhibit good contrast to ensure accurate reading.

The admissible deviation of the distance between any two scale marks, when compared to a standard, shall not exceed the value determined from the following equation:

$$\Delta l = \pm [0,02 + l(2 \times 10^{-5})]$$

where

Δl is the admissible deviation, in millimetres, at 20 °C;

l is the distance, in millimetres, between any two scale marks.

7 Zero-point error

The zero-point error of the levelling staff is the difference between the nominal value of the first decimetre (of the levelling staff) and its true value. Since the true value cannot be measured, the value obtained using a reference standard (the conventional true value) shall be used for the true value. This measurement shall be made parallel to the staff length axis and perpendicular to the baseplate, at 20 °C. The zero-point error shall not exceed 0,05 mm. Provision for adjusting the zero-point shall be made.

8 Baseplate

The baseplate shall have on its lower side a hardened stainless steel plate. The flatness deviation of the plate shall not exceed 0,02 mm. The baseplate shall be perpendicular, within $\pm 5'$, to the staff length axis.

9 Accessories

At a suitable position on the staff frame, two foldable handles and fittings for struts shall be provided.

The alternative use of a centring ring at the baseplate should be possible.

10 Circular level

A circular level having an (usable) indicating range of $15' \pm 5'$ shall be fixed to the backside of the levelling staff.

11 Designation and marking

The marking shall indicate at least the following data on the backside of the levelling staff:

- the name or trademark of the manufacturer (or responsible supplier);
- the individual identification number (serial number).

The staff may be marked additionally on the backside with the designation as shown below for the example of a precision levelling staff of 2 m length:

Invar levelling staff		ISO 12858-1 - 2
Description _____		
International Standard number _____		
Nominal length (m) _____		

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