INTERNATIONAL STANDARD

ISO 7500-2

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Metallic materials — Verification of static uniaxial testing machines —

Part 2:
Tension creep testing machines — Verification of the applied load

Matériaux métalliques — Vérification des machines pour essais statiques uniaxiaux —

Partie 2: Machines d'essai de fluage en traction — Vérification de la charge appliquée

Reference number
ISO 7500-2:1996(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 7500-2 was prepared by Technical Committee ISO/TC 164, *Mechanical testing of metals*, Subcommittee SC 1, *Uniaxial testing*.

ISO 7500 consists of the following parts, under the general title *Metallic materials — Verification of static uniaxial testing machines*:

— *Part 1: Tensile testing machines*

— *Part 2: Tension creep testing machines — Verification of the applied load*

Annex A forms an integral part of this part of ISO 7500.

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Metallic materials — Verification of static uniaxial testing machines —

Part 2:
Tension creep testing machines — Verification of the applied load

1 Scope

This part of ISO 7500 specifies the verification of testing machines used for uniaxial creep testing in tension in accordance with ISO 204.

The verification consists of

— a general inspection of the testing machine;

— a verification of the load applied by the testing machine.

This part of ISO 7500 applies to dead weight and lever type creep testing machines. The machines with a load measuring system[1] shall be verified in accordance with ISO 7500-1.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 7500. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 7500 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 204:—[2], *Metallic materials — Uniaxial creep testing in tension.*

ISO 376:1987, *Metallic materials — Calibration of force proving instruments used for the verification of uniaxial testing machines.*

ISO 7500-1:1986, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tensile testing machines.*

3 Symbols and their meanings

For the purposes of this part of ISO 7500, the symbols given in table 1 shall apply.

For the purposes of this part of ISO 7500 the following types of creep testing machines are recognized:

— deadweight machines, with or without guides (see figures 1 and 2);

— overslung or underslung lever machines (see figures 3, 4 and 5);

— jockey weight machines, either with overslung or underslung lever (see figures 6 and 7);

— any combination of the types of machines mentioned above (see figure 8).

4 General inspection of the testing machine

The verification of the testing machine shall only be carried out if the machine is in good working order. For this purpose, a general inspection of the machine shall be carried out before verification of the load applied by the machine (see annex A).

1) For the purposes of this part of ISO 7500, a force measuring system comprises load cell plus conditioning plus indicator.

2) To be published. (Revision of ISO/R 204:1961 and ISO/R 206:1961)

Table 1 — Symbols and their meanings

Symbol	Unit	Meaning
F_N	N	Maximum capacity of the load range of the testing machine
F_i	N	Load applied by the testing machine to be verified — for deadweight machines: $F_i = mg$ [1)] — for lever-type machines: $F_i = mgR$ [1)] — for jockey weight machines, the value of F_i is indicated on the scale of the machine
F	N	True load indicated by the force-proving instrument
$\overline{F}$	N	Arithmetic mean of several measurements of F for the same discrete load
F_{max}, F_{min}	N	Highest or lowest value of F for the same discrete load
F_M	N	Force exerted by the masses on the scale pan of the machine
F_V	N	Lower limit of the verified load range
R	—	Lever ratio used for the verification
b	%	Relative repeatability error of the testing machine
d	N	Discrimination threshold
d_1	N	Discrimination threshold corresponding to 20 % of the maximum force range (F_N)
a	%	Relative discrimination threshold
q	%	Relative accuracy error of the testing machine

1) g = local acceleration due to gravity, in metres per second squared.

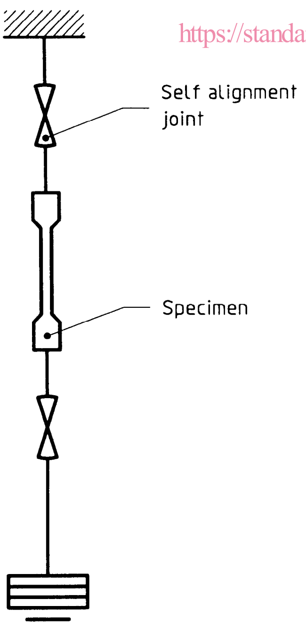

Figure 1 — Schematic representation of the operating principle of a deadweight tensile creep testing machine (example)

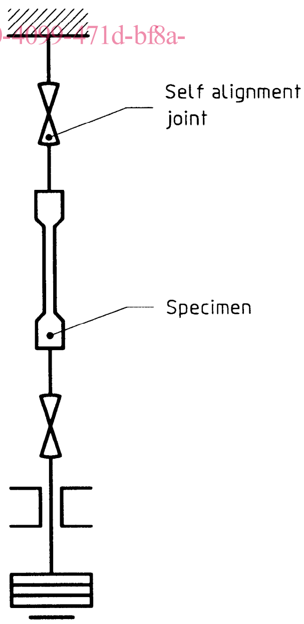

Figure 2 — Schematic representation of the operating principle of a deadweight tensile creep testing machine with guides (example)

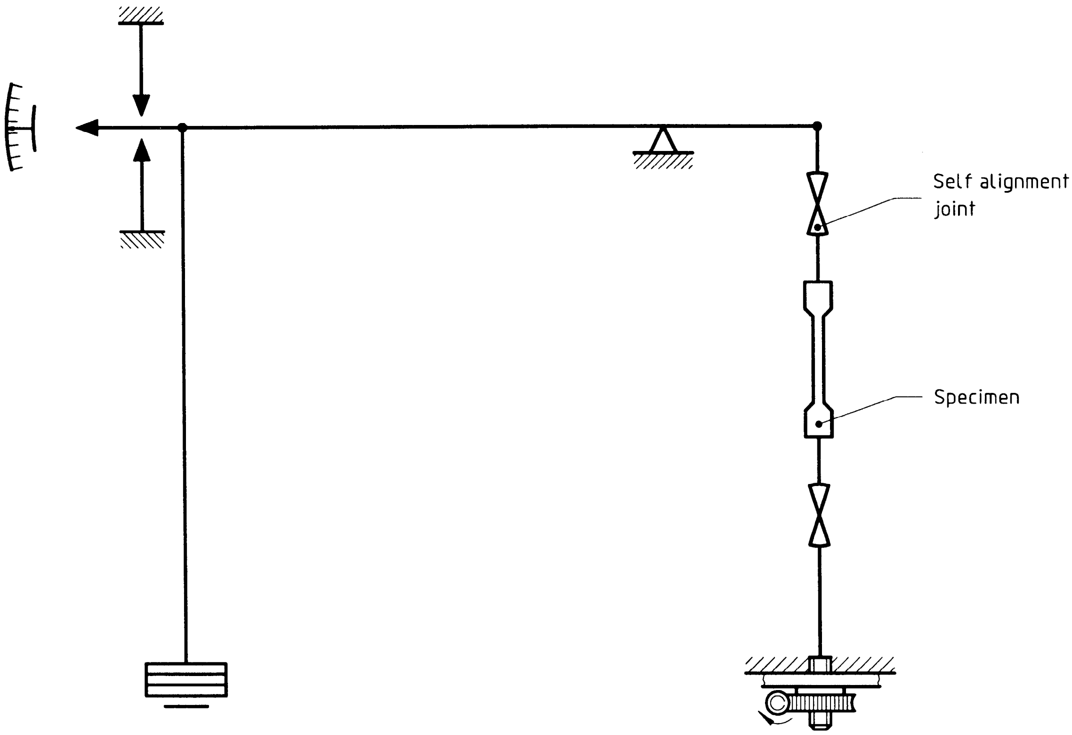

Figure 3 — Schematic representation of the operating principle of an overslung lever tensile creep testing machine (example)

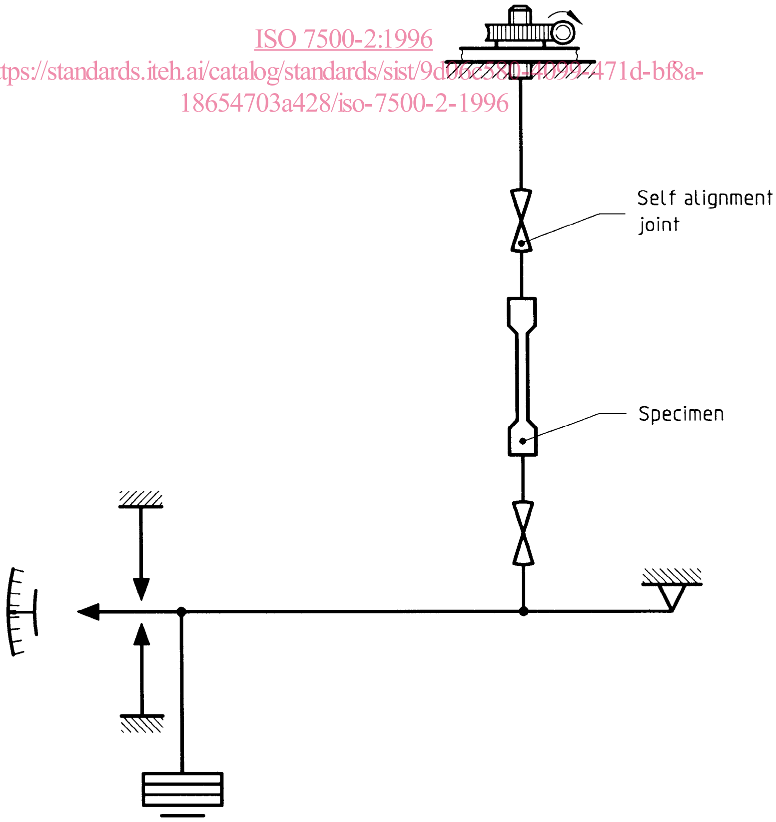

Figure 4 — Schematic representation of the operating principle of an underslung lever tensile creep testing machine (example)

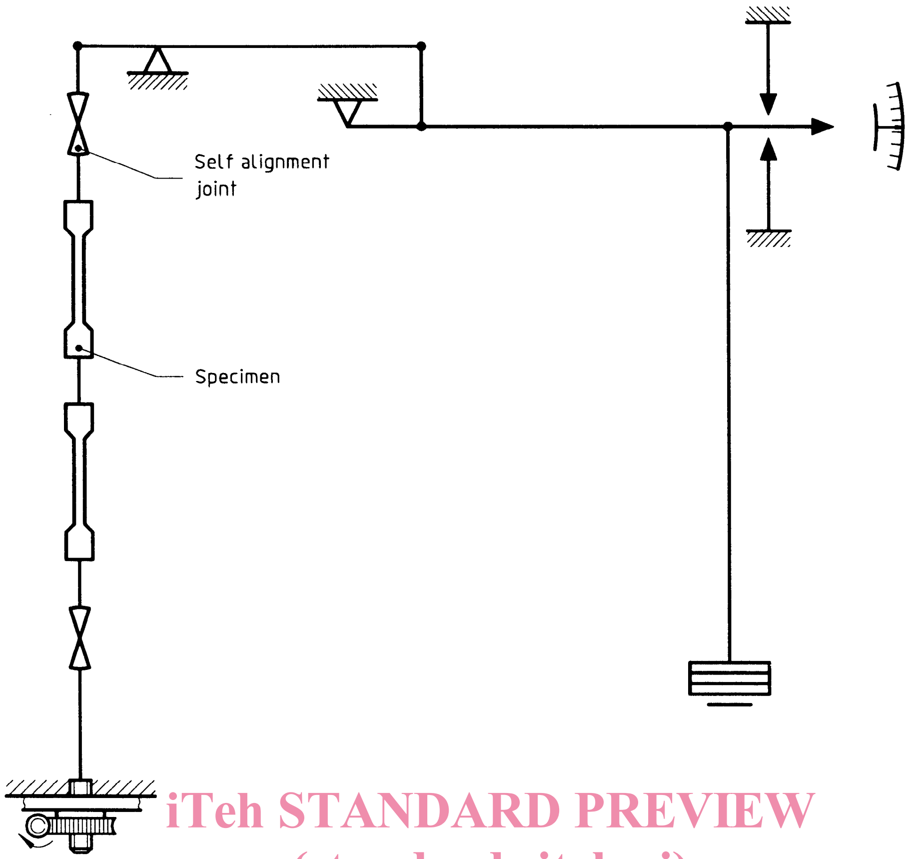

Figure 5 — Schematic representation of the operating principle of an overslung double lever tensile creep testing machine (example)

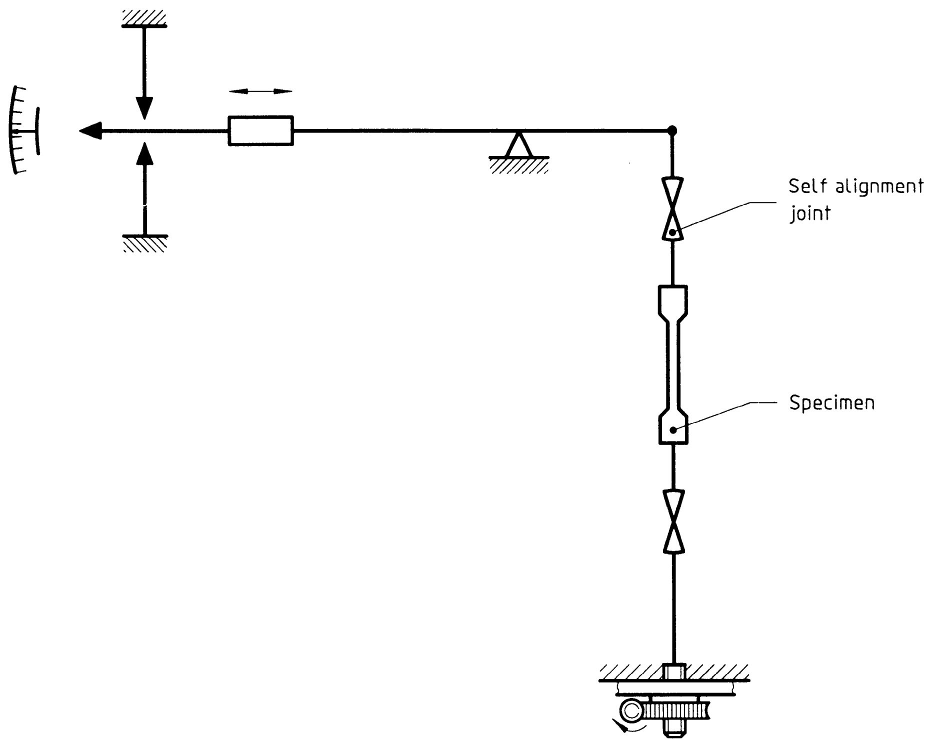

Figure 6 — Schematic representation of the operating principle of an overslung lever tensile creep testing machine with jockey weight (example)

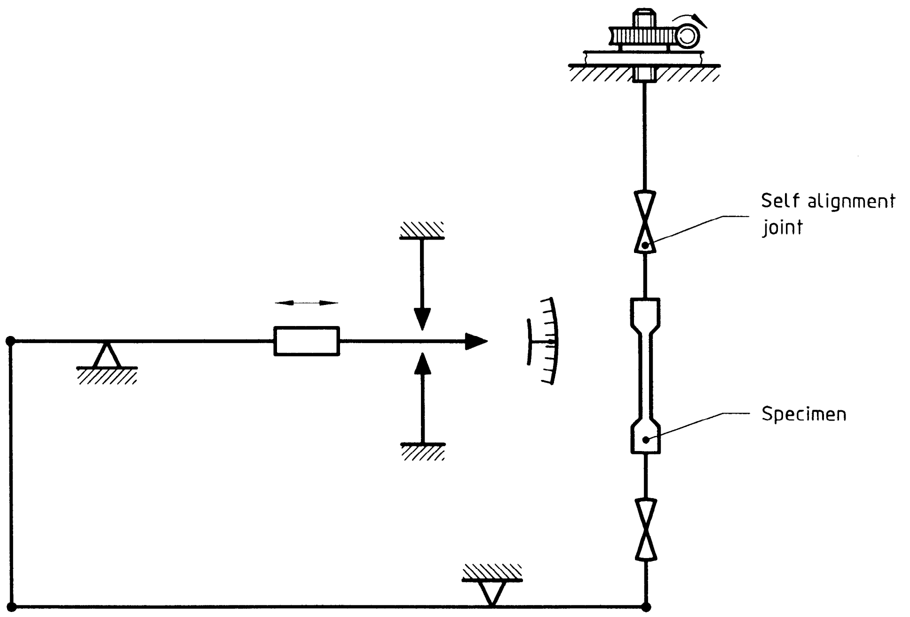

Figure 7 — Schematic representation of the operating principle of an underslung double lever tensile creep testing machine with jockey weight (example)

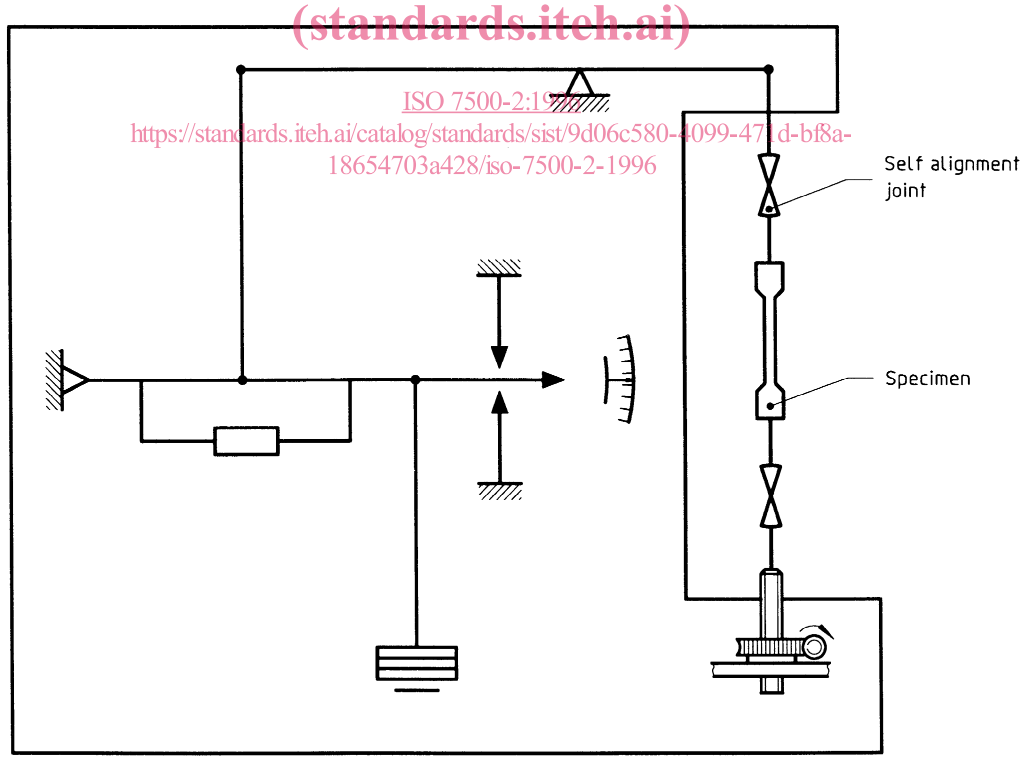

Figure 8 — Schematic representation of the operating principle of a tensile creep testing machine using a combination of different loading systems (example)

5 Verification of the load applied by the testing machine

5.1 General

This verification shall be carried out for each of the load ranges used. if the testing machine has several load ranges, each range[3], shall be regarded as a separate testing machine.

This verification shall be carried out using tension force-proving instruments. These instruments shall be in accordance with ISO 376. The class of the force-proving instrument shall be equal to or superior to the class determined for the creep testing machine.

5.2 Masses

The masses used to apply the forces during verification shall be the masses normally used during testing, which can be either:

a) known masses with an accuracy equal to or better than ± 0,1 %; verified at least every 10 years, or;

b) masses dedicated for use with a given creep testing machine applied in the same sequence as during the test.

5.3 Determination of the discrimination threshold

The discrimination threshold d of the machine is defined as the smallest increment of force that can be applied and detected during the verification procedure.

The discrimination threshold d shall be determined at 20 %, 60 % and 100 % of the maximum load F_N of the force measuring range. If loads of a magnitude less than $0{,}2F_N$ are to be tested (see 5.2), the discrimination threshold must additionally be determined at the lower limit of the provided testing range.

The discrimination threshold d is measured as the magnitude of the force resulting from the smallest mass added to, or removed from, the scale pan of the machine or the load which corresponds to the smallest recordable movement of the jockey weight which causes a detectable change at the indicator of the force-proving instrument.

The relative discrimination threshold a is calculated for each value of load specified according to the following formula:

$$a = \frac{d}{F} \times 100$$

and shall remain within the limits given in table 2 for the class of machine considered.

The discrimination threshold d shall be expressed in newtons

5.4 Determination of the lower limit of verification

The lower limit of verification F_V shall be specified according to table 2.

Table 2 — Lower limit of verification

Class	F_V
0,5	$400d_1$
1	$200d_1$
2	$100d_1$

NOTE — d_1 is the discrimination threshold corresponding to 20 % of the force measuring range.

NOTE 1 The lower limit of verification of the machine may be less than the permissible operating range of the equivalent grade force-proving instrument used to determine the discrimination threshold at the 60 % and maximum load conditions.

Consequently, if one wishes to accurately verify the testing machine load at the lower end of the range as well, it will be necessary to employ two measuring instruments, one for the upper range and a second one having appropriate capacity for the extreme lower measuring range.

5.5 Test procedure

Verification shall be carried out for each load range for which a grade is sought.

Verification shall not be performed below the lower limit F_V for any load range.

5.5.1 Alignment

The force-proving device shall be mounted in the machine with the self-alignment devices normally used included at each end of the loading train.

3) In the case of a deadweight machine, load range means the range over which the machine is to be used; in the case of a lever-type machine it is the load range for each separate lever ratio.

5.5.2 Balancing the lever

It is necessary to balance the loading train to achieve a zero loading reading on the force-proving device when it is mounted in the loading train in place of the test piece. The precise method of balancing is dependent upon the design of machine, however in general the procedures given in 5.5.2.1 and 5.5.2.2 will be applicable.

In some machines, it is not possible to fully balance the lever, in which case the minimum force that is applied to the test piece with no masses on the scale pan shall be recorded on the verification report and taken into account when calculating the load applied to the test piece when undertaking a creep test.

5.5.2.1 Overslung lever

The load verification device shall be hung in the loading train in place of the test specimen, with the lower loading bar disconnected immediately below the proving device. The lever shall then be balanced by movement of the adjustment weight normally attached to the machine, or by the addition of an extra balancing weight. The load indicator of the verification device shall be set to zero before connecting the lower loading bar.

NOTE 2 It must be remembered that the lever will need to be rebalanced before commencing creep testing.

5.5.2.2 Underslung lever

Because of the geometrical design of underslung lever machines it is seldom possible to balance the mass of the lower loading bars, lever and scale pan. It is therefore necessary to zero the force-proving device with the lower loading bar disconnected, and then merely to note the load applied when the loading train is reconnected and the system adjusted to bring the lever to the normal operating position with no masses placed on the scale pan. If this load is greater than that calculated in 5.4 then it shall become the lower limit of verification

5.5.3 Temperature compensation

Sufficient time shall be allowed for the verification equipment to attain a stable temperature. The temperature shall be noted at the beginning and end of the application of each series of loads. Where necessary, temperature corrections shall be applied to the deflections of proving devices using the equations given in ISO 376.

5.5.4 Conditioning

In order to condition the system, it is necessary to exercise the creep testing machine and force-proving device three times between zero force and the maximum load to be measured. Then, the force-proving device shall be reset to the zero force position.

5.5.5 Selection of test forces

A series of at least five approximately equispaced loads starting at 20 % of the force range or the lower limit of verification, whichever is greater, shall be applied.

When required, additional loads below 20 % of the load range down to the lower limit of verification (see 5.4) may be applied. One load is to be applied for each increment of 5 %, or portion thereof, of the scale to be verified below 20 % of the load range.

5.5.6 Application of test loads

For each range, the series of loads shall be applied in ascending order and each series shall be repeated to give three series of such loads. After each series of applications the load shall be completely removed.

All three series of loads shall be applied with the loading system at the mid point of the normal operating range (zero position). The measurements shall be conducted after the system has been stabilized especially for machines with a damping device.

NOTE 3 On an overslung lever or a single underslung lever creep testing machine, this requirement implies that the three series of loads are applied with the lever in the horizontal position.

Further, it has to be ensured that:

— each test load applied will be free of shock and vibration, so that the load will therefore not exceed its nominal value by more than the maximum permissible error for the machine grade in question;

— in case of lever type machines it has to be verified that the permissible deviation of the lever from its horizontal position is exactly marked. In the range between these marked inclinations of the lever, it shall be checked to ensure that the load is within the permitted limits. This check shall be carried out for the lowest and highest load of the range at the lower position of the lever. This procedure shall ensure that the deviation of the test load from its nominal value during the total duration of the creep test is kept within the limits of the maximum permissible error for the machine grade in question.