

OBSOLESCE
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Method for

Specifying the performance of stabilized power supply apparatus

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- Department of Trade and Industry (British Calibration Service)
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- United Kingdom Atomic Energy Authority

This British Standard, having been approved by the Telecommunication Industry Standards Committee, was published under the authority of the Executive Board on 30 September 1975

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Foreword

Obsolescent (by Amendment No. 1).

The need for the method covered by this British Standard has been reviewed and it has been decided that, in the interests of rationalization, it should be declared obsolescent. Its application for new apparatus is, therefore, not recommended. The standard will be withdrawn in due course.

This British Standard has been prepared under the authority of the Telecommunication Industry Standards Committee. It is identical in technical content with IEC Publication 443 “*Stabilized supply apparatus for measurement*”.

This standard is one of a series, all based on IEC Publications, which sets out the methods of specifying the performance of various kinds of signal generator in accordance with the principles laid down in BS 4889 “*Method for specifying the performance of electronic measuring equipment*”. These related standards are:

BS 4980, *Method for specifying the performance of audio frequency generators*.

BS 5134, *Method for specifying the performance of amplitude-modulated signal generators*.

BS 5133, *Method for specifying the performance of frequency-modulated signal generators*.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 32, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 General

1.1 Scope

1.1.1 This British Standard applies to supply apparatus with stabilization which is designed to supply calibrated values of voltage and/or current in connection with electrical measurements and to accessories used with such apparatus.

NOTE A supply apparatus designed to supply calibrated values is characterized by having a specified accuracy under reference conditions which is of the order of its stabilization. To apparatus falling within this scope, the same performance concept is applied as to electronic measuring equipment in general.

The other possibility is a supply apparatus having an accuracy under reference conditions which is appreciably lower than its stabilization performance.

It is not advisable to specify such apparatus in accordance with this standard.

1.1.2 According to the output quantity, this apparatus may be of one or more of the following kinds:

- d.c. supply with stabilized voltage
- a.c. supply with stabilized voltage
- d.c. supply with stabilized current
- a.c. supply with stabilized current.

1.1.3 Safety requirements are dealt with in BS 4743:1971.

1.1.4 Throughout this standard, the terms “supply apparatus” or “apparatus” only have been used to cover any apparatus and accessory according to the scope.

NOTE The titles of the British Standards referred to in this standard are listed on the inside back cover.

1.2 Object

The object of this standard is to unify methods of expression of electrical properties of stabilized supply apparatus for measurement; to establish the terminology and definitions related to this apparatus and to specify methods for testing these types of apparatus in order to verify compliance with claimed or assured properties.

2 Definitions

For the purposes of this British Standard, the following definitions apply.

2.1 Supply apparatus and components

2.1.1 supply apparatus

An apparatus which takes electrical energy from a supply source, in general from the supply mains, and supplies electrical energy, in a modified form, to one or more loads.

2.1.1.1

stabilized supply apparatus

a supply apparatus in which one or more of the output quantities are stabilized

2.1.2 Elements used with stabilization (see Figure 1)

2.1.2.1

output control device

the device by means of which the specified value as indicated in **2.2.1.1** and **2.2.1.2** is set

2.1.2.2

reference source

the source of an electrical quantity, the value of which is referred to in closed loop stabilization

2.1.2.3

comparator

the device which compares the value of an output quantity with a value specified for reference purpose and produces a difference signal

2.1.2.4

error amplifier

the device which amplifies the difference signal (error signal) of the comparator

2.1.2.5**final control element**

the last element which controls the output quantity to the specified value

2.1.3**accessory**

a device or an apparatus which is associated with the supply apparatus

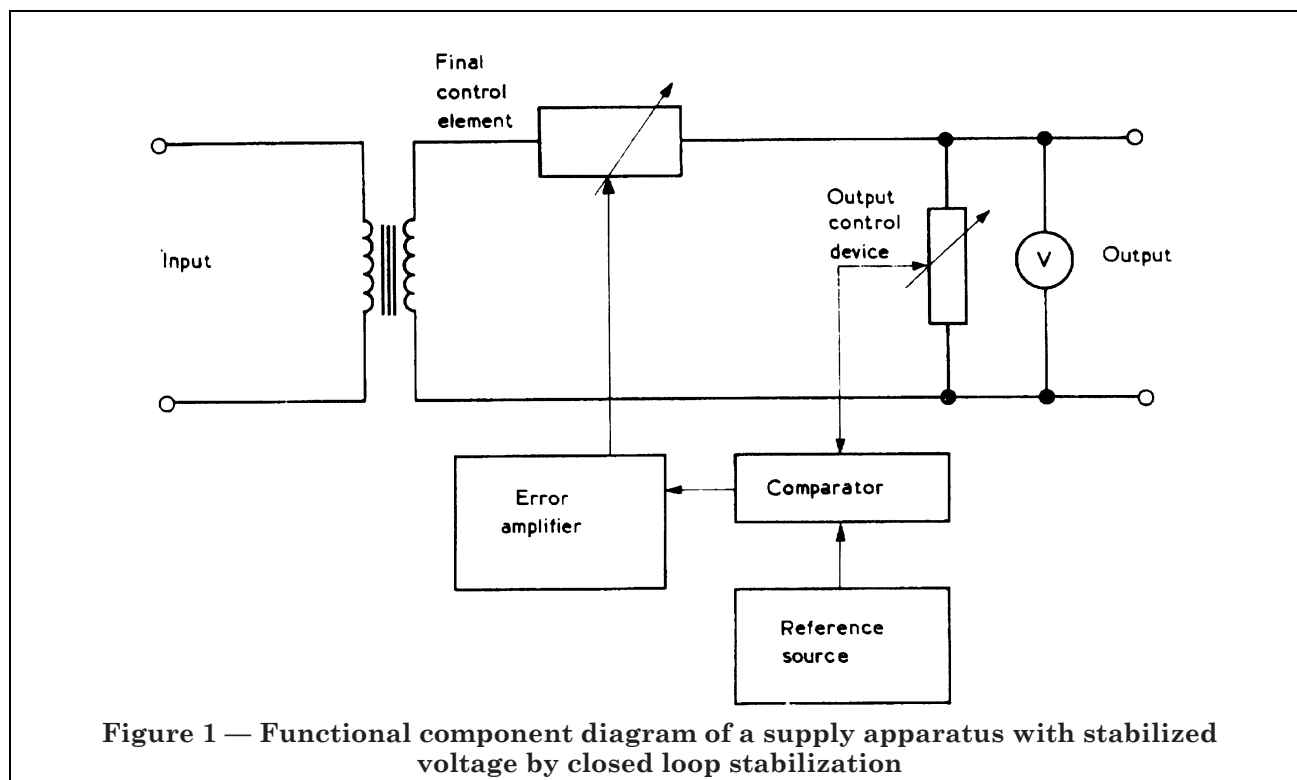


Figure 1 — Functional component diagram of a supply apparatus with stabilized voltage by closed loop stabilization

2.2 Basic terms**2.2.1 General****2.2.1.1****performance characteristic**

one of the quantities assigned to an apparatus in order to define by values, tolerances, ranges, etc. the performance of the apparatus

NOTE The term performance characteristic does not include influence quantities.

2.2.1.2**rated value**

the value (or one of the values) of a quantity to be supplied or set, which the manufacturer has assigned to the apparatus

NOTE 1 Thus, for a supply apparatus with a calibrated output control, the rated output is the value indicated by the control setting. For a supply with a fixed output, the rated output is the output indicated on the nameplate.

NOTE 2 The terms voltage and current with alternating quantities indicate r.m.s. values, unless otherwise specified.

2.2.1.3**rated range (setting range)**

the range of a quantity to be supplied or set, which the manufacturer has assigned to the apparatus

NOTE This is the range over which the value of the stabilized quantity may be adjusted.

2.2.1.4**effective range (control range)**

that part of the rated range where quantities can be supplied within the stated limits of error

2.2.2 stabilization

The reduction of the effect of changes of influence quantities and/or influencing characteristics on the output quantity by means inside the supply apparatus.

2.2.2.1**closed loop stabilization**

a mode of operation in which the value of an output quantity is compared with a reference value, and such that the difference of these values controls directly or indirectly the output quantity to the specified value

2.2.2.2**open loop stabilization**

a mode of operation in which the value of an output quantity is controlled by internal means to a specified value without evaluating the difference between the output and this specified value

2.2.2.3**stabilized quantity**

The output quantity (or one of the output quantities) of a supply apparatus to which stabilization is applied.

NOTE 1 In general, the output voltage and/or current will be stabilized.

NOTE 2 Supply apparatus with a.c. output may be characterized according to the quantity to be stabilized.

NOTE 3 There will be at least one stabilized quantity, but more than one stabilized quantity may be assigned to a particular apparatus. For example:

For a voltage stabilized apparatus, the voltage is the stabilized quantity and the current is an influencing characteristic. For a current stabilized apparatus, the current is the stabilized quantity and the voltage is an influencing characteristic. With a frequency (only) stabilized apparatus, the frequency is the stabilized quantity and both voltage and current are influencing characteristics.

2.2.2.3.1

for output voltage or current, distinction is made between:

average value stabilization

r.m.s. (effective) value stabilization

peak value stabilization

These terms denote that the given value of the output voltage (current) is stabilized to specified values.

2.2.2.4**remote sensing**

a means by which the supply apparatus monitors a stabilized output quantity directly at the load using extra "sensing" leads

NOTE The resulting circuit action compensates for voltage drops in the load leads up to a specified limit.

2.3 Terms related to performance specifications**2.3.1****influence quantity**

any quantity, generally external to a supply apparatus, which may affect the performance of the apparatus

NOTE Where a change of a performance characteristic affects another performance characteristic, it is referred to as an influencing characteristic.

2.3.2 reference conditions

A set of values with tolerances or of restricted ranges of influence quantities, and if necessary of influencing characteristics, specified for making comparison or calibration tests.

2.3.2.1**reference value**

the value of an influence quantity specified for the reference conditions

2.3.2.2

reference range

the range of an influence quantity specified for the reference conditions

2.3.3

rated range of use

the range of values for an influence quantity within which the requirements concerning operating error are satisfied

2.3.4

rated operating conditions

the whole of the effective range for performance characteristics and rated ranges of use for influence quantities, within which the performance of the apparatus is specified

2.3.5

limit conditions of operation

the whole of the range of values for influence quantities and influencing characteristics (beyond the rated ranges of use and effective range respectively) within which an apparatus can function without resulting damage or degradation of performance, when it is afterwards operated under rated operating conditions

NOTE The limit conditions will, in general, include overload.

2.3.6

conditions of storage and transport

the whole of the conditions of temperature, humidity, air pressure, vibration, shock, etc., within which the apparatus may be stored or transported in an inoperative condition, without resulting damage or degradation of performance when it is afterwards operated under rated operating conditions

2.4 Errors

2.4.1 error

For a supply apparatus, the error is the true value of the quantity supplied minus its rated, indicated or preset value. The true value of a quantity is the value that would be measured by a measuring process having no error. In practice, since this true value cannot be determined by measurement, a conventionally true value, approaching the true value as closely as necessary (having regard to the error to be determined), is used in place of the true value. This value may be traced to standards agreed upon by the manufacturer and the user, or to national standards. In both cases the uncertainty of the conventionally true value shall be stated.

2.4.1.1

absolute error

the error expressed algebraically, in the unit of the supplied quantity

2.4.1.2

relative error

the ratio of the absolute error to a stated value

2.4.1.3

percentage error

the relative error expressed as a percentage, such as percent of full scale (the maximum value of the effective range), percent of the indicated or preset value or of the rated value

2.4.1.4

fiducial value

a value to which reference is made in order to specify the percentage error, e.g. the upper limit of the effective range, or another clearly stated value

2.4.2

limits of error

the maximum values of error assigned by the manufacturer to a supplied quantity of an apparatus operating under specified conditions

2.4.3**intrinsic error**

the error determined under reference conditions

2.4.4**operating error**

the error determined under rated operating conditions

2.4.5**influence error**

the error determined when one influence quantity assumes any value within its rated range of use (or an influencing characteristic assumes any value within its effective range), all others being at reference conditions

NOTE When, over the whole rated range of use, a substantially linear relationship exists between the influence error and the effect causing it, the relationship may be conveniently expressed in coefficient form.

2.4.6**stability error**

the error which occurs in the indicated or supplied value of an apparatus during a specified time, other conditions remaining constant

NOTE Stability error includes drift and PARD (see 2.8).

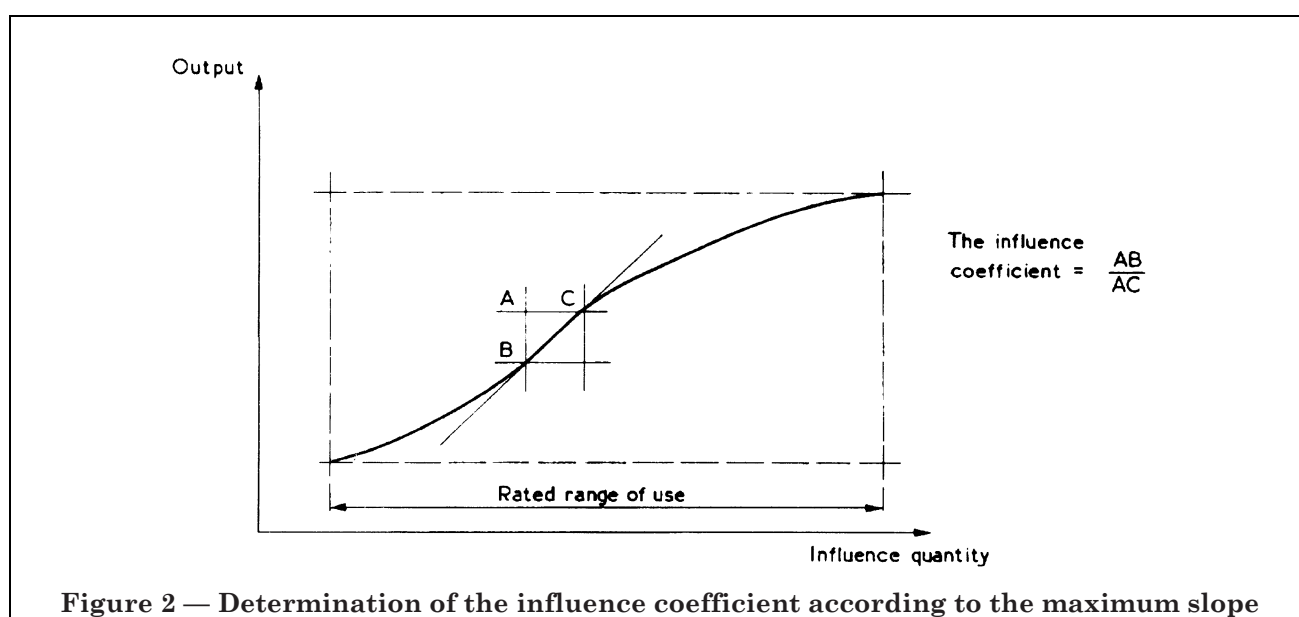
2.4.7**variation**

the difference between the values of a parameter when one influence quantity assumes successively two specified values within its rated range of use, the others being at reference conditions

2.4.8**influence coefficient**

the change in value of an output quantity per unit of one influence quantity with all other influence quantities maintained constant at reference conditions

NOTE The influence coefficient will always be given as the maximum slope of the characteristic (see Figure 2).



2.5 Waveform distortion

Definitions relating to waveform distortion may be included in a future edition of this standard. Suitable tests are described in 8.3.

2.6 Temperature performance

2.6.1

ambient temperature

the temperature of the medium in which the supply apparatus is immersed, usually the temperature of the air surrounding the apparatus

NOTE 1 The manufacturer will normally specify a permissible ambient temperature which must not be exceeded during operation of the power supply.

NOTE 2 For forced-cooled units, the ambient temperature is the temperature measured at the cooling intake.

2.6.2

thermal equilibrium

a state under which the internal temperature of a supply apparatus does not change significantly

2.6.3

settling time

the time interval between a change of an influence quantity or output setting and the point where changes of an output quantity are due only to drift or PARD (see 2.8.1)

2.6.4

warm-up time

the time interval after switching on the supply apparatus under specified conditions, necessary for it to comply with all performance requirements

2.7 Transient performance

2.7.1

overshoot amplitude

the difference between the peak value of a transient excursion of an output quantity, and its rated or final value

NOTE This concept is used in this standard only if the excursion is outside the limits of operating error.

2.7.2

recovery time

the time interval between the occurrence of a step change and the moment when the value of the output quantity enters and remains within the limits of operating error

Explanation of symbols used in Figure 3.

A = output amplitude.

I = influence quantity.

t = time.

A_1 = initial output amplitude, existing prior to step change.

ΔA = steady-state variation.

A_N = rated output value.

B_N = operating error band, centered about A_N .

O_N = overshoot amplitude with respect to rated value A_N .

I_1, I_2 = influence quantity before and after step change which affects output.

T_R = recovery time.

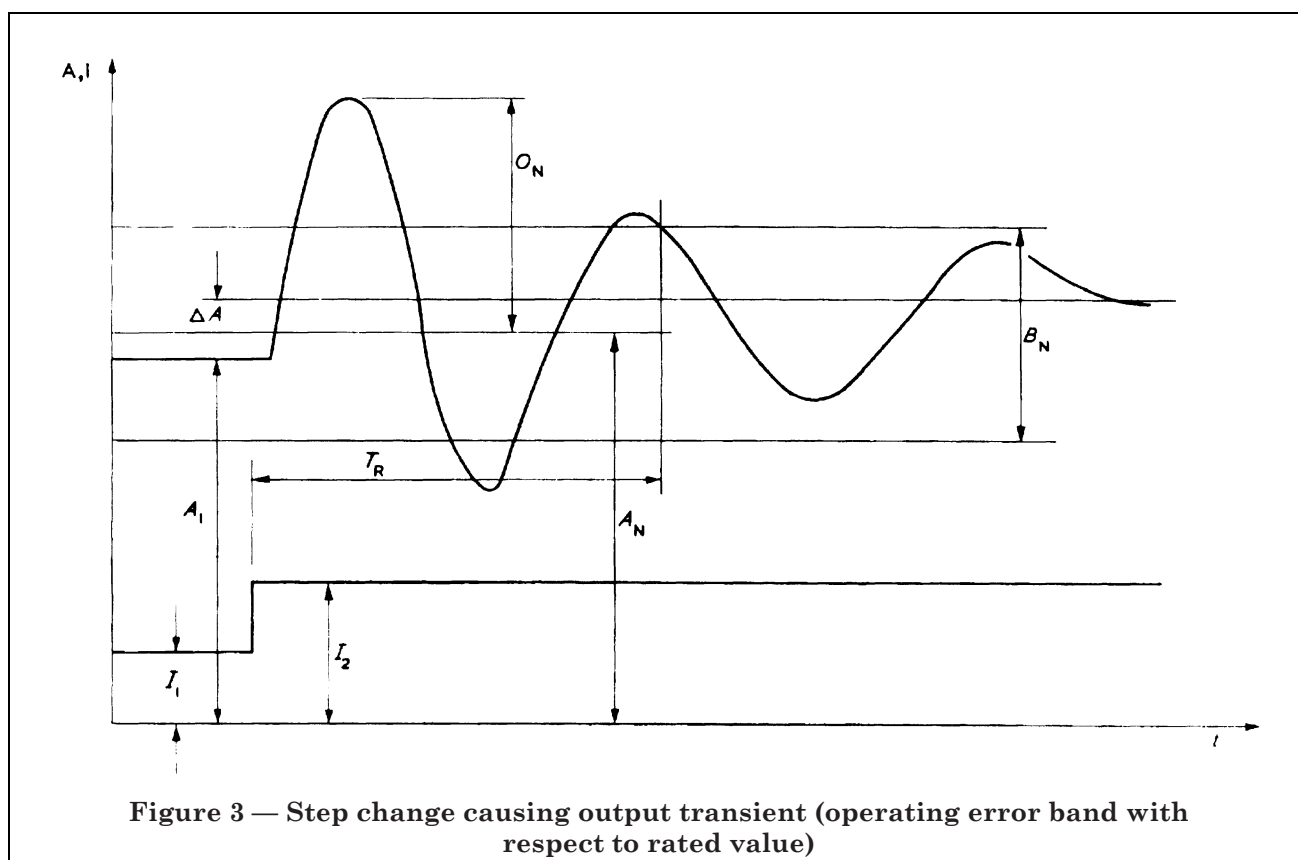


Figure 3 — Step change causing output transient (operating error band with respect to rated value)

2.8 Random and periodic deviations

2.8.1 PARD

The Periodic and Random Deviations of a d.c. output quantity from its average value, over a specified bandwidth, with all influence quantities and influencing characteristics maintained constant.

NOTE PARD may be stated in r.m.s. and/or peak-to-peak values for a specified bandwidth.

2.8.1.1

ripple

the periodic portion of PARD, usually harmonically related to the input mains frequency and/or internally-generated switching frequencies

2.8.1.2

noise

the random portion of PARD

NOTE For noise not primarily of thermal origin (switching noise, quantizing noise etc), it is desirable in order to describe the phenomenon to state the characteristics of the distribution law.

2.8.2

drift

the (unwanted) generally slow and continuous change in a supplied quantity during a specified time, other conditions remaining constant

NOTE Drift includes both periodic and random deviations over the bandwidth from zero frequency (d.c.) to a specified upper frequency limit. This specified upper frequency limit for drift should coincide with the lower frequency limit for PARD, so that all deviations under constant operating conditions are covered by one or the other specification.

2.9 Impedance (of circuits and insulation)

2.9.1 output impedance

The complex ratio of a sinusoidal voltage and sinusoidal current at the output terminals, the one being caused by the other and being of external origin.

NOTE It is a function of their frequency.

2.9.1.1

output resistance

the ratio of an incremental change of d.c. output voltage to an incremental change in d.c. output current; the one being caused by the other and being of external origin

2.9.2

capacitance to frame

the capacitance measured between a specified terminal and a common point such as frame, guard, or ground

2.9.3

transfer capacitance

the capacitance measured between the specified input terminals and output terminals

NOTE Sometimes referred to as "leakage capacitance".

2.9.4

output capacitance

in general, the capacitance measured between the output terminals. In particular, when the supply circuit employs a capacitor across the output terminals, the rated value of that capacitor

2.9.5

maximum floating voltage

for a floating output or input (control input) the maximum voltage that may be permanently maintained between the specified terminals and the frame

2.9.6

insulation resistance

the resistance measured between any pair of specified points insulated from one another

2.10 Controlled operation

2.10.1 control behaviour

Behaviour related to output changes resulting from intentional control by a human operator or by an electrical signal or a mechanical input.

2.10.1.1

discontinuous control resolution

for discontinuous control (e.g. by means of switches, wire wound adjustable resistors), the maximum increment in the value of a stabilized output quantity arising from the smallest reproducible control element step

2.10.1.2

incremental control coefficient

the ratio of an incremental change in a stabilized output quantity to the incremental change in control knob position causing it

2.10.2

control overshoot

an overshoot resulting from a step change in output control setting