

International Standard



8158

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Evaluation of the performance characteristics of gas analysers

Évaluation des caractéristiques des analyseurs de gaz

First edition — 1985-09-01

UDC 543.271

Ref. No. ISO 8158-1985 (E)

Descriptors : gas analysis, analysers, tests, performance tests.

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8158 was prepared by Technical Committee ISO/TC 158, *Analysis of gases*.

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Evaluation of the performance characteristics of gas analysers

1 Scope and field of application

This International Standard defines the main instrumental characteristics to be taken into consideration during the evaluation of gas analysers (continuous and discontinuous) and indicates the general principles and procedures of the test methods to be used in this evaluation. However, for some commercial transactions between manufacturers and users, the routine tests detailed in IEC document IEC/SC 66 D (Secretary) 20, *Expression of performance of gas analysers — Part 1: General* can be applied.

It can act as a guide to the official certification of gas analysers which comes within the scope of national legal metrology services.

2 General test conditions

2.1 Principle of an evaluation

Tests intended to determine the metrological characteristics consist in observing the operation and the indications of the instrument when it is receiving sequences of samples of gas of either known or stable and reproducible composition during the measuring period.

The environmental conditions under which the instrument is evaluated shall be known and recorded. Tests are applied to an instrument assembly that is defined and considered as a single entity (black box) for which the relation between the input and output is studied.

Generally separate aspects of the input/output relation of the instrument are studied by initiating an appropriate change in the input sample composition and observing the corresponding output signal. The procedure used should be suitably described and should be the most reliable possible. It should be based on the use of calibration gas mixtures, where these exist, the

preparation of which has been laid down by ISO/TC 158/SC 1, *Methods of preparation and definition of gas mixtures for calibration* (see the annex for a list of available documents on this subject).

A single evaluation is defined by the following items:

- description of the measuring assembly;
- installation of the analyser;
- definition of measuring sequences;
- environmental conditions;
- test mixtures;
- calibration procedure,

and depends **strongly** in particular on the definition of the **measuring sequence** within time.

These conditions are fixed at the beginning of the evaluation procedure not too far from usual operating conditions.

The principle of processing of the obtained data is given for every characteristic, without fixing in detail the acquisition and processing methods.

The values obtained are influenced by the imperfections of the test methods, including acquisition and processing of the data, and only represent estimates of those characteristics within the capabilities of the test equipment.

The significance of the results of tests carried out on a single analyser during a short period of time is obviously limited. It is indeed possible that for a given apparatus the results vary as a function of time and that these results are not always identical for two sets of apparatus of the same type. If it can be done, a repetition of tests enables this drawback to be limited.

2.2 Description of the measuring assembly to be evaluated

Gas analysers are generally complex measuring trains consisting of

- a system for sampling and transfer lines;
- a sensing cell or transducer;
- a system for processing the signals (for example an amplifier);
- an output assembly for reading, recording or data processing.

The same type of analyser can be used in many different applications with appropriate modifications of the measuring assembly. For a given evaluation all the separate points of the measuring assembly listed above shall therefore be clearly stated.

2.3 Installation of the analyser

Before operating the analyser, the user shall comply with the manufacturer’s operating instructions particularly with regard to the installation of equipment and the quality and quantity of the consumable products necessary. Evaluation of the analyser shall furthermore be performed taking account of the warm-up time.

2.4 Continuous and discontinuous analysers — Definition of measuring sequences

According to the characteristic to be evaluated, it may be necessary to distinguish between analysers with continuous and discontinuous response.

For analysers with a continuous response, each measurement from 4.2 onwards shall be carried out under stable conditions, i.e. after a waiting time t_1 which is long enough for the analyser to become stable. The value of measurement is taken as the mean value of the signal over a time interval t_2 ; t_1 and t_2 are fixed and recorded by the experimenter, they are chosen taking account of the dynamic response characteristics in order to obtain a significant measurement under stationary conditions.

The mean of the signal obtained over the time interval t_2 defines, by convention, an independent measurement. Each independent measurement is obtained after performing a complete cycle determined on the basis of t_1 and t_2 .

For analysers with a discontinuous response, each measurement will be carried out during an interval of time corresponding to a specified number of sequences and located beyond the response time.

2.5 Environmental conditions

According to the characteristic to be evaluated, tests shall be carried out either under laboratory conditions, i.e. environmental conditions considered as stable and with little constraint, or under extreme environmental conditions simulated in the laboratory. In the two cases, the conditions are known and reported, and if possible fixed. Tests in the field are not covered by this International Standard.

2.5.1 Tests under laboratory conditions

The reference conditions for testing shall be within the following limits:

- temperature: between 17 and 29 °C;
- relative humidity: between 45 % and 75 %;
- pressure: local atmospheric pressure;
- electrical supply.

The conditions of supply (system voltage, supply frequency, distortion of the supply with alternating current) can be selected from one of the categories of use given below (in accordance with IEC Publication 359, *Expression of the functional performance of electronic measuring equipment*).

However, under certain special conditions (apparatus operating conditions, national regulations) different values may be chosen.

2.5.1.1 System voltage (with distortion of the wave-form)

Reference value Tolerance on reference value Nominal region of operation Limit area of operation	Direct or alternating current (effective value)	Alternating current (peak value)
	Nominal voltage ± 1 % ± 10 % II – 12 % to + 10 % III – 20 % to + 15 %	Nominal voltage ± 2 % ± 12 % – 17 % to + 15 % – 30 % to + 25 %
	Identical with the nominal region of operation, unless otherwise specified.	