
INTERNATIONAL STANDARD



2810

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Paints and varnishes — Notes for guidance on the conduct of natural weathering tests

Peintures et vernis — Notes indicatives sur la conduite des essais de vieillissement naturel

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

International Standard ISO 2810 (originally ISO/DIS 2810 and Annex A) was drawn up by Technical Committee ISO/TC 35, *Paints and varnishes*, and circulated to the Member Bodies in May 1972 (DIS 2810) and in September 1972 (Annex A).

It has been approved by the Member Bodies of the following countries :

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The Member Body of the following country expressed disapproval of the document on technical grounds :

Canada

* DIS 2810 only.

** Annex only.

*** Disapproved the Annex.

Paints and varnishes — Notes for guidance on the conduct of natural weathering tests

0 INTRODUCTION

This International Standard is one of a series dealing with the sampling and testing of paints, varnishes and related products. It should be read in conjunction with ISO 1512, *Paints and varnishes — Sampling*, ISO 1513, *Paints and varnishes — Examination and preparation of samples for testing*, ISO 1514, *Paints and varnishes — Standard panels for testing*, and ISO 2808, *Paints and varnishes — Determination of film thickness*.

When natural weathering tests are carried out, the following supplementary information shall be supplied. This information shall be derived from the national standard or other document for the product under test or, where appropriate, shall be the subject of agreement between the interested parties.

- 1) Material and thickness of substrate.
- 2) Method of preparation of substrate and method of application of the test coating.
- 3) Thickness of coating, in micrometres, whether it is to be a single coating or a multicoat system, and whether both sides of the specimen are to be coated with the product under test.
- 4) Conditions of drying of coated test specimen (or conditions of stoving and ageing, if appropriate), intervals between coats and period of conditioning before exposure.
- 5) Whether bare areas are to be provided on the specimen and if so, their size and position and by what means they are to be made.
- 6) Details of any periodic washing or polishing procedure to be carried out during the course of exposure.
- 7) Any particular requirements regarding the location of the exposure.
- 8) The duration of the test and which characteristics of the product under test are to be considered in evaluation of its performance and, where requested, the method of removal of the coating from the substrate.

For short term tests see 2.4.

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the factors which need to be taken into consideration in the selection of methods for the exposure to natural weathering of paint films or systems for the purpose of evaluating their durability.

As far as is possible, a method is specified which is recommended for use where no specialized requirements apply.

NOTE — An annex gives information on the characterization of exposure sites.

2 GENERAL

2.1 Durability can be defined as the degree to which paint films or systems withstand the destructive effect of the conditions to which they are exposed. It is influenced by the manner, place and season in which the paint is exposed, and these factors must be given due consideration in selecting a test procedure appropriate to the proposed end-use of the product under test.

2.2 In particular, the factors to be considered include the following :

- 1) Location of the exposure site, for example, industrial, marine, rural, etc. In choosing sites, local gross influences on the general level of pollution shall be avoided, unless they are appropriate to the proposed end-use of the product under test.
- 2) Height, angle and aspect of exposure rack. These factors will govern the extent to which the specimens are affected by dew, frost, atmospheric pollutants, etc.
- 3) The nature of the terrain on which the rack is constructed (for example, concrete, grass, gravel, etc.). This may well affect the climatic conditions around the specimen under test. It would rarely be feasible to select an ideal terrain in practice, but the effect of any such variations will be minimized by ensuring that all specimens are situated sufficiently above the ground to avoid any interference (see 4.5).
- 4) Whether the performance of the paint on the face or the back of the specimen is of greater interest. Certain types of breakdown, for example, corrosion and mould growth, are frequently more severe on the sheltered parts of the specimen.

5) The end-use of the material, including its substrate and whether the film is to be washed or polished in service.

2.3 The results of test on an exposure rack will refer precisely only to the environment in which they were tested although, in practice, products will generally be used under a wide range of natural conditions. Provided that the test conditions are reasonably appropriate to the proposed end-use however, the relative performance of a number of products tested at the same time will enable valid deductions to be drawn. It is therefore desirable that a series of specimens for evaluation shall include one or more products of known performance to act as a standard of comparison.

2.4 The results of exposure tests may vary according to the time of year during which the tests are carried out, although the effect will be minimized if the exposure period is sufficiently long to "average out" any variations. It may be necessary in the case of exposure periods of less than a year, to carry out further tests, say 6 months later, if full characterization of the product is to be achieved.

2.5 Although the normal practice is to carry out exposure tests for a fixed period of time it may be preferable in certain circumstances, particularly for the determination of certain optical characteristics, to define the test period in terms of the quality and quantity of solar radiation to which the specimen is to be subjected. This procedure may in part overcome the seasonal variations referred to in 2.4.

2.6 Care is required in the selection of test specimens of variable substrates, for example, wood or weathered steel, and in these cases replication of the tests is essential if misleading results are to be avoided.

2.7 Washing and polishing will vary different aspects of durability and results obtained using these procedures shall be interpreted with caution unless the treatment is appropriate to the end-use of the product.

3 PREPARATION OF TEST SPECIMENS

3.1 The simplest and most widely used test specimen is a flat panel of the appropriate substrate, but much useful additional information may be obtained by carrying out exposure tests on structures. This is particularly so on wooden assemblies such as window frames, where paint performance at the joints is of interest. Design features which allow entrapment of water may also lead to premature paint failure, and assessment of performance under these conditions would normally involve the use of test specimens which closely reproduce the features of interest.

3.2 Unless otherwise stated, use an appropriate panel complying with and prepared in accordance with ISO 1514. In no case shall the area of the panel be less than 0,03 m² and no side shall be less than 100 mm.

3.3 Coat the specimen with the product(s) under test by the appropriate method and dry (or stove and age) each coat in the specified manner for the specified time. If normal drying conditions are specified these shall be interpreted as 23 ± 2 °C and relative humidity of 50 ± 5 % in a vertical position with free circulation of air and not exposed to direct sunlight.

3.4 It is generally preferred that both faces and the edges of test panels be coated with the product under test, unless it would not be so used in practice.

Alternatively, the back and edges may be coated with a good quality protective paint [see 2.2 (4)].

3.5 If specified, particularly in the case of corrosion tests, provide uncoated areas on the specimen preferably by one or more of the following methods :

3.5.1 After the specified drying time and immediately before placing the specimens on the exposure rack, make a scratch in the paint film, so as to expose the substrate. The scratch shall be made with a steel scribe, between 0,5 and 1 mm in width and ground to a chisel edge.

3.5.2 Before applying the product(s) under test, attach to the prepared specimen a strip of self-adhesive masking tape of agreed size and location. Coat the specimen in the normal way. After the specified drying time, and immediately before placing the specimen on the exposure rack, remove the masking tape. Clean off any residues of adhesive with a suitable solvent which does not affect the paint.

3.5.3 In the case of a standard test panel, coat the face or faces with the product under test, but leave the edges bare.

3.6 Determine the film thickness using one of the methods described in ISO 2808.

4 EXPOSURE RACKS

4.1 Exposure racks shall usually support the panels at an angle of 45° to the horizontal and facing toward the equator. In special circumstances, for example, the testing of textured wall finishes, vertical exposure may be preferred. By agreement other exposure angles or orientations may be adopted.

4.2 The racks shall be so situated that the specimens are not protected or overshadowed by neighbouring objects.

4.3 The construction of the racks shall be such that the backs of the specimens are freely exposed to the atmosphere and such that water drainage does not occur from one panel to another.

4.4 Specimens shall not be in electrical contact with metals during the exposure period, nor as far as possible in direct contact with wood or other porous material. A

suitable method of mounting panels is shown in figure 1. If panels are supported in grooves, then suitable drainage holes shall be provided to prevent accumulation of water.

4.5 Unless otherwise stated the racks shall be so constructed that all specimens are supported not less than 1 m above the level of the site. This will avoid any interference due to the nature of the terrain [see 2.2 (3)] or from tall vegetation on infrequently visited sites, and will avoid the possibility of contamination from splashing during heavy rainfall.

5 PROCEDURE

5.1 After the specified conditioning time expose the specimen on the rack for the specified time (see 2.5).

5.2 If specified, wash the whole or part of the specimen at the required intervals. It is preferable to wash a strip on the right or left of the panel face, rather than the top or bottom, although there may be reasons for defining the particular area selected. Where no specialized washing procedure is required, it has been found suitable to use distilled water containing 0,5 % of a neutral wetting agent. The solution may be applied with a soft brush, finally rinsing the surface thoroughly with distilled water.

5.3 If specified, wash as described in 5.2 and polish the whole or part of the specimen at the required intervals, using the specified polish.

5.4 Examine the test specimen at intervals, separately noting effects on front, back, edges or bare areas as appropriate. Examinations shall be at intervals appropriate to the rate of breakdown for change of colour, loss of gloss,

blistering, etc., of the paint film and for signs of corrosion of the substrate. Also examine at a magnification of about X25 for checking, cracking, blistering, etc., of the paint film and for signs of corrosion of the substrate. Examine for signs of chalking by wiping a small area of the surface with a piece of velvet of contrasting colour.

5.5 After the specified period of exposure, carry out a final examination of the coating. If it is required to examine the substrate for signs of attack, remove the coating by the specified method.

6 TEST REPORT

The test report shall include the following particulars :

- a) a reference to this International Standard or to a corresponding national standard;
- b) type and identification of product under test;
- c) the items of supplementary information referred to in the introduction to this International Standard;
- d) the national standard or other document supplying the information referred to in c) above;
- e) any deviation from the agreed test procedure;
- f) the results of the test in terms of the stated requirements;
- g) site and period of exposure and the date of its commencement.

It is preferred that wherever possible, the test report shall also contain :

- h) data concerning exposure conditions as given in the annex.

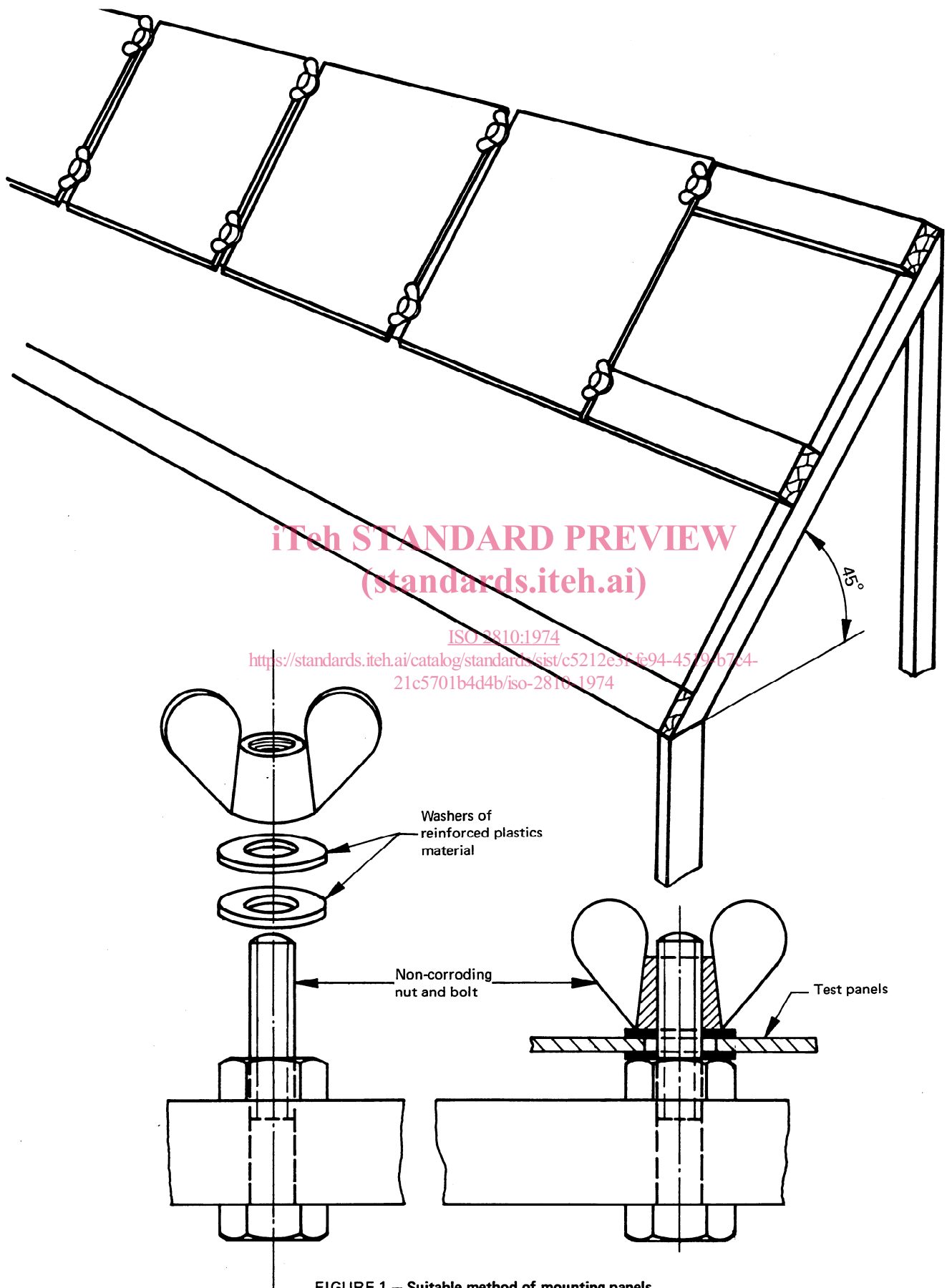


FIGURE 1 – Suitable method of mounting panels

ANNEX

INFORMATION ON EXPOSURE SITES

A.1 DEFINITION OF CLIMATIC AND ENVIRONMENTAL PARAMETERS OF EXPOSURE SITES

Natural climatic data as well as the various sources of pollution should be qualitatively and quantitatively defined.

A.1.1 Climatic data

The nature of the climate should where possible be defined in terms of the following classification and the altitude above sea level should also be stated.

NOTE – It is not possible to cover all climates using a reasonably simple scheme and where climates occur which do not fit into the scheme below, special reference to them should be made.

A.1.1.1 Humid tropical climates (mean temperature of coldest month above 18 °C and a relative humidity above 75 % for a substantial part of the year)

- 1) tropical climate without dry season;
- 2) tropical climate with dry season.

A.1.1.2 Tropical climates (mean temperature of coldest month above 18 °C and a relative humidity below 75 % for a substantial part of the year)

A.1.1.3 Very dry climates (conditions not permitting the growth of trees)

- 1) steppe climate;
- 2) desert climate.

A.1.1.4 Warm temperate climates (mean temperature of coldest month between 3 and 18 °C)

- 1) warm temperate climate without dry season;
- 2) warm temperate climate with dry summer (Mediterranean climate);
- 3) warm temperate climate with dry winter.

A.1.1.5 Cold temperate climates (mean temperature of coldest month below 3 °C and of warmest month above 10 °C)

- 1) cold temperate climate without dry season;
- 2) cold temperate climate with dry winter.

A.1.1.6 Polar climates (mean temperature of warmest month below 10 °C)

- 1) tundra climate (mean temperature of warmest month above 0 °C);
- 2) permafrost climate (mean temperature of warmest month below 0 °C).

A.1.1.7 High mountain climates (high UV radiation and large daily and seasonal variations in temperature)

A.1.2 Classification of sources of atmospheric pollution

The sources of atmospheric pollution should be stated and, in particular, whether the pollution is acid or alkaline in nature.

The sources of atmospheric pollution may be defined according to the following list :

- a) natural pollution (mineral, vegetable, animal or microbe);
- b) pollution due to land, maritime and air transport;
- c) pollution due to the incineration and treatment of urban refuse;
- d) pollution from the waste of various industries;
- e) pollution from domestic and industrial heating.

The environments may then be classified in terms of these different sources of pollution into the following principal types :

- 1) urban;
- 2) industrial;
- 3) marine;
- 4) rural;
- 5) mixed (industrial-marine, urban-rural, etc.)

A.2 MEASUREMENT OF CLIMATIC PARAMETERS AND ATMOSPHERIC POLLUTION**A.2.1 Measurement of climatic parameters**

It is recommended that the temperature, relative humidity, amount of precipitation, direction and speed of wind, mean daily sunshine and total incident radiation be continuously recorded.

The exacting nature of these measurements generally leads to the use of data from organizations and meteorological centres nearest the site concerned.

A.2.2 Measurement of atmospheric pollution

In the interests of simplicity, it is recommended that the measurement of pollution be limited to the following :

- 1) acidity;
- 2) deposits of solid matter;
- 3) amounts of chlorides and sulphates.

NOTES

1 As far as possible it is advisable to indicate each source of pollution on a map in relation to the test site.

2 It should be appreciated that there is considerable current development in the field of atmospheric pollution measurement.

A.2.2.1 Measurement of acidity of the atmospheres

Examples of suitable methods for trapping acidic products such as SO_4^{2-} , Cl^- , NO_3^- , F^- , are as follows :

A.2.2.1.1 HIGH ACIDITY METHOD

A given volume of air is sampled and washed in a flask containing a suitable solution of hydrogen peroxide (sulphur dioxide is oxidized to sulphuric acid). The acidic ions contained in the sample may then be determined in the laboratory. The equivalent, as sulphur dioxide, of the amount of "acid gas" contained in the sampled air is then determined in the laboratory. A suitable apparatus is shown in figure 2.

A.2.2.1.2 LECLERC METHOD

The sampling device, a strip of filter paper impregnated with a solution of sodium hydrogen carbonate in glycerol, is placed for a given period of time on the site. The amounts of the ions SO_4^{2-} , Cl^- , NO_3^- , F^- in the impregnating liquid are then determined in the laboratory by conventional means.

A.2.2.2 Measurement of solid deposits

Examples of suitable methods for determining atmospheric dust are as follows :

A.2.2.2.1 DETERMINATION OF SOLID CONTENT OF BLACK SMOKE

The measurement is carried out using the apparatus described in A.2.2.1.1, the filter C trapping the dust. The intensity of the stain on the filter paper is compared with

previously prepared standards. Alternatively it may be measured photometrically and related to the amount of solid matter by reference to a calibration graph.

A.2.2.2.2 DETERMINATION OF DEPOSITS USING SAMPLING PLATES

The collecting device is an aluminium plate, smeared with petroleum jelly. It is exposed for a standard period of time, then sampled for laboratory analysis. The coating is washed off with a suitable solvent and the solid material recovered by centrifuging and weighing.

A.2.2.3 Determination of amount of chlorides and sulphates

Examples of suitable methods are as follows :

A.2.2.3.1 THE AMBLER METHOD

The collecting device is shown in figure 3. Chlorides and sulphates are collected by a candle of absorbent gauze or filter paper, partially immersed in a 1 + 1 solution of glycerol in distilled water. After a standard period of time, their concentrations in the solution are determined in the laboratory by conventional means.

A.2.2.3.2 THE IRSID METHOD

This method involves the collection of chlorides and sulphates on a trough, from which they are washed into a flask by the rain or by regular washing (figure 4). The amounts deposited may then be determined in the laboratory by conventional means.

A.3 DIRECT ASSESSMENT OF THE AGGRESSIVENESS OF AN EXPOSURE SITE

The aggressiveness of an exposure site cannot be related simply and solely to measurement of its climatic and environmental parameters since the microclimate may have a significant effect. It is recommended, therefore, that aggressiveness be evaluated directly by measurement of mass loss, variation of mechanical properties and depth of pitting of reference materials, such as steel, copper, zinc and aluminium or by exposing standard paint systems of known characteristics. Each lot of specimens tested should be replaced by another lot of new identical test pieces in a continuing sequence.

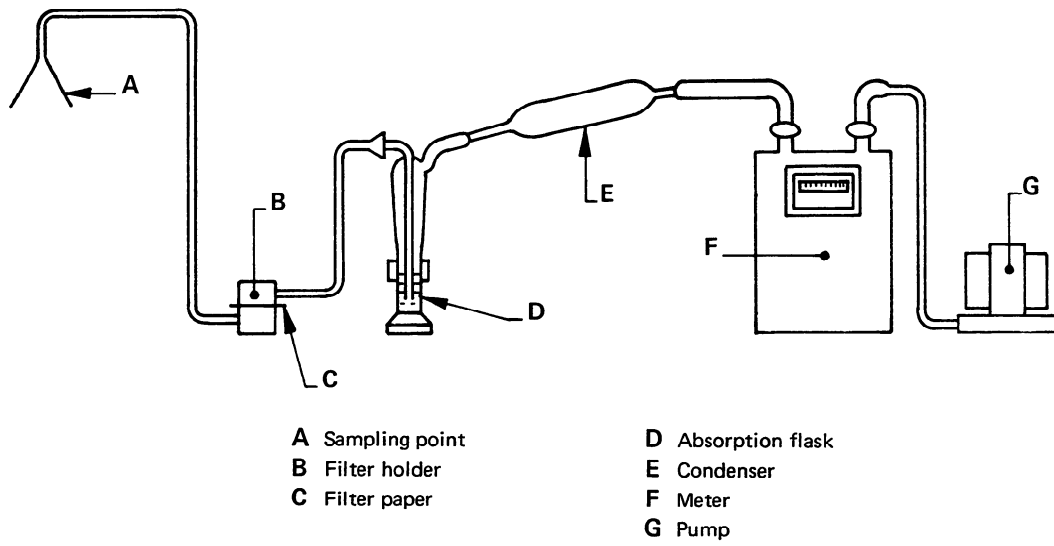


FIGURE 2 – Apparatus for high acidity method

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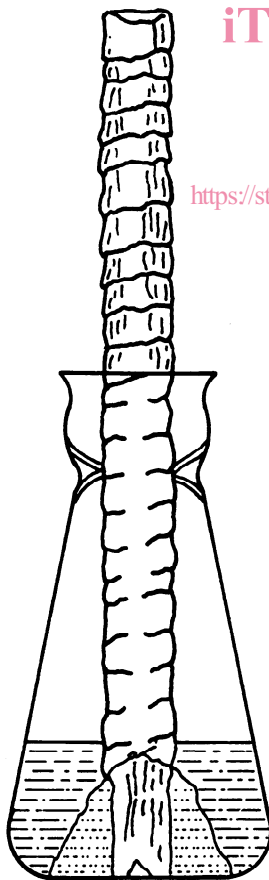


FIGURE 3 – Apparatus for Ambler method

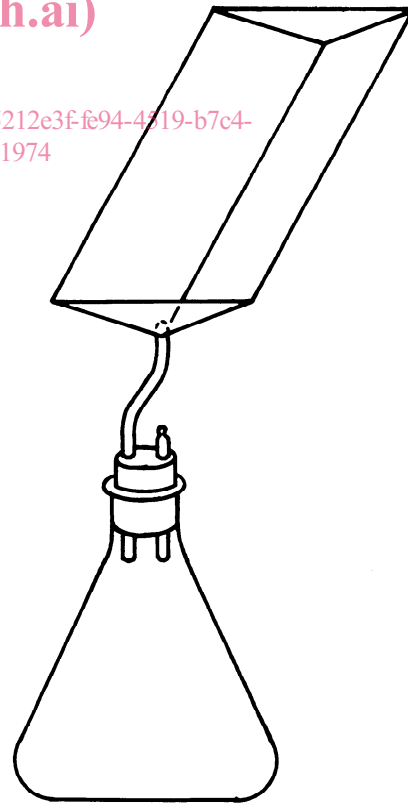


FIGURE 4 – Apparatus for Irsid method