# INTERNATIONAL STANDARD

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# Plastics piping systems — Glass-reinforced plastics (GRP) components — Determination of the amounts of constituents using the gravimetric method

*Systèmes de canalisations en matières plastiques — Composants plastiques renforcés de verre (PRV) — Détermination des teneurs des constituants par la méthode gravimétrique*



Reference number
ISO 7510:1997(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 7510 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 6, *Reinforced plastics pipes and fittings for all applications.*

This International Standard is technically identical to EN 637:1994.





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# Plastics piping systems — Glass-reinforced plastics (GRP) components — Determination of the amounts of constituents using the gravimetric method

## 1 Scope

This International Standard specifies a method for the determination of constituent materials of a test sample cut from a glass-reinforced plastics (GRP) component intended for use in a piping system. It includes determination of resin, glass, aggregate and filler contents, and determination of the type and arrangement of the constituent glass layers.

Two burning temperatures are given, related to the stability of the glass reinforcement at elevated temperatures.

Application to other composite components should be considered in the referring standard.



## 2 Principle

A test piece of known size and mass is heated to burn off the resin, and the residue analysed by separating and weighing the constituents.

NOTES

1 In the case of filled laminates, especially those containing fillers of small particle size (including thixotropic agents), accurate analysis of the constituents may prove difficult. This is because of the difficulty in separating such fillers from the other constituents and the risk of some filler being lost during combustion.

2 It is assumed that the following test parameters are set by the standard making reference to this standard:

a) whether or not the types of glass reinforcement are to be separated [see item c) of 5.6 and item h) of clause 7];

b) details of the grammage and/or presence of synthetic fibre veil, if known (see 5.8 and 6.6);

c) whether or not the glass content of each layer is to be determined (see 6.2);

d) whether or not the filler content is to be determined (see 6.5).

## 3 Apparatus

**3.1 Crucible**, of a suitable material and dimensions (see 4.1).

**3.2 Oven**, capable of maintaining a temperature of 105 °C to 110 °C.

**3.3 Electric muffle furnace, or microwave furnace**, capable of maintaining a temperature between 450 °C and 650 °C with an accuracy of ±20 °C.

**3.4 Bunsen burner**.

**3.5 Desiccator**.

**3.6 Balance**, accurate to 1 mg.

**3.7 Sieves**, of suitable mesh [see 5.6 item b)].

## 4 Test piece



### 4.1 Dimensions

The dimensions of the test piece shall be in accordance with the manufacturer's recommendations but not less than 60 mm by 40 mm in area and shall be the full thickness of the component from which the test piece was taken. It shall be cut square, have smooth edges and be free from dust.



### 4.2 Number

The number of test pieces shall be as specified in the referring standard.

## 5 Procedure

NOTE - Conditioning of the test piece is not required.

**5.1** Measure the axial and circumferential dimensions of the test piece to the nearest 0,1 mm. Calculate and record the area $A$, in square metres.

**5.2** Heat the crucible in the furnace to (625 ± 20) °C for 15 min. Cool in the desiccator and weigh to the nearest 10 mg. Record the mass, in grams, as $m_1$.

**5.3** If a test piece is derived from a component within 36 h of manufacture, the following drying procedure may be omitted (in which case proceed to 5.4), otherwise dry the test piece as follows.

Heat the crucible and test piece in the oven to between 105 °C to 110 °C for 2 h. Cool the crucible and test piece in the desiccator and weigh to the nearest 10 mg.

Repeat the heating for periods of 30 min until the mass is constant to within 10 mg. Record this total mass, $m_2$, in grams.

**5.4** Heat the crucible and test piece in a bunsen flame, a muffle or microwave furnace until the contents ignite. Maintain the temperature so that the test piece burns uniformly.

Take care to prevent the combustion proceeding so rapidly that there is a loss of non-combustible residue, such as filler.

**CAUTION - Avoid breathing the potentially noxious vapours.**



**5.5** Heat the crucible and residue in the muffle or microwave furnace at (625 ± 20) °C, or, if the reinforcement is unstable at 625 °C, at (550 ± 20) °C until all carbonaceous material has disappeared. Cool the crucible and residue in the desiccator and weigh these to the nearest 10 mg.



Repeat these operations until a mass constant to within 10 mg is obtained. Record the total mass, $m_3$, in grams.

NOTE - The time taken for the carbonaceous residue to disappear is largely dependent on the test piece shape. It can be 6 h or more, but is usually much less.

**5.6** Separate the residue $m_3$ into its constituents as follows:

a) Separate the layers using tweezers or a spatula, noting the number of layers and their layout.

b) For each layer, separate its constituents by scraping, shaking, brushing and/or sieving.

NOTE - If the quantity of filler is to be determined then suitable analytical techniques should be employed to separate the filler from the other residue.

c) If required, separate the various types of glass reinforcement.

**5.7** Determine the masses of the constituents as follows:

a) weigh the aggregate to the nearest 10 mg and record the mass, $m_4$, in grams;

b) to the nearest 10 mg, weigh and record the total mass of glass, $m_{5t}$, in grams, and, if required, weigh to the nearest 10 mg the various types of glass and record the corresponding masses as $m_{5a}$, $m_{5b}$, etc, in grams;

c) weigh the filler to the nearest 10 mg and record the mass, $m_6$, in grams.

**5.8** If the presence and grammage of any synthetic fibre veil included in the construction of the laminate is known or can be determined, estimate its mass, in grams, from the area of the test piece and the mass per unit area of the veil used. Record the estimated mass, $m_7$, in grams.

## 6 Calculation and expression of results

**6.1** Calculate the total glass content, $\Psi_{G,t}$, expressed as a percentage by mass, using the following equation:



$$\Psi_{G,t} = \frac{m_{5t}}{m_2 - m_1} \times 100$$



**6.2** If required, calculate the glass content of each individual layer, $\Psi_{G,a}$, $\Psi_{G,b}$, $\Psi_{G,c}$, ..., expressed as a percentage by mass, using the applicable equation from the following series:

$$\Psi_{G,a} = \frac{m_{5a}}{m_2 - m_1} \times 100, \quad \Psi_{G,b} = \frac{m_{5b}}{m_2 - m_1} \times 100, \quad \ldots$$

**6.3** Calculate the resin content, $\Psi_R$, expressed as a percentage by mass, using the following equation:

$$\Psi_R = \frac{(m_2 - m_3 - m_7)}{m_2 - m_1} \times 100$$

NOTE – The determined mass of resin will include any glass sizing removed during combustion.

**6.4** Calculate the aggregate content, $\psi_A$, expressed as a percentage by mass, using the following equation:

$$\psi_A = \frac{m_4}{m_2 - m_1} \times 100$$

**6.5** If required, calculate the filler content, $\psi_F$, expressed as a percentage by mass, using the following equation:

$$\psi_F = \frac{m_6}{m_2 - m_1} \times 100$$

**6.6** Calculate the estimated synthetic veil content (see 5.8), $\psi_V$, expressed as a percentage by mass, using the following equation:

$$\psi_V = \frac{m_7}{m_2 - m_1} \times 100$$

**6.7** Calculate the total mass of glass, $m_{G,t}$, in grams per square metre, of the laminate using the following equation:



$$m_{G,t} = \frac{m_{5t}}{A}$$



**6.8** If required, calculate the individual masses of glass, $m_{G,a}$, $m_{G,b}$, $m_{G,c}$, ..., in grams per square metre, of each individual layer of the laminate using the applicable equation from the following series:

$$m_{G,a} = \frac{m_{5a}}{A}, \qquad m_{G,b} = \frac{m_{5b}}{A}, \quad \ldots$$

## 7 Test report

The test report shall include the following information:

a) a reference to this International Standard and the referring standard;

b) the identification of the component tested;

c) the dimensions of each test piece;

d) the test temperatures (see 5.5);

e) whether preliminary drying (see 5.2) was carried out;

f) the percentage by mass of the constituents of the laminate;

g) the total mass of glass, $m_{G,t}$, of the laminate, in grams per square metre;

h) if required, the number of layers, and the type, disposition, layout and individual percentage by mass of each individual glass layer;

i) observations with regard to any irregularities noted during the test, such as excessively rapid combustion (see 5.4) or glass instability (see 5.5);

j) any factors which may have affected the results, such as any incidents or any operating details not specified in this International Standard;

k) the date of test.

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