INTERNATIONAL STANDARD

ISO 2738

Second edition
1987-04-15

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

Permeable sintered metal materials — Determination of density, oil content, and open porosity

Matériaux métalliques frittés perméables — Détermination de la masse volumique, de la teneur en huile et de la porosité ouverte

Reference number
ISO 2738 : 1987 (E)

Foreword

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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 2738 was prepared by Technical Committee ISO/TC 119, *Powder metallurgy.*

It cancels and replaces International Standards ISO 2737 : 1973 and ISO 2738 : 1973, of which it constitutes a technical revision.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Printed in Switzerland

Permeable sintered metal materials — Determination of density, oil content, and open porosity

1 Scope and field of application

This International Standard specifies methods of determining the density, oil content, and open porosity of permeable sintered metal materials.

It applies in particular to porous metal bearings and to structural parts produced by pressing, and sintering metal powders.

2 References

ISO 758, *Liquid chemical products for industrial use — Determination of density at* 20 °C.

ISO 3448, *Industrial liquid lubricants — ISO viscosity classification.*

ISO 3507, *Pyknometers.*

ISO 4495, *Lubricated metallic powders — Determination of lubricant content — Soxhlet extraction method.*

3 Symbols and designations

Table 1

Symbol	Designation	Unit
m_1	Initial mass of the test piece	g
m_2	Mass of the test piece after oil extraction and drying	g
m_3	Mass of the fully impregnated test piece	g
m_4	Mass of the test piece and filled pyknometer with the test piece outside the pyknometer	g
m_5	Mass of the test piece and filled pyknometer with the test piece inside the pyknometer	g
m_a	Mass of the fully or partially impregnated test piece plus supporting device (for example suspension wire) weighed in air	g
m_w	Mass of the fully or partially impregnated test piece plus supporting device (for example suspension wire) weighed in water	g
V	Volume of the test piece	cm^3
ϱ_w	Density of the water used	g/cm^3
ϱ_1	Density of the oil initially in the test piece[1)]	g/cm^3
ϱ_2	Density of the impregnating oil used[1)]	g/cm^3
ϱ_L	Density of the liquid in the pyknometer	g/cm^3

1) The oil density is assumed to be known or, if not, to be determined according to ISO 758.

4 Principle

4.1 Density

The density of the test piece may be expressed in two ways.

4.1.1 Dry density

This is determined by dividing the mass after drying by the volume.

4.1.2 Fully impregnated density (wet density)

This is determined by dividing the fully impregnated mass by the volume.

NOTE — The volume of the fully impregnated test piece (i.e. the total volume including the pores) is determined by liquid displacement methods.

4.2 Oil content

The oil content of the test piece may be expressed in two ways.

4.2.1 As a percentage by volume

This is determined by dividing the volume of the oil by the volume of the test piece and multiplying the ratio by 100.

4.2.2 As a percentage of the volume of the open porosity

This is determined by dividing the volume of the oil by the volume of the open porosity and multiplying the ratio by 100.

4.3 Open porosity

The open porosity of the test piece is expressed as a percentage by volume, by dividing the oil content after full impregnation by the volume of the test piece and multiplying the ratio by 100.

4.4 Volume

The volume of the test piece is determined by weighing the test piece suspended in air, and then weighing the test piece immersed in a liquid of known density.

The volume is calculated as the difference between the two weighing results divided by the density of the liquid.

4.5 Determinations

Depending upon which of the properties is to be determined, some or all of the test procedures in clause 7 are carried out. Table 2 shows the test procedures that are carried out for the property to be determined. The values obtained are inserted in the respective formulae given in clause 8 to obtain the desired property.

5 Apparatus

5.1 Analytical balance, of sufficient capacity, and accurate to 0,01 %.

5.2 Soxhlet extractor, with oil solvent.

5.3 Device for weighing the test piece in air and in liquid.

The liquid is usually water (see figures 1, 2 and 3).

5.4 Vessel, large enough to accommodate the test piece and the device (5.3) for weighing it, containing distilled or deionized water, or preferably degassed water, with 1 or 2 drops of wetting agent added.

5.5 Apparatus for vacuum impregnation of the test piece with oil.

5.6 Impregnation oil, of known density (see ISO 758 for the determination of the density of liquids).

Table 2

Test procedure	Symbol for result obtained	Properties to be determined				
		Density		Oil content		Open Porosity
		Dry	Fully impregnated	% (V/V)	% of open porosity	
Initial weighing of the test piece (7.1)	m_1			X	X	
Extraction of the oil contained in the pores of the test piece (7.2)		X		X	X	X
Determination of the mass of the test piece after oil extraction and drying (7.3)	m_2	X		X	X	X
Full impregnation of the test piece with an oil of known density (7.4)			X		X	X
Determination of the mass of the fully impregnated test piece (7.5)	m_3		X		X	X
Determination of the volume of the test piece (7.6)	V	X	X	X		X