INTERNATIONAL

RECOMMENDATION

OIML R 47

Edition 1979 (E)

Standard weights for testing of high capacity weighing machines

Poids étalons pour le contrôle des instruments de pesage de portée élevée

OIML R 47 Edition 1979 (E)

ORGANISATION INTERNATIONALE
DE MÉTROLOGIE LÉGALE

INTERNATIONAL ORGANIZATION
OF LEGAL METROLOGY

Foreword

The International Organization of Legal Metrology (OIML) is a worldwide, intergovernmental organization whose primary aim is to harmonize the regulations and metrological controls applied by the national metrological services, or related organizations, of its Member States.

The two main categories of OIML publications are:

- **International Recommendations (OIML R)**, which are model regulations that establish the metrological characteristics required of certain measuring instruments and which specify methods and equipment for checking their conformity ; the OIML Member States shall implement these Recommendations to the greatest possible extent;

- **International Documents (OIML D)**, which are informative in nature and intended to improve the work of the metrological services.

OIML Draft Recommendations and Documents are developed by technical committees or subcommittees which are formed by the Member States. Certain international and regional institutions also participate on a consultation basis.

Cooperative agreements are established between OIML and certain institutions, such as ISO and IEC, with the objective of avoiding contradictory requirements; consequently, manufacturers and users of measuring instruments, test laboratories, etc. may apply simultaneously OIML publications and those of other institutions.

International Recommendations and Inter-national Documents are published in French (F) and English (E) and are subject to periodic revision.

This publication – reference OIML R 47 (E), edition 1979 – which is under the responsibility of TC 9/SC 3 *Weights*, was sanctionned by the International Conference of Legal Metrology in 1976.

OIML publications may be obtained from the Organization's headquarters:

Bureau International de Métrologie Légale
11, rue Turgot - 75009 Paris - France
Telephone: 33 (0)1 48 78 12 82 and 42 85 27 11
Fax: 33 (0)1 42 82 17 27
E-mail: biml@oiml.org
Internet: www.oiml.org

Corrigendum January 1982

Some mistakes and omissions have been found in some of the diagrams of weights shown in the Annex of the Recommendation.

In addition, since publication of this Recommendation, weights of new design have been adopted by certain Services of Legal Metrology.

It should be remembered that the diagrams are given only for guidance.

STANDARD WEIGHTS for TESTING of HIGH CAPACITY WEIGHING MACHINES

1. Scope.

This Recommendation applies to standard weights having a nominal value equal to or greater than 50 kg, used for testing (and adjusting, where appropriate) of high capacity weighing machines in accuracy classes (III) (medium) and (IIII) (ordinary), which are defined in International Recommendation n° 3 : Metrological regulations for non-automatic weighing machines.

It sets forth the technical and metrological requirements to which these standard weights must conform.

In particular it establishes the values of the maximum permissible errors for standard weights and minimum densities as functions of the maximum number of scale divisions on the machines to be verified using these weights.

2. Nominal values.

The nominal value of the standard weight is 50 kg, or of the form $k \times 10^n$ kg, where k is generally equal to 1, 2 or 5, and n is whole number equal to or greater than 2.

3. Shape.

The standard weights must have a relatively simple shape, with no sharp edges or corners. They shall not have any cavities liable to cause a rapid accumulation of dirt.

If they are intended to run on a flat surface (or on rails), they must be equipped with roller tracks (or grooves) of limited area.

4. Basis of adjustment.

The standard weights must be adjusted in accordance with the requirements of points 4 and A.3. of the International Recommendation n° 33 : Conventional value of the result of weighing in air [(*)].

[(*)] It should be noted that the reference conditions applicable to the adjustinent of standard weights are as follows:

— standard reference density : 8 000 kg/m^3,
— ambient air density : 12 kg/m^3,
— equilibrium in air at 20 °C, without correction for air buoyancy.

5. Adjusting cavity.

The standard weights must include one or more adjusting cavities.

It must be possible to seal the closure of these cavities ; the closures must be watertight and airtight (e.g. by means of a joint).

The volume of adjusting cavities must be at least equal to 5/100 of the volume of the standard weight.

Furthermore, it is desirable that, after the initial adjustment, a volume of at least 1/100 of the volume of the standard weight remains empty.

6. Material.

Standard weights are in general made of grey cast iron.

They may be made of one or more other materials, provided the provisions of point 8 are observed.

The material used must be of such hardness and strength that they withstand the loads and shocks liable to occur under normal conditions of use.

7. Surface condition.

The standard weights may be coated with materials suitable for providing protection against corrosion by rendering their surface impermeable.

This coating must withstand shocks and atmospheric conditions. Zinc-plating is an example of a coating which meets these recommendations.

8. Metrological characteristics.

The maximum permissible error for the standard weights must not exceed 1/3 of maximum permissible error for the corresponding load considered, on the weighing machine under verification.

These maximum permissible errors for the standard weights must therefore be compatible with the number of scale divisions on the machines which they are intended to verify.

Furthermore, the density of standard weights must be such that a variation of ± 10 % ambient air density, with respect to its reference value (1.2 kg/m^3), does not produce a variation, in the result of weighing the standard weight in air, exceeding 1/4 of its maximum permissible error. (International Recommendation n° 33, point 3).

By way of application of these requirements, the following table gives examples of the relation between :

— the maximum number of scale divisions « n » on weighing machines under verification (assumed to be in accuracy class (III))

— the maximum permissible positive or negative relative error on standard weights used for initial verification of these machines,

and

— the corresponding lower limit for the density of the standard weights.

Maximum number of scale divisions « n » on weighing machines (accuracy class III), capable of verification with the standard weights during initial verification (*)	Maximum permissible positive or negative relative error on the standard weights	Minimum density kg/m^3
1 000	3.3/10 000	1 231
3 000	1.7/10 000	2 087
5 000	1.0/10 000	3 000
10 000	0.5/10 000	4 364

Note : Independent of the requirements concerning the density of the weights, it is desirable to obtain — particularly for reference standards or those of a high nominal value — a density of about 8 000 kg/m^3.

For example, a cast iron body may be used, which incorporates a special cavity in which a lead core may be cast, with a mass of approximately 30 % of the total nominal mass of the standard.

9. Inscriptions and markings.

Standard weights must carry the following :

— their nominal value in numerals, followed by the symbol for the unit used,

— the maximum number of scale divisions « n », for weighing machines which may be verified on initial verification,

and in accordance with national regulations :

— a verification mark, as appropriate with the date and validity of the verification.

10. Adjustment and verification.

Adjustment of the standard weigths must be such as to comply with the maximum permissible errors given in this Recommendation.

In particular this may be achieved in the case of adjustment by the double substitution weighing technique (Gauss transposition method, or Borda substitution method), using as reference standards, weights having an error of less than 1/3 the maximum permissible error for the weight to be adjusted, and as the comparator machine, a weighing machine for which the limit of repeatability error does not exceed 0.2 times the maximum permissible error for the weight to be adjusted.

(*) Standard weights used for initial verification of a weighing machine with « n» scale divisions may be used for the subsequent verification of a weighing machine with «pn» scale divisions, where the maximum permissible error for this subsequent verification is « p » times (where p has a value equal to or greater than 1), the maximum permissible error on initial verification.

ANNEX I
MAINTENANCE OF STANDARD WEIGHTS

Permanent use inside a building.

The standard weights used permanently inside a building, which are carefully handled with the aid of appropriate equipment, may maintain (in general for one year), a calibration accuracy of about 0.5/10 000.

Outdoor use

The standard weights to be used outdoors are usually installed in vehicles (lorries or trucks) especially designed for their transport and equipped (particularly in the case of lorries) with means of lifting and handling that make it possible to place them on the platforms of the machines to be verified.

Due to their use outdoors, the mass of these standard weights may vary (because of wear, corrosion, etc...).

Variations of about 1/10 000 have been observed over a period of use of about one year, making adjustment to better than 1/10 000 unnecessary.

In order for the errors to be compensating and non-cumulative, this adjustment must be made between — 1/10 000 and + 1/10 000 of the given nominal value.

A N N E X II
ABSOLUTE ERRORS FOR STANDARD WEIGHTS

Nominal value kg	Maximum permissible error for the standard weights			
	3.3/ 10 000	1.7/10 000	1/10 000	0.5/ 10 000
	Corresponding absolute error (grammes)			
50	17	8.5	5	2.5
100	33	17	10	5
200	66	33	20	10
500	170	85	50	25
1 000	330	170	100	50
2 000	660	330	200	100
5 000	1 700	850	500	250
	1 000	3 000	5 000	10 000
	Maximum number of scale divisions “n” on weighing machines (accuracy class (III)) capable of being verified (initial verification) with the standard weights (see note at bottom of page 5)			

ANNEX III

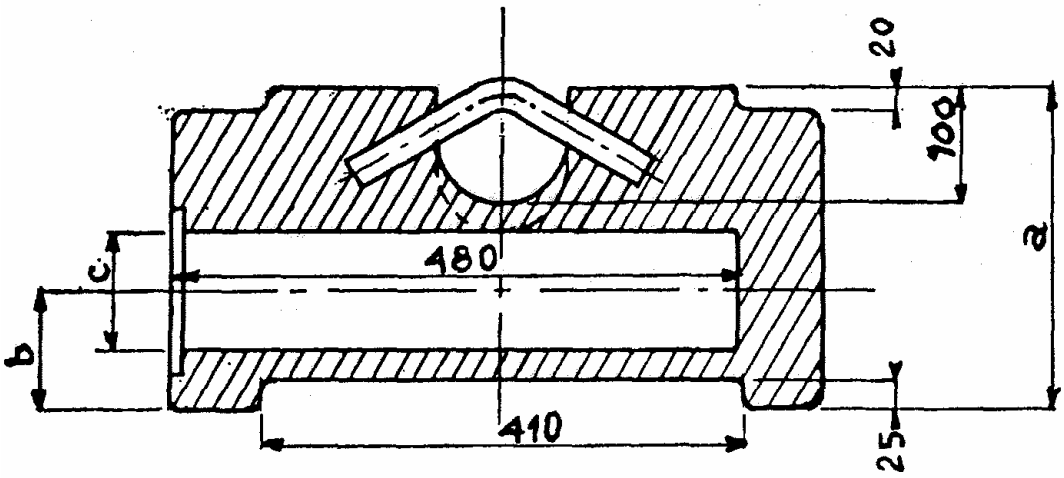
TYPICAL EXAMPLES

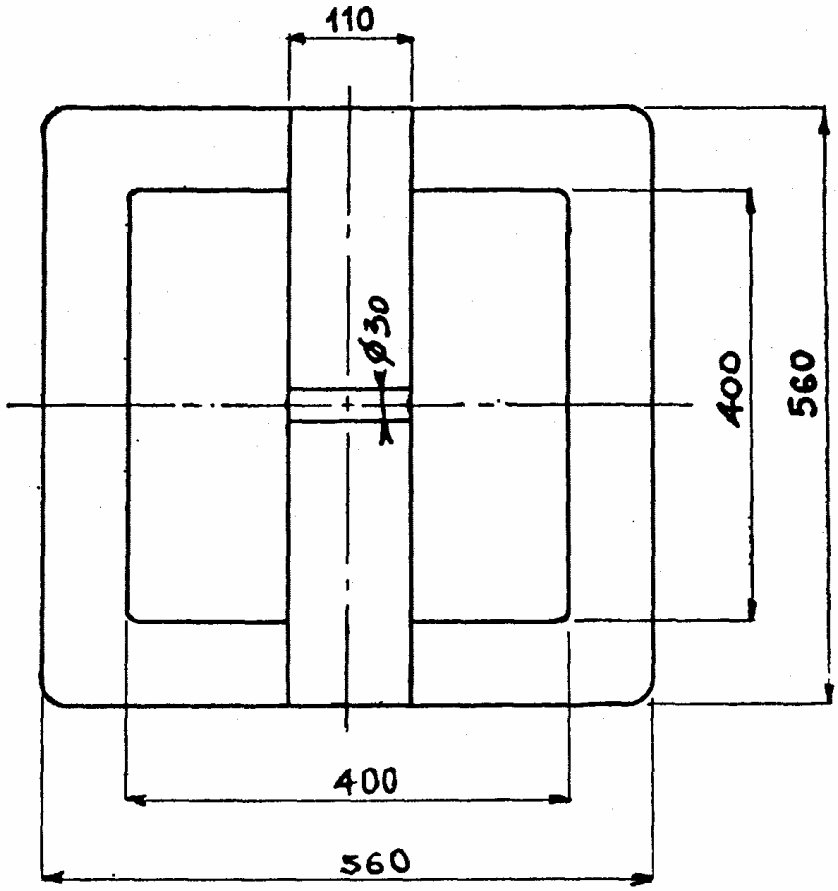
This annex contains diagrams of weights used for testing of high capacity weighing machines, which are considered suitable for use as patterns because of their design and ease of use.

It is left entirely for each country to decide on the shape and the dimensions for the weights subject to State controls.

For certain of the weights shown in the following pages, the constructional details can be obtained from the BIML.

RECTANGULAR STANDARD WEIGHTS
500 kg and 1 000 kg
SUITABLE FOR STACKING
dimensions (mm)





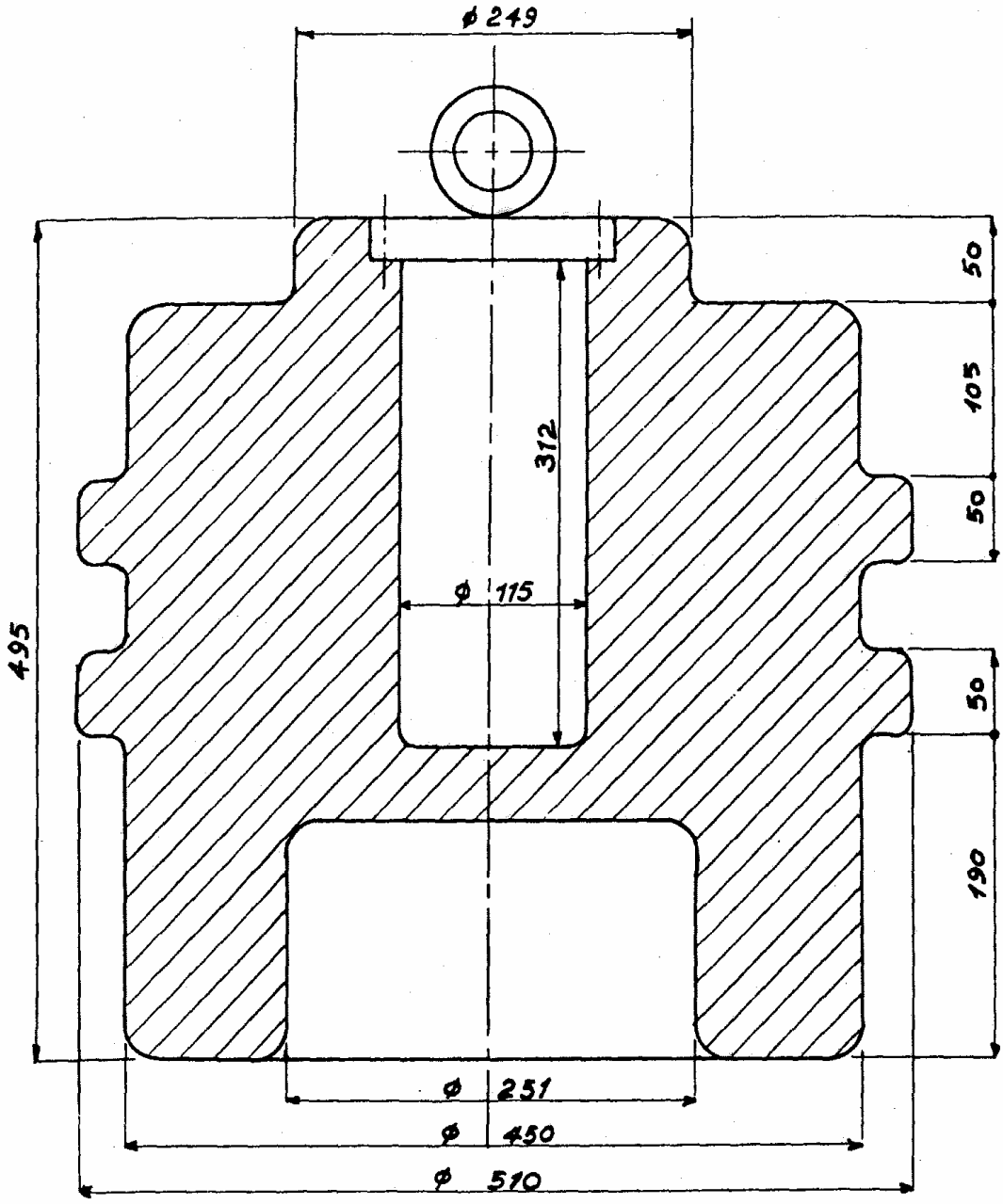
	a	b	c
500 kg	273	100	Ø 100
1 000 kg	504	120	Ø 140

CYLINDRICAL STANDARD WEIGHTS

500 kg and 1 000 kg

SUITABLE FOR STACKING AND ROLLING

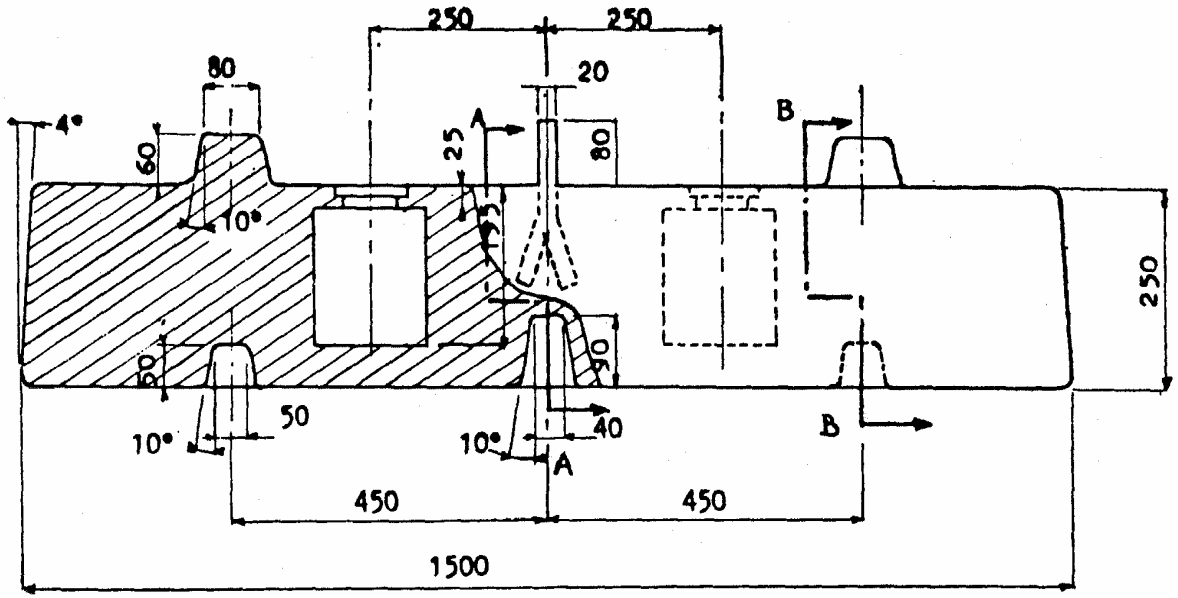
Dimensions (mm) for 500 kg weight



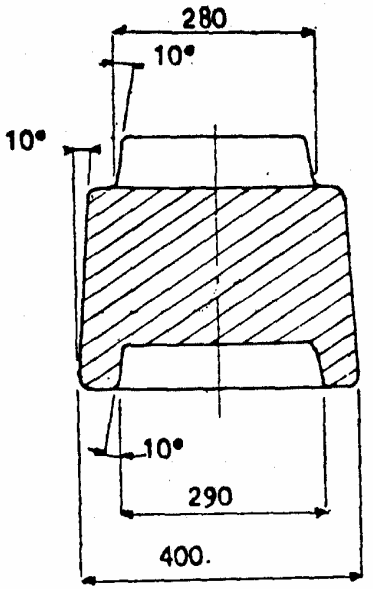
r = 10

R = 20

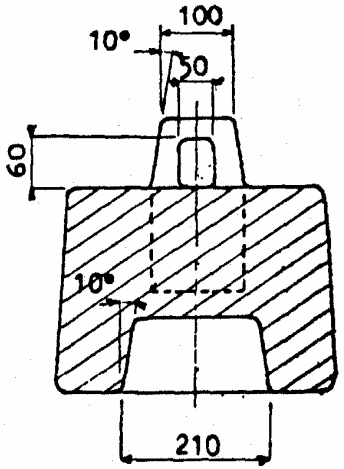
RECTANGULAR STANDARD WEIGHT 1 000 KG SUITABLE FOR STACKING

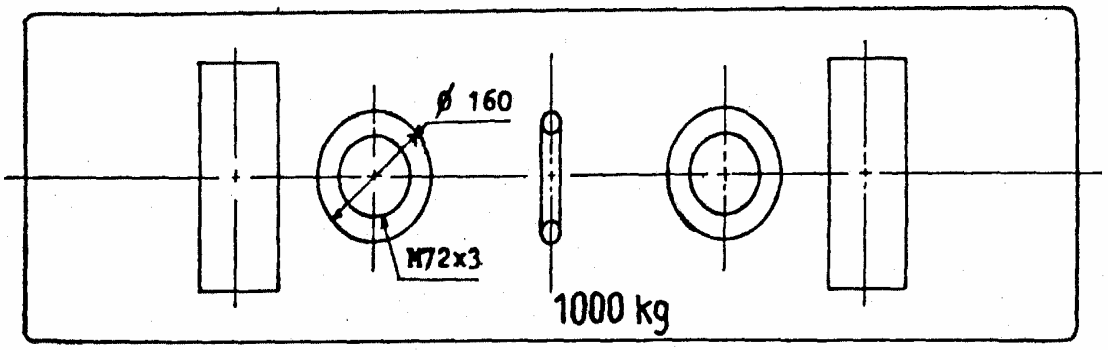


SECTION B B



SECTION A A

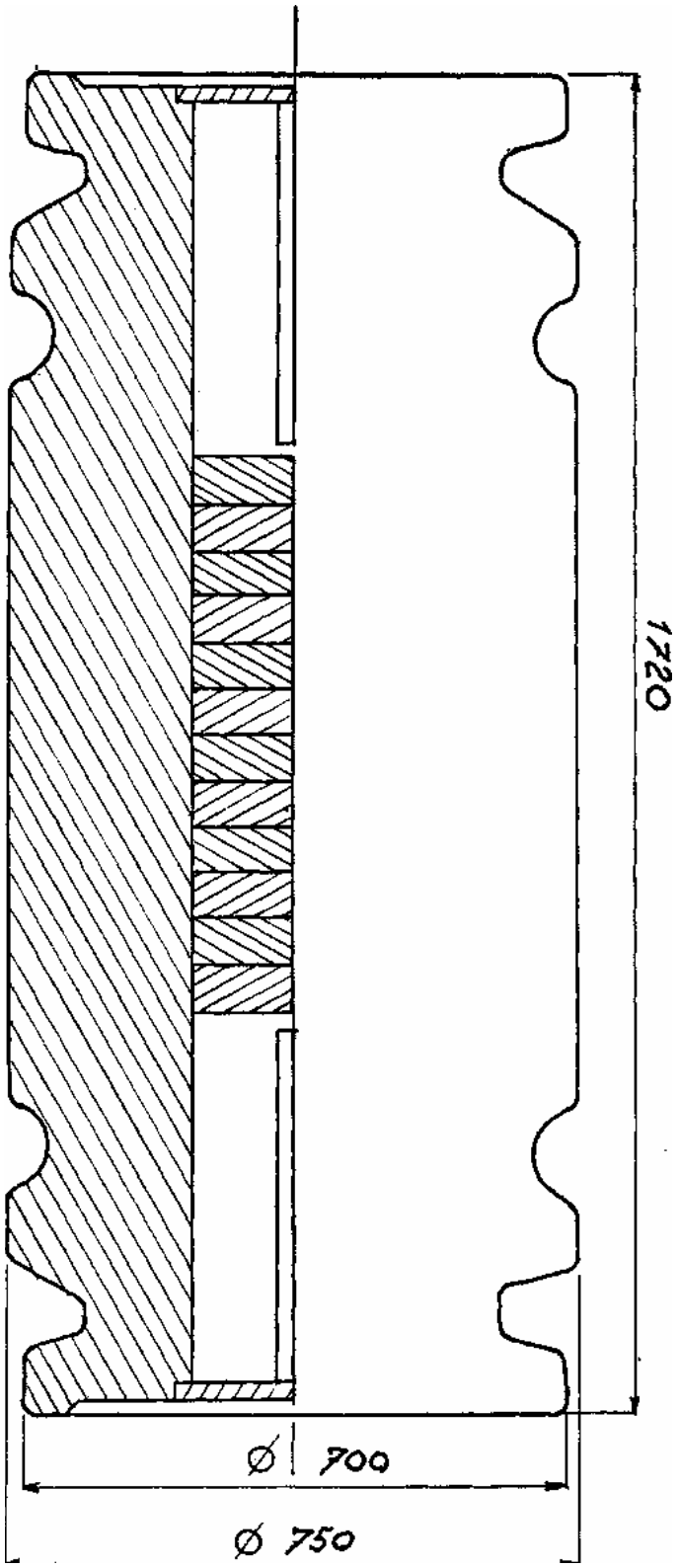




CYLINDRICAL STANDARD WEIGHT

5 000 kg

SUITABLE FOR ROLLING



Contents