INTERNATIONAL STANDARD

ISO 390

Asbestos-cement products — Sampling and inspection

Produits en amiante-ciment — Échantillonnage et contrôle

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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 390 was developed by Technical Committee ISO/TC 77, *Products in fibre reinforced cement*, and results from the merging of ISO Recommendations R 390-1964 and R 1260-1970, which are cancelled and replaced by the present document.

It was submitted directly to the ISO Council, in accordance with clause 6.12.1 of the Directives for the technical work of ISO, and with the agreement of the experts of Technical Committee ISO/TC 69, *Applications of statistical methods*.

ISO Recommendations R 390-1964 and R 1260-1970 (which now constitutes the annex to this International Standard) had been approved by the member bodies of the following countries :

Australia	Iran**	Portugal
Austria	Ireland	Romania
Belgium	Israel	South Africa, Rep. of
Brazil	Italy	Spain
Colombia*	Japan*	Sweden
Czechoslovakia*	Korea, Rep. of*	Switzerland
Denmark	Lebanon*	Turkey
Egypt, Arab Rep. of	Morocco*	United Kingdom
Finland*	Mexico	U.S.A.
France	Netherlands	U.S.S.R.*
Germany	New Zealand	Venezuela
Greece	Norway	Yugoslavia
Hungary	Peru	
India	Poland	

* approved ISO/R 390 only.

** approved ISO/R 1260 only.

No member body expressed disapproval of the documents.

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Asbestos-cement products — Sampling and inspection

1 SCOPE

This International Standard establishes certain rules for batching, sampling, inspection and acceptance/rejection of asbestos-cement products.

2 FIELD OF APPLICATION

The purpose of this International Standard is to provide a uniform method to be used in determining whether supplies of asbestos-cement goods should be accepted as conforming to the relevant International Standard requirements for such products.

It provides for a double sampling plan for the method of inspection by attributes as well as for an alternative single sampling plan for the method of inspection by variables.

3 DEFINITIONS

For the purpose of this International Standard, the following definitions apply.

3.1 inspection : The process of measuring, examining, testing, gauging or otherwise comparing the unit of product with the applicable requirements.

3.2 inspection by attributes : A system of inspection whereby the decision to accept or reject an inspection lot is based on the number of tested units of product classified as conforming or not conforming to certain requirements.

3.3 inspection by variables : A system of inspection whereby the decision to accept or reject an inspection lot is based on the average and variability of the measurements of a quality characteristic of the tested units of product.

3.4 sample : One or more units of product drawn from an inspection lot, the units of the sample being selected at random without regard to their quality.

3.5 range : The difference between the largest and smallest readings within a sample or group of samples.

3.6 consignment : That part of a delivery which comprises units of the same category.[1]

3.7 homogeneous consignment : A consignment comprising units of product made of the same ingredients and under essentially the same conditions (see 4.2).

3.8 sample size : The number of units of product in a sample.

3.9 unit of product : The entity of product inspected.

3.10 inspection lot : A fraction of a consignment/subconsignment accepted or rejected as a whole depending on the quality found by inspection of a sample drawn from the lot.

3.11 maximum inspection lot : The largest inspection lot which could, *a priori*, be expected to be homogeneous.

3.12 minimum inspection lot : The smallest inspection lot from which samples should be drawn.

3.13 double sampling plan : A sampling plan containing at most two samples, the initial (first) and the second samples. The final decision to accept or reject the inspection lot may be reached after inspecting the initial or both samples according to the provisions of clause 7.

3.14 single sampling plan : A sampling plan containing one sample only. The decision to accept or reject the inspection lot may be reached after inspecting the sample according to the provisions of clause 7.

3.15 relevant International Standard : The International Standard prepared by ISO/TC 77 for the particular type of asbestos-cement products.

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1) *Examples* :

Pipes of different diameters are regarded as belonging to different categories.

Sheets of different profiles are regarded as belonging to different categories.

Sheets of the same profile but of different lengths may be regarded as belonging to the same category.

3.16 sub-consignment : A homogeneous fraction of a consignment known or supposed to be non-homogeneous.

3.17 conforming unit : A unit of product which conforms to one of the applied tests of the relevant International Standard (in statistical text books, also termed "non-defective").

3.18 non-conforming unit : A unit of product which does not conform to one of the applied tests of the relevant International Standard (in statistical text books, also termed "defective").

4 DIVISION OF A CONSIGNMENT INTO INSPECTION LOTS

4.1 Homogeneous consignments

4.1.1 Any homogeneous consignment (or sub-consignment, see 4.2) shall be divided by the manufacturer into inspection lots, the maximum size of which shall be as given in the relevant International Standard.

4.1.2 Any fraction of a consignment remaining after removal of the highest possible number of maximum inspection lots and any homogeneous consignment (or sub-consignment) smaller than the maximum lot size, shall form an inspection lot if larger than the minimum lot size given in the relevant International Standard.

4.1.3 Consignments or fractions of consignments smaller than the minimum lot size given in the relevant International Standard shall not be submitted to sampling and testing.

4.2 Non-homogeneous consignments

Any consignment which is known to be or is expected to be non-homogeneous as regards any of the properties to be tested by sampling shall be divided by the manufacturer into assumed homogeneous sub-consignments prior to the division into inspection lots in accordance with 4.1.

5 SAMPLING

5.1 From each inspection lot (4.1.1 and 4.1.2), the purchaser may draw a sample, the size of which is indicated in table 1 (see 5.2 and 5.3).

5.2 The entry to table 1 is the number of units of product in the inspection lot (column 1), the sample size being indicated in column 2.

5.3 For products where all units undergo a compulsory non-destructive test during manufacture[1], the reduced sample size obtained by entering table 1 at column 7 may be applied.

5.4 The possibility mentioned in 5.3 is also available when the manufacturer guarantees his production or has it guaranteed by an independent control organization.[2]

5.5 When test pieces are cut from the units of the sample, the cutting shall be carried out by the manufacturer in the presence of the purchaser.

5.6 When the relevant International Standard calls for more than one property to be tested, the sample size shall be appropriately multiplied so as to secure for each test a number of test pieces equal to the sample size (see 5.2 and 5.3). From one unit of a sample, one test piece only shall be cut for a particular test, but for different tests, the necessary test pieces may be cut from the same unit of the sample.

6 INSPECTION

6.1 Each unit of the sample shall be tested as specified in the relevant International Standard.

6.2 The test results shall be evaluated either by the method of inspection by attributes (see 6.4 and 7.1) or by the method of inspection by variables (see 6.5 and 7.2).

6.3 The method of inspection by attributes should normally be employed. However, by agreement between the interested parties prior to the drawing of the samples (see 5.1), the method of inspection by variables, if applicable, may be employed.

6.4 When the method of inspection by attributes is employed, the number of non-conforming units in the sample shall be deduced from the test results and the acceptability of the inspection lot determined as prescribed in 7.1.

6.5 When the method of inspection by variables is employed, the test results shall be recorded so as to retain the order in which they are made and the acceptability of the inspection lot determined as prescribed in 7.2.

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1) Such as the watertightness test for pipes.

2) For example, use of statistical quality control methods in the works.

TABLE 1

1	2	Initial sample		Initial + second samples		7	Inspection by variables
Size of inspection lot	Sample size	Acceptance number Ac_1	Rejection number Re_1	Acceptance number Ac_2	Rejection number Re_2	Size of inspection lot for products tested during manufacture	Acceptability criterion[1] k
up to 100	3	0	2	1	2	up to 200	0,29
101 to 200	4	0	2	1	2	201 to 400	0,34
201 to 400	5	0	2	1	2	401 to 800	0,37
401 to 800	7	0	2	1	2	801 to 1 500	0,40
801 to 1 500	10	0	2	2	3	1 501 to 3 000	0,50
1 501 to 3 000	15	0	3	3	4	3 001 to 8 000	0,51
3 001 to 8 000	25	1	4	5	6	8 001 to 20 000	0,52
8 001 to 20 000	35	2	5	7	8	—	0,53

1) In applying this International Standard to the simultaneous inspection of the two limits of a given property, see the annex.

7 DETERMINATION OF ACCEPTABILITY OF INSPECTION LOTS

7.1 Inspection by attributes

7.1.1 When the number of non-conforming units found in the sample is equal to or less than the acceptance number Ac_1 indicated in column 3 of table 1, the inspection lot from which the sample was drawn shall be considered acceptable.

7.1.2 When the number of non-conforming units found in the sample is equal to or greater than the rejection number Re_1 indicated in column 4 of table 1, this may justify rejection of the inspection lot.

7.1.3 When the number of non-conforming units found in the sample lies between the acceptance number and the rejection number (columns 3 and 4 of table 1), a second sample of the same size as the initial sample (5.2, 5.3 and 5.4) shall be drawn and examined.

7.1.4 The second sample shall be inspected as indicated in 5.5, 5.6 and 6.4.

7.1.5 The number of non-conforming units found in the initial and in the second samples shall be totalled.

7.1.6 If the total number of non-conforming units is equal to or less than the acceptance number Ac_2 indicated in column 5 of table 1, the inspection lot shall be considered acceptable.

7.1.7 If the total number of non-conforming units is equal to or greater than the second rejection number Re_2 indicated in column 6 of table 1, this may justify rejection of the inspection lot.

7.1.8 When the relevant International Standard calls for more than one property to be tested, the second sample taken (see 7.1.3) shall only be inspected in accordance with those tests which at the inspection of the initial sample gave numbers of non-conforming units between the acceptance number Ac_1 and the rejection number Re_1.

7.2 Inspection by variables

The inspection shall be carried out on one sample, the size of which is given in column 2 of table 1, as follows :

a) divide the readings in the order made into groups of 5, except when the sample size is 3, 4, 5 or 7, in which cases the group size is the same as the sample size;

b) for each group, compute the range R;

c) of the group ranges R compute the average range $\bar{R}$;

d) compute the sample mean $\bar{X}$ by dividing the sum of the measurements by the sample size;

e) derive from table 1 (column 8) the acceptability criterion k;

f) compute the acceptability limit AL and determine the acceptability by means of table 2.

TABLE 2

Limit prescribed in the relevant International Standard	$AL =$	Acceptable if	Rejection justified if
Lower specified limit, L	$L + k\bar{R}$	$\bar{X} \geqslant AL$	$\bar{X} < AL$
Upper specified limit, U	$U - k\bar{R}$	$\bar{X} \leqslant AL$	$\bar{X} > AL$

ANNEX

GUIDE TO THE USE OF THIS INTERNATIONAL STANDARD

FOREWORD TO THE ANNEX

In drawing up this International Standard, ISO/TC 77 studied the American Military Standards 105 B and 414 and adopted many of the principles underlying those documents. It was felt, however, that the relationship between the manufacturer and purchaser of asbestos-cement products is very often quite different from the typical relationship in military procurements. For this and various other reasons, the committee decided to prepare its own standard concerning asbestos-cement products, together with an associated guide (the present annex).

With respect to this guide, it is also appropriate to refer to additional works of a more extensive character, for example :

— *Administration of sampling procedures for acceptance inspection*, Handbook H 105, Department of Defense, Washington D.C., 1954;

— *Defence guide to sampling inspection*, Ministry of Defence, London, 1962;

— *Mathematical and statistical principles underlying Military Standard 414*, Department of Defense, Washington D.C., 1958.

Those interested in systems of sampling inspection will profit from reading the latest editions of these handbooks.

The present guide, however, has the much more limited purpose of explaining the use of the very simple collection of sampling plans in this International Standard, which represents a balanced compromise between theoretical statistical points of view and practical economical considerations. It is the hope of the committee that the sampling plans will prove applicable in practice, and they will certainly give a safer basis for the distinction between good and inferior material than do the rules and methods hitherto used, thus providing greater protection to the user.

The sampling plans recommended have approximately the same properties as certain plans for which the *acceptable quality level (AQL)* is equal to 4 % in the military Standards studied.

A.1 SCOPE AND FIELD OF APPLICATION

This annex explains in more detail the rules laid down for batching, sampling and inspection, and clarifies the consequences of using the methods of sampling inspection recommended. Also, a number of examples are given. In addition, the conditions are described under which rejected lots may be resubmitted for inspection.

A.2 UNIT OF PRODUCT

The term "unit of product" means the entity to be inspected in order to determine its quality characteristics. The unit of product is specified in the relevant International Standard.

The unit of product is used as a counting unit in determining lot size, sample size, number of conforming units, etc.

A.3 CONFORMING AND NON-CONFORMING UNITS

A conforming unit is a unit of product having quality

characteristics in conformity with the specified requirements in the relevant International Standard.

Examples :

ISO/R 391, *Building and sanitary pipes in asbestos-cement* (sub-clause 2.4.3.1) specifies : The unit bursting stress R_t of pipes of type A should be not less than 100 kgf/cm² (10 MN/m²).

This means that a building and sanitary pipe of type A (i.e. one unit of product) having R_t equal to or larger than 100 kgf/cm² (10 MN/m²) is a conforming unit, whereas a pipe having R_t less than 100 kgf/cm² (10 MN/m²) is a non-conforming unit.

ISO/R 393, *Asbestos-cement corrugated sheets for roofing and cladding* (sub-clause 2.5.3) specifies : During the 24 h of the impermeability test, traces of moisture may appear on the lower surface, but in no instance should there be any formation of drops of water.

This means that the corrugated sheet from which the test piece is cut and which shows formation of drops of water during testing is a non-conforming unit.