International Standard 4179

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

Ductile iron pipes for pressure and non-pressure pipelines — Centrifugal cement mortar lining — General requirements

Tuyaux en fonte ductile pour canalisations avec et sans pression — Revêtement interne au mortier de ciment centrifugé — Prescriptions générales

Second edition — 1985-10-15

UDC 621.643.22 : 666.96 **Ref. No. ISO 4179-1985 (E)**

Descriptors : spheroidal-graphite cast-iron, cast iron products, pipelines, pipes (tubes), coatings, non-metallic coatings, linings, lining processes, cements, mortars (material), specifications, dimensions, thickness.

Price based on 4 pages

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.

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 4179 was prepared by Technical Committee ISO/TC 5, *Ferrous metal pipes and metallic fittings*.

ISO 4179 was first published in 1980. This second edition cancels and replaces the first edition, of which the following clauses have been revised technically.

Clause 1 : reference to ISO 7186 and a note have been added.

Clause 2 : ISO 6708 and ISO 7186 have been added.

Clause 4 : second paragraph has been altered to the 50 % value.

Clause 8 : second paragraph has been altered.

Table : addition of the values corresponding to DN group V.

Ductile iron pipes for pressure and non-pressure pipelines — Centrifugal cement mortar lining — General requirements

1 Scope and field of application

This International Standard specifies the nature, the method of application, the surface condition and the minimum thickness of internal linings of centrifuged cement mortar for ductile iron pipes for pressure and non-pressure pipelines as defined in ISO 2531 and ISO 7186.

NOTE — If these linings are used in the conveyance of particularly aggressive fluids, the following are permitted, either separately or in combination :

- an increase in the thickness of the lining;
- a change of the type of cement;
- the application of coating over the lining.

2 References

ISO 2531, *Ductile iron pipes, fittings and accessories for pressure pipelines.*

ISO 6600, *Ductile iron pipes — Centrifugal cement mortar lining — Composition controls of freshly applied mortar.*

ISO 6708, *Pipe components — Definition of nominal size.*

ISO 7186, *Ductile iron pipes and accessories for sewers and drains without pressure.*

3 Materials

3.1 Cement

The cement used for the lining shall conform to the standards on cement of the producing country.

The type of cement to be used is left to the discretion of the pipe manufacturer who shall, however, inform the customer.

3.2 Sand

The sand used shall have a controlled granulometric distribution from fine to coarser elements; it shall be clean and shall be composed of inert, hard, strong and stable granular particles.

Sampling shall be carried out in accordance with national standards for the testing of construction materials.

The granulometric curve for the sand shall be established using sieves standardized in the producing country and shall meet the following requirements :

— the fine fraction (comprising particles passing through a sieve of aperture size 0,125 mm) shall not be more than 10 % by mass;

— the fraction comprising grains up to a maximum diameter equal to one-third of the normal thickness of the mortar lining shall not be less than 50 % by mass;

— the coarsest fraction (comprising particles which do not pass through a sieve of the aperture size closest to half the normal thickness of the mortar lining) shall not exceed 5 % by mass.

The cleanliness of the sand is considered from the point of view of organic impurities and clay-bearing substances according to the methods described below.

The test for organic impurities shall be carried out by the colorimetric method in accordance with the standards in force in the producing country. (Using this method, the sand shall not produce any coloration darker than that of the reference solution.)

The determination of the content of clay-bearing substances in the sand and other fine particles (having dimensions less than 60 to 80 µm depending on the country) shall be carried out in accordance with the standards in force in the country producing the cement mortar lining.

This percentage shall not exceed 2 % by mass.

3.3 Water

The water used for the preparation of the mortar shall not contain substances deleterious to the mortar nor to the water it is eventually intended to transport in the pipe. The presence of solid mineral particles is, however, admissible provided that these requirements are still fulfilled.

3.4 Mortar

The mortar of the lining shall be composed of cement, sand and water.

Additives, which shall be specified, may be used, provided that they do not prejudice the quality of the coating and that of the transported water and that the lining remains in accordance with all the requirements of this International Standard.

The mortar shall be thoroughly mixed and shall have a consistency which results in a dense and homogeneous lining.

The mortar shall contain by mass at least one part of cement to 3,5 parts of sand (i.e. S/C $\leqslant$ 3,5 in mass in the mortar)[1].

4 Condition of the interior surface of the pipe before application of the lining

All foreign bodies, loose scale or any other material which could be detrimental to good contact between the metal and the lining shall be removed from the surface to which the lining is to be applied.

The inner surface of the pipe shall also be free of any metal projections likely to protrude beyond 50 % the thickness of the lining.

5 Application of the lining

The mortar of the lining is cast centrifugally inside the pipe[2].

Apart from the inner surface of the joint, the parts of the pipe coming into contact with the transported water shall be entirely covered with mortar.

The mortar shall be free of any cavities or visible air bubbles, and care shall be taken to ensure maximum density at all points. The consistency of the mortar, the time required and the speed of centrifuging the pipe shall be controlled so that segregation of the sand in the lining is reduced to a minimum.

Once centrifuging is finished, the lining shall be cured at temperatures greater than 0 °C. Any loss of water from the mortar by evaporation shall be sufficiently slow that hardening is not impeded.

Repairs to damaged or defective areas are allowable. The damaged mortar shall first be removed from these areas. Then the defective part shall be repaired by using, for example, a trowel with fresh mortar so that a continuous lining having a constant thickness is again obtained.

For the repair operation, the mortar shall have a suitable consistency; if necessary, additives may be included to obtain good adhesion against the side of the existing undamaged mortar.

6 Thickness of the lining

The normal thickness of the lining and the minimum permissible mean and local values are given in the table.

At the pipe ends, the lining may be reduced to values below the minimum thickness. The length of the chamfer shall be as small as possible but, in any case, shall be less than 50 mm.

7 Determination of lining thickness

The thickness of the lining is checked on the freshly centrifuged mortar by the insertion of a steel pin, or on the hardened mortar by means of a non-destructive method of measurement.

The thickness of the lining shall be measured at both ends of the pipe in at least one section perpendicular to the pipe axis.

In each section, which shall be at least 200 mm from the pipe end, measurements shall be taken at four points spaced at 90° intervals.

The values for the thickness of the lining shall be reported to the nearest 0,1 mm.

The lining thickness measured at any one point in the pipe shall not be smaller than the minimum value given in the table.

The arithmetic mean of the four measurements in each section shall not be less than the minimum mean value specified in the table.

8 Surface condition of the hardened lining

The surface of the cement mortar lining shall be uniformly smooth. Only isolated grains of sand are allowed to appear on the surface of the lining.

The lining shall not be friable and shall be free from corrugations or ridges that could reduce the thickness of the lining to less than the minimum value at one point, as specified in the table.

On contraction of the lining, the formation of cracks cannot be avoided. These cracks, together with other isolated cracks which may result from manufacture or may develop during transportation, are acceptable up to a width of 0,8 mm.

The structure of the lining is related to the centrifuging process.

On the inner surface of the lining, a thin layer of fine sand and cement is formed which may extend up to approximately one-quarter of the total thickness of the mortar.

1) For methods for determining this ratio of sand to cement (S/C), refer to ISO 6600.

2) Similarly, this International Standard is also valid for methods in which the cement mortar lining is applied by a centrifugal projection head.

9 Test conditions

The various checks specified in this International Standard shall be carried out under the following conditions.

9.1 Sand

In general, the determination of the granulometric curve of the sand on an average sample, for each supply source, corresponding to the quantity necessary for a week's production, can be regarded as adequate.

The check for organic impurities and the content of clay-bearing substances may only be possible on an average sample which is representative of the quantities necessary for a month's production.

The frequency of these various inspections may be changed depending on the regularity of the suppliers; in particular it shall be increased, at least temporarily, if supply sources are changed or if irregularities are noticed in supplies from the same origin.

9.2 Thickness of the lining

The thickness of the lining shall be inspected on at least one pipe per station and per centrifuging installation, for each diameter manufactured.

9.3 Appearance of the lining

Each pipe shall be inspected for the appearance of the lining, with special reference to the surface condition and the finish of the ends.

Any repairs considered to be necessary after this examination shall be carried out in accordance with the method described in clause 5.

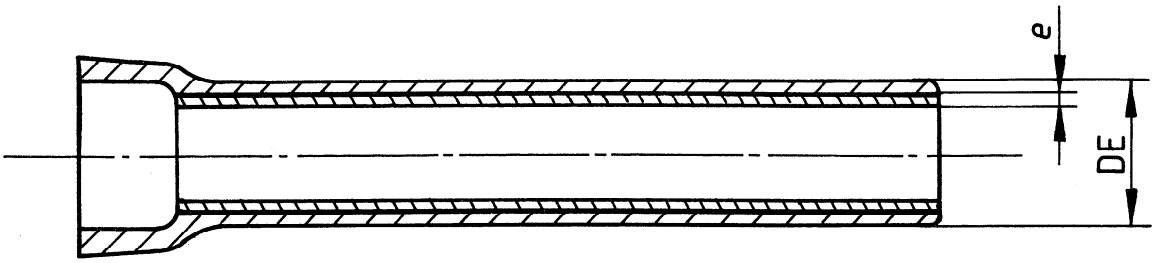

Table — Thickness of the cement mortar lining

Dimensions in millimetres

DN group	Nominal size[1] (DN)	DE	Layer thickness, *e*			Approximate mass per unit length[2] kg
			Normal	Minimum mean value	Minimum value at one point	
I	40	56	3	2,5	1,5[3]	0,8
	50	66				1
	60	77				1,3
	65	82				1,4
	80	98				1,7
	100	118				2,1
	125	144				2,7
	150	170				3,2
	200	222				4,2
	250	274				5,2
	300	326				6,3
II	350	378	5	4,5	2,5	12,3
	400	429				14
	500	532				17,5
	600	635				20,9
III	700	738	6	5,5	3,0	29,3
	800	842				33,4
	900	945				37,6
	1 000	1 048				41,7
	1 200	1 255				50
IV	1 400	1 462	9	8,0	4,0	87,6
	1 600	1 668				100,1
	1 800	1 875				112,5
	2 000	2 082				125
V	2 200	2 288	12	10,0	5,0	183,5
	2 400	2 495				200
	2 600	2 702				216,6

1) In accordance with ISO 6708.

2) Mass calculated on the basis of the normal thickness and an internal diameter equal to the value of the nominal size, taking a mass density of 2 200 kg/m^3.

3) According to available technical literature, the minimum local value of 1,5 mm may be regarded as adequate to ensure the protection of the pipe against corrosion.

This page intentionally left blank

This page intentionally left blank