International Standard 6600

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Ductile iron pipes — Centrifugal cement mortar lining — Composition controls of freshly applied mortar

Tuyaux en fonte ductile — Revêtement interne au mortier de ciment centrifugé — Contrôles de composition du mortier fraîchement appliqué

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Foreword

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Ductile iron pipes — Centrifugal cement mortar lining — Composition controls of freshly applied mortar

1 Scope and field of application

This International Standard specifies a certain number of methods used in the composition controls of cement mortar linings complying with the requirements of ISO 4179 and applied centrifugally on the inner surface of ductile iron pipes intended for transporting water under pressure as defined in ISO 2531.

2 References

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

ISO 4179, *Ductile iron pipes for pressure pipelines — Centrifugal cement mortar lining — General requirements.* [1]

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3 Composition controls of freshly applied mortar

3.1 General

The composition controls defined in this International Standard comprise the determination of the ratios S/C (mass of sand referred to the mass of cement) and E/C (mass of water referred to the mass of cement) of the freshly centrifuged mortar.

The samples of mortar used for this determination shall be taken from the lining less than 15 min after centrifugation inside the pipe.

Moreover, in order to take into account the phenomenon of segregation of the heavy elements of the mortar caused by the method of application of the lining by centrifugation and the heterogeneity of the layer, it is essential that the samples taken should be representative of the total thickness of the lining.

3.2 Determination of the ratio S/C

3.2.1 Equipment

The necessary equipment for this determination is as follows :

— one 0,16 mm sieve, or the nearest standardized sieve;

— one container of the same diameter as the sieve;

— one pair of shop scales.

3.2.2 Preliminary calibration

The determination of S/C necessitates a preliminary calibration which is carried out as follows :

— sieve 500 g of dry sand over the sieve indicated above;

— weigh the fraction of fine sand which has passed through the sieve, and express this fraction as a percentage. Let s be this percentage of fine sand.

3.2.3 Composition control of the mortar

The control of the ratio S/C is carried out as follows :

— weigh 500 g of cement mortar;

— place the sieve over the container and pour the mortar into the sieve;

— sieve the mortar under flowing water until the sand remaining in the sieve is clean;

— collect the cement and the fraction of fine sand passed through the sieve by the flowing water in the container;

— allow to settle for about 1 h, and siphon the clear water out of the container;

— dry and weigh the fractions S' of sand remaining on the sieve, and P of fine sand and cement collected in the container;

— calculate the proportions of the components as follows :

$$\text{sand} : S = \frac{S'}{(100 - s)} \qquad \ldots (1)$$

$$\text{cement} : C = P - (S - S') \qquad \ldots (2)$$

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— deduce the ratio S/C of the cement mortar by combining formulae (1) and (2).

3.3 Determination of the ratio E/C

The calculation of the ratio E/C necessitates the preliminary determination of S/C (see 3.2) and of E/M (mass of water referred to the mass of dried mortar), since these ratios are related by the following formula :

$$\frac{E}{C} = \frac{E}{M}\left(1 + \frac{S}{C}\right) \qquad \ldots (3)$$

The determination of E/M may be carried out by one of the two following methods :

3.3.1 Drying method

The principle of this method is to determine the quantity of water from the difference in mass of the sample of fresh mortar and the sample of dried mortar.

The equipment necessary for this determination is as follows :

— one container having the shape of a frying pan;

— one long steel spatula;

— one pair of shop scales;

— one litre of methylated spirits.

The procedure is as follows :

— take the frying pan which has been previously weighed

mass = empty frying pan = m_0

— place a known quantity of fresh mortar (for example 500 g) in the frying pan and weigh again;

mass = frying pan + fresh mortar = m_1

— add 250 cm³ of methylated spirits and mix well with the long steel spatula;

— ignite the methylated spirits and stir gently from time to time, taking care not to spill any;

— when the flames have died down, allow to cool and add 100 cm³ of methylated spirits, mix and ignite;

— weigh again;

mass = frying pan + dried mortar = m_2

— deduce from these various weighings the following proportions :

mass of water : $E = m_1 - m_2$

mass of dried mortar : $M = m_2 - m_0$

— calculate the ratio E/M as follows :

$$E/M = \frac{m_1 - m_2}{m_2 - m_0} \qquad \ldots (4)$$

— deduce the ratio E/C from formula (3).

3.3.2 Xylol method

The principle of this method is to measure the quantity of water collected during the distillation of a sample of fresh mortar to which xylol has been added.

The equipment necessary for this measuring is as follows :

— one distilling apparatus;

— one test tube;

— one pair of shop scales;

— approximately 150 cm³ of xylol.

The procedure is as follows :

— take a distilling flask which has been previously weighed;

mass = empty flask = m_0

— place a known quantity of fresh mortar (about 100 g) in the flask and weigh again;

mass = flask + fresh mortar = m_1

— add about 120 cm³ of xylol to the flask and carry out distillation;

— collect the water/xylol mixture in a calibrated test tube. After separation of the water from the xylol, read off the quantity of water collected, E;

— relate this quantity of water collected, E, to the mass of dry mortar, M;

$$M = (m_1 - m_0) - E$$

— calculate the ratio E/M with the following formula :

$$\frac{E}{M} = \frac{E}{(m_1 - m_0) - E} \qquad \ldots (5)$$

— deduce the ratio E/C with formula (3).

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