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METHODS FOR SAMPLING OF CAST IRON PIPES AND FITTINGS

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METHODS FOR SAMPLING OF CAST IRON PIPES AND FITTINGS

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Indian Standard

METHODS FOR SAMPLING OF CAST IRON PIPES AND FITTINGS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 14 March 1986, after the draft finalized by the Methods of Sampling Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 Cast iron pipes and fittings are extensively used in sanitation, water supply, gas supply and waste disposal. Sand cast iron spigot and socket pipes along with fittings are widely used as soil and waste pipes with suitable arrangements to obtain tight joints between successive components in the pipeline. Vertically cast iron pressure pipes and centrifugally cast (spun) iron pressure pipes are used for carrying water, gas and sewage. There has been a long felt need to formulate standard methods of sampling of these products for acceptance purposes.

0.3 Mere inspection of finished products will not improve the quality but proper quality control during the process of manufacture would substantially reduce the quality fluctuations of the ultimate product. For effective corrective action, Statistical Quality Control techniques help in arriving at correct and prompt decisions.

0.4 For guidelines in organizing a system for assuring the quality of products, reference may be made to IS : 10201-1982*.

0.5 This standard contains clauses **4.0** and **4.2** which call for agreement between the purchaser and supplier.

0.6 In reporting the results of a test or analysis, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960†.

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1. SCOPE

1.1 This standard prescribes the methods of sampling and criteria for conformity of cast iron pipes and fittings when they are inspected for acceptance in the form of a lot. It also recommends certain minimum level of process inspection.

*Manual on quality assurance systems.
†Rules for rounding off numerical values (*revised*).

1.2 It does not cover sampling methods for special types of cast iron pipes such as those used in petroleum industry.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Lot — A quantity of items submitted for inspection normally manufactured by one producer under conditions that are presumed uniform.

2.2 Lot Inspection — Any inspection of lot carried out to determine its quality and take corresponding action.

2.3 Sample — One or more items or a portion taken from a population intended to provide information on the population and to serve as a basis for decision on the population or on the process used for producing it.

2.4 Random Sampling — A procedure of selection in which the chance for the inclusion of any item in the sample is predetermined.

2.5 Sample Size — Number of items in a sample.

2.6 Defect — Non-conformity of an item with any of the specified requirements.

2.7 Defective — An item containing one or more defects.

2.8 Process Average — The average percentage defective of the products submitted by the producer for inspection.

2.9 Acceptance Quality Level (AQL) — The maximum percent defective which for the purpose of sampling inspection can be considered as a satisfactory process average.

2.10 Acceptance Number (*a*) — The maximum permissible number of defectives in a sample for acceptance of the lot.

3. PROCESS INSPECTION

3.1 The object of inspecting and testing cast iron pipes and fittings by the purchaser is to ensure their conformity to the specification requirements whereas inspection done by the manufacturer during production is to ensure conformity to relevant specifications as also to maintain better control over the process. Data from process inspection conducted at various stages of the process must provide an accurate reflection of the status and conditions of different operations of the manufacturing process.

3.2 Raw Material and Accessories — Inspection procedures for incoming raw materials like pig iron, bentonite, silica sand, coal dust, inoculants, etc, should be formulated and inspections carried out on

each consignment of raw materials to monitor the quality continuously. Patterns and dies should be checked periodically for dimensional conformity to drawings.

3.3 Recommended Process Inspection Schedule — Cast iron pipes are manufactured by different processes depending on requirements and end use. Hence it is difficult to stipulate a single process inspection procedure which will be suitable for all the processes. However, since a number of characteristics are common to all of them, a certain minimum frequency of inspection and testing can be recommended for the products as detailed in Table 1. For mechanical tests, sufficient number of test pieces should be prepared to provide for retesting in case the necessity arises. The preparation of test bars shall be in accordance with the requirements given in respective specifications.

TABLE 1 RECOMMENDED FREQUENCY OF INSPECTION AND TESTING FOR PROCESS CONTROL

Sl No.	Characteristic	Frequency	Remarks
(1)	(2)	(3)	(4)
i)	Chemical composition	One test from every melt; in case of continuous melting one for every 50 tonnes or part thereof	Wherever applicable
ii)	Tensile test	Every 4 hours of production or every 4 tonnes of finished product, whichever is larger in quantity irrespective of sizes For malleable cast iron pipe fittings, three test bars from each batch of items heat treated together in one annealing chamber shall be subjected to tensile test. These test bars shall be from three different heating zones (far end, middle and fore end) of the annealing furnace	
iii)	Ring test	In case of pipes of centrifugal castings in metal moulds, ring test also to be carried out with the same frequency as tensile test	
iv)	Hardness test	Same frequency as tensile test	
v)	Compression test	One sample from each category and from each heat treatment batch	Only for malleable cast iron pipe fittings as per IS : 1879 (Parts 1 to 10)-1975*

*Specification for malleable cast iron pipe fittings (*first revision*).

(*Continued*)

TABLE 1 RECOMMENDED FREQUENCY OF INSPECTION AND TESTING FOR PROCESS CONTROL — *Contd*

Sl No.	Characteristic	Frequency	Remarks
(1)	(2)	(3)	(4)
vi)	Surface defects	100 percent inspection at various stages of production	Various categories of defects and the percentage rejection to be noted at stripping machining and final inspection
vii)	Dimensional characteristics		
	a) Pipes	100 percent inspection	
	b) Fittings	100 percent inspection with gauges; 10 percent fittings for intricate dimensional measurements	
viii)	Straightness of pipes	100 percent inspection	
ix)	Mass of pipes/fittings	10 percent of finished items	
x)	a) Hydraulic test	100 percent testing	
	b) Repeat hydraulic test	As per IS : 1879 (Parts 1 to 10)-1975*	Only for malleable cast iron pipe fittings
xi)	Hammer test	100 percent testing only for pipes	
xii)	Coating test	Once a day for one coating formulation	
xiii)	Galvanizing	3 samples per shift of 8 hours	Wherever applicable

*Specification for malleable cast iron pipe fittings (*first revision*).

3.4 At every stage of inspection, the number of pipes/fittings rejected should be noted along with the cause for rejection. Such data may be collected for each lot or batch and successive rejection reports should from the basis for investigation into the shortfalls in the process. The rejection reports should also be made available if required, to the purchaser along with the test data of the accepted material under process.

4. LOT INSPECTION

4.0 In case adequate and satisfactory system of quality control has been maintained, the resulting data and information as given in **3.4** may be made available to the purchaser along with the pipes/fittings supplied to enable him to judge the acceptability of the lot. When it is not possible to make such information available to the purchaser or when the purchaser so desires, the procedure laid down in the following clauses shall be followed for determining the conformity of the lot of pipes/fittings to the requirements of relevant specifications.

4.1 Lot — In a consignment all pipes/fittings of the same class, type and dimensions produced by a single manufacturing unit shall constitute a lot of not more than 1 000 items. Each lot shall be inspected separately for ascertaining its conformity to the requirements of the relevant specification. In case of fittings, a lot may consist of items of nominal dimensions differing by not more than 25 mm; the type of fitting being the same.

4.2 Unless otherwise agreed to between the supplier and the purchaser, each and every item shall be inspected for surface defects, finish and other details such as position of sockets, flanges, threads, collars and access doors. Any pipe/fitting failing in one or more of the visual characteristics shall be deemed defective and accordingly rejected. If some requirements are optional and are subject to agreement between the purchaser and the supplier, these shall be decided prior to inspection.

4.3 The lot which has been found satisfactory in respect of visual characteristics shall be tested for dimensional requirements, weight and straightness. The number of items to be selected from the lot for checking the above requirements depends on the size of the lot and shall be as given in Table 2 in case of pipes only. These items shall be selected at random from the lot by using suitable random number table as given in IS : 4905-1968* or by any other procedure which ensures randomness.

TABLE 2 SCALE OF SAMPLING AND CRITERIA FOR ACCEPTANCE FOR DIMENSIONAL REQUIREMENTS, MASS AND STRAIGHTNESS OF PIPES

Lot Size	Sample Size	Acceptance No.
(1)	(2)	(3)
Up to 50	8	0
51 to 100	13	1
101 to 150	20	1
151 to 300	32	2
301 and above	50	3

Note — The associated AQL for this plan is approximately 2·5 percent.

4.3.1 Each of the items selected according to **4.3** shall be inspected for dimensional requirement, mass and straightness (wherever applicable). Any item failing to meet one or more of the above requirements shall be termed defective. If the number of defectives found in the sample is less than or equal to acceptance number given in col 3 of Table 2, the lot shall be deemed as conforming to the requirements specified under this clause. Otherwise, the lot shall be rejected or subjected to 100 percent inspection for the relevant requirements.

*Methods for random sampling.

4.4 The lot found conforming in respect of dimensional requirements of pipes/fittings shall then be tested for physical characteristics like tensile strength and hardness. For this purpose, the number of tests for each of the physical characteristics shall be at the rate of one per 4 tonnes of cast iron pipes/fittings subject to a minimum of 2 and a maximum of 10 tests. The test bars/pieces shall be supplied by the manufacturer taking care that they are made from the same material and batch to which the products belong. If necessary, test pieces may also be cut from finished pipes or fittings. The lot shall be accepted for physical characteristics if all the test results conform to the requirements given in relevant specifications.

4.5 Each pipe and fitting shall be subjected to hydraulic test at the manufacturer's premises with prior arrangement. For coating test, two samples from each lot shall be taken at random and subjected to appropriate test. These samples shall meet the coating requirements.

4.6 Samples/test bars selected for various tests shall bear proper identification marks and shall be preserved till the final decision on the lot is taken.