भारतीय मानक
Indian Standard

IS 14483 (Part 3) : 2018

उर्वरक एवं रसायनिक अन्त:क्षेपक पद्धति

भाग 3 उर्वरक टंकी — विशिष्टि

Fertilizer and Chemical Injector System

Part 3 Fertilizer Tank — Specification

ICS 65.060.35

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Farm Irrigation and Drainage Systems Sectional Committee, FAD 17

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards after the draft finalized by the Farm Irrigation and Drainage Systems Sectional Committee had been approved by the Food and Agriculture Division Council.

As the fertigation technique that is application of fertilizers through irrigation water in drip irrigation systems is fast becoming popular in the country with the increased use of drip/sprinkler irrigation systems, need was felt to formulate this new standard to standardize and improve the quality of fertilizer tanks in use and to rationalize the specifications.

The main objectives of this standard are:

i) To specify the nominal sizes and classify different types of fertilizer tanks according to the techniques used.
ii) To specify technical requirements for the effective and efficient use of the equipment.
iii) To specify health and safety aspects related to the equipment
iv) To specify maintenance requirements to sustain the corrosive action of fertilizers
v) To specify suitable test methods for evaluating the performance parameters of the equipment.

The figures given in the standard are only for illustrations showing typical installation of fertilizer tanks in the main line.

The standard on fertilizer and chemical injector system have already been formulated in two earlier parts. The other parts of this standard are as follows:

IS 14483 (Part 1) : 1997	Indian Standard fertilizer and chemical injection system Part 1 Venturi injector
IS 14483 (Part 2) : 2002	Indian Standard fertilizer and chemical injection system Part 2 Water-driven chemical injector pump

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

FERTILIZER AND CHEMICAL INJECTOR SYSTEM

PART 3 FERTILIZER TANK — SPECIFICATION

1 SCOPE

This standard specifies the mechanical and functional requirements for fertilizer tanks used in irrigation systems, test methods and the data to be supplied by the manufacturer to permit correct installation and operation in the field.

NOTE — This standard applies to fertilizer tanks working on the principle of differential pressure used in irrigation systems. This standard also applies to the fittings used for connecting fertilizer tanks with the irrigation systems.

2 REFERENCES

For the purpose of this standard the following Indian standards are necessary adjuncts to this standard. The following Indian Standards also contain provisions, which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

IS No.	*Title*
513 : 2008	Cold reduced low carbon steel sheets and strips
554 : 1999	Pipe threads where pressure — Tight joints are made on the threads — Dimensions, tolerances and designation (*fourth revision*)
1239 (Part 1) : 2004	Steel tubes, tubular and other wrought steel fittings — Part 1 : Steel tubes
1573 : 1986	Specification for electroplated coating of zinc on iron and steel.
2643 : 2005	Pipe threads where pressure — Tight joints are not made on the threads — Dimensions, tolerances and designation (*third revision*)
4736 : 1986	Specification for hot dip zinc coating on mild steel tubes
4905 : 2015	Random sampling and randomization procedures (*first revision*)
5382 : 1985	Rubber sealing rings for gas mains, water mains and sewers.
13871 : 1993	Powder coating specifications

3 DEFINITION

For the purpose of this standard the following definitions shall apply:

3.1 Fertilizer Tank — A metal or plastic or composite material pressure tank generally cylindrical in shape, used to inject fertilizer/chemical solution for injection into an irrigation system, using differential pressure.

3.2 Fertilizer Tank Assembly — A fertilizer tank with inlet-outlet pipes with connecting adaptor, inlet and outlet valve, drain valve, pressure check assembly, outlet filter.

3.3 Fertilizer Tank Inlet — Port through which water enters the fertilizer tank body.

3.4 Fertilizer Tank Outlet — Port through which water with dissolved fertilizers/chemicals or other additives flows out.

3.5 Differential Pressure Device — A device which operates manually or automatically to create a pressure difference between the inlet and the outlet. It can be a pressure reducing valve or manual throttle valve or any other device specified by the manufacturer.

3.6 Rubber or Plastic Bladder — A non-adhering bladder physically attached to the tank and constructed of rubber or plastic material to provide physical separation of liquid product from the tank side walls. Rubber or plastic bladder is constructed of material that are compatible with the contact material.

3.7 Fertilizer Tank Quantitative Model — A fertilizer tank fitted with two pipes, one for water inlet and the other for fertilizer solution outlet, to be connected to main water line with a differential pressure device between them which is used for creating a sufficient pressure difference to cause part of the flow to be diverted through the tank. The water entry point reaches to the bottom of the tank, thus mixing the solution and expelling it into the water line.

3.8 Fertilizer Tank Proportional Model with Rubber or Plastic Bladder — A fertilizer tank fitted with two pipes, one for water inlet and the other for fertilizer solution outlet, to be connected to main water line with a differential pressure device connected between them which is used for creating sufficient pressure difference to cause part of the flow to be diverted through the tank. Inside the tank there is a rubber/

plastic bladder which fills the tank. The fertilizer/ chemical solution is filled into the rubber/plastic bladder thereby insulating the metal tank from corrosion. Water from the main line enters between the tank and the bladder and compresses the contents. Since the pressure on the inlet side is greater than the outlet side, fertilizer/chemical solution is uniformly expelled into the water line.

3.9 Maximum Working Pressure (Pmax) — Highest water pressure declared by the manufacturer, at the inlet of a fertilizer tank not less than 800 kPa, to ensure proper fertilizer injection.

3.10 Nominal Test Pressure (Pn) — A reference pressure of 100 kPa at the inlet of fertilizer tank or any other pressure described in the publication of the manufacturer as 'nominal test pressure'.

3.11 Nominal Differential Pressure (Pd) — A reference differential pressure of 20 kPa or any other differential pressure declared by the manufacturer.

3.12 Nominal Injection Rate (Qn) — The injection rate of a fertilizer tank is expressed in liters per hour. It is the rate at which fertilizer/chemical solution is expelled out of the fertilizer tank operating at nominal test pressure (Pn) and nominal differential pressure (Pd) of 20 kPa with water temperature of 27± 3°C or as specified by the manufacturer.

3.13 Tank Volume — The approximate inside volume of the fertilizer tank or bladder of the fertilizer tank used to store fertilizer/chemical solution before injection, expressed in litres.

4 CLASSIFICATION

4.1 Based on the Type of the Fertilizer Tanks are Classified as follows :

4.1.1 *Quantitative model*

A fertilizer tank fitted with two pipes, one for water inlet and the other for fertilizer solution outlet, to be connected to main water line with a differential pressure device between them which is used for creating a sufficient pressure difference to cause part of the flow to be diverted through the tank. The water entry point reaches the bottom of the tank, thus mixing the solution and expelling it into the water line.

The solution in the tank is increasingly diluted. (*see* fig. 1)

4.1.2 *Proportionate model with rubber/plastic bladder*

A fertilizer tank fitted with two pipes, one for water inlet and the other for fertilizer solution outlet, to be connected to main water line with a differential pressure device connected between them which is

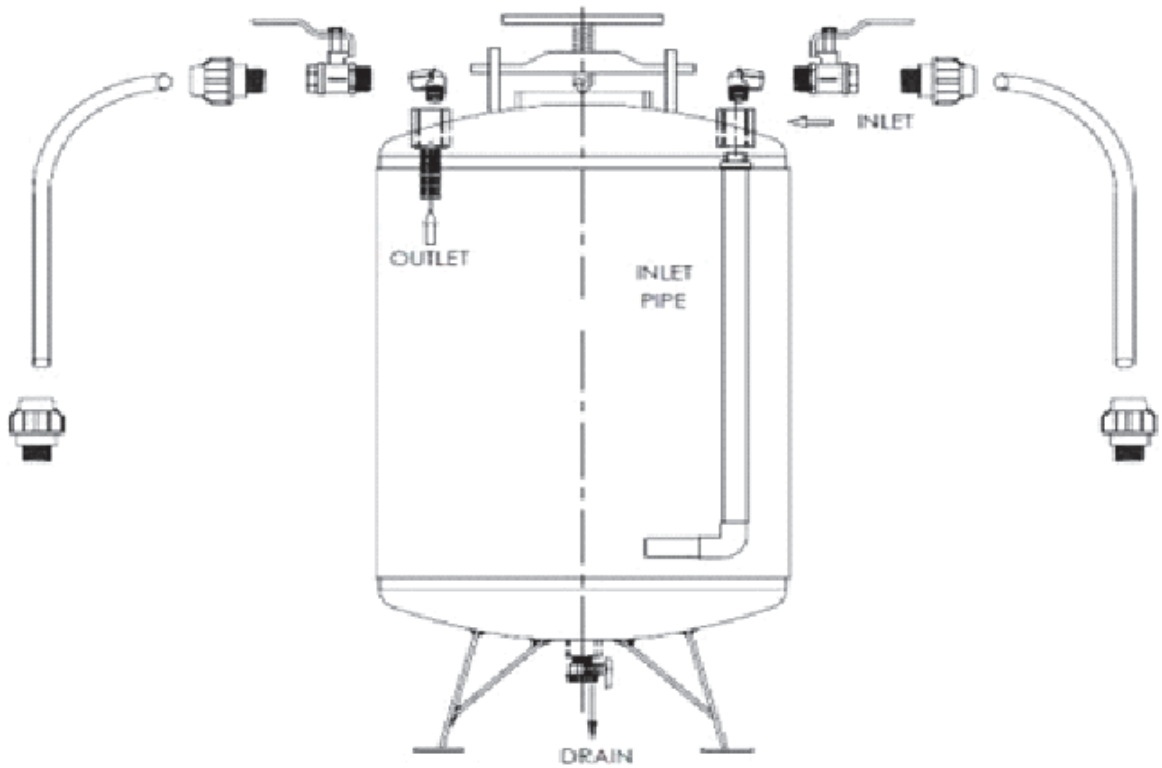

FIG. 1 QUANTITATIVE MODEL

used for creating sufficient pressure difference to cause part of the flow to be diverted through the tank. Inside the tank there is a rubber/plastic bladder which fills the tank. The fertilizer/chemical solution is filled into the rubber/plastic bladder thereby insulating the metal tank from corrosion. Water from the main line enters between the tank and the bladder and compresses the contents. Since the pressure on the inlet side is greater than the outlet side, fertilizer/ chemical solution is uniformly expelled into the water line. (see fig. 2)

The water inlet flow on the inlet side is generally metered and also adjusted by means of a regulating valve. The fertilizer concentration remains the same throughout and under stable condition is fairly accurately proportional to the irrigation discharge.

4.2 Based on the Volume of the Tank

Based on the volume of the tank or bladder it can be classified as 30, 60, 90, 120, 160, 180, 220 liters etc. or any other volume declared by the manufacturer.

5 MATERIAL

The material used in the manufacture of fertilizer tanks and their fittings shall be resistant to fertilizers and chemicals commonly employed in irrigation, and shall

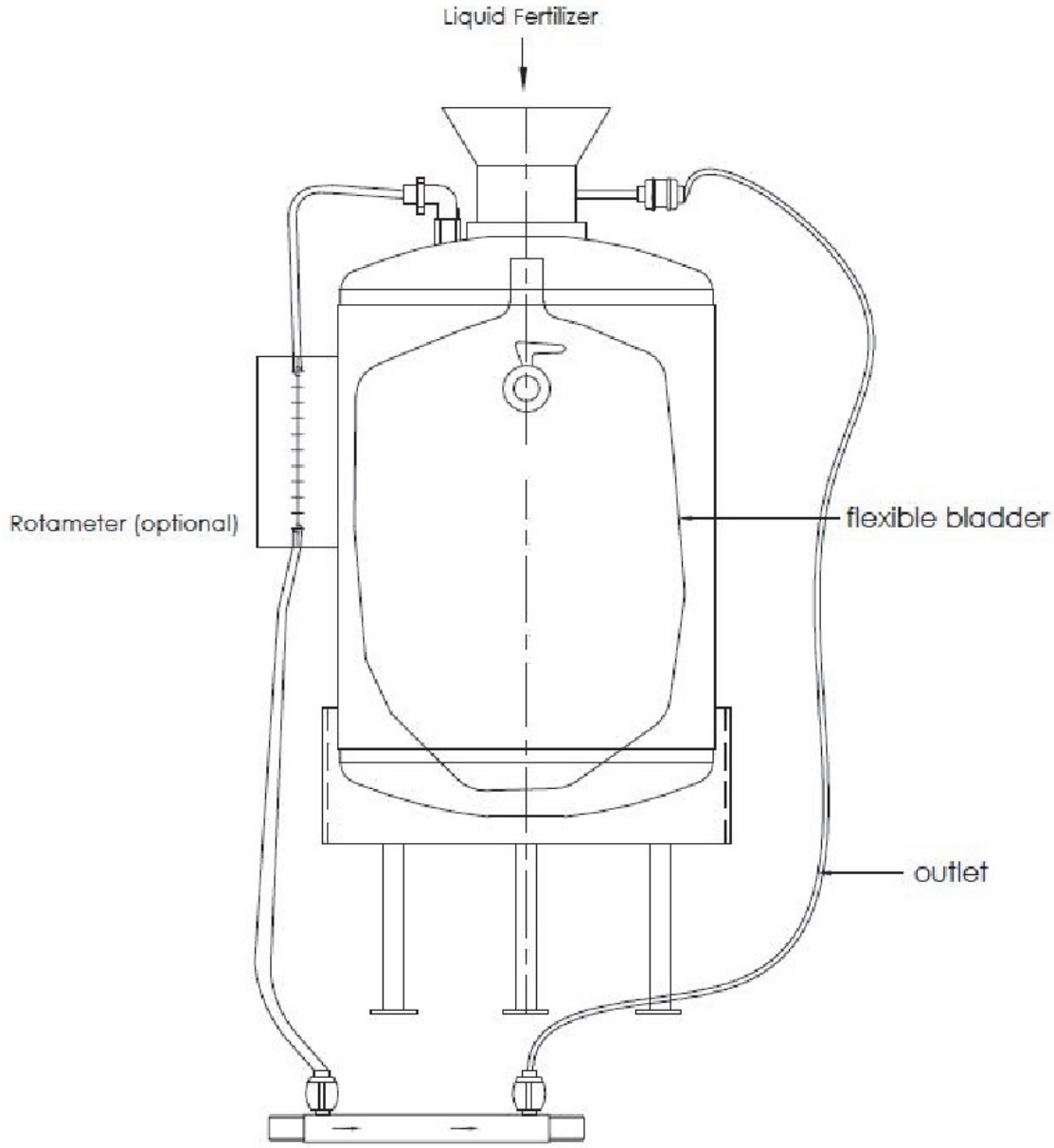

FIG. 2 PROPORTIONATE MODEL

be suitable for use with water at temperatures up to 60 °C and at nominal test pressure.

5.1.1 The materials shall not support the growth of algae. The plastic parts of the fertilizer tanks that are exposed to light, shall be protected against UV degradation.

5.1.2 The corrosive metals used in the manufacture of fertilizer tanks shall be duly protected with non-corrosive coating such as epoxy paint, rubberized or tar based powder coating paint or any other suitable coat. For metal fertilizer tank powder coating thickness should be minimum 70 microns.

6 CONSTRUCTIONAL REQUIREMENTS

6.1 Dimensions

In-side and outside diameter, height and wall thickness:

The inside diameters, outside diameter and height of the fertilizer tank, wall thickness and dimensions of the connecting fitting shall be as declared by the manufacturer.

The wall thickness shall be measured in accordance with a dial vernier/ball or micrometer. The resulting dimensions shall be expressed to the nearest 0.05 mm. The dimensions of the connecting fittings shall match the dimensions of the fertilizer tank, to ensure easy and reliable installation and operation. The assembly made with or without the use of clamping bands, shall be sufficiently strong to withstand the maximum working pressure.

NOTE — Clamping means, such as bands and screws, shall be non-corrosive materials or of materials protected against corrosion.

6.2 General

The fertilizer tanks, its parts and fittings, shall have no manufacturing defects that may impair their performance. The construction of the fertilizer tank and its fittings shall permit their easy connection, with or without clamping bands, whether the connection is made manually or by means of suitable tools supplied by the manufacturers.

7 TEST SPECIMENS AND TESTING CONDITIONS

7.1 Test Specimens

Test specimens shall be selected at random by the representative of the testing laboratory from a lot of at least 5 units.

7.2 Testing Conditions

Unless otherwise specified in the relevant clause, all tests shall be performed at ambient temperature and at water temperature of 27 ± 3°C.

7.3 Accuracy of Measuring Devices

7.3.1 The error, if any, in the measurement of water pressure shall not exceed 2 percent of the actual value.

7.3.2 During the test, the pressure shall not vary by more than 2 percent.

8 REQUIREMENTS

8.1 Resistance of Fertilizer Tanks to Hydrostatic Pressure at Ambient Temperature.

8.1.1 When tested in accordance with the test method given at **A-1**, the fertilizer tank assembly shall withstand the test pressure without showing signs of damage to the fertilizer tank or the connecting fittings. No leakage shall occur from body or fitting.

8.2 Resistance to Hydrostatic Pressure at Elevated Temperature

8.2.1 When tested in accordance with the test method given at **A-2**, the fertilizer tank assembly shall withstand the test pressure without showing signs of damage to the fertilizer tank or the connecting fittings. No leakage shall occur from body to fitting.

8.3 Injection Rate Calibration

8.3.1 *Injection rate calibration for fertilizer tank – quantitative model*

8.3.2 *Calibration of rate of injection*

8.3.2.1 When tested in accordance with the test method given at **A-3** of Annexure A, test results of injection rate obtained, shall be within 10 percent of the injection rate declared by the manufacturer.

8.3.3 *Calibration of injection time*

8.3.3.1 When tested in accordance with the test method given at **A-4** of Annexure A, test results of injection rate obtained, shall be within 10 percent of the injection rate declared by the manufacturer.

8.3.4 *Injection rate calibration for fertilizer tank — proportional model with* rubber/plastic bladder

8.3.5 *Calibration of rate of injection*

8.3.5.1 When tested in accordance with the test method given at **A-5** of Annexure A, Test results of injection rate obtained, shall be within 10 percent of the injection rate declared by the manufacturer.

8.3.6 *Calibration of injection time*

8.3.6.1 When tested in accordance with the test method given at **A-6** of Annexure A, residual solution shall not be more than 10 percent of the capacity of

bladder, within the time declared by the manufacturer.

9 DESIGNATION

9.1 Fertilizer Tank – Quantitative Model

Fertilizer tanks shall be designated by the words 'Quantative Model', reference to this Indian standard, nominal volume, inlet outlet connection size, maximum operating pressure (Pmax), nominal operating pressure (Pn), injection time at nominal operating pressure (Pn) and nominal differential pressure (Pd) etc.

9.2 Fertilizer Tank — Proportional Model with rubber/plastic bladder

Fertilizer tanks shall be designated by the words 'Proportional Model', reference to this Indian Standard, inlet outlet connection size, volume of bladder, maximum operating pressure (Pmax), nominal operating pressure (Pn), injection time at nominal operating pressure (Pn) and nominal differential pressure (Pd) etc.

10 MAINTENANCE AND PERIODIC CLEANING

10.1 Manufacturer shall supply guidelines for proper operation and maintenance of fertilizer tank along with safety instructions.

11 MARKING AND PACKING

11.1 Each fertilizer tank shall bear clear and permanent markings, indicating the following particulars:

a) Name of the manufacturer or his registered trade mark;
b) Nominal volume of the fertilizer tank;
c) Batch or Code No;
d) Designation in accordance with **9**;
e) Each fertilizer tank shall have clear marking preferably pictorial "Not for drinking"; and
f) Arrow indicating direction of flow.

11.2 BIS Certification Marking

Each product may also be marked with the Standard Mark.

11.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act,* 2016 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

11.3 Packing of Fertilizer Tank

11.3.1 Fertilizer tanks shall be duly packed in protective packing to avoid handling and transit damages.

12 DATA TO BE SUPPLIED BY THE MANUFACTURER WHEN EVER ASKED FOR

12.1 The manufacturer shall make available to the user, together with the fertilizer tank and fittings, catalogues or information sheets that include the following data:

a) Catalogue number of fertilizer tank and fitting;
b) Type of fittings for connecting fertilizer tank to supply network or appliances;
c) Instruction sheet for proper operation of fertilizer tank (the instruction sheets shall be dated);
d) Installation instructions for the fertilizer tank and fittings;
e) Range of working pressure of the fertilizer tank;
f) Classification of fertilizer tank;
g) Operating Characteristics of fertilizer tank (**8.3**);
h) Limitations of fertilizer tank use (fertilizers, chemicals, etc);
j) Maintenance and storage requirements;
k) Nominal test pressure;
m) Safety Instructions.

ANNEX A

A-1 RESISTANCE OF FERTILIZER TANKS TO HYDROSTATIC PRESSURE AT AMBIENT TEMPERATURE

A-1.1 Perform the test on fertilizer tank complete with assembly.

A-1.2 Connect the fertilizer tank assembly to a source of water, by means of an inlet fitting, and close its outlet end. Fill the fertilizer tank assembly with water and check that no air remains trapped in the pipe. Increase the water pressure gradually (10 s minimum) to the maximum working pressure (Pmax) and maintain the test pressure for 5 min.

A-1.3 Observe for any leakage from body or fitting and any signs of damage to the fertilizer tank or the connecting fittings.

A-2 RESISTANCE TO HYDROSTATIC PRESSURE AT ELEVATED TEMPERATURE

A-2.1 Perform the test on fertilizer tank at a temperature of 60 ± 2°C.

A-2.2 Perform the test on fertilizer tank complete with assembly.

A-2.3 Connect the fertilizer tank assembly to a source of water, by means of an inlet fittings, and close its outlet end. Fill the fertilizer tank assembly with water and check that no air remains trapped in the pipe. Increase the water pressure gradually (10 s minimum) to the nominal working pressure and maintain the test pressure for 15 min.

A-2.4 Observe for any leakage from body or fitting and any signs of damage to the fertilizer tank or the connecting fittings.

A-3 INJECTION RATE CALIBRATION FOR FERTILIZER TANK – QUANTITATIVE MODEL

A-3.1 Calibration of Rate of Injection

A-3.2 Perform the test on fertilizer tank at a temperature of 27 ± 3°C.

A-3.3 Install the fertilizer tank on a bypass line connecting main system flow pipeline and set nominal operating pressure (Pn).

A-3.4 Create pressure difference between the inlet and the outlet with the help of pressure reducing device or throttle valve. Set the differential pressure.

A-3.5 Measure the injection rate using Rotameter or other flow measuring device. Perform the test for atleast three values of differential pressures as declared by the manufacturer out of which one value shall always be nominal differential pressure (Pd). (for example, 20 kPa, 30 kPa and 50 kPa).

A-4 CALIBRATION OF INJECTION TIME

A-4.1 Perform this test on fertilizer tank at a temperature of 27 ± 3°C.

A-4.2 Install the fertilizer tank as stated in **8.2.1** or use easily identifiable and completely water soluble media as a solution to be used in fertilizer tank. (For example, acidic solution with *p*H up to 4).

A-4.3 Create pressure difference between the inlet and the outlet with the help of pressure reducing device or throttle valve equal to nominal differential pressure (Pd). Run the system for the time declared by the manufacturer. Employ suitable means to check and all the fertilizer from the tank is expelled in to the main pipe line. This may include litmus paper test, *p*H paper test, EC test, *p*H check or as per manufacturer's recommendations.

A-4.4 Observe for residual solution within the time + 10 percent of the time declared by themanufacturer.

A-5 INJECTION RATE CALIBRATION FOR FERTILIZER TANK PROPORTIONAL MODEL WITH RUBBER/PLASTIC BLADDER

A-5.1 Calibration of Rate of Injection

A-5.2 Perform the test on fertilizer tank at temp of 27 ±3°C.

A-5.3 Install the fertilizer tank on bypass line connecting main systems flow pipeline. Set nominal operating pressure and flow. Create pressure difference between the inlet and outlet.

A-5.4 Perform the test for at least three values of differential pressures as declared by the manufacturer out of which one value shall always be nominal differential pressure (Pd). (for example, 20 kPa, 30 kPa and 50 kPa).

A-5.5 Measure the injection rate using Rotameter or other flow measuring device.

A-6 CALIBRATION OF INJECTION TIME

A-6.1 Perform this test on fertilizer tank at a temperature of 27 ± 3°C.

A-6.2 Install the fertilizer tank as stated in **8.2.1** or use easily identifiable and completely water soluble media as a solution to be used in fertilizer tank. (For example, acidic solution with *p*H up to 4).

A-6.3 Create pressure difference between the inlet and the outlet with the help of pressure reducing device or throttle valve equal to nominal differential pressure (Pd). Run the system for the time declared by the manufacturer.

A-6.4 Take out the bladder assembly and check for residual solution.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards : Monthly Additions'.

This Indian Standard has been developed from Doc No.: FAD 17 (2583).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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