भारतीय मानक

Indian Standard

IS 14743 : 2024

सिंचाई उपस्कर — हाइड्रोसाइक्लोन फ़िल्टर — विशिष्टि

(पहला पुनरीक्षण)

Irrigation Equipment — Hydrocyclone Filters — Specification

(First Revision)

ICS 65.060.35

भारतीय मानक ब्यूरो
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February 2024 **Price Group 6**

Farm Irrigation and Drainage Systems Sectional Committee, FAD 17

FOREWORD

This Indian Standard (First Revision) 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.

A hydro-cyclone is combination of a vessel having an inlet and arrangement to create a spiral vortex flow, a centrally located rising up outlet and an underflow chamber or collection tank for collecting the sand removed from water. Hydrocyclones are essentially used to separate particles having specific gravity more than one (for example soil, sand etc) from water to be used for micro irrigation. Due to this basic function to separate the heavy particles, that enters with water flow, by process of centrifugal separation, it is also called centrifugal filter/sand separator.

Water enters the hydrocyclone and is rotated tangentially to create cyclonic spiral motion of water inside the body of the hydrocyclone filter. This rotational movement induces centrifugal force which pushes the sand and other suspended solids heavier than water to the body walls. This creates 'vortex' which impulses the sand and heavy particles downward into the underflow chamber of collection tank. The central flow regime of heavy particle free clean water rises up in spiral motion to the outlet. Thus the head loss between the hydrocyclone inlet and its outlet is indispensable. The centrifugal energy gained from the head (inlet pressure) is used to create centrifugal force to achieve the process of centrifugal separation.

This standard covering the covering the general constructional requirements and test methods of the hydrocyclone filters was first published in 1999. A need was felt to revise the standard in latest style of Indian Standard, incorporating following modifications as per the current manufacturing practices:

a) Definitions of hydrocyclone filter and cyclonic vessel have been modified for better comprehension and definition of loading rate has been added;
b) Provision of chamber cover has been removed considering the current manufacturing practices; and
c) To test the durability of the hydrocyclone, cyclic pressure test has been incorporated.

The composition of the Committee, responsible for the formulation of this standard is given in Annex A.

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 : 2022 'Rules for rounding off numerical values (*second revision*)'. 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

IRRIGATION EQUIPMENT — HYDROCYCLONE FILTERS — SPECIFICATION

(*First Revision*)

1 SCOPE

1.1 This standard specifies the general constructional requirements and test methods of the hydrocyclone filters, intended for operation in agricultural irrigation systems.

1.2 The standard does not deal with filtration ability, efficiency and capacity nor it deals with the hydrocyclone filters that integrate automatic or continued flushing of accumulated sand.

2 REFERENCES

The standards given below contain provisions which through reference in this text constitute provisions of this standard. At the time of publication, the editions indicated were valid. All the standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards:

IS No.	*Title*
IS 554 : 1999/ ISO 7-1 : 1994	Pipe threads where pressure-tight joints are made on the threads — Dimensions, tolerances and designation (*fourth revision*)
IS 2500 (Part 1) : 2000/ISO 2859-1 : 1999	Sampling procedures for inspection by attributes: Part 1 Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection (*third revision*)
IS 2643 : 2005/ ISO 228-1 : 2000	Pipe threads where pressure-tight joints are not made on the threads — Dimensions, tolerances and designation (*third revision*)
IS 6392 : 2020	Steel pipes flanges — Specification (*first revision*)

3 TERMINOLOGY

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

3.1 Ambient Temperature

Ambient temperature is the temperature of the air surrounding a component.

3.2 Clean Pressure Drop

Pressure drop of clean water filtered by a 200 mesh (75 micron) pre-filter between inlet and outlet of hydrocyclone filter.

3.3 Cyclonic Vessel

The vessel provided to generate enough time of concentration to the particles to travel towards outer wall of the vessel. On one side it is connected to inlet chamber and outlet pipe and on the other side it is connected to underflow chamber of sand collection tank.

3.4 Drain Port

It is provided for draining out water for cleaning the slurry in the underflow chamber either fitted with plug or a valve or a flexible tube with an end plug.

3.5 Height of Filter

The overall height of filter between the extremities of bottom of the underflow chamber in assembled condition to the connecting threads or flange of uprising outlet pipe.

3.6 Hydrocyclone Filter

A filtration device consisting of a cyclonic vessel having an arrangement to create spiral vortex flow, an inlet, a centrally rising up outlet and an underflow chamber for sand collection tank connected at the lower end, essentially having an opening for removal of accumulated entrapped particles.

3.7 Hydrocyclone Inlet

The pipe attached to the body and at the top of the conical/funnel shaped vessel to allow inflow of the stream of raw water and diverting water along the

inner wall of the conical vessel to convert into swirling/circular motion.

3.8 Hydrocyclone Outlet

A straight pipe starting from below the horizontal place of inlet and projecting at right angles from circular top of conical vessel, allowing clean water column to rise and flow out of vessel.

3.9 Length of Filter

The overall length between the extremities of the connecting threads or face to face distance between the connecting flanges of inlet and outlet of the filter.

3.10 Loading Rate

The average concentration of suspended particles in the inlet test fluid expressed in dry mass milligram per litre of the fluid (ppm).

3.11 Maximum Operating Flow

The maximum flow rate into the filter system specified by the manufacturer that ensures both proper filtration and head loss within the limit.

3.12 Maximum Operating Pressure (p_{mo})

The static water pressure immediately upstream of the filter inlet at which the filter is required to operate.

3.13 Minimum Operating Flow

The lowest flow rate into the filter system specified by the manufacturer that ensures both proper filtration and head loss within the limit (normally the flow rate that offers head loss of approximately 1.5 m of water column).

3.14 Nominal Size

A conventional numerical designation used to indicate the size of the filter. This designation equals the nominal size of the pipe to which the filter can be connected without intermediate fittings.

3.15 Range of Recommended Flow-Rate

The range of flow rates declared by the manufacturer for proper operation of the hydrocyclone filter (normally between head loss of 1.5 m to 5 m of water column).

3.16 Safe Maximum Pressure Drop

Maximum allowable pressure difference between inlet and outlet at nominal flow at given level of suspended sediments beyond which the filter is not recommended for continuous operation.

3.17 Underflow Chamber

A sand/sediment tank connected at narrow lower end of cyclonic vessel having an opening for drawing the filtrate sediments collected during the filtration process.

4 TECHNICAL REQUIREMENTS

4.1 Material

4.1.1 The parts of hydrocyclone filter that are in contact with the water shall be of non-toxic materials and shall be resistant to or protected against degradation caused by existing working conditions and types of water used in agricultural irrigation. The cyclonic vessel should also be resistant to environmental conditions. Components belonging to filters of the same size, type and model and produced by the same manufacturer, shall be replaceable and interchangeable.

4.1.2 Metallic body or parts shall be coated with durable abrasion resistant coating having a coating thickness more than 70 µm or hot dip galvanized to resist corrosion and under scouring

4.1.3 Plastic body or parts of the filter that are exposed to ultraviolet (UV) radiation under normal working conditions of the filter shall include additives to improve their resistance to UV radiation. Plastic parts that enclose water ways shall be opaque or shall be provided with an opaque cover design to black out all light from reaching clear water ways enclosures.

4.2 Construction

4.2.1 The construction of the filter shall be such as to ensure its proper installation in its intended location and position.

4.2.2 The filter shall be so designed that after assembly of the filter all the water flowing through the filter shall flow through inlet into cyclonic motion then to the outlet. The accumulated sand/slurry collected in the underflow tank should not be mixed with the processed water flowing through outlet.

4.3 Cyclonic Vessel

4.3.1 The cyclonic vessel shall be so designed that the dirt separated should slide easily to the underflow chamber without stoppage on any step or shelf.

4.3.2 The length of inlet pipe shall be such that it leaves sufficient clearance with the underflow chamber during fitment/installation.

4.3.3 The upward projecting length of outlet pipe shall be such that it allows fitment such as flange bolts at the top. The length of the outlet pipe immersed in water inside the cyclonic vessel shall be enough to allow only processed water to go out.

4.3.4 The capacity of underflow chamber shall be large enough to store slurry for sufficient duration of operation (at least one shift of the irrigation section). The cover of the chamber shall be attached by means of threads or by bolts or by any other manner that ensures full and uniform tightness around the periphery of the cover.

4.3.5 Inlet and outlet should have arrow marking indicating direction of flow.

4.4 Connections

4.4.1 In filters with threaded ends for direct connection to the supply line, the threads shall comply with IS 554 for GI fittings and IS 2643 for plastic fittings.

4.4.2 Flange connection if any shall comply with IS 6392.

4.4.3 The underflow chamber shall be provided with a drain plug or a valve or suitable purging arrangement for draining excess water while removal of slurry during the cleaning operation.

5 TESTS

Tests shall be conducted at ambient temperature except for the test at high temperature test in accordance with 5.2. The instrument used for measuring the various parameters shall permit measurements to an accuracy of within ± 2 percent of the actual values.

5.1 Resistance to Internal Hydrostatic Pressure

5.1.1 This test shall be performed on the filter with all its parts assembled for normal operation.

5.1.2 Before conducting the test on filters equipped with drain valve, open and close the drain valve 100 times while applying a water pressure equal to the maximum operating pressure multiplied by 0.75 at the inlet.

5.1.3 Close the chamber cover and outlet as per the manufacturer's recommendations.

5.1.4 Close the outlet of the filter by suitable means. Apply hydraulic pressure at the inlet of the filter and check that no air remains trapped in the system and that the water reaches all the places that maybe under pressure during the operation of the filter.

5.1.5 Raise the pressure gradually to 1.5 times the maximum operating pressure and maintain this pressure for five minute.

5.1.5.1 The filter shall withstand the test pressure without suffering damage or deformation.

5.1.5.2 No sign of leakage shall appear through the cyclonic vessel, underflow chambers and its opening and connections of drain/valve.

5.1.5.3 If gasket of the cover swells or its dislodged, reset the same, apply the pressure for additional 15 min and recheck for leakages. No leakages shall appear through the cover gasket.

5.2 Resistance to Internal Hydrostatic Pressure at Elevated Temperatures

5.2.1 Proceed as described in 5.1.1 to 5.1.4 but fill the filter with hot water at 60 °C ± 2 ºC and raise the internal pressure to the maximum operating pressure. Maintain the pressure and temperature for ± 15 min.

The filter shall not leak during this test.

5.2.2 After completing the test, disassemble the filter and check the parts for damage or deformation.

The parts of filter shall not show any sign of damage or deformation.

5.3 Pressure Drop Versus Flow

Pressure drop versus flow shall be reported for the purpose of establishing pressure flow relationships across the filter system. The specific criteria used for each test period and general test conditions shall be reported. The pressure versus flow tests shall be conducted with newly installed and cleaned underflow chamber filter.

5.3.1 *Test Period*

The duration (time) for each pressure flow combination depends on the time required for entire system to reach conditions of hydraulic equilibrium. These conditions may occur within 5 min to 10 min and to be determined by monitoring pressure land flow fluctuations. Take at least five readings of flow for period of 5 min and head loss shall be mean of 5 readings observed at the end of each minute at a given flow.

5.3.2 *Loading Rate*

The filter system shall be tested at each flow with clean water only which have passed through a pre-filter of 200 mesh (75 microns).

5.3.3 *Flows*

Tests shall be conducted at a minimum of five flow readings in nearly equal increments from about 80 percent of the manufacturer's minimum recommended operating flow to about 120 percent of manufacturer's maximum operating flow rate. All the flows used shall be reported.

5.3.4 *Testing Sequence*

Test shall be proceeded from lowest to the highest flow. If it is necessary to maintain the manufacturer's recommended pressure differential for proper separation process, then throttle the outlet by valve.

5.3.5 *Results*

The test result of clean pressure drop shall be within ± 10 percent of the declared value furnished by the manufacturers.

5.3.6 *Observation*

No leakage and excessive wear shall be observed during the test.

5.4 Cyclic Pressure Test

5.4.1 Position the filter in a test rig as shown in Fig 1. Fill the test system with water and raise its pressure up to 1.00 kg/cm^2.

5.4.2 Apply a cyclic pressure at both the inlet and the outlet of the filter, increasing gradually from 1.00 kg/cm^2 to the maximum operating pressure (p_{mo}) and then decreasing gradually back to 1.00 kg/cm^2, as shown in Fig. 2.

5.4.2.1 The duration of pressure increase or pressure decrease shall be (4 ± 0.5) s. While testing a filter of volume greater than 200 litres, this duration shall be (10 ± 1) s.

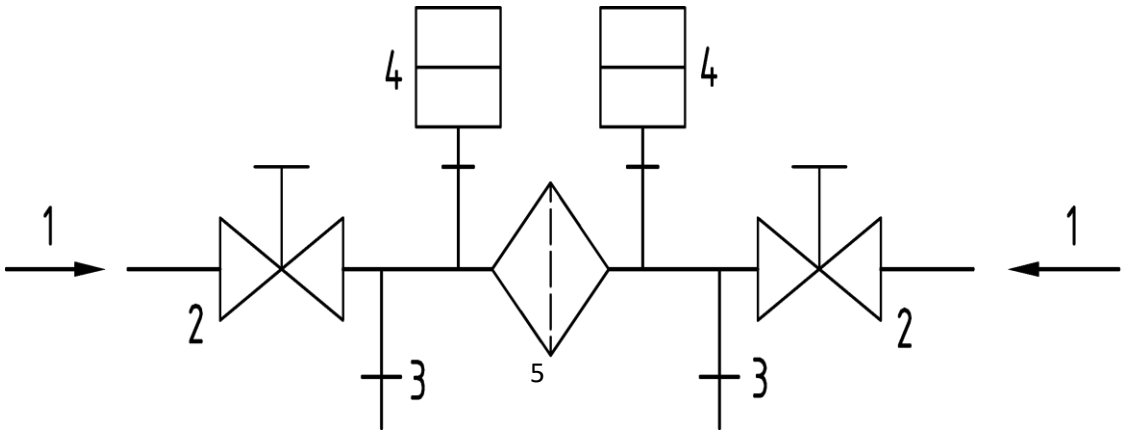
5.4.2.2 The duration of constant pressure periods shall be (4 ± 0.5) s.

5.4.3 Maintain the cyclic pressure sequence shown in Fig. 2 for 10,000 cycles.

5.4.4 Continue with another series of 1 000 cycles with the same pressure sequence, this time cycling between 1 bar and 1.5 × p_{mo}.

5.4.5 Set the pressure to 2 × p_{mo} for a filter with metallic housing, or to 1.5 × p_{mo} for a filter with plastics housing and maintain it for additional 30 min.

5.4.6 The filter complies with the test requirements if there is no evidence of leakage from the filter, and no fracture or other failure occurs during the test. The filter is regarded as having failed if it bursts or its joints show signs of leakage during the test. Packing leakage during the test shall not be a cause for rejection.



Key

1. Pressurizing device
2. Stop valve/solenoid valve
3. Drain valves
4. Pressure gauge
5. Filter under test

FIG. 1 CYCLIC PRESSURE TEST RIG

6 SAMPLING AND ACCEPTANCE REQUIREMENT

6.1 Type Test

The sample of the test specimens shall be taken at random by the testing laboratory's representative from a total of minimum 10 filters. The number of test specimens required for each test shall be as specified in the Table 1.

If the number of defective specimens in the sample is equal to or less than the acceptance number shown in Table 1, the lot shall be considered acceptable. If the number of defectives in the sample is greater than the acceptance number, the lot shall be rejected.

6.2 Acceptance Test

The test specified in 5.2 and 5.4 shall be only performed as part of type-tests at the time of inclusion and then at every one year frequency.

For acceptance of manufacturing lot or shipment of hydro-cyclone filters, the sampling shall be conducted according to IS 2500 (Part 1) based on the AQL 2.5 and Special Inspection Level IV.

For the tests specified in 5.1 and 5.3 the shipment or manufacturing lot complies with this standard if number of defective specimens found in the test does not exceed the acceptance number specified in IS 2500 (Part 1).

7 INFORMATION TO BE SUPPLIED BY THE MANUFACTURER

7.1 The manufacturer shall supply the following information about the hydrocyclone filter:

a) Name and address of the manufacturer;

b) Model and catalogue number of the filter;

c) Filter data:

1) Material of construction;
2) Nominal size (a single number designation is adequate if the inlet and outlet ports are the same size);
3) Maximum operating pressure;
4) Recommended range of design flow rates;
5) Dimensions of the filter;
6) Type of connections to the piping network;
7) Length of assembly;
8) Height of assembly;
9) Weight of filter empty and in operating condition;
10) Capacity of underflow chamber; and
11) Instructions for closing the cover and safety precautions.

d) Instructions for assembly, installation, operation cleaning, maintenance and troubleshooting;

e) List of spare parts;

f) Resistance to the chemical commonly used in irrigation;

g) Curve of clean pressure drop in the range of recommended flow rates plus 20 percent beyond each end of the range;

h) Maximum percentage of suspended heavy solid for effective working; and

j) Maximum allowable differential pressure.

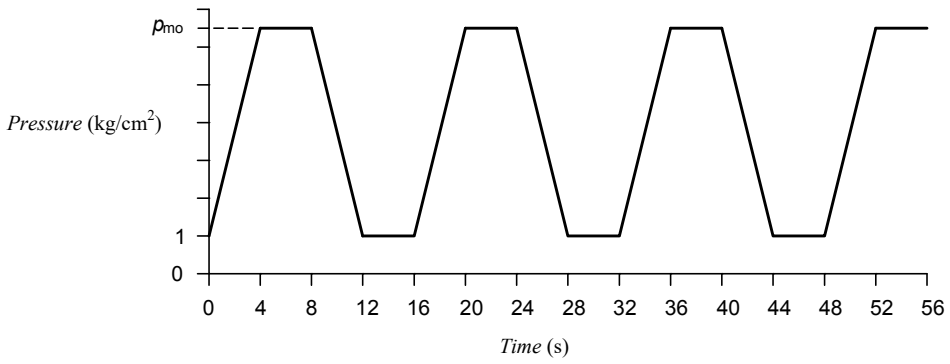


FIG. 2 CYCLIC PRESSURE SEQUENCE

8 MARKING

8.1 Each filter shall be marked with the following particulars on the filter:

a) Name of manufacturer and/or his trade- mark;
b) Model identification;
c) Nominal size;
d) Maximum operating pressure;
e) Arrow indication for inlet and outlet;
f) Recommended range of flow rate; and
g) Safety instructions for opening the cover of underflow chamber.

8.2 BIS Certification Marking

Each filter may also be marked with the Standard Mark.

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

Table 1 Number of Test Specimens and Acceptance Number

(*Clause* 6.1)

Sl No.	Clause No.	Name of Test	No. of Test Specimens	Acceptance No.
(1)	(2)	(3)	(4)	(5)
i)	5.1	Resistance of filter to internal hydrostatic pressure	3	0
ii)	5.2	Resistance of filter to internal hydrostatic pressure at high temperature	3	0
iii)	5.3	Clean pressure drop	2	0
iv)	5.4	Cyclic pressure test	1	0

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

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In Personal Capacity (*D-26, Pusa Campus, Agricultural Research Institute, New Delhi-110012*)	DR T. B. S. RAJPUT **(*Chairperson*)**
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Review of Indian Standards

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