**IS 14460 : 1997**

**Draft Indian Standard**

**SEED PROCESSING EQUIPMENT - GRAVITY SEPARATOR – SPECIFICATION**

**भारतीय मानक**

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**FOREWORD**

Agriculture and Food Processing Equipment Sectional Committee, FAD 20

This Indian Standard was adopted by the Bureau of Indian Standards after the draft finalized by the Agricultural Produce Processing and Milling Machinery Sectional Committee had been approved by the Food and Agriculture Divisional Council.

Seed of the same size and general shape can often be separated because they differ in specific gravity. This difference is very useful in removing light immature seed or heavy seed and rocks to improve the purity and germination of crop seed. This is basically the separation made by the gravity separator, which uses air as a separation substrate.

In the preparation of this standard assistance has been derived from the Maharashtra Hybrid Seed Corporation, Akola and National Seeds Corporation Ltd, Delhi.

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.

**1 SCOPE**

This standard specifies material, performance, constructional and other requirement of specific gravity separator.

**2 REFERENCES**

The standards given below 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 given below:

|  |  |
| --- | --- |
| *IS No.* | *Title* |
| 210 : 1993 | Grey iron castings (*fourth revision*) |
| 277 : 1992 | Galvanized steel sheet (plain and corrugated (*fifth revision*) |
| 399 : 1963 | Classification of commercial timbers and their tonal distribution |
| 2062 : 1992 | Steel for general structural purposes (*fourth revision*) |
| 4333 (Part 2) : 1977 | Methods for analysis for food grains: Part 2 Moisture |
| 4454 (Part 4) : 1975 | Steel wires for cold formed springs: Part 4 Stainless spring steel wire for normal corrosion resistance (*first revision*) |

**3 TERMINOLOGY**

**3.0** For the purpose of this standard the following definitions shall apply.

**3.1 Gravity Separator**

A machine used for upgrading of cleaned seed passed through an air-screen-cleaner. It separates from uniform sized seed material, lighter immature and insect damaged, rain damaged seed and heavy inert material based on specific gravity of different components in order to get good seed. The separation is achieved with the co-ordination of five adjustments (see 3.11).

**3.2 Raw Seed**

The seed received after threshing, containing good seed, inert matter, light and shriveled seed, oversized and undersized seed and weed seed.

**3.3 Cleaned Seed**

The seed from which chaff dust, undersize, oversize, removed by an air-screen cleaner.

**3.4 Good Seed**

The graded seed having high degree of physical purity as per standards prescribed under seed act.

**3.5 Pure Seed**

The graded seed completely free from visible physical impurity.

**3.6 Germination**

It is the emergence and development from the seed embryo of those essential structures which for the kind of seed in question are indicative of its ability to produce a normal plant under favorable conditions.

**3.7 Healthy or Viable Seed**

The physically pure seed capable of germination to give rise to healthy plant. Healthy seed percent is obtained by multiplying purity percent and germination percent and divided by 100.

**3.8 Body**

It is the stationary machine base frame with fans and air chamber connected with the deck with flexible tarpaulin shroud.

**3.9 Beck**

The deck is the adjustable frame fitted in the body with oscillating mechanism or table on which fluidization of material and separation is effected.

**3.10 Feed Rate**

The quantity of the cleaned seed fed into the specific gravity separator per unit time. It is important to maintain steady feed rate after machine setting to ensure quality.

**3.11 Adjustments**

The gravity separator is a versatile machine and can accomplish a wide range of separations primarily because it has many adjustments which allows the operator to control the separating action precisely. Five main adjustments areas given in **3.11.1** to **3.11.5**.

**3.11.1** *Feed Regulating Mechanism*

The mechanism which regulates the feed rate to the /specific gravity separator.

**3.11.2** *Air Control Device*

A mechanism at the air-inlet to the fans which regulates the air velocity or air pressure through the deck base and surface material at the outlet.

 NOTE - Air is used for stratification of seed material vertically on the deck, in which seed of higher specific gravity fall down through the substrata while seed of lower gravity will be buoyed up the strata.

**3.11.3** *End Slope*

Slope of deck from the feed hopper to the extreme discharge end, which controls the output capacity of the machine.

**3.11.4** *Side Slope*

The tilt or inclination of the deck from the low side to the high side of the discharge end.

**3.11.5** *Deck**Oscillation Speed Control*

The mechanism which regulates the motion of the deck per unit time.

3.12 *Divertors*

The devices used for collecting the seed in the deck delivery edges based on visual observation into graded sound seed, reject and middling.

3.13 *Middling*

The intermediate product in the gravity deck between heavier good seed and the light material contains too many good seed to be thrown away but too few to permit blending it into the good seed fraction. This product is run over the gravity separator again to salvage the good seed. In larger plants the middling is run in second gravity separator and the good seed obtained in two part separation is blended with that obtained from the first machine.

**TYPES**

**4.1** The gravity separators used in seed industry are of the following types based on the shape of the deck used:

1. Triangular type (see Fig. l), and
2. Rectangular type (see Fig. 2).

**5 SEPARATIONS**

**5.1** The following types of separation are effected in 4 fractions in both type of machines:

|  |  |  |  |
| --- | --- | --- | --- |
| a) | Fraction 1 | Light Seed | To be outright rejected |
| b) | Fraction 2 | Middling | A mixture of good seed and light seed-to be re-run simultaneously and blend the good seed recovered with fraction 3 |
| c) | Fraction 3 | Good Seed | Approved quality |
| d) | Fraction 4 | Heavy | A mixture of heavy seed and mud balls/stone-to be rerun at the end to recover the sound seed to blend in Fraction 3 |

**MATERIALS**

**6.1** The material of construction of various components of gravity separators shall be as given in column 3 of Table 1. The material may conform to the relevant Indian Standards given in co1 4.

**7 PERFORMANCE REQUIREMENTS**

**7.1** When tested in accordance with the method given in Annex A, the gravity separators shall conform to the following requirements:

1. Improvement in quality of seed percent between air-screen-cleaned input seed to gravity graded output seed shall be 10 percent minimum.
2. Improvement in bulk density/l 000 seed weight of air-screen-cleaned seed Versus gravity graded good seed shall be 2 percent minimum.
3. The percentage of inert matter in good seed shall not be more than 1 percent.
4. The percentage of lighter seed in good seed shall not be more than3 percent.

**7.1.1** The gravity separator shall withstand the tests given under **Annex A**.



**FIG.1 SCHEMATIC DIAGRAM GRAVITY SEPARATORS (TRIANGULAR TYPE)**

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**FIG. 2 SCHEMATIC DIAGRAM GRAVITY SEPARATOR (RETANGULAR TYPE)**

**Table 1 Material of Construction of Gravity Separators**

(*Clause* 6.1)

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl No.** | **Component** | **Material** | **Ref to Indian Standard** |
| **(1)** | **(3)** | **(3)** | **(4)** |
| a) | *Feeding Hopper* | Steel/Galvanized Sheet | 277 |
| i) | Feed control mechanism | Steel/Galvanized Sheet | 277 |
| ii) | Vibrator (optional) | Electromagnetic | - |
| b)  | *Deck* |  |  |
| i) | Deck frame | M. S. angle | 2062 |
| ii) | Deck surface | Wire mesh/perforated sheet (for bold seed) | - |
|  |  | Cloth/wire mesh(for small seed) | - |
| iii) | Dams on deck | Aluminium angle | - |
|  |  | Wooden batten | 399 |
| iv) | Springs | Spring steel | 4454 (Part 4) |
| c)  | Body | M.S. Plate | 2062 |
| i) | Fan | M.S. Plate | 2062 |
| ii) | Pulleys | Cast iron | 210 |
|  |  | Aluminium alloy | - |
|  |  | HDPE | - |
| iv) | Eccentric | Cast iron | 210 |
| v)  | Shaft | Mild steel | 2062 |
| vi) | Speed adjusting wheel | Mild steel | 2062 |
| vii) | Discharge spout | Steel/Galvanized Sheet | 277 |
| viii) | Air filter frame | Wood | 399 |
|  |  | Mild steel | 2062 |
|  |  | Fibre Glass | - |
| ix) | Air filter screen | Wire mesh with filter element | - |
| x) | Air control shutters | Steel/Galvanized Sheet | 277 |

**8 CONSTRUCTIONAL REQUIREMENTS**

**8.1** The sheets and plates used in construction of various parts shall be of minimum 1 mm and 3 mm thickness respectively.

**8.2** The dames on deck shall be of minimum 10 mm thickness if made of wood and of minimum 10 mm x 10 mm if made of aluminum angle.

**8.3** All other wooden components of the gravity separator shall be of minimum 20 mm thickness.

**9 OTHER REQUIREMENTS**

**9.1** The necessary bearings, eccentric, variable pulley and proper drive system shall be provided.

**9.2** The necessary provision of greasing, oiling for bearing shall be provided for the moving parts of the gravity separator. They shall be dust proof.

**9.3** The construction shall be such as to help easy and immediate repairs and maintenance.

**9.4** The machine shall be provided with easy facilities for adjustments (see **3.11**).

**10 WORKMANSHIP AND FINISH**

**10.1** The components of gravity separators shall be free from cracks, pits and other visual defects which may be detrimental for their use.

**10.2** The welding and joints, if any, shall not be porous and shall be smooth.

**10.3** The rust preventive coating shall be provided to the steel components and varnish to be provided to the wooden components.

**10.4** The control and adjustment provided shall be easy and operating smoothly.

**11 MARKING AND PACKING**

**11.1 Marking**

Each gravity separator shall be marked with the following particulars:

1. Manufacturers’ name and address.
2. Type and model number.
3. Power rating.
4. Drive details like number of oscillations of deck/min. rev/min of main shaft, air velocity of fan etc.
5. Batch or code number, if any; and
6. Year of manufacture.

**11.1.1** Each gravity separator may also be marked with the overall size and approximately weight of the machine or this information may be given in the cataloge supplied by the manufacturer.

**11.2 BIS Certification Marking**

Each gravity separator may also be marked with the Standard Mark.

**11.2.1** The use of the Standard Mark is governed by the provisions of Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

**11.3 Packing**

The packing of the gravity separator shall be done as agreed to between the purchaser and the supplier.

**ANNEX A**

(*Clauses* 7.1 and 7.1.1)

**METHODS OF TEST FOR GRAVITY SEPARATOR**

**A-l TEST MATERIAL**

**A-l.1** Sufficient quantity of cleaned seeds obtained from an air-screen cleaner of specified crop shall be taken for the test. The moisture contents of the throughput cleaned seed shall be determined in accordance with the method given in IS 4333 (Part 2). The seed lot selected for testing gravity separator shall have purity in the range of 70 to 80 percent.

**A-1.2** Random samples collected from air-screen cleaned seed and gravity separators 4 fractions shall be analyzed for bulk density, 1 000 seed weight, purity test and germination test. The average value shall be calculated from the analytical data and reported.

**A-2 RUNNING IN AND PRELIMINARY ADJUSTMENTS**

**A-2.1** The gravity separator shall be installed on leveled preferably on hard surface.

**A-2.2** The gravity separator shall be run-in for about 30 minutes before commencing the test. All the adjustments shall be carried out in accordance with the recommendations of the manufacturers.

**A-3 TEST AT NO LOAD**

**A-3.1** After running-in is over, the gravity separator shall be run at no load for 10 minutes at the specific speed. During and after the no load run, the visual observation at the specific gravity separator shall not show the following:

1. Presence of any marked vibration during operation;
2. Presence of undue knocking or rattling sound,
3. Any marked rise in bearing temperature;
4. Any marked unusual wear or slackness in any component; and
5. Any marked change in oscillation or slopes.

**A-4 TEST AT LOAD**

**A-4.1** The gravity separator shall be installed under a holding bin. The test material (see **A-1.1**) from an air-screen cleaner shall be passed on the gravity separator through holding bin and feed hopper. It shall be operated at its input capacity specified by the manufacturer for the particular crop seed, incorporating best combination of adjustments for a period of 30 minutes. During the running periods speed of shaft, speed of oscillation, end slope, side slope, air control lever position shall be noted.

Three sets of sample at the outlet chutes of all four fractions 1 to 4 either manually after each 10 minutes or continuously by automatic claw samplers for the entire period shall be collected. No sample shall be collected at the discharge edge of the deck which will give deceptive result.

**A-4.2 Preparation and Analysis of Samples**

**A-4.2.1** The samples drawn from each fraction chute shall be bulked separately chute wise and thoroughly mixed to form a composite sample. Bulk density of material received in each fraction shall be found by filling the same in a litre can and weighing the same.

**A-4.2.2** Each sample shall be further divided using a seed divider to get 100 gm representative sample.

**A-4.2.3** Each 100 gm sample shall be analyzed for physical purity-to find the percentage availability of the following different graded fractions:

|  |  |  |  |
| --- | --- | --- | --- |
| Fraction | 1 | Light Seed | To be analyzed for good seed content. |
| Fraction | 2 | Middling | To be analyzed for good seed content. |
| Fraction | 3 | Good Seed | To be analyzed for mud balls/stones and insect damaged and weed seed |
| Fraction | 4 | Heavy | To be analyzed for good seed content. |

**A-4.2.4** Weight of 1000 good seed in each fraction shall be taken to find the average weight of seed alone in each fraction.

**A-4.2.5** Germination of 300 seeds from above (see **A-4.2.4**) in each fraction shall be tested in seed testing lab. In 3 replicates of 100 seed each to find the percentage of healthy seed in each fraction. This will enable the operator to decide in reprocessing with proportional rejection to be adopted to augment maximum healthy/viable seed.

**A-4.2.6** Test at **A-4.2.1** to **A-4.2.5** shall also be conducted for the throughout cleaned seed random sample for comparison of improvements achieved in gravity grading.

**A-5 LONG RUN TEST**

The gravity separator shall be operated for a minimum duration of 20 hours at no load which could be covered by continuous run of at least 5 hours. During and after the operation no breakdown or defects shall develop in the separator.