भारतीय मानक **IS 18313 : 2023**

Indian Standard

मक्का के लिए डीहस्कर शेलर — विशिष्टि

Dehusker Sheller for Maize — Specification

ICS 65.060

भारतीय मानक ब्यूरो
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Agriculture and Food Processing Equipment Sectional Committee, FAD 20

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Agriculture and Food Processing Equipment Sectional Committee had been approved by the Food and Agriculture Division Council.

Dehusking and shelling are important post-harvest activities in maize crop, predominantly done by women. Traditionally, maize is manually dehusked and subsequently sun dried before being shelled by bullocks trampling or manual sheller. A manually operated tubular/fin type maize sheller removes grains from cobs, about 5 kg of grain can be removed in one hour. All these operations are time consuming and arduous resulting in huge losses in quality and quantity.

But nowadays, power operated dehusker sheller for maize are being extensively manufactured and used in the country for removing husk/sheath and separation of grains/kernels from cobs and replacing the traditional methods. Therefore, a need was felt for preparation of a standard to guide the manufacturers to produce quality product and also to help the users in selection of good quality dehusker sheller for maize.

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

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

DEHUSKER SHELLER FOR MAIZE — SPECIFICATION

1 SCOPE

1.1 This standard specifies the material, constructional, performance and other requirements of dehusker sheller for maize operated manually, by animal or by different power sources such as electric motor, diesel engine and tractor.

1.2 This standard also prescribes method of testing of power operated maize dehusker shellers to evaluate their performance and durability.

2 REFERENCES

The standards listed in Annex A contain provisions which, through reference in this text, constitute provisions 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 these standards.

3 TERMINOLOGY

3.0 For this standard, the following definitions shall apply.

3.1 Batch Test (Conformity of Production) — The tests conducted on maize dehusker sheller which have already undergone initial commercial test and are being manufactured/sold commercially in the country.

3.2 Clean Grain — Shelled grain/kernel free from refractions [*see* IS 4333 (Part 1)].

3.3 Cleaning Efficiency — Clean grains (*see* **3.2**) received at the specified grain outlet(s) with respect to total grain received at grain outlet(s) expressed as percentage by mass.

3.4 Commercial Test — The tests conducted for establishing performance characteristics of maize dehusker sheller that are ready for commercial production or already in production.

3.5 Composite Sample — The sample of the grain/kernel, husk and shelled cobs formed by combining and blending the primary samples (*see* **3.25**).

3.6 Concave Clearance — The maximum clearance between cylinder and concave.

3.7 Confidential Test — The test conducted for providing confidential information on the performance of maize dehusker sheller whether ready for commercial production or not, or to provide any special data that may be required by the manufacturer/applicant.

3.8 Damaged grains — Damaged grains received from total grain received (grain outlet, cylinder and dehusked cob outlet) and calculated as,

$$\text{Total damaged grains (\%)} = \frac{\text{Mass of shelled damged grains}}{\text{Mass of total grain}} \times 100$$

3.9 Dehusking Efficiency — Un-dehusked maize cobs received from outlet end or in cylinder after termination of threshing is weighed and dehusking efficiency is calculated as,

$$\text{Dehusking efficiency (\%)} = \frac{\text{Mass of dehusked cob received from outlet of machine, in kg}}{\text{Total un-dehusked cob fed, in kg}} \times 100$$

3.10 Evaluative Requirements — Requirement under this category are the ones which are mandatory for acceptance of the maize dehusker sheller for the purpose of commercial production/availing government subsidies and or finance from financing institutions. The testing agency will assess the performance of the maize dehusker sheller under test and release the report.

3.11 Feed Rate — The mass of the maize cobs fed into the maize dehusker sheller per unit time.

3.12 Final Sample — The sample drawn from the composite sample (*see* **3.5**) for analysis.

3.13 Foreign Matter — Includes inorganic and organic matter. The inorganic matter comprises sand, gravel, dirt, pebbles, stones, lumps of earth, clay, mud, iron chips, etc. The organic matter comprises chaff, straw, weed seeds and other inedible grains.

3.14 Grain Mixture — The mixture of clean, broken, un-threshed grains/kernel and foreign matter coming out of the main grain outlet(s).

3.15 Initial Commercial Test — The tests conducted on indigenous or imported prototype maize dehusker sheller ready for commercial production.

3.16 Input Capacity — The maximum feed rate at which the power requirement is minimum and total losses and efficiencies are within the specified limits (*see* **12** of IS 7051).

3.17 Maize Grain/Cob Ratio — After determining the mass of the dry samples as received from oven for moisture content, the cobs and maize grains are manually separated and weighed. The grains/cob including outer sheath (leaves) ratio (K) is calculated as,

$$K = \frac{\text{Mass of dry maize grain}}{\text{Mass of dry kernels and leaves}}$$

3.18 Non-Evaluative Requirements — Requirements under this category are the ones which are not mandatory for acceptance of the maize dehusker sheller for the purpose of commercial production/availing government subsidies and or finance from financing Institutions. However, the authorized testing agency may observe the performance for these requirements and record in the test report.

3.19 Output Capacity — The mass of the grains received at the specified grain outlet(s) when collected at input capacity.

3.20 Percentage of Blown Grain — The clean grain lost along with the hus/sheath/impurities with respect to total grain input expressed as percentage by mass.

3.21 Percentage of Broken Grain — The broken grain collected from all grain outlets with respect to total grain input expressed as percentage by mass.

3.22 Percentage of Spilled Grain — The clean grain dropped through the sieve and over-flown from sieve along with tailings with respect to total grain input, expressed as percentage by mass.

3.23 Percentage of Unthreshed Grain — The un-threshed grain from all outlets with respect to total grain input, expressed as percentage by mass.

3.24 Prime Mover — An electric motor or diesel engine or tractor power take-off is used for running the maize husker sheller.

3.25 Primary Sample — The mass of the grain, husk and shelled cobs taken from the outlets for a specified period of time.

3.26 Repeat Test — The tests conducted on maize dehusker sheller, to validate the performance in case of not meeting the evaluative requirements of this standard or to ascertain the re-occurrence of breakdown/defects observed in earlier tests, for the same parameter and on the same sample under the test after rectifying the defects or after replacing the defected part/sub-assembly by new part of the same specifications.

3.27 Routine Tests — Tests carried out on each dehusker sheller to check the requirements which are likely to vary during production.

3.28 Sample — The quantity of maize grain/kernel taken from the outlet at a particular time period.

3.29 Screen Pitch — Inclination of screen with the horizontal plane in degrees.

3.30 Sieve Clearance — The maximum vertical distance between two successive sieves.

3.31 Shelling Efficiency — The grain remained in the dehusked cobs received from outlet end or in cylinder after termination of threshing is weighed and shelling efficiency is calculated for cob-wise and grain-wise as:

$$\text{Shelling efficiency}_{(\text{cob})} = \frac{\text{Mass of dehusked cob from outlet of machine, in kg}}{\text{Total un-dehusked cob fed, in kg}} \times 100$$

$$\text{Shelling efficiency}_{(\text{grain})} = \frac{\text{Mass of grain from dehusked cob, in kg}}{\text{Total grain received from fed un-dehusked cob, in kg}} \times 100$$

3.32 Total Loss — The sum of the following losses in a dehusker sheller is expressed in percentage.

3.32.1 *Blown Loss* — The clean grain (*see* **3.2**) lost along with the husk with respect to total grain input, expressed as percentage by mass.

3.32.2 *Cracked and Broken Grain Loss* — Cracked and broken grains from the specified grain outlet(s) with respect to total grain received at outlet(s) expressed as percentage by mass.

3.32.3 *Sieve Loss* — The clean grain (*see* **3.2**) dropped through the sieve, left over sieve and stuck in the sheller with respect to total grain input, expressed as percentage by mass.

3.32.4 *Un-shelled Loss* — Un-shelled grain (*see* **3.35**) from all outlets with respect to total grain input, expressed as percentage by mass.

3.33 Throughput Capacity — The ratio of grain obtained during dehusking-shelling of un-dehusked maize cobs in total time of run of machine and throughput capacity of machine is calculated as:

$$\text{Throughput capacity, kg/h} = \frac{\text{Mass of grain obtained, in kg}}{\text{Total time of run of machine, in h}} \times 60$$

3.34 Type Test — Tests carried out on maize dehusker sheller to prove the conformity with the requirements of relevant standard. These are intended to prove the general qualities and design of a particular type of sheller.

3.35 Un-shelled/Un-threshed Grain — Grains/ kernel still in the cobs after the shelling/threshing.

4 TYPES

4.1 On the Basis of Dehusking/Shelling Unit

a) Disc type;
b) Cylinder type;
c) Spike tooth type; and
d) Axial flow type.

4.2 On The Basis of Method of Feeding

a) Hopper fed; and
b) Conveyor fed.

4.3 On The Basis of Power Source

a) Manually operated; and
b) Power operated [electric motor/engine/ tractor PTO operated (*see* Fig. 1)].

FIG. 1 POWER OPERATED DEHUSKER SHELLER

5 MATERIAL

5.1 Mild steel (*see* IS 2062), cast iron (*see* IS 210), galvanized steel (*see* IS 277) and mild steel wire (*see* IS 280) shall be used for the manufacture of different components of the sheller. The bearings, plumber blocks, keys, belts and pulleys shall conform to relevant Indian Standards listed in Table 1.

Table 1 List of Relevant Indian Standards for Construction of Different Components

(*Clause* 5.1)

Sl No.	Components	IS No.
(1)	(2)	(3)
i)	Flat pulley	IS 1691
ii)	Taper key and key way	IS 2292
iii)	Gib head keys and key ways	IS 2293
iv)	Woodruff keys and keyways	IS 2294
v)	V-belts	IS 2494 (Part 1)
vi)	V-grooved pulleys	IS 3142
vii)	Bearings	IS 4773

6 SPECIFICATION OF DEHUSKER SHELLER

6.1 Selection of Dehusker Sheller

The maize dehusker sheller shall be selected at random from the series production by the testing authority with the agreement of the manufacturer.

6.2 Specification and other Literature

The manufacturer shall supply all literature, operational manual and schematic diagram of material flow of the sheller. The manufacturer shall also supply the specification sheet duly filled in as given in Annex B, as well as any further information required to carry out the tests.

NOTE — Operational manual shall include maintenance and adjustments schedule and safety precautions.

7 TESTS

7.1 Type Tests

7.1.1 *General*

a) Checking of specification (*see* **7.4.1**);
b) Checking of material (*see* **7.4.2**); and
c) Visual observations and provision for adjustments (*see* **7.4.3**).

7.1.2 *Tests at No Load*

a) Power consumption (*see* **8.1.1**); and
b) Visual observations (*see* **8.1.2**).

7.1.3 *Tests at Load*

a) Short run tests (*see* **9.1**)

1) Total losses [*see* **9.1.8**(f)];
2) Shelling efficiency [*see* **9.1.9**(a)];
3) Cleaning efficiency [*see* **9.1.9**(b)];
4) Power consumption (*see* **9.1.10**);
5) Input capacity (*see* **9.1.11**);
6) Output capacity (*see* **9.1.12**);
7) Corrected output capacity (*see* **9.1.13**); and
8) Visual observations (*see* **9.1.4.6**).

b) Long run test (*see* **9.2**)

7.2 Routine Tests

7.2.1 *Essential*

a) Visual observations and provisions for adjustments (*see* **7.4.3**); and
b) Test at no load (*see* **8.1.1** and **8.1.2**).

7.2.2 *Optional*

a) Checking of specification (*see* **7.4.1**); and
b) Checking of material (*see* **7.4.2**).

7.3 Pre-test Observations

7.3.1 *Determination of Grain-Cob Ratio*

Take 10 samples of the de-sheathed (after removal of husk/sheath) cobs at random. Each sample shall be not less than 1 kg in mass. Separate the grain/kernel from the cobs manually for each sample. Take the mass of grain/kernel and shelled cob separately for each sample, and calculate their ratio. The average of the ten samples shall be taken as grain-cob ratio (*see* **3.17**).

7.3.2 *Moisture Content of Grain* (*M*)

Take suitable samples of grain (*see* **7.3.1**) and test them in accordance with IS 4333 (Part 2) for moisture determination.

$$M = \frac{\text{Mass of wet grain} - \text{Mass of dry grain at 130 °C for 2 h}}{\text{Mass of wet grain}} \times 100$$

7.3.3 *Running-in and Preliminary Adjustments*

The dehusker sheller shall be new and run-in before commencing the test by the manufacturer in accordance with the instructions and in collaboration with the testing authority for at least 1 hour. The adjustments for the speed of different shafts, concave clearance, speed of the prime mover, screen pitch, etc, shall be done according to manufacturer's recommendations.

7.4 General Tests

7.4.1 *Checking of Specification*

Check all the dimensions and specification mentioned by the manufacturer (*see* **6.2**) and record the data in proforma as given in Annex B.

7.4.2 *Checking of Material*

Check the material for all components and record the data in proforma as given in Annex C.

7.4.3 *Visual Observations and Provisions for Adjustments*

Record the observations and adjustments according to Annex D.

8 TESTS AT NO LOAD

8.1 Power Consumption

8.1.1 Install the dehusker sheller on level and preferably on hard surface. Remove the pneumatic wheels if provided to the dehusker sheller.

8.1.2 Set the clearances, screen pitch, etc, in accordance with manufacturer's recommendations. Use electric motor of appropriate power, duly fitted with an energy meter for running the dehusker sheller. If fitted with diesel engine or attached to PTO of tractor, have provision to measure the fuel consumption.

8.1.3 Run the dehusker sheller at no load for at least half-an-hour at the specified revolution of shelling unit and record the readings of the energy meter at interval of 5 minutes. The difference between two consecutive readings shall give power consumption for 5 minutes. Calculate power consumption at no load for one hour. If uses diesel as fuel measure the consumption during the time of run, at least for 30 minutes and record.

8.1.4 Record the data according to **E-1**.

8.2 Visual Observations

During and after completing power consumption test (*see* **8.1**), the observations given in **E-2** shall be made visually and recorded.

9 TESTS AT LOAD

9.1 Short Run Tests

9.1.1 Install the dehusker sheller on level and preferably on hard surface with its wheels removed, if any, and set the speed, clearances, screen pitch, etc, as per manufacturer's recommendations.

9.1.2 Take sufficient quantity of maize cobs of the same variety free from plant leaves, stalk, etc. The cobs should, as far as possible, be of the same size. The moisture content of the grain shall be 10 percent to 18 percent dry basis.

9.1.3 *Attachment of Prime Mover and Dehusker Sheller*

Attach the dehusker sheller with a suitable prime mover, preferably electric motor. An energy meter or some form of transmission dynamometer shall be fitted. The power delivered to the dehusker sheller may be supplied in following ways:

a) Direct coupling the prime mover with the main axle of the dehusker sheller; and
b) Connecting the prime mover with the help of flat or V-belt and pulleys with the main axle of the dehusker sheller.

In case of (a), the power delivered to the dehusker sheller would be the power output of the prime mover; whereas in case of (b), the allowances for flat belt and V-belt drive losses may be taken as 6 percent and 3 percent, respectively.

9.1.4 *Operation and Collection of Data*

Operate the dehusker sheller at the specified speed of the shelling unit for 1 hour at a feed rate 50 percent of the specified value by the manufacturer.

9.1.4.1 During the run period collect the following samples and data:

a) Four sets of primary samples from grain empty (shelled) cobs and impurities outlet for a period of 2 minutes for each set;
b) Record the speed of main shaft by a revolution counter or an accurately calibrated tachometer. The reading of energy meter or dynamometer shall also be taken at an interval of 15 minutes; and
c) Record the diesel consumed if attached to diesel engine or tractor PTO over a known running time and calculate the consumption per hour.

9.1.4.2 At the end of one-hour feeding, run the dehusker sheller idle for some time, so that practically the entire material already fed comes out. At the end of the test, collect the material dropped through sieve, retained on sieve, the material stuck in the dehusker sheller and the grain received at grain outlet(s).

9.1.4.3 Repeat the test given at **9.1.4** for minimum of three times at various feed rates covering the maximum feed rate.

9.1.4.4 Conduct the above test at feed rate which has been determined as input capacity (*see* **9.1.11**) at the following shelling unit speeds:

a) Speeds about 10 percent and 20 percent more than specified speed; and
b) Speeds about 10 percent and 20 percent less than specified speed.

9.1.4.5 Record the data according to Annex F.

9.1.4.6 *Visual observations*

During and after the run tests, inspect the dehusker sheller visually, and record the observations according to Annex F.

9.1.5 *Preparation of Composite Sample*

The primary samples [*see* **9.1.4.1(a)**] collected at a particular feed rate shall be thoroughly mixed and blended to constitute a homogenous composite sample for different outlets. The samples collected at sieve underflow, overflow and stuck in dehusker sheller should also be mixed thoroughly to form a composite sample.

9.1.6 *Selection of Final Sample*

Take 1 kg of final sample from each composite sample (see **9.1.5**) of different outlets. If it is not possible to get 1 kg sample at impurities outlet, take total composite sample as a final sample.

9.1.7 *Analysis of Final Sample*

Analyse the final sample (*see* **9.1.6**) obtained at different outlets for different feed rates by picking with hand separately for the following and record the

data according to Annex G:

a) Cracked and broken grain;
b) Refractions;
c) Unshelled grain; and
d) Clean grain.

NOTE — Analysis for cracked and broken grains shall be made only from the samples taken at specified grain outlet(s).

9.1.8 *Determination of Total Losses*

a) Total grain input = Feed rate × Grain content (*see* **7.3.1**)

b) Percentage of unshelled grain =

$$\frac{\text{Quantity of unshelled grain obtained from all outlets, in kg}}{\text{Total grain input, in kg}} \times 100$$

c) Percentage of cracked and broken grain =

$$\frac{\text{Cracked and broken grain from sepecified grain outlet(s), in kg}}{\text{Total grain received at grain outlet(s) in, kg}} \times 100$$

d) Percentage of blown grain =

$$\frac{\text{Quantity of clean grain obtained at impurities, in kg}}{\text{Total grain input, in kg}} \times 100$$

e) Percentage of sieve loss =

$$\frac{\text{(Clean grain obtained at sieve overflow + Sieve underflow + Stuck grain)}}{\text{Total grain input in, kg}} \times 100$$

f) Total losses = Sum of losses opined at (b), (c), (d) and (e) above.

9.1.8.1 Record the data according to Annex H.

9.1.9 *Determination of Efficiencies*

a) Shelling efficiency = 100 – Percentage of unshelled grains

b) Cleaning efficiency =

$$\frac{\text{Clean grain received at grain outlet(s), in kg}}{\text{Total grain received at grain outlet(s), in kg}}$$

9.1.9.1 Record the data according to Annex H.

9.1.10 *Determination of Power Consumption*

a) In case of energy meter fitted prime mover, the difference between two consecutive readings [*see* **9.1.4.1**(b)] shall give power consumption for 15 minutes. Calculate the power consumption for one hour giving due allowances to type of drive (*see* **9.1.3**);

b) In case of dynamometer fitted prime mover, the average of reading taken shall give the average torque required. Calculate the power requirement by the following formula; and

c) Power in kW =

$$\frac{\text{Torque in Nm} \times \text{Speed in rev/min}}{9549.30}$$

9.1.10.1 Record the data according to Annex H.

9.1.11 *Determination of Input Capacity*

Select the feed rate at which the total losses [*see* **9.1.8** (f)] and efficiencies (*see* **9.1.9**) are within the specified limits (*see* **10.1**) and power consumption is minimum. This should be achieved by drawing a curve for losses and efficiencies against various feed rates. Capacity in terms of energy consumed shall be calculated by dividing the capacity by power consumed (**9.1.10**).

9.1.11.1 Record the data according to Annex H.

9.1.12 *Determination of Output Capacity*

Take the mass of shelled grain received at specified grain outlet(s) and record the data according to Annex H.

9.1.13 *Determination of Corrected Output Capacity*

To avoid the variation of moisture content of grain and grain-cob ratio, the output capacity as obtained under **9.1.12** should be corrected at 12 percent moisture and 40 percent grain-cob ratio by the following formula:

$$W_1 = \frac{W \times (M - 12)}{88} \times \frac{40}{R}$$

where

W_1 = corrected output capacity, kg/h;
W = output capacity (*see* **9.1.12**), kg/h;
M = observed moisture content (*see* **7.3.2**), percent dry basis: and
R = observed grain-cob ratio in percent (*see* **7.3.1**).

9.1.13.1 Record the data according to Annex H.

9.2 Long Run Test

Operate the dehusker sheller for at least 20 hours which should be covered by continuous run of at least 5 hours. If facilities are available, it may be run for 50 hours. Record the major breakdowns, wear and tear, defects developed and repairs made, according to Annex J.

10 PERFORMANCE REQUIREMENTS

10.1 Total losses shall not exceed 8 percent in which cracked and broken grains shall be not more than 5 percent (*see* **9.1.8**).

10.2 Shelling efficiency shall be not less than 90 percent.

10.3 Cleaning efficiency shall be not less than 95 percent.

10.4 Input capacity per kWh shall be not less than 5 quintals of cobs.

10.5 Corrected output capacity shall be not less than 30 percent of the input capacity.

11 OTHER REQUIREMENTS

11.1 The fabrication of the maize sheller shall be rigid and strong.

11.2 Bearings shall be adequately protected against the ingress of dust.

11.3 Arrangements for belt tightening and lubrication of moving parts shall be made.

11.4 All the moving parts will be provided with guard/cover.

11.5 The direction of rotation will be marked on the moving pulleys, wheels, etc.

11.6 In case of belt drive, provision shall be made for belt tightening.

11.7 Provision for inspection window/cover may be made.

11.8 Shelling cylinder or disc shall be statically balanced.

11.9 Sieves shall be capable of easy cleaning and replacement.

11.10 Concave clearance, air displacement, screen pitch and sieve clearance shall, as far as possible, be adjustable.

11.11 Each sheller shall be provided with instruction manual containing full information on method of installation and operation of sheller. It shall also contain the information regarding maintenance, ordering replacement of parts and safety precautions.

12 WORKMANSHIP AND FINISH

12.1 The dehusker sheller shall be finished in such a manner that it shall be free from defects that may be detrimental for its use. The welding shall be satisfactory in all respects and should not be brittle or porous.

12.2 All exposed metallic surfaces shall be free from rust and shall be painted properly.

13 ACCESSORIES

13.1 The following accessories shall be supplied along with the sheller:

a) Flexible coupling or pulley;
b) Belts;
c) Oil lubricator or grease cups; and
d) Set of tools.

13.2 The following accessories may be supplied on the request of the purchaser:

a) Cylinder or disc;
b) Concave; and
c) Sieves.

14 MARKING AND PACKING

14.1 Each dehusker sheller shall be marked with the following information at a prominent place:

a) Manufacturer’s name and trade-mark, if any;
b) Model code and batch number;
c) Cylinder or disc size;
d) Recommended input capacity;
e) Direction of rotation of shelling unit and recommended rev/min; and
f) Recommended power requirement.

14.2 BIS Certification Marking

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.

14.3 Packing

The dehusker sheller and its components shall be packed as agreed to between the purchaser and the supplier, to avoid damage in transit.

15 SUMMARY REPORT

For the guidance of the users, compile a summary report on the proforma as given in Annex K.

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 210 : 2009	Grey iron castings — Specification (*fifth revision*)
IS 277 : 2018	Galvanized steel strips and sheets (plain and corrugated) — Specification (*seventh revision*)
IS 280 : 2006	Mild steel wire for general engineering purposes (*fourth revision*)
IS 1691: 1980	Specification for cast iron and mild steel flat pulleys (*second revision*)
IS 2062 : 2011	Hot rolled medium and high tensile structural steel — Specification (*seventh revision*)
IS 2292 : 1974	Specification for taper keys and keyways (*first revision*)
IS 2293 : 1974	Specification for gib - head keys and keyways (*first revision*)
IS 2294 : 1986	Specification for woodruff keys and keyways (*second revision*)
IS 2494 (Part 1): 1994	V-belts — Endless V-belts for industrial purposes: Part 1 General purpose — Specification (*second revision*)
IS 3142: 1993	Pulleys — V-grooved pulleys for endless V-belts sections Z, A, B, C, D and E and endless wedge belts sections SPZ, SPA, SPB and SPC — Specification (*second revision*)
IS 4333	Methods of analysis for foodgrains:
(Part 1) : 2018	Refractions (*third revision*)
(Part 2) : 2017/ ISO 712 : 2009	Determination of moisture content (*second revision*)
IS 4773 : 2017/ ISO 113 : 2010	Rolling bearings — Plummer block housings — Boundary dimensions (*third revision*)
IS 7051 : 2023	Power operated maize shellers — Specification

ANNEX B

(*Clauses* 6.2 *and* 7.4.1)

SPECIFICATION SHEET

To be filled by

Manufacturer Testing Station

B-1 GENERAL

a) Make
b) Model
c) Type
d) Year of manufacture
e) Name and address of manufacturer.

B-2 POWER UNIT

a) Provision
b) Type of prime mover
c) Recommended power, kW
d) Type of drive

B-3 MAIN DRIVE

a) Type
b) Size of belt
c) Size of pulley
d) Diameter of main shaft

B-4 DEHUSKING AND SHELLING UNIT

a) Type
b) Constructional features
c) Diameter, mm
d) Width, mm
e) Recommended speed, rpm
f) Number and size of beaters/projections/bars

B-5 CONCAVE

a) Type
b) Diameter, mm
c) Length, mm
d) Concave clearance range, mm
e) Recommended concave clearance, mm
f) Clearance adjustment provision

B-6 SIEVE

a) Type
b) Number
c) Total length and width, mm
d) Effective length and width, mm
e) Number of holes per cm^2 or 100 cm^2
f) Size of hole, mm
g) Sieve clearance, mm
h) Screen pitch range, mm
j) Recommended screen pitch, mm
k) Any mechanism to clean the sieve perforation

B-7 SHAKER

a) Type
b) Number of strokes per minute
c) Stroke length, mm

B-8 BLOWER

a) Number
b) Type
c) Number of blades
d) Size of blades, mm
e) Diameter, mm
f) Recommended speed, rpm
g) Recommended air displacement, m^3/min.
h) Provision for changing air displacement

B-9 ELEVATOR

a) Type
b) Capacity, kg/h
c) Grain spout size
d) Height above ground level, m

B-10 HOPPER

a) Type/shape
b) Capacity, kg
c) Method of feeding
d) Recommended maximum feed rate, kg/h

B-11 TRANSPORT

a) Type
b) Number of wheels*
c) Size of wheels*

B-12 FLY WHEEL SIZE

*In case wheels are not provided, details of alternative provision shall be given.

B-13 OVERALL DIMENSIONS

a) Length, m
b) Width, m
c) Height, m
d) Total mass, kg

B-14 TOOLS, ACCESSORIES AND MANUALS PROVIDED

NOTES

1 The items which are not applicable in a particular dehusker sheller shall be crossed while filling.
2 If any other items are provided, their details shall be filled in.

ANNEX C

(*Clause* 7.4.2)

DATA SHEET FOR MATERIAL OF CONSTRUCTION

C-1 DATE OF TEST

C-2 MATERIAL OF CONSTRUCTION

Sl No.	Component	Material	Size	Mass
(1)	(2)	(3)	(4)	(5)
i)	Frame			
ii)	Hopper			
iii)	Cylinder/Disc cover			
iv)	Cylinder/Disc			
v)	Beater/Projection/Bar			
vi)	Concave			
vii)	Blower			
viii)	Main shafts			
ix)	Blower shaft			
x)	Fly wheel			
xi)	Sieve			
xii)	Shaker			
xiii)	Elevator			
xiv)	Transport wheel			
xv)	Pulleys			
xvi)	Others			

NOTES

1 Delete the component which is not applicable to a particular dehusker sheller and add if any other component is provided.
2 Co1 (4) and (5) should be recorded wherever feasible.

(Testing Engineer/Personnel)

ANNEX D

(*Clause* 7.4.3)

DATA SHEET FOR VISUAL OBSERVATIONS AND PROVISIONS FOR ADJUSTMENTS

D-1 OBSERVATIONS

a) Adequacy of marking of inlet and outlets
b) Adequacy of marking of direction of rotation of dehusker shelling unit
c) Adequacy of protection of bearings against the ingress of dust
d) Adequacy of safety arrangements, specially at moving points
e) Provision for lubrication of moving parts
f) Provision for belt tightening
g) Provision for transportation
h) Provision for easy changing of components requiring frequent replacement
j) Provision for easy replacement and cleaning of screens
k) Provision for anti-corrosive coatings
m) Tightness of bolts and nuts and other fasteners
n) Balancing of dehusker shelling unit
p) Welding of seams
q) Other observations

D-2 PROVISION FOR ADJUSTMENTS OF

a) Feed rate
b) Concave clearance
c) Speed
d) Screen pitch
e) Sieve clearance
f) Air displacement

(Testing Engineer/Personnel)

ANNEX E

(*Clauses* 8.1.4 *and* 8.2)

DATA SHEET FOR TEST AT NO LOAD

E-1 POWER CONSUMPTION

a) Source of power
b) Type of drive
c) Total time of run
d) Energy meter readings at interval of 5 minutes
e) Fuel consumed, if operated by engine/tractor in 30 minutes
f) Average power consumption for 1 hour

E-2 OBSERVATIONS

a) Presence of any marked oscillation during operation
b) Presence of undue knocking or rattling sound
c) Frequent slippage of belts
d) Smooth running of shafts in their respective bearings
e) Any marked unusual wear or slackness in any component
f) Any marked rise in temperature in bearings or in any other components
g) Other observations

(Testing Engineer/Personnel)

ANNEX F

(*Clauses* 9.1.4.5 *and* 9.1.4.6)

DATA SHEET FOR TESTS AT LOAD

F-1 SOURCE OF POWER

F-2 POWER RATING

F-3 TYPE OF DRIVE

F-4 VARIETY OF MAIZE

F-5 GRAIN-COB RATIO

F-6 MOISTURE CONTENT, percent dry basis

F7 CONCAVE CLEARANCE, mm

F-8 SCREEN PITCH, mm

F-9 SIEVE CLEARANCE, mm

F-10 TEST DATA , (*see* Table 2)

F-11 OBSERVATIONS

a) Presence of any marked oscillation during operation
b) Presence of undue knocking or rattling sound
c) Frequent slippage of belts
d) Smooth running of shafts in their respective bearings
e) Frequent clogging of dehusker shelling units
f) Frequent clogging of sieve aperture
g) Smooth flowing of material through different components
h) Vibration free running of fan
j) Frequent clogging of grain in elevator unit
k) Any marked rise in bearing temperature
m) Any marked wear, deformation and breakdown
n) Frequent loosening of fasteners
p) Other observations (if any)

Table 2 Data Sheet for Test at Load

(*Clause* F-10)

Sl No.	Date	Starting Time	Stopping Time	Duration of Operation	$Speed (rev/min)	Feed* Rate (q/h)	Power Required (kW) or Fuel Consumed (l/h)	No. of Primary Samples	Quantity (kg) of Primary samples from			Total Quantity of Grain at Grain Outlet(s) (kg)	Total Quantity at Sieve Under Flow (kg)	Total Quantity of Material Stuck in Sheller (kg)
									Grain outlet(s)	Impurities Outlet	Shelled cobs outlet			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
								i)						
								ii)						
								iii)						
								iv)						

* The data shall be collected for every test conducted on different feed rate.

$ Test shall be conducted at specified speeds, also at aditional 10 percent and 20 percent of the specified speed.

(Testing Engineer/Personnel)

ANNEX G

(*Clause* 9.1.7)

DATA SHEET FOR ANALYSIS OF FINAL SAMPLES

Sl No.	**Feed Rate**	**Shelling Unit Speed,** rpm	**Sample from**	**Mass of (kg)**			
				Unshelled Grain	Cracked and Broken Grain	Clean Grain	Other Refractions
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			Grain outlet (s)				
			Impurities outlet				
			Shelled cobs outlet				
			Sieve underflow				
			Material stuck in sheller				

NOTE — For different feed rate and for different speed of shelling unit use the same proforma as above.

(Testing Engineer/Personnel)

ANNEX H

(*Clauses* 9.1.8.1, 9.1.9.1, 9.1.10.1, 9.1.11.1, 9.1.12 *and* 9.1.13.1)

DATA SHEET FOR LOSSES, EFFICIENCIES, POWER REQUIREMENT AND CAPACITIES

Sl No.	Item	Test No.									
		1	2	3	4	5	6	7	8	9	10
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
i)	Shelling unit speed, m/s (rpm)										
ii)	Feed rate, q/h										
iii)	Power required, kW/Fuel in l/h										
iv)	Total grain received at grain outlet(s), kg										
v)	Percentage of unshelled grain										
vi)	Percentage of cracked and broken grain										
vii)	Percentage of blown grain										
viii)	Percentage of sieve loss										
ix)	Percentage of total loss										
x)	Shelling efficiency, %										
xi)	Cleaning efficiency, %										
xii)	Input capacity, q/h										
xiii)	Output capacity, q/h										
xiv)	Corrected output capacity, q/h										

(Testing Engineer/Personnel)

ANNEX J

(*Clause* 9.2)

LONG RUN TEST DATA SHEET

J-1 TOTAL RUNNING TIME, h

J-2 CONTINUOUS RUNNING TIME, h

J-3 BREAKDOWNS IN SHELLING UNIT

J-4 BREAKDOWNS IN CLEANING UNIT

J-5 BREAKDOWNS IN ELEVATING UNIT

J-6 BREAKDOWNS IN BODY

J-7 ANY MAJOR REPAIRS CONDUCTED

J-8 ANY OTHER OBSERVATIONS

(Testing Engineer/Personnel)

ANNEX K

(*Clause* 15)

SUMMARY REPORT

K-1 NAME OF MANUFACTURER

K-2 MODEL NUMBER

K-3 NAME OF TESTING STATION

K-4 VARIETY OF MAIZE USED

K-5 GRAIN-COB RATIO

K-6 MOISTURE CONTENT, percent dry basis

K-7 ADJUSTMENTS

a) Speed
b) Screen pitch
c) Concave clearance
d) Sieve clearance
e) Air displacement

K-8 POWER REQUIREMENT, kW/FUEL CONSUMPTION, litre/h

a) At no load
b) At load on input capacity

K-9 LOSSES, PERCENT

a) Cracked and broken grain
b) Unshelled grain
c) Sieve loss
d) Blown loss
e) Total loss

K-10 INPUT CAPACITY, q/h

K-11 VARIATION ON INPUT CAPACITY

a) At 10 percent more than specified speed
b) At 20 percent more than specified speed
c) At 10 percent less than specified speed
d) At 20 percent less than specified speed

K-12 INPUT CAPACITY, q/kWh

K-13 OUTPUT CAPACITY, q/h

K-14 OUTPUT CAPACITY, q/kWh

K-15 CORRECTED OUTPUT CAPACITY, q/kWh; q/litre

K-16 ANY MARKED OBSERVATION AFFECTING PERFORMANCE

K-17 ANY MARKED BREAKDOWNS

K-18 OTHER OBSERVATIONS

(Testing Engineer/Personnel)

ANNEX L

(*Foreword*)

COMMITTEE COMPOSITION

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Organization	*Representative(s)*
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