भारतीय मानक

IS 7051 : 2023

Indian Standard

शक्ति चलित मक्का शेलर — विशिष्टि

(पहला पुनरीक्षण)

Power Operated Maize Shellers — Specification

(First Revision)

ICS 67.020

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Agriculture and Food Processing Equipment Sectional Committee, FAD 20

FOREWORD

This Indian Standard (First Revision) 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.

Separation of maize kernels/grains by beating the cobs with hand tools has been the traditional method for shelling of maize from very early times. Since the output by this method is low and cost of operation is high, power operated maize shellers are now being extensively used as an effective alternative. Therefore, a need was felt to develop Indian Standard on this subject for the guidance of users and manufacturers.

This standard was originally published in 1973 to specify the material, performance requirements and other requirements for power operated maize sheller. The test code for power maize sheller was published separately as IS 7052 : 1973. In this revision, the test code for power maize sheller has been merged with the material, performance, constructional and other requirements in a single standard to make the standard user friendly and for bringing better clarity. In this revision, following other modifications have been incorporated keeping in view the technological advancements in the field and the standard has been brought out in the latest style and format of the Indian Standards:

a) Classification of maize shellers on the basis of source of power to operate has been included.
b) Raw material requirements and performance requirements have been updated as per the current industrial practice.
c) Requirements related to safe operation of the sheller have been incorporated.

Upon publication of this standard, IS 7052 : 1973 stands withdrawn.

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

POWER OPERATED MAIZE SHELLERS — SPECIFICATION

(First Revision)

1 SCOPE

1.1 This standard specifies the material, performance, constructional and other requirements for power operated maize sheller.

1.2 This standard also prescribes the methods of testing of power operated maize sheller to evaluate its performance and durability.

2 REFERENCES

The standards listed in Annex A 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 edition of these standards.

3 TERMINOLOGY

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

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

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

3.3 Composite Sample — The sample of the grain, husk and shelled cobs formed by combining and blending the primary samples.

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

3.5 Feed Rate — The weight of the cobs fed into the sheller per unit time.

3.6 Final Sample — The sample drawn from the composite sample for analysis.

3.7 Input Capacity — The maximum feed rate at which the power requirement is minimum and total losses and efficiencies are within the specified limits (*see* **12.1**, **12.2** and **12.3**).

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

3.9 Power Operated Maize Sheller — A machine operated by a prime mover to separate the grains from cobs and also to remove the impurities from grains.

3.10 Primary Sample — The weight of the grain, husk and shelled cobs taken from the outlets fora specified period of time.

3.11 Prime Mover — An electric motor or engine or tractor used for running the sheller.

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

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

3.14 Shelling Efficiency — Percentage by weight of shelled grains from all outlets of the sheller with respect to total grain input.

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

3.16 Total Loss — The sum of the following losses in a sheller expressed in percentage.

3.16.1 *Blown Loss* **—** The clean grain lost along with the husk with respect to total grain input, expressed as percentage by weight.

3.16.2 *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 weight.

3.16.3 *Sieve Loss* **—** The clean grain dropped through the sieve, left over sieve and stuck in the

sheller with respect to total grain input, expressed as percentage by weight.

3.16.4 *Unshelled Loss* **—** Unshelled grain from all outlets with respect to total grain input, expressed as percentage by weight.

3.17 Type Test — Tests carried out on 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.

3.18 Unshelled Grain — Grains still in the cobs after the shelling.

4 TYPES

4.1 On the basis of shelling unit, the shellers shall be of the following two types:

a) Disc type; and
b) Cylinder type.

4.2 On the basis of method of feeding, the shellers shall be of the following two types:

a) Hopper fed; and
b) Conveyor fed.

4.3 On the basis of source of power to operate the sheller:

a) Operated by electric motor/engine; and
b) Tractor P.T.O operated.

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 given in Table 1.

6 SELECTION AND SPECIFICATION OF SHELLER FOR TEST

6.1 Selection of Sheller

The maize sheller shall be taken 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.

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

(*Clause* 5.1)

Sl No.	Components	Relevant IS No.
(1)	(2)	(3)
i)	Flat Pulley	IS 1691 : 1980
ii)	Taper key and key way	IS 2292 : 1974
iii)	Gib head keys and key ways	IS 2293 : 1974
iv)	Woodruff keys and keyways	IS 2294 : 1986
v)	V - Belts	IS 2494 (Part 1) : 1994
vi)	V - Grooved pulleys	IS 3142 : 1993
vii)	Bearings	IS 4773 : 2017/ISO 113 : 2010

7 TESTS

7.1 Type Tests

a) *General*

1) Checking of specification (*see* **9.1**);
2) Checking of material (*see* **9.2**); and
3) Visual observations and provision for adjustments (*see* **9.3**).

b) *Test at No Load*

1) Power consumption (*see* **10.1**); and
2) Visual observations (*see* **10.2**).

c) *Test at Load*

1) Short run tests (*see* **11.1**)
2) Total losses [*see* **11.1.8**(f)]
3) Shelling efficiency [*see* **11.1.9**(a)]
4) Cleaning efficiency [*see* **11.1.9**(b)]
5) Power consumption (*see* **11.1.10**)
6) Input capacity (*see* **11.1.11**)
7) Output capacity (*see* **11.1.12**)
8) Corrected output capacity (*see* **11.1.13**)
9) Visual observations (*see* **11.1.4.6**)

10) Long run test (*see* **11.2**)

7.2 Routine Tests

a) *Essential*

1) Visual observations and provisions for adjustments (*see* **9.3**); and
2) Test at no load (*see* **10.1** and **10.2**).

b) *Optional*

1) Checking of specification (*see* **9.1**); and
2) Checking of material (*see* **9.2**).

8 PRE-TEST OBSERVATIONS

8.1 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 weight. Separate the grain from the cobs manually for each sample. Take the weight of grain and shelled cob separately from each sample, and calculate their ratio. The average of the ten samples shall be taken as grain-cob ratio.

8.2 Moisture Content of Grain

Take suitable samples of grain (*see* **8.1**) and test them in accordance with IS 4333 (Part 2) for moisture determination and expressed in percent dry basis (d.b).

8.3 Running-in and Preliminary Adjustments

The 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 one 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.

9 GENERAL TESTS

9.1 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.

9.2 Checking of Material

Check the material for all components and record the data in prof or maas given in Annex C.

9.3 Visual Observations and Provisions for Adjustments

Record the observations and adjustments according to Annex C.

10 TEST AT NO LOAD

10.1 Power Consumption

10.1.1 Install the sheller on level and preferably on hard surface and 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 sheller.

10.1.2 Run the 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.

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

10.2 Visual Observations

During and after completing power consumption test (*see* **10.1**), the observations given in **E-2** shall be made visually and recorded.

11 TEST AT LOAD

11.1 Short Run Tests

11.1.1 Install the sheller on level and preferably on hard surface and set the clearances, screen pitch, etc, as per manufacturer's recommendations.

11.1.2 Take sufficient quantity of de-sheathed 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.

11.1.3 *Attachment of Prime Mover and Sheller*

Attach the 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 sheller may be supplied in following ways:

a) Direct coupling the prime mover with the main axle of the sheller; and
b) Connecting the prime mover with the help

of flat or V-belt and pulleys with the main axle of the sheller.

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

11.1.4 *Operation and Collection of Data*

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

11.1.4.1 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 two minutes for each set; and
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.

11.1.4.2 At the end of one hour feeding, run the 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 sheller and the grain received at grain outlet(s).

11.1.4.3 Repeat the test given at **10.1.4** for minimum of three times at various feed rates covering the maximum feed rate.

11.1.4.4 Conduct the above test at feed rate which has been determined as input capacity (*see* **11.1.11**) 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.

11.1.4.5 Record the data according to Annex F.

11.1.4.6 *Visual observations*

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

11.1.5 *Preparation of Composite Sample*

The primary samples [*see* **11.1.4.1** (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 sheller should also be mixed thoroughly to form a composite sample.

11.1.6 *Selection of Final Sample*

Take one kilogram of final sample from each composite sample (*see* **11.1.5**) of different outlets. If it is not possible to get one kilogram sample at impurities outlet, take total composite sample as a final sample.

11.1.7 *Analysis of Final Sample*

Analyze the final sample (*see* **11.1.6**) 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).

11.1.8 *Determination of Total Losses*

a) Total grain input = Feed rate × Grain content (*see* **8.1**)

b) Percentage of unshelled grain =

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

c) Percentage of cracked and broken grain =

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

d) Percentage of blown grain =

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

e) Percentage of sieve loss =

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

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

11.1.8.1 Record the data according, to Annex H.

11.1.9 *Determination of Efficiencies*

a) Shelling efficiency =

100 − Percentage of unshelled grains

b) Cleaning efficiency =

$$\frac{\text{Clean grain received at grain outlet(s), in kg}}{\text{Total grain received at grain outlet(s), in kg}} \times 100$$

11.1.9.1 Record the data according, to Annex H.

11.1.10 *Determination of Power Consumption*

a) In case of energy meter fitted prime mover, the difference between two consecutive readings [*see* **11.1.4.1** (b)] shall give power consumption for 15 minutes. Calculate the power consumption for one hour giving due allowances to type of drive (*see* **11.1.3**).

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:

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

11.1.10.1 Record the data according to Annex H.

11.1.11 *Determination of Input Capacity*

The feed rate shall be selected at which the total losses [*see* **11.1.8** (f)] and efficiencies (*see* **11.1.9**) are within the specified limits (*see* **12.1, 12.2** and **12.3**) 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 (*see* **11.1.10**).

11.1.11.1 Record the data according to Annex H.

11.1.12 *Determination of Output Capacity*

The weight of shelled grain received at specified grain outlet(s) shall be taken and record the data according to Annex H.

11.1.13 *Determination of Corrected Output Capacity*

To avoid the variation of moisture content of grain and grain-cob ratio, the output capacity as obtained under **11.1.12** should be corrected at 12 percent moisture and 40 percent grain-cob ratio by the following formula:

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

where

W_1 = corrected output capacity;
W = output capacity (*see* **11.1.12**);
M = observed moisture content (*see* **8.2**); and
R = observed grain-cob ratio in percent (*see* **8.1**).

11.1.13.1 Record the data according to Annex H.

11.2 Long Run Test

The sheller shall be operated 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. The major breakdowns, defects developed and repairs made shall be recorded, according to Annex J.

12 PERFORMANCE REQUIREMENTS

12.1 Total losses shall not exceed 10 percent in which cracked and broken grains shall be not more than 5 percent.

12.2 Shelling efficiency shall be not less than 90 percent.

12.3 Cleaning efficiency shall be not less than 95 percent.

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

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

13 OTHER REQUIREMENTS

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

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

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

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

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

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

13.7 Provision for inspection window/cover should be made.

13.8 Shelling cylinder or disc shall be statically balanced.

13.9 Sieves shall be capable of easy cleaning and replacement.

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

13.11 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.

14 WORKMANSHIP AND FINISH

14.1 The 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.

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

15 ACCESSORIES

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.
e) The following accessories may be supplied on the request of the purchaser:
f) Cylinder or disc;
g) Concave; and
h) Sieves.

16 TESTS

16.1 At least one sheller of each type shall be tested for type testing. Once a sheller has undergonetype tests, any major or essential alterations, which the manufacturer intends to make, shall be reported to the testing authority and further type test shall be carried out.

16.2 Each sheller of a type shall be tested for routine tests.

17 SUMMARY REPORT

17.1 For the guidance of the users, a summary report shall be compiled on the proforma as given in Annex K.

18 MARKING AND PACKING

Each 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.

18.2 Packing

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

18.3 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.

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*)

ANNEX B

(*Clauses* 6.2 *and* 9.1)

SPECIFICATION SHEET

B-1 GENERAL

a) Make
b) Model
c) Type
d) Year of manufacture

B-2 POWER UNIT

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

B-3 MAIN DRIVE

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

B-4 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
f) Size of hole, mm
g) Sieve clearance, mm
h) Screen pitch range
j) Recommended screen pitch

B-7 SHAKER

a) Type
b) Number of strokes per minute

B-8 BLOWER

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

B-9 ELEVATOR

a) Type
b) Capacity
c) Grain spout size
d) Height above ground level, mm

B-10 HOPPER

a) Type
b) Capacity
c) Method of feeding
d) Recommended maximum feed rate

B-11 TRANSPORT

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

B-12 FLY WHEEL SIZE

B-13 OVERALL DIMENSIONS

a) Length, mm
b) Width, mm
c) Height, mm
d) Total weight, kg

B-14 TOOLS, ACCESSORIES AND MANUALS

Provided/Not provided

NOTES

1 The items which are not applicable in a particular sheller shall be crossed while filling.
2 If any other items are provided, their details shall be filled in.
3 In case wheels are not provided, details of alternative provision shall be given.

ANNEX C

(*Clause* 9.2)

MATERIAL OF CONSTRUCTION DATA SHEET

C-1 DATE OF TEST

C-2 MATERIAL OF CONSTRUCTION

Sl No.	Component	Material	Size	Weight
(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 sheller and add if any other component is provided.

2 Co1 (4) and (5) should be recorded wherever feasible.

ANNEX D

(*Clause* 9.3)

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 shelling unit
c) Adequacy of protection of bearings against the ingress of dust
d) Adequacy of safety arrangements, especially 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 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

ANNEX E

(*Clause* 10.1.3 *and* 10.2)

TEST AT NO LOAD DATA SHEET

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) Average power consumption for one hour, kW or l/h, in case of fuel consumed when engine is used as power source

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 bearing temperature
g) Other observations

ANNEX F

(*Clauses* 11.1.4.5 *and* 11.1.4.6)

TEST AT LOAD DATA SHEET

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

F-7 CONCAVE CLEARANCE

F-8 SCREEN PITCH

F-9 SIEVE CLEARANCE

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 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 Test at Load Data Sheet

(*Clause* F-10)

Sl No.	Date	Starting Time	Stopping Time	Duration of Operation	$Speed (rev/min)	Feed Rate* (Quintal/h)	Power Required (kW) or Fuel Consumed (litre/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.

ANNEX G

(*Clause* 11.1.7)

DATA SHEET FOR ANALYSIS OF FINAL SAMPLES

Sl No.	Feed Rate	Shelling Unit Speed	Sample from	Weight of			
				Unshelled Grain	Cracked and Broken Grain	Clean Grain	Other Refractions
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)			Grain outlet (s)				
ii)			Impurities outlet				
iii)			Shelled cob soutlet				
iv)			Sieve underflow				
v)			Material stuck in sheller				

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

ANNEX H

(*Clauses* 11.1.8.1, 11.1.9.1, 11.1.10.1, 11.1.11.1, 11.1.12 *and* 11.1.13.1)

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										
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, percent										
xi)	Cleaning efficiency, percent										
xii)	Input capacity, q/h										
xiii)	Output capacity, q/h										
xiv)	Corrected output capacity, q/h										

ANNEX J

(*Clause* 11.2)

LONG RUN TEST DATA SHEET

J-1 TOTAL RUNNING TIME

J-2 CONTINUOUS RUNNING TIME

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

ANNEX K

(*Clause* 17.1)

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

K-7 ADJUSTMENTS

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

K-8 POWER/FUEL REQUIREMENT, kW OR l/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, QUINTALS/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

K-16 ANY MARKED OBSERVATION AFFECTING PERFORMANCE

K-17 ANY MARKED BREAKDOWNS

K-18 OTHER OBSERVATIONS

ANNEX L

(*Foreword*)

COMMITTEE COMPOSITION

Agriculture and Food Processing Equipment Sectional Committee, FAD 20

Organization	*Representative(s)*
Indian Council of Agricultural Research, New Delhi	DR SHYAM NARAYAN JHA **(*Chairperson*)**
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