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**भारतीय मानक**

**कटाई एवं संरक्षण के लिए उपकरण — गोल बेलर —**

**भाग 2 *कार्यनिष्पादन* परिक्षण विधि**

**Indian Standard**

**EQUIPMENT FOR HARVESTING AND CONSERVATION — ROUND BALERS — PART 2 PERFORMANCE TEST METHOD**

ICS 65.060.10

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**B U R E A U O F I N D I A N S T A N D A R D S**

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Agricultural Machinery and Equipment Sectional Committee, FAD 11

FOREWORD

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

A round baler is a farm machinery used to harvest and bale hay, straw, or other crop residues into round bales for storage or transportation. The machine consists of a pickup or gathering system that picks up the crop residue from the field and feeds it into a chamber, where it is compressed and wrapped with twine or netting to form a round bale. The finished bale is then ejected from the chamber and can be stored or transported to another location.

Round balers are a valuable tool for farmers, as they provide a convenient and efficient way to harvest and store forage crops. They can also help reduce labor costs and increase productivity, allowing farmers to focus on other important tasks on the farm.

This Indian Standard is being published in two parts. This standard (Part 2) covers the methods to test the performance of the tractor driven round baler. Part 1 covers the terminology and commerical specification for round balers and is an identical adoption of ISO 11450 : 1999 and its amendment no. 1 of 2016.

In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’.

**Indian Standard**

**EQUIPMENT FOR HARVESTING AND CONSERVATION — ROUND BALERS —**

**PART 2 PERFORMANCE TEST METHOD**

**1 SCOPE**

This standard covers the methods of tests to be conducted to assess the performance of tractor driven round baler (trailed type).

**2 REFERENCES**

The Indian Standards listed 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 standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated therein.

|  |  |
| --- | --- |
| *IS No.* | *Title* |
| IS 18383 (Part 1) : 2023/ ISO 11450 : 1999 | Equipment for harvesting and conservation — Round balers — Part 1: Terminology and commercial specifications |
| IS 17231: 2019/ISO 730 : 2009 | Agricultural wheeled tractors — Rear-mounted three-point linkage — Categories 1N, 1, 2N, 2, 3N, 3, 4N and 4 |
| IS 4931 (Part 3) : 2024/ISO 500-3 : 2014 | Agricultural Tractors — Rear-mounted power take-off types 1, 2, 3 and 4 Part 3 Main PTO dimensions and spline dimensions, location of PTO ( *fourth revision* ) |
| IS 4905: 2015/  ISO 24153 : 2009 | Random sampling and randomization procedures (*first revision*) |
| IS 5994 : 2022 | Agricultural tractors — Test code (*fourth revision*) |
| IS 8132 : 2023/ ISO 3600 : 2022 | Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Operator's manuals — Content and format (*third revision*) |
| IS 10743 : 1983 | Method for determination of centre of gravity of agricultural tractors |
| IS 12239 (Part-1): 2018/ ISO 4254-1: 2013 | Guide for safety and comfort of operator of agricultural tractors and power tiller — Part 1: General requirements (*second revision*) |
| IS 11859 : 2023/ ISO 789-3 : 2015 | Agricultural tractors — Test procedures — Turning and clearance diameters (*second revision*) |
| ISO 11684 : 2023 | Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Safety labels — General principles |

**3 TERMINOLOGY**

For the purposes of this standard, the definition of various terms given in IS 18383 (Part 1) shall apply.

**4 SAMPLING AND GENERAL GUIDELINES**

**4.1 Specification Sheet**

The manufacturer/applicant shall supply the specifications of the round baler consisting of the items listed in the specimen report given in Annex A as well as any additional data required to carry out the tests. The manufacturer shall also supply literature consisting of operational and maintenance manual, service manual and parts catalogue with the Baler. The literature should be in Hindi/English.

**4.2 Selection of Sample**

The baler shall either be selected at random (*see* IS 4905) from the production lot by the testing institute for commercial tests or shall be submitted by the applicant to the testing authority for confidential/initial commercial tests as the case may be. The Round Baler selected or submitted for test shall be completed with its usual accessories and in a condition generally offered for sale. The Round Baler shall be new and shall not be given any special treatment or preparation for test.

**4.3 Assembling and Preliminary Adjustments**

It would be the responsibility of the applicant to ascertain that round baler selected for testing is complete in all respects and necessary adjustments have been carried out in the presence of the representative of the testing institute.

**4.4 Conditions for Checking of Dimensions**

**4.4.1** The Round baler shall be standing on a firm, level and horizontal surface.

**4.4.2** The Round baler shall be stationary with its wheels and components in positions they would be as if the round baler was travelling in a straight line.

**4.4.3** The pressure in pneumatic tyres shall be adjusted to the value recommended by the applicant for field work.

The tyres shall be new. The measurement of height of lugs shall be made at the center line of tyres.

**4.4.4** Measurement conditions for various dimensions and characteristics as stipulated in IS 18383 (Part 1) shall also be followed.

**5 OTHER REQUIREMENTS**

**5.1** **Safety**

**5.1.1** Exposed moving parts like gear drives, chain drives, propeller shaft, bailing needle pedestal and other parts should be installed with shield, which should meet IS 12239 (Part 1).

**5.1.2** Knot-tying device (if applicable) should be protected in way that it should have minimal exposure to the weather conditions (like rain) or external factors which may cause functional obstacles (trash accumulation). The protection (Guard/barrier/shield) should be easy to open, secured after opening and accessible to see operating condition of knot- tying device from the outside after closing.

**5.1.3** Transmission mechanism like bale pickup unit, feeding unit and knot-tying device (If applicable) should be set with overload protection device and synchronous protective device; piston and bundling needle in the bundler machine should be installed with anti-bumping device; and the main transmission (gear) should be set with overrun clutch/dog clutch.

**5.1.4** Electrical connection should be protected with proper insulation and fuses or other overload protection devices shall be installed in electrical circuits to prevent potential electrical hazards. Electrical cables shall be protected from frequent abrasive material contacts which may damage the cable insulation. Electrical cables shall be located so that no portion is in contact with the moving parts or sharp edges.

**5.1.5** Nominal rotation frequency (RPM) and direction of rotation of the power input connection (marked by an arrow) shall be provided on the machine.

**5.1.6** Safety signs shall be appropriately displayed when necessary to alert the operator and others of the risk of personal injury during normal operation and servicing. Safety signs shall conform to the requirements of ISO 11684.

In particular, safety signs shall be provided on the machine drawing attention to:

a) The crushing and shearing points when working with machine;

b) The crushing hazard when the bale ejection door is open;

c) The risk of contact with moving parts of the tying mechanism;

**5.1.7** When it is necessary for the operator to work under raised parts (e.g. bale ejection door) of the machine in order to carry out maintenance or service, mechanical supports or hydraulic locking devices shall be provided to prevent inadvertent lowering. It shall be possible to control hydraulic locking devices and mechanical supports from outside the hazard zones.

a) Mechanical supporting devices shall withstand a load of 1.5 times the maximum static load to be supported.

b) Hydraulic locking devices shall be located on the hydraulic cylinder or connected to the hydraulic cylinder by rigid or flexible lines. In the latter case, the lines connecting the locking device to the hydraulic cylinder shall be designed to withstand a pressure at least four times the rated maximum hydraulic pressure.

NOTE — Verification of above may be demonstrated by manufacturer’s design (e.g., design schematics or drawing)

**5.2 Operator Manual**

The content and presentation shall be in accordance with IS 8132.

Comprehensive instructions and information on all aspects of the safe use of the machine, including suitable clothing and personal protective equipment requirements and the need for training, if necessary, shall be provided by the manufacturer in the operator's manual.

In particular, the following information shall be provided:

a) That guards be closed before starting and/or resuming operation of the machine;

b) That the operator shut the engine and PTO off and wait for all movement to stop before approaching the baler

c) The procedure to be followed for the threading of the twine, when the twine breaks and the feeding of the twine in the knitter.

d) The importance of regular maintenance of the baler and regular clearing of wrapped crop or tying material to reduce the possibility of fire

e) The hazards related to manually feeding the twine on to the bale to start the twine-tying process as the bale is rotating.

f) The procedures to be followed for changing the knives

g) Maximum travelling speed and ballast weight recommendation should be provided

**6 TESTS**

**6.1 Laboratory Tests**

**6.1.1** *Specification Checking*

The specifications of the picker given by the applicant (*see* **4.1**) shall be checked and reported in Annex A by the testing authority. While checking various dimensions, the conditions stipulated in **7.1** (summary of the field performance) shall be followed.

**6.1.2** *Material Analysis*

The hardness and chemical analysis of critical components, such as twin cutting knife shall be made and reported in Annex B.

**6.1.3** *Visual Observations and Checking of Provision for Adjustments*

The picker shall be subjected to thorough inspection with attention to bearings, drives and other moving parts, correctness of various adjustments, tightness of bolts and nuts, etc. The observation given in Annex C shall be recorded.

**6.1.4** *Bale Ejection Door Performance Test/ Hydraulic Reliability:*

1. Park the baler on level ground.
2. Maintain the picking unit height (reel height) at least 150 mm from ground.
3. Connect the baler’s hydraulic hoses with tractor’s quick action couplers as prescribed by manufacturer.
4. Keep the tractor in stationery position, turn on the tractor and engage the tractor PTO. Maintain the PTO RPM as prescribed by manufacturer.
5. Open the bale ejection door by hydraulic operating direction control valve.
6. Open and close the door for 100 cycles and make observations as mentioned in Annex D.

**6.1.4.1** *Requirements*

1. No leakage should occur in the hydraulic system when it’s at the rated pressure.
2. The hydraulic relief valve should be flexible and reliable and can play the security role within the specified pressure of a ± 0.5 MPa.

**6.1.5** *Turning Ability Test*

The test shall be carried out in accordance to IS 11859. During the test the baler shall remain attached, and the bailing/reel unit shall be up to 150 mm above the ground level.

The data shall be recorded in **E-1** of Annex E.

**6.1.6** *Position of Centre of Gravity*

The test shall be conducted in accordance with IS 10743. However, during the test the bale chamber shall be fully filled.

The data shall be recorded in **E-2** of Annex E.

**6.1.7** *Components / Assembly Inspection*

The critical components like gear, chain sprocket and belts, bearings, hydraulic pumps and roller as may be decided by the testing authority, shall be partially dismantled after conducting all tests including field tests. The observations listed under **10.1.1** to **10.1.11** of IS 5994 shall be made and reported in the format given in Annex E of IS 5994.

**6.2 Field Tests**

**6.2.1** *Test Field Investigation and Measurement*

The observation given in Annex F shall be recorded.

**6.2.2** *Test Field*

Measure the slope of the test area. Observe and record the landform and landscapes. Investigate the category of the meadow, forage grass type, the ratio of different forage grasses and crop yield per acre, etc.

**6.2.3** *Test Conditions*

**6.2.3.1** Test site should comply with requirements for operation of baler machine (bundler machine). Size and terrain of the plot should be representative of the local area.

**6.2.3.2** Material variety, windrow characteristics, width and thickness of windrow, quality of windrow per meter and paving quality should comply with requirements in instructions of baler machine (bundler machine).

**6.2.3.3** Moisture content of leguminous pasture and gramineous pasture should be in range of 17 percent to 23 percent while moisture content of wheat and rice straw and corn straw should be in range of 10 percent to 23 percent or based on agro-climatic condition suitable for crop type and baler use, in the region, in consultation with test agency.

**6.2.4** *Swath Character*

Take five swaths at random from the test area and measure the width, thickness, the quality per meter and the section. In the meanwhile, take the swath width as horizontal axis, and the swath thickness as vertical axis to draw a figure of swath section.

There should be three levels for assessment of the layout quality of swath:

a) First-rate swath ⎯ the plies are orderly, even and continuous.

b) Medium swath ⎯ the plies are relatively orderly, even and continuous, but some may be broken or packed too much.

c) Low-grade swath ⎯ the plies are in a mess, and the normal operation can be performed only after artificial settlement.

**6.2.5** *Moisture Content of Swath*

Take samples not less than 100 g from the upper, middle and lower part of each swath section, and weigh them. Weigh them again after they are dried for 5 h at the constant temperature of 105 ℃. The moisture content of swath is calculated according to formula (1)

(1)

Where:

is the moisture content of swath, in percent;

*G*sc is the mass of wet straw/hay, in g:

*G*gc is the mass of dry straw/hay, in g.

**6.2.6** *Grass Length After Harvest*

It is whole length of the left plant (except awn). For natural meadow, select more than 30 plants at random for each swath; for planting test field, select more than 10 plants at random for each swath. Measure its plant length for average.

**6.2.7** *Determination of Working Quality*

Five bales shall be tested according to following items.

**6.2.7.1** *Bale density*

Measure the width, diameter and quality of each bale respectively. Bale density is calculated according to formula (2)

(2)

Where:

*P* is the bale density, in kilogram per cubic meter (kg/m3);

*Gk* is the bale mass, in kilogram (kg);

*Vk* is the bale volume, in cubic meter (m3).

**6.2.7.2** *Straw recovery*

It is expressed as a percentage of straw/hay recovered by machine from the field while in bailing operation.

Where, *X* = Mass of loose straw/hay collected before bailing operation

*Y*= Mass of loose straw/hay collected after bailing operation

**6.2.7.3** *Percentage of unknotted bale*

Percentage of number of unknotted bales observed in respect of total number of bales counted during entire test.

where, *B* = Number of unknotted bales counted in entire test field

*A*= Total number of bales counted in entire test field

**6.2.7.4** *Pick-up loss rate*

The ratio of straw/hay mass left behind by pick-up unit to the swath mass in the length to be picked up is called pick-up loss rate. Measure four round trips, (take 10 m at random in each trip) and weigh the swath (a row or line of straw/hay) in this area, then collect and weigh the straw/hay (with a length of over one third of average grass length) left behind. Pick-up loss rate is calculated according to the formula (3)

(3)

Where:

is the pick-up loss rate, in percent;

*Gj* is the mass of straw/hay left behind in 10 m, in kilogram (kg);

*Gt* is the swath mass in 10 m, in kilogram (kg).

**6.2.7.5** *Bale forming loss rate*

The ratio of lost straw/hay mass in bale forming chamber to swath mass in the whole length to be picked up is called bale loss rate. Use a canvas to receive and weigh the scattered straw/hay in bale forming chamber during the formation of a bale. Measure four round trips and calculate according to formula (4)

(4)

Where:

is the bale forming loss rate, in percent;

*Gcs* is the lost straw/hay mass in bale forming chamber, in kilogram (kg);

*Gjx* is the straw/hay mass left behind per meter, in kilogram per meter (kg/m);

*Ld*is the whole length to be picked up, in meter (m),

*Gk* is the bale mass, in kilogram (kg)

**6.2.7.6** *Total straw/hay loss*

Straw/hay loss rate is calculated according to formula (5)

(5)

Where:

*S* is the total straw/hay loss, in percent,

*S*cx is the bale forming loss rate, in percent,

Sj is the pick-up loss rate, in percent.

**6.2.8** *Bale Forming Rate*

The ratio of bale forming number to total bale number is called bale forming rate. At least 100 bales shall be measured (it can be carried out in combination with production test), calculate according to formula (6)

(6)

Where:

*β* is the bale forming rate, in percent;

*Iz* is total bale number, in bale;

*Ic* is the bale forming number, in bale.

**6.2.9** *Consumption of Bale Sling*

Measure the weight of bale sling (twine or rope quantity) for five bales and calculate according to formula (7)

*Gs* = (7)

Where:

*Gs* is the weight of bale sling for one-ton straw/hay, in kilogram per ton (kg/t);

*Gks* is the weight of bale sling for one bale, in kilogram (kg)

*Gk* is the bale mass, in kilogram (kg)

**6.2.10** *Determination of Dynamic Indices (Speed, Power consumption)*

Round baler shall work under full load during measurement, and then measure four round trips.

**6.2.10.1** *Traction power of round baler*

Measure the average traction resistance before forming a bale in 30 meter and determine the passing time of the unit.

**6.2.10.1.1** *Calculate the working speed according to formula (8)*

V = (8)

Where:

*V* is the forward speed, in meter per second (m/s);

*L* is the distance to be measured, in meter (m);

*T* is the time, in second (s).

**6.2.10.1.2** *Calculate the traction/drawbar power according to formula (9)*

(9)

Where:

*Pq* is the traction power, in kilowatt (kW);

*Fq* is the average traction/soil or ground resistance, in kilo newton (kN),

*V* is the forward speed, in meter per second (m/s)

**6.2.10.1.3** *No-load power and transmission power of round baler*

Separately measure the PTO torque and rotating speed of tractor under no-load power and before forming a bale in 30 m.

**6.2.10.1.4** *Calculate no-load power according to formula (10)*

(10)

Where:

*Pk* is the no-load power, in kilowatt (kW);

*Mk* is the average torque of PTO under no load, in kilonewton meter (kN.m);

*nk* is the average rotating speed of PTO under no load, in revolution per minute (r/min).

**6.2.10.1.5** *Calculate transmission power according to formula (11)*

(11)

Where:

is the transmission power, in kilowatt (kW);

is the average torque of PTO, in kilonewton meter (kN.m);

is the average rotating speed of PTO, in revolution per minute (r/min.)

**6.2.10.1.6** *Total power consumption of round baler*

Calculate the total power consumption of round baler according to formula (12)

(12)

Where:

is the total power consumption of round baler, in kilowatt (kW)

is the transmission power, in kilowatt (kW)

is the traction power, in kilowatt (kW)

**6.3 Ease of Operation and Handling**

Observations shall be made on skill and intensity of effort required to operate various controls of the machine. Adequacy of accessibility of controls and visibility of the baling unit and instrumentation shall also be recorded. The note on operator’s working condition, the ease of setting adjustment, routine maintenance and other similar features shall also be made.

**6.4 Soundness of Construction**

Observations shall be made of these features which adversely affect the operation and efficiency of machine in the field. All the breakdowns and defects occurring during field evaluation period shall be recorded. The modification which could bring about improvement in the quality of rate of work shall also be noted.

**ANNEX A**

(*Clause* 4.1)

**BALER SPECIFICATION OF THE MACHINE (TO BE SUBMITTED BY MANUFACTURER)**

**A-0 DETAILS OF THE MANUFACTURER/APPLICANT**

|  |  |  |
| --- | --- | --- |
| **Sl. No.** | **Manufacturer** | **:** |
| 1 | Website | **:** |
| 2 | Telephone Number | **:** |
| 3 | Fax Number | **:** |
| 4 | GST TIN Number | **:** |
| 5 | E-mail address | **:** |
|  | **Applicant** | **:** |
| 1 | Website | **:** |
| 2 | Telephone Number | **:** |
| 3 | Fax Number | **:** |
| 4 | GST TIN Number | **:** |
| 5 | E-mail address | **:** |

**A-1 SPECIFICATIONS**

**A-1.1** **General Specifications of Machine**

|  |  |  |
| --- | --- | --- |
| 1. | Name of the Machine | **:** |
| 2. | Type | **:** |
| 3. | Product Details |  |
|  | 1. Make | **:** |
|  | 1. Model | **:** |
|  | 1. Serial number | **:** |
|  | 1. Manufacturers Address | **:** |
|  | 1. Year of manufacturer | **:** |
| 4. | Weight (kg) | **:** |
| 5. | Power source | **:** |
| 6. | Required power | **:** |
| 7. | PTO speed (rpm) | **:** |
| 8. | Suitable crop | **:** |

**A-1.2** **Prime mover used**

|  |  |  |
| --- | --- | --- |
| 1. | Tractor | **:** |
| 2. | Make & Model | **:** |
| 3. | Chassis serial No | **:** |
| 4. | Engine Serial No | **:** |

**A-1.3** **Construction Details**

**A-1.3.1** *Gear box*:

|  |  |  |
| --- | --- | --- |
| a. | Make | **:** |
| b. | Type | **:** |
| c. | No. of teeth on gears |  |
|  | Drive | **:** |
|  | Driven | **:** |
| d. | Reduction ratio (power input shaft to crown gear power output shaft) | **:** |
| e. | Oil capacity | **:** |
| f. | Oil grade | **:** |
| g. | Oil change period | **:** |
| h. | Method of driving | **:** |
| j. | Length of Splines (mm) | **:** |
| k. | No of Splines | **:** |
| m. | No of bearing & Location | **:** |

**A-1.3.2** *Three-point linkage:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl. No.** | **Particulars** | **As per**  **IS 17231** | **As**  **measured** | **Remarks** |
| **(Cat-II) (mm)** | **(mm)** |
| Upper Hitch Point | | | | |
|  | d1-Diameter of hitch pin hole |  |  |  |
|  | b2-Width between outer face of yoke |  |  |  |
|  | b1-Width between inner face of yoke |  |  |  |
| Lower Hitch Point | | | | |
|  | d2-Diameter of hitch pin |  |  |  |
|  | b3-Linch pin hole distance (Min) |  |  |  |
|  | L-Lower hitch point span |  |  |  |
| Other dimensions | | | | |
|  | D-Dia of Upper linch pin |  |  |  |
|  | d-Dia of Lower linch pin |  |  |  |
|  | h-Mast height |  |  |  |

**A-1.3.3** *Dimensions of implement Power Input Shaft (mm):*

|  |  |  |  |
| --- | --- | --- | --- |
| **Specification** | **As per IS 4931 (Part 3)** | **As observed** | **Remarks** |
| Nominal Speed |  |  |  |
| (rpm) |
| No of splines |  |  |  |
| Direction of rotation |  |  |  |
| DΦ |  |  |  |
| dΦ |  |  |  |
| a |  |  |  |
| c |  |  |  |
| B |  |  |  |
| W |  |  |  |

**A- 1.3.4** *Propeller Shaft (Cardan Shaft):*

Type: - Shielded telescopic (with two segments) having one universal joint on each segment with splined ends to insert the PTO of tractor and drive shaft of bevel box.

**A- 1.3.4.1** *Length of the shaft (mm):*

|  |  |
| --- | --- |
| Minimum | **:** |
| Maximum | **:** |
| Mass of shaft (kg) | **:** |

**A- 1.3.4.2** *Propeller shaft insert dimensions:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl. No** | **Notations** | **Dimension (mm)** | | **Conformity to IS** |
| **As per IS 4931 (Part 3)** | **As observed** |
| (1) | (2) | (3) | (4) | (5) |
| 1 | DΦ |  |  |  |
| 2 | dΦ |  |  |  |
| 3 | W |  |  |  |
| 4 | B |  |  |  |

**A- 1.3.5** *Pick-up/Feeding Mechanism:*

**A- 1.3.5.1** *Pick-up unit*

|  |  |
| --- | --- |
| Type | **:** |
| **Tine bar** |  |
| No of tine bars | **:** |
| Dimension of bars (Length x Diameter) (mm) | **:** |
| Type of tine bars | **:** |
| **Reel assembly** |  |
| Length of Reel assembly (mm) | **:** |
| No. of leaves on reel | **:** |
| Leaf dimension |  |
| (L x W x Thickness) (mm) | **:** |
| Leaf material | **:** |
| **Tines** |  |
| No. of tines on each bar | **:** |
| Total tines on reel assembly | **:** |
| Spacing between tines (mm) | **:** |
| Tine Length (mm) | **:** |
| Arrangement for raising and lowering reel assembly | **:** |
| Minimum distance from the ground level to tines (mm) |  |
|  | **:** |
| No of teeth on Sprocket |  |
| Drive | **:** |
| Driven | **:** |
| Speed reduction ratio from roller shaft to pick-up shaft | **:** |
| Method of Power Transmission | **:** |
| Size of chain |  |
| Length (mm) | **:** |
| Pitch (mm) | **:** |
| Tension control | **:** |
| Safety device | **:** |

**A-1.3.5.2** *Feeding mechanism guide bar*

|  |  |
| --- | --- |
| Type | **:** |
| Details of guide bar size |  |
| Length (mm) | **:** |
| Width (mm) | **:** |
| MS hollow pipe size | **:** |
| Length (mm) | **:** |
| Width (mm) | **:** |
| Horizontal MS rod size (mm) |  |
| Length (mm) | **:** |
| Width (mm) | **:** |

**A-1.3.5.3** *Slide cover*

|  |  |
| --- | --- |
| Type | **:** |
| Material | **:** |
| Thickness (mm) | **:** |

**A-1.3.6** *Baler Chamber*

|  |  |
| --- | --- |
| Type | **:** |
| No of Baling Roller | **:** |
| Method of operations | **:** |
| Number of strips in Bailing roller | **:** |
| Method of operation | **:** |
| Size of bale roller |  |
| Length (mm).apa | **:** |
| Diameter (mm) | **:** |
| Material | **:** |
| Size of Strip |  |
| Length (mm) | **:** |
| Width (mm) | **:** |
| Method of drive to bale roller | **:** |
| No. of teeth on main drive sprocket |  |
| Gear box crown sprocket (Drive) | **:** |
| Roller sprocket (Driven) | **:** |
| Speed reduction ratio to gear output shaft to roller shaft | **:** |
| Provision for tension control | **:** |
| Bale chamber size |  |
| Length (mm) | **:** |
| Diameter (mm) | **:** |
| Method of mounting of bale roller | **:** |
| Safety device | **:** |

**A-1.3.7** *Wedging plate*

|  |  |
| --- | --- |
| Type | **:** |
| Size (mm) | **:** |
| Length (Top) | **:** |
| Length (Bottom) | **:** |
| Height | **:** |
| Method of operation | **:** |
| Type of density adjustment mechanism | |
|  | **:** |

**A-2 WRAPPING MECHANISM**

**A-2.1 Twine Supporting Stand**

|  |  |
| --- | --- |
| Type | **:** |
| Twine bundle supporting stand size, m  Length of pipe (mm) (curved) | **:**  **:** |
| Diameter of pipe (mm) | **:** |
| No. of twine | **:** |
| Material of twine | **:** |

**A-2.2 Twine Path**

**A-2.3 Winding Arm**

|  |  |
| --- | --- |
| Type | **:** |
| Method of wrapping | **:** |

**A-2.3.1** *Details of Winding Arm Unit:*

|  |  |
| --- | --- |
| Type | **:** |
| Method of drive | **:** |

**A-3 BALE DISCHARGE MECHANISM:**

|  |  |
| --- | --- |
| Type | **:** |
| Method of operation | **:** |

**A-3.1 Bale Chamber Swings**

|  |  |
| --- | --- |
| Type | **:** |

**A-3.2 Bale Roll Out Mechanism**

|  |  |
| --- | --- |
| Type | **:** |
| Method of operation | **:** |
| Hydraulic cylinder size | **:** |
| Piston length (mm) | **:** |
| Diameter (mm) | **:** |
| Stroke length (mm) | **:** |

**A-3.2.1** *Bale counter unit*

|  |  |
| --- | --- |
| Type | **:** |
| Method of operation | **:** |

**A-3.3 Hydraulic Mechanism:**

|  |  |
| --- | --- |
| Type | **:** |
| Tank capacity (1lit) | **:** |
| Oil changing period (hr) | **:** |
| Recommended oil grade | **:** |

**A-3.3.1** *Hydraulic Pump:*

|  |  |
| --- | --- |
| Make | **:** |
| Type | **:** |
| Model | **:** |
| Method of drive | **:** |
| No of teeth on drive sprocket | **:** |
| No of teeth on driven sprocket | **:** |
| Speed reduction ratio for drive shaft to drive shaft | **:** |

**A-3.3.2** *Hydraulic Cylinder:*

|  |  |
| --- | --- |
| Type | **:** |
| No. of cylinder | **:** |
| Method of operation | **:** |

**A-3.4 Transport Wheels:**

|  |  |
| --- | --- |
| Type | **:** |
| No. of wheels | **:** |
| Size of wheel | **:** |
| Method of drive | **:** |
| Track width. mm | **:** |
| Recommended tyre pressure (kg/cm2) | **:** |
| Method of mounting | **:** |

**A-3.5 Supporting Stand for the Machine:**

|  |  |
| --- | --- |
| Type | **:** |

**A-3.5.1** *Size of supporting stand:*

|  |  |
| --- | --- |
| Inner hollow pipe (welded support pipe) |  |
| Length (mm) | **:** |
| Outer diameter (mm) | **:** |
| Inner hollow pipe (welded support pipe) |  |
| Length (mm) | **:** |
| Outer diameter (mm) | **:** |
| Wheel material |  |
| Material | **:** |
| Diameter (mm) | **:** |

**A-4 SAFETY DEVICES PROVIDED ON THE MACHINE**:

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl. No.** | **Assembly** | **Type of safety**  **mechanism** | **Location** |
| 1 | Reel assembly |  |  |
| 2 | Bale roll assembly |  |  |
| 3 | PTO shaft |  |  |
| 4 | Twine chamber |  |  |
| 5 | Safety cover |  |  |

**A-5 OVERALL DIMENSIONS:**

|  |  |
| --- | --- |
| Length (mm) | **:** |
| Width (mm) | **:** |
| Height (mm) | **:** |
| Total mass, kg | **:** |

**A-6 TOTAL NUMBER OF LUBRICATING POINTS:**

|  |  |
| --- | --- |
| Greasing | **:** |
| Oiling | **:** |
| Grease cup/pipe | **:** |

**ANNEX B**

(*Clause* 6.1.2)

**MATERIAL OF CONSTRUCTION AND HARDNESS**

**B-1 DATA SHEET FOR MATERIAL OF CONSTRUCTION**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl. No** | **Elements of composition** | **Knife (percent)** | **Any other part** |
| (1) | (2) | (3) | (4) |
| 1 | Carbon |  |  |
| 2 | Manganese |  |  |
| 3 | Phosphorus |  |  |
| 4 | Sulphur |  |  |
| 5 | Silicon |  |  |
| 6 | Copper |  |  |
| 7 | Nickel |  |  |
| 8 | Chromium |  |  |
| 9 | Tin |  |  |
| 10 | Molybdenum |  |  |

**B-2 HARDNESS OF KNIFE (HRC)**

a) Hardened zone

1) Minimum

2) Maximum

b) Remainder zone

1) Minimum

2) Maximum

**ANNEX C**

(*Clause* 6.1.3)

**DATA SHEET FOR VISUAL OBSERVATIONS AND PROVISION FOR ADJUSTMENTS**

**C-1 OBSERVATIONS**

a) Adequacy of marking of inlets and outlets

b) Adequacy of protection of bearing against the ingress of dust

c) Adequacy of safety arrangements, especially at moving points

d) Provision of lubrication of moving parts

e) Provision for easy changing of components requiring frequent replacement

f) Provision for easy replacement and cleaning of spindles

g) Tightness of bolts and nuts and other fasteners

h) Provision of belt tightening

j) Other observations

**C-2 PROVISION FOR ADJUSTMENTS**

1. Reel height
2. Bale density
3. Bale ejection Time
4. Roller tensioner setting
5. twine refilling
6. any other setting mentioned by manufacturer

Testing Engineer

**ANNEX D**

**DOOR PERFORMANCE AND RELIABILITY**

(*Clause* 6.1.4)

1. Make and Model of the Baler:
2. Date of test:
3. Location of test:
4. Hydraulic Oil Temperature:
5. Rated hydraulic system pressure: Pressure relief valve pressure:
6. Prime mover Make and Model:
7. Adjustment made prior to the test conducted:

|  |  |  |  |
| --- | --- | --- | --- |
| **Cycles (100 cycles**  **observation)** | **Rated pressure** | **Time taken to open the door when lever actuated** | **Any leakage observe/ malfunctioning** |
| First cycle |  |  |  |
| 50th Cycle |  |  |  |
| 100th cycle |  |  |  |

**ANNEX E**

**TURNING ABILITY TEST**

(*Clause* 6.1.5, 6.1.6 *and* 6.1.7)

**E-1 TURNING ABILITY**

a) Details of wheels’ equipment:

b) Wheel track, mm

i) Drive wheel

ii) Steering wheel

c) Size and pressure of tyres:

i) Drive wheel

ii) Steering wheel

d) Type of drive:

i) 2 wheel

ii) 4 wheel

e) Wheel base, mm

f) Test data

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Description** | **Minimum Turning Diameter** | | **Minimum Turning Space Diameter** | |
| **Right Hand, m** | **Left Hand, m** | **Right Hand, m** | **Left Hand, m** |
| With brakes applied |  |  |  |  |
| With brakes released |  |  |  |  |

**E-2 LOCATION OF CENTRE OF GRAVITY**

a) Height above ground, mm

b) Forward distance from the vertical plane containing the axis of the rear wheels, mm

c) Distance from the median plane parallel to the longitudinal axis of picker bisecting the driving wheel track, mm

**ANNEX F**

**FIELD PERFORMANCE DATA**

(*Clause* 6.1.1)

**F-1 FIELD PERFORMANCE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl.No.** | **Particulars** | **Performance test – I** | **Performance test - II** | **Performance test - III** |
| **(1)** | **(2)** | **(3)** | **(4)** | **(5)** |
|  | Date of test |  |  |  |
|  | Location |  |  |  |
|  | Kind of field (upland/lowland) |  |  |  |
|  | Crop |  |  |  |
|  | Variety |  |  |  |
|  | Harvesting method |  |  |  |
|  | Harvester used |  |  |  |
|  | Average standing stubble height in the field (cm) |  |  |  |
|  | Field moisture condition suitable for tractor maneuvering |  |  |  |
|  | Average loose straw length (cm) |  |  |  |
|  | Average width of loose straw heaped in field after harvesting by combine harvester (cm) |  |  |  |
|  | Loose straw moisture content (percent) |  |  |  |
|  | Power source |  |  |  |
|  | Tractor model |  |  |  |
|  | Power available (hp) |  |  |  |
|  | Engine speed (rpm) |  |  |  |
|  | Gear used |  |  |  |
|  | Average speed of operation (km/h) |  |  |  |
|  | PTO speed corresponding to engine operating speed (rpm) |  |  |  |
|  | Speed of pickup roller (rpm) |  |  |  |
|  | Speed of chamber roller (rpm) |  |  |  |
|  | Working width of baler (cm) |  |  |  |
|  | Average size of bale (Height x Diameter) (cm) |  |  |  |
|  | Average weight of one bale (kg) |  |  |  |
|  | Percentage of variation in weight from the mean value of Weight of bales |  |  |  |
|  | Average volume of one bale (m3) |  |  |  |
|  | Bulk density of bale (kg/m3) |  |  |  |
|  | No. of passes required to cover width of loose straw heaped in  field operated by combine harvester |  |  |  |
|  | Loose straw weight/ m3 before operation (gm) |  |  |  |
|  | Loose straw weight/ m3 after operation (gm) |  |  |  |
|  | Straw recovery (percent) |  |  |  |
|  | Straw Losses |  |  |  |
|  | Setting in twine winding used  Sling/winding rope consumption |  |  |  |
|  | Medium - No. of winding/bale |  |  |  |
|  | Total operating time(h) |  |  |  |
|  | Time lost owing to |  |  |  |
|  | i) Shifting time from one field to another field (min) |  |  |  |
|  | ii) Adjustment (min) |  |  |  |
|  | iii) Others (min) |  |  |  |
|  | Actual operating time (hr) |  |  |  |
|  | Field capacity (ha/hr) |  |  |  |
|  | Field efficiency (percent) |  |  |  |
|  | Time required for one hectare (hr) |  |  |  |
|  | Bale output |  |  |  |
|  | No. of bales (hr) |  |  |  |
|  | Bales kg/hr |  |  |  |
|  | Number of bales formed per hectare |  |  |  |
|  | Fuel consumption |  |  |  |
|  | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_lit/h |  |  |  |
|  | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_lit/ha |  |  |  |
|  | Breakdown, repair, replacement of parts during test |  |  |  |
|  | Operator |  |  |  |

**F-2 BALER PERFORMANCE – QUALITY OF WORK**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No.** |  | |  | |  | |
| **Weight of each bale (kg)** | **Percentage of variation in weight from the mean value of weight of bales** | **Weight of each bale (kg)** | **Percentage of variation in weight from the mean value of the weight of bales** | **Weight of each bale (kg)** | **Percentage of variation in weight from the mean value of the weight of bales** |
| **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** | **(7)** |
| i) |  |  |  |  |  |  |
| ii) |  |  |  |  |  |  |
| iii) |  |  |  |  |  |  |
| iv) |  |  |  |  |  |  |
| v) |  |  |  |  |  |  |
| **Mean**  **value** |  |  |  |  |  |  |

**ANNEX G**

(*Foreword*)

**COMMITTEE COMPOSITION**

Agricultural Machinery and Equipment Sectional Committee, FAD 11

| *Organization* | *Representative(s)* |
| --- | --- |
| ICAR - Central Institute of Agricultural Engineering, Bhopal | Dr C. R. MEHTA **(*Chairperson*)** |
| Agriculture Machinery Manufacturers Association, Pune | Dr Surendra Singh  Shri Mitul Panchal (*Alternate*) |
| All India Farmers Alliance, New Delhi | Dr RAJARAM TRIPATHI  SMT APURVA TRIPATHI (*Alternate*) |
| Aspee Agro Equipment Private Limited, Mumbai | Shri JATIN S. PATEL  Shri GANGADHAR VARPE (*Alternate*) |
| Automotive Research Association of India, Pune | Shri A. Akbar Badusha  Shri GIRISH TANAWADE (*Alternate I*)  Shri GANGARAM AUTI (*Alternate II*) |
| CCS Haryana Agricultural University, Hisar | Dr VIJAYA RANI |
| CLAAS India Private Limited, Chandigarh | Shri KRISHNA PRABHAKAR |
| CNH Industrial India Private Limited, Pune | SHRI SANTHOSH RAO  Shri SUJIT HINGE (*Alternate*) |
| Central Farm Machinery Training and Testing Institute, Budni | SHRI ANIL KUMAR UpadhyaY  Shri CHAKRADHAR V. CHIMOTE (*Alternate*) |
| Consumer Guidance Society of India, Mumbai | Shri Sitaram Dixit |
| Dasmesh Mechanical Works Private Limited, Malerkotla | Shri Sarbjeet Singh Panesar  Shri Gurdeep Singh Panesar (*Alternate*) |
| ICAR - All India Coordinated Research Project on Ergonomics and Safety in Agriculture, Bhopal | Dr K. N. AGRAWAL  Dr Rahul R Potdar (*Alternate*)  Smt Sweeti Kumari (*Alternate*) |
| ICAR - All India Coordinated Research Project on Utilization of Animal Energy, Bhopal | Dr S P Singh |
| ICAR - Central Institute of Agricultural Engineering, Bhopal | Dr V.P. Chaudhary  Dr UADY R. BADEGAONKAR (*Alternate*)  Dr DILIP JAT (*young professional*) |
| Indian Council of Agricultural Research, New Delhi | Dr Panna Lal Singh |
| John Deere India Private Limited, Pune | Shri ANAND RAJ  Shri CHANDRASHEKHAR DESHMUKH (*Alternate*) |
| Kerala Agro Machinery Corporation Ltd. (KAMCO), Athani | Shri A. Unnikrishnan  Shri P. C. SAJIMON (*Alternate*) |
| Kubota Agricultural Machinery India Private Limited, Faridabad | Shri ASHOK KUMAR  Shri Ashish Kumar Mallarh (*Alternate*) |
| Maharana Pratap University of Agricultural and Technology, Udaipur | Dr Sanwal Singh Meena |
| Mahatma Phule Krishi Vidyapeeth, Rahuri | Dr Sachin Madhukar  Shri Vikram Parasharam Kad (*Alternate I*)  Dr. Avdhut Ashok Walun (*Alternate II*) |
| Mahindra and Mahindra Limited, Mumbai | Shri PRADEEP SHINDE |
| Ministry of Agriculture, Department of Agriculture, New Delhi | Dr V.N. KALE  Shri ARVIND N. MESHRAM (*Alternate*) |
| National Institute of Plant Health Management, Hyderabad | Dr VIDHU KAMPURATH P.  Shri MUTYALA UDAYA (*Alternate*) |
| North Eastern Region Farm Machinery Training and Testing Institute, Biswanath Chariali | Dr P. P. Rao  Shri S. G. Pawar (*Alternate*)  Shri KHAGENDRA BORA (*young professional*) (*Alternate II*) |
| Northern Region Farm Machinery Training and Testing Institute, Hisar | Dr Mukesh Jain  Shri Sanjay Kumar (*Alternate*) |
| Odisha University of Agriculture and Technology, Bhubaneswar | Dr Debaraj Behera  Dr. Padma Lochan Pradhan (*Alternate I*)  Dr. Prerana Priyadarsini (*Alternate II*) |
| Power Tillers Manufacturers Association, Kolkata | Shri A. R. Ganesh Kumar |
| Punjab Agricultural University, Ludhiana | Dr Mahesh Kumar Narang  Dr. Rajesh Goyal (*Alternate*)  Shri APOORV PRAKASH (*young professional*) (*Alternate* II) |
| Southern Region Farm Machinery Training And Testing Institute, Tractor Nagar | Dr B.M. Nandede |
| Tamil Nadu Agricultural University, Coimbatore | Dr R. Kavitha  Dr A. Surendra Kumar (*Alternate*)  Dr A. P. Mohankumar (*young professional*) (*Alternate* II) |
| Tirth Agro Technology Pvt. Ltd. 'Shaktiman', Bhunava, Gujarat | Shri Parag Devidas Badgujar  Shri Ravi Mathur (*Alternate*) |
| Tractor and Mechanization Association, New Delhi | Shri Mohit Kumar  Shri Mansingh Jagdale (*Alternate*) |
| Tube Investments Clean Mobility Private Limited, Chennai | Shri Vivek Gupta  Shri S. O. Tyagi (*Alternate*) |
| Voluntary Organisation in Interest of Consumer Education (VOICE), New Delhi | Shri B. K. Mukhopadhyay |
| BIS Directorate General | SHRIMATI SUNEETI TOTEJA, SCIENTIST ‘F’/SENIOR DIRECTOR AND HEAD (FOOD AND AGRICULTURE DEPARTMENT) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)] |

*Member Secretary*

SHRI VIKRANT CHAUHAN

SCIENTIST ‘B’/ASSISTANT DIRECTOR

(FOOD AND AGRICULTURE DEPARTMENT), BIS