भारतीय मानक **IS 18717 : 2024**

Indian Standard

कम्बाइन हार्वेस्टर के लिए पुआल प्रबंधन प्रणाली (एसएमएस) — कार्यकारिता परीक्षण पद्धति

Straw Management System (SMS) for Combine Harvesters — Performance Test Method

ICS 65.060.01

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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 Agriculture Machinery and Equipment Sectional Committee had been approved by the Food and Agriculture Division Council.

Straw management system (SMS) for combine harvesters is an agricultural machinery used to facilitate in-situ management of crop residue. Generally, SMS is attached near to the straw discharge outlet of combine harvester to collect, chop and uniformly spread loose chopped straw on the harvested field.

This standard covers the method of tests to be conducted to assess the performance of straw management system mounted on combine harvester to bring uniformity in process of establishing the performance of the machine.

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

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

STRAW MANAGEMENT SYSTEM (SMS) FOR COMBINE HARVESTERS — PERFORMANCE TEST METHOD

1 SCOPE

This standard covers the methods of tests to be conducted to assess the performance of straw management system (SMS) mounted on a grain combine harvester.

2 REFERENCES

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

IS No.	*Title*
IS 4905 : 2015/ ISO 24153 : 2009	Random sampling and randomization procedures (*first revision*)
IS 6024 : 1983	Specifications for guards for harvesting machines (*first revision*)
IS 6025 : 2024	Knife sections for harvesting machines — Specification (*second revision*)
IS 10378 : 2024	Knife back for harvesting machines — Specification (*first revision*)
IS 12239 (Part 1) : 2018/ISO 4254-1 : 2013	Guide for safety and comfort of operator of agricultural tractors and power tillers: Part 1 General requirements (*second revision*)

3 TERMS AND DEFINITIONS

3.1 Straw Chopper — Assembly mounted on straw discharge section of combine harvester to collect threshed straw and cut it into desired sizes. It also helps to deliver the cut straw to spreader to further spread it into the field. A typical chopper consists of a rotary shaft mounted with numbers of rows of blades named as flail for chopping of straw either by shearing or impact action.

3.1.1 *Flail Blade* — Blades (either serrated or plain) that are pivoted in pairs on bars welded to rotary shaft in chopper assembly.

3.1.2 *Fixed Blade* — Stationary blades, which are generally positioned in a row below rotary shaft. Purpose of fixed blade is to help flail blades to chop the straw. Length of fixed blades can be adjusted to achieve desired length of chopped straw.

3.2 Spreader — Spreader helps to guide and spread the chopped straw which comes out of chopper assembly of SMS system.

3.2.1 *Flap* — Part of spreader assembly, which help in guiding the chopped straw coming out from the spreader. These are generally adjustable with certain limits.

4 GENERAL GUIDELINES

4.1 Specification Sheet

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

NOTE — For guidance of the applicant/manufacturer, a specification sheet of the straw management system is provided at Annex B.

4.2 Safety

The machine shall be in accordance with the safety requirements and/or protective measures as given in IS 12239 (Part 1). The manufacturer shall also provide the information on safe working practices which would eliminate or reduce the hazards arising from the intended use of these machines by operator during normal operation and service. The note on any safety device, such as slip clutches, speed sensor/indicator, shall be provided. Any other safety feature shall also provided.

4.3 Sampling

The SMS 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 SMS selected or submitted for test shall be complete with its usual accessories and in a condition generally offered for sale. The SMS shall be new and shall not be given any special treatment or preparation for test.

4.4 Running-in

4.4.1 The SMS shall be run-in at the testing institute by the applicant in collaboration with the testing institute before the start of the test, under his/her responsibility and in accordance with his/her usual instructions. If this procedure becomes impracticable for any reasons, the testing institute shall run-in the SMS provided that the permission of the applicant or his/her representative, who will remain responsible for running-in, is obtained.

4.4.2 The duration of running-in and place shall be indicated.

4.5 Servicing and Preliminary Settings After Running-in

After completion of running-in test, the servicing/adjustments as per printed literature/ information supplied by the applicant/manufacturer shall be done. No adjustment shall be made unless it is recommended in the literature or specific recommendations are submitted before start of test. The parts which are replaced shall be reported.

4.6 Repair and Adjustment During Test

The applicant/manufacturer, during the course of test shall not make or introduce any major adjustment or introduce any major alterations or modifications which may affect the normal performance. However, normal operational adjustments, to suit crop and field conditions or as conformance to the specifications made available to the testing authority, can be made during the test. In case of SMS for confidential test, the testing authority at its discretion can permit major alterations or modifications on the request of the applicant. Any repair or adjustment during test may be recorded in data sheet as given in Annex C.

4.7 Conditions for Checking of Dimensions

4.7.1 The SMS shall be mounted on combine harvester as recommended by manufacturer. In case, it is absolutely not possible to check the dimensions, the SMS shall be kept on a firm, levelled and horizontal surface in the same orientation, as mounted on combine harvester.

4.7.2 Measurement conditions for various dimensions and characteristics as stipulated shall also be followed.

5 TESTS

5.1 Laboratory Tests

5.1.1 *Specification Checking*

The specification of the SMS given by the applicant (*see* **4.1**) shall be checked and reported in test report by the testing authority as per Annex A. While checking various dimensions, the conditions stipulated in **4.7** shall be followed.

5.1.2 *Material Analysis*

The hardness testing and chemical analysis of critical components, such as flail blade, fixed blade and bushes for flail blades shall be made and reported as per Annex D.

5.1.3 *Visual Observations and Checking of Provision for Adjustments*

The SMS shall be subjected to thorough inspection with particular attention to bearings, drives and other moving parts, correctness of various adjustments, tightness of bolts and nuts, etc. The observation shall be recorded and reported as per Annex E.

5.1.4 *Checking of Wear*

The wear of blades on dimensional and weight basis shall be reported as given in Annex F.

5.1.5 *Dynamic Balancing*

Rotor dynamic balancing test shall be performed to measure unbalanced weight and angle at each end of the rotor. Data should be reported as per Annex G.

5.2 Field Tests

5.2.1 *Crop Conditions*

Crop condition during testing must be recorded and reported as per Annex H. The individual experimental unit on which the sample is tested will be referred to as a plot. Plots should be chosen to represent field characteristics.

5.2.1.1 *Field condition*

The ground surface of field waiting for harvesting shall be rather flat, have no ditch and big ridge, dry and passed easily by the combine harvester having

SMS mounted. The barriers which cannot be removed shall have obvious signs. Wherever possible, barriers/obstacles need to be avoided.

5.2.2 *General Condition for Operation*

The combine-SMS combination shall be operated by an experienced operator. The applicant or his representative shall demonstrate the operation of the combine-SMS combination to the testing authority in actual field condition. The testing shall not be carried out until the testing authority is satisfied that the machine is operating correctly. Before starting the test, the SMS shall be adjusted as per manufacturer's recommendations. This adjustment may be modified to obtain the highest efficiency regarded as reasonable by the testing authority and the applicant's representative. Performance values obtained during preliminary adjustment need not be reported. Manufacturer's recommendations for various adjustment shall be followed.

5.2.3 *Conducting the Test*

5.2.3.1 Minimum three plots for the test run of at least 15 m shall be selected randomly within the area to harvest. The area from where the sample is to be collected shall preferably be 1 m in direction of travel and full width of cutter bar of the machine.

5.2.3.2 Spreader flaps shall be adjusted in such a manner so that entire chopped straw fall within the cutting width of the combine harvester.

5.2.3.3 The combine-SMS combination should be operated for at least 10 min before recording the data to ensure that the crop mover, and the straw walker system has been filled. The combine-SMS combination should be operated at a uniform speed and in such a manner as to use its full cutting width.

NOTE — As far as possible, a constant stubble height shall be maintained.

5.2.3.4 In each field, the test shall be carried out at the same forward speed as used in the preliminary adjustment.

5.2.3.5 Changes in the forward speed as adjusted before the test and any stoppage during the test run shall not be permitted. If this happens because of some unavoidable circumstances the test observations shall be repeated.

5.2.3.6 To collect the chopped straw left by the spreader, one long piece of cloth with width and length of suitable size to comfortably cover the maximum spread of chopped straw behind the combine-SMS combination should be used (preferably 1.2 times of maximum spread of chopped straw). This chopped straw collection cloth should be placed on ground after afflux of chaff and other material from shoe/chaffer board settled on ground and before the afflux from spreader (that is, chopped straw) fall on the ground.

NOTE — Also, length of the collection cloth should be oriented in perpendicular direction to the motion of the combine-SMS combination. This is necessary to collect only chopped straw from spreader (*see* Fig. 1).

5.2.3.7 Area of collected material over collection cloth shall be divided into four equal sample areas along the length of the collection cloth. Chopped straw in each sample area shall be collected separately as shown in Fig. 2. Care should be taken while dividing the area loose chopped straw from one area do not get mixed with another area. Each sample shall be named as shown in Fig. 3. Chopped straw in each area shall be collected for further analysis.

FIG. 1 CHOPPED STRAW OVER COLLECTION CLOTH

FIG. 2 COLLECTION OF CHOPPED STRAW SAMPLES FOR ANALYSIS

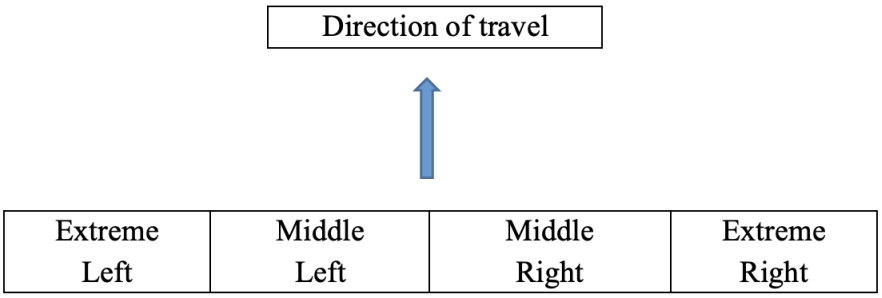


FIG. 3 NOMENCLATURE OF SAMPLES FOR ANALYSIS

5.2.3.8 Data related to weight of loose chopped straw in each sample area shall be recorded and analyzed as per Annex J for uniformity of spreading in terms of coefficient of variation (CV).

$$CV = \sigma/\mu$$

where

σ = standard deviation of samples; and

μ = mean of samples.

Minimum of three observations shall be taken. Observed average percentage coefficient of variation shall be reported.

5.2.3.9 For determining average weighted mean chop size, minimum three sample area of chopped straw shall be selected. The chopped straw collected in each sample area shall be segregated based on the size of chopped straw as shown in Fig. 4. Weight of each sub-sample shall be recorded as percentage of total chopped straw collected.

5.2.3.10 Data from above exercise shall be recorded into tabular form (*see* Annex K) for determining weighted mean chop size of the SMS. Minimum three observations shall be taken to determine average weighted mean chop size.

6 EVALUATIVE REQUIREMENTS

Requirements under this category are the ones which are mandatory for acceptance of the straw management system for the purpose of subsidies and financing.

All dimensions are in millimeters.

FIG. 4 DIFFERENT CHOP SIZE OF STRAW AFTER SEGREGATION

7 NON-EVALUATIVE REQUIREMENTS

Requirements under this category are the ones which are not mandatory for acceptance of the straw management system for the purpose of subsidies and financing. However, the authorized testing agency shall observe the performance for these requirements and record in the test report.

8 ACCEPTANCE CRITERIA FOR PERFORMANCE CHARACTERISTICS

8.1 The product may be accepted for performance after confirming compliance to all evaluative requirements. Performance characteristics of straw management system, along with the tolerances for the declared values and in certain cases minimum/ maximum values as per given in Table 1.

8.2 Acceptance Criteria in Case of Breakdowns/ Defects

8.2.1 The product may be accepted subject to the following conditions:

a) There is no 'critical breakdown' during the course of testing;

b) There are not more than two 'major breakdowns' and neither of them is of repetitive nature;

c) There are not more than five 'minor defects' during the test and the frequency of any defect is not more than two; and

d) In no case, the total no. of breakdowns exceeds five that is, (2 major + 3 minor) or (1 major + 4 minor) or 5 minor breakdowns.

8.2.2 In case of multiple consequential failures resulting from a single defect/breakdown, the primary single defect/breakdown shall only be counted.

8.2.3 Replacement of gaskets, seals, 'O' rings, etc other than the defected parts during repair, dismantling and re-assembly of any aggregate shall not be considered as breakdown.

8.2.4 Categorization of defects in terms of "critical", "major" and "minor" for various sub-assemblies/parts are provided in the Annex L, Annex M and Annex N.

Table 1 Parameters Applicable for Qualifying Minimum Performance Criteria

(*Clause* 8.1)

Sl No.	Characteristics	Category (Evaluative/ Non-Evaluative)	Requirement (R)/ Declaration (D)	Tolerance
(1)	(2)	(3)	(4)	(5)
i)	Field performance for straw management system			
a)	Uniformity of straw spread, CV (%)	Evaluative	20 (*Max*) (R)	–
b)	Weighed mean size of chopped straw, cm	Evaluative	20 (*Max*) (R)	–
ii)	Safety requirements for straw management system			
a)	Guards against all moving parts/drives and hot parts	Evaluative	Essential (R)	–
b)	RPM indicator for rotor	Evaluative	Desirable	–
c)	Overlapping of flail and fixed serrated blades	Evaluative	Essential (R) The clearance of the flail and fixed serrated blades should be adjustable	–
iii)	Material of construction for			
a)	Knife guard	Non-evaluative	Conforming to IS 6024 (R)	–
b)	Knife blade	Non-evaluative	Conforming to IS 6025 (R)	–
c)	Knife back	Non-evaluative	Conforming to IS 10378 (R)	–
d)	Material of blades for straw management system (SMS)	Non-evaluative	The flail and fixed blades shall be manufactured from steel having the following chemical composition or such other composition as shall be agreed to between the supplier and the purchaser: a) Carbon 0.70 percent to 1 percent; b) Manganese 0.60 percent to 0.97 percent;	–

Table 1 (*Concluded*)

Sl No.	Characteristics	Category (Evaluative/ Non-Evaluative)	Requirement (R)/ Declaration (D)	Tolerance
(1)	(2)	(3)	(4)	(5)
			c) Chrome 0.1 percent; and d) Nickel 0.1 percent.	
e)	Bushes for flail blades	Non-evaluative	Mild steel (R)	–
f)	Hardness of flail blades for straw management system (SMS)	Non evaluative	Bush section: 20 to 35 HRC (R)	–
			Edge section (hardened zone): 48 to 58 HRC (R)	–
			Remainder zone: 20 to 35 HRC (R)	–
g)	Hardness of serrated blades for straw management system (SMS) :	Non evaluative	Bush section: 20 to 35 HRC (R)	–
			Edge section (hardened zone): 48 to 58 HRC (R)	–
			Remainder zone: 20 to 35 HRC (R)	–

ANNEX A

(*Clauses* 4.1 *and* 5.1.1)

SPECIFICATION SHEET FOR STRAW MANAGEMENT SYSTEM (SMS)

A-1 GENERAL

a) Name and address of applicant
b) Name and address of manufacturer
c) Make
d) Model
e) Type
f) Year of manufacture
g) Serial number
h) Recommended make and model of combine harvester (s)
j) Recommended power of combine harvester, kW

A- 2 ROTOR

a) Rotor diameter, mm
b) No. of lugs on rotor in a row
c) No. of rows in periphery
d) Length of pivotal flail, mm
e) Width of flail, mm
f) Thickness of flail, mm
g) No. of flail in one set;
h) Spacing between adjacent flail unit, mm
j) No. of rows/bar of serrated blade
k) No. of serrated blades, mm
m) Clearance between flail blade and overlapping of flail blade and fixed blade (*Max* and *Min*)
n) Rotor rpm
p) Rotor balancing

A-3 TRANSMISSION

a) Diameter of drive pulley
b) Diameter of driven pulley

A- 4 SPREADER

a) Total no. of flaps
b) Length of flap, mm
c) Distance between flaps, in (left to right)
d) Spreader angle with horizontal, degree
e) Spreader angle with line of travel, degree
f) Spreader sheet thickness, mm

A-5 OVERALL DIMENSION

a) Length, mm

b) Width, mm

c) Height, mm

d) Overall mass, kg

A-6 COLOR

A-7 METHOD OF ATTACHMENT TO COMBINE HARVESTER

A-8 METHOD OF ADJUSTMENTS

a) Overlapping of flail and stationary blades

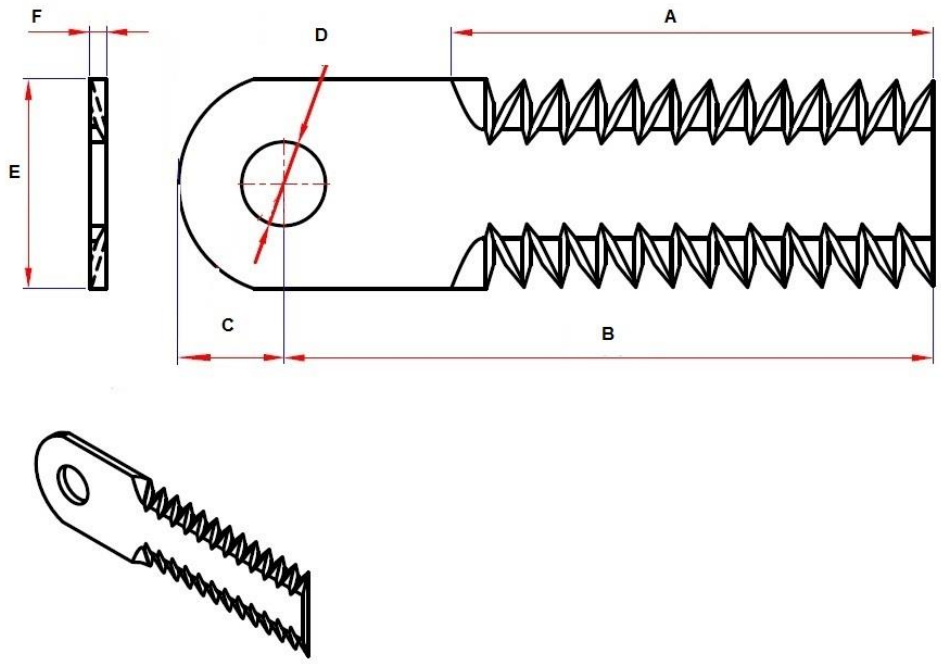
b) Spreader angle with horizontal plane

c) Flap's angle with vertical plane

d) Any other adjustment

A-9 DIMENSIONS OF FLAIL BLADE SECTION (*see* Fig. 5)

Sl No.	*Designation*	*Observed Dimensions*
(1)	(2)	(3)
i)	A	
ii)	B	
iii)	C	
iv)	D	
v)	E	
vi)	F	

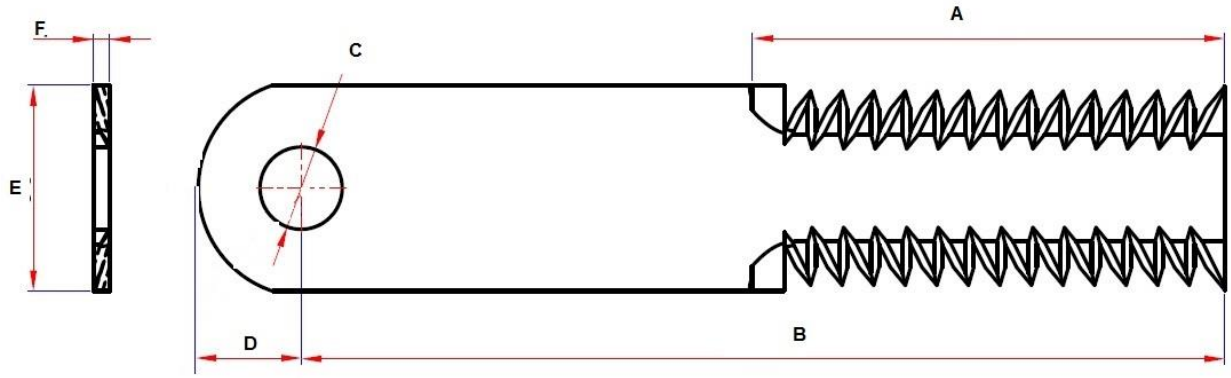


NOTE — Above design is for illustration only, manufacturer may have different flail blade design.

FIG. 5 FLAIL BLADE SECTION

A-10 DIMENSIONS OF FIXED BLADE SECTION (*see* Fig. 6)

Sl No.	*Designation*	*Observed Dimensions*
(1)	(2)	(3)
i)	A	
ii)	B	
iii)	C	
iv)	D	
v)	E	
vi)	F	

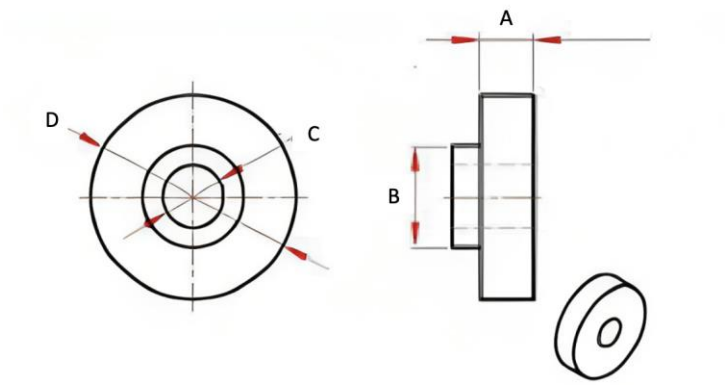


NOTE — Above design is for illustration only, manufacturer may have different fixed blade design.

FIG. 6 FIXED BLADE SECTION

A-11 DIMENSIONS OF BUSH WITH COLLAR SECTION (*see* Fig. 7)

Sl No.	*Designation*	*Observed Dimensions*
(1)	(2)	(3)
i)	A	
ii)	B	
iii)	C	
iv)	D	

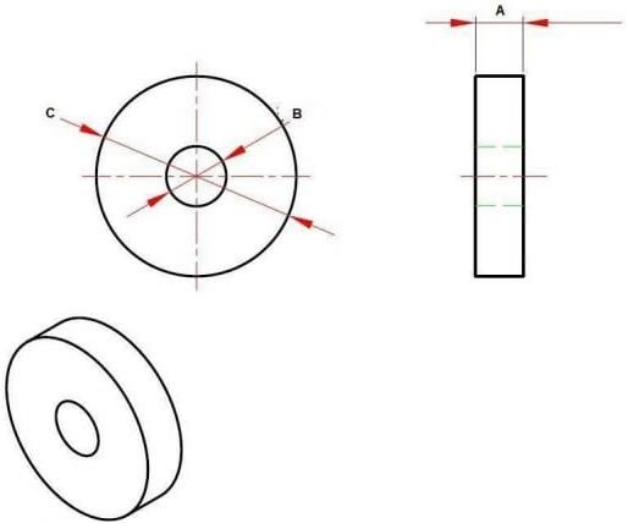


NOTE — Above design is for illustration only, manufacturer may have bush with different design.

FIG. 7 BUSH WITH COLLAR SECTION

A-12 DIMENSIONS OF BUSH WITHOUT COLLAR SECTION (*see* Fig. 8)

Sl No.	*Designation*	*Observed Dimensions*
(1)	(2)	(3)
i)	A	
ii)	B	
iii)	C	



NOTE — Above design is for illustration only, manufacturer may have bush with different design.

FIG. 8 BUSH WITHOUT COLLAR SECTION

ANNEX B

(*Clause* 4.1)

SPECIFICATION OF STRAW MANAGEMENT SYSTEM (SMS)

Table 2 Specification Sheet for Straw Management System for Guidance

Sl No.	Parameters	Specification	
		Self-Propelled	Track Type
(1)	(2)	(3)	(4)
	Rotor		
i)	Rotor pipe diameter, mm	110 to 165	70 to 210
ii)	No. of lugs on rotor in a row	3 (*Min*)	3 (*Min*)
iii)	No. of rows in periphery	4	4
iv)	Length of pivotal flail (blade) from centre of hole to tip, mm	100 to 180	100 to 180
v)	Width of flail (blade), mm	Straight 50 to 60 Tapered 25 to 60	Straight 25 to 60
vi)	Thickness of flail (blade), mm	3.0 (*Min*)	3.0 (*Min*)
vii)	No. of flails (blade) in one set	1 (*Min*)	
viii)	No. of rows/bars of blades	1	
ix)	Spacing between blades, mm	20 (*Min*)	
x)	Overlapping of pivotal blade on serrated/plain blade, mm	25 (*Min*) (adjustable)	
	Spreader		
xi)	Length of flap, mm	200 (*Min*)	
xii)	Distance between flaps (left to right)	Adjustable	
xiii)	Spreader angle with horizontal, degree	Adjustable preferably downwards	
xiv)	Spread sheet thickness, mm	1.5 (*Min*)	
xv)	SMS sheet thickness, mm	1.5 (*Min*)	
xvi)	Rotor balancing	Should be dynamically balanced	
xvii)	Rotor rpm	1 500 (*Min*)	1 200 (*Min*)
xviii)	Peripheral speed, m/s	40 (*Min*)	40 (*Min*)
xix)	Fitting of SMS on combine harvester	Rigidly fixed to the combine chassis	
xx)	Fitting of power transmission system on combine harvester	Rigidly fixed to the combine chassis	

Table 2 (*Concluded*)

Sl No.	Parameters	Specification	
		Self-Propelled	Track Type
(1)	(2)	(3)	(4)
xxi)	Marking/labeling of machine	Labeling plate should be riveted on the body of machine having name and address of manufacturer, country of origin, make, model, year of manufacture, serial no., type, size, required size of prime mover (kW), weight of the machine (kg)	
xxii)	Literature	Operator manual, service manual and parts catalogue should be provided	

ANNEX C

(*Clause* 4.6)

DATA SHEET FOR REPAIR AND ADJUSTMENT DURING TESTING

Sl No.	Duration of Running	Defect/ Breakage	Major/ Minor	Repaired/not Repaired	Duration for Repair	Possible Cause of Defect
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)						
ii)						
iii)						
iv)						

ANNEX D

(*Clause* 5.1.2)

DATA SHEETS FOR MATERIAL ANALYSIS

D-1 DATA SHEET FOR CHEMICAL ANALYSIS OF CRITICAL COMPONENTS OF SMS

Sl No.	Critical Component	Carbon (%)	Manganese (%)	Phosphorus (%)	Sulphur (%)	Silicon (%)	Boron (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)							
ii)							
iii)							
iv)							

D-2 DATA SHEET FOR HARDNESS OF CONSTRUCTIONAL MATERIAL

Sl No.	Critical Component	Material of Construction	Hardness
(1)	(2)	(3)	(4)
i)			
ii)			
iii)			
iv)			

ANNEX E

(*Clause* 5.1.3)

DATA SHEET FOR VISUAL OBSERVATION AND CHECKING OF PROVISION FOR ADJUSTMENTS

E-1 OBSERVATION

i)	Adequacy of marking of direction of rotation of rotating shaft	:
ii)	Adequacy of protection of bearing against the ingress of dust	:
iii)	Adequacy of safety covers especially at moving points	:
iv)	Provision of lubrication of moving parts	:
v)	Provision of belt/chain tightening	:
vi)	Provision of ease of changing of components requiring frequent replacement (flail blade, fixed blades, etc)	:
vi)	Tightening of bolts, nuts and other fasteners	:
vii)	Any other observations	:

E-2 PROVISION FOR ADJUSTMENTS

i)	Length of cut of straw	:
ii)	Chopped straw spread	:
iii)	Chopped straw throw	:
iv)	Any other adjustment	:

ANNEX F

(*Clause* 5.1.4)

DATA SHEET FOR PERCENTAGE WEAR OF COMPONENT

Sl No.	Component	Mass/Dimension of Component Before Test		Mass/Dimension of Component After Test		Percentage Wear	
		Mass	Major Dimension	Mass	Major Dimension	Mass	Major Dimension
		(g)	(mm)	(g)	(mm)	(%)	(%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)							
ii)							
iii)							
iv)							

ANNEX G

(*Clause* 5.1.5)

DATA SHEET FOR ROTOR DYNAMIC BALANCING TEST

Date: Mass of the job (kg):
Make/model of dynamic balancing machine: Balancing speed (rpm):

Sl No.	Particulars	As Permissible	As Observed	Remarks
(1)	(2)	(3)	(4)	(5)
i)	Unbalanced weight (left side plane), g			
ii)	Unbalanced weight (right side plane), g			
iii)	Unbalanced angle (left side plane), degree			
iv)	Unbalanced angle (right side plane), degree			

ANNEX H

(*Clause* 5.2.1)

CROP CONDITION

Variety…… Location…….

Sl No.	Crop Condition	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Average
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Plant population, No./m^2						
ii)	Available straw mass/ unit area, kg/m^2						
iii)	Moisture content of straw, percent (db)						
iv)	Height of stubble before harvest, mm						
v)	Height of stubble after harvest, mm						

ANNEX J

(*Clause* 5.2.3.8)

EVALUATION OF SMS FOR UNIFORMITY OF SPREADING

Observation No. …. Spreader flap position… Date…… Vehicle speed …….

Sl No.	Sample Position	Weight of Loose Chopped Straw per m^2, g	Coefficient of Variation (%)
(1)	(2)	(3)	(4)
i)	Extreme left		
ii)	Middle left		
iii)	Middle right		
iv)	Extreme right		

ANNEX K

(*Clause* 5.2.3.10)

WEIGHTED MEAN CHOP SIZE (CHOPPING EFFECTIVENESS)

Observation No. … Blade overlap ……. Date……

Sl No.	Range, mm	Average Range, mm	% Chop Size from Sample	Weighed Mean Chop Size, mm
(1)	(2)	(3)	(4)	(5)
i)	< 25	12.5		
ii)	25 to 75	50		
iii)	75 to 125	100		
iv)	125 to 200	162.5		
v)	> 200	350		

ANNEX L

(*Clause* 8.2.4)

CATEGORIES OF BREAKDOWN/DEFECT (CRITICAL BREAKDOWN/DEFECTS)

Code No. Critical	Aggregate	Defects	Sub-assembly/Part
(1)	(2)	(3)	(4)
L 1	Transmission	Breakage	Transmission housing
L 2	Rotor	-do-	Rotor assembly
L 3	Attachment with combine chassis	-do-	Mounting/channel section bolted to harvester

ANNEX M

(*Clause* 8.2.4)

CATEGORIES OF BREAKDOWNS/DEFECTS (MAJOR BREAKDOWN/DEFECTS)

Code	Aggregate	Critical Defects	Sub-assembly/Part
(1)	(2)	(3)	(4)
M 1	Transmission	Breakage	V-Belt and pulley section
M 2	Rotor	-do-	Rotor
M 3	Rotor section	-do-	Rotor bearing bracket
M 4	Attachment with combine chassis	-do-	Channel section bolted to harvester
M 5	Rotor section	-do-	Rotor hub/shaft

ANNEX N

(*Clause* 8.2.4)

CATEGORIES OF BREAKDOWNS/DEFECTS (MINOR BREAKDOWN/DEFECTS)

Code	Aggregate	Critical Defects	Sub-assembly/Part
(1)	(2)	(3)	(4)
N 1	Spreader unit	Damage to louvers of spreader	Spreader
N 2	Rotor assembly section	Breakage	Fail blades
N 3	Rotor section	-do-	Fixed serrated blades
N 4	Attachment with combine chassis	-do-	Welded joints

ANNEX P

(*Foreword*)

COMMITTEE COMPOSITION

Agriculture 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 SHRIMATI APURVA TRIPATHI (*Alternate*)
Aspee Agro Equipment Pvt Ltd, 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)
Central Farm Machinery Training and Testing Institute, Budni	SHRI ANIL KUMAR UPADHYAY
CCS Haryana Agricultural University, Hisar	DR VIJAYA RANI
CLAAS India Pvt Ltd, Chandigarh	SHRI KRISHNA PRABHAKAR SINGH
CNH Industrial India Pvt Ltd, Pune	SHRI SANTHOSH RAO SHRI SUJIT HINGE (*Alternate*)
Consumer Guidance Society of India, Mumbai	SHRI SITARAM DIXIT
Dasmesh Mechanical Works Pvt Ltd, Malerkotla	SHRI SARBJEET SINGH PANESAR SHRI GURDEEP SINGH PANESAR (*Alternate*)
ICAR - All India Coordinated Research Project on Ergonomics and Safety in Agriculture, Bhopal	DR RAHUL R. POTDAR SHRIMATI SWEETI KUMARI (*Alternate*)
ICAR - All India Coordinated Research Project on Farm Implements and Machinery, Bhopal	DR K. N. AGRAWAL
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 U. R. BADEGAONKAR (*Alternate* I) DR DILIP JAT (*Alternate* II)
Indian Council of Agricultural Research, New Delhi	DR PANNA LAL SINGH
John Deere India Pvt Ltd, Pune	SHRI ANAND RAJ SHRI CHANDRASHEKHAR DESHMUKH (*Alternate* I) SHRI PRATIK DURAPHE (*Alternate* II)

Organization	*Representative(s)*
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Kubota Agricultural Machinery India Pvt Ltd, Faridabad	SHRI ASHOK KUMAR SHRI ASHISH KUMAR MALLARH (*Alternate*)
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National Institute of Plant Health Management, Hyderabad	DR VIDHU KAMPURATH P. SHRI MUTYALA UDAYA (*Alternate*)
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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
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Voluntary Organisation in Interest of Consumer Education (VOICE), New Delhi	SHRI B. K. MUKHOPADHYAY

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Member Secretary
SHRI VIKRANT CHAUHAN
SCIENTIST 'B'/ASSISTANT DIRECTOR
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