

व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT

संख्या / No. : Comb - 124/1627
माह / Month: July, 2014



**SELF PROPELLED COMBINE HARVESTER
'AGRI MAXX BIHAR (4LZ-1.5)'**



सत्यमेव जयते

भारत सरकार
कृषि मंत्रालय
(कृषि एवं सहकारिता विभाग)



**GOVERNMENT OF INDIA
MINISTRY OF AGRICULTURE
(DEPARTMENT OF AGRICULTURE & COOPERATION)**

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16.5 Bearings:

All the bearings of different assemblies of the combine were inspected and found in normal working conditions.

16.6 Wear of tyre

The wear of tyre condition of tyre found normal and no sign of crack or damage observed after hours of field and lab test.

16.7 Wear of the Peg tooth:

The wear of the peg tooth of the threshing cylinder and concave was measured. The percentage wear on mass basis was computed and the results are given below:

Sl. No.	Original mass before test (g)	Mass after 52.99 hours of test (g)	Percent wear (%)
a)	Peg tooth of threshing cylinder:		
1.	5372.1	5366.6	0.10
2.	5357.6	5347.5	0.19
3.	5210.9	5203.1	0.15
4.	5301.5	5293.8	0.15

17 SUMMARY OF OBSERVATIONS, COMMENTS AND RECOMMENDATIONS

17.1 Engine Performance Test:

Engine Brake power, kW (Ps)	Crankshaft torque, Nm(kgf-m)	Engine speed (rpm)	Hourly fuel consumption kg/h (l/h)	Specific fuel consumption kg/kWh (kg/hph)	Specific energy, kWh/l (hph/l)
i) Maximum power - 2 hours test:					
37.13 (50.48)	150.0 (15.30)	2475	11.802/ 9.862	0.266/ 0.195	3.146/ 4.276
22.64 (30.78)	137.2 (13.99)	1650	6.627/ 5.540	0.245/ 0.180	3.414/4.643**
ii) Power at rated engine speed (2600 rpm)					
36.11 (49.03)	138.7 (14.14)	2600	11.628/ 9.733	0.270/ 0.199	3.105/ 4.222
34.97 (47.55)	134.5 (13.72)	2600	11.254/ 9.273	0.265/ 0.195	3.107/4.225*
iii) Maximum torque:					
29.22 (39.73)	171.9 (17.53)	1700	8.850/ 7.390	0.253/ 0.186	3.302/ 4.489
27.13 (36.89)	164.4 (16.76)	1650	8.264/ 6.818	0.251/ 0.185	3.283/ 4.464*
21.78 (29.61)	138.3 (14.10)	1575	6.468 (5.414)	0.249/ 0.183	3.367/ 4.578**



iv) Five hour rating test: *					
a) Engine loaded to 90% of maximum power:					
33.60 (45.68)	129.0 (13.15)	2605	11.086/ 9.137	0.272/ 0.200	3.032/ 4.123*
b) maximum power:					
36.13 (49.12)	144.5 (14.73)	2500	11.651/ 9.606	0.266/ 0.915	3.101/ 4.216*

* **Under high ambient condition.**

Remarks:

- i) The maximum power output of the engine was observed as 37.13 kW (50.48 Ps) and 22.64 kW (30.78 Ps) at 2475 & 1650 rpm of engine at full throttle and setting recommend for field operation respectively.
- ii) The specific fuel consumption corresponding to maximum power at full throttle setting and setting recommended for field operation was measured as 0.266 Kg/kwh (0.195 kg/hph) and 0.245 Kg/kWh (0.180) kg/hp-h respectively.
- iii) The back-up torque of the engine was measured as 14.07% under natural ambient condition at full throttle.
- iv) The maximum smoke density was recorded as (Bosch No.). 2.30
- v) The maximum temperature of engine oil, coolant (water) and exhaust gas were observed as 118.5, 79 and 496.6° respectively.
- vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.526 g/kWh (0.387 g/hph) and 0.72% of total coolant capacity respectively.
- vii) The loading of engine is feasible only up to 1600 rpm beyond that there was hunting and vibration were observed, therefore the engine limit for using the engine till rpm drop to 1600 rpm.

17.2 Turning ability:

The radius of turning circle at LHS and RHS was observed satisfactory.

17.3 Visibility:

The visibility around the cutter bar from operator's seat in normal sitting position is satisfactory.

17.4 Braking Performance:

The maximum stopping distance and pedal force corresponding of 2.5 m/sec² were 6.62 m and 277 N minimum stopping distance is 4.17 m corresponding to 309N pedal force. The performance of parking brake found satisfactory.

17.5 Mechanical Vibration:

The amplitude of mechanical vibration of components are given in chapter 12 of this report. The observation reading marked (*) for various assemblies on higher side and suitable arrangement should be provided to dampen the vibration for operator's comfort.

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17.6 Noise measurement:

- i) The ambient noise emitted by the machine was measured as 92.6 dB(A).
- ii) The noise at driver's ear level was measured as 97.4 dB(A).

17.7 Field Test:

17.7.1 Summary of field tests:

The results of the field test for paddy harvesting are summarized below:

S. No.	Observation	Range of observations	Average of observations
1.	Speed of operation, kmph	1.69 to 2.73	1.96
2.	Area covered (ha/h)	0.182 to 0.268	0.213
3.	Fuel consumption: - (l/h) - (l/ha)	3.562 to 4.482 13.955 to 23.344	4.032 19.293
4.	Crop throughput (tonne/h)	2.69 to 5.46	3.67
5.	Grain breakage in main grain outlet(%)	Nil to 0.332	0.147
6.	Header losses(%)	0.217 to 0.707	0.468
7.	Total non-collectable losses(%)	0.358 to 1.545	0.885
8.	Total collectable losses(%)	0.072 to 1.881	0.942
9.	Total processing losses(%)	0.215 to 2.778	1.506
10.	Threshing efficiency(%)	98.09 to 99.93	99.04
11.	Cleaning efficiency(%)	96.06 to 96.77	96.49



17.7.1.1 Paddy Harvesting:

17.7.1.2 Quality of Work:

During paddy harvesting, the grain breakage in different varieties of paddy ranged from Nil to 0.332%. The rack and shoe losses varied from 0.030 to 0.432% and 0.015 to 0.406% respectively. The header losses in paddy varied from 0.217 to 0.707%.

The total non-collectable losses in different varieties of paddy ranged from 0.358 to 1.545%. The collectable losses from 0.072 to 1.881%, and the total processing losses in different varieties of crops ranged 0.215 to 2.778%. The threshing efficiency varied from 98.09 to 99.93 %. The cleaning efficiency varied from and 96.06 to 96.77%.

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17.7.1.3 Quality of Work:

- i) The grain breakage ranged from Nil to 0.332% (Avg.0.147%) which normal.
- ii) The total non-collectable losses ranged from 0.358 to 1.545% (Avg.0.885%) which is normal.
- iii) The total processing losses ranged from 0.215 to 2.778% (Avg.1.506%) which is normal.
- iv) The threshing efficiency ranged from 98.09 to 99.93% (Avg. 99.04%) which is normal.
- v) The cleaning efficiency ranged from 96.06 to 96.77% (Avg. 96.49%), which is slightly lower side.

17.7.1.4 Break down and repairs:

It was observed that material of the clutch plate is made of Asbestos the use of the material is not recommended from the hygienic point of view.

17.7.2 Harvesting of any other crops:

The combine harvester is not recommended for harvesting in wheat and other dry crop due to the location of the exhaust outlet and the higher non collectable losses and low cleaning efficiency observed during initial run due to which the firm has withdraw its testing in wheat crop.

17.7.3 Ease of Operation and Safety Provision:

- i) The controls provided around the operator are within easy reach, but not labelled with symbols as per Indian standard. Therefore it is recommended that the symbols as per the requirement of IS-6283-1998 may be provided.
- ii) Spark arresting device is not provided in the engine exhaust system which is considered essential.
- iii) Slip clutch / safety device in knife drive, crop auger drive grain and tailing auger drive and threshing drum drive are considered essential from safety point of view which needs to be provided.
- iv) The mechanical arrangement for adjusting the reel speed is not provided, needs to be added such that the same could be controlled from operators position.
- v) During CG test of a combine, beyond 13 degree of tilt angle, header get strike to ground Hence, working of a machine is limited by 13 degree slope in a hilly area.
- vi) Mechanical lock for reel in raised position needs to be provided to ensure safety while working on cutter bar
- vii) Air cleaner service indicator has been provided for operator's ease and safety of engine.
- viii) A provision for speed variation of threshing drum should be provided for different variety and condition of paddy crops.

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- ix) Due to non AC provision which increases the operator fatigue under hot climate condition.
- x) Gear shifting is not smooth.

17.7.4 Assessment of Wear:

- i) The wear of engine components i.e cylinder liners, piston, piston rings, valves, valve guides, springs, big-end bearings and main bearings were observed within the permissible limit.
- ii) The transmission gears and components were found in normal working condition.
- iii) The timing gears, clutch lining, release bearing were found in normal working condition.
- iv) The condition of the components of hydraulic system and steering system was observed to be normal.
- v) The condition of the bearing, chains, sprockets and belts was observed to be normal.
- vi) The components of starter motor and alternator were found in normal working condition.
- vii) The rate of wear of rack bar of threshing cylinder & concave were observed to be normal.

17.8 Hardness and Chemical composition:

1. The Hardness of knife guard is not complying with specified limit of IS: 6025-1999.
2. The carbon & manganese content of knife blade and carbon content of knife back are not complying with specified limit of IS:6025-1999 & IS:10378-1982 respectively.

17.9 Maintenance/Service problems:

No noticeable maintenance/service problem was observed during the course of test at this Institute.

17.10 Identification plate of Combine Harvester:

The identification plate is provided on the combine harvester as specified in IS: 10273-1999.

17.11 Literature supplied with the Machine:

The technical literature is provided in Chinese language which needs to be modified in Hindi, English & other regional language as per the IS:8132-1999 for the guidance of user.

18. SELECTED PERFORMANCE AND OTHER CHARACTERISTICS AS PER IS: 15806-2008.

Sr. No.	Characteristics	Requirement	Declared	Observed	Remark
1.	Prime mover performance				
i)	Max. Power (absolute) Average max. power observed during 2 hrs. max. power test in natural ambient condition kW(Ps)	It should not be less than 5% of the declared value.	38.0	37.13	Conform

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ii)	Max. power observed during test after adjusting the no load engine speed as per recommendation of the manufacturer for field work, kW (Ps)	Max. power observed must not be less than 5% of declared value.	38.0	22.64	Does not conform
iii)	Power at rated engine speed, kW (Ps)	The observed value must not be less than 5% of the declared value by the applicant.	38.0	36.11	Conform
iv)	Specific fuel consumption g/kWh.	The average observed value during 2 hr. max. power test must be within $\pm 5\%$ of the declared value by applicant/manufacturer.	265	266	Conform
v)	Max. smoke density (bosch no.) at 80% load between the speed at max. power & 55% of speed at max. or 1000 rpm which ever is higher, should be observed as per CMVR rule	For tractor :- 5.2 bosch no. or 75 hartridge For engine :- Free deceleration or natural aspirated or turbo charges - 65 hartridge		2.30	Conform
vi)	Max. crank shaft torque, (N-m) observed during the test after no load engine speed is adjusted as per manufacture's recommendation for field work	It must not be less than 8% of declare value by manufacturer.	180	138.3	Does not conform
vii)	Back up torque, %	7% min.		14.07	Conform
viii)	Max. operating temp. To be declared by manufacturer	i) engine oil	120	118.5	Conform
		ii) Coolant	100	79	Conform
ix)	Lubrication oil consumption, g/kWh	1% of SFC at 5hr. max. power test during high ambient condition	2.650	0.526	Conform

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2.	Brake performance				
i)	Max. stopping distance at a force equal to or less than 600 N on break pedal, m	$10 \text{ m or } S \leq 0.15V + V^2/130$ V= speed corresponding to 80% of design max. speed, kmph	-	4.17	Conform
ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec ² .	$\leq 600\text{N.}$	-	242	Conform
iii)	Whether parking brake is effective at a force of 600 N at foot pedal or 400 N at Hand and lever	Yes or No	-	Yes	Conform
3.	Mechanical vibration				
i)	Operator's platform	120 μm max.		260	Does not conform
ii)	Steering control wheel	150 μm max.		370	Does not conform
iii)	Seat with driver seated	120 μm max.		250	Does not conform
4.	Air cleaner oil pull over				
i)	Max. oil pull over in % age when tested in accordance with IS: 8122 pt. (II)-2000	0.25% max.		Not applicable as dry type air cleaner is provided.	-
5.	Noise measurement				
i)	Max. ambient noise emitted by combine dB (A)	88 dB (A)		92.6	Does not conform
ii)	Max. noise at operator's ear level dB (A)	98 dB (A)		97.4	Conform
6.	Discard limit				
i)	Cylinder bore diameter	Must not exceed the values declared by the manufacture	95.17	95.02	Conform
ii)	Piston liner side clearance	-do-	0.40	0.14	Conform
iii)	Ring end gap	-do-	1.50	1 st comp- 0.45 2 nd Comp- 0.70 Oil control- 0.40	Conform



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iv)	Ring groove clearance	-do-	0.12 for second compression ring & oil ring	1 st control-NA 2 nd control-0.03 Oil control-0.02	Conform
v)	Diametrical and axial clearance of big end bearing	-do-	Diametrical 0.20 Axial 0.60	Diametrical 0.09 Axial 0.15	Conform Conform
vi)	Diametrical and axial clearance of main bearings	-do-	Diametrical 0.22 Float 0.40	Diametrical 0.09 Float 0.5	Conform Conform
vii)	Height of lining over met head, mm	Not applicable	Up to rivet head	1.10	Conform
viii)	Height of lining over rivet head, mm	Not applicable	Up to rivet head	1.70	Conform

7. Field performance

i)	Suitability for crops	Wheat & paddy essential	It is a paddy special combine	-	-
ii)	Grain breakage in grain tank	≤ 2.5 %	-	Nil to 0.332% (Avg. 147%)	Conform
iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean	-	0.358 to 1.545 (Avg. 0.885)	Conform
iv)	Threshing efficiency	≥ 98% wheat & paddy	-	98.09 to 99.93 (Avg. 99.04)	Conform
v)	Cleaning efficiency	≥ 96 % wheat & paddy	-	96.06 to 96.77% (Avg. 96.49%)	Conform

8. Safety requirement

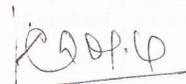
i)	Guards against all moving per	Essential	-	Provided	Conform
ii)	Lighting arrangement a) Head light b) Parking light c) Indication d) Reverse gear e) Brake f) Number plate	Essential as per CMVR	Not applicable	CMVR test is not conducted yet	Does not conform
iii)	Grain tank cover	Essential	-	Not provided	Does not conform
iv)	Spark arrester in engine's exhaust	Essential	-	Not provided	Does not conform
v)	Stone trap before concave	Essential	-	Not provided	Does not conform
vi)	Rear view mirror	Essential	-	Provided	Conforms
vii)	Slip clutch at following drives -	Essential	-	Not provided	Does not conform

	a) Cutting platform b) under shout conveyor drive c) Grain & tailing elevator			Not provided Not provided	
viii)	Anti slip surfaces at operator platform & ladder & proper gripping for the control levers	Essential	-	Provided	Conform
ix)	Working clearance around the controls	Essential 70 mm, min.	-	Provided	Conform
x)	Labelling of control gauge	Essential	-	Not Provided	Does not conform
9.	Material & Construction				
i)	Guard should conform to IS: 6024 - 1983	The guard (except ledger plate) shall be manufactured from malleable iron casting (IS: 2108-1977), steel casting (IS: 1030-1974) or steel forging (IS: 2004-1978)		Uncertain as the relevant code does not specify the content limit	-- 
ii)	Knife blade As per IS :6025 -1982	It must have Chemical composition as C= 0.70-0.95 % Mn =0.30-0.50 %		C= 0.52 Mn= 1.10	Does not conform Does not conform
iii)	Knife back Must meet the requirement of IS:10378-1982	The knife back shall be manufactured from Carbon Steel having minimum carbon content of 0.35 % (min).		C= 0.18	Does not conform
10.	Labelling of combine harvester				
	It should conform to IS: 10273-1987	Essential, It should mention make & model, Engine No., Chassis No., Year of manufacture, Power & SFC of engine		Provided	Conform

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11.	Break down (critical major & minor)			
		Essential as per IS: 15806-2008 Annexure A1, A2, A3	None	Conform

TESTING AUTHORITY

(R.K. NEMA) AGRICULTURAL ENGINEER	
(P. K. CHOPRA) SENIOR AGRICULTURAL ENGINEER	
(HIMAT SINGH) -DIRECTOR-	

Tests conducted/Reports compiled by S.A. HINGE (AAE)

Applicant's comments

Sr. No.	Clause No.	Comments
1.	3, i, ii, iii	We will reduce the mechanical vibration in next production.
2.	8, x	We will provide labeling to the controls with symbols.
3.	-	We will provide technical literature in Hindi and other regional language for the guidance of users.

All of the necessary comments are added in a final test report.