

व्यावसायिक परीक्षण रिपोर्ट  
COMMERCIAL TEST REPORT

संख्या / No. : COMB-64/1366  
माह/ Month :September, 2011



**SELF PROPELLED COMBINE HARVESTER  
'NEW HIRA, GAJRAJ-685 (TRACK TYPE)'**



सत्यमेव जयते

भारत सरकार  
कृषि मंत्रालय  
(कृषि एवं सहकारिता विभाग)

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

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b)	Bar of threshing cylinder:		
1.	215.0	213.1	0.88
2.	217.3	215.2	0.97
3.	215.5	213.8	0.79
4.	213.8	211.7	0.98
5.	208.5	206.8	0.82
6.	218.0	216.1	0.87

## 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)
<b>i) Maximum power - 2 hours test:</b>					
53.5 (72.7)	260.9 (26.6)	2050	11.32 (13.68)	0.212 (0.156)	3.911 (5.317)
<b>ii) Maximum torque:</b>					
42.2 (57.4)	281.3(28.7)	1500	8.50 (10.28)	0.201 (0.148)	4.105(5.581)
40.6 (55.1)	270.3(25.1)	1500	8.32 (10.13)	0.205(0.151)	4.003(5.443)*
<b>iii) Five hour rating test:</b>					
<b>a) Engine loaded to 90% of maximum power:</b>					
47.9(65.2)	230.4(23.5)	2081	10.11 (12.31)	0.211(0.155)	3.998(5.436)*
<b>b) maximum power:</b>					
51.3(69.8)	250.4 (25.6)	2050	10.98 (13.36)	0.214(0.158)	3.841(5.223)*

\* Under high ambient condition.

#### Remarks:

- The maximum power output of the engine was observed as 53.5 kW (72.7 Ps) at 2050 rpm of engine at full throttle.
- The specific fuel consumption corresponding to maximum power at full throttle setting measured as 0.212 Kg/kwh (0.156 kg/hph).
- The back-up torque of the engine was measured as 7.04 % under natural ambient condition at full throttle.
- The maximum smoke density was recorded as 2.52 (Bosch No.).
- The maximum temperature of engine oil, coolant(water) and exhaust gas were observed as 105, 98 and 595°C respectively.
- The lubricating oil & coolant consumption during five hours rating test were measured as 0.110 g/kWh (0.084 g/hph) 1.09% of total coolant capacity respectively.

**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:**  
No specific brake mechanism is provided. The combine stops by bringing the control levers of LHS and RHS, driving roller/track to the neutral position.

**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.

**17.6 Noise measurement:**

- i) The ambient noise emitted by the machine was measured as 87.2 dB(A).
- ii) The noise at driver's ear level was measured as 95.3 dB(A) which is within limit when compared to permissible levels of 98 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	3.99 to 5.58	4.46
2.	Area covered (ha/h)	0.42 to 0.47	0.44
3.	Fuel consumption: - (l/h) - (l/ha)	7.0 to 8.40 15.34 to 18.47	7.69 17.40
4.	Crop throughput (tonne/h)	6.86 to 11.99	8.60
5.	Grain breakage in main grain outlet(%)	0.735 to 1.041	0.900
6.	Header losses(%)	0.184 to 0.912	0.397
7.	Total non-collectable losses(%)	0.332 to 1.466	0.874
8.	Total collectable losses(%)	0.070 to 0.576	0.181
9.	Total processing losses(%)	1.256 to 2.242	1.557
10.	Threshing efficiency(%)	99.4 to 99.9	99.8
11.	Cleaning efficiency(%)	96.3 to 98.2	97.4

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#### 17.7.1.1 Paddy Harvesting:

- i) The grain breakage ranged from 0.735 to 1.041 % which is normal.
- ii) The total non-collectable losses ranged from 0.332 to 1.466 % which is normal.
- iii) The total processing losses ranged from 1.256 to 2.242 % which is considered to be normal against max. limit of 2.5 % specified by BIS.
- iv) The threshing efficiency ranged from 99.4 to 99.9 % which is normal.
- v) The cleaning efficiency ranged from 96.3 to 98.2% which is normal.



#### 17.7.2 Harvesting of any other crops:

The performance of combine to harvest paddy crop was evaluated as the same was recommended by the applicant.

#### 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) The design of stone trap need to be modified for easy cleaning.
- iii) Spark arresting device is not provided in the engine exhaust system which is considered essential.
- iv) Slip clutch / safety device in knife drive, crop auger drive and threshing drum drive are considered essential from safety point of view which needs to be provided.
- v) The mechanical arrangement for adjusting the reel speed is not provided, this needs to be added such that the same could be controlled from operators position.
- vi) The grain tank is provided with transparent glass to know the grain fill.
- vii) Sometimes there was choking in feeder conveyer during the field test & therefore it is suggested to make some improvement/vertical clearance adjustment in feeder conveyer in future at regular production level to avoid the chocking of the feeder.

#### 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.

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- 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 peg teeth bar of threshing cylinder & concave were observed to be normal.

**17.8 Hardness and Chemical composition:**

- i) The Hardness of knife blade is not within the prescribed limit of IS :6025-1999.
- ii) Percentage of Manganese in knife blade does not conform with the limit specified in IS:6025-1999.
- iii) Percentage of carbon in knife back does not conform with the limit specified in IS:10378-1982.

Components with material conforming to the Indian Standard should be used at manufacturing level.

**17.9 Maintenance/Service problems:**

No noticeable maintenance/service problem was observed during the course of test at this Institute. However the air cleaner element change period and air cleaner closing indicator needs to be provided.

**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 following literature in English were supplied with the machine for reference during testing and these were found adequate, however, it needs to be provided in Hindi and other regional languages for the guidance of the users in accordance with IS:8132-1999.

1. Operator manual.
2. Service manual.
3. Part's catalogue

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

S. No.	Characteristics	Requirement	Declared	Observed	Remark
1.	<b>Prime mover performance</b>				
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.	55.9 (76.0)	53.5 (72.7)	Conforms

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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.	55.9 (76.0)	53.5 (72.7)	Conforms
iii)	Power at rated engine speed, kW (Ps)	The observed value must not be less than 5% of the declared value by the applicant.	55.9 (76.0)	53.5(72.7)	Conforms
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.	Not specified	212	<b>Does not conform</b>
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	5.2 Bosch No. required	2.52	Conforms
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.	250	281.3	Conforms
vii)	Back up torque, %	7% min.	--	7.04	Conforms
viii)	Max. operating temp. To be declared by manufacturer	i) engine oil	125	105.0	Conforms
		ii) Coolant	115	98.0	Conforms
ix)	Lubrication oil consumption, g/kWh	1% of SFC at max. power during high ambient condition	2.14 g/kWh	0.11	Conforms



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2.	<b>Brake performance</b>					
	i)	Max. stopping distance at a force equal to or less than 600 N on brake pedal, m	$10\text{ m or } S \leq 0.15V + V^2/130$ V= speed corresponding to 80% of design max. speed, kmph	--	-	Not applicable for track type combine
	ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec <sup>2</sup> .	$\leq 600\text{N.}$	--	Negligible	Not applicable
	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	Yes
3.	<b>Mechanical vibration</b>					
	i)	Operator's platform	120 $\mu\text{m}$ max.	--	182	<b>Does not conform</b>
	ii)	Steering wheel	150 $\mu\text{m}$ max.	--	N.A.	No, Steering wheel is provided
	iii)	Seat with driver seated	120 $\mu\text{m}$ max.	--	229	<b>Does not conform</b>
4.	<b>Air cleaner oil pull over</b>					
	i)	Max. oil pull over in % age when tested in accordance with IS: 8122 pt. (II)-2000	0.25% max.	--	N.A.	Not applicable as dry type filter is provided
5.	<b>Noise measurement</b>					
	i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	--	87.2	Conforms
	ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,	--	95.3	Conforms
6.	<b>Discard limit</b>					
	i)	Cylinder bore diameter	Should not exceed the values declared by the manufacture	104.5	104.03	Conforms
	ii)	Piston diameter	--do--	103.0	103.44	Conforms
	iii)	Ring end gap	--do--	0.75	0.50	Conforms
	iv)	Ring groove clearance	--do--	0.125	0.05	Conforms
	v)	Diametrical and axial clearance of big end bearing	--do--	Diametrical - 0.15 Axial - 0.30	0.04 0.25	Conforms Conforms

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	vi)	Diametrical and axial clearance of main bearings	--do--	Diame- trical - 0.15 Axial - 0.22	0.05	Conforms
	vii)	Thickness of brake lining	--do--	Not applicable	-	Conforms
	viii)	Thickness of clutch plate	--do--	Not applicable	-	Not applicable
7.	<b>Field performance</b>					
	i)	Suitability for crops	Wheat & paddy essential	Paddy	The combine was operated in paddy crop only.	--
	ii)	Grain breakage in grain tank	≤ 2.5 %	--	Paddy- 0.735-1.041% (Avg. 0.900%)	Conforms
	iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean	--	Paddy- 0.332-1.466% (Avg. 0.874%)	Conforms
	iv)	Threshing efficiency	≥ 98% wheat & paddy	--	Paddy- 99.4-99.9% (Avg.- 99.8%)	Conforms
	v)	Cleaning efficiency	≥ 96 % wheat & paddy	--	Paddy- 96.3-98.2% (Avg. 97.4%)	Conforms
8.	<b>Safety requirement</b>					
	i)	Guards against all moving per	Essential	--	Provided	Conforms
	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 as the machine is of track type.	--
	iii)	Grain tank cover	Essential	--	Not Provided	<b>Does not conform</b>
	iv)	Spark arrester in engine's exhaust	Essential	--	Not provided	<b>Does not conform</b>
	v)	Stone trap before concave	Essential	--	Provided	Conforms
	vi)	Rear view mirror	Essential	--	Not provided	<b>Does not conform</b>

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9	vii)	Slip clutch at following drives – a) Cutting platform b) under shout conveyor drive c) Grain & tailing elevator	Essential	--	Not provided	Does not conform
	viii)	Anti slip surfaces at operator platform & ladder & proper gripping for the control levers	Essential	--	Provided	Conforms
	ix)	Working clearance around the controls	Essential 70 mm, min.	--	Provided	Conforms
	x)	Labelling of control gauge	Essential	--	Not provided	Does not conform
	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)	Not specified	Not applicable	Uncertain-able
	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=0.76% Mn=0.66%	Conforms 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 %	--	C=0.12% Si=0.12% Mn=0.53% P=0.040% S=0.035%	Does not conform
	10.	<b>Labelling of combine harvester</b>				
	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	Conforms	

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



**TESTING AUTHORITY:**

(R. M. TIWARI) ASSISTANT ENGINEER (W/S)	
(P. K. CHOPRA) SENIOR AGRICULTURAL ENGINEER	
(A. N. MESHAM) -DIRECTOR-	

Test report compiled by Sh. B.N. Dixit, S.T.A.

**APPLICANT'S COMMENTS**

S.No.	Our Reference	Applicant's comments
1.	Para 14.3	<ul style="list-style-type: none"> <li>• Labelling of safety controls around driver is done in regular production.</li> <li>• Safety clutch will be provided to avoid stone entry.</li> <li>• Fire extinguisher and first aid box will be the regular feature.</li> </ul>
2.	Para 14.4	Additional light shall be provided at the centre for more visibility during night.
3.	Para 14.5	Rubber pads on engine base provided to dampen mechanical vibration.
4.	Para 17.7.3	<ul style="list-style-type: none"> <li>• Spark arrester will be provided in future production.</li> <li>• Mechanical arrangement of adjusting the reel shall be provided.</li> <li>• The vertical clearance has been increase to avoid chocking of feed box which was observed in tall variety.</li> </ul>