

व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT

संख्या / No. : COMB-61/1347
माह/ Month : June, 2011



"K. RAMA-1008"
SELF PROPELLED COMBINE HARVESTER



सत्यमेव जयते

भारत सरकार
कृषि मंत्रालय
(कृषि एवं सहकारिता विभाग)

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

उत्तरी क्षेत्र कृषि मशीनरी प्रशिक्षण एवं परीक्षण संस्थान
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Sl. No.	Original mass before test (g)	Mass after 52.4 hours of test (g)	Wear (%)
a) Peg teeth of threshing cylinder:			
1.	227.3	225.0	1.01
2.	223.0	221.2	0.50
3	224.0	221.9	0.94
4	231.4	228.0	1.47
5	218.6	215.9	1.19
6	228.5	227.1	0.61
7	229.1	227.5	0.70
8	229.4	228.5	0.61
9	227.3	224.0	1.45
b) Peg teeth of Concave:			
1	229.5	227.0	1.09
2	224.6	222.5	0.93
3	230.4	228.9	0.65
4	230.0	228.7	0.57
5.	225.5	223.4	0.93
6.	217.1	215.4	0.78
7.	220.5	218.2	1.04
8.	229.5	227.0	1.09
9.	230.3	226.3	1.70

18 SUMMARY OF OBSERVATIONS, COMMENTS AND RECOMMENDATIONS**18.1 Engine Performance Test:**

Engine Brake power, kW (Ps)	Crankshaft torque, Nm(kgf-m)	Engine speed (rpm)	Hourly fuel consumption		Kg/kWh (kg/hph)	Specific energy, kWh/l (hph/l)
			kg/h	l/h		
i) Maximum power - 2 hours test:						
78.3(106.5)	348.4(35.5)	2250	19.58	23.56	0.250(0.184)	3.32(4.52)
59.4(80.7)	395.1(40.3)	1503	13.48	16.24	0.227(0.167)	3.36(4.97) **
ii) Power at rated engine speed (2200 rpm)						
77.4(105.2)	352.0(35.9)	2200	19.41	23.34	0.251(0.185)	3.32(4.51)
75.9(103.2)	345.1(35.2)	2200	18.19	22.06	0.240(0.177)	3.44(4.68) *
iii) Maximum torque:						
48.2(65.5)	401.8(40.9)	1200	12.06	14.52	0.235(0.173)	3.32(4.51)
49.1(66.8)	409.2(41.7)	1200	11.03	13.26	0.225(0.165)	3.70(5.03) **
45.6(62.0)	380.2(38.8)	1200	10.02	12.15	0.220(0.162)	3.75(5.10) *
iv) Five hour rating test:						
a) Engine loaded to 90% of maximum power:						
69.6 (94.6)	306.0(31.2)	2279	17.26	20.86	0.246 (0.181)	3.34 (4.59)
b) maximum power:						
76.2(103.6)	340.0 (34.7)	2243	18.53	22.48	0.243 (0.179)	3.39 (4.61)

* Under high ambient condition.

** At no load speed corresponding to rated speed specified for field work.

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Remarks:

- i) The maximum power output of 2 hrs test of the engine was observed as 78.3 kW (106.5 Ps) & 59.4 kW (80.7 Ps) at 2250 rpm and 1503 rpm of engine at full throttle and setting recommend for field operation respectively.
- ii) The specific fuel consumption corresponding to maximum power of hrs test at full throttle and setting recommended for field operation was measured as 0.250 & 0.227 Kg/kWh (0.184 & 0.167 kg/hph).
- iii) The back-up torque of the engine was measured as 14.5 % under natural ambient field condition at recommended engine speed for field operation.
- iv) The maximum smoke density was recorded as 2.22 (Bosch No.) which is within specified limit.
- v) The maximum temperature of engine oil, coolant(water) and exhaust gas was observed as 127.5, 107 and 693 °C respectively.
- vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.558 (0.410) g/kWh (g/hph) and 7.14% of total coolant capacity respectively.

18.2 Turning ability:

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



18.3 Visibility:

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

18.4 Braking Performance:

- i) The mean deceleration and stopping distance corresponding to 243 N pedal force was measured as 2.55 m/sec² and 7.41 m respectively and the performance is in line with the IS 12207-1987.
- ii) The performance of parking brake was found satisfactory.

18.5 Mechanical Vibration:

The amplitude of mechanical vibration of components marked as (*) in chapter 13 of this report are on higher side. This calls for providing suitable remedial measures to dampen the vibration in order to improve the operator's comfort and service life of various components & sub assemblies.

18.6 Noise measurement:

- i) The ambient noise emitted by the machine was measured as 88.0 dB(A) which is as per IS:12180 (pt. II) when compared to warning levels of 88 dB(A).
- ii) The noise at driver's ear level was measured as 98 dB(A) which may be considered as per compared with warning and danger levels of 98 dB(A) respectively as per IS:12180 (pt. II).

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18.7 Air cleaner oil pull over test

The maximum oil pull over was observed as 0.13 % which is normal.

18.8 Field Test:

18.8.1 Summary of field tests:

The results of the field test are summarized below:

Sl. No.	O b s e r v a t i o n	Wheat harvesting	Paddy harvesting
1.	Speed of operation, kmph	3.02 to 3.92	2.48 to 2.92
2.	Area covered, ha/h	0.871 to 1.190	0.670 to 0.825
3.	Fuel consumption:		
	- l/h	7.01 to 8.53	7.23 to 8.51
	- l/ha	7.05 to 8.92	9.53 to 12.70
4.	Crop throughput, tonne/h	5.6 to 12.1	8.8 to 14.2
5.	Grain breakage in main grain outlet, %	0.268 to 0.869	0.405 to 0.804
6.	Header losses, %	0.400 to 1.226	0.344 to 0.681
7.	Total non-collectable losses, %	0.760 to 2.039	0.578 to 1.188
8.	Total collectable losses, %	0.200 to 1.257	0.403 to 0.800
9.	Total processing losses, %	0.932 to 2.310	1.342 to 1.904
10.	Threshing efficiency, %	98.4 to 99.6	99.0 to 99.4
11.	Cleaning efficiency, %	97.5 to 98.8	95.8 to 97.8

18.8.1.1 Wheat Harvesting:

- i) The grain breakage in all the varieties tested was measured as 0.268 to 0.869 % which is normal .
- ii) The total non collectable losses ranged from 0.760 to 2.039 percent. The major constituent of non-collectable losses is header loss.
- iii) The total processing losses ranged from 0.932 to 2.310 %.
- iv) The threshing efficiency ranged from 98.4 to 99.6%.
- v) The cleaning efficiency ranged from 97.5 to 98.8%.
Necessary improvements to bring down header losses are required to be incorporated.

18.8.1.2 Paddy Harvesting:

- i) The grain breakage ranged from 0.405 to 0.804 % .
- ii) The total non-collectable losses ranged from 0.578 to 1.188 %.
- iii) The total processing losses ranged from 1.342 to 1.904 %.
- iv) The threshing efficiency ranged from 99.0 to 99.4 %.
- v) The cleaning efficiency ranged from 95.8 to 97.8%.

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18.8.2 **Harvesting of any other crops:**

The performance of combine to harvest wheat, paddy crops was evaluated as the same were recommended by the applicant.

18.8.3 **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) Safety device / slip clutches in knife drive auger etc. drive are considered essential from safety point of view which needs to be provided.
- iv) The mechanical arrangement for adjusting the reel speed though provided, needs to be modified such that the same could be controlled from operators position.
- v) A telescopic shaft as a lock for header assembly in raised position is provided to ensure safety while working on cutter bar.

18.8.4 **Assessment of Wear:**

- i) The discard limits for engine components i.e. cylinder liner, piston, piston rings, valves & valve guides have not been specified by the applicant. It is, therefore, not possible to ascertain their wear with reference to discard 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 brake, 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 rasp bar and peg teeth of threshing cylinder & concave were observed to be normal.

18.9 **Hardness and Chemical composition:**

The Hardness & chemical composition of knife blade does not conform to IS . It should be incorporated at production level.

18.10 **Maintenance/Service problems:**

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

18.11 **Labelling of Combine Harvester:**

The labelling plate is not provided on the combine harvester. But it needs to be provided as per IS:10273-1999.

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18.12 Literature supplied with the Machine:

The operator manual for combine harvester which comprises of operation, maintenance and repair of combine harvester is provided. However, it should also be modified as per relevant Indian standards IS:8132-1983 in English, Hindi and other Regional language to guide the users.

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

S. 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.	81.0(110.0)	78.9(107.2)	Conforms
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.	61 kW (1500-1600 rpm)	59.4(80.7)	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.	80.0 at 2200 rpm	77.4(105.2)	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.	302 g/kwh	250	Does not 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	5.2	2.22	Conforms

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	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.	400 N-m	401.0	Conforms
	vii)	Back up torque, %	7% min.	-	14.5	Conforms
	viii)	Max. operating temp. To be declared by manufacturer	i) engine oil	135° C	127.5° C	Conforms
			ii) Coolant	125° C	107° C	Conforms
	ix)	Lubrication oil consumption, g/kWh	1% of SFC at 5hr. max. power test during high ambient condition	3 g/kWh	0.558	Conforms
2.	Brake performance					
	i)	Max. stopping distance at a force equal to or less than 600 N on break pedal, m, corresponding to a declaration of 2.5 m/sec ²	10 m or $S \leq 0.15V + V^2/130$ V= speed corresponding to 80% of design max. speed, kmph	10 m	7.41 (cold)	Conforms
	ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec ² .	$\leq 600N.$	600 N	243	Conforms
	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	Provided	Conforms
3.	Mechanical vibration					
	i)	Operator's platform	120 μ m max.	--	156	Does not conform
	ii)	Steering wheel	150 μ m max.	--	428	Does not conform
	iii)	Seat with driver seated	120 μ m max.	--	216	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.	0.25	0.13	Conforms

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5.	Noise measurement					
	i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	--	88	Conforms
	ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,	--	98	Conforms
6.	Discard limit					
	i)	Cylinder bore diameter	Should not exceed the values declared by the manufacture	107.554	107.30	Conforms
	ii)	Piston diameter	--do--	107.07	107.04	Conforms
	iii)	Ring end gap	--do--	2.032	0.45	Conforms
	iv)	Ring groove clearance	--do--	0.254	0.09	Conforms
	v)	Diametrical and axial clearance of big end bearing	--do--	Diametrical -0.15	0.11	Conforms
				Axial -0.30	0.25	Conforms
	vi)	Diametrical and axial clearance of main bearings	--do--	Diametrical -0.15	0.09	Conforms
				Axial -0.25	0.15	Conforms
	vii)	Thickness of brake lining	--do--	16 to 18	17.5	Conforms
	viii)	Thickness of clutch plate	--do--	10.0 to 11.0	10.6 to 10.85	Conforms
7.	Field performance					
	i)	Suitability for crops	Wheat & paddy essential	Wheat & paddy	Suitable for Wheat & paddy	Conforms
	ii)	Grain breakage in grain tank	≤ 2.5 %	--	Wheat- 0.268-0.869% (Avg. -0.494%)	Conforms
					Paddy- 0.405-0.804% (Avg. 0.572%)	
	iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean	--	Wheat- 0.760-2.039% (Avg. -1.436%)	Conforms
					Paddy- 0.578-1.188% (Avg. 0.894%)	
	iv)	Threshing efficiency	≥ 98% wheat & paddy	--	Wheat- 98.4-99.6% (Avg.- 99.1%)	Conforms
					Paddy- 99.0-99.4% (Avg.- 99.2%)	

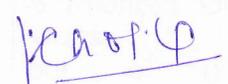
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	v)	Cleaning efficiency	≥ 96 % wheat & paddy	--	Wheat- 97.5-98.1% (Avg. -97.9%) Paddy- 95.8-97.8% (Avg. 97.0%)	Conforms Conforms
8.	Safety requirement					
	i)	Guards against all moving per	Essential	--	Provided	Conforms
	ii)	Lighting arrangement a) Head light b) Parking light c) Indication d) Reverse gear e) Brake f) Number plate	Essential as per CMVR	--	Provided as per CMVR report No. CMVR/Comb-01/2007-2008 dated 02.4.2007	Conforms 
	iii)	Grain tank cover	Essential	--	Provided	Conforms
	iv)	Spark arrester in engine's exhaust	Essential	--	Not provided	Does not conform
	v)	Stone trap before concave	Essential	--	Provided	Conforms
	vi)	Rear view mirror	Essential	--	Provided	Conforms
	vii)	Slip clutch at following drives - a) Cutting platform b) under shout conveyor drive c) Grain & tailing elevator	Essential	--	Provided Provided Not provided	Conforms 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	--	Provided	Conforms
9.	Material of 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)	Not specified	C = 0.47 Si=0.35 Mn=74 P=0.032 S=0.025	As unascertainable as the limit of the elements as observed are not specified in the relevant code.

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	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=0.84 Mn=0.74	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 %	--	C=0.13	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	Conforms
11.	Break down (critical major & minor)					
			Essential as per IS: 15806-2008 Annexure A1, A2, A3	--	None	Conforms

TESTING AUTHORITY:

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Applicant's comments :- No comments received