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व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT

संख्या / No. : COMB-72/1425
माह/ Month : August, 2012



**SELF PROPELLED PADDY COMBINE HARVESTER
'STANDARD TSC 513 CLASSIC (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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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:					
50.87 (69.12)	254.1(25.91)	2002	15.11 (18.12)	0.297 (0.218)	2.807(3.817)
47.55 (64.65)	301.9(30.79)	1575	12.16 (14.59)	0.256(0.188)	3.259(4.431)**
ii) Power at rated engine speed (2200)					
45.67 (62.09)	207.6 (21.17)	2200	14.84 (17.77)	0.325 (0.239)	2.570 (3.494)
42.31 (57.53)	192.3 (19.61)	2200	13.20 (16.01)	0.312 (0.229)	2.643 (3.593)*
iii) Maximum torque:					
42.97 (58.42)	330.5(33.70)	1300	10.79 (12.94)	0.251 (0.185)	3.321(4.515)
41.68 (56.67)	333.4(34.0)	1250	10.27 (12.31)	0.246(0.181)	3.386(4.604)**
40.03 (54.43)	307.7 (31.38)	1301	10.07 (12.24)	0.252 (0.185)	3.270 (4.447)**
iv) Five hour rating test:					
a) Engine loaded to 90% of maximum power:					
45.18 (61.43)	213 (21.72)	2121	14.40 (17.49)	0.319 (0.234)	2.583(3.512)*
b) maximum power:					
47.12 (64.06)	235.6 (24.02)	2000	14.24 (17.30)	0.302 (0.222)	2.724(3.703)*

- Under high ambient condition.
- At no load speed corresponding to rated speed specified for field work.

Remarks:

- The maximum power output of the engine was observed as 50.87 kW (69.12 Ps) & 47.55KW (64.65Ps) at 2002 rpm and 1575 rpm of engine at full throttle and setting recommend for field operation and setting respectively.
- The specific fuel consumption corresponding to maximum power at full throttle setting and setting recommended for field operation was measured as 0.297 & 0.256 Kg/kwh (0.218 & 0.188 kg/hph) respectively. The specific fuel consumption is consider to be slightly on higher side at full throttle setting.
- The back-up torque of the engine was measured as 29.56 % under natural ambient condition at full throttle.
- The maximum smoke density was recorded as 2.62 (Bosch No.).
- The maximum temperature of engine oil, coolant(water) and exhaust gas were observed as 98, 88 and 514°C respectively.
- The lubricating oil & coolant consumption during five hours rating test were measured as 0.543 g/kWh (0.400 g/hph) 2.34% of total coolant capacity respectively.



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- 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 separate 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 13 components out of 17 has been observed with specified limit.
- 17.6 Noise measurement:**
- The ambient noise emitted by the machine was measured as 87.8 dB(A). Which is on higher side when compared to warning levels of 85 dB(A)
 - The noise at driver's ear level was measured as 91.6 dB(A) which is on higher side when compared with warning and danger levels of 85 and 90 dB(A) respectively for an exposure of 8 hours per day specified by ILO.

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 all the specifications
1.	Speed of operation, kmph	2.0 to 2.85	2.49
2.	Area covered (ha/h)	0.364 to 0.536	0.455
3.	Fuel consumption: - (l/h) - (l/ha)	8.11 to 10.08 17.64 to 22.54	9.055 20.09
4.	Crop throughput (tonne/h)	3.48 to 6.03	4.56
5.	Grain breakage in main grain outlet(%)	0.026 to 2.110	0.842
6.	Header losses(%)	0.086 to 1.790	0.663
7.	Total non-collectable losses(%)	0.175 to 2.038	0.792
8.	Total collectable losses(%)	Nil to 2.273	0.643
9.	Total processing losses(%)	0.248 to 3.610	1.614
10.	Threshing efficiency(%)	97.69 to 100.0	99.03
11.	Cleaning efficiency(%)	93.67 to 98.43	96.92

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17.7.1.1 Paddy Harvesting:

- i) The grain breakage ranged from 0.026 to 2.110 % which is normal.
- ii) The total non-collectable losses ranged from 0.175 to 2.038 % which is normal.
- iii) The total processing losses ranged from 0.248 to 3.610 % which is considered to be higher side against max. limit of 2.5 % specified by BIS.
- iv) The threshing efficiency ranged from 97.69 to 100.0% which is considered to be slightly on the lower side.
- v) The cleaning efficiency ranged from 93.67 to 98.43% which is considered to be slightly on the lower side.

Necessary improvements to be incorporated to reduce the total processing losses and to improve cleaning & threshing efficiency.



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 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) Air cleaner service indicator has not been provided for operators ease and safety of engine, this position seems essential, may be provided in future production.
- viii) Manufacturer has provided mechanically operated speed variator assembly at the threshing drum pulley. But there is no any remarkable change in threshing drum speed, hence there is necessary to make some improvements in it.

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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 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) Manganese content in knife blade is not conforming limit of IS:6025-1999, hence, knife blade should be used at regular production that conforms to prescribed code.

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 The manufacturer has provided a separate trolley for easy and timely transport of the combine unit with the help of tractor.

17.12 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. Part's catalogue

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18. 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.	52.0	50.87	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.	51.78	47.55	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.	48.0	45.67	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.	280	297	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	-	2.62	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.	311.5	333.4	Conforms



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	vii)	Back up torque, %	7% min.	--	29.56	Conforms
	viii)	Max. operating temp. To be declared by manufacturer	i) engine oil	145	98	Conforms
			ii) Coolant	115	87	Conforms
	ix)	Lubrication oil consumption, g/kWh	1% of SFC at max. power during high ambient condition	3.02 1% of SFC observed during high ambient	0.543	Conforms
2. Brake performance						
	i)	Max. stopping distance at a force equal to or less than 600 N on break pedal, m	10 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 ² .	$\leq 600N$.	--	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	Conforms
3. Mechanical vibration						
	i)	Operator's platform	120 μ m max.	--	12	Conforms
	ii)	Steering wheel	150 μ m max.	--	120	Conforms
	iii)	Seat with driver seated	120 μ m max.	--	60	Conforms
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.	--	N.A.	Not applicable as dry type filter is provided
5. Noise measurement						
	i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	--	87.8	Conforms
	ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,	--	91.6	Conforms

6.	Discard limit					
	i)	Cylinder diameter bore	Should not exceed the values declared by the manufacture	105.519	105.070	Conforms
	ii)	Piston diameter	-do-	0.45	0.18	Conforms
	iii)	Ring end gap	--do--	2.0	1.10	Conforms
	iv)	Ring groove clearance	--do--	0.20	0.19	Conforms
	v)	Diametrical and axial clearance of big end bearing	--do--	Diametrical - 0.30 Axial - 0.20	0.12	Conforms
	vi)	Diametrical and axial clearance of main bearings	--do--	Diametrical - 0.20 Axial - 0.30	0.15	Conforms
	vii)	Thickness of brake lining	--do--	Not applicable	-	Not applicable
	viii)	Thickness of clutch plate	--do--	Not applicable	-	Not applicable
7.	Field performance					
	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- 0.026-2.110% (Avg. 0.842%)	Conforms
	iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean	--	Paddy- 0.175-2.038% (Avg. 0.792%)	Conforms
	iv)	Threshing efficiency	≥ 98% wheat & paddy	--	Paddy- 97.69-100.0% (Avg.- 99.03%)	Conforms
	v)	Cleaning efficiency	≥ 96 % wheat & paddy	--	Paddy- 93.67-98.43% (Avg. 96.92%)	Conforms
8.	Safety requirement					
	i)	Guards against all moving per	Essential	--	Provided	Conforms



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9	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	--	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	--	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	--	provided	Conforms
	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	Not applicable	-	
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=0.75% Mn=0.63%	Conforms Does not conform	

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	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 %	--	Carbon content is 0.61%	Conforms
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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Tests conducted/Reports compiled by :

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Applicants comments

All of the applicant comments are recorded and added in the final test report