

व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT

संख्या / No. : Comb-99/1523
माह / Month: July, 2013



SELF PROPELLED COMBINE HARVESTER
“CROP TIGER 40 TERRA TRAC (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:					
56.18 (76.38)	252.5(25.75)	2225	13.61(16.39)	0.242(0.178)	3.428(4.660)
ii) Power at rated engine speed (2200 rpm)					
55.46(75.40)	252.1(25.71)	2200	13.35(16.09)	0.241(0.177)	3.447(4.686)
52.62(71.54)	239.2(24.39)	2200	12.44(15.63)	0.236(0.174)	3.367(4.577)*
iii) Maximum torque:					
44.38(60.34)	286.3(29.19)	1550	10.05(12.09)	0.226(0.167)	3.671(4.991)
40.43(54.97)	269.5(27.48)	1500	9.33(11.36)	0.231(0.170)	3.559(4.839)*
iv) Five hour rating test:					
a) Engine loaded to 90% of maximum power:					
48.32(65.70)	212.3(21.65)	2276	12.22(14.87)	0.253(0.186)	3.249(4.418)
b) maximum power:					
52.80(71.79)	234.7(23.93)	2250	13.20(16.08)	0.250(0.184)	3.284(4.465)

* Under high ambient condition.

Remarks:

- i) The maximum power output of the engine was observed as 56.18 kW (76.38 Ps) at 2225 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 0.242 Kg/kWh (0.178 kg/hph).
- iii) The back-up torque of the engine was measured as 13.79 % under natural ambient condition at full throttle.
- iv) The maximum smoke density was recorded as 0.10 (Bosch No.).
- v) The maximum temperature of engine oil, coolant (water) and exhaust gas were observed as 109.6, 89 and 409.2°C respectively.
- vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.614 g/kWh (0.451 g/hph) and 0.60 % 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:

Machine having no any service and parking brakes provision, hence this test should not be applicable for this machine.

17.5 Mechanical Vibration:

The amplitude of mechanical vibration of components is given 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 operational comfort and service life of various components & sub assemblies.

17.6 Noise measurement:

- i) The ambient noise emitted by the machine was measured as 86.3dB (A) which is normal against the limit of 88 dB(A).
- ii) The noise at driver's ear level was measured as 92.7 dB (A) which is normal the limit 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	Wheat harvesting	Paddy harvesting	Avg. observation	
				Wheat	Paddy
1.	Speed of operation, kmph	2.41 to 3.51	2.51 to 2.74	3.11	2.64
2.	Area covered (ha/h)	0.415 to 0.577	0.314 to 0.419	0.510	0.378
3.	Fuel consumption: - (l/h) - (l/ha)	7.675 to 9.510 14.642 to 21.932	7.733 to 9.856 20.244 to 29.484	8.743 16.666	8.848 23.646
4.	Crop throughput (tonne/h)	2.95 to 5.43	6.76 to 7.98	3.88	7.39
5.	Grain breakage in main grain outlet(%)	0.231 to 1.036	0.500 to 1.707	0.626	1.228
6.	Header losses(%)	0.352 to 2.826	0.217 to 0.601	1.140	0.354
7.	Total non-collectable losses(%)	0.424 to 2.977	0.313 to 1.322	1.221	0.846
8.	Total collectable losses(%)	0.352 to 1.002	0.030 to 1.101	0.688	0.317
9.	Total processing losses(%)	0.961 to 1.838	1.411 to 2.589	1.395	2.037
10.	Threshing efficiency(%)	98.96 to 99.53	98.89 to 99.89	99.19	99.68
11.	Cleaning efficiency(%)	97.50 to 98.47	96.37 to 98.57	97.99	97.27

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17.7.1.1 **Wheat & Paddy Harvesting**

- i) The grain breakage ranged from 0.231 to 1.036 and 0.500 to 1.707 % for wheat and paddy crop respectively which is considered to normal.
- ii) The total non-collectable losses ranged from 0.424 to 2.977% and 0.313 to 1.322 % for wheat and paddy crop respectively which considered to be on higher side, for wheat crop.
- iii) The total processing losses ranged from 0.961 to 1.838 % and 1.411 to 2.589% for wheat and paddy crop respectively which is considered to be on slightly higher side for paddy crop.
- iv) The threshing efficiency ranged from 98.96 to 99.53% and 98.89 to 99.89% for wheat and paddy crop respectively which is considered to normal.
- v) The cleaning efficiency ranged from 97.50 to 98.47% and 96.37 to 98.57% for wheat and paddy crop respectively which is considered to normal.

17.7.2 **Break down and repairs:**

No any category of breakdown was observed during entire 58.43 h operation of the machine.

17.7.3 **Harvesting of any other crops:**

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

17.7.4 **Ease of Operation and Safety Provision:**

- i) The controls provided around the operator are within easy reach, and labelled with symbols as per Indian standard IS:6283-1998.
- ii) The stone trap is provided 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, tailing & grain 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 provided
- vi) Mechanical lock for reel in raised position needs to be provided to ensure safety while working on cutter bar.

17.7.5 **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 critical components of threshing cylinder & concave were observed to be normal.

17.8 Hardness and Chemical composition:

- i) The Hardness of knife blade and knife guard are not within the prescribed limit of IS :6025-1999.
- ii) The manganese content of knife blade, does not conform the prescribed limit of IS: 6025-1999.

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.	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.	56.0(76.14)	56.18(76.38)

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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	Max. power observed must not be less than 5% of declared value.	56.0(76.14)	56.18(76.38)	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.	56.0(76.14)	55.46(75.40)	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.	235	242	Conforms
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	0.16	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.	275	269.5	Conforms
vii)	Back up torque, %	7% min.	--	13.79	Conforms
viii)	Max. operating temp. To be declared by manufacturer	i) engine oil	130	109.6	Conforms
		ii) Coolant	110	89	Conforms
ix)	Lubrication oil consumption, g/kWh	1% of SFC at max. power during high ambient condition	2.42 +10%	0.614	Conforms
2.	Brake performance				
i)	Max. stopping distance at a force equal to or less	10 m or $S \leq 0.15V + V^2/130$	--	Machine having no any	--

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	than 600 N on break pedal, m	V= speed corresponding to 80% of design max. speed, kmph		separate service brake and parking brake provision hence not applicable	
	ii) Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec ² .	≤ 600N.	--	-do-	--
	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	--	-do-	--
3.	Mechanical vibration				
	i) Operator's platform	120 µm max.	--	410	Does not conform
	ii) Steering wheel	150 µm max.	--	Not applicable	--
	iii) Seat with driver seated	120 µm max.	--	530	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.	--	Machine having dry type air cleaner. Hence, it is not applicable	--
5.	Noise measurement				
	i) Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	--	86.3	Conforms
	ii) Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,	--	92.7	Conforms
6.	Discard limit				
	i) Cylinder bore diameter	Should not exceed the values declared by the manufacture	97.135	97.020	Conforms
	ii) Piston diameter	-do-	96.755	96.87	Conforms
	iii) Ring end gap	-do-	1.50	0.50	Conforms
	iv) Ring groove clearance	-do-	0.15	0.05	Conforms
	v) Diametrical and axial clearance of big end bearing	-do-	Diametrical- 0.20 Axial - 0.50	Diametrical- 0.12 Axial - 0.40	Conforms
	vi) Diametrical and axial clearance of main	-do-	Diametrical- 0.20	Diametrical- 0.16	Conforms

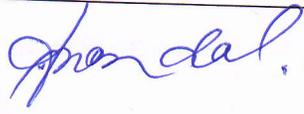
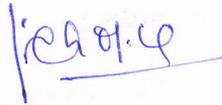
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	bearings		Axial - 0.50	Axial - 0.20	Conforms
vii)	Thickness of brake lining	Not applicable	--	--	--
viii)	Thickness of clutch plate	Not applicable	--	--	--
7.	Field performance				
i)	Suitability for crops	Wheat & paddy essential	Wheat & paddy	Suitable for Wheat & paddy.	Conforms
ii)	Grain breakage in grain tank	≤ 2.5 %	--	Wheat-(0.231 to 1.036) Avg-0.626 Paddy-(0.500 to 1.707) Avg-1.228	Conforms Conforms
iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean	--	Wheat-(0.424 to 2.977) Avg-1.221 Paddy- (0.313 to 1.322) Avg-0.846	Conforms Conforms
iv)	Threshing efficiency	≥ 98% wheat & paddy	--	Wheat-(98.96 to 99.53) Avg-99.19 Paddy-(98.89 to 99.89) Avg-99.68	Conforms Conforms
v)	Cleaning efficiency	≥ 96 % wheat & paddy	--	Wheat-(97.50 to 98.47) Avg-97.99 Paddy-(96.37 to 98.57) Avg-97.27	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	Not applicable	Not applicable	-	--
iii)	Grain tank cover	Essential	--	Provided	Conforms

9.	iv)	Spark arrester in engine's exhaust	Essential	--	Not provided	However the turbo charged engine eliminates the requirement of the separate spark arrester	
	v)	Stone trap before concave	Essential	--	Provided	Conforms	
	vi)	Rear view mirror	Essential	--	Provided	Conforms	
	vii)	Slip clutch at following drives - a) Cutting platform auger b) under shout conveyer drive c) Grain & tailing elevator	Essential	--	Provided Not provided Not provided	Conforms only for cutting platform auger	
	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 applicable	Knife guard is not provided in a machine	--	
	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-0.58%	Conforms only for carbon	
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-0.43%	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 A ₁ , A ₂ , A ₃	--	None	Conforms

TESTING AUTHORITY:

(J.P.MANDAL) AGRICULTURAL ENGINEER	
(P. K. CHOPRA) SENIOR AGRICULTURAL ENGINEER	
(HIMAT SINGH) -DIRECTOR-	



Test conducted/and report compiled by Sh. S.A Hinge, S.T.A.

APPLICANT'S COMMENTS

- All of the necessary comments were received and recorded in a DTR
1. We would be looking into possibility to reduce vibration level at regular production level.
 2. Your's valuable comments and suggestions are well taken and improvements will be carried out whatever necessary.
 3. Slip clutch is provide in reel drive which works as safety device for cutting platform, also the cutting platform and under shout conveyor driven by belt drive which itself work as slip belt as safety device. Shear bolt is provided in grain conveying auger which work as safety device for grain and tailing elevator.