

व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT

संख्या / No. : COMB-52/1241
माह/ Month : May, 2010



DHIMAN- 930
SELF PROPELLED COMBINE HARVESTER



भारत सरकार
कृषि मंत्रालय
(कृषि एवं सहकारिता विभाग)

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

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b)	Peg teeth of Concave:		
1	227.1	225.6	0.66
2	221.8	220.0	0.81
3	219.6	217.2	1.09
4	219.1	218.0	0.50
5	221.4	219.6	0.81
6	221.9	220.0	0.86

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/h / (l/h)	Specific fuel consumption kg/kwh (kg/hph)	Specific energy, kWh/l (hph/l)
i) Maximum power - 2 hours test:					
78.2 (106.4)	350.8 (35.8)	2230	20.71 (24.89)	0.265 (0.195)	3.143 (4.274)
58.7 (79.8)	404.4 (41.3)	1451	14.81 (17.81)	0.252 (0.186)	3.294 (4.479)**
ii) Power at rated engine speed (2200 rpm)					
77.8 (105.8)	353.4 (36.1)	2200	20.62 (24.78)	0.265 (0.195)	3.138 (4.266)
76.8 (104.4)	349.2 (35.6)	2200	20.26 (24.38)	0.264 (0.194)	3.151 (4.284)*

iii) Maximum torque:					
50.0 (68.0)	416.5 (42.5)	1200	13.09 (15.75)	0.262 (0.193)	3.173 (4.315)
53.2 (72.3)	408.4 (41.7)	1302	13.76 (16.50)	0.259 (0.190)	3.222 (4.381)
49.2 (66.9)	416.1 (42.5)	1182	12.85 (15.43)	0.261 (0.192)	3.187 (4.334)
iv) Five hour rating test:					
a) Engine loaded to 90% of maximum power:					
70.6 (96.0)	313.5 (32.0)	2252	18.44 (22.20)	0.261 (0.192)	3.181 (4.325)
b) maximum power:					
77.0 (104.7)	348.4 (35.5)	2211	20.55 (24.69)	0.267 (0.196)	3.119 (4.240)

* Under high ambient condition.

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

Remarks:

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- i) The maximum power output of the engine was observed as 78.2 kW (106.4 Ps) & 58.7 kW (79.8 Ps) at 2230 rpm and 1451 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 and setting recommended for field operation was measured as 0.265 & 0.252 Kg/kwh (0.195 & 0.186 kg/hph).
- iii) The back-up torque of the engine was measured as 17.9 % in natural ambient at full throttle.
- iv) The maximum smoke density was recorded as 2.36 (Bosch No.).
- v) The maximum temperature of engine oil, coolant(water) and exhaust gas was observed as 126, 105 and 671° C respectively.
- vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.103 g/kWh and 7.41% of total coolant capacity respectively.

18.2 Turning ability:

0.645m variation is observed in turning circle at LHS and RHS which should be corrected at manufacturing level.

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 185 N pedal force was measured as 2.50 m/sec² and 9.59 m respectively.
- 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 operational comfort and service life of various components & sub assemblies.

18.6 Noise measurement:

- i) The ambient noise emitted by the machine was measured as 87.8 dB(A).
- ii) The noise at driver's ear level was measured as 97.8 dB(A).

18.7 Air cleaner oil pull over test

The maximum oil pull over was observed as 0.10 %.

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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	W heat harvesting	Paddy harvesting
1.	Speed of operation (kmph)	4.11 to 6.52	2.14 to 3.24
2.	Area covered (ha/h)	1.06 to 1.56	0.55 to 0.87
3.	Fuel consumption: - (l/h) - (l/ha)	6.71 to 9.00 4.50 to 8.02	7.21 to 8.17 8.92 to 14.07
4.	Crop throughput (tonne/h)	8.27 to 9.83	5.94 to 12.4
5.	Grain breakage in main grain outlet(%)	0.777 to 1.668	0.972 to 1.800
6.	Header losses(%)	0.924 to 2.830	0.990 to 3.677
7.	Total non-collectable losses(%)	1.301 to 3.145	2.403 to 6.139
8.	Total collectable losses(%)	0.010 to 0.196	0.300 to 1.070
9.	Total processing losses(%)	1.286 to 2.716	2.279 to 4.699
10.	Threshing efficiency(%)	99.8 to 99.9	98.0 to 99.9
11.	Cleaning efficiency(%)	96.5 to 98.7	92.5 to 95.0

18.8.1.1 Wheat Harvesting:

- i) The grain breakage in all the varieties tested was measured as 0.777 to 1.668 % which is normal .
- ii) The total non collectable losses ranged from 1.301 to 3.145 percent. The major constituent of non-collectable losses is header loss.
- iii) The total processing losses ranged from 1.286 to 2.716 %.
- iv) The threshing efficiency ranged from 99.8 to 99.9%.
- v) The cleaning efficiency ranged from 96.5 to 98.7%.

Necessary improvements to bring down grain breakage and processing losses are required to be incorporated.

18.8.1.2 Paddy Harvesting:

- i) The grain breakage ranged from 0.972 to 1.800 % .
- ii) The total non-collectable losses ranged from 2.403 to 6.139 %.
- iii) The total processing losses ranged from 2.279 to 4.699 %.

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- iv) The threshing efficiency ranged from 98.0 to 99.9 %.
- v) The cleaning efficiency ranged from 92.5 to 95.0%.

Necessary improvements to bring down grain breakage and processing losses and clearing efficiency are required to be incorporated.

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) 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 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 though provided, needs to be modified such that the same could be controlled from operators position.
- vi) The grain tank needs to be provided with suitable device to know the grain fill.

18.8.4 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 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.

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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 provided on the combine harvester. But it needs to be provided as per IS:10273-1999.

18.12 Literature supplied with the Machine:

18.12.1 The following literature was supplied with the machine for reference during testing

Operator manual for combine harvester which comprises of operation, maintenance and repair of combine harvester is provided. It should be brought out in Hindi and other regional languages also as per relevant Indian standards to guide to users and operator of combine.

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)	78.2(106.4)	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.	Not specified	58.7(79.8)	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.	81.0(110.0)	78.2(106.4)	Conforms
iv)	Specific fuel consumption g/kWh.	The average observed value during 2 hr. max. power test must be within $\pm 5\%$ of	Not specified	265	Does not conform

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		the declared value by applicant/manufacturer.			
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	--	2.36	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.	400	416.1(42.5)	Conforms
vii)	Back up torque, %	7% min.	--	17.9	Conforms
viii)	Max. operating temp. To be declared by manufacturer	i) engine oil ii) Coolant	130° C 110° C	126° C 109° C	Conforms Conforms
ix)	Lubrication oil consumption, g/kWh	1% of SFC at 5hr. max. power test during high ambient condition	--	0.103	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	--	4.35	Conforms
ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec ² .	$\leq 600N$.	--	185	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	Conforms

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3.	Mechanical vibration					
	i)	Operator's platform	120 µm max.	--	328	Does not conform
	ii)	Steering wheel	150 µm max.	--	498	Does not conform
	iii)	Seat with driver seated	120 µm max.	--	233	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.	--	0.10	Conforms
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,	--	97.8	Conforms
6.	Discard limit					
	i)	Cylinder bore diameter	Should not exceed the values declared by the manufacture	107.546	107.45	Conforms
	ii)	Piston diameter	--do--	Not specified	106.35	Does not conform
	iii)	Ring end gap	--do--	0.55	0.50	Conforms
	iv)	Ring groove clearance	--do--	0.254	0.160	Conforms
	v)	Diametrical and axial clearance of big end bearing	--do--	Diametrical 0.178	0.11	Conforms
				Axial - Not specified	0.20	Does not conform
	vi)	Diametrical and axial clearance of main bearings	--do--	Diametrical - 0.178	0.11	Conforms
				Axial - 0.254	0.10	Conforms
	vii)	Thickness of brake lining	--do--	Up to rivet head	11.0	Conforms
	viii)	Thickness of clutch plate	--do--	Up to rivet head	8.0	Conforms

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7.	Field performance				
i)	Suitability for crops	Wheat & paddy essential	Wheat & paddy	Suitable for Wheat & paddy	Conforms
ii)	Grain breakage in grain tank	$\leq 2.5\%$	--	Wheat- 0.777-1.668% (Avg. -1.323%) Paddy- 0.972-1.800% (Avg. 0.1484%)	Conforms
iii)	Non collectable losses	$\leq 2.5\%$ for wheat, paddy & gram $\leq 4.0\%$ for soybean	--	Wheat- 1.301-3.145% (Avg. -2.294%) Paddy- 2.403-6.139% (Avg. 3.992%)	Conforms Does not conform
iv)	Threshing efficiency	$\geq 98\%$ wheat & paddy	--	Wheat- 99.8-99.9% (Avg.- 99.9%) Paddy- 98.0-99.9% (Avg.- 98.9%)	Conforms Conforms
v)	Cleaning efficiency	$\geq 96\%$ wheat & paddy	--	Wheat- 96.5-98.7% (Avg. -97.8%) Paddy- 92.5-95.0% (Avg. 93.6%)	Conforms Does not conform
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-75/2002-03 dated 21.10.2002	Conforms
iii)	Grain tank cover	Essential	--	Not provided	Does not conform

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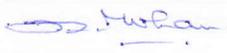
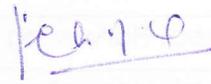
9.	iv)	Spark arrester in engine's exhaust	Essential	--	Not provided	Does not conform	
	v)	Stone trap before concave	Essential	--	Provided	Conforms	
	vi)	Rear view mirror	Essential	--	Provided	Conforms	
	vii)	Slip clutch at following drives – a) Cutting platform b) under shout conveyor drive c) Grain & 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 declared	Not declared	--	
	ii)	Knife blade As per IS :6025 -1982	It must have Chemical composition as C= 0.70-0.95 % Mn =0.30-0.50 %	Not declared	C = 0.81% Mn = 0.26 %		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 %	Not declared	C = 0.15		Does not conform	

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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

The declaration by the manufacturers have not been submitted inspite of the repeated reminders, have been considered as does not conform.

TESTING AUTHORITY:

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