

व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT

संख्या / No. : COMB-57/1340
माह/ Month : May, 2011



**MANPREET-765
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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16.9 Wear of the Peg Teeth:

The wear of the peg teeth of the threshing cylinder and concave was measured. The percentage wear on mass basis was computed and the results are given below:

Sl. No.	Original mass before test (g)	Mass after 55.3 hours of test (g)	Percent wear by weight (%)
a) Peg teeth of threshing cylinder:			
1.	213.0	212.6	0.19
2.	214.7	214.3	0.19
3	218.4	218.0	0.18
4	212.0	210.2	0.85
5	216.3	215.5	0.37
6	207.9	207.1	0.38
7	209.2	209.0	0.10
8	215.4	214.8	0.28
b) Peg teeth of Concave:			
1	211.2	210.1	0.52
2	217.5	215.6	0.87
3	207.9	207.0	0.43
4	213.4	212.6	0.37
5	215.4	214.4	0.46
6	212.5	211.6	0.42

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:					
97.4 (132.4)	309.1 (31.5)	3150	30.6(37.4)	0.314 (0.231)	2.60 (3.54)
67.1 (91.3)	432.8 (44.1)	1550	15.8(19.3)	0.235 (0.173)	3.48 (4.73)**
ii) Power at rated engine speed (3200 rpm)					
99.8 (135.1)	311.8 (31.8)	3200	31.2(38.1)	0.312 (0.230)	2.62 (3.55)
92.1 (125.3)	287.8 (29.3)	3200	30.2(36.9)	0.327 (0.241)	2.50 (3.40)*
iii) Maximum torque:					
58.0 (78.9)	446.0 (45.5)	1300	14.3(17.5)	0.247 (0.181)	3.31 (4.51)
54.0 (73.5)	415.7 (42.4)	1300	13.9(16.9)	0.257 (0.189)	3.20 (4.35)*
58.1 (79.0)	446.8 (45.5)	1300	14.2(17.3)	0.244 (0.180)	3.36 (4.50)**

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iv) Five hour rating test:					
a) Engine loaded to 90% of maximum power:					
89.4(121.5)	288.3(29.4)	3100	29.2(35.7)	0.327(0.241)	2.50(3.40)
b) maximum power:					
90.6(123.2)	312.4(31.8)	2900	28.1(34.4)	0.311(0.228)	2.64(3.58)

* Under high ambient condition.

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

Remarks:

- i) The maximum power output of the engine was observed as 97.4 kW (132.4 Ps) & 67.1 kW (91.3 Ps) at 3150 rpm and 1550 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 0.314 & 0.235 Kg/kwh (0.231 & 0.173 kg/hph).
- iii) The back-up torque of the engine was measured as 38.4 % in natural ambient at full throttle.
- iv) The maximum smoke density was recorded as 2.36 (Bosch No.) which is within permissible limit
- v) The maximum temperature of engine oil, coolant(water) and exhaust gas was observed as 125.2, 96.4 and 741°C respectively.
- vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.518 g/kWh(0.381 g/hph) and 0.83% of total coolant capacity respectively.
- vii) The manufacturer must use the top water tank type conventional aluminium radiator on engine mounted on the combine harvester at regular production level which is also used during the engine performance test.

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:

- i) The mean deceleration and stopping distance corresponding to 726 N pedal force was measured as 7.27 m/sec² and 1.50 m respectively. The performance is in line with the IS:12207-1987.
- ii) The performance of parking brake was found satisfactory.

17.5 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.

17.6 Noise measurement:

The noise tests at standard level and at operator's ear level do not conform to the level 88 dB(A) and 98 dB(A) as specified in IS:12180-2000. This has to be looked into at regular production level.

17.7 Field Test:**17.7.1 Summary of field tests:**

The results of the field test are summarized below:

S. No	Observation	Range of observation		Average of observation	
		Wheat Harvesting	Paddy Harvesting	Wheat Harvesting	Paddy Harvesting
1.	Speed of operation (kmph)	3.1 to 4.0	1.5 to 3.7		
2.	Area covered (ha/h)	0.874 to 1.440	0.412 to 0.854		
3.	Fuel consumption: - (l/h) - (l/ha)	7.04 to 8.53 4.89 to 9.25	6.46 to 7.90 8.36 to 18.93		
4.	Crop throughput (tonne/h)	4.6 to 10.1	5.8 to 16.6		
5.	Grain breakage in main grain outlet(%)	0.70 to 1.40	0.80 to 1.20	1.03	1.08
6.	Header losses(%)	0.260 to 1.662	1.450 to 3.527	0.728	1.964
7.	Total non-collectable losses(%)	0.286 to 1.875	2.766 to 5.065	0.774	3.828
8.	Total collectable losses(%)	0.274 to 0.901	1.629 to 3.329	0.543	2.352
9.	Total processing losses(%)	1.329 to 2.333	4.357 to 6.704	1.615	5.297
10.	Threshing efficiency(%)	99.07 to 99.72	96.38 to 97.91	99.45	97.13
11.	Cleaning efficiency(%)	95.37 to 97.70	91.20 to 92.80	96.71	92.10

17.7.1.1 Wheat Harvesting:

- i) The grain breakage in all the varieties tested was measured as 0.70 to 1.40 % which is normal .
- ii) The total non collectable losses ranged from 0.286 to 1.875 percent. The major constituent of non-collectable losses is header loss.
- iii) The total processing losses ranged from 1.329 to 2.333 % which is within normal limit when compared to maximum limit of 2.5% specified by BIS. The major constituent of processing losses is grain breakage.
- iv) The threshing efficiency ranged from 99.07 to 99.72% which is considered normal.
- v) The cleaning efficiency ranged from 95.37 to 97.70% which is considered normal.

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17.7.1.2 Paddy Harvesting:

- i) The grain breakage ranged from 0.80 to 1.20 % which is considered normal.
- ii) The total non-collectable losses ranged from 2.766 to 5.065 % which is considered to be on higher side.
- iii) The total processing losses ranged from 4.357 to 6.704 % which is considered to be on higher side against maximum limit of 2.50% specified by BIS.
- iv) The threshing efficiency ranged from 96.38 to 97.91 % which is normal.
- v) The cleaning efficiency ranged from 91.20 to 92.80% which is considered to be slightly on the lower side.

Necessary improvements to bring down header losses are required to be incorporated.

17.7.2 Harvesting of any other crops:

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

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 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 grain fill indicator device.
- vii) Mechanical lock for reel in raised position needs to be provided to ensure safety which working on cutter bar.

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.

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- 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 as normal.

17.8 Hardness and Chemical composition:

17.8.1 Hardness of knife blade in reminder zone does not conform with the limits of hardness specified in IS:6025-1999 and hardness of knife guard does not conform with the limits of hardness specified in IS:6024-1999.

17.8.2 Manganese content in Knife blade material is higher than the limits specified in IS:6025-1999 . Knife Blade and knife guard conforming to IS requirements should be used at regular production level.

17.8.3 The carbon content of the knife back as specified in IS:10378-1992 is not complying with specified limit. This should be looked into at regular production level.

17.9 Maintenance/Service problems:

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

17.10 Defects & Problems:

During engine performance test overheating of engine was noticed. The problem of the overheating was solved as per details given under Para-15, Page 33 of the report. In view of this, it is recommended that the machines if the commercial production should be provided with the modified radiator with which the engine test has been completed successfully.

17.10 Labelling of Combine Harvester:

The labelling plate as per IS:10273-1999 is provided on the combine harvester.

17.11 Literature supplied with the Machine:

Operator manual for prime mover (engine) for repair and maintenance is provided. However, a manual in respect of combine harvester as a whole should be brought out in Hindi and other regional languages also as per relevant Indian standards to guide to users and operator of combine.

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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.	N.A.	97.4	Unascertainable
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.	N.A.	66.7	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.	104.5	99.8	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.	232	314	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 whichever 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	65	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.	412	446.8	Conforms

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	vii)	Back up torque, %	7% min.	--	38.4	Conforms
	viii)	Max. operating temp. To be declared by manufacturer	i) engine oil	120 ⁰ C	125.2 ⁰ C	Does not conform
			ii) Coolant	90 to 100 ⁰ C	96.4 ⁰ C	Conforms
	ix)	Lubrication oil consumption, g/kWh	1% of SFC at 5hr. max. power test during high ambient condition	3.11	0.518	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	--	1.5m	Conforms
	ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec ² .	$\leq 600N.$	--	406 N	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
3.	Mechanical vibration					
	i)	Operator's platform	120 μ m max.	--	260	Does not conform
	ii)	Steering wheel	150 μ m max.	--	173	Does not conform
	iii)	Seat with driver seated	120 μ m max.	--	125	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.	--	Not applicable as dry filter is used.	-
5.	Noise measurement					
	i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	--	91.9	Does not conform
	ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,	--	103.5	Does not conform

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6.	Discard limit				
i)	Cylinder diameter bore	Should not exceed the values declared by the manufacture	100.25	100.01 to 100.04	Conforms
ii)	Piston diameter	-do-	99.83 to 99.90	99.88 to 99.90	Conforms
iii)	Ring end gap	--do--	1.5	0.28 to 0.50	Conforms
iv)	Ring groove clearance	--do--	0.15 to 0.20	0.07 to 0.10	Conforms
v)	Diametrical and axial clearance of big end bearing	-do-	0.2 and 0.6	Diametrical 0.04 to 0.08 Axial - 0.15 to 0.20	Conforms Conforms
vi)	Diametrical and axial clearance of main bearings	--do--	0.15 & 0.40	Diametrical 0.04 to 0.08 Axial - 0.20	Conforms Conforms
vii)	Thickness of brake lining	--do--	Not specified	6.0	Unascertainable
viii)	Thickness of clutch plate	--do--	Not specified	10.0	-do-
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- 0.70 to 1.40 (Avg. -1.03%) Paddy- 0.80 to 1.20 (Avg. 1.08%)	Conforms for both wheat and paddy
iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean	--	Wheat- 0.286 to 1.875 (Avg. -0.774%) Paddy- 2.766 to 5.065 (Avg. 3.828%)	Conforms Does not conform for paddy
iv)	Threshing efficiency	≥ 98% wheat & paddy	--	Wheat- 99.07 to 99.72 (Avg.- 99.45%) Paddy- 96.38 to 97.91 (Avg.- 97.13%)	Conforms Does not conform for paddy
v)	Cleaning efficiency	≥ 96 % wheat & paddy	--	Wheat- 95.37 to 97.70 (Avg. -96.71%) Paddy- 91.20 to 92.80 (Avg. 92.10%)	Does not conform for wheat and paddy

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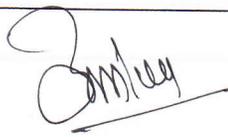
8.	Safety requirement					
	i)	Guards against all moving per	Essential	--	Provided	Conforms
	ii)	Lighting arrangement a) Head light b) Parking light c) Indication d) Reverse gear e) Brake f) Number plate	Essential as per CMVR	--	Provided as per CMVR Test Report No. CMVR/ Comb 10/196-2009-10 dated 27.4.2009 from CFMT&TI, Budni.	Conforms
	iii)	Grain tank cover	Essential	--	Half grain tank covered	Does not conform
	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 shot conveyor drive c) Grain & tailing elevator	Essential	--	Provided Provided Provided in grain elevator Not provided in tailing elevator	Conforms Conforms Conforms 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
	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)	-	-

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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=0.82 Mn=0.76	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 %	-	0.16%	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 *

*It will subject if the engine of the combine is provided with the modified radiator assembly provided for engine performance test and specified as under Para 15.

TESTING AUTHORITY

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

Applicants comments : Received and added