

व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT

संख्या / No. : Comb - 121/1614
माह / Month: May, 2014



**SELF PROPELLED COMBINE HARVESTER
'JAI BHARAT-730'**



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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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					
70.7(96.1)	321.3(32.8)	2200	20.51(24.82)	0.290(0.213)	2.848(3.872)
52.6(71.5)	351.0(35.8)	1500	12.65(15.25)	0.240(0.177)	3.453(4.695)**
ii) Power at rated engine speed (2200 rpm)					
70.95(96.5)	322.5(32.9)	2200	20.53(24.70)	0.289(0.213)	2.872(3.905)
69.61(94.6)	316.4(32.3)	2200	20.16(24.55)	0.290(0.213)	2.835(3.855)*
iii) Maximum torque					
54.01(73.4)	385.8(39.4)	1400	12.81(15.45)	0.237(0.174)	3.496(4.753)
51.45(70.0)	367.5(37.5)	1400	12.44(15.13)	0.242(0.178)	3.401(4.623)*
48.75(66.3)	375.0(38.3)	1300	11.38(13.71)	0.233(0.171)	3.556(4.835)**
v) Five hour rating test					
a) Engine loaded to 90% of maximum power load					
65.0(88.4)	285.1(29.1)	2282	20.0(24.39)	0.308(0.226)	2.667(3.626)*
b) Engine loaded to maximum power load					
69.5(94.5)	316.0(32.2)	2200	20.32(24.78)	0.292(0.215)	2.805(3.814)*

* Under high ambient conditions

** at 1650 rpm engine speed recommended for field operation.

Remarks

- i) The maximum power output of the engine was observed as 70.7 kW (96.1 Ps) & 52.6 kW (71.5 Ps) at 2200 rpm and 1500 rpm of engine at full throttle and setting recommend for field operation respectively under natural ambient condition during 2 hours maximum power test.
- ii) The specific fuel consumption corresponding to maximum power at full throttle and setting recommended for field operation was measured as 0.290 Kg/kWh (0.213 kg/hph) and 0.240 kg/kWh (0.177 kg/hph) under natural ambient condition during 2 hours maximum power test.
- iii) The back-up torque of the engine was measured as 19.6 % in natural ambient at full throttle speed.
- iv) The maximum smoke density was recorded as 3.12 (Bosch No.) which is within permissible limit.

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- v) The maximum temperature of engine oil, coolant (water) and exhaust gas was observed as 117.4, 102.0 and 501.0 respectively under high ambient conditions respectively.
- vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.334 g/kWh (0.246 g/hph) and 1.90% of total coolant capacity respectively.

17.2 Turning ability

The radius of turning circle at LHS and RHS was observed satisfactory. Combine is not provided with independent brake pedals for right and left brake for making short turns.

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 pedal force required to mean deceleration of 2.5 m/sec² was observed as 252 Newtons.
- ii) The minimum stopping distance was 6.30 meter against the permissible distance 8.94 mm of the speed of 25.7 km/h
- iii) The performance of parking brake was found satisfactory.

17.5 Mechanical Vibration

The amplitude of mechanical vibration of components marked as (*) in para 12 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 level at bystander's position found 91.3 dB(A) which does not conform with specified noise level 88dB(A) in IS 12180:2000. The noise level at driver's ear level is found 99.0 dB(A) which does not conform with specified noise level of 98dB(A) in IS 12180:2000

17.7 Field Test

The results of the field test are summarized below:



S. No	Parameters	Range of parameters		Average of parameters	
		Wheat Harvesting	Paddy Harvesting	Wheat Harvesting	Paddy Harvesting
1.	Speed of operation (kmph)	2.74 to 3.04	2.75 to 2.90	2.91	2.80
2.	Area covered (ha/h)	0.900 to 0.975	0.655 to 0.895	0.933	0.801
3.	Fuel consumption: - (l/h) - (l/ha)	8.370 to 10.433 8.890 to 11.592	7.042 to 8.197 7.868 to 11.480	8.972 9.641	7.426 9.459
4.	Crop throughput (tonne/h)	8.513 to 9.354	7.355 to 12.125	8.959	10.058
5.	Grain breakage in main grain outlet(%)	1.135 to 1.892	0.372 to 1.305	1.448	0.772
6.	Header losses(%)	0.464 to 0.859	0.442 to 0.862	0.706	0.579
7.	Total non-collectable losses(%)	0.509 to 0.904	0.566 to 0.994	0.788	0.730

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8.	Total collectable losses(%)	0.269 to 0.909	0.353 to 0.836	0.469	0.632
9.	Total processing losses(%)	1.571 to 2.439	0.914 to 1.925	1.999	1.554
10.	Threshing efficiency(%)	99.08 to 99.72	98.15 to 98.78	99.52	98.56
11.	Cleaning efficiency(%)	96.10 to 96.63	96.20 to 96.90	96.35	96.51

17.7.1 Wheat Harvesting

- i) The grain breakage in all the varieties tested ranged from 1.135 to 1.892% (average 1.448%) which is within the specified limit of 2.5% in IS: 15806-2008.
- ii) The total non collectable losses ranged from 0.509 to 0.904% (average 0.788%), which is within specified limit of 2.5% as specified in IS: 15806-2008.
- iii) The total processing losses ranged from 1.57 to 2.439% (average 1.999%) which is within the specified limit of 2.5% in IS: 8122(Part-1)1994.
- iv) The threshing efficiency ranged from 99.08 to 99.72% (average 99.52%) which is above the specified limit of 98% in IS:15806-2008.
- v) The cleaning efficiency ranged from 96.10 to 96.63% (average 96.35%) which is above the specified limit of 96% in IS:15806-2008.

17.7.2 Paddy Harvesting

- i) The grain breakage ranged from 0.372 to 1.305% (average 0.772%) which is within specified limit of 2.5% in IS:15806-2008.
- ii) The total non-collectable losses ranged from 0.566 to 0.994% (average 0.730%) which is within specified limit of 2.5% in IS:15806-2008.
- iii) The total processing losses ranged from 0.914 to 1.925 % (average 1.554%) which is within specified limit of 2.5% in IS:8122 (Part-1)1994.
- iv) The threshing efficiency ranged from 98.15 to 98.78 % (average 98.56%) which is above the specified limit of 98% in IS: 15806-2008.
- v) The cleaning efficiency ranged from 96.20 to 96.90% (average 96.51%) which is above the specified limit of 96% in IS: 15806-2008.

Losses are within the specified limit and efficiencies are above the specified limit of Indian Standard on both the crops.

17.7.3 Harvesting of any other crops

The performance of combine to harvest wheat and paddy crops was evaluated as 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 but not with symbols as per Indian standard. Therefore, it is recommended that the symbols as per the requirement of IS-6283-1998 may be provided at production level.
- ii) The design of stone trap need to be modified for easy cleaning without removing header unit.
- iii) Spark arresting device is not provided in the engine exhaust system which is considered essential.
- iv) Slip clutch / safety device in lifting platform and grain & tailing elevator are considered essential from safety point of view which needs to be provided at production level.
- v) The mechanical arrangement for adjusting the reel speed though provided needs to be modified such that the same could be controlled from operator's position.
- vi) The grain tank needs to be provided with suitable grain fill indicator device.

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vii) 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.
- 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 Chemical composition

Chemical composition of knife blade and knife back does not conform with the chemical composition specified in IS 6025:1982 for knife blade and IS 10378:1982 for knife back. Components with chemical composition conforming to Indian Standard should be used at production level.

17.9 Maintenance/Service problems

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

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

No operator manual or technical literature is provided. Therefore the manufacturer must brought the operators manual in accordance with IS:8132-1999 in Hindi, English & other regional language for the guidance of end user and technician.



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

S. No.	Characteristics	Requirement	Declared	Observed	Remark
i.) Prime mover performance					
a)	Max. Power (absolute) Average max. power observed during 2 hrs. max. power test under natural ambient condition kW(Ps)	It should not be less than 5% of the declared value by the manufacturer	74.3	70.7 (96.1)	Conforms
b)	Max. power observed during the 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 by the manufacturer	Not specified	52.6 (71.5)	Conforms

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c)	Power at rated engine speed, kW(Ps)	The observed value must not be less than 5% of the declared value by the manufacturer	74.3	70.95 (96.5)	Conforms
d)	Specific fuel consumption g/kWh.	The average observed value under 2 hr. max. power test must be within $\pm 5\%$ of the declared value by manufacturer.	238 $\pm 5\%$	290	Does not conform
e)	Max. smoke density (bosch no.) at 80% load between the speed at max. power & 55% of speed at max. power 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	--	3.12	Conforms
f)	Max. crank shaft torque, observed during the test after no load engine speed is adjusted as per manufacture's recommendation for field work, N-m	It must not be less than 8% of declared value by the manufacturer.	Not specified	375	
g)	Back up torque, percent	7 Percent, Min.	-	19.6	Conforms
h)	Max. operating Temperature, °C 1. engine oil 2. Coolant	To be declared by the manufacturer	120°C (Engine oil) 108°C (coolant)	117.4°C 102°C	Conforms Conforms
i)	Lubrication oil consumption, g/kWh	1% of SFC at 5hr. max. power test under high ambient condition with tolerance limit of +10%.	2.92+10%	0.334	Conforms
ii.) Brake performance					
a)	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	-	6.30	Conforms
b)	Max. force exerted on the brake pedal to achieve a deceleration of 2.5 m/sec ² .	$\leq 600N$.	--	252N	Conforms
c)	Whether parking brake is effective at a force of 600 N at foot pedal or 400 N at Hand and lever	Yes / No	--	Yes	Conforms

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iii.) Mechanical vibration (amplitude of vibration) at					
a)	Operator's platform	120 µm Max.	--	180 µm	Does not conform
b)	Steering wheel	150 µm Max.	--	400 µm	Does not conform
c)	Seat (with driver seated)	120 µm Max.	--	230 µm	Does not conform
iv.) Air cleaner oil pull over					
a)	Maximum percentage of oil pull over	0.25 percent Max.	--	Not applicable	--
v.) Noise measurement					
a)	Max. ambient noise emitted by the combine dB (A)	88 dB (A) as per CMVR	--	91.3	Does not conform
b)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,	--	99.0	Does not conform
vi.) Discard limit of					
a)	Cylinder bore diameter, mm	To be specified by the manufacturer	104.15	104.03 (maximum)	Conforms
b)	Piston diameter, mm	-do-	Not specified	103.11 (minimum)	-
c)	Ring end gap, mm	--do--	1.2	0.50 (maximum)	Conforms
d)	Ring groove clearance, mm	--do--	Top 0.7 Second 0.2 Oil ring 0.1	- 0.13 (maximum) 0.09 (maximum)	Conforms
e)	Diametrical and axial clearance of main bearings, mm	--do--	Diame- trical 0.13 Axial 0.40	0.08 (maximum) 0.30	Conforms Conforms
f)	Diametrical and axial clearance of big end bearing, mm	-do-	Diame- trical 0.12 Axial 0.40	0.08 (maximum) 0.10	Conforms Conforms
g)	Thickness of brake lining mm	--do--	-	4.89	--
h)	Thickness of clutch plate, mm	--do--	-	11.2	Conforms
vii.) Field performance					
a)	Suitability for the crops	Wheat & paddy (Essential)	-	Suitable for Wheat & paddy	Conforms
b)	Grain breakage in the grain tank	≤ 2.5 percent	-	Wheat 1.135 to 1.892% (average 1.448%) Paddy 0.372 to 1.305% (average 0.772%)	Conforms Conforms
c)	Non collectable losses	≤ 2.5% for wheat, paddy & gram and ≤ 4.0% for soyabean	-	Wheat- 0.509 to 0.904 % (average	Conforms

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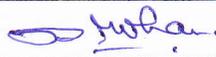
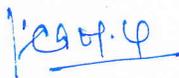
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				0.788%) Paddy 0.566 to 0.994% (average 0.730%)	Conforms
d)	Threshing efficiency	≥ 98% for wheat & paddy	-	Wheat 99.08 to 99.72% (average 99.52%) Paddy 98.15 to 98.78% (average 98.56%)	Conforms Conforms
e)	Cleaning efficiency	≥ 96 % for wheat as well as paddy	-	Wheat 96.10 to 96.63% (average 96.35%) Paddy 96.20 to 96.90% (average 96.51%)	Conforms Conforms
viii.) Safety requirement					
a)	Guards against all moving parts/drives and hot parts	Essential	--	Provided	Conforms
b)	Lighting arrangement - Head light - Parking light - Indication - Reverse gear - Brake - Number plate	As per CMVR	--	Provided	Conforms
c)	Grain tank cover	Essential	--	Not provided	Does not Conform
d)	Spark arrester in engine exhaust	Essential	--	Not provided	Does not Conform
e)	Stone trap before concave	Essential	--	Provided	Conforms
f)	Rear view mirror	Essential	--	Provided	Conforms
g)	Slip clutch at following drives - 1) Cutting platform auger drive 2) under shot conveyor drive 3) Grain & tailing elevator drive	Essential	--	Not Provided Provided Not provided	Does not Conform Conforms Does not conform
h)	Anti slip surfaces at operator platform & ladder & proper gripping for the control levers	Essential	--	Provided	Conforms
i)	Working clearance around the controls	70 mm, Min. Essential	--	Provided	Conforms
j)	Labelling of control, gauges	Essential	--	Provided	Conforms

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ix.) Material of construction :					
a)	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)	-	Result is awaited	--
b)	Knife blade As per IS :6025 - 1982	It must have Chemical composition as Carbon 0.70-0.95 % Manganese 0.30-0.50 %	-	Carbon 0.60% Manganese 0.80%	Does not conform
c)	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 0.11%	Does not conform
x.) 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
xi.) Break down (critical, major & minor)					
	As per annexure A of IS: 15806-2008 Critical- NIL Major- 3, Max Minor- 5, Max		--	NIL	Conforms

TESTING AUTHORITY

(R.M. TIWARI) AGRICULTURAL ENGINEER	
(P. K. CHOPRA) SENIOR AGRICULTURAL ENGINEER	
(HIMAT SINGH) -DIRECTOR-	

APPLICANT'S COMMENTS

No specific comments received

