

व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT

संख्या / No. : Comb- 96/1519
माह / Month: June 2013



SELF PROPELLED COMBINE HARVESTER
"ISHER-767"



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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4	236.0	221.3	6.23
5	216.2	215.8	0.19

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					
92.1(125.2)	409.2(41.8)	2250	24.468 (29.611)	0.266 (0.195)	3.110(4.228)
77.2 (105.0)	550.9 (56.2)	1400	18.251 (22.012)	0.237 (0.174)	3.505 (4.765)**
ii) Power at rated engine speed (2200 rpm)					
94.3(128.2)	428.6(43.7)	2200	24.507 (29.634)	0.260 (0.191)	3.182(4.327)
87.0(118.3)	395.3(40.3)	2200	23.858 (29.060)	0.274 (0.202)	2.994(4.070)*
iii) Maximum torque					
79.9(108.6)	550.8(56.2)	1450	18.878 (22.773)	0.236 (0.174)	3.509(4.770)
67.7(92.0)	520.7(53.1)	1300	17.207 (20.959)	0.254 (0.187)	3.230(4.392)*
70.0 (95.2)	583.0(59.5)	1200	17.133 (20.618)	0.244 (0.179)	40.086 (5.555)**
iv) Five hour rating test*					
a) Engine loaded to 90% of maximum power					
81.4(110.7)	356.6(36.4)	2283	22.441(27.330)	0.276 (0.203)	2.980(4.052)
b) maximum power					
89.7(122.0)	407.7(41.6)	2200	24.133 (29.395)	0.269(0.198)	3.052(4.149)

* Under high ambient condition.

** At part throttle speed specified for field work (1650 rpm).

Remarks

- The maximum power output of the engine was observed as 92.1 kW (125.2 Ps) & 77.2 kW (105.0 Ps) at 2250 rpm and 1400 rpm of engine at full throttle and setting recommend for field operation respectively.
- The specific fuel consumption corresponding to maximum power at full throttle and setting recommended for field operation was measured as 0.266 and 0.237 Kg/kwh (0.195 and 0.174 kg/hph).
- The back-up torque of the engine was measured as 30.8 % in natural ambient at full throttle which is normal.
- The maximum smoke density was recorded as 4.45 (Bosch No.) which is within permissible limit
- The maximum temperature of engine oil, coolant (water) and exhaust gas was observed as 108.4, 99.0 and 499.2°C respectively.
- The lubricating oil & coolant consumption during five hours rating test were

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measured as 0.392 g/kWh (0.288 g/hph) and 0.32% 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.

17.3 Visibility

The visibility around the cutter bar from operator's seat in normal sitting position is satisfactory.

17.4 Braking Performance

- The brake pedal force and stopping distance corresponding to 2.5 m/sec² are 9.62 m and 188.9N respectively and the performance is in line with the IS 12207-1987 & CMVR requirements.
- 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 level at bystander and at operator's ear level is found 86.3 and 95.1 dB(A) respectively which is within specified noise level 88 dB(A) and 98 dB(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)	2.08 to 2.18	3.13 to 3.31	2.13	3.21
2.	Area covered (ha/h)	0.726 to 0.806	0.596 to 1.099	0.773	0.860
3.	Fuel consumption: - (l/h) - (l/ha)	9.026 to 12.346 12.084 to 15.318	7.250 to 9.615 7.526 to 12.164	10.260 13.279	8.676 10.350
4.	Crop throughput (tonne/h)	6.109 to 8.185	6.749 to 17.376	6.779	11.299
5.	Grain breakage in main grain outlet(%)	1.112 to 1.684	0.893 to 1.749	1.517	1.246
6.	Header losses(%)	1.014 to 1.631	0.057 to 0.588	1.269	0.320
7.	Total non-collectable losses(%)	1.018 to 1.645	0.213 to 0.654	1.277	0.430
8.	Total collectable losses(%)	0.029 to 0.200	0.661 to 1.440	1.647	1.116
9.	Total processing losses(%)	1.152 to 1.886	2.050 to 3.398	0.125	2.472
10.	Threshing efficiency(%)	99.80 to 99.97	98.50 to 99.33	99.87	98.87
11.	Cleaning efficiency(%)	96.27 to 96.87	96.10 to 96.93	96.61	96.49

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17.7.1 Wheat Harvesting

- i) The grain breakage in PBW 373 variety was measured as 1.112 to 1.684% (Average 1.517%) which is within the specified limit of 2.5% in IS: 15806-2008.
- ii) The total non collectable losses ranged from 1.018 to 1.645% (Average 1.277%) which is within specified limit of 2.5% in IS: 15806-2008.
- iii) The total processing losses ranged from 1.152 to 1.886% (Avg. 0.125%) which is within specified limit of 2.5% in IS: 8122(Part-1)1994.
- iv) The threshing efficiency ranged from 99.80 to 99.97% (Average 99.87%) which is above the specified limit of 98% in IS:15806-2008.
- v) The cleaning efficiency ranged from 96.27 to 96.87% (Average 96.61%) which is above the specified limit of 96% in IS:15806-2008.



17.7.2 Paddy Harvesting

- i) The grain breakage ranged from 0.893 to 1.749% (Average 1.246%) which is within specified limit of 2.5% in IS:15806-2008.
 - ii) The total non-collectable losses ranged from 0.213 to 0.654% (Average 0.430%) which is within specified limit of 2.5% in IS:15806-2008.
 - iii) The total processing losses ranged from 2.050 to 3.398 % (Average 2.472%). Average value is within specified limit of 2.5% in IS:8122(Part-1)1994.
 - iv) The threshing efficiency ranged from 98.50 to 99.33 % (Average 98.87%) which is above the specified limit of 98% in IS:15806-2008.
 - v) The cleaning efficiency ranged from 96.10 to 96.93% (Average 96.49%) 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 the same were recommended by the applicant.

17.7.4 Ease of Operation and Safety Provision

- i) The controls provided around the operator are within easy reach 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 operators position.
- vi) The grain tank needs to be provided with suitable grain fill indicator device.

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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 Hardness and Chemical composition

- i) Hardness of knife blade does not conform with the limits of hardness specified in IS: 6025-2004 for both hardened zone and remainder zone.
- ii) Chemical composition of knife blade does not conform with limits specified in IS: 6025-2004 for manganese. Components 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:

Operator manual for prime mover (engine) for repair and maintenance is provided. However, it needs to be modified as per IS:8132-1999 in Hindi and other regional languages 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.	96.0 (130.5)	92.1(125.2)	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.	75-80 (102 to108.8)	77.2(105)	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.	96.0 (130.5)	94.3(128.2)	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 $\pm 5\%$	266	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	--	4.45	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 declared value by manufacturer.	475 N-m	583	Conforms
vii)	Back up torque, %	7% min.	--	30.8	Conforms
viii)	Max. operating temp. To be declared by manufacturer	i) engine oil ii) Coolant	120 95	108.4 99.0	Conforms Does not conform



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	ix)	Lubrication oil consumption, g/kWh	1% of SFC at 5hr. max. power test during high ambient condition with tolerance limit of +10%.	2.69±10%	0.392	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	--	9.62N at 188.7N	Conforms
	ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec ² .	≤ 600N.	--	188.7N	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 μm max.	--	140 μm	Does not conform
	ii)	Steering wheel	150 μm max.	--	150 μm	Conforms
	iii)	Seat with driver seated	120 μm max.	--	80 μm	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.	--	Not applicable as dry type air cleaner is provided	--
5.	Noise measurement					
	i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	--	86.3 dB(A)	Conforms
	ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,	--	95.1dB(A)	Conforms
6.	Discard limit					
	i)	Cylinder bore diameter, mm	Should not exceed the values declared by the manufacture	107.534	107.32(max)	Conforms
	ii)	Piston diameter, mm	-do-	106.40	106.56(min)	Conforms
	iii)	Ring end gap, mm	--do--	2.0	0.60(max)	Conforms
	iv)	Ring groove clearance, mm	--do--	0.20	0.07 to 0.11	Conforms
	v)	Diametrical and axial clearance of big end bearing, mm	-do-	Diametrical 0.18 Axial 0.25	Diametrical 0.10(max) Axial - 0.15(max)	Conforms

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	vi)	Diametrical and axial clearance of main bearings, mm	--do--	Diame- trical 0.178 Axial 0.356	Diametrical 0.10(max) Axial 0.15	Conforms Conforms
	vii)	Thickness of brake lining mm	--do--	Up to rivet head	5.0 mm above rivet head	Conforms
	viii)	Thickness of clutch plate, mm	--do--	Up to rivet head	5.0 mm above rivet head	Conforms
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- 1.112 to 1.684% (Avg.=1.517%) Paddy- 0.893 to 1.749% (Avg.=1.246%)	Conforms for both wheat and paddy
	iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean	--	Wheat- 1.018 to 1.645% (Avg.=1.277%) Paddy- 0.213 to 0.654% (Avg.= 0.430%)	Conforms for both wheat and paddy
	iv)	Threshing efficiency	≥ 98% wheat & paddy	--	Wheat- 99.80 to 99.97% (Avg.=99.87%) Paddy- 98.50 to 99.33% (Avg.=98.87%)	Conforms for both wheat and paddy
	v)	Cleaning efficiency	≥ 96 % wheat & paddy	--	Wheat- 96.27 to 96.87% (Avg.=96.61%) Paddy- 96.10 to 96.93 (Avg.=96.49%)	Conforms for both wheat and paddy
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	Conforms
	iii)	Grain tank cover	Essential	--	Not provided	Does not Conform



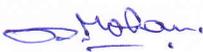
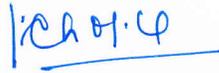
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9.	iv)	Spark arrester in engine's exhaust	Essential	--	Not provided	-- (However the turbo charged engine eliminates the requirement of the separate spark arrester)	
	v)	Stone trap before concave	Essential	--	Provided	Conforms	
	vi)	Rear view mirror	Essential	--	Provided	Conforms	
	vii)	Slip clutch at following drives - a) Cutting platform b) under shot conveyor drive c) Grain & tailing elevator	Essential	--	Not Provided Provide Not Provided	Does not Conform 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	--	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)	-	C=0.10% Mn=0.25% Si=0.07% P=0.116% S=0.031%	Unascertainable as the relevant code does not specify the limit of content.	
	ii)	Knife blade As per IS :6025 -1982	It must have Chemical composition as C= 0.70-0.95 % Mn =0.30-0.50 %	-	0.85% 0.64%	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=0.36%	Conforms		

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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 *

TESTING AUTHORITY

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



APPLICANT'S COMMENTS

S.No	Our reference	Applicant's comments
1.	Para 18 selected performance and other characteristics as per IS 15806:2008 S. No 3(i)	Operator's platform to be supported properly without vibrations regular production level in future
2.	Para 18 selected performance and other characteristics as per IS 15806:2008 S. No 8(iii)	Grain tank cover to be provided in future at regular production level.
3.	Para 18 selected performance and other characteristics as per IS 15806:2008 S. No 8(vii)	In future slip clutches will be provided in our product ISHER 767 at regular production level.