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व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT

संख्या / No. : COMB-68/1421
माह/ Month : August, 2012



**SELF PROPELLED COMBINE HARVESTER
'GURDIAL-651'**



उ. भू. कृषि. विभाग, हिसार
पुस्तकालय
प्रबोधन संग्रह...
दिनांक
मूल्य

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
ड्रैक्टर नगर, सिरसा रोड, हिसार -125001 (हरियाणा)

**NORTHERN REGION FARM MACHINERY TRAINING AND TESTING INSTITUTE
TRACTOR NAGAR, SIRSA ROAD, HISAR-125001 (HARYANA)**

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17.9 Wear of rasp bar:

Sr. No.	Mass of rasp bar before test (g)	Mass of rasp bar after 50.9 h of test (g)	Wear (%) by weight
1	6164	6108	0.91
2	6077	6024	0.87
3	6072	6029	0.71
4	5904	5852	0.88

**17.10 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 25.31 hours of test (g)	Percent wear by weight (%)
a) Peg teeth of threshing cylinder:			
1.	220.0	219.2	0.36
2.	224.7	223.7	0.45
3	207.8	206.4	0.67
4	229.5	228.5	0.44
5	221.4	220.3	0.50
6	225.8	224.2	0.71
7	212.8	211.3	0.70
8	226.0	224.7	0.58
b) Peg teeth of Concave:			
1	223.0	222.2	0.36
2	216.7	215.6	0.51
3	212.7	211.6	0.52
4	216.5	215.3	0.55
5	218.5	217.0	0.69
6	220.2	219.6	0.27

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:					
80.37(109.30)	349.4(35.6)	2300	21.182 (25.368)	0.263(0.194)	3.168(4.309)
64.12(87.20)	388.6(39.6)	1650	15.769 (18.885)	0.246(0.181)	3.396(4.618)**

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ii) Power at rated engine speed (2200 rpm)

78.56(106.84)	357.1(36.4)	2200	20.589 (24.657)	0.262(0.193)	3.156(4.333)
75.72(102.98)	344.2(35.1)	2200	20.019 (23.974)	0.264(0.194)	3.158(4.295)*

iii) Maximum torque:

49.33(67.09)	411.1(41.9)	1200	11.921 (14.277)	0.242(0.178)	3.455(4.699)
53.83(73.21)	384.5(39.2)	1400	13.329 (15.963)	0.248(0.182)	3.372(4.586)*
46.66(63.45)	405.7(41.4)	1150	11.120 (13.318)	0.238(0.175)	3.504(4.764)**

iv) Five hour rating test:**a) Engine loaded to 90% of maximum power:**

70.70(96.15)	301.7(30.8)	2343	18.781 (22.491)	0.266(0.194)	3.144(4.275)
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b) maximum power:

76.42(103.93)	335.9(34.3)	2275	20.674 (24.760)	0.271(0.199)	3.087(4.198)
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*** 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 80.4 kW (109.3 Ps) & 64.1 kW (87.2 Ps) at 2300 rpm and 1650 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 0.263 & 0.246 Kg/kwh (0.194 & 0.181 kg/hph).
- iii) The back-up torque of the engine was measured as 18.7 % in natural ambient at full throttle.
- iv) The maximum smoke density was recorded as 2.12 (Bosch No.) which is within permissible limit
- v) The maximum temperature of engine oil, coolant(water) and exhaust gas was observed as 138.5, 111.9 and 719°C respectively.
- vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.855 (0.628) g/kWh (g/hph) and 4.3% of total coolant capacity respectively.

18.2 Turning ability:

The radius of turning circle at LHS and RHS was observed satisfactory. Combine is provided with independent brake pads for right and left brake.

18.3 Visibility:

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

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18.4 Braking Performance:

- i) The mean deceleration and stopping distance corresponding to 285 N pedal force was measured as 3.86 m/sec² and 5.06 m respectively. The performance is in line with the IS:12207-1987.
- 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:

The noise level at standard level and at operator's ear level is found 85.6 and 95.7 dB(A) respectively which is within specified noise level 88 dB(A) and 98 dB(A) in IS:12180-2000.

18.7 Air cleaner oil pull over test:

The maximum oil pull over was observed as 0.21%.

18.8 Field Test:

18.8.1 Summary of field tests:

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)	3.89 to 4.06	1.67 to 1.81		
2.	Area covered (ha/h)	0.740 to 1.480	0.430 to 0.808		
3.	Fuel consumption: - (l/h) - (l/ha)	5.962 to 7.444 5.014 to 9.030	5.467 to 9.346 9.780 to 12.858		
4.	Crop throughput (tonne/h)	10.3 to 16.2	5.4 to 8.2		
5.	Grain breakage in main grain outlet(%)	0.464 to 1.396	0.809 to 4.303	0.755	1.659
6.	Header losses(%)	0.565 to 2.609	0.067 to 0.811	1.477	0.414
7.	Total non-collectable losses(%)	0.621 to 2.761	0.074 to 0.849	1.599	0.433
8.	Total collectable losses(%)	0.000 to 0.890	1.488 to 4.450	0.333	2.827
9.	Total processing losses(%)	0.542 to 1.980	2.406 to 8.249	1.207	4.505
10.	Threshing efficiency(%)	99.08 to 99.99	95.51 to 98.51	99.65	97.15
11.	Cleaning efficiency(%)	97.07 to 99.17	89.47 to 96.33	98.10	93.77

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18.8.1.1 Wheat Harvesting:

- i) The grain breakage in all the varieties tested was measured as 0.464 to 1.396 (Average 0.755) which is within specified limit of 2.5% as specified in IS:15806-2008.
- ii) The total non collectable losses ranged from 0.621 to 2.761 percent (Average 1.599) which is within specified limit of 2.5% as specified in IS:15806-2008.
- iii) The total processing losses ranged from 0.542 to 1.980 % (Avg. 1.207%).
- iv) The threshing efficiency ranged from 99.08 to 99.99% (Average 99.65) which is above the specified limit of 98% as specified in IS:15806-2008.
- v) The cleaning efficiency ranged from 99.07 to 99.17% (Average 98.10%) which is above the specified limit of 96% as specified in IS:15806-2008.

18.8.1.2 Paddy Harvesting:

- i) The grain breakage ranged from 0.809 to 4.303 % (Average 1.659) which is within specified limit of 2.5% as specified in IS:15806-2008..
- ii) The total non-collectable losses ranged from 0.074 to 0.849% (Average 0.433) which is within specified limit of 2.5% as specified in IS:15806-2008..
- iii) The total processing losses ranged from 2.406 to 8.249 % (Average 4.505%).
- iv) The threshing efficiency ranged from 95.51 to 98.51 %(Average 97.15%) which is below the specified limit of 98% as specified in IS:15806-2008.
- v) The cleaning efficiency ranged from 89.47 to 96.33% (Average 93.77%) which is on the lower side from the limit of 96% as specified in IS:15806-2008.

Necessary improvements to increase cleaning efficiency and threshing 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 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, undershot conveyor and grain & tailing elevator are considered essential from safety point of view which needs to be provided at production level.

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- 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 while working on cutter bar.

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 as normal.



18.9 Hardness and Chemical composition:

- 18.9.1 Hardness of knife blade in hardened zone and 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.
- 18.9.2 Chemical composition of knife blade and knife back does not conform with the limits specified in respective Indian Standard. Components with chemical composition conforming to Indian standard should be used 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 as per IS:10273-1999 is provided on the combine harvester.

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18.12 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.

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)	80.37(109.3)	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.	71.3(97.0)	64.7(88.0)	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.	80.9 (110 Ps)	78.56(106.8)	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.	233.3	263	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	-	2.12	Conforms

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	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.	389.3	405.7	Conforms
	vii)	Back up torque, %	7% min.	--	18.7	Conforms
	viii)	Max. operating temp. To be declared by manufacturer	i) engine oil ii) Coolant	160° C 95° C	138.5° C 111.9° C	Conforms Does not conform
	ix)	Lubrication oil consumption, g/kWh	1% of SFC at 5hr. max. power test with tolerance of +10% during high ambient condition	2.98	0.855	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	5.19	5.06	Conforms
	ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec ² .	≤ 600N.	--	285 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 µm max.	--	100	Conforms
	ii)	Steering wheel	150 µm max.	--	90	Conforms
	iii)	Seat with driver seate	120 µm max.	--	90	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.	--	0.21	Conforms

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5.		Noise measurement				
i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	--	85.6	Conforms	
ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,	--	95.7	Conforms	
6.		Discard limit				
i)	Cylinder bore diameter, mm	Should not exceed the values declared by the manufacture	107.546 mm	107.31	Conforms	
ii)	Piston diameter, mm	-do-	106.228	106.53 (min.)	Conforms	
iii)	Ring end gap, mm	--do--	2.25	0.45(max.)	Conforms	
iv)	Ring groove clearance, mm	--do--	0.254	0.21(max.)	Conforms	
v)	Diametrical and axial clearance of big end bearing, mm	-do-	Diametrical 0.500 Axial - 0.150	Diametrical 0.090 Axial - 0.15	Conforms	
vi)	Diametrical and axial clearance of main bearings, mm	--do--	0.356 mm	Diametrical 0.09 Axial - 0.10	Conforms	Conforms
vii)	Thickness of brake lining, mm	--do--	Upto rivet head	6.0	Conforms	
viii)	Thickness of clutch plate, mm	--do--	-do-	11.7	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- 0.755 (Avg.) Paddy- 1.659 (Avg.)	Conforms for both wheat and paddy	
iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean	--	Wheat- 1.599 (Avg.) Paddy- 0.433 (Avg.)	Conforms Conforms	
iv)	Threshing efficiency	≥ 98% wheat & paddy	--	Wheat- 99.65 Paddy- 97.15	Conforms Does not conform for paddy	
v)	Cleaning efficiency	≥ 96 % wheat & paddy	--	Wheat- 98.10 Paddy- 93.77	Conforms Does not conform for 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	--	Not provided	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	--	Not Provided Not Provided Not provided	Does not conform Does not conform 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
Material of construction :					
i)	Guard should conforms 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)	-	-	Unascertainable as the relevant code does not specify the content limit.
ii)	Knife blade As per IS :6025 -1982	It must have Chemical composition as C= 0.70-0.95 %	-	C= 0.84 Mn= 0.74	Conforms Does not conform

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		Mn =0.30-0.50 %			
iii)	Knife back Must meet requirement IS:10378-1982	The knife back shall be manufactured from Carbon Steel having minimum carbon content of 0.35 %	-	Carbon content is 0.22%	Does not conform
10.	Labelling of combine harvester				
	It should conforms 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) ASSISTANT ENGINEER (W/S)	
(P. K. CHOPRA) SENIOR AGRICULTURAL ENGINEER	
A. N. MESHRAM -DIRECTOR-	

APPLICANT' S COMMENTS

The firm has submitted an undertaking to remove the non conformity of the following clauses mentioned under Para 19 by making improvement in their combine harvester :-

- S.No. 7 (iv) : Threshing efficiency in paddy crop
- S.No. 7(v) : Cleaning efficiency in paddy crop
- S.No. 8 (iii) : Grain tank cover
- S.No. 8(iv) : Spark arrester in engine exhaust
- S.No. 8(viii) : Safety clutches at cutting platform, undershot conveyor,
grain and tailing auger
- S.No. 8(x) : Labelling of control gauges as per BIS.