व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT

संख्या / No. : Comb-134/1694/2014
माह / Month: December, 2014

SELF PROPELLED COMBINE HARVESTER 'CRUZER 7504 DLX-SP'

सत्यमेव जयते

भारत सरकार
कृषि मंत्रालय
कृषि एवं सहकारिता विभाग)

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

उत्तरी क्षेत्र कृषि मशीनरी प्रशिक्षण एवं परीक्षण संस्थान
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4	214.5	214.1	0.19
5	204.5	204.4	0.05
6	215.0	214.6	0.19
7	221.3	221.0	0.14
8	215.8	215.5	0.14
b)	**Peg teeth of Concave:**		
1	215.7	215.2	0.23
2	213.0	212.7	0.14
3	218.6	218.3	0.14
4	196.0	195.9	0.05
5	215.7	215.4	0.14
6	222.5	222.1	0.18
7	216.1	215.9	0.09
8	208.2	208.0	0.10

16.10 Wear of rasp bar Maize harvesting

Sr. No.	Mass of raspbar before test, g	Mass of raspbar after 29.27 h. of test, g	wear (%) by weight
1.	4651.9	4639.2	0.27
2.	4416.9	4405.9	0.25
3.	4574.5	4561.3	0.29
4.	4481.0	4469.1	0.27

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 consump-tion kg/h / (l/h)	Specific fuel consump- tion kg/kwh (kg/hph)	Specific energy, kWh/l (hph/l)
i) Maximum power - 2 hours test:					
50.16(68.20)	217.7(22.2)	2200	14.550/17.505	0.290/0.213	2.865/3.896
40.70(55.34)	232.0(22.2)	1675	11.945/14.407	0.293/0.213	2.825/3.841**
ii) Power at rated engine speed (2200 rpm)					
50.16(68.20)	217.7(22.2)	2200	14.486/17.432	0.289/0.212	2.877/3.912
45.67(62.09)	198.2(20.2)	2200	13.806/16.775	0.303/0.222	2.723/3.701*
iii) Maximum torque:					
38.95(52.96)	265.7(27.1)	1400	10.492/12.626	0.269/0.198	3.085/4.195
33.23(45.18)	230.8(23.5)	1375	8.832/10.718	0.266/0.195	3.100/4.215*
32.64(44.38)	259.7(26.5)	1200	8.274/9.969	0.253/0.186	3.274/4.452**
iv) Five hour rating test:					
a) Engine loaded to 90% of maximum power:					
42.91(58.34)	179.0(18.3)	2290	13.485/16.405	0.314/0.231	2.616/3.556*

b) maximum power:					
45.65(62.07)	198.1(20.2)	2200	13.743/16.734	0.301/0.221	2.728/3.709*

* **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 50.16 (68.20) & 40.70(55.34) kW(Ps) at 2200 rpm and 1675 rpm respectively of engine at full throttle and setting recommend for field operation respectively, under natural ambient conditions during 2 hrs maximum power test.

ii) The specific fuel consumption corresponding to maximum power at full throttle and settings recommended for field operation was measured as 0.290 (0.213) and 0.293 (0.213) kg/kWh (kg/hph), under natural ambient conditions during 2 hrs maximum power test.

iii) The back-up torque of the engine was measured as 22.02 % in natural ambient at full throttle where as field rpm setting it was 10.48% corresponding to field rpm setting of 2200 rpm respectively.

iv) The maximum smoke density was recorded as 2.87 (Bosch No.) which is within permissible limit as specified in IS:15806-2008.

v) The maximum temperature of engine oil, coolant (water) and exhaust gas was observed as 130, 114 and 625 respectively, under high ambient condition.

vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.513 g/kWh(0.377 g/hph) and 1.08% of total coolant capacity respectively.

17.2 Turning ability:

The radius of turning circle at LHS and RHS was observed satisfactory. Combine is provided with independent foot 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:

i) The minimum stopping distance was observed as 9.12 h.

ii) The pedal force corresponding to mean deceleration of 2.5 m/sec^2 was observed as 104.9 N respectively.

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:

i) The ambient noise emitted by the machine was measured as 88.9 db(A)as against the maximum specified limit of 88 db(A) with relevant BIS code, which exceeds be limit.

Ii) The max. noise at driver's ear level was measured as 100.0 dB(A) as against the maximum specified limit of 98 db(A) in relevant BIS code.

17.7 Air cleaner oil pull over test

This test is not applicable due to dry type air cleaner.

17.8 Field Test:

17.8.1 Summary of field tests:

The results of the field test are summarized below:

S. No	Parameters	Wheat Harvesting	Paddy Harvesting	Maize Harvesting	Average		
					Wheat	Paddy	Maize
1.	Speed of operation (kmph)	2.76 to 2.95	2.49 to 2.80	0.63 to 0.94	2.85	2.59	0.84
2.	Area covered (ha/h)	0.503 to 0.598	0.568 to 0.655	0.183 to 0.244	0.552	0.606	0.215
3.	Fuel consumption: - (l/h) - (l/ha)	6.744 to 7.831 12.385 to 14.889	7.754 to 8.261 11.838 to 14.057	6.045 to 7.055 26.414 to 33.748	7.392 13.432	7.953 13.150	6.383 29.839
4.	Crop throughput (tonne/h)	3.41 to 7.96	5.71 to 9.27	Nil	4.60	7.27	Nil
5.	Grain breakage in main grain outlet(%)	0.354 to 1.233	0.233 to 1.143	4.502 to 6.896	0.862	0.624	6.002
6.	Header losses(%)	0.319 to 3.143	0.362 to 1.717	0.058 to 2.393	1.611	0.938	0.905
7.	Total non-collectable losses(%)	0.439 to 3.384	0.615 to 1.764	0.083 to 2.408	1.832	1.075	0.944
8.	Total collectable losses(%)	0.128 to 1.311	1.214 to 2.159	Nil	0.427	1.831	Nil
9.	Total processing losses(%)	0.723 to 1.905	2.309 to 3.108	4.517 to 6.951	1.510	2.592	6.041
10.	Threshing efficiency(%)	99.46 to 99.85	97.83 to 98.77	100.0	99.67	98.15	100.0
11.	Cleaning efficiency(%)	97.70 to 98.43	95.60 to 96.33	91.07 to 94.50	97.99	95.88	92.68

17.7.1.1 Wheat Harvesting:

i) The grain breakage in all the varieties tested was measured as 0.354 to 1.233% (Avg. 0.862%) which is within specified limit of 2.5% as specified in IS: 15806-2008.

ii) The total non collectable losses ranged from 0.439 to 3.384 percent (Avg. 1.832%) which is within specified limit of 2.5% as specified in IS: 15806-2008.

iii) The total processing losses ranged from 0.723 to 1.905% (Avg. 1.510%).

iv) The threshing efficiency ranged from 99.46 to 99.85% (Avg. 99.67%) which is within the specified limit of 98% as specified in IS : 15806-2008.

v) The cleaning efficiency ranged from 97.70 to 98.43% (Avg. 97.99%) which is within limit of 96% as specified in IS: 15806-2008.

17.7.1.2 Paddy Harvesting:

i) The grain breakage ranged from 0.233 to 1.143% (Avg. 0.624) which is within specified limit of 2.5% as per specified in IS: 15806-2008.

ii) The total non-collectable losses ranged from 0.615 to 1.764% (Avg. 1.075%) which is within specified limit of 2.5% as specified in IS: 15806-2008.

iii) The total processing losses ranged from 2.309 to 3.108% (Avg. 2.592%).

iv) The threshing efficiency ranged from 97.83 to 98.77% (Average 98.15%) which is with in specified limit of 98% as per specified in IS: 15806-2008.

v) The cleaning efficiency ranged from 95.60 to 96.33% (Avg. 95.88%) which is slightly lower than the limit of 96% as specified in IS: 15806-2008.

17.7.1.3 Maize Harvesting

i) The grain breakage ranged from 4.502 to 6.896% (Avg. 6.002%) which is higher side.

ii) The total non-collectable losses ranged from 0.083 to 2.408% (Avg. 0.944%) which is normal side.

iii) The total processing losses ranged from 4.517 to 6.951% (Avg. 6.041%). Which is higher side.

iv) The threshing efficiency ranged from 97.83 to 98.77% (Average 98.15%) which is with in specified limit of 100% as per specified in IS: 15806-2008. Which is normal side.

v) The cleaning efficiency ranged from 91.07 to 94.50% (Avg. 92.68%) which is lower side.

17.7.2 Harvesting of any other crops:

The performance of combine to harvest wheat, paddy and maize 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 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 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 by a hydraulic system.

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.

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.

17.9 Hardness and Chemical composition:

17.9.1 Hardness of knife blade in reminder zone knife guard and raspbar was measured as 17 and 18 HRC respectively which are not conforming to IS: 6025-1999, IS: 6024-1999 & IS: 10378-1982 respectively.

17.9.2 Manganese content of knife blade & carbon content of knife guard are does not conforming to is 6025-1982 & IS 10378-1982.

17.10 Maintenance/defect problems:

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

The frequently overheating is found, which is serious for continue for continue working of machine, hence new radiator (make radis, 12.5 lit capacity) with a one blower fan are fitted in front of the engine &at rearside of a combine.

Electrical wiring problems frequently arised, it tends to malfunctioning of starting switch & gauges.

During Maize harvesting excessive grain breakage losses & lower cleaning efficiency are observed, these should be need to do improvement in crop guide arrangement from corn header side to guide a crop material and better trash control during threshing & cleaning operation.

17.11 Labelling of Combine Harvester:

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

17.12 Literature supplied with the Machine:

Operator manual, part catalogue and service manual are provided for customer guide. However, a manual in respect of combine harvester as a whole should be brought out in Hindi and other regional languages as per relevant Indian standards IS:8132-1999 to guide to users and operator of combine.

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.	55.1 (74.8)	50.16 (68.20)	**Does not conform**
	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.	51.8 (70.5)	40.70 (55.34)	**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.	55.1 (74.8)	50.16 (68.20)	**Does not conform**
	iv)	Specific fuel consumption g/kWh.	The average observed value during 2 hr. max. power test must be within ±5% of the declared value by applicant/ manufacturer.	250	290	**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	-	2.87	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.	295	259.7	Does not conform

	vii)	Back up torque, %	7% min.		22.02	Conforms
	viii)	Max. operating temp. To be declared by manufacturer	i) engine oil ii) Coolant	132 110	128 114	Conforms **Does not conform**
	ix)	Lubrication oil consumption, g/kWh	1% of SFC at 5hr. max. power test during high ambient condition	2.50	0.513	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≤ 0.15V + V^2/130 V=speed corresponding to 80% of design max. speed, kmph	-	9.12	Conforms
	ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec^2.	≤ 600N.	-	104.9	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.	-	210	**Does not conform**
	ii)	Steering wheel	150 µm max.	-	510	**Does not conform**
	iii)	Seat with driver seated	120 µm max.	-	180	**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	Not applicable		-	-
5.	**Noise measurement**					
	i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR		88.9	**Does not conform**
	ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,		100	**Does not conform**

6.	**Discard limit**					
	i)	Cylinder bore diameter, mm	Should not exceed the values declared by the manufacture	95.18	95.04	Conforms
	ii)	Piston diameter	-do-	94.75	94.88	Conforms
	iii)	Ring end gap	--do--	1st comp ring-1.5 2nd comp ring-1.5 Oil control- 1.5	1st comp ring-0.20 2nd comp ring-0.85 Oil control- 0.35	Conforms
	iv)	Ring groove clearance	--do--	1st comp ring-NA 2nd comp ring-0.25 Oil control-0.25	1st comp ring-NA 2nd comp ring-0.06 Oil control- 0.04	Conforms
	v)	Diametrical and axial clearance of big end bearing	-do-	Diametrical – 0.25 Axial- 0.75	Diametrical – 0.09 Axial- 0.20	Conforms
	vi)	Diametrical and axial clearance of main bearings	--do--	Diametrical – 0.25 Axial- 0.50	Diametrical – 0.13 Axial- 0.10	Conforms
	vii)	Height over the rivet of a brake lining	Not applicable	Up to rivet head	1.45 (Transmission clutch plate) 1.48 (PTO clutch plate)	Conforms
	viii)	Height over the rivet of a clutch plate	--do--	Up to rivet head	1.45 (Transmission clutch plate) 1.48 (PTO clutch plate)	Conforms
7.	**Field performance**					
	i)	Suitability for crops	Wheat & paddy essential		Wheat, paddy & maize	Conforms
	ii)	Grain breakage in grain tank	≤ 2.5 %		Wheat- 0.354 to 1.233 % (Avg.0.862%) Paddy-0.233 to 1.143% (Avg.0.624%) Maize4.502 to 6.896 (Avg.6.002%)	Conforms Conforms -

	iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean		Wheat-0.439 to 3.384% (Avg.1.832%) Paddy-0.615 to 1.764% (Avg.1.075%) Maize-0.083 to 2.408% (Avg.0.944%)	Conforms Conforms -
	iv)	Threshing efficiency	≥ 98% wheat & paddy		Wheat- 99.46 to 99.85% (Avg. 99.67%) Paddy-97.83 to 98.77% (Avg.98.15%) Maize 100% (Avg. 100%)	Conforms Conforms -
	v)	Cleaning efficiency	≥ 96 % wheat & paddy		Wheat- 97.70 to 98.43% (Avg. 97.99%) Paddy-95.60 to 96.33% (Avg. 95.88%) Maize-91.07 to 94.50% (Avg.92.68%)	Conforms **For wheat** -
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 with CMVR certification No. CMVR/ COMB-SP/2012-13/123	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	Essential	Provided	Not Provided	**Does not conform**

		b) under shot conveyor drive c) Grain & tailing elevator		Provided Not Provided	Provided Provided in only grain elevator	Conforms Conforms only for grain elevator
	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	--	Labelled with symbols	Conforms
9.	**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)	-	C - 0.21 Si - 0.38 Mn - 0.38 P - 0.02 S – 0.005	The limits are not specified in the relevant code.
	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 – 0.75 Mn – 0.64	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 %	-	C – 0.10	**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 A_1, A_2, A_3	--	1.Overheating problem arised, hene new radiator & blower fan fitted in front of engine (Major) 2. Malfunctioning of electrical wiring (Major)	Conforms

TESTING AUTHORITY

G.R. AMBALKAR **Agricultural Engineer**	Ambalkar
R.K. NEMA **Senior Agricultural Engineer**	Ram
HIMAT SINGH **Director**	HS

Test report compiled by: **Sh. S.A. Hinge, Sr. Tech. Assistant**

19. Applicants comments

Sr. No.	Para	Applicant's comment
1.	All	All the suggestions for improving the performance and conformity to the requirement, provision of safety arrangements would be appropriately taken up and incorporated suitably.