व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT

संख्या / **No. : Comb – 110/1602**
माह / **Month: May, 2014**

SELF PROPELLED COMBINE HARVESTER 'MATHARU-8500'

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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17.7 Bearings:

All the bearings of different assemblies of the combine were inspected and found in normal working conditions.

17.8 Wear of rasp bar

Sr. No.	Mass of rasp bar before test (g)	Mass of rasp bar after 26.67h test (g)	Wear (%) by weight
1	5956	5916	0.63
2	5755	5707	0.83
3	5805	5760	0.78
4	5801	5759	0.72

17.9 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 25.08 h of test (g)	Percent wear by weight (%)
a)	**Peg teeth of threshing cylinder:**		
1.	215.1	214.3	0.37
2.	221.9	220.6	0.59
3	221.8	221.2	0.27
4	216.7	216.0	0.32
5	208.9	208.0	0.43
6	211.9	210.9	0.47
7	218.5	217.7	0.37
8	215.4	214.2	0.56
b)	**Peg teeth of Concave:**		
1	198.5	198.3	0.10
2	213.6	213.1	0.23
3	212.7	212.4	0.14
4	222.0	221.8	0.09

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 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:					
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)	4.086(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 no load speed corresponding to rated speed of 1700 rpm specified for field work.**

Remarks:

i) 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.

ii) The specific fuel consumption corresponding to maximum power at full throttle and setting recommended for field operation was measured as 0. 266 & 0.237 Kg/kwh (0.195 & 0.174 kg/hph).

iii) The back-up torque of the engine was measured as 30.8 % under natural ambient at full throttle.

iv) The maximum smoke density was recorded as 4.45 (Bosch No.) which is within permissible limit

v) The maximum temperature of engine oil, coolant(water) and exhaust gas was observed as 108.4, 99 and 492° C respectively.

vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.392(0.288) g/kWh (g/hph) and 0.32% of total coolant capacity respectively.

18.2 Turning ability:

The radius of turning circle at LHS and RHS was observed satisfactory.

18.3 Visibility:

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

18.4 Braking Performance:

i) The stopping distance and pedal force corresponding to deceleration of 2.5 m/sec^2 where measured as 13.9 m and 252 N 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 ambient noise emitted by the machine at bystander and driver's ear level were measured as 91.2 & 99.8 dB (a) respectively.

18.7 Field Test:

18.7.1 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)	3.64 to 3.70	3.41 to 4.33	3.66	3.62
2.	Area covered (ha/h)	1.03 to 1.20	0.88 to 0.98	1.09	0.93
3.	Fuel consumption: - (l/h) - (l/ha)	 7.0 to 8.24 6.37 to 7.83	 8.12 to 10.0 8.28 to 10.90	 7.69 7.07	 9.19 9.91
4.	Crop throughput (tonne/h)	8.92 to 15.38	18.15 to 23.83	12.11	20.55
5.	Grain breakage in main grain outlet(%)	1.710 to 1.915	1.212 to 2.290	1.824	1.619
6.	Header losses(%)	0.647 to 1.483	0.460 to 0.828	0.924	0.725
7.	Total non-collectable losses(%)	0.748 to 1.493	0.491 to 1.071	1.057	0.860
8.	Total collectable losses(%)	0.100 to 0.230	0.00 to 0.834	0.152	0.415
9.	Total processing losses(%)	1.964 to 2.240	1.525 to 2.431	2.109	2.169
10.	Threshing efficiency(%)	99.8 to 99.9	99.2 to 99.9	99.8	99.6
11.	Cleaning efficiency(%)	96.4 to 97.3	95.7 to 96.4	96.7	96.1

18.7.1.1 Wheat Harvesting:

i) The grain breakage in all the varieties tested was measured as 1.710 to 1.915%.
ii) The total non collectable losses ranged from 0.748 to 1.493 %.
iii) The total processing losses ranged from 1.964 to 2.240 % .
iv) The threshing efficiency ranged from 99.8 to 99.9%.
v) The cleaning efficiency ranged from 96.4 to 97.3% .

18.7.1.2 Paddy Harvesting:

i) The grain breakage ranged from 1.212 to 2.290 % .
ii) The total non-collectable losses ranged from 0.491 to 1.071% .
iii) The total processing losses ranged from 1.525 to 2.431%.
iv) The threshing efficiency ranged from 99.2 to 99.9%.
v) The cleaning efficiency ranged from 95.7 to 96.4%

18.7.2 Harvesting of any other crops:

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

18.7.3 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) Although a slip clutch is provided at undershot conveyor but it should also be provided at front feeding auger & grain & tailing elevator.

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) A dust blower is provided below operator control panel to throw away the dust coming to operator front side.

18.7.4 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.

18.8 Hardness and Chemical composition:

18.8.1 Hardness of knife blade in hardened zone is higher, whereas the hardness of knife guard is lower than the limit as specified in IS:6025-2004 and IS:6024-2004 respectively. These should be looked into at regular production level.

18.8.2 Manganese content in knife blade is higher & carbon content in knife back is lower than the limits as specified in relevant codes. These should be looked into in future production.

18.9 Labelling of Combine Harvester:

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

18.10 Literature supplied with the Machine:

Following literature were supplied by the manufacturer

1. Operator manual
2. Parts catalogue
3. Service book
4. Leaflet.

Although the literature are sufficient, however this should be modified as per IS : 8132-1999 in Hindi & other regional languages to guide to users and operator of combine harvester

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.	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 (102.0 -108.8)	77.2(105.0)	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 ±5% of the declared value by applicant/ manufacturer.	235±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		2.73 to 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 declare value by manufacturer.	~475	583.0	Conforms
	vii)	Back up torque, %	7% min.	--	30.8	Conforms
	viii)	Max. operating temp. To be declared by manufacturer	i) engine oil ii) Coolant	120 110	108.4 99.0	Conforms
	ix)	Lubrication oil consumption, g/kWh	1% of SFC at 5hr. max. power test during high ambient condition	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≤ 0.15V + $V^2/130$ V=speed corresponding to 80% of design max. speed, kmph		8.82	Conforms
	ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec^2.	≤ 600N.		252	Conforms

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	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.		120	Conforms
	ii)	Steering wheel	150 µm max.		90	Conforms
	iii)	Seat with driver seated	120 µm max.		60	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 the engine has dry type air cleaner	--
5.	**Noise measurement**					
	i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR		91.2	**Does not conform**
	ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,		99.8	**Does not conform**
6.	**Discard limit**					
	i)	Cylinder bore diameter, mm	Should not exceed the values declared by the manufacture	107.534	107.28%	Conforms
	ii)	Piston diameter	-do-	106.40	106.49	Conforms
	iii)	Ring end gap	--do--	2.0	0.60	Conforms
	iv)	Ring groove clearance	--do--	0.20	0.08	Conforms
	v)	Diametrical and axial clearance of big end bearing	-do-	Diametrical -0.18 Axial-0.25	Diametrical -0.10 Axial-0.25	Conforms
	vi)	Diametrical and axial clearance of main bearings	--do--	Diametrical -0.178 Axial-0.356	Diametrical -0.10 Axial-0.10	Conforms
	vii)	Thickness of brake lining	--do--	Not applicable	Brake shoe of ceramic material is provided	--
	viii)	Thickness of clutch plate	--do--	Up to rivet head	2.1 to 2.3mm over the rivet head	Conforms

7.	**Field performance**					
	i)	Suitability for crops	Wheat & paddy essential		Wheat & paddy	Conforms
	ii)	Grain breakage in grain tank	≤ 2.5 %		Wheat (1.710 to 1.915%) **Av.=1.824%** Paddy (1.212 to 2.290%) **Av.=1.619%**	Conforms
	iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram . ≤ 4.0% for soybean		Wheat (0.748 to 1.493%) **Av.=1.057%** Paddy (0.491 to 1.071%) **Av.=0.860%**	Conforms
	iv)	Threshing efficiency	≥ 98% wheat & paddy		Wheat (99.8 to 99.9%) **Av.=99.8%** Paddy (99.2 to 99.9%) **Av.99.6%**	Conforms
	v)	Cleaning efficiency	≥ 96 % wheat & paddy		Wheat (96.4 to 97.3%) **Av.=96.7%** Paddy (95.7 to 96.4%) **Av.=96.1%**	Conforms
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 report No. CMVR/comb-SP/2014-15/152 May, 2014	Conforms
	iii)	Grain tank cover	Essential		Provided	Conforms
	iv)	Spark arrester in engine's exhaust	Essential		Not provided however turbo charger eliminates the turbo charger requirement	--
	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			Conforms for b) only

		auger b) under shot conveyor drive c) Grain & tailing 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		Provided	Conforms
9.	**Material of construction :**					
	i)	Knife guard should conforms to IS: 6024 - 2004	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=0.46% Si= 0.22% Mn= 0.73% P= 0.021% S=0.016%	Unascertain -able as the relevant code does not specify the content limits.
	ii)	Knife blade As per IS :6025 -2004	It must have Chemical composition as C= 0.70-0.95 % Mn =0.30-0.50 %	-	C= 0.77% Mn= 0.71%	Conforms for carbon only
	iii)	Knife back Must meet the requirement of IS:10378-2006	The knife back shall be manufactured from Carbon Steel having minimum carbon content of 0.35 %	-	C= 0.13%	**Does not conform**
10.	**Labelling of combine harvester**					
	It should conforms to IS: 10273-2004		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		None	Conforms