

व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT

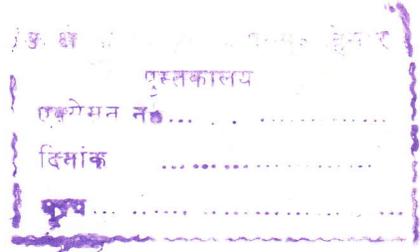
संख्या / No. : COMB-69/1422
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**SELF PROPELLED COMBINE HARVESTER
'NEW MATHARU-5100'**



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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11	224.9	223.0	0.84
12	225.1	224.4	0.31
13	203.0	201.9	0.54
14	227.7	226.9	0.35
15	212.4	210.9	0.71
16	227.0	225.7	0.57
b) Peg teeth of Concave:			
1	206.5	205.4	0.53
2	205.1	204.1	0.49
3	214.5	213.6	0.42
4	216.0	214.8	0.56
5	211.4	210.5	0.43
6	216.5	215.4	0.51
7	216.0	215.1	0.42
8	209.5	208.4	0.53
9	201.2	200.4	0.40

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:					
77.2(105)	339.7(34.6)	2271	20.56(24.65)	0.266(0.196)	3.13(4.26)
59.4(80.7)	396.3(40.4)	1499	14.24(17.06)	0.240(0.176)	3.48(4.73)**
ii) Power at rated engine speed (2200 rpm)					
76.1(103.5)	346.0(35.3)	2200	20.28(24.23)	0.266(0.196)	3.14(4.27)
73.9(100.5)	335.0(34.2)	2200	19.11(23.17)	0.259(0.190)	3.19(4.34)*
iii) Maximum torque:					
48.2(65.6)	402(41.0)	1200	11.53(13.81)	0.239(0.176)	3.49(4.75)
50.1(68.1)	402.5(41.0)	1248	12.03(14.34)	0.240(0.176)	3.49(4.75)**
48.0(65.8)	384.7(39.2)	1250	12.10(14.67)	0.250(0.185)	3.27(4.45)*
iv) Five hour rating test:					
a) Engine loaded to 90% of maximum power:					
68.7(93.4)	297.6(30.3)	2307	17.72(21.48)	0.258(0.189)	3.20(4.35)
b) maximum power:					
74.9(101.8)	330.0(33.7)	2269	20.10(24.36)	0.268(0.197)	3.07(4.18)

* Under high ambient condition.

** At no load speed corresponding to rated speed specified for field work.

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Remarks:

- i) The maximum power output of 2 hr test the engine was observed as 77.2 kW (105.0 Ps) & 59.4 kW (80.7 Ps) at 2271 rpm and 1499 rpm of engine at full throttle and setting recommend for field operation respectively.
- ii) The specific fuel consumption corresponding to maximum power of 2h at full throttle and setting recommended for field operation was measured as 0.266 & 0.240 Kg/kwh (0.196 & 0.176 kg/hph).
- iii) The back-up torque of the engine was measured as 17.5 % in natural ambient at full throttle.
- iv) The maximum smoke density was recorded as 2.18 (Bosch No.) which is within permissible limit
- v) The maximum temperature of engine oil, coolant(water) and exhaust gas was observed as 129, 105 and 699°C respectively.
- vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.558(0.410) g/kWh (g/hph) and 5.52% 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 mean deceleration and stopping distance corresponding to 203 N pedal force was measured as 2.52 m/sec² and 8.9 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:

- i) The ambient noise emitted by the machine was measured as 87.0 dB (A) which is with in warning and danger limits of 88 dB(A) respectively.
- ii) He noise at driver's ear level was measured as 96.8 dB(A) which is on higher side when compared with warning and danger levels of 98dB(A) respectively for an exposure of 8 hours per day specified by ILO.

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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)	2.83 to 3.41	2.48 to 2.72	3.09	2.76
2.	Area covered (ha/h)	0.867 to 1.110	0.767 to 0.897	0.967	0.822
3.	Fuel consumption: - (l/h) - (l/ha)	7.02 to 8.10 6.32 to 8.83	7.32 to 8.58 8.85 to 10.30	7.72 8.05	7.98 9.72
4.	Crop throughput (tonne/h)	6.5 to 11.9	14.6 to 18.9	9.7	16.6
5.	Grain breakage in main grain outlet(%)	0.398 to 0.904	0.401 to 0.705	0.511	0.533
6.	Header losses(%)	0.349 to 0.831	0.326 to 0.385	0.549	0.371
7.	Total non-collectable losses(%)	0.540 to 1.507	0.557 to 0.849	0.936	0.679
8.	Total collectable losses(%)	0.199 to 0.647	0.403 to 0.810	0.400	0.593
9.	Total processing losses(%)	0.795 to 1.947	1.104 to 1.664	1.297	1.431
10.	Threshing efficiency(%)	99.1 to 99.7	99.1 to 99.5	99.5	99.3
11.	Cleaning efficiency(%)	97.1 to 98.7	96.6 to 97.2	98.1	96.9

18.7.1.1 Wheat Harvesting:

- i) The grain breakage in all the varieties tested was measured as 0.398 to 0.904%.
- ii) The total non collectable losses ranged from 0.540 to 1.507 percent .
- iii) The total processing losses ranged from 0.795 to 1.947% .
- iv) The threshing efficiency ranged from 99.1 to 99.7%.
- v) The cleaning efficiency ranged from 97.1 to 98.7% .

18.7.1.2 Paddy Harvesting:

- i) The grain breakage ranged from 0.401 to 0.705 % .
- ii) The total non-collectable losses ranged from 0.557 to 0.849% .
- iii) The total processing losses ranged from 1.104to 1.664 % .
- iv) The threshing efficiency ranged from 99.1 to 99.5 %.
- v) The cleaning efficiency ranged from 96.6 to 97.2%

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.

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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) Spark arresting device is provided in the engine exhaust system which is considered essential.
- iv) Slip clutch / safety device in knife drive, threshing drum, undershot convey etc. 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.
- vi) The grain tank needs to be provided with suitable grain fill indicator device.

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 reminder zone and knife guard do not conform with the limits as specified in IS:6025-1999 and IS:6024-1999. These should be looked into at regular production level

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18.8.2 The chemical composition of knife blade and knife back do not complying with the relevant IS:6025-1999 and IS:10378-1982 respectively. It should be looked into at regular production level.

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:**

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 as per IS: 8132-1999 in Hindi and other regional languages 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)	77.2(105.0)	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.	63(85) (1600-1700 rpm)	59.4(80.7)	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.	81.0 (110 Ps)	76.1(103.0)	Does not Conform
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.	260	260	Conforms
v)	Max. smoke density (bosch no.) at 80% load between the speed at max. power	For tractor :- 5.2 bosch no. or 75 hartridge For engine :-	5.2	2.18	Conforms

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	& 55% of speed at max. or 1000 rpm which ever is higher, should be observed as per CMVR rule	Free deceleration or natural aspirated or turbo charges - 65 hartridge			
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.	400	402.5	Conforms
vii)	Back up torque, %	7% min.	7%	17.5%	Conforms
viii)	Max. operating temp. To be declared by manufacturer	i) engine oil	140° C	129° C	Conforms
		ii) Coolant	120° C	105° C	Conforms
ix)	Lubrication oil consumption, g/kWh	1% of SFC at 5hr. max. power test during high ambient condition	2.68	0.558	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	10.0	5.12	Conforms
ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec ² .	$\leq 600N$.	600	203	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 μ m max.	--	130	Does not conform
ii)	Steering wheel	150 μ m max.	--	570	Does not conform
iii)	Seat with driver seated	120 μ m max.	--	160	Does not conform



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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.	0.25	0.22	Conforms
5.	Noise measurement				
i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	--	87.0	Conforms
ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,	--	96.8	Conforms
6.	Discard limit				
i)	Cylinder bore diameter, mm	Should not exceed the values declared by the manufacture	107.546 mm	107.29	Conforms
ii)	Piston diameter	-do-	107.07	107.06	Conforms
iii)	Ring end gap	--do--	2.032mm	0.55(Max.)	Conforms
iv)	Ring groove clearance	--do--	0.254mm	0.100(max.)	Conforms
v)	Diametrical and axial clearance of big end bearing	-do-	0.178/0.254	Diametrical 0.11 Axial - 0.20	Conforms
vi)	Diametrical and axial clearance of main bearings	--do--	0.178/0.254	Diametrical 0.10 Axial - 0.15	Conforms Conforms
vii)	Thickness of brake lining	--do--	16.18	16.5	Conforms
viii)	Thickness of clutch plate	--do--	10.12	11.7 to 11.9	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- (0.398 to 0.904%) Avg.-0.511% Paddy- (0.401 to 0.7.05 %) Avg.-0.533%	Conforms for both wheat and paddy
iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean	--	Wheat- (0.540 to 1.507%) Avg.-0.936 Paddy- (0.557 to 0.849%) Avg.- 0.679%	Conforms for both wheat and paddy

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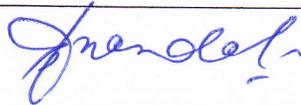
	iv) Threshing efficiency	≥ 98% wheat & paddy	--	Wheat- (99.1 to 99.7%) Avg.-99.5% Paddy- (99.1 to 99.5%) Avg.- 99.3%	Conforms for both wheat and paddy
	v) Cleaning efficiency	≥ 96 % wheat & paddy	--	Wheat- (97.1 to 98.7%) Avg.-98.1% Paddy- (96.6 to 97.2) Avg.-96.9%	Conforms for both wheat and paddy
8.	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 as per CMVR Test Report No. CMVR/Comb-SP/2010/ 50 dated 5.10.2010 from NFMT&TI, Hisar	Conforms
	iii) Grain tank cover	Essential	--	Provided	Conforms
	iv) Spark arrester in engine's exhaust	Essential	--	Provided	Conforms
	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	--	Provided	Conforms



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9.	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=0.50% Si=0.26 Mn=1.36% P=0.042 S=0.040	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 % Mn =0.30-0.50 %	-	C=0.80% Mn=0.73%	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=0.12	Does not conform
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

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Applicants comments : Nil comments received

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