



**SELF PROPELLED COMBINE HARVESTER
"BALKAR – 7500 (TRACK TYPE)"**



सत्यमेव जयते

**भारत सरकार
कृषि मंत्रालय
(कृषि एवं सहकारिता विभाग)**

**GOVERNMENT OF INDIA
MINISTRY OF AGRICULTURE
(DEPARTMENT OF AGRICULTURE & COOPERATION)**

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a) Peg tooth of threshing cylinder:			
S.No.	Mass of peg tooth before test (grain)	Mass of peg tooth after 26.84 h. test (grain)	Percentage of wear on mass basis (%)
1.	192.2	191.3	0.47
2.	190.0	188.2	0.95
3.	214.3	212.6	0.79
4.	208.0	207.0	0.48
5.	193.2	191.3	0.98
6.	194.9	193.3	0.82
7.	189.1	186.4	1.43
8.	224.4	223.5	0.40
b) Peg tooth of concave:			
1	211.4	210.7	0.33
2	201.4	200.8	0.30
3	211.8	211.0	0.38
4	210.7	209.5	0.57
5	207.0	206.2	0.39
6	219.5	219.0	0.23
7	212.1	211.3	0.38
8	212.1	209.5	1.23

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:					
54.87(74.60)	246.6(25.15)	2225	14.98/18.47	0.273(0.201)	3.037(4.128)
51.93(70.61)	256.4(26.15)	2025	13.84/16.68	0.267(0.197)	3.113(4.233)**
ii) Power at rated engine speed (2200 rpm)					
54.69(74.36)	248.6(25.35)	2200	14.96/18.00	0.274(0.201)	3.038(4.131)
52.07(70.80)	236.7(25.14)	2200	14.55/17.66	0.279(0.206)	2.948(4.009)*
iii) Maximum torque:					
47.23(64.21)	277.8(28.33)	1700	12.25/14.78	0.259(0.191)	3.196(4.344)
46.44(63.14)	277.4(28.29)	1675	12.15/14.64	0.272(0.200)	3.172(4.313)**
44.72(60.80)	267.0(27.23)	1675	11.85/14.36	0.265(0.195)	3.114(4.234)*

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iv) Five hour rating test:

a) Engine loaded to 90% of maximum power:

48.01(65.28)	213.0(21.72)	2254	12.96/15.76	0.270(0.199)	3.047(4.142)
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b) maximum power:

51.59(70.14)	234.5(23.91)	2200	14.71/18.00	0.285(0.210)	2.867(3.898)
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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 54.87 kW (74.60 Ps) and 51.93KW(70.61Ps) at 2225 and 2025 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 setting and setting recommended for field operation was measured as 0.273 Kg/kwh (0.201 kg/hph) and 0.267Kg KWh (0.197) kg/hp-h) respectively.
- iii) The back-up torque of the engine was measured as 12.84 % under natural ambient condition at full throttle.
- iv) The maximum smoke density was recorded as 1.78 (Bosch No.).
- v) The maximum temperature of engine oil, coolant(water) and exhaust gas were observed as 115.8, 108 and 700.1°C respectively.
- vi) The lubricating oil & coolant consumption during five hours rating test were measured as 233 g/kWh (171 g/hph) and 0.43 % of total coolant capacity respectively.

17.2 Turning ability:

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

17.3 Visibility:

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

17.4 Braking Performance:

No specific brake mechanism is provided. The combine stops by bringing the control levers of LHS and RHS, driving roller/track to the neutral position.

17.5 Mechanical Vibration:

The amplitude of mechanical vibration of components are given in chapter 12 of this report. The observation reading marked (*) for various assemblies on higher side and suitable arrangement should be provided to dampen the vibration for operator's comfort.

17.6 Noise measurement:

- i) The ambient noise emitted by the machine was measured as 90.1 dB(A).
- ii) The noise at driver's ear level was measured as 96.2 dB(A) .



17.7 Field Test:

17.7.1 Summary of field tests:

The results of the field test for paddy harvesting are summarized below:

S. No.	Observation	Wheat harvesting	Paddy harvesting	Average observation	
				Wheat harvesting	Wheat harvesting
1.	Speed of operation, kmph	1.75 to 2.11	2.12 to 3.55	1.88	3.09
2.	Area covered (ha/h)	0.300 to 0.374	0.387 to 0.523	0.335	0.480
3.	Fuel consumption: - (l/h) - (l/ha)	5.450 to 7.100 15.370 to 22.320	6.173 to 7.385 12.626 to 16.327	6.146 18.477	6.671 13.985
4.	Crop throughput (tonne/h)	2.65 to 4.46	3.72 to 8.36	3.53	5.84
5.	Grain breakage in main grain outlet(%)	0.267 to 0.925	0.030 to 1.484	0.621	0.619
6.	Header losses(%)	0.859 to 1.732	0.032 to 0.592	1.248	0.210
7.	Total non-collectable losses(%)	0.884 to 1.810	0.230 to 1.315	1.296	0.633
8.	Total collectable losses(%)	0.227 to 1.023	0.375 to 1.284	0.590	0.856
9.	Total processing losses(%)	0.653 to 1.916	0.988 to 2.853	1.259	1.898
10.	Threshing efficiency(%)	98.96 to 99.77	98.65 to 99.63	99.40	99.10
11.	Cleaning efficiency(%)	97.57 to 98.94	96.77 to 97.47	98.35	97.10

17.7.1.1 Wheat Harvesting

- i) The grain breakage ranged from 0.267 to 0.925 % which is normal.
- ii) The total non-collectable losses ranged from 0.884 to 1.810 % which is normal.
- iii) The total processing losses ranged from 0.653 to 1.916 %.
- iv) The threshing efficiency ranged from 98.96 to 99.77 %.
- v) The cleaning efficiency ranged from 97.57 to 98.94%.

17.7.1.2 Paddy Harvesting:

- i) The grain breakage ranged from 0.030 to 1.484% which is normal.
- ii) The total non-collectable losses ranged from 0.230 to 1.315 % which is normal.
- iii) The total processing losses ranged from 0.988 to 2.853 %.
- iv) The threshing efficiency ranged from 98.65 to 99.63 %.
- v) The cleaning efficiency ranged from 96.77 to 97.47%.

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17.7.2 Break down and repairs:

No any breakdown was observed during entire 53.57 running hours in a field test.

17.7.3 Harvesting of any other crops:

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

17.7.4 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) Spark arresting device is not provided in the engine exhaust system which is considered essential.
- iii) Slip clutch / safety device in knife drive, crop auger drive and threshing drum drive are considered essential from safety point of view which needs to be provided.
- iv) The mechanical arrangement for adjusting the reel speed is not provided, this needs to be added such that the same could be controlled from operators position.
- v) The grain tank is provided with transparent glass to know the grain fill.
- vi) Mechanical lock for reel in raised position needs to be provided to ensure safety while working on cutter bar.
- vii) Air cleaner service indicator has been provided for operator's ease and safety of engine.
- viii) Grain tank cover is not provided, which are considered essential.



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 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 peg teeth bar of threshing cylinder & concave were observed to be normal.

17.8 Hardness and Chemical composition:

- i) The Hardness of knife blade is not within the prescribed limit of IS :6025-1999.
- ii) Manganese content in knife blade and Carbon content in knife back does not conform the requirement as per IS: 6025-1999 and IS: 10378-1982 respectively.

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17.9 Maintenance/Service problems:

No noticeable maintenance/service problem was observed during the course of test at this Institute. However the air cleaner element change period and air cleaner closing indicator needs to be provided.

17.10 Identification plate of Combine Harvester:

The identification plate is provided on the combine harvester as specified in IS:10273-1999.

17.11 Literature supplied with the Machine:

The following literature in English were supplied with the machine for reference during testing and these were found adequate, however, it needs to be modified in Hindi and other regional languages for the guidance of the users in accordance with IS:8132-1999.

1. Operator manual.
2. Service manual.
3. Part's catalogue

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.	56.0 (76.0)	54.87(74.60)	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.	53.0(72.06)	51.93 (70.61)	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.	56.0 (76.0)	54.69(74.36)	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.	263	273	Conforms

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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	5.2 Bosch No. required	1.78	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.	250	277.4	Conforms
vii)	Back up torque, %	7% min.	--	12.84	Conforms
viii)	Max. operating temp. To be declared by manufacturer	i) engine oil ii) Coolant	130 110	115.8 108	Conforms Conforms
ix)	Lubrication oil consumption, g/kWh	1% of SFC at max. power during high ambient condition	2.630	0.233	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	--	Not applicable for track type combine	-
ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec ² .	$\leq 600N.$	--	-do-	-
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	--	-do-	-
3.	Mechanical vibration				
i)	Operator's platform	120 μ m max.	--	400	Does not conform
ii)	Steering wheel	150 μ m max.	--	Not applicable	-



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	iii)	Seat with driver seated	120 µm max.	--	340	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	0.25% max.	--	N.A.	Not applicable as dry type filter is provided
5.	Noise measurement					
	i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	--	90.1	Does not conform
	ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,	--	96.2	Conforms
6.	Discard limit					
	i)	Cylinder bore diameter	Should not exceed the values declared by the manufacture	104.5	104.03	Conforms
	ii)	Piston diameter	-do-	103.75	103.84	Conforms
	iii)	Ring end gap	-do-	1.50	0.50	Conforms
	iv)	Ring groove clearance	-do-	0.20	0.07	Conforms
	v)	Diametrical and axial clearance of big end bearing	-do-	Diametrical -0.25	Diametrical-0.10	Conforms
				Axial-0.50	Axial-0.35	Conforms
	vi)	Diametrical and axial clearance of main bearings	-do-	Diametrical -0.25	Diametrical-0.11	Conforms
				End float-0.25	End float-0.05	Conforms
	vii)	Thickness of brake lining	-do-	-	Not applicable	-
	viii)	Thickness of clutch plate	-do-	-	Not applicable	-
7.	Field performance					
	i)	Suitability for crops	Wheat & paddy essential	-	The combine was operated in Wheat & Paddy crop.	Conforms
	ii)	Grain breakage in grain tank	≤ 2.5 %	--	Wheat-0.621 (0.267 to 0.925)	Conforms
					Paddy-0.619 (0.030 to 1.484)	Conforms
	iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean	--	Wheat-1.296 (0.884 to 1.810)	Conforms
					Paddy- 0.633 (0.230 to 1.315)	Conforms

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	iv)	Threshing efficiency	≥ 98% wheat & paddy	--	Wheat-99.40 (98.96 to 99.77) Paddy-99.10 (98.65 to 99.63)	Conforms Conforms
	v)	Cleaning efficiency	≥ 96 % wheat & paddy	--	Wheat-98.35 (97.57 to 98.94) Paddy-97.10 (96.77 to 97.44)	Conforms 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	Not applicable	-	--
	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 shout conveyor drive c) Grain & tailing elevator	Essential	--	Not provided	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
9.	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:		Not applicable, Knife guard are not provided	-



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		1030-1974) or steel forging (IS: 2004-1978)			
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- 0.65	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- 0.14	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	--	None	Conforms