



**SELF PROPELLED COMBINE HARVESTER
"PANESAR TC -731 (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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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:					
53.2 (72.3)	236.3 (24.1)	2250	13.069 (15.653)	0.246 (0.181)	3.399 (4.621)
48.6 (66.1)	239.7 (24.5)	2025	11.771 (14.132)	0.242(0.178)	4.677 (6.359)**
ii) Maximum torque:					
43.5 (59.1)	255.6 (26.1)	1700	10.126 (12.157)	0.233 (0.171)	3.578 (4.865)
40.3 (54.8)	236.9 (24.2)	1700	9.650 (11.755)	0.239 (0.176)	3.428 (4.661)*
43.6 (59.3)	256.4 (26.2)	1700	10.100 (12.126)	0.232 (0.170)	4.317 (5.869)**
iii) Five hour rating test:					
a) Engine loaded to 90% of maximum power:					
45.7 (62.1)	201.6 (20.6)	2268	11.506 (14.013)	0.252 (0.185)	3.263 (4.436)*
b) maximum power:					
49.1 (66.7)	222.9 (22.7)	2202	12.473 (15.193)	0.254 (0.187)	3.230 (4.392)*

* Under high ambient condition.

** At field setting

Remarks:

- The maximum power output of the engine was observed as 53.2(72.3) & 48.6(66.1) kW(Ps) at 2250 & 2025 rpm of engine at full throttle and the engine rpm recommended for field setting respectively.
- The specific fuel consumption corresponding to maximum power at full throttle and setting recommended for field work were measured as 0.246 Kg/kWh (0.181 kg/hph) and 0.242 kg/kwh (0.178)g/hph respectively.
- The back-up torque of the engine was measured as 7.62 % under natural ambient condition at full throttle.
- The maximum smoke density was recorded as 4.0 (Bosch No.).
- The maximum temperature of engine oil, coolant(water) and exhaust gas were observed as 103, 100 and 607° C respectively under high ambient condition.
- The lubricating oil & coolant consumption during five hours rating test were measured as 0.591 g/kWh (0.435 g/hph) 0.88% of total coolant capacity respectively.



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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:

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.

18.5 Mechanical Vibration:

The amplitude of mechanical vibration of components are given in chapter 13 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.

18.6 Noise measurement:

- i) The ambient noise emitted by the machine was measured as 87.9 dB(A) against the BIS limit of 88dB(A).
- ii) The noise at driver's ear level was measured as 96.4 dB(A) which is within limit when compared to permissible levels of 98 dB(A)

18.7 Field Test:

18.7.1 Summary of field tests:

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

S. No.	Observation	Range of observations	Average of observations
1.	Speed of operation, kmph	2.98 to 3.80	3.36
2.	Area covered (ha/h)	0.40 to 0.45	0.42
3.	Fuel consumption: - (l/h) - (l/ha)	0.588 to 7.63 13.05 to 17.75	6.84 16.19
4.	Crop throughput (tonne/h)	5.99 to 9.14	7.78
5.	Grain breakage in main grain outlet(%)	0.233 to 0.729	0.429
6.	Header losses(%)	0.224 to 2.041	0.832
7.	Total non-collectable losses(%)	0.484 to 2.655	1.313
8.	Total collectable losses(%)	0.230 to 0.669	0.387
9.	Total processing losses(%)	0.948 to 1.857	1.297
10.	Threshing efficiency(%)	99.3 to 99.8	99.6
11.	Cleaning efficiency(%)	96.1 to 96.7	96.5

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18.7.1.1 Paddy Harvesting:

- i) The grain breakage ranged from 0.233 to 0.729 %.
- ii) The total non-collectable losses ranged from 0.484 to 2.655 %.
- iii) The total processing losses ranged from 0.948 to 1.857 %.
- iv) The threshing efficiency ranged from 99.3 to 99.8 %.
- v) The cleaning efficiency ranged from 96.1 to 96.7%.

18.7.2 Harvesting of any other crops:

The performance of combine to harvest paddy crop was evaluated as the same was 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) Provision for easy cleaning of stone trap is provided.
- iii) Spark arresting device is not provided in the engine exhaust system which is considered essential.
- iv) Slip clutch / safety device at front conveying auger, undershot conveyor & grain tailing elevators, drive are considered essential from safety point of view which needs to be provided.
- v) 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.
- vi) The grain tank is provided with transparent glass to know the grain fill.
- vii) Sometimes there was choking in feeder conveyor during the field test & therefore it is suggested to make some improvement/vertical clearance adjustment in feeder conveyer in future at regular production level to avoid the chocking of the feeder.



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.

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- 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.

18.8 Hardness and Chemical composition:

- i) The Hardness of knife blade at remainder zone is higher than the prescribed limit of IS: 6025-1999.
- ii) Percentage of Manganese in knife blade is higher than the limit specified in IS: 6025-1999.
- iii) Percentage of carbon in knife back is lower than the limit specified in IS:10378-1982.

Therefore content of all the specified element may kindly be looked into for the respective components for compliance with reference relevant BIS code.

18.9 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.

18.10 Identification plate of Combine Harvester:

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

18.11 Literature supplied with the Machine:

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

1. Engine operator manual.
2. Brief printed specification of Machine.

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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.	56.0(76.1)	53.2 (72.3)	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.	(50-53) kW	48.6(66.1)	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(76.1)	52.4(71.2)	Does not 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.	229	246	Does not conforms
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		4.0	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.	250.0	256.4	Conforms
	vii)	Back up torque, %	7% min.	--	7.62	Conforms
	viii)	Max. operating temp. To be declared by manufacturer	i) engine oil ii) Coolant	(110 - 120)°C (110 - 120)°C	103 100	Conforms
	ix)	Lubrication oil consumption, g/kWh	1% of SFC at max. power during high ambient condition	2.54+10%	0.591	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	Not applicable for track type combine
	ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec ² .	$\leq 600N$.	--	Not applicable for track type combine	Not applicable for track type combine
	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	--	Not applicable for track type combine	Not applicable for track type combine
3.	Mechanical vibration					
	i)	Operator's platform	120 μ m max.	--	270	Does not conform
	ii)	Steering wheel	150 μ m max.	--	N.A	-
	iii)	Seat with driver seated	120 μ m max.	--	210	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.	--	0.25%	Conforms

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5. Noise measurement						
i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	--	87.9	Conforms	
ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,	--	96.4	Conforms	
6. Discard limit						
i)	Cylinder bore diameter	Should not exceed the values declared by the manufacture	104.15	104.05	Conforms	
ii)	Piston diameter	--do--	103.0	103.63	Conforms	
iii)	Ring end gap	--do--				
iv)	Ring groove clearance	--do--	1.2	0.50	Conforms	
v)	Diametrical and axial clearance of big end bearing	--do--	Diame- trical - 0.12 Axial - 0.50	Diame- trical - 0.06 Axial - 0.45	Conforms	
vi)	Diametrical and axial clearance of main bearings	--do--	0.13 max	Diame- trical - 0.07 Axial - 0.10	Conforms	
vii)	Thickness of brake lining	--do--	Not applicable	Not applicable	--	
viii)	Thickness of clutch plate	--do--	Not applicable	Not applicable	--	
7. Field performance						
i)	Suitability for crops	Wheat & paddy essential	Paddy	Recommen- ded for paddy only	Conforms	
ii)	Grain breakage in grain tank	≤ 2.5 %	--	Paddy 0.233 to 0.729 (Avg.0.429%)	Conforms	
iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean	--	Paddy 0.484 to 2.655 (Avg.1.313%)	Conforms	
iv)	Threshing efficiency	≥ 98% wheat & paddy	--	Paddy 99.3 to 99.8 (Avg.99.6%)	Conforms	
v)	Cleaning efficiency	≥ 96 % wheat & paddy	--	Paddy 96.1 to 96.7 (Avg.96.5%)	Conforms	



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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	--	CMVR is not applicable for track type combine, However, lightning arrangement is provided as per 3.2.10.8 of the test report	--
	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	--		
9	i)	Guard should conform 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=0.72% Si=0.60% Mn=0.20% P=0.017% S=0.609%	Uncertain - able as the code does not specify the content limit.

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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=0.75% Mn=0.62%	Conforms Does not conform
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=0.18%	Does not conform
10.	Labelling of combine harvester				
	It should conform 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	--	One belt (Engine to main transmission pulley) broke but was not repeatitive in nature	Conforms



TESTING AUTHORITY:

(R. M. TIWARI) AGRICULTURAL ENGINEER	
(P. K. CHOPRA) SENIOR AGRICULTURAL ENGINEER	
(HIMAT SINGH) -DIRECTOR-	

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APPLICANT'S COMMENTS

No comment received