



**SELF PROPELLED COMBINE HARVESTER
"REDLANDS TR-22 (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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16.6 Wear of track:

The wear of track condition of track found normal and no sign of crack or damage observed after 84.73 hours of field and lab tests.

16.7 Wear of the Peg Teeth bar:

The wear of the peg teeth bar 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 50.08 hours of test (g)	Percent wear (%)
a)	Bar of threshing cylinder:		
1.	5021.7	5006.2	0.31
2.	5901.4	5885.1	0.28
3.	5912.0	5894.5	0.30

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:					
53.0 (72.1)	230.2(23.5)	2300	12.53 (15.07)	0.237(0.174)	3.517(4.782)
ii) Power at rated engine speed (2400 rpm)					
52.7(71.7)	219.7(22.4)	2400	12.26 (14.72)	0.233 (0.171)	3.580(4.868)
51.6(70.2)	215.1(21.9)	2400	12.14 (14.71)	0.235(0.173)	3.508(4.769)*
iii) Maximum torque:					
50.7(68.9)	253.4(25.9)	2000	11.87 (14.27)	0.234(0.172)	3.553(4.831)
50.1(68.1)	250.4(25.6)	2000	11.74 (14.26)	0.234(0.172)	3.513(4.77)*
iii) Five hour rating test:					
a) Engine loaded to 90% of maximum power:					
50.1(68.1)	207.6(21.2)	2415	11.77(14.30)	0.235(0.173)	3.505(4.765)*
b) maximum power:					
51.7(70.3)	222.4(22.7)	2325	11.89(14.47)	0.230(0.169)	3.574(4.859)*

* Under high ambient condition.

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Remarks:

- i) The maximum power output of the engine was observed as 53.0 kW (72.1 Ps) at 2300 rpm of engine at full throttle.
- ii) The specific fuel consumption corresponding to maximum power at full throttle setting measured as 0.237 Kg/kwh (0.174 kg/hph).
- iii) The back-up torque of the engine was measured as 8.52 & 8.87 % under natural ambient condition at full throttle and high ambient at full throttle respectively.
- iv) The maximum smoke density was recorded as 3.73 (Bosch No.).
- v) The maximum temperature of engine oil, coolant(water) and exhaust gas were observed as 131.5, 112 and 578° C respectively.
- vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.623 g/kWh (0.458 g/hph) 1.475% of total coolant capacity respectively.
- vii) A butterfly must be provided prior to turbo charger to avoid hunting and abnormal vibration of the engine.



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 ground speed 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 88.2 dB (A) which is on higher side as for the specified limit of 88dB (A) in relevant code.
- ii) The noise at driver's ear level was measured as 96.4 dB(A) which is within the specified limit of 98 dB(A) as per relevant IS standard.

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	Paddy harvesting	Average of parameters
1.	Speed of operation, kmph	2.58 to 4.10	3.18
2.	Area covered (ha/h)	0.35 to 0.45	0.40
3.	Fuel consumption: - (l/h) - (l/ha)	7.03 to 8.74 17.67 to 22.79	7.93 19.79
4.	Crop throughput (t/h)	5.36 to 10.80	7.59
5.	Grain breakage in main grain outlet(%)	0.232 to 0.776	0.388
6.	Header losses(%)	0.115 to 0.927	0.518
7.	Total non-collectable losses(%)	0.352 to 1.933	1.077
8.	Total collectable losses(%)	0.071 to 0.233	0.165
9.	Total processing losses(%)	0.617 to 1.565	1.112
10.	Threshing efficiency(%)	99.7 to 99.9	99.8
11.	Cleaning efficiency(%)	96.4 to 97.2	96.85

17.7.1.1 Paddy Harvesting:

- i) The grain breakage ranged from 0.232 to 0.776%.
- ii) The total non-collectable losses ranged from 0.352 to 1.933%.
- iii) The total processing losses ranged from 0.617 to 1.565%.
- iv) The threshing efficiency ranged from 99.7 to 99.9
- v) The cleaning efficiency ranged from 96.4 to 97.2%.

Break down and repairs

Pitman arm broke during paddy harvesting field test.

17.7.2 Harvesting of any other crops:

The performance of combine to harvest paddy crop was evaluated as the same was recommended by the applicant.

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.

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- ii) Spark arresting device is not provided in the engine exhaust system which is considered essential.
- iii) Slip clutch / safety device at undershot conveyor, feeding auger & grain and tailing elevator 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 grain fill indicating sensor.
- vi) Mechanical lock for reel in raised position needs to be provided to ensure safety while working on cutter bar.
- vii) During the field test unloading of grain was time taking as well as not smooth therefore it is suggested to make improvement in it in future at regular production level.

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 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 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.

17.9 Maintenance/Service problems:

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

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 provided in Hindi and other regional languages for the guidance of the users in accordance with IS:8132-1999.

1. Operator manual.
2. Service manual.



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18. SELECTED PERFORMANCE AND OTHER CHARACTERISTICS AS PER IS: 15806-2008.

Sl. 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.	50.0	53.0	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.	N.A	N.A	N.A As no separate engine performance test conducted for field setting
iii)	Power at rated engine speed, kW (Ps)	The observed value must not be less than 5% of the declared value by the applicant.	44.0	52.7	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.	220	237	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		2.09 to 3.73	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	253.4	Conforms

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	vii)	Back up torque, %	7% min.	--	8.52	Conforms
	viii)	Max. operating temp. To be declared by manufacturer	i) engine oil	135	131.5	Conforms
			ii) Coolant	115	112	Conforms
	ix)	Lubrication oil consumption, g/kWh	1% of SFC at max. power during high ambient condition	2.30+10%	0.623	Conforms
2.	Brake performance					
	i)	Max. stopping distance at a force equal to or less than 600 N on brake 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 .	$\leq 600N$.	--	---	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	--	Yes	Yes
3.	Mechanical vibration					
	i)	Operator's platform	120 μ m max.	--	230	Does not conform
	ii)	Steering wheel	150 μ m max.	--	N.A.	--
	iii)	Seat with driver seated	120 μ m max.	--	320	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.	--	0.24	Conforms
5.	Noise measurement					
	i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	--	88.2	Does not conform
	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	95.5	95.02	Conforms
	ii)	Piston diameter	-do-	94.5	94.60	Conforms
	iii)	Ring end gap	--do--	1.5	0.90	Conforms



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	iv)	Ring groove clearance	--do--	0.14	0.07	Conforms
	v)	Diametrical and axial clearance of big end bearing	--do--	0.20	Diametrical - 0.08 Axial - 0.35	Conforms Does not conform
	vi)	Diametrical and axial clearance of main bearings	--do--	0.20	Diametrical - 0.09 Axial - 0.10	Conforms 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	Recommended for paddy only	Conforms
	ii)	Grain breakage in grain tank	≤ 2.5 %	--	Paddy- 0.232 to 0.776% (Avg. 0.388%)	Conforms
	iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean	--	Paddy- 0.352 to 1.933% (Avg. 1.077%)	Conforms
	iv)	Threshing efficiency	≥ 98% wheat & paddy	--	Paddy- 99.7 to 99.9% (Avg.- 99.8%)	Conforms
	v)	Cleaning efficiency	≥ 96 % wheat & paddy	--	Paddy- 96.4 to 97.2 (Avg. 96.85%)	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	--	CMVR not applicable for track type combine	--
	iii)	Grain tank cover	Essential	--	Provided	Conforms
	iv)	Spark arrester in engine's exhaust	Essential	--	Not provided	Does not conform
	v)	Stone trap before concave	Essential	--	Not provided	Does not conform
	vi)	Rear view mirror	Essential	--	Provided	Conforms
	vii)	Slip clutch at following drives - a) Cutting platform	Essential	--	Not provided	Does not conform

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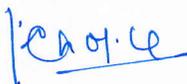
9		b) under shout conveyor drive c) Grain & tailing elevator				
	viii)	Anti slip surfaces at operator platform & ladder & proper gripping for the control levers	Essential	--	Provided	Conforms
	ix)	Working clearance around the controls	Essential 70 mm, min.	--	Provided	Conforms
	x)	Labelling of control gauge	Essential	--	Provided	Conforms
	i)	Knife 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=0.80% Si=0.20% Mn=0.71% P=0.010% S=0.002%	Uncertain-able as the relevant code does not specify the content limit.
	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=0.63% Mn=0.69%	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=0.10%	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	



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11.	Break down (critical major & minor)				
		Essential as per IS: 15806-2008 Annexure A1, A2, A3	--	Breakdown of pitman arm (MJ-20) occurred during field test but it was not repetitive in nature	Conforms

TESTING AUTHORITY

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

Test report compiled by Sh. B.N. Dixit, S.T.A.

APPLICANT'S COMMENTS

Received and added in report