

**SELF PROPELLED COMBINE HARVESTER
“PREET – 949 TAF (TRACK TYPE)”**



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

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

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b)	Peg tooth bar of Separator drum:		
1	382.1	381.3	0.21
2	386.6	382.5	1.06
3	385.0	383.9	0.29
4	374.5	374.0	0.13

16 SUMMARY OF OBSERVATIONS, COMMENTS AND RECOMMENDATIONS

16.1 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:					
49.88 (67.83)	219.25 (22.4)	2275	13.287 (16.204)	0.266 (0.196)	3.078 (4.186)
49.40 (67.19)	235.3 (24.0)	2100	12.643 (15.418)	0.256 (0.188)	3.322 (4.519)**
ii) Power at rated engine speed (2200 rpm)					
49.61 (67.47)	225.5 (23.0)	2200	12.907 (15.740)	0.260 (0.191)	3.152 (4.287)
47.50 (64.60)	215.9 (22.0)	2200	12.637 (15.411)	0.266 (0.196)	3.082 (4.192)**
iii) Maximum torque:					
40.00 (54.40)	250.0 (25.5)	1600	10.059 (12.267)	0.251 (0.185)	3.261 (4.435)
37.74 (51.33)	235.9 (24.1)	1600	9.781 (11.928)	0.259 (0.191)	3.164 (4.303)*
40.53 (55.12)	253.3 (25.8)	1600	10.110 (12.329)	0.249 (0.183)	3.287 (4.471)**
iv) Five hour rating test:*					
a) Engine loaded to 90% of maximum power:					
43.46 (59.10)	191.7 (19.6)	2267	11.952 (14.576)	0.275 (0.202)	3.008 (4.119)
b) maximum power:					
47.26 (64.28)	213.1 (21.7)	2218	12.820 (15.634)	0.272 (0.200)	3.023 (4.110)

* 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 the engine was observed as 49.88 kW (67.83 Ps) & 49.40 kW (67.19 Ps) at 2275 rpm and 2100 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 0.266 and 0.260 kg/kwh (0.196 and 0.188 kg/hph) respectively.
- iii) The back-up torque of the engine was measured as 12.31 % which is considered to be normal.
- iv) The maximum smoke density was recorded as 4.39 (Bosch No.) which is within the permissible limit.
- v) The maximum temperature of engine oil, coolant (water) and exhaust gas was observed as 113.3, 108 and 574 °C respectively.
- vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.753 g/kWh (0.554 g/hph) and 1.61% of total coolant capacity respectively.

16.2 Turning ability:

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



16.3 Visibility:

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

16.4 Mechanical Vibration:

The amplitude of mechanical vibration of components in chapter 11 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.

16.5 Noise measurement:

- i) The ambient noise emitted by the machine was measured as 87.1 dB(A) which is with in limit when compared to warning level of 88 dB(A).
- ii) The noise at driver's ear level was measured as 99.1 dB(A) which is on higher side when compared with warning and danger levels of 98 dB(A) for an exposure of 8 hours per day specified in Indian Standard.

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16.6 Field Test:

Summary of field tests:

The results of the field test are summarized below:

Sr.No.	O b s e r v a t i o n	Range of observation	Average of observation
1.	Speed of operation (kmph)	3.27 to 4.15	3.71
2.	Area covered (ha/h)	0.225 to 0.459	0.306
3.	Fuel consumption:		
	- (l/h)	6.867 to 12.030	9.245
	- (l/ha)	14.961 to 53.467	32.950
4.	Crop throughput (tonne/h)	7.236 to 10.233	8.338
5.	Grain breakage in main grain outlet(%)	0.201 to 0.669	0.464
6.	Header losses(%)	0.129 to 0.496	0.275
7.	Total non-collectable losses(%)	0.309 to 1.449	0.627
8.	Total collectable losses(%)	0.653 to 1.768	1.116
9.	Total processing losses(%)	1.187 to 3.590	1.925
10.	Threshing efficiency(%)	98.21 to 99.34	98.87
11.	Cleaning efficiency(%)	94.95 to 98.25	96.98

16.6.1 Paddy Harvesting:

- i) The grain breakage ranged from 0.201 to 0.669 % (Avg. 0.464%) which is lower than the specified limit of 2.5 % in Indian standard.
- ii) The total non-collectable losses ranged from 0.309 to 1.449% (Avg. 0.627 %) which is lower than the specified limit of 2.5 % in Indian standard.
- iii) The total processing losses ranged from 1.187 to 3.590% (Avg. 1.925%). Average processing loss is lower than the specified limit of 2.5% in IS 8122 (Part 1) : 1994.
- iv) The threshing efficiency ranged from 98.2 to 99.34 % (Avg. 98.87%) which is higher than the minimum threshing efficiency 98% in Indian standard.
- v) The cleaning efficiency ranged from 94.95 to 98.25 % (Avg. 96.98%). Average cleaning efficiency is higher than the minimum cleaning efficiency 96% in Indian standard.

Losses are lower than the specified limit in Indian standard. Threshing efficiency and cleaning efficiency is higher than the specified limit in Indian standard. Field performance of machine is satisfactory.

16.6.2 Harvesting of any other crops:

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

16.6.3 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) 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. Provision should be made to change the reel speed.
- v) The grain tank needs to be provided with suitable device to know the grain fill.
- vi) Air cleaner service indicator has been provided for operator's ease and safety of engine.

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

16.7 Hardness and Chemical composition:

The Hardness of knife blade is 41 and 44 HRC in remainder zone and hardened zone respectively which is below the prescribed hardness in IS 6025-1982.

Chemical composition of knife blade does not conform with the limit prescribed in IS 6025-1999 for Manganese element.

Blades conforming to Indian Standard should be used at production level.



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16.8 Maintenance/Service problems:

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

16.9 Labelling of Combine Harvester:

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

16.10 Literature supplied with the Machine:

The following literature was supplied with the machine for reference during testing

Operator's manual for combine harvester which comprises of operation, maintenance and repair of combine harvester is provided. It should be brought out in regional languages also as per relevant Indian standards. The specification given in service manual and specifications sheet may be corrected.

17. 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 (76)	49.88 (67.83)	Does not conform
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	49.40 (67.19)	Does not conform
iii)	Power at rated engine speed, kW(Ps)	The observed value must not be less than 5% of the declared value by the applicant.	55.9 (76)	49.61 (67.47)	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	N.A	266	Does not conform

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		value by applicant/ manufacturer.			
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	-	4.39	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.	28 kgm (275 Nm)	250 Nm	Does not conform
vii)	Back up torque, %	7% min.	-	12.31	Conforms
viii)	Max. operating temp. To be declared by manufacturer	i) engine oil	130	113.3	Conforms
		ii) Coolant	105	108.0	Does not conform
ix)	Lubrication oil consumption, g/kWh	1% of SFC at 5hr. max. power test during high ambient condition + 10% tolerance	2.72 + 10%	0.753	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-	-

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3.	Mechanical vibration					
	i)	Operator's platform	120 µm max.	-	340 µm	Does not conform
	ii)	Accelerator lever	150 µm max.	-	280 µm	Does not conform
	iii)	Seat with driver seated	120 µm max.	-	340 µm	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.	-	Not applicable as dry air cleaner is used	-
5.	Noise measurement					
	i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	-	87.1	Conforms
	ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,	-	99.1	Does not conform
6.	Discard limit					
	i)	Cylinder bore diameter	Should not exceed the values declared by the manufacture	97.3	97.5	Conforms
	ii)	Piston diameter	--do--	N.A	96.89	Does not conform
	iii)	Ring end gap	--do--	0.40 (1 st compression ring) 0.60 (2 nd compression ring) 0.45 (Oil ring)	0.35 max (1 st compression ring) 0.50 max (2 nd compression ring) 0.30 max (Oil ring)	Conforms
	iv)	Ring groove clearance	--do--	0.155 (1 st compression ring) 0.090 (2 nd compression ring) 0.060 (Oil ring)	0.11 max. (1 st compression ring) 0.050 max (2 nd compression ring) 0.03 max (Oil ring)	Conforms
	v)	Diametrical and axial clearance of big end bearing	--do--	Diametric al = 0.5 Axial = 0.4	Diametrical 0.13 Axial 0.4	Conforms

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	vi)	Diametrical and axial clearance of main bearings	--do--	0.40 (Diametric al) 0.4(Axial)	0.09 (Diametric) 0.20 (Axial)	Conforms
	vii)	Thickness of brake lining	--do--	Not applicabl e	Not applicable as no separate breaking arrangement is provided	-
	viii)	Thickness of clutch plate	--do--	Not applicabl e	Not applicable as hydraulic motor are used to engage the drive	- 
7.	Field performance					
	i)	Suitability for crops	Wheat & paddy essential	Paddy	Paddy	Does not conforms
	ii)	Grain breakage in grain tank	≤ 2.5 %	-	0.201 to 0.669 (Avg. 0.464)	Conforms
	iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean	-	0.3092 to 1.449 (Avg. 1.925)	Conforms
	iv)	Threshing efficiency	≥ 98% wheat & paddy	-	98.212 to 99.34 (Avg. 98.87)	Conforms
	v)	Cleaning efficiency	≥ 96 % wheat & paddy	-	94.952 to 98.25 (Avg. 96.98)	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 for track combine	-
	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	-	Not provided	Does not conform

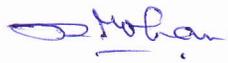
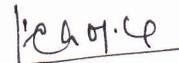
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9.	vi)	Rear view mirror	Essential	-	Not provided	Does not conform	
	vii)	Slip clutch at following drives –			Not provided	Does not conform	
		a) Cutting platform	Essential	-			
		b) under shout conveyor drive	Essential	-			
		c) Grain & tailing elevator	Essential	-			
	viii)	Anti slip surfaces at operator platform & ladder & proper gripping for the control levers	Essential	-	Provided	Conform	
	ix)	Working clearance around the controls	Essential 70 mm, min.	-	Provided	Conform	
	x)	Labelling of control gauge	Essential	-	Not provided	Does not conform	
	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)	Not specified		Not applicable as knife guards are not provided	-
ii)	Knife blade As per IS :6025 -1982	It must have Chemical composition as Carbon = 0.70-0.95 % Manganese = 0.30-0.50 %	-do-		Carbon = 0.72% Manganese = 0.60%	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 %	-do-		Carbon = 0.25%	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	-	NIL	Conforms

TESTING AUTHORITY:

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Applicant's comments
No comments received

