



**SELF PROPELLED, WHEAT COMBINE HARVESTER
PUNNI, GRAIN CRUISER**



भारत सरकार

Government of India

कृषि एवं किसान कल्याण मंत्रालय

Ministry of Agriculture and Farmers Welfare

कृषि, सहकारिता एवं किसान कल्याण विभाग

Department of Agriculture, Cooperation and Farmers Welfare

उत्तरी क्षेत्र कृषि मशीनरी प्रशिक्षण एवं परीक्षण संस्थान

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b)	Blade of threshing cylinder		
1	359.0	358.1	0.25
2	357.8	357.2	0.17
3	363.5	363.0	0.14
4	361.6	361.1	0.14
5	360.9	360.3	0.17
6	362.6	362.1	0.14
7	360.1	359.6	0.14
8	357.9	357.1	0.22
9	359.2	358.7	0.14
10	356.2	355.4	0.22
11	360.0	359.5	0.14
12	356.5	356.0	0.14

17. SUMMARY OF OBSERVATIONS

17.1 Engine Performance Test:

Brake power (kW)	Engine speed (rpm)	Fuel consumption			Specific energy, kWh/l
		l/h	kg/h	Specific, kg/ kWh	
1	2	3	4	5	6
a) Maximum power – Two hour test:					
62.9	2049	18.45	15.22	0.242	3.38
54.2	1549	14.70	12.19	0.225	3.69*
b) Power at rated engine speed: (2200 rpm)					
62.0	2199	18.76	14.47	0.250	3.31

*High idle at No load was 1650 rpm recommended for field operation.

ENGINE TEST (HIGH AMBIENT)

Brake power (kW)	Engine speed (rpm)	Fuel consumption			Specific energy, kWh/l
		l/h	kg/h	Specific, kg/ kWh	
(1)	(2)	(3)	(4)	(5)	(6)
a) Maximum power-					
60.4	2049	17.84	14.59	0.242	3.38
b) Power at rated engine speed: (2200 rpm)					
59.4	2199	18.30	14.99	0.252	3.24



17.2 Field test**17.2.1 Summary of field tests**

The results of the field test are summarized below:-

S. No	Parameters	Observed range
		Wheat harvesting
1.	Range of average speed of operation (kmph)	1.64 to 2.16
2.	Range of average area covered (ha/h)	0.347 to 0.493
3.	Maximum average fuel consumption: - (l/h) - (l/ha)	9.37 25.72
4.	Range of average crop throughput (tonne/h)	3.64 to 6.33
5.	Maximum average grain breakage in main grain outlet(%)	1.43
6.	Maximum average header losses (%)	0.88
7.	Maximum average total non-collectable losses (%)	0.9
8.	Maximum average total collectable losses (%) (un threshed + broken from main outlet)	1.5
9.	Maximum rubbish/foreign matter in the grain tank (excluding weed and other seed material) (%)	0.7
10.	Maximum average total processing losses(%)	2.1
11.	Minimum average threshing efficiency(%)	98.5
12.	Minimum average cleaning efficiency(%)	97.9

17.3 Conformity to Indian Standard

- (i) IS: 6025-1982 (Reaffirmed 2014)-Specification for : **Does not conform in toto**
knife section for harvesting machine.
- (ii) IS: 6024-1983 (Reaffirmed 2014)-Specification for : **Does not conform in toto**
knife guards for harvesting machines.
- (iii) IS: 10378-1982 (Reaffirmed 2016)-Specification of : **Does not conform in toto**
knife back for harvesting machine.
- (iv) IS: 6283 (Part I)-2006 & IS:6283 (Part-II) (Reaffirmed : **Does not conform in toto**
2014)-Tractors and machinery for agriculture and forestry, powered lawn and garden equipment-symbol for operator controls and other displays.
- (v) IS: 8133-1983 (Reaffirmed 2014)-Guidelines for : **Does not conform in toto**
location & operation of operator controls on agricultural tractors and machinery.

18. SELECTED PERFORMANCE AND OTHER CHARACTERISTICS AS PER O.M.

S. No	Characteristics	Category (Evaluative/ Non evaluative)	Requirement /Declaration	Tolerance	Observed	Remarks
1.	Prime mover performance					
a)	Max. Power (absolute) Average max. power observed during 2 hrs. max. power test in natural ambient condition, kW	Evaluative	62.0	±5% of declared value	62.9	Conforms
b)	Max. power observed during test after adjusting the no load engine speed as per recommendation of the manufacturer for field work, kW	Evaluative	54.0	±5% of declared value	54.2	Conforms
c)	Power at rated engine speed, kW (under natural ambient condition)	Evaluative	62.0	±5% of declared value	62.0	Conforms
d)	Specific fuel consumption corresponding to average maximum power under 2h maximum power test, g/kWh.	Evaluative	248	+5% of declared value	242	Conforms
e)	Max. smoke density at 80% load between the speed at max. power & 55% of speed at max. or 1000 rpm whichever is higher	Evaluative	As per CMVR maximum smoke density light absorption coefficient 3.25 per meter/hartridge unit 75	Nil	0.61 ^{m-1}	Conforms
f)	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	Evaluative	330	±8% of declared value	355.7	Conforms
g)	Back up torque, %	Evaluative	7 percent min.	--	21.29	Conforms
h)	Max. Operating temperature, °C i) Engine oil ii) Coolant	Evaluative	130 105	Should not exceeds the declared value	116 94	Conforms Conforms

	i)	Lubrication oil consumption, g/kWh	Evaluative	Not exceeding 1 % of SFC at maximum power (high ambient)	Nil	0.210	Conforms
2. Brake performance							
	i)	Max. Stopping distance at a force equal to or less than 600 N on brake pedal (m)- (cold brake and hot brake)	Evaluative	As per requirement of CMVR	Nil	Cold - 7.60 m Hot - 8.20 m	Conforms
	ii)	Effectiveness of parking brake at a force of 600 N at foot pedal or 400 N at hand lever	Evaluative	--	Nil	Effective	Conforms
3. Mechanical vibration							
	i)	Operator's platform	Non evaluative	120	Nil	830	Does not conform
	ii)	Steering control wheel	Non evaluative	150	Nil	1200	Does not conform
	iii)	Seat with driver seated	Non evaluative	120	Nil	645	Does not conform
4. Noise measurement							
	i)	Max. ambient noise emitted by combine at bystanders position dB (A)	Evaluative	88	Nil	85.7	Conforms
	ii)	Max. noise at operator's ear level dB (A)	Evaluative	98	Nil	93.8	Conforms
5. Header lifting Test							
	i)	Satisfactory completion of header lifting test	Evaluative	-	Nil	Satisfactory completed	Conforms
6. Discard limit							
	a)	Cylinder bore diameter, mm	Evaluative	104.15	Should not exceed the values declared by the manufacture	104.04	Conforms
	b)	Piston diameter, mm	Evaluative	103.826 to 103.858	-do-	103.92	Conforms
	c)	Piston to cylinder liner clearance at skirt	Evaluative	0.20	-do-	0.11	Conforms

d)	Ring end gap, mm	Evaluative				
	i) Top compression ring		1.2	-do-	0.55	Conforms
	ii) 2 nd compression ring		1.2		0.60	Conforms
	iii) Oil ring		1.2		0.55	Conforms
e)	Ring groove clearance, mm					
	1. Top compression ring	Evaluative	Taper ring	-do-	Taper ring	--
	2. 2 nd compression ring		0.20		0.06	Conforms
	3. Oil ring		0.20		0.04	Conforms
f)	Diametrical and axial clearance of big end bearing, mm	Evaluative		-do-		
	Diametrical		0.13		0.08	Conforms
	Axial		0.60		0.38	Conforms
g)	Diametrical and axial clearance of main bearings, mm	Evaluative		-do-		
	Diametrical		0.13		0.11	Conforms
	Axial/crank shaft end float		0.40		0.06	Conforms
h)	Thickness of brake lining, mm	Evaluative	Wear up to rivet head	-do-	4.1 to 4.5 above rivet head	Conforms
i)	Thickness of clutch plate, mm	Evaluative	Wear up to rivet head	-do-	2.2 to 2.4 above rivet head	Conforms

7. Field performance

i)	Suitability for crops	Evaluative	Wheat & paddy (Wheel type) Paddy (Track type)	Nil	Wheat only	Conforms
ii)	Average processing losses (%)	Evaluative	Wheat : Max 3% Barley : Max 4% Rice : Max 4% Sorghum : Max 3% Maize : Max 4% Oil seed rape : Max 4% Soya : Beans : Max 5%	Nil	Wheat (max) 2.1 %	Conforms

8. Safety requirement

a)	Guards against all moving parts	Evaluative	Provided	--	Provided	Conforms
b)	Lighting arrangement	Evaluative	Provided	-	Provided	Conforms
c)	Grain tank cover	Evaluative	Essential	-	Provided	Conforms

d)	Spark arrester in engine's exhaust	Evaluative	Essential	-	Not provided whereas turbo charger is provided in exhaust system	--
e)	Stone trap before concave	Evaluative	Essential	-	Provided	Conforms
f)	Rear view mirror	Evaluative	Essential	-	Provided	Conforms
g)	Fire extinguisher	Evaluative	Essential	-	Provided	Conforms
h)	Slip clutch at following drives –			-		
	i) Cutting platform auger	Evaluative	Essential		Not provided	Does not conform
	ii) undershot conveyor drive	Non evaluative	Essential		Not provided	Does not conform
	iii) Grain & tailing elevator	Non evaluative	Essential		Not provided	Does not conform
i)	Anti slip surfaces at operator platform & ladder & proper gripping for the control levers.	Evaluative	Essential	-	Provided	Conforms
j)	Working clearance around the controls	Non evaluative	Essential 70 mm, min	-	Provided	Conforms
k)	Labelling of control and gauges	Evaluative	Essential	-	Not provided fully	Does not conform in toto

9. Material of construction :

i)	Knife guard should conform to IS: 6024 - 1983	Non evaluative	Should have maximum hardness 163 HB	-	Hardness 318 to 405 HB	Does not conform
ii)	Knife blade As per IS :6025 -1982	Non evaluative	It must have chemical composition as C=0.70 - 0.95% Mn=0.30 - 0.50%	-	C = 0.6789 Mn = 0.7011	Does not conform Does not conform

iii)	Knife back should meet the requirement of IS:10378-1982	Non evaluative	The knife back should be manufactured from carbon steel having minimum carbon content of 0.35%	--	C = 0.1912	Does not conform
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10. Labelling of combine harvester

	Labelling of combine harvester	Evaluative	Should conform to the requirements of CMVR along with max engine power/max PTO power and SFC	--	SFC is not specified	Does not conform in toto
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11. Break down (critical, major & minor)

Sr. No.	Category of breakdowns	Category (Evaluative/ Non evaluative)	Requirements as per OM	As observed	Whether meets the requirements (Yes/No)
1.	Critical	Evaluative	No critical breakdown	None	Yes
2.	Major	Evaluative	Not more than two and neither of them should be repetitive in nature	One (Mj-10)	Yes
3.	Minor	Evaluative	Not more than five and frequency of each should not be more than two	None	Yes
4.	Total breakdown	Evaluative	In no case total no of (major + minor) breakdowns exceed five	None	Yes

13	Submission of literature	Evaluative	Submission of literature such as workshop/service manual, parts catalogue, operation manual to test agency	Instruction manual cum parts catalogue and engine operator manual provided	Does not conform in toto
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19. COMMENTS AND RECOMMENDATIONS

19.1 Mechanical vibration

The amplitude of mechanical vibration of components marked as (*) in chapter 12 of this test report are observed 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.

19.2 Field performance test

i) **The main clutch shaft of the combine harvester broke during field performance test which is the major breakdown (Mj10) as per O.M.. This should be looked into for improvement.**

ii) The leakage of hydraulic oil was observed from the suction pipe (tank to pump) for header. It was rectified replacing hose. This should be looked into.

The following features may be considered for providing on combine harvester.

- i) Provision for speed variation for threshing cylinder.
- ii) Provision for speed variation of blower.

19.3 Ease of operation and safety provisions

i) **It is recommended that the symbols as per IS 6283 (Part I) 2006 & IS 6283 (Part II) 2000 be provided.**

ii) **Safety arrangement/provision/device, is not provided on the following drives, therefore, they need to be considered for providing.**

- Cutting platform auger
- Undershot conveyer
- Threshing drum
- Grain elevator
- Upper grain auger
- Bottom tailing auger
- Tailing elevator
- Upper tailing elevator
- Grain conveying auger (Bottom of grain tank)

iii) **No arrangement is provided for varying the blower speed. It should be looked into.**

iv) **No arrangement is provided for varying oscillation of top & bottom sieve. In order to encounter the different and varying crop variety/ conditions, this arrangement may be considered for providing.**

v) **Provision for indication of grain tank filling is not provided. It may be provided for providing.**



- vi) On the engine labelling plate the engine power is specified as 101 HP which is grossly misleading as during engine performance test the maximum engine power is observed as 62.9 kW (86.71 HP). It should be looked into for corrective action.
- vii) The grade of hydraulic oil, steering oil, transmission oil, final drive oil & grease is not specified. For correct, smoother and trouble-free operation, these MUST be specified.
- viii) The clearance between valve guide and valve stem has reached upto the discard limit in such a short period of operation. It MUST be looked into for quality improvement.
- ix) Safety against accidental start of engine is not provided. It should be provided.

19.4 Applicant had declared "initial value" of piston diameter at skirt as 103.826 to 103.856 mm, vis a vis its discard limit as 103.99 mm. As diameter of piston decreases due to wear, and not increases, this declaration being technically improbable, is not acceptable. The observed value, however, was observed to be 103.92 mm, which is more than even initial value, and therefore, going by any analysis, the wear on piston skirt has to be within limit. All the same, in order to set right the facts, the applicant may look in to it for corrective action.

19.5 Hardness and chemical composition

19.5.1 Chemical composition of knife blade is not within the limit specified in IS:6025-1982. It should be looked into for corrective action.

19.5.2 The carbon content of knife back does not conform to the requirement of IS 10378-1982. It should be looked into for improvement.

19.5.3 The hardness of knife guard does not conform to the requirements of IS 6024-1983. It should be looked into for improvement.

19.6 On the labelling plate of the machine the S.F.C. is not specified. It may be considered for providing.

19.7 The labelling of oiling and greasing points with frequency of service and grade of lubricant is not provided on machine. It should be provided for facilitating correct maintenance of the machine.



19.8 Literature supplied with the machine

Though the following literatures is supplied by the applicant, they do not provide all essential information and far from satisfactory:-

1. Instruction manual cum parts catalogue for combine harvester
2. Operator manual for Engine.

It is recommended that literature be brought out as per IS: 8132-1999

Apart from the above, the service manual for combine harvester & engine must also be brought out.

TESTING AUTHORITY

R. K. NEMA SENIOR AGRICULTURAL ENGINEER	
P. K. PANDEY DIRECTOR	

Draft test report compiled by V.S. Shinde, Senior Technical Assistant.

20. APPLICANT'S COMMENTS

Para No	Our reference	Applicant's comment
20.1	18(10),19.6	Labelling of combine will be done indicating max power, and SFC.
20.2	19.3(ii)	Safety arrangement /provision/device will be provided.
20.3	19.3(v)	This will be considered.
20.4	19.5	In future, the knife blade will be provided after verifying the chemical composition of knife blade & its hardness etc.
20.5	19.7	Labelling of oiling, greasing points, frequency of service and grade of lubricant will be done on machine.
20.6	-	In response to draft test report the applicant has specified the following: Grade of hydraulic, steering transmission and final drive oil : EP-68 Type of grease : Multipurpose-3

