

व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT

संख्या / No. : Comb - 122/1621
माह / Month: June, 2014



**SELF PROPELLED COMBINE HARVESTER
'AMAN-516'**



सत्यमेव जयते

भारत सरकार
कृषि मंत्रालय
(कृषि एवं सहकारिता विभाग)



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

उत्तरी क्षेत्र कृषि मशीनरी प्रशिक्षण एवं परीक्षण संस्थान
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Comb -122/1621	SELF PROPELLED COMBINE HARVESTER 'AMAN-516'	COMMERCIAL (ICT)	50 of 68
----------------	--	---------------------	----------

4	217.1	216.3	0.37
5	217.8	217.0	0.37
6	218.9	217.2	0.78
7	195.0	193.3	0.83
8	213.0	212.8	0.56

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:					
70.7(96.1)	321.3(32.8)	2200	20.51(24.82)	0.290(0.213)	2.848(3.872)
52.6(71.5)	351.0(35.8)	1500	12.65(15.25)	0.240(0.177)	3.453(4.695)****
ii) Power at rated engine speed (2200 rpm)					
70.95(96.5)	322.5(32.9)	2200	20.53(24.70)	0.289(0.213)	2.872(3.905)
69.61(94.6)	316.4(32.3)	2200	20.16(24.55)	0.290(0.213)	2.835(3.855)*
iii) Maximum torque:					
54.01(73.4)	385.8(39.4)	1400	12.81(15.45)	0.237(0.174)	3.496(4.753)
51.45(70.0)	367.5(37.5)	1400	12.44(15.13)	0.242(0.178)	3.401(4.623)*
48.75(66.3)	375.0(38.3)	1300	11.38(13.71)	0.233(0.171)	3.556(4.835)****
v) Five hour rating test:					
a) Engine loaded to 90% of maximum power:					
65.0(88.4)	285.1(29.1)	2282	20.0(24.39)	0.308(0.226)	2.667(3.626)*
b) maximum power:					
69.5(94.5)	316.0(32.2)	2200	20.32(24.78)	0.292(0.215)	2.805(3.814)*

* Under high ambient conditions
Field settings

**** at 1650 rpm

Remarks:

- The maximum power output of the engine was observed as 70.7 kW (96.1 Ps) & 52.6 kW/ (71.5 ps) at 2200 rpm and 1500 rpm of engine at full throttle and setting recommend for field operation respectively.
- The specific fuel consumption corresponding to maximum power at full throttle and setting recommended for field operation was measured as 0.290 (0.213) & 0.240 (0.177)Kg/kWh
- The back-up torque of the engine was measured as 19.6 % under natural ambient at full throttle.

Comb -122/1621	SELF PROPELLED COMBINE HARVESTER 'AMAN-516'	COMMERCIAL (ICT)	51 of 68
----------------	--	---------------------	----------

- iv) The maximum smoke density was recorded as 3.12 (Bosch No.) which is within permissible limit
- v) The maximum temperature of engine oil, coolant (water) and exhaust gas was observed as 117.4, 102.0 and 501.0 C respectively.
- vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.334 g/kWh (0.246) g/kWh (g/hph) and 1.90% of total coolant capacity respectively.

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:

- i) The pedal force and stopping distance corresponding to mean deceleration of 2.5 m/sec² were observed 208N and 14.5 m.
- ii) The performance of parking brake was found satisfactory.

18.5 Mechanical Vibration:

The amplitude of mechanical vibration of components marked as (*) in chapter 13 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.

18.6 Noise measurement:

The ambient noise emitted by the machine at bystander and driver's ear level were measured as 92.4 & 100.6 dB (a) respectively, which is not complying with the specified limit of 88 & 98 dB(A) on the relevant code.

18.7 Field Test:

18.7.1 Summary of field tests:

The results of the field test are summarized below:

S. No	Parameters	Range of parameters		Average of parameters	
		Wheat Harvesting	Paddy Harvesting	Wheat Harvesting	Paddy Harvesting
1.	Speed of operation (kmph)	2.85 to 3.52	2.81 to 3.16	3.23	2.93
2.	Area covered (ha/h)	0.938 to 1.114	0.798 to 0.893	1.035	0.834
3.	Fuel consumption: - (l/h) - (l/ha)	7.93 to 9.38 7.19 to 9.88	7.91 to 9.21 9.24 to 11.67	8.710 8.590	8.57 10.32
4.	Crop throughput (tonne/h)	10.5 to 16.2	12.1 to 16.8	12.8	14.0
5.	Grain breakage in main grain outlet (%)	0.433 to 1.111	0.438 to 1.330	0.784	0.948
6.	Header losses (%)	0.434 to 0.639	0.371 to 0.821	0.576	0.593

Comb -122/1621	SELF PROPELLED COMBINE HARVESTER 'AMAN-516'	COMMERCIAL (ICT)	52 of 68
----------------	--	---------------------	----------

7.	Total non-collectable losses(%)	0.640 to 1.076	0.634 to 1.781	0.931	1.205
8.	Total collectable losses(%)	0.807 to 1.209	0.232 to 1.108	0.906	0.664
9.	Total processing losses(%)	1.754 to 2.196	1.719 to 2.469	2.079	2.225
10.	Threshing efficiency(%)	98.7 to 99.1	98.7 to 99.6	98.93	99.1
11.	Cleaning efficiency(%)	96.2 to 96.7	96.1 to 96.4	96.5	96.1

18.7.1.1 Wheat Harvesting:

- i) The grain breakage in all the varieties tested was measured as 0.433 to 1.111%.
- ii) The total non collectable losses ranged from 0.640 to 1.076 percent .
- iii) The total processing losses ranged from 1.754 to 2.196 % .
- iv) The threshing efficiency ranged from 98.7 to 99.1%.
- v) The cleaning efficiency ranged from 96.2 to 96.7% .

18.7.1.2 Paddy Harvesting:

- i) The grain breakage ranged from 0.438 to 1.330 % .
- ii) The total non-collectable losses ranged from 0.634 to 1.781% .
- iii) The total processing losses ranged from 1.719 to 2.469% .
- iv) The threshing efficiency ranged from 98.7 to 79.6 %.
- v) The cleaning efficiency ranged from 96.1 to 96.4%



18.7.2 Harvesting of any other crops:

The performance of combine to harvest wheat & paddy crops have evaluated as the same were 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) The design of stone trap need to be modified for easy cleaning without removing header unit.
- iii) Spark arresting device is not provided in the engine exhaust system which is considered essential.
- iv) Slip clutch / safety device in knife drive is considered essential from safety point of view which needs to be provided.
- v) The mechanical arrangement for adjusting the reel speed though provided, needs to be modified such that the same could be controlled from operators position.
- vi) The grain tank needs to be provided with suitable grain fill indicator device.

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.
- iii) The timing gears, clutch lining, release bearing were found in normal working condition.

Comb -122/1621	SELF PROPELLED COMBINE HARVESTER 'AMAN-516'	COMMERCIAL (ICT)	53 of 68
----------------	--	---------------------	----------

- iv) The condition of the components of brake, 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 rasp bar and peg teeth of threshing cylinder & concave were observed as normal.

18.8 Hardness and Chemical composition:

18.8.1 Hardness of knife guard does not conform with the limits as specified in IS:6024-1999. These should be looked into at regular production level

18.8.2 Manganese content in knife blade is higher than the limit as specified in BIS. This should be looked in to at regular production level.

18.9 Labelling of Combine Harvester:

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

18.10 Literature supplied with the Machine:

A complete manual for operation servicing, repair maintenance & part catalogue in the r/o combine harvester must be brought out as per IS:8132 in Hindi, English & other regional languages.

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.	74.3	70.7(96.1)	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.	Not specified	52.6 (71.5) Corresponding to no load rpm and 1650 rpm	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.	74.3	70.95 (96.5)	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	$238 \pm 5\%$	290	Does not conform

Comb -122/1621	SELF PROPELLED COMBINE HARVESTER 'AMAN-516'	COMMERCIAL (ICT)	54 of 68
----------------	--	---------------------	----------

		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	-	3.12	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.	Not specified	375.0 @ 1650 rpm	- 
vii)	Back up torque, %	7% min.	-	19.6	Conforms
viii)	Max. operating temp. To be declared by manufacturer	i) engine oil ii) Coolant	120° C 108° C	117.4° C 102° C	Conforms Conforms
ix)	Lubrication oil consumption, g/kWh	1% of SFC at 5hr. max. power test during high ambient condition	2.92 + 10%	0.334	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	10.0	8.89	Conforms
ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec ² .	≤ 600N.	600	208	Conforms
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	Conforms
3.	Mechanical vibration				
i)	Operator's platform	120 μm max.	--	110	Conforms
ii)	Steering wheel	150 μm max.	--	200	Does not conform

Comb -122/1621	SELF PROPELLED COMBINE HARVESTER 'AMAN-516'	COMMERCIAL (ICT)	55 of 68
----------------	--	---------------------	----------

	iii)	Seat with driver seated	120 µm max.	--	460	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 type air cleaner is provided	--
5.	Noise measurement					
	i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	-	92.4	Does not conform
	ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,	-	100.6	Does not conform
6.	Discard limit					
	i)	Cylinder bore diameter, mm	Should not exceed the values declared by the manufacture	104.15	104.02	Conforms
	ii)	Piston diameter	-do-	Not specified	0.11	-
	iii)	Ring end gap	--do--	1.2	0.501	Conforms
	iv)	Ring groove clearance	--do--	Top -0.7 Middle-0.2 Oil-0.5	0.07 0.07	Conforms Conforms
	v)	Diametrical and axial clearance of big end bearing	-do-	Dia- 0.1 Axial - 0.60	Dia. 0.06 Axial-0.25	Conforms Conforms
	vi)	Diametrical and axial clearance of main bearings	--do--	Dia- 0.13 Axial - 0.40	Dia-0.06 Axial-0.20	Conforms Conforms
	vii)	Thickness of brake lining	--do--	--	Not applicable as ceramettic brake lining is provided	--
	viii)	Thickness of clutch plate	--do--	Up to rivet head	1.86 to 2.47	Conforms
7.	Field performance					
	i)	Suitability for crops	Wheat & paddy essential	Wheat & paddy	Suitable for Wheat & paddy	Conforms
	ii)	Grain breakage in grain tank	≤ 2.5 %	--	Wheat- 0.433 to 1.111 Avg. 0.784 Paddy- 0.438 to 1.330 Avg. 0.948	Conforms for both wheat and paddy

Comb -122/1621	SELF PROPELLED COMBINE HARVESTER 'AMAN-516'	COMMERCIAL (ICT)	56 of 68
----------------	--	---------------------	----------

iii)	Non collectable losses	$\leq 2.5\%$ for wheat, paddy & gram $\leq 4.0\%$ for soybean	--	Wheat- 0.640 to 1.076 Avg. 0.931 Paddy- 0.634 to 1.781 Avg. 1.205	Conforms for both wheat and paddy
iv)	Threshing efficiency	$\geq 98\%$ wheat & paddy	--	Wheat- 98.7 to 99.1 Avg. 98.93 Paddy- 98.7 to 99.61 Avg. 99.19	Conforms for both wheat and paddy
v)	Cleaning efficiency	$\geq 96\%$ wheat & paddy	--	Wheat- 96.2 to 96.7 Avg. 96.5 Paddy- 96.1 to 96.4 Avg. 96.1	Conforms for both wheat and paddy

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/Comb-SP/2014-15/159	Conforms 
iii)	Grain tank cover	Essential	--	Provided	Conforms
iv)	Spark arrester in engine's exhaust	Essential	--	Not provided	However, turbocharger eliminates the requirement of spark arrester
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 shot conveyor drive c) Grain & tailing elevator	Essential	--	Provided Provided Provided	Conforms Conforms Conforms
viii)	Anti slip surfaces at operator platform & ladder & proper gripping for the control levers	Essential	--	Provided	Conforms

Comb -122/1621	SELF PROPELLED COMBINE HARVESTER 'AMAN-516'	COMMERCIAL (ICT)	57 of 68
----------------	--	---------------------	----------

9.	ix)	Working clearance around the controls	Essential 70 mm, min.	--	Provided	Conforms
	x)	Labelling of control gauge	Essential	--	provided	Conforms
	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	C= 0.13 Si= 0.21 Mn= 0.52 P= 0.026 S= 0.018	Unascertainable as the relevant code does not specify the limit of content.
	ii)	Knife blade As per IS :6025 -1999	It must have Chemical composition as C= 0.70-0.95 % Mn =0.30-0.50 %	-	C= 0.72 Mn= 0.98	Conforms Only for carbon
	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= 0.35	Conforms
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	
11.	Break down (critical, major & minor)					
		Essential as per IS: 15806-2008 Annexure A1, A2, A3	--	None	Conforms	