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व्यावसायिक परीक्षण रिपोर्ट  
COMMERCIAL TEST REPORT

संख्या / No. : Comb – 114/1606  
माह / Month: May, 2014



**SELF PROPELLED COMBINE HARVESTER  
'S-4900 (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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Comb – 114/1606	SELF PROPELLED COMBINE HARVESTER 'S-4900 (TRACK TYPE)'	COMMERCIAL (ICT)	47 of 64
-----------------	---	---------------------	----------

### 16.7 Wear of the spike peg tooth:

The wear of the Spike peg tooth of the threshing cylinder and concave was measured. The percentage wear on mass basis was completed and the results are given below:

a) Peg tooth of threshing cylinder:			
S.No.	Mass of peg tooth before test (grain)	Mass of peg tooth after 52.86 h. test (grain)	Percentage of wear on mass basis (%)
1.	206.6	205.4	0.58
2.	209.0	207.8	0.57
3.	213.4	211.5	0.89
4.	220.6	216.2	1.99
5.	223.0	221.2	0.81
6.	218.0	213.9	1.88
7.	212.3	209.3	1.41
8.	216.5	214.4	0.97
b) Peg tooth of concave:			
1	215.0	212.6	1.12
2	215.5	213.6	0.88
3	212.1	209.1	1.41
4	218.0	215.2	1.28
5	210.5	208.3	1.05
6	220.0	216.5	1.59

## 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:					
55.96(76.08)	248.7(25.36)	2250	14.384/17.2 54	0.257/0.189	3.243(4.409)
51.21(69.63)	262.6(26.78)	1950	12.718/15.2 77	0.248/0.183	3.352(4.558)**

ii) Power at rated engine speed (2200 rpm)					
55.64(75.65)	252.9(25.79)	2200	14.241/17.0 75	0.256/0.188	3.259(4.430)
51.52(70.05)	234.2(23.88)	2200	13.537/16.4 29	0.263/0.193	3.136(4.264)

Comb – 114/1606	SELF PROPELLED COMBINE HARVESTER 'S-4900 (TRACK TYPE)'	COMMERCIAL (ICT)	48 of 64
-----------------	---	---------------------	----------

<b>iii) Maximum torque:</b>					
43.66(59.36)	268.7(27.40)	1625	10.606/12.7 32	0.243/0.179	3.429(4.662)
41.03(55.79)	252.5(25.75)	1625	10.112/12.2 72	0.246/0.181	3.343(4.546)*
44.81(60.92)	271.6(27.70)	1650	10.794/12.9 27	0.241/0.177	3.466(4.713)**
<b>iv) Five hour rating test:</b>					
<b>a) Engine loaded to 90% of maximum power:</b>					
46.83(63.67)	204.7(20.87)	2288	11.996/14.5 65	0.256/0.188	3.215(4.371)*
<b>b) maximum power:</b>					
52.21(70.99)	229.5(23.40)	2275	13.596/16.5 30	0.260/0.192	3.158(4.295)*

- \* Under high ambient condition.
- \*\* At no load speed corresponding to rated speed specified for field work.

**Remarks:**

- The maximum power output of the engine was observed as 55.96 kW (76.08 Ps) and 51.21KW(69.63Ps) at 2250 and 1950 rpm of engine at full throttle and setting recommend for field operation respectively.
- The specific fuel consumption corresponding to maximum power at full throttle setting and setting recommended for field operation was measured as 0.257 Kg/kwh (0.189 kg/hph) and 0.248Kg KWh (0.183) kg/hp-h) respectively.
- The back-up torque of the engine was measured as 8.04 % under natural ambient condition at full throttle.
- The maximum smoke density was recorded as 3.36 (Bosch No.).
- The maximum temperature of engine oil, coolant (water) and exhaust gas were observed as 119.1, 106 and 382.4° C respectively.
- The lubricating oil & coolant consumption during five hours rating test were measured as 0.682 g/kWh (0.501 g/hph) and 0.33 % of total coolant capacity respectively.

**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 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.



Comb – 114/1606	SELF PROPELLED COMBINE HARVESTER 'S-4900 (TRACK TYPE)'	COMMERCIAL (ICT)	49 of 64
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**17.6 Noise measurement:**

- i) The ambient noise emitted by the machine was measured as 83.4dB(A).
- ii) The noise at driver's ear level was measured as 93.1 dB(A) .

**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 observation
			Paddy harvesting
1.	Speed of operation, kmph	1.61 to 2.80	2.13
2.	Area covered (ha/h)	0.220 to 0.346	0.281
3.	Fuel consumption: - (l/h) - (l/ha)	5.127 to 7.086 17.584 to 29.649	6.242 22.669
4.	Crop throughput (tonne/h)	3.26 to 7.46	5.35
5.	Grain breakage in main grain outlet(%)	0.071 to 1.915	0.603
6.	Header losses(%)	0.265 to 0.646	0.430
7.	Total non-collectable losses(%)	0.598 to 1.571	1.021
8.	Total collectable losses(%)	0.574 to 1.944	1.367
9.	Total processing losses(%)	1.219 to 4.331	2.561
10.	Threshing efficiency(%)	97.98 to 99.42	98.59
11.	Cleaning efficiency(%)	96.10 to 97.50	96.43

**17.7.2 Break down and repairs:**

No any breakdown was observed during entire running hours in a field test.

**17.7.3 Harvesting of any other crops:**

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

**17.7.4 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.

Comb – 114/1606	SELF PROPELLED COMBINE HARVESTER 'S-4900 (TRACK TYPE)'	COMMERCIAL (ICT)	50 of 64
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- 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 looked into regular production level.
- iv) The arrangement for adjusting the reel speed is not provided; this needs to be added and should be controlled from operator's position.
- v) The grain tank is provided with transparent glass to know the grain fill.
- vi) Air cleaner service indicator has been provided for operator's ease and safety of engine.
- vii) Grain tank cover is not provided, which are considered essential.

#### 17.7.5 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 controls 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 was observed as normal.

#### 17.8 Hardness and Chemical composition:

- i) The Hardness of lower knife blade is not within the prescribed limit of IS :6025-1999.
- ii) Manganese content in knife blade and Carbon content in knife back does not conform the requirement as per IS: 6025-1999 and IS: 10378-1982 respectively.

#### 17.9 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.

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

1. Operator manual.
2. Part's catalogue

Comb – 114/1606	SELF PROPELLED COMBINE HARVESTER 'S-4900 (TRACK TYPE)'	COMMERCIAL (ICT)	51 of 64
-----------------	---	---------------------	----------

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

S. No.	Characteristics	Requirement	Declared	Observed	Remark
1.	<b>Prime mover performance</b>				
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 (76.0)	55.96(76.08)	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.	53.0(72.06)	51.21(69.63)	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 (76.0)	55.64(75.65)	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.	263	257	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	5.2 Bosch No. required	3.36	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.	260	271.6	Conforms

Comb - 114/1606	SELF PROPELLED COMBINE HARVESTER 'S-4900 (TRACK TYPE)'	COMMERCIAL (ICT)	52 of 64
-----------------	---	---------------------	----------

	vii)	Back up torque, %	7% min.	--	8.04	Conforms
	viii)	Max. operating temp. To be declared by manufacturer	i) engine oil	125	119.1	Conforms
			ii) Coolant	115	106	Conforms
	ix)	Lubrication oil consumption, g/kWh	1% of SFC at max. power during high ambient condition	2.630	0.682	Conforms
<b>2.</b>	<b>Brake performance</b>					
	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 <sup>2</sup> .	$\leq 600N$ .	--	-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-	-
<b>3.</b>	<b>Mechanical vibration</b>					
	i)	Operator's platform	120 $\mu$ m max.	--	390	<b>Does not conform</b>
	ii)	Steering levers	150 $\mu$ m max.	--	320	<b>Does not conform</b>
	iii)	Seat with driver seated	120 $\mu$ m max.	--	340	<b>Does not conform</b>
<b>4.</b>	<b>Air cleaner oil pull over</b>					
	i)	Max. oil pull over in % age when tested in accordance with IS: 8122 pt. (II)-2000	0.25% max.	--	N.A.	Not applicable as dry type filter is provided
<b>5.</b>	<b>Noise measurement</b>					
	i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	--	83.4	Conforms
	ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,	--	93.1	Conforms



Comb - 114/1606	SELF PROPELLED COMBINE HARVESTER 'S-4900 (TRACK TYPE)'	COMMERCIAL (ICT)	53 of 64
-----------------	---	---------------------	----------

<b>6.</b>	<b>Discard limit</b>					
i)	Cylinder bore diameter	Should not exceed the values declared by the manufacture	104.5 (Max.)	104.03	Conforms	
ii)	Piston diameter	-do-	103.75 (Min.)	103.90	Conforms	
iii)	Ring end gap	-do-	1.50	1 <sup>st</sup> comp-0.40 2 <sup>nd</sup> comp-0.45 Oil control-0.40	Conforms	
iv)	Ring groove clearance	-do-	0.20	1 <sup>st</sup> Comp-0.07 2 <sup>nd</sup> Comp-0.05 Oil control-0.04	Conforms	
v)	Diametrical and axial clearance of big end bearing	-do-	Diametrical -0.25	Diametrical-0.10	Conforms	
vi)			Axial-0.50	Axial-0.25	Conforms	
vi)	Diametrical and axial clearance of main bearings	-do-	Diametrical -0.25	Diametrical-0.05	Conforms	
vii)			Axial-0.25	Axial-0.05	Conforms	
vii)	Thickness of brake lining	-do-	NA		-	
viii)	Thickness of clutch plate	-do-	NA		-	
<b>7.</b>	<b>Field performance</b>					
i)	Suitability for crops	Wheat & paddy essential	-	Applicable only for paddy crop	--	
ii)	Grain breakage in grain tank	≤ 2.5 %	--	0.071 to 1.915% (Avg. 0.603)	Conforms Conforms	
iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram	--	0.598 to 1.571% (Avg.1.201%)	Conforms	
iv)		≤ 4.0% for soybean			Conforms	
iv)	Threshing efficiency	≥ 98% wheat & paddy	--	97.98 to 99.42% (Avg. 98.59%)	Conforms	
v)	Cleaning efficiency	≥ 96 % wheat & paddy	--	96.10 to 97.50% (Avg. 96.43%)	Conforms	

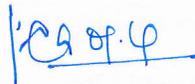
8. Safety requirement					
i)	Guards against all moving parts	Essential		Not provided	Does not conform
ii)	Lighting arrangement a) Head light b) Parking light c) Indication d) Reverse gear e) Brake f) Number plate	Essential as per CMVR		CMVR not applicable	--
iii)	Grain tank cover	Essential		Not provided	<b>Does not conform</b>
iv)	Spark arrester in engine's exhaust	Essential		Not provided	<b>Does not conform</b>
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 Not provided Not provided	<b>Does not conform</b>
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
9.					
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)		Knife guard is not provided in the machine	-
ii)	Knife blade As per IS :6025 -1982	It must have Chemical composition as C= 0.70-0.95 % Mn =0.30-0.50 %	--	Upper knife blade C-0.81 Mn-0.73 Lower knife blade C-0.77 Mn-0.65	Only conforms for carbon content



Comb - 114/1606	SELF PROPELLED COMBINE HARVESTER 'S-4900 (TRACK TYPE)'	COMMERCIAL (ICT)	55 of 64
-----------------	---	---------------------	----------

	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-0.23	<b>Does not conform</b>
<b>10.</b>	<b>Labelling of combine harvester</b>					
		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
<b>11.</b>	<b>Break down (critical major &amp; minor)</b>					
			Essential as per IS: 15806-2008 Annexure A1, A2, A3	--	None	Conforms

**TESTING AUTHORITY**

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