

व्यावसायिक परीक्षण रिपोर्ट  
COMMERCIAL TEST REPORT

संख्या / No. : Comb - 115/1607

माह / Month: May, 2014



**SELF PROPELLED COMBINE HARVESTER**

**'GAHIR-930'**



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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**16.9 Wear of the Peg Teeth:**

The wear of the peg teeth 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 hours of test 29.17 (g)	Percent wear by weight (%)
<b>a) Peg teeth of threshing cylinder:</b>			
1.	219.3	216.8	1.14
2.	220.3	218.6	0.77
3	231.0	227.6	1.47
4	220.5	217.7	1.27
5	216.5	213.0	1.62
6	229.1	226.2	1.27
7	211.0	208.4	1.23
8	215.9	214.5	0.65
<b>b) Peg teeth of Concave:</b>			
1	221.1	218.6	1.13
2	213.8	210.1	1.73
3	215.2	212.3	1.35
4	225.0	221.9	1.38
5	224.8	222.9	0.85
6	210.0	205.4	2.19
7	217.2	215.0	1.01
8	219.1	216.0	1.41
9	225.0	222.3	1.20

**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)
<b>i) Maximum power - 2 hours test:</b>					
70.7(96.1)	321.3(32.8)	2200	20.51(24.82)	0.290(0.213)	2.848(3.872)
57.0(77.5)	356.3(36.4)	1600	13.89(16.72)	0.244(0.179)	3.409(4.635)**



**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)*
54.42(74.0)	388.7(39.7)	1400	12.87(15.50)	0.236(0.174)	3.511(4.774)**

**iv) 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)*
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**b) maximum power:**

69.5(94.5)	316.0(32.2)	2200	20.32(24.78)	0.292(0.215)	2.805(3.184)*
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\* Under high ambient condition.

\*\* At no load speed corresponding to rated speed specified for field work.

**Remarks:**

- i) The maximum power output of the engine was observed as 70.7 (96.1) & 57.0(77.5) kW(Ps) at 2200 rpm and 1600 rpm respectively of engine at full throttle and setting recommend for field operation respectively, under during 2 hrs maximum power test, under natural ambient condition.
- ii) The specific fuel consumption corresponding to maximum power at full throttle and settings recommended for field operation was measured as 0.290(0.213) and 0.244(0.179) kg/kWh (kg/hph), during 2 hrs maximum power test, under natural ambient condition.
- iii) The back-up torque of the engine was observed as 19.6 % in natural ambient at full throttle where at field speed setting of 1750 engine rpm it was 5.1 %.
- iv) The maximum smoke density was recorded as 3.12 (Bosch No.) which is within permissible limit as specified in IS:15806-2008.
- v) The maximum temperature of engine oil, coolant (water) and exhaust gas was observed as 117.4, 102.0 and 501.0 respectively, under high ambient condition.
- vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.334 g/kWh (0.246 g/hph) and 1.90% of total coolant capacity respectively.

**17.2 Turning ability:**

The radius of turning circle at LHS and RHS was observed satisfactory. Combine is provided with single foot pedals for right and left brake.

**17.3 Visibility:**

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

**17.4 Braking Performance:**

- i) The maximum stopping distance and pedal force corresponding to mean deceleration of 2.5 m/sec<sup>2</sup> were 10.05 m and 204 N respectively. Minimum stopping distance is 7.1 m corresponding to the pedal force of 322N.
- ii) The performance of parking brake was found satisfactory.

**17.5 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.

**17.6 Noise measurement:**

- i) The ambient noise emitted by the machine was measured as 89.1 db(A) as against the maximum specified limit of 88 db(A) with relevant BIS
- ii) The noise at driver's ear level was measured as 99.4 dB(A) as against the maximum specified limit of 98 db(A) in relevant BIS code.

**17.7 Air cleaner oil pull over test**

This test is not applicable due to dry type air cleaner.

**17.8 Field Test:****17.8.1 Summary of field tests:**

The results of the field test are summarized below:

S. No	Parameters	Wheat Harvesting	Paddy Harvesting	Average	
				Wheat	Paddy
1.	Speed of operation (kmph)	3.92 to 4.10	3.39 to 3.78	4.03	3.56
2.	Area covered (ha/h)	0.825 to 1.169	0.647 to 0.972	0.975	0.803
3.	Fuel consumption: - (l/h) - (l/ha)	7.143 to 8.687 7.431 to 8.654	7.407 to 8.897 8.354 to 12.340	7.960 8.206	8.048 10.249
4.	Crop throughput (tonne/h)	7.39 to 13.26	7.82 to 13.06	10.79	9.49
5.	Grain breakage in main grain outlet(%)	0.169 to 0.369	0.304 to 1.063	0.210	0.716



6.	Header losses(%)	0.259 to 0.849	0.361 to 0.489	0.558	0.406
7.	Total non-collectable losses(%)	0.321 to 0.936	0.421 to 0.565	0.627	0.474
8.	Total collectable losses(%)	0.130 to 0.230	0.632 to 1.434	0.198	1.155
9.	Total processing losses(%)	0.346 to 0.678	1.189 to 2.350	0.477	1.939
10.	Threshing efficiency(%)	99.77 to 99.87	98.56 to 99.36	99.80	98.84
11.	Cleaning efficiency(%)	98.80 to 99.33	99.63 to 97.57	99.08	96.93

**17.7.1.1 Wheat Harvesting:**

- i) The grain breakage in all the varieties tested was measured as 0.169 to 0.369 (Avg. 0.210) which is within specified limit of 2.5% as specified in IS: 15806-2008.
- ii) The total non collectable losses ranged from 0.321 to 0.936 percent (Avg. 0.627) which is within specified limit of 2.5% as specified in IS: 15806-2008.
- iii) The total processing losses ranged from 0.346 to 0.678% (Avg. 0.477 %).
- iv) The threshing efficiency ranged from 99.77 to 99.87% (Avg. 99.80) which is within the specified limit of 98% as specified in IS : 15806-2008.
- v) The cleaning efficiency ranged from 98.80 to 99.33% (Avg. 99.08) which is within limit of 96% as specified in IS: 15806-2008.

**17.7.1.2 Paddy Harvesting:**

- i) The grain breakage ranged from 0.304 to 1.063 % (Avg. 0.716) which is within specified limit of 2.5% as per specified in IS: 15806-2008.
- ii) The total non-collectable losses ranged from 0.421 to 0.565 % (Avg. 0.474) which is within specified limit of 2.5% as specified in IS: 15806-2008.
- iii) The total processing losses ranged from 0.1.189 to 2.350 % (Avg. 1.939%).
- iv) The threshing efficiency ranged from 98.56 to 99.36 % (Average 98.84) which is with in specified limit of 98% as per specified in IS: 15806-2008.
- v) The cleaning efficiency ranged from 96.63 to 97.57% (Avg. 96.93) which is within the limit of 96% as specified in IS: 15806-2008.

**17.7.2 Harvesting of any other crops:**

The performance of combine to harvest wheat, paddy crops was evaluated as the same were 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.
- 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 grain elevator and tailing elevator drive are 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 by a hydraulic system.

#### 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 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.

#### 17.9 Hardness and Chemical composition:

- 17.9.1** Hardness of knife gaurd and raspbar do not conform the limits as specified in IS:6025-1999 and 10378-1982. These should be looked into at regular production level.  
The Manganese content of knife blade and carbon content of knife back are not conform the prescribed limit of IS:6025-1999 & IS:10378-1982 respectively.

#### 17.10 Maintenance/Service problems:

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

#### 17.10 Defects & Problems:

No noticeable defect or problem was observed during entire test of the combine harvester.

#### 17.11 Labelling of Combine Harvester:

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

#### 17.12 Literature supplied with the Machine:

Operator manual for prime mover (engine) for repair and maintenance is provided. However, a manual in respect of combine harvester as a whole should be brought out in Hindi and other regional languages as per relevant Indian standards IS:8132-1999 to guide to users and operator of combine.

**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.	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	57.0 (77.5)	-
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 applicant/ manufacturer.	238	290	<b>Does not conform</b>
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	5.20	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.	450	388.7	<b>Does not conform</b>

COMB -115/1607	SELF PROPELLED COMBINE HARVESTER 'GAHIR-930'	COMMERCIAL (ICT)	60 of 76
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	vii)	Back up torque, %	7% min.	-	19.6	Conforms
	viii)	Max. operating temp. To be declared by manufacturer	i) engine oil	120	117.4	Conforms
			ii) Coolant	108	102	Conforms
	ix)	Lubrication oil consumption, g/kWh	1% of SFC at 5hr. max. power test during high ambient condition	2.90	0.334	Conforms
2.	<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 $S \leq 0.15V + V^2/130$ $V = \text{speed}$ corresponding to 80% of design max. speed, kmph	10.0	7.12	Conforms
	ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec <sup>2</sup> .	$\leq 600N$ .	-	204	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.	<b>Mechanical vibration</b>					
	i)	Operator's platform	120 $\mu\text{m}$ max.		230	<b>Does not conform</b>
	ii)	Steering wheel	150 $\mu\text{m}$ max.		140	Conforms
	iii)	Seat with driver seated	120 $\mu\text{m}$ max.		100	Conforms
4.	<b>Air cleaner oil pull over</b>					
	i)	Max. oil pull over in % age when tested in accordance with IS: 8122 pt. (II)-2000	Not applicable	Machine having dry type air cleaner, hence test is not conducted		-
5.	<b>Noise measurement</b>					
	i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	-	89.1	<b>Does not conform</b>
	ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,		99.4	<b>Does not conform</b>

6.	<b>Discard limit</b>				
i)	Cylinder bore diameter, mm	Should not exceed the values declared by the manufacture	104.15	104.01	Conforms
ii)	Piston diameter	-do-	Not specified	103.12	-
iii)	Ring end gap	--do--	1 <sup>st</sup> comp - 1.2 2 <sup>nd</sup> comp-1.2 Oil control-1.2	0.45 0.45 0.30	Conforms Conforms Conforms
iv)	Ring groove clearance	--do--	1 <sup>st</sup> comp-0.7 2 <sup>nd</sup> comp-0.2 Oil control-0.1	NA 0.04 0.03	- Conforms Conforms
v)	Diametrical and axial clearance of big end bearing	-do-	Diametrical-0.12 Axial-0.6	0.10 0.15	Conforms Conforms
vi)	Diametrical and axial clearance of main bearings	--do--	Diametrical-0.13 End float-0.4	0.09 0.10	Conforms
vii)	Height over the rivet of a brake lining	Up to rivet	-	1.50	Conforms
viii)	Height over the rivet of a clutch plate	Up to rivet	-	1.80	Conforms
7.	<b>Field performance</b>				
i)	Suitability for crops	Wheat & paddy essential		Both for wheel and paddy are provided	Conforms
ii)	Grain breakage in grain tank	≤ 2.5 %		Wheat (0.169 to 0.369)% Avg.0.210% Paddy (0.304 to 1.063) Avg.0.716%	Conforms
iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean		Wheat (0.321 to 0.936%) Avg. 0.627% Paddy (0.421 to 0.565%) Avg.0.474%	Conforms
iv)	Threshing efficiency	≥ 98% wheat & paddy		Wheat (99.77 to 99.87%) Avg. 99.80% Paddy (98.56 to 99.36%) Avg.98.84%	Conforms

	v)	Cleaning efficiency	≥ 96 % wheat & paddy			Wheat (98.80 to 99.33%) Avg.99.08% Paddy (96.63 to 97.57%) Avg.96.93%	Conforms
8.	<b>Safety requirement</b>						
	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	--		Provided with CMVR certification No. CMVR/ COMB-SP/2093-14/128 Date 17.05.2013	Conforms
	iii)	Grain tank cover	Essential	--		Provided	Conforms
	iv)	Spark arrester in engine's exhaust	Essential	--		Not provided 	However the turbocharged engine eliminates the requirement of the separate 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 Not Provided	Provided Provided Not provided	Conforms Conforms <b>Does not conform</b>
9.	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	--		Labelled with symbols	Conforms

<b>Material of construction :</b>					
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)	-	Uncertain able as the relevant code doest specify the content limit	-
ii)	Knife blade As per IS :6025 -1982	It must have Chemical composition as C= 0.70-0.95 % Mn =0.30-0.50 %	-	C- 0.78% Mn- 0.75%	Conforms <b>Does not conform</b>
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- 0.16%	<b>Does not conform</b>
10.	<b>Labelling of combine harvester</b>				
	It should conforms to IS: 10273-1987	Essential, It should mention make & model, Engine No. Chassis No., Year of manufacture, Power & SFC of engine	--	Provided	Conforms
11.	<b>Break down (critical, major &amp; minor)</b>				
		Essential as per IS: 15806-2008 Annexure A1, A2, A3	--	None	Conforms