

व्यावसायिक परीक्षण रिपोर्ट  
COMMERCIAL TEST REPORT

संख्या / No. : Comb - 107/1599

माह / Month: May, 2014



SELF PROPELLED COMBINE HARVESTER  
'G.N-995'



सत्यमेव जयते

भारत सरकार  
कृषि मंत्रालय  
(कृषि एवं सहकारिता विभाग)



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

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## 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 l/h/kg/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	24.82/20.51	0.290(0.213)	2.848(3.872)
52.6(71.5)	351.0(35.8)	1500	15.25/12.65	0.240(0.177)	3.453(4.695)**
<b>ii) Power at rated engine speed (2200 rpm)</b>					
70.95(96.5)	322.5(32.9)	2200	24.70/20.53	0.289(0.213)	2.872(3.905)
69.61(94.6)	316.4(32.3)	2200	24.55/20.16	0.290(0.213)	2.835(3.855)*
<b>iii) Maximum torque:</b>					
54.01(73.4)	385.8(39.4)	1400	15.45/12.81	0.237(0.174)	3.496(4.753)
51.45(70.0)	367.5(37.5)	1400	15.13/12.44	0.242(0.178)	3.401(4.623)*
48.75(66.3)	375.0(38.3)	1300	13.71/11.38	0.233(0.171)	3.556(4.835)**
<b>iv) Five hour rating test:</b>					
<b>a) Engine loaded to 90% of maximum power:</b>					
65.0(88.4)	285.1(29.1)	2282	24.39/20.00	0.308(0.226)	2.667(3.626)
<b>b) maximum power:</b>					
69.5(94.5)	316.0(32.2)	2200	24.78/20.32	0.292(0.215)	2.805(3.184)

\* 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 70.7 kW (96.1 Ps) & 52.6 kW (71.5 Ps) at 2200 rpm and 1600 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 and 0.240Kg/kwh (0.213 & 0.177kg/hph).
- The back-up torque of the engine was measured as 19.6% under natural ambient at full throttle.
- The maximum smoke density was recorded as 3.12 (Bosch No.) which is within permissible limit
- The maximum temperature of engine oil, coolant (water) and exhaust gas was observed as 117.4, 102.0 and 501°C respectively.
- The lubricating oil & coolant consumption during five hours rating test were measured as 0.334(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.



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### 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 maximum stopping distance corresponding to mean deceleration of 2.5 m/sec<sup>2</sup> were observed 255 N and 7.0m.
- 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 89.7 & 100.3 dB (a) respectively

### 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)	3.96 to 4.51	2.53 to 3.88	4.24	3.40
2.	Area covered (ha/h)	0.855 to 1.006	0.657 to 0.871	0.934	0.727
3.	Fuel consumption: - (l/h) - (l/ha)	6.384 to 7.853 7.468 to 8.566	7.416 to 8.000 8.667 to 11.720	7.272 7.791	7.681 10.684
4.	Crop throughput (tonne/h)	7.53 to 13.74	9.20 to 13.95	10.25	11.86
5.	Grain breakage in main grain outlet(%)	0.130 to 0.331	0.333 to 1.064	0.244	0.589
6.	Header losses(%)	0.065 to 0.991	0.104 to 0.281	0.489	0.170
7.	Total non-collectable losses(%)	0.369 to 1.222	0.150 to 0.322	0.665	0.209
8.	Total collectable losses(%)	0.069 to 0.229	1.145 to 1.887	0.146	1.451
9.	Total processing losses(%)	0.489 to 0.663	1.770 to 2.261	0.566	2.079
10.	Threshing efficiency(%)	99.77 to 99.93	98.10 to 98.85	99.85	98.54
11.	Cleaning efficiency(%)	98.74 to 99.23	96.33 to 97.17	99.06	96.77

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#### 18.7.1.1 Wheat Harvesting:

- i) The grain breakage in all the varieties tested was measured as 0.130 to 0.331%.
- ii) The total non collectable losses ranged from 0.369 to 1.222 percent.
- iii) The total processing losses ranged from 0.489 to 0.663 %.
- iv) The threshing efficiency ranged from 99.77 to 99.93%.
- v) The cleaning efficiency ranged from 98.74 to 99.23%.

#### 18.7.1.2 Paddy Harvesting:

- i) The grain breakage ranged from 0.333 to 1.064% .
- ii) The total non-collectable losses ranged from 0.150 to 0.322% .
- iii) The total processing losses ranged from 1.770 to 2.261% .
- iv) The threshing efficiency ranged from 98.10 to 98.85%.
- v) The cleaning efficiency ranged from 96.33 to 97.17%

#### 18.7.2 Harvesting of any other crops:

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

#### 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 grain and tailing auger 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 operator's position.



#### 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.

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- 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 and raspbar do not conform with the limits as specified in IS:6025-1999 and IS:10378-1982. These should be looked into at regular production level

**18.8.2** The manganese content of knife blade and carbon content of knife back are not conforms the prescribed limit of IS:6025-1999 & IS:10378-1982 respectively.

**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 booklet containing brief information of machine, its operation, adjustments and maintenance schedule is provided by the manufacturer. However, this should be brought out as per IS: 8132-1999 in Hindi and other regional languages to guide to users and operator of combine harvester.

**19. 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

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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)	-
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 whichever 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	375.50	<b>Does not conform</b>
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



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<b>2.</b>	<b>Brake performance</b>				
i)	Max. stopping distance at a force equal to or less than 600 N on brake pedal, m	$10 \text{ m or } S \leq 0.15V + V^2/130$ V= speed corresponding to 80% of design max. speed, kmph	-	7.04	Conforms
ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec <sup>2</sup> .	$\leq 600\text{N.}$	-	255	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
<b>3.</b>	<b>Mechanical vibration</b>				
i)	Operator's platform	120 $\mu\text{m}$ max.	-	140	<b>Does not conform</b>
ii)	Steering wheel	150 $\mu\text{m}$ max.	-	110	Conforms
iii)	Seat with driver seated	120 $\mu\text{m}$ max.	-	120	Conforms
<b>4.</b>	<b>Air cleaner oil pull over</b>				
i)	Max. oil pull over in % age when tested in accordance with IS: P8122 pt. (II)-2000	0.25% max.	Machine is provided with dry type air cleaner hence test is not applicable	NA	--
<b>5.</b>	<b>Noise measurement</b>				
i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR		89.7	<b>Does not conform</b>
ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,		100.3	<b>Does not conform</b>
<b>6.</b>	<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-	0.45 0.45 0.30	Conforms Conforms Conforms

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			1.2 Oil control- 1.2		
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)	Thickness of brake lining	--do--	Up to rivet	8.0	Conforms
viii)	Thickness of clutch plate	--do--	Up to rivet	10.65	Conforms
7.	<b>Field performance</b>			Provided	Conforms
i)	Suitability for crops	Wheat & paddy essential			Conforms
ii)	Grain breakage in grain tank	≤ 2.5 %		Wheat (0.130 to 0.331%) Avg. 0.244% Paddy (0.333 to 1.064%) Avg. 0.589%	Conforms
iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean		Wheat (0.369 to 1.222%) Avg. 0.665% Paddy (0.150 to 0.322%) Avg. 0.209%	Conforms
iv)	Threshing efficiency	≥ 98% wheat & paddy		Wheat (99.77 to 99.93%) Avg. 99.85% Paddy (98.10 to 98.85%) Avg. 98.54%	Conforms
v)	Cleaning efficiency	≥ 96 % wheat & paddy		Wheat (98.74 to 99.23%)	Conforms



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					Avg. 99.06% Paddy (96.33 to 97.13%) Avg. 96.77%	
<b>8.</b>	<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-COMB-SP/2013-14/130 dated May, 2013			Provided	Conforms
iii)	Grain tank cover	Essential			Provided	Conforms
iv)	Spark arrester in engine's exhaust	Essential			Not provided	- However the turbo charged 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  Not provided	Conforms except for grain & tailing elevator
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
<b>9.</b>	<b>Material of construction :</b>					
i)	Guard should conform to IS: 6024 - 1983	The guard (except ledger plate) shall be manufactured from			Uncertain able as the relevant	--

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		malleable iron casting ( IS: 2108-1977), steel casting (IS: 1030-1974) or steel forging (IS: 2004-1978)		code does not specify the content limit	
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= 0.79% 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= 0.30%	<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

