

व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT

संख्या / No. : Comb-91/1510
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**SELF PROPELLED COMBINE HARVESTER
“GURDEEP - 427”**



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
ट्रैक्टर नगर, सिरसा रोड, हिसार - 125001 (हरियाणा)

NORTHERN REGION FARM MACHINERY TRAINING AND TESTING INSTITUTE
TRACTOR NAGAR, SIRSA ROAD, HISAR-125001 (HARYANA)

Telephone : 01662- 276172, 276824
Website : <http://nrfmtti.dacnet.nic.in>

Telefax No. : 01662-276984
E-Mail : fmti-nr@nic.in

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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 kg/h (l/h)	Specific fuel consumption kg/kwh (kg/hph)	Specific energy, kWh/l (hph/l)
i) Maximum power - 2 hours test:					
92.1(125.2)	409.2(41.8)	2250	24.468 (29.611)	0.266(0.195)	3.110(4.228)
77.2(105.0)	550.9(56.2)	1400	18.251 (22.012)	0.237(0.174)	3.505(4.765)**
ii) Power at rated engine speed (2200 rpm)					
94.3(128.2)	428.6(43.7)	2200	24.507 (29.634)	0.260(0.191)	3.182(4.327)
87.0(118.3)	395.3(40.3)	2200	23.858 (29.060)	0.274(0.202)	2.994(4.070)*
iii) Maximum torque:					
79.9(108.6)	550.8(56.2)	1450	18.878 (22.773)	0.236(0.174)	3.509(4.770)
67.7(92.0)	520.7(53.1)	1300	17.207 (20.959)	0.254(0.187)	3.230(4.392)*
70.0(95.2)	583.0(59.5)	1200	17.133 (20.618)	0.244(0.179)	4.086(5.555)**
iv) Five hour rating test:					
a) Engine loaded to 90% of maximum power:					
81.4(110.7)	356.6(36.4)	2283	22.441(27.330)	0.276 (0.203)	2.980(4.052)*
b) maximum power:					
89.7(122.0)	407.7(41.6)	2200	24.133 (29.395)	0.269(0.198)	3.052(4.149)*

* Under high ambient condition.

** At no load speed corresponding to rated speed of 1700 rpm specified for field work.

Remarks:

- i) The maximum power output of the engine was observed as 92.1 kW (125.2 Ps) & 77.2 kW (105.0 Ps) at 2250 rpm and 1400 rpm of engine at full throttle and setting recommended for field operation respectively.
- ii) The specific fuel consumption corresponding to maximum power at full throttle and setting recommended for field operation was measured as 0.266 & 0.237 Kg/kwh (0.195 & 0.174 kg/hph).
- iii) The back-up torque of the engine was measured as 30.8 % under natural ambient at full throttle.
- iv) The maximum smoke density was recorded as 4.45 (Bosch No.) which is within permissible limit
- v) The maximum temperature of engine oil, coolant(water) and exhaust gas was observed as 108.4, 99 and 492°C respectively.
- vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.392(0.288) g/kWh (g/hph) and 0.32% 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 stopping distance and pedal force corresponding to deceleration of 2.5 m/sec² where measured as 12.8 m and 210.2 N respectively. The performance is in line with the IS: 12207-1987.
- 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 93.8 & 92.8 dB (a) respectively. The noise at operator's level is lesser due to the operator's cabin.

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)	3.24 to 3.41	3.22 to 3.44	3.36	3.28
2.	Area covered (ha/h)	0.93 to 1.15	0.76 to 0.84	1.00	0.80
3.	Fuel consumption: - (l/h) - (l/ha)	9.75 to 11.69 8.99 to 11.92	8.0 to 9.44 9.84 to 11.23	10.41 10.42	8.39 10.46
4.	Crop throughput (tonne/h)	8.99 to 14.39	12.04 to 17.71	11.68	14.90
5.	Grain breakage in main grain outlet(%)	1.071 to 1.697	0.302 to 0.503	1.382	0.384
6.	Header losses(%)	0.795 to 1.250	0.639 to 1.145	0.957	0.899
7.	Total non-collectable losses(%)	0.867 to 1.311	0.870 to 1.735	1.021	1.365
8.	Total collectable losses(%)	Nil to 0.527	0.202 to 0.677	0.227	0.407
9.	Total processing losses(%)	1.157 to 2.020	0.946 to 1.544	1.673	1.257
10.	Threshing efficiency(%)	99.5 to 99.9	99.3 to 99.8	99.7	99.6
11.	Cleaning efficiency(%)	97.3 to 97.9	96.4 to 96.9	97.6	96.6



18.7.1.1 Wheat Harvesting:

- i) The grain breakage in all the varieties tested was measured as 1.071 to 1.697%.
- ii) The total non collectable losses ranged from 0.867 to 1.311 %.
- iii) The total processing losses ranged from 1.157 to 2.020 % .
- iv) The threshing efficiency ranged from 99.5 to 99.9%.
- v) The cleaning efficiency ranged from 97.3 to 97.9% .

18.7.1.2 Paddy Harvesting:

- i) The grain breakage ranged from 0.302 to 0.503 % .
- ii) The total non-collectable losses ranged from 0.870 to 1.735% .
- iii) The total processing losses ranged from 0.946 to 1.544 % .
- iv) The threshing efficiency ranged from 99.3 to 99.8%.
- v) The cleaning efficiency ranged from 96.4 to 96.9%

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 combine is equipped with air-conditioned operator's cabin which provides operator ease and comfort for tier less working for a longer duration of combine operation.
- ii) 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.
- iii) The design of stone trap need to be modified for easy cleaning without removing header unit.
- iv) Spark arresting device is not provided in the engine exhaust system which is considered essential.
- v) Slip clutch / safety device at undershot conveyor, front feeding auger and grain and tailing elevator are considered essential from safety point of view which needs to be provided.
- vi) The mechanical arrangement for adjusting the reel speed though provided, needs to be modified such that the same could be controlled from operators position.

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- vii) 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.
- 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 blade in remainder zone is higher, whereas the hardness of knife guard is lower than the limit as specified in IS:6025-2004 and IS:6024-2004 respectively. These should be looked into at regular production level.
- 18.8.2 Carbon content in knife back is lower whereas Manganese content in knife blade is higher than the limit as specified in IS: 10378-2006 & IS: 6025-2004 respectively. This should be looked into at 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 booklet containing brief information of machine, operation & adjustments is provided by the manufacturer. However, this should be modified 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.	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.	96.0(130.5)	92.1(125.2)	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.	75-80 (101.9-108.8)	77.2 (105.0)	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.	96.0(130.5)	92.1(125.2)	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.	235 $\pm 5\%$	266	Does not conform
	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	2.73 to 4.45	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.	~475	583.0(59.5)	Conforms

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	vii)	Back up torque, %	7% min.	--		Conforms
	viii)	Max. operating temp. To be declared by manufacturer	i) engine oil ii) Coolant	120° C 110° C	108.4° C 99 °C	Conforms Conforms
	ix)	Lubrication oil consumption, g/kWh	1% of SFC at 5hr. max. power test during high ambient condition	2.69+10%	0.392	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	7.15	Conforms
	ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec ² .	≤ 600N.	600	210.2	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.	--	160	Does not conform
	ii)	Steering wheel	150 µm max.	--	370	Does not conform
	iii)	Seat with driver seated	120 µm max.	--	120	Conforms
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	--
	ii)					
5.	Noise measurement					
	i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	--	93.8	Does not conform
	ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,	--	92.8 Operator's cabin is there.	Conforms

6. Discard limit					
i)	Cylinder bore diameter, mm	Should not exceed the values declared by the manufacture	107.534	107.26	Conforms
	Piston diameter	-do-	106.40	106.51	Conforms
	Ring end gap	--do--	2.0	0.60	Conforms
	Ring groove clearance	--do--	0.20	0.08	Conforms
	Diametrical and axial clearance of big end bearing	-do-	Diametrical-0.18 Axial -0.25	Diametrical-0.10 Axial – 0.25	Conforms
	Diametrical and axial clearance of main bearings	--do--	Diametrical -0.178 Axial -0.356	Diametrical -0.07 Axial – 0.10	Conforms
	Thickness of brake lining	--do--	Up to rivet head	(2.0 to 2.5 over rivet head)	Conforms
	Thickness of clutch plate	--do--	Up to rivet head	1.5 to 1.75 mm Over the rivet head	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-1.071 to 1.697% (Avg.=1.382%) Paddy-0.302 to 0.503% (Avg.=0.384%)	Conforms for both wheat and paddy
iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean	--	Wheat-0.867 to 1.311% (Avg.=1.021%) Paddy-0.870 to 1.735% (Avg.= 1.365%)	Conforms for both wheat and paddy
iv)	Threshing efficiency	≥ 98% wheat & paddy	--	Wheat-99.5 to 99.9% (Avg.=99.7%) Paddy-99.3 to 99.8% (Avg.=99.6%)	Conforms for both wheat and paddy

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	v)	Cleaning efficiency	$\geq 96\%$ wheat & paddy	--	Wheat- 97.3 to 97.9% (Avg.=97.6%) Paddy- 96.4 to 96.9% (Avg.=96.6%)	Conforms for both wheat and paddy
8.	Safety requirement					
	i)	Guards against all moving parts	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 as per CMVR Report No. CMVR/Comb-SP/2013-14/ 127 dated 10.05.2013	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 auger b) under shot conveyor drive c) Grain & tailing elevator	Essential	--	Not provided	Does not Conform
	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

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9.	x)	Labelling of control gauge	Essential	--	provided	Conforms
	Material of construction :					
	i)	Knife guard should conforms to IS: 6024 - 2004	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)	-	C=0.45% Si=0.25% Mn=0.70% P=0.038% S=0.038%	Unascertainable as the relevant code does not specify the limit of content.
	ii)	Knife blade As per IS :6025 -2004	It must have Chemical composition as C = 0.70-0.95 % Mn =0.30-0.50 %	-	C=0.83% Mn=0.71%	Conforms for carbon only
	iii)	Knife back Must meet the requirement of IS:10378-2006	The knife back shall be manufactured from Carbon Steel having minimum carbon content of 0.35 %	-	C=0.16%	Does not conform
10.	Labelling of combine harvester					
	It should conforms to IS: 10273-2004		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	

TESTING AUTHORITY

(R.M. TIWARI) AGRICULTURAL ENGINEER(W/S)	
(P. K. CHOPRA) SENIOR AGRICULTURAL ENGINEER	
(HIMAT SINGH) -DIRECTOR-	

Tests conducted/Reports compiled by :
B.N. Dixit(Senior Technical Assistant)

Applicant's comments

Received and added