June 30
July-1

व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT

संख्या / **No. : Comb – 111/1603**
माह / **Month: May, 2014**

SELF PROPELLED COMBINE HARVESTER 'KULDEEP-932'

सत्यमेव जयते

भारत सरकार
कृषि मंत्रालय
(कृषि एवं सहकारिता विभाग)

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

उत्तरी क्षेत्र कृषि मशीनरी प्रशिक्षण एवं परीक्षण संस्थान
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17.9 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 28.77 hours of test (g)	Percent wear by weight (%)
a)	**Peg teeth of threshing cylinder:**		
1.	207.4	206.9	0.24
2.	222.6	221.5	0.49
3	220.0	218.3	0.77
4	220.4	218.7	0.77
5	212.0	210.4	0.75
6	227.3	226.1	0.53
7	206.3	204.8	0.72
8	211.2	210.1	0.52
b)	**Peg teeth of Concave:**		
1	221.1	221.0	0.49
2	218.7	217.2	0.68
3	220.5	219.4	0.50
4	216.8	215.2	0.79
5	224.1	223.0	0.49
6	229.9	229.0	0.39
7	213.5	212.4	0.52
8	228.3	226.2	0.91
9	229.1	228.0	0.48

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)
79.8 (108.5	579.8(59.2)	1375	18.574 (22.365)	0.233 (0.171)	3.566 (4.848)****
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)
72.1 (98.0)	601.0(61.3)	1200	17.555(21.126)	0.243 (0.179)	3.413 (4.640)****
v) 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 conditions

Field settings

**** at 1600 rpm

i) The maximum power output of the engine was observed as 92.1 kW (125.2 Ps) & 79.8 kW (108.5 Ps) at 2250 rpm and 1600 rpm of engine at full throttle and setting recommend 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 & 0.233 Kg/kwh (0.195 & 0.171 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.

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/sec^2 were observed 280 N and 11.0 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 bistander and driver's ear level were measured as 87.8 & 97.8 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)	2.95 to 3.59	2.85 to 3.57	3.39	3.15
2.	Area covered (ha/h)	0.947 to 1.189	0.803 to 0.927	1.071	0.848
3.	Fuel consumption: - (l/h) - (l/ha)	8.34 to 9.62 7.99 to 9.12	8.20 to 9.80 9.93 to 11.54	9.11 8.53	9.01 10.61
4.	Crop throughput (tonne/h)	10.1 to 15.0	14.2 to 17.7	12.4	16.2
5.	Grain breakage in main grain outlet(%)	0.370 to 1.010	0.407 to 0.937	0.791	0.701
6.	Header losses(%)	0.397 to 0.829	0.321 to 0.816	0.604	0.499
7.	Total non-collectable losses(%)	0.604 to 1.299	0.555 to 1.250	1.018	0.837
8.	Total collectable losses(%)	0.470 to 1.000	0.712 to 1.107	0.784	0.932
9.	Total processing losses(%)	1.677 to 2.424	1.353 to 2.347	1.989	1.972
10.	Threshing efficiency(%)	98.8 to 99.7	98.7 to 99.2	99.2	98.9
11.	Cleaning efficiency(%)	96.2 to 97.5	96.1 to 96.7	96.9	96.5

18.7.1.1 Wheat Harvesting:

i) The grain breakage in all the varieties tested was measured as 0.370 to 1.010%.
ii) The rack and sieve losses ranged from 0.079 to 0.346 and 0.100 to 0.331 percent respectively.
iii) The header losses varied from 0.397 to 0.829 %
iv) The collectable losses ranged from 0.470 to 1.00%
v) The total non collectable losses ranged from 0.604 to 1.299 % .
vi) The total processing losses ranged from 1.677 to 2.424 % .
vii) The threshing efficiency ranged from 98.8 to 99.7%.
viii) The cleaning efficiency ranged from 96.2 to 97.5% .

18.7.1.2 Paddy Harvesting:

i) The grain breakage ranged from 0.407 to 0.937 % .
ii) The rack and sieve losses ranged from 0.112 to 0.217 and 0.112 to 0.243 percent respectively.
iii) The header losses varied from 0.321 to 0.816%.

iv) The collectable losses ranged from 0.712 to 1.107%
v) The total non-collectable losses ranged from 0.555 to 1.250% .
vi) The total processing losses ranged from 1.353 to 2.347% .
vii) The threshing efficiency ranged from 98.8 to 99.2 %.
viii) The cleaning efficiency ranged from 96.1 to 96.7%

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) Slip clutch / safety device in knife drive is considered essential from safety point of view which needs to be provided.
iv) The mechanical arrangement for adjusting the reel speed though provided, needs to be modified such that the same could be controlled from operators position.
v) 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 guard do not conform with the limits as specified in IS:6025-1999 and IS:6024-1999. These should be looked into at regular production level

18.8.2 Chemical analysis data for knife blade & knife back does not conform with the limits is specified in IS 6025-1999 & IS 10378-1982. 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:

The following literature were supplied by the firm in English.

1. Operator manual
2. Service manual
3. Part catalogue

However the manual have to be modified in accordance with 8132-1999 and brought in Hindi & other regional language for the guidance to user and operator of the 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 Max 75-80	79.8(108.5) at 1600 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.	96.0(130.5)	94.3(128.2)	Conforms
	iv)	Specific fuel consumption g/kWh.	The average observed value during 2 hr. max. power test must be within ±5% of the declared value by applicant/ manufacturer.	235 ± 5%	266	Does not 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	-	4.45	Conforms

	vi)	Max. crank shaft torque, (N–m) observed during the test at 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 Nm	601.0(61.3)	Conforms
	vii)	Back up torque, %	7% min.		30.8%	Conforms
	viii)	Max. operating temp. To be declared by manufacturer	i) engine oil ii) Coolant	120 95⁰ C	108.4 99.0⁰ C	Conforms Does not 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≤ 0.15V + $V^2/130$ V=speed corresponding to 80% of design max. speed, kmph	10.0	6.03	Conforms
	ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec^2.	≤ 600N.	600	280	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.	--	170	Does not conforms
	ii)	Steering wheel	150 µm max.	--	140	Conforms
	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	--

5.	**Noise measurement**					
	i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	8.8	87.8	Conforms
	ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,	98	97.8	Conforms
6.	**Discard limit**					
	i)	Cylinder bore diameter, mm	Should not exceed the values declared by the manufacture	107.534	107.29	Conforms
	ii)	Piston diameter	-do-	106.40	106.54	Conforms
	iii)	Ring end gap	--do--	2.0	0.6 max	Conforms
	iv)	Ring groove clearance	--do--	0.20	0.08 max	Conforms
	v)	Diametrical and axial clearance of big end bearing	-do-	Diame - trical – 0.18 Axial – 0.25	Diame - trical – 0.09 Axial – 0.20	Conforms Conforms
	vi)	Diametrical and axial clearance of main bearings	--do--	Diametrica 0.178 Axial – 0.356	Diametrical – 0.11 Axial – 0.10	Conforms Conforms
	vii)	Thickness of brake lining	--do--	Up to rivet head	Not applicable as the ceramic break lining is provided	Conforms
	viii)	Thickness of clutch plate	--do--	Up to rivet head	2.43 to 3.4	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- (0.370 to 1.010% Avg.=0.791% Paddy- (0.407 to 0.937%) Avg.=0.701%	Conforms for both wheat and paddy
	iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean	--	Wheat- 0.604 to 1.299% (Avg. 1.018%) Paddy- 0.555 to 1.250% (Avg. 0.837%)	Conforms for both wheat and paddy

	iv)	Threshing efficiency	≥ 98% wheat & paddy	--	Wheat- 98.8 to 99.7% (Avg. 99.2%) Paddy- 98.7 to 99.2% (Avg.98.9%)	Conforms for both wheat and paddy
	v)	Cleaning efficiency	≥ 96 % wheat & paddy	--	Wheat- 96.2 to 97.5% (Avg.96.9%) Paddy- 96.1 to 96.7% (Avg.96.5%)	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	--	Provided as per CMVR Test Report No. CMVR/Comb-SP/2013-14/132 dated 03.06.2013 from NFMT&TI, Hisar	Conforms
	iii)	Grain tank cover	Essential	--	Provided	-
	iv)	Spark arrester in engine's exhaust	Essential	--	Not provided	However, the turbocharg-er 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
	ix)	Working clearance around the controls	Essential 70 mm, min.	--	Provided	Conforms

9.	x)	Labelling of control gauge	Essential	--	provided	Conforms
	Material of construction :					
	i)	Guard should conforms 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)	-	C= 0.41 Si= 0.16 Mn= 0.63 P= 0.024 S= 0.022	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= 0.70 Mn= 0.74	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= 0.18	**Does not conform**
10.	**Labelling of combine harvester**					
	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.	**Break down (critical, major & minor)**					
			Essential as per IS: 15806-2008 Annexure A_1, A_2, A_3	--	None	Conforms

TESTING AUTHORITY

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(P. K. CHOPRA) SENIOR AGRICULTURAL ENGINEER	PKCh 01.4
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Applicant's comments

We will improve all the non compliance parameters of the test report in further future production.