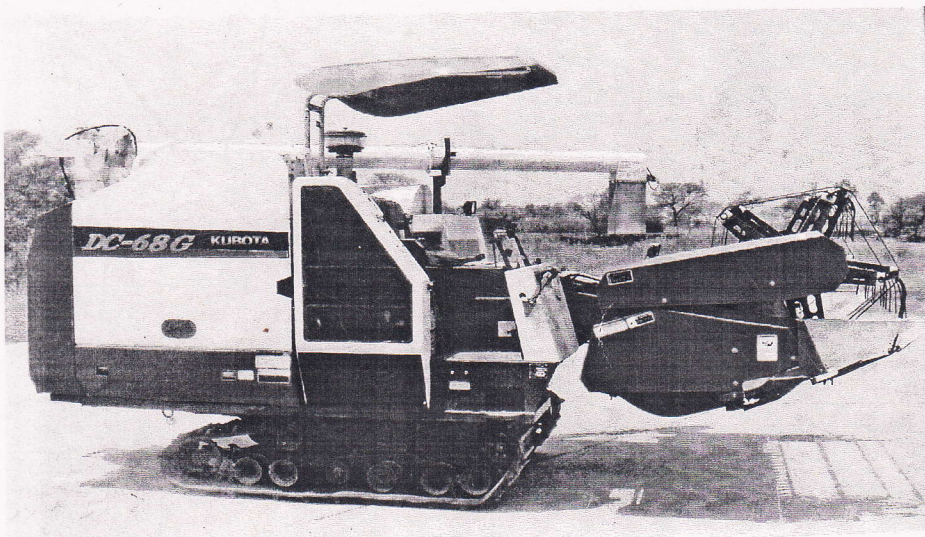


व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT

संख्या / No. : COMB-49/1223
माह/ Month : April, 2010



**COMBINE HARVESTER
KUBOTA DC- 68G (TRACK TYPE)**



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

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16.5 Bearings:

All the bearings of different assemblies of the combine were inspected and found in normal working conditions.

16.6 Wear of track:

The wear of track condition of track found normal and no sign of crack or damage observed after 144.91 hours of field and lab test.

16.7 Wear of the Peg Teeth bar:

The wear of the peg teeth bar 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 144.41 hours of test (g)	Percent wear (%)
a) Peg teeth of threshing cylinder:			
1.	70.4	67.4	4.26
2.	66.36	64.1	3.75
3	75.1	72.2	3.86
4	61.8	59.6	3.56
b) Bar of threshing cylinder:			
1	4714.5	4642.5	1.32
2	4805.6	4734.6	1.48
3	4854.3	4781.3	1.50
4.	4738.4	4680.4	1.22

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:					
46.7(63.5)	173.0(17.7)	2700	12.17(14.66)	0.261(0.192)	3.185(4.330)
42.2(61.1)	175.1(17.9)	2525	11.53(13.85)	0.261(0.192)	3.192(340)**
ii) Power at rated engine speed (2700 rpm)					
47.2*64.9)	176.5(18.0)	2700	12.35(14.81)	0.259(0.190)	3.221(4.379)
44.5(60.5)	164.7(16.8)	2700	12.04(14.52)	0.271(0.199)	3.624(5.022)*
iii) Maximum torque:					
29.5(40.17)	218.4(22.3)	1350	6.72(8.07)	0.228(0.168)	3.653(4.967)
35.5(48.3)	208.9(21.3)	1700	8.03(9.71)	0.226(0.166)	3.657(4.972)*
28.1(38.2)	216.3(22.1)	1300	6.57(7.91)	0.234(0.172)	3.555(4.833)**

iv) Five hour rating test:					
a) Engine loaded to 90% of maximum power:					
40.1 (54.5)	145.2 (14.8)	2761	10.89 (13.16)	0.271 (0.199)	3.047 (4.142)
b) maximum power:					
43.6 (59.3)	161.6 (16.5)	2700	11.80 (14.27)	0.271 (0.199)	3.058 (4.158)

* 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 46.7 kW (63.5 Ps) & 42.2 kW (61.1 Ps) at 2700 rpm and 2525 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 setting and setting recommended for field operation was measured as 0.261 Kg/kwh (0.192 kg/hph).
- iii) The back-up torque of the engine was measured as 23.7 % under natural ambient condition at full throttle.
- iv) The maximum smoke density was recorded as 2.04 (Bosch No.).
- v) The maximum temperature of engine oil, coolant(water) and exhaust gas were observed as 118,103 and 597°C respectively.
- vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.20 g/kWh (0.147 g/hph) and 0.35% 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 Mechanical Vibration:

The amplitude of mechanical vibration of components are given in chapter 12 of this report.

17.5 Noise measurement:

- i) The ambient noise emitted by the machine was measured as 82,8 dB(A) which.
- ii) The noise at driver's ear level was measured as 96.2 dB(A).

17.6 Field Test:**17.6.1 Summary of field tests:**

The results of the field test are summarized below:

S. No.	Observation	Wheat harvesting	Paddy harvesting
1.	Speed of operation (kmph)	4.75 to 5.47	5.30 to 5.64
2.	Area covered (ha/h)	0.38 to 0.57	0.41 to 0.65
3.	Fuel consumption: - (l/h) - (l/ha)	5.0 to 6.63 8.75 to 16.58	5.67 to 7.8 10.32 to 16.27
4.	Crop throughput (tonne/h)	3.5 to 6.70	6.18 to 12.51
5.	Grain breakage in main grain outlet(%)	0.030 to 0.740	Nil to 0.302
6.	Header losses(%)	0.317 to 3.662	0.342 to 1.456
7.	Total non-collectable losses(%)	0.998 to 4.831	0.735 to 4.607
8.	Total collectable losses(%)	0.010 to 0.300	0.030 to 2.005
9.	Total processing losses(%)	0.659 to 2.102	0.524 to 3.459
10.	Threshing efficiency(%)	99.8 to 99.9	97.9 to 99.9
11.	Cleaning efficiency(%)	98.1 to 99.3	92.6 to 99.3

17.6.1.1 Wheat Harvesting:

- i) The grain breakage ranged from 0.030 to 0.740 %.
- ii) The total non-collectable losses ranged from 0.998 to 4.83 %.
- iii) The total processing losses ranged from 0.659 to 2.102 %.
- iv) The threshing efficiency ranged from 99.8 to 99.9 %.
- v) The cleaning efficiency ranged from 98.1 to 99.3%.

17.6.1.1 Paddy Harvesting:

- i) The grain breakage ranged from Nil to 0.302 %.
- ii) The total non-collectable losses ranged from 0.735 to 4.607 %.
- iii) The total processing losses ranged from 0.524 to 3.459 %.
- iv) The threshing efficiency ranged from 97.9 to 99.9 %.
- v) The cleaning efficiency ranged from 92.6 to 99.3%.

17.6.2 Break down and repairs

Rear dust control plate broke during wheat harvesting.

17.6.3 Harvesting of any other crops:

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

17.6.4 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.
- 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 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 is provided with suitable device to know the grain fill.
- vi) Mechanical lock for reel in raised position needs to be provided to ensure safety while working on cutter bar.
- vii) Air cleaner service indicator has been provided for operator's ease and safety of engine.

17.6.5 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 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 peg teeth bar of threshing cylinder & concave were observed to be normal.

17.7 Hardness and Chemical composition:

The Hardness and chemical composition of knife blade are not within the prescribed limit of IS :6025-1999.

17.8 Maintenance/Service problems:

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

17.9 Identification plate of Combine Harvester:

The identification plate is provided on the combine harvester as specified in IS:10273-1999.

17.10 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 developed in Hindi and other regional languages for the guidance of the users

1. Operator manual.
2. Service manual.

18. 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	It should not be less than 5% of the declared value.	47.4	46.7	Conforms
ii)	Max. power observed during test after adjusting the no load engine speed as per recommendation of the manufacturer for field work, kW	Max. power observed must not be less than 5% of declared value.	46.0	44.2	Conforms
iii)	Power at rated engine speed, kW	The observed value must not be less than 5% of the declared value by the applicant.	47.4	46.7	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.	253	261	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	--	2.04	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.	120	218.4	Conforms
vii)	Back up torque, %	7% min.	--	23.7	Conforms
viii)	Max. operating temp. To be declared by manufacturer	i) engine oil	135° C	118	Conforms
		ii) Coolant	125° C	103	Conforms
ix)	Lubrication oil consumption, g/kWh	1% of SFC at max. power during high ambient condition	--	0.200	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	--	Not applicable as the combine is tract type	--
ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec ² .	$\leq 600N.$	--	Not applicable as the combine is tract type	--

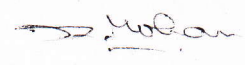
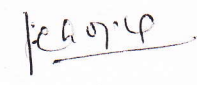
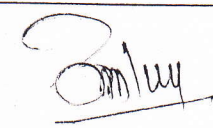
	iii)	Whether parking brake is effective at a force of 600 N at foot pedal or 400 N at Hand and lever	Yes or No	--	Yes	Conforms
3.	Mechanical vibration					
	i)	Operator's platform	120 μ m max.	--	615	Does not conform
	ii)	Steering wheel	150 μ m max.	--	930	Does not conform
	iii)	Seat with driver seated	120 μ m max.	--	820	Does not conform
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 the air cleaner is of dry type	--
5.	Noise measurement					
	i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	--	82.8	Conforms
	ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,	--	96.2	Conforms
6.	Discard limit					
	i)	Cylinder bore diameter	Should not exceed the values declared by the manufacture	87.17	87.03	Conforms
	ii)	Piston diameter	-do-	Not specified	86.50	Does not conform
	iii)	Ring end gap	--do--	1.25	0.55	Conforms
	iv)	Ring groove clearance	--do--	Comp. ring-0.20 Oil ring - 0.15	0.10 0.05	Conforms Conforms
	v)	Diametrical and axial clearance of big end bearing	--do--	Diametrical - 0.20 Axial - 0.5	0.09 0.30	Conforms Conforms
	vi)	Diametrical and axial clearance of main bearings	--do--	Diametrical - 0.20 Axial - 0.50	0.10 0.20	Conforms Conforms
	vii)	Thickness of brake lining	--do--	Not applicable	--	--
	viii)	Thickness of clutch plate	--do--	Not applicable	-do-	--

7. Field performance										
i)	Suitability for crops	Wheat & paddy essential	--	Wheat & paddy	Conforms					
ii)	Grain breakage in grain tank	≤ 2.5 %	--	Wheat- 0.030-0.740% (Avg. - 0.253%)	Conforms					
				Paddy- 0.00-0.302% (Avg. 0.177%)	Conforms					
iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean	--	Wheat- 0.998-4.836% (Avg. - 2.324%)	Conforms					
				Paddy- 0.735-4.607% (Avg. 1.813%)	Conforms					
iv)	Threshing efficiency	≥ 98% wheat & paddy	--	Wheat- 99.8-99.9% (Avg.- 99.9%)	Conforms					
				Paddy- 97.9-99.9% (Avg.- 99.61%)	Conforms					
v)	Cleaning efficiency	≥ 96 % wheat & paddy	--	Wheat- 98.1-99.3% (Avg. -98.9%)	Conforms					
				Paddy- 92.6-99.3% (Avg. 96.7%)	Conforms					
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	--	Not applicable as the machine is of track type.	--					
					iii)	Grain tank cover	Essential	--	Provided	Conforms
					iv)	Spark arrester in engine's exhaust	Essential	--	Not provided	Does not conform
					v)	Stone trap before concave	Essential	--	Not provided	Does not conform
					vi)	Rear view mirror	Essential	--	Not provided	Does not conform
					vii)	Slip clutch at following drives - a) Cutting platform	Essential	--	Slip clutche provided for cutting	Conforms

	b) under shout conveyor drive c) Grain & tailing elevator			platform & undershot conveyor and one alarm indicator is provided to indicate overloading of 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
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)	Not specified	-	Uncertain-able
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 = 0.62% Mn = 0.78%	Does not conform Does not conform
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 %	--	Carbon content in knife back is 0.60%.	Conforms
10.	Labelling of combine harvester				
	It should conform to IS: 10273-1987	Essential, It should mention make & model,	--	Provided	Conforms

		Engine No. Chassis No., Year of manufacture, Power & SFC of engine		
11.	Break down (critical major & minor)			
		Essential as per IS: 15806-2008 Annexure A1, A2, A3	--	Breakage of rear dust adjusting plate but not repetitive in nature
				Conforms

TESTING AUTHORITY:

(R. M. TIWARI) ASSISTANT ENGINEER (W/S)	
(P. K. CHOPRA) SENIOR AGRICULTURAL ENGINEER	
(A. N. MESHRAM) -DIRECTOR-	

Test report compiled by Sh. B.N. Dexit (Tech. Asstt.)

APPLICANTS COMMENTS

S.No.	Reference	Applicant's comments
1.	Appendix -IV & V	The cleaning efficiency in some variety of paddy are affected due to high grain straw ratio or high intensity of weeds.
2.	Para 3.3.7 Hardness of critical components	In case of cutter bar blade, the hardness is limited to certain region but for knife guard matter will be forwarded to the Production Department to improve it.
3.	Para 18, Sr. No. 6 ii) Piston size	Piston is designed in such a way that its diameter varies according to the position of measurement.
4.	Para 18, Sr. No. 8 vi) Rear view mirror	Rear view mirror is not required as the machine has to work only in field, there is no recommendation to drive on road.