



**SELF PROPELLED COMBINE HARVESTER
'CHARAN-732'**



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

17.8 Wear of rasp bar

Sr. No.	Mass of rasp bar before test (g)	Mass of rasp bar after 28.08 h test (g)	Wear (%) by weight
1	5884.9	5851.3	0.57
2	5579.9	5517.5	1.12
3	5947.2	5911.2	0.61
4	5766.5	5736.9	0.51

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 25.08 h of test (g)	Percent wear by weight (%)
a) Peg teeth of threshing cylinder:			
1.	206.3	205.1	0.58
2.	222.6	221.3	0.58
3	192.0	191.1	0.47
4	204.6	203.6	0.49
5	204.5	203.5	0.49
6	196.2	195.4	0.41
7	195.7	194.8	0.46
8	196.3	195.1	0.61
b) Peg teeth of Concave:			
1	202.0	201.0	0.50
2	207.6	206.5	0.53
3	209.8	208.5	0.62
4	189.1	188.5	0.32

18 SUMMARY OF OBSERVATIONS, COMMENTS AND RECOMMENDATIONS

18.1 Engine Performance Test:

Engine Brake power, kW	Engine speed (rpm)	Hourly fuel consumption (l/h)	fuel kg/h	Specific fuel consumption kg/kwh	Specific energy, kWh/l
i) Maximum power - 2 hours test:					
70.7	2200	20.51 (24.82)		0.290	2.848
52.6	1500	12.65 (15.25)		0.240	3.453**
ii) Power at rated engine speed (2200 rpm)					
70.95	2200	20.53 (24.70)		0.289	2.872

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69.61	2200	20.16 (24.55)	0.290	2.835*
iii) Maximum torque:				
54.01	1400	12.81 (15.45)	0.237	3.496
51.45	1400	12.44 (15.13)	0.242	3.401*
48.75	1300	11.38 (13.71)	0.233	3.556**
iv) Five hour rating test:				
a) Engine loaded to 90% of maximum power:				
65.0	2282	20.0 (24.39)	0.308	2.667*
b) maximum power:				
69.5	2200	20.32 (24.78)	0.292	2.805*

* Under high ambient condition.

** Specified for field work.

Remarks:

- i) The maximum power output of the engine was observed as 70.7 kW & 52.6 kW at 2200 rpm and 1500 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 0.290 & 0.240 Kg/kwh.
- iii) The back-up torque of the engine was measured as 19.6 % under natural ambient at full throttle.
- iv) The maximum smoke density was recorded as 3.12 (Bosch No.) which is within permissible limit
- v) The maximum temperature of engine oil, coolant(water) and exhaust gas was observed as 117.4, 102.0 and 501° C respectively.
- vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.334 g/kWh and 1.90% of total coolant capacity respectively.

18.2 Turning ability:

The diameter 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 minimum stopping distance and pedal force corresponding to deceleration of 2.5 m/sec² were observed as 5.74 m and 287 N respectively. The performance is in line with the IS: 12207-2008.
- 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 94 & 102 dB (a) respectively. The noise at operator's ear level exceeds the limit of 98 dB(A) specified by IS:15806-2007

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)	3.32 to 3.72	1.98 to 3.64	3.49	3.17
2.	Area covered (ha/h)	1.07 to 1.30	0.62 to 0.90	1.15	0.82
3.	Fuel consumption: - (l/h) - (l/ha)	7.275 to 8.50 5.60 to 7.91	7.51 to 8.0 8.44 to 12.24	7.81 6.81	7.69 9.52
4.	Crop throughput (tonne/h)	8.89 to 10.0	7.72 to 19.6	9.44	13.92
5.	Grain breakage in main grain outlet(%)	1.052 to 2.064	0.781 to 1.745	1.514	1.215
6.	Header losses(%)	1.069 to 2.250	1.165 to 2.672	1.709	1.726
7.	Total non-collectable losses(%)	1.275 to 2.292	1.372 to 2.941	1.807	1.933
8.	Total collectable losses(%)	0.226 to 0.621	0.030 to 0.274	0.441	0.115
9.	Total processing losses(%)	1.393 to 2.699	1.103 to 2.113	2.053	1.537
10.	Threshing efficiency(%)	99.4 to 99.8	99.7 to 99.9	99.6	99.9
11.	Cleaning efficiency(%)	96.5 to 98.5	96.2 to 96.8	97.3	96.5

18.7.1.1 Wheat Harvesting:

- i) The grain breakage in all the varieties tested was measured as 1.052 to 2.064%.
- ii) The total non collectable losses ranged from 1.275 to 2.292 %.
- iii) The total processing losses ranged from 1.393 to 2.699 % .
- iv) The threshing efficiency ranged from 99.4 to 99.8%.
- v) The cleaning efficiency ranged from 96.5 to 98.5%.

18.7.1.2 Paddy Harvesting:

- i) The grain breakage ranged from 0.781 to 1.745 % .
- ii) The total non-collectable losses ranged from 1.372 to 2.941%.
- iii) The total processing losses ranged from 1.103 to 2.113%.
- iv) The threshing efficiency ranged from 99.7 to 99.9%.
- v) The cleaning efficiency ranged from 96.2 to 96.8%

**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) Slip clutch should be provided at front feeding auger, grain & tailing elevator and at undershot conveyor.
- 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.
- vi) The grain tank needs to be provided with suitable grain fill indicator device.
- vii) A dust blower is provided below operator control panel to throw away the dust coming to operator front side.

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 at remainder zone is lower whereas at hardened zone it conforms to the limit as specified in relevant code IS:6025-2004.

18.8.2 Hardness of knife guard is lower than the limit as specified in IS:6024-2004. This should be looked into in future at regular production level

18.8.3 Chemical composition of knife blade conforms to their relevant code.

18.8.4 Carbon content of knife back is lower then the limit as specified in IS:10378-2006. This should be looked into in future 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:

Following literature were supplied by the manufacturer

1. Operator manual in English
2. Parts catalogue in Hindi, English & Punjabi
3. Service book in English
4. Leaflet.

Although the literature are sufficient, however operator manual & service book also should be modified as per IS: 8132-1999 in Hindi & 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	It should not be less than 5% of the declared value.	74.3	70.7	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.	55.0	52.6	Conforms
iii)	Power at rated engine speed, kW	The observed value must not be less than 5% of the declared value by the applicant.	74.3	70.95	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 \pm 5	290	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	-	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.	350	358	Conforms
vii)	Back up torque, %	7% min.	--	19.6	Conforms
viii)	Max. operating temp. To be declared by manufacturer. ^o C	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	2.92+10%	0.334	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		3.79	Conforms
ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec ² .	$\leq 600N$.		287	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 μ m max.		210	Does not conform

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	ii)	Steering wheel	150 µm max.		300	Does not conform
	iii)	Seat with driver seated	120 µm max.		200	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 engine has dry type air cleaner	--
5.	Noise measurement					
	i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR		94	Does not conform
	ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,		102	Does not conform
6.	Discard limit					
	i)	Cylinder bore diameter, mm	Should not exceed the values declared by the manufacture	104.15	104.01	Conforms
	ii)	Piston diameter	--do--	103.25	103.48	Conforms
	iii)	Ring end gap	--do--	1.2	0.65	Conforms
	iv)	Ring groove clearance	--do--	Top-0.7 Second-0.2 Oil ring-0.1	- Second-0.10 Oil ring-0.08	Conforms
	v)	Diametrical and axial clearance of big end bearing	--do--	Diametrical - 0.12 Axial-0.60	Diametrical- 0.06 Axial-0.25	Conforms
	vi)	Diametrical and axial clearance of main bearings	--do--	Diametrical - 0.13 Axial-0.40	Diametrical - 0.07 Axial-0.15	Conforms
	vii)	Thickness of brake lining	--do--	Up to rivet head	4.1 to 4.3 mm over the rivet head	Conforms
	viii)	Thickness of clutch plate	--do--	Up to rivet head	1.8 to 2.4 mm over the rivet head	Conforms
7.	Field performance					
	i)	Suitability for crops	Wheat & paddy essential		Wheat & paddy	Conforms



ii)	Grain breakage in grain tank	$\leq 2.5\%$		Wheat (1.052 to 2.064%) Av.=1.514% Paddy (0.781 to 1.745%) Av.=1.215%	Conforms
iii)	Non collectable losses	$\leq 2.5\%$ for wheat, paddy & gram $\leq 4.0\%$ for soybean		Wheat (1.275 to 2.292%) Av.=1.807% Paddy (1.372 to 2.941%) Av.=1.933%	Conforms
iv)	Threshing efficiency	$\geq 98\%$ wheat & paddy		Wheat (99.4 to 99.8%) Av.=99.7% Paddy (99.7 to 99.9%) Av.99.9%	Conforms
v)	Cleaning efficiency	$\geq 96\%$ wheat & paddy		Wheat (96.5 to 98.5%) Av.=97.3% Paddy (96.2 to 96.8%) Av.=96.5%	Conforms
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	Conforms
iii)	Grain tank cover	Essential		Provided	Conforms
✓ iv)	Spark arrester in engine's exhaust	Essential		Not provided however turbo charger eliminates the turbo charger 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 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
x)	Labelling of control and gauges	Essential		Provided	Conforms
9.	Material of construction :				
i)	Knife guard should conform 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=0.4223% Si= 0.4490% Mn= 0.4865% P= 0.0268% S=Nil%	Unascertainable as the relevant code does not specify the content limits.
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= 0.7410% Mn= 0.4873%	Conforms
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= 0.2448%	Does not conform

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10. Labelling of combine harvester					
	It should conform 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)					
Sr. No.	Category of breakdowns	Category (evaluative/ Non evaluative)	Requirements as per IS: 15806-2008	As observed	Whether meets the requirements (Yes/No.)
1.	Critical	Evaluative	No critical breakdown	None	Yes
2.	Major	Evaluative	Not more than three and neither of them should be repetitive in nature	None	Yes
3.	Minor	Evaluative	Not more than five and frequency of each should not be more than three	None	Yes

TESTING AUTHORITY

G.R. AMBALKAR Agricultural Engineer	
R.K. NEMA Senior Agricultural Engineer	
HIMAT SINGH Director	

Test report compiled by: Sh. B.N. Dixit, Sr. Tech. Assistant

20.

APPLICANT'S COMMENTS

Para No.	Our reference	Applicant's comments
20.1	19 (3 (i) (ii) (iii))	We will dry to reduce the vibration of assemblies in future at our regular production level.
20.2	19 (5 (i) (ii))	We will dry to reduce noise level of our machine at our regular production.
20.3	19 (8 (vii))	We will provide it in regular production in future.