



**SELF PROPELLED COMBINE HARVESTER
"K.S.A-8500"**



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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| Sl. No. | Original mass before test (g) | Mass after hours of test 29.81 (g) | Percent wear by weight (%) |
|---------|---|------------------------------------|----------------------------|
| a) | Peg teeth of threshing cylinder: | | |
| 1. | 193.2 | 192.3 | 0.47 |
| 2. | 190.1 | 189.3 | 0.42 |
| 3 | 195.6 | 194.6 | 0.51 |
| 4 | 199.7 | 198.3 | 0.70 |
| 5 | 189.2 | 188.6 | 0.48 |
| 6 | 191.9 | 190.3 | 0.83 |
| 7 | 198.9 | 198.3 | 0.30 |
| 8 | 199.1 | 198.3 | 0.40 |
| b) | Peg teeth of Concave: | | |
| 1 | 213.8 | 213.2 | 0.28 |
| 2 | 198.3 | 197.6 | 0.35 |
| 3 | 196.0 | 195.5 | 0.26 |
| 4 | 212.7 | 211.6 | 0.52 |
| 5 | 210.3 | 208.6 | 0.81 |
| 6 | 208.2 | 207.4 | 0.38 |

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: | | | | | |
| 74.3(100.9) | 334.0(34.0) | 2125 | 19.33(23.40) | 0.260(0.191) | 3.172(4.311) |
| 52.0(70.7) | 320.6(32.7) | 1550 | 11.78(14.19) | 0.226(0.166) | 3.668(4.988)** |
| ii) Power at rated engine speed (2200 rpm) | | | | | |
| 75.2(102.2) | 326.8(33.3) | 2200 | 19.92(24.04) | 0.265(0.195) | 3.128(4.252) |
| 73.3(99.7) | 318.1(32.4) | 2200 | 19.50(23.72) | 0.266(0.195) | 3.090(4.203)* |
| iii) Maximum torque: | | | | | |
| 62.9(85.5) | 375.5(38.3) | 1600 | 14.50(17.49) | 0.230(0.169) | 3.597(4.889) |
| 60.7(82.5) | 362.4(37.0) | 1600 | 14.01(17.02) | 0.231(0.169) | 3.566(4.847)* |
| 48.8(66.3) | 345.8(35.2) | 1350 | 10.80(13.00) | 0.221(0.163) | 3.753(5.099)** |
| iv) Five hour rating test: | | | | | |
| a) Engine loaded to 90% of maximum power: | | | | | |
| 71.2(96.7) | 295.8(30.2) | 2298 | 19.76(24.06) | 0.277(0.204) | 2.957(4.019)* |

b) maximum power:

| | | | | | |
|------------|-------------|------|--------------|--------------|---------------|
| 73.4(99.8) | 330.1(33.6) | 2126 | 19.21(23.34) | 0.261(0.192) | 3.146(4.274)* |
|------------|-------------|------|--------------|--------------|---------------|

* Under high ambient condition.

** At field setting

- i) The maximum power output of the engine was observed as 74.3(100.9) & 52.0(70.7) kW(Ps) at 2125 rpm and 1550 rpm of engine at full throttle and setting recommend for field operation respectively, under during 2 hrs maximum power test, under natural ambient condition.
- ii) The specific fuel consumption corresponding to maximum power at full throttle and settings recommended for field operation was measured as 0.260(0.191) and 0.226(0.166) kg/kWh (kg/hph), during 2 hrs maximum power test, under natural ambient condition.
- iii) The back-up torque of the engine was observed as 10.17% in natural ambient at full throttle whereas, at field speed setting of 1650 engine rpm it was 5.45%.
- iv) The maximum smoke density was recorded as 1.70 (Bosch No.) which is within the permissible limit as specified in IS:15806-2008.
- v) The maximum temperature of engine oil and coolant (water) was observed as 105.5 and 92.0 respectively.
- vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.218 g/kWh (0.161 g/hph) and 0.73% 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 Braking Performance:

- i) The braking effort and stopping distance corresponding to mean declaration 2.5 m/sec^2 , observed as 244.7 N and 8.5 m under cold condition.
- ii) The performance of parking brake was found satisfactory.

17.5 Mechanical Vibration:

The amplitude of mechanical vibration of components marked as (*) in chapter 12 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.

17.6 Noise measurement:

- i) The ambient noise emitted by the machine was measured as 87.7 db(A) as against the maximum specified limit of 88 db(A) with relevant BIS code.
- ii) The noise at driver's ear level was measured as 97.8 dB(A) as against the maximum specified limit of 98 db(A) in relevant BIS code.

17.7 Air cleaner oil pull over test

This test is not applicable due to dry type air cleaner.

17.8 Field Test:**17.8.1 Summary of field tests:**

The results of the field test are summarized below:

| S. No | Parameters | Range of parameters | | Average of parameters | |
|-------|--|------------------------------------|----------------------------------|-----------------------|----------------|
| | | Paddy Harvesting | Wheat Harvesting | Paddy | Wheat |
| 1. | Speed of operation (kmph) | 2.51 to 2.72 | 2.27 to 2.95 | 2.63 | 2.80 |
| 2. | Area covered (ha/h) | 0.426 to 0.654 | 0.611 to 0.648 | 0.517 | 0.629 |
| 3. | Fuel consumption: - (l/h) - (l/ha) | 5.881 to 7.797 10.099 to 15.920 | 5.247 to 6.250 8.430 to 9.790 | 6.769 13.307 | 5.776 9.181 |
| 4. | Crop throughput (tonne/h) | 9.93 to 15.20 | 5.80 to 10.47 | 13.30 | 8.26 |
| 5. | Grain breakage in main grain outlet (%) | 0.130 to 0.233 | 0.001 to 1.400 | 0.196 | 0.803 |
| 6. | Header losses (%) | 0.073 to 0.150 | 0.004 to 0.798 | 0.100 | 0.367 |
| 7. | Total non-collectable losses (%) | 0.095 to 0.171 | 0.017 to 0.857 | 0.122 | 0.435 |
| 8. | Total collectable losses (%) | 0.631 to 1.10 | 0.232 to 1.128 | 0.695 | 0.527 |
| 9. | Total processing losses (%) | 0.364 to 1.321 | 0.722 to 2.233 | 0.914 | 1.405 |
| 10. | Threshing efficiency (%) | 98.89 to 99.72 | 98.86 to 99.77 | 99.27 | 99.47 |
| 11. | Cleaning efficiency (%) | 97.60 to 98.90 | 97.20 to 98.14 | 98.53 | 97.86 |

17.7.1.1 Wheat Harvesting:

- i) The grain breakage in all the varieties tested was measured as 0.001 to 1.400% (Avg. 0.803%) which is within specified limit of 2.5% as specified in IS: 15806-2008.
- ii) The total non collectable losses ranged from 0.232 to 1.128% (Avg. 0.527%) which is within specified limit of 2.5% as specified in IS: 15806-2008.
- iii) The total processing losses ranged from 0.722 to 2.333% (Avg. 1.405 %).
- iv) The threshing efficiency ranged from 98.86 to 99.77% (Avg. 99.47%) which is within the specified limit of 98% as specified in IS : 15806-2008.
- v) The cleaning efficiency ranged from 97.20 to 98.14% (Avg. 97.86%) which is within limit of 96% as specified in IS: 15806-2008.

17.7.1.2 Paddy Harvesting:

- i) The grain breakage ranged from 0.130 to 0.233% (Avg. 0.196%) which is within specified limit of 2.5% as per specified in IS: 15806-2008.
- ii) The total non-collectable losses ranged from 0.095 to 0.171% (Avg. 0.122%) which is within specified limit of 2.5% as specified in IS: 15806-2008.
- iii) The total processing losses ranged from 0.364 to 1.321% (Avg. 0.914%).
- iv) The threshing efficiency ranged from 98.89 to 99.92% (Average 99.27%) which is with in specified limit of 98% as per specified in IS: 15806-2008.
- v) The cleaning efficiency ranged from 97.60 to 98.90% (Avg. 98.53%) which is within the limit of 96% as specified in IS: 15806-2008.

17.7.2 Harvesting of any other crops:

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

17.7.3 Ease of Operation and Safety Provision:

- i) The controls provided around the operator are within easy reach.
- 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 elevator and tailing elevator drive are considered essential from safety point of view which needs to be provided.
- v) The mechanical arrangement for adjusting the reel speed should have to provide and needs to be modified such that the same could be controlled from operators position by a hydraulic system.

17.7.4 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.

17.9 Hardness and Chemical composition:

17.9.1 Hardness of knife guard and peg tooth are not conforming to IS:6025-1999 and IS:10378-1982.

17.9.2 Manganese and carbon content of knife blade and knife back do not complying to IS: 6025-1999 and IS:10378-1982 respectively.

17.10 Maintenance/Service problems:

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

17.10 Defects & Problems:

No noticeable defect or problem was observed during entire test of the combine harvester.

17.11 Labelling of Combine Harvester:

The labelling plate as per IS: 10273-1999 is provided on the combine harvester.

17.12 Literature supplied with the Machine:

The operator's manual, spare part catalogue and service manual of the combine should be brought out as per relevant Indian standard IS:8132-1999 in Hindi and other regional language to guide user and service personal.

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 kW(Ps) | It should not be less than 5% of the declared value. | 74.3 (101.0) | 74.3 (101.0) | 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 | Not specified | 52.0 (70.7) | -- |

| | | | | | | |
|----|--------------------------|---|--|-----------------|-----------------|---|
| | 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 (101.0) | 75.2 (102.2) | 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. | 265 | 260 | 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 | 5.2 | 1.70 | 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. | 390 | 375.5 | Conforms  |
| | vii) | Back up torque, % | 7% min. | -- | 10.17 | Conforms |
| | viii) | Max. operating temp. To be declared by manufacturer | i) engine oil ii) Coolant | 120 95 | 105.5 92 | Conforms Conforms |
| | ix) | Lubrication oil consumption, g/kWh | 1% of SFC at 5hr. max. power test during high ambient condition | 2.73 | 0.218 | 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 | -- | 8.5 | Conforms |
| | ii) | Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec ² . | $\leq 600N$. | -- | 244.7 | 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. | -- | 210 | Does not conform |
| | ii) | Steering wheel | 150 µm max. | -- | 260 | Does not conform |
| | iii) | Seat with driver seated | 120 µm max. | -- | 230 | 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 | Not applicable | -- | Machine is provided with dry type air cleaner hence test is avoided | -- |
| 5. | Noise measurement | | | | | |
| | i) | Max. ambient noise emitted by combine dB (A) | 88 dB (A) as per CMVR | -- | 87.7 | Conforms |
| | ii) | Max. noise at operator's ear level dB (A) | 98 dB (A) as per CMVR, | -- | 97.8 | Conforms |
| 6. | Discard limit | | | | | |
| | i) | Cylinder bore diameter, mm | Should not exceed the values declared by the manufacture | 104.15 | 104.02 | Conforms |
| | ii) | Piston diameter | -do- | 103.88 | 103.88 | Conforms |
| | iii) | Ring end gap | --do-- | 1 st comp - 1.2 2 nd comp-1.2 Oil control-1.2 | 0.55 0.60 0.60 | Conforms Conforms Conforms |
| | iv) | Ring groove clearance | --do-- | 1 st comp-0.7 2 nd comp-0.2 Oil control-0.2 | NA 0.05 0.05 | - Conforms Conforms |
| | v) | Diametrical and axial clearance of big end bearing | -do- | Diametrical-0.12(Max) Axial NA | 0.11 0.15 | Conforms for Diametrical clearance only |
| | vi) | Diametrical crank shaft end float. | -do- | 0.10 | 0.10 | Conforms |
| | | Axial Crank shaft end float. | -do- | 0.5 | 0.05 | Conforms |
| | vii) | Height over the rivet of a brake lining | Not applicable | Up to rivet head | 1.5 mm over the rivet head | Conforms |

| | | | | | | |
|----|---------------------------|--|--|------------------|---|-------------------------|
| | viii) | Height over the rivet of a clutch plate | -do- | Up to rivet head | 2.32 mm over the rivet head | Conforms |
| 7. | Field performance | | | | | |
| | i) | Suitability for crops | Wheat & paddy essential | -- | Recommended for paddy and wheat | Conforms |
| | ii) | Grain breakage in grain tank | ≤ 2.5 % | -- | Paddy-0.130 to 0.233 Avg. 0.196 Wheat-0.001 to 1.400 Avg. 0.803 | Conforms |
| | iii) | Non collectable losses | ≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean | -- | Paddy-0.095 to 0.171 Avg. 0.122 Wheat 0.017 to 0.857 Avg. 0.435 | Conforms |
| | iv) | Threshing efficiency | ≥ 98% wheat & paddy | -- | Paddy-98.89 to 99.72 Avg. 99.27 Wheat-98.86 to 99.77 Avg. 99.47 | Conforms |
| | v) | Cleaning efficiency | ≥ 96 % wheat & paddy | -- | Paddy- 97.60 to 98.90 Avg. 98.53 Wheat-97.20 to 98.14 Avg. 97.86 | 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 | -- | Provided with CMVR certification No. CMVR/ COMB—SP/2014-15/157 | Conforms |
| | iii) | Grain tank cover | Essential | -- | Provided | Conforms |
| | iv) | Spark arrester in engine's exhaust | Essential | -- | Not provided, however the turbocharger is provided in engine exhaust. | Does not conform |
| | v) | Stone trap before concave | Essential | -- | Provided | Conforms |
| | vi) | Rear view mirror | Essential | -- | Provided | Conforms |
| | vii) | Slip clutch at following drives – a) Cutting platform | Essential | Provided | Provided | Conforms |

| | | | | | |
|-----------|---|--|----------|--|---|
| | b) under shot conveyor drive | | Provided | Provided | Conforms |
| | c) Grain & tailing elevator | | Provided | Provided | 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 |
| x) | Labelling of control gauge | Essential | -- | Labelled with symbols | Conforms |
| 9. | Material of construction : | | | | |
| 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) | -- | C= 0.26% Si= 0.29% Mn= 0.34% P= 0.026% S= 0.020% | Unascertain-able as the relevant code does not specify the content limit. |
| 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= 0.90% Mn= 0.55% | Conforms 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 % | -- | C= 0.13% | Does not conform |
| 10 | Labelling of combine harvester | | | | |
| | 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 |