COMMERCIAL TEST REPORT

SELF PROPELLED COMBINE HARVESTER
"GURDEEP-527"

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

NORTHERN REGION FARM MACHINERY TRAINING AND TESTING INSTITUTE
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### 18 SUMMARY OF OBSERVATIONS, COMMENTS AND RECOMMENDATIONS

#### 18.1 Engine Performance Test:

<table>
<thead>
<tr>
<th>Engine Brake power, kW (Ps)</th>
<th>Crankshaft torque, Nm(kgf-m)</th>
<th>Engine speed (rpm)</th>
<th>Hourly fuel consumption kg/h / l/h</th>
<th>Specific fuel consumption kg/kwh (kg/hph)</th>
<th>Specific energy, kWh/l (hph/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>i) Maximum power - 2 hours test:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>79.9 (108.7)</td>
<td>360.3 (36.8)</td>
<td>2220</td>
<td>21.85 (26.29)</td>
<td>0.273 (0.201)</td>
<td>3.042 (4.136)</td>
</tr>
<tr>
<td>59.8 (81.3)</td>
<td>398.7 (40.7)</td>
<td>1499</td>
<td>15.07 (18.13)</td>
<td>0.252 (0.185)</td>
<td>3.298 (4.485)**</td>
</tr>
<tr>
<td><strong>ii) Power at rated engine speed (2200 rpm)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>79.6 (108.2)</td>
<td>362.0 (36.9)</td>
<td>2200</td>
<td>21.84 (26.28)</td>
<td>0.274 (0.202)</td>
<td>3.029 (4.118)</td>
</tr>
<tr>
<td>75.7 (102.9)</td>
<td>344.2 (35.1)</td>
<td>2200</td>
<td>21.08 (25.58)</td>
<td>0.278 (0.204)</td>
<td>2.959 (4.024)*</td>
</tr>
<tr>
<td><strong>iii) Maximum torque:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44.7 (60.8)</td>
<td>406.5 (41.5)</td>
<td>1100</td>
<td>11.66 (14.04)</td>
<td>0.260 (0.191)</td>
<td>3.185 (4.331)</td>
</tr>
<tr>
<td>48.3 (65.7)</td>
<td>402.4 (41.1)</td>
<td>1200</td>
<td>12.60 (15.29)</td>
<td>0.261 (0.192)</td>
<td>3.158 (4.294)*</td>
</tr>
<tr>
<td>49.9 (67.8)</td>
<td>415.7 (42.7)</td>
<td>1200</td>
<td>12.94 (15.57)</td>
<td>0.259 (0.190)</td>
<td>3.204 (4.356)**</td>
</tr>
<tr>
<td><strong>iv) Five hour rating test:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Engine loaded to 90% of maximum power:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>69.8 (94.4)</td>
<td>308.4 (31.5)</td>
<td>2265</td>
<td>18.17 (22.05)</td>
<td>0.260 (0.191)</td>
<td>3.167 (4.306)*</td>
</tr>
<tr>
<td>b) maximum power:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>76.7 (104.3)</td>
<td>345.4 (35.2)</td>
<td>2220</td>
<td>21.02 (25.52)</td>
<td>0.274 (0.202)</td>
<td>3.006 (4.087)*</td>
</tr>
</tbody>
</table>

* Under high ambient condition.
** At no load speed corresponding to rated speed specified for field work.

**Remarks:**

1. The maximum power output of the engine was observed as 79.9 kW (108.7 Ps) & 59.8 kW (81.3 Ps) at 2220 rpm and 1499 rpm of engine at full throttle and setting recommend for field operation respectively.
2. The specific fuel consumption corresponding to maximum power at full throttle and setting recommended for field operation was measured as 0.273 & 0.252 Kg/kwh (0.201 & 0.185 kg/hph).
3. The back-up torque of the engine was measured as 12.6 % in natural ambient at full throttle.
4. The maximum smoke density was recorded as 2.20 (Bosch No.).
5. The maximum temperature of engine oil, coolant(water) and exhaust gas was observed as 123, 94 and 708°c respectively.
6. The lubricating oil & coolant consumption during five hours rating test were measured as 0.126 g/kWh and 6.21% of total coolant capacity respectively.
18.2 Turning ability:  
Turning ability of combine was observed as 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 mean deceleration and stopping distance corresponding to 228 N pedal force was measured as 2.50 m/sec² and 11.50 m respectively.

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:  
i) The ambient noise emitted by the machine was measured as 87.8 dB(A).

18.7 Air cleaner oil pull over test  
The maximum oil pull over was observed as 0.22%.

18.8 Field Test:  
18.8.1 Summary of field tests:  
The results of the field test are summarized below:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Observation</th>
<th>Wheat harvesting</th>
<th>Paddy harvesting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Speed of operation (kmph)</td>
<td>2.94 to 3.77</td>
<td>3.03 to 3.21</td>
</tr>
<tr>
<td>2.</td>
<td>Area covered (ha/h)</td>
<td>0.91 to 1.18</td>
<td>0.75 to 1.19</td>
</tr>
</tbody>
</table>
| 3.     | Fuel consumption:  
- (l/h) | 8.77 to 9.14 | 6.07 to 8.55 |
|        | - (l/ha) | 7.43 to 9.72 | 6.32 to 11.37 |
| 4.     | Crop throughput (tonne/h) | 10.19 to 15.97 | 5.89 to 19.89 |
| 5.     | Grain breakage in main grain outlet(%) | 0.302 to 0.996 | 0.609 to 1.182 |
| 6.     | Header losses(%) | 0.300 to 0.794 | 0.301 to 2.716 |
| 7.     | Total non-collectable losses(%) | 0.356 to 0.847 | 0.311 to 2.864 |
| 8.     | Total collectable losses(%) | Nil to 0.400 | 0.401 to 2.087 |
| 9.     | Total processing losses(%) | 0.554 to 1.411 | 1.151 to 2.927 |
| 10.    | Threshing efficiency(%) | 99.59 to 99.99 | 97.9 to 99.6 |
| 11.    | Cleaning efficiency(%) | 97.87 to 98.97 | 95.6 to 97.7 |
18.8.1.1 Wheat Harvesting:
   i) The grain breakage in all the varieties tested was measured as 0.302 to 0.966 %.
   ii) The total non collectable losses ranged from 0.356 to 0.847 percent. The major constituent of non-collectable losses is header loss.
   iii) The total processing losses ranged from 0.554 to 1.411 %.
   iv) The threshing efficiency ranged from 99.59 to 99.99%.
   v) The cleaning efficiency ranged from 97.87 to 98.97%.

Necessary improvements to bring down grain breakage and processing losses are required to be incorporated.

18.8.1.2 Paddy Harvesting:
   i) The grain breakage ranged from 0.609 to 1.182 %.
   ii) The total non-collectable losses ranged from 0.311 to 2.864 %.
   iii) The total processing losses ranged from 1.151 to 2.927 %.
   iv) The threshing efficiency ranged from 97.9 to 99.6 %.
   v) The cleaning efficiency ranged from 95.6 to 97.7%.

Necessary improvements to reduce processing losses and increase cleaning efficiency are required to be incorporated.

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

18.8.3 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.
   iii) Spark arresting device is not provided in the engine exhaust system which is considered essential.
   iv) Slip clutch / safety device in knife drive and threshing drum drive are considered essential from safety point of view which needs to be provided.
   v) The mechanical arrangement for adjusting the reel speed though provided but it needs to be modified such that the same could be controlled from operators position.
vi) The grain tank needs to be provided with suitable device to know the grain fill.

18.8.4 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 were observed as normal.

v) The condition of the bearing, chains, sprockets and belts observed as 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.

18.9 Hardness and Chemical composition:

The Hardness & chemical composition of knife blade does not conform to IS:6825-1993. The improvement should be made to comply with BIS standard under reference at regular production level.

18.10 Maintenance/Service problems:

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

18.11 Labelling of Combine Harvester:

The labelling plate is provided on the combine harvester. But it needs to be modified as per IS:10273-1999.

18.12 Literature supplied with the Machine:

18.12.1 The following literature was supplied with the machine for reference during testing

A booklet for combine harvester which comprises of operation, maintenance and repair of combine harvester is provided. It should be brought out as per IS:8132-1983 in Hindi or English and other regional languages to guide users and operators of combine.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Characteristics</th>
<th>Requirement</th>
<th>Declared</th>
<th>Observed</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prime mover performance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. i)</td>
<td>Max. Power (absolute) Average max. power observed during 2 hrs. max. power test in natural ambient condition kW(Ps)</td>
<td>It should not be less than 5% of the declared value.</td>
<td>81.0(110.0)</td>
<td>79.9(108.7)</td>
<td>Conforms</td>
</tr>
<tr>
<td>1. ii)</td>
<td>Max. power observed during test after adjusting the no load engine speed as per recommendation of the manufacturer for field work, kW(Ps)</td>
<td>Max. power observed must not be less than 5% of declared value.</td>
<td>Not specified</td>
<td>59.8(81.3)</td>
<td>Does not conform</td>
</tr>
<tr>
<td>1. iii)</td>
<td>Power at rated engine speed, kW(Ps)</td>
<td>The observed value must not be less than 5% of the declared value by the applicant.</td>
<td>81.0(110.0)</td>
<td>79.6(108.2)</td>
<td>Conforms</td>
</tr>
<tr>
<td>1. iv)</td>
<td>Specific fuel consumption g/kWh.</td>
<td>The average observed value during 2 hr. max. power test must be within ±5% of the declared value by applicant/manufacturer.</td>
<td>Not specified</td>
<td>273</td>
<td>Does not conform</td>
</tr>
<tr>
<td>1. v)</td>
<td>Max. smoke density (bosch no.) at 80% load between the speed at max. power &amp; 55% of speed at max. or 1000 rpm which ever is higher, should be observed as per CMVR rule</td>
<td>For tractor: 5.2 bosch no. or 75 hartridge For engine: Free deceleration or natural aspirated or turbo charges - 65 hartridge</td>
<td>--</td>
<td>2.20 Bosch No.</td>
<td>Conforms</td>
</tr>
<tr>
<td>1. vi)</td>
<td>Max. crank shaft torque, (N-m) observed during the test after no load engine speed is adjusted as per manufacturer's recommendation for field work</td>
<td>It must not be less than 8% of declare value by manufacturer.</td>
<td>400</td>
<td>415.7</td>
<td>Conforms</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>---</td>
</tr>
<tr>
<td>vii)</td>
<td>Back up torque, %</td>
<td>7% min.</td>
<td>--</td>
<td>12.6</td>
<td>Conforms</td>
</tr>
<tr>
<td>viii)</td>
<td>Max. operating temp. To be declared by manufacturer</td>
<td>i) engine oil</td>
<td>130° C</td>
<td>123° C</td>
<td>Conforms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii) Coolant</td>
<td>110° C</td>
<td>94° C</td>
<td>Conforms</td>
</tr>
<tr>
<td>ix)</td>
<td>Lubrication oil consumption, g/kWh</td>
<td>1% of SFC at 5hr. max. power test during high ambient condition</td>
<td>2.6</td>
<td>0.126</td>
<td>Conforms</td>
</tr>
</tbody>
</table>

2. **Brake performance**

i) **Max. stopping distance at a force equal to or less than 600 N on break pedal, m**

\[
10 \text{ m} \text{ or } S \leq 0.15V + \frac{V^2}{130} \quad \forall \text{ speed corresponding to } 80\% \text{ of design max. speed, kmph}
\]

\[
S = \frac{2.6}{V^2/130 + 0.15V}
\]

\[
V = 6.05 \text{ km/h}
\]

Conforms

ii) **Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec².**

\[
\leq 600\text{N.}
\]

\[
= 228 \text{ N}
\]

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**

\[
120 \mu\text{m max.}
\]

\[
= 317 \mu\text{m}
\]

Does not conform

ii) **Steering wheel**

\[
150 \mu\text{m max.}
\]

\[
= 658 \mu\text{m}
\]

Does not conform

iii) **Seat with driver seated**

\[
120 \mu\text{m max.}
\]

\[
= 410 \mu\text{m}
\]

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**

\[
0.25\% \text{ max.}
\]

\[
= 0.22
\]

Conforms

5. **Noise measurement**

i) **Max. ambient noise emitted by combine dB (A)**

\[
88 \text{ dB (A) as per CMVR}
\]

\[
= 87.8 \text{ dB (A) as per CMVR}
\]

Conforms

ii) **Max. noise at operator’s ear level dB (A)**

\[
98 \text{ dB (A) as per CMVR}
\]

\[
= 96.8 \text{ dB (A) as per CMVR}
\]

Conforms

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### Discard limit

<table>
<thead>
<tr>
<th>i)</th>
<th>Cylinder bore diameter</th>
<th>Should not exceed the values declared by the manufacture</th>
<th>107.546</th>
<th>107.26</th>
<th>Conforms</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii)</td>
<td>Piston diameter</td>
<td>-do-</td>
<td>Not specified</td>
<td>106.79</td>
<td>Does not conform</td>
</tr>
<tr>
<td>iii)</td>
<td>Ring end gap</td>
<td>-do-</td>
<td>0.55</td>
<td>0.50</td>
<td>Conforms</td>
</tr>
<tr>
<td>iv)</td>
<td>Ring groove clearance</td>
<td>-do-</td>
<td>0.254</td>
<td>0.05</td>
<td>Conforms</td>
</tr>
<tr>
<td>v)</td>
<td>Diametrical and axial clearance of big end bearing</td>
<td>-do-</td>
<td>Diametrical 0.178 Axial - Not specified</td>
<td>0.09</td>
<td>Conforms</td>
</tr>
<tr>
<td>vi)</td>
<td>Diametrical and axial clearance of main bearings</td>
<td>-do-</td>
<td>Diametrical - 0.178 Axial - 0.254</td>
<td>0.16</td>
<td>Conforms</td>
</tr>
<tr>
<td>vii)</td>
<td>Thickness of brake lining</td>
<td>-do-</td>
<td>Up to rivet head</td>
<td>11.3</td>
<td>Conforms</td>
</tr>
<tr>
<td>viii)</td>
<td>Thickness of clutch plate</td>
<td>-do-</td>
<td>Up to rivet head</td>
<td>8.0</td>
<td>Conforms</td>
</tr>
</tbody>
</table>

### Field performance

<table>
<thead>
<tr>
<th>i)</th>
<th>Suitability for crops</th>
<th>Wheat &amp; paddy essential</th>
<th>Wheat &amp; paddy</th>
<th>Suitable for Wheat &amp; paddy</th>
<th>Conforms</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii)</td>
<td>Grain breakage in grain tank</td>
<td>≤ 2.5%</td>
<td>--</td>
<td>Wheat- 0.302-0.996% (Avg.-0.670%) Paddy- 0.609-1.182% (Avg.-0.785%)</td>
<td>Conforms</td>
</tr>
<tr>
<td>iii)</td>
<td>Non collectable losses</td>
<td>≤ 2.5% for wheat, paddy &amp; gram ≤ 4.0% for soybean</td>
<td>--</td>
<td>Wheat- 0.356-0.847% (Avg.-0.623%) Paddy- 0.311-2.864% (Avg.-1.176%)</td>
<td>Conforms</td>
</tr>
<tr>
<td>iv)</td>
<td>Threshing efficiency</td>
<td>≥ 98% wheat &amp; paddy</td>
<td>--</td>
<td>Wheat- 99.59-99.99% (Avg.-99.78%) Paddy- 97.9-99.6% (Avg.-98.9%)</td>
<td>Conforms</td>
</tr>
</tbody>
</table>
| v)  | Cleaning efficiency | ≥ 96% wheat & paddy | -- | Wheat- 97.87-98.97%  
(Avg. -98.5%)  
Paddy- 95.6-97.7%  
(Avg. 96.3%) | Conforms

8. **Safety requirement**

| i)  | Guards against all moving per | Essential | -- | Provided | Conforms
| ii) | Lighting arrangement | Essential as per CMVR | -- | Provided as per CMVR report No. CMVR/Comb -SP/2009/24 dated 31.1.2010 | Conforms
| a) Head light |  |  |  |  |  
| b) Parking light |  |  |  |  |  
| c) Indication |  |  |  |  |  
| d) Reverse gear |  |  |  |  |  
| e) Brake |  |  |  |  |  
| f) Number plate |  |  |  |  |  
| iii) | Grain tank cover | Essential | -- | Partially covered | Does not conform
| iv) | Spark arrester in engine’s exhaust | Essential | -- | Not provided | 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  
b) under shout conveyor drive  
c) Grain & tailing elevator | Essential | -- | Only b) is 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 gauge | Essential | -- | Not provided | Does not conform

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<table>
<thead>
<tr>
<th>Material of construction:</th>
<th>Guard should conforms to IS: 6024 - 1983</th>
<th>Not declared</th>
<th>Carbon= 0.40 Silicon= 0.23 Manganese= 0.65 Phosphorous=0.036 Sulphur= 0.039</th>
<th>Unascertainable as the relevant code does not specify the content limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii) Knife blade As per IS :6025 -1982</td>
<td>It must have Chemical composition as C= 0.70-0.95 % Mn =0.30-0.50 %</td>
<td>Not declared</td>
<td>Carbon = 0.83 Manganese=0.63</td>
<td>Conforms Does not conform</td>
</tr>
<tr>
<td>iii) Knife back Must meet the requirement of IS:10378-1982</td>
<td>The knife back shall be manufactured from Carbon Steel having minimum carbon content of 0.35 %</td>
<td>Not declared</td>
<td>Carbon= 0.12</td>
<td>Does not conform</td>
</tr>
</tbody>
</table>

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 A1, A2, A3 -- None Conforms

TESTING AUTHORITY:

R. M. TIWARI
ASSISTANT ENGINEER (W/S)

(P. K. CHOPRA)
SENIOR AGRICULTURAL ENGINEER

A. N. MESHRAM
-DIRECTOR-


Applicant’s comments
Comments received and added in the final test report.