SELF PROPELLED COMBINE HARVESTER
(WALK BEHIND TRACK TYPE)
‘USHA LUBES, GY4L-0.9A’

GOVERNMENT OF INDIA
MINISTRY OF AGRICULTURE AND FARMERS WELFARE
(DEPARTMENT OF AGRICULTURE & COOPERATION)

NORTHERN REGION FARM MACHINERY TRAINING AND TESTING INSTITUTE
TRACTOR NAGAR, SIRSA ROAD, HISAR-125001 (HARYANA)
15.4 Chains, Sprockets and Belts:
All the chains, sprockets and belts were visually inspected and found in normal condition.

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

15.6 Wear of track:
The wear of track and condition of track was found normal and no sign of crack or damage observed after 57.67 hours of field and lab test.

16. SUMMARY OF OBSERVATIONS, COMMENTS AND RECOMMENDATIONS

16.1 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>i) Maximum power - 2 hours test:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.59 (13.04)</td>
<td>26.57 (2.71)</td>
<td>3446</td>
<td>5.506 (6.632)</td>
<td>0.574 (0.422)</td>
<td>1.45 (1.97)</td>
</tr>
<tr>
<td>7.18 (9.76)</td>
<td>29.16 (2.97)</td>
<td>2350</td>
<td>2.066 (2.486)</td>
<td>0.287 (0.211)</td>
<td>2.89 (3.93)**</td>
</tr>
<tr>
<td>ii) Power at rated engine speed (3600 rpm)</td>
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<td></td>
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<tr>
<td>9.13 (12.41)</td>
<td>24.2 (2.47)</td>
<td>3600</td>
<td>3.325 (4.000)</td>
<td>0.364 (0.268)</td>
<td>2.28 (3.10)</td>
</tr>
<tr>
<td>8.64 (11.25)</td>
<td>22.9 (2.30)</td>
<td>3600</td>
<td>4.083 (4.955)</td>
<td>0.451 (0.322)</td>
<td>1.83 (2.48)*</td>
</tr>
<tr>
<td>iii) Maximum torque:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.56 (12.99)</td>
<td>27.1 (2.76)</td>
<td>3370</td>
<td>5.038 (6.071)</td>
<td>0.527 (0.388)</td>
<td>1.58 (2.14)</td>
</tr>
<tr>
<td>8.95 (12.17)</td>
<td>25.5 (2.60)</td>
<td>3350</td>
<td>5.656 (6.864)</td>
<td>0.632 (0.465)</td>
<td>1.30 (1.77)*</td>
</tr>
<tr>
<td>6.88 (9.35)</td>
<td>29.2 (2.97)</td>
<td>2250</td>
<td>2.055 (2.474)</td>
<td>0.299 (0.220)</td>
<td>2.78 (3.78)</td>
</tr>
<tr>
<td>iv) Five hour rating test:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Engine loaded to 90% of maximum power:</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.61 (11.71)</td>
<td>22.6 (2.3)</td>
<td>3637</td>
<td>2.597 (3.145)</td>
<td>0.301 (0.221)</td>
<td>2.74 (3.73)*</td>
</tr>
<tr>
<td>b) maximum power:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.93 (12.14)</td>
<td>25.07 (2.5)</td>
<td>3400</td>
<td>5.514 (6.683)</td>
<td>0.617 (0.454)</td>
<td>1.34 (1.82)*</td>
</tr>
</tbody>
</table>

* Under high ambient condition
** Field setting in natural ambient condition (rpm recommended for field work)

Remarks:

i) The maximum power output of the engine was observed as 9.59 kW and 7.18 kW at 3446 and 2350 rpm of engine at full throttle and throttle setting recommendation for field operation respectively in natural ambient condition.

ii) The specific fuel consumption corresponding to maximum power at full throttle setting and setting recommended for field operation was measured as 0.574 kg/kwh and 0.287 kg/kwh respectively.

iii) The back-up torque of the engine was measured as 1.50 & 0.79 % under natural ambient condition and in high ambient conditions at full throttle respectively. Which is very less against the requirement of 7%. It may be looked into.
iv) Continuous black smoke was observed from silencer during the engine performance test which is undesirable.

v) The maximum smoke density was recorded as 9.4 Bosch No. which is higher than the specified limit value of 5.2 Bosch No. as per IS: 15806:2008.

vi) The maximum temperature of engine oil and exhaust gas were observed as 131 °C and 748 °C. Which exceed the specified limit. It should be looked into.

vii) The lubricating oil consumption during five hours rating test were measured as 1.42 g/kWh.

viii) The maximum crank shaft torque of the engine was observed as 27.1, 29.2 and 25.1 Nm at full throttle, setting recommended for field operation in natural ambient and full throttle at high ambient respectively.

ix) At max. power and two hours max. power test, excessive black smoke was emitted by the engine resulting into high fuel consumption was observed.

x) At further loading after 2225 rpm, the engine speed start fluctuation and the engine does not sustain the load.

16.2 Turning ability
The turning ability of the combine harvester is normal.

16.3 Visibility
The cutter bar of the machine is not visible to the operator.

16.4 Mechanical Vibration
The amplitude of mechanical vibration of components are given in chapter 10 of this report. The observation reading marked (*) for various assemblies on higher side and suitable arrangement may be provided to dampen the vibration for operator’s comfort.

16.5 Noise measurement
The ambient noise emitted by the machine was measured as 89 dB(A) and the noise at driver’s ear level was measured as 101 dB(A). It is on higher side. Suitable measures for reduction of noise level may be taken. The safety warning labels due to noise hazards may be provided and it may be recommended to were eye and ear protection during operation.

16.6 Air cleaner oil pull over
Percentage of oil pull over (mass basis) was observed as 1.11% against the specified limit of 0.25% as per IS: 8122 (Part-II): 2000. It is on higher side. It should be looked into for corrective action.

16.7 Field test
As per recommendations by the applicant the field test for paddy harvesting only was conducted for 50.25 hrs.

16.7.1 Summary of field tests:
The results of the field test are summarized below:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Observation</th>
<th>Paddy harvesting</th>
<th>Average of observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Speed of operation (kmph)</td>
<td>0.086 to 1.73</td>
<td>1.50</td>
</tr>
<tr>
<td>2.</td>
<td>Area covered (ha/h)</td>
<td>0.065 to 0.11</td>
<td>0.09</td>
</tr>
<tr>
<td>3.</td>
<td>Fuel consumption:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- (l/h)</td>
<td>0.800 to 1.300</td>
<td>0.987</td>
</tr>
<tr>
<td></td>
<td>- (l/ha)</td>
<td>10.00 to 12.88</td>
<td>11.152</td>
</tr>
<tr>
<td>4.</td>
<td>Crop throughput (tonne/h)</td>
<td>0.549 to 0.991</td>
<td>0.825</td>
</tr>
</tbody>
</table>
5. Grain breakage in main grain outlet (%) | Nil to 0.172 | 0.068
6. Header losses (%) | 0.409 to 4.037 | 1.738
7. Total non-collectable losses (%) | 1.911 to 4.867 | 3.234
8. Total collectable losses (%) | 0.030 to 0.728 | 0.300
9. Total processing losses (%) | 1.068 to 2.984 | 1.865
10. Threshing efficiency (%) | 99.2 to 99.9 | 99.65
11. Cleaning efficiency (%) | 95.4 to 97.0 | 96.28

16.7.2 Paddy Harvesting:
i) The grain breakage ranged from Nil to 0.172 percent (Avg. 0.068 percent).
ii) The total non-collectable losses ranged from 1.911 to 4.867 percent (Avg. 3.234 percent). It is higher than the specified limit. It should be looked into.
iii) The total processing losses ranged from 1.068 to 2.984 percent (Avg. 1.865 percent).
iv) The threshing efficiency ranged from 99.2 to 99.9 percent (Avg. 99.65 percent).
v) The cleaning efficiency ranged from 95.4 to 97.0 percent (Avg. 96.28 percent).

16.7.3 Harvesting of any other crops
The performance of combine to harvest paddy crop was evaluated as the same were recommended by the applicant.

16.8 Break down and repairs
No breakdown occurred during field & lab tests.

16.9 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 IS:6283-1998 may be provided.
ii) Spark arresting device is not provided in the engine exhaust system which is considered essential. It may be provided.
iii) Slip clutch / safety device in knife drive platform auger and threshing drum drive are not provided. It may be provided safety point of view.
iv) Adequate safety and hazards warning labels should be provided on the machine and it should be also be included in the operator’s manual.

16.10 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.
v) The condition of the bearing, chains, sprockets and belts was observed to be normal.
vii) The components of starter motor and alternator were found in normal working condition.

16.11 Hardness and chemical composition
The Hardness and chemical composition of knife blade and knife back are not within the prescribed limit of IS: 6025-1999. It may be looked into for corrective action.
### 16.12 Maintenance/service problems
No noticeable service/maintenance problem was observed during field testing of combine harvester.

### 16.13 Identification plate of combine harvester:
The identification plate is provided on the combine harvester. The chassis number, engine, make, model, SFC and serial number is not provided on it. It should be provided. The make of combine harvester is specified as ‘USHA LUBES’ by the applicant whereas it is not provided on labelling plate on anywhere on the machine.

### 16.14 Literature supplied with the machine
The following literature in English were supplied with the machine for reference during testing.

1. Operation manual-GY4L-09, GY4L-0.9A Combine Harvester of Chengdu Gangyi Machinery Co. Ltd.
2. Operation manual-KAIAO Air Cooled Diesel Engine
3. Parts assembly drawing of combine harvester and engine.

These were found adequate however, it need to be updated as per IS 8132:1999 and brought up in Hindi and other regional language for the guidance of the users. The contact details of Indian supplier and service points are not provided in literature. It may be provided.

### 17. SELECTED PERFORMANCE AND OTHER CHARACTERISTICS AS PER IS: 15806-2008.

<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>1.</td>
<td>Prime mover performance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>i) Max. Power (absolute) Average max. power observed during 2 hrs. max. power test in natural ambient condition</td>
<td>It should not be less than 5% of the declared value.</td>
<td>9.6</td>
<td>9.59</td>
<td>Conforms</td>
</tr>
<tr>
<td></td>
<td>ii) Max. power observed during test after adjusting the no load engine speed as per recommendation of the manufacturer for field work, kW</td>
<td>Max. power observed must not be less than 5% of declared value.</td>
<td>9.6</td>
<td>7.18</td>
<td>Does not conform</td>
</tr>
<tr>
<td></td>
<td>iii) Power at rated engine speed, kW</td>
<td>The observed value must not be less than 5% of the declared value by the applicant.</td>
<td>9.2</td>
<td>9.13</td>
<td>Conforms</td>
</tr>
</tbody>
</table>