COMMERCIAL TEST REPORT

ZENOAH FBC-42/4350 DW
FALCON SUPER CUT BRUSH/WEED CUTTER

Government of India
Ministry of Agriculture and Farmers Welfare
Department of Agriculture, Cooperation and Farmers Welfare
Northern Region Farm Machinery Training and Testing Institute

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Tele./FAX: 01662-276984
6. **FUEL & LUBRICANTS**

6.1 Fuel

Fuel: Unleaded Petrol

6.2 Lubricants

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Particulars</th>
<th>As recommended by the manufacturer</th>
<th>As used during the test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lubricant to add in fuel</td>
<td>Zenoah oil/JASO FD grade/ISO-I-EGD Grade</td>
<td>2T oil (JASO FC grade)</td>
</tr>
<tr>
<td>2</td>
<td>Gear case</td>
<td>Multi-purpose grease</td>
<td>As recommended</td>
</tr>
</tbody>
</table>

7. **RUNNING-IN**

In the agreement with the applicant’s representative, the brush cutter was run-in for 0.5 hours before actual test. All the fasteners were checked and tightened thereafter.

8. **ENGINE PERFORMANCE TEST**

The prime mover (petrol engine) fitted in the Zenoah FBC-42/4350 DW Brush Cutter is of 1.5 kW and not tested for performance separately, the performance parameters as declared by the manufacturer/applicant is reproduced hereunder:-

8.1 Performance related parameter declared by the manufacturer/applicant

- Recommended high idle speed, rpm: 12000
- Recommended low idle speed, rpm: 2500
- Maximum power, kW: 1.5

9. **MECHANICAL VIBRATION MEASUREMENT AT HANDLES**

The amplitude of mechanical vibration on the handles of brush cutter was recorded as under

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Location</th>
<th>HD (μ)</th>
<th>VD (μ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Handle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Right</td>
<td>110</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>Engine cover</td>
<td>400</td>
<td>500</td>
</tr>
<tr>
<td>3</td>
<td>Frame pipe</td>
<td>300</td>
<td>400</td>
</tr>
</tbody>
</table>

10. **NOISE MEASUREMENT**

*Noise at operator’s ear level*

Date of test: 25.04.2016

Type of sound level meter: CESVA-SC 20E

Temperature, °C: 40

Pressure, kPa: 98.3

Relative humidity, %: 27

Background noise level, dB(A): 50

Observed noise level, dB(A): 105
11. HARDNESS AND CHEMICAL COMPOSITION OF ROTOR BLADES

11.1 Hardness:

11.1.1 Hardness of triangular blade:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>As per IS: 6025:1982 HRC</th>
<th>As observed (HRC)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>48 to 58</td>
<td>47 to 49</td>
<td>Conforms</td>
</tr>
</tbody>
</table>

11.2 Chemical composition analysis:

11.2.1 Triangular blade:

<table>
<thead>
<tr>
<th>Constituents</th>
<th>As per IS: 6025-1982</th>
<th>Composition as observed (% of weight)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon (C)</td>
<td>0.70-0.95</td>
<td>0.5174</td>
<td>Does not conforms</td>
</tr>
<tr>
<td>Manganese (Mn)</td>
<td>0.30 to 0.50</td>
<td>0.3349</td>
<td>Conforms</td>
</tr>
<tr>
<td>Silicon (Si)</td>
<td>--</td>
<td>0.2215</td>
<td>--</td>
</tr>
<tr>
<td>Sulphur (S)</td>
<td>--</td>
<td>0.0000</td>
<td>--</td>
</tr>
<tr>
<td>Phosphorous (P)</td>
<td>--</td>
<td>0.0120</td>
<td>--</td>
</tr>
</tbody>
</table>

12. FIELD TEST

Field tests for 25.80 hrs. duration comprising of grass cutting with nylon rope and weeds/bush cutting using triangular blade attachments were carried out for 10.6 hrs. and 15.3 hrs. respectively. A total of 6 test trials were conducted. No load engine speed was observed as 6900 to 7100 rpm. Detailed results of field tests are shown in Annexure-I & II and summarized in the ensuing table. Details about the operator are show in Annexure-III.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Field condition</th>
<th>Intensity of grass/bush/weeds</th>
<th>Average number of bush/weeds in 1 sq.m</th>
<th>Avg. height of grass/bush/weeds, cm</th>
<th>Avg. Diameter of bush/weed, mm</th>
<th>Avg. Mass of grass cut (kg/h)/mass of bush/weed cut, (kg/h)</th>
<th>Average speed of operation, km/h</th>
<th>Avg. area covered (Rate of work), ha/h</th>
<th>Avg. Time required for one hectare, h</th>
<th>Avg. Fuel consumption l/h</th>
<th>Avg. Fuel consumption l/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Level</td>
<td>--</td>
<td>114 to 156</td>
<td>106 to 154</td>
<td>1.6 to 4.1</td>
<td>386.4 to 489.2</td>
<td>0.97 to 1.35</td>
<td>0.046 to 0.06</td>
<td>16.67 to 21.74</td>
<td>0.51 to 0.62</td>
<td>8.81 to 12.20</td>
</tr>
<tr>
<td>2</td>
<td>Level</td>
<td>High</td>
<td>High</td>
<td></td>
<td></td>
<td></td>
<td>1.10 to 1.67</td>
<td>0.052 to 0.06</td>
<td>16.67 to 19.23</td>
<td>0.54 to 0.59</td>
<td>8.95 to 11.29</td>
</tr>
<tr>
<td>3</td>
<td>Level</td>
<td>High</td>
<td>High</td>
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<td></td>
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<tr>
<td>4</td>
<td>Level</td>
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<td>High</td>
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<tr>
<td>5</td>
<td>Level</td>
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<tr>
<td>6</td>
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<td>High</td>
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<td>7</td>
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<tr>
<td>9</td>
<td>Level</td>
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<td>High</td>
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<td></td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>10</td>
<td>Level</td>
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<td>High</td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

12.1 Grass cutting using nylon rope assembly

12.1.1 Rate of work

i) Average area covered (rate of work) was observed as 0.046 to 0.060 ha/h
ii) Average speed of operation was observed as 0.97 to 1.37 kmph
iii) Average time required for one hectare was observed as 16.67 to 21.74 h
iv) Average mass of grass cut was observed as 0.51 to 0.62 l/h

12.1.2 Fuel consumption

Average fuel consumption was observed as 0.51 to 0.62 l/h and 8.81 to 12.20 ha/h
12.2 Weeds/bush cutting using triangular blade

12.2.1 Rate of work
   i) The average area covered (rate of work) was observed as 0.052 to 0.06 ha/h and the average speed ofoperation varies from 1.10 to 1.67 kmph.
   ii) Average time required for one hectare was observed as 16.67 to 19.23 hours
   iii) Average number of weeds/bush cut in one hour was observed as 61234 to 97718 of average diameter of 1.6 to 4.1 mm
   iv) Average number of weeds/bush in one square meter area was 114 to 156
   v) Average mass of weeds/bush cutted was 925.5 to 1570.7 kg/h

12.2.2 Fuel consumption
   Fuel consumption was observed as 0.54 to 0.59 l/h and 8.95 to 11.29 l/ha.

12.3 Labour requirement
   Two skilled operator was needed to operate the bush cutter continuously. Additionally, one more labour is needed gather the collected bush/weeds.

12.4 Adequacy of power of prime mover
   The power of prime mover was found adequate.

12.5 Wear analysis of critical components

<table>
<thead>
<tr>
<th>Component</th>
<th>Duration of operation (h)</th>
<th>Initial length/ mass (gm/mm)</th>
<th>Length/ Mass after operation</th>
<th>Loss of length/ mass</th>
<th>Percentage wear</th>
<th>Percentage wear on hour basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nylon rope</td>
<td>10.55</td>
<td>5950 mm</td>
<td>1300 mm</td>
<td>4650 mm</td>
<td>78.15</td>
<td>7.40</td>
</tr>
<tr>
<td>Triangular blade</td>
<td>15.25</td>
<td>208.7 gm</td>
<td>200 gm</td>
<td>8.7 gm</td>
<td>4.17</td>
<td>0.27</td>
</tr>
</tbody>
</table>

13. EASE OF OPERATION, ADJUSTMENTS AND SAFETY:
The machine is easy to operate and there is no problem was observed during the test except, the fatigue was observed during the operation of the machine due to excessive mechanical vibration and noise.

Work rest cycle for operator during grass and weeds/bush cutting with nylon rope assembly and triangular blade attachment was as follows

45 minute work  →  10 minutes rest  →  30 minutes work  →  10 minutes rest  →
30 minutes work  →  10 minutes rest  →  30 minutes work  →  so on

14. DEFECTS, BREAKDOWNS AND REPAIRS
   No breakdown occurred during 10.6 hours of grass cutting and 15.3 hours of weeds/bush cutting operation.

15. COMMENTS AND RECOMMENDATIONS
   i) The maximum sound pressure level at operator’s ear level was observed as 105 dB(A), which appears to be on higher side. As the sound pressure level is directly influencing the Human/operator’s Health, Safety and Comfort; and therefore suitable corrective action may be taken.
ii) The equivalent mechanical vibration on handle, engine cover & frame pipe was observed as 180, 500 and 400 micron. The mechanical vibration is directly concerned with operator’s Health, Safety and Comfort; apart from the useful life of the machine’s components. In view of the above, this deserves to be given top priority for corrective action.

iii) The capacity of fuel tank is only 0.95 liter, which does not appear to be adequate. This calls for necessary modification.

iv) A fuel on/off knob may be considered for providing in the fuel system of engine.

v) The hardness of triangular blade was recorded as 47 to 49, against the requirement of 48 to 58 HRC as per IS: 6025:1982. This should be looked into for necessary improvement in the quality of material of blades.

vi) The chemical composition of triangular blade does not conform, in full, to the IS: 6025-1982. This should be looked into.

vii) The marking/labeling provided is not adequate. It is therefore recommended to provide the marking/labeling plate with following details

i) Make
ii) Model
iii) Serial No.
iv) Year of manufacture
v) Manufacturer's address
vi) Engine No.
vi) Chassis No.
vi) Max. power (kW)
ix) Specific fuel consumption (g/kWh)

viii) Periodical greasing is required to be done by removing allen key bolts, which may be provided with grease nipples.

ix) During test applicant representative recommends to use 2T (JASO FC grade) oil for mixing in fuel where as in the operator's manual Zenoah oil/JASO FD grade/ ISO-I-EGD Grade oil is recommended. It should be looked into for suitable corrective action. Equivalent Indian Brand name of lub. oil should be specified.

x) Safety provisions/safety wear
i) All the safety accessories recommended for safety operation should be provided with machine.
ii) Safety signs and hazard pictorials are not provided on the machine. It must be provided on the machine for safety of user.