COMMERCIAL TEST REPORT

ZENOAH FBC-52/5050 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

Tractor Nagar, Sirsa Road, HISAR, (Haryana)-125 001

[ISO 9001:2008 COMPLIANT INSTITUTION]

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Tele./FAX: 01662-276984
8. ENGINE PERFORMANCE TEST
The prime mover (petrol engine) fitted in the Zenoah FBC-52/5050 DW Brush Cutter is of 2.4 kW and not tested for performance separately and 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 to 13000
Recommended low idle speed, rpm : 2800 ±200
Maximum power, kW : 2.4@ 9000 rpm

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>150</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>Right</td>
<td>150</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>230</td>
<td>550</td>
</tr>
<tr>
<td>2</td>
<td>Engine cover</td>
<td>1000</td>
<td>700</td>
</tr>
<tr>
<td>3</td>
<td>Frame pipe</td>
<td>1160</td>
<td>1140</td>
</tr>
</tbody>
</table>

10. NOISE MEASUREMENT AT OPERATOR'S EAR LEVEL
Noise at operator's ear level
Date of test : 05.05.2016
Type of sound level meter : Sound level meter, CESVA-SC ZOE
Temperature, °C : 40
Pressure, kPa : 98.3
Relative humidity, % : 26
Background noise level, dB(A) : 50
Observed noise level, dB(A) : 103

11. HARDNESS AND CHEMICAL COMPOSITION OF ROTOR BLADES
11.1 Hardness:
11.1.1 Hardness of circular 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>46 to 48</td>
<td>Conforms</td>
</tr>
</tbody>
</table>

11.2 Chemical composition analysis:
11.2.1 Circular 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>0.9513</td>
<td>Conforms</td>
</tr>
<tr>
<td>Manganese (Mn)</td>
<td>0.30 to 0.50</td>
<td>1.2223</td>
<td></td>
</tr>
<tr>
<td>Silicon (Si)</td>
<td>--</td>
<td>3.2394</td>
<td>--</td>
</tr>
<tr>
<td>Sulphur (S)</td>
<td>--</td>
<td>0.0000</td>
<td>--</td>
</tr>
<tr>
<td>Phosphorus (P)</td>
<td>--</td>
<td>0.0083</td>
<td>--</td>
</tr>
</tbody>
</table>
12. **FIELD TEST**

Field tests for 25.4 hours duration comprising of grass cutting with nylon rope assembly and weeds/bush cutting using circular blade attachments were carried out for 10.2 hrs. and 15.2 hours respectively. Total of 6 number of test trials were conducted. During test no load engine speed was observed as 8000± 250 rpm. Detailed results of field tests are shown in Annexure-I & II and summarized in the table. Details about the operator are shown in Annexure-III.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Parameters</th>
<th>Grass cutting</th>
<th>Weeds cutting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Field condition</td>
<td>Level</td>
<td>Level</td>
</tr>
<tr>
<td>2</td>
<td>Intensity of grass/bush/weeds</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>3</td>
<td>Average number of weeds/bush/in 1 m²/No. of weeds in 1 m²</td>
<td>--</td>
<td>119 to 153</td>
</tr>
<tr>
<td>4</td>
<td>Avg. height of grass/bush/weeds, cm</td>
<td>28. to 63</td>
<td>95 to 134</td>
</tr>
<tr>
<td>5</td>
<td>Avg. dia. of bush/weed, mm</td>
<td>--</td>
<td>3.9 to 5.9</td>
</tr>
<tr>
<td>6</td>
<td>Avg. mass of weed cut, (kg/h)/ mass of weeds/bush cutted (kg/h)</td>
<td>355 to 480</td>
<td>490 to 680</td>
</tr>
<tr>
<td>7</td>
<td>Average speed of operation, km/h</td>
<td>0.99 to 1.01</td>
<td>0.77 to 1.04</td>
</tr>
<tr>
<td>8</td>
<td>Rate of work, ha/h</td>
<td>0.050 to 0.078</td>
<td>0.076 to 0.086</td>
</tr>
<tr>
<td>9</td>
<td>Time required for one hectare, h</td>
<td>12.82 to 20.0</td>
<td>13.16 to 15.63</td>
</tr>
<tr>
<td>10</td>
<td>Fuel consumption</td>
<td>l/h 0.723 to 1.02 l/ha 10.38 to 20.40</td>
<td>0.725 to 0.932 l/ha 9.54 to 14.12</td>
</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 0.050 to 0.078 ha/h.

ii) Average speed of operation was observed as 0.99 to 1.01 km/h.

iii) Average time required for one hectare was observed as 12.82 to 20.0 hours.

iv) Average mass of grass cut was observed as 355 to 380 kg/h.

12.1.2 **Fuel consumption**

Average fuel consumption was observed as 0.723 to 1.02 l/h and 10.38 to 20.40 ha/h.

12.2 **Weeds/bush cutting using circular blade**

12.2.1 **Rate of work**

i) The average area covered (rate of work) was observed as 0.076 to 0.086 ha/h and the average speed of operation varies from 0.77 to 1.04 km/h.

ii) Average time required for one hectare was observed as 13.16 to 15.63 hours.

iii) Average number of weeds/bush in one square meter area was 119 to 153.

iv) Average mass of weeds/bush cutted was 490 to 680 kg/h.

12.2.2 **Fuel consumption**

Fuel consumption was observed as 0.725 to 0.932 l/h and 9.54 to 14.12 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
12.5.1  Circular blade/nylon rope attachment

<table>
<thead>
<tr>
<th>Component</th>
<th>Duration of operation (h)</th>
<th>Initial mass/length</th>
<th>Mass/length after operation</th>
<th>Loss of mass/length (g)</th>
<th>Percentage wear</th>
<th>Percentage wear on hour basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nylon rope</td>
<td>11.11</td>
<td>5355 mm</td>
<td>68.7 mm</td>
<td>4668</td>
<td>87.17</td>
<td>7.85</td>
</tr>
<tr>
<td>Circular blade</td>
<td>21.73</td>
<td>507.3 gm</td>
<td>453.2 gm</td>
<td>54.1 gm</td>
<td>10.66</td>
<td>0.49</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 25.4 hrs. of grass & weeds /brush cutting operation.

15.  COMMENTS AND RECOMMENDATIONS
i) The equivalent sound level pressure at operator’s ear level was found as 103.3 dB(A), respectively, 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 maximum mechanical vibration on handle, engine cover & frame pipe was observed as 550, 1000 and 1160 micron respectively. 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 0.80 ltr., which does not appear to be adequate. This calls for necessary modification.

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

v) The hardness of triangular blade was recorded as 46 to 48, 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 circular blade does not conform, in full, to the IS:6025-1982. This should be looked into.

vii) The particular provided marking/labeling 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.
  vii) Chassis No.
  viii) 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-l-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.

16. TECHNICAL LITERATURE:
   i) Owner’s manual was supplied by the manufacturer for reference during testing in English. It is however recommended that same may be revised as per IS: 8132-1999. The parts catalogue and service manual may also be bought out. The literatures may also be made available in Hindi and other regional languages for guidance of users.
   ii) The engine specification/performance parameter should be declared in the operator’s manual.

TESTING AUTHORITY

G. R. AMBALKAR
AGRICULTURAL ENGINEER

R. K. NEMA
SENIOR AGRICULTURAL ENGINEER

P. K. PANDEY
DIRECTOR

17. APPLICANT’S COMMENTS

<table>
<thead>
<tr>
<th>Para No.</th>
<th>Our Reference</th>
<th>Applicant’s Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.1</td>
<td>11</td>
<td>We will improve the hardness of triangular blade and circular disc of weed/brush cutter as per IS: 6025-1982.</td>
</tr>
<tr>
<td>17.2</td>
<td>11.2.1</td>
<td>We will change the chemical composition of triangular blade of brush/weed cutter as per IS: 6690-1981.</td>
</tr>
<tr>
<td>17.3</td>
<td>15.7</td>
<td>We will provide the labeling plate on brush/weed cutter.</td>
</tr>
</tbody>
</table>