व्यावसायिक परीक्षण रिपोर्ट | संख्या/No. : **T- 1271/1798/2019**

**COMMERCIAL TEST REPORT (Initial)** | माह/Month : **October, 2019**

**(यह परीक्षण रिपोर्ट 31/10/2022 तक वैध है। / THIS TEST REPORT IS VALID UPTO: 31/10/2022)**


# SWARAJ, 717 ES TRACTOR

सत्यमेव जयते

**भारत सरकार**

**कृषि एवं किसान कल्याण मंत्रालय**

कृषि, सहकारिता एवं किसान कल्याण विभाग

मशीनीकरण एवं प्रोद्योगिकी प्रभाग

**GOVERNMENT OF INDIA**

**MINISTRY OF AGRICULTURE AND FARMERS WELFARE**

DEPARTMENT OF AGRICULTURE, CO-OPERATION AND FARMERS WELFARE

Mechanization & Technology Division

**केन्द्रीय कृषि मशीनरी प्रशिक्षण एवं परीक्षण संस्थान**

ट्रैक्टर नगर, बुदनी (म.प्र.) - ४६६ ४४५

**CENTRAL FARM MACHINERY TRAINING & TESTING INSTITUTE**

**(An ISO 9001: 2015 Certified Institute)**

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**Manufacturer** : **M/s. Mahindra & Mahindra Ltd.**
**Farm Equipment Sector, Swaraj Division**
**Phase- IV, Industrial Area, S.A.S. Nagar,**
**Mohali, Punjab – 160 055**

| Month: October | Test Report No. T- 1271/1798/2019 | Year : 2019 |
|---|---|---|



**GOVERNMENT OF INDIA**

**CENTRAL FARM MACHINERY TRAINING & TESTING INSTITUTE**

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FAX: 07564-234743

| | | |
|---|---|---|
| Type of Test | : | **COMMERCIAL (Initial)** |
| Test code/Procedure | : | IS: 5994-1998 (Reaffirmed in 2014)<br>IS: 9253-2013 and IS: 12207-2019. |
| Period of Test | : | February, 2019 to October, 2019 |
| Test Report No. | : | **T- 1271/1798/2019** |
| Month/Year | : | **October, 2019** |

i) The results reported in this report are observed values and no corrections have been applied for atmospheric and site conditions.

ii) The data given in this report pertain to the particular machine submitted by the applicant, for tests.

iii) The results presented in this report do not in any way attribute to the durability of the machine.

iv) This report should not be reproduced in part or full without prior permission of the Director, Central Farm Machinery Training and Testing Institute, Budni (M.P.)

## SELECTED CONVERSIONS & ABBREVIATIONS

**S E L E C T E D  C O N V E R S I O N S**

| Sl. No | Units | Conversion Factor |
|---|---|---|
| 1 | **Force:** | |
| | 1 kgf | 9.80665 N |
| | | 2.20462 lbf |
| 2 | **Power:** | |
| | 1 hp | 1.01387metric hp (Ps) |
| | | 745.7 W |
| | 1 Ps | 735.5 W |
| | 1 kW | 1.35962 Ps |
| 3 | **Pressure:** | |
| | 1 psi | 6.895 kPa |
| | 1 kgf/cm$^2$ | 98.067 kPa = 735.56 mm of Hg |
| | 1 bar | 100 kPa = 10 N/cm$^2$ |
| | 1 mm of Hg | 1.3332 m-bar |

**A B B R E V I A T I O N S**

| | |
|---|---|
| apa | As per applicant |
| TDC | Top Dead Centre |
| IS | Indian Standard |
| LHS/RHS | Left Hand Side/<br>Right Hand Side |
| Hg. | Mercury |
| Temp. | Temperature |
| N.R. | Not recorded |
| rpm | Revolutions per minute |
| O.D/I.D | Outer diameter/<br>Inner diameter |
| N.A. | Not available/<br>Not applicable |
| PTO | Power take-off |
| R.H | Relative Humidity |

## C O N T E N T S

| | | |
|---|---|---|
| **Manufacturer** | : | **M/s. Mahindra & Mahindra Ltd. (Farm Equipment Sector),** Swaraj Division, Phase- IV, Industrial Area, S.A.S. Nagar, Mohali, Punjab – 160 055 |
| Location of manufacturing plant | : | **M/s. Mahindra & Mahindra Ltd. (Farm Equipment Sector),** Agri Development Centre, Village: Mehla, Tehsil-Dudu, Jaipur – Ajmer Road |
| Test requested by (applicant) | : | The manufacturer |
| Selected for test by | : | Applicant |
| Place of running-in | : | At applicant's works |
| **Duration of said running-in (h):** | | |
| - Engine | : | 15 |
| - Transmission | : | 30 |
| **Method of Selection** | : | The tractor was submitted directly by the applicant for test. Hence, method of selection is not known. |

## 1. SPECIFICATIONS

**1.1 Tractor:**

| | | |
|---|---|---|
| Make | : | Swaraj |
| Model | : | 717 ES |
| Variants, if any: | : | None |
| Brand name | : | Swaraj 717 ES |
| Type | : | Four wheeled, rear wheel driven, unit construction, general purpose, agricultural tractor |
| Month & Year of manufacture | : | 05 / 18 |
| Chassis number | : | MBNZMEBXEJJB00001 |
| Country of Origin | : | India |

**1.2 Engine:**

| | | |
|---|---|---|
| Make | : | Mahindra & Mahindra ltd. |
| Model | : | MM0863NA014T ES |
| Type | : | Four stroke, liquid cooled, direct injection, naturally aspirated, compression ignition, diesel engine. |
| Serial number | : | GJB6BAA9008 |
| **Engine speed (Manufacturer's recommended production setting) (rpm) :** | | |
| - Maximum speed at no load | : | 2500 to 2600 |
| - Low idle speed | : | 950 to 1150 |
| - Speed at maximum torque | : | 1000 to 1400 |
| **Rated speed, (rpm):** | | |
| - For PTO use | : | 2300 |
| - For drawbar use | : | 2300 |

**1.3 Cylinder & Cylinder Head:**

| | | |
|---|---|---|
| Number | : | One |
| Disposition | : | Vertical |
| Bore/stroke, (mm) | : | 100 / 110 |
| Capacity as specified by the applicant, (cc) | : | 863.5 |
| Compression ratio, (apa) | : | 18.5 (±1) : 1 |
| Type of cylinder head | : | Monoblock |
| Type of cylinder liners | : | Wet, non replaceable |
| Type of combustion chamber | : | Open re-entrant cavity on piston crown |
| Arrangement of valves | : | Overhead, Inline |
| **Valve clearance (cold/hot):** | | |
| - Inlet valve, (mm) | : | 0.10 / 0.10 |
| - Exhaust valve, (mm) | : | 0.10 / 0.10 |

| | | | |
|---|---|---|---|
| **1.4** | **Fuel System:** | | |
| | Type of fuel feed system | : | Gravity feed |
| **1.4.1** | **Fuel tank:** | | |
| | Capacity, (l) | : | 21.90 |
| | Location | : | Above the clutch housing |
| | Provision for draining of sediments/ water | : | Not provided |
| | Material of fuel tank | : | Metallic |
| **1.4.2** | **Water Separator** | : | **Not provided** |
| **1.4.3** | **Fuel feed pump** | : | **Not provided** |
| **1.4.4** | **Fuel filters:** | | |
| | Make | : | Bosch, India |
| | Model/Group combination No. | : | F 002 H20 108 |
| | Numbers | : | One |
| | Type of elements | : | Paper element |
| | Capacity of final stage filter, ( l ) | : | 0.45 |
| **1.4.5** | **Fuel Injection pump:** | | |
| | Make | : | Bosch, India |
| | Model/Group combination No. | : | F002 F20 039 (BDC = 82.8 + 0.8) |
| | Type | : | Plunger |
| | Serial number | : | Not available |
| | Location | : | On LHS of engine |
| | Method of drive | : | Through camshaft (a separate cam lob is provided on it) |
| **1.4.6** | **Fuel injectors:** | | |
| | Make | : | Bosch, India |
| | Model/Group combination No.: | | |
| | Holder Number | : | F002 C70 562 |
| | Nozzle Number | : | DSLA 150P 2127 |
| | Type | : | Multi hole (05 holes) |
| | Manufacturer's production pressure setting, (MPa) | : | 24.2 to 25.6 |
| | Injection timing | : | 14° ± 1.5° before TDC |
| **1.4.7** | **Governor:** | | |
| | Make | : | Mahindra & Mahindra (apa) |
| | Model/Group combination No. | : | Inbuilt with FIP |
| | Type | : | Mechanical, centrifugal, variable speed (having 04 nos. of steel balls on grooved plate) |
| | Location & drive | : | Mounted on engine crankshaft & through crankshaft |
| | Rated engine speed, (rpm) | : | 2300 |
| | Governed range of engine speed (rpm) | : | 950 to 2600 |
| **1.5** | **Air Intake system:** | | |
| **1.5.1** | **Pre-cleaner:** | | |
| | Make | : | Popular |
| | Type | : | Centrifugal with transparent dust collector |
| | Location | : | Above main air cleaner inlet tube outside the bonnet |
| **1.5.2** | **Air cleaner:** | | |
| | Make | : | Not available |
| | Type | : | Oil bath |
| | Location | : | On LHS of engine, outside the bonnet |
| | Range of suction pressure at maximum power, (kPa) | : | 2.6 to 3.5 |
| | Air cleaner bowl capacity,(l) | : | 0.50 |
| | Oil change period | : | Change after every 250 hours of operation |

**1.6 Exhaust System:**

| | | |
|---|---|---|
| Type of silencer | : | Updraft (Cylindrical) |
| Position of silencer outlet with respect to SIP, (mm): | | |
| - Vertical | : | 760 |
| - Longitudinal | : | 1165 |
| - Lateral | : | 420 (on RHS) |
| Range of exhaust gas pressure at maximum power, (kPa) | : | 2.3 to 2.7 |
| Provision of spark arresting device | : | **None** |
| Provision against entry of rain water | : | A bend is provided at the top of silencer |

**1.7 Lubricating system:**

| | | |
|---|---|---|
| Type | : | Force feed cum splash |
| Oil sump capacity, ( l ) | : | 2.10 |
| Total lub oil capacity, ( l ) | : | 2.76 |
| Oil change period | : | Change after every 250 hours of operation. |
| Cooling device, (if any) | : | **None** |

**1.7.1 Filters:**

| | | |
|---|---|---|
| Make | : | Not available |
| Type | : | Full flow, spin on, throw away |
| Number (s) | : | One |

**1.7.2 Pump:**

| | | |
|---|---|---|
| Make | : | Not available |
| Type | : | Gear |
| Method of drive | : | Through timing gears |
| Pressure release setting, (kPa) | : | 300 (apa) |
| Minimum permissible pressure, (kPa) | : | 80 to 100 (apa) |

**1.8 Cooling system:**

| | | |
|---|---|---|
| Type | : | Forced circulation of coolant and water |
| Coolant as recommended | : | Lubz Co-op. India / Rewale Engg. Pvt. / Tide Water Oil India Ltd. (apa) |
| Coolant and water ratio | : | 30 : 70 (apa) |
| **Details of pump** | : | Centrifugal pump with semi-open impeller of 78.7 mm outer diameter, having seven numbers of vanes and driven through crankshaft pulley by a cogged V-belt common to alternator. |
| **Details of fan** | : | Suction type having six polypropylene blades of 305 mm diameter and mounted on common shaft of water pump |
| Means of temperature control | : | None |
| Bare radiator capacity, ( l ) | : | 0.90 |
| Total coolant capacity, ( l ) | : | 3.15 |
| Radiator cap pressure, kPa | : | 88 |

**1.9 Starting System:**

| | | |
|---|---|---|
| Type | : | 12V, DC, Electrical |
| Aid for cold starting | : | None |
| Any other device provided for easy starting. | : | None |

**1.10 Electrical System:**

**1.10.1 Battery:**

| | | |
|---|---|---|
| Make & Model | : | Exide & MFS70R (MF) |
| Type | : | Lead acid |
| Capacity and rating | : | 12V, 65 Ah at 20 hours discharge rate |
| Location | : | On RHS of clutch housing |

**1.10.2 Starter:**

| | | |
|---|---|---|
| Make | : | Auto lek |
| Model | : | STM 1105 |
| Voltage/Type | : | Pre-engaging, solenoid operated |
| Capacity and rating | : | 12V & 2.2 kW |
| Serial Number | : | Not available |

**1.10.3 Generator:**

| | | |
|---|---|---|
| Make | : | Auto lek |
| Model | : | ALM 4001T |
| Type | : | Alternator |
| Serial number | : | Not available |
| Output rating | : | 12 V & Not available |
| Method of drive | : | Driven through crank shaft pulley by a cogged "V" belt, common to water pump pulley |

**1.10.4 Voltage regulator** : In built with alternator

**1.10.5 Details of lights:**

| Description | No. & capacity of bulbs | Height of the centre of beam above ground level,(mm) | Size of beam, mm) | Distance between centre of the beam and outside edge of tractor at standard rear track setting, (mm) |
|---|---|---|---|---|
| **Front Lights:** | | | | |
| - Head lights | 2, 12V, 60/55W | 925 | 135 x 105 | 408 |
| - Parking lights | 2, 12V, 5W | 835 | 40 x 65 | 150 |
| - Turn-cum-Hazard Indicators | 2, 12V, 21W | 835 | 75 x 65 | 100 |
| **Rear lights:** | | | | |
| - Brake lights | 2, 12V, 21/5W | 835 | 40 x 70 | 160 |
| - Tail light | 2, 12V, 5W | 835 | 40 x 70 | 120 |
| - Turn-cum-Hazard Indicators | 2, 12V, 21W | 835 | 40 x 70 | 80 |
| Reflectors (Red) | 2 | 835 | 40 x 70 | 120 |
| Plough light (on RHS mudguard) | 1, 12V, 55W | 910 | 110 Φ | 265 |
| Registration plate Light | Part of rear combination light assembly | | | |

**1.10.6 Main switch** : Key turn type, having three positions viz: **OFF, Circuit ON** and **START**

**1.10.7 Light switch** : Rotary type having four positions viz.
i) Off
ii) Parking lights + dashboard lights
iii) Head lights (short beam) + (ii)
iv) Head light (long beam) + (ii)

**1.10.8 Horn:**

| | | |
|---|---|---|
| Make | : | Minda |
| Type | : | 12V, 2B, electromagnetically vibrated diaphragm |
| Location | : | In-front of radiator, under the bonnet |

**1.10.9 Fuse box** : Contains 04 numbers of fuses of following capacities :-

| Capacity | 20A | 10A |
|---|---|---|
| Number | 01 | 03 |

**1.10.10 Details of other electrical accessories:**

**1.10.10.1 Flasher Unit:**

| | | |
|---|---|---|
| Make | : | Interface |
| Capacity: | | |
| - Turn signal | : | 21W x 2 + 2W x 1 |
| - Hazard signal | : | 21W x 4 + 2W x 2 |
| Flashes/Min. | : | 85 |

**1.10.10.2 Seven pin socket for trailer lights** : Provided

**1.10.10.3 Safety against accidental start** : **Not provided**

**1.11 Instrument panel details:**

**i)** Engine speed-cum-cumulative digital run hour meter (8-28)x100 rpm
**ii)** Lubricating oil pressure indicator
**iii)** Coolant temperature gauge with colour zone
**iv)** Battery charging warning indicator lamp
**v)** Fuel level gauge with colour zone
**vi)** Head light long beam ON indicator light
**vii)** Turn-cum-hazard lights indicator
**viii)** Turn indicator switch
**ix)** Hazard light switch
**x)** Horn push button
**xi)** Hand accelerator lever
**xii)** Main switch (Key turn type)
**xiii)** Light switch (rotary type)
**xiv)** Steering control wheel
**xv)** Rear view mirror
**xvi)** Fuel shut-off control knob

**1.12 Transmission System:**

**1.12.1 Clutch:**

| | | |
|---|---|---|
| Make | : | Valeo |
| Type | : | Single, dry friction plate |
| No. of friction plate (s) | : | One |
| Size, OD/ID, (mm) | : | 199.8 / 134.4 Ø |
| Method of operation: | : | By depressing clutch pedal fully provided on LHS of operator's seat |
| Material of clutch lining | : | F410, organic, asbestos free (apa) |

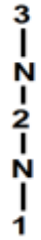
**1.12.2 Gear box:**

| | | |
|---|---|---|
| Make | : | Mahindra (apa) |
| Model | : | ATR 62086 (apa) |
| Type | : | Mechanical, sliding mesh gears |

**No. of speeds:**

| | | |
|---|---|---|
| - Forward | : | 06 |
| - Reverse | : | 03 |
| Location of gear shifting levers: | : | Side shift |
| Main gear shifting lever | : | On LHS of the operator's seat |
| Range selection lever | : | On RHS of the operator's seat |

Gear shifting pattern :




Main gear shift lever


Range selection lever

Oil capacity, (l) : 14.70 (Common with differential, rear axle, final drive & hydraulic system).

Oil changing period : Change after every 1000 hours of operation.

**1.12.3 Nominal Speed:**

| Movement | Gear No. | No. of engine revolutions for one revolution of driving wheel | Nominal speed at rated engine speed when fitted with **8 - 18** size tyres of **395 mm** radius index, (kmph) |
|---|---|---|---|
| Forward | L1 | 170.06 | 2.02 |
| | L2 | 89.28 | 3.84 |
| | L3 | 60.04 | 5.71 |
| | H1 | 38.41 | 8.90 |
| | H2 | 20.16 | 16.98 |
| | H3 | 13.56 | 25.27 |
| Reverse | R1 | 178.54 | 1.92 |
| | R2 | 93.71 | 3.65 |
| | R3 | 63.10 | 5.42 |

**1.12.4 Differential unit:**

Type : Crown wheel and bevel pinion, with differential unit accommodated inside the differential housing.

Reduction through crown wheel and bevel pinion : 4.1 **:** 1 (41/10T)

Oil capacity, ( l ) : 14.70 (Common with gearbox, rear axle, final drive & hydraulic system).

Oil changing period : Change after every 1000 hours of operation.

**Differential lock : Not provided**

**1.12.5 Rear axle & final drive:**

Type : Bull & pinion type final drive accommodated inside the differential housing

Reduction through final drive : 3.428 **:** 1 (48/14T)

Oil capacity of final drive, ( l ) : 14.70 (Common with gearbox, differential & hydraulic system).

Oil changing period : Change after every 1000 hours of operation.

**1.13 Power lift Hydraulic System:**

Make : Swaraj

Type : Open centre, live & ADDC

No. and type of cylinder : One, single acting

Type of linkage lock for transport : Hydraulic response control knob in fully closed position act as transport lock

**1.13.1 Hydraulic pump:**

| | | |
|---|---|---|
| Make | : | Not available |
| Type | : | Gear |
| Location & drive | : | On front of engine crankshaft & through crankshaft |
| No. & type of filters | : | One & Full flow spin on throw away |
| Hydraulic oil capacity, ( l ) | : | 14.70 (Common with transmission system). |
| Oil change period | : | Change after every 1000 hours of operation. |
| Provision for external tapping | : | Provided |
| Details of control levers | : | **i)** Position control lever (Black)<br>**ii)** Draft control lever( Red)<br>**iii)** Hydraulic response control knob on distributor. |
| Method of draft sensing | : | Through top link |

**1.13.2 Three point linkage:**

| S. No. | Parameters | | As per IS:4468-1997(Part-I) (Reaffirmed in October, 2017) (Cat.I / Cat.IN), (mm) | As measured (mm) | Remarks |
|---|---|---|---|---|---|
| **I.** | **Upper hitch points:** | | | | |
| | a) | Dia of hitch pin hole | 19.30 to 19.50 / 19.30 to 19.51 | 19.44 | Conforms to Cat. I & IN |
| | b) | Width of ball | 44.0 (max.) / 44.0 (max.) | 43.90 | Conforms to Cat. I & IN |
| **II.** | **Lower hitch points:** | | | | |
| | a) | Dia of hitch pin hole | 22.40 to 22.65 / 22.40 to 22.73 | 22.55 | Conforms to Cat. I & IN |
| | b) | Width of ball | 34.8 to 35.0 / 34.8 to 35.0 / | 34.97 | Conforms to Cat. I & IN |
| **III.** | Lateral distance from lower hitch point to centre line of tractor | | 359 / 218 | 218 | Conforms to Cat. IN |
| **IV.** | Lateral movement of lower hitch points. | | 100 (min) / 50 (min) | 153 | Conforms to Cat. I & IN |
| **V.** | Distance from end of power take-off to centre of lower hitch point (lower links in horizontal position) | | 450 to 575 / 300 to 375 | 335 | Conforms to Cat. IN |
| **VI.** | Transport height | | 820 (min)/ 600 (min) | 610 | Conforms to Cat. IN |
| **VII.** | Power range (without load) | | 560(min)/ 420 (min) | 445 | Conforms to Cat. IN |
| **VIII.** | Leveling adjustment | | 100 (min)/ 75 (min) | 300 | Conforms to Cat. I & IN |
| **IX.** | Lower hitch point tyre clearance | | 100 (min)/ 100 (min) | 140 | Conforms to Cat. I & IN |
| **X.** | Lower hitch point height | | 200 (max)/ 200 (max) | 165 | Conforms to Cat. I & IN |

**1.13.3 Linkage geometry dimensions (Refer Fig.-1 (a)):**

The following are dimensions observed, corresponding to **395** mm as tyre dynamic radius index:

| S. No. | Parameter | Notation | Dimension or range, (mm) | Setting used during test, (mm) |
|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) |
| 1. | Length of lower link | A | 445 | 445 |
| 2. | Length of lift arm | B | 200 | 200 |
| 3. | Length of lift rods | C | 445 | 445 |
| 4. | Length of top link | D | 360 to 480 | 410 |
| 5. | Distance of lift rod connection point from pivot point of lower link | E | 230 | 230 |
| 6. | Distance of lower link pivot point from rear wheel axis: | | | |
| | -Horizontally | F | 170, behind | 170, behind |
| | -Vertically | G | 190, below | 190, below |
| 7. | Distance of upper link pivot point from rear wheel axis: | | | |
| | -Horizontally | H | 205, behind | 205, behind |
| | -Vertically | J | 305, above | 305, above |
| 8. | Distance of lift arm pivot point from rear wheel axis: | | | |
| | -Horizontally | K | 60, behind | 60, behind |
| | -Vertically | L | 320, above | 320, above |
| 9. | Height of lower hitch points relative to the rear wheel axis: | | | |
| | - In high position | M | 215, above | 215, above |
| | - In low position | N | 230, below | 230, below |
| 10. | Height of lower link hitch points when locked in transport position | 215 | | |

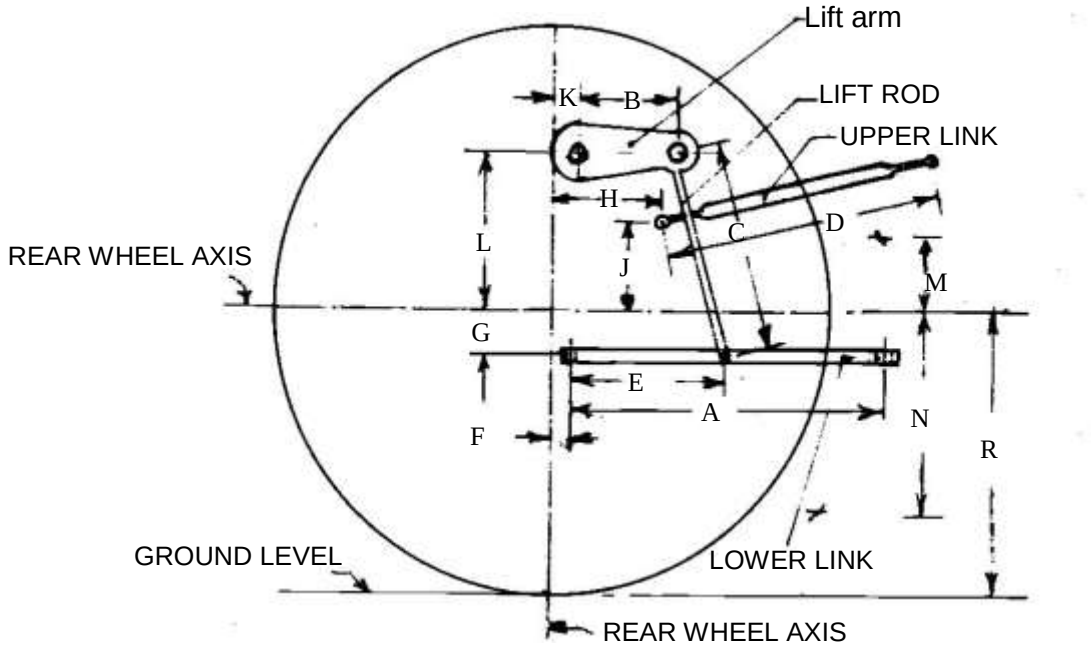
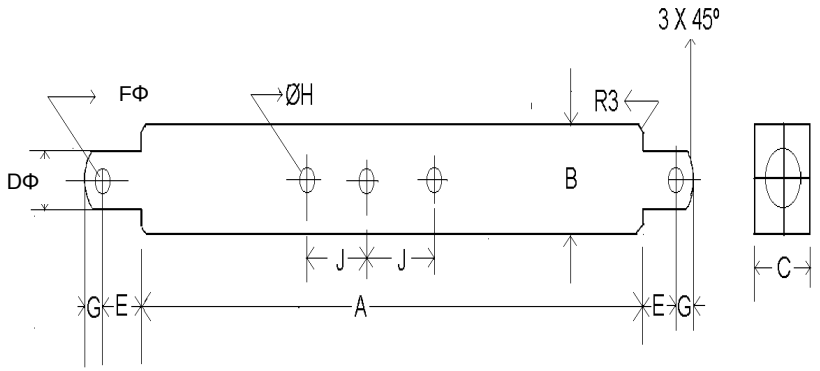



**Fig.1 (a): DIMENSIONAL NOTATIONS FOR TABLE OF LINKAGE GEOMETRY**

**1.13.4 Drawbar:**

**1.13.4.1 Linkage Drawbar (Refer Fig.1 (b)):**

| Notation | As per IS: 12953-1990, (Reaffirmed in October, 2017) **(Cat.I / Cat. IN) ,** (mm) | As measured, (mm) | Remarks |
|---|---|---|---|
| A | 683 ± 1.5/400 ± 1.5 | 401.0 | Conforms to Cat. IN |
| B | 75 (min)/75 (min) | 76.2 | Conforms to Cat. I & IN |
| C | 30 (min) / 30 (min) | 31.8 | Conforms to Cat. I & IN |
| D∅ | 21.79 to 22.0/21.79 to 22.0 | 21.9 | Conforms to Cat. I & IN |
| E | 39.0 (min/)39.0 (min) | 44.2 | Conforms to Cat. I & IN |
| F∅ | 12.0 (min)/12.0 (min) | 12.2 | Conforms to Cat. I & IN |
| G | 15.0 (min)/15.0 (min) | 19.2 | Conforms to Cat. I & IN |
| H∅ | 25 ± 1/25 ± 1 | 25.4 | Conforms to Cat. I & IN |
| J | 80 ± 1.5/80 ± 1.5 | 80.0 | Conforms to Cat. I & IN |
| No. of holes | 7/5 | 05 | Conforms to Cat. IN |




**1(b): DIMENSIONAL NOTATIONS FOR LINKAGE DRAWBAR**

**1.13.4.2 Swinging drawbar : Not provided**

**1.13.4.3 Provision for coupling of trailer brakes : Not provided**

**1.14 Power take-off shaft:**

| | | |
|---|---|---|
| Type | : | Type-I, Not independent |
| Method of engaging | : | By a hand lever provided on LHS of operator's seat. |
| No. of shaft(s) | : | One |
| PTO speed corresponding to rated engine speed, (rpm) | : | 605 |
| Distance behind rear axle, (mm) | : | 273 |
| Engine to PTO speed ratio | : | 3.800 : 1 |
| Whether the PTO shaft is capable of transmitting the full power of engine | : | Yes |
| Other PTO speeds corresponding to engine speeds | : | None |

**1.14.1 Specifications of Power Take-Off Shaft: -**

| Specification | As per IS: 4931-1995 (Reaffirmed in 2014), Type-I | As observed | Remarks |
|---|---|---|---|
| Nominal speed, (rpm) | 540 ± 10 | 540 rpm of PTO shaft corresponds to 2052 rpm of engine | Conforms |
| No. of splines | 6 | 6 | Conforms |
| Direction of rotation | Clockwise | Clockwise | Conforms |
| Location | The position of the centre of the end of PTO shaft shall be within 50mm to right or left of the centre line of the tractor | In the center line of the tractor | Conforms |
| **Dimensions, (mm) Refer Fig. 2 :** | | | |
| D∅ | 34.79 ± 0.06 | 34.83 | Conforms |
| d∅ | 28.91 ± 0.05 | 28.88 | Conforms |
| B∅ | 29.4 ± 0.1 | 29.40 | Conforms |
| A∅ (Optional) | 8.3 ± 0.1 | 8.30 | Conforms |
| W | 8.69 – 0.09<br>- 0.16 | 8.55 | Conforms |
| a | 7 | 7 | Conforms |
| b (Optional) | 25 ± 0.5 | 25.5 | Conforms |
| c | 38 | 38 | Conforms |
| X | $30^o$ | $30^o$ | Conforms |
| B | 76 (min) | 84.0 | Conforms |
| h* | 450 to 675 | 445 | Conforms |

**Remark (*):** 350 mm for tractors having track width less than 1150 mm

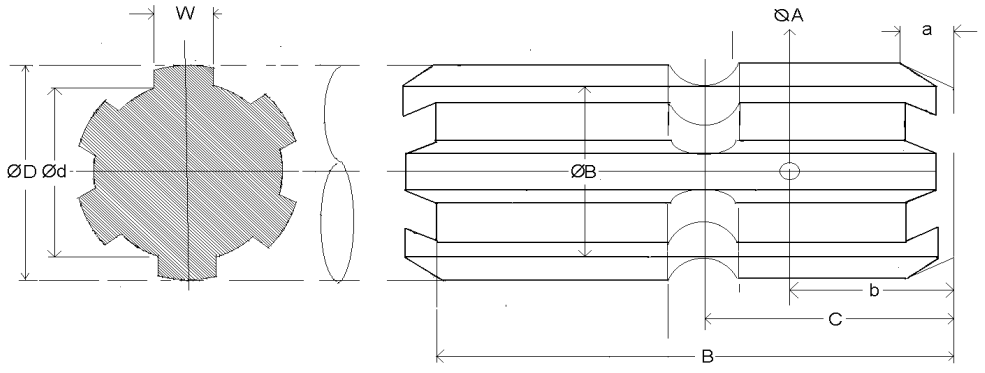



**Fig.2: DIMENSIONAL NOTATIONS FOR TYPE-I POWER TAKE-OFF SHAFT**

**1.14.2 Power Take-off Master Shield : Not provided**

**1.15 Towing hitch:**

**1.15.1 Front:**

| | | |
|---|---|---|
| Type | : | Clevis |
| Location | : | At front, on front engine support |
| Height above ground level,(mm) | : | 354 |
| Type of adjustment | : | Fixed |
| Width of clevis, (mm) | : | 47.7 |
| Dia of pin hole, (mm) | : | 33.9 |

**1.15.2 Rear:**

| | | |
|---|---|---|
| Type | : | Clevis |
| Location | : | Rear of the differential housing |
| Height above ground level, (mm): | : | 435 |
| - No. of positions | : | 01 |
| Type of adjustment | : | Fixed |
| Distance of hitch point,(mm): | | |
| - From rear axle centre | : | 370 |
| - From power take-off shaft end | : | 97 |
| Dia of pin hole, (mm) | : | 32.9 |
| Width of clevis, (mm) | : | 80.0 |

**1.16 Steering:**

| | | |
|---|---|---|
| Make | : | Rane |
| Type | : | Mechanical, worm & roller with single drop arm |
| Location | : | Above clutch housing |
| Method of operation | : | Manually by steering control wheel |
| Diameter of steering control wheel, (mm) | : | 412 |
| Steering oil capacity, ( l ) | : | 0.32 |
| Lubricant change period | : | Change after every 1000 hours of operation. |

**1.17 Brakes:**

**1.17.1 Service Brake:**

| | | |
|---|---|---|
| Make | : | Not available |
| Type | : | Mechanical, dry discs |
| Location | : | At the rear half axle shaft |
| No. of disc(s) | : | Two (on each wheel side) |
| Area of liners, ($cm^2$) | : | 56.5 (on each wheel side) |
| Material of liners | : | AF 3459 (apa) |
| Method of operation | : | Independent or combined pedal operated by right foot. |

**1.17.2 Parking Brake:**

| | | |
|---|---|---|
| Type | : | Pawl & ratchet arrangement |
| Location & Method of operation | : | Service brake acts as parking brake when locked in position by a hand lever after pressing service brake pedal, provided on RHS of operator's seat |

**1.18 Wheel Equipment:**

**1.18.1 Steered Wheel(s):**

| | | |
|---|---|---|
| Make | : | Good Year |
| Number(s) | : | 02 |
| Type of tyre | : | Pneumatic, ribbed |
| Size | : | 5.25 - 14 |
| Ply rating | : | 06 |
| Maximum permissible load on each tyre at inflation pressure recommended for road work, (kgf) | : | 375 @ 210 kPa |

**Recommended inflation pressure, (kPa) :**

| | | |
|---|---|---|
| - For field work | : | 215 |
| - For transport | : | 245 |
| Track width, (mm) | : | **970 (std.)** & 1010 |
| Method of changing track width | : | By reversing the wheel disc |
| Make & size of wheel rim | : | SSWL & 3.5J x 14 |

**1.18.2 Drive wheel(s):**

| | | |
|---|---|---|
| Make | : | Good Year |
| Number (s) | : | 02 |
| Type of tyre | : | Pneumatic, Traction |
| Size | : | 8 -18 |
| Ply rating | : | 04 |
| Maximum permissible load on each tyre at inflation pressure recommended for road work, (kgf) | : | 520 @ 157 kPa |

**Recommended inflation pressure, (kPa):**

| | | |
|---|---|---|
| - For field work | : | 85 |
| - For transport | : | 157 |
| Track width, (mm) | : | 895 & **1005 (std.)** |
| Method of changing track width | : | By reversing the wheel disc |
| Make & size of wheel rim | : | SSWL & 5.5F x 18 |

| | | | |
|---|---|---|---|
| **1.18.3** | **Wheel base, (mm)** | : | 1490 |
| | Method of changing wheel base, if any, and range | : | **None** |

**1.19 Operator's seat:**

| | | |
|---|---|---|
| Make | : | Not available |
| Type | : | Cushioned seat with back rest |
| Type of Suspension | : | Two helical coil springs |
| Type of Dampening | : | One, Hydraulic shock absorber |
| **Range of adjustment,(mm):** | | |
| - Vertical (back rest) | : | Nil |
| - Lateral | : | Nil |
| - Longitudinal | : | $\pm$ 25 |

**1.20 Provision for safety and comfort of operator:**

**1.20.1 Conformity with IS: 12343-1998 (Reaffirmed in 2014)**

All parameters meet with the requirements of IS: 12343-1998: (Re-affirmed in 2014), **except the following**:-

**i)** Longitudinal distance from centre of steering control wheel to seat index point.

**1.20.2 Conformity with IS: 6283 (Part-1) – 2006 (Re-affirmed in 2014) & IS: 6283 (Part-2) – 2007 (Re-affirmed in 2014):**

All the controls are identifiable with symbols as per IS: 6283 (Part-1) – 2006 (Re-affirmed in 2014) & IS: 6283 (Part-2) – 2007 (Re-affirmed 2014).

**i)** Grease lubricant frequency chart has been not provided.

**ii)** Oil lubricant, type & frequency chart have been not provided.

**1.20.3 Conformity with IS:8133-1983 (Re-affirmed in 2014), except the following:**

Location and movement of various controls meet the requirement of IS: 8133-1983 (Re-affirmed in 2014), **except the following**:

**i)** Safety switch against the accidental start is not provided.

**ii)** Differential lock is not provided

**1.20.4 Conformity with IS: 12239 (Part-1)-1996 (Re-affirmed in October, 2017):**

Meets the requirements of IS:12239 (Part-1)-1996 (Re-affirmed in October, 2017), **except the following**:

**i)** Spark arresting device in the exhaust system is not provided.

**1.20.5 Conformity with IS:12239 (Part-2)-1999 (Re-affirmed in 2014):**

Meets the requirements of IS:12239 (Part-2)-1999 (Re-affirmed in 2014), **except the following**:

**i)** PTO shaft master shield is not provided

**ii)** PTO shaft cover is not provided

**iii)** Working clearance between draft control lever & position control lever and between PTO engaging lever & main gear shift lever is less than the minimum requirement.

**1.20.6 Conformity with IS: 14683 – 1999 (Re-affirmed in 2014) :**

All lighting arrangements meet the requirements of IS: 14683-1999 (Re-affirmed in 2014).

**1.20.7 Rear view mirror:**

Rear view mirror has been provided.

**1.20.8 Slow moving emblem:**

Slow moving emblem has been provided.

**1.21 Labelling of tractor as per IS: 10273-1987 (Reaffirmed in March, 2014)**:

**Locations of labelling plate:-** The labelling plate is riveted on outside of LHS fender and provides the following information:

| **Name of Manufacturer** | **Swaraj Division Tractors, Mahindra & Mahindra Ltd.** |
|---|---|
| Make | Swaraj |
| Model | 717 ES |
| Month & Year of manufacture | 05 / 18 |
| Engine Serial Number | GJB6BAA9008 |
| Chassis Serial Number | MBNZMEBXEJJB00001 |
| Maximum PTO Power, kW | 8.2 |
| Specific fuel consumption, g/kWh | 280 |

**1.22 Ballast Mass, (kg):**

| Particulars | | As used during drawbar test | As used during field test | As used during Haulage test |
|---|---|---|---|---|
| | | | Dry land | |
| Front | C.I. weight | Nil | Nil | Nil |
| | Water | Nil | Nil | Nil |
| Rear | C.I. weight | Nil | Nil | Nil |
| | Water | Nil | Nil | Nil |
| | Additional weight, if any | Nil | Nil | Nil |

**1.22.1 Standard ballast, if any:** Not provided

**1.23 Masses:**

| Particulars | | Mass of the tractor without operator but with all the liquid reservoirs full, (kg) | | |
|---|---|---|---|---|
| | | Front | Rear | Total |
| i) | Unballast | 330 | 530 | 860 |
| ii) | With unballast as used during drawbar performance test. | 330 | 530 | 860 |
| iii) | With unballast as used during ploughing, rotavation dry land field test | 330 | 530 | 860 |
| iv) | With unballast as used during haulage test with trailer hitch, canopy and drawbar. | 330 | 530 | 860 |

**1.24 Overall dimensions:**

| Condition | Length, (mm) | Width, (mm) | Height, (mm) | | Ground Clearance, (mm) |
|---|---|---|---|---|---|
| | | | With exhaust pipe | Without exhaust pipe | |
| With Unballast | 2460 | 1220 | 1800 | 1285 (At steering control wheel) | 250 (Below transmission housing drain plug) |

**1.25 Number of external lubricating points:**

- Oiling : Nil
- Grease nipples : 15
- Grease cups : 02

**1.26 Colour of tractor:**

Chassis & engine : Grey
Bonnet : Blue
Mudguard : Creamy white
Rim and disc : Creamy white

**1.27 Optional features,** if any : None

## 2. FUEL AND LUBRICANTS

**2.1 Fuel** : The High-speed diesel oil supplied by M/s Indian Oil Corporation Limited having density of 0.836 g/cc at 15°C was used.

**2.2 Lubricants:**

| Sl. No. | Particulars | As recommended by the manufacturer | As used during the test |
|---|---|---|---|
| 1. | Air Cleaner & Engine | 20 W 40 | 20 W 40 |
| 2. | Gearbox, differential, rear axle, final drive & hydraulic system oil | EP-90 | Oil originally filled in the tractor systems was not changed |
| 3. | Steering system | SAE 140 | --do-- |
| 4. | Grease | Servo grease MP | MP Grease |

## 3. PTO PERFORMANCE TEST

Date(s) of test : 29.03.2019, 10.04.2019 & 17.05.2019

Tractor run at the Institute prior to start of PTO test (h) : 7.09

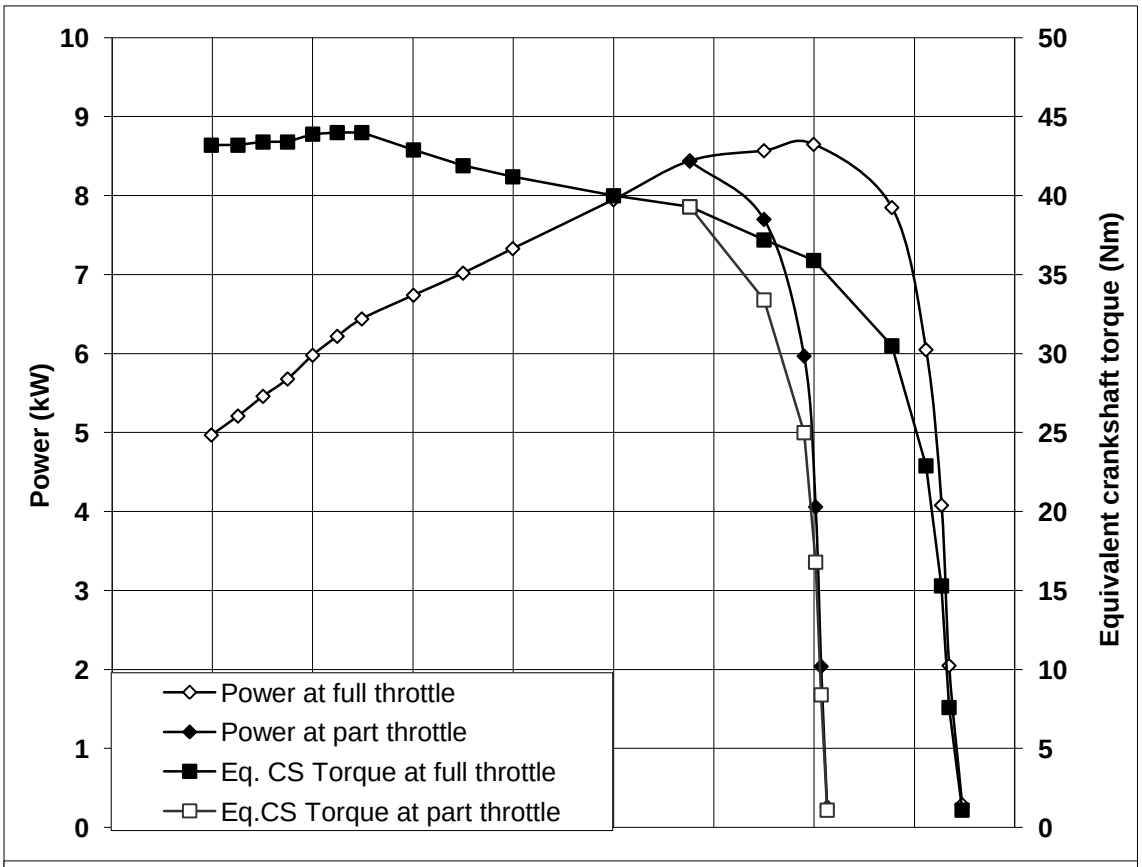
Type of dynamometer bench used : SAJ AG-250 Eddy Current.

**3.1** The results of power take-off performance are tabulated in Table**-1** and graphically represented in **Fig. 3, 4 and 5.**

**Table – 1**

| Power, (kW) | Speed (rpm) | | Fuel consumption | | | Specific energy (kWh/l) |
|---|---|---|---|---|---|---|
| | PTO | Engine | (l/h) | (kg/h) | Specific, (kg/ kWh) | |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **a) Maximum power – 2 hours test:** | | | | | | |
| 8.7 | 605 | 2299 | 2.93 | 2.44 | 0.280 | 2.97 |
| 8.1 | 605 | 2290 | 2.75 | 2.30 | 0.284 | 2.95* |
| **b) Power at rated engine speed (2300 rpm):** | | | | | | |
| 8.7 | 605 | 2299 | 2.93 | 2.44 | 0.280 | 2.97 |
| 8.1 | 605 | 2290 | 2.75 | 2.30 | 0.284 | 2.95* |
| **c) Power at standard power take-off speed (540 ± 10 rpm):** | | | | | | |
| 8.4 | 540 | 2052 | 2.67 | 2.23 | 0.265 | 3.15 |
| 8.1 | 540 | 2052 | 2.66 | 2.22 | 0.274 | 3.05* |
| **d) Varying loads at rated engine speed (2300 rpm):** | | | | | | |
| **i) Torque corresponding to maximum power available at rated engine speed:** | | | | | | |
| 8.7 | 605 | 2299 | 2.93 | 2.44 | 0.280 | 2.97 |
| **ii) 85% of the torque obtained in (i):** | | | | | | |
| 7.9 | 646 | 2455 | 2.83 | 2.37 | 0.300 | 2.79 |
| **iii) 75% of the torque obtained in (ii) :** | | | | | | |
| 6.1 | 664 | 2523 | 2.40 | 2.01 | 0.330 | 2.54 |
| **iv) 50% of the torque obtained in (ii) :** | | | | | | |
| 4.1 | 672 | 2554 | 1.98 | 1.66 | 0.445 | 2.07 |
| **v) 25% of the torque obtained in (ii) :** | | | | | | |
| 2.1 | 676 | 2569 | 1.61 | 1.35 | 0.643 | 1.30 |
| **vi) Unloaded:** | | | | | | |
| 0.3 | 683 | 2595 | 1.40 | 1.17 | 3.900 | 0.21 |
| **e) Varying loads at Standard PTO Speed (540 ± 10 rpm):** | | | | | | |
| **i) Torque corresponding to maximum power available at standard PTO speed:** | | | | | | |
| 8.4 | 540 | 2052 | 2.67 | 2.23 | 0.265 | 3.15 |
| **ii) 85% of the torque obtained in (i) :** | | | | | | |
| 7.7 | 579 | 2200 | 2.56 | 2.14 | 0.278 | 3.00 |
| **iii) 75% of the torque obtained in (ii) :** | | | | | | |
| 6.0 | 600 | 2280 | 2.18 | 1.83 | 0.305 | 2.75 |
| **iv) 50% of the torque obtained in (ii):** | | | | | | |
| 4.1 | 606 | 2303 | 1.77 | 1.48 | 0.361 | 2.32 |
| **v) 25% of the torque obtained in (ii) :** | | | | | | |
| 2.0 | 609 | 2314 | 1.38 | 1.15 | 0.575 | 1.45 |
| **vi) Unloaded:** | | | | | | |
| 0.3 | 612 | 2326 | 1.05 | 0.88 | 2.933 | 0.29 |

*** Under high ambient conditions**



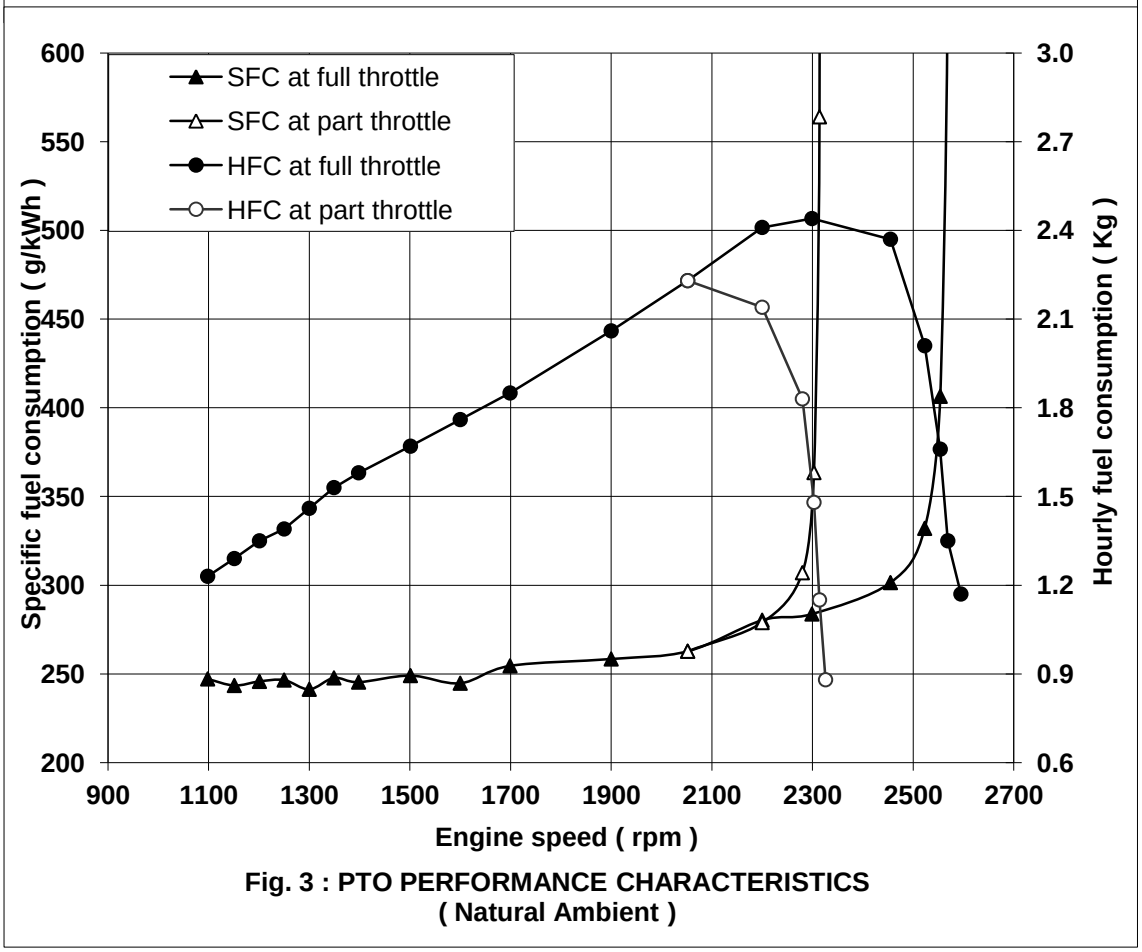




**Fig. 3 : PTO PERFORMANCE CHARACTERISTICS**
**( Natural Ambient )**

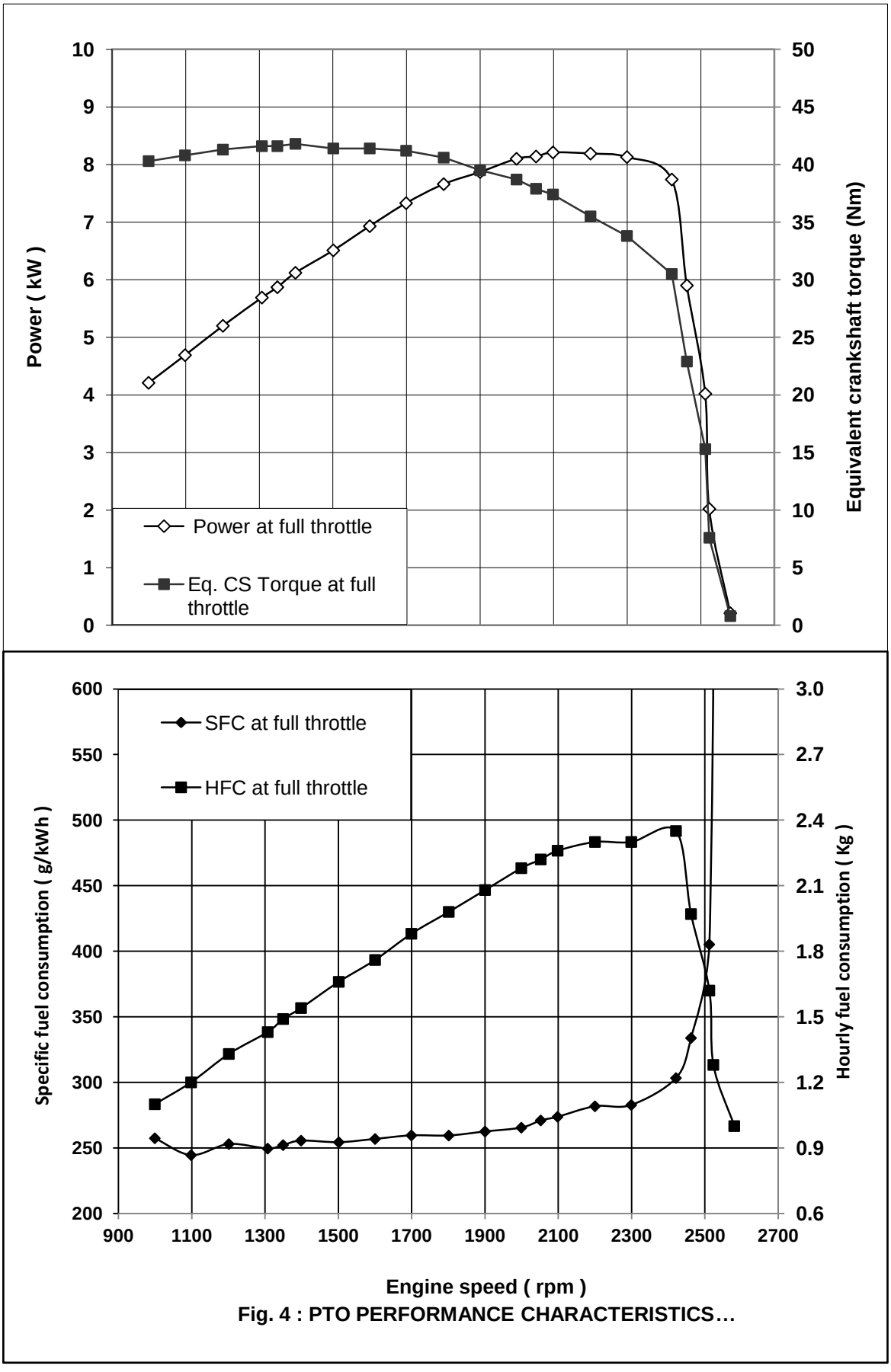



**Fig. 4 : PTO PERFORMANCE CHARACTERISTICS…**

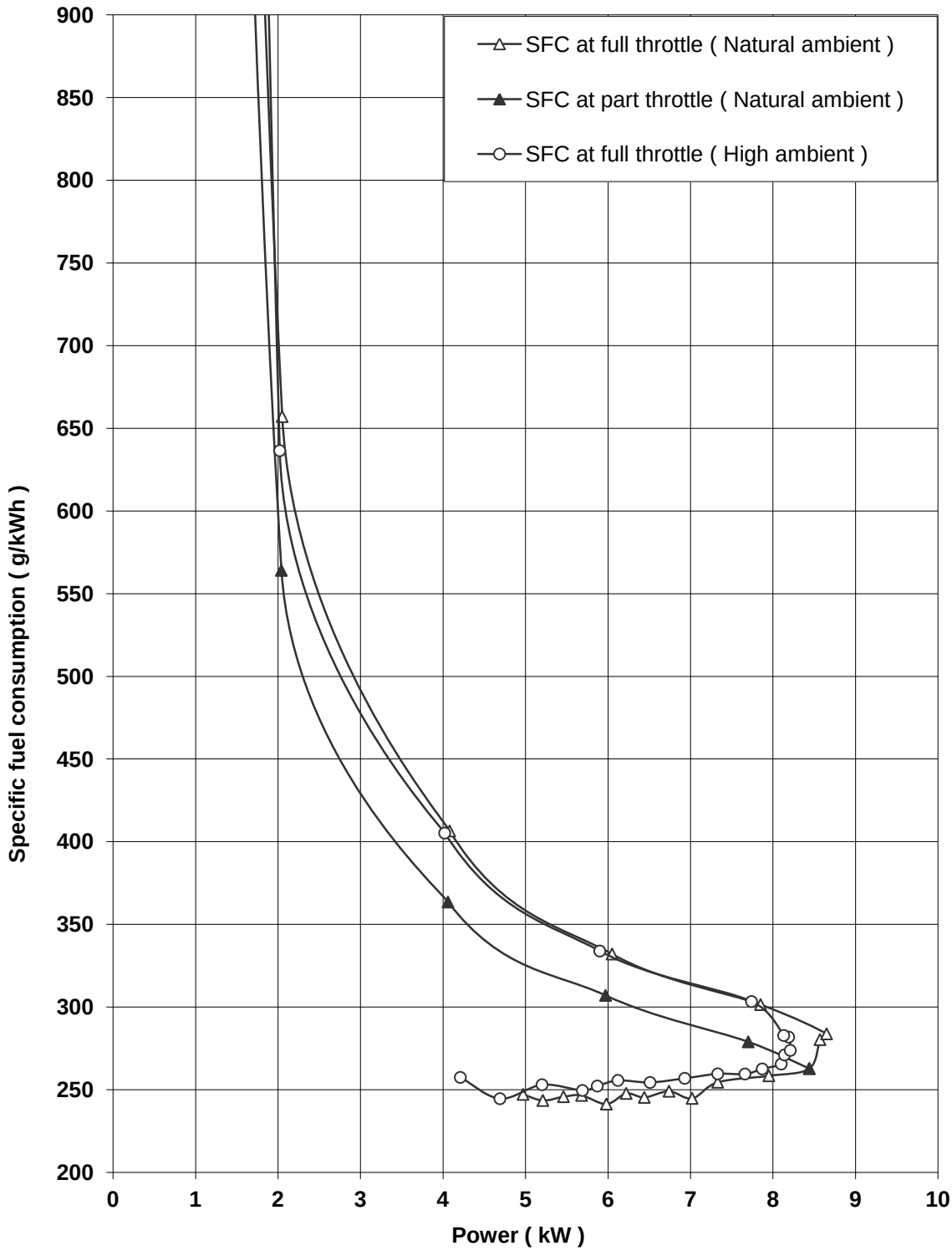



**Fig. 5 : PTO PERFORMANCE CHARACTERISTICS**

| | | Natural ambient | High ambient |
|---|---|---|---|
| -No load maximum engine speed, (rpm) | : | 2595 | 2580 |
| -Equivalent crankshaft torque at maximum power, (Nm ) | : | 35.9 | 33.8 |
| -Maximum equivalent crankshaft torque, (Nm) | : | 44.0 | 41.8 |
| -Engine speed at maximum equivalent crankshaft torque, (rpm) | : | 1349 | 1398 |
| Backup torque, (%) | : | 22.6 | --- |
| Smoke level (maximum light absorption coefficient, per meter) | : | 0.27 | --- |
| **- Range of atmospheric conditions:** | | | |
| Temperature, ( $^{o}$C) | : | 26 to 28 | 41 to 43 |
| Pressure, (kPa) | : | 98.7 to 99.1 | 99.6 to 99.9 |
| Relative humidity, (%) | : | 39 to 42 | 27 to 30 |
| **-Maximum temperatures, ($^{o}$C):** | | | |
| Engine oil | : | 83 | 86 |
| Coolant (Water + Coolant) | : | 66 | 85 |
| Fuel | : | 33 | 45 |
| Air intake | : | 29 | 44 |
| Exhaust gas | : | 328 | 527 |
| **-Pressure at maximum power:** | | | |
| Intake air, (kPa) | : | 2.6 to 3.5 | 1.4 to 1.7 |
| Exhaust gas, (kPa) | : | 2.3 to 2.7 | 2.5 to 3.3 |
| **-Consumptions:** | | | |
| Lub oil, (g/kWh) | : | -- | 0.98 |
| Coolant (% of total coolant capacity) | : | -- | 1.6 |

## 4. DRAWBAR PERFORMANCE TEST

| | | |
|---|---|---|
| Date(s) of test | : | 09.07.2019, 10.07.2019 & 11.07.2019 |
| Tractor run at the Institute prior to start of drawbar test, (h) | : | 30.74 |
| Type of track | : | Concrete |
| **Height of drawbar, (mm):** | | |
| - Without ballast | : | 410 |

**4.1** The results of drawbar performance test consisting of maximum power and pull with unballast and ten hours test are tabulated in **Table – 2.** The results of the tests with unballast are also represented graphically in **Fig. 6 & 7**

**Table – 2**

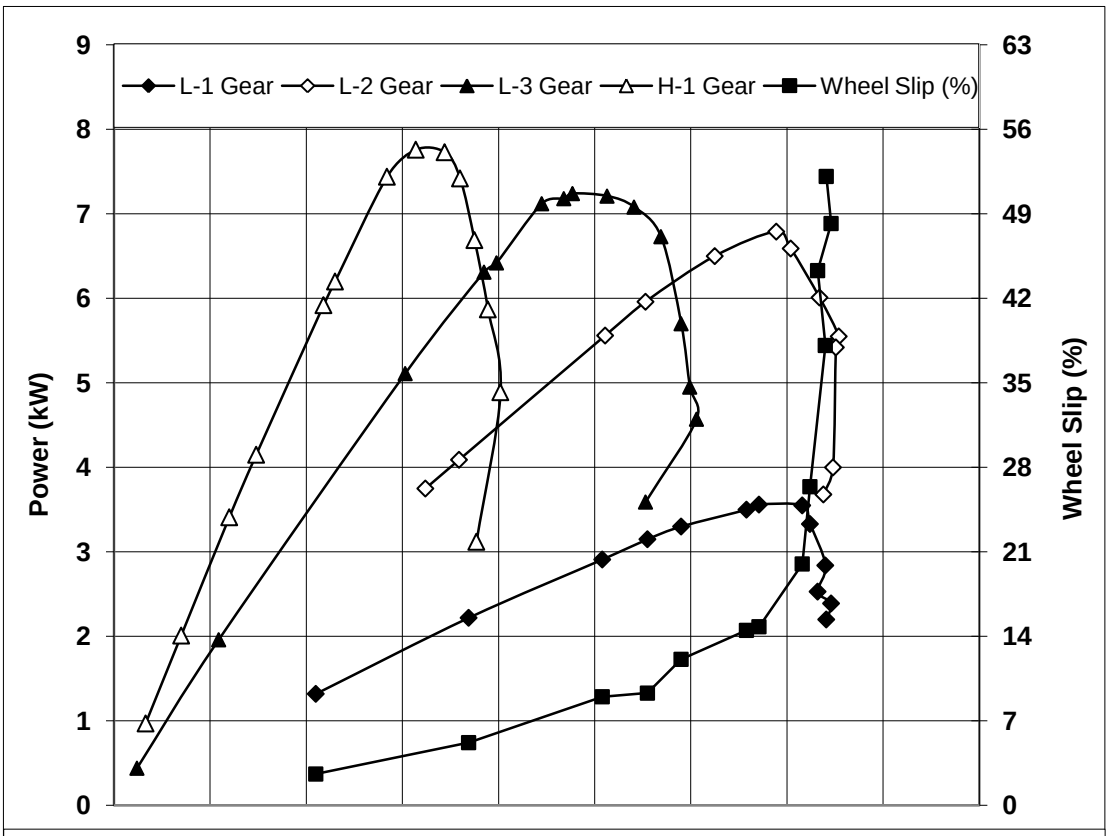
## DRAWBAR PERFORMANCE TEST

| Gear | Travel Speed, (km/h) | Draw-bar power, (kW) | Draw-bar pull, (kN) | Engine Speed, (rpm) | Wheel Slip, (%) | Fuel consumption | | Specific Energy, (kWh/l) | Atmospheric conditions | | | Temperature (°C) | | | | Max. sust-ained pull, (kN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | (kg/kWh) | (l/h) | | Temp (°C) | Pre-ssure (kPa) | R.H. (%) | Fuel | Trans. oil | Coolant (water) | Eng-ine oil | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| **i) Maximum power test (Tractor unballasted):** | | | | | | | | | | | | | | | | |
| L1 | 1.91 | 3.6 | 6.71 | 2500 | 14.8 | 0.489 | 2.11 | 1.71 | 28 | 97.6 | 73 | 41 | 59 | 71 | 91 | 7.46 |
| L2 | 3.37 | 6.6 | 7.04 | 2329 | 15.1 | 0.365 | 2.88 | 2.29 | 30 | 97.4 | 73 | 44 | 55 | 81 | 86 | 7.54 |
| L3 | 5.47 | 7.2 | 4.77 | 2299 | 6.1 | 0.347 | 2.99 | 2.41 | 28 | 97.7 | 70 | 41 | 58 | 80 | 92 | 6.06 |
| H1 | 8.89 | 7.8 | 3.14 | 2303 | 2.3 | 0.316 | 2.95 | 2.64 | 26 | 97.8 | 77 | 39 | 52 | 78 | 86 | 4.02 |
| **ii) Five hours test at 75 percent of pull obtained at max. Power (Unballasted wheeled tractor):** | | | | | | | | | | | | | | | | |
| L2 | 3.86 | 5.7 | 5.28 | 2442 | 8.6 | 0.366 | 2.53 | 2.24 | 26 to 30 | 97.5 to 97.8 | 68 to 85 | 39 to 44 | 56 to 61 | 73 to 77 | 90 to 94 | -- |
| **iii) Five hours test at pull corresponding to 15 percent wheel slip (Unballasted wheeled tractor):** | | | | | | | | | | | | | | | | |
| L1 | 1.98 | 3.70 | 6.72 | 2468 | --- | 0.44 | 1.99 | 1.86 | 28 to 32 | 97.6 to 97.9 | 57 to 79 | 41 to 48 | 55 to 61 | 69 to 73 | 86 to 93 | -- |

**iv)** The coolant (water) and lub oil consumption during 10 hours test were observed as **3.0 ml/h & 5.0 ml/h** respectively.

**v)** Tyre Creeping, (mm):
- LHS : Nil
- RHS : Nil

**vi)** Maximum temperatures during entire drawbar test, (°C):
Engine oil : 94
Coolant (water) : 85
Transmission oil : 61
Fuel : 48



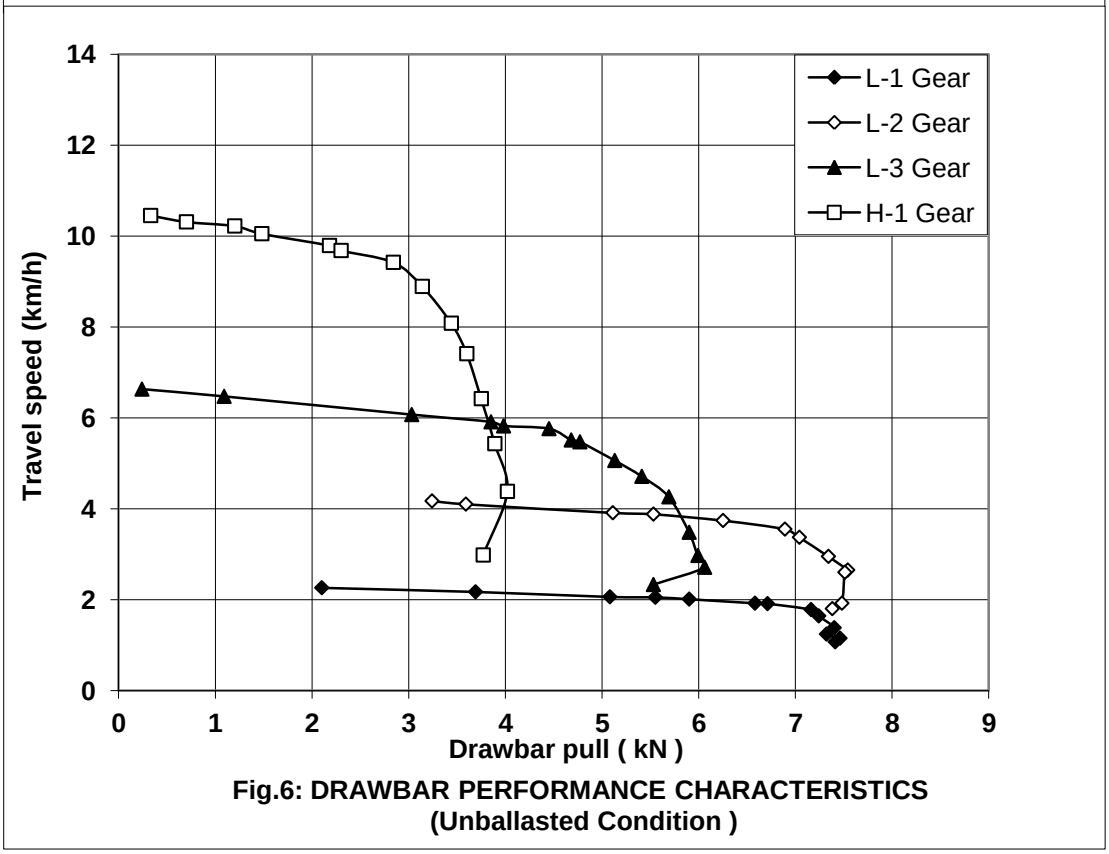




**Fig.6: DRAWBAR PERFORMANCE CHARACTERISTICS**
**(Unballasted Condition )**

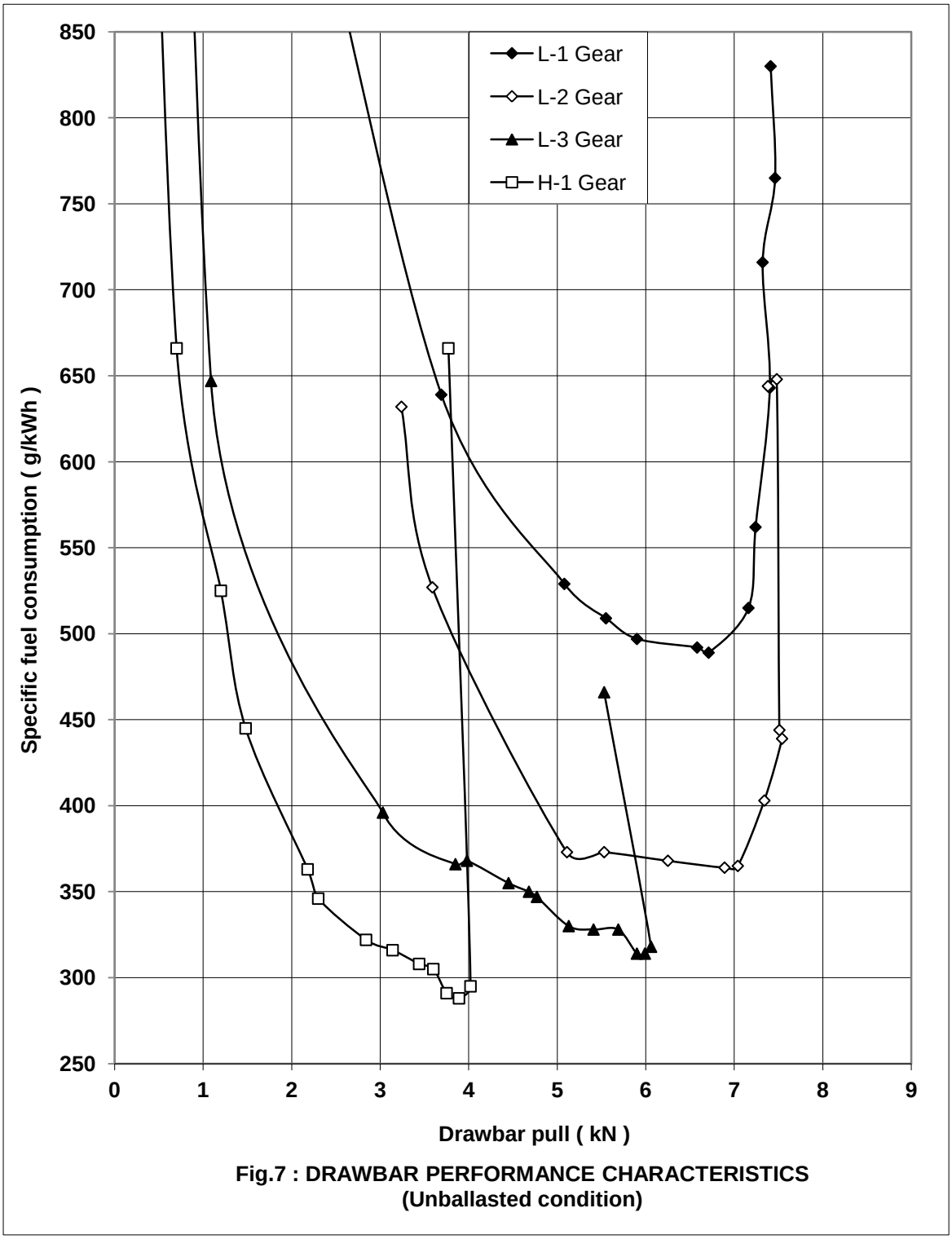



**Fig.7 : DRAWBAR PERFORMANCE CHARACTERISTICS (Unballasted condition)**

## 5. POWER LIFT AND HYDRAULIC PUMP PERFORMANCE TEST

Date(s) of test : 28.05.2019 & 29.05.2019

Tractor run at the Institute prior to start of hydraulic test, (h) : 19.69

Pump speed at rated engine speed, (rpm) : 2300

### 5.1 Hydraulic power test:

Pump delivery rate at minimum pressure and rated engine speed, (l/min) : 15.4

Maximum hydraulic power, (kW) : 2.5

Pump delivery rate at maximum hydraulic power, (l/min) : 14.8

Pressure at maximum hydraulic power, (MPa) : 10.0

Sustained pressure of the open relief valve, (MPa) : 13.0

**Tapping point:**

a) Relief valve test : At external circuit

b) Pump performance test : At pump outlet

Temperature of hydraulic fluid, (°C) : 60 to 63

### 5.2 Lifting capacity test:

| Test | Height of lower hitch point above ground in down position, (mm) | Vertical move-ment with lifting forces, (mm) | Maximum corrected force exerted through full range, (kN) | Correspo nding pressure, (MPa) | Moment about rear axle, (kN-m) | Max. tilt angle of mast from vertical (degrees) |
|---|---|---|---|---|---|---|
| At hitch points | 165 | 420 | 7.92 | 11.7 | 4.87 | -- |
| On the standard frame | 165 | 430 | 4.32 | 11.7 | 5.29 | 21.1 |

### 5.3 Maintenance of lift load:

Force applied at the frame, (kN) : 3.88

Temperature of hydraulic fluid at the start of test, (°C) : 60

**Test data:**

| Elapsed time (minute) | 5 | 10 | 15 | 20 | 25 | 30 |
|---|---|---|---|---|---|---|
| Cumulative drop in height of lift, (mm) | 06 | 10 | 11 | 12 | 14 | 14 |

## 6. BRAKE TEST

**6.1 Service brake:**

**6.1.1 Cold brake test:**

Date of test(s) : 01.03.2019 & 07.03.2019

Type of Track : Concrete

Maximum attainable speed (kmph)**:**

-Without Ballast : 28.45

| | | At maximum attainable speed | | | |
|---|---|---|---|---|---|
| Unballasted tractor | Braking device control force, (N) | 487 | 386 | 384 | 182 |
| | Mean deceleration, (m/sec$^2$) | 4.80 | 4.56 | 3.81 | 2.50 |
| | Stopping distance, (m) | 6.50 | 6.85 | 8.20 | 12.49 |
| | | At 25 kmph travel speed | | | |
| Unballasted tractor | Braking device control force, (N) | 513 | 411 | 308 | 205 |
| | Mean deceleration, (m/ sec$^2$) | 5.42 | 4.02 | 3.44 | 2.50 |
| | Stopping distance, (m) | 4.45 | 6.00 | 7.00 | 9.65 |

**6.1.2 Brake fade test**:

| | At maximum attainable speed | | | |
|---|---|---|---|---|
| Braking device control force, (N) | 477 | 383 | 289 | 195 |
| Mean deceleration, (m/ sec$^2$) | 4.49 | 3.97 | 3.35 | 2.50 |
| Stopping distance, (m) | 6.95 | 7.86 | 9.33 | 12.49 |

| | At 25 kmph travel speed | | | |
|---|---|---|---|---|
| Braking device control force, (N) | 514 | 420 | 325 | 230 |
| Mean deceleration, (m/ sec$^2$) | 4.92 | 3.77 | 3.44 | 2.50 |
| Stopping distance, (m) | 4.90 | 6.40 | 7.00 | 9.65 |

Maximum deviation of tractor from its original course, (m) : None

Abnormal vibration : None

The brakes were heated by : Self braking

**Remark:** Applicant has not recommended road ballast mass, therefore brake test in road ballast condition was not conducted.

**6.2 Parking brake test:**

| Particulars | 18 percent slope | | 12 percent slope with trailer of 0.86 tones. | |
|---|---|---|---|---|
| | Up | Down | Up | Down |
| Braking device control force, (N) | 335 | 384 | 558 | 512 |
| Efficacy of parking brake | ----------Effective---------- | | | |

## 7. NOISE MEASUREMENT

### 7.1 Noise at bystander's position:

Date of test : 28.02.2019
Type of track : Concrete
Background noise level, dB (A) : 51

**Atmospheric conditions:**

Temperature, (°C) : 25
Pressure, (kPa) : 97.7
Relative humidity, (%) : 38
Wind velocity, (m/s) : 2.7

**Test Data:**

| S. No. | Gear | Traveling speed before acceleration, (kmph) | Noise level, dB (A) |
|---|---|---|---|
| 1. | L1 | 1.70 | 80 |
| 2. | L2 | 3.24 | 80 |
| 3. | L3 | 4.80 | 79 |
| 4. | H1 | 7.60 | 79 |
| 5. | H2 | 14.06 | 79 |
| 6. | H3 | 21.34 | 78 |

### 7.2 Noise at operator's ear level:

Date of test : 09.07.2019
Type of track : Concrete
Background noise level, dB(A) : 54

**Atmospheric conditions:**

Temperature, (°C) : 30
Pressure, (kPa) : 97.5
Relative humidity, (%) : 69
Wind velocity, (m/s) : 2.1

**Test Data:**

| Gear | Drawbar pull at which the tractor developed the max. noise level, (kN ) | Corresponding traveling speed, (kmph) | Noise level, dB(A) |
|---|---|---|---|
| L1 | 5.90 to 7.16 | 2.01 to 1.78 | 94 |
| L2 | 5.11 to 7.04 | 3.91 to 3.37 | 94 |
| L3 | 3.85 to 4.77 | 5.91 to 5.47 | 95 |
| H1* | 1.48 to 3.14 | 10.05 to 8.89 | 95 |

***** Gear corresponds to the nominal travelling speed nearest to **7.5** kmph**.**

## 8. MECHANICAL VIBRATION MEASUREMENT

Date of test : 31.05.2019
Type of test surface : Concrete

| Sl. No. | Measuring points | | Vibration, microns | | | |
|---|---|---|---|---|---|---|
| | | | At load corresponding to 85% of max. PTO power | | At no load | |
| | | | VD | HD | VD | HD |
| i) | Foot rest | Left | 60 | 30 | 20 | 40 |
| | | Right | 40 | 40 | 30 | 30 |
| ii) | Steering wheel | | 360* | 370* | 280* | 300* |
| iii) | Seat | Bottom | 60 | 100 | 30 | 60 |
| | | Back | 60 | 150* | 50 | 30 |
| iv) | Mudguard | Left | 170* | 160* | 70 | 100 |
| | | Right | 180* | 160* | 140* | 60 |
| v) | Head light | Left | 350* | 320* | 190* | 160* |
| | | Right | 350* | 310* | 190* | 160* |
| vi) | Battery base, centre | | 130* | 90 | 170* | 100 |
| vii) | Tail light | Left | 140* | 110* | 180* | 120* |
| | | Right | 220* | 120* | 250* | 200* |
| viii) | Plough light | | 390* | 330* | 270* | 350* |
| ix) | Gear shifting lever | | 190* | 150* | 30 | 30 |
| x) | Accelerator lever | Hand | 240* | 210* | 110* | 150* |
| | | Foot | 190* | 150* | 140* | 140* |
| xi) | Brake pedal | Left | 170* | 180* | 120* | 90 |
| | | Right | 180* | 160* | 180* | 160* |
| xii) | Clutch pedal | | 100 | 90 | 100 | 130* |
| xiii) | Main hydraulic control lever | | 140* | 170* | 100 | 100 |
| xiv) | PTO engaging lever | | 60 | 70 | 30 | 30 |

***The amplitude of mechanical vibration is on higher side.**

## 9. AIR CLEANER OIL PULL OVER TEST

Date of test : 26.02.2019

**Atmospheric conditions**

Temperature, (ºC) : 27 to 30
Pressure, (kPa) : 97.3 to 99.5
Relative humidity, (%) : 21 to 43
Mass of oil before test, (g) : 507.36

| Sl .No. | Position of tractor | Loss of oil (g) | Oil pull over (%) | Engine oil pressure |
|---|---|---|---|---|
| i) | Tractor parked on level ground | 1.00 | 0.20 | Normal |
| ii) | Tractor tilted to 15 deg laterally with RHS up | 1.00 | 0.20 | Normal |
| iii) | Tractor tilted to 15 deg laterally with LHS up | 0.30 | 0.06 | Normal |
| iv) | Tractor tilted to 15 deg longitudinally with front end up | 0.50 | 0.10 | Normal |
| v) | Tractor tilted to 15 deg longitudinally with rear end up | 0.70 | 0.14 | Normal |

## 10. LOCATION OF CENTRE OF GRAVITY

| Condition | Particulars | Coordinates |
|---|---|---|
| Tractor under standard ballasted condition but with all the liquid reservoirs full & the operator replaced by a 75 kg mass on the seat | Height above ground, (mm) | 442 |
| | Distance forward from the vertical plane containing the axis of rear wheels, (mm) | 574 |
| | Distance from the median plane parallel to the longitudinal axis of tractor bisecting the track, (mm) | 19 (in RHS) |

## 11. TURNING ABILITY

| Characteristics | Minimum turning diameter, (m) | | Minimum clearance diameter, (m) | |
|---|---|---|---|---|
| | LHS | RHS | LHS | RHS |
| Brakes released | 6.33 | 6.30 | 6.60 | 6.58 |
| Brake applied | 5.58 | 5.39 | 5.85 | 5.67 |

## 12. OPERATORS'S FIELD OF VISION

**12.1** The operator's field of vision to the front and rear from the operator's seat with standard fitment of bonnet style is represented in **Fig. 8 (a)** as per the following details**:**

**(i)** The non visible space in front is **4580 mm** which is **3.07** times of its wheel base i.e. 1490 mm.

**(ii)** The non visible space in LHS & RHS is **1230 mm** which is **1.22** times of its rear standard track width i.e.1005 mm.

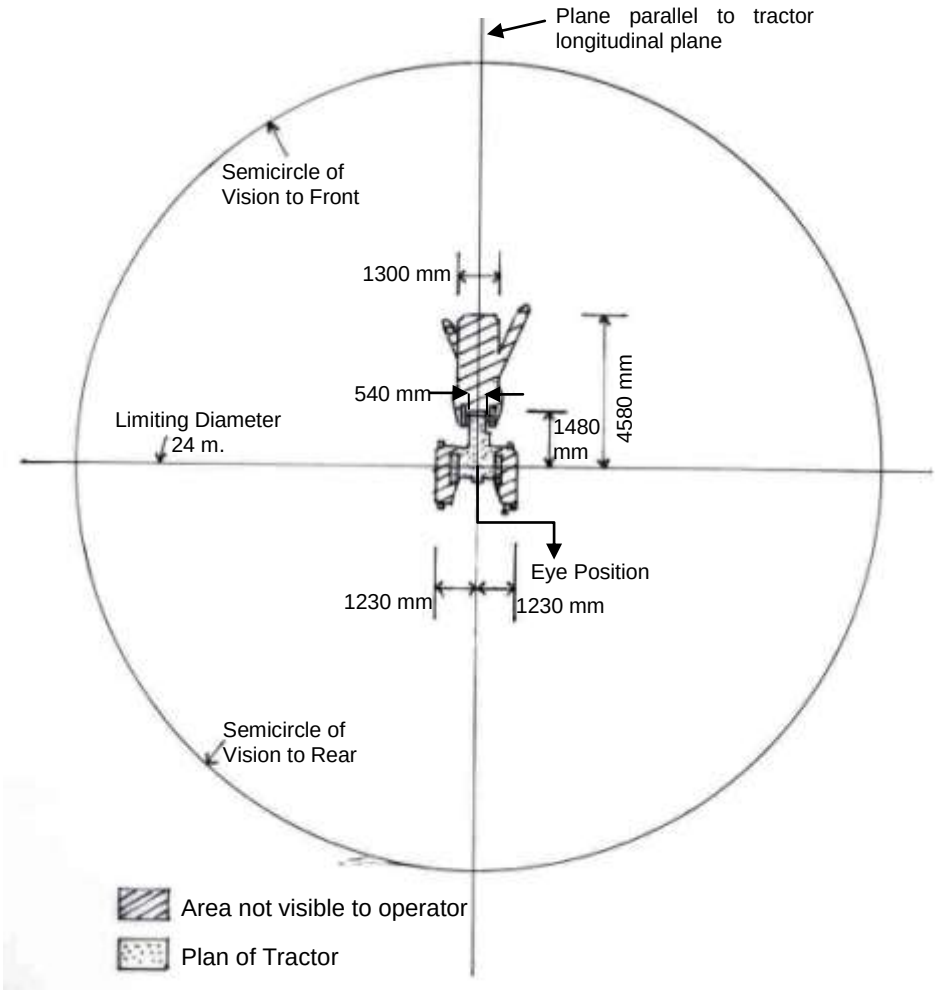



**Fig. 8: OPERATOR'S FIELD OF VISION**

## 13. FIELD TEST

**13.1** The field tests comprising of M.B. ploughing and Rotavation were conducted for 26.0 and 27.5 hours respectively.

All the field tests were conducted at the full accelerator settings, when the no load speed of the engine varied from 2569 to 2580 rpm.

**13.2** The brief specifications of the implements used during field tests are given in **Annexure – I**

**13.3** The summary of field test observation with M.B. plough and rotavator are given in **Table – 3.**

**Table – 3**

**SUMMARY OF FIELD PERFORMANCE TEST**

| S No. | Parameter/operation | M.B. Ploughing | Rotavation |
|---|---|---|---|
| i) | Type of soil | Heavy | Heavy |
| ii) | Av. Soil moisture, (%) | 10 to 16 | 10 to 16 |
| iii) | Bulk density of soil, (g/cc) | 1.6 to 1.90 | 1.60 to 1.65 |
| iv) | Cone index,(kg/cm$^2$) | 7.32 to 8.18 | 5.79 to 7.66 |
| v) | Gear used | L-2 | L-1 |
| vi) | Av. Speed of operation, (kmph) | 3.19 to 3.55 | 2.04 to 2.08 |
| vii) | Av. Wheel slip, (%) | 13.3 to 17.1 | -1.9 to -1.3 |
| viii) | Av. Depth of cut,(cm) | 14 to 15 | 6 |
| ix) | Av. Working width,(cm) | 40 to 49 | 68 to 77 |
| x) | Area covered,(ha/h) | 0.109 to 0.143 | 0.124 to 0.136 |
| xi) | Fuel consumption: | | |
| | - (l/h) | 1.61 to 2.00 | 1.93 to 2.08 |
| | - (l/ha) | 12.38 to 14.67 | 14.55 to 16.39 |
| xii) | Av. Draft of implement, (kN) | 2.6 to 3.73 | -- |

**Remarks:** The average lubrication oil and coolant (water) consumptions during the entire field tests were recorded as **1.50 ml/h** & **1.50 ml/h** respectively.

**13.4 Wet land cultivation (Puddling):**

**13.4.1** The manufacturer has recommended that the tractor is not suitable for wet land cultivation (puddling) test. Therefore, the wet land cultivation (puddling and water proof) test has not been conducted.

## 14. HAULAGE TEST

| | | |
|---|---|---|
| Type of trailer | : | **Two wheel (Single axle)** |
| Gross mass of trailer (Tonne) | : | 1.5 |
| Height of trailer hitch above ground level, (mm) | : | 320 |
| Gear used during the test for negotiating slopes upto 8% | : | H3 |
| Average travel speed,(kmph) | : | 26.12 to 26.34 |
| Average fuel consumption: | | |
| - (l/h) | : | 2.02 to 2.23 |
| - (ml/km/(Tonne) | : | 51.6 to 56.4 |
| Average distance traveled per litre of fuel consumption, (km) | : | 11.82 to 12.93 |
| **General observations:** | | |
| Effectiveness of brakes | : | Effective |
| Maneuverability of tractor-trailer combination | : | Satisfactory |

## 15. COMPONENTS/ASSEMBLY INSPECTION

The engine and other assemblies were dismantled after **102.56 hours** of tractor operation at this Institute.

### 15.1 Engine:

#### 15.1.1 Cylinder bore:

| Cylinder bore dia, (mm) | | | | | | Max. permissible wear limit, (mm) |
|---|---|---|---|---|---|---|
| Top position | | Middle position | | Bottom position | | |
| Thrust side | Non-thrust side | Thrust side | Non-thrust side | Thrust side | Non-thrust Side | |
| 99.976 | 99.981 | 99.976 | 99.975 | 99.978 | 99.979 | 101.18 |

#### 15.1.2 Piston:

| Piston dia, (mm) | | | | Max. permissible wear limit, for piston dia. at the skirt, (mm) | Clearance between piston to cylinder liner at the skirt, (mm) | |
|---|---|---|---|---|---|---|
| Top (above top compression ring) | | At skirt | | | | |
| Thrust side | Non-thrust Side | Thrust side | Non-thrust Side | | As measured | Max. permissible limit |
| 99.495 | 99.490 | 99.833 | *** | 99.58 | 0.148 | 1.10 |

(***) Not measured due to piston design features.

#### 15.1.3 Ring end gap:

| Rings | Ring end gap, (mm) | | | Max. permissible ring end gap limit,(mm) |
|---|---|---|---|---|
| | Top | Middle | Bottom | |
| 1st comp. ring | 0.50 | 0.50 | 0.55 | 2.20 |
| 2nd comp. ring | 0.80 | 0.80 | 0.75 | 2.20 |
| Oil ring | 0.60 | 0.60 | 0.60 | 2.20 |

#### 15.1.4 Ring side clearance:

| Rings | Ring side clearance, (mm) | Max. permissible clearance limit, (mm) |
|---|---|---|
| 1st Compression ring | --Tapered-- | -- |
| 2nd Compression ring | 0.069 | 0.35 |
| Oil ring | 0.049 | 0.25 |

#### 15.1.5 Main Journal Bush:

| Bearing No. | Diametrical Clearance, (mm) | Crankshaft end float, (mm) | Max. permissible wear limit, (mm) | |
|---|---|---|---|---|
| | | | Diametrical clearance | Crankshaft end float |
| 1. | 0.069 to 0.157 | 0.38 | 0.20 | 1.00 |
| 2. | 0.095 to 0.106 | | | |

#### 15.1.6 Big end bearings:

| Bearing No. | Clearance, (mm) | | Max. permissible wear limit,(mm) | |
|---|---|---|---|---|
| | Diametrical | Axial | Diametrical | Axial |
| 1. | 0.098 to 0.131 | 0.20 | 0.18 | 0.80 |

**15.1.7 Valve, guides and timing gears:**

| | | Observation | |
|---|---|---|---|
| Any marked sign of overheating of valves | : | None | |
| Pitting of seat/faces of valves | : | None | |
| Any visual damage to the teeth of timing gears | : | None | |
| **Spring rate, ( N/mm):** | | | |
| Intake valve spring | : | 25.45 | Against the discard limit of 16 N/mm |
| Exhaust valve spring | : | 27.30 | |
| **Clearance between valve guide and valve stem, (mm):** | | | |
| - Intake valve | : | 0.073 | Against discard limit of 0.125 mm |
| - Exhaust valve | : | 0.082 | |

**15.2 Clutch:**

| | | | |
|---|---|---|---|
| Any marked wear on clutch friction plates | : | None | |
| Condition of clutch release bearing | : | Normal | |
| Condition of pilot bearing | : | Normal | |
| Condition of springs and release leavers | : | Normal | |
| Presence of oil in clutch housing | : | None | |
| Any marks on fly wheel/ pressure plate | : | None | |
| Overall thickness of plate | : | 8.74 to 8.79 | Against the discard limit of up to rivet head |
| Height of lining over rivet head, (mm) | : | 1.63 to 1.73 | |

**15.3 Transmission gears:**

| | | | |
|---|---|---|---|
| Any visual damage, pitting & chipping of any transmission gear teeth | : | None | |
| Backlash between crown wheel and pinion, (mm) | : | 0.36 | Against the discard limit of 0.50 mm |

**15.4 Brakes:**

| Description | Initial specified thickness of brake disc, (mm) | Measured overall thickness of brake disc after test, (mm) | Measured depth of groove above rivet head, (mm) | Minimum permissible depth of oil groove of brake lining (mm) |
|---|---|---|---|---|
| Left | 12.3 to 12.9 | 12.45 to 12.52 | 1.36 to 1.59 | Up to rivet head |
| Right | 12.3 to 12.9 | 12.44 to 12.52 | 1.38 to 1.55 | Up to rivet head |

**15.5 Front axle:**

| | | | |
|---|---|---|---|
| Any marked wear of king pins | : | None | |
| Any marked wear of king pin bushes | : | None | |
| Clearance between king pin and bushes, (mm) | : | 0.11 to 0.26 | Against discard limit of 0.30 mm |
| Condition of thrust bearing | : | Normal | |
| Condition of bearings for stub axles | : | Normal | |
| Condition of seals for stub axles and king pins | : | Normal | |
| Clearance between centre pin and bush, (mm) | : | 0.18 to 0.36 | Against discard limit of 0.30 mm |

**15.6 Steering system:**

| | | |
|---|---|---|
| Visual condition of the components of complete steering assembly | : | Normal |

**15.7 Starter motor & Alternator:**

| | | |
|---|---|---|
| Presence of soil/oil in housing | : | None |
| Condition of bearings and other components | : | Normal |

## 16. ADJUSTMENTS, DEFECTS, BREAKDOWNS AND REPAIRS

| S. No. | Adjustment/ Defects/ Breakdowns and Repairs | Category of breakdown | Tractor run hours |
|---|---|---|---|
| 1. | During PTO performance test under natural ambient condition leakage of engine lubrication oil was found through timing cover oil seal. The oil seal (Part No. 006008955B1) was replaced with new one of same specification. | **Mn8** | 13.52 |
| 2. | During PTO performance test under high ambient condition again leakage of engine lubrication oil was found through timing cover oil seal. The oil seal (Part No. 006008955B1) was replaced with new one of same specification. | **Mn8** | 15.07 |
| 3. | During dry land field operation of Rotavator no load engine speed was recorded as 2299 rpm against the declaration of 2500 to 2600 rpm, thereafter throttle cable length was adjusted externally to maintain the no load engine rpm within the given range. | -- | 62.06 |

## 17. SUMMARY OF OBSERVATIONS, COMMENTS & RECOMMENDATIONS

**17.1** Evaluative (mandatory) / Non-evaluation (Non-mandatory) parameter applicable for qualifying Minimum Performance criteria as per Clause-4 (Table-1) of **IS: 12207-2019** for acceptance of the tractor for the purpose of subsidies/NABARD financing are summarized as under:-

| S. No. | Characteristic | Category (Evaluative / Non Evaluative) | Requirements as per IS: 12207-2019 | Values declared by the applicant (D) / Requirement (R) | As obser-ved | Whether meets the require-ments (Yes/No) |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 17.1.1 | **PTO Performance :** | | | | | |
| **a)** | Max. power under 2 h test, (kW ) (Natural ambient condition) | Evaluative | Declared value to be achieved with a tolerance of: ± 5% for PTO power or engine power >26 kW, ± 10% for PTO power or Engine power ≤ 26 kW. | 8.2 (D) | 8.7 | Yes |
| **b)** | Power at rated engine speed, (kW) | Non Evaluative | -do- | 8.2 (D) | 8.7 | Yes |
| **c)** | Specific fuel consumption corresponding to maximum power, (g/kWh) | Evaluative | + 10% Max. | 280 (D) | 280 | Yes |
| **d)** | Maximum equivalent crankshaft torque, (Nm) | Non Evaluative | ± 8% | 43 (D) | 44.0 | Yes |
| **e)** | Back-up torque, percent | Evaluative | 12 percent, min. | 10 (D)<br>12 (R) | 22.6 | Yes |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| **f)** | Maximum operating temperature($^{O}$C) | | | | | |
| | 1) Engine oil | Evaluative | The declared value should not exceed the max. value specified by the oil company and the observed value under high ambient condition should not exceed the declaration. | 130 (D) | 86 | Yes |
| | 2) Coolant (liquid) | Evaluative | The declared value should not exceed the boiling temperature of coolant under the pressurized or otherwise and the observed value under high ambient condition should not exceed the declaration. | 110 (D) | 85 | Yes |
| **g)** | Engine oil consumption, (g/kWh) | Evaluative | Not exceeding 1% of SFC at max. power under High ambient conditions | 2.84 (R) | 0.98 | Yes |
| **h)** | Smoke level, ($m^{-1}$) | Evaluative | Maximum light absorption coefficient of 3.25 per metre or equivalent BOSCH No. 5.2 or 75 Hatridge value (**As per CMVR**) | 3.25 (R) | 0.27 | Yes |
| **17.1.2** | **Drawbar performance:** | | | | | |
| **a)** | Maximum drawbar pull with ballast corresponding to 15 percent wheel slip, (kN) | Non Evaluative | Minimum 70% of static mass with ballast | Manufacturer has not recommended any ballast mass, therefore this test was not conducted. | Not appli-cable | -- |
| **b)** | Maximum drawbar pull with unballast corresponding to 15 percent wheel slip, (kN) | Evaluative | Minimum 70% of static mass of tractor without/ standard ballast | 5.91 Minimum (R)<br>5.40 (D) | 7.04 | Yes |
| **c)** | Maximum drawbar power without ballast, or with standard ballast as the case may be, kW | Evaluative | Minimum 80 % of PTO power as referred in Sl No. i) a) of PTO performance in case of tractors having total static mass > 1500 kg Minimum 75 % of PTO power as referred in Sl No. i) a) of PTO performance in case of light weight tractors having 1500 kg total static mass of tractor Minimum 75 % of the engine power as referred in Sl No. i) a) of engine performance in case of tractors which do not have a PTO shaft. | 6.5 Minimum (R)<br>6.15 (D) | 7.8 | Yes |
| **d)** | For the tractors fitted with air conditioned /heated cabin Maximum drawbar power without ballast, or with standard ballast as the case may be, kW | Evaluative | Minimum 70 % of PTO power as referred in Sl No. i) a) of PTO performance in case of tractors having total static mass > 1500 kg. | NA | NA | -- |
| **e)** | Maximum transmission oil temperature ($^{o}$C) | Evaluative | The declared value should not exceed the maximum value specified by oil company | 110 (D) | 61 | Yes |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| **17.1.3** | **Power lift and hydraulic pump performance :** | | | | | |
| **a)** | Maximum lifting capacity throughout the range of lift, (kN): | | | | | |
| | 1) At hitch points | Evaluative | ±10 percent | 7.30 (D) | 7.92 | Yes |
| | 2) With the standard frame | Evaluative | The lift capacity should at least be 24 kg/PTO kW. and it should be 21.5 kg/engine kW where the tractor is not provided with a PTO shaft | 4.40 (D)<br>2.05 Minimum (R) | 4.32 | Yes |
| **b)** | Maximum drop in the height of the point of application of the force after each 5 minutes interval for a total duration of 30 minute, (mm) | Non Evaluative | The observed value should not exceed 50 mm | 50 (D) | 14 | Yes |
| **17.1.4** | **Brake performance at 25 kmph:** | | | | | |
| **a)** | Maximum stopping distance at a force, equal to or less than 600 N on brake pedal with unballast, (m): | | | | | |
| | 1) Cold brake | Evaluative | 10 | 10 (R) | 4.45 | Yes |
| | 2) Hot brake | Evaluative | 10 | 10 (R) | 4.90 | Yes |
| **b)** | Maximum force exerted on the brake pedal to achieve a deceleration of 2.5 $m/s^2$, (N) | Evaluative | 600 | 600 (R) | 205 to 230 | Yes |
| **c)** | Whether parking brake is effective at a force of 600 N at foot pedal(s) or 400 N at hand lever, (N) | Evaluative | Yes / No | Yes (R) | 558 | Yes |
| **17.1.5** | **Noise measurement :** | | | | | |
| **a)** | Maximum ambient noise emitted by the tractor, dB(A) | Evaluative | As per CMVR | 85 (R) | 80 | Yes |
| **b)** | Maximum noise at operator's ear level, dB(A) | Evaluative | As per CMVR | 96 (R) | 95 | Yes |
| **17.1.6** | **Amplitude of mechanical vibrations at :** | | | | | |
| | 1) Left foot rest | Non Evaluative | 100 microns (max) | 100(R) | 60 | Yes |
| | 2) Right foot rest | | --do-- | | 40 | Yes |
| | 3) Seat (with driver seated) | | --do-- | | 150 | **No** |
| | 4) Steering wheel | | --do-- | | 370 | **No** |
| **17.1.7** | **Air cleaner oil pull over:** | Evaluative | 0.25 % (max.) | 0.25 % (max.) | 0.20 | Yes |
| **17.1.8** | **Haulage requirements :** | | | | | |
| **a)** | Gross mass of the trailer, (tones): | | | | | |
| | Two wheel | Non Evaluative | -- | 1.5 (D) | 1.5 | Yes |
| **b)** | Distance travelled / litre of fuel consumption, (km/l): | | | | | |
| | Two wheel | Non Evaluative | -- | 9 to 12 (D) | 11.82 to 12.93 | **No** |
| **c)** | Fuel consumption (ml/km/tonne): | | | | | |
| | Two wheel | Non Evaluative | -- | 50 to 55 (D) | 51.6 to 56.4 | **No** |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| **17.1.9** | **Wetland cultivation :** | | | | | |
| | Sealing for the following assemblies: | Evaluative | The identified assemblies should essentially meet the requirement of IS: 11082. No water ingress in the identified assembly given in column-2. If tractor does not meet the requirements of wetland cultivation, it may be recommended for dry land operation only. | There should be no ingress of water and / or mud (R) | . The manufacturer has not recommended the tractor for wetland cultivation (puddling operation) | Not appl-icable |
| | 1) Clutch assembly | -do- | | | | |
| | 2) Brake housings | -do- | | | | |
| | 3) Front axle hubs | -do- | | | | |
| | 4) Engine Oil | -do- | | | | |
| | 5) Transmission Oil | -do- | | | | |
| **17.1.10** | **Safety features :** | | | | | |
| **a)** | Guards against moving and hot parts | Evaluative | Belt drvies, pullies, silencer, hydraulics pipes(as per IS-12239 Part 2) | -- | Meet the requirements | Yes |
| **b)** | Lighting arrangement | Evaluative | As per CMVR | -- | Meet the requirements | Yes |
| **c)** | Seating requirements (Tractors having more than 1150 mm rear track width) | Non Evaluative | Should meet the requirements of IS: 12343 (As amended from time to time) | -- | Not applicable | -- |
| **d)** | Technical requirements for PTO shaft | Evaluative | Should meet the requirements of IS: 4931 (As amended from time to time) | -- | Meet the requirements | Yes |
| **e)** | Dimensions of three point linkage | Non Evaluative | Should meet the requirements of IS: 4468 (Part-I) (As amended from time to time) | - | Meet the requirements | Yes |
| **f)** | Specifications of linkage drawbar | Evaluative | Should meet the requirements of IS 12953 (As amended from time to time) | - | Meet the requirements | Yes |
| **g)** | Specifications of Swinging drawbar (wherever fitted) | Evaluative | Should meet the requirements of IS 12362 (Part 3) (As amended from time to time) | - | Not provided | -- |
| **h)** | 1) Maximum travelling speed at rated engine speed in reverse gears, kmph | Evaluative | Should not exceed 20 Kmph | - | 5.42 (Meets the requirement) | Yes |
| | 2) Audible warning signal on tractor. | Evaluative | As soon as the travelling speed in reverse gear reaches to 20 kmph, an audible warning signal on tractor shall be activated. | Not applica ble | Not applicable | -- |

| 1 | 2 | | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| **17.1.11** | **Labelling of tractors (Provision of labelling plate):** | | | | | | |
| | 1) | Make | Evaluative | Should conform to the requirements of CMVR along-with declared value of PTO in kW and year of manufacture in numerical<br>MM \| YY<br>Digit 01-12 in box No.1 for MM will represent the month and next two digit in the box No.2 for YY will represent the year of manufacturing | -- | Swaraj | Yes |
| | 2) | Model | Evaluative | | -- | 717 ES | Yes |
| | 3) | Month & Year of manufacture | Evaluative | | -- | 05 / 18 | Yes |
| | 4) | Engine number | Evaluative | | -- | GJB6BAA9008 | Yes |
| | 5) | Chassis number | Evaluative | | -- | MBNZMEBXEJJB00001 | Yes |
| | 6) | Declaration of PTO power, kW | Evaluative | | -- | 8.2 | Yes |
| **17.1.12** | **Discard limit for:** | | | | | | |
| **(a)** | Cylinder bore diameter, (mm) | | Evaluative | To be specified by Manufacturer | 100.18 | 99.976 | Yes |
| **(b)** | Clearance between piston & cylinder liner at skirt, (mm) | | Non Evaluative | | 1.10 | 0.148 | Yes |
| **(c)** | Piston diameter | | Non Evaluative | | 99.58 | 99.833 | Yes |
| **(d)** | **Ring end gap (mm):** | | | | | | |
| | - | Top comp. ring. | Evaluative | -do- | 2.20 | 0.50 to 0.55 | Yes |
| | - | 2nd comp. ring. | | -do- | 2.20 | 0.75 to 0.80 | Yes |
| | - | Oil ring. | | -do- | 2.20 | 0.60 | Yes |
| **(e)** | **Ring groove clearance (mm):** | | | | | | |
| | - | Top comp. ring. | Evaluative | -do- | --Tapered-- | | Yes |
| | - | 2nd comp. ring. | | -do- | 0.35 | 0.069 | Yes |
| | - | Oil ring. | | -do- | 0.25 | 0.049 | Yes |
| **(f)** | Diametrical clearance of main journal bush (mm): | | Evaluative | -do- | 0.20 | 0.069 to 0.157 | Yes |
| **(g)** | **Clearance of big end bearings, (mm):** | | | | | | |
| | - | Diametrical | Evaluative | -do- | 0.18 | 0.098 to 0.131 | Yes |
| | - | Axial | Evaluative | -do- | 0.80 | 0.20 | Yes |
| **(h)** | Crankshaft end float | | Evaluative | -do- | 1.00 | 0.28 | Yes |
| **(i)** | Clearance between king pin and bush,(mm) | | Non Evaluative | -do- | 0.30 | 0.11 to 0.26 | Yes |
| **(j)** | Clearance between center pin and bush,(mm) | | Non Evaluative | -do- | 0.30 | 0.18 to 0.36 | **No** |
| **17.1.13** | **Literature (Submission to test agency)** | | | | | | |
| **(a)** | Operator manual | | Evaluative | Provided / Not Provided | Provided | Provided | Yes |
| **(b)** | Parts Catalogue | | Evaluative | Provided / Not Provided | Provided | Provided | Yes |
| **(c)** | Workshop/ Service manual | | Evaluative | Provided / Not Provided | Provided | Provided | Yes |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| **17.1.14** | **Fitment of Roll Over Protective Structure (ROPS):** for tractors having more than 1150 mm rear track width | Evaluative | ROPS should meet the requirement of IS:11821 or OECD code or equivalent International Standard | Provided | Not applicable | -- |
| **17.1.15** | **Standard accessories** | Evaluative | Trailer hitch, front tow hook, linkage drawbar should be provided with tractor | Provided | Provided | Yes |
| **17.1.16** | **Accessories (Optional)** | Non Evaluative | Ballast weights if fitted should meet the requirement of CMVR. | Provided | Not applicable | -- |

| **17.1.17** | **CATEGORY OF BREAKDOWNS / DEFECTS :** | | | | |
|---|---|---|---|---|---|
| **S. No.** | **Category of Breakdown** | **Category (Evaluative / Non Evaluative)** | **Requirements as per IS: 12207-2019** | **As observed** | **Whether meets the requirement (Yes/No.)** |
| 1. | Critical breakdown | Evaluative | There is no 'critical breakdown' during the course of testing | None | Yes |
| 2. | Major breakdowns | Evaluative | There are not more than 2 major breakdowns and neither of them is of repetitive nature | None | Yes |
| 3. | Minor breakdowns | Evaluative | There are not more than 5 minor defects during the test and the frequency of each is not be more than two | **02 (Mn8 & Mn8)** | Yes |
| 4. | Total breakdowns | Evaluative | In no case, the total number of breakdowns should exceed five that is, (2 major + 3 minor) or (1 major + 4 minor) or 5 minor breakdowns | **02** | Yes |

**17.2 Conformity with following IS:**

**i)** Guide lines for declaration of power and specific fuel consumption and labelling of agricultural tractors (First revision) [IS10273: 1987 (Reaffirmed 2014)] **:** Conforms

**ii)** Agricultural tractors - Rear mounted power take-off - Types 1, 2 and 3 (third revision) [IS:4931-1995 (Reaffirmed 2014)] **:** Conforms

**iii)** Agricultural wheeled tractors - Three-point linkage: Part 2 Category 1N (Narrow Hitch) (Third Revision) [IS 4468 (Part-2):1993/ ISO 730-2:1979 (Reaffirmed 2014)] **:** Conforms

**iv)** Drawbar for agricultural tractors – Link type [IS 12953:1990 (Reaffirmed October, 2017)] **:** Conforms

| | | | |
|---|---|---|---|
| **v)** | Agricultural tractors - Operator's seat technical requirement [IS 12343 –1998 (First revision) (Reaffirmed 2014)] (Tractors having more than 1150 mm rear track width) | **:** | Not applicable |
| **vi)** | Guide for safety & comfort of operator of agricultural tractors: Part 1 General requirements (first revision): [IS 12239 (PT-1) 1996/ISO 4254-1:1989 (Reaffirmed October, 2017)] | **:** | **Does not conform** |
| **vii)** | Guide for safety & comfort of operator of agricultural tractors: Part 1 General requirements (first revision): [IS 12239 (PT-2) 1996/ISO 4254-1:1989 (Reaffirmed October, 2017)] | **:** | **Does not conform** |
| **viii)** | Tractors and machinery for agriculture and forestry, powered lawn and garden equipment - Symbols for operator controls and other displays Part 2 Symbols for agricultural tractors and machinery [IS:6283 (Part-1)- 2006 and IS: 6283 (Part-2)-2007 (Reaffirmed 2014)] | **:** | **Does not conform** |
| **ix)** | Guide lines for location and operation of operator controls on agricultural tractors and machinery (first revision) IS: 8133-1983 (Reaffirmed 2014)] | **:** | **Does not conform** |
| **x)** | Agricultural Tractors and Machinery - Lighting device for travel on public roads (IS: 14683-1999) (Reaffirmed 2014)] | **:** | Conforms |

**17.3 Salient Observations:**

**17.3.1 Laboratory tests:**

**17.3.1.1 PTO Performance:**

**i)** The maximum PTO power was recorded as **8.7 kW** against the declaration of **8.2 kW,** which meets the requirement of IS: 12207-2019 with regard to tolerance limit.

**ii)** The specific fuel consumption corresponding to maximum power was recorded as **280 g/kWh** against the declaration of **280 g/kWh**, which is within the tolerance limit of IS: 12207-2019.

**iii)** The maximum equivalent crankshaft torque was recorded as **44 N-m** against the declaration of **43 N-m**, which is within the permissible limit as per requirement of IS: 12207-2019.

**iv)** The backup torque was recorded as **22.6 %.**

**v)** There was drop of **6.9 %** in maximum PTO power during high ambient condition and natural ambient condition, which is considered on higher side. This should be looked into for necessary corrective action.

**vi)** During PTO performance test leakage of engine lubrication oil was observed twice through timing cover oil seal. The oil seal (Part No. 006008955B1) was replaced with new one of same specification. This repetitive breakdown has been categorized under **Mn8** as per IS:12207-2019. This should be looked into for necessary corrective action at production level.

**17.3.1.2 Hydraulic Performance:**

The moment about rear axle with standard frame was computed as **5.29 kN-m**. Whereas, the moment about front axle was computed as **4.82 kN-m.** The moment about rear axle is on higher side as compared to the moment about front axle. It is, therefore, recommended that the lifting capacity of the hydraulic system may be reduced suitably or additional ballast mass may be provided at front axle to avoid the front lifting of the tractor.

**17.3.1.4 Mechanical Vibration:**

The amplitude of mechanical vibration on various assemblies marked as (*) in Chapter-8 of this test report is on higher side, especially at seat and steering control wheel. This calls for dampening down of vibrations to improve the operational comfort and service life of components.

**17.3.1.5 Three Point Linkage:**

Some of the parameters of three point linkages conform to Cat. I and some of them conform to Cat. IN of IS: 4468 (Part-I): 1997 (Re-affirmed in October, 2017). Keeping in view the spirit of standardization, necessary improvements may be incorporated.

**17.3.1.6 Symbols as per IS: 6283 (Part-1) – 2006 (Re-affirmed in 2014) & IS: 6283 (Part-2) – 2007 (Re-affirmed 2014).**

**i)** Grease lubricant frequency chart has been not provided.
**ii)** Oil lubricant, type & frequency chart have been not provided.

**17.3.1.7 Components/Assembly Inspection**

Clearance between center pin and bush has been measured as **0.18 to 0.36** mm against the discard limit of **0.30**. The clearance has crossed the discard limit only after 102.56 hr of operation. This should be looked into for corrective action at production level.

**17.4. Field performance test:**

**17.4.1.1** During dry land rotavation no load engine speed was recorded as 2299 rpm against the declaration of 2500 to 2600 rpm, thereafter throttle cable length was adjusted externally to maintain the no load engine speed within the given range. This should be looked into for necessary corrective action.

**17.4.1.2 Wet land cultivation:**

The manufacturer has recommended that the tractor is not suitable for wet land cultivation (puddling operation). Therefore, the wet land cultivation (puddling and water proof) test has not been conducted. Hence tractor is not suitable for wet land cultivation as per IS: 12207-2019.

**17.4.1.3 Haulage test:**

Distance travelled / litre (km/l) and unit fuel consumption (ml/km/tonne) were recorded as **11.82 to 12.93 km/l** and **51.6 to 56.4 ml/km/tone** against the declaration of **9 to 12 km/l and 50 to 55 ml/km/tonne** respectively, which does not meet the requirement of IS: 12207-2019 with regard to tolerance limit. This should be looked into for necessary corrective action.

**17.5 Maintenance / Service Problems:**

No noticeable maintenance or service problem was observed during the test.

**17.6 Recommendation with regard to safety on tractor:**

The following requirements, inter alia, may be considered for incorporation on the tractor:

**i)** Safety switch against the accidental start should be provided.
**ii)** Differential lock should be provided to work in different soil condition.
**iii)** Spark arresting device in the exhaust system should be provided.
**iv)** There should be provision to couple trailer brake valve.
**v)** Master shield on PTO shaft should be provided.
**vi)** PTO shaft cover should be provided
**vii)** Working clearance between draft control lever & position control lever and between PTO engaging lever & main gear shift lever should be as per relevant standard.

**17.7 Adequacy of Literature supplied with machine:**

**17.7.1** The following literature has been supplied with the tractor for reference during the testing.

**i)** Operator's manual for Swaraj 717 ES tractor model
**ii)** Part's catalogue of Swaraj 717 ES tractor model
**iii)** Service manual of Swaraj 717 ES tractor model

**17.7.2** The supplied literature was found adequate, **except the following**:-

**i)** Oil change period of air cleaner bowl, steering system given in the schedule & maintenance chart of Operator's manual and Service manual (Part I) does not match with specifications submitted by applicant.

**ii)** Different lubricant grade recommended for engine lubrications, air cleaner and steering system has not been mentioned in the operator's and service manual submitted by the applicant.

**iii)** Schedule and maintenance chart has not been provided in the service manual.

**iv)** Discard limit of different components of tractor given in the service manual does not match with specification submitted by the applicant.

**17.7.3** These literatures may also be brought out in national & other regional languages for the guidance of user's and service personnel.

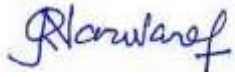
## 18. CITIZEN CHARTER

| Time frame for Testing & Evaluation as per Citizen Charter | Duration of Test | Whether the Test Report is released within the time frame given in Citizen Charter | Remarks |
|---|---|---|---|
| 10 Months | 09 Months (February, 2019 to October, 2019) | Yes | --- |

**TESTING AUTHORITY:**

**RAJNEESH PATEL**
**AGRICULTURAL ENGINEER**

**C.V. CHIMOTE**
**TEST ENGINEER**



**J.J.R. NARWARE**
**DIRECTOR**

## 19. APPLICANT'S COMMENTS

| Para No. | Our Reference | Applicant's comments |
|---|---|---|
| **19.1** | 17.2 (vi, vii, viii & ix), 17.3.1.1 (v & vi), 17.3.1.4, 17.3.1.5, 17.3.1.7, 17.4.1.1, 17.4.1.3, 17.6 (i, ii, iii, iv, v, vi & vii) & 17.7.2 (i, ii, iii & iv) | Necessary corrective action will be taken during regular production. |
| **19.2** | 17.3.1.2 | Study & trial are under process for necessary corrective action. |

**ANNEXURE- I**

## BRIEF SPECIFICATION OF IMPLEMENTS USED DURING FIELD TEST

| S. No. | Parameters | M.B. Plough | Rotavator |
|---|---|---|---|
| 1 | Make | Escorts | Mahindra |
| 2 | Type | Mounted | Mounted |
| 3 | No. of bottom / Blades | Two | 16 in 4 flanges |
| 4 | Type of bottom / Blades | Sod | Hatchet |
| 5 | Size of bottom / Blades (mm) | 170 | 220 x 68 x 7.7 |
| 6 | Spacing of bottom /Flanges, (mm) | 220 | 190 |
| 7 | Lower hitch point span, (mm) | 510 | 515 |
| 8 | Mast height, (mm) | 420 | 365 |
| 9 | Overall Dimensions (mm): | | |
| | Length | 1250 | 745 |
| | Width | 740 | 1010 |
| | Height | 840 | 790 |
| 10 | Gross Mass, (Kg) | 70 | 100 |

**ANNEXURE-II**

## TRACTOR RUN HOURS DURING TEST

| A. | LABORATORY AND TRACK TESTS: | HOURS |
|---|---|---|
| 1. | Running-in | -- |
| 2. | PTO performance test | 12.10 |
| 3. | Power lift and hydraulic pump performance test | 2.53 |
| 4. | Drawbar performance test | 14.07 |
| 5. | Turning ability | 0.25 |
| 6. | Location of centre of gravity | 0.25 |
| 7. | Operator's field of vision | Nil |
| 8. | Brake test | 1.83 |
| 9. | Noise measurement | 1.5 |
| 10. | Mechanical vibration test | 0.66 |
| 11. | Air cleaner oil pull over test | 3.5 |
| 12. | Theoretical speed test | 1.10 |
| **B.** | **FIELD TEST:** | |
| 1. | M.B. ploughing | 26.0 |
| 2. | Rotavation | 27.5 |
| **C.** | **HAULAGE TEST:** | 6.31 |
| **D.** | Miscellaneous test and other run hours including idle run, transportation, trials and preparation for test | 4.96 |
| | **TOTAL:** | **102.56** |