OECD Approval No. : 2 / 2 374

Date of approval : 20th June, 2007

**Report on test in accordance with**
**OECD STANDARD CODE 2**
**for the Official Testing of Agricultural and Forestry Tractors**




## Agricultural Tractor

# SONALIKA INTERNATIONAL DI 60 (4 WD) TRACTOR

**ZB – 30 km/h**

**Manufactured by** : **M/s International Tractors Ltd.**
Village - Chak Gujran
P.O. - Piplanwala, Jalandhar Road,
Distt. **HOSHIARPUR** (Punjab) 146 022, **INDIA**

**Submitted for test by** : **The manufacturer**

**Report No.** : **T- 589/1090/14/OECD**

**Date** : **June, 2007**

**GOVERNMENT OF INDIA**
**Ministry of Agriculture, (Deptt. of Agriculture and Co-opn.)**
**CENTRAL FARM MACHINERY TRAINING & TESTING INSTITUTE**
**P.O. Tractor Nagar, BUDNI (M.P.) 466 445**
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Web site : dacnet.nic.in/cfmtti

This is a report on a tractor test in accordance with **OECD STANDARD CODE 2** for the Official Testing of Agricultural and Forestry Tractors.

It does not contain an evaluation of the tractor on practical work.

| | | | |
|---|---|---|---|
| **Date of approval:** | **20th June, 2007** | **OECD No.:** | **2 / 2 374** |

In this report units of all performance characteristics are given corresponding to the International system of units.

| The relationship to the Technical System of Units is given by the following conversions: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Force | 1 | kN | = | 1000 | N | = | 102 | kgf |
| Power | 1 | kW | = | 1000 | W | = | 1.36 | Ps |
| Pressure | 1 | MPa | = | 10 | bar | = | 10.2 | $kgf/cm^2$ |
| | 100 | kPa | = | 1000 | mbar | = | 750.1 | mm of Hg |

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### Statement

The information opposite each item in the specification portion of this report has been validated by the Testing Station. An item marked [C] indicates to the test report user that the information declared by the manufacturer has been checked whereas an item marked [D] indicates that the manufacturer's declaration has been endorsed.

| | | | |
|---|---|---|---|
| [C] | Tractor manufacturer's name and address | : | M/s International Tractors Limited,<br>Village Chak Gujran,<br>P.O. Piplanwala ,<br>Jalandhar Road,<br>HOSHIARPUR (Pb.) – 146 022 |
| [D] | Location of tractor assembly | : | Village Chak Gujran,<br>P.O. Piplanwala ,<br>Jalandhar Road,<br>HOSHIARPUR (Pb.) – 146 022 |
| [D] | Submitted for test by | : | The manufacturer |
| [C] | Selected for test by | : | Testing Authority in the agreement with the manufacturer |
| [D] | Place of running-in | : | Central Farm Machinery Training & Testing Institute,<br>Tractor Nagar,<br>Budni (M.P.) – 466 445 |
| [D] | Duration of running-in | : | 35 hours |
| [C] | Location of test | : | Government of India,<br>Central Farm Machinery Training and Testing Institute,<br>P.O.- Tractor Nagar,<br>BUDNI – 466 445 (M.P.), INDIA |

## 1. SPECIFICATIONS OF TRACTOR

**1.1 Identification:**

**1.1.1**

| | | | |
|---|---|---|---|
| [C] | Make of tractor | : | Sonalika International |
| [C] | Model (trade name) | : | DI – 60 |
| [C] | Type | : | 4WD, Agricultural tractor |

**1.1.2 Numbers:**

| | | | |
|---|---|---|---|
| [D] | 1st Serial No. or prototype | : | 57427 |
| [C] | Serial No. | : | 0503ZB63220/3 |

| | | | |
|---|---|---|---|
| **1.1.3** | **Other specification (if applicable):** | | |
| [D] | Model(s) for other countries | : | **None** |
| [C] | Transmission type or gear ranges | : | 8 speed, mechanical, constant mesh |
| [C] | Speed version | : | 30 km/h |
| [D] | Manufacturer identification or Technical type no. | : | ZB |
| **1.2** | **Engine:** | | |
| [C] | Make | : | Sonalika |
| [C] | Model | : | 4100FL |
| [C] | Type | : | Four stroke, water cooled, direct injection diesel engine |
| [C] | Serial No. | : | 56558 |
| **1.2.1** | **Cylinders:** | | |
| [C] | Number and disposition | : | Four, vertical, in-line |
| [D] | Bore/Stroke | : | 100 mm / 118 mm |
| [D] | Capacity | : | 3707 $cm^3$ |
| [D] | Compression ratio | : | 18.4 : 1 |
| [D] | Arrangement of valves | : | Overhead |
| [D] | Cylinder liners | : | Wet |
| **1.2.2** | **Supercharging:** | : | **Not provided** |
| **1.2.3** | **Fuel system:** | | |
| [C] | Fuel feed system | : | Lift pump, piston-type, integral with fuel injection pump |
| | **Filter(s):** | | |
| [C] | Make | : | MICO |
| [C] | Model | : | 9 451 037 405 |
| [C] | Type | : | Primary cloth and secondary paper element |
| [C] | Number | : | Two |
| [D] | Capacity of fuel tank | : | 55 $dm^3$ |
| | **Injection pumps:** | | |
| [C] | Make | : | BOSCH |
| [C] | Model | : | F002 A0Z 499 / PES 4A 90D 320 RS 3599 |
| [C] | Type | : | Plunger, in-line |
| [C] | Serial Number | : | 58256723 |

| | | | |
|---|---|---|---|
| | **Manufacturer's production setting of injection pump:** | | |
| [D] | Flow rate (rated engine speed & full load) | : | 12.00 to 13.00 $dm^3/h$ |
| [D] | Timing | : | 14 degree before TDC |
| | **Injectors:** | | |
| [D] | Make | : | MICO |
| [D] | Model | : | F002 C7Z 252 |
| [D] | Type | : | Multihole |
| [D] | Injection pressure | : | 25.5 to 26.3 MPa |

**1.2.4 Governor:**

| | | | |
|---|---|---|---|
| [D] | Make | : | MICO |
| [D] | Model | : | RSV 325 ... 1100 A5C 1442R |
| [D] | Type | : | Mechanical, variable speed |
| [D] | Governed range of engine speed | : | 650 ± 50 to 2400 ± 50 rev/min |
| [C] | Rated engine speed | : | 2200 rev/min. |

**1.2.5 Air cleaner:**

| | | | |
|---|---|---|---|
| | **Pre-cleaner:** | | |
| [C] | Make | : | Donaldson |
| [C] | Model | : | Not specified |
| [C] | Type | : | Cyclone type, integrated with main air cleaner |
| [C] | Location of air intake | : | Forward of radiator, under the bonnet |
| | **Main cleaner:** | | |
| [C] | Make | : | Donaldson |
| [C] | Model | : | LDC S/2 |
| [C] | Type | : | Dry, paper element |
| [C] | Maintenance indicator | : | Warning light on dash board |

| | | | |
|---|---|---|---|
| **1.2.6** | **Lubricating System:** | | |
| [D] | Type of feed pump | : | Gear pump |
| [C] | Type of filter(s) | : | Full flow, replaceable paper element |
| [C] | Number of filter(s) | : | One |
| **1.2.7** | **Cooling System:** | | |
| [C] | Type of coolant | : | Water |
| [D] | Type of pump | : | Centrifugal pump |
| | **Specification of fan:** | | |
| [C] | Number of fan blades | : | 6 |
| [C] | Fan diameter | : | 380 mm |
| [D] | Total coolant capacity | : | 10.5 $dm^3$ |
| [C] | Type of temperature control | : | Thermostat |
| [D] | Superpressure system | : | 49 kPa |
| **1.2.8** | **Starting system:** | | |
| [C] | Make | : | LUCAS – TVS |
| [C] | Model | : | 3SM114 |
| [C] | Type | : | Electrical, solenoid operated |
| [D] | Starter motor power rating | : | 1.9 kW |
| [C] | Cold starting aid | : | None |
| [C] | Safety device | : | None |
| **1.2.9** | **Electrical System:** | | |
| [C] | Voltage | : | 12V |
| | **Generator:** | | |
| [C] | Make | : | MICO |
| [C] | Model | : | F 002 GIA075 |
| [C] | Type | : | Alternator |
| [D] | Power | : | 0.40 kW @ 6000 rev/min |

**Battery:**

[C] Number : One

[D] Rating : 88 Ah at 20 hours discharge rate

**1.2.10 Exhaust System:**

[D] Make : Sonalika

[C] Model : None

[C] Type : Updraft, elliptical

[C] Location : On RHS of engine

**1.3 Transmission:**

**1.3.1 Clutch (Travel and power take-off):**

[D] Make : LUK India

[D] Model : LUK DC 280

[D] Type : Dual, Dry (for travel and PTO)

[D] Number of plate(s) : Two

[D] Diameter of plate(s) : 280 mm (for both travelling and PTO)

[C] Method of operation:
- Travel : By pressing the clutch pedal, on LHS, half way
- PTO : By pressing the same pedal fully

**1.3.2 Gear Box:**

[D] Make : Sonalika

[D] Model : Solis III CM10/30

[D] Type : Constant mesh

| | Description: | Forward | Reverse |
|---|---|---|---|
| [C] | Number of gears | 4 | 1 |
| [C] | Number of ranges | 2 ('L' & 'H') | 2 ('L' & 'H') |
| [C] | Total of arrangements | 8 | 2 |

'L' = Low, 'H' = High

[D] Available options : None

**1.3.3 Rear axle and final drives:**

[D] Make : Sonalika

[D] Model : CWP/2SG

[D] Type : Crown wheel and pinion with spur gear reduction.

**Differential lock:**

| | | | |
|---|---|---|---|
| [D] | Make | : | Sonalika |
| [D] | Type | : | Dog clutch |
| [C] | Method of engagement | : | By depressing a pedal on RHS |
| [C] | Method of disengagement | : | By releasing the above pedal |

**1.3.4 Front axle and final drives:**

| | | | |
|---|---|---|---|
| [D] | Make | : | Carraro |
| [D] | Mode | : | 20.11 |
| [D] | Type | : | Crown wheel and outboard epicylic gear reduction. |
| | - Differential lock | : | **None** |

**1.3.5 Total ratios and traveling speeds:**

| | Movement | GEAR | RANGE | Number of engine revolutions for one revolution of the driving wheels | Nominal traveling speed (*) at rated engine speed of **2200** rev/min, (km/h) |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| [C] | Forward | 1 | L | 197.2 | 2.82 |
| [C] | | 2 | L | 138.8 | 4.00 |
| [C] | | 3 | L | 87.8 | 6.33 |
| [C] | | 4 | L | 64.6 | 8.61 |
| [C] | | 1 | H | 49.1 | 11.31 |
| [C] | | 2 | H | 34.6 | 16.07 |
| [C] | | 3 | H | 21.8 | 25.44 |
| [C] | | 4 | H | 16.1 | 34.53 |
| [C] | Reverse | -- | L | 148.5 | 3.74 |
| [C] | | -- | H | 37.0 | 15.00 |

* Calculated with a tyre dynamic radius index of 670 mm (ISO: 4251-1-1998)

'L' = Low, 'H '= High

| | | | |
|---|---|---|---|
| [C] | Number of revolution of front wheels for one revolution of rear wheels | : | 1.418 |

| | | | |
|---|---|---|---|
| **1.4** | **Power take-off:** | | |
| **1.4.1** | **Main Power Take-Off:** | | |
| [C] | Type | : | Semi Independent |
| [C] | Method of engagement | : | Mechanical, by a hand lever |
| [C] | Number of shafts | : | One |
| [C] | Method of changing power take-off shaft ends and speeds. | : | **None** |
| **1.4.1.1** | **Power take-off proportional to engine speed:** | | |
| | **Power take-off at 540 (rev/min):** | | |
| [C] | - Location | : | At rear of tractor |
| [C] | - Diameter of power take-off shaft end | : | 34.84 mm |
| [C] | - Number of splines | : | 6 |
| [C] | - Height above ground | : | 665 mm |
| [C] | - Distance from the median plane of the tractor | : | 0 mm |
| [C] | - Distance behind rear wheel axis | : | 360 mm |
| [C] | - PTO speed at rated engine speed | : | 707 rev/min |
| [C] | - Engine speed at standard power take-off speed | : | 1680 rev/min |
| [C] | - Ratio of rotation speeds (Engine speed/ PTO speed | : | 3.111 : 1 |
| [D] | - Power restriction | : | **None** |
| [D] | Maximum torque transmissible | : | 1250 Nm |
| [C] | Direction of rotation (viewed from rear of tractor) | : | Clockwise |

| | | | |
|---|---|---|---|
| **1.4.1.2** | **Power take-off proportional to ground speed** | : | **Not applicable** |
| **1.4.2** | **Optional power take-off** | : | **None** |
| **1.5** | **Hydraulic power-lift:** | | |
| [D] | Make | : | Sonalika |
| [C] | Model | : | Sonalika New Hydraulics |
| [C] | Type of hydraulic system | : | Open centre |
| [C] | Type and number of cylinders | : | Single acting, one |
| [C] | Type of linkage lock for transport | : | Hydraulic |
| [D] | Relief valve pressure setting (tolerance) | : | 20 ± 1 MPa |
| [D] | Opening pressure of cylinder safety valve | : | 21 ± 1 MPa |
| [D] | Lift pump type | : | Gear type |
| [D] | Transmission between pump and engine | : | Gear drive |
| [D] | Number and Type of filter(s) | : | One, strainer type |
| [C] | Site of oil reservoir | : | Transmission housing |
| | **Type, number and location of tapping points:** | | |
| [C] | - Type | : | Quick coupling |
| [C] | - Number | : | Two |
| [C] | - Location | : | Behind the operator's seat |
| [D] | - Maximum volume of oil available to external cylinders | : | 58.0 $dm^3$ |

**1.6 Three point linkage:**

[C] Category : 2 (In conformity of ISO 730-1 : 1994 + Corr. 1:1995 and ISO 730-2 : 1979)

[C] Category adapter : None

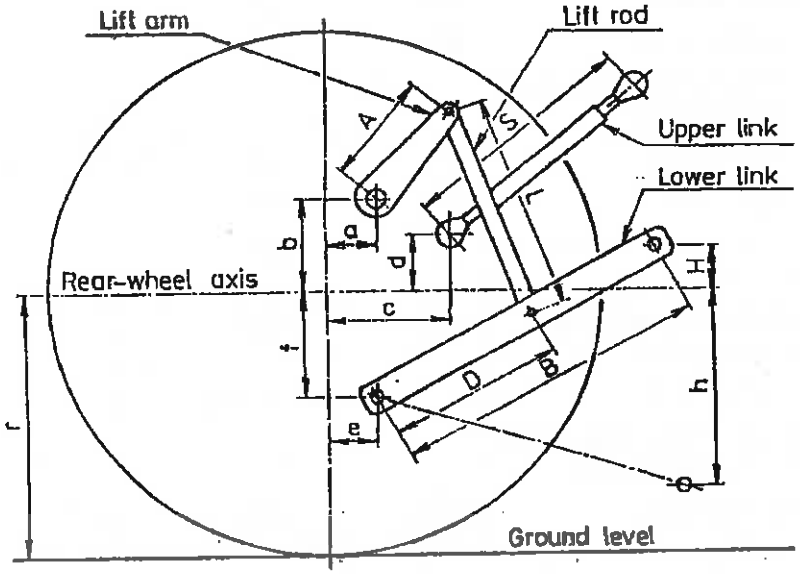



Fig. 1 .1

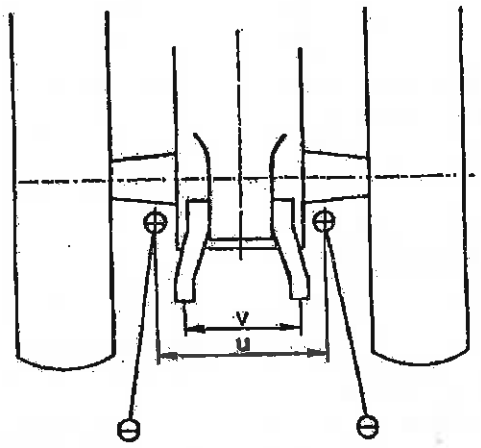



Fig. 1.2

**Table: Linkage Geometry dimensions (Ref. fig. 1.1 & 1.2):**

| | | | Dimension or range, (mm) | Settings used during test, (mm) |
|---|---|---|---|---|
| [C] | Length of lift arms: | (A) | 240 | 240 |
| [C] | Length of lower links: | (B) | 765 | 765 |
| | Distance of lift arm pivot point from rear-wheel axis: | | | |
| [C] | - Horizontally | (a) | 20 | 20 |
| [C] | - Vertically | (b) | 350 | 350 |
| [C] | Horizontal distance between the 2 lower link points: | (u) | 530 | 530 |
| [C] | Horizontal distance between the 2 lift arm end points: | (v) | 610 | 610 |
| [C] | Length of upper link: | (S) | 430 to 575 | 490 |
| | Distance of upper link pivot point from rear wheel axis: | | | |
| [C] | - Horizontally | (c) | 375 | 375 |
| [C] | - Vertically | (d) | 265 & 305 | 305 |
| | Distance of lower link pivot point from rear wheel axis: | | | |
| [C] | - Horizontally | (e) | 110 | 110 |
| [C] | - Vertically | (f) | 155 | 155 |
| [C] | Distance of lower link pivot points to lift rod pivot points on lower links: | (D) | 280 & 350 | 280 |
| [C] | Length of lift rods: | (L) | From 610 to 770 | 620 |
| | Height of lower hitch points relative to the rear-wheel axis: | | | |
| [C] | - in low position | (h) | - 670 to - 425 | - 470 |
| [C] | - in high position | (H) | From 165 to 245 | 220 |
| [C] | Height above ground of lower hitch points when locked in transport position (*) | -- | Any height within lift range | |
| (*) Assuming r=670mm, tyre dynamic radius index of ISO: 4251-1:1998 | | | | |

**1.7 Swinging drawbar : Not provided**

| | | | |
|---|---|---|---|
| **1.8** | **Trailer hitch** | | |
| [C] | - Type | : | Clevis |
| [C] | - Hole diameter | : | 34 mm |
| [C] | - Height above ground | : | 735 mm & 855 mm |
| [C] | - Distance of hitch point from rear wheel axis, horizontally | : | 493 mm |
| | Distance of hitch point from power take-off shaft end: | | |
| [C] | - Vertically | : | 70 mm & 190 mm |
| [C] | - Horizontally | : | 133 mm |
| [D] | - Maximum vertical permissible load | : | 9 kN |
| **1.9** | **Holes drawbar:** | | |
| [C] | Number of holes | : | 7 |
| [C] | Distance between holes | : | 80 mm |
| [C] | Hole diameter | : | 25 mm |
| [C] | Thickness / Width of drawbar | : | 30 mm/ 75 mm |
| [C] | Height above ground:<br>- Minimum<br>- Maximum | :<br>: | <br>0 mm<br>915 mm |
| [C] | Horizontal distance to power take-off shaft end (rear) | : | 515 mm |
| **1.10** | **Steering:** | | |
| [D] | Make | : | Danfoss |
| [D] | Model | : | OSPC 100 LS |
| [D] | Type | : | Hydraulic, open centre |
| [D] | Method of operation | : | Hydraulic power assisted |
| [D] | Pump(s) | : | Gear type |
| [D] | Ram(s) | : | Double acting cylinder |
| [D] | Working pressure | : | 14 ± 1 MPa |

| | | | |
|---|---|---|---|
| **1.11** | **Brakes:** | | |
| **1.11.1** | **Service brake:** | | |
| [D] | Make | : | Brake India Ltd., |
| [D] | Model | : | DB 7.5/4 |
| [D] | Type | : | Dry, disc |
| [C] | Method of operation | : | Mechanical, independent or coupled pedal operation |
| [C] | Trailer braking take-off | : | None |
| **1.11.2** | **Parking brake:** | | |
| [C] | Type | : | Pawl and rachet |
| [C] | Method of operation | : | Manual, by pawl & ratchet arrangement on pedal |
| **1.12** | **Wheels:** | | |
| | Number | | |
| [C] | Front | : | Two (steering as well as driving wheels) |
| [C] | Rear | : | Two (driving) |
| [C] | Wheel base | : | 2310 mm |

**Track width adjustment:**

| | | Minimum [mm] | Maximum [mm] | Adjustment method |
|---|---|---|---|---|
| [D] | Front | 1560 | 1861 | Reversing wheels and offset lug rims |
| [D] | Rear | 1422 | 1920 | Reversing wheels and offset lug rims |

**1.13 Protective structure : Not provided**

**1.14 Seat:**

**1.14.1 Driver's seat:**

| | | | |
|---|---|---|---|
| [C] | Make | : | M/s Kalka Steels Ltd., India |
| [C] | Model | : | Kalka Cu-150 |
| [C] | Type | : | Cushioned |
| [C] | Seat and steering wheel reversible | : | No |
| [C] | Type of suspension | : | Coil springs |
| [C] | Type of damping | : | Hydraulic shock absorber |

**Range of adjustment:**

| | | | |
|---|---|---|---|
| [C] | Longitudinally | : | ± 50 mm |
| [C] | Vertically | : | Nil |
| [C] | Safety belt | : | Not provided |

**1.14.2** Optional driver's seat(s) : **Not provided**

**1.14.3** Passenger seat : Cushioned seat provided

**1.15 Lighting:**

| | | Height of centre above ground | Size | Distance from outside edge of lights to median plane of tractor |
|---|---|---|---|---|
| | | [mm] | [mm] | [mm] |
| [C] | Head lights | 1097 | 140 x 90 | 200 |
| [C] | Side lights | 1385 | 70 x 68 | 779 |
| [C] | Rear lights | 1375 | 100 x 68 | 700 |
| [C] | Reflectors | 1375 | 60 x 30 | 632 |

## 2. TEST CONDITIONS

**2.1 Overall dimensions (unballasted tractor)**

| Length [mm] | Width | | Height at top of | |
|---|---|---|---|---|
| | Minimum [mm] | Maximum [mm] | Steering wheel [mm] | Exhaust pipe [mm] |
| 3780 | 1850 | 2350 | 1800 | 2365 |

**2.2** Ground clearance (unballasted tractor) : 360 mm

Clearance – limiting part : Front differential housing

**2.3 Tractor Mass:**

| | | Unballasted | |
|---|---|---|---|
| | | Without driver | With driver |
| | | [kg] | [kg] |
| | Front | 1205 | 1215 |
| | Rear | 1630 | 1695 |
| | Total | 2835 | 2910 |

**2.4 Tyres and track width specifications:**

| | Tyres | | Front | Rear |
|---|---|---|---|---|
| | - Dimensions | | 9.50 – 24 | 16.9 – 28 |
| | - Ply rating | | 8 | 12 |
| | - Type | | Pneumatic, Diagonal | Pneumatic, Diagonal |
| | - Maximum load (tyre manufacturer's) | kN | 9.0 | 26.7 |
| | - Maximum load (tractor manufacturer's) | kN | 8.8 | 26.7 |
| | - Inflation pressure (tyre manufacturer's) | kPa | 205 | 240 |
| | - Dynamic radius index | mm | 495 | 670 |
| | - Chosen track width | mm | 1560 | 1422 |

**2.5 Fuel:**

Type : High speed diesel conforming to IS:1460-2000

Density at 15 °C : 0.840 g/cm$^3$

**2.6 Oils and lubrication:**

**2.6.1** Capacity and change interval:

| | Capacity, [ dm$^3$ ] | Oil change, [ h ] | Filter change, [ h ] |
|---|---|---|---|
| Engine oil sump | 12.5 | First change after 50 hrs of operation and subsequently after 250 hrs of operation. | First change after 50 hrs of operation and subsequently after 250 hrs of operation. |
| Gear box, steering and rear axle | 58.0 | 1000 | -- |
| Hydraulic | In common with gear box | | 300 |
| Front axle | 5.5 | 900 | -- |

**2.6.2 Specifications:**

| | Recommended | Used during test |
|---|---|---|
| **Engine:** | | |
| Type | SAE 20W-40 | As recommended |
| Viscosity | 14.0 to 16.0 cSt at 100$^0$C | |
| Classification | API – CD | |

| **Transmission, Hydraulic fluid, Steering, Rear axle and front axle oil:** | | |
|---|---|---|
| Type | SAE EP-80 | As recommended |
| Viscosity | 9 to 11 cSt | |
| Classification | GL 4 | |

**2.6.3 Grease:**

Number of lubricating points:

Grease nipples : 16 Nos.

Grease cups : 01 No.

## 3. COMPULSORY TESTS RESULTS

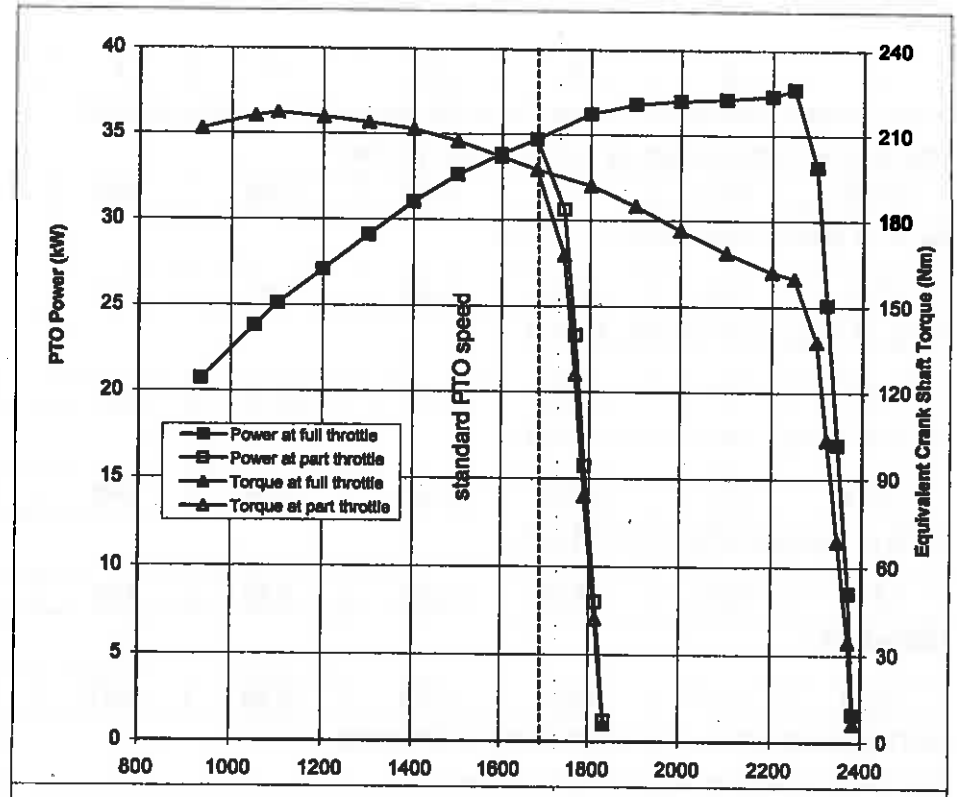
**3.1 Main power take-off:**

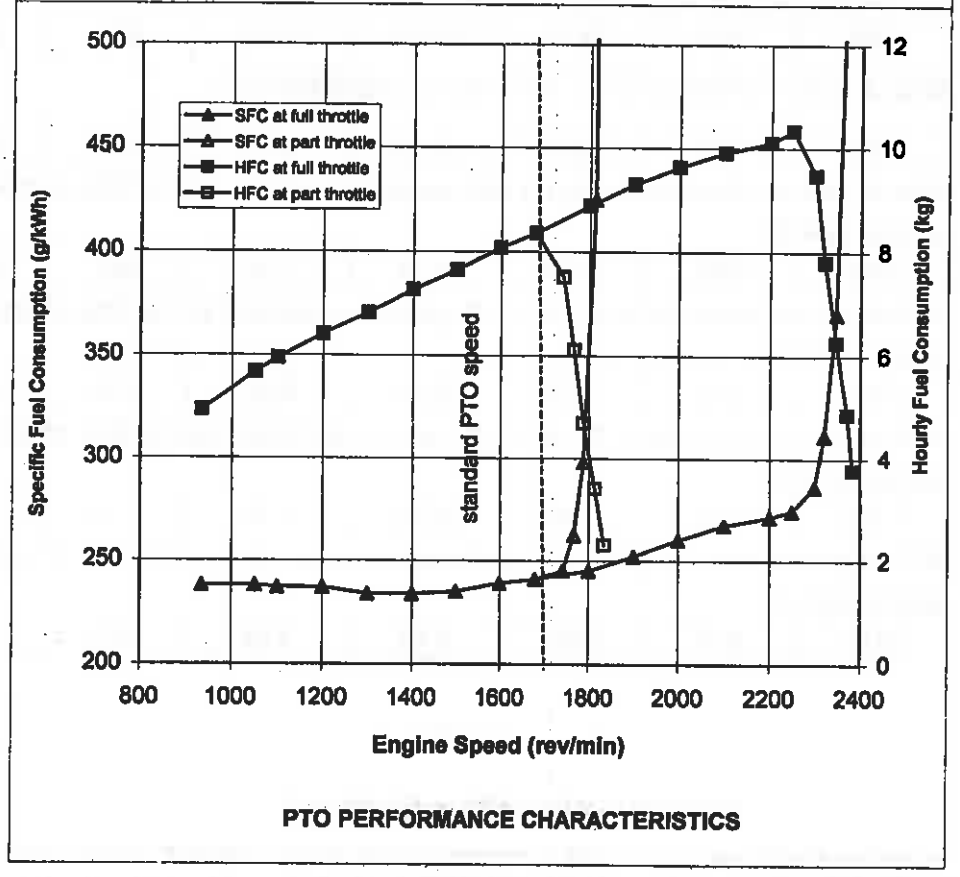
Date and location of tests : 19.04.2006, CFMT&TI, BUDNI (M.P.), India

Type of dynamometer bench : FUCHINO, Eddy current

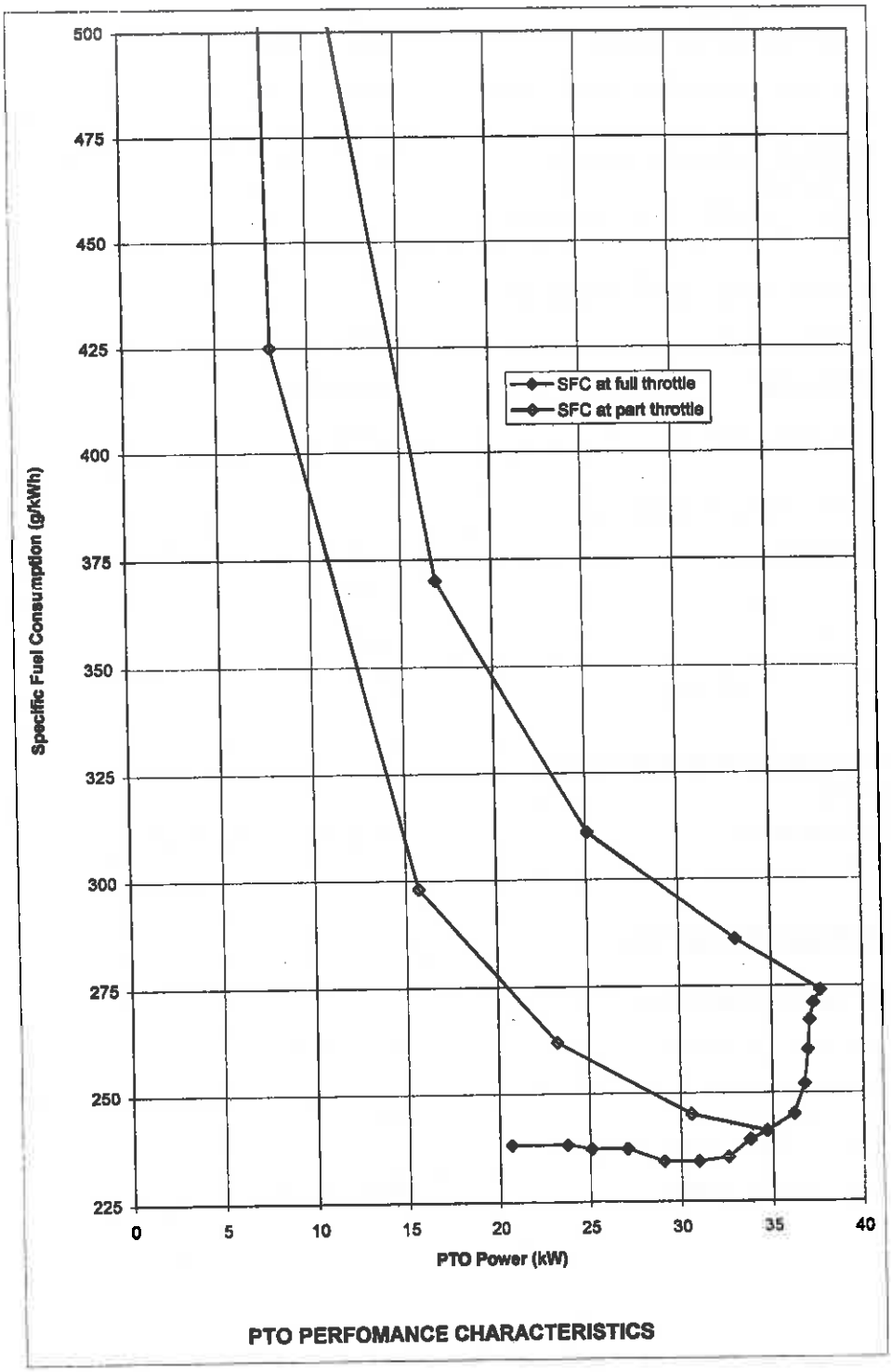
| Power, [ kW ] | Speed | | | Fuel consumption | | | Specific Energy, [ kWh/l ] |
|---|---|---|---|---|---|---|---|
| | Engine | PTO | Fan | Hourly | | Specific | |
| | [ rev/min ] | | | [ l / h ] | [ kg / h ] | [ g/kWh ] | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| **3.1.1** | **Maximum Power – One-Hour Test:** | | | | | | |
| 37.7 | 2249 | 723 | 3550 | 12.30 | 10.33 | 274 | 3.07 |
| **3.1.2** | **Power at Rated Engine Speed (2200 rev/min) :** | | | | | | |
| 37.3 | 2200 | 707 | 3471 | 12.04 | 10.11 | 271 | 3.10 |
| **3.1.3** | **Standard Power Take-Off Speed [540 ± 10 (rev/min)] :** | | | | | | |
| 34.7 | 1680 | 540 | 2651 | 9.95 | 8.36 | 241 | 3.49 |
| **3.1.4** | **Part Loads:** | | | | | | |
| **3.1.4.1** | **The torque corresponding to maximum power at rated engine speed :** | | | | | | |
| 37.3 | 2200 | 707 | 3471 | 12.04 | 10.11 | 271 | 3.10 |
| **3.1.4.2** | **85 % of torque obtained in 3.1.4.1 :** | | | | | | |
| 33.1 | 2299 | 739 | 3628 | 11.27 | 9.47 | 286 | 2.94 |
| **3.1.4.3** | **75 % of torque defined in 3.1.4.2 :** | | | | | | |
| 25.1 | 2321 | 746 | 3662 | 9.29 | 7.80 | 311 | 2.70 |
| **3.1.4.4** | **50 % of torque defined in 3.1.4.2 :** | | | | | | |
| 16.9 | 2346 | 754 | 3702 | 7.45 | 6.26 | 370 | 2.27 |
| **3.1.4.5** | **25 % of torque defined in 3.1.4.2 :** | | | | | | |
| 8.5 | 2371 | 762 | 3741 | 5.79 | 4.86 | 572 | 1.47 |
| **3.1.4.6** | **Unloaded :** | | | | | | |
| 1.6 | 2383 | 766 | 3761 | 4.49 | 3.77 | 2356 | 0.36 |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| **3.1.5** | **Part Loads at Standard Power Take-Off Speed [540± 10 (rev/min)] :** | | | | | | |
| **3.1.5.1** | **The torque corresponding to maximum power :** | | | | | | |
| 34.7 | 1680 | 540 | 2651 | 9.95 | 8.36 | 241 | 3.49 |
| **3.1.5.2** | **85 % of torque obtained in 3.1.5.1 :** | | | | | | |
| 30.6 | 1742 | 560 | 2750 | 8.94 | 7.51 | 245 | 3.42 |
| **3.1.5.3** | **75 % of torque defined in 3.1.5.2 :** | | | | | | |
| 23.3 | 1767 | 568 | 2789 | 7.26 | 6.10 | 262 | 3.21 |
| **3.1.5.4** | **50 % of torque defined in 3.1.5.2 :** | | | | | | |
| 15.7 | 1789 | 575 | 2823 | 5.57 | 4.68 | 298 | 2.82 |
| **3.1.5.5** | **25 % of torque defined in 3.1.5.2 :** | | | | | | |
| 8.0 | 1814 | 583 | 2863 | 4.05 | 3.40 | 425 | 1.98 |
| **3.1.5.6** | **Unloaded :** | | | | | | |
| 1.2 | 1835 | 590 | 2897 | 2.74 | 2.30 | 1917 | 0.44 |
| **3.1.6** | **PART LOADS AT DIFFERENT ENGINE SPEEDS** | | | | | | |
| **3.1.6.1** | **maximum power at rated engine speed:** | | | | | | |
| 37.3 | 2200 | 707 | 3471 | 12.04 | 10.11 | 271 | 3.10 |
| **3.1.6.2** | **80% of power obtained in 3.1.6.1 at max. speed setting :** | | | | | | |
| 29.8 | 2308 | 742 | 3643 | 10.42 | 8.75 | 294 | 2.86 |
| **3.1.6.3** | **80% of power obtained in 3.6.1.1 with governor control set to 90% of rated engine speed :** | | | | | | |
| 29.8 | 1979 | 636 | 3123 | 9.29 | 7.80 | 262 | 3.21 |
| **3.1.6.4** | **40% of power obtained in 3.1.6.1 with governor control set to 90% of rated engine speed :** | | | | | | |
| 14.9 | 1979 | 636 | 3123 | 5.99 | 5.03 | 338 | 2.49 |
| **3.1.6.5** | **60% of power obtained in 3.1.6.1 with governor control set to 60% of rated engine speed :** | | | | | | |
| 22.4 | 1319 | 424 | 2082 | 6.36 | 5.34 | 238 | 3.52 |
| **3.1.6.6** | **40% of power obtained in 3.1.6.1 with governor control set to 60% of rated engine speed :** | | | | | | |
| 14.9 | 1319 | 424 | 2082 | 4.57 | 3.84 | 258 | 3.26 |




PTO PERFORMANCE CHARACTERISTICS




PTO PERFOMANCE CHARACTERISTICS

| | | |
|---|---|---|
| No load maximum engine speed | : | 2383 rev/min |
| Torque (equivalent crankshaft) at maximum power: | | |
| - At rated engine speed | : | 162.01 Nm |
| - At one – hour (max. power) test | : | 159.87 Nm |
| Maximum torque (equivalent crankshaft) (Engine speed: 1101 (rev/min) | : | 217.29 Nm |

**Mean atmospheric conditions:**

| | | |
|---|---|---|
| - Temperature | : | 23°C |
| - Pressure | : | 98.1 kPa |
| - Relative humidity | : | 28 % |

**Maximum temperatures:**

| | | |
|---|---|---|
| - Coolant | : | 96°C |
| - Engine oil | : | 92°C |
| - Fuel | : | 39°C |
| - Engine air intake | : | 30°C |

**3.2 Hydraulic power and lifting force:**

Date of tests : 11.07.2006 & 12.07.2006

**3.2.1 Hydraulic Power Test:**

**3.2.1.1 Hydraulic Fluid Data:**

| | | |
|---|---|---|
| - Hydraulic fluid type | : | SAE EP-80 |
| - Viscosity index (ISO 3448 + Corr1: 1993) | : | 100 |
| - Viscosity at 65 °C | : | 60 to 65 cSt |

### 3.2.1.2 Compulsory Reporting (Test Results):

| | | Press-ure, [MPa] | Reservoir oil Temp. °C | | Engine speed, [rev/min ] | Flow rate, [ l/min ] | Power, [ kW ] |
|---|---|---|---|---|---|---|---|
| | | | Min | Max. | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1. | Rated Engine speed (Manufacturer's specification) | -- | -- | -- | 2200 | -- | -- |
| 2. | Maximum (sustained) pressure with relief valve open as measured at the coupler. Pump stalled- No | 20.0 | 60 | 65 | 2377 | 0.0 | 0.0 |
| 3. | Flow rate corres-ponding to a hydraulic pressure equivalent to 90% of the actual relief valve pressure setting and corresponding hydraulic power. | 18.0 | 64 | | 2380 | 10.00 | 3.0 |
| 4. | Maximum available flow and maximum power from one coupler pair | 16.0 | 63 | | 2383 | 16.39 | 4.4 |
| 5. | Maximum available flow and maximum power from coupler pairs operating simultaneously (flow through two or in over coupler pair if required) | Not applicable | Not applicable | | Not applicable | Not applicable | Not applicable |

### 3.2.2 Power Lift Test:

-Linkage settings for test - See **Table at Page 10, and Fig. 1.1 & 1.2**

| | At hitch point | On the frame |
|---|---|---|
| Height of lower hitch points above ground in down position | 200 mm | 200 mm |
| Vertical movement:<br>- Without lifting force<br>- With lifting force | <br>690 mm<br>675 mm | <br>690<br>680 |
| Maximum corrected force exerted through full range | 12.8 kN | 9.1 kN |
| Corresponding pressure of hydraulic fluid | 18.0 MPa | 18.0 MPa |
| Moment about rear wheel axle | 11.2 kNm | 13.5 kNm |
| Maximum tilt angle of mast from vertical | -- | 12 degree |

| Lifting height relative to the horizontal plane including the lower link pivot points: | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | -310 | -300 | -200 | -100 | 0 | +100 | +200 | +300 | +330 | +360 | +365 | +370 |
| Lifting forces (the values of the force measured have been corrected to correspond to a hydraulic pressure equivalent to 90% of actual relief valve pressure setting of the hydraulic lift system.) | | | | | | | | | | | | |
| At the hitch point in (kN) | 12.8 | 13.6 | 13.3 | 14.3 | 15.1 | 15.7 | 16.5 | 17.8 | 17.6 | 17.9 | 18.2 | -- |
| Corresponding pressure 18.0 MPa: | | | | | | | | | | | | |
| At the frame in (kN) | 14.7 | 14.3 | 13.2 | 12.7 | 12.4 | 11.8 | 10.8 | 10.0 | 9.6 | 9.3 | 9.2 | 9.1 |
| Corresponding pressure 18.0 MPa | | | | | | | | | | | | |

### 3.3 Drawbar power test (unballasted tractor):

Date(s) of tests : 29.06.2006 and 03.07.2006

Type of track : Concrete

Rolling radius of rear tyres : 681.2 mm

| Height of drawbar above ground, (mm) | Tyre inflation pressure | |
|---|---|---|
| | Front | Rear |
| | kPa | kPa |
| 550 | 205 | 110 |

## DRAWBAR TEST RESULTS

| Gear Number, Group & Range | Draw-bar power, [ kW ] | Draw-bar pull , [ kN ] | Speed, [Km/h] | Engine speed, [ rev/ min ] | FAN speed [ rev/ min ] | Slip of wheels [ % ] | Specific fuel cons-ump-tion, [g/kWh] | Specific Energy, [kWh/l] | Temperature, °C ] | | | Atmospheric conditions | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Fuel | Cool-ant | Eng-ine oil | Temp [ °C ] | R.H. [ % ] | Pres-sure [kPa] |
| **3.3.1** | **Maximum Power In tested Gears (Unballasted tractor):** | | | | | | | | | | | | | |
| L1 | 17.5 | 24.5 | 2.57 | 2321 | 3669 | 14.9 | 438 | 1.92 | 38 | 80 | 94 | 31 | 49 | 97.9 |
| L2 | 24.0 | 24.0 | 3.60 | 2296 | 3630 | 15.1 | 397 | 2.11 | 37 | 83 | 95 | 31 | 49 | 97.9 |
| L3 | 28.2 | 16.8 | 6.04 | 2198 | 3475 | 6.1 | 353 | 2.38 | 37 | 84 | 94 | 31 | 50 | 97.9 |
| L4 | 28.4 | 12.2 | 8.39 | 2194 | 3469 | 3.9 | 350 | 2.40 | 36 | 83 | 91 | 30 | 50 | 98.0 |
| H1 | 27.7 | 8.9 | 11.20 | 2199 | 3477 | 2.5 | 368 | 2.28 | 35 | 83 | 79 | 30 | 51 | 98.0 |
| **3.3.2** | **Fuel Consumption:** | | | | | | | | | | | | | |
| **3.3.2.1** | In Selected gear / speed setting nearest 7.5 km/h, at maximum power at rated engine speed: | | | | | | | | | | | | | |
| L4 | 28.4 | 12.2 | 8.39 | 2194 | 3469 | 3.9 | 350 | 2.40 | 36 | 83 | 91 | 30 | 50 | 98.0 |
| **3.3.2.1.1** | 75% of pull corresponding to maximum power at rated engine speed: | | | | | | | | | | | | | |
| L4 | 22.7 | 9.1 | 8.98 | 2316 | 3661 | 2.7 | 404 | 2.08 | 36 | 82 | 75 | 31 | 50 | 97.8 |
| **3.3.2.1.2** | 50% of pull corresponding to maximum power at rated engine speed: | | | | | | | | | | | | | |
| L4 | 15.8 | 6.2 | 9.15 | 2335 | 3691 | 1.5 | 482 | 1.74 | 36 | 79 | 79 | 31 | 50 | 97.8 |
| **3.3.2.1.3** | Next higher gear at reduced engine speed: Same pull and traveling speed as in 3.3.2.1.1: | | | | | | | | | | | | | |
| H1 | 22.7 | 9.2 | 8.87 | 1746 | 2759 | 2.8 | 331 | 2.54 | 37 | 83 | 82 | 31 | 50 | 97.8 |
| **3.3.2.1.4** | Next higher gear at reduced engine speed: Same pull and traveling speed as in 3.3.2.1.2: | | | | | | | | | | | | | |
| H1 | 15.4 | 6.1 | 9.09 | 1763 | 2787 | 1.3 | 391 | 2.15 | 38 | 80 | 84 | 31 | 49 | 97.8 |
| **3.3.2.2** | In selected gear/speed nearest between 7 km/h and 10 km/h at rated engine speed: | | | | | | | | | | | | | |
| L4 | 28.4 | 12.2 | 8.39 | 2194 | 3469 | 3.9 | 350 | 2.40 | 36 | 83 | 91 | 30 | 50 | 98.0 |
| **3.3.2.2.1** | 75% of pull corresponding to maximum power at rated engine speed: | | | | | | | | | | | | | |
| L4 | 22.7 | 9.1 | 8.98 | 2316 | 3661 | 2.7 | 404 | 2.08 | 36 | 82 | 75 | 31 | 50 | 97.8 |
| **3.3.2.2.2** | 50% of pull corresponding to maximum power at rated engine speed: | | | | | | | | | | | | | |
| L4 | 15.8 | 6.2 | 9.15 | 2335 | 3691 | 1.5 | 482 | 1.74 | 36 | 79 | 79 | 31 | 50 | 97.8 |
| **3.3.2.2.3** | Next higher gear at reduced engine speed: Same pull and traveling speed as in 3.3.2.2.1: | | | | | | | | | | | | | |
| H1 | 22.7 | 9.2 | 8.87 | 1746 | 2759 | 2.8 | 331 | 2.54 | 37 | 83 | 82 | 31 | 50 | 97.8 |
| **3.3.2.2.4** | Next higher gear at reduced engine speed: Same pull and traveling speed as in 3.3.2.2.2: | | | | | | | | | | | | | |
| H1 | 15.4 | 6.1 | 9.09 | 1763 | 2787 | 1.3 | 391 | 2.15 | 38 | 80 | 84 | 31 | 49 | 97.8 |

## 4. OPTIONAL TESTS RESULTS

### 4.1 Turning area and turning circle:

Wheels Equipment:

- Front : 9.50 – 24, 8PR
- Rear : 16.9 – 28, 12PR

Track width:

- Front : 1560 mm
- Rear : 1520 mm

| | Without brakes | |
|---|---|---|
| | Right-hand | Left-hand |
| | [ m ] | [ m ] |
| Radius of turning area | 5.49 | 5.61 |
| Radius of turning circle | 5.35 | 5.47 |

### 4.2 Braking:

Date(s) of test : 09.10.2006 and 19.12.2006

Mass of ballasted tractor:

- Front : 1794 kg
- Rear : 2490 kg
- -Total : 4284 kg

#### 4.2.1 Cold Service braking device test:

| Unballasted tractor | | | |
|---|---|---|---|
| Speed before application of brake | Braking device control force | Mean deceleration | Minimum stopping distance with out locking the wheels |
| [ km/h ] | [ kN ] | [ $m/s^2$ ] | [ m ] |
| 36.9 | 0.09 | 2.95 | 17.80 |
| 36.9 | 0.14 | 3.35 | 15.70 |
| 36.9 | 0.17 | 3.49 | 15.05 |
| 36.9 | 0.22 | 3.67 | 14.30 |
| 36.9 | 0.26 | 4.27 | 12.30 |
| 36.9 | 0.28 | 4.49 | 11.70 |
| 36.9 | 0.34 | 5.90 | 8.90 |

Maximum deviation of the tractor from its original course : **None**

Abnormal vibration : **None**

| Ballasted tractor | | | |
|---|---|---|---|
| Speed before application of brake | Braking device control force | Mean deceleration | Minimum stopping distance with out locking the wheels |
| [ km/h ] | [ kN ] | [ $m/s^2$ ] | [ m ] |
| 35.8 | 0.08 | 1.81 | 27.3 |
| 35.8 | 0.09 | 2.72 | 18.2 |
| 35.8 | 0.15 | 3.11 | 15.9 |
| 35.8 | 0.18 | 3.19 | 15.5 |
| 35.8 | 0.25 | 3.53 | 14.0 |
| 35.8 | 0.27 | 3.80 | 13.0 |
| 35.8 | 0.29 | 4.22 | 11.7 |
| 35.8 | 0.34 | 5.49 | 9.0 |

Maximum deviation of the tractor from its original course : **None**

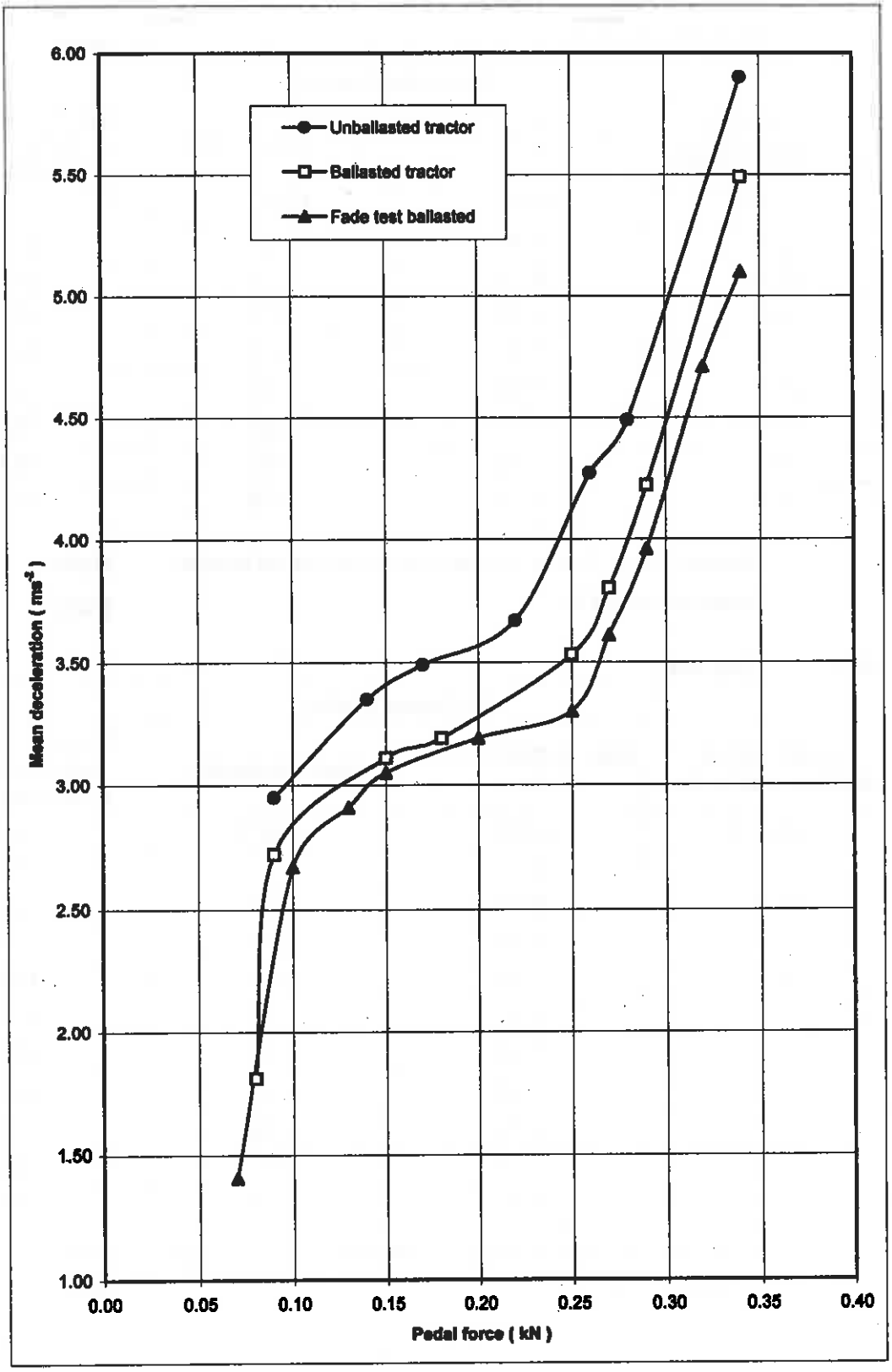
Abnormal vibration : **None**

**4.2.2 Fade test:**

| Ballasted tractor | | | |
|---|---|---|---|
| Speed before application of brake | Braking device control force | Mean deceleration | Minimum stopping distance with out locking the wheels |
| [ km/h ] | [ kN ] | [ $m/s^2$ ] | [ m ] |
| 35.8 | 0.07 | 1.41 | 35.0 |
| 35.8 | 0.10 | 2.67 | 18.5 |
| 35.8 | 0.13 | 2.91 | 17.0 |
| 35.8 | 0.15 | 3.05 | 16.2 |
| 35.8 | 0.20 | 3.19 | 15.5 |
| 35.8 | 0.25 | 3.30 | 15.0 |
| 35.8 | 0.27 | 3.61 | 13.7 |
| 35.8 | 0.29 | 3.96 | 12.5 |
| 35.8 | 0.32 | 4.71 | 10.5 |
| 35.8 | 0.34 | 5.10 | 9.7 |

Maximum deviation of the tractor from its original course : **None**

Abnormal vibration : **None**


Unballasted tractor
Ballasted tractor
Fade test ballasted
Mean deceleration ( ms-2 )
Pedal force ( kN )
6.00
5.50
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40

Brake heating method : By means of towing the tractor for 1 Km at 80% of maximum speed with a pedal force corresponding to a deceleration of $1ms^{-2}$ in cold brake test.

**4.2.3 Parking braking device test:**

| | Up hill | Down hill |
|---|---|---|
| Braking device control force | 0.12 kN | 0.12 kN |

## 5. REPAIR AND ADJUSTMENTS PRIOR TO TESTS

-- None --

## 6. REMARKS

-- None --

**TEST CARRIED OUT AT CFMT & TI., BUDNI (M.P.), INDIA**

**TESTING AUTHORITY**

**P. K. PANDEY**
SENIOR TEST ENGINEER

**M. L. MEHTA**
DIRECTOR

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