T.E.

व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT (Initial)

संख्या / No. : T-1122/1648/2017
माह / Month : December, 2017

SWARAJ 742 FE TRACTOR

सत्यमेव जयते

भारत सरकार
कृषि एवं किसान कल्याण मंत्रालय
(कृषि, सहकारिता एवं किसान कल्याण विभाग)
GOVERNMENT OF INDIA
MINISTRY OF AGRICULTURE AND FARMERS WELFARE
(DEPARTMENT OF AGRICULTURE, CO-OPERATION AND FARMERS WELFARE)
केन्द्रीय कृषि मशीनरी प्रशिक्षण एवं परीक्षण संस्थान
ट्रैक्टर नगर, बुदनी (म.प्र.) ४६६ ४४५
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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: December	Test Report No. T- 1122/1648/2017	Year: 2017

सत्यमेव जयते

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Type of Test	:	**COMMERCIAL (Initial)**
Test code/Procedure	:	IS: 5994-1998 (Reaffirmed in 2009) and IS: 12207-2014.
Period of Test	:	March, 2017 to October, 2017
Test Report No.	:	**T- 1122/1648/2017**
Month/Year	:	**December, 2017**

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

SELECTED CONVERSIONS		
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

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

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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**
Test requested by (applicant)	:	The manufacturer
Selected for test by	:	Applicant
Place of running-in	:	At manufacturer's works
Duration of said running-in (h):		
- Engine	:	28
- Transmission	:	32
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	:	742 FE
Variants if any	:	None
Brand name	:	Swaraj
Type	:	Four wheeled, rear wheel driven, general purpose agricultural tractor.
Year of manufacture	:	2016
Chassis number	:	WYCH92606100001
Country of Origin	:	India

1.2 Engine:

Make	:	M/s. Swaraj Engines Limited (apa)
Model	:	SK342NR
Type	:	Four stroke, naturally aspirated, liquid cooled, direct injection, diesel engine.
Serial number	:	42.1001/SWG13096
Engine speed (Manufacturer's recommended production setting, (rpm) :		
- Maximum speed at no load,(rpm)	:	2100 to 2200
- Low idle speed, (rpm)	:	580 to 700
- Speed at maximum torque, (rpm)	:	1000 to 1400
Rated speed, (rpm):		
- For PTO use	:	2000
- For drawbar use	:	2000

1.3 Cylinder & Cylinder Head:

Number	:	Three
Disposition	:	Vertical, inline
Bore/stroke, (mm)	:	110/110 (apa)
Capacity as specified by the applicant, (cc)	:	3136
Compression ratio, (apa)	:	17.8 ± 0.5 : 1
Type of cylinder head	:	Individual
Type of cylinder liners	:	Wet, replaceable
Type of combustion chamber	:	Ré-entrant, cavity on piston crown
Arrangement of valves	:	Over head, Inline

	Valve clearance (cold):		
	- Inlet valve, (mm)	:	0.25 to 0.30
	- Exhaust valve, (mm)	:	0.30 to 0.35
1.4	**Fuel System:**		
	Type of fuel system	:	Gravity and force feed
	Fuel tank:		
	Capacity, (l)	:	48.9
	Location	:	Above clutch housing
	Provision for draining of sediments /water	:	Provided
	Type of fuel tank	:	Metallic
1.4.1	**Water separator:**		
	Make	:	Alert
	Type	:	Inverted funnel gravity separation
	Location	:	In between fuel tank & filters on LHS of engine.
	Capacity (l)	:	0.50
1.4.2	**Fuel feed pump:**		
	Make	:	Bosch, India
	Type	:	plunger
	Model/Group combination No.	:	FP/KSG22AD105 (apa)
	Provision of sediment bowl	:	Provided (Metallic)
	Method of drive	:	Through cam shaft of fuel injection pump
1.4.3	**Fuel filters:**		
	Make	:	Bosch, India
	Model/Group combination No.	:	F002 H20 105
	Number	:	Two
	Type of elements:		
	- Primary	:	Cloth
	- Secondary	:	Paper
	Capacity of final stage filter, (l)	:	0.50
1.4.4	**Fuel Injection pump:**		
	Make	:	Bosch, India
	Model/Group combination No.	:	F002 A2Z A17
	Type	:	Inline, plunger
	Serial number	:	65445118
	Method of drive	:	Through timing gears
1.4.5	**Fuel injectors:**		
	Make	:	Bosch, India
	Nozzle Holder No.	:	F 002 C70 552
	Nozzle No.	:	DSL A 154 P 1542
	Type	:	Multi hole (Five holes)
	Manufacturer's production pressure setting, (MPa)	:	26.0 + 0.8
	Injection timing	:	10.5 ±1° before TDC
	Firing order	:	1-2-3
1.4.6	**Governor:**		
	Make	:	Bosch, India
	Model/Group combination No.	:	RSV 325...1000A1C1377R
	Type	:	Mechanical, centrifugal, variable speed.
	Rated engine speed, (rpm)	:	2000
	Governed range of engine speed, (rpm)	:	580 to 2200

1.5 Air Intake System:

1.5.1 Pre-cleaner:

Make	:	Swaraj
Type	:	Cyclonic with transparent dust collector
Location	:	On top of main air cleaner inlet tube.

1.5.2 Air cleaner:

Make	:	Swaraj
Type	:	Oil bath
Location	:	On LHS of engine outside the bonnet
Range of suction pressure at maximum power, (kPa)	:	2.8
Oil capacity,(l)	:	0.80
Oil change period	:	After every 8-16 hours of operation in dusty condition whereas after every 50 hours of operation in normal working condition.

1.6 Exhaust system:

Type of silencer	:	Updraft, cylindrical
Position of silencer outlet with Respect to SIP, (mm):		
- Vertical	:	880
- Longitudinal	:	1460
- Lateral	:	450 (on RHS)
Range of exhaust gas pressure at maximum power, (kPa)	:	7.1 to 8.3
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)	:	7.00
Total lub oil capacity, (l)	:	7.70
Oil change period	:	First change after 50 hours and subsequently after every 250 hours of operation.
Cooling device, (if any)	:	Provided

1.7.1 Details of oil cooler:

Make	:	Not available
Model	:	Not available
Type	:	Circular plate type heat exchanger
No. of plates & diameter,	:	3 & 93.0 mm
Location	:	On LHS of engine head

Filters:

Make	:	SEL
Type	:	Full flow, spin on, throw away paper element.
Number	:	One

Pump:

Type	:	Gear
Method of drive	:	Through timing gear
Pressure release setting, (kPa)	:	550 ± 50
Minimum permissible pressure, (kPa)	:	50

1.8 Cooling system:

Type	:	Forced circulation of liquid
Brand name of coolant	:	Coolant (RWT Green)
Coolant water ratio	:	7.50 : 92.50
Details of pump	:	Centrifugal, semi-open impeller of 78.9 mm diameter, having 06 number of vanes and driven through crankshaft pulley by a cogged "V"-belt common to alternator.
Details of fan	:	Suction type, six plastic blades of 375 mm diameter and and mounted on water pump shaft.
Means of temperature control	:	Thermostat
Bare radiator capacity, (l)	:	2.50
Capacity of expansion flask, (l)	:	0.90
Total coolant capacity, (l)	:	8.25
Radiator cap pressure, (kPa)	:	90

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 Express & MHD 1000
Type	:	Lead acid, 12V
Capacity and rating	:	88 Ah at 20 hours discharge rate
Location	:	On RHS of clutch housing in a separate metallic box.

1.10.2 Starter:

Make	:	Lucas TVS
Model	:	M 14
Type	:	Pre-engaging solenoid operated
Capacity and rating	:	12V, 2.2 kW
Serial Number	:	260 – 24285B

1.10.3 Generator:

Make	:	Lucas TVS
Model	:	A 115 - 36
Type	:	Alternator
Serial number	:	269212470
Output rating	:	12V, 36 Amp
Method of drive	:	Through crankshaft pulley by a cogged V-belt common to water pump.

1.10.4 Voltage regulator: : In built with alternator

1.10.5 Details of lights:

Description	No. & capacity of bulbs (W)	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, 35/35W	1210	100 x 130	720
- Parking lights	2, 12V, 5W	1280	65 x 65	165
- Turn-cum-hazard Indicator light	2, 12V, 21W	1280	65 x 70	100
- Reflectors (white)	2	1280	30 x 55	210
Rear lights:				
- Parking-cum-brake light	2, 12V, 21/5 W	1285	65 x 65	225
- Turn-cum-hazard Indicator light	2, 12V, 21W	1285	65 x 70	155
Reflectors (Red)	2	1285	30 x 55	255
Plough light (on RHS mudguard)	1, 12 V, 55W	1435	125 ϕ	155
Registration plate light	Part of rear combination lamp assembly			

1.10.6 Main switch : Key turn type having three positions viz.
i) OFF
ii) Circuit 'ON'
iii) START

1.10.7 Light switch : Rotary type having four positions viz.
i) OFF
ii) Parking + dash board light
iii) Head light (long beam) + (ii)
iv) Head light (short beam) + (ii)

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

1.10.9 Fuse box : Contains four number of fuses having following capacities

10 A	15 A
03	01

1.10.10 Details of other electrical accessories:

1.10.10.1 Flasher Unit:
Make : Interface
Capacity:
-Turn signal : 12V, 21W x 2 + 2W x 1
- Hazard signal : 12V, 21W x 4 + 2W x 2
Flashes/Min. : 85

1.12.3 **Nominal Speeds:**

Movement	Gear No.	No of engine revolutions for one revolution of driving wheel	Nominal speed at rated engine speed when fitted with **13.6-28 size** tyres of **610 mm** radius index, (kmph)
Forward	L1	157.10	2.92
	L2	116.26	3.95
	L3	70.03	6.57
	L4	51.27	8.97
	H1	47.99	9.59
	H2	35.41	12.98
	H3	21.32	21.59
	H4	15.61	29.47
Reverse	LR	132.92	3.46
	HR	40.40	11.38

1.12.4 **Differential unit:**

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

Reduction through crown wheel & pinion : 3.231 : 1 (42/13 T)

Oil capacity of differential unit, (l) : 54.0 (common with gear box, final drive, hydraulic & brakes system).

Oil changing period : After every 1600 hours of operation

Differential lock : **Not provided**

1.12.5 **Rear axle & Final drive:**

Type : Bull gear and pinion reduction unit accommodated in differential housing.

Reduction through final drive : 4.833 : 1 (58/12T)

Oil capacity of final drive, (l) : 54.0 (common with gear box, differential housing, hydraulic & brakes system).

Oil changing period : After every **1600** hours of operation

1.13 **Power lift:**

Make : Swaraj (apa)

Type : Open centre, live, ADDC

No. and type of cylinder : One, single acting

Type of linkage lock for transport : Hydraulic response control valve in fully closed position acts as a transport lock.

1.13.1 **Hydraulic pump :**

- Make : Rexroth
- Type : Gear
- Location & drive : On RHS of engine & through timing gears.

No. & type of filters : Two, one suction strainer and one spin on throw away paper element.

Hydraulic oil capacity, (l) : 54.0 (common with transmission & brakes system).

Oil change period : After every 1600 hours of operation.

Provision for external tapping : Provided

Details of control levers :
i) Position control lever (Black)
ii) Draft control lever (Red)
iii) Response control valve

Method of draft sensing : Through top link

1.13.2 Three point linkage:

S. No.	Observations		As per IS: 4468-(Part-1) -1997, (Cat.I / Cat.II), (mm)	As measured (mm)	Remarks
I.	**Upper hitch points:**				
	a)	Dia of hitch pin hole	19.30 to 19.50 / 25.70 to 25.90	25.9	Conforms to Cat.II
	b)	Width of ball	44.0 (max.) / 51.0 (max.)	51.0	Conforms to Cat.II
II.	**Lower hitch points:**				
	a)	Dia of hitch pin hole	22.40 to 22.65 / 28.70 to 29.00	29.0	Conforms to Cat.II
	b)	Width of ball	34.8 to 35.0 / 44.8 to 45.0	44.9	Conforms to Cat.II
III.	Lateral distance from lower hitch point to centre line of tractor		359 / 435	364	**Does not conform**
IV.	Lateral movement of lower hitch points		100 (min) / 125 (min)	270	Conforms to Cat.I & II
V.	Distance from end of power take-off to centre of lower hitch point (lower links in horizontal position)		450 to 575 / 550 to 625	520	Conforms to Cat-I & II
VI.	Transport height		820 (min)/ 950 (min)	975	Conforms to Cat-I & II
VII.	Power range (without force)		560(min)/ 650 (min)	645	Conforms to Cat.I & II
VIII.	Leveling adjustment		100 (min)/ 100 (min)	400	Conforms to cat I & II
IX.	Lower hitch point clearance		100 (min)/ 100 (min)	190	Conforms to Cat-I & II
X.	Lower hitch point height		200 (max)/ 200 (max)	200	Conforms to Cat-I & II

1.13.3 Linkage geometry dimensions {Refer Fig.-1(A)}:

The following are dimensions observed, corresponding to **610 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	785	785
2.	Length of lift arm	B	240	240
3.	Length of lift rods	C	605 to 715	655
4.	Length of top link	D	545 to 740	545
5.	Distance of lift rod connection point from pivot point of lower link	E	400 & 450	450
6.	Distance of lower link pivot point from rear wheel axis:			
	-Horizontally	F	90, behind	90, behind
	-Vertically	G	150, below	150, below
7.	Distance of upper link pivot point from rear wheel axis:			
	-Horizontally	H	350, 350 & 350, behind	350, behind
	-Vertically	J	260, 290 & 320, above	290, above

(1)	(2)	(3)	(4)	(5)
8.	Distance of lift arm pivot point from rear wheel axis:			
	-Horizontally	K	85, forward	85, forward
	-Vertically	L	365, above	365, above
9.	Height of lower hitch points relative to the rear wheel axis:			
	- In high position	M	180 to 365	235
	- In low position	N	-570 to -180	410
10.	Height of lower link hitch points when locked in transport position	235		

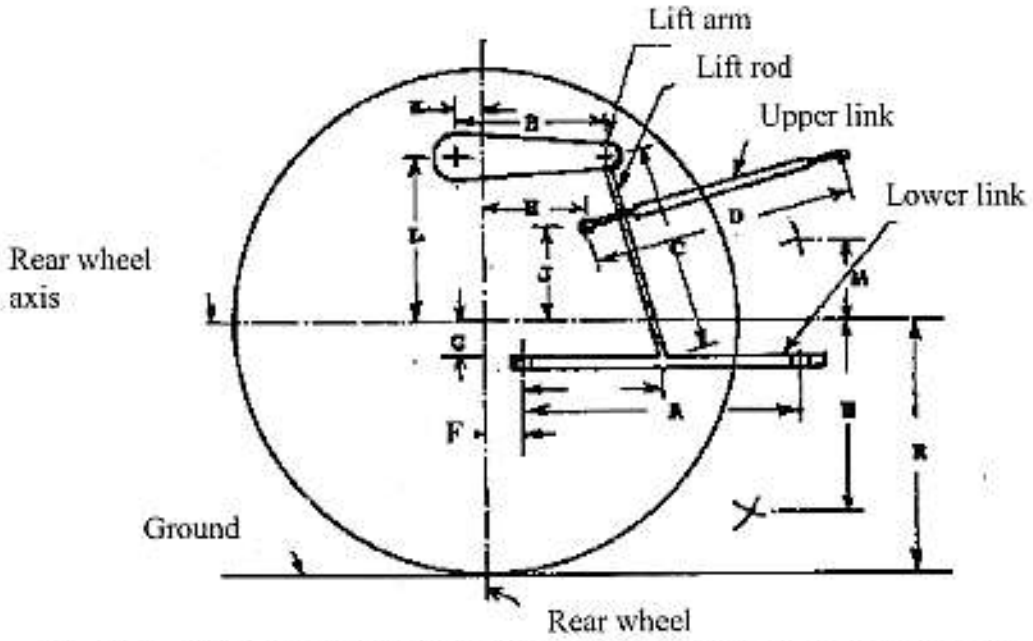


Fig. 1 (A): DIMENSIONAL NOTATIONS FOR TABLE OF LINKAGE GEOMETRY

1.13.4 Drawbar:

1.13.4.1 Linkage Drawbar [Refer Fig.1(B)] :

Notation	As per IS: 12953-1990, **(Cat.I) / (Cat.II)**, (mm)	As measured, (mm)	Remarks
A	683 ± 1.5 / 825 ± 1.5	682.00	Conforms to Cat.-I
B	75 (min) / 75 (min)	75.00	Conforms to Cat. I & II
C	30 (min) / 30 (min)	30.00	Conforms to Cat. I & II
DØ	21.79 to 22.0 / 27.79 to 28.0	27.94	Conforms to Cat. II
E	39.0 (min) / 49.0 (min)	54.80	Conforms to Cat. I & II
FØ	12.0 (min) / 12.0 (min)	12.50	Conforms to Cat. I & II
G	15.0 (min) /15.0 (min)	15.80	Conforms to Cat. I & II
HØ	25 ± 1 / 25 ± 1	25.00	Conforms to Cat. I & II
J	80 ± 1.5 / 80 ± 1.5	80.00	Conforms to Cat. I & II
No. of holes	7 / 9	7	Conforms to Cat. I

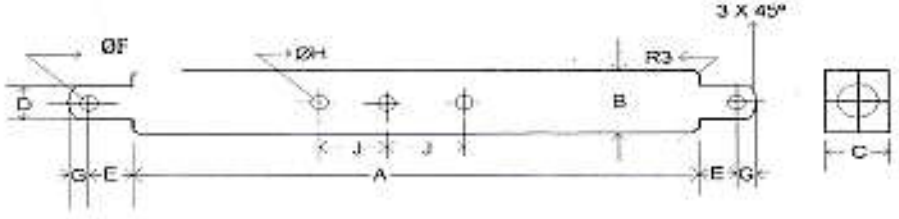


Fig. 1 (B): DIMENSIONAL NOTATIONS FOR LINKAGE DRAWBAR

1.13.4.2 Swinging drawbar: : **Not provided**

1.13.4.3 Provision for coupling of trailer brakes : 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) : 653

Distance behind rear axle, (mm) : 355

Engine to PTO speed ratio : 3.0625 : 1

Weather the PTO shaft is capable of transmitting full power of the engine. : Yes

1.14.1 Specifications of Power Take-Off Shaft: -

Specification	As per IS: 4931-1995 (Type-2)	As observed	Remarks
Nominal speed, (rpm)	540 ± 10	540 rpm of PTO shaft corresponds to 1654 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.	08 mm towards left side from centre median plane	Conforms
Dimensions, (mm) {See Fig. 2(A)}:			
DØ	34.79 ± 0.06	34.79	Conforms
dØ	28.91 ± 0.05	28.86	Conforms
BØ	29.40 ± 0.10	29.41	Conforms
AØ (Optional)	8.30 ± 0.10	8.70	**Does not conform**
W	8.69 – 0.09 -0.16	8.55	Conforms
a	7	7	Conforms
b	25 ± 0.50	25	Conforms
c	38.0	38.0	Conforms
x	30°	30°	Conforms
B	76 (min)	79	Conforms
h	450 to 675	625	Conforms

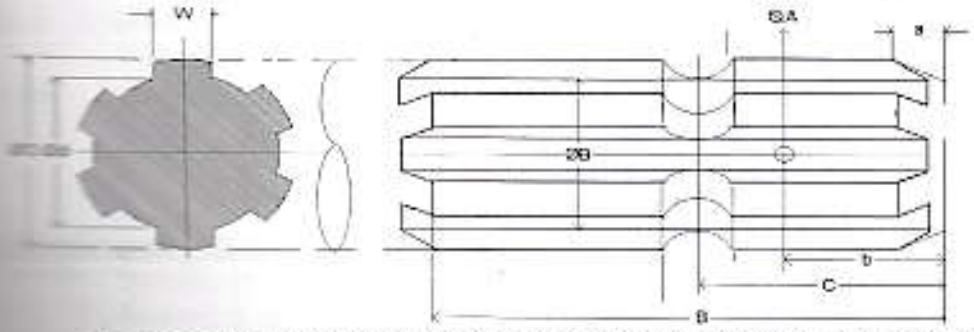


Fig. 2(a): DIMENSIONAL NOTATIONS FOR TYPE-I POWER TAKE-OFF SHAFT

1.14.2 Power Take-off Master Shield (Type I&II) [See Fig. 2 (b)]:			
Notation, (mm)	As Per IS: 4931-1995,(mm)	As observed	Remarks
k	70 (min)	85	Conforms
m	125 ± 5	125	Conforms
n	85 ± 5	80	Conforms
p	285 ± 5	180	Conforms
r	76 (max)	0	Conforms

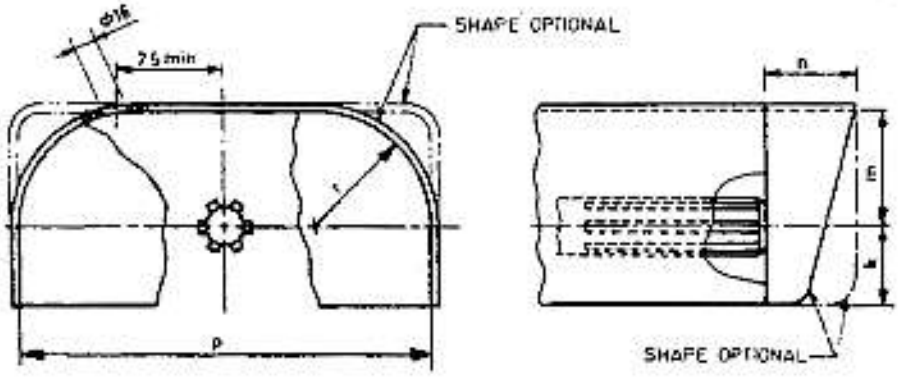


Fig. 2. (b): DIMENSIONAL NOTATION OF PTO SHAFT MASTER SHIELD

1.15 Towing hitch:

1.15.1 Front:

Type	:	Clevis
Location	:	At front of the tractor
Height above ground level, (mm)	:	630
Type of adjustment	:	Fixed
Width of clevis, (mm)	:	63.8
Dia of pin hole, (mm)	:	26.2

1.15.2 Rear:

Type	:	Clevis
Location	:	At rear of transmission housing
Height above ground level, (mm):		
- Maximum	:	795
- Minimum	:	545
Number of positions	:	06
Type of adjustment	:	By changing and reversing the hitch on its mounting bracket
Distance of hitch point, (mm):		
- From rear wheel centre	:	445
- From power take-off shaft end	:	90
Dia of pin hole,	:	34.7
Width of clevis,	:	80.0

1.16 Steering:

Make	:	ZF, India
Type	:	Mechanical, worm & roller with single drop arm.
Location	:	Above the gearbox housing
Method of operation	:	Manual, through steering control wheel
Diameter of steering control wheel, (mm)	:	425
Steering oil capacity, (l)	:	0.45
Lubricant change period	:	After every 1600 hours of operation

1.17 Brakes:

1.17.1 Service Brake:

Make	:	JMIL
Type	:	Mechanical, oil immersed multi discs
Location	:	On bull pinion half axle shaft outside the differential housing
No. of disc(s)	:	04 ((on each wheel side)
Area of liners, (cm^2)	:	917.6 (on each wheel side)
Material of liners	:	Paper based (apa)
Method of operation	:	Individual or combined RHS foot pedal operated.

1.17.2 Parking Brake:

Make	:	Pawl and ratchet arrangement
Location and method of operation	:	Service brake act as a parking brake when locked in position by a hand lever provided on RHS of operator's seat

1.18 Wheel Equipment:

1.18.1 Steered Wheel,(s):

Make	:	MRF, Shakti Life
Number	:	2
Type of tyre	:	Pneumatic, ribbed
Size	:	6.00-16
Ply rating	:	8
Maximum permissible loading capacity of each tyre at 450 kPa pressure, (kgf)	:	675
Recommended inflation pressure, (kPa) :		
- For field work	:	235
- For transport	:	235
Track width, (mm)	:	1195, 1305 (std.), 1405, 1415, 1495 & 1605
Method of changing track width	:	By reversing the wheel disc and extending the telescopic front axle
Make & size of rim	:	SSWL & 4.5 E x 16

1.18.2 Drive wheel(s):

Make	:	MRF, Shakti Life
Number	:	2
Type of tyre	:	Pneumatic, traction
Size	:	13.6-28
Ply rating	:	12
Maximum permissible loading capacity of each tyre at 230 kPa pressure, (kgf)	:	1800
Recommended inflation pressure, (kPa):		
- For field work	:	108
- For transport	:	108
Track width, (mm)	:	1350 (std.), 1570, 1580, 1790, 1880 & 1900
Method of changing track width	:	By changing and reversing the wheel disc on off-set rim lugs.
Make & size of rim	:	SSWL & W 12 x 28

1.18.3 Wheel base, (mm) : 1950

Method of changing wheel base, if any, and range : **None**

1.19 **Operator's seat:**

Make	:	Not available
Type	:	Cushioned seat with backrest
Type of suspension	:	02, Helical coil spring
Type of damping	:	01, Hydraulic shock absorber
Range of adjustment, (mm):		
Vertical	:	NIL
Lateral	:	NIL
Longitudinal	:	± 60

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

1.20.1 **Operator's Seat:**
Operator's seat meets the minimum requirements of IS: 12343-1998 (Re-affirmed in March, 2009).

1.20.2 **Conformity with IS: 6283 (Part-1) – 2006 (Re-affirmed in March, 2009) & IS: 6283 (Part-2) – 2007 (Re-affirmed in March, 2009):**

Controls are identifiable with symbols as per **IS: 6283 (Part-1) – 2006 (Re-affirmed in March, 2009) & IS: 6283 (Part-2) – 2007 (Re-affirmed in March, 2009).**

1.20.3 **Conformity with IS:8133-1983 (Re-affirmed in March, 2009):**

Location and movement of various controls meets the requirement of **IS:8133-1983 (Re-affirmed in March, 2009), except the following:**
i) The fuel shut-off knob does not remain in stop position.
ii) Differential lock is not provided

1.20.4 **Conformity with IS: 12239 (Part-1)-1996 (Re-affirmed in February, 2012):**
Meets the requirements of **IS: 12239 (Part-1)-1996 (Re-affirmed in February, 2012), except the following:**
i) Provision of spark arresting device in the exhaust system.

1.20.5 **Conformity with IS:12239 (Part-2)-1999 (Re-affirmed in March, 2009):**
Meets the requirements of **IS:12239 (Part-2)-1999 (Re-affirmed in March, 2009).**
i) Working clearance around the position and draft control lever of hydraulic system is less than the minimum requirement.

1.20.6 **Conformity with IS: 14683 – 1999 (Re-affirmed in March, 2009) :**
Lighting requirements conform to IS: 14683-1999.

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, 2009):**
Location of labelling plate: The labeling plate is riveted on LHS of gearbox housing and provides the following information:

Name of Manufacturer	**Swaraj Division Tractors, Mahindra & Mahindra Limited**
Make	SWARAJ
Model	742 FE
Year of manufacturer	WY (i.e. 2016)
Engine Serial Number	42.1001/SWG13096
Chassis Serial Number	WYCH92606100001
Maximum P.T.O Power, kW	28.18
Specific fuel consumption, g/kwh	265

1.22 Ballast Conditions:

Particulars		As used during drawbar test	As used during field test		As used during Haulage test
			Dry land	Wet land	
Front	C.I. weight	90	90	Half cage Wheel with puddler	90
	Water	Nil	Nil		Nil
Rear	C.I. weight	480	400		240
	Water	240	Nil		Nil

1.23 Masses:

Particulars		Mass of the tractor without operator but with all the liquid reservoirs full, (kg)		
		Front	Rear	Total
i)	Without ballast	780	1240	2020
ii)	With ballast as used during drawbar performance test	920	1915	2835
iii)	With ballast as used during field test	920	1640	2550
iv)	As used during wet land operation (half cage wheel)	785	1330	2115
v)	With ballast as used during haulage test with trailer hitch and canopy	915	1460	2375

1.24 Overall dimensions:

Condition	Length, (mm)	Width, (mm)	Height, (mm)		Ground clearance, (mm)
			With exhaust pipe	Without exhaust pipe	
Without ballast	3480	1710	2215	1805 (Pre air cleaner)	415 (below differential housing)

1.25 Number of external lubricating Points:

- Oiling : Nil
- Greasing cups : 02
- Greasing nipples : 19

1.26 Colour of tractor:

Chassis & engine : Smoke grey

Sheet metal:

Bonnet : Blue

Mudguard, Wheel rim & disc : White

1.27 Optional features of Base model : 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.	Engine	SAE 20W40	As recommended
2.	Air cleaner oil	SAE 30	As recommended
3.	Transmission, Brake & Hydraulic system	Servo Transtrac 30	Oil originally filled in the tractor's system was not changed
4.	Steering system	Servo Transtrac 30	-do-
5.	Grease	Multi purpose grease	Servo grease MP

1. PTO PERFORMANCE TEST

Date(s) of test : 15.05.2017 & 16.05.2017

Tractor run at the Institute prior to start of PTO test (h) : 7.56

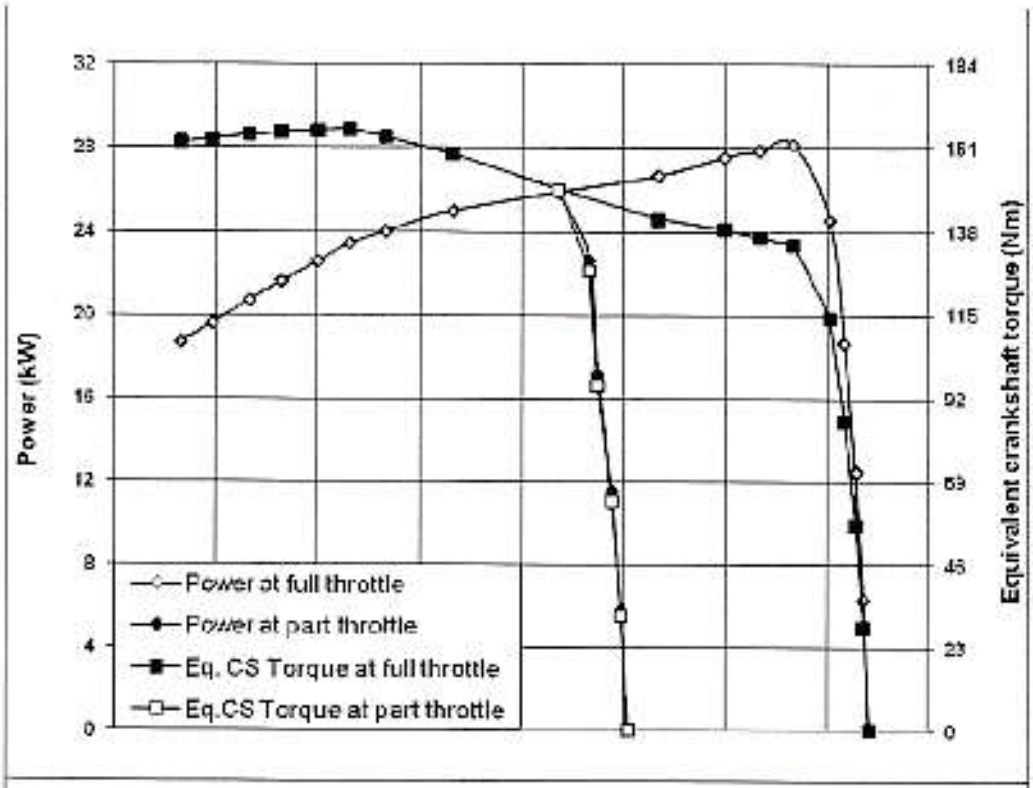
Type of dynamometer bench : SAJ – AG 250 , Eddy Current

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:						
28.2	653	2000	8.80	7.35	0.261	3.20
26.8	653	2000	8.37	6.99	0.261	3.20*
b) Power at rated engine speed (2000 rpm):						
28.2	653	2000	8.80	7.35	0.261	3.20
26.8	653	2000	8.37	6.99	0.261	3.20*
c) Power at standard power take-off speed (540 ± 10 rpm):						
25.9	540	1654	7.63	6.38	0.246	3.90
24.9	540	1654	7.39	6.18	0.248	3.37*
d) Varying loads at rated engine speed:						
i) Torque corresponding to maximum power available at rated engine speed:						
28.2	653	2000	8.80	7.35	0.261	3.20
ii) 85% of the torque obtained in (i):						
24.6	671	2055	7.80	6.52	0.265	3.15
iii) 75% of the torque obtained in (ii) :6.28						
18.7	678	2076	6.28	5.25	0.281	3.00
iv) 50% of the torque obtained in (ii) :						
12.5	683	2092	4.97	4.16	0.333	2.52
v) 25% of the torque obtained in (ii) :						
6.3	687	2104	3.72	3.11	0.494	1.69
vi) Unloaded:						
0.1	690	2113	2.53	2.12	21.200	0.03
e) Varying loads at part throttle:						
i) Torque corresponding to maximum power available at standard PTO speed (540 ± 10 rpm):						
25.9	540	1654	7.63	6.38	0.246	3.90
ii) 85% of the torque obtained in (i):						
22.7	555	1700	6.69	5.59	0.246	3.39
iii) 75% of the torque defined in (ii):						
17.2	559	1712	5.30	4.43	0.258	3.25
iv) 50% of the torque defined in (ii):						
11.6	566	1733	4.10	3.43	0.297	2.83
v) 25% of the torque defined in (ii):						
5.9	570	1746	2.95	2.46	0.417	2.00
vi) Unloaded:						
0.1	574	1758	1.85	1.55	15.500	0.03

*Under high ambient conditions



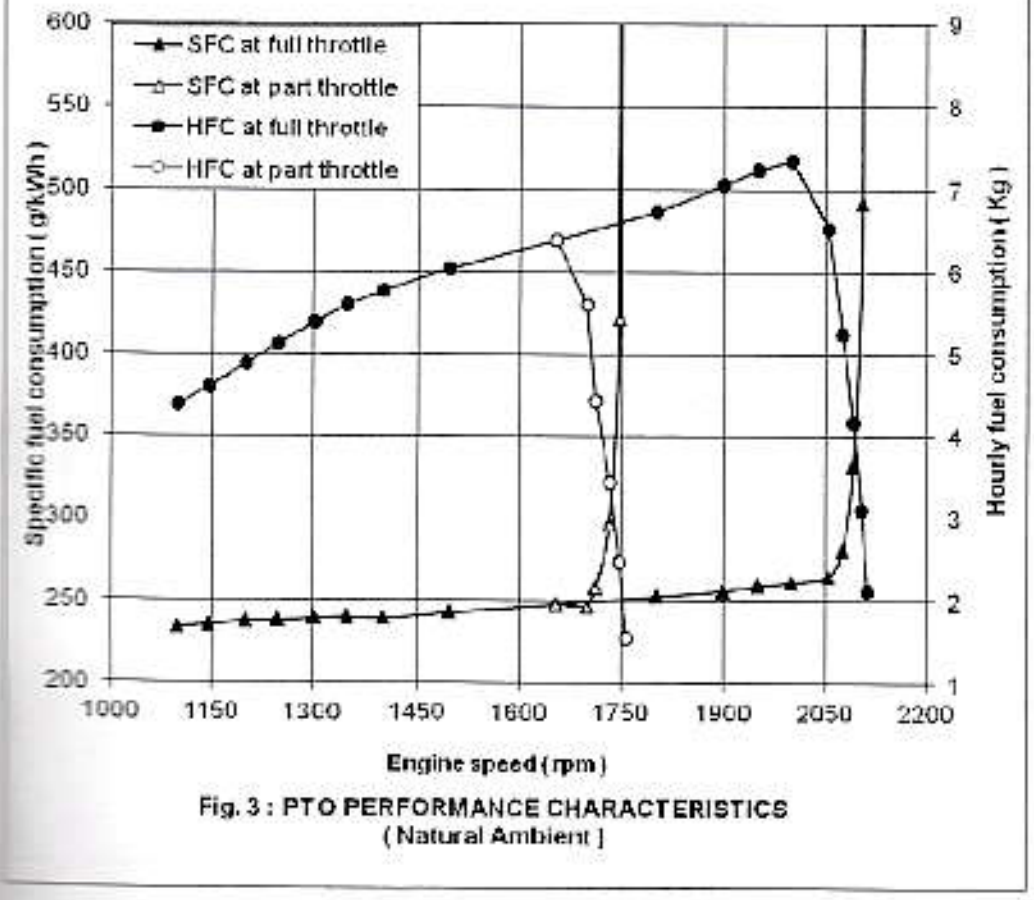
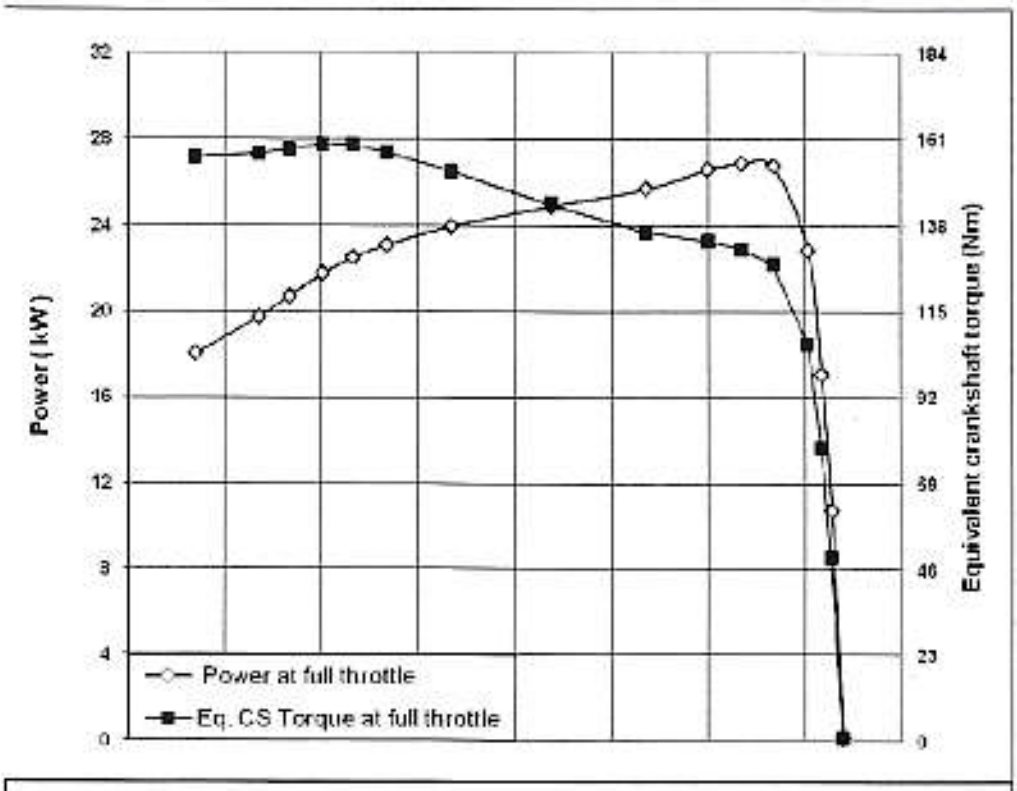


Fig. 3 : PTO PERFORMANCE CHARACTERISTICS
(Natural Ambient)



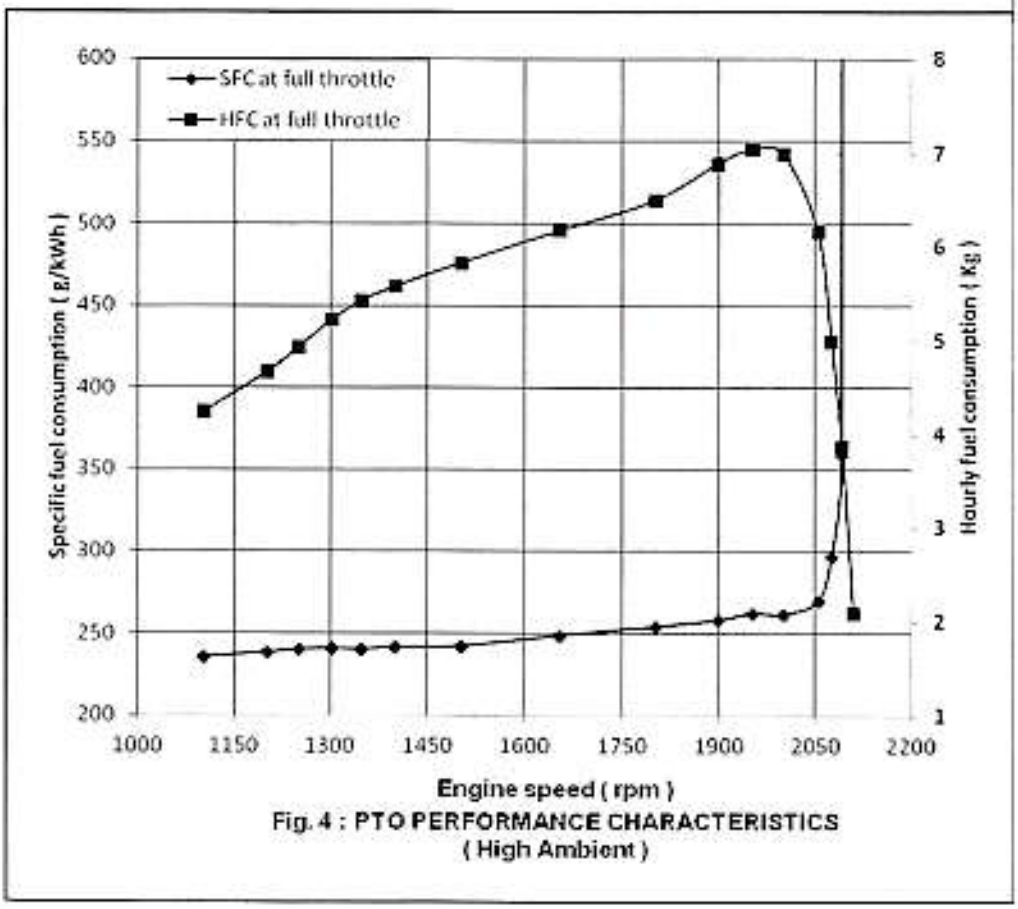


Fig. 4 : PTO PERFORMANCE CHARACTERISTICS
(High Ambient)

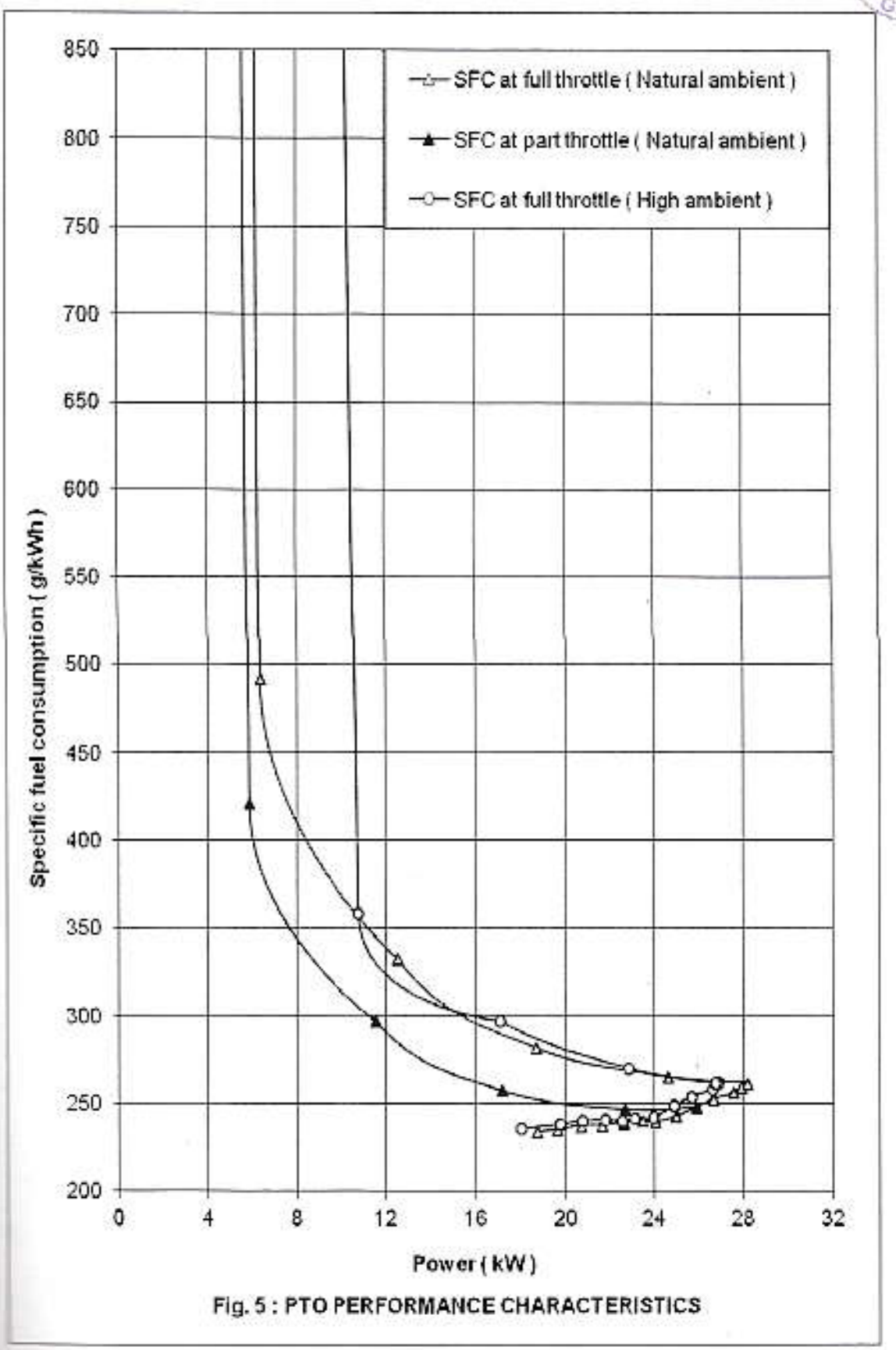


Fig. 5 : PTO PERFORMANCE CHARACTERISTICS

		Natural ambient	High ambient
-No load maximum engine speed, (rpm)	:	2113	2110
-Equivalent crankshaft torque at maximum power, (Nm)	:	134.6	127.7
- Maximum equivalent crankshaft torque, (Nm)	:	166.1	159.5
-Engine speed at maximum equivalent crankshaft torque, (rpm)	:	1348	1302
- Back-up torque, percent	:	23.4	24.9
-Smoke level, maximum light absorption coefficient (per meter)	:	0.24	-
- Range of atmospheric conditions:			
Temperature, (deg.C)	:	29 to 32	42 to 44
Pressure, (kPa)	:	98.2 to 98.7	99.3 to 99.6
Relative humidity, (%)	:	63 to 72	23 to 34
- Maximum temperatures (degree):			
Engine oil	:	90	99
Coolant (water)	:	81	94
Fuel	:	47	60
Air intake	:	30	43
Exhaust gas	:	513	515
- Pressure at maximum power:			
Intake air, (kPa)	:	2.8	2.8 to 2.9
Exhaust gas,(kPa)	:	7.1 to 8.3	6.7 to 6.9
- Consumptions:			
Lub. oil, (g/kWh)	:	--	0.37
Coolant (water % of total coolant capacity)	:	--	Nil

4. DRAWBAR PERFORMANCE TEST

Date(s) of test	:	05.09.2017, 08.09.2017 & 11.09.2017
Tractor run at the Institute prior to start of drawbar performance test, (h)	:	32.2
Type of track	:	Concrete
Height of drawbar, (mm):		
- Without ballast	:	610
- With ballast	:	550

4.1 The results of drawbar performance test consisting of maximum power and pull without ballast / with ballast and ten hours test are tabulated in **Table - 2**. The results of the tests with ballast 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	Cool-ant (water + coolant)	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	2.64	15.9	21.73	2065	15.1	0.347	6.60	2.41	33	98.3	55	42	59	76	88	24.27
L2	3.55	21.5	21.80	2045	14.8	0.332	8.73	2.46	33	98.4	54	42	58	80	89	23.86
L3	6.22	23.4	13.55	2006	8.5	0.314	8.70	2.66	31	98.5	68	41	53	81	88	16.81
L4	8.65	22.9	9.54	2002	6.6	0.323	8.85	2.59	30	98.5	68	39	52	79	85	12.49
H1	9.26	23.4	9.08	2000	6.4	0.316	8.85	2.64	30	98.6	68	38	38	79	81	11.53
ii) Maximum power test (Tractor Ballasted):																
L1	2.68	11.4	15.27	2085	14.9	0.404	5.51	2.03	29	98.3	72	38	55	75	85	16.16
L2	3.58	15.2	15.30	2071	15.4	0.357	6.49	2.34	29	98.3	72	38	53	76	86	16.19
L3	6.20	23.2	13.46	2011	9.3	0.321	8.91	2.60	29	98.3	67	38	52	79	86	14.28
L4	8.68	23.8	9.88	2000	6.5	0.315	8.97	2.65	30	98.4	74	30	38	80	84	11.67
H1	9.31	24.6	9.50	1998	6.1	0.304	8.95	2.75	28	98.4	74	36	36	78	79	11.18

Table-2 (Contd.)

(Contd.) Table – 2

Gear	Travel Speed, (km/h)	Draw-bar power, (kW)	Draw-bar pull, (kN)	Engine Speed, (rpm)	Wheel Slip, (%)	Fuel consumption (kg/kWh)	Fuel consumption (l/h)	Specific Energy, (kWh/l)	Atmospheric conditions: Te-mp (°C)	Atmospheric conditions: Pre-ssure (kPa)	Atmospheric conditions: R.H., (%)	Temperature (°C): Fuel	Temperature (°C): Trans. oil	Temperature (°C): Coolant (water + coolant)	Temperature (°C): Engine oil	Max. sust-ained pull, (kN)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
iii) Five hours test at 75 percent of pull obtained at max. Power (ballasted wheeled tractor):																
L3	6.49	18.4	11.18	2060	7.91	0.310	7.24	2.54	27 to 30	98.6 to 98.8	65 to 79	35 to 41	33 to 63	73 to 78	70 to 88	--
iv) Five hours test at pull obtained at 15 percent of pull (ballasted wheeled tractor):																
L2	3.54	21.5	21.84	2044	---	0.339	8.88	2.42	27 to 32	98.3 to 98.6	62 to 78	37 to 43	63 to 75	76 to 80	87 to 91	--

i) The coolant (water) and lub. oil consumption during 10 hours test were observed as **Nil** and **Nil** respectively.

ii) Tyre Creeping, (mm):

-LHS : Nil

-RHS : 15

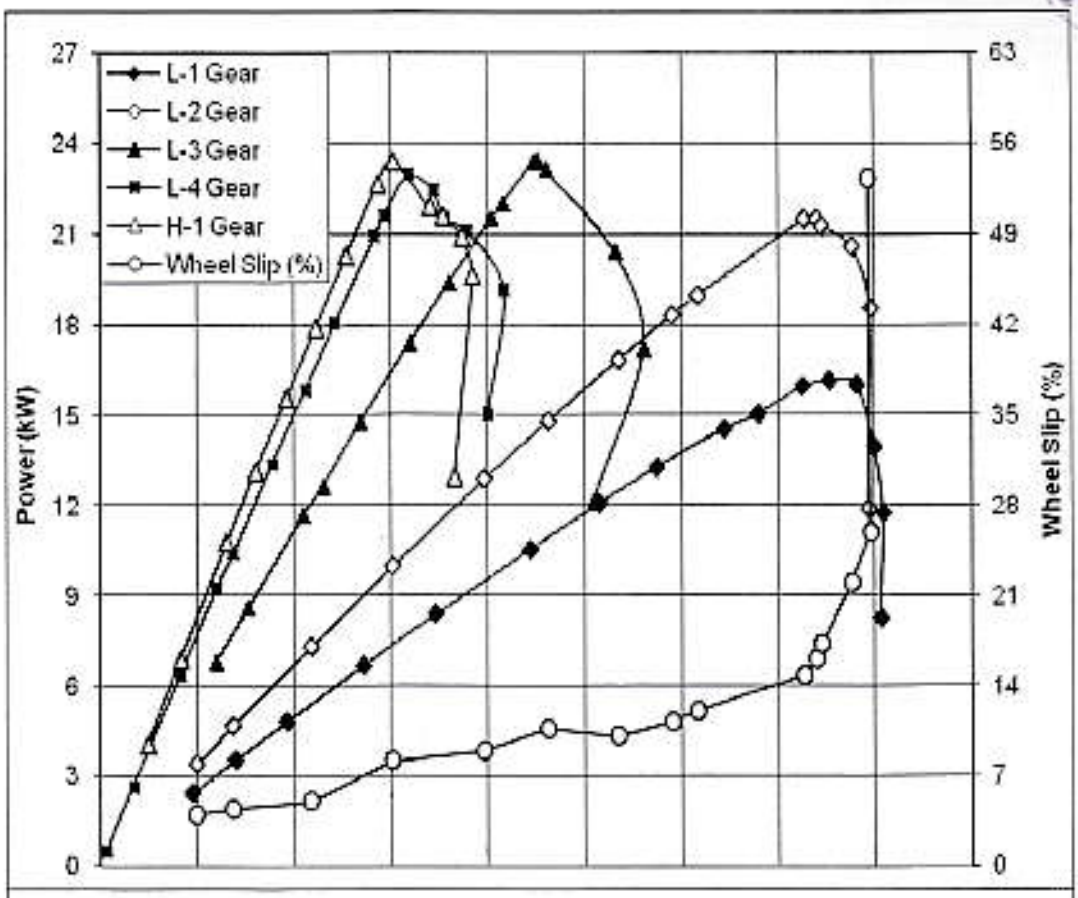
iii) Maximum temperatures during entire drawbar test, (°C):

Engine oil : 91

Coolant (water + coolant) : 86

Transmission oil : 75

Fuel : 44



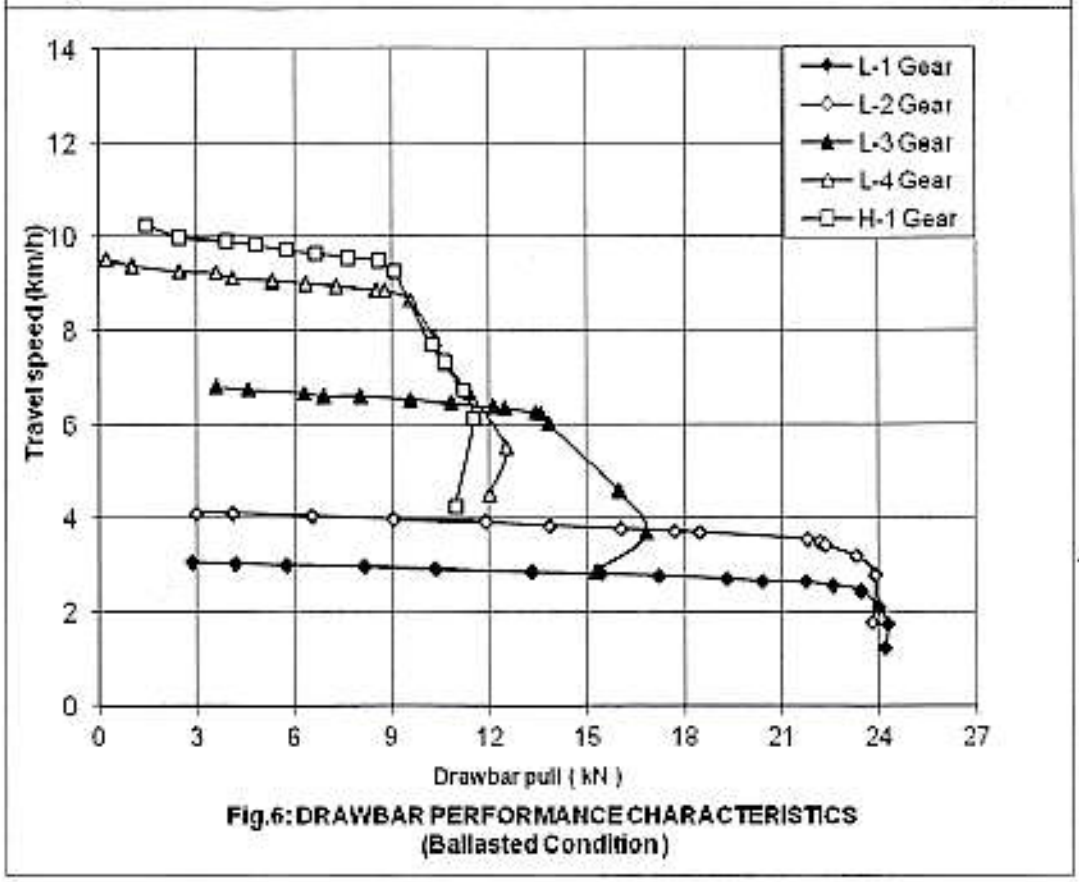


Fig.6: DRAWBAR PERFORMANCE CHARACTERISTICS (Ballasted Condition)

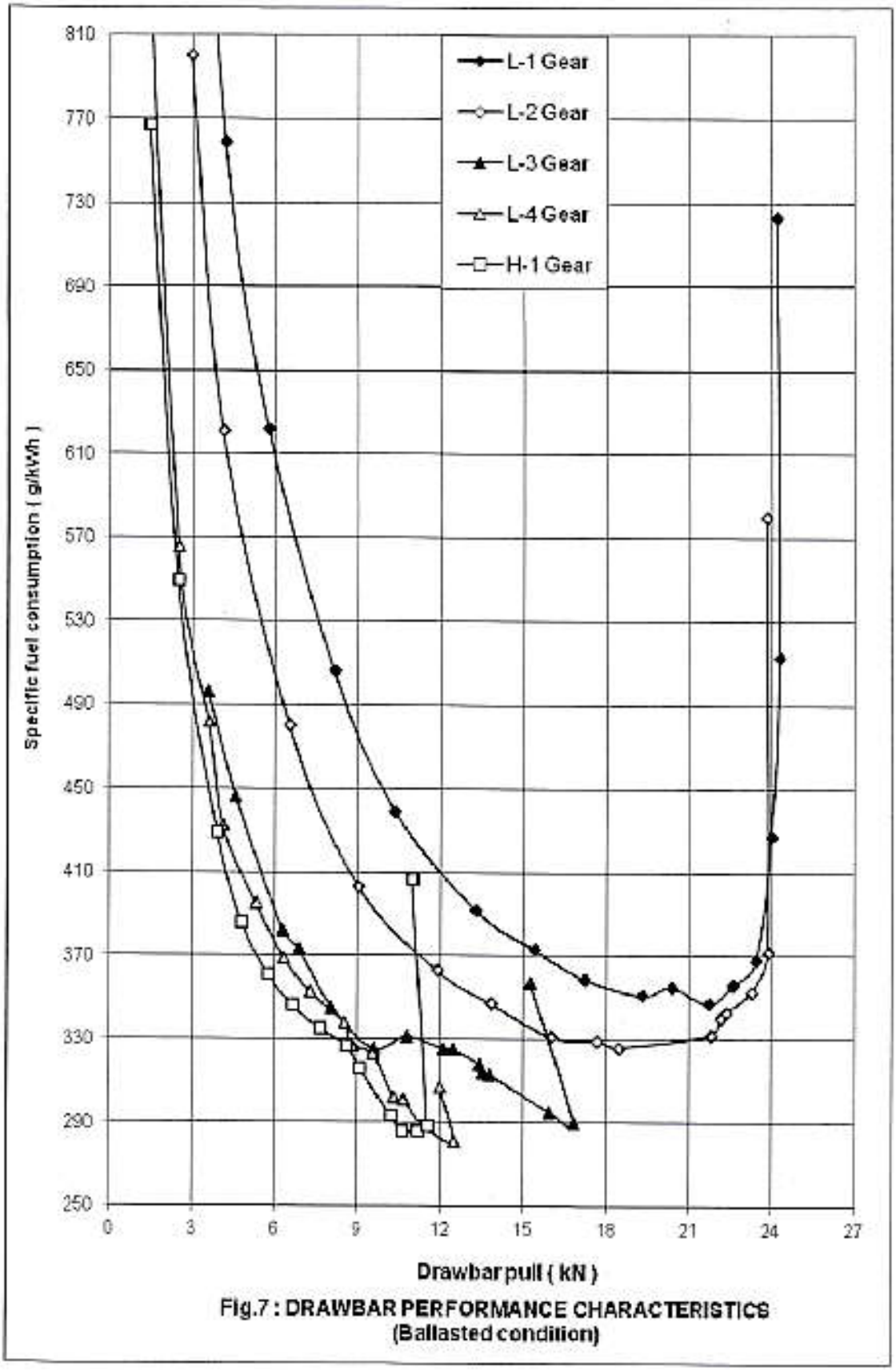


Fig.7 : DRAWBAR PERFORMANCE CHARACTERISTICS
(Ballasted condition)

5. POWER LIFT AND HYDRAULIC PUMP PERFORMANCE TEST

Date(s) of test : 30.05.2017 & 31.05.2017
Tractor run at the Institute prior to start of hydraulic test, (h) : 22.06
Pump speed at rated engine speed, (rpm) : 1500

5.1 Hydraulic power test:

Pump delivery rate at min. pressure and rated engine speed, (l/min) : 28.6
Maximum hydraulic power,(kW) : 6.3
Pump delivery rate at maximum hydraulic power, (l/min) : 27.2
Pressure at maximum hydraulic power, (MPa) : 14.0
Sustained pressure of the open relief valve, (MPa) : 17.0

Tapping point:

a) Relief valve test : External circuit
b) Pump performance test : 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 Movement with lifting forces, (mm)	Maximum corrected force exerted through full range, (kN)	Corres-ponding pressur e, (MPa)	Moment about rear axle, (kN-m)	Maximum tilt angle of mast from vertical , (degrees)
At hitch points	200	630	17.45	15.3	15.27	--
On the standard frame	200	630	11.51	15.3	17.09	11.4

5.3 Maintenance of lift load:

Force applied at the frame, (kN) : 10.35
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)	08	13	18	23	31	31

6. BRAKE TEST

6.1 Service brake:

6.1.1 Cold brake test:

Date of test : 19.04.2017 & 20.04.2017
Type of track : Concrete
Maximum attainable speed, (kmph):
- Unballasted : 31.4
- With road ballasted : 31.4

		At maximum attainable speed			
Unballasted tractor	Braking device control force, (N)	562	518	475	431
	Mean deceleration, (m/sec^2)	2.90	2.58	2.54	2.50
	Stopping distance, (m)	13.30	14.72	14.97	15.22
Road Ballasted tractor	Braking device control force, (N)	563	535	507	479
	Mean deceleration, (m/sec^2)	2.69	2.61	2.54	2.50
	Stopping distance, (m)	14.16	14.57	14.97	15.22

		At 25 kmph travel speed			
Unballasted tractor	Braking device control force, (N)	507	486	464	442
	Mean deceleration, (m/sec^2)	2.83	2.61	2.56	2.50
	Stopping distance, (m)	8.77	9.24	9.42	9.65
Road Ballasted tractor	Braking device control force, (N)	586	548	510	473
	Mean deceleration, (m/sec^2)	2.77	2.63	2.58	2.50
	Stopping distance, (m)	8.81	9.15	9.36	9.65

6.1.2 Brake fade test:

		At maximum attainable speed			
Road Ballasted tractor	Braking device control force,(N)	563	549	535	521
	Mean deceleration, (m/sec^2)	2.64	2.60	2.54	2.50
	Stopping distance, (m)	14.29	14.62	14.96	15.22

		At 25 kmph travel speed			
Road Ballasted tractor	Braking device control force,(N)	592	567	542	518
	Mean deceleration, (m/sec^2)	2.64	2.54	2.51	2.50
	Stopping distance, (m)	9.39	9.51	9.62	9.65

Maximum deviation of tractor from its original course, (m) : None
Abnormal vibration : None
The brakes were heated by : Self braking

6.2 Parking brake test:

Particulars	Parked on 18 percent slope		Parked on 12 percent slope with trailer of 2.01 tonnes.	
	Facing Up	Facing Down	Facing Up	Facing Down
Braking device control force, (N)	416	444	330	348
Efficacy of parking brake	---------- Effective ----------			

7. NOISE MEASUREMENT

7.1 Noise at bystander's position:

Date of test	:	12.10.2017
Type of track	:	Concrete
Background noise level, dB (A)	:	54
Atmospheric conditions:		
Temperature, (°C)	:	34
Pressure, (kPa)	:	98.2
Relative humidity, (%)	:	49
Wind velocity, (m/s)	:	0.8

Test Data:

S. No.	Gear	Travelling speed before acceleration, (kmph)	Noise level , dB (A)
1.	L1	2.34	81
2.	L2	3.17	81
3.	L3	5.24	81
4.	L4	7.19	81
5.	H1	7.70	81
6.	H2	10.42	80
7.	H3	17.37	80
8.	H4	23.46	81

7.2 Noise at operator's ear level:

Date of test	:	05.09.2017
Type of track	:	Concrete
Background noise level, dB (A)	:	54
Atmospheric conditions:		
Temperature, (°C)	:	28
Pressure, (kPa)	:	98.2
Relative humidity, (%)	:	71
Wind velocity, (m/s)	:	1.4

Test Data:

Gear	Drawbar pull at which the tractor develops the maximum noise level, (kN)	Corresponding travelling speed, (kmph)	Noise level dB (A)
L1	11.89 to 15.43	2.88 to 2.64	92
L2	7.55 to 15.51	4.04 to 3.54	92
*L3	9.50 to 13.36	6.53 to 6.08	93
L4	6.15 to 9.97	9.16 to 8.61	93
H1	7.58 to 9.34	9.66 to 9.36	93

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

8. AIR CLEANER OIL PULL-OVER TEST

Date(s) of test : 04.04.2017

Atmospheric conditions:

- Temperature, (°C) : 33 to 34
- Pressure, (kPa) : 96.7
- Relative humidity, (%) : 23 to 34

Mass of oil before test,(g) :

S. No.	Position of tractor	Loss of oil (g)	Oil pull – over (%)	Engine oil pressure
i)	Tractor parked on level ground	0.80	0.10	Normal
ii)	Tractor tilted 15° laterally on RHS	0.20	0.03	-do-
iii)	Tractor tilted 15° laterally on LHS	0.50	0.07	-do-
iv)	Tractor tilted 15° longitudinally with front end up	0.30	0.04	-do-
v)	Tractor tilted 15° longitudinally with front end down	0.50	0.07	-do-

9. MECHANICAL VIBRATION MEASUREMENT

Date of test : 29.05.2017

Type of test surface : Concrete

Sl. No.	Measuring points		Vibration, microns			
			At load corresponding to 85% of max. PTO power		At no load	
			HD	VD	HD	VD
i)	Foot rest	Left	210*	190*	130*	140*
		Right	150*	250*	280*	130*
ii)	Steering wheel		70	180*	60	170*
iii)	Seat	Bottom	100	90	130*	70
		Back	30	90	20	60
iv)	Mudguard	Left	40	100	80	70
		Right	210*	190*	150*	120*
v)	Head light	Left	60	100	50	90
		Right	60	90	70	70
vi)	Battery base, centre		160*	190*	130*	190*
vii)	Tail light	Left	180*	110*	200*	60
		Right	220*	150*	210*	120*
viii)	Plough light		140*	440*	230*	410*
ix)	Gear shifting lever		50	120*	40	100
x)	Accelerator lever	Hand	120*	270*	90	110*
		Foot	160*	150*	110*	150*
xi)	Brake pedal	Left	100	140*	130*	140*
		Right	270*	140*	170*	150*
xii)	Clutch pedal		230*	160*	150*	150*
xiii)	Main hydraulic control lever		140*	60	30	30
xiv)	PTO engaging lever		70	50	30	70

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

10. LOCATION OF CENTRE OF GRAVITY

Condition	Particulars	Coordinates
Tractor under unballasted condition but with all the liquid reservoirs full & the operator replaced by a 75 kg mass on the seat	Height above ground, (mm)	814.5
	Distance forward from the vertical plane containing the axis of rear wheels, (mm)	746.4
	Distance from the median plane parallel to the longitudinal axis of tractor bisecting the track, (mm)	9.7 (towards RHS)

11. TURNING ABILITY

Characteristics	Minimum turning diameter,(m)		Minimum clearance diameter,(m)	
	LHS	RHS	LHS	RHS
Brakes released	6.73	6.72	6.97	6.96
Brake applied	6.03	5.95	6.25	6.17

12. OPERATOR'S FIELD OF VISION

The operator's field of vision to the front and rear from the operator's seat is represented in **Fig. 8.** The observations are as under:

1. The non visible space in front is **7300 mm** which is **3.74** times of wheel base (i.e. 1950 mm).
2. The non-visible space on LHS and RHS is **2700 mm** which is **2.00** times of standard rear track width (i.e. 1350 mm).

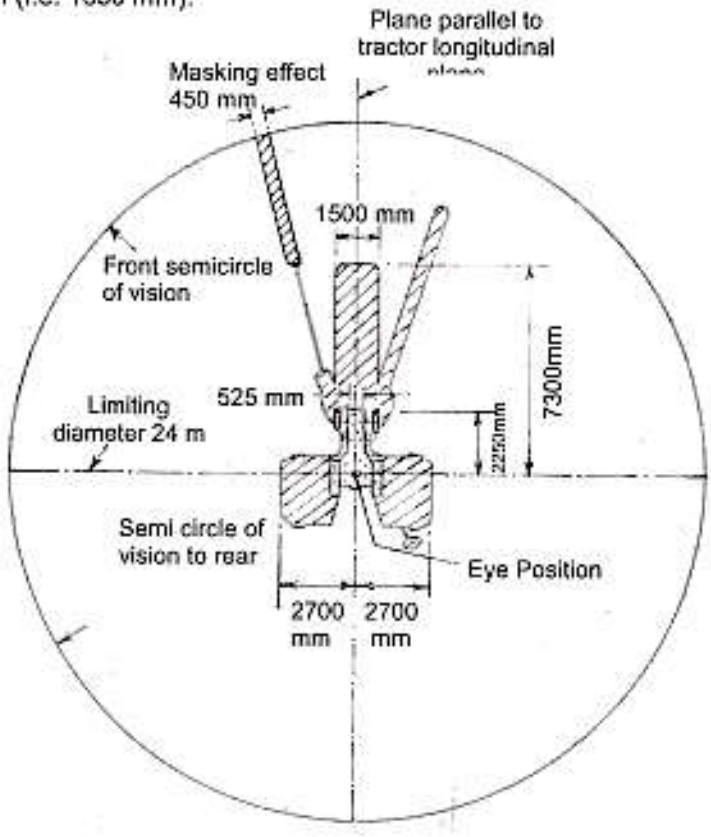


Fig. 8: Operator's field of vision

13. FIELD TEST

13.1 The field tests comprising of Disc Ploughing, rotavation and puddling (including water proof test) were conducted for **10.99, 10.43** and **15.39** hours respectively.
All the field tests were conducted at the full accelerator settings, when the no load speed of the engine varied from **2120** to **2129 rpm.**

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

13.3 The summary of field test observation with Disc Plough, rotavator and puddling is given in **Table - 3.**

Table – 3

SUMMARY OF FIELD PERFORMANCE TEST

Sl. No.	Parameter/operation	Disc Ploughing	Rotavation	Puddling
i)	Type of soil	Light	Light	Heavy
ii)	Av. soil moisture, (%) / Av. depth of standing water, (cm)	7 to 8	4 to 10	13 to 16
iii)	Bulk density of soil, (g/cc)	1.8 to 1.9	1.8 to 2.0	-
iv)	Cone index, (kg/sq.cm) / Puddling index, (%)	2.30 to 7.66	7.32 to 8.17	83.56
v)	Gear used	L-2	L-2	L-2
vi)	Av. speed of operation, (kmph)	3.61 to 3.66	4.03 to 4.09	3.16 to 3.33
vii)	Av. wheel slip, (%) / Av. Travel reduction, (%)	10.5 to 12.1	-2.1 to -0.3	3.3 to 6.3
viii)	Av. depth of cut, (cm) / Av. Depth of puddles, (cm)	20 to 26	7	28
ix)	Av. working width, (cm)	83 to 95	145 to 151	--
x)	Area covered, (ha/h)	0.239 to 0.303	0.504 to 0.528	--
xi)	**Fuel consumption:**			
	- (l/h)	3.84 to 4.01	4.95 to 4.98	3.98 to 4.05
	- (l/ha)	13.23 to 16.07	9.37 to 9.88	--
xii)	Av. draft of implement, (kN)	7.1	--	--

Remarks: The average lub oil and coolant (water) consumptions during the entire field tests were observed **2.20** and **2.20 ml/h** respectively.

13.4 Wet land cultivation (Puddling):

13.4.1 The tractor was fitted with half cage wheels and paddy harrow (puddler) for conducting the pudlling operation. The brief specifications of half cage wheels are given in **Annexure – II**

13.4.2 After completion of puddling test and water proof test, the tractor was partially dismantled to check effectiveness of sealing provided against ingress of water and / or mud in various assemblies / components as per requirements of IS : 11082 – 1984 (Technical requirement of Agriculture tractors for wet land cultivation). The observations recorded were as under.

S. No.	Location	Whether ingress of mud/or water	Remarks
1.	King pin assemblies	No	None
2.	Stub axles	No	
3.	Centre pin assembly	No	
4.	Clutch assembly	No	
5.	Brake housing	No	
6.	Engine sump, transmission, hydraulic, brake housing and air cleaner.	No	
7.	Alternator	No	
8.	Starter motor	No	

14. HAULAGE TEST

Type of trailer:		Two wheel (Single axle)	Four wheel (Double axle)
Gross mass of trailer, (tonnes)	:	5.0	6.0
Height of trailer hitch above ground level, (mm)	:	605	630
Gear used during the test for negotiating slopes upto 8%	:	H4	H4
Average travel speed, (kmph)	:	29.54 to 29.97	29.75 to 30.18
Average fuel consumption:			
- (l/h)	:	5.85 to 6.05	6.02 to 6.04
- (ml/km/tonne)	:	39.65 to 40.37	33.24 to 33.84
Average distance traveled per litre of fuel consumption, (km)	:	4.95 to 5.04	4.92 to 5.01
General observations:			
Effectiveness of brakes	:	Effective	Effective
Maneuverability of tractor-trailer Combination	:	Satisfactory	Satisfactory

15. COMPONENTS/ASSEMBLY INSPECTION

The engine and other assemblies were dismantled after **91.7** hours of tractor operation at this Institute.

15.1 Engine:

15.1.1 Cylinder bore:

Cylinder No.	Cylinder bore dia, (mm)						Max. permissible limit, (mm)
	Top position		Middle position		Bottom position		
	Thrust side	Non-thrust side	Thrust side	Non-thrust side	Thrust side	Non-thrust side	
1.	109.979	109.982	109.979	109.982	109.975	109.985	110.225
2.	109.972	109.978	109.976	109.980	109.978	109.981	
3.	109.980	109.979	109.978	109.981	109.978	109.977	

15.1.2 Piston:

Piston No.	Piston dia, (mm)				Max. permissible wear limit,	Piston to cylinder liner clearance at skirt (mm)	
	Top (above top compression ring)		At skirt			As observed	Max. permissible limit,
	Thrust Side	Non-thrust side	Thrust side	Non-thrust side			
1.	109.380	109.390	109.870	*	Not specified	0.115	0.60
2.	109.355	109.340	109.880	*		0.101	
3.	109.355	109.360	109.880	*		0.100	

* Not measured due to design constraint.

15.1.3 Ring end gap:

Rings	Ring end gap, (mm)									Max. Permissible end gap limit, (mm)
	Cylinder No.1			Cylinder No. 2			Cylinder No. 3			
	Top	Middle	Bottom	Top	Middle	Bottom	Top	Middle	Bottom	
1st comp. ring	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	1.75
2nd comp. ring	0.35	0.35	0.35	0.35	0.40	0.40	0.35	0.40	0.40	1.75
Oil ring	0.30	0.30	0.35	0.35	0.40	0.40	0.35	0.40	0.40	1.75

15.1.4 Ring side clearance:

Rings	Ring side clearance, (mm)			Max. Permissible clearance limit, (mm)
	Piston-I	Piston-II	Piston-III	
1st Compression ring	---------Tapper Ring--------			--
2nd Compression ring	0.086	0.081	0.079	1.75
Oil ring	0.078	0.078	0.079	1.75

15.1.5 Main bearings:

Bearing No.	Diametrical Clearance, (mm)	Crankshaft end float, (mm)	Max. permissible clearance limit, (mm)	
			Diametrical clearance	Crankshaft end float
1.	0.098 to 0.102	0.20	0.30	0.50
2.	0.088 to 0.095			
3.	0.097 to 0.101			
4.	0.095 to 0.112			

15.1.6 Big end bearings:

Bearing No.	Clearance, (mm)		Max. permissible clearance limit, (mm)	
	Diametrical	Axial	Diametrical	Axial
1.	0.112 to 0.125	0.30	0.30	0.60
2.	0.111 to 0.129	0.30		
3.	0.100 to 0.102	0.30		

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	:	22.71 to 24.51	Against the discard limit of 9.8 N/mm
Exhaust valve spring	:	23.04 to 25.17	
Clearance between valve guide and valve stem, (mm):			
Intake valve	:	0.042 to 0.047	Against discard limit of 0.25 mm
Exhaust valve	:	0.047 to 0.054	

15.2 Clutch:

Any marked wear on clutch friction plate(s)	:	**None**	
Condition of clutch release bearing	:	Normal	
Condition of pilot bearing	:	Normal	
Condition of diaphragm springs.	:	Normal	
Presence of oil in clutch housing	:	None	
Any marks on fly wheel/pressure plate	:	None	
Overall thickness of clutch plate,(mm)	:	10.61 to 10.68	Wear up to rivet head
Height of lining over rivet head, (mm)	:	2.74 to 3.01	Up to rivet head fouling

15.3 Transmission gears:

Any visual damage, pitting & chipping of any transmission gear teeth	:	**None**	
Backlash between crown wheel and Pinion, (mm)	:	0.30	Discard limit is not specified. However there is provision to adjust backlash through check nut and shims

15.4 Brakes:

Description	Initial specified thickness of brake disc, (mm)	Measured thickness of brake disc after test,(mm)	Measured depth of oil groove of brake lining, (mm)	Minimum permissible depth of oil groove of brake lining, (mm)
Left	4.75 ±0.05	4.744 to 4.801	1.03 to 1.21	Wear till groove base
Right	4.75 ±0.05	4.695 to 4.813	0.90 to 1.07	

15.5 Front axle:

Any marked wear of king pins	:	None	
Any marked wear of king pin bushes	:	None	
Clearance between king pins and bushes, (mm)	:	0.098 to 0.105	Against discard limit of 0.60 mm
Condition of thrust bearings	:	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)	:	0.121 to 0.139	Against discard limit of 0.80 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

Sl. No.	Adjustments/Defects/Breakdowns and Repairs	Categories of Breakdowns	Tractor run hours
--None--			

17. SUMMARY OF OBSERVATIONS, COMMENTS & RECOMMENDATIONS

17.1 Evaluative (mandatory) / Non-evaluative (Non-mandatory) parameters applicable for qualifying Minimum Performance criteria as per Clause-4 (Table-1) of IS: 12207-2014 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: 12207-2014	Values declared by the applicant (D) / Requirement(R)	As observed	Whether meets the requirements (Yes/No.)
1	2	3	4	5	6	7
17.1.1	**PTO Performance :**					
a)	Maximum power under 2 h test, (kW) (Natural ambient condition)	Evaluative	Declared value to be achieved with a tolerance of: -5 / +10% for PTO power >26 kW. –7.5/+10% for PTO power ≤ 26 kW or-5 / +10% for Engine power >26 kW. –7.5/+10% for Engine power ≤ 26 kW	28.18 (D)	28.2	Yes
b)	Power at rated engine speed, (kW)	Non Evaluative	-do-	28.18 (D)	28.2	Yes
c)	Specific fuel consumption corresponding to maximum power, (g/kWh)	Non Evaluative	+ 5%	265 (D)	261	Yes
d)	Maximum equivalent crankshaft torque, (Nm)	Non Evaluative	± 8%	167 (D)	166.1	Yes
e)	Back-up torque, percent	Non Evaluative	10 percent, min.	10 percent, min (R)	23.4	Yes
f)	**Maximum operating temperature, (^{o}C)**					
	1) Engine oil	Non 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)	99	Yes
	2) Coolant (water)	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.	115 (118)	94	Yes
g)	Engine oil consumption, (g/kWh)	Evaluative	Not exceeding 1% of SFC at max. power under High ambient conditions	2.61 (R) 1% of SFC (D)	0.37	Yes
h)	Smoke level	Evaluative	Maximum light absorption coefficient of 3.25 per meter or equivalent BOSCH No. 5.2 or 75 Hatridge value (As per CMVR)	3.25 per meter (R)	0.24	Yes

1	2	3	4	5	6	7
17.1.2	**Drawbar performance :**					
a)	Max. drawbar pull with ballast corresponding to 15 percent wheel slip, (kN)	Non Evaluative	Minimum 65% of static mass with ballast	18.0 (D) 18.07 (R) Minimum	21.80	Yes
b)	Maximum drawbar pull without ballast corresponding to 15 percent wheel slip, (kN)	Evaluative	Minimum 65% of static mass of tractor without ballast	13.0 (D) 12.88 (R) Minimum	15.30	Yes
c)	Maximum drawbar power without ballast, (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.	23.0 (D) 22.6 (R) Minimum	24.6	Yes
d)	Max. transmission oil temperature (°C)	Non Evaluative	The declared value should not exceed the maximum value specified by oil company	110 (D)	75.0	Yes
17.1.3.	**Power lift and hydraulic pump performance :**					
a)	Maximum lifting capacity throughout the range of lift, (kN):					
	1) At hitch points	Non Evaluative	[Tolerance of minus 10%]	14.71 (D)	17.45	No
	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	10.78 (D) 6.64 (R) (Minimum)	11.51	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	Observed value should not exceed 50 mm.	50 (D) 50 (R)	31	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 road ballast, (m):					
	1) Cold brake	Evaluative	10	10 (R)	8.81	Yes
	2) Hot brake	Evaluative	10	10 (R)	9.39	Yes
b)	Maximum force exerted on the brake pedal to achieve a deceleration of 2.5 m/s^2 (N)	Evaluative	600	600 (R)	473 to 518	Yes

1	2		3	4	5	6	7
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)	444	Yes
17.1.5	**Noise measurement:**						
a)	Maximum ambient noise emitted by the tractor dB(A)		Evaluative	As per CMVR	88 (R)	81	Yes
b)	Maximum noise at operator's ear level dB(A)		Evaluative	As per CMVR	96 (R)	93	Yes
17.1.6	**Amplitude of mechanical vibrations at :**						
	1)	Left foot rest	Non Evaluative	100 microns (max)	100 (R)	210	**No**
	2)	Right foot rest				240	**No**
	3)	Seat (with driver seated)	Non Evaluative	100 microns (max)	100 (R)	130	**No**
	4)	Steering Wheel	Non Evaluative	100 microns (max)	100 (R)	180	**No**
17.1.7	**Air Cleaner**						
	Max. oil pull over, (%)		Non Evaluative	0.25% (max.)	0.25% (max.)	0.10	Yes
17.1.8	**Haulage requirements :**						
a)	Gross mass of the trailers, (tones):						
	1)	Two wheel	Non Evaluative	--	5.0 (D)	6.0	Yes
	2)	Four wheel		--	6.0 (D)	6.0	Yes
b)	Distance travelled / litre of fuel consumption, (km/l):						
	1)	Two wheel	Non Evaluative	--	4.0 to 5.0 (D)	5.0	Yes
	2)	Four wheel		--	5.0 to 6.0 (D)	4.9 to 5.0	**No**
c)	Fuel consumption (cc/km/tonne):						
	1)	Two wheel	Non Evaluative	--	30 to 40 (D)	39.7 to 40.4	**No**
	2)	Four wheel		--	30 to 40 (D)	33.2 to 33.8	Yes
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	No ingress of water and/or mud was observed	Yes
	1)	Clutch assembly	-do-				
	2)	Brake housings	-do-				
	3)	Front axle hubs	-do-				
	4)	Engine oil	-do-				
	5)	Transmission oil	-do-				

1	2	3	4	5	6	7
17.1.10	**Safety features :**					
a)	Guards against moving and hot parts	Evaluative	Belt drives, pulley, silencer, hydraulic pipes (As per IS 12239 part 2)	--	Meets the requirement	Yes
b)	Lighting arrangement	Evaluative	As per CMVR	--	Meets the requirement	Yes
c)	Seating requirement (Tractors having more than 1150 mm rear track width)	Non-Evaluative	Should meet the requirements of IS 12343 (as amended from time to time)	--	Meets the requirement	Yes
d)	Technical requirements for PTO shaft	Non-Evaluative	Should meet the requirements of IS 4931 (as amended from time to time)	--	Meets the requirement	Yes
e)	Dimension of three point linkage	Non-Evaluative	Should meet the requirements of IS 4468 (part 1) (as amended from time to time)	--	Does not meet the requirement	**No**
f)	Specification of linkage and swinging drawbars	Non-Evaluative	Should meet the requirements of IS 12953 and IS 12362 (part 3) (as amended from time to time)	--	Meets the requirement	Yes

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 HP	SWARAJ	Yes
	2)	Model	Evaluative		742 FE	Yes
	3)	Year of manufacture	Evaluative		WY (i.e. 2016)	Yes
	4)	Engine number	Evaluative		42.1001/SWG13096	Yes
	5)	Chassis number	Evaluative		WYCH92606100001	Yes
	6)	Declaration of PTO power, (kW)	Evaluative		28.18	Yes

17.1.12	**Discard limit for:**						
(a)	Cylinder bore diameter, (mm)	Evaluative	To be specified by the manufacturer	110.225 (D)	109.972 to 109.985	Yes
(b)	Clearance between piston & cylinder liner at skirt, (mm)	Non Evaluative		0.60	0.100 to 0.115	Yes
(c)	**Ring end gap (mm):**					
	- Top comp. ring	Evaluative	-do-	1.75	0.55	Yes
	- 2nd comp. ring		-do-	1.75	0.35 to 0.40	Yes
	- Oil ring		-do-	1.75	0.30 to 0.40	Yes
(d)	**Ring groove clearance (mm):**					
	- Top comp. ring	Evaluative	---Tappered---			--
	- 2nd comp. ring		-do-	0.25	0.079 to 0.086	Yes
	- Oil ring		-do-	0.25	0.078 to 0.079	Yes

1	2	3	4	5	6	7
(e)	**Clearance of main bearings (mm):**					
	- Diametrical clearance	Evaluative	-do-	0.30	0.088 to 0.112	Yes
	- Crankshaft end float	Evaluative		0.50	0.20	Yes
(f)	**Clearance of big end bearings, (mm):**					
	- Diametrical	Evaluative	-do-	0.30	0.100 to 0.129	Yes
	- Axial	Evaluative	-do-	0.60	0.30	Yes
(g)	Clearance between king pin and bush, (mm)	Non Evaluative	-do-	0.60	0.098 to 0.105	Yes
(h)	Clearance between centre pin and bush, (mm)	Non Evaluative	-do-	0.80	0.121 to 0.139	Yes
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

17.1.14	**CATEGORY OF BREAKDOWNS / DEFECTS :**				
S. No.	**Category of breakdowns**	**Category (Evaluative / Non Evaluative)**	**Requirements as per IS: 12207-2014**	**As observed**	**Whether meets the require-ments (Yes/No.)**
1.	Critical	Evaluative	No critical breakdown	None	Yes
2.	Major	Evaluative	Not more than two and neither of them should be repetitive in nature	None	Yes
3.	Minor	Evaluative	Not more than five and frequency of each should not be more than two.	None	Yes
4.	Total breakdowns	Evaluative	In no case, the total number of breakdowns should exceed five, that is, (2 major + 3 minor) or 5 minor breakdowns.	None	Yes

17.2	**Optional requirements as per Clause-4 (Table-2) of IS:12207-2014:**			
S. No.	**Characteristic**	**Requirements as per IS: 12207-2014**	**As observed**	**Whether meets the require-ments (Yes/No.)**
1.	Fitment of ROPS	With a provision for fitment of ROPS.	Not provided	**No**
		If ROPS fitted it should meet the requirement of IS: 11821-1992	Not provided	Not applicable
2.	Accessories	Trailer hitch, front tow hook, linkage drawbar may be provided.	Provided	Yes

17.3 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 2009)]	:	Conforms
ii)	Agricultural tractors - Rear mounted power take-off - Types 1, 2 and 3 (third revision) [IS:4931-1995 (Reaffirmed 2009)]	:	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 2009)]	:	**Does not conform**
iv)	Drawbar for agricultural tractors – Link type [IS 12953:1990 (Reaffirmed 2007)]	:	Conforms
v)	Agricultural tractors - Operator's seat technical requirement [IS 12343 –1998 (First revision) (Reaffirmed 2009)]	:	Conforms
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 2009)]	:	**Does not conform**
vii)	Tractors and machinery for agriculture and forestry – Technical means for ensuring safety Part 2: Tractors (first revision) (IS 12239 (PT-2) 1999) (Reaffirmed 2009)]	:	**Does not conform**
viii)	Guide lines for location and operation of operator controls on agricultural tractors and machinery (first revision) IS: 8133-1983 (Reaffirmed 2009)]	:	**Does not conform**
ix)	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 2009)]	:	Conforms
x)	Agricultural Tractors and Machinery - Lighting device for travel on public roads (IS: 14683-1999) (Reaffirmed 2009)]	:	Conforms

17.4 Salient Observations:

17.4.1 Laboratory tests:

17.4.1.1 PTO Performance Test:

i) The maximum PTO power was recorded as **28.2 kW** against the declaration of **28.2 kW,** which meets the requirement of IS: 12207-2014 with regard to tolerance limit.

ii) The specific fuel consumption corresponding to maximum power was recorded as **261 g/kWh** against the declaration of **265 g/kWh**, which is within the tolerance limit of IS: 12207-2014.

iii) The maximum equivalent crankshaft torque was recorded as **166.1 N-m** against the declaration of **167.0 N-m**, which is within the permissible limit as specified in IS: 12207-2014.

iv) The backup torque is **23.4** %.

v) There is PTO power drop of **4.96 %** from natural to high ambient condition. This should be looked into for necessary corrective action.

17.4.1.2 Drawbar performance test:

i) During ten hours drawbar test creeping of RHS rear tyre over the rims was recorded as **15 mm**. This should be looked into for necessary corrective action.

17.4.1.3 **Hydraulic performance test:**

i) The moment about rear axle at lower hitch and with standard frame was calculated as **15.27 & 17.09 kN-m** respectively, whereas, the moment about front axle was calculated as **14.92 kN-m** under unballasted condition. The moment about rear axle is on higher side as compared to the moment about front axle under unballasted condition. It is, therefore, recommended that the lifting capacity of the hydraulic system may be reduced suitably or ballast recommendation may be reviewed to avoid the front lifting of the tractor.

17.4.1.4 **Mechanical Vibration:**

The amplitude of mechanical vibration on various assemblies marked as (*) in Chapter – 9 of this test report is on higher side. This calls for dampening down of vibrations especially on left & right foot rest, operator's seat and steering control wheel to improve the operational comfort and service life of components.

17.4.1.5 **PTO shaft:**

The dimension "AØ" of PTO shaft does not meet the requirement of the IS: 4931 - 1995. This should be looked into for necessary corrective action.

17.4.1.6 **Three point linkage:**

The dimension of lateral distance from lower hitch point to centre line of tractor does not meet the requirement of IS: 4468 -1997 (Part-1). 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) There should be provision for spark arresting device in exhaust system.
ii) There should be provision of differential lock.
iii) The fuel shut-off knob should remain in stop position.
iv) The working clearance between the position and draft control lever should be provided as per IS: 12239 (Part-2) – 1999.

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

17.7.1 Literature was supplied with the tractor for reference during the test.

a) Operator's manual of tractor model **SWARAJ 742 FE**.
b) Parts catalogue of tractor model **SWARAJ 742 FE**.
c) Service Manual of tractor model **SWARAJ 742 FE**.

17.7.2 The supplied literature was found adequate; except the following

a) Oil grade recommended in operator's manual for steering system does not match with specifications submitted by applicant.

However, these literatures should also be brought out in other vernacular languages of India for guidance of users

18. Citizen charter

Duration of Test	Time frame for testing & evaluation as per citizen charter	Whether the report released within time frame given in the citizen charter	Remark
08 Months (March, 2017 to October, 2017)	10 Months	Yes	--

TESTING AUTHORITY:

RAJNEESH PATEL
AGRICULTURAL ENGINEER

Y.K.RAO
SENIOR AGRICULTURAL ENGINEER

J.J.R. NARWARE
DIRECTOR

The report compiled by: Shri **Rajneesh Patel**, Agricultural Engineer.

19. APPLICANT'S COMMENTS

Para No.	Our Reference	Applicant's comments
19.1	1.20.3, 1.20.4, 1.20.5 (i), 17.6	This requirement is being revisited for necessary corrective action at our end.
19.2	17.3 (iii), (vi), (vii) & (viii)	Study & trials are under progress for necessary corrective action.
19.3	17.4.1.1 (v), 14.7.1.2 (i), 17.4.1.3, 17.4.1.4, 17.4.1.5 & 17.4.1.6	These requirements are being revisited for necessary corrective action at our end.
19.4	17.7.2	Literatures are already printed in all regional language for end user and necessary corrective action will be incorporated.

ANNEXURE- I

BRIEF SPECIFICATION OF IMPLEMENTS USED DURING FIELD TEST

S. No.	Parameters	Disc Plough	Rotavator	Puddler
1	Make	Fieldking	ACE	Not available
2	Type	Mounted	Mounted	Mounted
3	No. of Discs / Blades	Three	36 in 7 flanges	10 (5 in 2 gangs)
4	Type of Discs / Blades	Plain concave	Hatchet	Notched concave
5	Size of Discs / Blades (mm)	250	130 x 115 x 7	450
6	Spacing of Discs /Flanges, (mm)	510	210	170
7	Lower hitch point span, (mm)	825	750	700
8	Mast height, (mm)	570	640	395
9	Overall Dimensions (mm):			
	Length	2010	620	1300
	Width	1385	1760	2492
	Height	1200	1130	1230
10	Gross Mass, (Kg)	350	345	245

ANNEXURE-II

BRIEF SPECIFICATION OF HALF CAGE WHEEL

S. No.	Parameters	Specification
1	Type	Half cage wheel
2	Outer dia. (mm)	1055
3	Width (mm)	350
4	No. & Type of Lugs	12, straight lugs made of MS angle section welded to angle iron frame
5	Size of angle section, (mm)	50 x 50 x 3
6	Length of lug, (mm)	350
7	Spacing of lug, (mm)	280
8	Weight of each cage wheel (kg)	50

ANNEXURE - III

TRACTOR RUN HOURS DURING TEST

A.	LABORATORY AND TRACK TESTS:	HOURS
1.	Running-in	--
2.	PTO performance test	10.84
3.	Power lift and hydraulic pump performance test	3.75
4.	Drawbar performance test	14.39
5.	Turning ability	0.20
6.	Location of centre of gravity	0.20
7.	Operator's field of vision	Nil
8.	Brake test	2.73
9.	Noise measurement	1.50
10.	Mechanical vibration test	0.83
11.	Nominal speed test	1.41
12.	Air cleaner oil pull over test	3.5
B.	FIELD TEST:	
1.	Disc ploughing	10.99
2.	Rotavation	10.43
3.	Puddling (including 5.0 hours water proof test)	15.39
C.	HAULAGE TEST:	5.54
D.	Miscellaneous test and other run hours including idle run, transportation, trials and preparation for test	9.97
	TOTAL:	91.67