



**MITSUBISHI SHAKTI MT 180 D TRACTOR**



भारत सरकार

**GOVERNMENT OF INDIA**

कृषि मंत्रालय (कृषि एवं सहकारिता विभाग, मशीनीकरण एवं प्रोद्योगिकी प्रभाग)

Ministry of Agriculture (Deptt. of Agri. & Co-op, Mechanization & Technology Division)

**केन्द्रीय कृषि मशीनरी प्रशिक्षण एवं परीक्षण संस्थान**

**CENTRAL FARM MACHINERY TRAINING & TESTING INSTITUTE**

**(An ISO : 9001-2008 Certified Institute)**

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T- 902/1417/2014

**MITSUBISHI SHAKTI MT 180 D TRACTOR -  
Commercial (Batch) Test**

**Manufacturer** : M/s. VST Tillers Tractors Limited  
P.B. No 4801, Mahadevpura Post,  
White Field Road,  
Bangalore-560048

Test requested by : The manufacturer  
Place of running-in : CFMT&TI, Budni  
Duration of said running-in, (h):  
- Engine : 10  
- Transmission : 10

**Method of Selection** : The test sample was selected randomly out of Five tractors from the production line by the representative of testing authority.

**1. SPECIFICATIONS**

**1.1 Tractor:**  
Make : Mitsubishi Shakti  
Model : MT 180D  
Brand name : NA  
Variants. If any: NONE  
Type : Four wheeled ,Four wheel drive, unit construction, general purpose agricultural tractor

Year of manufacture : 2012  
Chassis number : T12L 038186  
Country of origin : India

**1.2 Engine:**  
Make : Mitsubishi Shakti  
Model : K 3 C  
Type : Four Stroke, Water cooled, Vertical Inline, Indirect injection, naturally aspirated , diesel engine

Serial number : C12L 039731  
Country of origin : India

**1.2.1 Engine speed (rpm), (Manufacturer's recommended production setting),:**  
- Maximum speed at no load : 2900± 25  
- Low idle speed : 800± 50  
- Speed at maximum torque : 2050

**Rated speed, (rpm):**  
- For PTO use : 2700  
- For drawbar use : 2700

**1.3 Cylinder & Cylinder Head:**  
Number : 3  
Disposition : Vertical inline  
Bore/stroke, (mm) : 70/78  
Capacity as specified by the applicant, (cc) : 900.51  
Compression ratio : 23 :1  
Type of cylinder head : Monoblock



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Type of cylinder liners : Wet, Non-replaceable  
Type of combustion chamber : In direct injection  
Arrangement of valves : Overhead inline

**Valve clearance (cold/hot):**  
- Inlet valve, (mm) : 0.25  
- Exhaust valve, (mm) : 0.25

**1.4 Fuel System:**  
Type of fuel feed system : Gravity

**1.4.1 Fuel tank:**  
Capacity, (l) : 17.9  
Location : Above clutch housing  
Provision for draining of sediments/ water : None  
Material of fuel tank : Metallic  
: Not provided

**1.4.2 Fuel feed pump:**

**1.4.3 Fuel filters:**  
Make : Bosch  
Model/Group combination No. : F 002H 20108  
Number : One  
Type of elements : Paper  
Capacity of final stage filter, (l) : 0.400

**1.4.4 Fuel Injection pump:**  
Make : Bosch  
Model/Group combination No. : 9410 030 523  
Type : Inline Plunger  
Serial number : Not Available  
Method of drive : Through cam shaft gear

**1.4.5 Fuel injectors:**  
Make : Bosch  
Model : 0431 211 013/HB  
Type : Pintle  
Manufacturer's production pressure : 11.77+0.98  
setting, (MPa) : 21 degree BTDC  
Injection timing : 1-3-2  
Firing order

**1.4.6 Governor:**  
Make : VST (apa)  
Model/Group combination No. : NA  
Type : Mechanical, centrifugal variable speed  
Governed range of engine speed, (rpm) : 800 to 2925

**1.5 Air intake system:**

**1.5.1 Pre-cleaner:**  
Make : VST (apa)  
Type : Centrifugal with transparent dust collector.  
Location : Above main air cleaner inlet tube, outside the bonnet in RHS

**1.5.2 Air cleaner:**  
Make : VST  
Type : Oil bath



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**Previous Sample**

- iii) The noise at operator's ear level is 100 dB (A) which was higher than the warning/danger limits of 90 dB (A) .
- iv) The amplitude of mechanical vibration on various assemblies marked as (\*) in Chapter-9 of test report No T-376/782 were on higher side. This calls for dampening down of vibrations to improve the operational comfort and service life of components.

**13.4 Adequacy of literature:**

- i) The following literature was supplied with the tractor for reference during the test.
- a) Owner's manual
- b) Spare Parts Catalogue
- c) Workshop/Service manual for K3C Model Engine
- ii) It is, however, recommended that operator's manual be revised/updated as per IS: 8132-1999.

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**Present Sample**

The noise at operator's ear level is 93 dB (A) which is under the limits of 98 dB (A)/

The amplitude of mechanical vibration on various assemblies marked as (\*) in Chapter-9 of this test report are on higher side. This calls for dampening down of vibrations to improve the operational comfort and service life of components.

The following literature was supplied with the tractor for reference during the test.

- a) Operation & 's Maintenance owner's manual
- b) Spare Parts Catalogue
- c) Workshop /Instruction manual

The revised literature supplied was found adequate. However, the following points needs to be incorporated in owner's/operator's manual.

- i) Details of all variants along with their features at a glance should be provided in the operator's manual.

These literatures may also be brought out in National & other regional languages for guidance of user's.

**14. SUMMARY OF OBSERVATIONS, COMMENTS & RECOMMENDATIONS**

14.1 Evaluative (mandatory) / Non-evaluation (Non-mandatory) parameter applicable for qualifying Minimum Performance criteria as per Clause-4 (Table-1) of IS: 12207-2008 for acceptance of the tractor for the purpose of subsidies/NABARD financing are summarized as under:

Sl. No.	Characteristic	Category (Evaluative / Non Evaluative)	Requirements as per IS: 12207-2008	Values declared by the applicant/ (D) Requirement (R)	As observed	Whether meets the requirements (Yes/No.)
1	2	3	4	5	6	7
<b>14.1.1</b>	<b>PTO Performance :</b>					
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 >35hp. -7.5/+10% for PTO power ≤ 35 hp	10.3 (D)	10.0	Yes
b)	Power at rated engine speed, (kW)	Non Evaluative	-do-	10.3 (D)	10.0	Yes
c)	Specific fuel consumption corresponding to maximum power, (g/kWh)	Non Evaluative	+ 5%	355 (D)	341	Yes



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1	2	3	4	6	7		
d)	Maximum equivalent crankshaft torque, (Nm)	Non Evaluative	± 8%	45.5 (D) 37.1	No		
e)	Back-up torque, percent	Non Evaluative	7 percent, min.	9.4 (D) 5.1	NO		
f)	<b>Maximum operating temperature, (°C)</b>						
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)	117	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.	120 (D)	109	Yes	
g)	Engine oil consumption, (g/kWh)	Evaluative	Not exceeding 1% of SFC at max. power under High ambient conditions	3.41 (R)	0.23	Yes	
h)	Smoke level	Evaluative	Maximum light absorption coefficient of 3.25 per metre or equivalent BOSCH No. 5.2 or 75 Hatridge value (As per CMVR)	3.25 per metre (R)	0.58	Yes	
<b>14.1.2</b>	<b>Drawbar performance :</b>						
a)	Maximum drawbar pull with ballast corresponding to 15 percent wheel slip, (kN)	Non Evaluative	Minimum 65% of static mass with ballast	Ballasting not recommended by the manufacturer	---	---	
b)	Max. drawbar pull with standard ballast corresponding to 15 percent wheel slip, (kN)	Evaluative	Minimum 65% of static mass of tractor without ballast	5.45 (R)	6.8 (Minimum) (D)	7.03	Yes
c)	Maximum drawbar power with standard ballast, (kW).	Evaluative	Min. 80% of PTO power as referred in 15.1.1 (a) of PTO performance	8.0 (R)	10.4 (Minimum) (D)	8.8	Yes
d)	Maximum transmission oil temperature (°C)	Non Evaluative	The declared value should not exceed the maximum value specified by oil company	120 (D)	86	Yes	



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1	2	3	4	5	6	7
<b>14.1.3</b>	<b>Power lift and hydraulic pump performance :</b>					
a)	Maximum lifting capacity throughout the range of lift, (kN):					
1)	At hitch points	Non Evaluative	[Tolerance of minus 10%]	5.63 (D)	4.14	No
2)	With the standard frame	Evaluative	The lift capacity should at least be 18 kg/PTO hp. and it should be 16 kg/engine hp where the tractor is not provided with a PTO shaft	2.3 (R) (Minimum)	2.93	Yes
				3.99 (D)		
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 Minutes, (mm)	Non Evaluative	[Tolerance of plus 5 mm]	4.0 (D)	0	Yes
<b>14.1.4</b>	<b>Brake performance at Max. Attainable speed (14.5) kmph:</b>					
a)	Maximum stopping distance at a force, equal to or less than 600 N on brake pedal with Std.ballast, (m):					
1)	Cold brake	Evaluative	10	10 (R)	3.30	Yes
2)	Hot brake	Evaluative	10	10 (R)	3.25	Yes
b)	Maximum force exerted on the brake pedal to achieve a deceleration of 2.5 m/s <sup>2</sup> (N)	Evaluative	600	600 (R)	168 to 189	Yes
c)	Whether parking brake is effective at a force of 600 N at foot pedal(s) or 400 N at hand lever	Evaluative	Yes / No	Yes (R)	Yes	Yes
<b>14.1.5</b>	<b>Noise measurement :</b>					
a)	Maximum ambient noise emitted by the tractor dB(A)	Evaluative	As per CMVR	88 (Maximum) (R)	79	Yes
b)	Maximum noise at operator's ear level dB(A)	Evaluative	As per CMVR	98 (Maximum) (R)	93	Yes
<b>14.1.6</b>	<b>Amplitude of mechanical vibrations at :</b>					
1)	Left foot rest	Non Evaluative	100 microns (max)	100 (Maximum) (R)	180	No
2)	Right foot rest				180	No
3)	Seat (with driver seated)				160	No
4)	Steering Wheel				160	No
<b>14.1.7</b>	<b>Haulage requirements :</b>					
a)	Gross mass of the trailers, (tones):					
1)	Two wheel	Non Evaluative	--	3.0 (D)	3.0	Yes
2)	Four wheel					
				Not Recommended	--	--



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1	2	3	4	5	6	7
b)	Distance travelled / litre of fuel consumption, (km/l):					
1)	Two wheel	Non Evaluative	--	6.0 (D)	4.96 to 5.01	No
c)	Fuel consumption (ml/km/tonne):					
1)	Two wheel	Non Evaluative	--	58.0 (D)	66.49 to 67.0	No
<b>14.1.8</b>	<b>Wetland cultivation :</b>					
	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.		As per clause 7.2 of IS: 12207-2008, the field test during the batch testing of this tractor model was not conducted.	...
1)	Clutch assembly	-do-				
2)	Brake housings	-do-				
3)	Front axle hubs	-do-				
<b>14.1.9</b>	<b>Safety features :</b>					
a)	Guards against moving and hot parts	Evaluative	As per CMVR	At present no requirements	provided	Yes
b)	Lighting arrangement	Evaluative	As per CMVR	--	Provided	Yes
<b>14.1.10</b>	<b>Labelling of tractors (Provision of labelling plate):</b>					
1)	Make	Evaluative	Should conform to the requirements of CMVR along with declared value of PTO HP	--	Mitsubishi Shakti	Yes
2)	Model	Evaluative		--	MT 180 D	Yes
3)	Year of manufacture	Evaluative		--	2012	Yes
4)	Engine number	Evaluative		--	C 12 L-039731	Yes
5)	Chassis number	Evaluative		--	T 12 L-038186	Yes
6)	Declaration of PTO power, kW	Evaluative		--	10.3	Yes
<b>14.1.11</b>	<b>Discard limit for:</b>					
a)	Cylinder bore diameter, (mm)	Evaluative	To be specified by the manufacturer	70.950	70.02 to 70.03	Yes
b)	Clearance between piston & cylinder liner at skirt, (mm)	Non Evaluative		0.30	0.112 to 0.138	Yes
c)	<b>Ring end gap (mm):</b>					
-	Top comp. ring.	Evaluative	-do-	1.5	0.25 to 0.30	Yes
-	2 <sup>nd</sup> comp. ring.		-do-	1.5	0.30 to 0.35	Yes
-	3 <sup>rd</sup> comp. ring.		-do-	1.5	0.30 to 0.35	Yes
-	Oil ring.		-do-	1.5	0.20 to 0.25	Yes



d)	Ring groove clearance (mm):					
	- Top comp. ring.	Evaluative	-do-	..	Tapped	...
	- 2 <sup>nd</sup> comp. ring.		-do-	0.30	0.058 to 0.060	Yes
	- 3 <sup>rd</sup> comp. ring.		-do-	0.30	0.060 to 0.064	Yes
	- Oil ring.		-do-	0.20	0.062 to 0.068	Yes
e)	Clearance of main bearings (mm):					
	- Diametrical clearance	Evaluative	To be specified by the manufacturer	0.10	0.069 to 0.080	Yes
	- Crankshaft end float	Evaluative		0.50	0.40	Yes
f)	Clearance of big end bearings, (mm):					
	- Diametrical	Evaluative	-do-	0.15	0.057 to 0.068	Yes
	- Axial	Evaluative	-do-	0.50	0.35 to 0.40	Yes
g)	Clearance between king pin and bush, (mm)	Non Evaluative	-do-	1.25	0.093 to 0.104	Yes
h)	Clearance between centre pin and bush, (mm)	Non Evaluative	-do-	1.0	0.078 to 0.082	Yes

14.1.12 ACCEPTANCE CRITERIA IN CASE OF BREAKDOWNS / DEFECTS :

S. No.	Category of breakdowns	Category (Evaluative / Non Evaluative)	Requirements as per IS: 12207-2008	As observed	Whether meets the requirements (Yes/No.)
1	2	3	4	5	6
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

14.1.13 Optional requirements as per Clause-4 (Table-2) of IS:12207-2008:

S. No.	Characteristic	Requirements as per IS: 12207-2008	AS observed	Whether meets the requirements (Yes/No.)
1.	Maximum oil pull over, (%)	0.25% (max.)	0.20	Yes
2.	Seating requirements	Should meet the requirements of IS: 12343-1998	Does not meet the requirements	No
3.	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	ROPS not fitted	---



4.	Technical requirements for PTO shaft	Should meet the requirements of IS: 4931 -1995	Does not meet the requirements	No
5.	Dimensions of three point linkage	Should meet the requirements of IS: 4468 (Part-I)-1997	Does not meet the requirements	No
6.	Specifications of linkage drawbar	Should meet the requirements of IS: 12953-1990.	Does not meet the requirements	No
	Specification of swinging drawbar	Should meet the requirements of IS: 12362 Part 3-1994.	Not provided	--
7.	Accessories	Trailer hitch, front tow hook, linkage drawbar may be provided.	Front tow hook not provided	No

14.1.14 Conformity with following IS:

- i) Guidelines for declaration of power and specific fuel consumption and labeling of agricultural tractors (First revision) [IS 10273:1987 (Reaffirmed in March, 2009)] : Conforms
- ii) Agricultural tractors - Rear mounted power take-off - Types 1, 2 and 3(third revision)[IS: 4931-1995 (Reaffirmed in March, 2009)] : Does not conform
- iii) Agricultural wheeled tractors - Rear mounted three-point linkage: Part 1 Categories 1, 2, 3 & 4 (fourth revision) [IS 4468 (Part-I):1997 (Reaffirmed in March, 2007)/ISO 730-1:1994] : Does not conform
- iv) Drawbar for agricultural tractors - Link type [IS 12953:1990 (Reaffirmed in March, 2007)] : Does not conform
- v) Agricultural tractors - Operator's seat technical requirement [IS 12343 -1998 (First revision) (Reaffirmed in March, 2009)] : Does not conform
- vi) Guide for safety & comfort of operator of agricultural tractors: Part 1 General requirements (first revision) : [IS 12239 (PT-1)-1996 (Reaffirmed in March, 2009)/ISO 4254-1:1989] : 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 in March, 2009)] : Does not conform
- viii) Tractors and machinery for agriculture and forestry, powered lawn and garden equipment - Symbols for operator controls and other displays [IS: 6283 (Part-1 & Part-2) -2006 & 2007(Reaffirmed in March, 2009)/ ISO 3767-2:1991] : Does not conform
- ix) Guide lines for location and operation of operator controls on agricultural tractors and machinery (first revision) (IS: 8133 - 1983) (Reaffirmed in March, 2009)] : Conforms
- x) Agricultural Tractor & Machinery Lighting device for travel on public roads (IS: 14683-1999) (Reaffirmed in March, 2009)] : Conforms



14.2 Salient Observations:

14.2.1 Laboratory tests:

14.2.1.1 PTO Performance:

- i) The backup torque is. 5.05 % against the requirements of minimum 7 % This should be looked in to.
- ii) The specific fuel consumption corresponding to maximum power was measured as 341 g/kWh against the declaration of 355 g/kWh, which is within the tolerance limit of IS: 12207-2008.

14.2.1.2 Hydraulic performance

- i) Maximum lifting capacity throughout the range of lift, at drawbar hitch point was observed as 4.14 (kN) against the declared value of 5.63 (kN) & which is towards lower way so it need to be corrected.
- ii) The angle through which the mast rotates over the full range of lift was observed as 6.2 degree against the requirements of 10 degrees as per IS 12224 - 1987

14.2.1.3 Mechanical Vibration:

The amplitude of mechanical vibration on various assemblies marked as (\*) in Chapter-9 of this test report is on higher side, especially at foot rest, Steering control wheel, mud guard , clutch pedal, brake pedal , accelerator levers and hydraulic control lever. This calls for dampening down of vibrations to improve the operational comfort and service life of components.

14.2.1.4 Haulage requirements :

- i) Distance travelled / liter of fuel consumption, (km/l) was observed as 4.96 to 5.01 against the declaration of 6.0 which is need for corrective actions.
- ii) Specific Fuel consumption (ml/km/tonne) was observed as 66.49 to 67.0 against the declaration of 58.0 (D) which is need for corrective actions.

14.2.1.5 Power take off shaft :

- i) The dimension d?of power take off shaft and some dimension of its shield do not meet the requirements of IS 4931-1995. This should be looked in to.

14.2.1.6 Three point linkage:

- i) The width & dia. of ball for lower hitch point & dia. of upper pin whole do not meet the requirements of IS 4468 (Part 1) 1998

14.2.1.7 Linkage drawbar :

- i) Many dimensions of linkage drawbar do not meet the requirements of IS: 12953-1990 should be looked in to.

14.2.1.8 Wear assessment :

Backlash between crown wheel and pinion was not specified by the manufacturer. This should be looked in to.

14.3 Maintenance / Service Problems:

The engine lubricating oil and transmission/hydraulic oil change period after first service has been illustrated as after each 100 and 200 hrs respectively for engine oil and transmission oil. This change period may be re-examined as the lubricants used nowadays requires longer change periods.

14.4 Recommendation with regard to safety on tractor:

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

- i) The width of seat, its inclination towards rear direction is less and no vertical adjustment for the operator's seat is provided.



- ii) Vertical distance of steering control wheel from SIP is less.
- iii) Provision for spark arresting device in exhaust system.
- iv) The full width of rear wheels of tractor is not fully guarded by the mud guard, the rear mudguards should be re designed/improved to enhance the safety

14.5 Adequacy of Literature supplied with machine:

The following literature has been supplied by the applicant.

- i) Instruction manual
  - ii) Service log book
  - iii) Part's catalogue
  - iv) As per instruction manual manufacture recommends about steering gear box oil needs not to change periodically and replaced on overhauling which should be re-examined., as no overhauling period is mentioned in the manual and lubricating oil needs to change periodically as per its chemical nature.
- 14.5.1
- i) The service manual should be developed illustrating all the aspects of service/repair limits and process
  - ii) The literature should also be developed in other regional languages

15.0 Citizen charter

Duration of Test	Test duration under citizen charter	Whether the report released within time frame given in the citizen charter	Remark
March 2013 to November 2013 9 Months	10 Months	Yes	--

TESTING AUTHORITY:

*P.K. Verma*  
P.K.VERMA  
SENIOR AGRICULTURAL ENGINEER

*C.R. Lohi*  
C.R.LOHI  
DIRECTOR

Test report compiled by Shree Nitesh Kumar Verma