



**FORCE MOTORS LIMITED,
BALWAN 550 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

CENTRAL FARM MACHINERY TRAINING & TESTING INSTITUTE

(An ISO : 9001 - 2015 Certified Institute)

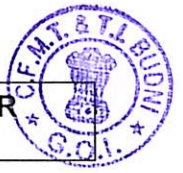
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T-1136/1662/2018

**FORCE MOTORS LIMITED , BALWAN 550 TRACTOR
Commercial (First Batch) Test**

Manufacturer : M/s. Force Motors Ltd.
Mumbai - Pune Road
Akurdi, PUNE (M.S.) - 411 035

Test requested by : M/s. Force Motors Ltd.
Mumbai - Pune Road
Akurdi, PUNE (M.S.) - 411 035

Place of running-in : At manufacturer works place.

Duration of said running-in, (h):

- Engine : 30

- Transmission : 33

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

1. SPECIFICATIONS

- 1.1 Tractor:**
- Make : M/s. Force Motors Ltd.
- Model : BALWAN 550
- Brand, if any : None
- Type : Four wheeled, rear-wheel driven, unit construction, general purpose agricultural tractor.
- Chassis serial number : T23000301C17
- Year of manufacture : 2017
- Country of origin : India
- Variants if any : None
- 1.2 Engine:**
- Make : M/s Force Motors ltd.
- Model : TD 2600 F(50)
- Type : Four stroke, naturally aspirated, water, cooled, direct injection, diesel engine.
- Serial number : D08011103
- Year of manufacture : 2017
- 1.2.1 Engine speed(Manufacturer's recommended production setting), (rpm):**
- Maximum speed at no load : 2800-2900
- Low idle speed : 700-750
- Speed at maximum torque : 1500-1700
- Rated speed, (rpm):**
- For PTO use : 2600
- For drawbar use : 2600
- 1.3 Cylinder & Cylinder Head:**
- Number : Four
- Disposition : Vertical, Inline
- Bore/stroke, (mm) : 90.9/100.0



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: 12207-2014 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
14.1.1 PTO Performance :						
a)	Maximum power under 2 hours 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	33.0 (D)	33.2	Yes
b)	Power at rated engine speed, (kW)	Non Evaluative	-do-	33.0 (D)	33.2	Yes
c)	Specific fuel consumption corresponding to maximum power, (g/kWh)	Non Evaluative	+ 5%	265 (D)	268	Yes
d)	Maximum equivalent crankshaft torque, (Nm)	Non Evaluative	± 8%	145(D)	149.5	Yes
e)	Back-up torque, percent	Non Evaluative	10 percent, minimum (R)	10 (R)	22.7	Yes
f) Maximum operating temperature (°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)	110	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.	110 (D)	92	Yes
g)	Engine oil consumption, (g/kWh)	Evaluative	Not exceeding 1% of SFC at max. power under High ambient conditions	2.50 (R)	0.29	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)	1.81 per meter	Yes



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1	2	3	4	5	6	7	
14.1.2 Drawbar performance :							
a)	Maximum drawbar pull with ballast corresponding to 15 percent wheel slip, (kN)	Non Evaluative	Minimum 65% of static mass with ballast	23.5 (D)	25.62	Yes	
				21.67 (R)			
b)	Maximum drawbar pull without ballast corresponding to 15 percent wheel slip, (kN)	Evaluative	Minimum 65% of static mass of tractor without ballast	16.0 (D)	16.67	Yes	
				12.94 (R)			
c)	Maximum drawbar power without ballast, (kW).	Evaluative	Minimum 80 % of PTO power as referred in SI No. i) a) of PTO performance in case of tractors having total static mass > 1500 kg Minimum 75 % of PTO power as referred in SI 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 SI No. i) a) of engine performance in case of tractors which do not have a PTO shaft.	26.5(D)	27.9	Yes	
				26.6 (R)			
d)	Maximum transmission oil temperature (°C)	Non Evaluative	The declared value should not exceed the maximum value specified by oil company	130 (D)	109	Yes	
14.1.3 Power lift and hydraulic pump performance :							
a)	Maximum lifting capacity throughout the range of lift, (kN):			14.21 (D)	13.23	Yes	
	1)	At hitch points	Non Evaluative [Tolerance of minus 10%]	10.29 (D)	8.88	Yes	
	2)	With the standard frame	Evaluative The lift capacity should at least be 24 kg/PTO kW. and it should be 21.5 kg/engine kW where the tractor is not provided with a PTO shaft	7.81 (R)			
b)	Maximum drop in the height of the point of application of the force after each 5 minutes interval for a total duration of 30 minute, (mm)	Non Evaluative	The observed value should not exceed 50 mm	0 (D)	0	Yes	
14.1.4 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):			10 (R)	9.65	Yes	
	1)	Cold brake	Evaluative	10	10 (R)	9.65	Yes
		Hot brake	Evaluative	10			
b)	Maximum force exerted on the brake pedal to achieve a deceleration of 2.5 m/s ² (N)	Evaluative	600	600 (R)	557 to 571	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	



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1	2	3	4	5	6	7	
14.1.5	Noise measurement :						
a)	Maximum ambient noise emitted by the tractor dB(A)	Evaluative	As per CMVR	88 (R)	83	Yes	
b)	Maximum noise at operator's ear level dB(A)	Evaluative	As per CMVR	96 (R)	96	Yes	
14.1.6	Amplitude of mechanical vibrations at :						
			100 microns (max)	100 (R)	100	Yes	
1)	Left foot rest	Non Evaluative		100 (R)	60	Yes	
	Right foot rest		-do-	100 (R)	100	Yes	
2)	Seat (with driver seated)		-do-	100 (R)	200	No	
3)	Steering wheel						
14.1.7	Haulage requirements :						
a)	Gross mass of the trailers, (tones):			As specified by the manufacturer	5.5 (D)	5.5	Yes
1)	Two wheel	Non Evaluative	---	7.0 (D)	7.0	Yes	
2)	Four wheel						
b)	Distance travelled / litre of fuel consumption, (km/l):						
			--do--	4 to 5 (D)	4.35 to 4.38	Yes	
1)	Two wheel	Non Evaluative	--do--	4 to 5 (D)	3.87 to 3.90	No	
2)	Four wheel						
c)	Fuel consumption (ml/km/tonne):						
			--do--	30 to 40 (D)	41.5 to 41.8	No	
1)	Two wheel	Non Evaluative	--do--	30 to 40 (D)	36.6 to 36.9	Yes	
2)	Four wheel						
14.1.8	Wetland cultivation :						
	Sealing for the following assemblies:	Evaluative	The identified assemblies should essentially meet the requirement of IS: 11082. No water ingress in the identified assembly given in column-2. If tractor does not meet the requirements of wetland cultivation, it may be recommended for dry land operation only.	There should be no ingress of water and/or mud (R)	The manufacturer has recommended that the tractor is not suitable for wetland cultivation	No	
1)	Clutch assembly	-do-					
2)	Brake housings	-do-					
3)	Front axle hubs	-do-					
4)	Engine Oil	-do-					
5)	Transmission Oil	-do-					
14.1.9	Safety features :						
a)	Guards against moving and hot parts	Evaluative	As per CMVR	--	Meet the requirements	Yes	
b)	Lighting arrangement	Evaluative	----	--	Meet the requirements	Yes	
c)	Seating requirements (Tractors having more than 1150 mm rear track width)	Non Evaluative	Should meet the requirements of IS: 12343 (As amended from time to time)	--	Does not meet the requirements	No	



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1	2	3	4	5	6	7
d)	Technical requirements for PTO shaft	Non Evaluative	Should meet the requirements of IS: 4931 (As amended from time to time)	--	Meet the requirements	Yes
e)	Dimensions of three point linkage	Non Evaluative	Should meet the requirements of IS: 4468 (Part-I) (As amended from time to time)	--	Meet the requirements	Yes
f)	Specifications of linkage	Non Evaluative	Should meet the requirements of IS 12953 and IS 12362 (Part 3) (As amended from time to time)	--	Meet the requirements	Yes
	Swinging drawbar			--	Not Provided	---
14.1.10	Labelling of tractors (Provision of labelling plate):			--	FORCE MOTORS LTD.	Yes
	1) Make	Evaluative	Should conform to the requirements of CMVR along-with declared value of PTO HP	--	BALWAN 550	Yes
	2) Model	Evaluative		--	2017	Yes
	3) Year of manufacture	Evaluative		--	D08011103	Yes
	4) Engine number	Evaluative		--	T23000301C17	Yes
	5) Chassis number	Evaluative		--	33	Yes
	6) Declaration of PTO power, (kW)	Evaluative		--		
14.1.11	Discard limit for:			To be specified by the manufacturer	91.128	90.90 to 90.92
(a)	Cylinder bore diameter, (mm)	Evaluative		0.120	0.043 to 0.057	Yes
(b)	Clearance between piston & cylinder liner at skirt, (mm)	Non Evaluative	-do-			
(c)	Ring end gap (mm):			1.50	0.094 to 0.123	Yes
	- 1 st comp. ring.	Evaluative	-do-	1.50	0.079 to 0.088	Yes
	- 2 nd comp. ring.		-do-	1.50	0.013 to 0.019	Yes
	- Oil ring.		-do-			
Ring groove clearance (mm):				0.20	0.094 to 0.123	Yes
(d)	- 1 st comp. ring.	Evaluative	-do-	0.15	0.079 to 0.088	Yes
	- 2 nd comp. ring.		-do-	0.10	0.013 to 0.019	Yes
	- Oil ring.		-do-			
(e)	Clearance of main bearings (mm):			0.24	0.051 to 0.075	Yes
	- Diametrical clearance	Evaluative	-do-	0.50	0.15	Yes
(f)	Clearance of big end bearings, (mm):			0.24	0.053 to 0.074	Yes
	- Diametrical	Evaluative	-do-	0.50	0.15	Yes
	- Axial	Evaluative	-do-	1.5	0.055 to 0.080	Yes
	- Clearance between king pin and bush, (mm)	Non Evaluative	-do-	1.5	0.014 to 0.113	Yes
(g)	Clearance between king pin and bush, (mm)	Non Evaluative	-do-	1.5	0.014 to 0.113	Yes
(h)	Clearance between center pin and bush, (mm)	Non Evaluative	-do-			



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1	2	3	4	5	6	7
14.1.12	Literature (Submission to test agency)					
(a)	Operator manual	Evaluative	Provided/Not Provided	As per relevant IS-8132	Provided	Yes
(b)	Parts Catalogue	Evaluative	Provided/Not Provided		Provided	Yes
(c)	Workshop/ Service manual	Evaluative	Provided/Not Provided		Provided	Yes

14.1.13 CATEGORY OF BREAKDOWNS / DEFECTS :

S. No.	Category of Breakdown	Category (Evaluative / Non Evaluative)	Requirements as per IS: 12207-2014	As observed	Whether meets the requirement (Yes/No.)
1.	Critical breakdown	Evaluative	No critical breakdown	None	Yes
2.	Major breakdowns	Evaluative	Not more than two and neither of them should be repetitive in nature	One (Mj-22)	Yes
3.	Minor breakdowns	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	One (Mj-22)	Yes

14.2 Optional requirements as per Clause-4 (Table-2) of IS:12207-2014:

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

- 14.3 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] : **Conforms**
 - iv) Drawbar for agricultural tractors – Link type [IS 12953:1990 (Reaffirmed in March, 2007)] : **Conforms**



- 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) : Conforms
:[IS 12239 (PT-1)-1996 (Reaffirmed in March, 2009)/ISO 4254-1:1989]
- 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)] : Conforms
- 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

14.4 Salient Observations:

14.4.1 Laboratory tests:

14.4.1.1 PTO Performance:

- i) The backup torque is only **22.7%**.
- ii) The maximum power was recorded as **32.2 & 33.2 kW** in case of previous & present sample respectively against the declaration of **33.0 kW**, which meets the requirement of IS: 12207-2014 with regard to tolerance.

14.4.1.2 Hydraulic performance:

- i) The lifting capacity at standard frame was recorded as **8.88 kN** and the moment about the rear axle was computed as **13.11 kN-m**. The moment about rear axle is on higher side when compared to the moment about front axle i.e. **17.34 kN** under ballasted condition. It is therefore, recommended that the lifting capacity of the hydraulic system may be reduced suitably or additional standard ballast mass at front axle may be provided to avoid front lifting of the tractor.

14.4.1.3 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 the steering control wheel. This calls for dampening down of vibrations to improve the operational comfort and service life of components.

14.4.1.4 Air cleaner oil pull over test:

The Air cleaner oil pull over was recorded as **15.6 %** against the maximum limit of **0.25 %** which calls for the necessary improvement in the air intake system of the tractor.



- 14.4.1.5 Three point linkage:**
During the specification of three point linkage, the lift rod was set in fully closed position in the first hole of lower link from the articulated point of the tractor. As per dimensions requirement the lift arm should be lift fully to measure max height of lower link hitch point. So it was seen that during lifting the lift rod ,RHS lift rod got broken & LHS side lift rod was slightly bend . So the lift rod assembly **part number (B008753801303)** were replaced with new ones .This breakdown has been categorized as under **(Mj-22)** Major (Bending of three point linkage). It is therefore recommended that, the quality of lift rod used on the tractor should be improved.
- 14.4.1.6 Specification of power take-off Shaft :**
The dimension "BØ" of the power take-off master shield ref. fig. 2(a) does not meet the requirement of IS: 4931-1995. This should be looked into for necessary corrective action.
- 14.4.1.7 Operator's Seat:**
Vertical distance of foot rest from seat index point ,longitudinal distance of steering control wheel & differential lock pedal from seat index point does not meet the requirements of IS: 12343:1998 and calls for necessary corrective action.
- 14.4.1.8 Symbols of operator's control and other displays:**
The colour codes for engine revolution gauge has not been provided
- 14.4.1.9 Noise level test at bystanders position :**
During the noise level test at bystanders position the needle of Engine speed-cum-cumulative run hour meter was got broken & so it was replaced with new ones meter.
- 14.4.2 Wetland cultivation (puddling operation):**
Wetland operation (Puddling operation):
The manufacturer has recommended that the tractor is not suitable for wetland cultivation (puddling operation). Hence, the wetland cultivation (puddling operation) was not conducted. **Therefore, the declaration of the fact that the tractor is not suitable for Wetland cultivation (Puddling operation) should be mentioned clearly and boldly in all the literature relevant to this tractor model.**
- 14.5 Maintenance / Service Problems:**
No noticeable maintenance or service problem was observed during the test.
- 14.6 Recommendation with regard to safety on tractor:**
The following requirements, inter alia, may be considered for incorporation on the tractor:
- i) Provision for spark arresting device in exhaust system.
 - ii) Provision of Vertical retainers provided accept clutch pedal where it is only outside.
 - iii) The minimum cautionary notice as per clause 11.2 of IS: 12239 (Part-2)-1999 has not been provided.
- 14.7 Adequacy of Literature supplied with machine:**
14.7.1 The following literature was supplied with the tractor for reference during the test.
- a) Operation and maintenance owner's manual for Balwan 550
 - b) Workshop manual
 - c) Spare Parts Catalogue for Balwan 550

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- 14.7.2** The revised literature supplied was found adequate. However, the following points needs to be incorporated in owners/operator's manual.
- Details of all variants along with their features at a glance should be provided in the operator's manual.
 - The specification details as max .power, specific fuel consumption, drawbar pull and power, hydraulic power, haulage requirement and its performance, recommendation of ballasting for various operation, preparation and maintenance of tractor for wet land cultivation should be update in owner's manual in secured binding form.
 - The hydraulic external circuit lever details should be provided in owner's manual.
- 14.7.3** These literatures may also be brought out in National & other regional languages for guidance of user's.

15. CITIZEN CHARTER

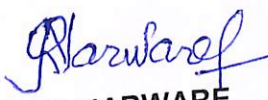
Time frame for Testing & Evaluation as per Citizen Charter	Duration of Test	Whether the Test Report is released within the time frame given in Citizen Charter	Remarks
10 Months	08 Months (June , 2017 to January , 2018)	Yes	None

TESTING AUTHORITY:


C.S RAGHUWANSHI
 AGRICULTURAL ENGINEER


C. V. CHIMOTE
 TEST ENGINEER


Y.K.RAO
 SENIOR AGRICULTURAL
 ENGINEER


J.J.R. NARWARE
 DIRECTOR

16. Applicant's Comments

Para No.	Our Reference	Applicant's comments
16.1	14.3 (ii) & (v), 14.4.1.6 & 14.4.1.7	We will ensure dimensional conformance in series production.
16.2	14.4.1.3, 14.4.1.8, 14.6 (i), (ii) & (iii),	We have noted the point & care will be taken to establish the compliance.
16.3	13.5.1 (a), 14.1.7 (b) & (c), 14.4.1.4 & 14.4.1.9	We have noted the point & will make necessary improvements in series production subsequently.