



FORCE MOTORS LIMITED, BALWAN 330 TRACTOR



भारत सरकार

GOVERNMENT OF INDIA

कृषि मंत्रालय (कृषि एवं सहकारिता विभाग, मशीनीकरण एवं प्रौद्योगिकी 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-916/1432/2014

**FORCE MOTORS LIMITED, BALWAN 330 TRACTOR –
Commercial (Batch) Test**

Manufacturer : M/s. Force Motors Ltd.,
Mumbai - Pune Road,
Akurdi,
Pune – 411 035

Test requested by : The manufacturer

Place of running-in : At CFMT&TI, Budni

Duration of said running-in, (h):

- Engine : 30
- Transmission : 33

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

1. SPECIFICATIONS

- 1.1 Tractor:**
- Make : Force Motors Ltd.
 - Model : BALWAN 330
 - Variants if any : None
 - Type : Four wheeled, Rear-wheel driven, Standard Agricultural Tractor.
 - Year of manufacture : 2013
 - Chassis Sr. number : T07021745A13
 - Country of origin : India
- 1.2 Engine:**
- Make : Force Motors Ltd.
 - Model : TD 1950 F(31)
 - Type : Four stroke, naturally aspirated, water cooled, direct injection, diesel engine.
 - Serial number : D10024523
- 1.2.1 Engine speed(Manufacturer's recommended production setting), (rpm):**
- Maximum speed at no load : 2400 to 2500
 - Low idle speed : 700 to 750
 - Speed at maximum torque : 1200 to 1400
- Rated speed, (rpm):**
- For PTO use : 2200
 - For drawbar use : 2200
- 1.3 Cylinder & Cylinder Head:**
- Number : Three
 - Disposition : Vertical, Inline
 - Bore / stroke, (mm) (apa) : 90.9 / 100.0
 - Capacity as specified by the applicant, (cc) (apa) : 1947
 - Compression ratio : 18.3 : 1 to 18.8 :1
 - Type of cylinder head : Mono block
 - Type of cylinder liners : Dry, replaceable



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14. SUMMARY OF OBSERVATIONS, COMMENTS & RECOMMENDATIONS

14.1 Evaluative (mandatory) / Non-evaluative (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:

S. 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
14.1.1 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 >35hp. -7.5/+10% for PTO power ≤ 35 hp	20.8 (D)	19.4	Yes
b)	Power at rated engine speed, (kW)	Non Evaluative	-do-	20.8 (D)	19.1	Yes
c)	Specific fuel consumption corresponding to maximum power, (g/kWh)	Non Evaluative	± 5%	249 (D)	263	No
d)	Maximum equivalent crankshaft torque, (Nm)	Non Evaluative	± 8%	110 (D)	100.3	No
e)	Back-up torque, percent	Non Evaluative	7 percent, min.	7 percent, min. (R) / 20 (D)	22.0	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)	99	Yes
2)	Coolant	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)	90	Yes
g)	Engine oil consumption, (g/kWh)	Evaluative	Not exceeding 1% of SFC at max. power under High ambient conditions	2.5 (D) / Max 2.59 (R)	1.5	Yes
h)	Smoke level (per meter)	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 (D/R)	0.57	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	15.23 (D) 15.30 min.(R)	16.37	Yes
b)	Max. drawbar pull without ballast corresponding to 15 percent wheel slip, (kN)	Evaluative	Minimum 65% of static mass of tractor with standard ballast	10.96(D) 10.84 min.(R)	12.26	Yes
c)	Maximum drawbar power without ballast, (kW).	Evaluative	Min. 80% of PTO power as referred in 15.1.1 (a) of PTO performance	16.8(D) 15.5 Min (R)	17.1	Yes
d)	Maximum transmission oil temperature (°C)	Non Evaluative	The declared value should not exceed the maximum value specified by oil company	130 (D)	89	Yes
14.1.3 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%]	11.30 (D)	11.17	Yes
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	5.04(D) 4.66(R)	8.08	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 Minutes, (mm)	Non Evaluative	[Tolerance of plus 5 mm]	Nil	Nil	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):						
1)	Cold brake	Evaluative	10	10 (R)	7.56	Yes
2)	Hot brake	Evaluative	10	10 (R)	8.25	Yes
b)	Maximum force exerted on the brake pedal to achieve a deceleration of 2.5 m/s ² (N)	Evaluative	600	600 (D)	371 to 394	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



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 Maximum (R)	86	Yes
b)	Maximum noise at operator's ear level dB(A)	Evaluative	As per CMVR	98 Maximum (R)	94	Yes
14.1.6 Amplitude of mechanical vibrations at :						
1)	Left foot rest	Non Evaluative	100 microns (max)	100 Maximum (R)	180	No
2)	Right foot rest				170	No
3)	Seat (with driver seated)				100	Yes
4)	Steering wheel				190	No
14.1.7 Haulage requirements :						
a) Gross mass of the trailers, (tones):						
1)	Two wheel	Non Evaluative	--	3.5 (D)	3.5	Yes
2)	Four wheel		--	5.0 (D)	5.0	Yes
b) Distance travelled / litre of fuel consumption, (km/l):						
1)	Two wheel	Non Evaluative	--	-- (D)	7.35 to 7.79	No
2)	Four wheel		--	-- (D)	6.02	Yes
c) Fuel consumption (ml/km/tonne):						
1)	Two wheel	Non Evaluative	--	-- (D)	36.7 to 38.86	--
2)	Four wheel		--	-- (D)	33.24	--
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)	As per clause 7.2, test was not conducted	As per test report No. T-663/1169 tractor meets the requirement Hence Wet land test does not conducted
1)	Clutch assembly	-do-				
2)	Brake housings	-do-				
3)	Front axle hubs	-do-				
14.1.9 Safety features :						
a)	Guards against moving and hot parts	Evaluative	As per CMVR	At present no requirements	--	--
b)	Lighting arrangement	Evaluative	As per CMVR	--	--	--



1	2	3	4	5	6	7
14.1.10 Labelling of tractors (Provision of labelling plate):						
1)	Make	Evaluative	Should conform to the requirements of CMVR along-with declared value of PTO HP	--	Force Motors Ltd.	Yes
2)	Model	Evaluative		--	BALWAN 330	Yes
3)	Year of manufacture	Evaluative		--	2013	Yes
4)	Engine serial number	Evaluative		--	D10024523	Yes
5)	Chassis serial number	Evaluative		--	T07021745A1 3	Yes
6)	Declaration of PTO power, (kW)	Evaluative		--	20.8	Yes
14.1.11 Discard limit for:						
a)	Cylinder bore diameter, (mm)	Evaluative	To be specified by the manufacturer	91.128	90.90 to 90.92	Yes
b)	Clearance between piston & cylinder liner at skirt, (mm)	Non Evaluative		0.120	0.038 to 0.056	Yes
(c) Ring end gap (mm):						
-	Top comp. ring.	Evaluative	-do-	1.50	0.40	Yes
-	2 nd comp. ring.		-do-	1.50	1.05 to 1.10	Yes
-	Oil ring.		-do-	1.50	0.35 to 0.40	Yes
(d) Ring groove clearance (mm):						
-	Top comp. ring.	Evaluative	-do-	0.20	0.141 to 0.142	Yes
-	2 nd comp. ring.		-do-	0.15	0.102 to 0.103	Yes
-	Oil ring.		-do-	0.10	0.062 to 0.068	Yes
(e) Clearance of main bearings (mm):						
-	Diametrical clearance	Evaluative	To be specified by the manufacturer	0.120	0.093 to 0.107	Yes
-	Crankshaft end float	Evaluative		0.50	0.16	Yes
(f) Clearance of big end bearings, (mm):						
-	Diametrical	Evaluative	-do-	--	0.090 to 0.091	Yes
-	Axial	Evaluative	-do-	1.5	0.123 to 0.135	Yes
(g) Clearance between king pin and bush, (mm)						
-	King pin and bush	Non Evaluative	-do-	1.5	0.090 to 0.097	Yes
(h) Clearance between centre pin and bush, (mm)						
-	Centre pin and bush	Non Evaluative	-do-	--	--	--



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.	Critical	Evaluative	There should be no 'critical breakdown' during its validation after all tests including Repeat / Supplementary tests.	None	Yes
2.	Major	Evaluative	There should not be more than two 'major breakdowns' and neither of them is of repetitive nature	None	Yes
3.	Minor	Evaluative	There should not be more than five 'minor defects' during the test 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

14.2 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	2	3	4	5
1	Air cleaner oil pull over, max. oil pull over (%)	0.25% (max.)	0.06%	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. If ROPS fitted it should meet the requirement of IS: 11821-1992	Not Provided ROPS not fitted	No Not applicable
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	Not applicable
7.	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] : **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)] : **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]] : **Conforms**
- 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 maximum power was recorded as 21.0 & 19.4 kW in case of previous & present sample respectively against the declaration of 20.8 kW, which meets the requirement of IS: 12207-2008 with regard to tolerance.
- ii) The specific fuel consumption corresponding to maximum power in case of previous and present sample was measured as 256 & 263 g/kWh respectively against the declaration of 249 g/kWh, which Does not meet the requirement of IS: 12207-2008 with regard to tolerance.
- iii) The percentage of backup torque was recorded as 24 & 22 % in case of previous & present sample respectively and meets the requirement of IS: 12207-2008 with regard to tolerance.
- iv) During the PTO performance test the maximum PTO power was observed 19.02 kW which is less than the minimum requirement by 0.2 kW, which does not meet the requirement of IS : 12207 – 2008. Now the applicant requested for the following checks.
 1. Air filter was clean
 2. Fuel filter was check and it was replace with new one
 3. Injector nozzle opening pressure was check and observed as normal
 4. Tappet setting was done as per the service manual

14.4.1.2 Drawbar Performance:

- i) The maximum drawbar power under unballasted condition was observed as 16.8 kW & 17.1 kW in case of previous & present sample respectively.



- ii) The maximum drawbar pull under unballasted condition was observed as 11.51kN & 12.26kN in case of previous & present sample respectively.
- iii) The maximum drawbar pull under ballasted condition was observed as 15.97 kN & 16.37 kN in case of previous & present sample respectively.
- iv) During 10 hour drawbar test, the tyre creeping over rim of 55 mm & 50 mm was observed on LHS & RHS wheel rims respectively. This may be looked into for necessary corrective action.

14.4.1.3 Mechanical Vibration:

The amplitude of mechanical vibration on various assemblies marked as (*) in Chapter-9 of this test report are on higher side specially at steering control wheel. Accelerator lever & brake pedals. This calls for dampening down of vibrations to improve the operational comfort and service life of components.

14.4.1.4 Specification of power take-off Shaft :

The dimension of the power take-off shaft does not meet the requirement of IS: 4931-1995.

14.4.2 Field performance:

The field test with Disc Plough, cultivator and puddling was conducted during the batch test and the major breakdowns were not observed in the field test during Batch Test of the tractor model as tested vide test report No. T- 663/1169 (April, 2009). So, as per the provision as laid down in clause 7.2 of IS: 12207- 2008, the field test during the batch testing of this tractor model is not required.

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 of spark arresting device in the exhaust system.
- ii) Working clearance around external circuit lever as per relevant Indian Standard.

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) Operator's Manual for Balwan 330 model of tractors.
- b) Spare Parts Catalogue for Balwan 330 model of tractors.
- c) Work shop manual (for Balwan 330 Tractor).

14.7.2

The 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.
- ii) Change of air cleaner period given in maintenance manual is different from the specification sheet submitted by the applicant.
- iii) The some discard limit is not declared by the applicant.
- iv) The grade of lubricant is also different from maintenance manual to the specification sheet submitted by the applicant. The main difference are given below:
 - Gear box oil change period (common to differential housing, rear axle final drive & brake housing).
 - Steering housing.

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

15.0 Citizen charter

Duration of Test	Test duration under citizen charter	Whether the report released within time frame given citizen charter	Remark, if any
09 Months (Jun, 2013 to February, 2014)	10 Months	Yes	---

TESTING AUTHORITY:

H.L.YADAV
SENIOR AGRICULTURAL ENGINEER

C.R.LOHI
DIRECTOR

Test Report compiled by: **Shri P RISHI PRAKASH**, Assistant Agricultural Engineer.

16. Applicant's Comments

Para No.	Our Reference	Applicant's comments
16.1	1.13.2 (iii), 1.13.4.1, 1.14.1, 1.20.1(i)	We will ensure dimensional conformance in series production.
16.2	2.2	We will update the grade in maintenance manual.
16.3	9 (i), (ii), (iv), (ix), (x), (xi), (xii), (xiv)	We will ensure conformance to amplitude of mechanical vibration in series production.
16.4	13.4(ii)	Noted the content and implemented the operator's manual.