



FORCE MOTORS LIMITED, BALWAN 500 DLX 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-915/1431/2014

**FORCE MOTORS LIMITED , BALWAN 500 DLX TRACTOR
Commercial (Initial) Test**

Initially "BALWAN 500 DLX" model of tractor was submitted for variant test, the Base model of the tractor was OX-45 (Model renamed as Balwan 500) vide test report no T-326/707 released in 1996. During PTO performance test the instability (Governor hunting) of engine was observed after every minute. Thereafter the firm has submitted request for withdraw of said test sample and incomplete test report no T-843/1353/2012 was released in August, 2012. Subsequently the manufacturer submitted the same model of tractor for Initial Commercial Test. All tests as per the relevant test codes were conducted and this report is released as Initial Commercial Test report on the test sample.

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 : CFMT&TI, Budni (MP)

Duration of said running-in, (h):

- Engine : 30
- Transmission : 33

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 : M/s. Force Motors Ltd.
- Model : BALWAN 500 DLX
- Brand, if any : None
- Type : Four wheeled, rear-wheel driven, unit construction, general purpose agricultural tractor.
- Year of manufacture : 2011
- Chassis Sr. number : T06008360H11
- Country of origin : India
- Variants if any : None



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17. SUMMARY OF OBSERVATIONS, COMMENTS & RECOMMENDATIONS

17.1 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
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 >35hp. - 7.5/+10% for PTO power ≤ 35 hp	30.9 (D)	30.0	Yes
b)	Power at rated engine speed, (kW)	Non Evaluative	-do-	30.9 (D)	30.0	Yes
c)	Specific fuel consumption corresponding to maximum power, (g/kWh)	Non Evaluative	+ 5%	247(D)	250	Yes
d)	Maximum equivalent crankshaft torque, (Nm)	Non Evaluative	± 8%	147.8 (D)	149.1	Yes
e)	Back-up torque, percent	Non Evaluative	7 percent, min.	7 percent, min. (R) 10 (D)	14.5	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)	109	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)	95	Yes
g)	Engine oil consumption, (g/kWh)	Evaluative	Not exceeding 1% of SFC at max. power under High ambient conditions	2.50 (D) 2.54 (R)	0.140	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)	2.6 (D)	1.10	Yes



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1	2	3	4	5	6	7
17.1.2 Drawbar performance :						
a)	Maximum drawbar pull with ballast corresponding to 15 percent wheel slip, (kN)	Non Evaluative	Minimum 65% of static mass with ballast	22.5 (D) 19.66 (R)	25.46	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	14.5 (D) 12.56 (R)	15.69	Yes
c)	Maximum drawbar power without ballast, (kW).	Evaluative	Min. 80% of PTO power as referred in 15.1.1 (a) of PTO performance	26.5 (D) 24.0(R)	25.6	Yes
d)	Maximum transmission oil temperature (°C)	Non Evaluative	The declared value should not exceed the maximum value specified by oil company	130 (D)	103	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%]	14.21 (D) 12.79 (R)	12.33	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	10.29 (D) 7.10 min (R)	9.71	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
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)	8.08	Yes
2)	Hot brake	Evaluative	10	10 (R)	8.84	Yes
b)	Maximum force exerted on the brake pedal to achieve a deceleration of 2.5 m/s ² (N)	Evaluative	600	450 (D) 600 maximum (R)	395 to 406	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	Evaluative	Yes / No	Yes (R)	Yes	Yes
17.1.5 Noise measurement :						
a)	Maximum ambient noise emitted by the tractor dB(A)	Evaluative	As per CMVR	88 (Maximum) (R)	82	Yes
b)	Maximum noise at operator's ear level dB(A)	Evaluative	As per CMVR	98 (Maximum) (R)	95	Yes
17.1.6 Amplitude of mechanical vibrations at :						
1)	Left foot rest	Non Evaluative	100 microns (max)	100 (Maximum) (R)	130	No
2)	Right foot rest				100	Yes
3)	Seat (with driver seated)				90	Yes
4)	Steering wheel				380	No
17.1.7 Haulage requirements :						
a) Gross mass of the trailers, (tonnes):						
1)	Two wheel	Non	--	5.0 (D)	5.0	Yes
2)	Four wheel	Evaluative	--	6.5 (D)	6.5	Yes
b) Distance traveled / liter of fuel consumption, (km/l):						
1)	Two wheel	Non Evaluative	--	4.0 to 5.0 (D)	4.69 to 4.73	Yes
2)	Four wheel				4.0 to 5.0 (D)	4.27 to 4.41
c) Fuel consumption (ml/km/tonne):						
1)	Two wheel	Non Evaluative	--	30 to 40(D)	42.30 to 42.61	No
2)	Four wheel				30 to 40(D)	34.90 to 36.03
17.1.8 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)	No ingress of water and/or mud was observed	Yes
1)	Clutch assembly	-do-				
2)	Brake housings	-do-				
3)	Front axle hubs	-do-				



1	2	3	4	5	6	7
17.1.9 Safety features :						
a)	Guards against moving and hot parts	Evaluative	As per CMVR	At present no requirements	--	--
b)	Lighting arrangement	Evaluative	As per CMVR	--	Provided	Yes
17.1.10 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 500 DLX	Yes
3) Year of manufacture		Evaluative		--	2011	Yes
4) Engine serial number		Evaluative		--	D 08008557	Yes
5) Chassis serial number		Evaluative		--	T06008360 H 11	Yes
6) Declaration of PTO power, (kW)		Evaluative		--	30.9	Yes
17.1.11 Discard limit for:						
a)	Cylinder bore diameter, (mm)	Evaluative	To be specified by the manufacturer	91.128	90.93	Yes
b)	Clearance between piston & cylinder liner at skirt, (mm)	Non Evaluative		0.120	0.047 to 0.049	Yes
(c) Ring end gap (mm):						
-do-		Evaluative	1.50	0.45 to 0.50	Yes	
- Top comp. ring.			1.50	1.0 to 1.10	Yes	
- 2 nd comp. ring.			1.50	0.40 to 0.45	Yes	
- Oil ring.						
(d) Ring groove clearance (mm):						
-do-		Evaluative	0.20	0.127 to 0.128	--	
- Top comp. ring.			0.15	0.097 to 0.108	Yes	
- 2 nd comp. ring.			0.10	0.054 to 0.059	Yes	
- Oil ring.						
(e) Clearance of main bearings (mm):						
-do-		Evaluative	To be specified by the manufacturer	0.24	0.045 to 0.056	Yes
- Diametrical clearance				0.50	0.15	Yes
- Crankshaft end float						
(f) Clearance of big end bearings, (mm):						
-do-		Evaluative	-do-	0.24	0.048 to 0.059	Yes
- Diametrical				0.50	0.15	Yes
- Axial				1.5	0.065 to 0.067	Yes
(g) Clearance between king pin and bush, (mm)						
-do-		Non Evaluative	-do-			



1	2	3	4	5	6	7
(h)	Clearance between centre pin and bush, (mm)	Non Evaluative	-do-	1.5	0.093 to 0.095	Yes

17.1.12 CATEGORY OF BREAKDOWNS / DEFECTS :					
Sl. 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	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:12207-2008:				
S. No.	Characteristic	Requirements as per IS: 12207-2008	As observed	Whether meets the requirements (Yes/No.)
1	Air cleaner oil pull over, max. oil pull over (%)	0.25% (max.)	0.10	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.	Provided	Yes
		If ROPS fitted it should meet the requirement of IS: 11821-1992	ROPS not fitted	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	Meets the requirements	Yes
6.	Specifications of linkage drawbar	Should meet the requirements of IS: 12953-1990.	Meets the requirements	Yes
	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



- 17.3 **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)] : **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) : [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]] : **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**

17.4 **Salient Observations:**

- 17.4.1 **Laboratory tests:**
- 17.4.1.1 **PTO Performance:**
- i) The backup torque is **only 14.5%**.
 - ii) The specific fuel consumption corresponding to maximum power was measured as **250g/kWh** against the declaration of 247 g/kWh, which is within the tolerance limit as specified in the IS: 12207-2008.



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17.4.1.2 Drawbar Performance (Supplementary test):

- i) During the 10 hour drawbar performance test under ballasted condition, the LHS rear tyre got puncture due creeping of tyre over rim .So ,the tube were replaced with new one.
- ii) During the 10 hour drawbar test at the 15 % wheel slip, the LHS rear tyre got puncture due to creeping of tyre over the rim. So, the LHS rear wheel tube was replaced with new one.
- iii) The problem of creeping of tyre over rim ,applicant to replaced the both LHS & RHS rear tube & again during the 10 hour drawbar performance test under ballasted condition the LHS rear tyre got puncture due creeping of tyre over rim.
- iv) **Due to problem of creeping of rear tyre over rim, the manufacturer requested to replace the existing rim size 'W12' to new one of rim size 'W13' and rear tyre pressure from 120 kPa to 140 kPa. Hence as per IS:12207-2008 supplementary test (drawbar test) conducted by replacing both the rear rim of revised specification and change rear tyre pressure.**
- v) After completion of repeat drawbar performance test tyre creeping was observed LHS and RHS 40 mm and 35 mm respectively which is on higher side and calls for necessary corrective action..

17.4.1.3 Hydraulic performance:

- i) The maximum lifting capacity at hitch points was observed as **12.33 kN** against the declared value of **14.21 kN** which does not meet the requirement. This should be looked into.

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, especially at the steering control operational comfort and service life of components.

17.4.1.5 Three point linkage:

The lateral distance from lower hitch point to centre line of tractor, lower hitch point tyre clearance does not meet the requirements of IS: 4468 (Part -I 1997)& some of the parameters of the three point linkage conform to Cat.-I and some of them improvements may be incorporated.

17.4.1.6 Specification of power take-off Shaft :

The dimension "p" 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.

17.4.1.7 Operator's Seat:

Longitudinal distance from seat index point to the center of steering control wheel , differential lock pedal & vertical distance from seat index point from footrest does not meet the requirements of IS: 12343:1998 and calls for necessary corrective action.



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- 17.4.1.8 Symbols of operator's control and other displays:**
The colour codes for engine revolution gauge has not been provided

17.4.2 Field performance:

- 17.4.2.1 Wetland cultivation (puddling operation):**
The tractor meets the requirements of IS: 11082-1984 & is found suitable for wetland cultivation (puddling operation).

- 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) Provision for spark arresting device in exhaust system.
 - ii) Provision of Vertical retainness 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.

- 17.7 Adequacy of Literature supplied with machine:**
- 17.7.1** The following literature was supplied with the tractor for reference during the test.
- a) Operation and maintenance owner's manual for Balwan 400/400DLX 450/500/500DLX
 - b) Spare Parts Catalogue for Balwan 400/400DLX 450/500/500DLX

- 17.7.2** The revised literature supplied was found adequate. However, the following points needs to be incorporated in owners/operator's manual.
- i) Details of all variants along with their features at a glance should be provided in the operator's manual.
 - ii) 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.
 - iii) The hydraulic external circuit lever details should be provided in owner's manual.

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



18. 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 + 4 month Supplementary test	12 Months (February , 2013 to February, 2014)	Yes	None
*Remarks: (1) 4 months time period was required in supplementary test of drawbar test.			

TESTING AUTHORITY:

P.K. Verma

P.K VERMA
SENIOR AGRICULTURAL ENGINEER

C.R. Lohi

C.R LOHI
DIRECTOR

Test report compiled by Shri. Chanchlesh Singh Raghuwanshi, Assistant Agri. Engineer

19. Applicant's Comments

Para No.	Our Reference	Applicant's comments
19.1	17.4.1.5, 17.4.1.6, 17.4.1.7	We will ensure dimensional conformance in series production.
19.2	17.4.1.8 & 17.6	We have noted the point and care will be taken to establish the compliance.
19.3	17.4.1.4	We will ensure conformance to amplitude of mechanical vibration in series production.



ANNEXURE - I

BRIEF SPECIFICATION OF IMPLEMENTS USED DURING FIELD TEST

S. No.	Item	Disc Plough	Rotavator	Paddy Puddler
1.	Make	N.A.	Howard	N. A.
2.	Type	Mounted	Mounted	Mounted
3.	No. of bottom/blades	Three	36, in 7 flange	12, 6 in each gang
4.	Type of bottom/blades	General purpose	Hatchet	Notched concave
5.	Size of bottom/blades, (mm)	335	225 x 50 x 10	460
6.	Spacing of bottom/flanges, (mm)	405	250	165
7.	Lower hitch point span, (mm)	954	720	680
8.	Mast height, (mm)	560	481	460
9.	Overall dimensions, (mm):			
	- Length	1930	1750	1190
	- Width	1175	1000	2425
	- Height	1075	980	1335
10.	Gross mass, (kg)	300	345	245

ANNEXURE - II

BRIEF SPECIFICATION OF FULL CAGE WHEEL

S. No.	Items	Specification
1.	Type	Full cage wheel
2.	Dia, (mm)	1210
3.	Width, (mm)	900
4.	No. and types of lugs	24, straight lugs made up of MS-angle section welded to angle iron frame.
5.	Size of angle section, (mm)	40 x 40 x 5
6.	Length of lugs, (mm)	444
7.	Spacing of lugs, (mm)	290
8.	Weight of each cage wheels (kg)	120