



FORCE MOTORS, BALWAN 400 TRACTOR



भारत सरकार
कृषि मंत्रालय
(कृषि एवं सहकारिता विभाग)

GOVERNMENT OF INDIA
MINISTRY OF AGRICULTURE
(DEPARTMENT OF AGRICULTURE & CO-OPERATION)

केन्द्रीय कृषि मशीनरी प्रशिक्षण एवं परीक्षण संस्थान
ट्रैक्टर नगर, बुदनी (म.प्र.) ४६६ ४४५

CENTRAL FARM MACHINERY TRAINING & TESTING INSTITUTE
TRACTOR NAGAR, BUDNI (M.P.) - 466 445

E-mail : fmti-mp@nic.in

Web site : cfmtti.dacnet.nic.in

Telephone : 07564-234729

Fax : 07564-234743



T-835/1344/2012

**FORCE MOTORS , BALWAN 400 TRACTOR –
Commercial (Batch) Test**

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

Test requested by : The manufacturer

Place of running-in : 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 400
Variants if any : None
Type : Four wheeled, Rear-wheel driven,
Standard Agricultural Tractor.
Year of manufacture : 2011
Chassis Sr. number : T07020926 H 11
Country of origin : India
- 1.2 Engine:**
- Make : Force Motors Ltd.
Model : TD 1950 F(36)
Type : Four stroke, naturally aspirated, water
cooled, direct injection, diesel engine.
Serial number : D10021671
- 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 : 1300 to 1500
- Rated speed, (rpm):**
- For PTO use : 2200
- For drawbar use : 2200
- 1.3 Cylinder & Cylinder Head:**
- Number : Three
Disposition : Vertical, inline
Bore / stroke, (mm) : 90.9 / 100.0
Capacity as specified by the applicant, (cc) : 1947



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Previous Sample

vi) The amplitude of mechanical vibration on various assemblies marked as (*) in Chapter-9 of test report No T-499/976 were on higher side. This calls for dampening down of vibrations to improve the operational comfort and service life of components.

14.4 Adequacy of literature:

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

a) Owner's manual

ii) It is, however, recommended that operator's manual be revised/updated as per IS: 8132-1999.

Present Sample

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 (For Balwan 400 / 450 / 500 tractor models)

b) Spare Parts Catalogue (For Balwan 400 / 450 / 500 tractor models)

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

i) Details of all variant models along with their relevant 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.

15. SUMMARY OF OBSERVATIONS, COMMENTS & RECOMMENDATIONS

15.1 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
15.1.1	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	24.0 (D)	22.5	Yes
b)	Power at rated engine speed, (kW)	Non Evaluative	-do-	24.0 (D)	22.5	Yes
c)	Specific fuel consumption corresponding to maximum power, (g/kWh)	Non Evaluative	± 5%	247 (D)	259	Yes
d)	Maximum equivalent crankshaft torque, (Nm)	Non Evaluative	± 8%	114.3 (D)	110.4	Yes



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1	2	3	4	5	6	7
e)	Back-up torque, percent	Non Evaluative	7 percent, min.	7 percent, min. (R) / 9.6 (D)	12.9	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)	112	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)	100	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)	0.41	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) / 3.25 (R)	1.71	Yes
15.1.2	Drawbar performance :					
a)	Maximum drawbar pull with ballast corresponding to 15 percent wheel slip, (kN)	Non Evaluative	Minimum 65% of static mass with ballast	17.2(D) 16.50 min.(R)	20.01	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	12.8(D) 11.63 min.(R)	13.36	Yes
c)	Maximum drawbar power without ballast, (kW).	Evaluative	Min. 80% of PTO power as referred in 15.1.1 (a) of PTO performance	20.8(D) 18.0 Min (R)	21.0	Yes
d)	Maximum transmission oil temperature (°C)	Non Evaluative	The declared value should not exceed the maximum value specified by oil company	110 (D)	89	Yes
15.1.3	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%]	14.18 (D)	13.82	Yes



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1	2	3	4	5	6	7
	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	9.88(D) 5.33(R)	9.59	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
15.1.4 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)	7.41	Yes
	2) Hot brake	Evaluative	10	10 (R)	7.03	Yes
b)	Maximum force exerted on the brake pedal to achieve a deceleration of 2.5 m/s ² (N)	Evaluative	600	200 (D) 600 (R)	254 to 268	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
15.1.5 Noise measurement :						
a)	Maximum ambient noise emitted by the tractor dB(A)	Evaluative	As per CMVR	88 Maximum (R)	84	Yes
b)	Maximum noise at operator's ear level dB(A)	Evaluative	As per CMVR	98 Maximum (R)	96	Yes
15.1.6 Amplitude of mechanical vibrations at :						
	1) Left foot rest	Non Evaluative	100 microns (max)	100 Maximum (R)	90	Yes
	2) Right foot rest				90	Yes
	3) Seat (with driver seated)				100	Yes
	4) Steering wheel				130	No
15.1.7 Haulage requirements :						
a)	Gross mass of the trailers, (tones):					
	1) Two wheel	Non Evaluative	--	4.0 (D)	4.0	Yes
	2) Four wheel	Evaluative	--	5.5 (D)	5.5	Yes
b)	Distance travelled / litre of fuel consumption, (km/l):					
	1) Two wheel	Non Evaluative	--	6.0 (D)	5.21 to 5.51	No
	2) Four wheel		--	5.0 (D)	5.09 to 5.25	Yes



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1	2	3	4	5	6	7
c)	Fuel consumption (ml/km/tonne):					
1)	Two wheel	Non Evaluative	--	40 (D)	45.33 to 47.98	No
2)	Four wheel		--	35 (D)	34.62 to 35.72	Yes

15.1.8 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-499/976 tractor meets the requirements
1)	Clutch assembly	-do-				
2)	Brake housings	-do-				
3)	Front axle hubs	-do-				

15.1.9 Safety features :						
a)	Guards against moving and hot parts	Evaluative	As per CMVR	At present no requirements	Provided	--
b)	Lighting arrangement	Evaluative	As per CMVR	--	Provided	Yes

15.1.10 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 400	Yes
3)	Year of manufacture	Evaluative		--	2011	Yes
4)	Engine serial number	Evaluative		--	D10021671	Yes
5)	Chassis serial number	Evaluative		--	T 07020926 H11	Yes
6)	Declaration of PTO power, (kW)	Evaluative		--	24.0	Yes

15.1.11 Discard limit for:						
(a)	Cylinder bore diameter, (mm)	Evaluative	To be specified by the manufacturer	91.128	90.930 to 90.94	Yes
(b)	Clearance between piston & cylinder liner at skirt, (mm)	Non Evaluative		0.120	0.058 to 0.062	Yes
(c)	Ring end gap (mm):					
-	Top comp. ring.	Evaluative	-do-	1.50	0.30 to 0.35	Yes
-	2 nd comp. ring.		-do-	1.50	0.90 to 0.95	Yes
-	Oil ring.		-do-	1.50	0.30 to 0.40	Yes

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1	2	3	4	5	6	7
(d)	Ring groove clearance (mm):					
	- Top comp. ring.	Evaluative	-do-	0.20	0.115 to 0.117	Yes
	- 2 nd comp. ring.		-do-	0.15	0.09 to 0.094	Yes
	- Oil ring.		-do-	0.10	0.038 to 0.039	Yes
(e)	Clearance of main bearings (mm):					
	- Diametrical clearance	Evaluative	To be specified by the manufacturer	0.240	0.107 to 0.110	Yes
	- Crankshaft end float	Evaluative		0.50	0.22	Yes
(f)	Clearance of big end bearings, (mm):					
	- Diametrical	Evaluative	-do-	0.240	0.072 to 0.078	Yes
	- Axial	Evaluative	-do-	0.50	0.25	Yes
(g)	Clearance between king pin and bush, (mm)	Non Evaluative	-do-	1.5	0.066 to 0.115	Yes
(h)	Clearance between centre pin and bush, (mm)	Non Evaluative	-do-	1.5	0.076 to 0.84	Yes

15.1.12 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

15.2 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.)	0.03	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



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1	2	3	4	5
4.	Technical requirements for PTO shaft	Should meet the requirements of IS: 4931 -1995	Does not meets 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.	Meet 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

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

**15.4 Salient Observations:****15.4.1 Laboratory tests:****15.4.1.1 PTO Performance:**

- i) The maximum power was recorded as 24.0 & 22.5 kW in case of previous & present sample respectively against the declaration of 24.0 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 **253 & 259 g/kWh** respectively against the declaration of **247 g/kWh**, which meets the requirement of IS: 12207-2008 with regard to tolerance.
- iii) The percentage of backup torque was recorded as 9.9 & 12.9 % in case of previous & present sample respectively and meets the requirement of IS: 12207-2008 with regard to tolerance.

15.4.1.2 Drawbar Performance:

- i) The maximum drawbar power under unballasted condition was observed as 20.8 kW & 21.0 kW in case of previous & present sample respectively.
- ii) The maximum drawbar pull under unballasted condition was observed as 12.8 kN & 13.36 kN in case of previous & present sample respectively.
- iii) The maximum drawbar pull under ballasted condition was observed as 17.2 kN & 20.01 kN in case of previous & present sample respectively.
- v) During 10 hour drawbar test, the tyre creeping over rim of 90 mm & 30 mm was observed on LHS & RHS wheel rims respectively. This may be looked into for necessary corrective action.

15.4.1.3 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.

15.4.1.4 Specification of power take-off Shaft :

The dimension "Aø" of the power take-off shaft does not meet the requirement of IS: 4932-2995. This should be looked into for necessary corrective action.

15.4.2 Field performance:

The field test with M.B. 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- 499/976 (August, 2004). 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.

However, the field test with the Rotavator was conducted and the summary of field performance test is presented in Chapter-10 of this report.

15.5 Maintenance / Service Problems:

No noticeable maintenance or service problem was observed during the test.

15.6 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.



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- 15.7 Adequacy of Literature supplied with machine:**
- 15.7.1** The following literature was supplied with the tractor for reference during the test.
- Operator's Manual for Balwan 400/450/500 model of tractors
 - Spare Parts Catalogue for Balwan 400/450/500 model of tractors
- 15.7.2** The revised literature supplied was found adequate. However, the following points needs to be incorporated in owner's/operator's manual.
- Details of all variants along with their features at a glance should be provided in the operator's manual.
- 15.7.3** These literatures may also be brought out in National & other regional languages for guidance of user's.

TESTING AUTHORITY:

**C. V. CHIMOTE
TEST ENGINEER**

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

**V. N. KALE
DIRECTOR**

Test Report compiled by: Shri Nitesh Kumar Verma, Senior Technical Assistant.



16. APPLICANT'S COMMENTS

Para No.	Our Reference	Applicant's comments
16.1	Para 1.14.1	This dimension will be ensured in future.
16.2	Para 1.20.2 (i)	We have noted the point and care will be taken to establish the compliance.
16.3	Para 1.20.5 (i)	The error in the working clearance around the external circuit lever and mudguard could be only manufacturing error. This will be taken care in series of production.

ANNEXURE – ITRACTOR RUN HOURS DURING TEST

A.	LABORATORY AND TRACK TESTS:	HOURS
1.	Running-in	63.0
2.	PTO performance test	11.3
3.	Power lift and hydraulic pump performance test	2.4
4.	Drawbar performance test	16.6
5.	Brake test	1.5
6.	Noise measurement	1.1
7.	Mechanical vibration test	1.0
8.	Air cleaner oil pull over test	3.5
9.	Theoretical speed test	0.5
B.	FIELD TEST:	
1.	Rotavation	11.0
	HAULAGE TEST:	10.1
D.	Miscellaneous test and other run hours including idle run, transportation, trials and preparation for test	3.5
	TOTAL:	125.5

ANNEXURE – IIBrief specifications of Implements used during field Test

Sl. No.	Item	Rotavator
1.	Make	Howard
2.	Type	Mounted
3.	No. of bottoms /blades	36, in 7 flange
4.	Types of bottoms / blades	Hatchet
5.	Size of bottoms /blades(mm)	225x 50 x 10
6.	Spacing of bottoms flange, mm	250
7.	Lower hitch point span,(mm)	720
8.	Mast height,(mm)	481
9.	Overall dimensions, (mm)	
	-Length	1750
	- Width	1000
	- Height	980
10.	Gross mass, (kg)	345