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FORCE MOTORS LIMITED, BALWAN 400 S DLX TRACTOR



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भारत सरकार

GOVERNMENT OF INDIA

कृषि एवं किसान कल्याण मंत्रालय (कृषि एवं सहकारिता विभाग, मशीनीकरण एवं प्रौद्योगिकी प्रभाग)
Ministry of Agriculture and Farmers Welfare (Deptt. of Agri. & Co-op, Mechanization & Technology Division)

CENTRAL FARM MACHINERY TRAINING & TESTING INSTITUTE

(An ISO : 9001 - 2008 Certified Institute)

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T-980/1504/2015

FORCE MOTORS LIMITED, BALWAN 400 S DLX TRACTOR
Commercial (Initial) Test

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

Test requested by : The manufacturer
Place of running-in : At applicant's works.
Duration of said running-in, (h):
- Engine : 30
- Transmission : 30

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 : Force Motors Ltd.
Model : BALWAN 400 S DLX
Variants, if any : None
Type : Four wheeled Rear-wheel driven, General purpose Agricultural Tractor.
Year of manufacture : 2014
Chassis Sr. number : T07022518 C14
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 : D10027372
- 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) (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
Type of combustion chamber : Direct injection, open cavity on piston crown (re-entrant type).
Arrangement of valves : Single Overhead cam shaft



17. SUMMARY OF OBSERVATIONS, COMMENTS & RECOMMENDATIONS

16.1 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 is summarized as under:

S. No.	Characteristic	Category (Evaluative / Non Evaluative)	Requirements as per IS: 12207-2014	Values declared by the applicant/ requirement	As observed	Whether meets the require- ments (Yes/No)
1	2	3	4	5	6	7
17.1.1 PTO Performance :						
a)	- Max. power under 2 h 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	23.0	23.3	Yes
b)	Power at rated engine speed, (kW)	Non Evaluative	-do-	23.0	23.3	Yes
c)	Specific fuel consumption corresponding to maximum power, (g/kWh)	Non Evaluative	± 5%	247	257	Yes
d)	Maximum equivalent crankshaft torque, (Nm)	Non Evaluative	± 8%	114.3 (D)	111.1	Yes
e)	Back-up torque, percent	Non Evaluative	10 percent, min.	10 percent, min (R) 7percent, min (D)	10.0	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)	111	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)	97	Yes



1	2	3	4	5	6	7
g)	Engine oil consumption, (g/kWh)	Evaluative	Not exceeding 1% of SFC at max. power under High ambient conditions	2.60 (R) 2.50 (D)	0.37	Yes
h)	Smoke level	Evaluative	Maximum light absorption coefficient of 3.25/m or equivalent BOSCH No.5.2 or 75 Hatridge value 9as per CMVR)	3.25 per meter (R)	1.36	Yes
17.1.2 Drawbar performance :						
a)	Max. drawbar pull with ballast corresponding to 15 percent wheel slip, (kN)	Non Evaluative	Minimum 65% of static mass with ballast	16.96 (R) 17.2 (D)	19.20	Yes
b)	Max. drawbar pull with Un-ballasted corresponding to 15 percent wheel slip, (kN)	Evaluative	Minimum 65% of static mass of tractor without ballast/ with standard ballast	12.05 (R) 12.8 (D)	14.29	Yes
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.	18.6 (R) 20.8 (D)	21.2	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
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%]	13.8 (D)	13.69	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	5.50 (R) 9.5 (D)	9.45	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 minute, (mm)	Non Evaluative	The observed value should not exceed 50 mm	Nil (D)	00	Yes



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1	2	3	4	5	6	7
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 Un ballast*, (m):					
	1) Cold brake	Evaluative	10	10	8.56	Yes
	2) Hot brake	Evaluative	10	10	8.71	Yes
b)	Maximum force exerted on the brake pedal to achieve a deceleration of 2.5 m/s ² (N)	Evaluative	600	600	244 to 315	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	Yes	Yes
*Manufacturer not recommended the road ballast						
17.1.5	Noise measurement :					
a)	Maximum ambient noise emitted by the tractor dB(A)	Evaluative	As per CMVR	88	84	Yes
b)	Maximum noise at operator's ear level dB(A)	Evaluative	As per CMVR	98	96	Yes
17.1.6	Amplitude of mechanical vibrations at :					
	1) Right foot rest	Non Evaluative	100 microns (max.)	100 micron (max)	60	Yes
	left foot rest				110	No
	2) Seat (with driver seated)				30	Yes
	3) Steering control wheel				70	Yes
17.1.7	Haulage requirements :					
a)	Gross mass of the trailers, (tones):					
	1) Two wheel	Non Evaluative	--	4.0 (D)	4.0	Yes
	2) Four wheel		--	5.5 (D)	5.5	Yes
b)	Distance travelled / litre of fuel consumption, (km/l):					
	1) Two wheel	Non Evaluative	--	5.0	6.17 to 7.13	Yes
	2) Four wheel		--	6.0	5.99	Yes
c)	Fuel consumption (ml/km/tonne):					
	1) Two wheel	Non Evaluative	--	40	35.06 to 40.5	Yes
	2) Four wheel		--	35	30.33	Yes



1	2	3	4	5	6	7
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	No ingress of water was observed during water proof test	Yes
	1) Clutch assembly	-do-				
	2) Brake housings	-do-				
	3) Front axle hubs	-do-				
	4) Engine Oil	-do-				
5) Transmissi on Oil	-do-					
17.1.9	Safety features :					
a)	Guards against moving and hot parts	Evaluative	As per CMVR	...	Provided	Yes
b)	Lighting arrangement	Evaluative	As per CMVR		Provided	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 Conform	No
d)	Technical requirements for PTO shaft	Non Evaluative	Should meet the requirements of IS: 4931 (As amended from time to time)	--	Does not Conform	No
e)	Dimensions of three point linkage	Non Evaluative	Should meet the requirements of IS: 4468 (Part-I) (As amended from time to time)	--	Conforms	Yes
f)	Specifications of linkage drawbar	Non Evaluative	Should meet the requirements of IS 12953 and IS 12362 (Part 3) (As amended from time to time)	--	Meets the requirements	Yes
	Swinging drawbar				Not Provided	Not applicable
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 400 S DLX	Yes
3)	Year of manufacture	Evaluative		--	2014	Yes
4)	Chassis number	Evaluative		--	T07022518 C 14	Yes
5)	Engine number	Evaluative		--	D10027372	Yes
6)	Declaration of PTO power, (kW)	Evaluative		--	23.0	Yes



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17.1.11 Discard limit for:						
1	2	3	4	5	6	7
(a)	Cylinder bore diameter, (mm)	Evaluative	To be declared by the manufacturer	91.128	90.93 to 90.94	Yes
(b)	Clearance between piston & cylinder liner at skirt, (mm)	Non Evaluative	-do-	0.120	0.042 to 0.063	Yes
(c)	Ring end gap (mm):					
	- Top comp. ring.	Evaluative	-do-	1.50	0.35 to 0.45	Yes
	- 2 nd comp. ring.		-do-	1.50	1.00 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	0.116 to 0.136	Yes
	- 2 nd comp. ring.		-do-	0.15	0.081 to 0.087	Yes
	- Oil ring.		-do-	0.10	0.038 to 0.048	Yes
(e)	Clearance of main bearings (mm):					
	- Diametrical clearance	Evaluative	-do-	0.240	0.066 to 0.097	Yes
	- Crankshaft end float	Evaluative	-do-	0.50	0.20	Yes
(g)	Clearance of big end bearings, (mm):					
	- Diametrical	Evaluative	To be declared by the manufacturer	0.240	0.069 to 0.074	Yes
	- Axial	Evaluative	-do-	0.50	0.20	Yes
(h)	Clearance between king pin and bush, (mm)	Non Evaluative	-do-	1.50	0.050 to 0.095	Yes
(i)	Clearance between center pin and bush, (mm)	Non Evaluative	-do-	1.50	0.087 to 0.096	Yes
17.1.12 Literature						
(a)	Operator manual	Evaluative	Provided/Not Provided	As per relevant IS Code (IS 8132)	Provided	Yes
(b)	Parts Catalogue	Evaluative	Provided/Not Provided	As per relevant IS Code (IS 8132)	Provided	Yes
(c)	Workshop/ Service manual	Evaluative	Provided/Not Provided	As per relevant IS Code (IS 8132)	Provided	Yes



17.1.12 CATEGORY OF BREAKDOWNS / DEFECTS :					
Sl. No.	Category of breakdowns	Category (Evaluative / Non Evaluative)	Requirements as per IS: 12207-2014	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:12207-2014:				
S. No.	Characteristic	Requirements as per IS: 12207-2014	AS observed	Remarks
1	2	3	4	5
1	Air cleaner oil pull over, max. oil pull over (%)	0.25% (max.)	0.05 to 0.06 % (Conforms)	Yes
2.	Sealing requirements	Should meet the requirements of IS: 12343-1998	Does not conform	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	--
4.	Technical requirements for PTO shaft & its Master shield	Should meet the requirements of IS: 4931 -1995	Does not conform	No
5.	Dimensions of three point linkage	Should meet the requirements of IS: 4468 (Part-I)-1997	Conforms	Yes
6.	Specifications of linkage drawbar.	Should meet the requirements of IS: 12953-1990	Conforms	Yes
7.	Specifications of swinging drawbar	Should meet the requirements of IS:12362 Part 3-1994.	Not provided	--
8.	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] : 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] : **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 specific fuel consumption corresponding to maximum power measured as 257 g/kWh against the declaration of 247 g/kWh, which meets the requirement of IS: 12207-2014 with regard to tolerance.
- ii) The backup torque is 10.0 and which is exactly equals to the minimum requirement (10% min.) of IS: 12207-2014. This needs to be improved.

17.4.1.2 Drawbar Performance:

- i) During 10 hour drawbar test, the creeping of LHS & RHS rear tyre over the rims were observed as 55 & 45 mm respectively, which was considered on higher side. This may be looked into for necessary corrective action.

17.4.1.3 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.

17.4.1.4 Wet land cultivation (Puddling test)

The half cage wheels provided during the test are not meets the requirement of IS 9939. This should be provided with specifications of relevant IS.

17.4.1.5 Specification of power take-off Shaft :

Some dimensions as 'A \emptyset ' and 'c' of the power take-off shaft does not meet the requirement of IS: 4931-1995.

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



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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) Operator's Manual for Balwan 400 S DLX tractor.
- b) Spare Parts Catalogue for Balwan 400 S DLX tractor.
- c) Work shop manual (for Balwan 400 S DLX tractor).

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

- i) The specification of PTO power, Drawbar Power, Hydraulic power, lifting capacity, haulage recommended capacity, tyre recommended pressure, recommendation of implement details for dry land and wet land operation should require providing in owner's manual.
- iv) The grade of lubricant and oil change period is also different from maintenance manual to the specification sheet submitted by the applicant. This should be looked into.

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

18. Citizen Charter

Duration of Test	Test duration under citizen charter	Whether the report released within time frame given citizen charter	Remark, if any
13 Months (August 2014 to August 2015)	10 Months	No	The applicant delayed to provide the cage wheels for wet land cultivation.

TESTING AUTHORITY:

PRADIPKUMAR C. MESHAM
SENIOR AGRICULTURAL ENGINEER

C.R.LOHI
DIRECTOR

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



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19. APPLICANT'S COMMENTS

Sl. No.	Para No.	Our Reference	Applicant's comments
1	19.1	1.20.1	We will ensure dimensional conformance in series production.
2	19.2	1.20.4	We understand that spark arrester is necessary only on the engine which has smoke and also high oil consumption. Since our Balwan 400 S – DLX engine meets TREM III A norms in respect of exhaust pollution. Also the oil consumption is less. Hence fitment of spark arrester may not be necessary.
3	19.3	1.20.5	We have noted the point and care will be taken to establish the compliance.
4	19.4	13.4.1	We have noted the point and care will be taken to establish the compliance.
5	19.5	17.3 ii)	We have noted the point and care will be taken to establish the compliance.
6	19.6	17.3 v)	We will ensure dimensional conformance in series production.
7	19.7		We understand that spark arrester is necessary only on the engine which has smoke and also high oil consumption. Since our Balwan 400 S – DLX engine meets TREM III A norms in respect of exhaust pollution. Also the oil consumption is less. Hence fitment of spark arrester may not be necessary.

ANNEXURE- I

BRIEF SPECIFICATION OF IMPLEMENTS USED DURING FIELD TEST

S. No	Item	Disc Plough	Rotavator	Puddler
1.	Make	John Deere	Kubota	Not available
2.	Type	Mounted	Mounted	Mounted
3.	No. of Disc/blades	Two	36,in 7 flange	12 (6 in each gang)
4.	Type of Disc/blades	Plane concave	Hatchet	Notched
5.	Size of bottoms/blades, (mm)	635	215 x 70 x 5	460
6.	Spacing of bottoms/flanges, (mm)	510	250	164
7.	Lower hitch point span, (mm)	635	660	680
8.	Mast height, (mm)	470	505	680
9.	Overall dimensions, (mm):			
	- Length	1520	946	1190
	- Width	1190	1777	1810
	- Height	1005	1074	1330
10.	Gross mass, (kg)	310	404	240

**ANNEXURE - II****BRIEF SPECIFICATION OF HALF CAGE WHEEL**

S/No.	Items	Specification
1.	Type	Half cage wheel
2.	Outer dia, (mm)	1075
3.	Width, (mm)	355
4.	No. and types of lugs	16, Straight lugs made of M.S. angle section welded to angle iron frame
5.	Size of angle section, (mm)	50 x 20 x 6
6.	Length of lug, (mm)	350
7.	Spacing of lug, (mm)	190
8.	Weight of each cage wheels, (kg)	80

ANNEXURE - III**TRACTOR RUN HOURS DURING TEST**

A.	LABORATORY AND TRACK TESTS:	HOURS
1.	Running-in	--
2.	PTO performance test	8.7
3.	Power lift and hydraulic pump performance test	2.6
4.	Drawbar performance test	15.3
5.	Turning ability	0.2
6.	Location of centre of gravity	0.2
7.	Operator's field of vision	0.2
8.	Brake test	2.6
9.	Noise measurement	1.5
10.	Air cleaner oil pull over test	3.5
11.	Mechanical vibration test	1.0
12.	Nominal speed test	0.5
B.	FIELD TEST:	
1.	Disc ploughing	10.0
2.	Rotavation	11.0
3.	Wet land including water proof test	15.4
C.	HAULAGE TEST:	4.8
D.	Miscellaneous test and other run hours including 'idle run, transportation, trials and preparation for test	4.2
	TOTAL:	81.7