



FORCE MOTORS LIMITED, Balwan 500 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
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**FORCE MOTORS LIMITED , BALWAN 500 TRACTOR –
Commercial (Batch) Test**

The Tractor was tested at this Institute for Initial Commercial Test (ICT) vide Test Report No. as Tempo OX-45 tractor, T-326/707 Year-1996 (Converted from confidential to commercial). Thereafter following commercial (BT) has been tested for this tractor model.

Sl. No.	Name of Tractor	Test Report No.	Month & Year
1.	Tempo OX -45 Tractor Commercial (Batch Test) Ist	T-406/829	September, 2000
2.	Tempo Balwan 500 Commercial (Batch Test) IInd (Model renamed due to change of firm name)	T-501/978	August, 2004

Now the tractor model "Balwan 500" has undergone Commercial Batch Test (IInd).

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 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 : M/s. Force Motors Ltd.
- Model : BALWAN 500
- Brand, if any : Force
- Type : Four wheeled, rear-wheel driven, unit construction, general purpose agricultural tractor.
- Year of manufacture : 2011
- Chassis Sr. number : T 06008364 H 11
- Country of origin : India
- Variants if any

Sl. No.	Variant models	Test Report No.	Month & Year	Variant Feature
1.	Tempo OX-45 (Balwan 500) Tractor Comm. (Variant test)	T-455/907	Nov., 2002	Changes in Sheet metal as: i) Decals (sticker: Tempo OX-45 to Tempo Balwan 500 ii) Bonnet style inclined toward front to flat



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Previous Sample

- ii) It is, however, recommended that operator's manual be revised/updated as per IS: 8132-1999 with the inclusion of, inter alia, fuel saving tips

Present Sample

The 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.

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-evaluation (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	30.9 (D)	30.9	Yes
b)	Power at rated engine speed, (kW)	Non Evaluative	-do-	30.9 (D)	30.9	Yes
c)	Specific fuel consumption corresponding to maximum power, (g/kWh)	Non Evaluative	+ 5%	247(D)	253	Yes
d)	Maximum equivalent crankshaft torque, (Nm)	Non Evaluative	± 8%	147.8 (D)	149.3	Yes
e)	Back-up torque, percent	Non Evaluative	7 percent, min.	7 percent, min. (R) 10 (D)	11.42	Yes



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1	2	3	4	5	6	7	
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)	116	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)	99	Yes
g)	Engine oil consumption, (g/kWh)		Evaluative	Not exceeding 1% of SFC at max. power under High ambient conditions	2.5 (D) 2.53 (R)	0.39 2	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)	1.55	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	22.5 (D)	26.3	Yes
					19.35 min.(R)		
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)	14.8	Yes
					11.63 min (R)		
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)	23.1	Yes
					24.72 min (R)		
d)	Maximum transmission oil temperature (°C)		Non Evaluative	The declared value should not exceed the maximum value specified by oil company	110 (D)	103	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%]	14.21 (D)	13.8 0	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	10.29 (D) 7.31 min (R)	9.19	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

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15.1.4

a)

b)

c)

15.1.5

a)

b)

15.1.6

15.1.7

a)

b)

c)

15.1.8

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1	2	3	4	5	6	7
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)	7.62	Yes
	2) Hot brake	Evaluative	10	10 (R)	8.30	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)	247 to 305	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)	82	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)	100	Yes
	2) Right foot rest				90	Yes
	3) Seat (with driver seated)				50	Yes
	4) Steering wheel				100	Yes
15.1.7	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 4.98	Yes
	2) Four wheel		--	4.0 to 5.0 (D)	4.66 to 4.87	Yes
c)	Fuel consumption (ml/km/tonne):					
	1) Two wheel	Non Evaluative	--	30 to 40 (D)	40.19 to 42.61	Yes
	2) Four wheel		--	30 to 40 (D)	31.62 to 33.01	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, of IS 12207-2008 test was not conducted, since during ICT the tractor meets the requirement	Yes
	1) Clutch assembly	-do-				
	2) Brake housings	-do-				
	3) Front axle hubs	-do-				
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1	2	3	4	5	6	7
15.1.9	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
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 500	Yes
3)	Year of manufacture	Evaluative		--	2011	Yes
4)	Engine serial number	Evaluative		--	D 08008560	Yes
5)	Chassis serial number	Evaluative		--	T 06008364 H 11	Yes
6)	Declaration of PTO power, (kW)	Evaluative		--	30.9	Yes
15.1.11	Discard limit for:					
(a)	Cylinder bore diameter, (mm)	Evaluative	To be specified by the manufacturer	91.128	90.94	Yes
(b)	Clearance between piston & cylinder liner at skirt, (mm)	Non Evaluative		0.120	0.052 to 0.055	Yes
(c)	Ring end gap (mm):					
-	Top comp. ring.	Evaluative	-do-	1.50	0.30 to 0.45	Yes
-	2 nd comp. ring.		-do-	1.50	0.95 to 1.10	Yes
-	Oil ring.		-do-	1.50	0.25 to 0.45	Yes
(d)	Ring groove clearance (mm):					
-	Top comp. ring.	Evaluative	-do-	0.20	0.125 to 0.127	--
-	2 nd comp. ring.		-do-	0.15	0.097 to 0.108	Yes
-	Oil ring.		-do-	0.10	0.054 to 0.059	Yes
(e)	Clearance of main bearings (mm):					
-	Diametrical clearance	Evaluative	To be specified by the manufacturer	0.24	0.063 to 0.078	Yes
-	Crankshaft end float	Evaluative		0.50	0.16	Yes
(f)	Clearance of big end bearings, (mm):					
-	Diametrical	Evaluative	-do-	0.24	0.063 to 0.086	Yes
-	Axial	Evaluative	-do-	0.50	0.15	Yes
(g)	Clearance between king pin and bush, (mm)	Non Evaluative	-do-	1.5	0.071 to 0.093	Yes
(h)	Clearance between centre pin and bush, (mm)	Non Evaluative	-do-	1.5	0.064 to 0.07	Yes

15.1.1 C

Sl. No.

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15.1.1 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

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	Air cleaner oil pull over, max. oil pull over (%)	0.25% (max.)	0.14	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	Meets the requirements	Yes
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 : Conforms
consumption and labeling of agricultural tractors (First revision) [IS: 10273-1987 (Reaffirmed in March, 2009)]



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- ii) Agricultural tractors – Rear mounted power take-off - : Conforms
Types 1, 2 and 3(third revision)[IS: 4931-1995
(Reaffirmed in March, 2009)]
- iii) Agricultural wheeled tractors - Rear mounted three- : Conforms
point linkage: Part 1 Categories 1, 2, 3 & 4 (fourth
revision) [IS 4468 (Part-I):1997 (Reaffirmed in March,
2007)/ISO 730-1:1994] 15.4.1.1
- iv) Drawbar for agricultural tractors – Link type [IS : Conforms
12953:1990 (Reaffirmed in March, 2007)]
- v) Agricultural tractors - Operator's seat technical : Does not conform
requirement [IS 12343 -1998 (First revision)
(Reaffirmed in March, 2009)]
- vi) Guide for safety & comfort of operator of agricultural : Does not conform
tractors: Part 1 General requirements (first revision) :
[IS 12239 (PT-1)-1996 (Reaffirmed in March,
2009)/ISO 4254-1:1989] 15.4.1
- vii) Tractors and machinery for agriculture and forestry – : Does not conform
Technical means for ensuring safety Part 2: Tractors
(first revision) IS 12239 (PT-2)-1999 (Reaffirmed in
March, 2009)]
- viii) Tractors and machinery for agriculture and forestry, : Does not conform
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)] 15.4.1
- ix) Guide lines for location and operation of operator : Conforms
controls on agricultural tractors and machinery (first
revision) (IS: 8133 – 1983) (Reaffirmed in March,
2009)] 15.4.1
- x) Agricultural Tractor & Machinery Lighting device for : Conforms
travel on public roads (IS: 14683-1999) (Reaffirmed in
March, 2009)] 15.4.1

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

- i) The percentage of backup torque was recorded as 11.0 & 11.42 % in case of previous & present sample respectively. 15.4.1
- ii) The maximum power was recorded as 31.8 & 30.9 kW in case of previous & present sample respectively against the declaration of 30.9 kW, which is 2.83 % less in case of present test sample. 15.4.1
- iii) The specific fuel consumption corresponding to maximum power in case of previous and present sample was measured as 248 & 253 g/kWh respectively against the declaration of 247 g/kWh. Improvements were not recorded in the specific fuel consumption in the present sample. 15.4.1
- iv) The power drop under high ambient condition in compare to the natural ambient condition was recorded as 3.24 %. 15.4

15.4.1.2 Drawbar Performance:

- i) The maximum drawbar power with un-ballasted tractor was recorded as 26.4 kW & 26.3 kW in case of previously tested and present test sample against the minimum requirement of 25.4 & 24.7 kW respectively.
- ii) The maximum drawbar pull corresponding to 15% wheel slip with un-ballasted tractor was recorded as 14.8 kN in case of previously tested and present test sample against the minimum requirement of 12.24 & 12.27 kN respectively.



- iii) During 10 hr drawbar performance the tyre creeping over rim of RHS tyre were observed as 40 mm in present test sample respectively, it is on higher side and should be looked into.

15.4.1.3 Hydraulic performance:

- i) The maximum lifting capacity at hitch points and at the standard frame was observed as 13.80 kN and 9.19 kN against the declared value of 14.21 KN and 10.29 kN respectively.
- ii) The moment about rear axle with standard frame was calculated as 17.97 kN-m and the moment about front axle was calculated as 11.57 kN-m. The moment about rear axle is on higher side as compared to the moment about front axle. It is, therefore, recommended that the lifting capacity of the hydraulic system may be reduced or suitable standard ballast may be provided to avoid the front lifting of the tractor.

15.4.1.4 Mechanical Vibration:

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

15.4.1.5 Three point linkage:

Some of the parameters of the three point linkage conform to Cat.-I and some of them conform to Cat.-II. Keeping in view of the spirit of standardization, the necessary improvements may be incorporated.

15.4.1.6 Specification of power take-off Shaft :

The dimension "c" of the power take-off shaft (ref. fig. 2(a) does not meet the requirement of IS: 4932-2995. This should be looked into for necessary corrective action.

15.4.1.7 Operator's Seat:

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

15.4.1.8 Controls:

Controls are not identifiable with symbols for oil lubricant type & its frequency and turn signals for left-right movement as per the requirements of IS: 12343:1998 and calls for necessary corrective action.

15.4.1.9 General:

The discard limit for some measurement has been changed during submit ion of every batch testing of the tractor. The discard limit for crankshaft end float and piston ring end gap exceeds in compare to the discard limit of Initial commercial test. This should be looked into.

15.4.2 Field performance:

The major breakdowns were not observed in the field test during Commercial Test (BT) of the tractor model "Tempo Balwan 500" (base OX -45) tested vide test report No. T-501/978 (August, 2004). So, as per the provision laid down in clause 7.2 of IS: 12207- 2008, the complete field test on this tractor model was not conducted during the batch testing. However the field test with rotavator implements was conducted, which was not cover during the previous commercial test and the summary of field performance test is presented in Chapter-10 of this report.



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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 for spark arresting device in exhaust system.
- ii) Provision of vertical retainers at both sides of clutch pedal.
- iii) The minimum cautionary notice as per clause 11.2 of IS: 12239 (Part-2)-1999 has not been provided.
- iv) The working clearance around hydraulic operating lever (raise/ lower) and external circuit lever should be provided as per the requirement of relevant Indian Standard
- v) Provision for the PTO master shield

15.7 Adequacy of Literature supplied with machine:

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

- a) Operation and maintenance owner's manual for Balwan 400/450/500
- b) Workshop manual
- c) Spare Parts Catalogue for Balwan 400/450/500

15.7.2 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.

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

TESTING AUTHORITY:

PRADIP C. MESHAM
AGRICULTURAL ENGINEER

H. L. YADAV
SENIOR AGRICULTURAL ENGINEER

V.N. KALE
DIRECTOR



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)	This will be taken care in series of production.
16.4	Para 14.1.8 (ii)	This dimension will be ensured in future.
16.5	Para 14.1.8 (vii)	This will be taken care in series of production
16.6	Para 14.1.8 (ix)	We have noted the point and care will be taken to establish the compliance.

ANNEXURE - ITRACTOR RUN HOURS DURING TEST

A	LABORATORY AND TRACK TESTS:	HOURS
1.	Running-in	63.0
2.	PTO performance test	7.66
3.	Power lift and hydraulic pump performance test	0.39
4.	Drawbar performance test	14.33
5.	Brake test	1.95
6.	Noise measurement	1.0
7.	Mechanical vibration test	1.0
8.	Air cleaner oil pull over test	3.50
9.	Theoretical speed test	0.45
B	FIELD TEST	10.0
C	HAULAGE TEST:	9.27
D	Miscellaneous test and other run hours including idle run, transportation, trials and preparation for test, warming up	9.97
	TOTAL:	122.52



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ANNEXURE – II

Brief specifications of Implements used during field Test (present sample)

SI. NO.	Item	ROTAVATOR
1.	Make	Howard
2.	Type	Mounted
3.	No. of blades	36
4.	Types of blades	Hatchet
5.	Size of blades(mm)	255 x 50 x10
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

ANNEXURE –III

Brief specifications of Implements used during field Test of Commercial Test (BT)

SI No.	Item	M. B. Plough	Disc Plough	Cultivator	Paddy Harrow
1	Make	N.A.	N.A.	TAFE ACCESS	ITL
2	Type	Mounted	Mounted	Mounted, spring loaded	Mounted
3	No. of bottoms/discs/tyne	Three	Three	Eleven	Twelve
4	Type of bottoms/discs/tyne	General purpose	Plain concave	Reversible	Notched Concave
5	Size of bottoms/discs/tyne	335	630	240 x 55	375
6	Spacing of bottoms/discs/tyne	405	510	246	160
7	Lower hitch point span, (mm)	954	755	760	625
8	Mast height, (mm)	560	390/430	465	460
9	Overall dimensions, (mm)				
	- Length	1930	1805	855	1500
	- Width	1175	1050	2590	2425
	- Height	1075	1140	1055	1280
10	Gross mass, (kg)	300	275	370	265