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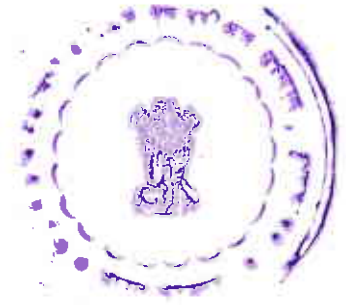
व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT (Initial)

संख्या / No. : T-842/1352/2012
माह / Month : August, 2012

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SWARAJ 744 XM 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

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SWARAJ 744 XM TRACTOR – Commercial (Initial)

- Manufacturer** : Mahindra & Mahindra Ltd.,
Swaraj Division
Phase IV, Industrial Area, S.A.S. Nagar
(Mohali)
Near Chandigarh – 160 055
- Test requested by** : Mahindra & Mahindra Ltd.,
Swaraj Division
Phase IV, Industrial Area, S.A.S. Nagar
(Mohali)
Near Chandigarh – 160 055
- Place of running-in** : At Applicant's works
- Duration of said running-in, (h):**
- Engine : 28
 - Transmission : 32
- 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 : Swaraj
 - Model : 744 XM
 - Type : Four wheeled, rear-wheel driven, unit construction general purpose, agricultural tractor
 - Year of manufacture : 2011
 - Chassis number : WWCG 49606141681
 - Country of origin : India
- 1.2 Engine:**
- Make : Swaraj
 - Model : RB 30 XM
 - Type : Water cooled, four stroke, direct injection diesel engine
 - Serial number : 43.1021/SPG 07258
- 1.2.1 Engine speed(Manufacturer's recommended production setting), (rpm):**
- Maximum speed at no load : 1900 to 2000
 - Low idle speed : 580 to 700
 - Speed at maximum torque : 1000 to 1400
- Rated speed, (rpm):**
- For PTO use : 1800
 - For drawbar use : 1800



17. SUMMARY OF OBSERVATIONS, COMMENTS & RECOMMENDATIONS

17.1 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:

Sl. 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	30.1 (D)	29.3	Yes
b)	Power at rated engine speed, (kW)	Non Evaluative	-do-	30.1 (D)	29.3	Yes
c)	Specific fuel consumption corresponding to maximum power, (g/kWh)	Non Evaluative	± 5%	258 (D)	254	Yes
d)	Maximum equivalent crankshaft torque, (Nm)	Non Evaluative	± 8%	188 (D)	184.5	Yes
e)	Back-up torque, percent	Non Evaluative	10 percent, min.	15 % (D)/ 10% (R)	18.6	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)	105	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.	115 (D)	98	Yes
g)	Engine oil consumption, (g/kWh)	Evaluative	Not exceeding 1% of SFC at max. power under High ambient conditions	2.54 (R)	0.34	Yes
h)	Smoke level	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 per metre (R)	0.19	Yes

1
17.1.2

a)

b)

c)

d)

17.1.3

a)

b)

17.1.4

a)

b)

c)

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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	18.42 (R) 21 (D)	25.0	Yes
b)	Max. drawbar pull without ballast corresponding to 15 percent wheel slip, (kN)	Evaluative	Minimum 65% of static mass of tractor without ballast	13.26 (R) 15 (D)	17.4	Yes
c)	Maximum drawbar power without ballast, (kW).	Evaluative	Min. 80% of PTO power as referred in 16.1.1 (a) of PTO performance	23.4 (R) 25 (D)	25.4	Yes
d)	Maximum transmission oil temperature (°C)	Non Evaluative	The declared value should not exceed the maximum value specified by oil company	110 (D)	56	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%]	14.71 (D)	19.67	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	6.94 (R) (Minimum) 10.78 (D)	13.97	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]	50 (R)	29	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)	8.32	Yes
	2) Hot brake	Evaluative	10	10 (R)	8.64	Yes
b)	Maximum force exerted on the brake pedal to achieve a deceleration of 2.5 m/s ² (N)	Evaluative	600	600 (R)	210 to 277	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



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17.1.5 Noise measurement :						
a)	Maximum ambient noise emitted by the tractor dB(A)	Evaluative	As per CMVR	88 (R)	82	Yes
b)	Maximum noise at operator's ear level dB(A)	Evaluative	As per CMVR	98 (R)	94	Yes
17.1.6 Amplitude of mechanical vibrations at :						
1)	Left foot rest	Non Evaluative	100 microns (max)	100 (R)	140	No
2)	Right foot rest				110	No
3)	Seat (with driver seated)				90	Yes
4)	Steering Wheel				90	Yes
17.1.7 Haulage requirements :						
a) Gross mass of the trailers, (tones):						
1)	Two wheel	Non Evaluative	--	5.0 (D)	5.0	Yes
2)	Four wheel		--	6.0 (D)	6.0	Yes
b) Distance travelled / litre of fuel consumption, (km/l):						
1)	Two wheel	Non Evaluative	--	5.0 to 6.5 (D)	5.05 to 5.21	Yes
2)	Four wheel		4.0 to 5.0 (D)	5.0 to 6.0	Yes	
c) Fuel consumption (ml/km/tonne):						
1)	Two wheel	Non Evaluative	--	30 to 40 (D)	38.38 to 39.59	Yes
2)	Four wheel		--	30 to 40 (D)	33.49 to 33.75	Yes
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 mud and / or water was observed	Yes
1)	Clutch assembly	-do-				
2)	Brake housings	-do-				
3)	Front axle hubs	-do-				

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17.1.9

a)

b)

17.1.10

17.1.11

a)

b)

c)

d)

e)

f)

g)

h)

CEN



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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	provided	Yes
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	--	Swaraj	Yes
2)	Model	Evaluative		--	744 XM	Yes
3)	Year of manufacture	Evaluative		--	WW	Yes
4)	Engine number	Evaluative		--	43.1021/SPG0725 8	Yes
5)	Chassis number	Evaluative		--	WWCG 49606141681	Yes
6)	Declaration of PTO power, (kW)	Evaluative		--	30.1 (41.0)	Yes
17.1.11	Discard limit for:					
(a)	Cylinder bore diameter, (mm)	Evaluative	To be specified by the manufacturer	110.225	100.03 to 100.04	Yes
(b)	Clearance between piston & cylinder liner at skirt, (mm)	Non Evaluative		0.60 (D)	0.188 to 0.189	Yes
(c)	Ring end gap (mm):					
-	Top comp. ring.	Evaluative	-do-	1.75	0.55 to 0.60	Yes
-	2 nd comp. ring.		-do-	1.75	0.45	Yes
-	Oil ring.		-do-	1.75	0.45	Yes
(d)	Ring groove clearance (mm):					
-	Top comp. ring.	Evaluative	-do-	--	Tapered	--
-	2 nd comp. ring.		-do-	0.25	0.079 to 0.082	Yes
-	Oil ring.		-do-	0.25	0.058 to 0.062	Yes
(e)	Clearance of main bearings (mm):					
-	Diametrical clearance	Evaluative	To be specified by the manufacturer	0.30	0.126 to 0.138	Yes
-	Crankshaft end float	Evaluative		0.50	0.30	Yes
(f)	Clearance of big end bearings, (mm):					
-	Diametrical	Evaluative	-do-	0.30	0.134 to 0.137	Yes
-	Axial	Evaluative	-do-	0.60	0.25 to 0.30	Yes
(g)	Clearance between king pin and bush, (mm)	Non Evaluative	-do-	0.60	0.11 to 0.13	Yes
(h)	Clearance between centre pin and bush, (mm)	Non Evaluative	-do-	0.80	0.12	Yes



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17.1.12 CATEGORY 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	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	2	3	4	5
1	Maximum 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.	Not provided	No
		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	Does not meets the requirements	No
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	--
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)] : Conforms



- 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)] : Conforms
- 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)] : 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

17.4 Salient Observations:

17.4.1 Laboratory tests:

17.4.1.1 PTO Performance:

- i) The backup torque is. **18.6%**.
- ii) The specific fuel consumption corresponding to maximum power was measured as **256 g/kWh** against the declaration of **254 g/kWh**, which is within the tolerance limit of IS: 12207-2008.
- iii) The power drop under high ambient condition in compare to the natural ambient condition was recorded as **6.14 %**. This should be looked into.

17.4.1.2 Mechanical Vibration:

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

17.4.1.3 Three point linkage:

Lateral distance from lower hitch point to center line of tractor does not meet the requirements of **IS-4468-(Part I)-1997**. This should be looked into



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- 17.4.1.4 Drawbar linkages**
Some of the parameters of the drawbar 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.
- 17.4.2 Field performance test:**
17.4.2.2 Wet land cultivation (Puddling operation):
No ingress of mud/or water was observed during wetland cultivation. Hence the tractor meets the requirements for wet land cultivation (Puddling operation) as per IS: 11082-1984 and found suitable for wetland cultivation.
- 17.5 Maintenance / Service Problems:**
No noticeable maintenance/ 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) The working clearance around draft control lever and position control lever should be as per IS: 12239 (Part-2) – 1999.
 - iii) Provision of vertical retainers on both sides of clutch and brake pedals.
 - iv) Provision of differential lock.
 - v) The minimum cautionary notice should be as per clause 11.2 of IS: 12239 (Part-2)-1999.
 - vi) The guard for alternator and silencer should be as per IS: 12239 (Part-2)-1999
- 17.7 Adequacy of Literature supplied with machine:**
The following literature has been supplied with the tractor
- i) Tractor's part's catalogue
- Operator's Manual and Service Manual should be provided **essentially with inclusion** of all specific data and information required for users.
- 17.7.1** The literatures should also be brought out in national **as well as other** regional languages for the guidance of users and service personnel.

TESTING AUTHORITY:

PRADIPKUMAR C. MESHAM
AGRICULTURAL ENGINEER

P. K. VERMA
SENIOR AGRICULTURAL ENGINEER

V.N. KALE
DIRECTOR



18. APPLICANT'S COMMENTS

Para No.	Our Reference	Applicant's comments
18.1	Para 17.3 (iii)	These requirements are being revisited for necessary corrective action at our end
18.2	Para 17.4.1.1 (iii), 17.4.1.2, 17.6 (ii)	Study & trials are under progress for necessary corrective action.
18.3	Para 17.4.1.3, 17.4.1.4, 17.6 (iii, v)	These requirements are being revisited for necessary corrective action at our end.

ANNEXURE – I

TRACTOR RUN HOURS DURING TEST

A.	LABORATORY AND TRACK TESTS:	HOURS
1.	Running-in	--
2.	PTO performance test	11.97
3.	Power lift and hydraulic pump performance test	0.57
4.	Drawbar performance test	14.48
5.	Turning ability	0.50
6.	Location of centre of gravity	0.50
7.	Operator's field of vision	0.20
8.	Brake test	1.50
9.	Noise measurement	1.13
10.	Air Cleaner oil pullover test	3.50
11.	Mechanical vibration test	1.00
12.	Nominal speed test	1.08
B.	FIELD TEST:	
1.	Mould Board ploughing	11.25
2.	Rotavation	10.17
3.	Wet land (puddling) operation (including water proof test)	15.2
C.	HAULAGE TEST:	9.37
D.	Miscellaneous test and other run hours including idle run, transportation, trials and preparation for test	10.15
	TOTAL:	92.57



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ANNEXURE- II

BRIEF SPECIFICATION OF IMPLEMENTS USED DURING FIELD TEST

S. No	Item	M.B. Plough Plough	Rotavator	Paddy puddler
1	2	3	4	5
1.	Make	Anil Industries	Howard	NA
2.	Type	Mounted	Mounted	Mounted
3.	No. of Disc/blades	3	36 in 7 flange	10 (5x5)
4.	Type of Disc/blades	General purpose	Hatchet	Notched concave
5.	Size of bottoms/blades, (mm)	320	225 x 50 x 10	450
6.	Spacing of bottoms/flanges, (mm)	260	250	170
7.	Lower hitch point span, (mm)	750	720	700
8.	Mast height, (mm)	570	481	395
9.	Overall dimensions, (mm):			
	- Length	2100	1750	1300
	- Width	1180	1000	2492
	- Height	1220	980	1230
10.	Gross mass, (kg)	355	345	245

ANNEXURE-III

BRIEF SPECIFICATION OF HALF CAGE WHEEL

Sr. No.	Items	Specification
1	Type	Half cage wheel
2	Outer dia. (mm)	1800
3	Width (mm)	355
4	No. & Type of Lugs	12, straight lugs made of MS angle section welded to angle iron frame
5	Size of angle section, (mm)	50 x 45 x5
6	Length of lug, (mm)	350
7	Spacing of lug, (mm)	205
8	Weight of each cage wheel (kg)	60