

व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT (Initial)

संख्या / No. : T-1016/1540/2016
माह / Month : March, 2016



SWARAJ 824 XM TRACTOR



सत्यमेव जयते

भारत सरकार

कृषि एवं किसान कल्याण मंत्रालय
(कृषि, सहकारिता एवं किसान कल्याण विभाग)

GOVERNMENT OF INDIA

MINISTRY OF AGRICULTURE AND FARMERS WELFARE

(DEPARTMENT OF AGRICULTURE, CO-OPERATION AND FARMERS WELFARE)

केन्द्रीय कृषि मशीनरी प्रशिक्षण एवं परीक्षण संस्थान

ट्रैक्टर नगर, बुदनी (म.प्र.) ४६६ ४४५

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T- 1016/1540/2016

SWARAJ 824 XM TRACTOR – Commercial (Initial)

Manufacturer	:	M/s. Mahindra & Mahindra Limited, Farm Equipment Sector, Swaraj Division, Phase-IV, Industrial Area, S.A.S. Nagar, Mohali Punjab-160 055
Test requested by (applicant)	:	M/s. Mahindra & Mahindra Limited, Farm Equipment Sector, Swaraj Division, Phase-IV, Industrial Area, S.A.S. Nagar, Mohali Punjab-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	:	824 XM
Type	:	Four wheeled, rear-wheel driven, unit construction, general purpose, agricultural tractor
Year of manufacture	:	WV (i.e. 2015)
Chassis number	:	WVTA 89405100001
Country of origin	:	India
1.2 Engine:		
Make	:	M/s Swaraj Engines Ltd.
Model	:	S-15 XME
Type	:	Water cooled, naturally aspirated, four stroke, direct injection, diesel engine
Serial number	:	S 15 XM-106/SVA00052
1.2.1 Engine speed(Manufacturer's recommended production setting), (rpm):		
- Maximum speed at no load	:	1690 to 1810
- Low idle speed	:	550 to 650
- Speed at maximum torque	:	950 to 1250
Rated speed, (rpm):		
- For PTO use	:	
- For drawbar use	:	1650
1.3 Cylinder & Cylinder Head:		
Number	:	One
Disposition	:	Vertical
Bore/stroke, (mm)	:	120/136 (apa)
Capacity as specified by the applicant, (cc)	:	1537
Compression ratio	:	19.6 (± 0.5) : 1 (apa)
Type of cylinder head	:	Monoblock
Type of cylinder liners	:	Wet, replaceable
Type of combustion chamber	:	Re-entrant cavity on piston head
Arrangement of valves	:	Overhead



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: 12207-2014 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: 12207-2014	Values declared by the applicant/ (D) Requirement (R)	As observed	Whether meets the require- ments (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 >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	13.1 (D)	13.7	Yes
b)	Power at rated engine speed, (kW)	Non Evaluative	-do-	13.1 (D)	13.5	Yes
c)	Specific fuel consumption corresponding to maximum power, (g/kWh)	Non Evaluative	+ 5%	272 (D)	269	Yes
d)	Maximum equivalent crankshaft torque, (Nm)	Non Evaluative	± 8%	103.2 (D)	94.4	Yes
e)	Back-up torque, percent	Non Evaluative	10 percent, min.	10 min. (D)	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)	102	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.	118 (D)	87	Yes
g)	3) Engine oil consumption, (g/kWh)	Evaluative	Not exceeding 1% of SFC at max. power under High ambient conditions	2.68 (R)	1.67	Yes
h)	4) 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 meter (R)	0.09	Yes



T- 1016/1540/2016

SWARAJ 824 XM TRACTOR – Commercial (Initial)

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	16.00, min. (D) 15.52 (R) min.	14.17	No
b)	Max. drawbar pull without ballast corresponding to 15 percent wheel slip, (kN)	Evaluative	Minimum 65% of static mass of tractor without ballast	12.00, min. (D) 11.73 (R) min.	13.48	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.	10.5 (D) min 10.3 (R) min..	12.1	Yes
d)	Maximum transmission oil temperature (°C)	Non Evaluative	The declared value should not exceed the maximum value specified by oil company	110 (D)	58	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%]	9.81 (D)	10.00	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	3.22 (R) Minimum 7.65 (D)	8.43	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)	9.65	Yes
2)	Hot brake	Evaluative	10	10 (R)	9.65	Yes
b)	Maximum force exerted on the brake pedal to achieve a deceleration of 2.5 m/s ² (N)	Evaluative	600	600 (R)	392 to 403	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)	Effective	Yes
17.1.5 Noise measurement :						
a)	Maximum ambient noise emitted by the tractor, dB(A)	Evaluative	As per CMVR	88 (R)	88	Yes
b)	Maximum noise at operator's ear level, dB(A)	Evaluative	As per CMVR	96 (R)	94	Yes



T- 1016/1540/2016

SWARAJ 824 XM TRACTOR – Commercial (Initial)

1	2	3	4	5	6	7
17.1.6	Amplitude of mechanical vibrations at :					
1)	Left foot rest	Non Evaluative	100 microns (max)	100 (R)	90	Yes
2)	Right foot rest				130	No
3)	Seat (with driver seated)				130	No
4)	Steering Wheel				260	No
17.1.7	Air cleaner oil pull over:					
1)	Max. percentage of oil pull over	Non Evaluative	0.25 percent maximum/tolerance Nil	0.25% Max.	0.17	Yes
17.1.8	Haulage requirements :					
a)	Gross mass of the trailers, (tones):					
1)	Two wheel	Non	--	4.0 (D)	4.0	Yes
2)	Four wheel	Evaluative	--	4.0 (D)	4.0	Yes
b)	Distance travelled / litre of fuel consumption, (km/l):					
1)	Two wheel	Non Evaluative	--	5.0 to 7.0 (D)	7.38 to 8.03	No
2)	Four wheel		5.0 to 7.0 (D)	7.95 to 8.19	No	
c)	Fuel consumption (ml/km/tonne):					
1)	Two wheel	Non Evaluative	--	35 to 45 (D)	31.12 to 33.84	No
2)	Four wheel		--	35 to 45 (D)	30.52 to 31.43	No
17.1.9	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-				
4)	Engine oil	-do-				
5)	Transmission oil	-do-				
17.1.10	Safety features :					
a)	Guards against moving and hot parts	Evaluative	Belt drives, pulley, silencer, hydraulic pipes (As per IS 12239 (part 2) -1999)	--	Meets the requirement	Yes
b)	Lighting arrangement (Tractor having more than 1150 mm rear track width)	Evaluative	As per CMVR 14603-1999	--	Meets the requirement	Yes
c)	Seating requirement (Tractors having more than 1150 mm rear track width)	Non-Evaluative	Should meet the requirements of IS 12343 (as amended from time to time)	Not Applicable (track width less than 1500 mm)	--	--



T- 1016/1540/2016

SWARAJ 824 XM TRACTOR – Commercial (Initial)

1	2	3	4	5	6	7
d)	Technical requirements for PTO shaft	Non-Evaluative	Should meet the requirements of IS 4931 (as amended from time to time)	--	Does not meet the requirement	No
e)	Dimension of three point linkage	Non-Evaluative	Should meet the requirements of IS 4468 (part 1) (as amended from time to time)	--	Does not meet the requirement	No
f)	Specification of linkage and swinging drawbars	Non-Evaluative	Should meet the requirements of IS 12953 and IS 12362 (part 3) (as amended from time to time)	--	Does not meet the requirement	No
17.1.11	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		- 824 XM		Yes
	3) Year of manufacture	Evaluative		- WV		Yes
	4) Engine number	Evaluative		- S15XM-106/SUA00052		Yes
	5) Chassis number	Evaluative		- WVTA 89405100001		Yes
	6) Declaration of PTO power, (kW)	Evaluative		- 13.1		Yes
17.1.12	Discard limit for:					
(a)	Cylinder bore diameter, (mm)	Evaluative	To be specified by the manufacturer	120.30	120.00	Yes
(b)	Clearance between piston & cylinder liner at skirt, (mm)	Non Evaluative		0.550	0.114 to 0.360	Yes
(c)	Ring end gap (mm):					
	- Top comp. ring.	Evaluative	-do-	2.50	0.45	Yes
	- 2 nd comp. ring.		-do-	2.50	0.50 to 0.55	Yes
	- Oil ring.		-do-	2.50	0.55	Yes
(d)	Ring groove clearance (mm):					
	- Top comp. ring.	Evaluative	-do-	--	Taper rings	--
	- 2 nd comp. ring.		-do-	0.25	0.068	Yes
	- Oil ring.		-do-	0.25	0.057	Yes
(e)	Clearance of main bearings (mm):					
	- Diametrical clearance	Evaluative	To be specified by the manufacturer	0.30	0.109 to 0.147	Yes
	- Crankshaft end float	Evaluative		0.60	0.20	Yes
(f)	Clearance of big end bearings, (mm):					
	- Diametrical	Evaluative	-do-	0.30	0.090 to 0.124	Yes
	- Axial	Evaluative	-do-*	0.60	0.35	Yes
(g)	Clearance between king pin and bush, (mm)	Non Evaluative	-do-	0.60	0.087 to 0.114	Yes
(h)	Clearance between centre pin and bush, (mm)	Non Evaluative	-do-	0.80	0.125 to 0.141	Yes



1	2	3	4	5	6	7
17.1.13	Literature (Submission to test agency)					
(a)	Operator manual	Evaluative	Provided/Not Provided	As relevant Code 8132)	per IS (IS	Provided Yes
(b)	Parts Catalogue	Evaluative	Provided/Not Provided	As relevant Code 8132)	per IS (IS	Provided Yes
(c)	Workshop/Service manual	Evaluative	Provided/Not Provided	As relevant Code 8132)	per IS (IS	Provided Yes

17.1.14 CATEGORY OF BREAKDOWNS / DEFECTS :

S. 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	Whether meets the requirements (Yes/No.)
1	2	3	4	5
1	Maximum oil pull over, (%)	0.25% (max.)	0.17	Yes
2.	Fitment of ROPS	With a provision for fitment of ROPS.	Not provided	--
		If ROPS fitted it should meet the requirement of IS: 11821-1992	ROPS not fitted	--
3.	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**



T- 1016/1540/2016

SWARAJ 824 XM TRACTOR – Commercial (Initial)

- iii) Agricultural wheeled tractors - Rear mounted three-point linkage: : **Does not conform**
Part 1 Categories 1, 2, 3 & 4 (fourth revision) [IS 4468(Part-1):1997 (Reaffirmed in March, 2007)]
- iv) Drawbar for agricultural tractors – Link type [IS 12953:1990 : **Does not conform**
(Reaffirmed in March, 2007)]
- v) Agricultural tractors - Operator's seat technical requirement :
(First revision) [IS 12343:1998 (Reaffirmed in March, 2009)] : --
(Trackwidth less than 1500 mm)
- vi) Guide for safety & comfort of operator of agricultural tractors: : **Does not conform**
Part 1 General requirements (first revision) :[IS 12239 (PT-1)-1996 (Reaffirmed in March, 2007)]/ISO 4254-1:1989]
- vii) Tractors and machinery for agriculture and forestry – Technical : Conforms
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, powered : Conforms
lawn and garden equipment – Symbols for operator controls and other displays [IS: 6283 (Part-1)-2006 (Reaffirmed in March, 2009) and IS:6283 (Part-2)-2007 (Reaffirmed in March, 2009)]
- ix) Guide lines for location and operation of operator controls on : **Does not conform**
agricultural tractors and machinery (first revision) (IS: 8133 – 1983 (Reaffirmed in March, 2009))
- x) Agricultural Tractor & Machinery Lighting device for travel on : Conforms
public roads [(IS: 14683-1999 (Reaffirmed in March, 2009))

17.4 Salient Observations:**17.4.1 Laboratory tests:****17.4.1.1 PTO Performance:**

The backup torque is 18.6 %.

17.4.1.2 Drawbar performance:

The maximum drawbar pull with ballast corresponding to 15 percent wheel slip was recorded as 14.17 kN against the minimum requirement of 15.52 kN as per IS: 12207-2014. This calls for necessary corrective action.

17.4.1.3 Mechanical Vibration:

The amplitude of mechanical vibration on various assemblies marked as (*) especially at right foot rest, seat and steering control wheel 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.

17.4.1.4 Hydraulic test

The total cumulative drop of lower link during load maintenance test was observed as 125 mm, which indicates the internal leakage in the hydraulic system. This should be looked into

17.4.1.5 Power take off shaft:

The dimensions "d" and "A" of Power Take Off shaft does not meet the requirements of IS: 4931-1995. This should be looked into for necessary corrective action.

**17.4.1.6 Three point linkage:**

- i) The width of ball of lower hitch point does not meet the requirements of IS: 4468 (Part-1) - 1997
- ii) The lateral distance from lower hitch point to centre line of tractor does not meet the requirements of IS: 4468 (Part-1) - 1997
- iii) The lower hitch point height does not meet the requirements of IS: 4468 (Part-1) - 1997. This should be looked into for necessary corrective action.

17.4.1.7 Linkage drawbar:

The dimensions " D₁" of Linkage Drawbar does not meet the requirements of IS: 12953-1995. This should be looked into for necessary corrective action.

17.4.1.8 Components/assembly inspection:

The overall thickness of brake discs measured after tests was recorded higher than the initial specified values. This should be looked into for necessary corrective action.

17.4.2 Field performance test:

During the rotavation and puddling operations the on load engine rpm was recorded below the rated engine speed of the tractor, it means the tractor was not able to take load during rotavation and puddling operations. This should be looked into.

17.4.3 Haulage requirements:

The distance travelled per liter of fuel (km/l) and fuel consumption (ml/km/tonne) recorded during the haulage performance test are not as per the values declared by the applicant. This should be looked into.

17.5 Maintenance / Service Problems:

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

17.7 Recommendation with regard to safety on tractor:

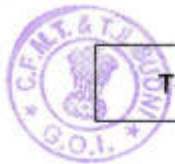
The following requirements, inter alia, may be considered for incorporation on the tractor:

- i) Proper inclination of operator's seat towards rear direction.
- ii) Provision for spark arresting device in exhaust system.
- iii) Sufficient width of step.
- iv) Provision of differential lock.
- v) Working clearance around the draft control and position control lever

17.8 Adequacy of Literature supplied with machine:

- 17.8.1**
- i) Operator's Manual
 - ii) Spare Parts Catalogue
 - iii) Service Manual

- 17.8.2**
- The literatures should also be brought out in national, as well as other regional languages for the guidance of users and service personnel.



T- 1016/1540/2016

SWARAJ 824 XM TRACTOR – Commercial (Initial)

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 (March, 2015 to March, 2016)	10 Months	No	None

TESTING AUTHORITY:

C. K. TJARE
AGRICULTURAL ENGINEER

P. C. MESHARAM
SENIOR AGRICULTURAL ENGINEER

C.R.LOHI
DIRECTOR

19. APPLICANT'S COMMENTS

Para No.	Our Reference	Applicant's comments
19.1	1.20.1(i),1.20.4(i)(ii), 1.20.5(i) & 17.7(i)(iv) (v)(vi)(vii)	These requirements are being revisited for necessary corrective action at our end
19.2	17.3(ii)(iii)(iv)(vi)&(ix)	Study & trials are under progress for necessary corrective action
19.3	17.4.1.2,17.4.1.3, 17.4.1.4 & 17.4.1.5	These requirements are being revisited for necessary corrective action at our end
19.4	17.4.1.6(i)(ii)(iii), 17.4.1.7,17.4.1.8,17.4.2 17.4.3	Study & trials are under progress for necessary corrective action

**ANNEXURE-I****BRIEF SPECIFICATION OF IMPLEMENTS USED DURING FIELD TEST**

S.No	Item	Disc Plough	Rotavator	Paddy puddler
1.	Make	John Deere	NA	ACE
2.	Type	Mounted	mounted	Mounted
3.	No. of bottoms /blades	2	24 in 4 flange	12(6 in each gang)
4.	Type of bottom /blades	Plain concave	Hatchet	Notched
5.	Size of bottoms/blades, (mm)	640	270x30x10	500
6.	Spacing of bottoms/flanges, (mm)	260	240	180
7.	Lower hitch point span, (mm)	850	730	835
8.	Mast height, (mm)	500	600	510
9.	Overall dimensions, (mm):			
	- Length	1570	1280	1020
	- Width	1050	1040	2070
	- Height	1040	920	1045
10.	Gross mass, (kg)	355	150	440

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

S. No.	Items	Specifications
1.	Type	Half cage wheel
2.	Dia, (mm)	1085
3.	Width, (mm)	340
4.	No. and types of lugs	12, straight lugs of MS angle section welded to angle iron frame
5.	Size of angle section, (mm)	50x50x5
6.	Length of lugs, (mm)	340
7.	Spacing of lugs, (mm)	275
8.	Weight of each cage wheels (kg)	60



T- 1016/1540/2016

SWARAJ 824 XM TRACTOR – Commercial (Initial)

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

A.	LABORATORY AND TRACK TESTS:	HOURS
1.	Running-in	--
2.	PTO performance test	20.73
3.	Power lift and hydraulic pump performance test	2.75
4.	Drawbar performance test	18.29
5.	Turning ability	0.40
6.	Location of centre of gravity	0.20
7.	Operator's field of vision	0.20
8.	Brake test	4.00
9.	Noise measurement	1.75
10.	Air Cleaner oil pullover test	3.50
11.	Mechanical vibration test	1.0
12.	Nominal speed test	0.17
B.	FIELD TEST:	
1.	Ploughing	10.80
2.	Rotavation	10.34
3.	Wet land (puddling) operation (including water proof test)	15.42
C.	HAULAGE TEST:	6.53
D.	Miscellaneous test and other run hours including idle run, transportation, trials and preparation for test	6.97
	TOTAL:	103.05