



SWARAJ 855 XM Sensilift



भारत सरकार

GOVERNMENT OF INDIA

कृषि मंत्रालय (कृषि एवं सहकारिता विभाग, मशीनीकरण एवं प्रौद्योगिकी प्रभाग)

Ministry of Agriculture (Deptt. of Agri. & Co-op, Mechanization & Technology Division)

केन्द्रीय कृषि मशीनरी प्रशिक्षण एवं परीक्षण संस्थान

CENTRAL FARM MACHINERY TRAINING & TESTING INSTITUTE

(An ISO : 9001-2008 Certified Institute)

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T-886/1401/2013

SWARAJ 855 XM Sensilift TRACTOR – Commercial (Initial)

Manufacturer : M/s. Mahindra & Mahindra Ltd.
Swaraj Division, Phase- IV, Industrial Area,
S.A.S. Nagar, Distt. – Mohali (Punjab)
Near Chandigarh - 160 055

Test requested by (applicant) : M/s. Mahindra & Mahindra Ltd.,
Swaraj Division, Phase- IV, Industrial Area,
S.A.S. Nagar, Distt. – Mohali (Punjab)
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 : 855 XM Sensilift
- Type : Four wheeled, rear-wheel driven, unit construction
general purpose, agricultural tractor
- Year of manufacture : 2012
- Chassis number : WACL63918961630
- Country of origin : India
- 1.2 Engine:**
- Make : Swaraj
- Model : RB 33 XM+
- Type : Water cooled, naturally aspirated, four stroke,
direct injection, diesel engine
- Serial number : 47.3046/SRH 07682S
- 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
- 1.3 Cylinder & Cylinder Head:**
- Number : Three
- Disposition : Vertical, Inline
- Bore/stroke, (mm) : 110/122 (apa)
- Capacity as specified by the applicant, (cc) : 3480
- Compression ratio : 19.2 (± 0.5) : 1
- Type of cylinder head : Individual
- Type of cylinder liners : Wet, replaceable
- Type of combustion chamber : Direct combustion, Re-entrant
piston crown
- Arrangement of valves : Overhead, inline



T-886/1401/2013

SWARAJ 855 XM Sensilift TRACTOR – Commercial (Initial)

Valve clearance (cold):

- Inlet valve, (mm) : 0.25 to 0.30

- Exhaust valve, (mm) : 0.30 to 0.35

1.4 Fuel System:

Type of fuel feed system : Gravity and force feed

1.4.1 Fuel tank:

Capacity, (l) : 61.40

Location : Above clutch housing

Provision for draining of sediments/
water : Not provided, however a water separator and
sediment bowl is provided

Material of fuel tank : Metallic

1.4.2 Water Separator:

Make : Alert

Type : Inverted funnel gravity separation

Location : In between fuel tank & filters on LHS of
engine.

Capacity (l) : 0.5

1.4.3 Fuel feed pump:

Make : Bosch, India

Type : Plunger with hand primer

Model/Group combination No. : FP/KS22AD62, 9440 030 029

Provision of sediment bowl : Provided (Metallic)

Method of drive : Through cam shaft of fuel injection pump

1.4.4 Fuel filters:

Make : Bosch, India

Model/Group combination No. : F 002 H20 105

Number : Two

Type of elements:

- Primary : Cloth

- Secondary : Paper

Capacity of final stage filter, (l) : 0.45

1.4.5 Fuel Injection pump:

Make : Bosch, India

Model/Group combination No. : F 002 AOZ 797/PES 3A90 D320 RS 2000

Type : Inline, plunger

Serial number : 20580646

Method of drive : Through timing gears

1.4.6 Fuel injectors:

Make : Bosch, India

Model : F 002 C70 552

Type : Multi hole (five holes)

Manufacturer's production pressure
setting, (MPa) : 25.0 to 25.8

Injection timing : 12 ± 1 degree before TDC

Firing order : 1-2-3



T-886/1401/2013

SWARAJ 855 XM Sensilift TRACTOR – Commercial (Initial)

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	33.8 (D)	32.3	Yes
b)	Power at rated engine speed, (kW)	Non Evaluative	-do-	33.8 (D)	32.3	Yes
c)	Specific fuel consumption corresponding to maximum power, (g/kWh)	Non Evaluative	± 5%	258 (D)	259	Yes
d)	Maximum equivalent crankshaft torque, (Nm)	Non Evaluative	± 8%	210 (D)	209.5	Yes
e)	Back-up torque, percent	Non Evaluative	10 percent, min.	18 % (D)	22.2	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)	110	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)	3) Engine oil consumption, (g/kWh)	Evaluative	Not exceeding 1% of SFC at max. power under High ambient conditions	2.61 (R)	0.29	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 metre (R)	0.28	Yes



T-886/1401/2013

SWARAJ 855 XM Sensilift 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	20.75 (R) Minimum 24.00 (D)	26.32	Yes
b)	Max. drawbar pull without ballast corresponding to 15 percent wheel slip, (kN)	Evaluative	Minimum 65% of static mass of tractor without ballast	14.25 (R) Minimum 16.00(D)	17.86	Yes
c)	Maximum drawbar power without ballast, (kW).	Evaluative	Min. 80% of PTO power as referred in 16.1.1 (a) of PTO performance	25.8 (R) Minimum 27.5 (D)	26.8	Yes
d)	Maximum transmission oil temperature (°C)	Non Evaluative	The declared value should not exceed the maximum value specified by oil company	110 (D)	80	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%]	16.67 (D)	21.41	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	7.65 (R) Minimum 11.77 (D)	16.13	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)	11	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)	7.39	Yes
2)	Hot brake	Evaluative	10	10 (R)	7.45	Yes
b)	Maximum force exerted on the brake pedal to achieve a deceleration of 2.5 m/s ² (N)	Evaluative	600	600 (R)	168 to 190	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
17.1.5 Noise measurement :						
a)	Maximum ambient noise emitted by the tractor, dB(A)	Evaluative	As per CMVR	88 (R)	84	Yes
b)	Maximum noise at operator's ear level, dB(A)	Evaluative	As per CMVR	98 (R)	94	Yes



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)	120	No
	2) Right foot rest				130	No
	3) Seat (with driver seated)				70	Yes
	4) Steering Wheel				140	No
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		--	7.0 (D)	7.0	Yes
b)	Distance travelled / litre of fuel consumption, (km/l):					
	1) Two wheel	Non Evaluative	--	5.0 to 6.0 (D)	4.47 to 4.56	No
2) Four wheel	--		5.0 to 6.0 (D)	4.57 to 4.69	No	
c)	Fuel consumption (ml/km/tonne):					
	1) Two wheel	Non Evaluative	--	30 to 40 (D)	43.82 to 44.73	No
2) Four wheel	--		25 to 35 (D)	30.43 to 31.30	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-				
17.1.9	Safety features :					
a)	Guards against moving and hot parts	Evaluative	As per CMVR	At present no requirements	Provided	Yes
		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		--	855 XM Sensilift	Yes
	3) Year of manufacture	Evaluative		--	WA (2012)	Yes
	4) Engine number	Evaluative		--	WACL6391 8961630	Yes
	5) Chassis number	Evaluative		--	47.3046/SR H 07682S	Yes
	6) Declaration of PTO power, (kW)	Evaluative		--	33.8	Yes



1	2	3	4	5	6	7
17.1.11	Discard limit for:					
(a)	Cylinder bore diameter, (mm)	Evaluative	To be specified by the manufacturer	110.225	100.02 to 100.04	Yes
		Non Evaluative		0.60	0.173 to 0.175	Yes
(b)	Clearance between piston & cylinder liner at skirt, (mm)	Non Evaluative				
(c)	Ring end gap (mm):					
	- Top comp. ring.	Evaluative	-do-	1.75	0.40 to 0.50	Yes
	- 2 nd comp. ring.			1.75	0.40 to 0.45	Yes
	- Oil ring.			1.75	0.30 to 0.35	Yes
(d)	Ring groove clearance (mm):					
	- Top comp. ring.	Evaluative	-do-	--	Taper rings	--
	- 2 nd comp. ring.			0.25	0.059 to 0.068	Yes
	- Oil ring.			0.25	0.046 to 0.059	Yes
(e)	Clearance of main bearings (mm):					
	- Diametrical clearance	Evaluative	To be specified by the manufacturer	0.30	0.103 to 0.117	Yes
	- Crankshaft end float	Evaluative		0.50	0.25	Yes
(f)	Clearance of big end bearings, (mm):					
	- Diametrical	Evaluative	-do-	0.30	0.105 to 0.112	Yes
	- Axial	Evaluative	-do-	0.60	0.20	Yes
(g)	Clearance between king pin and bush, (mm)	Non Evaluative	-do-	0.60	0.09 to 0.10	Yes
(h)	Clearance between centre pin and bush, (mm)	Non Evaluative	-do-	0.80	0.11 to 0.13	Yes

17.1.12 CATEGORY OF BREAKDOWNS / DEFECTS :				As observed	Whether meets the requirements (Yes/No.)
S. No.	Category of breakdowns	Category (Evaluative / Non Evaluative)	Requirements as per IS: 12207-2008		
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.)	0.04	Yes
2.	Seating requirements	Should meet the requirements of IS: 12343-1998	Meets the requirements	Yes
3.	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	--
4.	Technical requirements for PTO shaft	Should meet the requirements of IS: 4931 -1995	Meets the requirement	Yes
5.	Dimensions of three point linkage	Should meet the requirements of IS: 4468 (Part-I)-1997	Does not meet the requirements	No
6.	Specifications of linkage drawbar	Should meet the requirements of IS: 12953-1990.	Does not meet the requirements	No
	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.	Not provided (Front tow hook not provided)	No

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)] : Does not conform
- iv) Drawbar for agricultural tractors – Link type [IS 12953:1990 (Reaffirmed in March, 2007)] : Does not conform
- v) Agricultural tractors - Operator's seat technical requirement (First revision) [IS 12343:1998 (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, 2007)]/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)-2006 (Reaffirmed in March, 2009) and IS:6283 (Part-2)-2007 (Reaffirmed in March, 2009)] : 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 22.2%.
- ii) The specific fuel consumption corresponding to maximum power was measured as 259 g/kWh against the declaration of 258 g/kWh, which is within the tolerance limit of IS: 12207-2008.

17.4.1.2 Drawbar performance:

During drawbar performance test, rear tyre creeping was observed as 65 & 50 mm for LHS and RHS tyres respectively which is on higher side and calls for necessary corrective action.

17.4.1.3 Mechanical Vibration:

The amplitude of mechanical vibration especially driver's seat and steering wheel and the 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.

17.4.1.4 Three point linkage:

- i) The diameter of hitch pin hole of upper hitch points & 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 for necessary corrective action.
- ii) 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.

17.4.1.5 Drawbar linkage:

- i) The dimension "B" & "DØ" of the linkage drawbar does not meet the requirements of IS: 12953-1990. This should be looked into for necessary corrective action.
- ii) Some of the parameters of linkage drawbar conform to Cat. I and some of them conform to Cat.II. In view of the spirit of standardization, necessary improvements may be incorporated.

17.4.2 Field performance test:

17.4.2.1 Wet land cultivation (Puddling operation):

No ingress of mud and / or water was noticed during puddling operation of the tractor and meet the requirements of IS: 11082-1984 (Technical requirements of agricultural tractors for wetland operation). Therefore, the tractor is recommended as suitable for wetland operation (Puddling).

17.5

Haulage test:

- i) The distance travelled / litre of fuel consumption with two wheel and four wheel trailer was observed as 4.47 to 4.56 and 4.57 to 4.69 km/l against the declaration of 5.00 to 6.00 km/l. This does not meet the requirement of IS: 12207-2008 and therefore, should be looked into for necessary corrective action.
- ii) The specific fuel consumption (ml/km/tonne) with two wheel trailer was observed as 43.28 to 44.73 ml/km/tonne against the declaration of 30 to 40 ml/km/tonne, which does not meet the requirements of IS: 12207-2008. This should look into for necessary corrective action.



T-886/1401/2013

SWARAJ 855 XM Sensilift TRACTOR – Commercial (Initial)

- 17.6 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:
- Provision for spark arresting device in exhaust system.
 - Provision of differential lock.
 - The guard for silencer should be provided.
 - Front tow hook should be provided.
- 17.8 Adequacy of Literature supplied with machine:**
The following literature has been supplied with the tractor
- Operator's manual (For Swaraj 855 FE, 855 XM, 744 FE, 744 XM and 855 XM Sensilift tractors models).
 - Spare part's catalogue (For Swaraj 744 XM, 855 XM and 855 XM Sensilift tractors models).
- Service Manual should be provided essentially with inclusion of all specific data and information required for users.
- 17.8.1** The literatures should also be brought out in national as well as other regional languages for the guidance of users and service personnel.

18. Citizen charter

Duration of Test	Test duration under citizen charter	Whether the report released within time frame given citizen charter	Remark, if any
10 Months	7 Months (January, 2013 to July, 2013)	Yes	None

TESTING AUTHORITY:

C. V. CHIMOTE
TEST ENGINEER

P. K. VERMA
SENIOR AGRICULTURAL ENGINEER

C.R. LOHI
DIRECTOR

Test Report compiled by: Shri. Pramod Yadav, Senior Technical Assistant.

CENTRAL FARM MACHINERY TRAINING & TESTING INSTITUTE – BUDHNI

Page 45 of 47



T-886/1401/2013

SWARAJ 855 XM Sensilift TRACTOR – Commercial (Initial)

19. Applicant's Comments

Para No.	Our Reference	Applicant's comments
19.1	17.3 (iii), (iv), (vi), (vii), 17.4.1.4, 17.4.1.5	These requirements are being revisited for necessary corrective action at our end.
19.2	17.4.1.3	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	Anil Industries	Howard	NA
2.	Type	Mounted	Mounted	Mounted
3.	No. of Disc/blades	3	42 in 7 flange	10 (5x5)
4.	Type of Disc/blades	Plain concave	Hatchet	Notched concave
5.	Size of bottoms/blades, (mm)	620	225 x 50 x 10	450
6.	Spacing of bottoms/flanges, (mm)	455	250	170
7.	Lower hitch point span, (mm)	690	720	700
8.	Mast height, (mm)	455	481	395
9.	Overall dimensions, (mm):			
	- Length	1610	1850	1300
	- Width	850	1000	2492
	- Height	1080	980	1230
10.	Gross mass, (kg)	370	375	245

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

S. 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 x 5
6	Length of lug, (mm)	350
7	Spacing of lug, (mm)	205
8	Weight of each cage wheel (kg)	65

CENTRAL FARM MACHINERY TRAINING & TESTING INSTITUTE – BUDHNI

Page 46 of 47