



**SWARAJ 735 FEe 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

**CENTRAL FARM MACHINERY TRAINING & TESTING INSTITUTE**

(An ISO : 9001 - 2008 Certified Institute)

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Manufacturer : **M/s. Mahindra & Mahindra Ltd.**  
Swaraj Division, Phase- IV, Industrial  
Area S.A.S. Nagar, Mohali,  
Punjab - 160055

Test requested by (applicant) : **M/s. Mahindra & Mahindra Ltd.,**  
Swaraj Division, Phase- IV, Industrial  
Area S.A.S. Nagar, Mohali,  
Punjab - 160055

Selected for test by : Applicant

Place of running-in : At manufacturer'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.

1.4

1.4.1

### 1. SPECIFICATIONS

#### 1.1 Tractor:

Make : Swaraj

Model : 735 FEe

Variants if any : None

Brand name : Swaraj

Type : Four wheeled, rear wheel driven,  
general purpose agricultural tractor.

Year of manufacture : 2015

Chassis number : WVTK30404113324

Country of Origin : INDIA

1.4.2

#### 1.2 Engine:

Make : M/s. Swaraj Engines Ltd.

Model : RV30XM+ 3A

Type : Four stroke, naturally aspirated, liquid  
cooled, direct injection, diesel engine.

Serial number : 33.1008/SUK03015

**Engine speed (Manufacturer's recommended production setting, (rpm) :**

- Maximum speed at no load,(rpm) : 1900 - 2000

- Low idle speed, (rpm) : 580 - 700

- Speed at maximum torque, (rpm) : 1000 - 1400

**Rated speed, (rpm):**

- For PTO use : 1800

- For drawbar use : 1800

1.4.4

#### 1.3 Cylinder & Cylinder Head:

Number : Three

Disposition : Vertical, inline

Bore/stroke, (mm) : 100/110

1.4.5



### 17. SUMMARY OF OBSERVATIONS, COMMENTS & RECOMMENDATIONS

17.1 Evaluative (mandatory) / Non-evaluative (Non-mandatory) parameters 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:

S. 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 requirem ents (Yes/No.)
1	2	3	4	5	6	7
<b>17.1.1 PTO Performance :</b>						
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	20.6 (D)	21.5	Yes
b)	Power at rated engine speed, (kW)	Non Evaluative	-do-	20.6 (D)	21.5	Yes
c)	Specific fuel consumption corresponding to maximum power, (g/kWh)	Non Evaluative	+ 5%	260	253	Yes
d)	Maximum equivalent crankshaft torque, (Nm)	Non Evaluative	± 8%	135	138.1	Yes
e)	Back-up torque, percent	Non Evaluative	10 percent, min.	10 percent, min (R)	21.1	Yes
<b>f) Maximum operating temperature, (°C)</b>						
	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	114	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	100	Yes
g)	Engine oil consumption, (g/kWh)	Evaluative	Not exceeding 1% of SFC at max. power under High ambient conditions	2.55 (R) 1% of SFC (D)	0.60	Yes
h)	Smoke level	Evaluative	Maximum light absorption coefficient of 3.25 per meter or equivalent BOSCH No. 5.2 or 75 Hatridge value (As per CMVR)	3.25 per meter (R)	0.21	Yes

1	2	3	4	5	6	7
<b>17.1.2 Drawbar performance :</b>						
a)	Max. drawbar pull with ballast corresponding to 15 percent wheel slip, (kN)	Non Evaluative	Minimum 65% of static mass with ballast	16.86 (D) 17.06 (R) Minimum	21.51	Yes
b)	Maximum drawbar pull without ballast corresponding to 15 percent wheel slip, (kN)	Evaluative	Minimum 65% of static mass of tractor without ballast	11.86 (D) 12.05 (R) Minimum	15.35	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.	16.5 (D) 17.2 (R) Minimum	18.7	Yes
d)	Max. transmission oil temperature (°C)	Non Evaluative	The declared value should not exceed the maximum value specified by oil company	110 (D)	59	Yes
<b>17.1.3. Power lift and hydraulic pump performance :</b>						
a)	Maximum lifting capacity throughout the range of lift, (kN):					
1)	At hitch points	Non Evaluative	[Tolerance of minus 10%]	8.83 (D)	8.51	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	6.90 (D) 5.06 (R) (Minimum)	7.39	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	Observed value should not exceed 50 mm.	50 (D) 50 (R)	47	Yes
<b>17.1.4 Brake performance at 25 kmph:</b>						
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)	8.90	Yes
2)	Hot brake	Evaluative	10	10 (R)	9.17	Yes
b)	Maximum force exerted on the brake pedal to achieve a deceleration of 2.5 m/s <sup>2</sup> (N)	Evaluative	600	600 (R)	361 to 387	Yes



1	2	3	4	5	6	7
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)	80	Yes
b)	Maximum noise at operator's ear level dB(A)	Evaluative	As per CMVR	96 (R)	91	Yes

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	Evaluative	100 microns (max)	100 (R)	130	No
3)	Seat (with driver seated)	Non Evaluative	100 microns (max)	100 (R)	150	No
4)	Steering Wheel	Non Evaluative	100 microns (max)	100 (R)	120	No

17.1.7 Air Cleaner						
	Max. oil pull over, (%)	Non Evaluative	0.25% (max.)	0.25% (max.)	0.18	Yes

17.1.8 Haulage requirements :						
a)	Gross mass of the trailers, (tones):					
1)	Two wheel	Non Evaluative	--	5.0 (D)	5.0	Yes
2)	Four wheel	Evaluative	--	5.5 (D)	5.5	Yes
b)	Distance travelled / litre of fuel consumption, (km/l):					
1)	Two wheel	Non Evaluative	--	5.0 to 6.5 (D)	6.22 to 6.46	Yes
2)	Four wheel	Evaluative	--	5.0 to 6.5 (D)	5.63	Yes
c)	Fuel consumption (cc/km/tonne):					
1)	Two wheel	Non Evaluative	--	30 - 35 (D)	31 to 32	Yes
2)	Four wheel	Evaluative	--	30 - 35 (D)	32	Yes

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 water and/or mud 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)	--	Conforms	Yes
b)	Lighting arrangement	Evaluative	As per CMVR	--	Provided	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)	--	Conforms	Yes
d)	Technical requirements for PTO shaft	Non-Evaluative	Should meet the requirements of IS 4931 (as amended from time to time)	--	Conform	Yes
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 conform	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)	--	Conforms	Yes

**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		735FEe	Yes
3)	Year of manufacture	Evaluative		WV (2015)	Yes
4)	Engine number	Evaluative		33.1008/SUK03015	Yes
5)	Chassis number	Evaluative		WVTK30404113324	Yes
6)	Declaration of PTO power, (kW)	Evaluative		20.6	Yes

**17.1.12 Discard limit for:**

(a)	Cylinder bore diameter, (mm)	Evaluative	To be specified by the manufacturer	100.23(D)	99.99 to 100.00	Yes
(b)	Clearance between piston & cylinder liner at skirt, (mm)	Non Evaluative		0.60	0.07 to 0.08	Yes

**(c) Ring end gap (mm):**

-	Top comp. ring	Evaluative	-do-	2.5	0.40 to 0.50	Yes
-	2 <sup>nd</sup> comp. ring		-do-	2.5	0.70 to 0.80	Yes
-	Oil ring		-do-	2.0	1.00 to 1.20	Yes

**(d) Ring groove clearance (mm):**

-	Top comp. ring	Evaluative	-do-	0.50	Tapped	Yes
-	2 <sup>nd</sup> comp. ring		-do-	0.50	0.061 to 0.068	Yes
-	Oil ring		-do-	0.25	0.050 to 0.057	Yes

**(e) Clearance of main bearings (mm):**

-	Diametrical clearance	Evaluative	-do-	0.30	0.087 to 0.108	Yes
-	Crankshaft end float	Evaluative		0.50	0.25	Yes



(f)	Clearance of big end bearings, (mm):						
	-	Diametrical	Evaluative	-do-	0.30	0.085 to 0.236	Yes
	-	Axial	Evaluative	-do-	0.60	0.3	Yes
(g)		Clearance between king pin and bush, (mm)	Non Evaluative	-do-	0.60	0.08 to 0.14	Yes
(h)		Clearance between centre pin and bush, (mm)	Non Evaluative	-do-	0.80	0.10 to 0.13	Yes

<b>17.1.13</b>	<b>Literature (Submission to test agency)</b>					
(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

<b>17.1.14</b>	<b>CATEGORY OF BREAKDOWNS / DEFECTS :</b>				
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

<b>17.2</b>	<b>Optional requirements as per Clause-4 (Table-2) of IS:12207-2014:</b>			
S. No.	Characteristic	Requirements as per IS: 12207-2014	As observed	Whether meets the requirements (Yes/No.)
1.	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	Not provided	Not applicable
2.	Accessories	Trailer hitch, front tow hook, linkage drawbar may be provided.	Provided	Yes



- 17.3 Conformity with following IS:**
- i) Guide lines for declaration of power and specific fuel consumption and labelling of agricultural tractors (First revision) [IS10273: 1987 (Reaffirmed 2009)] : Conforms
  - ii) Agricultural tractors - Rear mounted power take-off - Types 1, 2 and 3 (third revision) [IS:4931-1995 (Reaffirmed 2009)] : Conforms
  - iii) Agricultural wheeled tractors - Three-point linkage: Part 2 Category 1N (Narrow Hitch) (Third Revision) [IS 4468 (Part-2):1993/ ISO 730-2:1979 (Reaffirmed 2009)] : Does not conform
  - iv) Drawbar for agricultural tractors – Link type [IS 12953:1990 (Reaffirmed 2007)] : Conforms
  - v) Agricultural tractors - Operator's seat technical requirement [IS 12343 –1998 (First revision) (Reaffirmed 2009)] : Conforms
  - vi) Guide for safety & comfort of operator of agricultural tractors: Part 1 General requirements (first revision): [IS 12239 (PT-1) 1996/ISO 4254-1:1989 (Reaffirmed 2009)] : 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 2009)] : Does not conform
  - viii) Guide lines for location and operation of operator controls on agricultural tractors and machinery (first revision) IS: 8133-1983 (Reaffirmed 2009)] : Does not conform
  - ix) Tractors and machinery for agriculture and forestry, powered lawn and garden equipment - Symbols for operator controls and other displays Part 2 Symbols for agricultural tractors and machinery [IS:6283 (Part-1)- 2006 and IS: 6283 (Part-2)-2007 (Reaffirmed 2009)] : Conforms
  - x) Agricultural Tractors and Machinery - Lighting device for travel on public roads (IS: 14683-1999) (Reaffirmed 2009)] : Conforms

**17.4 Salient Observations:**

**17.4.1 Laboratory tests:**

**17.4.1.1 PTO performance:**

- i) The maximum power was observed **21.5 kW** against the declaration of **20.6 kW**. Which is within the tolerance limit of IS: 12207-2014.
- ii) The specific fuel consumption corresponding to maximum power was measured as **253 g/kWh** against the declaration of **260 g/kWh**, which is within the tolerance limit of IS: 12207-2014.
- iii) The backup torque was observed as **21.1 %**.

**17.4.1.2 Drawbar performance :**

- i) During ten hours drawbar test, the creeping on LHS rear tyre over the rim was observed 25 mm. This should 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 is on higher side, especially on the right foot rest, seat and steering wheel. This calls for dampening down of vibrations to improve the operational comfort and service life of components.

**17.4.1.4 Three point linkage:**

The 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.

**17.4.1.5 Operator's work place:**

Spark arresting devices shall be provided in the exhaust system of the tractor.

**17.4.1.6 Location and movement of operator's controls:**

The fuel shut-off knob for stop does not remain in stop position without application of sustains manual effort. This should be looked into for corrective action.

**17.4.2 Field performance test:****17.4.2.1 Wetland 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 found as suitable for wetland operation (Puddling).

**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 for spark arresting device in exhaust system.
- ii) The fuel shut-off knob for stop does not remain in stop position without application of sustains manual effort so it should be provided in this way that should be easy handling of tractor for safety propose.
- iii) The Alternator, Belt drive crankshaft pulley to alternator and V-belt should be guarded so that operator's hand may not come in contact with the us.

**17.7 Adequacy of Literature supplied with machine:****17.7.1** The following literature was supplied with the tractor for reference during the testing.

- i) Operator's Manual in respect of Swaraj 735 FEe tractor.
- ii) Tractor Parts Catalogue in respect of Swaraj 735 FEe tractor.
- iii) Service Manual in respect of Swaraj 735 FEe tractor.



17.7.2 The literatures supplied by applicant should also in national as well as other regional languages for the guidance of users and service personnel.

### 18. Citizen charter

Time frame for Testing & Evaluation as per Citizen Charter	Duration of Test	Whether the Test Report is released within the time frame given in Citizen Charter	Remarks
10 Months	10 Months (February, 2016 to November, 2016)	Yes	-

### TESTING AUTHORITY:

**C.V.CHIMOTE**  
TEST ENGINEER

**Y.K.RAO**  
SENIOR AGRICULTURAL ENGINEER

**J.J.R.NARWARE**  
DIRECTOR

This test report is compiled by Shri. Shwetabh Singh, Senior Tech. Assistant

### 19. APPLICANT'S COMMENTS

Para No.	Our Reference	Applicant's comments
19.1	1.20.3 (I)(ii), 17.4.1.6, 1.20.4 (i), 17.4.1.5, 17.3 (iii)(vi)(vii)(viii), 17.6(i)(ii) & (iii)	These requirements are being revised for necessary corrective action at our end.
19.2	17.4.1.2 (i), 17.4.1.3 & 17.4.1.4	Study and trails are under progress for necessary corrective action.
19.3	17.7.2	Suggested corrections are incorporated and literatures are already printed in all regional language for end users.

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

S.No	Parameters	Disc Plough	Rotavator	Paddy puddler
1.	Make	John Deere	Sonalika	ACE
2.	Type	Mounted	Mounted	Mounted
3.	No. of Disc/blades	02	30	12 (6 in each gang)
4.	Type of Disc/blades	Plain concave	Hatchet	Notched
5.	Size of bottoms/blades, (mm)	640	110x75x8	500
6.	Spacing of bottoms/flanges, (mm)	260	210	180
7.	Lower hitch point span, (mm)	850	650	835
8.	Mast height, (mm)	500	600	510
9.	<b>Overall dimensions, (mm):</b>			
	- Length	1570	720	1020
	- Width	1050	1260	2070
	- Height	1040	990	1050
10.	Gross mass, (kg)	355	290	305

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

S. No.	Parameters	Specification
1.	Type	Half cage wheel
2.	Dia, (mm)	1800
3.	Width, (mm)	355
4.	No. and types of lugs	12, straight lugs made of MS angle section welded to angle iron frame
5.	Size of angle section, (mm)	50x45x5
6.	Length of lugs, (mm)	350
7.	Spacing of lugs, (mm)	205
8.	Weight of each cage wheels (kg)	65

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

<b>A.</b>	<b>LABORATORY AND TRACK TESTS:</b>	<b>HOURS</b>
1.	Running-in	--
2.	PTO performance test	11.0
3.	Power lift and hydraulic pump performance test	3.45
4.	Drawbar performance test	18.42
5.	Turning ability	0.4
6.	Air cleaner oil pull over test	3.50
7.	Location of centre of gravity	-
8.	Operator's field of vision	-
9.	Brake test	2.41
10.	Noise measurement	1.51
11.	Mechanical vibration test	1.0
12.	Nominal speed test	0.63
<b>B.</b>	<b>FIELD TEST:</b>	
1.	Disc ploughing	10.50
2.	Rotavation	10.35
3.	Puddling (including 5 hrs water proof test)	15.0
<b>C.</b>	<b>HAULAGE TEST:</b>	3.59
<b>D.</b>	Miscellaneous test and other run hours including idle run, transportation, trials and preparation for test	8.74
	<b>TOTAL:</b>	<b>90.5</b>