



SWARAJ 744 FE XTRA 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

TRACTOR NAGAR, BUDNI (M.P.) - 466 445

E-mail : fmti-mp@nic.in Web site : cfmtti.dacnet.nic.in



1. SPECIFICATIONS

- 1.1 Tractor:**
- Make : Swaraj
 - Model : 744 FE Xtra
 - Variants if any : None
 - Brand name : Swaraj
 - Type : Four wheeled, rear wheel driven, general purpose agricultural tractor.
 - Year of manufacture : 2011
 - Chassis number : WW CH 40606143345
 - Country of Origin : INDIA
- 1.2 Engine:**
- Make : M/s. Kirloskar oil Engines Ltd.
 - Model : RB30XM
 - Type : Four stroke, naturally aspirated, liquid cooled, direct injection, diesel engine.
 - Serial number : 43.3014/SPG08714S
- 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
- 1.3 Cylinder & Cylinder Head:**
- Number : Three
 - Disposition : Vertical, inline
 - Bore/stroke, (mm) : 110/116
 - Capacity as specified by the applicant, (cc) : 3307
 - Compression ratio, (apa) : 19.5 ± 0.5 : 1
 - Type of cylinder head : Integral CI
 - Type of cylinder liners : Wet, replaceable
 - Type of combustion chamber : Ré-entrant cavity on piston crown
 - Arrangement of valves : Over head. Inline
- Valve clearance (cold):**
- Inlet valve, (mm) : 0.25 - 0.30
 - Exhaust valve, (mm) : 0.30 - 0.35
- 1.4 Fuel System:**
- Type of fuel system : Gravity and force feed
 - Fuel tank:**
 - Capacity, (l) : 50.00
 - Location : Above clutch housing
 - Provision for draining of sediments / water : **Not provided**
 - Type of fuel tank : Metallic
- 1.4.1 Water separator:**
- Make : Alert
 - Type : Inverted funnel gravity separation
 - Location : In between fuel tank & filters on LHS of engine.
 - Capacity (l) : 0.50



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16. ADJUSTMENTS, DEFECTS, BREAKDOWNS AND REPAIRS

S. No.	Adjustments/Defects/Breakdowns and repairs	Tractor run hours
	NONE	

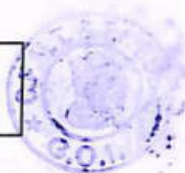
17. SUMMARY OF OBSERVATIONS, COMMENTS & RECOMMENDATIONS

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:

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
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)	31.3	Yes
b)	Power at rated engine speed, kW)	Non Evaluative	-do-	30.1(D)	30.9	Yes
c)	Specific fuel consumption corresponding to maximum power, (g/kWh)	Non Evaluative	± 5%	258 (D)	251	Yes
d)	Maximum equivalent crankshaft torque, (Nm)	Non Evaluative	± 8%	188.0 (D)	192	Yes
e)	Back-up torque, percent	Non Evaluative	7 percent, min.	7 percent 15(D)	14.4	Yes
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)	104	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	2.58 (R)	0.35	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 meter	0.30 per meter	Yes



17.1.2	Drawbar performance :						
a)	Max. drawbar pull with ballast corresponding to 15 percent wheel slip, (kN)	Non Evaluative	Minimum 65% of static mass with ballast	21 (D)	23.53	Yes	
				18.23 (R)			
b)	Max. drawbar pull without ballast corresponding to 15 percent wheel slip, (kN)	Evaluative	Minimum 65% of static mass of tractor without ballast	15 (D)	16.15	Yes	
				13.07 (R)			
c)	Maximum drawbar power without ballast (kW).	Evaluative	Min. 80% of PTO power as referred in 16.1.1 (a) of PTO performance	25.0 (D) 25.02 (R)	27.82	Yes	
d)	Max. transmission oil temperature (°C)	Non Evaluative	The declared value should not exceed the maximum value specified by oil company	110	77	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)	19.77	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	10.78(D)	12.85	Yes
					7.4(R)		
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	[Tolerance of plus 5 mm]	150 (D) 50 (R)	4.0	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)	7.91	Yes
	2)	Hot brake	Evaluative	10	10 (R)	7.84	Yes
b)	Maximum force exerted on the brake pedal to achieve a deceleration of 2.5 m/s ² (N)	Evaluative	600	600 (R)	177 to 217	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	Yes	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)	93	Yes	



17.1.6	Amplitude of mechanical vibrations at :					
1)	Left foot rest	Non Evaluative	100 microns (max)	100 (R)	90	Yes
	Right foot rest			100 (R)	150	No
	2) Seat (with driver seated)			100 (R)	80	Yes
3)	Steering wheel			100 (R)	150	No
17.1.7	Haulage requirements :					
a)	Gross mass of the trailers, (tones):					
	1)	Two wheel	Non Evaluative	--	5.0 (D)	5.0
2)	Four wheel	Evaluative	--	6.0 (D)	6.0	Yes
b)	Distance travelled / litre of fuel consumption, (km):					
	1)	Two wheel	Non Evaluative	--	5.0 to 6.0 (D)	4.9 to 5.05
2)	Four wheel	--		4.0 to 5.0 (D)	5.13 to 5.29	No
c)	Fuel consumption (ml/km/tonne):					
	1)	Two wheel	Non Evaluative	--	30 to 40 (D)	39.59 to 40.80
2)	Four wheel	--		30 to 40 (D)	31.48 to 32.49	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 (R)	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	--	--
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 FE XTRA	Yes
	3)	Year of manufacture		Evaluative	(2011)	Yes
	4)	Engine number		Evaluative	43.3014/SPG08714S	Yes
5)	Chassis number	Evaluative		WWCH40606143345	Yes	
6)	Declaration of PTO power, (kW)	Evaluative		30.1	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	110.03 to 110.04	Yes
(b)	Clearance between piston & cylinder liner at skirt, (mm)	Non Evaluative	-do-	0.60	0.166 to 0.170	Yes
(c)	Ring end gap (mm):					
	- Top comp. ring.	Evaluative	-do-	1.75	0.45 to 0.55	Yes
	- 2 nd comp. ring.		-do-	1.75	0.40 to 0.45	Yes
- Oil ring.	-do-		1.75	0.35 to 0.50	Yes	
(d)	Ring groove clearance (mm):					
	- Top comp. ring.	Evaluative	-do-	0.25	Tapper	Yes
	- 2 nd comp. ring.		-do-	0.25	0.052 to 0.055	Yes
	- Oil ring.		-do-	0.25	0.054 to 0.058	Yes
(e)	Clearance of main bearings (mm):					
	- Diametrical clearance	Evaluative	-do-	0.30	0.082 to 0.109	Yes
	- Crankshaft end float	Evaluative	-do-	0.50	0.25	Yes
(f)	Clearance of big end bearings, (mm):					
	- Diametrical	Evaluative	-do-	0.30	0.067 to 0.083	Yes
	- Axial	Evaluative	-do-	0.60		Yes
(g)	Clearance between king pin and bush, (mm)	Non Evaluative	-do-	0.60	0.093 to 0.111	Yes
(h)	Clearance between center pin and bush, (mm)	Non Evaluative	- do -	0.80	0.164 to 0.176	Yes

17.1.12 CATEGORY OF BREAKDOWNS / DEFECTS :					
S. No.	Characteristic	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	Air cleaner oil pull over, max. oil pull over (%)	0.25% (max.)	0.08	Yes
2.	Seating requirements	Should meet the requirements of IS: 12343-1998	Meets the requirements	Yes



1	2	3	4	5
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	Does not meets the requirements	No
6.	Specifications of linkage drawbar	Should meet the requirements of IS: 12953-1990	Meets the requirements	Yes
	Specifications 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

- 17.3 Conformity with following IS:
- i) Guide lines 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, 2009)/ISO730-1:1994] : Does not conform
 - iv) Drawbar for agricultural tractors – Link type [IS 12953:1990 (Reaffirmed in March, 2009)] : Conforms
 - v) Agricultural tractors - Operator's seat technical requirement [IS 12343 -1998 (First revision) (Re-affirmed 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, 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
 - viii) Tractors and machinery for agriculture and forestry – Technical means for ensuring safety Part 2: Tractors (first revision) [(IS 12239 (PT-2) 1999) (Re-affirmed in March, 2009)] : Does not conform
 - ix) Guide lines for location and operation of operator controls on agricultural tractors and machinery (first revision) (IS: 8133 – 1983) (Re-affirmed in March, 2009). : Conforms
 - x) Agricultural Tractor & Machinery Lighting device for travel on public roads (IS: 14683-1999) (Re-affirmed in March, 2009) : Conforms



17.4 Salient Observations:

17.4.1 Laboratory tests:

17.4.1.1 PTO Performance:

- i) The backup torque is 14.4 %.
- ii) The specific fuel consumption corresponding to maximum power was recorded as **251 g/kWh**, against the declaration of 258 g/kWh, which meet the requirement of IS: 12207-2008 with regard to tolerance.
- iii) The power drop of 8.3 % was recorded in high ambient condition as compared to natural ambient condition. It is considered on higher side and calls for necessary corrective action.

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, especially at the steering control wheel, mud guard, head light, battery base terminals, hand accelerator lever clutch & brake pedal and foot rests. 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 centre line of tractor does not meet the requirements of IS 4468: 1997. It should be looked into for compliance.

16.4.1.4 Linkage Drawbar:

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

16.4.1.5 Location and operation of operator's control:

The working clearance around the position control lever was observed as 35 mm against the minimum requirement of 70 mm as per per IS: 12239 (Part 2)-1996 This should be looked into for necessary corrective action.

17.4.2 Field Performance:

17.4.2.1 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 as per IS: 11082-1984 and found suitable for wetland cultivation

17.5 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 drive 'V' belt for the alternator should be protected

17.6 Maintenance / Service Problems:

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



17.7 Adequacy of Literature supplied with machine:

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

- i) Operator's Manual ,Swaraj 855 FE Xtra,855XM,744FE Xtra,744 XM
- ii) Spare parts catalogue, Swaraj 855 FE Xtra,744FE Xtra

17.7.1 Therefore it is recommended that, the service/workshop manual for this tractor model should be brought out as per IS: 8132-1999 (Reaffirmed in march, 2009) for the guidance of users and service personnel in national as well as other regional languages.

TESTING AUTHORITY:

PK Verma
P.K. VERMA
SENIOR AGRICULTURAL ENGINEER

C.R. LOHI
C.R.LOHI
DIRECTOR

Test Report compiled by: **Shri Nitesh Kumar Verma**, Senior Technical Assistant.

18. APPLICANT'S COMMENTS

Para No.	Our Reference	Applicant's comments
18.1	Para 17.3 (iii) 17.4.1.3	These requirements are being revisited for necessary corrective action at our end
18.2	Para (iii), 17.4.1.1, 17.4.1.2	Study & trials are under progress for necessary corrective action.
18.3	17.5(i),17.5(ii),17.3 (iv,viii)	These requirements are being revisited for necessary corrective action at our end.
18.4	17.4.1.4, 17.4.1.5	These requirements are being revisited for necessary corrective action at our end.



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ANNEXURE-I**COMPARATIVE MAJOR MODIFICATION IN THE SPECIFICATION OF THE TRACTOR**

S. No.	Particulars	Previous sample refer report no. T-401/821	Present sample
1	Model	744 FE	744 FE XTRA
2	Engine model	RB30 TR	RB30XM
3	Compression ratio	17:1	19.5± 0.5 :1
4	High idle speed (rpm)	2100-2160	1950 ±50
5	Low idle speed (rpm)	650±50	640±60
6	Rated engine speed (rpm)	2000	1800
7	Speed at maximum torque (rpm)	1400 ± 150	1200±200
8	Stroke (mm)	110	116
9	Capacity as specified (cc)	3136	3307
10	Inlet valve clearance (mm)	0.25	0.25 – 0.30
11	Exhaust valve clearance (mm)	0.35	0.30 – 0.35
12	Capacity of A/C bowl (l)	0.55	0.8
13	Range of suction pressure (kPa)	1.6-3.6	2.7 to 2.8
14	Capacity of expansion flask (l)	Not provided	1.0
15	Range of exhaust gas pressure (kPa)	2.4 to 6.0	6.5 to 8.0
16	Model / group combination number of FIP	9400 030 694 PES3A90D320RS 2888	F 002 AOZ 877 PES3A90D320RS2000
17	Injection timing	24° ± 1°	12° ± 1°
18	Fuel delivery (mm ³)@ rated rpm for 500 nos. strokes	53 ± 3	55 ± 3
19	Model / group combination number of governor	RSV 325...1000 A1C 835 R	RSV 325...900 A 1C 1570 R
20	Speed range (rpm)	600 to 2160	580 to 2000
21	Model / group combination number of Injector	9430 031 261	F 002 C 70 552
22	Injector opening pressure (Mpa)	20.59 ± 0.98	25.0 + 0.8
23	Location of battery	Behind operator seat	On RHS of clutch housing in a separate metallic box
24	Material of clutch lining & its diameter	Asbestos moulded & 308	F510 MCC (Valeo) & 310
25	Range of speed- Forward (Kmph)	3.29 to 30.95	3.11 to 29.23
26	Range of speed – Reverse(Kmph)	4.60 to 15.11	4.34 to 14.27
27	Reduction through final drive	4.833 :1	4.385:1 (57/13 T)
28	Type of brakes	Dry	Wet (Oil immersed discs)
29	Area of brake lining (cm ²)	721.3(each side)	950.0 (each side)
30	PTO speed corresponding to rated engine speed (rpm)	976	588
31	Engine to PTO speed ratio	2.049:1	3.063 :1
32	Speed of hydraulic pump corresponding to rated engine speed (rpm)	1500	1350
33	Discharge of hydraulic pump at minimum pressure (l)	18.5	24.17
34	Maximum hydraulic power (kW)	4.0	6.03
35	Pump delivery rate at maximum power (l)	16.0	23.35
36	Height of rear towing hitch (mm)	595-760	440-710
37	Masses (kgf) of the unballsted tractor	750/1180/1930	750/1300/2050
38	Maximum PTO power (kW)	30.4	31.3



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

S.No.	Item	Disc Plough	Rotavator	Puddler
1.	Make	M & M	Howard	Not available
2.	Type	Mounted	Mounted	Mounted
3.	No. of bottom / blades	3	36,in 7 flange	12 (6 in each gang)
4.	Type of bottom / blades	Plane Concave	Hatchet	Notched
5.	Size of bottom / blades, (mm)	625	225x 50 x 10	460
6.	Spacing of bottom/blades, (mm)	455	250	164
7.	Lower hitch point span, (mm)	690	720	680
8.	Mast height, (mm)	455	481	680
9.	Overall dimensions, (mm):			
	- Length	1610	1750	1190
	- Width	850	1000	1810
	- Height	1080	980	1330
10.	Gross mass, (kg)	370	345	240

ANNEXURE-III**BRIEF SPECIFICATION OF CAGE WHEEL**

S. No.	Items	Specification
1.	Type	Half cage wheel
2.	Diameter, (mm)	1085
3.	Width, (mm)	340
4.	No. and type of lugs	12, straight lugs made 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 wheel, (kg)	60

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

A.	LABORATORY AND TRACK TESTS:	HOURS
1.	Running-in	—
2.	PTO performance test	12.5
3.	Power lift and hydraulic pump performance test	3.4
4.	Drawbar performance test	14.02
5.	Turning ability	0.2
6.	Location of centre of gravity	0.2
7.	Operator's field of vision	—
8.	Brake test	1.7
9.	Noise measurement	1.2
10.	Mechanical vibration test	1.0
11.	Theoretical speed test	0.93
12.	Air cleaner oil pull over	3.5
B.	FIELD TEST:	
1.	Disc ploughing	10.1
2.	Rotavation	10.23
3.	Puddling (Including water proof test)	15.3
C.	HAULAGE TEST:	10.1
D.	Miscellaneous test and other run hours including idle run, transportation, trials and preparation for test	4.72
	TOTAL:	89.1