



## SWARAJ 960 FE 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 & Farmers Welfare)

केन्द्रीय कृषि मशीनरी प्रशिक्षण एवं परीक्षण संस्थान

ट्रैक्टर नगर, बुदनी (म.प्र.) 466 445

**CENTRAL FARM MACHINERY TRAINING & TESTING INSTITUTE**

(An ISO : 9001 - 2015 Certified Institute)

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

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Website : <http://www.fmttibudni.gov.in>



**Manufacturer** : M/s. Mahindra & Mahindra Ltd.  
Farm Equipment Sector, Swaraj Division  
Phase- IV, Industrial Area, S.A.S. Nagar,  
Mohali, Punjab – 160 055

Test requested by : The manufacturer  
Selected for test by : The Applicant  
Place of running-in : At manufacturer's works  
Duration of said running-in, (h):  
- Engine : 28  
- Transmission : 32

**Method of Selection** : Due to Covid-19 pandemic, it was not possible to conduct the random selection. Nor was it possible for applicant to facilitate the random selection. As a last resort, applicant requested to allow the direct submission of test sample which was allowed.

## 2.0 FUEL AND LUBRICANTS

**2.1 Fuel** : The High-speed diesel oil supplied by M/s Indian Oil Corporation Limited having density of 0.836 g/cc at 15°C was used.

### 2.2 Lubricants:

S. No.	Particulars	As recommended by the manufacturer	As used during the test
1.	Engine	SAE 20W40	As recommended
2.	Gear box, differential, rear axle, final drive, hydraulic & brake system oil	TRACTELF 2371	Oil originally filled in the tractor system were not changed
3.	Steering oil reservoir	EP-80	
4.	Grease	MP Grease	MP Grease

## 3.1 SPECIFICATIONS

3.1.1	Tractor:	Previous Sample	Present Sample
	Make	: SWARAJ	SWARAJ
	Model	: 960 FE	960 FE
	Brand name	: Swaraj	Swaraj
	Variant, if any	: None	None
	Type	: Four wheeled, Rear wheel drive, unit construction, general purpose, Agricultural Tractor.	
	Year of manufacture	: WX	07 20
	Chassis number	: WXCK67930100001	MBNBL55AALCH12985
	Country of origin	: India	India
3.1.2	Engine:		
	Make	: M/s Swaraj Engines Ltd.	
	Model	: RB33XP	
	Type	: Four stroke, liquid cooled, direct injection, diesel engine.	
	Serial number	: 47.3053/STG1216V	47.3052 / SB 413508
	Year of manufacture	: 2014	2020
	Country of origin	: India	India



## 5. ADJUSTMENTS, DEFECTS, BREAKDOWNS AND REPAIRS

Sl. No.	Adjustments/Defects/Breakdowns and Repairs	Tractor run hours
--	-None-	--

## 6.0 SUMMARY OF OBSERVATIONS, COMMENTS &amp; RECOMMENDATIONS

- 6.1 On the basis of test conducted the performance results have been summarized as evaluative (mandatory) and non – evaluative (not mandatory) parameters applicable for qualifying Minimum Performance Criteria as per clause-4 table-1 of Indian Standard 12207: 2019 for acceptance of tractor for the purpose of subsidies/NABARD financing for the applicable features for this tractor model.

Sl. No.	Characteristic	Category (Evaluative / Non-Evaluative)	Requirements as per IS: 12207-2019	Values declared by the applicant/ requirement		As observed		Whether present model meets the requirements (Yes/No)
				Previous sample	Present sample	Previous sample	Present sample	
1	2	3	4	5 a	5 b	6 a	6 b	7
6.1.1	<b>PTO Performance:</b>							
a)	Max. power under 2 h test, (kW) (Natural ambient condition)	Evaluative	Declared value to be achieved with a tolerance of: $\pm 5\%$ for PTO power or engine power $> 26$ kW, $\pm 10\%$ for PTO power or Engine power $\leq 26$ kW.	35.5 (D)	35.5 (D)	34.2	35.9	Yes
b)	Power at rated engine speed, (kW)	Non-Evaluative	-do-	35.5 (D)	35.5 (D)	34.2	35.9	Yes
c)	Specific fuel consumption corresponding to maximum power, (g/kWh)	Evaluative	+ 10% Max.	270 (D)	270 (D)	278	264	Yes
d)	Maximum equivalent crankshaft torque, (Nm)	Non-Evaluative	$\pm 8\%$	210 (D)	210 (D)	207	214	Yes
e)	Back-up torque, percent	Evaluative	12 percent, min.	12 (D)	12 (D)	27.2	24.9	Yes
f)	Maximum operating temperature ( $^{\circ}\text{C}$ )							
1)	Engine oil	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)	130 (D)	107	99	Yes
2)	Coolant (liquid)	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)	115 (D)	93	92	Yes



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g)	Engine oil consumption, (g/kWh)	Evaluative	Not exceeding 1% of SFC at max. power under High ambient conditions	2.78 (Max) (R)	2.68 (Max) (R)	0.42	0.49	Yes
h)	Smoke level, (m <sup>-1</sup> )	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 (Max) (R)	3.25 (Max) (R)	0.30	0.37	Yes
<b>6.1.2 Drawbar performance:</b>								
a)	Max. drawbar pull with ballasted corresponding to 15 percent wheel slip, (kN)	Non-Evaluative	Minimum 70% of static mass of tractor with ballast.	24.0 (D)		27.87	26.32	Yes
				22.58 (R) Min				
b)	Max. drawbar pull without ballasted as the case may be corresponding to 15 percent wheel slip, (kN)	Evaluative	Minimum 70% of static mass of tractor without ballast or with standard ballast, as the case may be.	16.0 (D)		20.0	19.17	Yes
				15.58 (R) Minimum				
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.	28.5 (D)		30.0	30.7	Yes
				27.4 (R) Minimum				
d)	Maximum transmission oil temperature (°C)	Evaluative	The declared value should not exceed the maximum value specified by oil company	110 (D)		81	81	Yes
<b>6.1.3 Power lift and hydraulic pump performance:</b>								
<b>a) Maximum lifting capacity throughout the range of lift, (kN):</b>								
1)	At hitch points	Evaluative	Tolerance of ± 10%	16.67 (D)	19.61 (D)	16.45	21.20	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.	11.77 (D)	15.69 (D)	12.96	15.49	Yes
				5.06 (R) Min	8.45 (R) Min			
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	The observed value should not exceed 50 mm	50 (D) Max		45	10	Yes



1	2	3	4	5 a	5 b	6 a	6 b	7
<b>6.1.4</b>	<b>Wetland cultivation:</b>							
	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 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-						
<b>6.1.5</b>	<b>Safety features:</b>							
<b>a)</b>	Guards against moving and hot parts	Evaluative	Belt drives, pulleys, silencer, hydraulic pipes (As per IS 12239 (Part2)			Meets the requirement		Yes
<b>b)</b>	Lighting arrangement	Evaluative	As per CMVR			Meets the requirement		Yes
<b>c)</b>	Seating requirements (Tractors having more than 1150 mm rear track width)	Non-Evaluative	Should meet the requirements of IS: 12343 (As amended from time to time)			Meets the requirement		Yes
<b>d)</b>	Technical requirements for PTO shaft	Evaluative	Should meet the requirements of IS: 4931 (As amended from time to time)			Meets the requirement		Yes
<b>e)</b>	Dimensions of three-point linkage	Non-Evaluative	Should meet the requirements of IS: 4468 (Part-I) (As amended from time to time)			Does not meet the requirement		No
<b>f)</b>	Specifications of linkage	Evaluative	Should meet the requirements of IS: 12953 (As amended from time to time)			Meets the requirement		Yes
<b>g)</b>	Swinging drawbar (wherever fitted)	Evaluative	Should meet the requirement of IS: 12362 (Part 3) (As amended from time to time)			Not Provided		--
<b>h)</b>	1	Maximum travelling speed at rated engine speed in reverse gears, Kmph	Evaluative	Should not exceed 20 Kmph		12.61 kmph Meets the requirement		Yes
	2	Audible warning signal on tractor	Evaluative	As soon as the travelling speed in reverse gear reaches to 20 kmph, an audible warning signal on tractor shall be activated. The safety aspects about the operation of shuttle technology shall be brought in operation and manufacturer /dealer shall ensure the training on this aspect to operator before the delivery of tractor.		Not applicable		--



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1	2	3	4	5 a	5 b	6 a	6 b	7
<b>6.1.6</b>	<b>Labelling of tractors (Provision of labelling plate):</b>							
1)	Make	Evaluative	Should conform to the requirements of CMVR along with maximum PTO Power in kW and year of manufacture in numerical form.  Digit 01 – 12 in box No.1 for MM will represent the months and next two digits in box No.2 for YY will represent the year of manufacturing.	SWARAJ				Yes
2)	Model	Evaluative		960FE				Yes
3)	Month & Year of manufacture	Evaluative		07	20			Yes
4)	Engine number	Evaluative		47.3052/SBH13508				Yes
5)	Chassis number	Evaluative		MM	YY	MBNBL55ALGH12985		Yes
6)	Maximum PTO power, (kW)	Evaluative		35.5				Yes
7)	Specific fuel consumption, g/kWh	Evaluative		270				Yes
<b>6.1.7</b>	<b>Literature (Submission to test agency)</b>							
(a)	Operator manual	Evaluative	Provided / Not Provided	Provided	Provided			Yes
(b)	Parts Catalogue	Evaluative	Provided / Not Provided	Provided	Provided			Yes
(c)	Workshop/ Service manual	Evaluative	Provided / Not Provided	Provided	Provided			Yes
<b>6.1.8</b>	<b>Fitment of Roll Over Protective Structures (ROPS):</b>							
	For tractor having more than 1150 mm rear track width	Evaluative	ROPS should meet the requirement of IS:1182 or OECD code or equivalent International Standard	--	Not Applicable			Not Applicable
<b>6.1.9</b>	Standard Accessories	Evaluative	Trailer hitch, front tow hook, linkage drawbar should be provided with tractor	--	Provided			Yes
<b>6.1.10</b>	Accessories (optional)	Non Evaluative	Ballast weight, if fitted, should meet the requirement of CMVR.	--	Provided			Yes
<b>6.2</b>	<b>CATEGORY OF BREAKDOWNS / DEFECTS ( As per clause 5.0 of IS:12207-2019):</b>							
Sl. No.	Category of breakdowns	Category (Evaluative / Non-Evaluative)	Requirements as per IS: 12207-2019	As observed	Whether meets the Requirements (Yes/No.)			
1.	Critical	Evaluative	No critical breakdown	None	Yes			
2.	Major	Evaluative	Not more than one and neither of them should be repetitive in nature	None	Yes			
3.	Minor	Evaluative	Not more than three 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 four, that is, (1 major + 3 minor) or 4 minor breakdowns.	None	Yes			

**6.3 Salient Observations:**

**6.3.1 Laboratory tests:**

**6.3.1.1 PTO Performance Test:**

- i) The maximum power in case of previous & present sample were observed as **34.2 & 35.9 kW** against the declaration of **35.5 kW** respectively, which meets the requirement of IS: 12207-2019 with regard to tolerance limit.



- ii) The specific fuel consumption corresponding to maximum power in case of previous & present sample was recorded as **278 & 264 g/kWh** against the declaration of **270 g/kWh**, which meets the requirement of IS: 12207-2019 with regard to tolerance limit.
- iii) The backup torque is **24.9 %** & meets the evaluative requirement of IS: 12207-2019.

#### 6.3.1.2 Drawbar performance test:

- i) The maximum drawbar power in case of previous & present sample with unballasted condition was recorded as **30.0 kW & 30.7 kW** against the minimum requirement of **27.4 kW & 28.7 kW** respectively which meets the requirement of IS: 12207-2019.
- ii) The maximum drawbar pull in case of previous & present sample with unballast condition corresponding to 15%-wheel slip was recorded as **20.0 kN and 19.17 kN** respectively against the minimum requirement of **15.90 & 15.58 kN** which meets the requirement of IS: 12207-2019.

#### 6.3.1.3 Hydraulic performance test:

- i) Maximum lifting capacity throughout the range of lift at hitch point and standard frame was recorded as **21.20 kN & 15.49 kN** respectively against the declaration of **19.61 kN & 15.69 kN** respectively. which meet the evaluative requirement of IS:12207-2019.

#### 6.3.1.4 Three-point linkage:

- i) The dimension of lateral distance from lower hitch point to centre line of tractor does not meet the requirement of IS: 4468 (Part I) – 1997. This is recommended to looked into for necessary corrective action.
- ii) Some of the parameters conform to Cat. I and some of them conform to Cat. II. Keeping in view the spirit of standardization, necessary improvement may be incorporated.

#### 6.4 Maintenance / Service Problems:

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

#### 6.5 Recommendation with regard to safety on tractor:

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

- i) Provision for spark arrester in exhaust system should be provided as per IS-12239 (Part-I) 2018.
- ii) Width of foot step should be as per relevant standard IS: 12239 (Part-1) – 2018.
- iii) The working clearance between the draft control lever and position control lever should be provided as per IS: 12239 (Part-2) – 1999.
- iv) The fuel shut-off knob should be remained in stop position as per IS: 8133 - 1983.
- v) PTO master shield should be provided as per IS:4931-1995.

#### 6.6 Adequacy of Literature supplied with machine:

6.6.1 The supplied literature was found adequate

- a) Operator's manual of SWARAJ 960 FE tractor.
- b) Parts catalogue of SWARAJ 960 FE tractor.
- c) Service Manual of SWARAJ 960 FE tractor.

6.6.2 The supplied literature was found adequate.

6.6.3 However, these literatures should be brought out in other vernacular languages of India for guidance of users.



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C.V. CHIMOTE TEST ENGINEER	
Y.K. RAO SENIOR AGRICULTURAL ENGINEER	
P.K. PANDEY DIRECTOR	

Draft test report compiled by: Sh. C.S. Raghuwanshi, Agricultural Engineer.

**7. APPLICANT'S COMMENTS**

Para no.	Our reference	Applicant comments
7.1	6.3.1.4 & 6.5	Study & trails are under progress for necessary corrective action.
7.2	6.6.3	Literatures are already printed in all regional language for end user.



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

S. No.	Parameters	Disc Plough	Rotavator	Puddler
1	Make	Fieldking	Fieldking	ACE
2	Type	Mounted	Mounted	Mounted
3	No. of Discs / Blades	Three	42 in 7 flanges	12 (6 in 2 gangs)
4	Type of Discs / Blades	Plain concave	Hatchet	Notched
5	Size of Discs / Blades (mm)	385	280 x 85 x 7	500
6	Spacing of Discs /Flanges, (mm)	280	245	180
7	Lower hitch point span, (mm)	785	800	835
8	Mast height, (mm)	510	600	510
9	Overall Dimensions (mm):			
	Length	1940	1100	1020
	Width	1040	2020	2070
	Height	1220	1150	1050
10	Gross Mass, (Kg)	270	445	305

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

S. No.	Parameters	Specification
1	Type	Half cage wheel
2	Outer dia. (mm)	1200
3	Width (mm)	360
4	No. & Type of Lugs	14, straight lugs made of MS angle section welded to angle iron frame
5	Size of angle section, (mm)	50 x 50 x 5
6	Length of lug, (mm)	360
7	Spacing of lug, (mm)	260
8	Weight of each cage wheel (kg)	100

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

A.	LABORATORY AND TRACK TESTS	HOURS
1.	Running-in (Engine-28 & Transmission- 32)	50.0
2.	Nominal speed test	1.3
3.	PTO performance test	16.3
4.	Drawbar performance test	16.8
5.	Power lift and hydraulic pump performance test	3.0
B.	Field test	
1.	Rotavation	11.0
2.	Ploughing	10.9
3.	Wet Land (puddling) operation (including water proof test)	10.7
C.	Miscellaneous test and other run hours including idle run, transportation, trials and preparation for test	1.3
<b>TOTAL:</b>		<b>86.3</b>