

Application Reference No. 28/2023-24/83

(यह परीक्षण रिपोर्ट 31/05/2029 तक वैध है / THIS TEST REPORT IS VALID UPTO 31/05/2029)



Make of Agricultural Tractor : SWARAJ
Model : 963 FE 4x4
Manufactured by : M/s. Mahindra & Mahindra Ltd.
Farm Equipment Sector, Swaraj Division
Phase- IV, Industrial Area, S.A.S. Nagar,
Mohali, Punjab – 160 055



भारत सरकार

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

GOVERNMENT OF INDIA
MINISTRY OF AGRICULTURE AND FARMERS WELFARE
(DEPARTMENT OF AGRICULTURE & FARMERS WELFARE)

केन्द्रीय कृषि मशीनरी प्रशिक्षण एवं परीक्षण संस्थान
ट्रैक्टर नगर, बुदनी (म.प्र.) 466 445

CENTRAL FARM MACHINERY TRAINING & TESTING INSTITUTE
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T-1849/2380/2024	SWARAJ, 963 FE 4x4 TRACTOR– INITIAL COMMERCIAL TEST
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IMPORTANT INFORMATION

The Government of India, Ministry of Agriculture and Farmers' Welfare has directed, vide a OM No. 13-17/2021-M&T (I&P) dated 28.07.2022, that since 15th August, 2022, only mandatory tests will be carried out on a tractor unless applicant has expressly requested for optional tests as well, mentioned in the above captioned OM.

In the instant case, there is no request from the applicant to carry out the optional tests hence only Mandatory Tests, as given below, have been conducted and reported in this report: -

1. PTO performance
2. Hydraulic performance
3. Drawbar performance
4. Brake performance

Month: May	Test Report No.: T- 1849/2380/2024	Year: 2024
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There is apparently “Three Modes” in the tractor. The applicant has christened the different mode as ‘ECO’, ‘Power’ and ‘Haulage’. However, the applicant vide letter no. SD/Budni/ICT/23-24/963FE4X4/A-18/L-01 dated 07.11.2023 requested to conduct the test only on so called ‘Power’ mode. Therefore, this report contains the observation on the so called ‘Power’ mode only.

[C]	Tractor manufacturer’s name and address	:	M/s. Mahindra & Mahindra Ltd. (Farm Equipment Sector), Swaraj Division, Phase- IV, Industrial Area, S.A.S. Nagar, Mohali, Punjab – 160 055
[C]	Submitted for test by (Applicant)	:	The Manufacturer
[C]	Selected for test by	:	The Ministry vide OM No. 13-17/2021 - M&T (I&P) dated 28.07.2022, has allowed the applicant to submit the test sample directly to the Institute without requiring any random selection for Initial Commercial Testing. Thus, the applicant directly submitted the test sample to the Institute for test.
[D]	Place of running-in	:	At manufacturer’s works
[D]	Duration of running-in, (h):		
	-Engine	:	28
	-Transmission	:	32
[C]	Location of test	:	Government of India, Central Farm Machinery Training and Testing Institute, P.O. - Tractor Nagar, BUDNI – 466445 (M.P.), INDIA

1. SPECIFICATIONS OF TRACTOR

1.1 Identification:

1.1.1 Denomination

[C]	Make of tractor	:	SWARAJ
[C]	Model	:	963 FE 4x4
[C]	Type	:	4WD, Standard Agricultural Tractor.
[C]	Month & year of manufacture	:	08/23
[D]	Country of origin	:	India

1.1.2 Numbers:

[D]	1 st Serial No. or prototype	:	MBNBP55AAPCB15515
[C]	Serial No.	:	MBNBP55AAPCK16239

1.2 Engine:

[D]	Manufacturer’s address	:	M/s. Swaraj Engine Ltd., Plot No. 2, Industrial Area, Phase-9, Mohali, Punjab-160062
[C]	Make	:	Swaraj Engines Ltd.
[C]	Model	:	SK360C
[C]	Type	:	Four stroke, naturally aspirated, liquid cooled, common rail direct injection (CRDI), diesel engine.
[C]	Serial No.	:	FZ.5102/SFK39818

1.2.1 Cylinders:

[C]	Number/disposition	:	Three/ Vertical, inline
[D]	Bore / Stroke, (mm)	:	110 / 134
[D]	Capacity, cm ³	:	3820
[D]	Compression ratio	:	18.2 (±0.5): 1
[D]	Arrangement of valves	:	Overhead
[D]	Cylinder liners	:	Wet, replaceable
[D]	Type of combustion chamber	:	Open re-entrant

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6. SUMMARY OF OBSERVATIONS, COMMENTS & RECOMMENDATIONS

6.1 On the basis of test conducted the performance results have been summarized as evaluative (mandatory) / Non-evaluative (Non-mandatory) parameters applicable for Qualifying Minimum Performance criteria as per Clause-4 (Table-1) of **IS: 12207-2022** 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: 12207-2022	Values declared by the applicant/ (D) Requirement (R)	As observed	Whether meets the requirements (Yes/No)
1	2	3	4	5	6	7
MANDATORY TESTS: (As per Ministry's Office Memorandum No. 13-17/2021-M&T (I&P) dated 28th of July, 2022).						
6.1.1	PTO Performance:					
a)	Maximum power under 2 h test, (kW) (Natural ambient condition)	Evaluative	Declared value to be achieved with a tolerance of: $\pm 5\%$ for PTO power and or engine power > 26 kW. $\pm 10\%$ for PTO power and or engine ≤ 26 kW.	38.5 (D)	38.3*	Yes
b)	Power at rated engine speed, (kW)	Non Evaluative	-do-	38.5 (D)	38.5*	Yes
c)	Specific fuel consumption corresponding to maximum power, (g/kWh)	Evaluative	Should not be more than 10% of declared value	285 (D)	275	Yes
d)	Maximum equivalent crankshaft torque, (Nm)	Non Evaluative	$\pm 8\%$	250 (D)	229.5	No
e)	Back-up torque, percent	Evaluative	Should be minimum 12 percent	12 (D) 12 (R)	31.0	Yes
f)	Maximum operating temperature, ($^{\circ}$ C):					
	1) Engine oil	Evaluative	The declared value should not exceed the <i>Max</i> value specified by the oil company and the observed value under natural ambient/high ambient condition should not exceed the declaration	130 (D)	103	Yes
	2) Coolant	Evaluative	Observed value should not exceed the declared value or boiling point of coolant at radiator cap pressure whichever is lower. The boiling point of the coolant at radiator pressure shall be provided by the applicant.	115 (D)	100	Yes
g)	Engine oil consumption, (g/kWh)	Evaluative	The value would be based on the test conducted under natural ambient condition	2.75 Maximum (R)	0.22	Yes
h)	Smoke level, m^{-1}	Evaluative	Max Smoke level shall be reported out of 6 readings tested as per IS 12062 and observed value should be well within the required limits.	3.25 per meter Maximum (R)	0.04	Yes

*The power at rated engine speed was higher than the average power observed during two hours maximum power test.

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1	2	3	4	5	6	7
6.1.2	Drawbar performance:					
a)	Max. drawbar pull with ballast corresponding to 15 percent wheel slip, (kN)	Non-Evaluative	Minimum 70% of static mass of tractor with ballast.	*	*	*
b)	Max. drawbar pull without ballast corresponding to 15 percent wheel slip, (kN)	Evaluative	In case of tractors having total static mass \geq 1500 kg, Min 70% of static mass of tractor without ballast or with standard ballast, as the case may be. In case of light weight tractors having \leq 1500 kg total static mass of tractor, Min. 65% of static mass of tractor without ballast or with standard ballast, as the case may be.	21.15 (D) 20.80 (R)	27.11	Yes
c)	Maximum drawbar power without ballast/ with standard 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 \leq 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.	30.8 (D) 30.6 (R)	32.8	Yes
d)	Maximum transmission oil temperature, ($^{\circ}$ C)	Evaluative	The declared value should not exceed the maximum value specified by oil company	120 (D)	105	Yes
*Applicant has not recommended ballasting for drawbar test. Hence, drawbar performance test under ballasted condition was not conducted.						
6.1.3	Power lift and hydraulic pump performance:					
a)	Maximum lifting capacity throughout the range of lift, (kN):					
1)	At hitch points	Evaluative	Should not be less than 90% of declared value.	21.57 (D) 19.41 (R) Minimum	20.73	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.	17.65 (D) 9.01 (R) Minimum	20.63	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	The observed value should not exceed 50 mm	50 (D) Maximum	10	Yes

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1	2	3	4	5	6	7
6.1.4	Brake performance at 25 kmph:					
a)	Maximum stopping distance at a force, equal to or less than 600 N on brake pedal without ballast, (m):					
	1) Cold brake	Evaluative	10	10 (R)	7.14	Yes
	2) Hot brake	Evaluative	10	10 (R)	7.20	Yes
b)	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	Yes	Yes
6.1.5	OPTIONAL TESTS: As the applicant has not applied for any optional tests, therefore no optional tests was conducted.					
6.1.6	Safety features:					
a)	Guards against moving and hot parts	Evaluative	Belt drives, pulleys, silencer, hydraulic pipes [As per IS 12239 (Part2)]	Meets the requirement	Yes	
b)	Lighting arrangement	Evaluative	As per CMVR	Meets the requirement	Yes	
c)	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)	Does not meet the requirement	No	
d)	Technical requirements for PTO shaft	Non Evaluative	Should meet the requirements of IS: 4931 (As amended from time to time)	Meets the requirement	Yes	
e)	Dimensions of three-point linkage	Non Evaluative	Should meet the requirements of IS: 17231-2019 (As amended from time to time)	Does not meet the requirement	No	
f)	Specifications of linkage drawbar	Non Evaluative	Should meet the requirements of IS: 12953 (As amended from time to time)	Meets the requirement	Yes	
g)	Specifications of Swinging drawbar (wherever fitted)	Non Evaluative	Should meet the requirement of IS: 12362 (Part-3) (As amended from time to time)	Not provided	Not applicable	
h)	Audible warning signal on tractor	Evaluative	If tractor travel speed in reverse gear exceeds 20 kmph, an audible warning signal on tractor shall get activated. A sticker to the effect that "operating the tractor beyond 20 kmph speed in reverse gear is not safe" should be prominently displayed.	Provided (The audible warning signal on tractor is activated when the speed in HR gear reaches to 13.76 kmph.)	Yes	
6.1.7	Labelling of tractors (Provision of labelling plate):					
	1) Make	Evaluative	Should conform to the requirements of CMVR along-with declared value of PTO in kW, Specific fuel consumption (SFC) corresponding to maximum power in g/kWh and year of manufacture in numerical form MM YY Digit 01-12 in box No. 1 for MM will represent the month and next two digit in the box No. 2 for YY will represent the year of manufacturing	SWARAJ	Yes	
	2) Model	Evaluative		963 FE 4x4	Yes	
	3) Month & Year of manufacture	Evaluative		08 / 23	Yes	
	4) Engine number	Evaluative		FZ.5102 /SFK39818	Yes	
	5) Chassis number	Evaluative		MBNBP55AA PCK16239	Yes	
	6) Maximum PTO power, (kW)	Evaluative		38.5	Yes	
	7) Specific fuel consumption, g/kWh	Evaluative		285	Yes	

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1	2	3	4	5	6	7
6.1.8	Literature (Submission to test agency):					
(a)	Operator manual	Evaluative	The printed literature in booklet form should be provided as per IS 8132 and should submit along with the test sample.		Provided	Yes
(b)	Parts Catalogue	Evaluative			Provided	Yes
(c)	Workshop/ Service manual	Evaluative			Provided	Yes
6.1.9	Fitment of Roll Over Protective Structures (ROPS):					
	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 fitted	Not applicable
6.1.10	Standard Accessories	Evaluative	Trailer hitch, front tow hook, linkage drawbar should be provided with tractor		Provided	Yes
6.1.11	Accessories (optional)	Non Evaluative	Ballast weight, if fitted, should meet the requirement of CMVR		Not fitted	Not applicable

6.2 CATEGORY OF BREAKDOWNS / DEFECTS (As per clause 5.0 of IS:12207-2022):					
S. No.	Category of break-downs	Category (Evaluative / Non Evaluative)	Requirements as per IS: 12207-2022	As observed	Whether meets the Requirements (Yes/No)
1.	Critical	Evaluative	There is no 'critical breakdown' during the course of testing	None	Yes
2.	Major	Evaluative	There are not more than 2 major break downs and neither of them should be of repetitive nature.	None	Yes
3.	Minor	Evaluative	There are not more than 5 minor defects during the test and neither of them should be of repetitive nature.	None	Yes
4.	Total breakdowns	Evaluative	In no case, the total number of break downs should exceed five that is, (2 major + 3 minor) or (1 major + 4 minor) or 5 minor breakdowns.	None	Yes

6.3 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 Year 2019)] : Conforms
- ii) Agricultural tractors - Rear mounted power take-off - Types 1, 2 and 3 (third revision) [IS:4931-1995 (Reaffirmed Year 2019)] : Conforms
- iii) Agricultural wheeled tractors – Rear mounted three-point linkage: Categories 1N,1,2N, 2, 3N, 3,4N & 4 [IS: 17231:2019] : **Does not conform**
- iv) Drawbar for agricultural tractors – Link type [IS 12953:1990 (Reaffirmed Year 2022)] : Conforms
- v) Agricultural tractors- Operator's seat technical requirement [IS12343 - 2021] : **Does not conform**
- vi) Guide for safety & comfort of operator of agricultural tractors:Part 1 General requirements (first revision):[IS 12239 (Part 1) - 2018] : **Does not conform**

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- vii) Tractors and machinery for agriculture and forestry – Technical means for ensuring safety Part 2: Tractors (first revision) (IS 12239 (Part 2) 1999) (Reaffirmed Year 2019)] : **Does not conform**
- viii) Guide lines for location and operation of operator controls on agricultural tractors and machinery [IS: 8133 - 2021] : **Does not conform**
- ix) Tractors and machinery for agriculture and forestry, powered lawn and garden equipment - Symbols for operator controls and other displays Part2 Symbols for agricultural tractors and machinery [IS: 6283(Part-1) - 2006 (Reaffirmed Year 2019) and IS: 6283 (Part-2) – 2007 (Reaffirmed Year 2019)] : Conforms
- x) Agricultural Tractors and Machinery-Lighting device for travel on public roads (IS:14683-1999) (Reaffirmed Year 2019)] : Conforms

6.4 Salient Observations:

6.4.1 PTO performance test:

- i) The applicant vide letter no. SD/Budni/ICT/23-24/963FE4X4/A-18/L-01 dated 07.11.2023 has requested to restrict the PTO performance test up to 1000 engine rpm during the test at full load & varying speed, which was allowed. Hence, test at full load and varying speed under natural and high ambient conditions were conducted up to 1000 engine rpm.
- ii) The maximum equivalent crankshaft torque was recorded as 229.5 N-m against the declaration of 250 N-m, which does not meet the non-evaluative requirement of IS 12207: 2022. Even though this parameter is categorized as 'Non-Evaluative', as per IS: 12207-2022, yet for the sake of improvement it would be advisable to look into the matter to make it conforming to the requirement.

6.4.2 Hydraulic performance test:

During lifting capacity test at coupled frame, tilt angle of mast over the range of lift was observed 3.7 degrees against the minimum requirement of 10 degree as per IS: 12224-1987. This should be looked into for necessary corrective action.

6.4.3 Dimensions of three point linkage:

The following parameters does not meet the requirements of IS: 17231-2019 and needs to be looked into for necessary corrective actions:

- i) Lateral distance from lower hitch point to centre line of tractor has been measured as 364 mm against the requirement of 435 mm.
- ii) Distance from end of power take-off to centre of lower hitch point (lower links in horizontal position) has been measured as 530 mm against the requirement of 550 to 625 mm.
- iii) Movement range has been measured as 610 mm against the minimum requirement of 650 mm.

6.4.4 PTO master shield:

PTO master shield has not been provided on tractor. This should be looked into for necessary corrective action.

6.4.5 Operator's seat:

The following parameters does not meet the requirement of IS: 12343-2021:

- i) Vertical distance from SIP to centre of accelerator pedal has been measured as 480 mm against the requirement of 230 to 460 mm.
- ii) Longitudinal distance from SIP to centre of differential lock pedal has been measured as 165 mm against the requirement of 410 to 720 mm.
- iii) Vertical distance of SIP from centre of steering control wheel has been measured as 200 mm against the requirement of 265 to 385 mm.
- iv) Vertical distance of SIP from foot rest has been measured as 540 mm against the requirement of 450 to 520 mm

Therefore, all of the above should be looked into for necessary corrective action.

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6.4.6 Operator's work place:

The following parameters does not meet the requirement of IS: 12239 (Part-I) -2018.

- (i) Vertical retainness on inner sides of clutch pedal has not been provided.
- (ii) Spark arresting device has not been provided in the exhaust system.

Therefore, all of the above should be looked into for necessary corrective action.

6.5 Maintenance / Service Problems:

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

6.6 Recommendation with regard to safety on tractor:

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

- i) Identification of hand controls by colour has not been provided as per the requirement as laid down in Table – 5 of IS: 8133-2021.
- ii) The hand accelerator lever, when moved away from the operator (i.e. forward) decreases the engine speed, which does not meet the requirement as laid down in Table – 1 of IS: 8133-2021.

All of the above should be looked into for necessary corrective action.




6.7 Adequacy of Literature supplied with machine:

6.7.1 Literature was supplied with the tractor for reference during the test.

- i) Operator Manual for "Swaraj 963 FE 4X4" tractor model.
- ii) Parts Catalogue for "Swaraj 963 FE 4X4" tractor model.
- iii) Service Manual (Part - I & II) for "Swaraj 963 FE 4X4" tractor model.

TEST CARRIED OUT AT C.F.M.T. & T.I., BUDNI (M.P.), INDIA

TESTING AUTHORITY

B.N. DIXIT AGRICULTURAL ENGINEER	
R.P. PANDEY S.I.E. (TESTING HEAD)	
A. K. UPADHYAY DIRECTOR (I/C)	

Draft Test Report compiled by **Partha Lodh**, Senior Technical Assistant

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7. APPLICANT'S COMMENTS

Para no.	Our reference	Applicant comments
7.1	6.4.1, 6.4.2 & 6.4.3	These requirements are being revisited for necessary corrective action at our end.
7.2	6.4.4, 6.4.5, 6.4.6 & 6.6	Study & trials are under progress for necessary corrective action.

ANNEXURE-I

TRACTOR RUN HOURS DURING TEST

A.	LABORATORY AND TRACK TESTS:	HOURS
1.	Running-in	Applicant has declared it to be conducted on their work place.
2.	PTO performance test	12.9
3.	Power lift and hydraulic pump performance test	4.3
4.	Drawbar performance test	9.2
5.	Brake performance test	1.2
6.	Nominal speed test	2.0
B.	Miscellaneous test and other run hours including idle run, transportation, trials and preparation for test.	1.2
TOTAL:		30.8