



**MAHINDRA, ARJUN 555 DI
(Brand Name : Ultra-1) TRACTOR**



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-888/1403/2013

MAHINDRA, ARJUN 555 DI TRACTOR
(Brand Name : Ultra-1) - Commercial (Initial)

The Mahindra Arjun 555 DI & Mahindra Arjun Ultra-1 555 DI Tractor Tractor had undergone Initial Commercial testing at this Institute vide test report No. T-456/908, November, 2002 & T-565/1058, Dec. 2006 respectively and the Commercial (Batch) testing of the said models were due in September, 2007. The firm M/s. Mahindra & Mahindra Ltd., (Farm Equipment Sector) Akurli Road, Kandivli (E) MUMBAI - 400 101, instead of offering this tractor models for commercial (Batch) testing, the firm vide their letter No. Nil dated 11 February 2012 has requested for Initial Commercial testing of Mahindra Arjun 555 DI Brand Name-Ultra-1 tractor model. The firm has informed that, "They have upgraded this tractor model with the configurations to meet Bharat Stage (Trem)-IIIA emission norms as well as other modifications in technical specification, to meet the end customer requirements. The firm, via letter no. Nil, dated 10/08/2013 stated that the firm had stopped/ceased the production of the tractors having technical specifications mentioned those in the test report No.T-456/908, November, 2002 & T-565/1058, Dec. 2006 & provided the last chassis no. i.e. NNABOO464, Aug.2013 & NNHJ01556, Aug.2013 respectively for the said tractor models. before release of the draft test report of submitted sample.

Therefore, the applicant's request was accepted by the competent authority and the Mahindra Arjun 555 DI, Brand Name: Ultra I, tractor model with changed technical specifications was tested under Initial Commercial Test., which supersedes of the following test reports released earlier with effect from the date of release of this test report :-

S. No.	Make & Model of the tractor	Nature of test	Test report No.	Last chassis no provided by the firm
1.	Mahindra Arjun 555 DI	ICT	T-456/908, November, 2002	NNABOO464, Aug.2013
2.	Mahindra Arjun Ultra-1 555 DI Tractor	ICT (Variant)	T-565/1058, Dec. 2006	NNHJ01556, Aug.2013

Manufacturer

- : M/s. Mahindra & Mahindra Limited
(Farm Equipment Sector)
Akurli Road, Kandivli (E)
MUMBAI - 400 101
- : (i) M/s. Mahindra & Mahindra Limited
(Farm Equipment Sector)
Akurli Road, Kandivli (E)
MUMBAI - 400 101
- (ii) M/s. Mahindra & Mahindra Limited
(Farm Equipment Sector)
Hingna Road, Hingna MIDC
NAGPUR - 440 016. (Maharashtra)
- (iii) M/s. Mahindra & Mahindra Limited
(Farm Equipment Sector)
Agri Business Development Centre,
Khatima Panipat Highway, Udham
Singh Nagar, Vil. Lalpur, Tehsil-Kichha,
RUDRAPUR - 263 153, (Uttanchal)
- (iv) M/s. Mahindra & Mahindra Limited
(Farm Equipment Sector)
Agri Development Centre, Vil-Mehla
Tehsil - Dudu Jaipur- Ajmer Road,
JAIPUR - 303 007, (Rajasthan)
- (v) Near Bidar 'T' Junction, Mahindra
Nagar, Zaheerabad- 502 220
Medak District, Andhra Pradesh

Location of manufacturing plants (apa)



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MAHINDRA, ARJUN 555 DI TRACTOR
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Test requested by (applicant) : M/s. Mahindra & Mahindra Limited
(Farm Equipment Sector)
Akurli Road, Kandivli (E)
MUMBAI - 400 101

Selected for test by : Applicant

Place of running-in : At applicant's works

Duration of said running-in (h):

- Engine : 15

- Transmission : 30

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 : Mahindra
Model : Arjun 555 DI
Brand Name : Ultra-1
Variants, if any :

Variant model	Brand Name	Variant features
Arjun 555 DI	Ultra 1 DLX	Power steering, Oil Immersed Brakes, CR PTO

Type : Four wheeled, rear-wheel driven, Standard Agricultural Tractor.

Year of manufacture : October 2011

Chassis serial number : NNA 145

Country of origin : India

1.2 Engine:

Make : Mahindra
Model : NE452 3A
Type : Four stroke, naturally aspirated, liquid cooled, direct injection, diesel engine.

Serial number : NNA 145

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

- Maximum speed at no load : 2250 to 2350
- Low idle speed : 750 to 850
- Speed at maximum torque : 1200 to 1500

Rated speed, (rpm):

- For PTO use : 2100
- For drawbar use : 2100

1.3 Cylinder & Cylinder Head:

Number : Four
Disposition : Vertical, Inline
Bore/stroke, (mm) : 94/110
Capacity as specified by the applicant, (cc) : 3054
Compression ratio : 19.4 : 1
Type of cylinder head : Monoblock
Type of cylinder liners : Wet, replaceable



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16. SUMMARY OF OBSERVATIONS, COMMENTS & RECOMMENDATIONS

16.1 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
16.1.1 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	33.5 (D) 31.8(R)	32.7	Yes
b)	Power at rated engine speed, (kW)	Non Evaluative	-do-	33.5 (D) 31.8 (R)	32.4	Yes
c)	Specific fuel consumption corresponding to maximum power, (g/kWh)	Non Evaluative	± 5%	251(D) 238 (R)	241	Yes
d)	Maximum equivalent crankshaft torque, (Nm)	Non Evaluative	± 8%	181.48(D) 166.96 (R)	176.3	Yes
e)	Back-up torque, percent	Non Evaluative	7 percent, min.	7% (R)	22.43	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	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.	110(D)	92	Yes
g)	Engine oil consumption, (g/kWh)	Evaluative	Not exceeding 1% of SFC at max. power under High ambient conditions	1% of SFC(D) 2.44 (R)	1.24	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 metre (R) 0.20 (D)	0.10	Yes



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1	2	3	4	5	6	7	
16.1.2 Drawbar performance :							
a)	Maximum drawbar pull with ballast corresponding to 15 percent wheel slip, (kN)	Non Evaluative	Minimum 65% of static mass with ballast	19.40(D) 19.95 (R)	25.47	Yes	
b)	Max. drawbar pull with standard ballast corresponding to 15 percent wheel slip, (kN)	Evaluative	Minimum 65% of static mass of tractor without ballast	14.41(D) 14.66 (R)	17.89	Yes	
c)	Maximum drawbar power with standard ballast, (kW).	Evaluative	Min. 80% of PTO power as referred in 16.1.1 (a) of PTO performance	26.8 (D) 26.2 (R)	27.8	Yes	
d)	Maximum transmission oil temperature (°C)	Non Evaluative	The declared value should not exceed the maximum value specified by oil company	110 (D)	64	Yes	
16.1.3 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%]	16.18 (D)	17.72	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	11.28 (D) 7.74 (R)	12.37	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]	250 (D) 50 (R)	35	Yes	
16.1.4 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):							
				10	10 (R)	7.06	Yes
				10	10 (R)	6.95	Yes
1)	Cold brake	Evaluative		10		243	Yes
2)	Hot brake	Evaluative				to 254	
b)	Maximum force exerted on the brake pedal to achieve a deceleration of 2.5 m/s ² (N)	Evaluative	600	600 (R)			Yes
16.1.5 Noise measurement :							
a)	Maximum ambient noise emitted by the tractor dB(A)	Evaluative	As per CMVR	88 (R)	86	Yes	
b)	Maximum noise at operator's ear level dB(A)	Evaluative	As per CMVR	98 (R)	93	Yes	



1	2	3	4	5	6	7
16.1.6	Amplitude of mechanical vibrations at :					
1)	Left foot rest	Non Evaluative	100 microns (max)	100 (R)	100	Yes
2)	Right foot rest				60	Yes
3)	Seat (with driver seated)				140	No
4)	Steering Wheel				60	Yes
16.1.7	Haulage requirements :					
a)	Gross mass of the trailers, (tonnes):					
1)	Two wheel	Non Evaluative	--	5.0 (D)	5.0	Yes
2)	Four wheel	Evaluative	--	8.0 (D)	8.0	Yes
b)	Distance travelled / litre of fuel consumption, (km/l):					
1)	Two wheel	Non Evaluative	--	5.66 to 6.10	4.83 to 5.05	No
2)	Four wheel	Evaluative	--	5.47 to 5.51	3.95 to 4.11	No
c)	Fuel consumption (ml/km/tonne):					
1)	Two wheel	Non Evaluative	--	32.79 to 35.36	39.6 to 41.4	No
2)	Four wheel	Evaluative	--	22.67 to 22.86	30.41 to 31.64	No
16.1.8	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-				
16.1.9	Safety features :					
a)	Guards against moving and hot parts	Evaluative	As per CMVR	At present no requirements	Provided	--
b)	Lighting arrangement	Evaluative	As per CMVR	--	Provided	Yes
16.1.10	Labelling of tractors (Provision of labelling plate):					
1)	Make	Evaluative	Should conform to the requirements of CMVR along with declared value of PTO HP	--	Mahindra	Yes
2)	Model	Evaluative		--	ARJUN 555 DI 2011	Yes
3)	Year manufacture of	Evaluative		--	NNA 145	Yes
4)	Engine number	Evaluative		--	NNA 145	Yes
5)	Chassis number	Evaluative		--	33.5	Yes
6)	Declaration of PTO power, (kW)	Evaluative		--		Yes



1	2	3	4	5	6	7
16.1.11	Discard limit for:					
(a)	Cylinder bore diameter, (mm)	Evaluative	To be specified by the manufacturer	94.522	94.00 to 94.01	Yes
(b)	Clearance between piston & cylinder liner at skirt, (mm)	Non Evaluative		0.5	0.093 to 0.104	Yes
(c)	Ring end gap (mm):					
	- Top comp ring.	Evaluative		-do-	2.5	0.30
	- 2 nd comp ring.			-do-	2.5	0.90
	- Oil ring.			-do-	2.0	0.35
(d)	Ring groove clearance (mm):					
	- Top comp ring.	Evaluative		-do-
	- 2 nd comp ring.			-do-	0.30	0.052 to 0.058
	- Oil ring.			-do-	0.25	0.033 to 0.049
(e)	Clearance of main bearings (mm):					
	- Diametrical clearance	Evaluative	To be specified by the manufacturer	0.60	0.056 to 0.087	Yes
	- Crankshaft end float	Evaluative		0.90	0.20	Yes
(f)	Clearance of big end bearings, (mm):					
	- Diametrical	Evaluative	-do-	0.200	0.055 to 0.113	Yes
	- Axial	Evaluative	-do-	0.750	0.25	Yes
(g)	Clearance between king pin and bush, (mm)	Non Evaluative	-do-	0.200	0.089 to 0.178	Yes
(h)	Clearance between centre pin and bush, (mm)	Non Evaluative	-do-	0.205	0.084 to 0.085	Yes

16.1.12	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



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16.2 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	Maximum oil pull over, (%)	0.25% (max.)	Dry type air cleaner provided	Not applicable
2	Seating requirements	Should meet the requirements of IS: 12343-1998	Does not meet the requirements	No
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	Does not meet the requirements	No
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.	Meets the requirements	Yes
	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.	Meets the requirements	Yes

16.3 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)] : Does not conform
- 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)/ISO 730-1:1994] : Does not conform
- iv) Drawbar for agricultural tractors – Link type [IS 12953:1990 (Reaffirmed in March, 2007)] : Conforms
- v) Agricultural tractors - Operator's seat technical requirement [IS 12343 -1998 (First revision) (Reaffirmed in March, 2009)] : Does not conform
- vi) Guide for safety & comfort of operator of agricultural tractors: Part 1 General requirements (first revision) : Does not conform
[IS 12239 (PT-1)-1996 (Reaffirmed in March, 2009)/ISO 4254-1:1989]
- 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



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- viii) Tractors and machinery for agriculture and forestry, powered lawn and garden equipment – Symbols for operator controls and other displays [IS: 6283 (Part-1 & Part-2) –2006 & 2007(Reaffirmed in March, 2009)/ ISO 3767-2:1991]] : 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

16.4 Salient Observations:

16.4.1 Laboratory tests:

16.4.1.1 PTO Performance:

- i) The backup torque was observed as 22.43%.
- ii) The specific fuel consumption corresponding to maximum power was measured as 241 g/kWh against the declaration of 251 g/kWh, which is within the tolerance limit of IS: 12207-2008.

16.4.1.2 Drawbar performance:

During ten hours drawbar test, creeping of LHS & RHS rear tyre over the rims was observed as 75 mm & 85 mm respectively. This should be looked into for necessary corrective action.

16.4.1.3 Hydraulic Performance:

- i) The maximum lifting capacity throughout the range of lift at lower hitch points & at standard frame were observed as 17.72 & 12.37 kN against the declaration of 16.18 & 11.28 kN respectively, which meet the requirements of IS: 12207-2008 with regard to tolerance.
- ii) The moment about rear axle with standard frame was calculated as 18.74 kN-m. Whereas, the moment about front axle was calculated as 17.71 kN-m under standard ballasted condition. The moment about rear axle is on higher side as compared to the moment about front axle. It is, therefore, recommended that the lifting capacity of the hydraulic system may be reduced suitably or standard ballast recommendation may be reviewed to avoid the front lifting of the tractor.

16.4.1.4 Mechanical Vibration:

The amplitude of mechanical vibration on various assemblies marked as (*) in Chapter-8 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.

16.4.1.5 Three point linkage:

Some of the parameters of three point linkage conforms to Cat.I and some of them conforms to Cat.II. Keeping in view the spirit of standardization, necessary improvement may be incorporated.

16.4.1.6 Specifications of Power Take-off Shaft:

- i) Dimension "AΦ" of PTO shaft does not meet the requirement of IS: 4931:1995. This should be looked into for necessary corrective action.



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MAHINDRA, ARJUN 555 DI TRACTOR
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- (i) The engine and chassis serial number of the tractor were embossed/ punched same (NNA 145) at engine housing & labelling plate respectively. **The engine and chassis serial number of the tractor should be given separately for its noteworthy identification.**
- (ii) The brand name of the tractor has been specified as "Ultra 1" vide specification sheet. Whereas, the same has not been mentioned on the labelling plate. It is, therefore, recommended that the brand name "Ultra 1" may be mentioned on the labeling plate of tractor for its noteworthy identification.

16.4.2 Field Performance:**16.4.2.1 Dry land Operation:**

- i) The average area covered in disc ploughing operation with recommended size of plough was recorded in the range of 0.160 to 0.167 ha/h. Keeping in view the PTO power of the tractor, the area coverage is considered less, hence the recommended size of the plough may be reviewed.
- ii) The average fuel required to cover one hectare area was recorded in the range of 20.48 to 21.81 liters/ha; during disc ploughing operation with recommended size of plough. The fuel consumed in ploughing operation is considered high and calls for necessary corrective action.

16.4.2.2 Wetland Cultivation (Puddling Operation):

No ingress of mud/or water was noticed during puddling operation of the tractor. Hence, It meets the requirements of IS: 11082-1984 reaffirmed in 2000 (Technical requirements of agricultural tractors for wetland operation). The tractor is suitable for wetland operation (Puddling).

16.4.2.3 Haulage Performance:

- (i) The fuel consumption with two wheel & four wheel trailer were observed as 39.59 to 41.4 & 30.41 to 31.64 ml/km/tonne respectively against the declaration 34.79 to 35.36 & 22.67 to 22.86 ml/km/tonne respectively. This does not meet the requirement of IS: 12207-2008 and therefore, should be looked into for necessary corrective action.

16.5 Maintenance / Service Problems:

No noticeable maintenance or service problem was observed during the test. However, Suitable provision for draining of the sediments/water may be provided at the fuel tank.

16.6 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) Provision of suitable guard at exhaust silencer.
iii) The working clearance between the parking brake lever and the mudguard is 35 mm and hence does not meet the requirement of IS: 12239 (Part-2) - 1999.

16.7 Component/Assembly inspection & Wear assessment

- i) Backlash between crown wheel and pinion was observed as 0.20 mm which approaches to its discard limit of 0.21mm, so it may look for corrective actions.

16.7 Adequacy of Literature supplied with machine:

The following literature has been supplied with the tractor

- i) Operator's Manual (Arjun ultra-1 model tractors)
ii) Tractor's part's catalogue (Arjun ultra-1 model tractors)
iii) Service Manual (Arjun ultra-1 model tractors)



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- 16.7.2** The literature supplied was found adequate. However, The literatures should also be brought out in national as well as other regional languages for the guidance of users and service personnel.

17. 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	6 Months (July, 2012 to December, 2012)	Yes	None

TESTING AUTHORITY:

P.K. VERMA
SENIOR AGRICULTURAL ENGINEER

C.R. LOHI
DIRECTOR

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

18. Applicant's Comments

Para No.	Our Reference	Applicant's comments
18.1	16.4.1.2, 16.4.1.3(ii), 16.4.1.4, 16.4.1.5, 16.4.1.6, 16.4.2.1(i) & (ii), 16.6 (i), (ii) & (iii), 16.7(i)	Observation will be studied and necessary action will be incorporated.