



MAHINDRA, 215 (Brand Name : Yuvraj 215) 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

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2. 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 & air cleaner oil | 15W40 | As recommended |
| 2. | Transmission & hydraulic system | EP-90 | Oil originally filled in the tractor systems were not changed |
| 3. | Steering system | SAE140 | |
| 4. | Grease | Servo Grease MP | MP Grease |

3. ESSENTIAL TESTS

3.1. SPECIFICATIONS

| | <u>Previous sample</u> | <u>Present sample</u> |
|--|------------------------|---|
| 3.1.1 Tractor: | | |
| Make | : | Mahindra |
| Model | : | 215 |
| Brand name | : | Yuvraj 215 |
| Type | : | Four wheeled, Rear wheel driven, Standard, Agricultural Tractor |
| Year of manufacture | : | 2008 |
| Chassis Serial number | : | AGR 1005 |
| Country of Origin | : | India |
| 3.1.2 Engine: | | |
| Make | : | Mahindra (apa) Mahindra |
| Model | : | FMW 100 |
| Type | : | Four stroke, water cooled, naturally aspirated with internal EGR, direct injection, diesel engine |
| Serial number | : | BL 42 GHE63AA8784 |
| Engine speed (Manufacturer's recommended production setting)(rpm) : | | |
| - Maximum speed at no load | : | 2500 to 2600 |
| - Low idle speed | : | 950 to 1150 |
| - Speed at maximum torque | : | 1200 to 1600 |
| Rated speed, (rpm): | | |
| - For PTO use | : | 2300 |
| - For drawbar use | : | 2300 |
| 3.1.3 Cylinder & Cylinder Head: | | |
| Number | : | One |
| Disposition | : | Vertical |
| Bore/stroke, (mm) | : | 100 / 110 |
| Capacity as specified by the applicant, (cc) | : | 863.5 (apa) |
| Compression ratio, (apa) | : | 18.5 ± 1.0 : 1 |
| Type of cylinder head | : | Monoblock |
| Type of cylinder liners | : | Wet, non replaceable |
| Type of combustion chamber | : | Direct combustion, Open, Re-entrant type Open, re-entrant type |
| Arrangement of valves | : | Overhead |
| Valve clearance (cold/hot): | | |
| - Inlet valve, (mm) | : | 0.10 / 0.10 0.20 / 0.20 |
| - Exhaust valve, (mm) | : | 0.10 / 0.10 0.10 / 0.10 |



5. ADJUSTMENTS, DEFECTS, BREAKDOWNS AND REPAIRS

| Sl. No. | Adjustments/Defects/Breakdowns and Repairs | Tractor run hours |
|---------|---|-------------------|
| (i) | <p>During PTO performance test under natural ambient condition, the maximum power was recorded as 9.5 kW against the declaration of 8.5 kW, which was 11.8 % higher than the maximum power requirement of 8.5 kW and does not meet the requirement.</p> <p>On the request of applicant, following checking / adjustment was carried out:-</p> <p>(a) Tappet clearance on inlet and exhaust valve was measured as 0.45 mm and 0.20 respectively, which was adjusted to declared value of 0.20 & 0.10 respectively.</p> <p>(b) Maximum no load engine was recorded as 2600 rpm, which was adjusted to 2550 rpm against the declaration value of 2500 to 2600 rpm.</p> <p>(c) Injector pressure was measured as 252 kg/cm² against the declaration of 251.87 to 266.14 kg/cm², hence no adjustment was done.</p> <p>(d) Fuel supply system pipe lines were cleaned.</p> <p>After above checking / adjustment, PTO test was re-conducted.</p> | 2.16 |
| (ii) | During the PTO performance test at no-load, low idle tractor's fuel supply system was taking air due to which two times tractor becomes shut-off. There after tractor was restarted after removing the air. | |

6. SUMMARY OF OBSERVATIONS, COMMENTS & 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: 2014 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: 12207-2014 | 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 PTO Performance : | | | | | | | | |
| a) | - Max. 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 | 9.04 (D) | 8.5 (D) | 8.9 | 8.8 | Yes |
| b) | Power at rated engine speed, (kW) | Non Evaluative | -do- | 9.04 (D) | 8.5 (D) | 8.7 | 8.8 | Yes |
| c) | Specific fuel consumption corresponding to maximum power, (g/kWh) | Non Evaluative | + 5% | 285 (D) | 285 (D) | 280 | 295 | Yes |
| d) | Maximum equivalent crankshaft torque, (Nm) | Non Evaluative | ± 8% | 43.0 (D) | 40.5 (D) | 47.9 | 48.5 | Yes |
| e) | Back-up torque, percent | Non Evaluative | 10 percent, min. | 10 (D) | 10 (D) | 27.4 | 33.6 | Yes |



| 1 | 2 | 3 | 4 | 5 a | 5 b | 6 a | 6 b | 7 | |
|----|---|----------------------------------|----------------|---|---------------|---------------|------|------|-----|
| f) | Maximum operating temperature ($^{\circ}\text{C}$): | | | | | | | | |
| | 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) | 130 (D) | 112 | 91 | 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. | 110 (D) | 110 (D) | 91 | 90 | Yes |
| g) | 3) | Engine oil consumption, (g/kWh) | Evaluative | Not exceeding 1% of SFC at max. power under High ambient conditions | 2.78 Max. (R) | 2.92 Max. (R) | 1.03 | 0.81 | Yes |
| h) | 4) | Smoke level, (m^{-1}) | 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) | 0.65 | 0.17 | Yes |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-------|---|------------------------------|---|----|--------------------------------------|-----------|
| 6.1.2 | Safety features : | | | | | |
| a) | Guards against moving and hot parts | Evaluative | Belt drives, pulleys, silencer, hydraulic pipes (As per IS 12239 (Part2) | -- | Meets the requirements | Yes |
| b) | Lighting arrangement | Evaluative | As per CMVR | -- | Meets the requirements | 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) | -- | Meets the requirements | Yes |
| d) | Technical requirements for PTO shaft | Non Evaluative | Should meet the requirements of IS: 4931 (As amended from time to time) | -- | Does not meet the requirement | No |
| e) | Dimensions of three point linkage | Non Evaluative | Should meet the requirements of IS: 4468 (Part-I) (As amended from time to time) | -- | Meet the requirements | Yes |
| f) | Specifications of linkage | Non Evaluative | Should meet the requirements of IS 12953 and IS 12362 (Part 3) (As amended from time to time) | -- | Meet the requirements | Yes |
| | Swinging drawbar | | | -- | Not Provided | -- |
| 6.1.3 | Labeling of tractors (Provision of labeling plate): | | | | | |
| | 1) | Make | Should conform to the requirements of CMVR along-with declared value of PTO HP | -- | Mahindra | Yes |
| | 2) | Model | | -- | 215 | Yes |
| | 3) | Engine number | | -- | GHE6BAA8784 | Yes |
| | 4) | Chassis number | | -- | MBNZJFAXUHGG 00681 | Yes |
| | 5) | Declaration of PTO power, kW | | -- | 8.5 | Yes |



| 6.1.4 Literature (Submission to test agency) | | | | | | |
|--|-----------------------------|------------|---------------------------|----------|----------|-----|
| (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 |

| 6.2 Conformity with following IS: | | <u>Previous sample</u> | <u>Present sample</u> |
|-----------------------------------|--|------------------------|-----------------------|
| 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)] | Conformed | Conforms |
| ii) | Agricultural tractors – Rear mounted power take-off - Types 1, 2 and 3 (third revision)[IS: 4931-1995 (Reaffirmed in March, 2009)] | Conformed | 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/ISO 730-1:1994 (Reaffirmed in March, 2009)] | Did not conform | Conforms |
| iv) | Drawbar for agricultural tractors – Link type [IS 12953:1990 (Reaffirmed in March, 2007)] | Conformed | Conforms |
| v) | Agricultural tractors - Operator's seat technical requirement [IS 12343 –1998 (First revision) (Reaffirmed in March, 2009)] | Did not conform | 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 in March, 2007)] | Did not conform | 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 & Part-2) –2006 & 2007 (Reaffirmed in March, 2009)]/ ISO 3767-2:1991]] | Did not conform | Does not conform |
| viii) | 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)] | Did not conform | Does not conform |
| ix) | Guide lines for location and operation of operator controls on agricultural tractors and machinery (first revision) (IS: 8133 – 1983) (Reaffirmed in March, 2009)] | Conformed | Conforms |
| x) | Agricultural Tractor & Machinery Lighting device for travel on public roads (IS: 14683-1999) (Reaffirmed in March, 2009)] | Conformed | Conforms |

**6.3 Salient Observations:****6.3.1 Laboratory tests:****6.3.1.1 PTO Performance:**

- i) The maximum PTO power was recorded as **8.8 kW** against the declaration of **8.5 kW**, which meets the requirement of IS: 12207-2014 with regard to tolerance limit.
- ii) The specific fuel consumption corresponding to maximum power was recorded as **295 g/kWh** against the declaration of **285 g/kWh**, which is within the tolerance limit of IS: 12207-2014.
- iii) The maximum equivalent crankshaft torque was recorded as **48.5 N-m** against the declaration of **40.5 N-m**, which is within the permissible limit as specified in IS: 12207-2014.
- iv) The backup torque is **33.6 %**.
- v) There is PTO power drop of **4.5 %** from natural to high ambient condition. This should be looked into for necessary corrective action.
- vi) During PTO performance test under natural ambient condition, the maximum power was recorded as **9.5 kW** against the declaration of **8.5 kW**, which was **11.8 %** higher than the maximum power requirement of **8.5 kW** and does not meet the requirement.

Thereafter, following checking / adjustment carryout out:

- a) Tappet clearance on inlet and exhaust valve was measured as **0.45 mm** and **0.20** respectively, which was adjusted to declared value of **0.20 & 0.10 mm** respectively
- b) Maximum no load engine was recorded as **2600 rpm**, which was adjusted to **2550 rpm** against the declaration value of **2500 to 2600 rpm**.
- c) Injector pressure was measured as **252 kg/cm²** against the declaration of **251.87 to 266.14 kg/cm²**, hence no adjustment was done
- d) Fuel supply system pipe lines were cleaned
- f) During the PTO performance test at no-load, low idle tractor's fuel supply system was taking air due to which two times tractor becomes shut-off. There after tractor was restarted after removing the air.

This is should be looked into for necessary corrective action.

6.3.1.2 Three point linkage:

The parameter "power range" of three point linkage does not meet the requirement of IS:4468 (Part I) – 1997 as well as some of the parameters of three point linkage conform to Cat. I and some of them conform to Cat.IN. 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) There should be provision for spark arresting device in exhaust system.
- ii) There should be provision of differential lock.
- iii) There should be provision against accidental start or safety switch.
- iv) The working clearance between the draft control lever and mudguard should be provided as per IS: 12239 (Part-2) – 1999.
- v) There should be provision of master shield on PTO shaft



- 6.6 Adequacy of Literature supplied with machine:**
- 6.6.1** Literature was supplied with the tractor for reference during the test.
- a) Operator's manual of **Mahindra 215 (YUVRAJ 215)** tractor model
 - b) Parts catalogue of **Mahindra 215 (YUVRAJ 215)** tractor model
 - c) Service Manual of **Mahindra 215 (YUVRAJ 215)** tractor model
- 6.6.2** The supplied literature was found adequate, **except the following:-**
- a) Tractor specification given in operator's manual does not match with specifications submitted by applicant.
 - b) Lubricants grade of air cleaner and engine is not given in operator's manual.
 - c) Valve clearance given in specifications of engine of service manual does not match with specifications submitted by applicant.
 - d) Scheduled servicing & routine maintenance chart is not provided in service manual except engine.
 - e) Lubricants grade, brand name of coolant are not given in service manual.
 - f) Tightening torque of various subassemblies given in service manual does not match with specifications submitted by applicant
- 6.6.3** However, these literatures should be brought out in other vernacular languages of India for guidance of users

7. CITIZEN CHARTER

| Duration of Test | Time frame for Testing & Evaluation as per Citizen Charter | Whether the Test Report is released within the time frame given in Citizen Charter | Remarks |
|---|--|--|---------|
| 07 Months (December, 2017 to June, 2018) | 10 Months | Yes | --- |

TESTING AUTHORITY:

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AGRICULTURAL ENGINEER

C.V. CHIMOTE
TEST ENGINEER

Y.K. RAO
SENIOR AGRICULTURAL ENGINEER

J.J.R. NARWARE
DIRECTOR

The report compiled by: **Shri Vithato Keyho**, Senior Technical Assistant

8. APPLICANT'S COMMENTS

| Para No. | Our Reference | Applicant's comments |
|----------|---|---|
| 8.1 | 6.3.1.1 (vi), 6.3.1.2, 6.5, 6.6.2 & 6.6.3 | Observations will be studied and necessary action will be incorporated. |